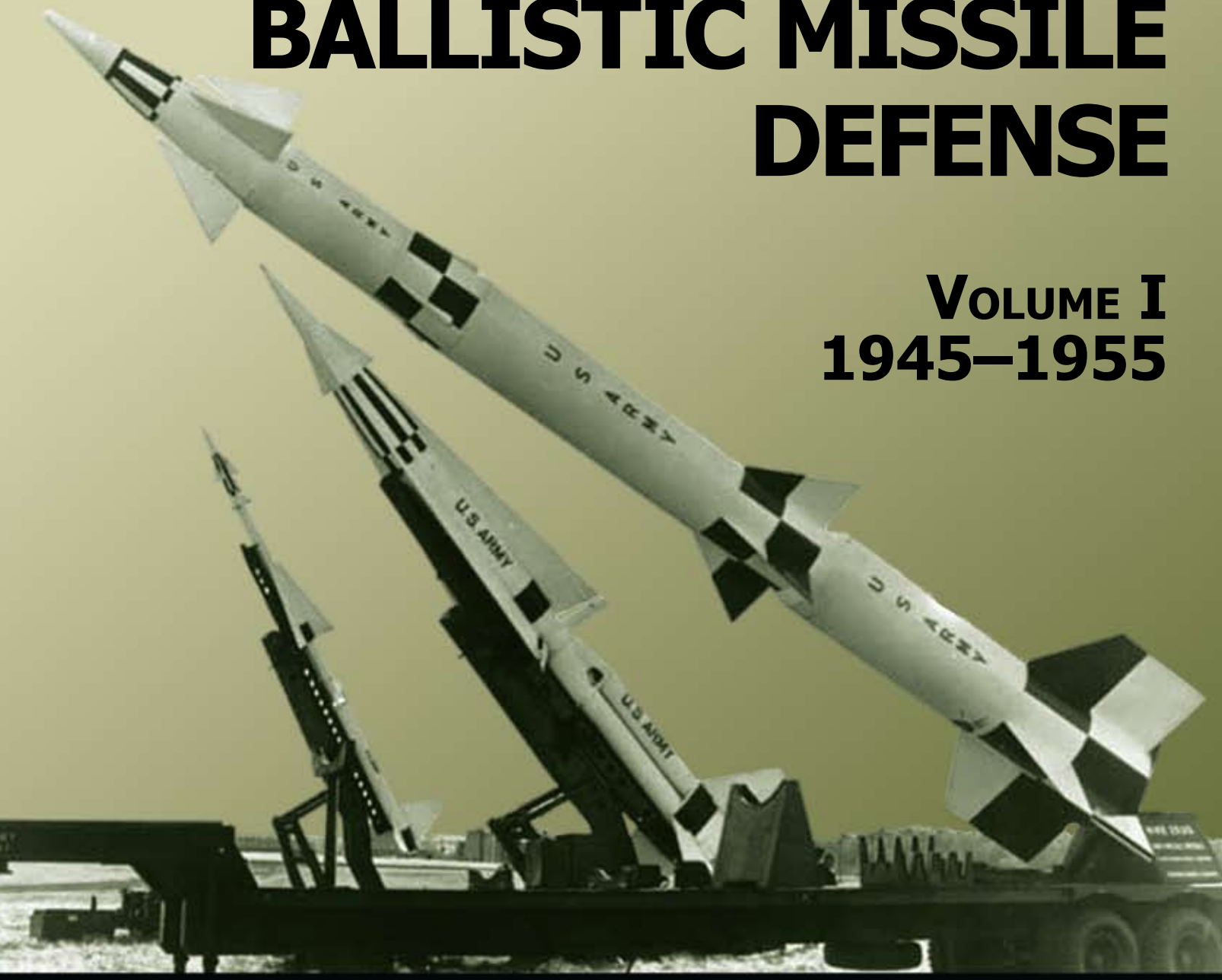
HISTORY OF STRATEGIC AIR AND BALLISTIC MISSILE DEFENSE

VOLUME I
1945–1955









Executive Summary

As part of a larger study of the strategic arms competition which developed after World War II between the United States and the U.S.S.R., this study of the two countries' strategies for air and ballistic missile defense addresses two broad subjects:

(1) How did each country approach the problem of defense against the threat from the air?
(2) Why did each country accent particular elements of an air defense strategy at various periods between 1945 and 1972?

The first question concerns the means that leaders chose for defense against an increasingly sophisticated offensive threat. For the most part, the history of that sequential selection of defenses from available technology and budgetary resources is a matter of evidential fact. In Chapters IV and V and several appendices of chronologies, tables, charts, maps and notes, this volume provides a distillation of those facts for the 1945–1955 period.

The second question, by far the more difficult of the two, concerns elite perceptions and motivations—the calculus of costs and returns whereby leaders assessed threats, risks and capabilities and devised strategy. The evidence provided by research on the first question offers only partial explanations for the second; observable weapons systems do not explain but only manifest prior decisions. Chapters I to III offer judgments about the relative importance of those decisions between 1945 and 1955 and about internal versus external factors that sustained the allocation of enormous Soviet and American resources to homeland defense against enemy bomber and missile threats.

For purposes of description and analysis, the post–World War II decade is logically split by the watershed outbreak of the Korean War in June 1950. Before 1950, American deployment of resources for air defense reflected the severe budget ceilings imposed on military planners, who generally sympathized with the post war emphasis on economic growth for civilian consumption. After 1950, all aspects of American air defense were expanded.

During the pre-1950 period, constrained by limited budgetary resources, military planners concerned with civil defense succeeded in transferring responsibility for that element of air and missile defense to a civilian planning agency, dependent for execution of plans on state and local civil defense volunteers. By 1950, increasing civilian scientist concern with possible Soviet nuclear attack had sensitized public opinion to the problem. The Federal Civil Defense Act of 1950 established a civil defense operating agency; but Congress then appropriated only token budgets for what was clearly perceived to be a "mobilization," not a peacetime institution.

Although the desirability of a nationally unified and integrated air defense command and control system was recognized early, limited resources helped delay the evolution from the Army Air Forces' impoverished Air Defense Command, established in March 1946, through the Continental Air Command (December 1948) to a Continental Air Defense Command in September 1954. Within the Air Force after 1950, competition

among differing functions (interceptor; penetration; tactical fighter) encouraged the conversion of older jets to the interceptor role (e.g., the F-88 which became the F-101). Still, the need for a "1954 interceptor" and the 1950–1951 competition yielded the XF-92 (later the F-102).

It was also limited budgets which constrained military planners from demanding expensive jet interceptors before 1950, although aircraft industry designers responded to defense requests for designs with a clear preference for jets and may be credited with providing the F-80 to units in time for the Korean War.

Lacking adequate air defense interceptor aircraft between 1945 and 1950, the Air Force sought to integrate most antiaircraft artillery into the Army Air Forces between 1944 and 1946; they sought operational control of all U.S. air defenses between 1946 and 1949. Within the limits of defense budgets, initial development activity for surface-to-air missiles proceeded in both the Army (Project Nike) and the Air Force (Bomarc) before the Korean War. This interservice competition for control of both antiaircraft artillery and the surface-to-air missiles was catalyzed by the appearance of a Soviet jet bomber in 1954.

Constrained budgets also confined the development of an effective early warning system to a succession of enormously expensive plans for a distant early warning (DEW) line, first conceived—and rejected—in 1946. It was not until 1950 that interim plans such as the Air Force's "Supremacy," "Lashup," and "Interim Program" could be consolidated in initial construction of a Canadian "Pinetree" line. An M.I.T. study of 1951 argued for extending early warning further away from the U.S., stimulating Canadian 1952 plans for a mid-Canada line, American 1953 final plans for the DEW line and a 1955 DEW-line extension into the Pacific Ocean with radar picket ships and airborne radar.

In the first post war decade, Soviet air defense was dominated by a concerted program to equip fighter forces with jet aircraft. A major commitment was made early in 1946 to focus on advanced jet engine development while using foreign technology to support intermediate aircraft development. The plan breaks down into three stages:

(1) The development of interim aircraft based on captured German engines. This stage resulted in the YAK-15 and MiG-9 aircraft which were first flown on April 24, 1947. These were produced in limited quantities—some 800 MiG-9's and 265 YAK-15's and 610 YAK-17's (an improved version of the YAK-15).

(2) The development of combat capabilities based on imported British technology, namely the Rolls Royce Nene and Derwent engines. This stage was to result in the YAK-23, the La-15, and the ubiquitous MiG-15. Altogether some 120 Lavochkin and 930 YAK-23 aircraft would be produced. Ultimately, approximately 12,500 MiG-15's would be produced in four variants: a day interceptor, an improved performance day interceptor, a limited all-weather interceptor, and a reconnaissance attack version.

(3) The development of advanced interceptors on the basis of native engine technology derived from the efforts of the Klimov, Lyulka, Mikhulin, and Zumansky engine design bureaus: Of the development efforts Klimov's V K-1 engine was the first and was used to power the MiG-15 bis the improved day interceptor.

As the 1946 plan was nearing fruition, the pattern of hectic development slowed. Instead of three or four prototypes being constructed in response to each established requirement, a strategy which focused on modification of the MiG-15 evolved. This strategy coincided with the Fifth Five-Year Plan which extended from 1951–1955. Only the MiG-17, a major redesign of the MiG-15, was committed to series production between 1950 and 1954.

In 1948, a requirement for an all-weather interceptor resulted in development of three different two-engine, radar-equipped prototypes—the Su-15, the La 200A, and the MiG-310. These were awkward designs

which attempted to incorporate two centrifugal flow engines and a radar in the same fuselage. They were dropped in favor of a radar modification of the MiG-15—a short-range interim expedient. It was not until 1951, with the development of the Mikhulin AM-5 small, efficient, axial-flow engine that a long-range, all-weather interceptor became technically convenient. Such an engine made practical an alternate aircraft configuration which would accommodate the large radome associated with Soviet air intercept radars of that era. There is sufficient evidence to believe that the aircraft which would eventually accommodate the "requirement" for an all-weather area interceptor, the YAK-25, arose outside of the normal process of Soviet research and development decision-making. The YAK-25 appears to have been the result of an initiative of the designer taken up directly with Stalin. Thus, the aircraft that was wanted concurrently with the formation of PVO in 1948 was not available until 1954.

As was the case in jet technology, the Soviet's post war SAM program was based on German technology. Unlike their well-developed aircraft design capabilities, however, the Soviets had carried on no practical work in guided missiles. Thus, while jet aircraft developed rapidly, SAMs developed at a slower pace with a much greater reliance on German technicians. At the end of the war, the Soviets found themselves with four candidate German systems for development: the Schmetterling, the Wasserfall, the Rheintochter III, and the Enzian. Of these, the only supersonic prototype, the Wasserfall, was ultimately chosen as the focus of development activity.

As the program was relatively more dependent on German technology than the jet aircraft program, so it was more dependent on German technicians. In 1946, a number of German technical teams were transported to the Soviet Union. By 1949, these teams had developed experimental designs for semi-active guidance, for computational equipment, and for a production version of the Wasserfall. In 1951, however, an improved design, about guidance details, was submitted by a German group located at Gorodlomlya. It is believed that this is the design which evolved to the SA-1 system which achieved operational capability in 1954. The SA-1 was deployed in 56 sites, each with 60 fixed launchers in two concentric circles around Moscow, and it appears the system was intended for deployment around Leningrad although construction ceased at an early stage. A more practical weapon, the SA-2, was apparently under way at that time.

Contrary to the trend in western development which shifted attention from guns to surface-to-air missiles, the Soviets maintained a strong AAA development effort. That the program was one of continued emphasis is evidenced by the pace of development: a 100-mm. gun in 1949, a 57-mm. weapon in 1950, and a 130-mm. gun in 1954. Associated with the new weapons were complementary systems of radar and optical fire control. The 100-mm. system was deployed around Moscow in 1950 and 1951 in numbers which, by one estimate, reached 720 while similar, but smaller deployments were undertaken around Warsaw Pact capitals. While it is evident that the Soviets continued a massive production and deployment effort for these and earlier weapons, at this point in the research it is impossible to validate data to a sufficient degree to draw well-founded conclusions. Detailed analysis of trends in AAA deployment and relations to the overall Soviet strategic defense effort will be deferred until subsequent volumes of this report.

Soviet early warning systems during World War II had relied primarily on visual and sound methods, although some radar equipment was apparently used. Still, the technology was available. During the later years of the war, the Soviets received samples and/or significant information on nearly all of the major U.S. and British radars which were in operation. This included the U.S. SCR-584 fire control radar, the British

searchlight control radar "Elsie," and a series of others. Possession or knowledge of these radars enabled the Soviets to produce similar models of their own.

From their experience in World War II, the Soviets determined that they would need an integrated, radar-based early warning system. This led to the fielding of an extensive radar early warning system by 1950. Soviet research, after a period of ample time to assimilate foreign technology and as a response to the increasing bomber threat, showed a marked increase in new or improved radar systems from 1952 to 1955. By 1955, the system afforded continuous coverage in fair depth for the entire country with the exception of the least vulnerable portions of the national frontier. It also encompassed Eastern Europe.

The air warning system had the following characteristics at this stage:

(1) Performance was still unimpressive by Western standards;
(2) Limited range necessitated the use of greater numbers of radars to give continuous coverage;
(3) The Soviet Union's great size, as further extended by the East European countries, permitted radar positioning far in advance of the area to be defended;
(4) The system was built for simplicity and relatively maintenance-free operation;
(5) Most of the equipment was mobile and extremely easy to conceal.

By 1948, Soviet civil defense programs had received increased attention in a variety of ways, including shelter construction in new buildings, mandatory study circles and instructor training programs, and periodic endorsements by the media. DOSAAF, a paramilitary organization which assumed responsibility for civil defense training and instruction, was established in 1951. Although few military personnel were previously involved in civil defense, less than two years later an antiaircraft general became chairman of DOSAAF, indicating the growing importance of its defense-related functions. The evolution of DOSAAF and civil defense was further marked by two events in 1955:

(1) The new DOSAAF commander, below, advocated the use of reserve or demobilized soldiers for training and instruction, and
(2) The first compulsory civil defense training, a 10-hour program, was initiated for the adult population of the Soviet Union.

These milestone events, which began the transition from a civilian-directed, local, voluntary civil defense structure to a military-directed nationwide, mandatory program were prefaced the preceding year by the first civil defense literature mentioning nuclear weapons. This public acknowledgement symbolized the beginning of a new civil defense orientation, one in which "weapons of mass destruction" had to be recognized as an inevitable part of defensive measures. Future civil defense developments, spurred by military-political debates over the outdated procedures of old programs, were a result of this changing strategic situation. Thus, civil defense maintained an important position in the defense branches of the Soviet military and eventually gained recognition by the political leaders of the U.S.S.R.

During the first decade after World War II, the contrasts between the two air defense systems of the world's greatest continental powers were striking. In the U.S.S.R., the defense clearly dominated Soviet development and deployment of an obsolescent but nationally integrated early warning system, supported by a diversity of improved antiaircraft artillery, high-speed (limited range) jet interceptors and surface-to-air missiles (to ring Moscow), all under a single national air defense agency aiming at the military integration of all national air defense resources, including civil defense.

In contrast, the United States (supported by Canada) was attempting to buy time with distance. After the Korean War began, forward deployment of American forces to the Western Pacific and Western Europe gradually provided a base structure for an American deterrent offensive capability. By 1955, homeland air defense, while not entirely neglected, had barely reached a consensus about nationally integrated command and control over limited antiaircraft, interceptor and surface-to-air missile defense systems. Early warning system construction was only beginning and civil defense was largely divorced from military influence.

Why were these contrasts so pronounced? Some of the reasons are so obvious as to require no extensive elucidation. The traditional political "style" of decision and administration in the two societies encouraged noisy controversy, debate and competition for control over decentralized centers of power, on the one hand, and an autocratic and highly centralized approach to problem-solving, on the other. Those historical distinctions in the political and decision process were reinforced by marked differences in economic capability. Impoverished after the war, the U.S.S.R. was in no position to waste resources—a fact which encouraged careful planning of both defense and non-defense resource allocations. Conversely, the United States emerged from the war as the wealthiest country on earth, facing an enormous demand by an impatient population for consumer goods, not more and more defense.

Deeply influenced by those traditional non-military considerations, the approach to air defense by each country's leaders was inevitably driven by a distinctive military heritage. For American leaders, the war confirmed the importance of keeping and fighting enemies at a distance, preferably thousands of miles across two oceans. The experience of the war further validated a continuing American faith in the offense, then (in 1945) translated in precedent and practice to a global stage. Finally, the tradition of competition between the Army and the Navy for resources and roles was a prevailing manifestation of American competitive political, economic, and administrative style.

In contrast, the war confirmed Soviet military planners' historic concern with surprise attack, probably from Europe, directed at the heart of the homeland. Unlike the Americans, who had the tradition and the capability of mobilizing and projecting offensive air and naval power over vast distances, the Soviets needed reliable defensive military power, principally ground forces supported by airpower, immediately available since time-distance factors precluded a lengthy mobilization process.

In the context of their distinctive military heritage, 1945 found the Soviets sensitized to the urgency of defense against a probable threat from Europe, where American and British airpower would be the most likely immediate threat. Air defense was, therefore, a matter of priority for the U.S.S.R. The Americans, confident of their doctrine, their capabilities and their prestige, facing no plausible threat from the air and sensitized in any case, to the foreign war (probably in Europe) instead of homeland defense, awarded air defense a secondary role in the priority of defense issues. Homeland defense was in Europe and Asia.

From the start-point in 1945 of differing priorities assigned to air defense, for reasons of long-term political, economic, and military ingredients in the security environment, American and Soviet strategies of response to perceived threats were largely the result of domestic political and economic considerations before 1950. Given the available technology (British and German, bought or captured) in the U.S.S.R., the Soviet focus on the application of that technology to improved antiaircraft artillery and the jet interceptor reflected the urgency and single-minded Stalinist decision-style of the period. Given their attitude plus a shortage of budgets for military purposes and their competition decision-style, Americans experimented with a variety of air-defense-relevant technologies without building an effective system.

After 1950, the availability of more budgetary resources permitted American defense planners to embark on an enormously expensive early warning system. That system reflected the logic of the American military ethic—to buy time with distance, a logic that erected concentric rings of defense and potential-military warning around the American heartland, first and foremost to the outer reaches of the European peninsula and the Western Pacific, then to early-warning radar lines in Canada and off the American coast. The Soviet (and Chinese) threats in Korea thus gave focus to a new sense of urgency and substance to pre-1950 concepts for American defense policy. The appearance of a Soviet H-bomb in 1953 and a Soviet jet bomber in 1954 plus rising tensions in Europe reinforced a burgeoning pace of strategic interaction after 1950 and encouraged the American development of both supersonic jet aircraft and surface-to-air ballistic missiles.

Initially constrained by their indigenous technology, the Soviets after 1950 urged advanced interceptor and SAM development while making-do with an improved version of the MiG-15 and passive nationally integrated civil defense system. By 1955, the increasing speed of high-altitude, American jet bombers and a coming generation of nuclear-tipped ballistic missiles had seriously eroded the defense utility of the East European buffer and underscored the need for a shift in Soviet emphasis from area and even point defense (whether with AAA, interceptors, or SAMs) to a deterrent offensive capability. The stage was set for a global strategic interaction dialogue in which technology and research and development would become the critical ingredients.

Chapter I

American and Soviet Strategy: A Comparison

A. Factors Influencing Air Defense Development and Deployment, 1945–1950

1. Perspectives of the Threat and Strategic Realities

Differing perspectives and heritages influenced the Soviet and American decision makers and strategists in initial post war security policy and action. Increasingly these would concern air defense, but it was late in the period before substantial commitments resulted. Soviet action bespoke a coherent, deliberate, and central strategy; the American effort appeared more expedient and diffuse.

Seeing the war to have destroyed the existing power balance in Europe and Asia, America thought it would take years before nations—particularly the Soviet Union—would recover from the damage and losses suffered during World War II. Fundamentally, the belief was general that the peoples of Europe and Asia could not possibly face another war. With the early breakdown of former colonial empires and the emergence of independent states, the post war period witnessed the removal of a major cause for war.

Sole possession by the United States of the atomic bomb made a large-scale war very unlikely. The judgment was general that it would be foolhardy for a power lacking nuclear weapons to engage in war against one that had the bomb and could deliver it. To the extent that the American public saw the Communists to be a military threat, the U.S. atomic monopoly provided a simple, solid answer. Basically, Americans thought that Communist resort to military force would result in full-scale war and, in such a war the United States would win with air/atomic power. A significant opinion thought it essential to control atomic arms. Future nuclear developments could produce even more powerful weapons. Countermeasures were unlikely and active defense difficult, even unrealistic. Retaliation capabilities would provide the principal security for the United States according to other sources.

In the immediate post war period within official Washington, the issue of a future atomic war seemed remote. In November 1945, the United States, Britain, and Canada agreed to give up atomic weapons and all other major weapons of mass destruction. One month later, at a meeting of the "Big Three" in Moscow, the Soviet Union agreed to the same terms. While the demobilization of U.S. military forces continued through the spring of 1946, Bernard Baruch, in a speech at the U.N., rejected the idea of making rules for a next war; announced the U.S. purpose as getting rid of war; and claimed disarmament was the way of stopping war. In October 1946, Soviet Foreign Minister Molotov proposed general disarmament.

Within the Soviet Union, however, the successful U.S. nuclear test and immediate employment in war of atomic weapons through strategic air strikes had shocked the leadership. Henry Kissinger described the impact of these events:

> The end of World War II confronted the Soviet leadership with a fearful/challenge. At the precise moment when Soviet armies stood in the center of a war-wrecked Europe and Lenin's prophecies of the doom of capitalism seemed on the verge of being fulfilled, a new weapon appeared, far transcending in power anything previously known. . . . Was this to be the result of twenty years of brutal repression and deprivation and of four years of cataclysmic war that at its end the capitalist enemy should emerge with a weapon which could imperil the Soviet state as never before?[1]

The U.S. nuclear monopoly underscored a fundamental strategic reality: America could obliterate Soviet cities but the Soviet Union had no capacity to attack the American homeland. The Soviets soon would reason that another strategic reality stemmed from the U.S. monopoly; in the near future, as a result of U.S. assistance, western nations could, with relative impunity, engage in actions against Soviet-controlled areas with the American nuclear shield to deter possible Soviet retaliation. Being vulnerable, the U.S.S.R. could not afford to challenge the West, especially the United States directly.

2. Impetus for Decisions

Such factors conditioned the long-standing Soviet disposition for defense. They also helped to put the Soviet atomic program into high gear. The U.S. Smythe Report, which provided a great volume of information on the U.S. atomic effort, was published in Moscow with an initial printing of 30,000 copies. An enforced development of the Soviet atomic bomb and the obvious priority assigned to the effort makes it clear that the Soviet leadership quickly recognized the strategic challenge in a U.S. nuclear monopoly. Unwilling to concede to the West the strategic power position thought to have been won through enormous Soviet sacrifice in the war against Germany, Stalin personally involved himself, along with other principals, in efforts to close the technological gaps that could influence the Soviet strategic position.

In the United States, the atomic bomb and the appearance of jets and missiles caused a lot of rethinking in the military and naval services. The facts of the bomb caused airpower enthusiasts to emphasize the need for a force in being to fill the basic strategic role of providing a first line of defense. While the ocean barriers remained, intercontinental warfare was approaching.

In keeping with the American hope for peace and security, however, many U.S. leaders became convinced that atomic power must be directed to the prevention of war. Before the summer-scheduled atomic tests of 1946, scientists "invaded" Washington and stormed Capitol Hill, urging Congress to cancel those tests with a zeal that put professional lobbyists and pressure groups to shame.[2] The Soviet Union claimed the tests were meant as "intimidation" and protested their being carried out. Concurrently, the Canadian Government released details of an extensive Soviet atomic espionage effort directed from the Ottawa Embassy of the U.S.S.R. The Soviet strategy appeared from these seemingly incidental events to be clear: all-out pursuit of an atomic capability while inhibiting further U.S. development in the nuclear field.

3. Influence of Intelligence and Some Economic Limitations

America judged the Soviets would take considerable time if they were to develop atomic weapons, comparing the tremendous U.S. effort and capacity with the war-damaged Soviet industrial base and limited technology.

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[1]Kissinger, *Nuclear Weapons and Foreign Policy*, p. 262.
[2]Strikland, *Scientists in Politics*, p. 2; Lapp, *The New Priesthood*, pp. 95–100.

In the fall of 1945 an official U.S. estimate deprecated the Soviet ability to develop "trans-ocean missiles" and "B-29 type" bombers, putting that possibility beyond 1950 while at the same time it projected the likelihood of later Soviet capabilities for attack against the United States.[3] A more immediate, even imminent, Soviet attack threat was acknowledged about three years later, however, in an early NSC paper which credited the Soviet TU-4—a "B-29 type" aircraft by then operational in the Soviet Air Force—as capable of attack against the United States. Among its conclusions, NSC 20/4 saw the U.S.S.R. also to be capable "by 1955" of "serious air attacks" against the United States.[4]

An immediate defense against mid-term potentials for air attack on the United States was not needed, it appeared, although U.S. air defense thinking anticipated the future; official positions were that active defenses could be mobilized when required. There was insufficient urgency to gain support for a USAF proposal for developing an early warning system; economy came first.

In the fall of 1947, soon after establishment as a separate service, the U.S. Air Force had developed a plan for an extensive aircraft control and warning system to provide a framework for what could be a functioning air defense system. Congress failed to act on legislation required to support the proposed system. More than a year would pass before required approval of a lesser program came about. This delay resulted in expedient action in 1948 to begin work on a temporary and limited program using available World War II equipment. While U.S. policy recognized growing Soviet hostility and improving military capabilities, air defense support was limited.

Implicitly, estimates at the time demonstrated the simple fact: the United States did not know what the Soviets were doing or had decided to do about strategic force development. Nor were these estimates the evident, direct cause of specific measures for the air defense of the United States. Current concepts inclined to a strategy to:

(1) Deny enemy bases close to America,
(2) Establish good warning,
(3) Improve AAA and fighters, and for the future,
(4) Design missiles to meet long-term offensive air and missile developments.

The 1947–1948 Air Force programs to develop radar warning for the United States, however, felt the pinch of economy; U.S. active military strength also declined through continued demobilization. Overall defense support was only about four percent of the U.S. gross national product. At the same time, however, the United States began an increasing involvement in questions of European security. U.S. views of the strategic situation there were mixed, although a consensus did develop in the face of apparent Soviet aggressiveness. In contrast, from the start of the Cold War, the Soviet leadership had a clear view of strategic purpose in Europe. Various measures were fused to further the security of the Soviet state. The military and technical requirements and priorities necessary to realize that goal rated strong support. The Tupolev copy of the U.S. B-29 illustrated that fact.

The TU-4 had come along more rapidly than anticipated, only one of a number of accelerated developments to confound the United States which were achieved through Soviet programs of enforced technical effort. Derived from three U.S. B-29's which had landed in the Soviet Union in 1944, this Soviet aircraft

[3]Joint Intelligence Committee, OJCS, "Strategic Vulnerability of the U.S.S.R. to Limited Air Attack," (JIC 329), 3 November 1945.
[4] NSC 20/4, 24 November 1948.

began to appear in production numbers in 1947, one year following establishment of Long Range Aviation as part of the Soviet Air Forces. U.S. intelligence saw the TU-4 as a B-29 and, therefore, ascribed to it a comparable role. Whatever its role as actually conceived and planned by Soviet leaders, early development of this aircraft was a noteworthy technical achievement. It gave clear evidence of growing Soviet capabilities, in an operational military sense and as a development milestone. Taken together with the deliberate, known Soviet programs for the systematic exploitation of German scientists and other western technology, U.S. intelligence needs concerning Soviet military capabilities seemed to be underscored.

While U.S. intelligence saw the TU-4 as a threat to the United States, the Soviet leaders looked to their developing strike force as a means of defending the homeland, since the TU-4 and the atomic weapon would allow attack of the forward bases needed to launch strikes against the U.S.S.R. Soviet naval capabilities would help against carriers. Protection of the homeland would be carried out by active, coordinated air defense. Growth of Soviet strategic power, therefore, generated intelligence requirements which soon became more acute and difficult when the Soviet Council of Ministers tightened security laws of the U.S.S.R. by issuing in the summer of 1947, a wide-ranging list of items constituting "state secrets."

From the beginning of the Cold War, the U.S. felt an increasing need for good intelligence and information concerning Soviet capabilities and actions. This requirement grew while demobilization caused continuing reductions in military intelligence organizations. That fact and the exclusive jurisdiction given to CIA in certain collection activity made for an increased dependence on CIA. As the Soviet military threat appeared to grow while military intelligence capabilities contracted, there was a tendency to attribute to CIA blame for all inadequacies in intelligence concerning the Soviet Union.

With U.S. official diplomatic representation to Moscow increasingly isolated as the Cold War developed, the Soviet atomic explosion in August 1949 made the COMINFORM's professed intention of "defeating" the West and "crushing" the imperialist camp more ominous. The Soviet pattern of action leading up to the atomic achievement appeared to many Americans as aggressive, sinister expansionism. The Soviet/Communist post war hard line was increasingly hostile; the growth in Soviet military capabilities seemingly backed aggressive intent.

4. Increasing Focus on Europe

The United States saw Soviet aggression in Europe to be growing in likelihood and soon became a conviction. The Soviets, aware of their vulnerability and conscious of the potentials of the atomic bomb quickly sought to ensure their territorial security, looking for a safe, secure protective belt of countries to cover their Western frontier. Initially, the effort attempted to gain Communist political control in areas occupied by Soviet military forces, particularly those countries along its frontiers.

By the winter of 1946–1947, the Soviet leadership decided that the United States would use its strength to define the "capitalist" system in Europe. Specific evidence was seen in Secretary of State James Byrnes' major speech in Stuttgart in September 1946 indicating that America would help reconstruct Germany and that U.S. troops would remain in Europe. The apparent U.S. generosity in helping European recovery and the Marshall Plan's call for "positions of strength," however, seemed to the Soviets to represent a coming threat.

It would be several years later before the United States officially recognized the hostile intent of the Soviet Union and not until 1950 did the NSC declare that U.S. policy would seek openly to reduce Soviet power and influence. In contrast, Stalin quickly had judged the U.S. intent in Europe to be threatening. In

early April, 1946, Stalin told the U.S. Ambassador, Bedell Smith, that the "United States of America has definitely aligned itself against the U.S.S.R."[5]

Soviet defensive concepts built on the view that the European area was the primary source of military threat. The Marshall Plan fed Soviet suspicions of U.S. motives because Moscow feared it represented a U.S. calculation that it was cheaper to buy Europeans as soldiers than to equip American forces. This explained U.S. reasons for demobilizing and the fact that the United States had no large, standing Army. Building "positions of strength" would allow successful local wars against Socialist states while retaining the capability for major war with strategic air and naval forces.

Soviet efforts to exploit post war advantages, gained through the Allied victory, involved attempts at expansion while the West demobilized military forces and attempted to rehabilitate Western Europe. However, initial Soviet moves were not made as reactions to specific U.S. or Western threats. Unwillingness to leave Azerbaijan, violations of the Yalta Agreement in Europe, pressures on Turkey, support of Greek guerrillas, an apparent takeover of Czechoslovakia, and support of Asian revolutionary forces were obviously Soviet efforts to expand. Coupled with a continued and increasingly hard line in dealing with the Western Allies, Soviet actions were taken to be dangerous. To the Americans, therefore, the growth in Soviet military capabilities appeared to back aggressive intent.

5. Strategic Concepts

With the resulting declaration of a containment doctrine in 1947, the need for more U.S. military strength grew. Containment required U.S. military strength to back the policy and to be prepared for war if it came although the basic concept also entailed promoting the strength of allies through economic and military assistance, primarily in Europe. The form U.S. military strength should assume became a debate. Air power issues began surfacing in the Pentagon where Secretary Forrestal was urging the development of air power to take place over a span of years. In the newly created Defense Department, he looked to the JCS to provide a "strategic plan" for the military establishment to bring into better "balance" the components of that establishment.

The President's Air Policy Commission, appointed in late 1947 and headed by Thomas K. Finletter, studied air power issues based principally on economic concern for the U.S. aviation industry. The Finletter report, however, stated that security would be found only in a policy of arming the United States strongly enough to deter attack. The Commission had tried to establish the date when an enemy action might have nuclear weapons in quantity but settled on 1 January 1953 through its own judgment. Above all, the report emphasized the need for: "A counter offensive air force in being which will be so powerful that if an aggressor does attack we will be able to attack with the utmost violence."[6] This accorded with the popular view and built upon existing capabilities and the extensive U.S. experience of the war.

Concurrently, the Republican Congress had organized a "Joint Congressional Aviation Policy Board," which also examined issues involved in providing well-balanced military and naval air forces. In a March 1948 report, this Board criticized the JCS for inability to develop a unified plan for defense of the United States and claimed that the only defense against modern war "will be swift and more devastating retaliatory

[5] Smith, *Moscow Mission*, p. 40.
[6] Survival in the Air Age: Report of the President's Air Policy Commission, p. 23.

attack."[7] These reports settled little; the B-36 versus the carrier arguments were ahead. That controversy marked the first really substantive post war examination of U.S. military policy and strategy and ritualized "strategic warfare." Prestige and boasts became mixed with convictions and experience. To Americans, military opinions and proposals were fractionated and confused. The bickering about the worth of sea power versus air power, carriers versus battleships, and the strength of the Navy and the Air Force confounded them.

The core of the Air Force–Navy conflict developed over the merits of the B-36. A specific consideration concerned the capability of bombers to penetrate Soviet air defenses. Questions came up about daylight penetration capabilities, expected attrition, and B-36 vulnerability due to slow speed. Soviet jet fighter developments and guided missiles being developed were recognized to improve defensive capabilities. The consideration of Soviet air defense capabilities, however, leaned substantially on U.S. Navy and Air Force operational experience during World War II more than on hard, current intelligence concerning those capabilities. Thus, important U.S. deliberations about security policy and strategy were marked by considerable bitterness and at least some ignorance.

Soviet political objectives were supported by exploitation of immediate opportunities in the post war period. While sensitive to a basic vulnerability in light of the U.S. nuclear monopoly, U.S. capabilities evidently did not bar early Soviet attempts at expansion. The Soviet strategy sought to discourage attacks on the homeland and reflected prudence and caution. Conditioned by events in China and other parts of Asia, however, the Soviets pursued aggressive actions against the West in Central Europe before having achieved atomic capabilities and in the face of significant residual resistance and ferment in the Eastern Europe region. By 1948, hardening Western attitudes, the growth and forward deployments of the U.S. Strategic Air Command accelerated Soviet efforts for defense.

6. Domestic Political Considerations

In Washington, Congress had, since the Republican victory in 1946, pressured the Administration for economies and pledged to reduce taxes. The Truman Doctrine and economic commitments for foreign rehabilitation represented substantial, growing expenditures. New or additional expenditures were resisted. Active opponents of the containment doctrine suggested Europe go it alone with a halt to U.S. economic support or held that reduced U.S. grants should suffice to aid Europe. Some argued that Asia, rather than Europe, rated priority in terms of the U.S. political and strategic focus. This view was given currency as the founding congress of the COMINFORM in 1947 witnessed Zhdenov's call for concerted, intensified activity in Asia as a means of putting the "rear of capitalist system in jeopardy."[8]

Republicans claimed that the Democratic administration had failed to secure U.S. strategic interests in the Far East. Concentration on Europe left Asia, with its vast territories and great populations, prey to Communist expansionism. In terms of world domination, Asia offered the Communists special opportunity. They were already supporting revolutionary activity in Burma, India, Indo-China, Malaya, China, and the Philippines.

Significant reserve about official American strategy perspectives for Europe existed and were later stated by Senator Taft: "Before the Russian threat, I was very dubious about the policy of advancing money

[7] National Aviation Policy, Report of the Congressional Aviation Policy Board, pp. 7–8.
[8] Ulam, Expansion and Coexistence: The History of Soviet Foreign Policy 1917–1967.

to Europe in such large amounts . . . All of this aid has been extended to Western Europe out of all proportion to our aid to the rest of the world. . . ."[9]

Seeing America as "the citadel of the free world," Senator Taft thought that Americans should give first consideration to defense of their own country, for its destruction would mean "an end to liberty everywhere . . . ."[10]

Political considerations showed in other ways. There was a sharp contest for control of atomic development; the McMahon bill appeared to be an effort to keep it from military hands with a new all-civilian Atomic Energy Commission to control future nuclear production. With military backing, an alternative appeared in the May-Johnson bill. The provisions of the May-Johnson bill differed only slightly from the McMahon bill. There would be a powerful AEC to control all phases of atomic energy research, development, and industrial uses. Stiff penalties for unauthorized disclosure of information would be enacted and military officers could serve on the Commission. Many scientists opposed this last provision and that provision did not appear in the McMahon Act, which was passed and signed into law. That appeared to limit U.S. military intelligence on defense policy.

Thus, the nation witnessed a number of split views about security and was a direct party to an official denial to the U.S. military establishment of the authority to develop the most potent weapon known. Senator Vandenberg, leader of the bi-partisan foreign policy, who agreed to the transfer of control over atomic energy to peacetime civilian control, wrote: "I do not agree that in the present world affairs the Army and the Navy should be totally excluded from consultation when they deem national security involved."[11] Yet, the President personally was active in denying the armed forces custody over atomic weapons and representation on the AEC. Mr. Truman believed the basic post war issue about nuclear weapons was linked to control. He later wrote: "I strongly emphasized the peacetime uses of atomic energy, and for that reason I felt it should not be controlled by the military."[12]

Even in 1948, at the time of the Berlin crisis, the President rejected a request of the Secretary of Defense, James Forrestal, for custody of atomic weapons on the grounds that he did not want "to have some dashing lieutenant colonel decide when it would be proper to drop one."[13]

In the Soviet Union, the U.S. nuclear monopoly limited the capacity for action because a direct challenge to the West entailed substantial risk. To undertake the development of an atomic program in the face of domestic demands for reconstruction theoretically entailed considerable political risk, but firm controls of Stalin and the Party leadership supported and facilitated defense planning. Defense priorities could be and were determined quickly and at the top.

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[9] Taft, *A Foreign Policy for Americans*, p. 85.
[10] Ibid., pp. 74–75.
[11] Vandenberg, *The Private Papers of Senator Vandenberg*, p. 256.
[12] Truman, *Memoirs II: Years of Trial and Hope*, p. 2.
[13] Millis, *The Forrestal Diaries*, p. 458. (The issue of custody would come up again. By 1949, when the possibility of a surprise atomic attack by the Soviets was more a reality after successful detonation of an atomic device and the TU-4 became operational in the Soviet Air Force, it was argued that to be instantly ready to retaliate it was necessary for the USAF to have atomic weapons ready and to maintain continuing control over them. President Truman ruled that the AEC would keep custody. In July 1950, after the outbreak of the Korean War, a decision was made to stockpile non-nuclear components of atomic bombs in Britain and, in April 1951, President Truman decided to transfer nuclear components to the armed forces. A significant part of the inventory was not transferred until after a special committee of the NSC recommended this action in September 1952. Hewlett and Duncan, *Atomic Shield*, pp. 521, 537–539, 585.)

The American process of strategic decision making was more tortured. Prestigious committees, commissions, and boards often invested energy and attention in becoming informed on national security issues; many became sounding boards; others eventuated as conduits for skillful, partisan pleaders. While Americans looked to the Washington leadership for ways to realize peace and security in the early post war period, there was no single focal point in the government for development of coherent policies to secure the peace.

7. Decision Style

Calls for firmness with the face of early Soviet moves lacked real definition and brought little action. Only gradually did U.S. policy take shape. Containment checked demobilization however and, from 1947, U.S. military capabilities in strategic striking power improved.

The U.S. decision-making process was more structured following enactment of the National Security Act. Changes in emphasis and procedures also followed but while machinery existed for handling important national security matters, playing by ear and ad hoc arrangements seemed a regular resort.

Apart from the lack of acceptance of a credible Soviet general war threat, U.S. security policy frequently lacked "national" perspectives; lack of general agreement on fundamental defense questions and basic strategic concepts tended to fragment and inhibit the evolution of U.S. security policy. The concept of "balance"—something for everyone—and consideration for "Allies'" sensitivities complicated policy making. While the NCS was proposed as a "policy forming" body to assist the President, the lack of a single decision point for security/defense matters was notable. Within the Defense Department, internal decisions, made in the post war period or derived from earlier practice carried over in the years that followed as precedents to govern in the allocation of roles and missions done by the general realignment of the National Military Establishment. Various boards and committees examined issues and made recommendations on the basis of merit, environment, and perceived interest.

Emphasizing a limited role for the NSC, President Truman, in the period from inception of the Council in September 1947 to late June 1950, attended only 11 of 56 meetings. As the Council functioned during the period, members of the NSC inevitably began to circumvent the established structure and procedures and to submit their recommendations directly to the Council or the President. More and more recommendations come to rest in ad hoc committees.

Following explosion of a Soviet atomic device in late 1949, President Truman directed that all major national security policies be "coordinated" through the NSC and its staff and he began to attend regularly the meetings of the Council. Soon, he directed a reorganization of the staff and greatly restricted attendance at NSC meetings. While the reorganization tightened the structure and limited attendance enhanced the role of the NSC, Walter Millis stated in 1950 that in the pre–Korean War period: "The effect of NSC is not prominent: NSC no doubt considered the staff papers, debated policy and arrived at recommendations, but every glimpse we have been given of the actual policy making process . . . shows Defense, State, the Budget Bureau, the White House making independent determinations—usually on a hasty if not extemporaneous basis—which really counted."[14]

[14] Millis, op. cit., pp. 454–455. As one illustration of ad hoc arrangements, General Bradley reported details of U.S. deliberations following the 25 June 1950 invasion of South Korea during the Congressional hearings on the relief of General McArthur held the following year. General Bradley reported that the President scheduled a 7:45 PM dinner on 25 June 1950 at Blair House to which Secretaries of State and Defense, together with Secretaries of the Armed Forces, General Bradley and the Joint Chiefs of Staff and certain State Department officials were invited. There was not enough time for prior JCS meetings or conferences by the Armed

But the NSC did develop and formally considered in early years basic studies dealing with the likelihood of Soviet threats to U.S. security which influenced planning and action for the strategic air defense of the United States. Approved by the President on 24 November 1948, NSC 20/4 concluded that the gravest threat to the United States stemmed from the "hostile designs" of the Soviet Union.

In April 1950, the NSC published a basic policy statement against the backdrop of an incident over the Baltic Sea the same week when a U.S. patrol plane was shot down by Soviet fighters and the Soviet Union officially protested to the United States an alleged violation of Soviet territory by the U.S. aircraft. U.S. policy, thereafter, would seek to reduce the power and influence of the U.S.S.R. which—in the view of the Joint Chiefs of Staff expressed in the NSC paper—could, if war should occur, overrun Western Europe, attack the British Isles by air and attack selected targets in North America with atomic weapons. After setting 1954 as the "critical date" when the Soviets would possess 200 atomic bombs, NSC 68 declared: "The United States must increase . . . air and civilian defenses to deter war and to provide reasonable assurance in event of war that it could survive the first blow."

While positive in its recognition of the need for an improved U.S. air defense, the primary threat foreseen in NSC 68 was a massive ground attack against a hostage Europe. It would take the partial mobilization following the outbreak of war in Korea to provide the real impetus for an improved U.S. continental air defense.

8. *Significant Initial Air Defense Decisions*

Soviet decision making built on the proven wartime arrangements and procedures of the combined political and military leadership under Stalin. While the problem of strategic air defense was new to the Soviets, they set out to analyze and utilize experience of World War II. Systematically they examined the feasibility of various air defense measures and attempted to determine the requirements for systems.

Extrapolating from known actions early Soviet decisions concerning air defense included:

(1) Closing the technological gap;
(2) Developing and deploying an early warning and surveillance system;
(3) Developing, producing, and deploying large numbers of clear weather jet interceptors; and
(4) Developing guided missile technology.

The precise times and circumstances relating to these decisions is difficult to affirm. Some appear to be the product of a continuing momentum; some may be linked with external factors. On balance, none taken in the initial post war period appear to be specific reaction to U.S. developments.

The Soviet strategic position, preferred strategy, experience of failure and success, ambitions, and personality of different principals in the decision-making process and internal competition for resources all impinged on how decisions were made. Contrasted with the United States, the Soviet Union obviously made decisions on the basis of Moscow's perception of goals and objectives. Top level direction and authority underwrote the decisions. Actions taken were in keeping with a hard, dogmatic line and in the face of the

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Forces Policy Council. The guests included some, but not all, NSC members. "A major portion of the evening was taken in the individual, unrehearsed, and unprepared statements of the several Chiefs and Secretaries"; this appears to constitute ad hoc arrangements (cf. General Bradley, *MacArthur Hearings* Part II, p. 1049; Ibid., Part IV, p. 2580).

U.S. nuclear monopoly at the beginning of the post war period. The U.S. monopoly did not impel Soviet air defense measures but may have emphasized their importance.

While the Soviet Union reduced and reorganized its Armed Forces and watched a growing "capitalist encirclement," actions were put in motion to have ready a balanced, integrated operational air defense force. Steps to this end were gradual, but accelerated in the late 1940's. With the Korean War, the Soviets made an increased commitment to the air defense of the homeland.

U.S. decisions for post war air defense were substantially influenced by the recommendations of the Patch and Simpson Boards which brought about a general reorganization of the Army in early 1946 and realigned research and development and procurement functions. Both boards also gave attention to an Army Air Force proposal that a large antiaircraft artillery component (118,610 personnel) be established in the post war Air Force. (See Appendix A for details of similar AAF proposals during World War II.) The Patch Board recommended the several artilleries—Coast, Field, Antiaircraft—be combined under the Army Ground Forces believing that transfer to the Air Force of AAA would have the Army/OSE AAA fire support useful against ground targets.[15] The Simpson Board treated the transfer question in more detail, stating:

(a) The Air Force is charged with the mission of air defense and will require antiaircraft artillery under its command to carry out this mission. However, the Board believes that for the immediate future, at least, antiaircraft artillery can be trained with and attached to Air Force units from time to time in order that the necessary coordination can be developed to enable the Air Force to carry out its mission of air defense.

(b) The Board also considered the enormous task the Air Force will have in carrying out the many additional duties that will devolve upon it when it becomes a separate Service. It is doubtful if the organization and training of antiaircraft units should be added to these new duties at present. At a later date when we have a Single Department of the Armed Forces, it may be found desirable to organize a common Antiaircraft Artillery Arm to serve the air, land and sea forces.

(c) The Board further believes that to transfer the antiaircraft artillery to the Air Forces because some of it is needed to operate with fighter aircraft in air defense would, in effect, constitute an admission that every Service must be completely self-contained. This is contrary to the best principles of organization.

(d) In view of the above, the Board believes that the recommendation of the Patch Board is sound and that the Antiaircraft Artillery should not be transferred to the Army Air Forces at present.[16]

The issue of control of AAA, then internal to the Army, would continue as a factor in the basic roles and missions allocation to occur as part of the realignment of the National Military Establishment under the National Security Set of 1947. A decision on the issue would establish a precedent, however, to guide or govern that later role and mission allocation.

The War Department, in early 1946, assigned responsibility for Continental defense to the Commanding General, Army Ground Forces. Following reaction by the Army Air Forces, the War Department published Circular 138 in May 1946 specifying that the recently established Air Defense Command of the Army Air Force would provide for the air defense of the United States.

In June 1946, AAF staff and the "Air Board"—a group of distinguished civilians, retired Air Force generals, principal Air Force commanders, and including the Commanding General, AAF—met in Washington

[15] War Department, "Reorganization of the War Department," Lieutenant General Patch.
[16] War Department, "Report of Board of Officers on Organization of the War Department," Lieutenant General W. H. Simpson, President.

to consider the antiaircraft question as developed by the Simpson Board. As a result, the AAF formulated ten proposals for presentation to the War Department which substantively urged integration of AAA into the Air Force. This elicited a reaction from the AGF and General Devers soon sent General Spaatz a study, "Security from Enemy Action," which took the basic position that defense against air attack by AA guns, within their range, was a ground force responsibility. In September 1946, the War Department decided that the AAF would control AA units with an operational air defense mission while AGF would provide technical training to AA units.

These judgments reflected World War II experiences and built upon retrospect. References to "assigned missions" and "unity of command" were frequent. Although some appreciation for the potential growth and importance of AAA was evident in the AAF position, its central concern was to control AAA to avoid the hazard of possible friendly fire against aircraft. A particular problem was identification.

The AAF believed the problem was insoluble. Positive identification was required more than ever. Visual identification was impracticable at greater ranges and generally unreliable. No system had been devised to assure positive identification. Since various elements of the Army were then engaged in development of guided missiles for air defense, the likelihood was that the greater ranges of such weapons and the increasing speed of aircraft and missiles would further complicate the identification problem.

B. Systems Developments

1. Unilateral Efforts, Service Concepts, and Continuing Momentum in a Context of Challenge and Change

During the initial post war period, U.S. air defense system developments progressed in various stages and at differing paces. There was no agreed master plan specifically to guide development of new air defense systems by the services (primarily Army and Air Force) to meet scheduled, required dates for having operational air defense capabilities deployed, manned, and ready.

The essence of most of the high-level plans and policy papers which addressed "requirements" for U.S. air defense was to point up a year of need when a significant threshold for Soviet atomic capabilities was expected. Implicitly, this indicated when U.S. forces and programs should be ready to help face that eventuality. NSC 68, the first comprehensive statement of a U.S. national strategy since the formation of the NSC, called for a great U.S. military build-up in the hopes of averting an all-out war with the Soviet Union. Prepared subsequent to the Soviet atomic explosion of 1949 and following the bitter debates about Service roles and missions and the U.S. H-bomb program, it appeared to confirm the U.S. strategy of retaliation. President Truman, however, had not approved the NSC 68 policy statement when Korean hostilities began and U.S. programs for air defense development continued on the basis of earlier, essentially unilateral, Service planning.

The debate preceding the H-bomb decision appears significant to historical consideration of air defense systems developments because strong support for a thermonuclear program gradually increased among the military services and, by bringing them together on that issue, not only helped to unify military concepts on strategic bombing but brought them in concert with the thinking of Secretary of Defense Louis Johnson who took a strong stand on the issue. At the same time, it appeared to put some distance between the military family and prominent, previously unchallenged political and scientific opinion which had become so significant in national security questions concerning the Soviet Union. That stand

was in step with American public opinion and the Congress, restive and apprehensive over the early Soviet atomic success and communist espionage, and apparently ill-disposed toward a proposal to delay further U.S. nuclear research.

Scientific advice on the H-bomb issue was split and, in the State Department, a strong difference of opinion existed between George Kennan, head of Policy Planning, and Paul Nitze who replaced him and who headed the joint ad-hoc State-Defense study group which developed the paper later designated NSC 68.[17] Kennan, the premier U.S. political expert on the Soviet Union, opposed the H-bomb because it could not conceivably have a purely military employment. He believed that current U.S. programs were sufficient to deter the Soviets. He regarded Soviet atomic attack on the United States as unlikely and impractical.[18]

Scientific opinion post war on any military development was significant. Prominent scientists like Vannevar Bush and Robert Oppenheimer, by their wartime roles and well-established reputations, became increasingly important because their views on military programs had consequences for other fields of military development. Vannevar Bush left a record of opposition to new missile ventures and as early as December 1945 he testified before a Congressional Committee that he considered a 3,000 mile missile "impossible" because, he added, "technically I don't think anybody in the world knows how to do such a thing. We can leave that out of our thinking."[19]A statement of that kind had to have effect on any concept for an antimissile development.

Bush didn't believe Soviet science and technology were to be feared because scientific progress depended upon political freedom. Reacting to questions about German development of the V-2 he asked if it had paid off and then answered that from a "strict damage and cost basis the answer is no."[20] Bush mocked military opinion on weapon developments and emphasized their great problems and costs.[21] Military experience did not provide senior officers who had significant influence with an authoritative basis for challenge of such views. General Eisenhower had said of the V-2 that, "if the Germans had succeeded in perfecting and using these new weapons six months earlier than he did, our invasion of Europe would have proved exceedingly difficult, perhaps impossible."[22] Discounting weapons on the basis of cost, despite risks, appeared easy at a time when economy was a watch word. Besides, other influential senior military officers, with significant credentials, provided apparently confirming predictions. General W. Bedell Smith, U.S. Ambassador at Moscow, later Director of Central Intelligence and Under Secretary of State, told Secretary Forrestal in July 1948 that the Soviets did not, in his opinion, have the industrial competence to develop the atomic bomb in quantity for five or even ten years.[23] General Leslie R. Groves, who supervised the Manhattan Project and

[17] Acheson, *Present at the Creation*, pp. 346–347.
[18] Futrell, op. cit., p. 221.
[19] U.S. Senate, Inquiry Into Satellite and Missile Programs, p. 823.
[20] Bush, *Modern Arms and Free Men*, pp. 203–210.
[21] Ibid. (Bush maintained that long-range missiles had no foreseeable future in war; jibing the military and their concepts he said: "We are decidedly interested in the question of whether there are soon to be high-trajectory guided missiles of this sort spanning thousands of miles and precisely hitting chosen targets. The question is particularly pertinent because some eminent military men, exhilarated perhaps by a short immersion in matters scientific, have publicly assented that there are. We have been regaled by scary articles, complete with maps and diagrams, implying that soon we are thus all to be exterminated or that we are to employ these devices to exterminate someone else. We even have the exposition of missiles fired so fast that they leave the earth and proceed about it indefinitely as satellites, like the moon, for some vaguely specified military purpose." Bush then went on to point out the great problems and costs involved in making intercontinental rockets.)
[22] Eisenhower, *Crusade in Europe*, p. 294.
[23] Futrell, op. cit., p. 222.

who knew the enormous problems of producing an atomic bomb, reportedly advised the U.S. Government that "the Soviets would need fifteen or twenty years to build the atomic bomb."[24]

How important scientific views like those Vannevar Bush advanced in the post war period cannot be stated precisely. There seems to be little question that his attitude made missiles and rockets look ridiculous to U.S. senior officials. When proposals for large missile programs went the route required for approval and authorization, the words and thoughts of scientific opinion—like Bush's—would be in the minds of various senior officials, particularly budget officials. Oppenheimer, as Chairman of the General Advisory Committee of the AEC, opposed the H-bomb and, during the four years after the war, led its opponents in advancing the case against its development largely on moral grounds.

These scientists had similar views of the world, the same belief in the dominance of American science, and shared a basic reluctance to promote significant new programs for military application. Bush felt the Communists could not advance science effectively. America would dominate the Soviet Union technologically; because it was free, the United States had little to fear from Soviet technology. Oppenheimer thought America should lead by example; since American science was so respected its actions would determine whether any nation would develop the H-bomb. Oppenheimer and Bush both thought America would lead and then Soviets would follow. Both opposed expensive new projects. In opposing military application of nuclear power and missiles, each would question technical feasibility and implied that all that was needed for war had already been developed.

Such perspectives had helped give rise to a national perspective that the Soviets were behind the United States in weapons technology. For five years after the war relatively little was done in the nuclear and missile fields even as the movement to link these weapons was under way, which would strip away America's traditional protection and leave the nation open to the threat of instant destruction. Those years were being used by the Soviets to close the technological gap. Not only did they develop their own technology but they also engaged in a major intelligence effort to gather technical and industrial know-how from the West. From individual agents to local native communists and direct open purchase, the Soviets gathered and exploited technical literature published in the West. By the fall of 1946, German missile components and a variety of test equipment were sent to the U.S.S.R. and German scientists worked there for about five years thereafter. By early 1947, a high-level coordinating group monitored Soviet missile developments and separate design teams began work on various missile projects, starting from German technology. While U.S. programs were opposed on various grounds, the Soviets were driving ahead in development of various projects having military application, including a high-priority effort for air defense, directed and supported by the top Soviet leadership. The technological gap which existed in 1945 vanished in some critical areas within a relatively few years. The myth of American scientific technical omniscience continued.

2. Air Defense Systems Components

a. Command and Control

Budgetary constraints, limited forces, and split views on roles and missions constrained effective arrangements for a centralized, unified U.S. air defense while the Soviets moved to develop an integrated organization built initially on the existing territorial jurisdiction and assigned responsibility of military

[24] Shepley and Blair, "The Hydrogen Bomb," p. 13.

district commanders for security of the Soviet state using available capabilities. By 1947 the concept of an integrated, national air defense organization emerged and an ordered progression to realize it begun.

b. Early Warning and GCI

Against the backdrop of directed economies, USAF planning for early warning generated a substantial program Supremacy, which was rejected in favor of a more limited eventual system. By the time of Korea, Lashup—an effort which began in late 1948—had 44 radar stations in operation. Stations were undermanned, personnel lacked training, and repair and maintenance were difficult. This stop-gap system later would be replaced by a 75-station, permanent net authorized by Congress and approved by the President in 1949.

Financial limitations affected the radar system development; in addition, however, priorities for SAC and the concept that attack would come over the polar area were great influences on this development. In turn, the Pearl Harbor investigation provided a compelling lesson not to be caught again by surprise air attack and that lesson impressed itself on Air Force commanders who had air defense responsibilities. The initial post war civil defense studies anticipating surprise attack against the United States also appear as significant influences on early warning developments. (The U.S. Civil Defense planning actions of the first five years represented a systematic and progressive development which culminated in the Federal Civil Defense Act of 1950 and the activation of a civil defense operating administration. The Act came into law in the crisis situation of the Korean War, however, and under the circumstances of the recent bitter debate about a U.S. thermonuclear program. As a result, it developed as an expedient, lacked substantial Federal fiscal support, and put responsibility for civil defense to State and local levels of government.)

The Soviets quickly recognized their technological lag in radar as early as 1945 when they obtained through lend-lease the U.S. SCR-584 and, through wartime aid from the United States and Britain, gained a ready base of radar technology. Based upon that and in recognition of their wartime experience and other operations (surprise attack and V-2 rockets) they quickly determined a need for effective early warning. Before 1950, they developed and fielded a Soviet-produced acquisition radar—Dumbo—and followed that soon thereafter with a product of native design, Token, which quickly spread across the country in the early 1950's.

c. Interceptor Development

At the end of the war, a U.S. decision to produce a jet interceptor resulted in the F-89. Decided on in August 1945, and originally envisaged as a propeller-driven aircraft—not because of a lack of appreciation of jet technology or budget constraints—the effort looked for a quick and reliable development. Most manufacturers' designs proposed jet-powered planes. A jet design became acceptable to the Air Force when some of the manufacturers' proposals were recognized as providing the desired, specified characteristics more easily through a jet-powered aircraft.

Appearance of the Soviet TU-4, however, found the United States facing a new threat. This tended to intensify U.S. concern for air defense but did not directly affect U.S. interceptor development. Operational deployments of available fighter capabilities stepped up. These tactical fighters served as interceptors for several years thereafter. Soon a replacement for the P-61 became critical and the T-33 was programmed for conversion to the F-94 largely because of crippling difficulty with the desired all-weather aircraft, the F-89. Concurrently, in order to have all-weather aircraft, the Air Force programmed a rapid conversion of the F-86.

Soviet aircraft development in the immediate post war period quickly sought a jet fighter responsive to Stalin's reported injunction to the Soviet aircraft industry to build aircraft that would fly higher, faster and further than any in the world. With a high priority, three or four competing programs were established to meet interceptor requirements. Stalin personally was interested and, twenty months after the first Soviet jet fighters, the MiG-15 was displayed and quickly put into production. It is noteworthy that this decision took place soon after the establishment of a national air defense component in 1948.

The context of Soviet immediate post war interceptor development indicates that the aircraft were not specifically designed against the early U.S. bomber threat. The prime impression of the development effort is that it appears to have been viewed as a technological competition with foreign fighters.

d. Surface-to-Air Missiles

Development of the Army's Nike family began in 1945, weathering reductions from an overall missile funding cut the following year and a more limited budget in 1947 and maintaining steady progress thereafter. By March 1950, the Nike development was projected to become an operational weapon system and received continued support after the Korean War.

Three months later, the product of two long-standing feasibility study projects were brought together to define the characteristics of another, but long-range air defense missile or pilotless interceptor for the Air Force, which was dubbed Bomarc.

The service rivalries over air defense missiles during the period concerned roles and missions and centered primarily on operational capabilities. As a jurisdictional question, the disputes over roles and missions impacted only obliquely on these technical developments.

German scientists and technicians assisted the Soviets in their early SAM developments. By the fall of 1946 Germans were engaged in missile projects which by 1948 included the conduct of electronic experiments for development of the guidance subsystem of what eventuated as the SA-1 weapon system.[25] By November 1950, they were tasked to develop the guidance system for the SA-1.[26] Available information makes it appear that this system was the principal air defense missile weapon under development at the time. As developed—with a capacity for simultaneous engagement of significant numbers of aircraft—and later deployed at Moscow, it was intended to counter large, massed bomber raids comparable to World War II operational activity. It is not evident that it was designed to counter any specific U.S. aircraft threat.

e. Ballistic Missile Defense

In the United States (and, inferred from available evidence, also in the Soviet Union) there was a recognition in the immediate post war period that the war had uncovered the remarkable demonstration of the nuclear weapon and a long-range missile. Their appearance and potentials would require consideration of possible defensive measures. This engendered a number of studies following the war, but these efforts must be characterized as early research. Their results inclined to the view that practical steps to develop defenses against missiles would have to await significant advances in various technologies. As one seeming contrast, however, it is noteworthy that in the Soviet Union, Stalin and Malenkov are

[25] DIA-ST-CS-14-1-68-INT, "Soviet SA-1 SAM Systems."
[26] Ibid.

reported personally to have encouraged the development of long-range, intercontinental missiles soon after the war. This stands apart from the perspective of a principal U.S. scientific advisor, Vannevar Bush, at about the same time.

f. Summary

Postwar, both the U.S. and U.S.S.R. faced challenges for national air and missile defense. These challenges were both technical and strategic. The basic technical requirements were driven largely by the demonstrated or potential advances in offensive capabilities, both air and missile.

Each nation recognized and responded to the challenge and quickly put in motion new weapon system developments for defense. Neither acted on the basis of a "master" air defense plan nor to generate a specific counter to the other's offensive capabilities or developments, during the initial post war period. Nonetheless, threat assessments, on a worst-case basis, conditioned by World War II thinking and experience, were reflected by later operational deployments.

Soviet judgments and actions regarding national air defense requirements were conditioned by and coordinated with integrated political military strategy. Soviet actions show an early, high-level commitment to strategic air defense measures and the establishment of an organization to protect the homeland. Based upon the record, there was a priority and willing support given to post war air defense in the U.S.S.R. A variety of difficulties and problems developed and substantial resources were required.

Before the successful Soviet atomic test, the United States saw no early and credible threat to the security of the continental United States. Initial organizing steps and developmental activities were faced with disparate, competing demands and proposals, budgetary constraints, limited resources, and considerable inertia. Air defense concepts at the time included an acceptance of the strategic realities existing in the U.S. nuclear monopoly and the proven American capacity for strategic bombardment. Active air defense would rely on mobilization of reserve and National Guard units and there would be time enough to recognize the need for their call to active service.

C. Factors Influencing Development and Deployment, 1950–1955

The Korean War permitted U.S. military strength to be rebuilt, neither exclusively nor primarily to fight in the Far East theater but to counter the growing threat, visualized by NSC 68 earlier in 1950, of increased Soviet strength and to build the mobilization base in the United States in readiness for a possible general war. In Washington in the fall and winter of 1950–1951, U.S. leaders seriously feared the war in Korea was a Soviet ruse, designed to cause U.S. forces to be committed to what General Bradley, Chairman of the Joint Chiefs of Staff, called "the wrong war in the wrong place," while the Soviets attacked in Europe. The JCS thought war in Europe was close.

In the period of the Korean War, a basic debate took hold in America arguing the choices of "containment" versus "liberation"—holding the line against further Communist expansion or attempting to roll back the extensive Soviet controls in Europe. In Europe and America at the time there was growing talk and action to set up a multi-national force (EDF) under a European Defense Community. Indications pointed to the likelihood that a West German force would be included in the EDF or become part of the NATO forces. Together with the rapid expansion and deployments of U.S. armed forces to the European area as well as to the Far East, these developments appeared to confirm prior Soviet perspectives on

U.S. motives in Europe, i.e., the real purpose of the U.S. rehabilitation effort was to develop military forces in order to threaten the U.S.S.R. From a meeting of Soviet and East European foreign ministers at Prague in 1950 there came a combined proposal to forbid German militarization while holding out a prospect for a unified Germany. Soviet moves seemed apprehensive. "Capitalist encirclement" seemed to be a reality.

Air defense requirements became larger as Western air offensive capabilities to threaten the U.S.S.R. grew. SAC had begun a regular system in 1948 to rotate bomber groups to England, Germany, and the Far East. Following the Korean War, a crash program to develop overseas bomber bases lengthened runways in England and Guam; opened French Moroccan bases in 1951; and in 1954, SAC aircraft began basing in Spain. Air refueling techniques pre-dated Korea but when the KC97 (tanker) fleet became operational in late 1951 the B-47s that were deploying that year became more significant pending the arrival of the B-52 on the operational scene in 1955.

Apart from those physical realities, the U.S. leadership confronted the issues of the on-going war against the backdrop of a rising concern about the 1952 general election. "Roll-back" advocates saw a significant shift in U.S. policy in 1951 because up until that time American post war support of Western Europe had emphasized economic rehabilitation. In the Mutual Security Act of 1951, that emphasis shifted to military aid. (Included in the Act was a provision authorizing $100 million to the President, whenever he deemed it to be in the U.S. national interest, to form military units of escaped Iron Curtain nationals or "for other purposes"; this provision immediately demonstrated Soviet sensitivities to possible subversive action or increased overt resistance in Eastern Europe. Vishinsky berated the U.S. motives and action in developing the Act at the U.N. General Assembly meeting in Paris in December 1951, two months after the Act became law. For several years thereafter this provision of the MSA of 1951—PL165, 82nd Congress—known as the Kersten Amendment, caused the Soviets to condemn U.S. intentions in various international forums and in their propaganda.)

To the Soviets it appeared easy to find confirmation of their worst fears. A long-standing belief seemed validated; militarists dominated the U.S. leadership—from Clay in Germany; Bedell Smith in Moscow; CIA and the State Department; Marshall in China, Defense, and State; MacArthur in Japan and later a Presidential hopeful; to Eisenhower in NATO and later the President. A genuine Soviet apprehensiveness may have caused fear that extremists were gaining power in America. This may have been a basis for Stalin's 1952 call for peaceful coexistence. The Soviets obviously were sensitive to U.S. aircraft operating near the homeland; in addition to the violent reaction in the Baltic in April 1950, a U.S. Navy aircraft was shot down in November 1951 and within two weeks, Soviet fighters forced a USAF C-47 to land in Hungary.

Following Stalin's death in 1953, Moscow surely had reason to be concerned about possible Western efforts to exploit political realignment in the transition. The basic vulnerability of the Soviet Union was especially great if, lacking a definite, secure Soviet hierarchy, the conditions giving rise to the Berlin riots of June 1953 and concurrent unrest in Poland and Czechoslovakia, were exploited by the U.S. "roll-back" extremists. What if that were coupled with air strikes against the U.S.S.R. on the theory that the advantageous time for an attack on the Soviet Union would be when the Kremlin leadership was disorganized? By this time, U.S. naval aviation, including nuclear strike aircraft, had been based in the Mediterranean region about two years and Soviet air defense now faced various air threats.

1. Air Defense Requirements and Related Actions

U.S. continental air defense began to grow with the mobilization effort of the Korean War. The pattern of action was erratic and moved forward primarily because of the war. Based upon an initial ADC plan of 1949, 37 vital industrial areas required defenses. In March 1950, a revised plan called for defense of 60 "critical" localities; 23 would be provided AAA defenses—3 atomic energy installations, 7 SAC bases, and 13 urban industrial centers. Sixty-six AAA battalions were required for this plan. At the time, 15 AAA battalions were available for continental air defense. Forty-four radar stations of the Lashup net were completed and operational but limited by use of World War II equipment. Nonetheless, some operational capability existed and, in April 1950, armed intercept of hostile aircraft was authorized in certain areas of the United States.

In the following year, the air defense system continued its gradual build-up, but the component elements faced difficulty. There was competition for priorities; the Air Force, as a service, faced the formidable tasks of building up SAC, fighting the war in Korea, and meeting the demands for tactical air forces to serve with augmented army forces in Europe. The Army devoted a fraction of its resources to continental air defense being heavily burdened by global commitments. Thus, calls for increased air defense by various congressional leaders in the Korean War period were generally unrealistic because they looked for immediately ready forces even though they were qualified by the caveat "as soon as possible."

When they surveyed national requirements and capabilities in 1951, the Joint Chiefs of Staff were evidently impressed by the growth of Soviet air capabilities as compared with those of the United States. The notion that the U.S. could easily and cheaply achieve qualitative and technical superiority over a backward enemy was dispelled by the MiG-15 in Korea.[27] The Air Force pointed out that the Soviet Union had engaged in an accelerated development program and emphasized the rapid conversion of its sizeable air forces to jets. General Twining reportedly stated that the Soviets had several hundred TU-4s available, and the fact of a rapid growth in radars and AAA defenses in the Soviet Union was noted.

Following a long review, the JCS recognized the air defense mission of the Air Force to be an essential "D-Day task." Giving it high priority, the JCS then said: "We place such high priority on this task because we know that our continental air defense system . . . could not stop all the bombers that might be sent against us hence, our long range atomic counterattack against enemy air forces must of necessity provide the principal means of our air defense of American cities and centers of production."[28]

The JCS thus recommended to the Secretary of Defense in the fall of 1951 that the Air Force structure be increased from 95 to 143 wings. President Truman approved the increase and provided the authorization for the Air Force to reach that level, not through FY 1953, but, as suggested by his economic advisors, in the FY 1954 budget. Thus, the target date would be 30 June 1955 and, under the FY 1953 and proposed FY 1954 budgets, the Air Force received substantially greater support than the Army and Navy. With the new Administration, Secretary of Defense Charles Wilson moved to change the FY 1954 budget, taking $5.0 billion from the Air Force, $1.7 billion from the Navy, and increasing the Army's share by $1.5 billion.

Wilson was trying to narrow the Korean War mobilization base. He questioned the basis for planning requirements and the practice of aiming at a "critical" date chosen more by guess than by knowledge when

[27] Futrell, op. cit., p. 295.
[28] Ibid., p. 296.

the Soviet threat supposedly would reach its peak. He asked proponents of a "counterattack" bombing strategy concerning:

(1) The need for a full intercontinental bomber force as well as full system of overseas bases to use for medium bombers and short-range aircraft;
(2) The need for so many bombers if three of them could carry the force of destruction it took 2,700 aircraft to lift for support of the St. Lo breakout in World War II;
(3) The need for 143 wings; he asked, if that total was irreducible, why was it when the number of aircraft per group had doubled since the concept and need for 143 wings developed.

Change was under way in the Defense Department. Both the Munitions Board and the Research and Development Board were abolished and more responsibility became vested in the Secretary of Defense, who sought to return the Joint Chiefs of Staff to "strategic planning." Appointment of Admiral Radford as the Chairman alarmed the Air Force, who recalled his prominent role in the B-36 controversy. The Air Force resisted the move to cut back the 143 wings, arguing against the concept of "balanced" forces. The question involved priorities. At issue was the minimum level of "air atomic" power needed to provide a *large margin of superiority* over the Soviets. That issue impacted air defense planning because other pressure had been building to improve continental air defense. The Air Force, responsible for air defense, argued for SAC to have an overwhelming force-in-being.

2. The Summer Study Group—Other Air Defense Views

In the summer of 1952 a group of scientists came together informally in Cambridge, Massachusetts, to discuss civil and military defenses. They were entirely an unsponsored and unofficial group, later known collectively as the Summer Study Group. They wrote a report based on their deliberations that concluded:

(1) The Soviet Union would be capable of crippling the United States by a surprise attack in two or three years by long-range bombers carrying atomic weapons;
(2) U.S. in-being and planned military and civil defenses were inadequate and capable of achieving no more than a 20 percent kill rate; and
(3) Foreseeable new technology (specifically "forward scatter" radar) would make it feasible to develop an air defense system capable of achieving a kill rate over enemy attackers of 60 percent to 70 percent.

They recommended establishing a distant early warning radar line across Canada to provide three to six hours of warning of approaching jet aircraft and establishment of a northward defense in depth. They also recommended a communications system capable of rapid transmission of air defense data through the use of automatic and integrated equipment, as well as new and improved interceptors, and the development of homing missiles for interception and destruction of enemy aircraft. Much of the technology involved in the new developments they visualized was still in the experimental stages, but the scientists had great faith in their ability to provide the hardware they anticipated. At first they estimated about a half-billion dollars to be required; later their estimate approximated $20 billion for the total project, including the computerized air direction centers. The group recommended an all-out effort to be ready by 1954.[29]

[29] Lapp and Alsop, "We Can Smash the Red A-Bombers," *Saturday Evening Post* (21 Mar 1953), p. 19.

The Air Force was not very receptive to the Summer Study Group report. Although the Air Force had responsibility for air defense among a number of missions, the leadership of the Air Force was unenthusiastic over the commitment of the several billion dollars required to fund the recommended developments, particularly in the light of the JCS action the year before. Soon, however, a great deal of public attention was given to the matter.

The scientists took their case to the American public by giving their report to the Alsop brothers—reporters and columnists with large reader followings. Articles appeared in the *Saturday Evening Post* and in syndicated newspaper columns telling the American people that American scientists had the answers to improving the inadequate U.S. active air defenses, and ". . . there is a way for us to be sure of destroying 85 percent—even 95 percent—of the attacking force, say the scientists."[30] The scientists did not rely on "leaks" to the public media alone, but by-passed the Air Force and Department of Defense and got their report to Jack Gorrie, Chairman of the National Security Resources Board. Gorrie introduced the report to the NSC with a strong recommendation for immediate construction of an Arctic warning line at a cost of $1 billion during the first three or four years. The Truman Administration deferred the question by a continuing study of air defense requirements. Secretary of Defense Lovett appointed a civilian committee, chaired by the President of the Bell Telephone Laboratories, Mervin Kelly, to study the air defense problem. The committee's findings would not fall due until the new Eisenhower Administration took office. Similarly, another legacy for the new administration, NSC 141, analyzed the implications of the Soviet development of the atomic bomb and included recommendations for more intensive efforts in air defense and civil defense.

The Truman Administration's bequests confronted the new administration with decision requirements for significant improvements (and expenditures) for continental defense, and indicated that the study of the Summer Study Group recommendations was under way.

Thus, the Eisenhower Administration quickly faced the problem of carrying out its campaign promises for reduced military spending aware that continental defenses had carried a low priority and needed extensive renovation to become effective. Another study group, composed of business executives, educators, and assorted labor leaders, publishers, lawyers, and one military officer, was appointed by the new Administration to study air defense from a civilian or "business" viewpoint. They recommended a policy of not rushing action on the air defense recommendations of the Summer Study Group, and did little to solve the President's dilemma.

The Kelly Committee reported in May 1953, and it too rejected the urgency of the Summer Study Group report, while recognizing the need for an improved continental air defense. The Kelly report stressed the need for a powerful SAC to deter attack and deplored the publicity promoting the scientists' misleading claims of capabilities for devising a more effective air defense system.

The Administration appointed yet another air defense study group, this time drawn from within the government, and chaired by President Eisenhower's war-time chief of operations in Europe, Major General "Pinky" Bull. General Bull had given his name to a study report on civil defense in 1948, and was a proven, skilled investigator. In July 1953, General Bull's study group reported in favor of spending $18 to $27 billion on U.S. air defense over the next five years. Another study group analyzing Soviet air-atomic capabilities also reported to the NSC favoring large expenditures on continental defense. The NSC noted the reports

[30] Futrell, op. cit., p. 303.

but continued its study of a strategy appropriate for the Eisenhower Administration, to be based on the need for a new balance between military and domestic demands.

3. Soviet Perspectives After Stalin

While the Eisenhower Administration's "New Look" strategy was developing, the Soviet leadership was assessing the growth in U.S. military might. The *overt manifestations of policy* under Malenkov appeared to indicate that the Soviet policy of aggressive expansionism would be replaced and Soviet energies given over to developing agricultural and consumer goods. Military requirements remained a reality because of obvious growth in U.S. capabilities and the strong anticommunist line in the West under the U.S. lead. There was distrust; Soviet initiatives about Germany had elicited little Western reaction.

The Soviets had reason to be pleased with their progress in weapons technology. The U.S. nuclear monopoly, which had radically altered the international balance of power, no longer existed; there was progress in the thermonuclear field; and, in missiles, the Soviet arsenal had an edge over the United States and was far advanced over those in Western Europe. Soviet scientists and engineers had developed anything they had been asked to do in the post war period. Approximately two years before the United States decided to undertake an intercontinental missile development program, the Soviet political leadership made the bold decision to build an intercontinental missile. Taken at a time when Soviet policy appeared to be in flux over basic questions of guns or butter, that decision appears remarkable. It represented a giant leap into the unknown; failure could be very costly. But the Soviets were willing to take the risks and gamble on a vision of a possible pay-off. To do so while many problems of Soviet security remained makes that decision seem daring. Apart from NATO's growing strength, the tasks of providing active air defense for the homeland remained to be solved. In this light, the ICBM decision provides a basis for the judgment that the relative effectiveness—and projected, planned development—of the Soviet air defense system was acceptable and proceeding in step with priorities desired and prescribed by the Soviet leadership. Apparently the Kremlin was satisfied.

By 1953, initial post war early warning had been strengthened by wide-scale deployment of the Token radar, a Soviet V-beam equipment inspired by the U.S. AN/CPS-6 V-beam set. This directly complemented the growth of jet fighters as the dominant and most significant part of the Soviet air defense forces. Soviet radars provided warning and made the fighter more effective by facilitating intercept. Later in the decade, a large-scale deployment of surface-to-air missiles would make ground systems the backbone of the PVO. In 1953, their development programs were already actively under way. Initial systems tests of the SA-1 took place in late 1952 and construction began in the Moscow area for the operational deployment of this system to begin by 1954. The SA-2 system began development in 1951.[31] At the same time, the Soviets had developed, produced, and deployed in the post war period two new AAA gun systems and new fire control systems including associated radars. Another, heavy gun system was being developed at the time and would be deployed by 1955. Development, production, and deployment of various jet aircraft, bombers, and fighters had already impressed the West and, while the post-Stalin policy review was going on a medium jet bomber, the TU-16 Badger became operational and the MiG-19, an initial, somewhat limited all-weather interceptor, was deployed with Soviet air defense units.

[31] DIA-ST-CS-14-02-70, "Soviet SA-2 Surface-to-Air Missile System," p. 163.

A sweeping reorganization of Soviet industry took place in 1953 and a number of separate production ministries amalgamated into four large "super" ministries to cover overall defense needs. Concurrently, the strength of Soviet armed forces had grown; a new division structure was introduced to give line divisions of the Soviet army increased, improved armor, artillery, mobility, and communications; and improved tactical air defense of the reorganized field forces introduced as part of a general modernization program.

4. Evolution of the "New Look"—NSC 162

A particular concern for U.S. planning, however, was the development of an extensive, sophisticated Soviet long-range bomber force. In 1954 and again in 1955, the Soviets put on an impressive show of aircraft in a Moscow fly-by. Demonstrating new aircraft in 1954 which appeared in considerable numbers in the show put on the following year suggested a three-year lead time advantage for the Soviet Union in development and production of a heavy jet bomber. While this factor was significant in U.S. decisions concerning air defense, principal immediate results were decisions for stepped up B-52 production and development of a U.S. ICBM. These appeared to reflect a changed U.S. judgment about Soviet technological capabilities. In October 1955 the NSC recommended the highest national priority be given to ICBM development and, by December, President Eisenhower had assigned highest priorities to the Atlas and Titan and Jupiter and Thor programs.

Soviet achievements, real or estimated, also impacted on Mr. Wilson's hope of getting away from "crisis" reactions aimed at a critical future date based upon essentially limited knowledge of growing Soviet military capabilities. U.S. rhetoric in the arguments over "containment" versus "liberation" had helped to develop general images of the Soviets and induced certain fears of them through concepts of a "tide of communism" that would "roll on" because of the diabolically clever apparatus of Soviet communism. Since the Communists had demonstrated aggressive expansionism and proved to be an open, difficult enemy in the Korean War, they had become literally, in the American mind-set, "the forces of aggression," and there was a need to be able to retaliate against their moves everywhere. In truth, in perceptions and in weapons systems, a firm foundation for a "strategic interaction" dialogue had been laid by the end of the Korean War.

Soon after the Soviet explosion of a thermonuclear device in August 1953, the National Security Council embodied the "New Look" strategy in NSC 162. Approved by the President in October 1953, the paper identified the threat by the Soviet Union as being "total," gave the Soviet Union the capability of making a nuclear air attack against the United States, concluded that national defense must have the highest priority in national strategy, and recommended that almost all the recommendations made by the Summer Study Group be approved. In effect, the American scientists, with an assist from the Soviet Union, won over the vast majority of the influential members of the new Eisenhower Administration who were primarily economy minded and pro strategic air power. In early 1954, the American and Canadian governments agreed to proceed with the development of the Distant Early Warning (DEW) Line in northern Canada and Alaska. The first construction on the DEW Line began in 1955, together with other measures to improve the air defense of the North American continent.

These developments together with the start of Nike deployments underscored the need for a joint, unified command for U.S. air defense. In 1954 the Joint Chiefs of Staff approved forming a joint command for the air defense of North America. The Continental Defense Command under the command of General Chidlaw, USAF, resulted. It included the Army Antiaircraft Command and Naval Forces assigned to conti-

nental defense. Since the new command was superimposed on the Air Force's ADC and responsive to the Chief of Staff of the Air Force acting as Executive Agent for the JCS, complaints against Air Force dominance of continental defense exacerbated a growing inter-service rivalry that concerned missiles.

5. Growing Differences

Basic differences between Army and Air Force concepts of defense surfaced again with the accelerated development of competing technological capabilities. The issues again centered on control of Army weapons. It came to the surface as a disagreement on the range of missile weapons to be developed by the Army. If the Army SAM development could be seen as no more than an extension of the traditional anti-aircraft artillery role it provoked little concern. The AAA role had emphasized localized "point" defenses. In contrast, Air Force interceptors had an "area" air defense role. The initial Nike missile system, Nike Ajax, developed and deployed in 1953 seemed to the Air Force to be in the category of "point defense" weapons but the development of Nike Hercules, with a considerably greater range, bothered the Air Force. Arguments on the merits of "point" versus "area" defense began in this decade, intensifying after 1955.

While fissures appeared in the U.S. efforts to coordinate a national air defense system, Soviet actions seemed to proceed as part of a steady growth with an integrated force. By 1954, the national air defense of the Soviet Union was made the responsibility of PVO Strany. Designated about the same time as CONAD in the United States, PVO Strany was headed by Soviet Army generals who identified fighter aviation as the most important element of Soviet air defense. Inter-service rivalry was not expressed although competition for budget and other resource support must be assumed. PVO Strany obviously enjoyed high priority; allocations for air defense rose rapidly during the Korean War but began to be challenged by requirements for strategic offensive systems and the context of reduced Soviet military budgets in 1953 and 1954. Economic and resource limitations beginning in 1954 appeared to make an impact on Soviet strategic air defense efforts about then.

D. Systems Development

1. An Overview

By the mid-1950's, the sizeable Soviet air defense forces; deployed radar warning and surveillance systems; very large numbers of antiaircraft guns and clear-weather fighters; great effort and high priority for developing defensive missile technologies manifested deliberate effort. By the end of the first post war decade, surface-to-air missiles were part of the active defense of Moscow. Civil defense received a big boost during this period when, in October 1952, the 19th Party Congress decided to develop an all-out defense of the Soviet Union.

U.S. strategic air defense moved from a low priority element in U.S. defense strategy to a high priority element in national security policy. Basic decisions were made to protect America against manned bomber attack with nuclear weapons; programs for early warning systems to provide six hours warning against a propeller-driven bomber and two hours warning for jet bombers began. Backing the early warning system was: an all-weather interceptor force and ground-based AAA and missile units. A variety of development and planned actions to expand and increase their efficiency and effectiveness and to field new, improved systems were under way. But the improvements and systems conceived did not address the on-coming threat; by 1955

it was evident that the Soviets had in motion significant long-range missile programs and were on the verge of testing a 1000-mile missile. Concurrently, however, U.S. air defense programs projected a defense against the air breathing threat. The associated ground environment conceived for control of the U.S. programmed strategic air defense structure would be critically vulnerable to possible missile attack.

The main thrust of U.S. civil defense built on the concept of evacuation which did little to defend the population against fallout. Lacking the specific impetus of the Korean War, attempts to delegate civil defense responsibilities to Federal agencies led to difficulty and confusion because of overlaps in mobilization planning. By the end of the period, U.S. civil defense organization and planning confronted many unresolved problems. The Federal Civil Defense Administration itself moved to Battle Creek, Michigan, during 1954 and, while less vulnerable to an attack against Washington, the agency's relocation from the center of government seemed to downgrade its prestige and effectiveness.

The contrast between the Soviet and U.S. air defense and civil defense programs of the early 1950's appears sharp. American programs slighted air defense in favor of offensive forces; Soviet planners obviously emphasized and sought, as soon as possible, an integrated, national air defense program and supported civil defense. Despite the handicaps of a war-damaged economy; long-standing, unfulfilled promises to the Soviet people of "the fruits of revolution"; and acute technological gaps, the Soviets made substantial progress in the decade after the war to protect the homeland. Stalin dominated the decision-making process and personally set the direction and priority given the effort. The U.S. air defense commitment, however, was gradual and disparate. Requirements derived from different perspectives and built on limited, and sometimes erroneous, information. Individual departments and agencies, both in and out of government conceived air defense weapon systems designs and unilaterally promoted their development. Lack of centralized, authoritative planning and direction, budget constraints despite a greatly superior economic position, and basic strategic disposition to favor the offense were substantive elements influencing the evolution of U.S. air defense.

2. Air Defense System Components

a. Command and Control

Accelerated efforts for integrating U.S. command and control arrangements followed the outbreak of the Korean War. Under an agreement concluded by General Collins, Army Chief of Staff, and General Vandenberg, Chief of Staff, USAF, in August 1950 the Air Force was authorized to determine the basic rules of engagement (ROE) to govern AA fire against an enemy; to draw up the conditions of alert for AA; and direct AA when to open and to hold fire. Covering air defense in the United States, the Collins Vandenberg Agreement gave rise to ADC issuing rules of engagement in February 1951 as active defenses grew in the continental United States. Under ADC's ROE, antiaircraft normally would be in a status of "Release Fire," whereby any aircraft declared to be hostile could be engaged. ADC indicated an order to "Hold Fire" would be given "only when necessary."

About a year later, these ROE changed. Under the new rules, three conditions were set. "Weapons Free" indicated that any target not identified as friendly could be fired on by AAA. "Weapons Tight" meant that only targets identified as hostile could be fired on by AAA and "Hold Fire" would provide an overriding command. "Weapons Tight" would constitute the normal AA status until an attack was imminent.

Various efforts to promote a unified air defense command developed during the period. Organizational proposals arose in 1950, again in 1953, and finally in 1954, culminated in CONAD.

The terms of reference establishing CONAD gave "operational control" to CINCONAD of all forces assigned or available. "Operational control" was defined to include:

(1) Direction of the tactical air battle
(2) Control of fighters
(3) Specifying the alert condition
(4) Stationing early warning units
(5) Deploying combat units of the command.

CONAD, after two years, was overhauled. Major problems the initial experience uncovered—apart from interservice difficulties—centered on the growth in the effectiveness of weapons and their impact on command and control (e.g., SAMs replacing guns with vastly superior performance capabilities in terms of range, maneuver, and kill probability). USAF controllers were not taking advantage of, or avoided use of, Army weapon capabilities and tended to rely on the fighter/interceptor. The identification issue plagued the CONAD components. There was a lack of confidence in the existing procedures and system and a mutually satisfactory and understood agreement, and doctrine on identification. These issues became more serious as steps progressed to provide improved capabilities for centralized CONAD control of the air battle. Longer-range ground control intercept equipment and early warning radars promised more effective intercept and held promise for automatic all-weather intercept. Since the speed of aircraft was increasing, the requirements for speedy, reliable identification were apparent; equally demanding were the needs for extensive communications, data link and rapid, continuing interchange of identification information on aircraft within the zone of responsibility of subordinate commanders.

Soviet national air defense forces grew after Korea and, together with preparations for the incorporation of the SA-1 system, growth helped to promote improved command and control of the growing force. In addition to the reorganization of Soviet armed forces in 1950, the establishment of PVO Strany as an operating organizational structure in 1954 and the employment of fighter aircraft with airborne radar from mid-1954 brought out other requirements for modifications in command and control procedures. Use of airborne radar improved the all-weather capabilities of the system and that fact, building on the operational experience derived from the Korean War, must have influenced control procedures. U.S. aircraft in Korea found that coordinated employment by the Communists of searchlights and fighters required significant use of electronic countermeasures, both jamming and chaff, in order to defeat those tactics. Communist AAA in Korea—weak by World War II standards—lacked radar. U.S. employment of ECM against communist air defense systems in Korea as late as 1953 is assumed to have induced some C^2 changes in PVO Strany. A basic concept appeared to have been to have fighter aircraft operate beyond the range of AAA. Soviet actions adhered to the basic operational principle of centralized control of all resources used in air defense. Recognizing such problem areas, Soviet air defense planners sought solutions, and anticipated the introduction of new, improved weapons and the growing needs for the coordination and mutual support of air defense forces deployed as part of PVO Strany.

b. Early Warning and Ground Controlled Intercept

Declared goals for Soviet air defense projected a defense in depth. Evidence of a continuing commitment to "brute force" solutions, high priority to warning, and indicative of the problems faced in protecting vast regions of the U.S.S.R., overlapping air surveillance and early warning networks began to appear in some regions of the Soviet Union during this period. Priority to these regions limited coverage capabilities in others. Large numbers of manned interceptors enabled the employment of barrier patrols to provide some warning and limited engagement capabilities for these regions in good weather. Visual observers also continued active even as overall radar warning capabilities grew.

The experience of the Korean War also showed the Soviets the increased importance of a first attack by jet fighters. In a "majority of cases" they found the first attack was the only possible one. This put a high premium on warning and effective GCI as well as improved pilot training. Thus, as PVO Strany moved to improve the Soviet national air defense system, increased and continuing emphasis was given to GCI equipment.

The Token development and deployment gave evidence of Soviet technological capacity since it marked a modest time lag between appearance of a prototype and the subsequent large-scale deployment. It provided a practical demonstration of the great strides made by the Soviets in mastering Western technology, but in particular, seemed to underscore the sense of urgency and purpose in Soviet air defense developments.

The concept of a DEW Line for U.S. continental defense was furthered by the Summer Study Group although its report ran into stiff opposition which felt the feasibility of the proposal was limited by funds and technology. The Bull report confirmed the Summer Study Group concepts, however, and recommended an expenditure of $18 billion to $25 billion over five years to automate air defense systems and establish the DEW Line. Technical problems and better understanding of costs uncovered when the program moved to operational status in 1957. Despite action to move the Pinetree line north and the stress on the need for warning of attack from 2,000 miles, U.S. programmed activity appeared to contrast sharply with the manifest determination and urgency of the Soviets.

Air defense requirements grew for the U.S.S.R. as the threat of Western strategic air increased. The Soviet actions to plug gaps in the developing air defense system with available capabilities and expedients contrasted with U.S. deliberations about costs and commitment to strategic offensive forces. The Soviet basic concern for warning was evident; less clear is whether it derived its form and dimension because of specific U.S. developments and deployments. As it uncovered, the major portion of the Soviet effort appeared to be directed against strategic attack possibilities. By the early 1950's, U.S. carrier aviation and the growth of NATO tactical capabilities extended the problem. Indicative of Soviet sensitivity and capability, incidents of reaction to U.S. flight activity in peripheral areas included shooting down a U.S. B-29 in October 1952 over the Kuriles, and another, two years later, over Hokkaido. As further evidence of the violence of Soviet reactions, a Navy P2V aircraft was shot down in September 1954 over the Sea of Japan and, earlier that year in Europe, two Navy aircraft were attacked by Soviet aircraft near the German border with Czechoslovakia.

c. Interceptor Development

In the early 1950's the predominant fighter in Soviet air defense was the MiG-15. By mid-1954, a trend had begun to employ fighters with airborne intercept (AI) radar capabilities. This had a marked effect on

the character of the air defense system by providing an all-weather capability. Introduction of the YAK-25, MiG-17, and MiG-19 aircraft were evidence of the Soviet effort for improved interceptors with some electronic capability and improved armament.

The day-version of the F-86, which was procured in quantity because it was the best fighter available at the time, remained in service for U.S. continental air defense until 1954. A new generation of supersonic interceptors began development in the early 1950's. The period saw an attempted speed-up of the F-89 program; an effort to plug the existing, perceived gap (F-80 and F-84); and programs to modify other aircraft as interceptors (F-94C and F-86D). The growing pressures of the Soviet Tu-4 force build-up, the Soviet atomic explosion, the outbreak of the war in Korea, and the availability of new technologies contributed to the difficulties of developing an integrated interceptor system. Because planned availability by 1954 of a desired interceptor was seen to be infeasible in late 1951, a planned aircraft (F-102) was expedited to provide an "interim interceptor." This soon ran into trouble; and although the F-102 flew successfully 3 years later, its accelerated development and production included a redesign of the fuselage. (Modifications and retrofitting continued for several years after the aircraft was first operationally deployed.)

By the mid-1950's, the evident need for greater range to meet improving Soviet bomber capabilities had coincided with prospects for an extensive ground environment; a long-range interceptor requirement resulted. To fill the gap until the ultimate aircraft (F-106) would be available, two interim interceptors (F-101 and F-104) with requisite range were adapted for air defense. These aircraft were not fully compatible with the SAGE system and later, difficulty occurred in trying to fit them into that system.

Rapid advances in technology, competing demands within the Air Force for fighter performance, and industrial influence extended and ramified the problems of U.S. interceptor development. By comparison, the progression of developing Soviet bomber capabilities appear less significant to that development.

d. Surface-to-Air Missiles

U.S. operational requirements for air defense missile support—for forces and weapons—derived somewhat after the fact of their technical development. The individual services conceived designs for weapons to meet the perceived needs of that service, not necessarily as a response to the statement of need by an operational commander. The long lead times in development of surface-to-air missiles exceeded operational planning cycles and clearly, therefore, their development was not driven by the specifics of the Soviet threat during this period.

Four months after the outbreak of the Korean War, Mr. K. T. Keller, retired former President and Chairman of the Board of Chrysler Corporation, was brought into the Defense Department as Director of Guided Missiles. Taking his instructions from the President to advance the U.S. missile program, Keller quickly pressed for workable systems. He understood that highest priorities were to be given to development of air defense missiles and he designated Nike, Terrier, and Sparrow for expedited development.[32] By November 1953, the Nike system was ready to begin an extensive deployment for defense of designated localities in U.S. Bomarc began development coincident with the SAGE evolution. By this time both Nike Hercules and HAWK systems were being developed.

CONAD was informed of these developments and operational planning for U.S. air defense increasingly took into account potential improvements and on-coming problems of coordination as these capabilities were

[32] Futrell, op. cit., p. 438.

forecasted and scheduled programs of trained forces and standard missile weapons became reality. While missile systems became increasingly significant to U.S. strategic air defense planning, their development did not stem directly from the specific capabilities of the Soviet offensive threat at the time. Defensive missile capabilities were the product of design and their performance characteristics derived essentially from those concepts, guided by service perceptions of need and realized by the available "state of the art" technologies.

Soviet SAM development culminated in the start of a missile defense for Moscow. Representing an extensive and high-priority effort, the Soviet program, however, was primarily devoted to developing required missile and guidance technologies. Preliminary actions were under way on the SA-2 system. German scientific support, significant to the SA-1 program, also backed this development. From the emphasis given the program and the extent of U.S. (and other Western) capabilities for offensive air attack against the Soviet Union, it appears that the Soviet SA-2 program was intended as a specific answer to the threat appreciation of U.S. capabilities held by PVO planners in the 1950's.

e. Ballistic Missile Defense

In the early 1950's, the Army examined critically the feasibility of ballistic missile defense leading to a decision in February 1955 to conduct specific economic and technical feasibility studies for a missile defense. Based upon the resulting assessment, in December 1955 the Army requested $7.7 million in supplemental FY 1956 funds for an antimissile program and called for the assignment of service responsibility in this area.

In 1953 and 1954 increasing intelligence reports of active Soviet missile tests gave rise to establishment of The Technological Capabilities Panel under the NSC. Reviewing these reports in 1955, the Panel recommended stepping up the U.S. missile program. Under the chairmanship of James R. Killian, the Panel projected a rapid rate of Soviet missile progress and predicted that soon the Soviets would be testing 1000-mile missiles which would enable them to threaten Western Europe. That same year U.S. radars based in Turkey to determine the extent of Soviet tests began picking up 750-mile missiles being tested by the Soviets.

This evidence made it clear that the Soviets had made great progress in rocketry. As a direct result, Army, Navy, and Air Force missile programs were accelerated by a crash effort for the development of 1,500-mile missiles. The Atlas priority was increased and Titan authorized. Redstone and Atlas had been in development ten years; these two were joined in 1955 by three more—Thor, Jupiter, and Minuteman. In September 1955, the Secretary of Defense was called on to decide between other intermediate-range missile proposals. They were similar; to choose was difficult; fear of Soviet missile progress a dominant factor. The U.S. was trying to catch up. On 8 November 1955, Mr. Wilson announced his decision to proceed with both programs. In effect, this provided for Polaris which began the following year.

The Wilson decision was based on the recommendations of the JCS which had an Army dissent because, as proposed, they would have excluded the most experienced U.S. missile team, the Army group at Huntsville, from participating in the effort to overtake the Soviet achievements. These facts were influential in the Army's collateral pursuit of Defense Department approval and action to develop an antimissile missile system.

E. Summary Judgments

Soviet strategy and action for air defense of the U.S.S.R. in the first decade following World War II demonstrate greater emphasis, more extensive commitment and higher national priority than the American

effort for continental air defense. Rapid, continuing growth within a phased, orderly development marked the Soviet pattern following a relatively slow start.

Technological limitations underlay Soviet moves to provide an effective, integrated national air defense. Qualitative deficiencies and gaps were recognized at the start and intensive effort made thereafter to offset such limitations through relatively large scale, quantitative commitment of resources and systematic wide-scale exploitation of foreign technology. While these conditions induced "crash" actions, progress to achieve an effective national air defense system was steady, consistent, and continuing. The goal of an integrated national system was established and adhered to. During this decade weapon systems for Soviet air defense were in a substantial transition: jet fighters entered the operational inventory quickly and quantity production backed the growing requirements of this component as the primary arm of PVO Strany. The systematic but accelerated development and deployment of a national radar warning and surveillance network was being advanced by a sustained effort and, while AAA guns continued as primary ground-based weapon systems, surface-to-air missile development progressed to the point of beginning an operational deployment. Command and control needed to provide an effective, flexible, coordinated yet centralized direction and employment of the various components developed concurrently with the growth of the overall system.

Soviet emphasis on quantitative solutions to air defense problems and technological limitations probably represented a combination of predisposition and experience. Traditional predilection for defense, World War II experience, and a doctrinal, strategic preference to have a reliable, self-contained capacity for security were in keeping with the work of an effective strategy: concentration. Genuine fear and a sense of inferiority gave impetus to the program, at least under the circumstances of the U.S. nuclear monopoly.

Soviet decisions probably built on a worst-case basis yet obviously were influenced by assessments of conditions of a future war. There is, however, little evidence to reflect Soviet air defense developments during the decade being directly responsive to decisions concerning strategic weapon systems.

The clear and overriding purpose of Soviet air defense during the decade was to "protect the homeland." Along with the growth of a substantial force for the purpose, Soviet air defense at the end of the period had solid acceptability and, in PVO Strany, an able, central institutional advocate for agreed programs to improve the defense of the homeland. In marked contrast to the Americans, the Soviets rarely criticized decisions; open criticism was lacking. The extensive Soviet efforts for air defense became part of the integrated national air defense program and tended to complement other commitments for "protection of the homeland."

U.S. efforts for continental air defense were keyed primarily by official and unofficial perceptions of the threat and continuing official views of fiscal constraints. Basically, U.S. strategy did not recognize an urgent need for active air defense until late in the decade when the Soviet threat was thought to be more real.

A basic issue underlying a seeming delay in progress toward a U.S. strategic air defense program during this decade involved contention over the commitment of resources. The contention centered on the unresolved question of what relative balance was wanted between the U.S. strategic forces and the growing Soviet forces. The U.S. strategy was agreed: the defense of the United States would be provided essentially by strategic air-atomic forces.

U.S. defense efforts showed a continuing concern for roles, functions and missions, repeated appeals for "balanced" forces, and delayed clean-cut decisions on the size of strategic offensive forces. Lacking resolution, that issue became extended and tended further to delay judgments on air defense.

Early Soviet commitment to national air defense represented a basic long-term strategic choice. Military requirements had to be supported because, despite the severe economic strain they entailed, the U.S.S.R. was strategically very vulnerable. The U.S. nuclear monopoly was a central fact influencing the Soviet overall strategy; national air defense complemented their forced-draft nuclear developments and concepts for defense against a threat from Europe.

The nuclear monopoly appeared to obviate choice in the American strategy. With a demonstrated air-atomic capacity, the strategy was nearly patent. Self-imposed post war economic constraints on military spending influenced the U.S. strategy and helped to affirm it but did not drive it. From the start, research and development for U.S. air defense projects had funding support; however, the American strategy inclined to accent strategic air offensive capabilities in basic post war defense policies.

Economic constraints substantially influenced the American strategy because of domestic political considerations. During the initial transition from war to peace and through the period of growing U.S. recognition of inimical Soviet intent, funding for U.S. military programs was limited. While the Korean War provided a specific basis for substantial subsequent support for U.S. military programs, U.S. decision makers were already disposed to a stronger stand against an aggressive communist expansionism.

The following chapters outline U.S. and Soviet strategies in greater detail, accenting factors bearing on decisions during the first decade after World War II relating to the development of capabilities for air defense, civil defense, and ballistic missile defense. Chapters II and III concern the American and Soviet strategies; Chapters IV and V treat U.S. and Soviet systems developments.

Chapter II

American Strategy for Air and Ballistic Missile Defense

A. 1945–1950: Entering the Atomic Era

1. World War II Heritage

a. Strategic Debate

World War II clearly established the strategic and tactical importance of air power, but the debates over the role of air power continued unabated after the war. The debate basically devolved to the question of "Air superiority, or superiority of the air arm?"

There were those who believed that control of the air was a prerequisite so that surface operations could be undertaken, and there were those who believed that the air arm could win unaided. There were equally strong proponents of the superiority of strategic air offensives over air defense forces and of the superiority of the defense over the offense. Each could point to various phases of World War II to support their position.

The introduction of the atomic bomb at the end of the war added a new dimension to the debate, which seemed to tilt in the direction of the strategic offensive advocates. Other new technology introduced late in the war obscured the issue and fed new fuel to the debate and new fire to the debaters. The jet-engine fighter aircraft strengthened the argument for the air defenders, as did the surface-to-air and air-to-air missiles, airborne radars, night fighters, and improved early warning and ground control radars. Since most of the new technology was relatively untested and in primitive states of development, there was no conclusive evidence for either side, and indeed the debate continues to this day.

The introduction of the supersonic V2 rocket by the Germans shortly before the invasion of France, added the problem of missile defense to those of the air defenders, and so the problem and the rhetoric escalated. Not only was there no agreement on very basic points concerning the use of air power, but there was no agreed-upon doctrine for such widely practiced operations as the air defense over ground armies and the tactical or close air support of ground forces. Though air power established itself as a critically important element of warfare, the end of World War II left many important questions on the future of air power unresolved.

b. Continental Defense

During World War II, the continental United States relied chiefly on its two flanking oceans for air defense, but the Army Air Forces did establish some 95 radar sites—65 of which were on the Pacific coast—four interceptor commands and a ground warning network supported by one and a half million volunteers of the Ground Observer Corps. A civilian civil defense organization was also created for the

purpose of protecting the civilian population and civilian industry. Perhaps fortunately, neither defense organization was ever really challenged by enemy forces. As the danger of enemy air attack on the United States became slight, the AAF substituted a standby defense system for its active system in September 1943, and inactivated the aircraft warning network in April 1944. President Truman abolished the Office of Civil Defense by Executive Order on 30 June 1945, in the first of many steps to cut the costs of the rapidly winding down war.

Although the defense of the continental United States was relatively unimportant when viewed in light of the other events of World War II, it left a certain legacy for the future. The Army Air Force was recognized and awarded the responsibility for air defense of the United States, supported by a civilian aircraft warning network and Army antiaircraft gun and balloon defenses. The ground defense of the United States was the responsibility of the Army with a tenuous but workable relationship with the civil defense organizations that proliferated across the nation. Both the air defense and the civil defense organizations were mobilized a relatively few months before the attack on Pearl Harbor, and could properly be called mobilization rather than peacetime organizations. Both air defense and civil defense were phased out before the end of the emergency, leaving no residual organizations for future continuity.

c. Lesson of Pearl Harbor

One important legacy of World War II that made a lasting impression on future strategic thought was the lesson of Pearl Harbor. One of the first orders of business after the war was a detailed and highly publicized investigation of the circumstances surrounding the success of the surprise attack on Pearl Harbor. Among the results of the investigations was the fact that radar was successful in detecting the approach of the Japanese air fleet; but administrative failure and break-down had negated the value of that tactical warning. The principal lesson learned was “don’t be surprised!” Much of the future thinking about the onset of another war was postulated on a war that would start with a surprise attack on the United States.

d. Strategic Doctrine

As World War II was the most total war in modern history, involving deliberate attacks on civilian populations and industry, the use of atomic weapons, and the doctrine of unconditional surrender imposed on Germany, and to a lesser degree, Japan, it was natural that this aspect was carried over in future planning after the war. Most strategists believed that future wars would probably be total wars with national survival at stake, and that atomic weapons would probably be used in future wars.

World War II confirmed the basic strategic doctrines of the U.S. military. The basis of that doctrine was reliance on the mobilization system for expanding small peacetime military services to whatever forces are required for successful military operations. The civilian industry of the U.S. provides the necessary equipment and supplies by dint of mobilization of the industrial base and diversion to wartime requirements. Using that system, the United States organized, trained, equipped, and supported over twelve million men in uniform (simultaneously) during World War II—the mightiest military force in the history of man. That force was projected overseas on a global basis to carry the offensive to the enemies, wherever they could be reached. The industrial base was so prolific that it provided surplus arms and supplies for the allies of the United States, the British, the French, the Russians, and the Chinese, as well as the means to transport the supplies to them and control the air and the seas between the continental United States and the overseas

destinations. The industrial output of the United States was so great that a considerable portion of it was excess to wartime requirements by the beginning of the summer of 1945.

While U.S. military men were indoctrinated with the spirit of the offensive, wartime experiences during World War II impressed them with the importance of providing protection for the vulnerable industrial mobilization base. Britain was successful in staving off concerted efforts by the predominately tactical German Air Force to bomb Britain into submission preparatory to a German invasion. Later attacks by German subsonic V1 rockets, largely directed against English population centers, were unsuccessful due to a combination of interception by British air defenses and the inherent lack of accuracy of the weapons. There were no defenses against the V2 attacks except overrunning the launcher sites with ground forces on the continent. Despite all three forms of air and missile attack, the British were able to maintain and improve their industrial output, principally because British industrial capacity was not targeted by the Germans.

Germany was subjected to devastating air attacks on civilian industry and population centers by British and American strategic bombers. The German air defense of the homeland made a number of basic mistakes, but by the end of 1944 was the most formidable the world had ever seen. Deployed within Germany were some 16,000 heavy antiaircraft guns, 50,000 light and mobile guns, 7,500 searchlights, and some 1,500 barrage balloons. The Germans had both ground and airborne radar, controlled the long ground approaches into their cities, and innovated in defensive fighter tactics in the attempt to inflict unacceptable bomber losses on the allied bombers. Despite Hitler's refusal to give the production of fighter/interceptors and jet aircraft first priority in the defense of the Reich, the German air defense was very nearly successful. Post war surveys determined that German production actually rose during 1944–1945, while still under the massed attacks of the greatest bomber forces mobilized during the war. The German air defense example left the U.S. air defenders with the belief that it was possible to organize an air defense system that could protect the industrial base and inflict unacceptable losses on an attacking strategic force.

The strategic air attack on Japan presented the "worst case" example of just what can happen to a civilian population and an industrial base when an effective air defense is absent. Japan sent its airpower far from the home islands. When the B-29 and naval air strikes took place, they were virtually unopposed in the air. In fact, the leader of B-29 forces stated that the air over Japan was safer than that over training bases in the United States. The air defenders in the United States military forces took the lesson of Japan to heart, much as those who adhered to the belief in the supremacy of air power held up Japan as an example of the ability of air power to win unaided.

World War II then, confirmed U.S. faith in the mobilization system and the mobilization industrial base, encouraged a belief in a global war started by a surprise attack, conclusively proved the virtue of the strategic offensive, and strongly implanted a relatively new belief in the necessity of providing effective defenses for the industrial base in the continental United States.

e. Demobilization

After the surrender of Japan in Tokyo Bay, the vast majority of the American people believed that the wartime emergency was over and that the United States should turn its complete attention to peace and away from the recent war. They had considerable reason to so believe after four long years of war and relative hardship required to overwhelm and subjugate the Axis nations. The United States had a monopoly of atomic weapons and there was no apparent enemy in sight. The United Nations organization was widely

heralded as the future guarantor of world order and peace. It followed that the United States no longer had a need for its very large and extremely powerful military forces. On the contrary, the American people wanted its men in uniform *home*, and the men in uniform couldn't wait to get home and out of uniform. The overseas forces were brought home and discharged as fast as shipping could move them, despite a point system designed to provide a system of justice for the returnees while preserving some semblance of occupation forces. Within a year the once-mighty U.S. armies, navies, and air forces had disintegrated, leaving a pale shadow of former military strength. This form of voluntary unilateral disarmament left ill-trained, under-manned, and generally combat-ineffective units deployed overseas to act as occupation forces and to man the overseas bases that supported them. Though total uniformed strength shrank to less than two and a half million men, they were deployed forward with barely enough strength in the continental United States to support a rotation base. Though not entirely by design, U.S. military strategists could not return to prewar isolationism from the rest of the world. The leaders of the U.S. military forces, at any rate, were men who were accustomed to thinking in a global context and being concerned with the global security environment.

2. Immediate Postwar Developments

a. Unification

Long before the final shot of World War II sounded, the military services began reviewing the lessons learned in preparation for the peacetime years to follow. Perhaps the primary lesson learned was the necessity for the integration of the nation's fighting forces into a single unified organization. Many of the major problems generated during the course of the war emanated from the division of the forces into the services of the Army (and Army Air Forces) and the Navy (and Marine Corps).

Although the War Department was opposed to the establishment of a separate air force, it became a strong advocate of a single unified military organization, with subordinate ground, air, and naval forces or services. The Navy, more or less self-contained with its own naval, ground, and air elements, feared that it would lose the Marine Corps and perhaps elements of its air arm in a functional reorganization, and thus fought a rearguard action against unification that continued long after the decision had been made in favor of such a unification. The Army Air Forces saw such a reorganization as its greatest hope to become an independent air arm, and consistently backed unification. From the first discussions of reorganization, it became apparent that there would be many hazy areas caused by a simple functional division, particularly in the boundary areas between ground, air, and sea.

There was little dispute among the services that air defense was a natural function of the air force and should be an assigned mission for a separate air force. There was little problem with the Navy for the senior officers of the Army Air Forces neither expected nor wanted to be assigned the mission of providing air defense for naval forces. The Marine Corps had its own air arm and organic ground air defense elements and was accustomed to close cooperation with the Navy for the air defense of its beachheads.

The heart of the air defense problem lay in the fact that the Army had a deep and abiding interest in retaining organic ground air defense units (antiaircraft, searchlights, barrage balloons, etc.) for the air defense of its deployed ground armies. There was a considerable Army investment in ground air defense equipment, and a portion of the Army's officer strength had specialized in the field of air defense.

Although the Army agreed in principle with the concept of establishing air superiority through centralized direction of all air resources in a theater, in practice they thoroughly disliked operating without air cover and air defense in the presence of an enemy air threat. Considerable acrimony had developed in certain theaters between Army air and ground commanders over the question of who controlled the air defense forces. The problem was generally finessed on a pragmatic basis as each theater commander attempted to resolve the issue without benefit of agreed-upon doctrine. As the Army prepared for the separation of its air arm in anticipation of unification, the problem was finessed once again, hopefully to be resolved by the overall reorganization plan.

b. Inter-Service Rivalry

The development of jet aircraft and the German introduction of V1 and V2 missiles led American air defense planners to conclude that air defense weapons with greater range, accuracy and destructive power were required to counter those specific threats. In 1944, the United States initiated several projects designed to fulfill the requirements for new air defense weapons. (See Chapter V.)

We have noted in Chapter I how the Antiaircraft Artillery Board (January 1944) described the military characteristics for a controlled antiaircraft rocket projectile and recommended that one be developed. Independently, a concept for radar ground guidance of a controlled antiaircraft rocket (using a radar to track the target continuously and a separate radar to track and guide an intercepting missile) was developed and incorporated into the design requirements.

Well before the end of World War II, while development activities for advanced antiaircraft weapons were being initiated, the ground and air defenders within the Army were contending for the control of the new weapons. The Army Air Forces had long wanted to bring all air defense weapons under its control in order to achieve unity of effort in air defense (as the British and German air defense forces were unified under their air arms). The Army Ground Forces resisted transferring Army AAA to the AAF, holding that AAA was an extension of artillery and properly a Ground Force weapon. The Army Ground Forces was investigating the development of the use of guided missiles in conventional ground to ground artillery. To resolve the issue the Army Deputy Chief of Staff, Lieutenant General Joseph McNarney, issued a policy directive to the Army Air Forces, the Army Ground Forces, and the Army Service Forces, allocating responsibility for research and development in the guided missile field.

The air arm did not agree with this directive and was successful in having the directive revoked in October 1946, by a directive which gave the Army Air Forces complete responsibility for all research and development in connection with guided missiles. By that time, however, enough research had been directed toward guided missiles in accordance with the McNarney Letter, so the mold was cast. (See Chapter V.)

Developments begun to counter technological capabilities that were introduced in World War II, at a time when there was no specific enemy threat in sight. The general threat they were designated to counter was the possibility of a yet-unnamed enemy combining the capabilities of the supersonic V2 missile with an atomic payload. The Army Ground Forces started its research early on a guided missile antiaircraft and antimissile projectile, while the Army Air Forces lagged behind with the development of an aerodynamic lift antimissile interceptor. Both branches of the Army turned to civilian industry to develop their concepts.

The two different systems were spawned in an atmosphere of rivalry between the ground and air elements of the Army, and after their development, were the basis of further interservice rivalry between the Army and the then independent U.S. Air Force.

c. Civil Defense

There were a series of civil defense study boards under the military, but no operational civil defense organization was developed until the Korean War took place. (See Chapter V.)

d. Guided Missile Development

ICBM research was not begun early as scientists doubted that an ICBM was feasible. Research concentrated on jet engine propulsion. Requirements were established for air defense guided missiles. (See Chapter V.)

e. Politicization of the Scientists

The atomic weapon was developed during World War II by scientists who worked under military direction in the closely controlled and highly classified Manhattan Project. Many of the scientists were thoughtful men who were able to consider the policy implications of the awesome weapon. By the extremely close-hold nature of their work, they were able to discuss the implications among themselves and develop beliefs and positions which were generally shared by the scientific community that had been marshaled to achieve the atomic breakthrough. These scientists believed that once the feasibility of the atomic weapon was demonstrated, there was no way to prevent other scientists from duplicating their efforts and developing similar atomic weapons. Carrying this logic a step further, they were able to see a very dangerous world emerging—one in which atomic bombs proliferated under military controls, with no possible defense against surprise atomic attacks except passive defenses. This dangerous world would lead to an erosion of the democratic process, the captivity of scientific knowledge by military leaders, and the eventual destruction of civilization.

Faced with conclusions which made a nuclear Armageddon virtually inevitable, the scientists were able to overcome their self-avowed naiveté in political and international matters to make recommendations on future controls for military applications of scientific knowledge, in general, and atomic energy control, in particular. The scientists were generally in agreement that secrecy coupled with scientific developments would contribute to a dangerous international arms race. They also generally agreed that the already developed atomic knowledge and technology should not remain the possession of any one nation (since it *could* not, given their foregone conclusions), but should be brought under some form of international control for the future safety of the world. They believed that nations would act like rational men and share their beliefs; that they had much more to gain from the peaceful exploitation of scientific knowledge than they did from engaging in a suicidal arms race. Some scientists combined the two aspects of the generally held beliefs and advocated providing all nations with full and complete knowledge of the facts about atomic weapons before they could develop those facts themselves in secrecy.

The scientists were realistic enough to believe that any international agreement on the control of atomic energy must be backed by real and effective controls, not just paper promises. They knew that national survival was too important a stake to trust to the unsupported goodwill of other nations. This issue has been

basic to disarmament negotiations to this day—how to establish effective international controls and inspection mechanisms. The scientists, however, reasoned that every nation has an interest in self-preservation and thus is deeply interested in achieving an agreement for control of the weapons of mass destruction. Such an agreement must essentially depend on the intensity and integrity of the nations' intentions and on each nation's readiness to surrender some of its sovereignty, in return for a peaceful future.

Holding such beliefs, it is not surprising that the scientists were opposed to using the atomic bombs on Japan, as that would be clear demonstration that the technology of atomic weaponry had been mastered. President Truman appointed a committee headed by Secretary of War Stimson to advise him on whether or not to use the atomic bomb against Japan, and on the post war disposition of atomic energy. The committee, composed of a number of wartime scientific leaders, weighed the matter carefully and regretfully recommended using the bomb against Japan. Dropping the bomb on Hiroshima and Nagasaki also had the effect of unmuzzling the younger scientists who opposed the decision and were no longer forced to remain silent by security requirements. They were vociferous in their demands for a "one world" policy toward atomic energy, and for establishing a United States Atomic Energy Commission under civilian control. They turned to the forum of public opinion and to politics to make their demands heard.

Having made the decision to use the atomic bomb, President Truman turned his attention to post war policy for the control of nuclear weapons. Secretary Stimson's committee of scientists also favored bringing atomic energy under some system of international control. After consultation with the British and Canadian atomic partners, a decision was announced in the Truman-Attlee-King Declaration of 15 November 1945. It was proposed that the United Nations Organization establish an atomic commission to eliminate the use of nuclear weapons, to promote the peaceful use of atomic energy, and to bring about an open world as far as nuclear energy was concerned. Since the ABC powers had a monopoly on atomic weapons at that time, it was clear that they favored international control of atomic weapons.

President Truman assigned Undersecretary of State Dean Acheson the task of developing detailed policy to implement the ABC Declaration. He, in turn, appointed an advisory panel of high-ranking American scientists, chaired by David Lilienthal, and including Robert Oppenheimer, both leading nuclear physicists. The report of the Lilienthal panel became the basis for the United States plan for the international control of atomic energy. As Bernard Baruch was the senior U.S. representative in the United Nations at the time of the atomic energy negotiations, the U.S. position became known as the Baruch Plan. It proposed an Atomic Development Authority which would be given monopoly control of all the world's dangerous fissionable materials and atomic production plants—in effect the U.S. inventory and production capability. Any attempt by any nation to produce atomic materials or weapons would be subject to such sanctions as the United Nations should determine. From the U.S. viewpoint the Baruch Plan would prevent any future surprise attack by preventing the proliferation of atomic weaponry. Since the United States already enjoyed a substantial advantage in the world as a result of its military-industrial production capacity and relatively remote geographical location, it could readily forego the atomic weapon in order to gain military security and freedom from a large military force in being.

The Soviet Union did not agree with the American position. It is now known that they were hard at work developing their own atomic capability with considerable assistance from their penetration of U.S. atomic secrets by means of their espionage apparatus in the United States. The Russians knew that time was on their side, and the Baruch Plan was defeated.

In effect, the U.S. Government adopted the idealistic beliefs of the U.S. scientists in a "one world" approach to the worldwide control of atomic energy. Though the Baruch Plan failed, many of the scientists retained their beliefs in the need for an open world with an atmosphere of mutual confidence and trust—until the Soviets exploded their first atomic device in August 1949. At that time many of the scientists experienced a change of heart and again turned to public opinion and political channels to influence public policy in quite a different direction, which would have a direct bearing on U.S. air defense strategy.

f. U.S. National Strategy

As a result of renewed faith in the pre-war mobilization system and the huge spasm of spontaneous demobilization after World War II, the United States attempted to return to its pre-war strategy. Although American military forces were substantially larger than in the years between World Wars I and II, military policy was based on relatively small standing forces and the mobilization of industry and the citizen-soldier. The realities of the U.S. support for the United Nations Organization and the worldwide forward deployment of U.S. forces after the war brought about certain modifications to the pre-war strategy. In effect the United States abandoned its traditional isolationism for collective security through the United Nations and continued cooperation with its wartime allies in the occupation of the lands of their former enemies. American military leaders continued their wartime predominance in foreign policy as leaders of the occupations of Germany and Japan, as High Commissioners of American interests in Austria, and as the senior American representatives in such far-flung places as Trieste, Korea, Berlin, and Moscow. It was generally accepted in 1945 that the key elements of future U.S. strategy would be:

(1) Support for the United Nations (to include military forces if required)
(2) Forward deployment in both the Atlantic and Pacific
(3) Relatively strong Air and Naval forces in being
(4) Continuation of the U.S. monopoly of atomic weapons pending an effective system of international controls
(5) A small Regular Army
(6) A large well-organized reserve of citizen soldiers provided by Universal Military Training

This strategy fitted the mood of the American people at that time, and indeed, it is doubtful if any more militant strategy would have been possible in face of the overwhelming desire to buy the cars and build the houses and raise the families that wartime conditions had precluded. There was a widespread feeling among Americans that all the enemies were defeated in World War II, and that the prestige that American military might had accrued in the war would deter any future enemies.

At the national level in the United States the decision makers were hard-headed realists who recognized that the overwhelming concern of the American people was for their own economic and domestic policies. President Truman placed a budget ceiling on the cost of U.S. armed forces and adamantly refused to raise it despite repeated requests by his key national security advisors. He did not concern himself much with the way the military services divided up that budget or what they bought with it, as long as they carried out the strategy and remained within the austere budgetary limitations he imposed.

He did concern himself with reorganizing the war-making structure and capability for fighting a future major war. He consistently fought for Universal Military Training, which was consistently denied by the Congress. The draft laws were not used and were allowed to expire. The military services were "unified" by the Military Security Act of 1947, which created a separate air service, as well as a national intelligence service (the Central Intelligence Group, later the CIA), the National Security Council, and an agency for planning wartime mobilization, the National Security Resources Board.

Due to the austere military budgets and reliance on the mobilization system, there was little thinking or planning for any future war except the "big war." Military planners and leaders were oriented towards a major war in Europe employing strategic airpower with nuclear weapons and a projection of mobilized U.S. military strength overseas to fight another total war. It was not anticipated that the Soviet Union would develop atomic weapons until after 1952, so the post war strategy was believed to be valid for some years. U.S. military forces were not ready for the events they experienced after 1947, though generally the responsibility for that lack of preparedness had been taken out of the hands of U.S. military leaders. President Truman determined both U.S. strategy and the U.S. force level prior to the Korean War.

g. U.S. Foreign Policy

The U.S.S.R. had not proved to be a particularly friendly or cooperative wartime ally, no doubt based on the fairly justifiable belief that she had nearly single-handedly met and bested the German war machine. Soviet casualties and war damages were huge and the feats of Soviet arms and production were formidable by any standards. Though there were very substantial contributions to the Soviet war-making capability by U.S. and British lend lease shipments, the abrupt cessation of that aid at the end of the war did much to negate any goodwill that may have emerged from it.

Though men of goodwill may have hoped for good post war relations between Russia and her wartime forces bedfellows, there was very little real evidence to support that optimistic outlook. Even before the end of World War II, Ambassador Harriman in Moscow cabled the warning: "The Soviet program is the establishment of totalitarianism ending personal liberty and democracy as we know it." The Soviets, he said, were simultaneously pursuing three lines: collaboration with the United States and Great Britain in establishing a world security organization; creation of their own security system by extending their sway over their neighbors; and extension of their influence into other countries through local Communist parties and the opportunities offered by economic chaos and democratic freedoms. Agreeing that the Soviets interpreted the "generous and considerate attitude" of the United States as a sign of weakness, he urged that the United States follow a tough policy and maintain positions that would be hard for the Soviet authorities if they maintained positions hard for us; and that we should hurt them if they hurt us.[1]

There was ample evidence that Harriman was correct in his assessment of the U.S.S.R.: the Russian backing of the Polish Communist group as the future government of Poland did not result in a fully Communist-controlled Polish Government until 1947, but Russian intentions were plain as early as 1945; the forcible installation of the Communist-dominated Groza government in Rumania in March 1945, and the subsequent refusal by the Russians to allow elections appeared to violate the Yalta Agreement. Rightly or wrongly, in Washington a number

[1] Huntington, *The Common Defense*, p. 33.

of the President's advisors accepted the Harriman analysis and President Truman himself quickly became disenchanted with the Russians and took an increasingly tough line with them from that time on.

On February 6, 1946, Generalissimo Stalin delivered a speech in which he stated that peaceful international order was "impossible under the present capitalistic development of world economy" and announced a five-year plan for massive industrial expansion.

Shortly thereafter from Moscow George F. Kennan cabled his explanation of Soviet behavior: "The Soviet leaders, he said, had inherited 'the traditional and instinctive Russian sense of insecurity' which reinforced their adherence to Marxist dogma and their view of the inevitability of conflict between the capitalist and communist worlds leading to the victory of the latter. Russia, he warned, would expand its influence through every possible means and attempt to fill every power vacuum. At times, tactical considerations might lead the Soviets to appear more friendly and amenable, but such moves were only temporary maneuvers." To meet this force Kennan urged "cohesion, firmness, and vigor."[2]

For the purpose of this study, it is useless to attempt to resolve the reasons for the onset of what came to be called the "Cold War." It was a real conflict between "East" and "West" and resulted in increasing antagonism at a level below total or nuclear warfare. In the three years after the end of World War II the Cold War expanded and widened the gap between antagonists—in Poland, Bulgaria, Yugoslavia, Albania, Hungary, divided and occupied Germany, Iran, Turkey, and Greece.

In March 1947, President Truman announced, and the Congress legislated, American aid for Greece and Turkey—the so-called Truman Doctrine. The United States had moved beyond diplomacy to throw its own resources into the conflict, after the British were forced to greatly curtail their aid to Greece due to economic conditions at home. The Soviet Union formed the Communist Information Bureau (Cominform) in October 1947, viewed by many as a resurrection of the old Comintern, and a clear indication that the world was divided into two camps—a bi-polar world.

In 1948 the United States introduced the Marshall Plan into Europe (first announced in June 1947); the Communists took over Czechoslovakia in February; Yugoslavia was read out of the Cominform for heresy; and the Soviet Union imposed the blockade on Berlin. The western allies responded with an airlift to supply Berlin and the United States moved several wings of B-29's to England and Germany, as many (including President Truman) believed that war was imminent between Russia and the west. The crisis passed without the expected violent confrontation, but undoubtedly the margin was close as the Soviet Union backed down and lifted the blockade the next year after the allies demonstrated their determination and ability to supply the city of Berlin.

The next year, 1949, 15 nations formed the alliance called the North Atlantic Treaty Organization (NATO), subsequently enlarged to include Greece and Turkey. In China the Chinese Communist Armies overran the entire Chinese mainland, forcing the withdrawal of the Chinese Nationalist forces to the island of Formosa (Taiwan). Shortly thereafter the world learned that the Soviet Union had exploded an atomic device, some years before it was expected. The waves of shock that were felt around the western world probably impacted greatest in the United States, which suddenly found itself no longer in possession of an atomic monopoly, but pursuing an outdated strategy of deliberate military weakness.

[2] Ibid., p. 34.

3. Planning and Developing an Air Defense

a. The Watershed Year: Controversy and Decisions in 1946

The first planning for the post war organization of the Armed Forces began in late 1943 in the War Department. Looking forward to unification of the Armed Forces, provisions were planned for a separate air force. General Marshall directed that planning be based on a relatively small standing Regular Army, but with a combat-ready air force capable on "M" Day of repelling an enemy attack or quashing any incipient threat to world peace. After rejection of over-ambitious initial force levels for the air force, Army Air Force planners settled on a minimum peacetime strength of 70 groups with approximately 400,000 personnel.

In November 1945, General Dwight D. Eisenhower became Army Chief of Staff, while General Carl Spaatz began to assume the duties of Commanding General, Army Air Forces, in anticipation of General Arnold's announced retirement. One of General Eisenhower's first actions was to appoint a board of officers, headed by Lieutenant General W. H. Simpson, to prepare a definitive plan for the reorganization of the Army and the Air Force that could be effected without enabling legislation and would provide for the separation of the Air Force from the Army. In January 1946, Generals Eisenhower and Spaatz agreed on an Air Force organization consisting of the following major commands: the Strategic Air Command, the Air Defense Command, the Tactical Air Command, the Air Transport Command and the supporting Air Technical Service Command, Air Training Command, the Air University, and the Air Force Center.

Army Air Forces leaders urged that the Air Defense Command should be the centralized system for controlling all means of air defense: fighter aircraft, radar, and antiaircraft artillery. Further, they wanted all antiaircraft artillery integrated into the Army Air Forces to make centralized control of air defense resources effective. Doctrinally, they were on sound footing for the War Department Field Manual 100-20, *Command and Employment of Air Power*, published in 1943 stated: ". . . [T]he efficient exploitation of the special capabilities of each (i.e., AAA and aviation) and the avoidance of unnecessary losses to friendly aviation demand that all be placed under the command of the air commander responsible for the area. This must be done."

Notwithstanding, the antiaircraft artillery officers in the Army did not want to be separated from the Army and integrated into the new Air Force. There were able to adequately influence the Simpson Board so that it recommended that the antiaircraft artillery should not be transferred to the Army Air Forces, but that antiaircraft artillery units should be trained and attached to Air Force units from time to time.

The Air Defense Command was activated in March 1946, at Mitchel Field, New York, under the command of Lieutenant General George E. Stratemeyer. By that time Army Air Force strength had diminished from 218 effective combat groups on V-J Day to less than 109 groups, many of which were not effective due to the high loss of skilled specialists to keep the aircraft flying. Army antiaircraft artillery strength was demobilized at a rapid rate until by the end of 1946 there were only two gun and two automatic weapons battalions in existence, all at cadre strength with zero combat effectiveness. The question of integrating AAA units into the Air Force became largely academic. By that same date the entire Army Air Forces were down to only 55 groups, of which only two could be counted as combat ready. It quickly became obvious that the Air Defense Command would be relegated to the role of a mobilization measure, to be given effective strength by mobilizing Air National Guard and Air Reserve units.

Despite the realities of the lack of tactical assets, the Army Air Forces assigned General Stratemeyer an air defense mission which assigned ADC control over antiaircraft artillery assigned to the air defense of the

United States. He was instructed to organize and administer the integrated air defense of the Continental United States and exercise direct control of all active measures of air defense. While attempting to carry out his mission, General Stratemeyer discovered that the War Department had previously assigned the Army Ground Forces the mission of: "Under the general plans of the War Department, and in conjunction with designated air, and naval commanders, prepare for, and on order, or in imminent emergency, execute planned operations for the defense of the United States. Coordinate ground plans, including coastal defense and antiaircraft projects, with designated air and naval commanders."

The Army Air Forces brought the ambiguity, or duplicity, to the attention of the War Department. The Commanding General of the Army Ground Forces, however, believed that his directive was doctrinally correct in that air defense could not be separated from national defense, and that any air attack would be accompanied by a ground attack. He felt that a task force composed of all services would be necessary to successfully meet such attacks, and that such a task force should be under the command of the Commanding General of the Army Ground Forces—the traditional defender of the Continental United States.

The War Department issued War Department Circular 138 in May 1946, designed to clarify responsibilities for air defense. The circular instructed the Army Air Forces ADC to provide for the air defense of the United States and to control and train such antiaircraft units as might be assigned to it. Since at that time there were no combat effective antiaircraft units, the Circular probably had air defense *after a mobilization* in mind. The circular also directed the Army Ground Forces and the Army Air Forces to cooperate in developing AAA tactics, in deciding upon the types of weapons required, and in drawing up manning and equipment documents for AAA units assigned to the defense of CONS. The AAF was also charged with recommending to the War Department the required antiaircraft artillery for CONS air defense.

The AGF disagreed with Circular 138 because it assigned control of AAA units to the Air Force. The Air Force was not fully satisfied with the circular because it did not assign AAA units to the ADC, but only provided for control over such units as might be assigned to it. Again, the absence of effective AAA units in the United States emphasizes the doctrinal or theoretical nature of the dispute.

The Army Air Force lost little time in convening a meeting of the Air Board and the Air Staff in early June of 1946, to resolve the problem of antiaircraft artillery. A memorandum was prepared and forwarded to the War Department, entitled "Recommended Policies on Air Defense and Security." The memorandum contained ten recommendations:

(1) To integrate antiaircraft artillery into the Army Air Force.
(2) To give priority to offensive air power and air defense units over all other national defense forces.
(3) To make the Commanding General, AAF, the principal advisor on all matters concerning air defense to include amounts of deployment of antiaircraft artillery, other than that required for local AAA defense of AGF tactical units.
(4) To maintain sufficient air defense units to all types in the regular establishment "to provide a nucleus quickly reinforceable by air to insure a reasonable defense of our overseas bases and to provide a framework for the rapid mobilization of our continental air defense."
(5) To organize all areas subject to air attack in the Zone of the Interior (Continental United States) and overseas into Air Defense Commands, subdivided as necessary, charged with:
    (a) The entire responsibility for air defense
    (b) Overall supervision of passive air defense
    (c) Control of AA fire of naval vessels when in port.

(6) To charge appropriate overseas Air Force Headquarters with air defense missions, in times of peace, with a deputy commander for air defense and a staff to permit continuity of air defense training and operations when the Air Force Headquarters is moved or engaged in another mission.

(7) In theaters of operations, air defense of areas forward of Air Defense Commands shall be charged to:

  (a) Army Ground Force Commanders for employment of assigned AAA forward of the AGF rear boundary but subject to AAF authority to restrict fire and illumination against unidentified aerial targets within rules prescribed by supreme commanders.

  (b) AAF Commanders for maintaining communications with AGF antiaircraft major control centers.

  (c) Tactical Air Force Commanders for employment of all air defense means other than antiaircraft artillery, over the entire area and for the employment of all antiaircraft artillery employed in the defense of air installations located in the area and that antiaircraft employed in the area in rear of the Army Ground Forces rear area boundary.

(8) All units capable of effective employment in air defense and assigned to other than Air Defense Commands would be made available to such commands in emergency and would also be made available to Air Defense Command for training for such emergency.

(9) Staffs of Air Defense Commands and subdivisions would include officers qualified in all specialties. There should be no parallel organizations such as antiaircraft commands.

(10) Qualified "ground combat" officers would be equally eligible with flying officers for command of air defense commands.

The Army Air Force air defense specialists wrapped up all of the air arm's disputes, hopes, goals, and aspirations in this one memorandum designed to settle once and for all the major air defense problems that were identified in World War II. As the Service charged with primary responsibility for air defense, they were on sound doctrinal grounds in making these recommendations.

The Army Ground Forces moved equally quickly and simultaneously in producing a study entitled *Security from Enemy Air Action*, which was forwarded to General Carl Spaatz, Commanding General AAF on 14 June 1946. The study concluded:

(1) Ground action against any adversary is basically a ground responsibility.

(2) Air power cannot efficiently be tied to the defense of any one point or small area.

(3) Antiaircraft artillery should be assigned the defense of specific points and small areas against enemy air operations.

(4) Within its range an adequate antiaircraft artillery defense is the most effective protection against enemy air action directed at the defended point.

(5) The combining of antiaircraft and fighter aircraft under joint command and control is not desirable tactically because of their differing tactical concepts and spheres of action and is objectionable because it destroys antiaircraft artillery flexibility.

(6) The problems of identification and recognition can be solved to a degree that will reasonably safeguard friendly aircraft.

(7) Exchange of information on airborne enemy aircraft among the air warning service, the antiaircraft artillery intelligence service, and the Navy centers should be continued and improved.

(8) Passive defense measures are inseparable for each unit and installation.

The study recommended that "air defense" remain an air force responsibility, but restricted to defense by air by piloted aircraft, by air launched missiles, and through an aircraft warning service. The purpose of air defense was to deny enemy air access to air space over friendly territory beyond the range of ground-to-air defenses. The study further recommended that antiaircraft defense be a ground force responsibil-

ity, and that it be defined as "all ground to air action." Such defenses would include antiaircraft artillery, searchlights, barrage balloons and intelligence service, with the purpose of defending specific objectives against enemy air action within effective range of its weapons.

The study recommended that the air forces be responsible for all operations against enemy air beyond the range of ground defenses, and for continuously advising appropriate ground defenses of the locations of friendly and enemy aircraft in the air. Ground forces would be responsible for the defense of objectives on the ground within the range of their weapons and would continuously advise the air forces of the locations of defended areas. Passive defenses would be the responsibility of each unit and installation commander.

At the heart of the AGF's arguments lay the old unsettled doctrinal dispute raised on many occasions during World War II. The antiaircraft artillerymen did not like to have the air force given the authority to tell the AAA to withhold fire. They believed that the air force did not have adequate faith in AAA to take the necessary precautions with friendly aircraft to enforce known procedures for identification of friendly aircraft. Rather than restrict friendly aircraft from flying over areas assigned AAA, or having them properly identify themselves so the AAA wouldn't fire on them, the air force had a tendency to require the AAA to withhold fire. The AGF believed that friendly aircraft defended best by destroying the enemy on or over its own territory, not by defensively protecting limited friendly areas and points. The AAF, on the other hand, had enough experience with having its own aircraft shot down by "friendly" AAA through lack of adequate coordination procedures, that it had become extremely chary of its own ground-to-air defenses.

The AGF study also addressed other arguments advanced by the air proponents. Among these were the joint use of radar, safety of friendly aircraft, and selection of the most adequate means to meet an attack. While admitting the great utility of the Air Force radars, the study pointed out that AAA had been forced to rely upon its own equipment for target acquisition because of the inadequacy of the Air Force air warning system. As for safeguarding friendly aircraft, "This is considered an avoidance of the problem of recognition and identification," the study stated. It then went on to list the means available to achieve identification and insisted that the identification problem was capable of solution. The AGF study took the firm position that AAA was the best means for air defense of local targets, and should be used to the exclusion of fighter aircraft.

Applying these arguments to continental defense, the Ground Forces proposed that they be given the mission of providing defense of ground targets from aerial attack within the range of their weapons. AGF would perform this mission by allotting AAA weapons to the Continental Armies, establishing priorities for defense upon the basis of directives from higher authority, and informing the Air Forces of the locations of ground defended areas. Within these areas, the friendly aircraft would be permitted to operate provided the defenses were advised of their approach. When attacking aircraft reached the defended area, AAA would open fire and fighter aircraft would break contact to wait until the enemy aircraft emerged from the confines of the ground defended area.

In August 1946, the AAF replied to the AGF memorandum. The principal AAF point was the importance of *unity of command*, long regarded by military men as one of the foremost principles of warfare. For a single mission, air defense, there must be a single commander. The speed and range of modern aircraft, together with the great destructive power they wield, made any attempt to divide the single mission of air defense between two separately operating agencies one that would be fought with disaster. The one air defense commander must have the authority over a wide area, the communications to reach all air defense resources instantaneously, and the power to direct and allocate air defense resources as he determines

proper. The AAF reply pointed out the obvious inefficiencies of split command with duplicate communications facilities, electronic countermeasures, detection systems, and intelligence systems.

The AAF felt that the AGF overly emphasized World War II experiences when the Allies enjoyed overwhelming air superiority. The homeland and the Army rear areas were virtually free from enemy air attack, allowing the AAA the freedom to move on with the ground armies. Further, fighter aircraft were never tied to the defense of fixed points, but carried on operations over fixed points if the tactical situation made such operations sound. The Ground Forces did not seem to recognize that future developments in ground-launched guided missiles might render these weapons far different from gun weapons in range and other characteristics. To limit aircraft to the sphere outside the range of ground-launched weapons when guided missiles reached an advanced state of development would probably be tactically unsound.

With respect to the AGF assertion that an adequate AAA was the best means of local air defense against targets within range, the AAF contended that each weapon had its own role to perform and, according to circumstances, one or the other would be the best weapon to use. As for the AGF position that ground action against any adversary was the responsibility of ground forces, the AAF retorted that the mission of the weapon was more important than the point in space from which it was launched. The recent war, it was asserted, had proved that the mission molded forces. Joint operations under the command of the service chiefly concerned with carrying out the mission was one of the most important lessons learned in the recent war.

Identification, the AAF said, was not a soluble problem. No system had yet been devised whereby identification could be achieved in an acceptable percentage of cases. Furthermore, no defense system could be based upon voluntary exchange of information between the AAA radar system and that of the air warning service. Those agencies must be under one commander.

The recently created Air Defense Command added several other objections to those raised by the AAF. Defense in-depth, ADC asserted, was made necessary by the speed of modern aircraft, and local air defenses as such might very well be eliminated in future air defense arrangements. Air attack might be sudden and without warning, so that in-being forces, under one commander, were requisite in peacetime. While recognizing the need for Ground Defense Zones in addition to Air Defense Zones, ADC felt that these zones should be designed according to weapon capability, and not assigned without qualification to particular commands. ADC did not commit itself to Rules of Engagement for such zones, and made no comment concerning those described by the AGF study. In summary, ADC recommended that the AGF principles be applied only within a single force, and that air defense be defined to embrace all measures designed to prevent or lower the effectiveness of air attack.

In September 1946, the War Department resolved the controversy by accepting the AAF position that the air defense mission was unitary. The AAF would control AAA units with air defense missions.

Decisions as to the future role of guided missiles in air defense were deliberately withheld, in order to "maintain service-wide doctrinal flexibility in the use of this arm . . . ." However, it was believed "neither feasible nor desirable" to change Circular 138, which provided for a single command charged with complete responsibility for carrying out the active defense of the United States against air attack. AAA employed with the ground forces was of primary concern to the Ground Forces, while AAA assigned the mission of CONUS air defense would come under the command of the Air Forces.

The War Department specified that both the AAF and the AGF should submit to the War Department their AAA requirements for the next three to five years. The Air Defense Command was to make its staff an

integrated one, incorporating AAA officers, and ensure that AAA assigned to it was trained in combat missions, not to interfere, however, with the fulfillment of the primary air defense responsibility. The Ground Forces, on their part, would continue to provide technical training for all AAA units.

Thus the doctrinal dispute over the control of AAA was settled at a time when there were virtually no air defense resources in being. It would have a major impact in later years when the Korean War emergency caused the mobilization of a CONUS air defense. The Air Force was never again to relinquish the dominant position in air defense.

b. The Early Impact of "Unification"

While the AGF and AAF were exchanging memorandums on air defense, planning for unification of the armed forces moved ahead, spurred by the Bikini Atoll atomic bomb test and the release of the United States Strategic Bombing Survey, both in July 1946. The Bikini test underlined the importance of the air arm in the nation's defenses, and the bombing survey explicitly recommended the establishment of a separate Air Force. The National Security Act of 1947 was passed by the Congress and implemented by the Executive Department in July of 1947. James Forrestal was named the first Secretary of Defense over the National, Military Establishment, unifying the Departments of the Army, Navy, and Air Force. The Joint Chiefs of Staff became a permanent organization, though without provision for a Chairman.

A series of agreements between the Army and Air Force took place to ensure the orderly division of functions and responsibilities as they became separate departments. One of the first agreements was signed in July 1947 between General Devers, Command General Army Ground Force, and General Spaatz, still signing as Commanding General Army Air Forces. The agreement simply stated that the Air Defense Command had responsibility for AGF units participating in air defense of the Zone of the Interior, when AGF AAA units were so designated and assigned. The ADC was to establish communications to the AAA units; the AAA units were to follow ADC standing operating instructions for assignment of targets, opening and ceasing fire, conditions of alert and minimum manning requirements. The extent of participation and the areas to be defended by the AAA units would be determined by joint agreement between Army commanders and corresponding Air Defense commanders. General Devers was not giving anything away that was not already directed, and there were no AAA units in existence to place under ADC control with the exception of antiaircraft school troops at Fort Bliss, Texas.

Chief of Staff of the Army, General Eisenhower, and General Spaatz signed over 200 agreements in separating the functions of the Army and Air Force. One of the Eisenhower-Spaatz agreements specifically confirmed the Devers-Spaatz agreement.

To further clarify the functions of each service, Secretary of Defense Forrestal held a series of conferences with the chiefs of the services in Key West, Florida, in March 1948. The Air Force was assigned responsibility for the defense of the United States against air attack. An Air Force attempt to have AAA units integrated into the Air Force was rejected by Secretary Forrestal. The Army retained the responsibility for organizing, gaining and equipping AAA units and providing them as required for Air Defense.

Despite the reorganization and "unification" of the military services, the budget for fiscal year 1949 was prepared by the individual services unilaterally without reference to the Joint Chiefs of Staff, and together totaled $10 billion—the amount that President Truman had established for total defense requirements. The Air Force piece of the budgetary pie allowed for a maximum of 55 combat groups and 17 separate squad-

rons, providing $700 million for the modernization of active groups by replacing World War II aircraft. The Army and Navy were funded at a level that would keep them in an appropriate balance with the air arm's forces. The small size of the Air Force appropriation made it impossible for the Air Force to do justice to all the missions assigned to it, and forced a priority system in order to do any one mission well. There was consensus among the Air Force leaders that the Strategic Air Command should have first priority. The Air Defense Command was unable to have its plans for an aircraft control and warning (AC&W) system funded in FY 1947, FY 1948, or FY 1949, although such a system was considered a prerequisite for a successful CONUS air defense.

The Air Force had devised an AC&W plan in late 1947, known as Supremacy, that was to be implemented within five years from the time that funds were allocated.[3] The plan called for providing 24-hour operation of Alaska and peripheral continental radar stations, and part-time operation of interior U.S. stations. The plan was to cost $388,000,000 to provide 411 radar stations, 374 of which would be in the continental United States, manned by 25,138 Regular Air Force and 13,788 National Guard troops. The Air Force had let a contract with General Electric for a new improved search radar (jointly funded with the Navy) which was to be in production by 1953. The ADC considered the Supremacy radar network as the minimum that would be acceptable, but wanted it tied in with the Canadian Air Defense Command, the Alaskan Air Command, and a proposed Northeast Air Command. General Stratemeyer also wanted the extension of coastal radar coverage by airborne early warning stations and radar picket ships. The ADC, in November of 1947, decided to go ahead with implementation of the plan with such AC&W assets as the ADC possessed.

The newly designated USAF assigned the ADC a definite mission directive in December 1947.[4] General Stratemeyer was directed to provide for the defense of the United States against air attack, using designated SAC and TAC units, and Air National Guard units in the event of war or an emergency. Although ADC was given very few means to carry out its mission, it had a clear directive to plan the air defense of CONUS. The existence of such an ADC air defense plan was to have major implications for the future.

c. Strategic Interaction: The Threat of War in 1948

In 1948, even while the Joint Chiefs of Staff were sitting with Secretary Forrestal at Key West, the crush of events in Europe brought about a war scare. The Communist coup in Czechoslovakia and German currency reform in the non-Communist zones caused General Clay, American Military Governor in Germany, to cable from Berlin that he believed war might come "with dramatic suddenness" at any moment.[5] Although there was no overall JCS increase in U.S. defense readiness, General Spaatz directed immediate augmentation of the Alaskan air defense system and ordered the Alaskan Air Command to operate its warning radars on a 24-hour basis by 4 April. Headquarters USAF moved fighter squadrons to Alaska and the Northwest, reinforced the Alaskan radar system with several radar sets, and directed ADC to reinforce the radars in the Seattle area and place the radars in 24-hour operation. General Spaatz ordered the ADC to place the air defense system in the Northwestern United States into immediate operation, to be continued for at least the next sixty days. Shortly after 12 April, ADC was given word that the crisis was over, and ten days later the

[3] USAF Historical Studies: No. 126, p. 11.
[4] Ibid., p. 12.
[5] Ibid., p. 19.

24-hour operations of the makeshift AC&W system was allowed to return to more normal operations. The short-lived crisis served to emphasize the meagerness of the resources available to General Stratemeyer; he wasted no time submitting his report to Headquarters USAF, recommending that the ADC be given the means for carrying out its mission.[6]

As if in reply, General Stratemeyer was ordered on 23 April 1948 to establish with his current resources AC&W systems in the Northwestern United States, the Northeastern United States, and the Albuquerque, New Mexico, areas, in that priority.[7] No additional funding was available nor were other additional resources available. Within the means available, General Stratemeyer and the ADC, strove to carry out the directive, but necessarily fell far short of minimum acceptable success. As any good commander would, General Stratemeyer protested his lack of readiness and resources to Headquarters USAF. Air defense exercises in May and June in both the Northwestern and Northeastern air defense regions further proved the inability of ADC to defend against hostile air attack. General Stratemeyer reported that he could not provide an effective air defense if he were provided all the resources of the entire USAF, as air defense depended on an effective AC&W system and the Air Force was lacking in those resources.[8]

The Air Force attempted to get its Supremacy plan before Congress in 1948, but could not get it out of JCS channels before Congress adjourned. The Air Force fell back and devised an Interim Program designed to use radar equipment already on hand or under current procurement.[9] This program called for 61 basic radars and 10 control centers to be deployed in 26 months, with an additional ten radars and one control station for Alaska. As the radars would provide only high-altitude coverage, a system of ground observers would be necessary for low-altitude coverage, plus Air National Guard gap fillers and air transportable radars. The Interim Program required supplemental appropriations by Congress in the amount of $44,300,000.

The Air Force position on the Interim Program from the first was that is was not a substitute for the Supremacy plan, but a makeshift substitute to fill the gap until the Supremacy plan network could be approved and constructed. Perhaps it was inevitable that the Department of Defense should seize on the Interim Plan as a less expensive substitute for the larger and more expensive original request. The ADC also planned a First Augmentation to the Interim Plan—the addition of 15 more radars at an additional cost of $41,900,000.[10] The Interim Plan and First Augmentation were eventually put together and placed before the Congress with a request for an appropriation of $85,500,000. The bill passed the Congress in March 1949, and was signed by President Truman, giving the USAF an authorization for an Aircraft Control and Warning System, but some time would elapse before the Congress was to appropriate money for the system, and more time would be required to build the system.

Pending construction of the permanent Modified Plan, the USAF worked out a temporary network to be put together with minimum cost on land already owned by the government, and using on-hand obsolescent radars. The temporary network would serve for training purposes and would provide some measure of defense pending construction of the desired network. The network was named Lashup for obvious reasons

[6] Ibid., p. 20.
[7] Ibid.
[8] Ibid., p. 21.
[9] Ibid., p. 23.
[10] Ibid., p. 24.

and would take two years to put together.[11] By the end of 1948 ADC began preliminary work on Lashup. The ADC could expect to see some semblance of an air defense system in 1950—until that time the CONUS was virtually defenseless against hostile air attack.

The Air Force had long believed that 70-group Air Force was the absolute minimum air power necessary for the security of the United States, but had accepted the 55-group Air Force imposed by President Truman's insistence on a $10 billion ceiling for defense spending. During Congressional hearings for the Defense Establishment's fiscal year 1949 budget, in March of 1948, Congress indicated an interest in a 70-group floor under the Air Force. Shortly thereafter the Soviet military blockade of Berlin began, which brought back into sharp focus the importance of airpower. Based on recommendations of the JCS, President Truman forwarded a request to Congress in May 1948, for a supplemental appropriation of $3,068,411,000, to be nearly equally split among the three services. The Air Force decided to attempt to activate additional groups by using many moth-balled airplanes, rather than buying all new aircraft, climbing in its planning almost to the 70-group level it advocated. It also contracted for 2,201 new aircraft from the augmented FY 1949 appropriations.

d. The Problem of Budgets

In mid-1948, an economic recession wiped out an expected budget surplus of $5 billion and caused a budget deficit of $2 billion, persuading President Truman to set a ceiling of $14.4 billion on the National Defense budget for fiscal year 1950. This was done in the summer of 1948 without consulting the National Security Council or the JCS. Air Force planning was forced to *reduce* its combat strength to 48 groups and 10 separate squadrons. To achieve this cutback from the 55-group strength, the Air Force concentrated on building up SAC at the expense of the other missions. In order to make the best use of all air resources in CONUS, rather than dividing them among several commands, the Continental Air Command was established at Mitchel Field on December 1, 1948.[12] ConAC received command of the six air forces formerly assigned to ADC and the Tactical Air Command, reducing both ADC and TAC to the status of operational headquarters. ConAC also assumed responsibility for the Air National Guard and the Air Reserve. This reorganization was completed on February 1, 1949. Lieutenant General Stratemeyer took over as Commanding General of ConAC. This economy measure reduced ADC to the status of a major command with no assigned air defense forces—it was to assume operational control over such forces as would be placed under it whenever an active air defense became necessary.

In March 1949, Louis M. Johnson succeeded Forrestal as Secretary of Defense, whereupon he instituted an economy program which cut all services proportionately in personnel, equipment and facilities. He continued the established concentration on strategic air power and SAC but cut the construction of the Navy supercarrier already under way. The Air Force cancelled orders for some 470 aircraft and concentrated its purchases on 75 additional B-36's for SAC. The Navy staged the so-called "revolt of the admirals" which placed the merits of the B-36 and the supercarrier before the public's eye in a heated controversy. Although the controversy was hailed as a manifestation of service rivalry, more properly it was a manifestation of an honest difference of opinion between members of two services of how the increasingly scarce defense dollar should be allocated for the overall defense of the United States. As the supercarrier was designed to carry Navy air-

[11] Ibid., p. 25.
[12] Ibid., p. 28.

craft with atomic weapons, the Navy naturally saw it as adding greater flexibility to the U.S. strategic offensive air capability. The public controversy, however, did nothing to further the cause of national defense.

e. Strategic Interaction Revisited: The Soviet Atomic Bomb, NSC 8, and Korea

At the time that the U.S.S.R. exploded its first experimental atomic device in August 1949, American scientists had not expected the event until 1952. The surprise sent shock waves throughout the United States that had far-reaching impact on the future military posture of the nation. The most immediate result was to stimulate research and development in the field of nuclear weapons development. The scientific community had resisted further atomic developments in general, and the development of a thermonuclear weapon in particular following the Soviet explosion, a public debate on the further development of the United States' atomic program ensued. During that debate, in January 1950, Dr. Klaus Fuchs, a former group leader of the Los Alamos atomic weapons laboratory, confessed that he had passed nuclear secrets to the Russians.[13] President Truman, on 31 January 1950, directed the Atomic Energy Commission to work on all forms of atomic weapons, including the hydrogen bomb. As a result of that directive, the United States developed a family of nuclear weapons, including an efficient atomic bomb capable of being carried by a fighter-type aircraft. The age of tactical nuclear weapons had arrived, and the age of fusion weapons was not far behind.

Concurrent with directing the new atomic program, President Truman directed the Departments of State and Defense to review U.S. foreign and domestic policy in light of the loss of China, the Soviet mastery of the atomic bomb, and the prospect of the hydrogen (fusion) bomb.[14] This directive took the action out of the National Security Council and resulted in an *ad hoc* joint State-Defense study group, chaired by Paul Nitze, director of the State Department Policy Planning Staff. The State Department, which had consistently borne the brunt of the military weakness of the United States in attempting to deal with world affairs, gave its full backing to the study effort.

The Department of Defense backing was confused and disjointed. Secretary Johnson and the Joint Chiefs of Staff had accepted President Truman's insistence on minimum military spending to protect the nation's economy. Since the summer of 1948, a belief had grown that the Soviets were deliberately maneuvering the United States into increasing its defense expenditures beyond that which the economy would safely bear. Military men and civilians alike had come to believe that the economy of the United States was its first line of strength and security, and that to damage it by overspending for defense was tantamount to losing a military war.[15] President Truman had reduced the FY 1951 military budget from $14.5 billion to $13.0 billion to compensate for the military aid sent to Europe to bolster the defenses of NATO allies. Although the military Joint Chiefs believed that the nation's security required expenditures of around $30 to $40 billion for defense, they quietly concurred in the $13 billion ceiling imposed on defense spending. This acquiescence was reflected in their initial attitude toward the directed strategic study.[16]

Under State Department leadership, the study advocated an immediate and large-scale build-up in U.S. military strength and that of U.S. allies to right the power imbalance with the Soviet Union, in the hopes of averting an all-out war with the Soviet Union by forcing a change in the nature of the Soviet system.

[13] Hammond, *The Cold War Years*, p. 38.
[14] Huntington, p. 49.
[15] Ibid.
[16] Ibid., p. 50.

Underlying that conclusion was the implicit belief that the Soviet Union only respected strength and would only change from its aggressive policies if faced with equal or greater strength.

The study group estimated that the Soviet Union would be adequately armed with nuclear weapons by 1954 to launch an all-out attack on the United States. The United States and its allies also faced the prospect of piecemeal aggression subversion, disunity in the NATO alliance, and loss of American will. President Truman referred the study to the NSC after it had received the concurrence of the four Joint Chiefs, the three service secretaries, a reluctant Secretary Johnson and the enthusiastic Secretary of State Acheson. The NSC assigned the number 68 to the study.[17] NSC 68 was the first comprehensive statement of a national strategy for the United States since the formation of the National Security Council. It meant tripling the budget, increasing taxes at a time when the Congress was reducing taxes, and arming in peacetime without the support of an aroused public. NSC 68 lay on President Truman's desk throughout the spring of 1950, with no approval from the President. The communist invasion of June 25, 1950, of South Korea resolved the issue. From the viewpoint of a rather lopsided international strategic arms competition, the Communist timing couldn't possibly have been better for the United States or worse for the Soviet Union.

4. Summary: 1945–1950

The period from the end of World War II until the outbreak of the Korean War saw the development of the Cold War with Russia which split the world into two hostile groups. The United States concentrated on the development of its economy and its monopoly of the atomic weapon, at the expense of military strength. Due to the deliberately low military expenditures, the military services had to skimp to meet their overseas deployment commitments, and neglect air defenses and civil defense except as planning activities. The military services turned to civilian industry for further development of the advanced technologies first demonstrated in World War II. Despite the development of a "unified" military department, the individual services controlled their own research and development programs which were in competition with one another. Due to budgetary limitations, and their own planning premises of a "big war," the U.S. military forces were not ready for the "limited" challenges of the Berlin Blockade and Korea. Instead they were planning the resolution of potential problems in mobilizing civilian industry and military reserve forces to meet the challenges of a "big war." The 1949 Soviet atomic explosion caught the U.S. by surprise and triggered off actions to greatly increase U.S. military strength. However, even with the scare effect of the Russian atomic bomb, it is doubtful if the American public would have supported the increased taxes and spending that such an increase would demand. That public reluctance was significantly reduced after the Communists committed open aggression against South Korea. The Korean invasion provided the event that U.S. national leaders needed to raise U.S. armaments to the level that the world situation required.

B. 1950–1955: Defense Against the World War II Threat

1. Strategic Interaction: Impact of the Korean War

a. Perceptions and Budgets

The well-prepared invasion by the North Korean armed forces of the Republic of Korea on June 25, 1950, was taken as another example of militant Communism on the move. The Communist takeover of

[17] Ibid.

China and the explosion of the Soviet atomic device thoroughly alerted U.S. policy makers to the lack of military preparedness of U.S. forces. Korea left no doubt that the Communists would use force to accomplish foreign policy objectives unless opposed by substantial military strength. It also provided a clear-cut provocation for response by U.S. military force, taking place as it did under the nose of the largest concentration of American military power outside the United States. The American response through the United Nations organization was measured and limited. President Truman was keenly aware of the Korean conflict having the potential to spread into a third world war, and was adamant that the conflict be limited to the borders of Korea. The United States was not prepared for a full-scale all-out war with Russia, and its allies in Europe were in an even more dangerous position. The major effort of U.S. policy toward the Korean War was to limit the conflict and prevent war. Certain of the President's subordinates did not comprehend that fact and were summarily relieved or allowed to resign.

The Korean War created a clear and present danger that the American public could rally behind. As a result the lid was raised on defense expenditures and tax revision was rewritten to raise individual and corporate income taxes. The money voted for rearmament totaled $22.3 billion in FY 1951, rose to $44.0 billion in FY 1952, and peaked at $50.4 billion in FY 1953.

b. The New Strategic Vision

From President Truman's viewpoint, the limited war in Korea made rearmament possible, but he made no bones of the fact that rearmament was not directed primarily at fighting the Korean War. The Administration was rearming to counterbalance the threat of increased Soviet strength and building the mobilization base of the United States up to a point where it greatly increased the readiness of American industry for full mobilization for the expected general war. General George Marshall replaced Secretary Johnson as Secretary of Defense in September 1950, and steadily built up U.S. military strength to act as a long-term deterrent to Soviet aggression, while preparing to fight a general war if deterrence failed.

The costs of the Korean War were thus a relatively minor portion of the increased Department of Defense budgets throughout all three years of the Korean War. The other measures that were taken to mobilize the nation's resources for war must be viewed in the light of an overall preparation for a much greater conflict than the relatively small and limited war in Korea, even after the Chinese forces entered the battle and temporarily tipped the scales in favor of the Communist forces. The enemy was clearly identified as the Soviet Union; the atomic threat posed by the Russians was revised from the 1954 estimate to 1952; and the fear on the part of U.S. policymakers was that Europe was the real target of Soviet aggression.[18] To meet that threat SAC was to be substantially expanded to the point where it would be able to absorb a Soviet surprise attack and still retaliate effectively against the U.S.S.R. The ground forces would be built up with strong ground reinforcements dispatched to bolster the ground defenses of NATO against the Red Army. Allied forces would be strengthened from the rearmament production effort to bolster collective security and insure the maintenance of bases overseas for U.S. projection of its military power overseas. July 1952 was conceived to be the target time of maximum danger.[19]

To strengthen the U.S. armed forces for that time of maximum danger, the planned strength of the armed forces included 20 Army division and 18 regimental combat teams; 1,130 ships in the Navy; 3 Marine divi-

[18] Ibid., p. 80.
[19] Ibid.

sions and 3 Marine air wings; 95 Air Force wings; and a total military strength of 3,636,000 men. The Air Force was projected to build to an over-all strength of 143 wings (first set for 1954 then stretched to 1955 to spread the cost more acceptably).

c. Organizational Changes for Air Defense

As the Korean War was the excuse for partial mobilization and rearmament to prepare to fight "the war" against the Soviet Union, a series of executive orders created emergency offices in the Executive Office of the President to handle the mobilization of the U.S. economy, the stockpiling of strategic resources, and the management of defense production. Due in part to the arousal of the U.S. public to the increased dangers of attack of the continental United States and in part as a "mobilization event" which had been planned for in peacetime, President Truman created the Federal Civil Defense Administration in December 1950.[20] At the same time he forwarded draft legislation to the Congress and asked them to expedite a bill which would provide legislative basis for the civil defense agency. Congress passed and the President signed the Federal Civil Defense Act of 1950, in January 1951, which satisfied the public clamor for and the mobilization requirement for an organization to provide for the defense of the civilian population and civilian industry. The Federal Civil Defense Administration was placed outside of the White House Executive Office and outside of any existing Federal department or agency. The legislation placed the responsibility for civil defense on State and local governments and gave the Civil Defense Administrator only token authority to coordinate the efforts of the several states. The civil defense legislation was designed only to respond to the current threat, and was not suitable for a long-term peacetime civil defense effort extending past the Korean emergency. The Congress voted only nominal appropriations for the FCDA, despite the formulation of a $2 billion Federal plan for the development of a shelter program, to be matched dollar for dollar by State and local governments. The first Civil Defense Administrator was a man whose name was virtually unknown on the national scene and who lacked any prestige to throw behind the program. Neither President Truman nor the Congress intended the civil defense effort to become effective except as a token effort.

Like civil defense, the mobilization and activation of an in-being active air defense of the continental United States was just another "mobilization event" in preparation for a general war with the Soviet Union. With the front pages of the newspapers filled with the news from Korea, and the mobilization of dozens of Army and Air Force units to meet force requirements for the buildup for deterrence, the activation of CONUS air defense went virtually unnoticed.

After the formation of ConAC in December 1948, the ADC was reduced to a planning headquarters while awaiting the assignment of air defense units by ConAC. The Army's air defense effort consisted of two regular AA battalions located at the Antiaircraft Artillery school at Fort Bliss, Texas. The ADC called a series of conferences on air defense which resulted in an air defense plan for the defense of CONUS. The plan was almost totally dependent on mobilization of Army and Air Force National Guard and Reserve units for implementation. In the initial plan in 1949, the ADC and Army planners decided on the protection of thirty-seven vital industrial areas with AA defenses, requiring 95 AA gun battalions and 127 AA automatic weapons battalions. For area defense, planners estimated that twelve groups of interceptors were required, totaling 900 interceptor aircraft. The Army planners felt the lack of an Army air defense command similar

[20] Executive Order 10186, Dec. 1, 1950.

to the Air Force's ADC, as each Zone of the Interior Army was charged with negotiating agreements for Air Force operational control of the AA units.

The Army Ground Forces was renamed the Army Field Forces in March 1948, with responsibility only for training, while the six continental armies were placed directly under the Army Chief of Staff. As an interim solution, the Army created an Antiaircraft Artillery staff section at ConAC, and started planning for the creation of an Army Antiaircraft Command to command AA units passed to the operational control of the ADC.

In March 1950, the Army and Air Defense Command revised the air defense plans, now agreeing that the sixty localities in the country which were judged critical for air defense, twenty-three would be provided with AA defenses.[21] These consisted of three atomic energy installations, seven Strategic Air Command bases and thirteen major industrial and population centers. A total of sixty-six AA battalions were required to man the defenses. By early 1950, the Army had started to build up the AA strength in the Active army. During 1949, fifteen battalions had been organized for CONUS defense.

Prior to the invasion of Korea, ConAC had recommended a reorganization of its many functions to assign all air defense responsibilities to the subordinate Eastern and Western Air Defense Forces, eliminating Headquarters, ADC.[22] It was almost an irony of fate that the recommendation was approved on 1 July 1950, at the very time that the slow build up of air defense forces was about to begin. As the Permanent System radar sites began to become operational and as additional newly organized Air Defense fighter squadrons were being organized, General Whitehead reversed the recommendation and proposed that the Air Defense Command be reactivated separate from ConAC.[23]

The Air Defense Command was redesignated a major USAF command on 10 November 1950, and reestablished on 1 January 1951 at Ent Air Force Base, Colorado Springs, Colorado, with General Whitehead as its commander. In April 1951, ARAACOM also moved to Colorado Springs, leasing space in the downtown Antlers Hotel (where it remained until August 1953, when it co-located with ADC at Ent AFB). On 10 April 1951 ARAACOM assumed command of 23 AA battalions and assorted other headquarters and units assigned to it by the Department of the Army. Most of the AA units were located at Army posts at considerable distances from the locations they were designated to defend.

d. Assets for Air Defense

When the Korean War broke out, the Army had 14 National Guard battalions, ready for employment in the defense of CONUS. Due to the shortfall from the required 66 battalions, San Francisco and four Air Force bases were deleted from the list of localities to be protected by AAA. The Army formed the Army Antiaircraft Command on 29 June 1950, to command the Army units allocated to the air defense of CONUS. ARAACOM was also charged with planning for the tactical deployment of AA units, and for becoming the Army component of a joint continental defense force, if and when the joint force was designated. No AA units were placed under ARAACOM control (and therefore none were placed under ADC operational control), as it slowly built up strength of its headquarters and acted as the AA element on the ConAC staffs. To be closer to ConAC, ARAACOM moved to Mitchel AFB, New York on 1 November 1950.

[21] Barnard, *The Gun Era*, p. 49.
[22] USAF Historical Studies: No. 126, p. 35.
[23] Ibid.

When the Korean War broke out, ConAC did not have much in the way of air defense assets to work with. The 44 radar stations of the Lashup radar network were completed and operational, but limited by World War II obsolescent radar equipment. The Air Force had to reallocate $50 million of appropriated funds from other projects to start construction on the high Priority Permanent System of radars in February 1950, with the first 24 radar sites to be constructed by the end of 1950. It would be May of 1952 before the original construction program for the Permanent System would be completed.

In April 1950, Lieutenant General Whitehead, commander of ConAC since April 1949, was authorized to begin armed interceptions over the Atomic Energy Commission installations and on the East Coast.[24] ConAC was authorized to organize a Ground Observer System and the CAA established. Air Defense Identification Zones (ADIZ) in the most vital defense areas. The Lashup AC&W network was placed on 24-hour operations, but it was not organized to handle sustained operations and they were later dropped.

General Whitehead estimated that a total of 61 air defense fighter squadrons were the minimum for an adequate air defense of CONUS.[25] When the Korean War buildup program began it was planned to organize a total of 35 regular air force squadrons for assignment to air defense, to be available by the end of June 1951. After repeatedly being turned down, his request for an additional 15 squadrons of Air National Guard was approved and the squadrons were federalized in early 1951. He further requested that another 23 ANG squadrons be mobilized as soon as adequate housing and operational facilities were available. By 1 March 1951 all but 16 ANG fighter squadrons were federalized, and those squadrons were programmed for air defense when they were made available. The squadrons were equipped with an assortment of propeller-driven and jet aircraft, few of which were all weather interceptors.

e. Summary of the First Year

By the end of the first year of the Korean War, bit by bit and piece by piece, the air defense of the Continental United States was building up. It could not be called a system as there was not a contiguous radar coverage; there were large gaps in the Ground Observer Corps coverage; the assigned fighter aircraft were severely restricted in their capability for around-the-clock coverage; there was not adequate AA artillery to protect targets that were designated as "vital"; and existing AA was still located far from its assigned tactical areas.

Air defense was not given a high priority in the overall defense buildup because few military men believed that an effective air defense was feasible or desirable in light of higher priority military requirements. Priority was afforded the vital industrial mobilization and production base, atomic production facilities, and the strategic air offensive deterrent. There was no concept of attempting to protect the citizens of the nation, except as they contributed to a vital defense function.

Korean War money was being used to fund production of many of the research and development air defense weapons that were developed after World War II, in anticipation of a more pressing need for air defense a few years in the future. The Air Force, which had principal responsibility for continental air defense, simply had its hands full building up SAC, fighting the war in Korea, and providing tactical air forces for the augmented ground forces in Europe. The Army, with similar global commitments in Korea and Europe, devoted only a small fraction of its resources to air defense, and was principally concerned

[24] Ibid., p. 31.
[25] Ibid., p. 34.

with keeping up with the Air Force's air defense efforts and providing suitable employment for its AAA units.

f. R&D Strategy: The Relationship Among Early Warning "Adequate" Attrition and Civil Defense

It was at this juncture that the Air Force decided to mobilize the efforts of the American scientific community to assist in tackling the air defense problem. When the Air Force was created as a separate service in 1947, it did not choose to establish the Army's arsenal system for the development of new weapons and equipment. As the Army Air Force had worked closely with the American civilian aircraft industry over the years, it continued that association when it became a separate service, and turned to other civilian industrial firms for the development of other non-aircraft requirements. Early in 1951 the Air Force contracted with the Massachusetts Institute of Technology for a study of the best means of proceeding with the difficult air defense problem. One of the recommendations of the study (Project Charles) was that a permanent laboratory be established with a civilian institution to work on the technical problems of air defense.[26] The laboratory was established at M.I.T., known as the Lincoln Laboratory, in September 1951, on contract with the Air Force. The Lincoln Laboratory immediately went to work on the technical problems of detection of enemy aircraft and their associated interception.

The scientists were working on an entirely different air defense problem from that encountered in World War II. World War II air defenses were designed to inflict an unacceptable attrition rate (probably anything over 10 percent) on enemy bombers making repeated attacks with conventional iron bombs. Even though 90 percent of the bombers made it through the defenses and dropped their bombs, in time the loss rate would be unacceptable by either damaging the morale of bomber crews or by destroying bombers faster than they could be produced. The advent of the atomic bomb with its tremendous destructive power made it imperative that attrition rates be raised drastically upward and as near to 100 percent as feasible, or the air defense would be ineffective. New tactics and new and rapid means of detecting enemy attacks and dispatching highly efficient weapons to destroy them must be developed. Adding additional increments of existing radars, antiaircraft guns, and day fighters just would not do the job.

The American scientific community that had become politicized in the days after Hiroshima and Nagasaki in the effort to bring atomic energy under international control, had become somewhat disillusioned when the Soviet Union exploded its atomic device. The scientists understood better than most Americans the truly terrifying effects of the atomic weapons, for atomic weapons effects was still a highly classified subject. Though the American scientific community was not a unified group, the scientists working on the Lincoln Laboratory air defense study tackled the subject with more than average enthusiasm in the determination to defend America against Russian atomic strikes.

In 1952 another group of scientists belonging to a research institute known as Associated Universities and headed by a President Emeritus of M.I.T., Lloyd Berkner, was awarded a contract by the Department of Defense (acting in behalf of the National Strategic Resources Board and Federal Civil Defense Administration). The contract called for an examination in depth of the civil defense program in the United States. The civil defense project was known by the name "East River" and was a massive investigation of all aspects of the subject. Some of the Associated Universities' scientists who worked on "East River" were

[26] Huntington, p. 329.

also members of the Lincoln Laboratories, and many members of the two groups were in close association. The scientists working on "East River" concluded that civil defense could not be effective without adequate warning time to permit the population to take shelter before an enemy attack—something in the nature of four to six hours' warning. As warning time was a function of the active air defense forces, the "East River" scientists prevailed upon the Lincoln Laboratory scientists to examine the question of the military defenses providing adequate warning time for the civil defenses.

In the summer of 1952 a group of Lincoln Laboratory and Associated Universities scientists came together informally in a caucus to discuss civil and military defenses. They were entirely an unsponsored and unofficial group, later known collectively as the Summer Study Group. They wrote a report[27] based on their deliberations that concluded:

(1) the Soviet Union would be capable of crippling the United States by a surprise attack in two or three years by long-range bombers carrying atomic weapons
(2) U.S. in-being and planned military and civil defenses were inadequate and capable of achieving no more than a 20 percent kill rate
(3) foreseeable new technology (specifically "forward scatter" radar) would make it feasible to develop an air defense system capable of achieving a kill rate over enemy attackers of 60 percent to 70 percent.

They recommended establishing a distant early warning radar line across Canada to provide three to six hours of warning of enemy bombers. They also recommended a communications *system* capable of rapid transmission of air defense data through the use of automatic and integrated equipment, as well as new and improved interceptors, and the development of homing missiles for interception and destruction of enemy aircraft. Much of the technology involved in the new developments they recommended was still in the experimental stages, but the scientists had great faith in their ability to provide the hardware they based their hopes for an improved air defense on.

The "East River" report also included a section on active air defenses that echoed the conclusions of the Summer Study Group. The Department of Defense neither expected nor wanted its civil defense study group to advise it on active military air defenses, and coolly brushed off the Associated Universities report with a terse letter of acknowledgement. The Air Force, as the official sponsors of the Lincoln Laboratory, was scarcely more receptive to the Summer Study Group report. Although the Air Force was charged with responsibility for air defense, it was only one of a number of missions and the leadership of the Air Force was unenthusiastic over the commitment of the several billion dollars required to, fund the recommended developments. The Air Force refused to forward the Summer Study Group recommendations to the National Security Council.

The scientists drew on their experience with politicization in the mid-1940's and took their case to the American public by giving their report to the Alsop brothers—reporters and columnists with large reader followings. Articles appeared in the *Saturday Evening Post* and in syndicated newspaper columns telling the American people that American scientists had the answers to improving the inadequate U.S. active air defenses, and ". . . there is a way for us to be sure of destroying 85 percent, even 95 percent, of the attacking force, say the scientists."[28]

[27] Ibid.
[28] *Saturday Evening Post*, March 21, 1953, p. 19.

The scientists did not rely on "leaks" to the public media alone, but by-passed the Air Force and Department of Defense and west directly to Jack Gorrie, Chairman of the National Security Resources Board. Gorrie, with a seat on the National Security Council, introduced the report to the NSC with a strong recommendation for immediate construction of an arctic warning line at a cost of $1 billion during the first three or four years. The Truman Administration was in its last days in office and did not choose to approve the recommendations, but deferred the question by continuing to study the needs of air defense. Secretary of Defense Lovett appointed a civilian committee, chaired by the President of the Bell Telephone Laboratories, Mervin Kelly, to study the air defense problem. Since the results of the committee's findings would not fall due until the new Eisenhower Administration took office, the membership and purpose of the Kelly Committee was cleared with prospective members of Eisenhower's new team. Similarly, NSC 141 was prepared and left as a legacy to the new administration.[29] It analyzed the implications of the Soviet development of the atomic bomb and recommended more intensive efforts in air defense and civil defense, among other recommendations. Thus the Truman Administration put the new administration on notice that significant improvements (and expenditures) were required for continental defense, and that a study of the Summer Study Group recommendations was under way.

g. The Eisenhower Administration

By the summer of 1952 the American public was surfeited with the stalemated Korean War and opposed to continued large expenditures for military forces at the expense of domestic needs. Eisenhower won the 1952 election on a platform of ending the Korean War and promised reductions in defense spending, a balanced budget, and reduced taxes. As the Eisenhower Administration assumed the leadership of the government it was faced with the problem of carrying out its campaign promises, yet aware that the continental defenses had been low priority in President Truman's administration and needed extensive renovation to become effective. Eisenhower's principal advisors promptly split on the continental defense issue, though in agreement that military spending overall must be reduced. Another study group, composed of business executives, educators, and assorted labor leaders, publishers, lawyers, and one military officer, was appointed to study air defense from a civilian or "business" viewpoint. As the group was headed by seven prominent businessmen, they were known as the "Seven Wise Men." They recommended a policy of not rushing into the air defense recommendations of the Summer Study Group, and did little to solve the President's dilemma.[30]

The Kelly Committee reported in May 1953.[31] It too rejected the urgency reflected in the Summer Study Group report, while recognizing the need for a much better continental air defense. It emphasized the need for a powerful SAC to deter attack by the Soviet Union, and deplored the publicity being stirred up by the scientists which was misleading the public with the claims for being able to devise an effective air defense system.

The Administration decided on more study of the air defense question and appointed yet another study group, this time drawn from within the government, and chaired by President Eisenhower's war-time chief of operations in Europe, Major General "Pinky" Bull. General Bull had given his name to a study report

[29] Huntington, p. 331.
[30] Ibid., p. 334.
[31] Ibid., p. 332.

on civil defense in 1948, and was a proven skilled investigator. In July 1953, General Bull's study group reported in favor of spending $18 to $27 billion on air defense over the next five years.[32]

Yet another study group analyzing Soviet air-atomic capabilities also reported to the NSC in favor of large expenditures on continental defense. The NSC duly noted the reports and continued its study to a strategy appropriate for the Eisenhower Administration throughout the summer of 1953. The strategy was based on the need for a new balance between military and domestic demands, and was to be designed for the "long haul," as opposed to Truman's crash efforts to build military forces to peak in the "year of need" when the Soviets were expected to have a significant atomic capability.

2. Strategic Interaction: The Soviet Thermonuclear Device 1

At that critical point in decision making for continental defense, the Soviets inadvertently contributed the decisive argument when they exploded their first thermonuclear device on 12 August 1953. The Russian hydrogen bomb effectively ended the controversy in favor of going for an effective continental defense system.

a. The "New Look" Strategy

In order to get the best advice from the new incoming Joint Chiefs of Staff, President Eisenhower borrowed a technique from Prime Minister Winston Churchill and sent the Joint Chiefs off without benefit of staff to draft up their views on national strategy (to incorporate military strategy and implications on fiscal policy and other non-military strategy and implications on fiscal policy and other non-military aspects of governmental activity). The Joint Chiefs agreed that strong nuclear strategic retaliatory forces were first priority and that effective continental air defenses were second priority.[33] This was particularly significant because the Joint Chiefs made their conclusions *before* the Soviet nuclear explosion, and this was the first endorsement by the JCS that an effective air defense was both feasible and necessary.

The National Security Council embodied the "New Look" strategy in NSC 162, approved in October 1953.[34] The paper identified the threat by the Soviet Union as being "total"; gave the Soviet Union the capability of making a nuclear air attack against the U.S.; concluded that national defense must have the highest priority in national strategy; and recommended that almost all the recommendations made by the Summer Study Group be approved. In effect, the American scientists, with an assist from the Soviet Union, won over the vast majority of the influential members of the new Eisenhower Administration who were primarily economy-minded and pro strategic air power. The decision to build an effective air defense was not accepted by many of its opponents, and President Eisenhower did not make a point of issuing a comprehensive public statement explaining the administration's new strategy. In light of the fact that NSC 162 proposed spending $20 billion over the next five years on continental defense, the President's decision to keep his hand close to his vest was probably prudent.

b. The DEW Line

President Eisenhower visited Canada and stated that the American and Canadian Chiefs of Staff were in agreement on measures to be taken in matters of joint defense. In early 1954 the American and Canadian

[32] Ibid., p. 333.
[33] Ibid.
[34] Ibid., p. 334.

governments agreed to proceed with the development of the Distant Early Warning (DEW) Line in northern Canada and Alaska. The first construction on the DEW Line began in 1955, together with other measures to improve the air defense of the North American continent.

The FY 1954 budget was revised downward by $5.1 billion with very substantial cuts in all the military services, except the Air Force, which was projected to increase to an end-strength of 137 wings over the 1953 strength of 110 wings. The FY 1955 budget was also revised downward, with the exception of approximately $1 billion more for continental defense, spread over all three services, with the bulk going to the Air Force for significant increases in fighter-interceptor wings, radar warning and control, and for communications systems. That amount was certainly not the $4 billion called for in NSC 162, but it did reflect a new commitment to continental defense at a time when other defense outlays were decreasing.

The Eisenhower Administration's emphasis on SAC and continental defense upset the traditional slicing of the defense budget pie approximately equally among the three services. The Air Force ended up with twice the money allocated the other two services. This caused the top leaders in the Air Force to alter their opposition to continental defense as being in competition with SAC. It also set the stage for greater in-fighting between the Army and Air Force as the Army fought to establish a strategic role for itself and thus regain its nearly equal slice of the budgetary pie.

c. Continental Defense Command

In 1954 the Joint Chiefs of Staff voted to form a joint command over the air defense of North America. The Continental Defense Command under the former leader of the Air Defense Command, General Chidlaw, was formed. It included the Army Antiaircraft Command and the naval forces assigned to continental defenses. This did little to mollify the Army's complaints against Air Force dominance of continental defense and exacerbated inter-service rivalry even further.

3. Summary: 1950–1955

By 1955 the air defense of the continental United States had moved from the status of a low priority element of military strategy to a top priority element of national strategy. The Eisenhower Administration made the decision to build an effective air defense system designed to afford protection to every American against attacks by enemy manned bombers carrying nuclear weapons. As Russia was identified as the enemy, the air defense system was planned facing northward in permanent sites. To provide early warning and interception of Russian bomber attacks, a contiguous line of radars across the northern United States and southern Canada (the Pine Tree Line) was planned for joint operation. Another line of radars (the Mid-Canada Line) was to be built by Canada along the 55th parallel to provide early warning for Canadian air defense forces. By 1955 the Distant Early Warning Line was under construction in northern Canada, to be completed in July 1957, to provide six hours warning against a propeller-driven bomber, and two hours for jet bombers and possibly missiles. Backing up the early warning system was a force of over 1,200 all weather interceptors based in 41 locations in the United States and Alaska. The Army provided point defenses with 79 AA battalions, 38 of which were equipped with Nike Ajax missiles, and the remainder of which were being converted as the missiles became available. The Nike Hercules missile was successfully tested in 1955 and was programmed to replace the Nike Ajax as it came off the production lines. Plans were being developed to tip the Nike missiles with atomic warheads. Other new developments in air defense weapons and systems

were rapidly being developed to provide rapid and automated command and control facilities, supersonic interceptors, unmanned long-range interceptors (Bomarc), seaward extensions of the radar lines, and new and improved air-to-air weapons. The air defense effort was more or less under unified control with the Air Force as executive agent with control over subordinate Army, Navy, and Air Force elements. Prospects for future expansion, increased efficiency, and greater effectiveness were bright. There seemed to be little doubt that the future combined and joint air defense system for the North American Continent would be the most effective air defense against the World War II manned bomber ever devised.

Unfortunately, the Soviets demonstrated their new jet bombers and the turbo-prop Bear bomber in the 1954 and 1955 May Day parades, thus rendering the American air defense system largely obsolescent. The Soviets' new strategic offensive capability once again caught the U.S. air defenders by surprise and seriously compromised the very extensive effort put forth to defend against the TU-4 Soviet bomber force. This would ultimately prove fatal to the concept of providing the United States with an effective air defense against enemy attack. There had been too much publicity and ballyhoo about building an effective air defense system, which resulted in a great deal of money and effort put into "sunk costs" for a permanent and rigid air defense system that was only marginally effective against advanced enemy aircraft. Against intercontinental ballistic missiles, which followed shortly thereafter, the air defense system was totally ineffective. Even the most rudimentary application of "cost effectiveness" analysis quickly established the lack of efficiency involved in maintaining a $30 billion dollar air defense with annual operating costs of over $2 billion to defend against several hundred obsolete Soviet bombers. For all intents and purposes the U.S. air defense system was dead in 1955, but it would be years before it was dismantled and buried.

4. Evaluation of U.S. Strategic Air Defense 1945–1955

Though the lessons of World War II clearly identified air and civil defense as critically important elements of national military strategy, the United States placed them in low priority in 1945 to 1950. The principal reasons to justify the lack of continental defense were the importance given to the civilian economy over military preparedness, the reliance on a strategy of nuclear deterrence based on an atomic monopoly, and the absence of a credible Soviet general war threat. The Soviet threat was seen to be principally the threat of a massive ground attack against a hostage Europe, and creeping expansionism around the perimeter of the Communist Bloc. The U.S. response was the strategy of containment largely carried out by providing economic and military aid to willing non-communist nations surrounding the Communist Bloc, with particular attention to Europe.

The Soviets severely challenged the U.S. strategy by the early detonation of a fission device in 1949, which provided a strong impetus to U.S. general re-armament against the U.S.S.R. The overthrow of China by the Chinese Red Army was seen as an act of aggression by a protégé of the Soviet Union, and signaled Communism's willingness to use force to achieve its goals. The invasion of South Korea by the North Koreans under the guns of the largest overseas concentration of U.S. military power, provided a provocation for placing U.S. military forces in the path of communist aggression and for massive U.S. re-armament against the Soviet Union.

As a result of a partial mobilization for re-armament under the cover of the Korean emergency, continental defenses were brought into being. U.S. air defenses were gradually built up by organizing new air defense units as a result of an overall mobilization process, and by federalizing National Guard and Reserve

units for the Korean emergency. A civil defense administration was activated as a mobilization procedure and response to growing public concern for its own safety. Neither the air nor the civil defense organizations were given a high priority in relation to building up SAC, reinforcing Europe, rearming allies, or fighting the Korean War.

American scientists became vitally interested in continental defense and promised technological developments to make an effective air defense feasible. The U.S. military leaders were not particularly interested in building an expensive air defense system, and were highly skeptical of the effectiveness of such a defense. The American public grew tired of the Korean War and the high costs of re-armament and elected an administration that promised to end the war and cut down on military costs. The Eisenhower Administration took office and halted the Korean War through negotiations backed by a nuclear threat. The U.S. military forces were trimmed down for a long-haul confrontation and Cold War. Public pressure stirred up by the news media and the scientists clamored for effective continental defenses. The explosion of the Soviet fusion device in August 1953 probably tipped the balance in favor of building an effective U.S. air defense of the North American continent. The Eisenhower Administration adopted effective air defense as the number two priority of its national strategy, though it did not publicize the fact. The armed services jumped on the air defense bandwagon and put service money on air defense weapons and systems they had long been developing. The Army and Air Force saw the strategic air defense mission as a source of high-priority support for an expanding piece of the military budget. Though the Air Force had won a clear doctrinal superiority and had a virtual monopoly in the command and control, radar, and interceptor elements of air defense, it had failed to develop true ground-to-air guided missiles. The Army, through an early start and a highly successful research and development effort, emerged with a clear advantage in air defense guided missiles which showed promise for antimissile applications. The Army built up its air defense artillery and equipped it with guided missiles, approaching numerical parity with the Air Force in 1955. The Joint Chiefs of Staff created a joint air defense command with the Air Force in command to create unity of effort and to put an end to inter-service rivalry in the air defense field.

By 1955 the U.S. military was committed to develop an effective air defense to provide protection to the entire North American continent. The Soviets demonstrated a growing capability to penetrate the air defense system with jet bombers and to circumvent it by low-flying long endurance turbo-prop aircraft. The promised technological advances were not adequate to overcome the new threat, and proved to be totally inadequate to meet the missile threat when it appeared. The growing costs of an air defense system that was capable of countering only the obsolescent elements of the growing Soviet threat eventually doomed it to reduction and dismantlement. Never again would the American Government and American people put their money and faith into an air defense system that would be incapable of meeting new technological advances in the enemy strategic offensive forces.

Chapter III

Soviet Strategy for Air and Ballistic Missile Defense

A. The Historical Backdrop

1. Long-Term Factors

The development of Soviet air and missile defense after 1945 must be viewed from the perspective of a series of long-term factors which have conditioned Soviet attitudes toward defense in general, the nature of the primary threat, the pursuit and use of technology, the conduct of debate, and the accomplishment of decisions.

Soviet concern for defense is based on both doctrinal and historical grounds. Lenin identified imperialism as the final stage of capitalism, and domestic communist propaganda has continuously belabored the danger from capitalist encirclement. There was the further worry that the capitalist countries, goaded to action by the threat to their security posed by domestic but Soviet-supported communist parties, might strike at what, between the two world wars, was the world's solitary communist country. At the same time, the Soviets fully appreciated that their own regime was spawned by the shambles stemming from Russian involvement in World War I; that their government was almost toppled by foreign intervention during the Civil War of 1918–1920; that Japanese aggression had to be blunted in 1938; and that they almost succumbed to Nazi Germany in World War II. They also realized that at the end of World War II there was considerable hostility toward communism and thus toward the Soviet Union in both West European countries and the United States and, in fact, that there was some expressed sentiment for the forces of the Western Allies to top off the victory over fascism with a victory over communism.

From the viewpoint of Russian leaders, the traditional source of military threats to Russian security has been the European balance of power system. The rapid rise of Germany under Hitler following the German defeat in World War I was simply another very recent example of the manner in which European countries could quickly forge and project military power. At the end of World War II Europe could still be viewed as the principal source of threat to the Soviet Union, this despite the strategic power which had obviously accrued to the United States. The bulk of the Soviet population and industry was still in basic proximity to Western Europe. Distances across Asiatic Russia were huge. The commitment of U.S. bombers across the pole had not yet jelled as a capability. And finally the threat from theater forces in Western Europe fitted more into past pattern. The new traditions of the air age would have strategic air attack serving as an extension of theater operations. Thus, there was no automatic recognition of the United States as posing the main strategic threat to the Soviet Union, either with respect to military force requirements in general or strategic air defense in particular.

Historically, the early example of Peter the Great's aggressive interests in the fruit of the European industrial evolution established a pattern of Russian search for foreign technology. By 1945, Soviet industry

was still very new. Although it had accomplished enormous production feats, the general level of technology was still low. Extensive experience had already been gained during the 1930's in the successful adaptation of foreign technology. The ever-present goal was to catch up with and surpass the leading capitalist countries, and the pursuit of this goal was reinforced by success. In turn, espionage and any other feasible avenues for getting at foreign technology were viewed as legitimate and, indeed, preferable means for improving Soviet technology.

Just as Russian domestic political tradition had accepted authoritarian power in the hands of the Czar, so the conduct of debate within the Soviet government, the Soviet military, and Soviet society as a whole has followed the rules of "democratic centralism." Under this concept, debate and criticism have been allowed but have been kept within generally understood limits. Once a decision was made, strict compliance would be demanded. The purges of the 1930's, including those which devastated the military command structure—3 out of 5 marshals, all 11 Deputy Commissars of Defense, 75 out of 80 members of the Military Soviet, all military district commanders who held that position in June 1937, and 13 out of 15 army commanders all killed[1] left an imprint on attitudes wherein a decision on force structure, relative priorities, etc. would be adhered to without substantial challenge. The weight of that system by 1945 made for considerable inertia once a specific direction had been established.

These factors of military, technological, and political traditions set the stage for what was to be a generally consistent march toward a unified air and missile defense system after 1945. At least until the death of Stalin, there was relatively little discernible debate over roles and missions of different force components (e.g., between representatives of fighter aviation and antiaircraft artillery) and no real opportunity for competition to develop, for example, between the Soviet army and the air force.

2. Soviet Air Defense: The Inter-War Years

Because the Soviet Union was a continental European power, the Soviets had to weigh the need for air defense well before the approach of World War II. In 1930, a special directorate was established within the Headquarters of the Red Army, subsequently becoming the independent Main Air Defense Directorate of the Red Army, with responsibility for general air defense planning on a countrywide scale. M. Ye. Medvedev, the head of this directorate, wrote in a book published in 1932 that: "the air defense of points and objectives had to be in full readiness to ward off an enemy air attack even during peacetime; for this the whole air defense organizational and control system had to be identical in peacetime to what it would be in wartime."[2] Thus these two elements of air defense strategy—countrywide air defense planning and combat readiness in peacetime—which were to become essential in the post–World War II environment had their origin well before the war. Implementation, however, was by no means immediate. At times—to use a favorite Leninist argument—it was necessary to take one step backward in order to take two forward.

As the time for World War II drew near, two principles underlay Soviet air defense organization:

(1) The provision of protection for the important political and industrial-economic objectives and railway communications in the zone threatened by enemy aviation, and

[1] Kolkowicz, p. 60.
[2] Batitskiy, *Voyennaya Mysl'*, p. 31.

(2) The decisive massing of forces and means for the defense of the more important centers and objectives of the country, employing the concept of a "circular" or all-around defense to protect the individual objectives.

The country was divided into air defense zones which corresponded territorially with the military districts.[3] The zones were divided in turn into air defense regions within which there were individual air defense posts.

The largest administrative-political and industrial centers of the country—Moscow, Leningrad, and Baku—had the most highly developed air defense system, echeloned in-depth with all types of air defense forces. Almost half of all Soviet medium antiaircraft artillery batteries and considerable forces of fighter aircraft defended these centers.[4]

Organizationally, air defense corps were established for the major centers. These corps, in turn, included antiaircraft artillery divisions; antiaircraft searchlight regiments; air warning, observation, and communication regiments; barrage balloon regiments; and machine gun regiments. Certain other centers, such as Kiev, were defended by air defense divisions of similar but scaled-down composition. Thus, by 1941 the bulk of the air defense means had been welded into combined arms commands. The fighter aviation, which was assigned to the air defense of major centers, was still under the command of air forces of the military districts. At the same time, the basing of fighter aviation was accomplished under a common air defense plan. The fighter aviation participated in all joint air defense exercises, and in case of war was to come under operational subordination to air defense large unit commanders for the performance of joint missions.[5] In another mark of the time, the Higher Military School for Air Defense was established in 1941.[6]

3. World War II Experience

For the Soviet military the taste of victory in World War II was enormously exhilarating and satisfying. The experience shaped Soviet attitudes toward defense for the next 25 years. The initial German attack was one of trauma for Soviet air defense. Some 1,200 airplanes were lost on the first day of the war.[7] German air capabilities, however, were geared more for support of front operations than for striking deep into the Soviet interior. In turn, as the Germans advanced toward Moscow and then toward Stalingrad, that industry which could be moved to the rear was so moved. That which could not be moved was largely destroyed, either initially by the Soviets as they retreated or later by the Germans as they withdrew back to the west. This pattern meant that after the first year and a half of the war the role of national air defense was substantially diminished. Even at its time of greatest significance, air defense tended to be an extension of tactical front operations.

At the end of 1941, major changes were made in the air defense system in order to improve the coordination and flexibility of the hard-pressed air defense capabilities. A commander of National Air Defense Forces was designated, and corresponding control elements were established, including an Air Defense Fighter Aviation Directorate and Headquarters and an Office of Chief of Air Defense Antiaircraft Artillery.

[3] Ibid., p. 32.
[4] Batitskiy, *Voyska Protivovozdurhnoy Oburony Strany*, p. 46.
[5] Ibid.
[6] Ibid., p. 50.
[7] Dzhordzhadze and Shesterin, p. 33.

Air defense forces were removed from the jurisdiction of the military districts and fronts and were placed under the Commander of National Air Defense Forces and his command elements. One exception was the forces under the Leningrad Military District, which were left under the Commander of Troops of the Leningrad Front. At the same time, previously existing air defense zones were redesignated as the Moscow and Leningrad corps and a number of air defense divisional regions.[8]

In June 1943, after the Battle of Stalingrad had swung the strategic balance toward the Soviets, another reorganization was accomplished in the air defense forces. Two air defense fronts—Western and Eastern—were established. The position of Commander of National Air Defense Forces was abolished, and responsibility for supervision of the activities of air defense fronts and zones, weapons planning, and supply was transferred to the Commander of Artillery of the Red Army. The following elements were placed under him: Central Headquarters of Air Defense Forces, Central Headquarters of Air Defense Fighter Aviation, the Main Air Defense Inspectorate, the Air Defense Forces Combat Training Directorate, and the Aircraft Warning Service Center. The fighter aviation defending Moscow was combined into the First Air Defense Fighter Army.[9]

The Western Air Defense Front was moving continuously to the west in the wake of the advancing theater forces. As a result, the forces of the Western Air Defense Front were heavily engaged against enemy aircraft, while those of the Eastern Front were rather idle. This led to another reorganization in the spring of 1944. The Western Front was changed into the Northern Front, while the Eastern Front became the Southern Air Defense Front. At the same time, a Transcaucasian Air Defense Front was also established. Later in the year, in December, another renaming occurred, again reflecting the geographical location of the air defense forces. The Northern and Southern air defense fronts became the Western and Southwestern fronts respectively, while a new, Central Air Defense Front, with headquarters in Moscow, was established to control the forces protecting objectives in the deep rear.[10]

Throughout the war air defense was essentially point defense, this being dictated largely by the technical level of the air defense forces in which the static nature of antiaircraft artillery, the limited range of fighter aviation, and inadequacies in warning, control, and communications limited the flexibility with which resources could be employed. There were some examples of a zone defense concept, although at a rudimentary level. The concentration of fighter aircraft in the Moscow area during the first year of the war, the establishment of a large Moscow Air Defense Zone, and the creation of an extensive warning and control system permitted the interception of German air attacks at some distance from Moscow and also the flexible defense of other cities and objectives in the greater Moscow industrial region.

Thus, Soviet air defense organization and concepts underwent considerable evolution, change, and development throughout the course of the war. Various lessons were perceived which were to influence the subsequent development of Soviet air defense. The importance of surprise—or rather the avoidance of it—received particular emphasis. Success of surprise air attacks was attributed to three things.[11] The first and principal reason was considered to be the failure to comprehend the importance of air power and air defense, with attention still focused predominately on land and sea battles. The second reason was

[8] Ibid., p. 35.
[9] Ibid., p. 37.
[10] Ibid., p. 39.
[11] Ibid., p. 34.

inadequate air defenses and a low level of air defense troop combat readiness. The third reason was the inadequate preparedness of command personnel in matters of combat against an air adversary. Other lessons concerned the need to improve integration of air defense to go beyond the point defense philosophy which characterized most of World War II air defense; to improve the technical capabilities of the weapons systems and of warning, command, control, and communications capabilities; to formulate the doctrinal concepts of modern air defense; and to adapt the overall air defense capabilities to the new conditions which followed the war. In some cases the lessons which were cited reflected problems which were soon to pass. In other cases the problems still have not been solved. Mass night attacks was an example of the former. One Soviet writer noted that the next problem on the post–World War II agenda would be the battle against wings and ballistic missiles.[12]

B. The Formative Years, 1945–1950

1. Strategic Context

With national air defense having little relevance during the concluding stages of the war, relatively few air defense forces were retained within the homeland. Nor was there any apparent rush to return active air defense forces from the forward area to stations within the Soviet Union once the war was over. For the air defense forces it appears that inertia prevailed. Since they were in the forward area when the war ended, that is where many remained.

In the meantime, demobilization was occurring. There was a reduction in the number of personnel in the National Air Defense Forces, and a changeover to peacetime staffs was accomplished.

The context for change within the Soviet national air defense system derived from both external and internal conditions and included political, economic, and technological considerations as well as basically military aspects.

Germany, prostrate, divided, and occupied, clearly posed no immediate threat, lacking both the military capability and the control of its destiny to recreate one. The United States and England, however, did possess a strategic air offensive capability and this basic capability had been enormously augmented by U.S. possession of the atomic bomb. There was a further question as to how other countries might augment the capabilities of these two. On the matter of intentions there was no clear-cut evidence of a U.S. or Western intention to initiate hostilities, but the communist takeover in Eastern Europe was clearly exacerbating relations between the Soviet Union and the West.

As time progressed, other sources of tension arose, including the prolonged and reluctantly ended Soviet presence in northern Iran, Soviet pressure on Turkey, Yugoslav pressure along its northwestern border, and finally the Berlin airlift. All of these events contributed to a hardening of Western positions, the formation of NATO in 1949, and with this a demonstration to the Soviets that their pressures had toughened Western resistance rather than undermining it and that military capabilities, including strategic air defense, would have to be strengthened in order to offset any growth of the power of NATO.

Technology was simultaneously posing a threat where it was being exploited by the West for its contribution to military capabilities and was also offering an opportunity to offset the strategic advantage accruing to the United States through its possession of nuclear weapons and strategic delivery means. For Soviet

[12] Batitskiy, *Voyska Protivovozdurhnoy Oburony Strany*, p. 341.

air defense the avenues to technological improvement were very evident—the development of jet fighters, surface-to-air missiles, and radar and communication systems—and much of the wherewithal was already in their hands, especially as a result of the capture of German scientists and materiel acquisitions through Land Lease.

Internally the problem was to rebuild the economy which had been enormously disrupted, both by the scorched earth policy followed by the Soviets as they retreated during the initial stages of the war and also by the later destruction which was dealt by the withdrawing Germans. Resource constraints were thus severe. Resources diverted to the military would slow the pace of economic reconstruction.

A further problem, peculiarly Soviet and Stalinist, was to ensure that even mild challenges to the prestige and preeminence of Stalin and the Communist Party be prevented. Consequently, the propaganda apparatus began to minimize the military's contribution to victory and to give all credit to Stalin and the Party. For example, wartime hero Marshal Zhukov was relegated to the command of a remote military district. Essentially this meant that Party dominance over the military was firmly reestablished and any tendency on the part of the military to have real debate over the roles and missions of the military and over the allocation of resources to and among the armed forces was minimized.

2. The Organizational Approach

During the war organizational changes were made as the situation dictated, especially as the line of the fighting front ebbed and flowed, first pushing deeply into the country and then moving away from key political and industrial objectives which had to be protected by national air defense forces. At the end of the war, adjustments were required, both to go to a peacetime situation and also to take into account the lessons of World War II and the new post war conditions.

In February 1946 the post of Commander of National Air Defense Forces was revived, although subordinate to the commander of Artillery of the Armed Forces. This partially corrected what Marshal Batitskiy later identified as a mistake in the organizational structure of the National Air Defense Forces when in 1943 the Commander of Artillery was given the additional responsibility of head of air defense forces. According to Batitskiy, this represented only a partial improvement because of the continuing subordination to the Commander of Artillery.[13] Meanwhile the four air defense fronts—Western, Southwestern, Central, and Transcaucasian—which had been created in 1944 were reorganized into air defense districts.

By 1948 the basic direction for Soviet air defense had been sorted out, and extensive organizational changes were made. The problem of the organizational structure of the National Air Defense Forces was entrusted to the Forces themselves and to the air defense elements of the Ground Forces and of the Navy. The entire country was divided into two sectors: border belts and internal territory. The responsibility for the air defense of the border belts was entrusted to the commanders of the respective military districts with all means of air defense located therein being subordinate to them. Responsibility for air defense of naval bases fell to the air defense forces of the fleets. Then in 1948 it was established for the first time that the National Air Defense Forces were an independent element of the Armed Forces on a par with the Ground Forces, Air Forces, and Navy.[14] In this way they were finally removed from under the Commander of Artillery.

[13] Batitskiy, *Voyennaya Mysl'*, p. 36.
[14] Batitskiy, *Voyska Protivovozdurhnoy Oburony Strany*, p. 350.

3. Pursuit of Systems Development

The basic theme which pervaded Soviet Air defense system development was to adapt advanced technology to air defense requirements. The approach which soon took shape was to draw upon technology wherever it could be found—abroad or at home—and to push for early deployment of new capabilities.

This Soviet effort to upgrade air defense capabilities was quickly reflected in the development of fighter aircraft. The Y-15 and M-9 jet fighters were demonstrated already at the Tushino Air Show in August 1946; however, neither of these aircraft met the criteria for mass deployment. A little over a year later, in December 1947, the first test flight was made of the M-15, and its extensive appearance in fighter aviation followed soon thereafter.[15] With the arrival of the MiG-15, the conversion for Soviet fighter aviation from piston aircraft to jets proceeded rapidly and was basically accomplished by 1952.

Although the first Soviet surface-to-air missile was not deployed until 1954, a major effort was begun immediately after the war, utilizing captured German scientists and the work which they had started, in order to create a Soviet SAM capability. At the same time, the improvement of antiaircraft artillery capabilities was also pushed, although it could have been anticipated that the significance of antiaircraft artillery in Soviet national air defense would begin to decline and that the extensive deployment of new AAA guns would be an expensive temporary measure. During the initial post war years, new 57- and 100-mm. guns offered better range and rate of fire. With improved target acquisition and fire control equipment they also had greater accuracy.

It was also clear to the Soviets that the wartime approach to early warning was largely inadequate and that it was necessary to have greatly expanded use of improved early warning radar. The route which was taken was to adapt foreign radar sets as quickly as possible and then proceed to the development of native sets. Work in this area went slowly at first, and it was only after 1950 that radar equipments began to appear in the kinds and amounts which were needed. Reflecting the attitudes of the early post war years, a particular concern of the time was how to combat massed enemy flights at night under conditions of radio and radar interference.[16]

During the initial post war years civil defense received little attention as an adjunct to air defense. A slight pickup occurred in 1948 in the form of shelter construction, mandatory study circles and instructor training programs, and periodic endorsements by the media.

4. Soviet Strategy

During the first post war years basic attention was paid to the elaboration of the theory for the organization and conduct of air defense of the major centers of the country. The principle of the massing of forces and means was put at the basis of air defense organization. The air defense of points, as during the war, was all-around. The focus of the forces was concentrated on the most likely directions of approach of enemy aircraft. It was felt that the air defense of an objective, because of the great speed of the means of air attack, should be deep and should be capable of defeating the attack along the approaches to the objective. Thus fighter aviation was echeloned along the approaches to defended objectives so that the fighters could make

[15] Ibid., p. 345.
[16] Ibid., p. 333.

consecutive strikes against the enemy. The gun fire area was also increased significantly with groups of batteries being located along several firing perimeters.[17]

At the same time it was recognized that more had to be done to provide the theoretical elaboration of what was largely a new phenomenon in military art, the concept of air defense operations. Work was begun along these lines in 1948, and since 1949 it has occupied a basic place in the operational training of the command and staff officers of the National Air Defense Forces. The term "air defense operations" was defined as the aggregate of the engagements and battles being carried out according to the unified strategy of the National Air Defense Forces in coordination with the fighter aviation and antiaircraft artillery of theater fronts and fleets for the purpose of stopping air operations undertaken by an enemy against major regions or objectives of the country.[18] It was felt that air defense operations could be conducted both by the forces of one district as well as by those of a group of air defense districts.

All elements of the air defense arms were to participate in operations; however, a decisive role was accorded to fighter aviation which had the following basic missions:

(1) During daytime: the complete destruction of aircraft flying individually or in small groups, particularly at high altitudes, at distant approaches to objectives, and the interception of enemy aviation formations and their destruction prior to their approach to defended regions and objectives
(2) During nighttime: interception and destruction of aircraft with radar or searchlight support
(3) The interception of enemy aircraft on their return flight, their pursuit and destruction
(4) The combating of unmanned air attack weapons by intercepting and destroying the cruise missiles or the parent aircraft from which they may be launched.[19]

Antiaircraft artillery was also named as a basic means of air defense. It was to defend against enemy aircraft and missiles which penetrated to the near approaches of a defended objective. Antiaircraft searchlights were also involved. They were to support night fighter operations when the fighters did not have radar sights and also to support the firing of antiaircraft artillery.

During this period there were no basic changes in the combat employment of fighter aviation. The combat formations of fighter aircraft consisted of several tactical groups. A portion of the fighters was assigned to an attack group for destroying bombers. Groups were also created to provide protective cover and to perform other missions. Group air combat was thus considered to be the basic type of combat.

5. Summary: 1945–1950

The concept which emerged between 1945 and 1950 was thus one which started with World War II experience as a foundation and, lacking other practical experience to the contrary, made only those adjustments which were clearly dictated by improved technology and capabilities of the air defense systems.

The first years after the war was a period of slowly building momentum—stagnant at first, picking up direction by mid-period, and then closing with a rush as new systems were deployed. But the link with the experience of World War II was still very strong.

In their perceptions the Soviets saw that, despite the victory which had been gained over Germany, there was a threat and a challenge posed by U.S. possession of the atomic bomb. The primary threat which existed

[17] Yakimanskiy, p. 66.
[18] Ibid., p. 68.
[19] Ibid., p. 69.

was the specter of the projection of "strategic" air power from European bases. This meant that air defense of the homeland had to have high priority. At the same time Soviet theater force capabilities, posing a threat to overrun Europe, represented a degree of deterrence to U.S. and British strategic air attack capabilities.

One basic Soviet response to the strategic air threat was to deploy available World War II aircraft and antiaircraft units around principal cities and industrial complexes and to increase the centralized control and integration of air defense capabilities. The second response was to pursue the exploitation of new technology, launching a conversion of fighter aviation to jet aircraft, improving the capabilities of AAA defense, creating a national radar early warning system, generally pushing the incorporation of electronics in air defense, and also pushing the development of both ground-to-air and air-to-air missiles. The net result was a pattern for future Soviet air and ballistic missile defense systems. Although many obsolescent and outmoded concepts still persisted, the direction had been firmly set.

C. The System Established, 1950–1955

1. The Strategic Context

The Korean War represented a watershed event in that it spurred both the United States and the Soviet Union to push the development of their strategic offensive and defensive capabilities. This in turn meant that an ever-escalating striving to achieve technological superiority became institutionalized and that the outmoded concepts of World War II were soon to be discarded.

With the onset of the Korean War, the U.S. attitudes which had hardened politically during the late 1940's were now reflected in a new approach to force deployment and operations. The increased range and speed of U.S. aircraft, their forward deployment, and the aggressive efforts to learn about Soviet air defense capabilities placed much greater stress on the Soviet system which then had to contend with a U.S. strategic bomber threat coming from all directions, not just the European Theater.

Meanwhile, the western offensive threat was institutionalized as the capabilities of NATO forces began to develop. This development led the Soviets to formalize their military arrangements with East European countries through the formation of the Warsaw Pact in 1955. While helping to rationalize Soviet military presence in Eastern Europe, the pact facilitated the accomplishment of combined military goals. The net result was to give added substance to the depth of the air defense system along the western approaches to the Soviet Union.

During the 1950–1955 period, the continuing advance of technology, reflected in the improvement of U.S. strategic attack capabilities, meant that the Soviet national air defense system, despite its extensive deployment and continuing improvement, lagged substantially in its ability to cope with the real offensive threat.

Internally, significant changes were also occurring. The death of Stalin in 1953 ended some of the arbitrariness which had characterized the official policy process and permitted the emergence of new flexibility. But there was no direct evidence during the rest of this period that the opportunity for flexibility was reflected in air defense policy.

2. Organizational Integrity Achieved

The organizational arrangements which were accomplished in 1948 were left unchanged until 1951. At that point, a border air defense line was set up in an effort to tighten the defenses in response to the pattern

of U.S. air operations around the periphery of the Soviet Union. These measures were found to be deficient since they complicated the maintenance of unity of command. Therefore, in 1953 the 1948 arrangement was reestablished.[20]

Finally, in 1954 the march toward centralization of the national air defense system reached its culmination with the establishment of the prestigious position of Commander-in-Chief of the National Air Defense Forces and by the comprehensive integration of air defense capabilities.[21] This involved close coordination between the air defense districts and also with the air defense forces of the theater forces and fleets. The new organizational structure permitted the echelonment of air defense forces to a considerable depth. Several echelons were created along approaches to the most important regions of the country. The first echelon consisted of the fighter aviation and antiaircraft artillery of the fronts and fleets. The operational mission of this echelon was to make the first attack against the incoming enemy bombers and also to deal with their fighter escorts.

The second echelon was composed of the forces of the air defense districts directly behind the rear boundaries of the fronts. The forces of this echelon were to continue the attack against the intruding enemy, if possible preventing their penetration any deeper into the country.

The third echelon consisted of the forces of the air defense districts in which the objectives of the enemy attack were located. Their objective was to defeat the enemy along the approaches to the objectives.[22]

3. The Systems Mix in Transition

Weapons systems development continued at a steady pace during this period as follow-on jet fighters were introduced; the 130-mm. antiaircraft gun was deployed, and the SA-1 missile was committed to the defense of Moscow. This represented a balanced program of weapons development and deployment in which gaps in capabilities were generally avoided, even when order of magnitude improvements could be anticipated in the near future. Thus, risk-taking was avoided and substantial resources were committed despite the awareness that systems would soon become obsolescent.

The Soviet commitment to MiG fighters continued with the deployment of the MiG-19 in 1953 and the completion of the development of the MiG-19 in 1955. Neither of these aircraft was the answer to the need for an all-weather jet interceptor which had been expressed in 1948. A partial answer was finally provided in 1955 with the appearance of the YAK-25. The thrust of the jet development program was to build on success, and the MiG series represented success. Fitted with a five-nautical-mile air intercept radar, the MiG aircraft had a limited all-weather capability which could be purported to be a solution. In any case, Stalin's profound satisfaction with the MiG fighters made the question of a good all-weather interceptor a non-problem from 1948 to 1951. Finally, in 1951, designer Yakovlev finally reached Stalin with a proposal, and the result was the YAK-25.

The deployment of the 130-mm. antiaircraft gun which had begun by 1955 represented the highest point in the use of antiaircraft artillery in the national air defense system. At the same time its appearance post dated that of the SA-1, and consequently its days of active use were numbered even before deployment began. Still, antiaircraft artillery in the hands of the North Koreans and Chinese had proved its value during

[20] Batitskiy, *Voyska Protivovozdurhnoy Oburony Strany*, pp. 352–353.
[21] Batitskiy, *Voyennaya Mysl'*, pp. 38–39.
[22] Batitskiy, *Voyska Protivovozdurhnoy Oburony Strany*, p. 355.

the Korean War, and thus it represented an acceptable interim solution until the SA-2 could be deployed. The SA-1, which began to appear in the defense of Moscow in 1954 served meanwhile to portend a new era in air defense wherein the primary role in air defense would pass from fighter aviation to surface-to-air missile troops.

Changes in the approach to civil defense presaged a greater role for it in the overall national air and missile defense system. DOSAAF was established in 1951 as a paramilitary organization with responsibilities which included civil defense training and instruction. Two years later an antiaircraft general was named chairman of DOSAAF. The new commander pushed the use of reserve and demobilized military personnel in training and instruction and initiated the first compulsory civil defense program which was conducted for the adult population of the Soviet Union. These events marked the beginning of the transition from a civil-directed, local, voluntary civil defense structure to a military-directed, nationwide, mandatory program.

4. The Interim Strategy

The period of the Korean War and its immediate aftermath was clearly transitional. The deployment of the SA-1 introduced a fundamentally new weapons system which was still inadequate for extensive deployment. The strategy therefore was to make full use of an obsolescing system—antiaircraft artillery—while awaiting the availability of more suitable air defense missiles. For example, in the antiaircraft artillery steps were taken to improve the density and effectiveness of the fire from the new 57-, 100-, and 130-mm. systems. Batteries of eight guns were created in place of previous ones with four, and close-set formations were used.

Marshal Batitskiy noted[23] that during this period the point principle of air defense was eliminated and that a new form of conducting battle action—the air defense operation—was established. Air defense operations were to pursue decisive objectives—to destroy the attacking enemy aircraft, to disrupt enemy air operations, and to provide total protection of the defended objectives. It was further intended that the air defense operations of the National Air Defense Forces would be complemented by operations involving Long Range Aviation and other means of attack against the main enemy airfields. At this stage it was felt that air defense operations would involve clashes between large masses of aircraft. Thus the main role in air defense operations was to be played by fighter aviation. Antiaircraft artillery was also considered to be an active arm of the air defense forces with the advantages of possessing strong firepower, being unaffected by weather conditions or the time of day, and being in constant readiness to open fire immediately.

5. The Korean Proving Ground

The Korean War provided the first real opportunity to test Soviet air defense systems and operational concepts. Although it was necessary to employ North Koreans and Chinese to test concepts and equipment under conditions which were strongly different from what would have been expected in defense of the Soviet Union, much was learned. For example, the increased role of the first air defense attack pass by jet interceptors was accepted. It was found that in a majority of cases the first pass was the only possible one. In this regard, there was a sharp rise in the demands placed upon fighter pilots in the areas of piloting technique and aerial gunnery.

[23] Ibid., p. 356.

Further experience was gained in attempting to react to U.S. flights along the periphery of the Soviet Union and to U.S. incursions over Soviet territory. These flights served to test the Soviet early warning system and also gave a measure of the responsiveness of Soviet fighter aviation.

6. Summary: 1950–1955

The period from 1950 to 1955 marked a new stage for Soviet air defense in which the primary threat was that of strategic air power encircling the U.S.S.R. Defense predominated in Soviet strategic systems thinking. At the same time, it was linked with the concept of an offensive against NATO as representing a deterrent counterbalance to U.S. strategic capabilities. Those capabilities required that the ever-lagging Soviet air defense be improved still more.

Soviet responses to these developments emphasized the continuing improvement of all systems, leaving primacy with fighter aviation for the moment while awaiting the availability of an air defense missile system which could be given extensive deployment.

D. Decision Making in Soviet Air and Missile Defense

1. The Problem of Data

There is little direct evidence with which to analyze the Soviet decision-making process as it functioned with respect to national air defense during the period from 1945 to 1955. Only Soviet aircraft designers' writings have provided virtually unique insights. Similar insights from the political leadership and from the military are generally lacking, although Khrushchev in his reminiscences does shed some light on the general decision-making process.

For this early period, there are no windows such as existed later with the IRONBARK material. And even the IRONBARK debate should probably be viewed as a unique event in which the only major debate—and a substantially controlled one at that—which occurred during the post war years happened to coincide with the one intelligence window that the U.S. had for viewing a secret debate.

Otherwise, our understanding of decision making in Soviet air defense has been based largely on developments which could be observed physically. This approach carried with it a tendency to see things as being smoother and less controversial than they probably were in actuality. But the two-fold pattern of rapid development and deployment of new systems and the complementary rather than competing nature of those systems suggests a simple and centralized decision-making process.

2. The Major Actors

The major actors in the decision-making process were individuals and groups in the political leadership. Their story is told in greater detail in Chapter V-B, but essentially it is a story of political leaders who had all of the seats of power firmly under control, who ruled in an autocratic and arbitrary style, who had long continuity in office, and who had a strong interest in military force structure and capabilities. The military and industry were supporting actors. They identified requirements and suggested solutions. Until his death, Stalin made the decisions, although key individuals around him also played a role. As is evident from the following statement, even Khrushchev was not one of those key individuals:

> . . . While Stalin was alive, he completely monopolized all decisions about our defenses. . . . We were sometimes present when such matters were discussed, but we weren't allowed to ask questions. . . .
>
> Not too long after Stalin's death, Korolyov (Soviet missile designer) came to a Politbureau meeting to report on his work. I don't want to exaggerate, but I'd say we gawked at what he showed us as if we were a bunch of sheep seeing a new gate for the first time. When he showed us one of his rockets, we thought it looked like nothing but a huge cigar-shaped tube, and we didn't believe it could fly. Korolyov took us on a tour of a launching pad and tried to explain to us how the rocket worked. We were like peasants in a marketplace. We walked around and around the rocket, touching it, tapping it to see if it was sturdy enough—we did everything but lick it to see how it tasted.[24]

The Soviet aircraft designer A.S. Yakovlev, whose writings are available in the West, provided detailed insights into Stalin's manner of functioning and the criteria which were important to him. In 1939, Yakovlev, along with 10 other designers, participated in a competition to produce new fighter designs. Stalin personally indicated what was wanted—the best flight and combat characteristics and the earliest delivery date. The first three available designs, one of which was Yakovlev's YAK-1 fighter, were committed to production before testing was even complete.

In 1946, the first Soviet jet fighters had just been produced and appeared at the Tushino Air Show in August of that year. The day after the air show, Stalin sent instructions that 10 to 15 of these new jets—the MiG-9 and the YAK-15—were to be ready for the October Revolution Parade less than three months away. The airplanes were ready on time.

Stalin's approach produced results, although not always the desirable ones. The requirement for an all-weather interceptor was posed in 1948. Lavochkin, Mikoyan, and Sukhoi had produced such aircraft by 1950, but they were unsatisfactory. Subsequently, it was decided to fit the MiG-15 with an air intercept radar, and an instant all-weather interceptor was the result.

Stalin's acceptance of this modification and his preference for continuing to improve the MiG series stymied the development of a true all-weather area defense interceptor until Yakovlev wrote directly to Stalin suggesting a new design. In meetings with Stalin, Yakovlev found that Beria tried to undercut his design and to put Yakovlev and Aviation Minister Khrunichev in personal jeopardy. Prodded by Beria, Stalin's temper flared, and it was only with great difficulty that he was persuaded to hear Yakovlev's full story. The result of the meeting was approval for Yakovlev to proceed with development of the YAK-25 all-weather interceptor.

The pattern of actor behavior expressed in these sequences and reflected in other examples as well had the following characteristics:

(1) Stalin had a strong degree of personal involvement in decisions on military systems and capabilities and almost totally dominated the decision-making process;
(2) Competition was built into the decision-making process but was controlled from above and was used as a device to increase the tempo of response to the demands of the political leadership;
(3) Preference was given to systems which promised early availability, simplicity of design, and reliability of operation;
(4) The opportunity for organized lobbying by groups or fashions within the military and industrial communities was virtually nonexistent. That lobbying which did exist was primarily from individual members of the design community directly to Stalin or to him through other members of the political hierarchy;
(5) Once they had established themselves, designers had the opportunity to suggest and innovate and gained a degree of continuing influence;

[24] Khrushchev, pp. 45–46.

(6) Arbitrary decisions by the political leadership governed the process and were frequently expressed in terms of highly compressed lead times;
(7) The supporting actors, especially the designers, were under extreme pressure to produce results and were gripped by a fear of the consequences of failure or misstep.

3. Influences on Decision Making

The major influences on the decision-making process were embodied in the perceptions and attitudes of the political leadership.

A very basic concern for the defense of the communist homeland evoked a sense of urgency in developing and fielding effective air defense systems. There was an apparent awareness of the inferiority of Soviet strategic offensive systems which in turn necessitated an emphasis on strategic defense coupled with the idea of holding Western Europe hostage to the capabilities of Soviet theater forces.

Technology, in the view of the Soviet leadership, was to be exploited in whatever way it would contribute to the enhancement of political, military, and economic power. Any backwardness of Soviet technology was not a signal for inaction but rather a stimulus to acquire technology by all possible means, but especially from foreign sources.

There was a strong tendency not to relax one's guard. Although the Korean War did not involve the Soviet Union directly, Soviet air defense was greatly strengthened during the war as a consequence of a more than doubling of the resources which were committed to it.

The threat of foreign air power was readily perceived, both because the power was openly displayed and also because the Soviets operated a very comprehensive espionage system.

Because of the absence of significant factional power outside the control of the Party, there was an absence of organized pressures from within the Soviet system. Inter-service rivalry was not permitted. The Soviet legislature was a rubber stamp organ. Industry was state-owned and party-controlled. Any effort on the part of the military, industry, or the legislature to exert organized influence and pressure on the decision-making process would have been viewed as a challenge to the political domination of the Party leadership and had no really opportunity to occur.

4. The Consequences

The decision-making process and the attitudes that went with it had the following consequences:

(1) High importance was attached to national air defense in relation to other force components;
(2) Early emphasis was placed on nationally integrated early warning, command and control, and civil defense;
(3) Early deployment of the first available and effective system was stressed;
(4) Simple, reliable systems were preferred rather than the most advanced possible system;
(5) Frequent incremental improvements were made in established systems;
(6) There was concurrent emphasis on the continuing development of new systems.

E. An Appraisal of the First Decade

1. The Accomplishments of the Period

A review of the entire period from 1945 to 1955 reveals a pattern of steady progress toward the creation of a strong and extensive national air defense system. At the same time, those things which were accom-

plished tended to lag substantially behind the threats which were posed. Thus, while the massiveness of the commitment of resources to air defense suggested enormous power built into the system, a problem of relative effectiveness still persisted.

Soviet attitudes of the period are reflected in the relative importance which they attached to strategic attack and defense systems and to the components within the overall air defense effort. Less clear is the absolute value of what they did and the rationality of their commitment of resources.

2. Relative Values

For the period before 1950, the data on force structure and operations are inadequate to support an analysis of the relative value attached to air defense and to the different elements of air defense. For the period from 1950 to 1955, the data have their inadequacies but are still useful for reflecting relative value and also the pattern of resource commitment.

Looking first at the relative commitment of resources to Soviet strategic attack forces and strategic defense forces (the amounts are in terms of billions of 1964 U.S. dollars), the following emerged[25]:

	1950	1951	1952	1953	1954	1955
Strategic Attack	1.88	1.96	1.94	1.88	2.56	3.93
Strategic Defense	1.95	2.45	3.67	4.24	4.30	4.57

In every case, the amount going to strategic defense was larger. Interestingly, the total for strategic attack remained relatively constant throughout the period of the Korean War, whereas the amount for strategic defense doubled. In 1954 and 1955 a convergence began to appear, reflecting both a slowing of the rate of investment in strategic defense and a dramatic increase in the flow of resources into strategic attack. It should be noted also that, for the remainder of the 1950's, air defense remained slightly ahead at about the same ratio as in 1955.

Looking now within air defense (again the amounts are given in billions of 1964 U.S. dollars), the initial and evolving relative emphases are readily seen[26]:

	1950	1951	1952	1953	1954	1955
Control and Warning	0.46	0.55	0.69	0.80	0.84	0.82
Interceptor Aircraft	0.72	0.93	1.81	2.38	2.13	1.97
SAMs	—	—	—	0.03	0.26	0.73
AAA	0.76	0.98	1.16	1.03	1.05	1.05
TOTAL	1.95	2.45	3.67	4.24	4.30	4.57

All force components increased over their 1950 levels with the greatest increase (three times at one point) being in the case of interceptor aircraft. The amount going to control and warning almost doubled

[25] CIA notes.
[26] Ibid.

from 1950 to 1953. Even antiaircraft artillery experienced a 50 percent rise from 1950 to 1952 and then receded slightly. The deployment of the SA-1 is reflected in the 1953 to 1955 expenditures on SAMs.

3. Absolute Values

The "absolute value" of the Soviet air defense system in terms of its ability to prevent unacceptable destruction by nuclear delivery systems is a different matter. Here there is a Soviet tendency to identify or admit deficiencies only after they have been corrected. A basic problem in the estimate of a Soviet notion of absolute value concerns their perception of the need for attrition of an attacking force. If the rates of World War II, or even several times those rates, would fail to cope with the atomic bomb and the hydrogen bomb, then something close to 100 percent might be required. This the Soviets did not discuss, nor did their capabilities suggest that they would be able to approach anywhere near this rate of attrition.

4. Strategic Decisions: Why and How

The factors influencing strategic decisions and the manner of reaching them can be summarized as follows:

(1) A fundamental Soviet preoccupation with the defense of the homeland, a general concern for defense in the context of European great power rivalries, and new awareness of the threat posed by Western strategic attack capabilities, especially U.S. nuclear delivery capabilities set the stage for Soviet decisions on strategic air defense;

(2) A basic tendency to centralize institutions in the Soviet society and the rationality of an integrated air defense system in light of World War II experience and evolving post war condition set the stage for a steady Soviet march toward an integrated system;

(3) Reorganizations of the Soviet Armed Forces did not noticeably hamper air defense programs but rather appeared to facilitate them;

(4) Service rivalries were sufficiently well contained so that they had no discernible effect on Soviet strategic air and missile defense doctrine, development, and deployments. In fact, Soviet air defense during the first post war decade was an organization headed by artillery generals which gave primary to fighter aviation;

(5) The availability of technology and the striving for its application had a strong influence on the continuing upgrading of Soviet air defense capabilities;

(6) Intelligence on the potential enemy was so readily available that intelligence misperceptions could have had little impact on decisions, unless it was in the sense of ascribing more aggressive intentions to the West than actually existed;

(7) There was an implicit competition for resources both between the civil and military sectors and between the military services; however, the competition did not prevent the channeling of massive resources into air defense;

(8) Finally, the key factor in Soviet decision making was the total domination of the society by the Communist Party leadership and, in particular, by Stalin personally.

Chapter IV

American Systems

A. Introduction

This chapter separately analyzes six general categories—or *streams*—of U.S. strategic air defense decision-making during the first post-WWII decade. In reality, these six streams are confluent; they comprise the entire set of air defense decisions made during the period. Yet, there is considerable heuristic value in the admittedly artificial separation of these *streams*.

The six streams are labeled: Civil Defense; Surface-to-Air Missiles; Ballistic Missile Defense; Interceptor Aircraft; Early Warning Systems; and Command, Control, Roles and Missions. Obviously, there is some overlap attending this scheme of separation, but the overlap is useful. For example, it will be seen that decision making in the area of Command, Control, Roles, and Missions (CCRM) is of one character when undertaken apart from any specific force-building context, but of a different character entirely when caught up in, say, the surface-to-air missile (SAM) rivalry. It is instructive to view CCRM decision making in both contexts—as an isolated issue and as a central issue in the SAM debate; because decisions which shaped CCRM were themselves made in both, as well as other, contexts.

Similarly, our discussion of ABM developments might have been subsumed in the analysis of SAM decision making. Instead, we have treated the ABM separately—for two reasons. First, ABM decision making was qualitatively different from the general body of SAM decision making. Second, and perhaps more important, ballistic missile defense (BMD) will be the central concept in our analysis of strategic air defense from 1956 to 1972; the reader is best served by the separate attention given the germination of the BMD concept and its associated technologies during the 1945–1955 period.

Our six-stream approach is primarily valuable because it illustrates six different kinds of decision making; each stream has its own unique pattern and intensity. The implications of this may be unsettling to those who search for a single best model of U.S. decision making; we admit to having been mildly unsettled ourselves, given our hope that we might uncover "the" pattern. The fact is, however, that the following pages confirm an almost irreducible complexity in the U.S. decision-making process.

The history of civil defense is a study in deferring a decision until an emergency provides the necessity to act, by continuously seeking another opinion. When the time came to organize a civil defense operational agency, the studies and plans were largely ignored and a weak, impotent organization was spawned.

In contrast, SAM decision making is illustrative of the most intense interservice rivalry to be found in any of the six streams. The brutal competition between ground and air forces for control of SAM RED and for control of operational systems was the driving force in the SAM programs. As in the case of a few other streams, external (i.e., Soviet) stimuli were secondary. The Nike's threat was the Bomarc, an unworthy adversary that was overwhelmed in the technological and bureaucratic arenas.

ABM decisions, however, did not much resemble this larger body of SAM decisions. Throughout this decade, ABM decisions focused on the definition of requirements and the conduct of feasibility studies. The field of endeavor was constrained by the fact that technology had not yet caught up to the idea of an antimissile missile system during these years.

Decisions regarding interceptor aircraft were of yet another genre. Service rivalries played only a limited role, and budgetary constraints, while inevitably impacting upon procurement, has a minimal effect upon the limiting factor of attaining sufficiently high interceptor *quality*. The primary force shaping interceptor decisions were: initial difficulty in determining the nature of the Soviet threat and of the appropriate response to it; technological bottlenecks resulting from the ever-increasing complexity of weapon requirements and the uneven development of different branches of relevant technology; and the need for haste that resulted from the unexpectedly rapid development of Soviet offensive capabilities.

Decisions regarding early warning (EW) and AC&W systems in many ways resembled those regarding civil defense. Radar nets were small potatoes, compared with missile or aircraft programs; and EW-AC&W decisions were small decisions. The intensity in this stream was low, decisions seeming at times to make themselves. This self-sustaining progression which characterized EW-AC&W decision making derived in large part from the relatively high level of external (Soviet) stimulus to this particular decision stream. No one seems to have questioned the *need* for EW; and, within the limits imposed by rather impecunious budget allocations, our warning lines advanced northward and incorporated increasingly sophisticated technology essentially apace with the development of the Soviet strategic bomber threat.

The sixth stream, CCRM, is characterized by continuing interservice disagreement over roles and missions. The basic problem stemmed from the desire of the field commander, be he air or ground, to have operational control over both tactical air and AAA assets in his area of operations. The problem evolved from War Department indecision when faced by AAF and AGF contentions, to relatively succinct role and mission statements by the Department of Defense. Constrained by austere budgets in the pre-1950 years, CCRM took on an increasing Air Force flavor by the end of the time period with the creation of the USAF-executed CONAD.

B. History of Civil Defense

1. World War II Background

Civil Defense in the United States dates back to 1916, prior to the U.S. entry into World War I, when Congress established the Council of National Defense for the purpose of mobilizing the resources of the nation for use in time of "need." The same month the United States entered World War I (April 1917), all States established a State Council Section to coordinate mobilization at the State levels. The participation by the various governments of the States in wartime measures has been a trademark of Civil Defense since that time.

Though the end of World War I quickly brought about the demise of Civil Defense, the legislation passed during war time lingered on to provide a foundation for the post–World War II Civil Defense program.

Again, the onset of World War II saw the creation of the National Defense Advisory Commission in May 1940, for the purpose of establishing administrative machinery for partial industrial mobilization. A year later the Office of Civil Defense was created by Executive Order from a branch of the National

Defense Advisory Commission—that branch which dealt with State and local cooperation. Mayor Fiorello La Guardia of New York City was appointed the first Director, operating directly under the President for the purpose of protecting civilian industry and the civilian population. OCD, in carrying out its role of protecting the civilian population, relied heavily on an organization of civilian volunteers in a highly decentralized structure based on regional offices.

Fortunately the Civil Defense organization was never given a real challenge by enemy forces during World War II. The only known bombing of the continental United States by manned enemy aircraft was conducted by a lone Japanese seaplane operating from a submarine off the coast of the State of California, early in the war. The pilot dropped incendiaries in a heavily timbered area (well known to Japanese pre-war lumber buyers) but failed to ignite the massive forest fires he was targeted to cause, due to an unseasonal heavy rainfall the day prior to the incident. The Japanese were also known to have launched several thousand balloons carrying antipersonnel bomblets into the jet stream, but succeeded only in killing six picnickers who apparently found and examined a grounded balloon. As it was difficult to sustain civilian volunteer interest in the face of an ever-decreasing threat, by the end of World War II the civilian leadership of U.S. Civil Defense has been replaced by the assignment of an Army Lieutenant General.

United States Civil Defense in World War II suffered from a number of shortfalls. First and foremost, it came into being "under the gun," some 20 months after hostilities began in Europe and less than 6 months before Pearl Harbor brought the country into the war. Before the appointment of a Federal Civil Defense, there were large numbers of citizens at the State and local levels who observed the British civil defense and realized that, unless we followed the British example, we would be exposed to similar losses and damage. Thus local communities anticipated U.S. involvement in the European War and organized numerous volunteer organizations to limit damage and save lives. When the Federal Civil Defense was created, it was given large responsibilities without commensurate authority over State and local civil defense entities. The result was a loosely coordinated effort among dissimilar organizations which depended heavily on "volunteerism" and cooperation for the limited successes that were achieved. Even that responsibility which was assigned was divided with the military, which had both responsibility and authority for the military security of the civilian population.

Large numbers of volunteers joined the various civil defense organizations immediately after Pearl Harbor, until by the end of January 1942, nearly 8,500 communities had enrolled more than 5,000,000 persons. Unfortunately, the activities of these volunteers were diverted from the primary objective of civil defense, resulting in protracted involvement in programs selling war bonds and stamps, child care, housing for war workers, family security, nutrition service, ballet dancing, consumer programs, race relations, and library service.

The third major shortfall was the lack of effective coordination between civilian defense and established Federal, State, and local agencies with overlapping responsibilities. Virtually every aspect of the volunteer Civil Defense program was already covered by an agency which was far better qualified to handle the responsibilities than were the paid and volunteer personnel available to the Office of Civilian Defense. It is difficult to escape the conclusion that if U.S. Civil Defense has been given a severe test by enemy air attacks, the results would have been chaotic, if not catastrophic. On the plus side, it was probably the greatest spontaneous outpouring of volunteer participation in a major cause in the history of any democratic nation.

World War II left a legacy of the awful role of offensive air power against the civilian populations of warring nations. Many observers were convinced that World War III would most certainly begin with a surprise attack on the United States with the purpose of destroying our war-making capacities. The war would be a total war involving both military and civilian targets, probably simultaneously. The United States would be without allies, since the initial devastation of the attack on the United States would be certain to deter less powerful potential allies. The civilian population of the United States would bear the brunt of the enemy attack for at least the first year of the war, as the forces for mobilization and counter-attack would take time to muster and prepare. Among other conclusions, given those beliefs, it would be difficult to deny that Civil Defense would play an important, perhaps crucial, role in the outcome of World War III.

It would be logical to assume that the explosion of the U.S. atomic bombs over Hiroshima and Nagasaki in August 1945 would have provided the impetus for post–World War II Civil Defense planning. When President Truman assumed office following the death of President Roosevelt, with the end of the war in sight, he cast about for means to cut the mounting costs of World War II. On 30 June 1945, by Executive Order, he abolished the Office of Civil Defense.[1] Immediately the War Department (Army) submitted a recommendation through staff channels that plans be made for "civilian participation against enemy action directed at civilians including civil installations and communities." The day before the first atomic bomb was exploded over Japan, the Commanding General of the Army Service Forces issued a directive to the Provost Marshal General requesting that his office conduct a study of Civil Defense, to include an evaluation of:

(1) Experiences of the former Office of Civilian Defense
(2) Experiences of comparable agencies in allied and enemy countries
(3) Current surveys by United States Bombing Survey Board
(4) Contribution of State Guards to Civilian defense during World War II.

It was further required that the study develop:

(1) The agency that should be responsible for future study and planning, and
(2) The agency of the government that should be responsible for implementing the plans.[2]

2. Initial Civil Defense Planning

Other writers have speculated on why the War Department should have been the agency to initiate peacetime Civil Defense planning. There was no enemy threat of any detectable magnitude in 1945, once the European members of the Axis surrendered and it was foreseeable that Japan could not long stand alone. The U.S. military had considerable Civil Defense experience during World War II through the participation of selected individual officers in U.S. Civilian Defense. The U.S. military also knew at first hand the significant role that British Civil Defense played in the overall war effort of Great Britain. They had seen the seriousness of the threat posed by German V1 and V2 rockets and knew that guided missile technology would play a major role as a strategic offensive weapon in future major wars. The military knew of the importance of strategic bombing in the campaign to defeat Germany, and also knew of the general ineffectiveness of German Civil Defense efforts in combating the damage to German civilian morale. As World War II wound down, the

[1] Office of the White House, Executive Order 9562, 30 June 1945.
[2] U.S. War Department, Army Service Forces, "Civilian Defense Against Enemy Action Directed at Civilians, their Installations and Communities."

War Department General Staff made a concerted effort to preserve the lessons learned from the war and initiated study efforts in many areas before experienced personnel and available records should disappear from the scene. As the War Department had primary responsibility for the ground and air defense of the continental United States, it was logical that it should study Civil Defense as a passive defense against enemy attack. The lack of a clearly identified enemy has never been a deterrent to military planning for "defense."

The Provost Marshal's staff studied civil defense during the period 4 August 1945 to 30 April 1946, and thus had available the World War II experiences of Great Britain, Germany, and Japan, as well as that of the United States.[3] The staff struggled with the dilemma of whether to honestly recommend what *should* be done, or whether to temper the ultimate conclusions to recommend that which public opinion would endure during peacetime.

The study assumed a "worst case" estimate of a future war, based on its examination of past experiences and contemporary concepts of the probable character of future war:

> . . . The next war will be a *total* war which may begin at *any* time; it will be fought at least initially, in the United States which will be attacked *first and without warning*; there will be strong undercover enemies from within who perhaps even now are working against us; and the enemy will be at least as competent and as powerful as we are. It logically must be assumed that the enemy will meet with considerable initial success and that millions of casualties—some published estimates run as high as forty million—most of whom will be civilians, possibly could occur during the first hours of a truly "lightning" war. Although it is assumed that we will possess strong existing task forces for counterattack, complete mobilization of our armed services probably will not occur within a year after some future M-Day. We cannot base our plans on having a large ally *at any time* during a future war since any potential ally, presumably being weaker than this country and seeing unprecedented terror and devastation being visited upon it, doubtless will make its own terms, however prejudicial to itself, with the enemy. The penalty for ineffective preparedness, whether or not it resulted in our capitulation to the enemy, would be tremendous and terrible. If we miraculously escaped the probable punishment for our sins of omission—that of going down to early or eventual defeat—the cost in lives, resources, wealth, and culture still would be appalling. If, on the other hand, we were forced to yield, those of our people who survived the ravages of total war would be marked for annihilation or perpetual bondage. An aggressor nation, in the absence of and unchecked by strong democratic allies, would seek nothing less.[4]

The report also hypothesized: "The brunt of an enemy attack, for at least the first year of the next war, will be borne by the civilian population. The ability of the people to withstand that attack will determine the outcome of the war and the future existence of the nation. Their ability to withstand the attack depends on the thoroughness and efficiency of plans prepared by the national government for their organization to resist and survive the attack."[5]

The study group did not hesitate to attack the then-current proposition that the explosion of two atomic bombs in Japan destroyed in that nation the last faint spark of will to resist. After careful examination of on-the-ground investigations by experts, the reports stated: "The will of the people in the two atomic target areas was only slightly affected, and that of the people throughout the rest of Japan, if affected at all, was in the direction of strengthening their resolve to resist and increasing their hatred of the enemy."[6]

While admitting that the atomic bomb in the hands of an enemy is capable of destruction and devastation so extensive that it is "horrible to contemplate," the report stated that it is possible to defend the civilian population against the effects of an atomic bomb with proper warning and by placing a disciplined

[3] U.S. War Department, Office of the Provost Marshal General, "Defense Against Enemy Action Directed at Civilians."
[4] Ibid., Par. 3, Exhibit "N."
[5] Ibid., p. 5.
[6] Ibid., p. 4, Par. 7a.

population in proper shelters. The report concluded that there is a defense against atomic bombs, and that is "a grave and fundamental responsibility of our government, and a natural function of its War Department to develop means of protection and to create plans to put those means of protection into effect *without delay*."[7]

After extensive study and deliberation, the Provost Marshal General's study group apparently decided to solve the dilemma of what to recommend by compromising and recommending that which public opinion would endure during peacetime. Their study of all available historical experience dictated that civil defense operating agencies must be formed in peacetime long before the onset of armed hostilities, for civil defense to be effective. The recommendations were directed toward establishing a civil defense *planning agency* in peacetime, to prepare for a declaration of a "limited national emergency." Only then would the skeleton civil defense organizations be mobilized and fully manned under a War Department chain of command. A declaration of full national emergency would be necessary to effect the total mobilization and operation of all civil defense activities. It is difficult to rationalize the recommendation for a three phase or step mobilization with the assumption that the next war will begin with an all-out surprise attack.

Though the study does not purport to go beyond "the category of a purely exploratory analysis," the recommendation was made that a separate permanent Civil Defense Division of the War Department General Staff be authorized and established. Pending the authorization for that separate Civil Defense Division, it was recommended that an interim agency be formed at once to operate under the Plans and Operations Division, War Department General Staff. The Provost Marshal General, Brigadier General Blackshear M. Bryan, in signing the report volunteered the information that his office would continue to study civil defense planning until such time as a new agency was created for that purpose. As the report was classified "Confidential" and was not declassified until 15 February 1965, the concern of the War Department about future wars and the safety of the civilian population was not revealed outside of the War Department.

Despite seeming inconsistencies between assumptions and recommendations, the Provost Marshal's study was notable for several reasons. While the study was being conducted, the United States dropped two atomic bombs on Japan, Japan surrendered, ending the global war, the United States had no known enemies of any significance and possessed a monopoly on atomic power, and the United States rapidly dismantled its military power as quickly as shipping could bring the scattered U.S. forces back to the United States. The first order of business of the United States was the conversion of its economy to a peacetime basis, the occupation and subjugation of its erstwhile enemies, Germany and Japan, and providing support for the new international organizations, the United Nations, the International Monetary Fund, etc. A highly vocal segment of American scientists were pushing very hard to bring the atomic weapon under international control in order to ensure that it would never be used in future wars. President Truman imposed severe budgetary ceilings on military appropriations, thereby reducing military strength to near impotence for the remainder of the decade of the 1940's. Many overseas bases were retained in support of the military occupations of Germany and Japan, thus giving the U.S. a *de facto* strategy of forward deployment, however thin the back-up and reserve military forces in the continental United States. Despite all this, the study group had the breadth of vision to look ahead and visualize a situation where a great power armed with atomic weapons might inflict a surprise attack on the United States. They tackled the awesome question of the effects of the

[7] Ibid., p. 3, Par. 4.

atomic weapon squarely, and declared that it was possible to prepare passive defenses which could save millions of lives in the face of an atomic attack. Finally, the study was emphatic that civil defense must be planned and prepared for immediately, and was successful in goading the War Department into establishing a Civil Defense Board.

In August 1946, the Acting Secretary of War informed the Director of the Bureau of the Budget that the War Department considered the subject of civil defense to be a matter of equal and direct interest to the civilian as well as to the military agencies of the government and since major matters of national policy were involved, the subject should be considered in conjunction with the overall study that the Bureau was making for the President with regard to the Reorganization Act of 1945.[8] The Director of the Budget replied that there was no argument that considerable work must be done in civilian defense planning during peace time to be prepared for a future emergency, and that they should move promptly to fix primary responsibility in an appropriate agency. He said:

> My main question is whether this phase of national preparedness planning should be considered by itself or whether the organization of all phases of the broader problem have to be considered together. We are now giving some attention to the whole question of how a National Security Resources Board, as recently endorsed by the President, should be organized. We have tentatively been looking on civilian defense planning as one aspect of the general problem with which that Board should be set up to deal. In any event, you may be sure that we will consider your suggestions carefully in conjunction with our work for the President in carrying out the provisions of the Reorganization Act of 1945.

On 25 November 1946, the Acting Secretary of War established the War Department Civil Defense Board headed by Major General Harold R. Bull, General Eisenhower's wartime operations chief in Europe. The mission assigned the board was:

(1) Allocation of responsibilities for civil defense to existing or new agencies of the Government
(2) The responsibilities which should be handled by the War Department and the allocation thereof to existing or new staff agencies
(3) The structural organization, from the national level down to the operating groups, and the authority which must be vested therein for the adequate discharge of its responsibilities
(4) The action in matters of civil defense which should be undertaken currently by the War Department pending the foregoing determinations.[9]

The Bull Board met with a sense of urgency. The members felt that civil defense was a matter of great national importance that no other agency of the government was planning. Many agencies of the government have direct interests in civil defense, as did almost every state and single city. Informally, the Director of the Bureau of the Budget stated that as part of the overall study for reorganization of the military into a single department, the administration wanted to create a National Security Resources Board which should probably assume overall responsibility for civil defense, but that the subject was sensitive and would require Congressional authorization and support. In the absence, of that authorization, the War Department was the only single Federal agency that could look at civil defense.

The Provost Marshal General's study had recommended the immediate formation of a civil defense agency within the War Department, but the War Department did not want to take that action until a broad

[8] U.S. National Military Establishment, Office of the Secretary of Defense. *A Study of Civil Defense*.
[9] Ibid., Par. 2, p. 1.

study by both the military and civilians had so recommended. In addition, the War Department budget and appropriations had been cut so severely that the War Department was reluctant to take on a new unassigned mission unless specifically assigned that responsibility (and by implication, unless it was specifically funded). There was also fear in the War Department that civil defense was so broad a responsibility that it would divert the War Department from its primary mission of "beating the enemy." The American Legion was after the War Department to publish a course of action on civil defense, as it wanted to publish its own plans and views in the forthcoming annual national convention. Also the members of the Board had other assigned duties to perform and wished to finish the study and get it over with in no more than three months' time. The War Department staff was operating on an austere basis and could ill afford the loss of the board members from their primary duties. The all-military board was appointed specifically to preclude the possibility of its being designated as the agency to continue civil defense planning.[10]

The board was entirely military, with senior Major Generals representing the Army Ground Forces, the Army Air Forces, the War Department General Staff, the National Guard Bureau, and the Bureau for Reserve and ROTC Affairs. Brigadier General Bryan, the Provost Marshal General, was also a member, providing continuity from the initial civil defense study. The board contained a representative of the Intelligence Division of the War Department General Staff, and its first order of business was to interview other members of the Intelligence Division. As a result, it reached much more moderate assumptions concerning the future than the Provost Marshal General's study group. In the opinion of the board:

> It may be expected that international agreements and organizations for the maintenance of peace will grow in effectiveness with time. The United States must, however, for the foreseeable future, provide for constant readiness to act to maintain its security.
>
> In the event of war, it is assumed that:
>
> a. Some period of strained relations, with or without declaration of emergency, will precede the outbreak of hostilities.
> b. The enemy may use weapons of mass destruction if he considers it to his advantage.
> c. There can be no guarantee of a specific warning of an attack.
> d. Strategic areas in the United States and its possessions, territories and trusteeship territories may be subjected to initial surprise attacks by air to cripple our industrial effort and destroy the will and ability of the people to resist.
> e. A major war involving the United States will require rapid total national mobilization.
> f. It may logically be anticipated that "Fifth Column" activities will have to be faced in the United States in case of an emergency.
>
> It is assumed that the armed forces will be united under a single department of national defense.[11]

This was an extraordinarily restrained and optimistic view of the future in light of the events that had transpired and were under way while the Bull Board deliberated (November 1946 to February 1947). Ex-Prime Minister Churchill made his famous "Iron Curtain" speech at Fulton, Missouri in March 1946, clearly anticipating the bi-polarization of the world into communist and anticommunist camps. The U.S.S.R. had revealed its expansionist intentions in Iran, Turkey, and Greece, and President Truman was priming himself to appear before Congress to "scare the hell out of the country" and request authority for $400 million assistance to Greece and Turkey—the historic Truman Doctrine. The intelligence community must have made clear to the Bull Board the growing possibilities of war between the United States and U.S.S.R.,

[10] Ibid., Annex I, p. 10.
[11] Ibid., Par. 6, p. 3.

as both sides became increasingly hostile and belligerent, and the United Nations was shown to be ineffective in handling the hard facts of the international competition.

During the next three months the Board interviewed 59 witnesses, representing the military, civilian organizations, and academia. In a very thorough and methodical fashion the Board probed in depth, examining wartime members of the Office of Civilian Defense, senior members of the Strategic Bombing Survey, experts from the Provost Marshal General's staff, scientific experts, and senior military commands who had World War II experience with civil defense. The Board also had the Provost Marshal General's study and annexes to assist them.

The conclusions reached by the Board were clear, direct and eminently sensible though it took 15 years before the same conclusions were reached by a "trial and error" process. The main points were:

(1) Civil defense is an essential part of national defense; no effective civil defense organization was in existence and no coordinated planning was being accomplished; and the nation should be organized immediately for civil defense.
(2) Civil defense as organized and directed in the United States during World War II would be inadequate for the future.
(3) A single, permanent, federal Civil Defense Agency should be responsible for planning, organizing, operating, coordinating, and directing civil defense matters at all levels of government. This agency should get its general national policy guidance from a cabinet level group. As civil defense is basically a civilian problem, it should be a separate civilian agency, but within the Department of the Armed Forces (later designated Department of Defense) for maximum guidance and cooperation.
(4) Regional civil defense organizations should be established and made responsible to the Director, Civil Defense Agency, for federal-state and interstate coordination. The States should be charged with responsibility for establishing and operating their necessary civil defense organizations in accordance with the general pattern determined by the Federal Government.
(5) Federal and State legislation is required to establish statutory civil defense organizations, define responsibilities, and allocate authority both in war and peace.
(6) The Secretary of War should recommend to the President that an early decision should be made to establish the Civil Defense Agency, and in the interim the War Department should be charged by the President to develop civil defense plans at once.[12]

The Board recognized that civil defense was part of a larger problem which involved many agencies at different levels. It did not want to burden the Civil Defense Agency with responsibilities for internal security, dispersal of industry, protective building construction, mass evacuation, the development of underground sites, and the many activities of volunteer agencies during wartime. It did base its civil defense concept heavily on Great Britain's model, fully recognizing the vital role played by the national government, while also embodying the principle of "self-help" and the principle of mutual aid. Unfortunately, these points were lost on later civil defense planners who directed civil defense efforts at those very endeavors. In particular, the principal of "self-help" was lifted out of context and used as a rationale for placing the main burden of civil defense on State and local government, not the Federal Government.

The Board did not recommend placing the Civil Defense Agency under the Department of the Armed Forces in order to build up the missions, appropriations or prestige of the armed services, but rather because testimony had fully established that many "States Righters" in a civilian civil defense organization would not take federal direction except from members of the armed services. In fact, the Board was chary that the

[12] Ibid., Pars. 20–26, pp. 20–21.

military might be distracted from their primary mission of "defeating the enemy" if overburdened with civil defense responsibilities. The military did not want to assume the responsibility for civil defense, but could not avoid it if it were to assume its rightful place in overall national defense.

The Bull Report was completed in February 1947, classified "Confidential." As a result, it had very little impact on public opinion. The recommendations contained in the report were not carried through, but they did provide a useful basis for further study of civil defense. In retrospect, this is not very surprising. The *verbatim* testimony in the annex to the report stated that the members of the Board knew that civil defense was essentially a civilian subject. They knew that further study of civil defense by a civilian board was necessary, and that the Bull Board was deliberately composed only of generals for the specific purpose of NOT involving them further in civil defense planning. They also knew that the Bureau of the Budget was planning the reorganization of the armed forces and that the National Security Resources Board was planned as the top-level policy-making organization to be charged with responsibility for civil defense. With all the changes in the air, about the best the Bull Board could do was to transmit a sense of urgency together with its truly outstanding recommendations.

Events were moving too quickly to expect a rapid reaction to the Bull Report recommendations. The National Security Act of 1947, creating the National Military Establishment, a separate U.S. Air Force, the National Security Council, the National Security Resources Board, and other means of directing and coordinating national security programs, was approved on 26 July 1947. A strong motivation behind President Truman's advocating a unified military establishment was his central concern with civilian control of the military establishment.[13] The new Secretary of Defense, James Forrestal, established the Office of Civil Defense Planning on March 27, 1948. Mr. Russell J. Hopley of Omaha, Nebraska, was appointed Director of the Office and Deputy to the Secretary of Defense for Civil Defense matters, from the position of President of the Northwestern Bell Telephone Company. He was assigned the mission:

(1) To provide for the development of detailed plans for, and the establishment of, an integrated national program of civil defense;
(2) To secure proper coordination and direction of all civil defense matters affecting the National Military Establishment; and
(3) To provide an effective means of liaison between the National Military Establishment and other governmental and private agencies on questions of civil defense.[14]

The Secretary of Defense Memorandum that established the Office of Civil Defense Planning was a logical extension of the "Bull Report" recommendations, which were abstract and general. Detailed guidance in the Memorandum made it clear that Mr. Hopley's task was to develop detailed plans and recommendations to be implemented by a "permanent federal civil defense agency which, in conjunction with the several States and their subdivisions, can undertake those peacetime preparations which are necessary to assure an adequate civil defense system in the event of a war."[15] The principle of peacetime civil defense planning had been established—the question remained "by whom" and "how."

[13] U.S. President (Truman), "Unification of the Armed Forces of the United States," Message from the President of the United States, 19 December 1945, pp. 6–7.
[14] U.S. Office of Civil Defense Planning, *Civil Defense for National Security*, p. 291.
[15] Ibid.

The staff selected for the Office of Civil Defense Planning consisted of 49 other individuals, only six of whom were military, selected from Federal, State, local governments, and industry. In addition, the OCDP was authorized to consult any persons of agencies within the National Military Establishment for information or assistance, and to solicit the help of other individuals or agencies, both governmental and private, it deemed appropriate. It was also authorized to establish such advisory committees as it deemed necessary to carry out its assigned duties.

In just over six months the OCDP produced a 300-page report entitled *Civil Defense for National Security*, published in unclassified form for public consumption on November 13, 1948, and thereafter generally known as the "Hopley Report." Mr. Hopley and his staff did a remarkable job of producing a comprehensive analysis and a detailed organizational outline to accomplish the assigned tasks. It is still viewed as a model textbook on a civil defense program for the United States, with few reservations. The OCDP did not take a strong position on the probability or shape of future wars, except to say that it hoped that ". . . International agreements and organizations for the maintenance of peace will succeed in their objective, and in the conviction that this nation does not want war; yet realistically facing the fact that as long as armies are maintained and war remains even a remote possibility, this country must be prepared for any eventuality."[16] It did give a clue that it thought that another atomic super power might be involved when it wrote: "If attack should come, it might be by bomber squadrons dropping atomic bombs, incendiaries or gas bombs, or super explosives, on one or a score of our major centers. It might come via guided missiles from distant points, or from submarines off the American shores. Or it might come from within the borders of the United States, through saboteurs and fifth columnists."[17] As justification for maintaining an Office of Civil Defense in peacetime, the report stated ". . . if there is a 'next War,' it may start, as did the last, with a surprise attack in force upon this continent."[18]

The program proposed by the report included:

(1) A National Office of Civil Defense, with a small but capable staff to furnish leadership and guidance in organizing and training the people for civil defense tasks
(2) Basic operational responsibility to be placed in States and communities, but with mutual assistance plans and mobile supporting facilities for aid in emergencies
(3) Maximum utilization of loyal volunteers, existing agencies and organizations, and all available skills and experiences
(4) Well organized and trained units in communities throughout the United States, its territories and possessions, prepared and equipped to meet the problems of enemy attack, and to be ready against any weapon that an enemy may use
(5) Intensive planning to meet the particular hazards of atomic or any other modern weapons of warfare
(6) A peacetime organization which should be used in natural disasters even though it may never have to be used in war[19]

On the question of the location of a National Office of Civil Defense in the Executive Branch of the Federal Government, the Hopley Report preferred that it report directly to the Secretary of Defense, but stated that it would be appropriate to have it report directly to the President.[20]

[16] Ibid., p. 2.
[17] Ibid.
[18] Ibid., p. 18.
[19] Ibid., p. 2.
[20] Ibid., p. 18.

A major difference from the Bull Report was the stress of the Hopley Report on the use of volunteers to perform all major operational activities. It envisioned as many as fifteen million people involved in all phases of civil defense, and even postulated that virtually every man woman and child would have to be assigned to tasks in a civil defense organization fighting for the nation's life. Concern was expressed, however, that men not be diverted from the Armed Forces to fill civil defense positions. In keeping with its general philosophy of building on existent capabilities, the Hopley Report stated "Full use should, of course, be made of civic, social, fraternal, veterans and other community organizations, including woman's groups, organizations of boys and girls, business, labor, agricultural and professional associations and the like."[21]

A unique aspect of the Hopley Report which placed it years ahead of its time, was its insistence on establishing a useful role for civil defense organizations, people, and equipment in peacetime. Specifically, it stated: "There should clearly be a basic purpose of disaster action in organizing for Civil Defense, for many parts of such an organization would be automatically adaptable to the handling of emergency situations in times of peace as in war."[22]

Perhaps the most unfortunate aspect of the Hopley Report, when viewed in retrospect, was its insistence that the basic principle for civil defense should be ". . . that the primary operating responsibility for civil defense must rest with state and local governments, that they must be the directing force in the protection of their own citizens."[23] When a civil defense operating agency was finally authorized at the Federal Government level, it was based firmly on that principle of the primacy of State and local governments.

By the time the Hopley Report was published, there was considerable interest in organization of local civil defense agencies, as there had been prior to World War II. The Berlin Blockade crisis grew out of a series of events in the Spring of 1948, culminating in Allied monetary reform for Germany in all zones except the Russian Zone. The Russians retaliated by blockading all access routes to Berlin except the air corridors, and cut off the flow of electric power from the Soviet sector of Berlin to the Western sectors. The Allies in turn cut off all trading between Western zones and East Berlin and the whole Soviet zone, denying East German industry the coal from the Ruhr. By the end of June 1948, President Truman had determined that there would be no withdrawal from Berlin. The decision was made to resupply Berlin by a makeshift airlift, assembling every transport aircraft that could be made available. In addition, B-29 aircraft were moved to West Germany and England. It was not announced whether or not they were equipped with atomic bombs, but the inference was clear.

By September, the situation was extremely dangerous so that the Western nations felt that they teetered on the edge of war.[24] The newspapers, of course, duly brought to the attention of the American people all of the implications of the situation. One of the by-products of the first war scare since the end of World War II was an increased interest in civil defense. The Hopley Report was issued at precisely the right time to capitalize on that interest, and it did much to further discussions of governmental organization for civil defense among responsible State and local officials. The 17 organizational charts at the back of the report provided the basis for much of the civil defense organization that ensued. Public reaction to the report was generally favorable, with a minimum of negative or critical comment in the public press. As a result, there

[21] Ibid., p. 16.
[22] Ibid., p. 17.
[23] U.S. National Military Establishment, Office of Civil Defense Planning. *Civil Defense for National Security*. "Hopley Report," p. 15.
[24] Truman, *Years of Trial and Hope*, p. 128.

was a great deal of civil defense legislation enacted as civil defense organizations were created by State and local governments.

At the national level, the Hopley Report did not attract comparable attention. By the time that President Truman took further action on civil defense, the crisis of the Berlin Blockade and airlift was passing as a result of successful allied supply of the besieged city. President Truman decided not to create a permanent Office of Civil Defense as recommended in the Hopley Report, but to further civil defense planning instead. He assigned responsibility for civil defense planning to the National Security Resources Board on March 3, 1949, thus removing civil defense from the military establishment.[25] The three civil defense studies compiled by the Department of Defense and the War Department had carried civil defense planning about as far as it could go. The President could not very well ignore the recommendations of those studies and expect the Department of Defense to continue civil defense planning indefinitely. As the National Security Resources Board was already assigned the mission of mobilization planning for the industrial base of war production, it was logical to also assign it the mission of mobilization planning for civil defense.

The NSRB carried out its civil defense mission in three distinct ways:

(1) The coordination of civil defense planning by other federal agencies;
(2) The education of civil defense workers and the public in furtherance of civil defense objectives; and
(3) Planning for a mobilization civil defense operating agency. It was also influential in simulating the continued development of civil defense activities at the State and local levels.

The NSRB expanded the planning initiated by the Hopley group by involving all of the pertinent federal agencies with civil defense functions in planning for mobilization or wartime civil defense operations. This coordination reached down as well as out to budding and existing local level civil defense organizations, greatly encouraging them in their search for federal support and guidance. The NSRB staff compiled numerous educational publications, the most famous of which, *Survival Under Atomic Attack*, was published in October 1950, eventually reaching a distribution of 250,000 copies and a wide readership. It was the first official publication which described the effects of atomic weapons in an unclassified text and layman's language, and elicited tremendous public interest.

3. Civil Defense Operating Agencies, 1951

Once again, the sweep of events overtook deliberate civil defense planning. Simulated by the open display of Russian force which accompanied the Berlin Blockade, the nations of Europe banded together to form the North Atlantic Treaty Organization, joined by the United States in July 1949. On September 23, 1949, President Truman announced that the U.S.S.R. had exploded an atomic device, ending the United States monopoly of the atomic bomb several years before the anticipated date. The psychological impact of that chain of events which reflected great concern with the status of U.S. military forces and defenses. Though this change in U.S. strategy of no longer relying on the monopoly in atomic weapons was not sudden and drastic, it did evolve into a new strategy of building up U.S. military forces to meet the requirements of a far more dangerous world. The takeover of China and the establishment of the People's Republic of China, announced on October 1, 1949, added to the swell of U.S. public opinion and interest in foreign

[25] Maxam, William P., *Federal Civil Defense 1946–1963: A Study*, p. 151.

affairs, and concern for U.S. security. Though there were extensive investigations and much acrimony concerning our "loss of China," U.S. public opinion turned from Asia to Europe, much as U.S. foreign policy "wrote off" China and dropped support of the Chinese Nationalists forces had ensconced on Taiwan. The invasion of South Korea by the Russian-sponsored forces of North Korea on 25 June 1950, brought the United Nations and the United States squarely into that conflict. President Truman proclaimed "the existence of a national emergency" on December 16, 1950, and the necessary machinery for wartime mobilization was triggered by a small "police action" on the rim of Asia.[26]

The NSRB submitted its civil defense report, *United States Civil Defense* (NSRD Document 128), to the President on 8 September 1950, and he in turn quickly forwarded it to the Congress for consideration on September 18, 1950. President Truman relieved the National Security Resources Board of the responsibility for civil defense on December 1, 1950, when he issued Executive Order 10186 temporarily establishing a Federal Civil Defense Administration in the Office for Emergency Management. Millard F. Caldwell was sworn in as the Federal Civil Defense Administrator on December 6, 1950.

United States Civil Defense,[27] commonly known as the "Blue Book," was a continuation of the Hopley Report in that it expanded the number of governmental agencies which would be responsible for future planning activities, and delegated more responsibility for program development of State and local agencies. It also expanded on the principle of "self-help" by declaring "civil defense rests upon the principle of self-protection by the individual, extended to include mutual self-protection on the part of groups and communities."[28] It also extended the remarks of the Hopley Report about the use of existing resources when it stated "Plans for civil defense . . . must be made with full recognition of the importance of maximum economy in the use of the available supply of men, money, materials."[29] Though that statement was probably written before the outbreak of the Korean War, it was interpreted after the outbreak of the Korean War and its subsequent demand on scarce resources. In that light, it further lessened any possibility of legislation for a strong civil defense.

The Congress circulated the draft legislation for civil defense among the agencies of the Federal Government that were involved, as well as to the Council of State Governors. The revised draft legislation was reintroduced in the House on November 30, and the Senate on December 1, the same day President Truman created the Federal Civil Defense Administration by Executive Order. The entry of the Chinese Communist forces into the Korean War cast a pall over the country as daily the headlines announced Communist advances and victories and U.N. forces withdrawals and defeats. President Truman addressed a letter to the Congress explaining his Executive Order and requesting rapid passage of the Civil Defense Act.

Congress did hold its hearings with a sense of urgency, but at the same time delved into the proposed legislation vigorously and comprehensively, calling many witnesses from the military services, Federal departments and agencies, State and local governments, professional and public organizations, and some individuals. There was general agreement with the basic thrust of the legislation, that it was both feasible and desirable to protect the civilian population of the United States against atomic bomb

[26] Office of the White House, Proclamation No. 2914, 15 F.R. 9029.
[27] Executive Office of the President, National Security Resources Board. *United States Civil Defense.*
[28] Ibid., p. 1.
[29] Ibid.

effects. There were few disagreements on the substance of the legislation and the recommended law. The notable exception came from witnesses representing the American Municipal Association, which represented the mayors of the American cities. The mayors strongly believed that Federal civil defense organization should be under the Department of Defense, if there was to be effective coordination between the civilians in the local municipalities and the military at the national level. All of the three previous reports on civil defense supported the mayors' judgment based on close examination of civil defense in the United States during World War II. At that particular point in time when the hearings were held, the Department of Defense was almost totally occupied with fighting the war in Korea and reinforcing U.S. military forces in Europe, and did not want to undertake civil defense as well. Thus, the mayors failed to get any support from the Department of Defense, which normally would have been strongly in their corner.

The mayors indicated two other major objections. The Blue Book concerned itself with the threat of atomic (or fission) bombs, as the thermonuclear (or fusion) bomb had not yet been developed. The atomic bomb with its limited nuclear yields had been employed only on cities, and was visualized primarily as a threat to the 50 largest American cities. In effect, the entire civil defense problem boiled down to protecting those 50 cities, since blankets of fallout were not envisioned as threatening non-urban areas. Yet, carried away by the concepts of "self-help" and "self-reliance," the legislation proposed funding civil defense by a matching funds provision. The local government (cities) were to put up the first dollar for civil defense, and the Federal Government would match it with the second dollar. Since the hearings were considering the expenditure of two billion dollars over a period of three years, the mayors of only 50 cities were faced with the problem of raising a like amount, though they lacked the tax base and means of the Federal Government. Due to the rapidity with which the legislation was introduced and the Federal Civil Defense Administration brought into being, the American Municipal Association was not prepared to introduce alternative formulas for dividing the funding responsibility between the Federal and local governments.

The mayors' third major objection grew out of the military type chain of command outlined in the Blue Book and proposed legislation, linking the Federal Government through the State governments to the local governments. This direct chain ignored the existing problem of almost uniformly bad relations between big cities and their host states, best exemplified by the long-standing feud between the New York State government in Albany, and the City of New York. The mayors, who were intimately familiar with their own feuds and State assemblies, felt that the chain would seriously impede efforts to develop effective civil defense efforts at their levels.

Despite the mayors' objections, Congress passed the proposed legislation after some reorganization of the act, clarification of some of the provisions, and the addition of some definitions. By January 2, the bill was passed by both houses, to be signed by the President on January 12, 1951, as Public Law 920, 81st Congress, the Federal Civil Defense Act of 1950.

The crisis of the war in Korea clearly provided the occasion for the rapid enactment of the Federal Civil Defense Act of 1950, and the activation of a civil defense operating administration. Growing awareness of vulnerability to atomic weapons delivered by Russian intercontinental bombers provided the cause. The American public was increasingly made aware that President Truman's pre–Korean War military budgets were so austere that they left the North American continent virtually defenseless in the event of a Russian

attack.[30] The Korean War "requirements" budget and supplements provided sufficient funds to activate an air defense for the United States by mobilizing National Guard and Reserve interceptor and antiaircraft units, but time was required to modernize and produce new equipment.

The Act of 1950 was passed under crisis conditions with the intent to do something about an existing threat, not as a sound legislative basis for a long-term future program which could build solidly on existing civil defense capabilities in anticipation of the day when the clearly identified enemy, Russia, would possess a truly significant atomic weapons capability. The civil defense program in the United States was launched with a very bad start from which it never entirely recovered.

The first Federal Civil Defense Administrator, Millard Caldwell, one-time Congressman and ex-Governor of Florida, was a political unknown who possessed little of the national prestige that would have gotten civil defense off to a flying start. The Congress, despite talk of appropriating two billion Federal dollars in the first three years, granted only token appropriations far below the level requested by the FCDA. Under the Act of 1950, the FCDA did not have the authority necessary to invoke an effective civil defense program, for the Act placed the responsibility for civil defense at the State and local levels. In redefining the term "civil defense," Congress made it so narrow as to exclude Federal civil defense assistance in countering natural disasters. It also excluded peacetime civil defense preparatory and regulative authorities, concentrating on national civil defense in time of emergency only. Like some other wartime emergency agencies that were created to expedite the prosecution of the Korean War, the FCDA was clearly a wartime emergency measure. The provision for fund splitting between Federal and local governments virtually ensured that civil defense would be funded at a very low level.

The Act of 1950 did not create new Federal instruments and authorizations with which to hammer out an effective civil defense system, but merely created an administration that was outside the Executive Office of the President and the departmental structure of the Executive Branch, with an Administrator who derived his authority from the President. If the Administrator were to become effective, however, he would necessarily need the authority to coordinate and direct (in the name of the President) other Federal departments and agencies, as well as State and local governments. That authority was not forthcoming. It can only be concluded that President Truman did not intend the FCDA to be more than a token emergency move to placate public opinion and concern for the safety of the civilian population in the face of a growing atomic bomb threat.

The main thrust of the FCDA under Governor Caldwell was on providing shelters against the effects of atomic attack. The majority of the talked-about 2 billion Federal dollars for civil defense was planned to go into deep shelters to protect the populations of the most likely targets (fifty cities) from blast, heat, and the initial radiation effects of atomic weapons. When it became obvious that the cities were not about to come up with that level of funding, the Federal program was shifted to surveying the sheltering capabilities of existing shelters in structure. Plans were made to develop and supplement existing capabilities to shelter the citizens of the critical urban areas, but they met with little enthusiasm from either the public or local governments.

In 1952, the Department of Defense contracted for a study of civil defense on behalf of the DOD, the NSRB, and the FCDA. The contractor was Associated Universities, headed by the President Emeritus of

[30] Martin, Harold H., "Could We Beat Back an Air Attack on the U.S.," *Saturday Evening Post*.

the Massachusetts Institute of Technology, Lloyd Berkner. President Berkner had been active in the studies of Air Defense of the North American Continent conducted in behalf of the U.S. Air Force by the Lincoln Laboratory, an adjunct of M.I.T. created in 1951 for the specific purpose of furthering the effectiveness of air defense. The civilian scientists of the Lincoln Laboratory had concluded collectively that based on anticipated advances in early warning radar technology, an effective air defense of the North American continent was both feasible and highly necessary. Many of the same civilian scientists who arrived at that conclusion were active in the study of civil defense, which was known by the code name "East River."[31]

The East River report was submitted in ten parts, Part I being the General Report, Part II covering Measures to Make Civil Defense Manageable, and the remainder devoted to CBR Warfare, Urban Vulnerability, the Destructive Threat of Atomic Weapons, Disaster Services and Operations, Warning and Communications for Civil Defense, Civil Defense Health and Welfare, and Information and Training for Civil Defense. The recommendations covered in Part I were general and included the following points[32]:

(1) Civil Defense must be a permanent partner in national defense.[33]
(2) The Civil Defense program must emphasize as a positive goal of first priority, those activities that will improve the individual citizen's chance of survival and minimize his property damage in the case of enemy attack.[34]
(3) A civilian Civil Defense must be developed to the maximum degree possible.[35]
(4) Civil Defense must be organized and operated on the principle that existing agencies and facilities should be used to the greatest extent possible.[36]
(5) Civil Defense must be accomplished, in the main, as an extension of the normal duties of various officials at all levels of government assisted by volunteers and volunteer organizations.[37]
(6) The Civil Defense job must be accurately dimensioned as a prerequisite to dividing it into its component parts.[38]
(7) The Civil Defense job must be delimited by Civil Defense.[39]
(8) Civil Defense functions must be clearly defined and responsibility for each function precisely assigned.[40]
(9) Civil Defense must conform to traditional and accepted methods, means, and organizations in carrying out its program.[41]
(10) Dual use of equipment and facilities for Civil Defense should be encouraged to the maximum practical degree.[42]
(11) All areas of the U.S. are not of equal vulnerability to the several elements of the threat and Civil Defense programs must be adjusted to the requirements of the individual area.[43]
(12) Civil Defense must be effectively organized with priorities for the most critical target and immediate support areas and then extended to other areas.[44]

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[31] Associated Universities, Inc. *Project East River*, New York, 1952.
[32] Ibid.
[33] Ibid., pp. 9–10.
[34] Ibid., pp. 10–11.
[35] Ibid., p. 11.
[36] Ibid.
[37] Ibid., p. 13.
[38] Ibid.
[39] Ibid.
[40] Ibid., p.14.
[41] Ibid.
[42] Ibid., pp. 14–15.
[43] Ibid., p. 15.
[44] Ibid.

(13) Reduction of target vulnerability is an essential function of Civil Defense.[45]

(14) Because of its complexity and magnitude, the Civil Defense task must be a continuing operation, carefully programmed.[46]

(15) The Civil Defense program must place first reliance on the efforts of the individual and the community to increase chances of survival, to minimize damage, and to recover as quickly as possible in the eventuality of an enemy attack.[47]

The report further spelled out what was meant by the statement that "The Civil Defense job must be delimited by Civil Defense." It stated that the Civil Defense tasks must be delimited through adoption of an effective military defense; and reduction of urban vulnerability.[48]

In Part IIA, the report spelled out those military measures that must be taken precedent to achieving a manageable Civil Defense: the Air Defense Command must provide one-hour warning of the approach of enemy aircraft, an enemy attack must be detected 2,000 miles from critical U.S. targets, interception of enemy aircraft must take place well out from the critical targets, the sea and land approaches of the United States must be covered by early warning radars, means must be developed of detecting low-flying enemy aircraft, electronic counter measures must be developed against enemy aircraft, no unidentified aircraft must be allowed in the Air Defense Identification Zones (ADIZs), an effective system for detecting enemy submarines must be developed, and a Joint Operational Development Force (for air defense) must be created.

The Department of Defense had seen those same recommendations before from the Lincoln Laboratory scientists, who had banded together in an extra-official group known as the "Summer Study Group" and submitted their opinion that an effective air defense was feasible and necessary. The Department of Defense did not agree with those conclusions and had no intention of spending the money, time or effort to make the air defense mobilized by the Korean War effective.

As a result, the East River report had little impact on civil defense through official channels. The scientists who were rebuffed by the lack of interest in their report, turned to unofficial channels and "leaked" their findings to select members of the press to transmit their sense of urgency about air defense to the American public. The net effect of the East River report was to turn the thrust of providing protection to the American civilian population from civil defense to air defense. It was not effective in bringing civil defense and military defense into successful cooperation.

4. The Period from 1952 to 1955

On October 31, 1952, an event took place which was to have a tremendous impact on civil defense—the United States successfully exploded a thermonuclear device at Eniwetok. The United States was in the midst of a Presidential election, which saw General Eisenhower elected on a ticket which promised peace in Korea and a reduction in military expenditures. With an imminent change in administrations, Millard Caldwell resigned as Federal Civil Defense Administrator on November 15, 1952. President Eisenhower appointed another ex-governor to follow him—Val Peterson, the outgoing Governor of Nebraska. Governor Peterson's ambition was to be Ambassador to India, but the opposition of Nebraska's United States Senators precluded that appointment. There was no Senate opposition to his appointment as Federal Civil Defense

[45] Ibid., p. 16.
[46] Ibid.
[47] Ibid., p. 17.
[48] Ibid., p. 21.

Administrator. Governor Peterson had to wait until 1957 to fulfill his diplomatic ambitions, when he was successfully nominated and confirmed as Ambassador to Denmark.

Governor Peterson quickly established the fact that the shelter program was ended when he announced that he was not going to request Congress to appropriate large amounts of money for shelter development and construction. He announced that evacuation of the heavily populated urban areas was feasible and would be the alternative to expensive digging and construction projects.

His timing was as bad in civil defense matters as it was in diplomatic matters, for the thermonuclear bomb's effects differed radically from the fission bomb in one other aspect beside the infinitely greater magnitude of the fusion bomb—it generated massive fallout that threatened urban and rural areas alike. While it was true that the effects of the thermonuclear bomb were highly classified, and also true that Russia was not expected to develop the thermonuclear weapon for at least three or four more years, his new policy was quickly overtaken by events. The Soviet Union exploded a thermonuclear device on August 12, 1953. Evacuation as the major thrust of U.S. civil defense, however, lingered on until 1958, when the emphasis changed to the construction of fallout shelters.

The creation by the Federal Civil Defense Act of 1950 of the FCDA as a wartime mobilization agency with authority to designate civil defense tasks to other Federal departments and agencies, brought the FCDA into conflict with other mobilization agencies. As has been seen, the FCDA was a statutory agency created by the Congress under Public Law 920. Prior to the passing of that law, President Truman created other defense mobilization offices by Executive Order, placing them in the Executive Office of the President.[49] The non-statutory Office of Defense Mobilization was created on December 16, 1953, which transferred certain functions of the National Security Resources Board to the Director of ODM. On June 12, 1953, Reorganization Plan Number 3 was signed which abolished the statutory National Security Resources Board and transferred its remaining functions to ODM. The "cease fire" in Korea became effective on July 26, 1953.

Though the immediate emergency triggered by the Korean War was ended, the era of Cold War which ensued was regarded as a continuing emergency of highly dangerous international competition which could bring war at any moment. Under those conditions the prospect of mobilization of the country's resources for war-fighting or for recovery from an enemy attack was given an immediacy that had previously been lacking in peacetime. Though ODM had relatively meager financial resources appropriated to it, it was able to draw on far greater resources of other government agencies and departments by designating mobilization responsibilities they were obligated to perform.

Beginning in 1954, the FCDA began to exercise its statutory authority by delegating civil defense responsibilities to other Federal agencies and departments. Though some of those delegations required the commitment of relatively meager resources (such as the one to the Attorney General), others required the commitment or earmarking of considerable resources (emergency stockpiles of medicines by the Secretary of HEW, food stockpiles by the Department of Agriculture, etc.). Inevitably there was confusion and overlapping between the mobilization requirements of ODM and the FCDA. As FCDA's delegation program picked up, pressure built to combine all non-military defense activities under one Federal agency, an event which took place in 1958.

[49] Office of the White House, Executive Order 10193 (15 F.R. 9031).

In the aftermath of the explosion of the Soviet Union thermonuclear device there was a great deal of discussion in the United States about dispersing the Federal Government to make it less vulnerable to an enemy strike on Washington, D.C. in August 1954, the Federal Civil Defense Administration itself was moved to Battle Creek, Michigan. Although the intent might have been admirable, the net effect of moving the FCDA hundreds of miles from the center of the Federal Government was to further downgrade its prestige and effectiveness at a time when it required a major injection of Presidential authority and attention to successfully grapple with the numerous unresolved problems of civil defense in the atomic age.

C. History of Surface-to-Air Missiles

1. Background

The decision to develop a guided antiaircraft missile may be traced back at least to January 1944, when the AAA Board, in a recommendation to the AAA Command, called for a missile development program and specified the characteristics that such a missile ought to have. As was true in the case of early post war decisions to develop interceptor aircraft, there was little evidence of concern on the part of the AAA Board with a specific external threat. Rather, as indicated by the target characteristics included in the Board's recommendation, there was a perceived need for a missile capable of destroying B-29 or B-36 type aircraft; although, in 1944, the United States alone possessed the capability of producing such aircraft.

Had there been a visible external threat driving the surface-to-air missile program the program might have been much less instructive for the student of U.S. strategic decision making. The bureaucratic combat which characterized the program might at least have been subdued—if not crushed—in the face of an urgent need for a defensive missile. But the urgency which did attend the program was generated from within, and was the product of an intense rivalry between, first, the Army air and ground forces, and later, the Air Force and the Army. In fact, there is perhaps no better illustration of interservice rivalry during the first post war decade than the program to develop the surface-to-air missile.

2. The AAF-ASF Split

The program under consideration would eventually split into two separate programs—one to produce the Bomarc, and one to produce the Nike. But it all began as a single effort on January 31, 1945, when a letter from the Chief of Ordnance to Bell Telephone Laboratories (BTL) "authorized negotiations for a formal study of an antiaircraft guided missile."[50] Almost immediately thereafter, in February, the AAF and ASF jointly contracted with BTL for a missile feasibility study.[51]

The stage had already been set for the coming split between AAF and ASF, when the "McNarney Letter" allocated missile R&D responsibilities between the AAF and ASF, giving the former control over missiles lifted by *aerodynamic* forces, and the latter control over those depending upon *momentum*.[52] Competition between the AAF and ASF would for several years focus on the aerodynamic-momentum design issue.

BTL would not complete its antiaircraft missile feasibility study until July 1945,[53] but an interim oral report delivered on May 14 showed AAF which way the wind was blowing. In June, AAF withdrew its

[50] U.S. Army, Chief of Ordnance, "Letter," 31 January 1945.
[51] Byland, 24 April 1954.
[52] DA PAM 70-10, p. 6. Also see Chapter I, this report.
[53] BTL, Historical Summary of Nike.

support from the BTL study and immediately contracted with Boeing for a separate feasibility study to be completed in September 1945.

BTL (in July)[54] and Boeing (in September)[55] submitted final reports to their respective clients, in each case affirming the feasibility of developing a guided surface-to-air weapon suitably matched to the client's design interests. BTL's paper study of Project Nike, "AGM Report: Study of an Antiaircraft Guided Missile System," included the following recommendations to ASF:

(1) Extend radar and computer techniques, and explore supersonic flight;
(2) But start now, without waiting for the completion of related research;
(3) Employ known devices, techniques, and methods to the greatest extent possible.

Boeing's report on Project GAPA (Ground-to-Air Pilotless Aircraft) conveyed a similar sense of urgency to AAF, but such stimulation was unnecessary for a client already lagging its competitor—ASF—by several months.

3. Work Begins on Nike and GAPA

On September 13, 1945, ASF approved BTL's Nike development plan; and on September 21 the development contract was initiated under the direction of the Rocket Branch of the Chief of Ordnance. Western Electric (BTL) was made the prime contractor and was given responsibility for the radar, computer, and guidance systems.[56] Subcontracts were let as follows:

(1) Douglas: airframe, booster, and launcher
(2) Aerojet: sustainer and booster
(3) Picatinny: warhead
(4) DOFL: fuse
(5) JPL: consultant.

In December 1945, AAF responded to Boeing's GAPA report by asking Boeing for a contract proposal to design the missile deemed feasible in September; in February 1946 Boeing was awarded the design study contract.[57]

The intra- and interservice rivalry over surface-to-air missiles during the 1946–1955 period was primarily a jurisdictional dispute which impacted only obliquely on the technical progression of the Nike and Bomarc programs. However, the technical histories of the two systems are interesting in their own right and are summarized here apart from the later discussion of the bureaucratic combat which surrounded them for a decade.

4. The Race of the Engineers

Shortly after awarding Boeing the GAPA design study contract, AAF initiated two parallel defensive missile study contracts. In March 1946, General Electric was given the contract to carry out Project Thumper, a study of "interceptor weapons for ballistic missile defense." In April AAF asked the University

[54] Semmens, BDM, *Chronology*.
[55] Air Materiel Command, Development of Guided Missiles.
[56] Semmens, BDM, Chronology; BTL, Historical Summary of Nike.
[57] Air Materiel Command, Development of Guided Missiles.

of Michigan to study, under the project name Wizard, the feasibility of a supersonic missile capable of reaching 500,000 feet. Thumper was intended to collide with a target similar to the German V-2 rocket. Wizard, a much more sophisticated weapon, was intended for use against a 4,000 mph target at an altitude anywhere between 60,000 and 500,000 feet.[58] Both Thumper and Wizard, because of their importance to later developments in the ballistic missile defense program, are treated in greater detail in section D, this chapter.

Meanwhile, Project GAPA was well under way. By the spring of 1947, it was estimated that the GAPA's development would be completed by 1949, at a total cost of $16.4 million. Already, in March 1947, 31 GAPA missiles had been successfully test fired; and it was promised that the fully developed system would be effective against a 0.9 Mach target at 70,000 feet—a capability superior to that expected of the Nike.

Both the GAPA and Nike programs continued apace into 1948, when the GAPA program was mortally wounded in the budget area. Adjustments to the FY 1949 budget, which spanned the period during which GAPA RED was to be completed, reduced GAPA funding to such a degree that only 70 test vehicles, rather than the intended operational arsenal, were to be produced. (In fact, over 100 vehicles were produced before the program was terminated.)

The GAPA program waned and waxed in 1949. It was first marked for termination, then rescued by an infusion of previously appropriated but unspent funds. General Electric's Project Thumper was terminated, freeing additional resources to sustain GAPA. However, a JCS review of the overall U.S. guided missile program concluded that there were too many short-range missiles being developed; it was determined that GAPA would be phased out entirely by 1951. As Richard F. McMullen has suggested: "In 1949 . . . a reshuffle of missions in the air defense field eliminated GAPA as a factor in air defense. The Joint Chiefs of Staff decided that the short range air defense missiles would thereafter fall within the purview of the Army, thereby preparing the way for what eventually emerged as the Nike antiaircraft missile."[59]

While GAPA was in its death throes, Nike was, comparatively speaking, thriving. Like GAPA, Nike had been somewhat set back by the 1946 missile R&D budget cut which had reduced overall missile funding from $29 million to $13 million, effectively eliminating 11 of the 28 active missile programs. Nike R&D funding fell from $5.2 million in 1946 to $3.0 million in 1947. But unlike GAPA, Nike recovered, enjoying annual increases in its R&D budget through 1952, when it reached a yearly high of $19.7 million.

Engineering progress was relatively steady in the Nike program. Having been given a 1-A priority by Army Ordnance in September 1946, the program generated a successful, 16-launch flight test series in 1948. By October 1949, the fragmentation warhead design had been accepted and frozen in OCM 33057.[60] Two months later, the ground portion of the missile tracking system was successfully tested. By March 1950, the experimental Nike had proved itself worthy of conversion to an operational weapons system, and Army Ordnance initiated the development of the Nike-1.

By this time, GAPA and the USAF were far behind in the race against Army's Nike. In addition to being concerned over an apparent loss of jurisdiction in the missile field, USAF was also worried that the cancellation of GAPA would lead to the dissolution of the dedicated missile R&D team which had been assembled at Boeing. In January 1950, USAF directed Boeing and the University of Michigan to conduct

[58] Semmens, BDM, *Chronology*.
[59] McMullen, p. 90.
[60] OCM 33057.

talks aimed at marrying the GAPA and Wizard technologies. The offspring of this shotgun wedding between GAPA and Wizard would be dubbed Bomarc.[61]

By June 1950, planning for the new missile had been completed.[62] It would not be a short-range missile like those thought by JCS to be in too great supply. Instead, its range would be eight times that of the Nike (200 nm vs. 25 nm). Its altitude capability would exceed Nike's by 33 percent (80,000 ft. vs. 60,000 ft.), and its maximum speed would be 3.0 mach, compared to Nike's 0.9 mach. Flight testing of the Bomarc was scheduled to begin in July 1951 and end in October 1954; IOC was expected in 1956.

While Bomarc was generally considered to be solely an antiaircraft system, Air University was to claim later that: ". . . the Bomarc was developed specifically for interception and destruction of enemy aircraft *and missiles* (emphasis added) before they approach target areas."[63] A USAF ADC Historical Study, however, suggested that Bomarc was "impotent" against Soviet ICBMs and that by October 1962, the Bomarc 1M-99B had only about a 50 percent chance of target interception against even aircraft.[64] Some confusion among laymen about Bomarc capabilities against ICBMs may have resulted from its interception tests against GAM-77 and Regulus Missiles; at any rate, Bomarc was not tested against ICBM target nosecones.[65]

It was in July 1950 that Nike-1's characteristics (summarized above) were officially reported to the three services. The system was described in these words: "Based on known capabilities or determined by analytical and experimental work, these objectives defined a defense weapon that would be effective not only against presently known designs of bomber aircraft but also against those predicted for . . . the near future."[66]

January 1951 was an important milestone for both the Bomarc and the Nike-1. USAF designated Boeing the prime contractor for the development of the missile whose characteristics had been defined in June 1950—i.e., the Bomarc. Also in January, K. T. Keller, the SECDEF's Director of Guided Missiles, told the Secretary that "immediate acceleration of production processes for Nike-1 (was) necessary in order to get the missile system out of R&D into the tactical weapon stage at the earliest practicable data."[67] The stated intent of this acceleration was to produce 1,000 missiles by the end of 1952, develop by the same date a production capacity of 1,000 missiles per month, and develop by the end of 1953 a capacity to produce ground support equipment for three battalions per month.

This acceleration of the Nike-1 program was echoed later in 1951, when USAF accelerated the development schedule of the Bomarc. By year's end, 12 test missiles had been produced by the Bomarc industrial team[68]:

(1) Boeing: airframe
(2) Aerojet: booster
(3) Marquadt: ramjet
(4) Westinghouse: target seeker
(5) DOFL: fuse
(6) Picatinny: warhead.

[61] McVeigh, *Development*.
[62] Ibid.
[63] Fundamentals of Aerospace Weapons Systems, p. 399.
[64] McMullen, "History of Air Defense Weapons 1946–1962," p. 350 & 366.
[65] Ibid., p. 348 & 353.
[66] BTL, Historical Summary of Nike.
[67] Keller, "Letter."
[68] Semmens, BDM, *Chronology*.

However, the original goal of commencing flight tests in July 1951 was not met. The first such test was conducted on September 10, 1952; like most of the tests which would follow, this first one was a failure.

Blame for the failure was laid on Aerojet, which had been unable to produce a satisfactory booster. In the spring of 1953, Reaction Motors was added to the Bomarc team as a hedge against further Aerojet failures. But by November 1953, Bomarc had amassed a considerable number of failures, and USAF decided to extend experimental work on the system for an additional year. Before the end of 1953, it was also decided that the Sage system being developed by Lincoln Laboratories would be used to control the Bomarc.[69]

In early 1954, WADC established a new schedule for the Bomarc development program, at the same time simplifying the program's objectives. Flight testing was to resume in May 1954, nearly three years after the original target data. Flight tests were to terminate in January 1956, with an IOC expected in 1959.[70] If the Bomarc had ever been in serious competition with the Nike, the competition ended with this acknowledgement that the system would not even be fully tested, much less deployed, during the first post war decade.

In contrast to the GAPA-Bomarc programs, the Nike had come a long way by 1955. In February 1951, the first Nike-1 production contract was let, with Redstone Arsenal responsible for overseeing production. Nine months later, in November 1951, Nike was first fired against an aerial target.

By the following spring, the Nike-1 program was advancing rapidly on several fronts. On March 11, 1952, the Ordnance Department initiated feasibility study of an alternate, nuclear warhead for Nike-1.[71] In April, the Department of the Army approved the allocation of 32 Nike battalions to 14 geographic areas. On April 10, the conventional Nike-1 warhead was tested and successfully destroyed a B-17 drone. On April 24, a complete Nike-1 system destroyed its target.

By July 1952, the program had advanced to the point of testing production-line missiles. The first such test was conducted on July 22—successfully. Seven months later, work began on the first Nike variant, Nike-B. On February 1, 1953, the project was undertaken by Westinghouse, with the prediction that the new system could be experimentally demonstrated in about three years. By October 1953, Nike-1 had reached the point of being fired by tactical units; and by the end of the year the first Nike Ajax was on site at Ft. Meade, Maryland.

The year 1954 was occupied with development of the Nike-B and refinement of the Nike-l. In September 1954, development of a cluster warhead for Nike-B was initiated. On October 1, a study was undertaken to examine the capabilities of the Nike-1 against low-altitude targets. On November 8, the SECDEF was informed of the conclusions of a most important study: the Nike-1 system could be modified to control the Nike-B without affecting the ability of the system to fire unmodified Nike-1 missiles. This conclusion virtually guaranteed a future for the Nike-B, a missile which would have probably faced severe difficulties if it had been deemed incompatible with the Nike-1 system. The year ended with the publication in OCM 35654 of the following developmental priorities:

(1) Nike-1
(2) Nike-B
(3) Improvement Program
(4) Solid propellant Nike.

[69] McVeigh, *Development*.
[70] Ibid.
[71] BTL, Historical Summary of Nike.

5. The Bureaucratic Struggle Over Missile Programs[72]

The McNarney letter set the stage for an intense struggle between AAF and ASF (later USAF and AGF) over control of air defense missile programs. On February 13, 1946, the Deputy Chief of Staff, USA, requested that major Army commands review the McNarney letter and recommend modifications to facilitate efficient performance. Despite the fact that his command had fared well in McNarney's allocation of responsibilities, the commander of AGF responded with a recommendation that the issue be reopened and new directives be prepared. This is not to say that AGF was prepared to yield any ground. On the contrary, what AGF sought (among other things) was complete operational control over surface-to-air, surface-to-surface, and sea-coast-defense missiles.

It was in fact this matter of operational control which would become central to the bureaucratic struggle. The USAF, for a variety of reasons, would eventually concede on the issue of RED jurisdiction. But for the duration of the first post war decade the battle would rage over operational control of air defense weaponry, especially surface-to-air missiles.

The battle over operational control was joined on the issue of AAA forces. In May 1946, the AAF achieved a victory in the form of a War Department circular (WDC 138) which assigned AAF ADC responsibility for the air defense of the CONUS. AAF was designated to control and train those AAA units assigned to it, and it was left to AAF to recommend to the War Department just how many such units should be assigned.[73] At a June meeting of the Air Board, it was decided to propose complete integration of anti-aircraft artillery into the AAF.

Later that same month, AGF proposed a somewhat self-serving compromise: AGF should be responsible for air defense within the area covered by ground weapons; AAF's mission should be the defense of those areas which AGF's weapons couldn't reach. This would, of course, mean AGF control over guided antiaircraft missiles as well as AAA.

AGF advanced this same argument in an August 26 letter to the Army Chief of Staff.[74] The letter noted that missile programs were sufficiently advanced to warrant a decision on operational control and that AGF was the logical recipient of that control.

On September 18, the War Department (WD) took a middle position in the debate. It agreed with AAF's argument that air defense must be unified, but claimed uncertainty on the future role of *missiles* in air defense, thereby encouraging a continuation of the AAF-AGF struggle over control of the most glamorous weapons in the air defense arsenal. WD did underwrite the integration of AAA units into AAF's ADC, but left AGF responsible for the technical training of these units.

AGF suffered a dramatic setback on October 7, 1946, when the Army Chief of Staff rescinded the McNarney letter and bestowed upon AAF responsibility for "R&D activities pertaining to GM (guided missiles) and associated items of equipment." Eight days later, AGF responded with a request for authority at least to establish the characteristics of those missiles which AGF would ultimately control. AGF further requested a determination on the issue of operational control of guided missiles.

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[72] Discussions of the bureaucratic struggle as it occurred in the context of ABM decision making may be found in this chapter, section D. See also the related material in this chapter, section G.
[73] WD, *WDC 138*.
[74] Commanding General, Army Ground Forces, Letter to Chief of Staff.

Early in 1947, AGF conducted its own study on policies regarding control of ground-launched missiles. The study concluded that AGF should control all such missiles. But later in 1947, the National Security Act and the JCS extensions thereto affirmed that the USAF would be responsible for "defense of the CONUS against air attack." At this point in the struggle, the eventual outcome was already apparent: USAF would not gain control of all missile RED budgets, but would instead be the executive agency over all air defense operations. AGF would retain possession of systems such as the Nike, but their operation would be ultimately commanded by a USAF lieutenant general. When the National Security Act became law, it specifically stated that "missiles designed for employment in support of Army tactical operations" would be assigned to the Army, but that missiles designed for employment in "area air defense" would belong the USAF.

Though the outcome of the struggle had been predictable in 1947, the battle for control of the SAMs (as well as AAA) raged on into 1948. In preparation for the March 1948 Key West Conference, USAF directed its own Air Defense Policy Panel to develop an AF position on air defense doctrine. Predictably, the Panel recommended, among other things, that AAA be integrated into the Air Force.[75]

But USAF's grab for complete *ownership* of AAA assets was in vain. At the March 11–14 Key West Conference, the Secretary of Defense insisted that the Army "organize, train and equip AAA units and provide them 'as required' for air defense." (JCS was directed to work out the necessary joint doctrine and procedures—a task which JCS would prove incapable of meeting.) However, USAF's claim to *operational* control of all air defense forces was substantiated by an April 21 SECDEF order which assigned "primary responsibility for air defense of CONUS to USAF . . . Army to provide forces 'as required.'"[76]

On March 16, two days after the close of the Key West Conference, the Army renewed its fight for operational control of SAMs. In a letter to the Organization and Training Division of the U.S. Army Staff, AFF recommended that existing agreements "be reworded to indicate that USAF has a primary interest in . . . air-launched guided missiles and the Army in ground launched guided missiles."[77] The Committee on Guided Missiles of the Research and Development Board allied itself with AFF by recommending on June 9 that "surface-to-air missiles be the responsibility of Army Ordnance." AFF advanced the same argument again on March 24, 1949, and on May 16, the secretary of the Army recommended to the SECDEF that Army be given R&D responsibility for all land-launched missiles, Air Force to retain only air-launched systems. This, in effect, was a request that the 7 October 1945 WD Memorandum, which had granted the AAF responsibility for ground-launched systems, be overturned.

On November 17, 1949, JCS rendered its "decision" on the SAM control issue: "It is impracticable at this time to assign the several services, in accordance with their assigned functions, responsibility for the entire guided missile field. As a general rule, guided missiles will be employed by the services in the manner and to the extent required to accomplish their assigned functions."[78] However, some encouragement was given to the Army by the attendant JCS decision that guided missiles which supplanted AAA would, indeed, be assigned to the Army.

[75] Semmens, BDM, *Chronology*.
[76] Ibid.
[77] U.S. Army Field Forces, Commanding General, "Letter to Director, Organization and Training Division, U.S. Army Staff," 16 March 1948.
[78] Semmens, BDM, *Chronology*.

By the summer of 1950, accord was near in the struggle for control of AAA forces. On July 11 it was officially stated that ARAACOM would assume command of all AAA units allocated to air defense. On August 1, Generals Lawton and Vandenberg, Chiefs of Staff of the Army and Air Force, agreed upon a nested command structure which conceded AAA command to Army, but attached these AAA commanders to various echelons of the USAF command structure. In each case the appropriate USAF division commander would exercise operational control of AAA "insofar as engagement and disengagement of fire is concerned." This structure having been established, ARAACOM was given responsibility on December 1, 1950, for planning all AAA defenses within the CONUS.

In April 1952, this nested command structure was refined in ADC and ARAACOM's "Mutual Agreement for the Air Defense of the United States." As previously agreed, deployed AAA units would be operationally controlled by USAF commanders, with control being exercised through local Army AAA commanders. A further refinement in June did away with separate AAA staff sections in ADC and established a process of coordination between the counterpart staff elements of collocated headquarters.

Later that same month, on June 20, Undersecretary of the Army Karl Bendetsen reinvigorated the Army-Air Force squabble over control of guided missiles. Surveying the events of the previous few years, Bendetsen concluded that the Air Force was attempting to usurp "Army's responsibility in the guided missile field." He urged that Army take on all responsibility—research test, procurement, and operation—for ground-launched missiles, regardless of range.

By 1954, however, USAF's hold on U.S. air defense assets was firmly established. In January, the JCS agreed to establish a joint command for air defense of the CONUS. In August, Continental Air Defense Command (CONAD) was instituted as a joint command under the JCS. CONAD was charged with coordinating and integrating the air defense capabilities of the three services under the control of a single commander. USAF, of course, was designated the executive agency.

D. History of Antiballistic Missiles

1. The Technological Problems

The history of U.S. efforts directed toward ballistic missile defense in the 1945–1955 period can best be characterized as a series of ongoing studies and established requirements. Although these efforts were not necessarily lackluster, neither did they fall within the limelight of research or policy attention. This was primarily due to the more immediate and pressing problems of development such as the need for improved air breathing threat defense systems. And while the guiding idea of many studies during this period was an eventual solution for the "hitting a bullet with a bullet" problem, the actual solution must be dated much later: it was not until 3 June 1960 that one U.S. guided missile intercepted another (a Nike Hercules destroyed a Corporal)[79] and not until 14 December 1961 that a Nike Zeus intercepted a Nike Hercules.[80] Even these interceptions were rudimentary in concept; it took until 19 July 1962 before a Nike Zeus actually successfully intercepted an ICBM target nosecone, and then under test conditions which some considered to be unrealistic.[81]

[79] Semmens, BDM, *Chronology*.
[80] Ibid.
[81] Ibid. For date only.

Beyond the missile interception problem was the lack of solution during the 1945–1955 period to a series of infinitely more complex and related problems of then-unknown dimensions: the effects of decoys, penetration aids, multiple reentry vehicles, saturation, blackout, and "soft" system components on a viable ballistic missile defense (BMD) system. To varying degrees, these problems were to plague U.S. BMD efforts throughout the 1960's; the longevity of these difficulties suggests the overwhelming task which faced pioneer researchers in the field.

In tracing the significant BMD study efforts conducted and requirements established before 1956, it is therefore obvious that the full multidimensionality of the BMD problem was not clear at that time. Hence the history itself does not address all aspects of the defense problem as it was to develop. The trail of these early research activities is also fraught with dead ends which failed to pan out developmentally upon further examination. For example, the familiar Project HAWK was initiated in December 1950 under a Research and Development Board guidance objective stating (among other things) a requirement for a SAM with the capability to destroy incoming guided missiles of specified speed and altitude characteristics.[82] By 15 March 1951, however, the Army contract awarded to Fairchild Aircraft Corporation for the HAWK study had limited the desired missile to an antiaircraft capability, a specification which is better known to most students of air defense.[83] Other study efforts during those years show similar changes in emphasis; as a consequence the history detailed here does not attempt to enumerate all such marginally informative cases but rather addresses decisions and projects in the mainstream of activities.

2. World War II Experience

Navy, Air Force (then AAF), and Army activities in BMD can be traced to the World War II years and the establishment of service guided missile and missile defense programs. The German V-2 missile was a threat faced by our European Allies, and was to motivate U.S. antimissile study efforts; the Japanese Kamikaze threat led to creation of the Navy KAN-1 (Little Joe) guided surface to air missile.[84] Even more specific on antimissile efforts, from the Navy standpoint, was a July 1944 Navy Bureau of Ordnance directive requesting an analysis and evaluation of task force protection against guided missiles launched from enemy aircraft.[85] By December 1944, the Chief of Naval Operations had directed that such a development project be undertaken under the code name Bumblebee; it was conducted at the Johns Hopkins Applied Physics Laboratory.[86]

From the Bumblebee research grew a family of surface-to-air missiles—the May Bee (later Terrier), Must Bee (later TalosX), and the Tartar. Of these three missiles, the much larger Talos with its range in excess of 100 nautical miles and altitude of 80,000 feet was to emerge in 1959 as the Navy's ABM alternative to the Army Zeus.[87]

3. Post War Developments

The earliest major air force effort in the SAM field which was to lead into their ABM development efforts was the GAPA (ground-to-air pilotless aircraft) project, active from 1945 to 1949.[88] This effort was

[82] DA Pam. 70-10, p. 202.
[83] Ibid., p. 203.
[84] *Air Defense: An Historical Analysis*, Vol. III, p. 37.
[85] Ibid., p. 48.
[86] Ibid., p. 48 for date. Adams, p. 18 for location of research.
[87] Ibid., p. 49 on range of Talos. Adams, p. 18 for location of research.
[88] Ibid., p. 50.

pure research directed at developing a family of missiles much as the Navy Bumblebee research was to concurrently develop—but in the case of the air force, over 100 experimental missiles of different configurations were eventually fired.[89]

At about the same time that GAPA was being initiated, the Army ground force and air force efforts in these early years were prodded by the McNarney letter (discussed in greater detail in Chapter 1 and in this chapter, section C), issued as an Army directive 2 October 1944. In January 1947, however, this division of responsibilities changed significantly—the War Department allocated all research and development responsibilities for guided missiles to the Army Air Force.[90] As indicated in the GAPA discussion (section C, this chapter), this allocation of responsibilities was to be effected yet again in 1949.

The antimissile study efforts resulting from these assignments of responsibilities in the guided missile field were to be developed concurrently by the separate services in consonance with service desires for a continued role in the field; the assignment of roles and missions was part and parcel of the actual research efforts.

Of greater importance than the GAPA developments were the Thumper and Wizard projects initiated in March and April 1946, respectively.[91] Thumper was an Army Air Force Project awarded by contract to GE for the study of interceptor weapons for BMD, and was the first program of its kind.[92] Thumper was to develop the ". . . 'collision intercept' method for destroying a ballistic missile. . ." and was later functionally merged with the similar Wizard program.[93] Wizard, too, was an Army Air Force contracted study, awarded to the University of Michigan's Aeronautical Research Center to investigate the possibility of developing a supersonic missile capable of reaching 500,000 feet altitude.[94]

Specifically, the study was an engineering project to determine the design for a missile capable of intercepting and destroying a V-2 surface-to-surface missile, although advanced missile threats were also to be encompassed. Operating at speeds of 4,000 to 5,000 MPH, Wizard was to have a 50 percent kill probability against a V-2.[95]

The general missile which Army Air Force planners envisioned as developing from both the Thumper and Wizard studies was to be 60 feet long and 6 feet in diameter, with a range of 550 miles.[96] The desired long range of this missile placed it far in the future in terms of development. By the spring of 1947, it was estimated that it would be five to ten years "before the necessary long-range ground radar, long-range and highly accurate guidance systems and long-range radar seekers could be developed for the test support of any antimissile missile devised by General Electric or the University of Michigan."[97]

The slowly evolving and futuristic nature of these projects, combined with the previously mentioned funding crisis of 1947, relegated Wizard and Thumper to less attention—by the summer of 1947 they were individually reduced to a long-term study basis, with General Electric to receive $500,000 a year and the

[89] Ibid., p. 50. GAPA and related programs are discussed in section C of this chapter.
[90] Barnard, p. 25.
[91] Semmens, BDM, *Chronology*.
[92] Ibid.
[93] Adams, p. 18.
[94] Semmens, BDM, *Chronology*.
[95] Air Defense: An Historical Analysis, Vol. III, p. 50.
[96] McMullen, "History of Air Defense Weapons, 1946–1962," p. 48.
[97] McMullen, op. cit., p. 49.

University of Michigan $1,000,000 a year for this purpose.[98] This situation continued until 1949, when the Thumper contract was allowed to lapse on 30 June since it in many ways duplicated the Wizard efforts.[99]

Parenthetically, Wizard developmental work was to continue beyond 1955; by the 1958–1959 period, however, the Air Force had concluded that the proposed Wizard system, advocated as an alternative to Nike Zeus, was indeed not cost effective.[100]

The Navy Bumblebee and Air Force Wizard studies paralleled an Army program which was to serve as the actual mainstay of U.S. BMD efforts in the post-1955 years. This comment is retrospective because in the 1945–1955 period, there was not and could not, because of the rudimentary state of research, be any clear choice among nascent BMD system concepts. The fact that the Army Nike Zeus program, not the Navy Talos or Air Force Wizard programs, was to evolve into the Nike X, and then the Sentinel and Safeguard BMD systems adds weight to the predisposition to treat Zeus more thoroughly than these other programs. Zeus, and its associated Plato System, also serves to demonstrate the role which BMD studies played in these early years of considering possible air defense against missiles—it was not until February 1955 that the Army concluded that the state of missile technology had advanced enough to warrant initiation of an economic and technical feasibility study for an anti-ICBM missile.[101] But Nike Zeus had its study antecedents long before that time.

The efforts can be traced generally to guided missile development programs initiated during World War II. Project ORDCIT (Ordnance–California Institute of Technology) was initiated in May 1944 to conduct development work on long-range missiles, ramjets, and associated launch equipment.[102] Along with ORDCIT went an appreciation for the long-term, potential threat posed by the German V-1 and V-2 rockets; the Army project Hermes, contracted with General Electric in November 1944, investigated characteristics of the V-2.[103]

By 8 February 1945 project Nike had been initiated, but was not initially concerned with BMD—the Bell Telephone Laboratories were tasked in this program to investigate the possibilities of an antiaircraft defense with characteristics superior to contemporary conventional artillery.[104] In late March of that year, the Army Assistant Chief of Staff, G-3, assigned roles to the Ground and Air Forces for establishing military characteristics and employment doctrine for surface-to-air missiles.[105] The roles were split depending on whether the missile was to complement AAA or fighter interceptors. On 20 June the Army Ground Forces Equipment Review (Cook) Board submitted its report on equipment for the post war Army, and included the following task: "High velocity guided missiles . . . capable of . . . destroying missiles of the V-2 type, should be developed at the earliest practicable date."[106] While the Cook Board task was a restatement of a need realized earlier (and was itself to be restated that August by Subcommittee No. 4 of the Guided Missiles Committee)[107] it was followed rapidly by the initiation of related study efforts—in July the Signal Corps established two basic research radar

[98] McMullen, op. cit., p. 49.
[99] McMullen, op. cit., p. 90.
[100] The date selected depends on which event is emphasized: the 16 Jan. 1958 Sec. Def. McElroy allocation of ABM development responsibility to the Army (Adams, p. 27) or the early 1959 USAF position on Wizard cost-effectiveness (Adams, p. 33).
[101] DA Pam. 70-10, p. 181.
[102] Ibid., p. 4.
[103] Ibid., p. 7.
[104] Ibid., p. 8.
[105] Ibid., p. 8.
[106] Ibid., p. 10.
[107] Ibid., p. 10 (refers to date in parentheses).

projects suitable for use in an antimissile defense system.[108] By this time work had also begun on the White Sands Proving Grounds, where it was to be continued through the fall assembling captured V-2 components and (at nearby Fort Bliss) German scientists recruited in project Paper Clip.[109]

At about this period of time, research developments, role designations, and related events began at a rapid pace. Juxtaposing all of these happenings together leaves a cloudy picture of which information was, or was not, significant for later occurrences. It therefore becomes much easier to trace separate but related "tracks" of activities individually through to 1955 rather than to consider all together in a year-by-year progression. Three such tracks have been chosen and will be discussed sequentially:

(1) The assignment of guided missile responsibilities to Army Ground and Air Forces, and later to the Army and USAF
(2) Statements of antimissile missile requirements
(3) Studies and operational tests conducted on systems related to Nike-Zeus and Plato

Two caveats must be added before the first track can be addressed. First, the popular name "Zeus" was not actually assigned to Nike II until 15 November 1956, so the history of the pre-1956 years cannot trace Nike-Zeus per se—only those activities which were related to Nike II. The same general observation applies to Plato, which significantly evolved in 1952. Secondly, the historical discussion must of necessity limit itself to events closely related to the selected tracks. It is clear, for example, that the assignment of guided missile RED roles to the military services is only part of a much larger picture involving decisions about offensive versus defensive U.S. strategies, budgetary considerations, and overall service roles and missions. This larger picture is covered in other portions of the study.

The McNarney letter of 2 October 1944, which allocated R&D responsibilities in the guided missile field to the military services (see earlier detailed description), was to serve as the guiding document on such roles for a short period of time. Although there was discussion within the War Department in February 1946 regarding possible changes to the McNarney allocations, nothing concrete resulted.[110] By late March the Joint Chiefs of Staff had directed the Joint Committee on New Weapons and Equipment to submit recommendations on the allocation of these responsibilities.[111] During August there were some reports of friction between the Army Air Forces and the Army Ordnance Department regarding these responsibilities, and the Commanding General of Army Ground Forces recommended to the Chief of Staff that the responsibility for any ground launched missile should be held by AGF.[112] On 7 October 1946, however, the Army Chief of Staff rescinded the McNarney directive, giving the Commanding General of Army Air Forces R&D responsibility for guided missiles.[113] This was not the end of the argument—in mid-October, Army Ground Forces requested the Chief of Staff to be given authority to establish military characteristics for missiles they would use.[114] By mid-January 1947, an AGF study recommended that they be given responsibility for operational employment of all ground launched missiles.[115]

[108] Ibid., p. 10.
[109] Ibid., p. 11.
[110] Ibid., p. 12.
[111] Ibid., p. 13.
[112] Ibid., p. 15.
[113] Ibid., p. 15.
[114] Ibid., p. 15.
[115] Ibid., p. 16.

Similar recommendations and apparent differences of opinion were to occur both before and after the National Security Act of 1947 became law on 15 September 1947.[116] The Act commented on the assignment of surface to-air missiles to the newly established services: "Security missiles designed for employment in support of Army tactical operations will be assigned to the United States Army . . . Missiles designed for employment in area air defense will be assigned to the United States Air Force."[117] Although on 20 March 1948 R&D responsibilities for guided missiles to be used by Department of the Army were transferred to it by USAF, a larger question was looming on the horizon—the assignment of single or split service responsibility for *all* guided missile activities.[118]

Three milestones regarding this problem were to occur between then and the end of 1955. The first was on 17 November 1949 when, in JCS 1620/12, the Joint Chiefs unanimously reached the conclusion that: "it is impracticable at this time to assign to the several services, in accordance with their assigned functions, responsibility for the entire guided missile field. As a general rule, guided missiles will be employed by the services in the manner and to the extent required to accomplish their assigned functions."[119]

Between that date and the fall of 1953, this statement (and its additional comments about guided missile types "normally" to be employed by each of the services, effecting the earlier discussed GAPA), stood as the only basic paper on the problem on which agreement had been reached by the three service chiefs.[120] Four other related and split JCS papers in the interim were never acted upon.[121] The second milestone occurred in mid-November 1953 when the Secretary of Defense reaffirmed the existing division of guided missile responsibilities—the Secretaries of the service Departments were authorized to approve the missile programs of their respective departments, and such approval was recognized as sufficient authority for subsequent fund obligation and program implementation.[122] Although this authorization did not address the division of interservice responsibilities, it did reflect official realization from the highest level of an already operating reality. The third milestone was to significantly alter the missile responsibility assignments made in JCS 1620/12. It did so in JCS 1620/95 on 9 September 1954, when responsibilities were divided thus:

> The U.S. Army will develop, procure, and employ such surface-to-air guided missiles . . . designed for effectiveness against enemy aircraft and missiles out to a range of approximately 50 nautical miles. b. The U.S. Navy will develop, procure, and employ such surface-to-air guided missiles as are required by its assigned functions. c. The U.S. Air Force will develop, procure, and employ such surface-to-air guided missiles . . . [for] continenta1 defense . . . of greater than 50 nautical miles horizontal range.[123]

Throughout the period, we thus see a slowly changing but eventually more distinct picture in the division of SAM responsibilities between the Services. However, JCS 1620/95 was not the end of controversy—the story continues in the post-1955 years where it will be discussed again.

The second major track to be elaborated upon encompasses the series of established requirements and statements of need for antimissile missiles. The first part of this story has already been mentioned in conjunction with World War II threats, and left the sequence of events during the fall of 1945. It continued

[116] Ibid., p. 17 for date only.
[117] Ibid., p. 17; this is not a direct quote from the Act, however.
[118] Ibid., p. 18; also see pp. 19–21.
[119] Ibid., p. 23.
[120] Ibid., p. 33.
[121] Ibid., p. 33.
[122] Ibid., p. 34.
[123] Ibid., p. 37.

in early January 1946 when the Commanding General, Army Ground Forces, both raised the problem of defense against the V-2 and established a requirement for a study program on the issue.[124] In early February, the Joint Committee on New Weapons and Equipment restated this antimissile need in its report on a Proposed National Program for Guided Missiles.[125] By 1 April Secretary of War Patterson had concurred on implementation of a national guided missile program; at the end of May the Stilwell Board established a requirement for a guided missile with a 100,000 yard range capable of intercepting missiles of the V-2 type.[126] Although the need for an antimissile missile was thus seen quite early in these years, it was not until January 1949 that the Army established a formal requirement for a SAM system to combat ballistic missiles.[127] It seems likely that the lack of practical results in the guided missile program contributed to the lack of a formal BMD requirement in earlier years; the program, in fact, was moving along quite slowly.[128]

Things were to continue in this same vein—in an 8 February 1950 memo to the Secretary of Defense: "The Secretary of the Army emphasized that as of that time there was no guided missile or other device in sight for protection against enemy supersonic guided missiles. That gap, he stated, existed because of the extreme technical difficulty in meeting or overtaking a missile traveling at supersonic speed."[129]

By mid-August of that year, a practical program looked even further away. At that time, Army Field Forces Board No. 4 commented on the absence of any Department of Army project to fulfill the antimissile missile requirement. The associated Signal Corps radar projects were considered not very active, and the board recommended that further antimissile missile studies be postponed until radar developments showed more promise.[130]

The seeds of Plato were sewn on 20 October 1952 when an Army G-4 conference designated the need for a theatre of operations antimissile system, which was the guiding idea of Plato.[131] Although studies were conducted on this idea and the overall need for a BMD system was restated by the Army Field Forces in late 1954, it was not until mid-1955 that this area of requirements was again viewed with deep criticality. This new found impetus was a direct result of an early 1955 Bell Telephone Laboratory Study, discussed as part of the third track.[132]

Overall through this time period, the desire for a ballistic missile defense system was thus stated and restated. The central reason for the lack of specificity in this perceived need was the rudimentary state of technology—the state of the art had not yet caught up to something which looked like a good idea.

The third track encompasses the studies actually conducted during these years on Army antimissile systems, and lacks clarity to the same degree that the second track does. The Nike program and Signal Corps radar projects have already been mentioned, and comprised the bulk of pre-1950 activities, along with general guided missile efforts. The Signal Corps projects were funded at $500,000 for FY's 1950, 1951, and 1952, but progress was slow because much basic research remained to be done.[133] On 18 December

[124] Ibid., p. 11.
[125] Ibid., p. 11.
[126] Ibid., p. 14.
[127] Ibid., p. 21.
[128] Ibid., p. 18 on the lack of practical results as reflected in Secretary of the Army Kenneth Royall's 17 April 1948 expression of concern for the same.
[129] Ibid., p. 23.
[130] Ibid., p. 25.
[131] Ibid., pp. 31, 37.
[132] Ibid., p. 37 on AFF requirement.
[133] Ibid., pp. 24–25.

1950 the JCS approved the Army's initiation of an antimissile project.[134] At the behest of the Secretary of the Army, Army Field Forces studied a preliminary report on Bomarc to assess its possible fulfillment of the recently established Army antimissile missile requirement.[135] On 18 October 1951, however, this study indicated that Bomarc would only partially fulfill the requirement.[136] By mid-September 1952 a contract had been awarded to Aerophysics Development Corporation for a feasibility study on ballistic missile defense. The content of their report, completed 15 May 1953, is instructive as to the level of development operant at the time: "The study defined the threats and critical problem areas and recommended research concentrated on the radar problem and the conduct of preliminary design efforts."[137]

Several similar studies aimed at determining feasibility were conducted during these years, and included (with starting dates): November 1952, Signal Corps—antimissile radar study; June 1953 Bendix Aircraft Corporation missile acquisition radar study (concluded in 1955 that the radar was feasible); September 1953 Sylvania Study (Plato) on antimissile missile feasibility; 25 May 1954 Cornell Aeronautical Laboratory study (Plato) on the previous Sylvania topic.[138]

Ongoing research conducted under these studies contributed to the Army decision in February 1955 to conduct an economic and technical feasibility study for a system to combat the ICBM.[139] The Bell Telephone Laboratories conducted this study beginning in March, with emphasis on the replacement of Nike I (Ajax) and Nike B (Hercules) in about 1965.[140] In May, a special Plato evaluation committee concluded that BMD was technically feasible; Plato study efforts were to continue through the end of the year with major efforts by Sylvania, Cornell Aeronautical Laboratories, and Pennsylvania State University.[141] By late fall 1955, the feasibility of the Plato theatre of operations system (using the Nike II—later Zeus—missile) and of the Nike II anti-ICBM concept were clear—at least to the Army.[142] In early December, based on this assessment, the Army requested $7.7 million in supplemental FY 1956 funds for the antimissile missile program.[143] It also called for a Department of Defense assignment of service responsibility for the area.[144]

The year thus ended on a positive note from the Army standpoint; that continued development was also favored by DOD would become clear in January 1956 when FY 1956 funds previously withheld were released for antimissile missile developmental work.[145]

E. History of Jet Interceptors

1. Background

The period from 1944 to mid-1948 constitutes a unity in respect to strategic planning and approaches to weapons development. However, owing to the considerable time lag between the appearance of new perceptions and approaches and their ultimate realization in concrete form, many consequences of devel-

[134] Ibid., p. 26.
[135] Ibid., p. 28.
[136] Ibid., p. 28.
[137] Ibid., p. 191.
[138] Ibid., pp. 191–192.
[139] Ibid., p. 181.
[140] Ibid., p. 181.
[141] Ibid., p. 192.
[142] Ibid., p. 42; see 5 December 1955 Director of R&D comments.
[143] Ibid., p. 42.
[144] Ibid., p. 42.
[145] Ibid., p. 182.

opments in 1944–1948 were still of major importance as late as 1953 or 1944; they will be traced in this section rather than in the rest, which treats the new developments of the period 1948–1955.

As the last year of World War II began, the military power of the United States had reached a tremendous level, both qualitatively and quantitatively; but military planners were already considering the implications of new technologies that promised to make the weapons and strategic concepts of the war obsolete. The first intercontinental bomber, the B-36, was under construction; both the Germans and the Americans had operational jet aircraft (the Me-262 and the P-80); German rockets were already in use as military weapons; and development of the atomic bomb, whose strategic implications transcended all foresight, was entering its final stages.

If the implications of these new developments were already partially apparent, the identification of a potential enemy whose military threat would require an urgent effort to build an extensive air defense had not yet been clearly made. It was mid-1945 before a new hostility and aggressiveness on the part of the Soviet Union began to manifest itself, and some years later that the military threat of this nation, with technological capabilities that were initially rated low by most Western observers, with an industry that had been severely damaged during the war and no wartime experience of strategic bombing, took shape as a long-range bomber fleet armed with atomic weapons. By the time the Soviet military threat attained these dimensions, the United States was in the process of developing an interceptor capability to confront it. An understanding of the nature of this development procedure, and a clarification of what forces, under immediate post war circumstances, drove or hindered it and to what extent the resultant weapons were commensurate with the Soviet threat, are of major importance to an understanding of the strategic arms race.

In 1944, the B-29 could well be considered to represent the most advanced bomber capability of the time. It was the fastest, longest-range bomber in the world, and its combat ceiling of more than 30,000 feet put it beyond the effective reach of almost any fighter plane in existence—a fact which made possible, for instance, the unescorted bombing of Japanese targets in 1944–1945. Beginning in 1944, the Army conducted tests in which the interception of B-29's flying at 30,000 feet was attempted with the new P-80 jet fighters. Although the service ceiling of the P-80 was well above that of the B-29, it had insufficient maneuverability at that altitude to make a successful interception. Although the tests established the fact that bomber capabilities were at the moment superior to fighter capabilities (a situation that had appeared and been reversed in the past), and undoubtedly gave some impetus to fighter development, the fact that the Soviets possessed no long-range bombers of their own manufacture in 1945 robbed the circumstance of much of its urgency.

A number of different propeller-driven aircraft types were assigned air defense roles in 1945–1946. Foremost among these was the P-47, a day-fighter with an excellent wartime record, which was phased out of active air defense service during 1947 but was used by the Air National Guard until early 1953. Another superb day-fighter, the P-51, was assigned to SAC for air defense. The twin-fuselage P-61, which had been used only sparingly during the war, was the primary night-fighter used for air defense until 1949, but with a combat ceiling of well under 30,000 feet it would have been of little use against a bomber such as the B-29. In January 1944, the development of the P-82, a double P-51, was begun, with an interceptor role envisioned. This aircraft, which became operational in 1949, proved unsatisfactory and was quickly phased out after limited procurement.

2. The Shift to Jet Interceptors

Although several jet aircraft were already being successfully flown (P-80) or were contracted for development (P-84, P-86) when the war came to an end, none of them was planned as an interceptor. The first decision to produce a jet interceptor came in late 1945 and resulted in the F-89. The process of making this decision seems to have been a complex one: the initial AAF design request, made in August 1945, was for a propeller-driven plane, but by November the idea of a jet design had been accepted. This jet aircraft was to be a successor to the P-61, but was to be effective in daylight as well as at night or in inclement weather. The day-fighter requirement was dropped in 1946 on the grounds that a heavy radar-equipped all-weather fighter would be no match for a small day-fighter.[146]

Because the F-89 was both the first and the only truly new interceptor design for which a prototype was contracted in the period 1944–1948, its origins merit consideration in some detail. The original August 1945 specifications for the propeller-driven plane call for a considerable increase in speed and rate of climb over the conventional planes than available or under development,[147] leading to the question why a jet aircraft was not originally specified. The cause was surely not a lack of appreciation of jet technology, and it is improbable that budgetary constraints were a major factor, in view of the relatively low cost of aircraft development: the initial development contract was for only $4 million, a very small amount compared with the $48 million spent on procurement of 48 production models of the F-89A in 1949.[148] In view of the large number of serious difficulties that beset the F-89 program between its inception and the end of 1952, it seems a reasonable supposition that planners felt the development of a propeller-driven model would offer a relatively quick and reliable development process, in which the problems encountered in developing all-weather electronics would not be compounded by the necessity of matching them to new and advanced airframe and engine designs with their own highly unpredictable problems.

When six manufacturers submitted design proposals in March 1946, most of the designs were for jet-powered planes, but a few were for conventional planes[149]; the fact suggests that the AAF had not changed to a hard-and-fast specification of a jet design, but had decided to admit that alternative as a result of initiatives from some of the manufacturers, since the characteristics originally specified would have been much easier to achieve with jet power.

Although the results of the interceptor tests with the B-29 were well known to Gen. LeMay, the Deputy Chief of Staff for Research and Development, who had planned the bombing missions over Japan in preparation for which they were conducted, the characteristics that were specified for the new plane at least partially under his authority were inferior to those of the P-80, which had been unsuccessful in the tests. It appears that a strong imperative to match the best U.S. offensive weapons with comparable defensive weapons was not yet felt in AAF aviation planning circles, although it was not long before the practice gained currency and urgency.

Flight tests on the XF-89 began in August 1948, and by October it had proved superior to other models being tested (the XF-87 and the Navy XF-30). Although the plane was viewed by some as the "best of a bad lot," the decision to procure it was made, and in May 1949 a contract for 48 F-89A's was signed.[150]

[146] Grant, p. 47; Semmens, BDM, *Chronology*, 28 August 1946.
[147] OSD, *Chronology*, p. 9.
[148] Ibid., pp. 31, 87.
[149] Ibid., p. 25.
[150] Ibid., p. 87.

The appearance in October 1947 of 48 Tu-4 bombers, copies of the B-29, during the celebration of the Russian Revolution,[151] was an event which served to focus and intensify U.S. perceptions of the Soviet air threat. The successful production of the Tu-4 meant that the Soviets now had a long-range bomber capability; in addition, it suggested that Soviet technological and industrial capabilities were greater than had been supposed, and that other unpleasant surprises might be in store. On the other hand, we know (with the benefit of hindsight) that the threat was a limited one. The Tu-4, like the B-29, was not an intercontinental bomber; with midair refueling it could possibly strike parts of the U.S. over the North Pole, but only on a one-way mission. Only a limited number of planes, however, was available at first and the usual malfunction problems, along with the necessity of using some of the planes for refueling, would reduce the number available for bombing considerably. Even more important, the Soviets did not yet have the atomic bomb. Clearly, the threat was not great; but reliable intelligence about Soviet capabilities was extremely scarce; the U.S. had no interceptor that was a match for the Tu-4; and it was not the job of U.S. military planners, especially those in SAC and ADC, to underestimate the threat of Soviet bomber capabilities.

The implications of this event in U.S. strategic thinking and weapons planning belong to the following section of this chapter, but the interim measures that were undertaken before new ideas and plans could be implemented belong to the present discussion. It was clear that more energetic pursuit of air defense was necessary, and one of the first steps that was taken was the transfer of jet F-84's, which had begun to be available in June 1947, to Air Defense Command. By 31 March 1948, ADC had 79 of them on hand, compared with 57 in the possession of the Tactical Air Command. The merger of ADC and TAC into the Continental Air Command (ConAC) in December 1948 made a total of 309 of the planes potentially available for air defense.[152]

The initial transfer of F-84's to ADC is especially striking in view of the fact that they were designed as fighter-bombers and would normally have been assigned chiefly to TAC. As interceptors, they were not very satisfactory: their speed and ceiling gave them only limited effectiveness against a B-29 or similar plane, and structural defects were a continuing problem.[153] Moreover, they were usable only as day-fighters; the night-fighter role was assigned to the conventional P-61, and briefly to the P-82, until new night and all-weather fighters became available beginning in late 1949.

The F-80 was somewhat more satisfactory as an interceptor, although it too was only a day-fighter, designed for a tactical role. Before the formation of ConAC, ADC had only 2 F-80's, but a total of 186 became available in ConAC, and 9 fighter-interceptor squadrons of F-80's had been assigned as of December 1948.[154] Notwithstanding the addition of the F-84 and the F-80 to the air defense force, the interceptor situation, particularly in bad weather, and against B-29 capabilities, was far from satisfactory. The Northwest maneuver in May 1948 produced the following results:

> The limitations of the defensive fighters in adverse weather conditions were emphasized during the maneuver. The P-61 fighter is of no practical value. Its speed and altitude limitations make it ineffective against today's bombers. . . . The P-80's were not equipped to penetrate an overcast. Replacement of instruments to relieve this limitation is in progress. The ground controller could not pick up, track and direct a P-80 with success. . . . The operation of the P-51's was hindered by adverse weather in the mountainous terrain.[155]

[151] Semmens, under date.
[152] *USAF Statistical Digest*, 1948, pp. 22, 29.
[153] See note 11.
[154] *USAF Statistical Digest*, 1948, pp. 26, 29; Grant, p. 50 (chart).
[155] Sturm, et al., p. 145.

Of the F-84, ConAC had the following opinion in November 1950: "The F-84D aircraft have little value as a fighter-interceptor . . . in view of the continued wing failures that have been encountered and the general inherent characteristics of the plane."[156]

In order to improve the capability of the interceptor force, yet another fighter originally intended for a fighter-bomber role was pressed into service. This was the F-86, originally designed for the Navy under the designation XFJ-1 as a carrier-based fighter and acquired by the AAF when the Navy decided not to procure it; the initial AAF development contract was signed in May 1945.[157] In speed, maneuverability, and combat ceiling the F-86 was far superior to any of the other Air Force jets, and it rapidly became the backbone of the interceptor force and the nearest approach to a truly satisfactory weapon among the interim models. Accepted for quantity procurement in the winter of 1948–1949, it achieved 10C at the end of May 1949; 12 squadrons were assigned to air defense by December 1950, when the phase-out of the F-80 was complete and that of the F-84 was under way. The day version of the F-86 was deployed on a large scale until 1954, when various all-weather aircraft took over virtually all interceptor duties.[158]

An all-weather jet interceptor capability was quite late being achieved. In view of the crippling delays in the development of the F-89, the Air Force was surely in need of an alternative. Work on the all-weather modification of the Sabre, the F-86D, began in 1949. The first F-86D was delivered in March 1951, and so urgent was the need to get this plane into service that it was targeted for production before the fire control and engine control systems had been proven. At that time, 341 were ordered; the number was raised to 979 2 months later. Unfortunately, in 1952 problems with the fire control and engine control systems delayed the program. Airframes piled up and could not be put into service; by January 1953, 2,500 planes were on order but fewer than 90 had been accepted.[159] Thereafter, the buildup in the number of planes in active service was rapid: more than 20 squadrons were in service by the end of 1953.[160]

In 1949, the year that work on the F-86D began, Lockheed proposed the rapid conversion of the T-33 trainer to a night-fighter. The T-33, based upon the F-80 design, was suitable for the purpose because it was a two-seat aircraft and thus afforded the space necessary for the radar equipment that was to be added. The modification program was completed rapidly, and deliveries of the interceptor, designated the F-94A, began in the second quarter of 1950.[161] By the end of the year six squadrons had been assigned, procurement orders having been greatly increased following the explosion of the first Soviet atomic bomb. In FY 1951, 176 F-9413's were delivered; another 180 were delivered in the first half of FY 1952.[162] The F-94C, an all-weather version, became operational in mid-1953, at about the same time as the all-weather F-86D, to which it was second in total numbers deployed.[163] These two fighters, together with a small number of F-89's, had the bulk of the interceptor duties until the F-101 and F-102 began to be operational in 1956.

When the F-86D began to arrive in air defense units, many pilots were dissatisfied with it because of the difficulty of using the intercept radar and piloting the plane at the same time.[164] Although pilots even-

[156] Sturm, et al., pp. 147–149.
[157] Semmens, under date.
[158] Grant, p. 52.
[159] Semmens, under dates.
[160] Grant, p. 50 (chart).
[161] *USAF Statistical Digest*, January 1949–June 1950, pp. 164–165.
[162] Semmens, June 1951, January 1952.
[163] Grant, p. 50 (chart).
[164] Sturm, et al., p. 156.

tually overcame this difficulty, it was clear that the limits of successful operation of a single-seat interceptor without the aid of some sort of ground control were being reached. The stage was set for an intensive effort to deal with this difficulty when a new generation of supersonic interceptors began to be developed in the early 1950's.

The later history of the F-89 involved many frustrations. Deliveries of the F-89 to operational units fell behind schedule from the beginning, and by June 1950 several deficiencies were apparent in the experimental models.[165] By late 1951, delivery was slowed considerably by defects in the aircraft, some of which made the interceptor ineffective above 30,000 feet. Since current plans called for the F-89 to constitute 25 percent of the ADC interceptor force, the aircraft had to be made combat-ready. But immediate improvement was not forthcoming, and during the first six months of 1952, the F-89 had seven accidents resulting in eight fatalities. Most of the defects were traceable to the attempt to increase output before the model had been adequately tested, in response to the extreme pressure to build up the interceptor force rapidly after the explosion of the Soviet atomic bomb.[166]

Although modifications were undertaken, at a cost of $17 million, the aircraft was grounded on 3 October 1952 until the major defects were corrected. The cost of the aircraft ultimately became triple that of an F-86D or F-94C; accordingly, when cuts in aircraft procurement were required, the F-89 program was a convenient place to begin. A further delaying factor was the lack of an adequate fire control system; armament development remained several years behind aircraft development throughout the post war years. Ultimately, production of the F-89 was accelerated during the second half of 1953, so that by the end of FY 1954 the Air Force had on hand a total of 349 F-89's of various models; of these, only 124 were assigned to ADC; the major air defense role had by then been assigned to the F-86D and F-94C. The F-89C almost reached obsolescence before it became operational in 1954; all versions of the F-89 left active service by the end of that year.[167]

3. Summary

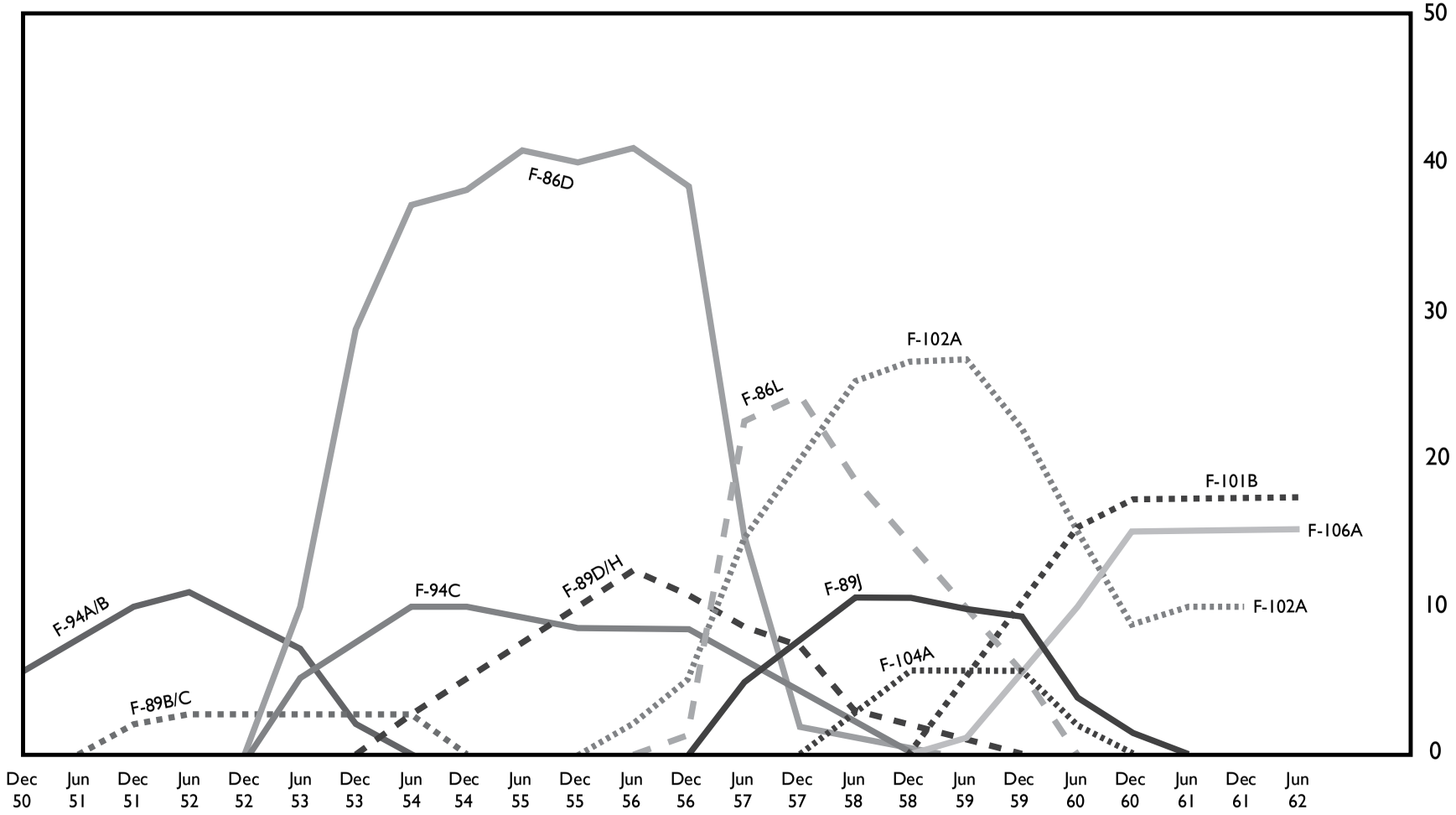
The overall pattern of interceptor deployment over the period 1946–1954 is shown in Figure 1.[168]

On the whole, American interceptor development before the advent of the Century Series in the 1950's was not fully adequate to counter the Soviet threat that arose in the late 1940's. The constraints were primarily conceptual and technological rather than budgetary or organizational.

The emergence of the Tu-4 threat in 1947 and Soviet possession of the atomic bomb in 1949 were considerably in advance of expectations, and by the time these events occurred the U.S. was committed to a new development program that promised to be marginal at best in its capability for meeting the threat. The shifts in the earliest statements of performance specifications for the F-89, as well as the heterogeneous nature of the industry response in March 1946 indicate how unclear the conception of the exact nature of air defense needs was. The haste engendered by the successive escalations of the perceived threat resulted in a speed-up of the only long-range program in process (the F-89) to a level that produced serious defects in the product; a rush to fill the air defense gap with planes developed for other purposes first brought in

[165] Grant, p. 49.
[166] Ibid., pp. 49, 52.
[167] OSD, *Chronology*, p. 180.
[168] McMullen, *History*, p. 197.

Figure 1—Fighter-Interceptor Squadrons by A/C Type



planes (the F-80 and F-84) that would have had only limited effectiveness against a B-29 type aircraft, but ultimately a strenuous effort at modification of other non-interceptor aircraft produced two interim interceptors, the F-94C and the F-86D, that did have a fair all-weather capability against the Tu-4. The overall picture is largely that a relatively unplanned effort to patch together an interceptor defense, which was conceptually remedied by decisions taken in late 1948 but could not be relieved in concrete terms until the middle of the next decade.

A second limiting factor was the unpredictability of technological advance during the period. Faced with the necessity of adopting and improving a bewildering variety of new technologies in the construction of aircraft with a more specialized mission than had been required before, the industry responded with strenuous efforts; but these efforts were not always successful, owing to the technological newness of so many components of an interceptor and to the prevailing relatively haphazard method of developing different elements such as airframe, engine, radar and fire control independently and then bringing them together as well as their characteristics would permit. (It should be noted, however, that difficulties similar to those encountered in the development of the F-89 and F-86D later slowed down the development of the F-102, which *was* planned as an integrated system.) Fortunately, the success of the industry in producing unexpectedly good aircraft for other purposes helped to redress the balance by making possible the modification of these aircraft (e.g., the P-80/T-33 and the F-86) for air defense uses.

Neither budgetary limitations nor service rivalries seem to have had a major retarding effect upon fighter development during the period. Budget cutbacks affected the total number of aircraft procured during the period, but the limiting factor in the jet interceptor force was quality, not quantity. RED costs were so small compared to procurement costs that R&D programs suffered comparatively little from the cutbacks, and even the costs of a major modification program such as that undertaken on the F-89 only led to reductions when it became clear that better and cheaper airplanes had become available.

The Air Force–Navy rivalry that continued through the period and culminated in the charges and countercharges of the B-36 hearings in 1949 focused almost totally upon the strategic offensive, leaving air defense largely unaffected. As the Army remained skeptical of the tactical value of jet aircraft until 1949 at the earliest,[169] there was little competition over jet development priorities from that quarter, and when a major shortage of procurement funds arose, it was frequently the tactical programs that were cut back. The two most important aircraft programs that were cut back in the period and the years immediately following were the F-93 (a fighter-bomber version of the F-86) and the F-88 (a penetration fighter, a type involved in a secondary mission of SAC).[170]

4. Decisions for Supersonic Interceptors, 1948–1955

Although the change of attitudes and methods in the area of strategic arms was a continuous process, the year 1948 has a good claim to be considered a watershed year in the history of interceptor development as well as in the larger strategic arena.

The increased clarity of strategic thinking which had been emerging for some time was signalized by the formulation by the Joint Chiefs of Staff of a definite conception of strategic operations against the Soviet

[169] *Aviation Week*, 25 July 1949, p. 16.
[170] Futrell, *Ideas, Concepts, Doctrine*, p. 225; Semmens, May 1951.

Union in early 1948.[171] Much thought had been devoted to the future development of this threat, and in 1948 both the report of the President's Air Policy Board and NSC 20/4 named the time at which the danger from Soviet power would likely become critical: 1 June 1953 in the former case and 1955 in the latter.[172]

In air defense, 1948 was the year in which plans were laid for an advanced interceptor to meet the anticipated Soviet capabilities of the middle 1950's. The successful realization of these plans, over a period of ten years, is the single instance in the entire post war period of a deliberately planned interceptor program that resulted in an operational aircraft fully equal to the role for which it was designed. The F-89 program that had gone before must be judged at least a partial failure; all other interceptors, before and after the 1954 Interceptor, were adaptations of aircraft originally designed for other roles. In a real sense, therefore, the interceptor program that was initiated in 1948 represents, in spite of the many difficulties that arose during its course, the high point of interceptor development efforts.

When, in October 1948, the decision was made to begin the development of a new all-weather jet interceptor, the pressure of the Tu-4 threat was still making itself felt in the decision, which opted for early availability of the aircraft rather than for a capability sufficient to deal with aircraft more advanced than the Tu-4—the anticipated Soviet B-47 type and B-52 type aircraft.[173] By January of 1949, however, a longer view was being taken, and the development of a capability beyond that of the expected future Soviet intercontinental jet bombers was being projected. The plane was dubbed the "1954 Interceptor," being expected to become operational in that year.[174]

In early 1949 the results of interceptor trials against the new B-36B bomber, which was then undergoing final testing, were made public. In the test, F-86A's, the best fighters then available, attempted interception of a B-36B at 43,000 feet. The fighters were able to reach this altitude, but maneuverability problems and lack of an adequate ground control severely limited their performance.[175] This test represented a continuance of the USAF policy, in the absence of reliable intelligence, of obtaining information on its requirements by matching its offensive and defensive weapons against each other. Its announcement, coupled with the announcement of coming requests for new design proposals (to lead to the first really new fighter prototypes since 1946), served to pave the way in Congress for acceptance of the new developmental proposals. It had the further consequence of further provoking the Navy, which was moving toward a showdown with the Air Force over the strategic mission, and which, viewing the Air Force announcement as a move to further increase its share of aircraft procurement funds, promptly offered to intercept a B-36 with its own McDonnell Banshees. The test never occurred, and since the conflict, insofar as it involved aviation, was really over the strategic offensive mission, had little effect on the AF interceptor development program.[176]

Discussions which ranged over the total air defense problem were held with industry representatives in May 1949. The development of a complete weapon system comprising airframe, power plant, armament, ground and airborne radar, communications, service facilities, and other aspects, was planned; the competition for the fire-control and electronic and control systems was held prior to the airframe competition, as

[171] At the Key West and Newport meetings in 1948.
[172] Futrell, op. cit., p. 209; Chapter I of this history.
[173] Semmens, 8 October 1948.
[174] Semmens, 13 January 1949.
[175] *Aviation Week*, 21 March 1949, p. 7, B-36.
[176] *Aviation Week*, 30 May 1949, p. 13; 6 June 1949, p. 11; B-36, Banshees.

the longest development period was expected in these areas.[177] By July 1951, three of six firms that had submitted airframe proposals, Convair, Lockheed, and Republic, were given contracts for "preliminary design and mock-up"; in this way small amounts were to be spent in acquiring initial information and the major production delayed.[178] But this sponsorship of closely competing programs was soon ended, and within two months the AF had made an initial commitment to Convair alone, placing the other design proposals on the back burner.[179]

The explosion of an atomic bomb by the Soviet Union in 1949 and the beginning of the Korean War in June 1950 greatly increased the pressure upon the AF to attain its advanced interceptor capability as soon as possible. But it soon became apparent that none of the original proposals would result in an operational aircraft by 1954. In particular, expected delays in delivery of the fire-control system and the engine put the projected availability of the Convair aircraft as late as 1956.[180] In view of this time lag, a reexamination of the interceptor program by the Board of Senior Officers revealed that a gap would exist between 1953 and 1955 during which the estimated speed of enemy bombers was Mach 0.8 to 0.85, a speed too great for the interim interceptors. Therefore, it appeared that, once again, an interim aircraft was needed.[181] Accordingly, in November 1951 the Air Force decided to expedite the development of the Convair plane with a different engine, under the designation F-102. Production of this "interim interceptor" was to be followed by completion of the "ultimate interceptor" as originally planned under the designation F-102B (later F-106).[182]

Production of the F-102 accordingly proceeded, encountering difficulties that entailed redesign of the fuselage into the "Coke bottle" shape and retooling to reduce the airframe weight; the resulting F-102A made its first successful flight on 19 December 1954 and became operational in mid-1956[183]; at this time the *complete* weapon system proved unsatisfactory, and modification and retrofitting extended the period before an acceptable level of overall effectiveness was attained to late 1958.[184]

The requirements for the F-102 had called for a rather short combat radius of 375 nautical miles, but after work had begun on it the U.S. radar defenses were considerably expanded northward, culminating in the 1954 decision to build the DEW Line within the Arctic Circle. As this expansion called for the coverage of a considerably larger area than that for which the F-102 had been planned, the Air Force on 19 February 1954 outlined requirements for a two-place long-range jet interceptor. In June 1954, the Air Research and Development Command recommended that the single-seat F-101, which originally was accepted in 1951 by the Air Force as a long-range escort fighter under the designation XF-88, but was cancelled in the same year for budgetary reasons, be adapted to serve as a long-range interceptor.[185]

The Air Defense Command was willing to accept the F-101, but the Air Force preferred to delay a decision until it could hold a design competition to get information on the possibility that an optimum long-range interceptor could be developed. Held in the summer of 1954, this design competition would stimulate interest that would eventually yield the design of the F-108, but it promised nothing that could

[177] Marschak, p. 99.
[178] Ibid., p. 101.
[179] Ibid., p. 102.
[180] Ibid., p. 102.
[181] Grant, p. 53.
[182] Marschak, p. 102.
[183] Ibid., pp. 102–109, gives a detailed account of the difficulties.
[184] Ibid., p. 109.
[185] Futrell, op. cit., pp. 484–485.

soon be available. The Air Defense Command apparently wanted more than industry could provide prior to 1960 or later, unless the Air Force would be willing to accept a four-engine fighter of virtually the same size as an airborne early warning aircraft. Facing these facts the Air Council on 16 February 1955 directed the procurement of two-place F-10113 Voodoo fighters to serve as interim long-range interceptors.[186]

When the Air Force issued its requirements description for the 1954 Interceptor electronics design competition on 18 August 1950, it noted that manual techniques of aircraft warning and control would impose "intolerable" delays under jet-age combat conditions, but did not attempt to describe the new ground environment that would be needed.[187] It was not until 1952 that a full-scale study of the needs and possibilities of a large-scale integrated ground control system was made; this study, conducted under the auspices of the Air Force–sponsored Project Lincoln, resulted in the construction of SAGE (Semi-Automatic Ground Environment), first on a trial basis in 1953, and then on an expanding scale throughout the continental U.S. over the rest of the decade. The 1954 Interceptor, ultimately the F-106, was designed to operate within this system.[188]

The adaptation of the F-104 as an interceptor belongs to the period after 1955, but the fact that it was substituted for the incomplete 1954 Interceptor justifies its mention here. The F-104 was developed by Lockheed by extensive modification of its unsuccessful entry in the interceptor competition of 1950–1951, which had been won by Convair.[189] Problems that had been encountered with the use of jet aircraft in the Korean War had strengthened the hand of tactical-fighter advocates in the Air Force and created an increased demand for a light tactical fighter. Lockheed won the contract in March 1953, and the first flight of a prototype took place in February 1954. In mid-1954 an impasse developed in the Air Force: heavy-fighter advocates, particularly in ADC, wanted a heavyweight fighter as best suited for all-weather use; light-fighter advocates, mostly from TAC, pointed to the events in Indochina as indications that the United States might soon be involved in another limited war, which would require advanced tactical fighters. The conflict was resolved at the instance of a third group, who suggested adding more equipment to the F-104 and switching to a more powerful engine. In the fall of 1954, the Air Force signed a contract for 17 F-104A airframes at a cost of $39 million; the first F-104A had its initial flight in February 1954.[190]

Since the F-104 had not been designed as a fighter-interceptor and possessed electronic equipment that was not compatible with the semiautomatic ground environment that the Air Defense Command was installing, ADC was reluctant to take the day fighter; but it recognized that it could get the F-104 without great delay, and in April 1955 it asked for six squadrons of the plane. While the F-104 was a flashy performer, it never met air defense requirements. In August 1957 the Air Force eventually limited F-104 programming to only two wings of aircraft and cancelled further production of the plane. At this time the Air Defense Command was rescheduled to receive only four squadrons of F-104's.[191]

5. Summary: 1950–1955

By 1955 the Air Defense Command possessed a good system to meet the threat of the Tu-4 offensive, and there was optimism that the air defense system could continue to outdistance the Soviets.

[186] Futrell, op. cit., p. 485.
[187] Futrell, op. cit., p. 484.
[188] Futrell, op. cit., pp. 486–487; Grant, pp. 73–74.
[189] Marschak, p. 110–111.
[190] Marschak, pp. 111–112, 114–115.
[191] Futrell, op. cit., p. 486.

Unfortunately, the Soviets achieved "qualitative surprise" and demonstrated on 1 May 1955 that their offensive capabilities had risen to a new plateau much sooner than had been anticipated. "We now have a good system to fight the Tu-4," observed General Partridge, who became Commander-in-Chief, Continental Air Defense Command on 20 July 1955. "Unfortunately, the Russians came along a little more rapidly than we anticipated in their technical developments, and they introduced the jet bombers and the Bear more rapidly than was forecast." Partridge also warned that "the defenses which we are . . . planning . . . take care of the Soviet threat up through the manned bomber, but the Soviets are said to be building an intercontinental ballistic missile, and we must somehow devise a defense against this type of attack. "[192] The immediate air defense problem in 1955–1956 concerned the development of capabilities to counter the Soviet Bison and Bear, both of which would likely possess a standoff missile capability equivalent to the Hound Dog. With one aerial refueling, the Soviet Bear, moreover, would be able to fly a circuitous route that would evade existing early warning lines in the Arctic. Since it was a turboprop aircraft, the Bear would not only have a very long range, but it would also be able to operate effectively at low altitudes.[193] The stage was set for another round of air defense planning.

F. History of Early Warning Systems, 1945–1955

1. Introduction

This portion of the larger study traces five distinctive tracks related to air defense early warning systems throughout this ten-year period. Track I covers the chronological developments and technical characteristics of the Distant Early Warning (DEW) line. Track II covers the history, technical characteristics, and effectiveness of the Lashup system; Track III traces the evolution of the Supremacy plan into the "Permanent" early warning system; Tracks IV and V describe the mid-Canada and Pinetree lines, respectively. Although admittedly these systems evolved during the same general time period, the decision was made to trace each separately so as not to confuse the reader with a plethora of information about all systems during short time periods. This procedure has the additional merit of being an innovative approach to the construction of an early warning system history; many studies on the same subject tend to lump all developmental decisions together, and in these cases it is difficult for the reader to discern any clear pattern of evolution for single systems.

2. The DEW Line

Planning for the creation of a DEW line began in 1946, when the Army Air Force first advanced a definitive[194] proposal for such a system. This plan was discarded shortly thereafter because of Congressionally inspired post war economies, which were to similarly restrict other air defense planning goals. By 1948, with the release of the USAF plan for a Supremacy air defense system of vast proportions (see detailed description in Track 111), it looked as though plans for a DEW line were dead. The USAF Air Defense Command (ADC) disagreed with Supremacy, for no provision was made in it for the Alaska to Greenland net with flanks guarded by aircraft and picket ships which ADC felt was necessary for 3 to 6 hours of

[192] 84th Congress, 2d Session, *Study of Air Power*, pp. 252–253.
[193] Futrell, op. cit., p. 488.
[194] Ray, p. 1.

warning time.[195] Supremacy was rejected in favor of a more limited eventual system because of post war budgetary priorities, and nothing was to develop on DEW for some time.

In September 1949, the Soviet Union exploded its first nuclear device. This calamitous event was followed in October 1949 by the establishment of Project Charles at MIT, a USAF-sponsored study of air defense.[196] The Project Charles report, completed in August 1951, showed the vulnerability of the U.S. to air attack and the real need for a DEW facility to provide the requisite early warning of impending attack.[197] By August 1952, the Project Charles recommendation had been seconded by the report of the Summer Study Group at MIT's Lincoln Laboratory. This report urged that a DEW line be built along the 70th parallel with water extensions to Hawaii and Scotland. Cost of such a line was estimated at a third of a billion dollars with an operational target date of late 1954 if the project took on a high priority designation.[198]

But the Summer Study Group report on DEW ran into stiff opposition in November 1952 when USAF and RAND concurred that DEW was an idea ahead of its time—their joint judgment was that insufficient funds and rudimentary technology combined to eliminate DEW from short-term consideration.[199] USAF was still seriously interested in studying the early warning problem, however, and in December, therefore, contracted with Western Electric for two test installations in light of the earlier RAND report.[200]

DEW had become an issue of some public concern by the spring of 1953; previous reports favoring the system combined with the ongoing Korean War and the new look it had engendered toward U.S. defense efforts brought the attentive public into the picture. The Alsop brothers and other journalists surfaced the DEW issue at that time, which was propitious for DEW since President Eisenhower had just taken office and the new administration brought with it new policy ideas.[201] In July the Secretary of Defense, in conjunction with other Eisenhower initiatives toward a restudy of American military needs, appointed a special group headed by Major General Harold Bull. The Bull report not only confirmed the views of the Summer Study Group, but also recommended the expenditure of $18 billion to $25 billion in the next five years to automate air defense systems and establish a DEW line.

New impetus was given to a rethinking of American defense efforts by the August 1953 Russian test of a hydrogen bomb; by October, the National Security Council had approved the Summer Study report, including the DEW line.[202] Within the context of other Eisenhower initiatives on increasing air defense which had been sent to Congress in January 1954, the NSC report of the previous fall was in turn approved by the President in February.[203] With this approval the DEW project was given to USAF; Western Electric was the contractor for what was labeled as Project Counterchange (later renamed Project Corrode) and for Project 572 to test communications in the early warning field.[204]

By June of that year, the Canadian–U.S. Military Study Group had recommended approval of the DEW line; the concept of the line was well on its way with the increased attention being directed at it.[205]

[195] Ray, p. 1.
[196] Ibid., p. 6.
[197] Ibid., p. 6.
[198] Ibid., p. 7.
[199] Ibid., p. 9.
[200] Ibid., p. 11.
[201] Ibid., p. 11.
[202] Ibid., p. 11.
[203] Ibid., p. 12.
[204] Ibid., p. 12.
[205] Ibid., p. 16.

In August, a USAF-RCAF committee was set up to develop mutually agreeable criteria for the tentative line. They endorsed a route from Herschel Island to Padloping Island, and integration of DEW with the "Alaska Ring" radar net. According to their report, the area from Kodiak Island to Hawaii would be covered via aircraft and picket ships; the Eastern extension on the opposite side was to go to Cape Farewell, Greenland, and then to the Azores.[206] Disagreement arose over placement of the line. USAF believed (along with the Navy) that the line should go to Iceland and Scotland on the Eastern side; ADC nonconcurred with this belief, objecting to it on the grounds that the route would be subject to "spoofing" raids by the U.S.S.R.[207] The Navy additionally wanted to change the Pacific route to a Midway-Adak line.[208]

By November, the Locations Study Group had combined these varying requests and had settled on a route from Cape Lisburne, Alaska, to Cape Dyer, Baffin Island. The tempo of events picked up rapidly from that time on. In December 1954 Western Electric was named the prime contractor for the system; in January 1955, the JCS approved the route previously suggested by the Locations Study Group. In May, formal agreement was reached with Canada to establish the DEW line in Canadian territory; by June, actual land construction of the line had begun.

Even in this flurry of activity, however, IOC for the line was somewhat in the future—in July, a contract was signed committing the contractor to complete DEW installation by mid-1957. Once this date had been established, personnel requirements could be dealt with—in August, authority was granted by the Secretary of the Air Force to staff the line with contract civilians. Carrying the story through the end of 1955, in December the JCS reconsidered placement of the line and accepted the Navy's earlier recommendation—they authorized the Midway-Adak route, plus some gap-filler radars for the Aleutian Islands.[209]

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[206] Ibid., p. 16.
[207] Ibid., p. 16.
[208] Ibid., p. 16.
[209] Ibid., p. 19. Included below is technical information about the DEW radars. All information is from Ray *except* the information on picket ship and aircraft systems. This data is from Wohlstetter, Appendices D, E, F, and N.

DEW Radar Systems

A. Technical

The central part of this line was built using specially designed equipment to withstand the existing environmental conditions.

1. Search Radar—AN/FPS-19

(1) L bank 1220–1350 MHz

(2) Two back-to-back antennas, each 36' wide x 11' high. One for low beam, one for high, each with its own radar. Rotation rate 1.25 rpm. Detection range about 160 nautical miles from altitudes of 5000 to 7000 feet.

2. Fluttar Radar—AN/PFS-23

CW Doppler system. Receivers and transmitters spaced alternately along line. 475–525 MHz, 1 Kw power. Antennas were 6' wide, 20' high and elevated from 100–400' above ground. These were for low-level detection, and were designed to work down to 200' elevation over land and 50' over water.

B. Technical

1. Radars—For the Alaska to Labrador Section

(1) Search radars

AN/FPS-19 L band search, two antennas per radome with one for high beam and one for low beam, 180º apart. Range 160 nautical miles for detection altitudes of 5000 to 7000 feet

(2) Doppler

AN/FPS-23 Fluttar systems

475 – 525 MHz, 1 Kw power, detection down to 200' over land, 50' over water

(3) Picket ships

Combination of DER (Destroyer Escort/Radar) and YAGR (Converted Liberty Ship) with AN/SPS-6C surveillance radar and AN/SPS-8 height finder. Range about 40 miles at 500' elevation due to earth's curvature

(4) Aircraft

Navy WV-2 or USAF RC-121 (converted Lockheed Constellation) using AN/APS-20 surveillance and AN/APS-45 height finder.

The most interesting portion of the DEW story thus clearly occurs after 1955, for the line was not operational until 1957. It was only then that full costs could be assessed for the system; it was only then that bugs could be worked out of the radars, one radar of which initially was to generate false alarm rates as high as four per minute from such sources as clouds and icebergs. The full details of these problems and costs will be covered in the second portion of this history.

3. Track II—Lashup

The story of the Lashup radar system is a short one of small proportions compared to later early warning nets. In October 1948, the Commanding General of the USAF Air Defense Command, General Stratemeyer, received $561,000 to start Lashup I by expanding the five-station radar net then in existence.[210] Lashup was tied to a renewed emphasis on defense given increased cold war hostilities at that time—earlier that same year, Czechoslovakia had fallen to communist control, and the Soviet blockade of Berlin had begun.

By early 1949, siting had been completed and some stations were in operation.[211] USAF also issued plans at that time for Lashup II to cover the Northeast, Northwest, and Sandia-Los Alamos areas.[212] It was also envisioned that as personnel and equipment became available the San Francisco, Los Angeles area would be covered.[213] On 1 June 1950, the completed Lashup net went into operation. In all, 44 stations were included and used World War II equipment—the system was a stopgap measure which had to suffice until the new "permanent" or "P" system installations had been completed.[214] By 1952, Lashup stations were gradually being phased out as the "P" system stations came into operation.[215]

But although Lashup was a short-lived system, its deployment proved beneficial in working out problems for later, more sophisticated nets. ADC admitted that Lashup was only good for training since outdated equipment in poor repair was used, and not enough personnel were available for 24-hour operations of even that equipment.[216] ADC's opinion of Lashup was that it was of prime benefit in showing what needed to be done to improve the system rather than as an effective early warning net.[217] They also believed that Lashup helped to promote greater harmony among air defense protagonists when they saw how bad the operation of Lashup actually was.[218]

The problems of the Northwest Lashup provide an example of the problems of the entire system. That portion of Lashup ran only 8–12 hours a day during its life span. Stations were undermanned by unskilled personnel; replacement parts were difficult to get; and there was a general lack of height finders among the stations.[219] Throughout Lashup, the AN/CPS-5 proved to be the system "workhorse" among the radars, although the AN/CPS-1 was considered to be the best unit.[220] The worst operational radar units were the AN/TPS-1B and the AN/TPS-10A.[221]

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[210] "Organization and Responsibility for Air Defense."
[211] Ibid.
[212] "The Air Defense of Atomic Energy Installations."
[213] Ibid.
[214] "Chronology of Blue Air Defense Systems."
[215] "Organization and Responsibility for Air Defense."
[216] Ray.
[217] "The Air Defense of the United States."
[218] Ibid.
[219] "The Air Defense of Atomic Energy Installations."
[220] "The Air Defense of the United States."
[221] Ibid.

But these problems of Lashup had to be expected because of the nature of the system—it was a crude attempt to answer a much larger question.

4. Track III—Supremacy and the "Permanent" System

After the end of World War II, the early warning radar net then in existence was decommissioned as part of the general return of men to civilian life. This left CONUS with no early warning facility, so the USAF attempted to plug the defensive gap by formulating the Supremacy plan. This plan called for a complex net of 223 CONUS radars and 37 Alaskan radars[222] and was approved for construction by the USAF Chief of Staff in November 1947.[223] When these plans were released in early 1948, ADC complained bitterly because there was no provision for land-based radars along upper North America. ADC wanted to include a system from Alaska to Greenland with the sea flanks guarded by picket ships and airborne radar placed to furnish three- to six-hour warning times. With the nation's general relaxation from the war effort, however, ADC's case was not stated vividly enough for either the USAF or the public to be impressed. General opinion was that the idea of a SAC deterrent force was sufficiently powerful to preclude attack on the United States, thus making an aircraft early-warning network unnecessary.

Budgetary restrictions continued to plague the military in this early postwar period, and in late 1948 the Supremacy plan was withdrawn for a more modest one called the Interim Program.[224] This was essentially Phase I of Supremacy and proposed to use radars either on hand or already on order, thus requesting funding only for facilities construction. The FY 1949 request was $45 million for this purpose. A "First Augmentation" was also requested at the same time. This augmentation was essentially Phase 11 of Supremacy and included funds for more radars, height finders, and their installation.[225]

In March 1949, Congress approved a permanent post war radar net for CONUS and Alaska. The bill signed by the President authorized the USAF to build a 75 station "permanent" aircraft control and warning net which was essentially the proposed Interim Program and its First Augmentation.[226]

After approval of the program and while waiting for an appropriation to clear Congress, the USAF diverted $50 million from aircraft procurement funds to get the program started. The USAF deemed coverage of the northern approaches to the continent to be of prime importance, so only $18.8 million of the diverted funds were earmarked for continental stations, with the bulk going to support the Alaska priority stations.[227]

A Congressional appropriation of $85.5 million was finally received in October of 1949 for construction of the "permanent" radar net.[228] Planning progressed for the priority Alaskan stations, and construction was ordered for 24 of these in December 1949. This first building phase was started in March of 1950 as soon as weather conditions became more favorable.[229]

Construction of the original "permanent" or "P" radar net was to in June of 1952.[230] Even before the net was finished, extensions into Canada to increase warning time for critical areas of the United States were being planned.

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[222] "Organization and Responsibility for Air Defense."
[223] "Chronology of Blue Air Defense Systems."
[224] Ibid.
[225] "Organization and Responsibility for Air Defense."
[226] "Chronology of Blue Air Defense Systems."
[227] "The Air Defense of the United States."
[228] "Chronology of Blue Air Defense Systems."
[229] Ibid.
[230] Wohlstetter, Appendix N. Included below is technical information about the "Permanent" system radars.

5. Track IV—The Mid-Canada Line

In October of 1952, Canada started plans for its own early-warning radar line crossing the middle of the country at about the 55th parallel.[231] These plans appear to be an effort on Canada's part to gain its own entry into the early warning system at not too much expense and gain an additional hour's warning time for most of its population centers. The United States was glad to cooperate with these plans and in October of 1953 the plans were approved by the Joint Canadian–U.S. Military Study Group.[232]

Shortly after the plans were approved, construction agreements were reached (the United States paid a share of the cost) and 1957 was set as the target year for operations to begin.[233]

The line was built approximately on the 55th parallel from Dawson Creek, B.C., to Hopedale, Lab. It was composed of 90 detection and 8 section control stations. All detection stations were unmanned and telemetered their data to the section control stations for analysis. The radars used were CW Doppler sets, either the U.S. AN/FPS-503 or the Canadian MK II Fluttar set.[234]

6. Track V—The Pinetree Line

While the U.S. "permanent" system was being built, planners were at work to extend its coverage northward. The first extension of the P system into Canada is sometimes called the Pinetree line, the "radar extension program," or the "Canadian extensions." In August of 1951 an exchange of notes between the United States and Canada constituted formal agreement to build the line.[235] A total of 33 sites were planned, mostly in the southeastern part of Canada. When costs were discussed, Canada bridled until the United States offered to pay two-thirds of the total. Construction was essentially complete by June of 1954, when all but one of the sites became operational.[236]

Figures 2 through 5 are graphic displays of the systems discussed in this section.

G. History of Command and Control, 1945–1955

1. Introduction

This segment of the larger history limits itself to some fairly well-defined subfields in the area of command and control. *Omitted* from detailed description are air defense weapons, the specific threat to CONUS, air defense outside of CONUS (including early warning systems), and the military hardware of command and control systems. Command and control roles and missions as they apply to surface-to-air weapons are discussed in detail in this chapter in section C.4. *Included* in the central focus of this segment are the roles, missions, and interservice relations in the formative periods of the Air Defense Command (ADC), Continental Air Command (CONAC), Army Antiaircraft Command (ARAACOM), and Continental Air Defense Command (CONAD) during the 1945–1955 period.

The difficulties involved in structuring the scope of the study in this manner have already been well put by a similar study:

[231] Ray.
[232] Ibid.
[233] "Chronology of Blue Air Defense Systems."
[234] "Operation of the Mid-Canada Line."
[235] "Chronology of Blue Air Defense Systems."
[236] Ibid.

Figure 2—Early-Warning Systems

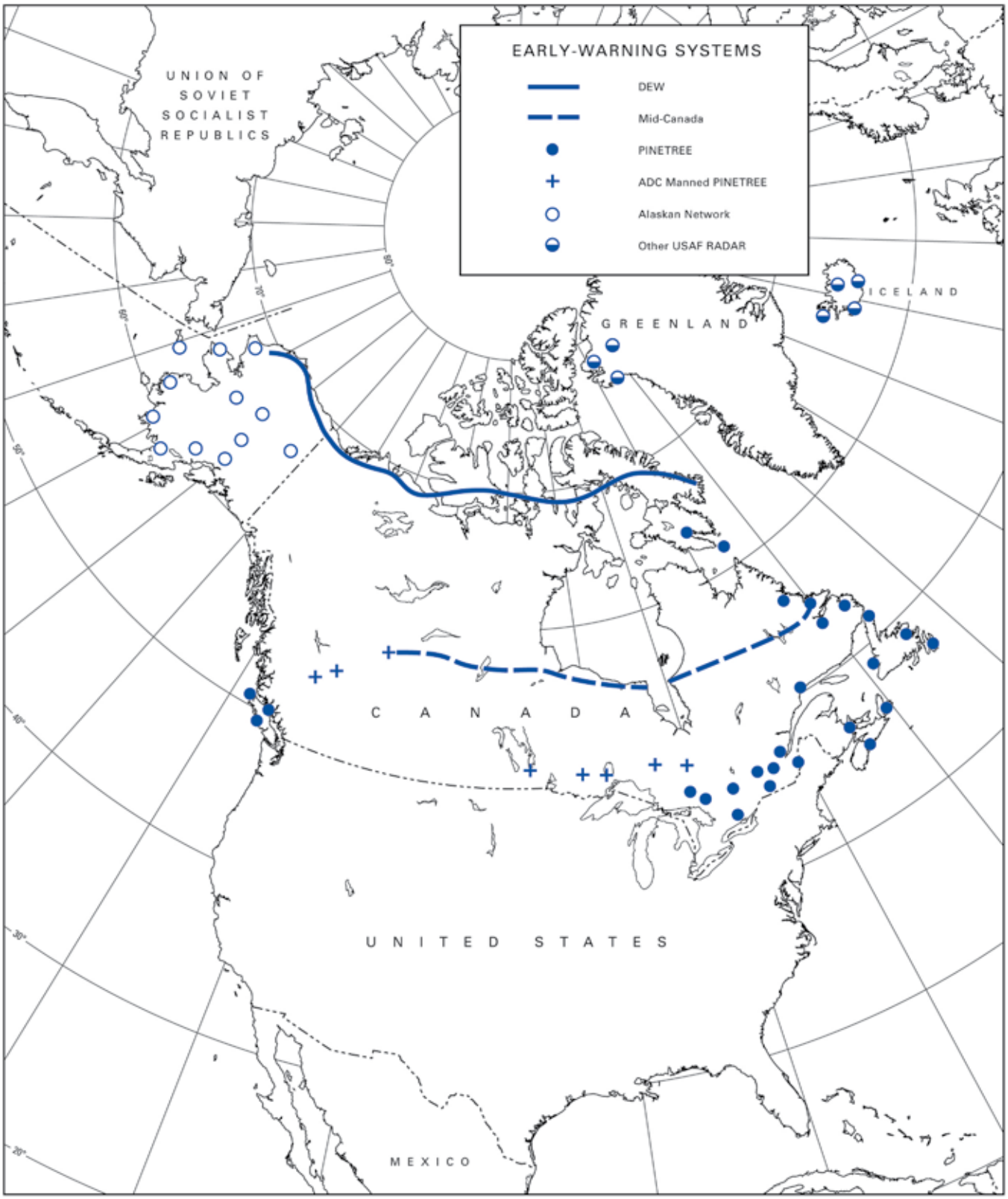


Figure 3—Lashup, Completed by April 1950

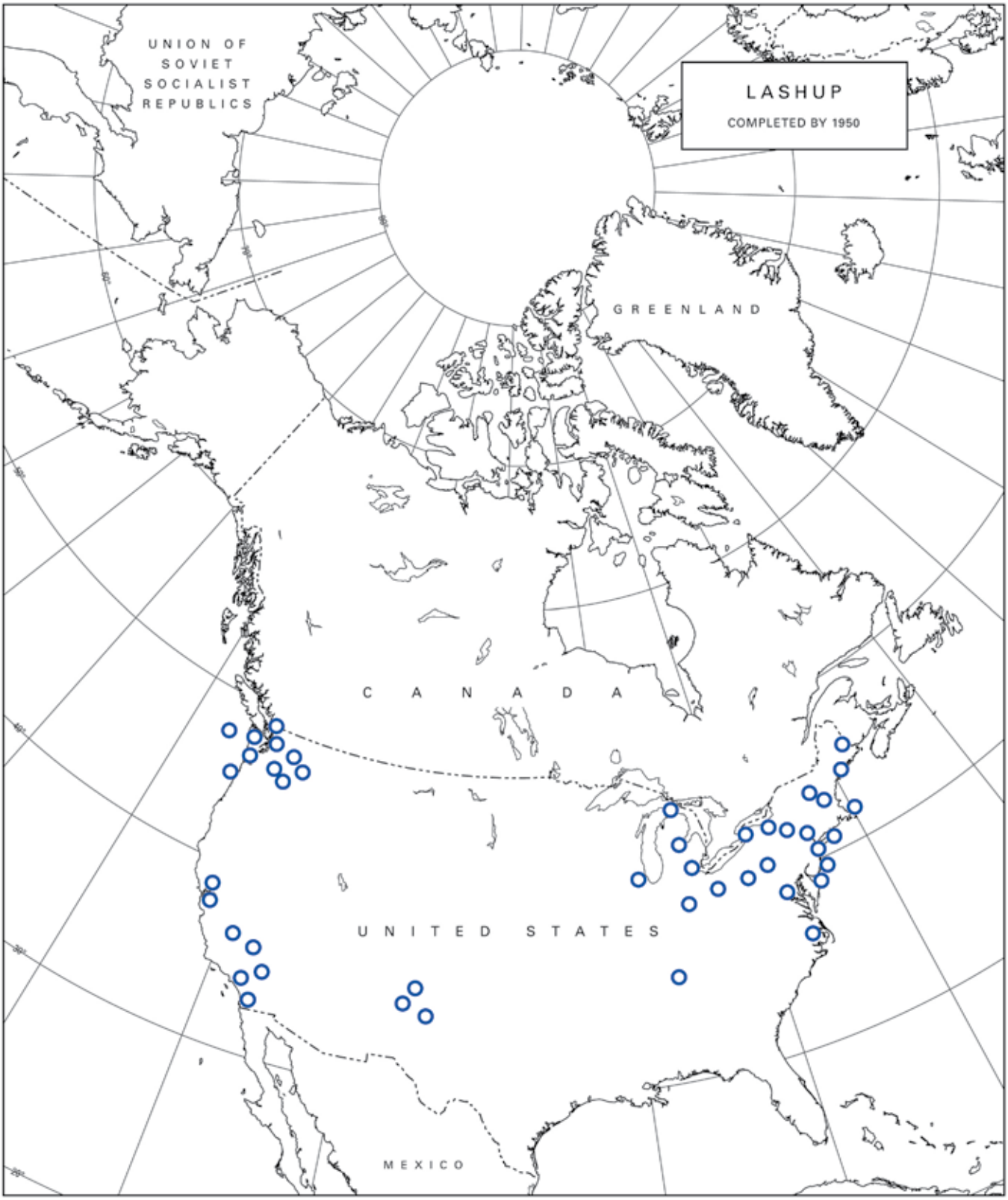


Figure 4—Permanent System

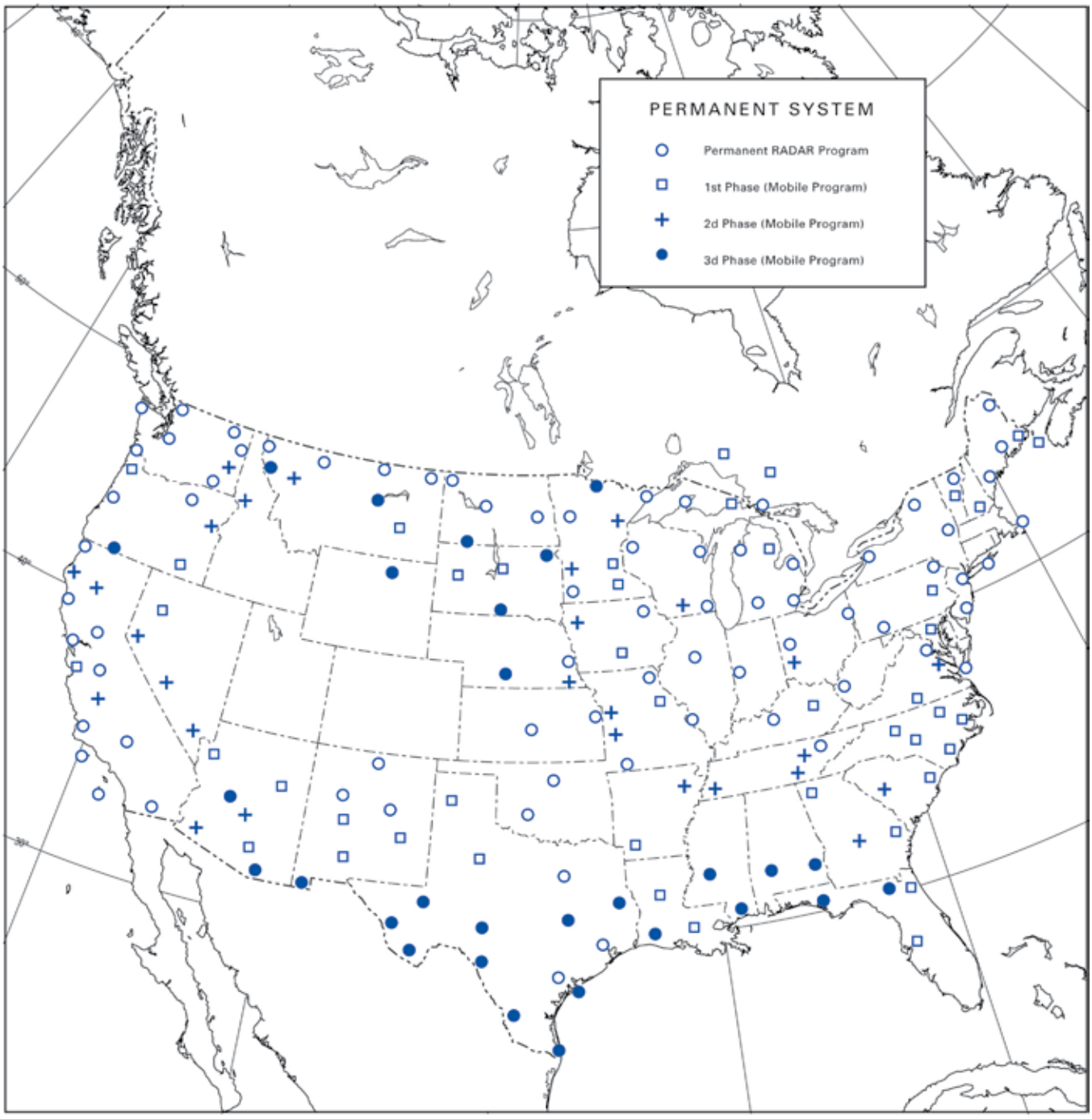
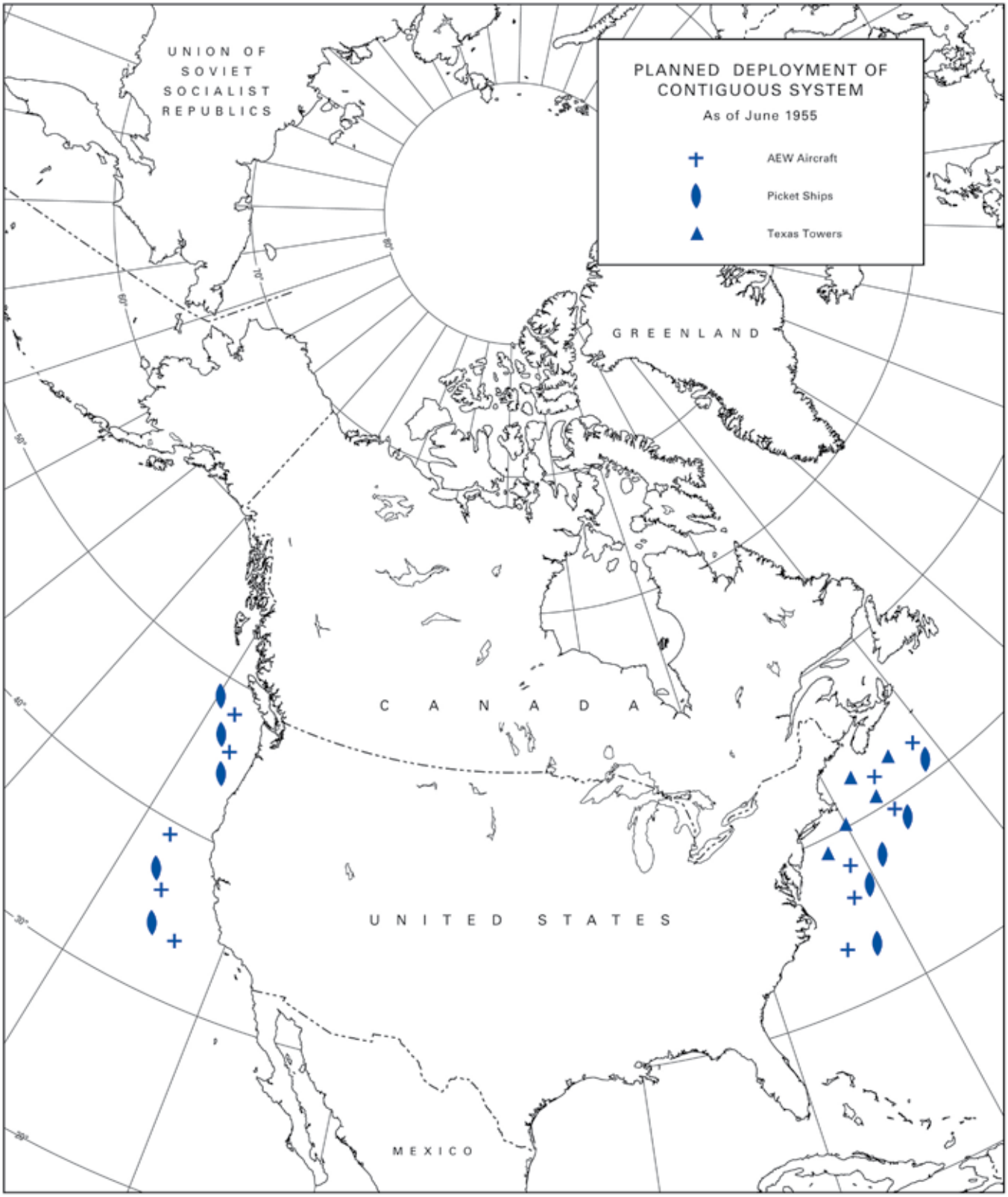


Figure 5—Planned Deployment of Contiguous System (as of June 1955)



> Isolating the organizational story from the history of the growth of the radar, fighter and antiaircraft forces was the most difficult problem. . . . To have ignored the influence on organization of the various expedients applied to the build-up of forces would have been to treat the evolution of the organization in a vacuum. On the other hand, to have made more than the merest reference to the force developments would have led to an obscuring of the central theme.[237]

In addition to the problem of scope is the fact that several comprehensive histories have already been written which trace the evolution of these organizations through the same period of time. While it is obviously more stimulating to "break new ground" in such an endeavor, this is not possible in this field. Primary source documentation has already been used by these other studies (especially in the classified literature) in an attempt to accurately portray the course of events and extent of service competition in the formation of air defense organizations. This effort can therefore not be pretentious; the best it can hope to do is to elaborate an accurate perspective on salient events during the time period.

2. Pre-1945 Decisions

The choice of 1945 as the first year of this history does not dovetail neatly with the formation of the first active air defense organization in the post war period. The Air Defense Command (ADC) is the first of the previously mentioned organizations to be discussed; there were actually three ADC's: one from 26 February 1940 to 2 July 1941; the second from March 1946 to July 1950; and the third from January 1951 through and beyond the end of our time period, 1955.[238] Therefore, discussion of the ADC initiated in 1946 must include information from the earlier period to reflect the state of affairs from 1945 on.

The earliest ADC grew out of a suggestion in November 1939 by then Chief of the Air Corps Major General Henry H. Arnold to the War Department that a unit be established to study the problem of CONUS air defense, an effort then absent.[239] The result of this suggestion was the establishment of an ADC on 26 February 1940, a planning body tasked to study the problem of attacking planes over the United States.[240] The study efforts of this first ADC fed into a War Department assignment of the mission of organizing, training for, and operating the air defenses of the United States to the Commanding General, GHQ Air Force in March 1941.[241] However, this responsibility was primarily for mobilization—under wartime conditions four newly created CONUS air defense commands were actually to be responsible for defense operations.[242] Thus CG GHQ air defense prerogatives were to be released to defense commanders once hostilities began. This problem of responsibilities was not particularly crucial, however: ". . . in spite of the increased emphasis on defense planning, the entire question of air defense was still generally considered to be an academic one in 1941, as it was to be later, in 1946–47."[243]

After Pearl Harbor, the concern for air defense took on a new seriousness. As an operationally dependable air defense system grew during the war, the question of doctrinal responsibilities for air defense roles and missions continued to evolve. Precursors of post war problems in the assignment of responsibilities are seen in two major documents developed during these years. The first is found in Field Manual 1-15, issued by the War Department in April 1942. Entitled "Tactics and Techniques of Air Fighting," this document

[237] Sturm, "Foreword."
[238] "The Air Defense of the United States," p. 11.
[239] Ibid., p. 10.
[240] Ibid., p. 11.
[241] Ibid., p. 13.
[242] Ibid., p. 14.
[243] Ibid., p. 17.

stated a position of much future controversy between the Army Air and Ground Forces: "The interceptor command must have operational control over all antiaircraft artillery, searchlights and barrage balloons in the defense area."[244] This control problem will be picked up again in the post war years.

Also significant was the historic Field Manual 100-20, *Command and Employment of Air Power*, issued in July 1943 by the War Department with initiation from AAF. As a precursor to the formation of the second ADC in 1946, the manual specified organizationally that: ". . . the normal composition of an air force includes a strategic air force, a tactical air force, an air defense command and an air service command."[245] Leading directly to post war interservice competition for roles and missions was the statement that: "Land Power and Air Power are co-equal and interdependent forces . . ." and that ". . . neither is auxiliary of the other."[246] Even more pertinent to the later controversy was a statement about air defense responsibilities of the air forces under a unified command structure such as existed in combat theaters: "When antiaircraft artillery searchlights, and barrage balloons operate in the air defense of the same area with aviation, the efficient exploitation of the special capabilities of each . . . demand that all be placed under the command of the air commander responsible for the area. This must be done."[247]

Within CONUS during the war, some disagreement continued over the assignment of operational control over antiaircraft artillery to either Army Air or Ground Forces. Little had been settled by the war's end, however, and it has been suggested that during this time the air defense mission was kept ". . . in a state of suspension between AAF and AGF."[248]

3. Immediate Post War Decisions

With the War Department reorganization of forces in the spring of 1946 to meet post war needs came air force organization along functional lines—but the establishment of priorities and the division of functional missions still remained moot points. An Air Defense Command was created in March 1946 (along with the Strategic and Tactical Air Commands and the Air Materiel Command) and was tasked with the interim mission to ". . . organize and administer the integrated air defense system of the continental United States . . . exercise direct control of all active measures and coordinate all passive means of air defense."[249] While this major mission statement appeared specific on the extent of control ADC was to have, the War Department by directive on 8 April 1946 also gave Army Ground Forces (AGF) a defensive mission:

> Under the general plans of the War Department, and in conjunction with designated air and Naval commanders, prepare for, and on order, or in imminent emergency, execute planned operations for the defense of the United States.
>
> Coordination. Coordinate ground plans, including coastal defense and antiaircraft projects, with designated air and naval commanders.[250]

Although it appeared that a broad charter had been granted to ADC, AGF also thus had a piece of the action—and the situation demanded clarification. By May the War Department sought to eliminate the existing confusion over air defense responsibilities with issuance of Circular 138. This circular had the

[244] Ibid., p. 26.
[245] Ibid., p. 26.
[246] Ibid., p. 26.
[247] Ibid., p. 27.
[248] Ibid., p. 29.
[249] McMullen, "History of Air Defense Weapons 1946–1962," p. 16.
[250] Barnard, p. 17.

net effect of satisfying neither the ADC nor the AGF. The assignment to ADC of control over CONUS air defense in 138 was not specifically defined to their satisfaction nor was AGF pleased since ADC was to control antiaircraft units.[251] The existence of this displeasure continued. The War Department was requested to clarify its position after issuance of Circular 138, but it only did so by "refusing to modify the definition of air defense enunciated in WD Circular 138, and, in effect, by sustaining the AAF contention that AA should not revert to exclusive Ground Forces control. At most, however, this hedged upon the broader issue involved, and retained the dual assignment of antiaircraft artillery to AAF and AGF previously announced by the War Department."[252]

This lack of mission and control clarity may well have been caused by the unstated view of the War Department and the Army Air Force (parent to the ADC) that air defense should be viewed as a mobilization effort rather than as something performed by an ongoing, active military organization with organic defense hardware.[253] At any rate the lack of clarity was to restrict ADC activities through 1947, along with constraints imposed by shortages of personnel, forces, and the weapons to perform its assigned mission.[254] ADC took third priority after SAC and TAC, a position which was to limit ADC to a small role including supervision of the air reserves and planning an air defense system for CONUS.[255]

But while ADC remained at dead center regarding its mission and equipment, the Army Air Force gained a distinct advantage over AGF in September 1946. The War Department resolved the antiaircraft gun control issue by deciding that: "AAF would control AA units with air defense missions."[256] Therefore although ADC was relegated to a relatively powerless role, AAF was on its way to a more powerful position which was to be reinforced by the creation of a separate U.S. Air Force in 1947.

The tempo of events picked up rapidly in 1947. Three plans formulated by ADC for the air defense of CONUS went unapproved by AAF through the spring and summer, for the services were anticipating resolution of the more important issue of separating the Army from the Air Force.[257] The National Security Act had been sent to Congress on 27 February; by July the Act was passed, and the USAF came into being in September.[258] In July the Commanding Generals of Army Ground and Air Forces, respectively Generals Devers and Spaatz, had agreed that the ADC had responsibility for AGF units participating in air defense within the zone of the interior (CONUS).[259] But the exact meaning of this declaration remained unclear, overshadowed by the larger event of service reorganization. Creation of an independent Air Force in September did little to help ADC; on 17 December USAF directed ADC to base future force planning on the premise that the "Air National Guard [would] constitute [ADC's] major source of Air Defense Units."[260] Ironically, this reinforcement of ADC's lack of organic hardware was followed two days later with a formal mission directive for which the command had been waiting for months. Air Force Regulation 20-13 was issued on 19 December, and specified that air defense was to be the command's "chief mission."[261]

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[251] Barnard, p. 17.
[252] "The Air Defense of the United States," p. 46.
[253] Futrell, "Ideas, Concept, Doctrine . . . ", p. 187.
[254] Sturm, p. 5.
[255] McMullen, op. cit., p. 22 on "Third Priority." Sturm, p. 5, on other information.
[256] Barnard, p. 20.
[257] McMullen, op. cit., p. 22.
[258] McMullen, op. cit., p. 22.
[259] Barnard, p. 22.
[260] McMullen, op. cit., p. 23.
[261] Sturm, p. 6.

Although these decisions clarified ADC's mission and status vis-à-vis the USAF, interservice roles remained to be agreed upon. In pursuance of such agreement Secretary of Defense Forrestal held a series of conferences at Key West, Florida, 11–14 March 1948, which resulted in service approval of the Air Force's air defense responsibilities. The Key West Agreements specified that:

> The Air Force was formally assigned the responsibility for defense of the United States against air attack, while the Army received the task of providing antiaircraft artillery units. Thus the Key West Agreements concluded the discussions and agreements which had been going on since early 1946. Although the Air Force accepted responsibility for air defense, and hence operational control of AA, they did not achieve the integration of AA into the Air Force. The details of implementing these agreements were left to the two services.[262]

During this same period of time in 1948, the cold war began to intensify but did not lead to an immediate strengthening in the U.S. air defense establishment. Among other things, in February communist control was attained over Czechoslovakia; in June the Russians began the Berlin blockade. While these occurrences contributed to the hardening of Soviet and U.S. policy positions, a domestic recession had greater impact on air defense efforts than overseas events. A budget surplus predicted in 1948 for FY 1949 quickly turned into a deficit of almost $2 billion.[263] With advice from the Bureau of the Budget in the summer of 1948, President Truman established an arbitrary defense budget ceiling of $14.4 billion for FY 1950.[264] The handwriting of fiscal austerity was on the wall for the Joint Chiefs; although FY 1950 was roughly a calendar year away at the time, the necessity for cutting back on desired programs seemed a certainty. It was within this context that any likelihood of new-found impetus for ADC was to drag on: ". . . although the urgency of clearing ADC's mission-laden decks was recognized in many official statements, little was done until the formation of the Continental Air Command (CONAC) in December 1948."[265]

In conjunction with the budgetary situation President Truman ordered the Air Force to reorganize for more economical use of available (especially civilian) assets on 15 October 1948.[266] As part of the subsequent reorganization, the administrative and logistical functions of ADC were doled out to the territorial air forces and the command itself became an operational headquarters under CONAC as of 1 December 1948.[267]

But while ADC was dissolved as a major command with the creation of CONAC, the pooling of available hardware that resulted brought about something ADC had long requested: an increase in operational forces. "On 30 November 1948, ADC had seven manned and equipped fighter squadrons earmarked for air defense purposes. The following day 16 manned and equipped fighter squadrons were available for air defense use."[268]

Developments internal to CONAC were to continue slowly during calendar year 1949 despite its auspicious beginnings in late 1948. Congressional action on Defense planning activities slowed during that year due to the Navy super-carrier–USAF B-36 controversy, and by the end of 1949 CONAC found itself with a small force increase over the strength of a year earlier—a total of ". . . 20 manned and equipped interceptor squadrons dedicated to air defense."[269]

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[262] Barnard, pp. 23–25.
[263] Futrell, op. cit., p. 222.
[264] Futrell, op. cit., p. 222.
[265] "The Air Defense of the United States," p. 53.
[266] Barnard, p. 29.
[267] "The Air Defense of the United States," p. 201.
[268] McMullen, op. cit., p. 30.
[269] McMullen, op. cit., p. 55.

Interservice agreement on the role which CONAC should play still remained to be worked out although the Air Force had temporarily solved its internal air defense organizational problem with the establishment of CONAC. The mission directive issued to CONAC 11 January 1949 indicated that its purpose was "to conduct the active air defense of the United States, cooperate with land and amphibious forces, supervise the Air Force reserve programs, and ready all forces under its jurisdiction."[270]

Joint Army and Air Force discussions continued during the winter of 1948–1949 over the exact meaning of these CONAC responsibilities. The problem was not a particularly crucial one for the Army, because although there was disagreement over which service should control AA fire (the then-prime contribution of the Army to air defense) there was only one regular army AA battalion in existence during early 1949—and it was stationed at the Army Antiaircraft Artillery School at Ft. Bliss.[271] By decision of General Omar Bradley, Army Chief of Staff, on 18 February 1949, "Army units . . . [were placed] under operational control of the Air Defense Command (ADC); with command exercised by AA Sections belonging to the ADC staff."[272] Disagreement within the Army below the level of the Chief of Staff over the meaning of the term "operational control" was to continue through 1949, and the situation remained unresolved until 1950.[273]

In the meantime ADC was further degraded within the CONAC structure. The transfer of organizational and operational responsibilities within CONAC under a general reorganization during 1949 eliminated the need for a command level between the CONAC commander and field commanders with area air defense responsibilities.[274]

> Consequently, in September [1949], the Headquarters Air Defense Command was reduced to record status.
>
> It remained in this state of limbo until 1 July 1950 when, in consonance with the sweeping reorganization of the command which took place at that time, it was completely dissolved.[275]

The on-paper reorganization of USAF's air defense efforts in September 1949 had led to the activation of two regional commands—the Eastern and Western Air Defense Forces. Predating this activation was the Soviet explosion of an atomic device in August 1949, which had given impetus to a more effective air defense organization; the newly created area commands were partially a result and were placed on the same command level as the numbered air forces, a situation which looked more workable than the continuation of an understaffed ADC HQ.[276]

Operational control arrangements between the two services for air defense hardware still remained to be worked out, however. The 1949 USAF position that AAA units should be placed under operational control of ADC, coupled with differences of opinion on the DA staff over the Bradley decision on air defense responsibilities, serve as examples of the continuing problems in determining appropriate service roles.[277]

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[270] Sturm, pp. 22–23.
[271] Barnard, p. 37.
[272] Ibid., p. 37.
[273] Ibid., pp. 37–39.
[274] Sturm, pp. 27–31.
[275] Ibid., p. 30.
[276] McMullen, op. cit., pp. 55–56 and Sturm, p. 43 on Russian A-bomb threat and the ADC.
[277] Futrell, op. cit., p. 284 on 1949 USAF position; Barnard, p. 43 on DA staff disagreement.

4. The Korean War Period

An increase (albeit a slow one) in the number of manned and equipped AAA units available led the Army to reconsider the AAA operational control problem in a conference 4–6 January 1950.[278] The issue at hand, from the Army standpoint, was the establishment of measures to prevent over control in air defense by the Air Force.[279] From this conference grew the recommendation that in the short run, an Army AA staff section should be established at CONAC; the Air Force concurred with this idea on 9 March of that year.[280] As a long-range plan for solution of the same problem, the conference recommended formation of an Army Air Defense Command, something which would in fact be established on 1 July 1950 as the Army element of CONAC under a slightly different name: the Army Antiaircraft Command (ARAACOM).[281] A series of USAF-Army agreements during the spring and summer of 1950 worked out joint target defense efforts, the most significant agreement of which occurred on 1 August 1950: "In a memorandum of agreement . . . Generals Vandenberg [USAF] and Collins [USA] decided between themselves that targets to be defended would be decided upon jointly by the Departments of Army and Air Force . . . and that Air Force air defense commanders would exercise operational control over antiaircraft artillery insofar as engagement and disengagement of fire is concerned."[282]

With this statement of agreement, the Army's operational control of AAA was definitely weakened; or as stated more strongly by an Army historian, the agreement ". . . significantly damaged AA's effectiveness."[283] The balance of air defense hardware control was clearly shifting in favor of the Air Force.

Providing a stimulus for a further review of air defense efforts during this time was the North Korean invasion of South Korea on 25 June 1950. The associated Congressional and service attention to CONUS defense, coupled with resultant manpower and materiel allocation increases for the services, fed in to the reestablishment of the USAF Air Defense Command as a major operational command on 1 January 1951.[284] On that date, an important reassignment of forces from CONAC to ADC occurred; ADC acquired: "The two Air Defense Forces, the air divisions, the fighter wings, groups, and squadrons, the AC&W groups and the radar squadrons, plus all of the other organizations whose primary duty under CONAC had been air defense. . . . "[285]

ADC had therefore become a command in its own right. The hardware strength of ADC was to move both up and down from the January baseline during 1951; while the size of the USAF weapons force doubled in the early months of that year, the need for overseas fighter units constrained any rapid increase in ADC-committed forces.[286]

Although ARAACOM HQ was collocated for closer liaison with the reinstituted ADC at Ent AFB, Colorado, on 15 January 1951, continuing problems remained to be worked out between the two organizations and between their parent services in the air defense field. ARAACOM, as ADC, had drastically increased its size in a short period of time; regarding ARAACOM, "From 11 July 1950 to 10 April 1951,

[278] Barnard, p. 43.
[279] Ibid., p. 46.
[280] Ibid., pp. 46, 53.
[281] Ibid., pp. 47, 55.
[282] Futrell, op. cit., p. 284.
[283] Barnard, p. 73.
[284] Ibid., p. 66.
[285] Sturm, p. 45.
[286] McMullen, op. cit., pp. 97–98.

[the] command increased from twelve men . . . to sixty-one units of assorted types and sizes."[287] Thus while earlier differences of opinion had existed between the services over roles and missions, the flavor of post-1950 discussions was modified by the fact that both of these service air defense organizations now had considerable physical strength. It took some time before new accommodations were to be reached between the two; the newly strengthened organizations individually found too many internal organizational problems to be dealt with in the short term to come to serious grips with any revision of the existing Collins-Vandenberg agreement. ARAACOM expanded from 23 battalions in mid-April 1951 to 45 battalions by the end of that year; internal headquarters reorganizations and the establishment of operational defenses for selected areas occupied most of the available time through that period.[288] ADC was similarly involved at this same time with CONUS sector divisions and manpower staffing assignments.

The next major interservice agreement occurred in the Chidlaw (CG, ADC)-Lewis (CG, ARAACOM) memorandum of July 1952. From this agreement ARAACOM gained the following:

a. Definition of the term Gun Defended Area (GDA). [Note: GDA was essentially a AAA free-fire zone]
b. Commitment by ADC to exercise operational control through AA defense commanders
c. ADC's pledge to designate GDA's as soon as possible
d. ADC's guarantee to provide space for AA staff sections
e. Assurance that ARAACOM would continue to prepare plans for AA defenses
f. The right to participate in ADC exercises
g. That ADC would relay intelligence data to ARAACOM
h. That cross service agreements could be used to support AA units defending Air Force Bases.[289]

Although ARAACOM had clearly gained by these points in the area of operational control compared to the earlier agreement since ADC would exercise its control through AA commanders, it was still obvious that ADC had the upper hand in the overall picture. ARAACOM was bargaining with ADC, not vice-versa.

Actions by ARAACOM and ADC from the Chidlaw-Lewis agreement through the end of 1953 are set within the context of organizational introspection. During this period, the Department of the Army demobilized National Guard units which had been mobilized to serve in Korea, and regular army units were activated to replace them. ARAACOM participated in this changeover, along with deploying a new gun weapons system (the 75-mm. Skysweeper) and modifying the responsibilities of its various headquarters for greater efficiency.[290] ARAACOM was also extremely busy with the conversion of gun battalions to Nike Ajax battalions. Although the first Nike Ajax unit was not on site until December 1953, prior activities to meet that deployment date required the development of individual and unit training plans, logistical studies, site selection, and unit reorganization schemes as major areas of concern.[291]

During this same period of time, ADC was striving to realize a previous planning goal for the projected 1953 ADC of 57 squadrons.[292] Although the ADC "pie in the sky" goal of late 1952 was for an eventual "ultimate" air defense force of 151 interceptor aircraft squadrons plus 30 Bomarc squadrons, by mid-1953

[287] Barnard, p. 75.
[288] Ibid., p. 92.
[289] Ibid., p. 117.
[290] Ibid., pp. 123, 133.
[291] Semmens, BDM, *Chronology*.
[292] McMullen, op. cit., p. 98.

they actually controlled 46 manned and equipped squadrons compared to 39 at the end of 1952.[293] ADC continued to strive for the goal of 57 squadrons through the end of 1953; this figure was eventually realized at the end of 1954 (although 2 of those so-designated had not yet been manned or equipped).[294]

Overlapping these events were the activities of the Joint Air Defense Board (JADB), established by the Air Force Chief of Staff in early 1952 to coordinate procedures and doctrines between the services. The "joint" nature of the board is in some doubt because of the source of establishment of the board; Lieutenant General Lewis (former ARAACOM CG) later described JADB as ". . . entirely useless and a waste of personnel."[295] Interservice work of the board was complicated by the extent of control the Air Force had already assured itself in the air defense field. ADC reflected their own view of this control in some basic tenets of air defense organization they set forth in early 1953, the most pertinent of which is the following: "Air Division Commanders should have control of all air defense tools in his (sic) area which are necessary for the active air defense."[296] An Army historian stated this tenet as an accomplished fact when he said that: "Since the Collins-Vandenberg agreement, the United States Air Force had operational control of AA units."[297] At any rate, the Joint Air Defense Board came to be viewed as an unacceptable solution to the problem of coordination in light of this Air Force control.

Somewhat predating serious reconsideration of the JADB but impacting on it was President Truman's acceptance of a set of recommendations about air defense from the National Security Resources Board. By acceptance of the recommendations, Truman ". . . thereby ruled that a continental defense system capable of withstanding any eventuality should be ready for service by the end of 1955."[298] Although this was a requirement established by a President who was to be out of office within a month, it contributed in a general way to the revision of the JADB by its statement—new attention was being directed at air defense.

5. Post–Korean War Developments

Other events were also to impact on the JADB issue and the larger issue of joint command. President Eisenhower took office in January 1953, and during the same month (July) that the Korean armistice was signed ordered the JCS to take a fresh look at U.S. military capabilities.[299] Chairman of the JCS Radford and Air Force Chief of Staff Twining began considering better solutions to interservice air defense coordination than the JADB in August of that year as part of their response to the President's request, and determined that a CONUS air defense command should be placed directly under the JCS rather than the then-current arrangement.[300] On 20 August 1953, the Soviet Union successfully tested a hydrogen bomb; this development plus the emerging need seen at the highest decision-making levels for a new look at U.S. defense capabilities served as a backdrop for the emerging reorganizational activities. Although ADC and ARAACOM continued to develop internally, the overall organization for air defense was now a question to be resolved by higher authority within the context of a new overall strategy. In October, the Chairman of the JCS requested that the NSC issue fundamental guidance on U.S. strategy; the response was NSC-162,

[293] McMullen, op. cit., pp. 98–100.
[294] McMullen, op. cit., pp. 100–101.
[295] Barnard, p. 159.
[296] Sturm, p. 69.
[297] Barnard, p. 159.
[298] Futrell, p. 304.
[299] Futrell, op. cit., p. 380.
[300] Barnard, p. 159.

which recommended increased spending of about $1 billion per year on air defense. President Eisenhower approved this recommendation and sent it to Congress on 7 January 1954.[301]

Continued consideration was given to modifying the existing air defense organizational structure during January. The JCS tasked the Joint Strategic Plans Committee to prepare the Terms of Reference for a joint command to replace the JADB; its report, completed in March, suggested that Army, Navy, and ADC views be obtained on such a command.[302]

As might have been anticipated, ADC and ARAACOM disagreed over the composition and organization of a new joint command. LTG John Lewis, CG, ARAACOM, basically recommended a command similar to that which then existed, with "the Air Force component, as the executive agent of the JCS, preparing and submitting plans, requirements, doctrine and procedure. When AA units deployed to tactical positions ADC would exercise operational control."[303]

But General Lewis' position received little support. Instead, the recommendations of General Benjamin Chidlaw, CG, ADC, held sway; without repeating his argument, the ideas are reflected in the CONAD decision:

> On 2 August 1954, the services resolved their differences, and JCS established Continental Air Defense Command (CONAD) on 1 September 1954. The United States Air Force was the victor in the settlement of the dispute. ADC assumed the dual role of a joint command. Its echelons picked up added designations as joint headquarters. . . . Although representatives from the Army and Navy were on the joint staffs; [sic] commanders and key staff officers were Air Force officers. In a sole concession to General Lewis, component forces retained the status of operational control upon deployment, as opposed to the attached status advocated by General Chidlaw. . . . [304]

The handwriting was on the wall; the Air Force had won the roles and missions argument. USAF was designated the executive agency for CONAD by JCS; General Chidlaw became the first CINCONAD, with the Army and Navy CONAD component force commanders as his "advisors" on antiaircraft and Naval force employment matters, respectively.[305] The extent of service control over CONAD is thus clear. A look at the organization's charter illuminates the CONAD mission. The "terms of reference" established for CONAD with its creation (serving until revision in September 1956), set out the extent of CONAD's control through the end of the time period covered here. Briefly, "CONAD's operational control . . . [consisted of] . . . the authority to direct the tactical air battle, including engagement and disengagement of weapons and control of fighters; specify the conditions of alert; station the early warning elements; and locate and deploy the combat elements of the command in accordance with JCS-approved plans."[306]

CONAD, through USAF, was therefore in the driver's seat of CONUS air defense efforts.

Although by the end of 1955 ARAACOM's 79 weapons battalions outnumbered the interceptor squadrons of ADC (which continued to work toward attainment of the USAF-projected ADC strength of 69 squadrons for mid-1957, a net desired increase of 12 over those authorized by the end of 1954), it was clear that ARAACOM's numerical unit strength would not offset the predominant Air Force role which had been established with the creation of CONAD.[307]

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[301] Futrell, op. cit., p. 381.
[302] Sturm, pp. 85–86.
[303] Barnard, p. 160.
[304] Barnard, p. 162.
[305] Sturm, pp. 89–90.
[306] Air Defense: An Historical Analysis, Vol. III, p. 110.
[307] McMullen, op. cit., pp. 100–101.

6. Summary

Throughout the 1945–1955 period, organization for air defense was stimulated by a number of factors including response to threats and events external to the United States. Significant external stimuli included: Soviet and other communist actions in Eastern and Western Europe during the late 1940's; Soviet atomic capabilities as evidenced in their nuclear weapons tests; and, the impetus the Korean War gave to a build-up of U.S. military forces. However, the exact extent to which these events brought about modifications in the size of, and organization for, air defense is difficult to determine.

Air defense organization was also affected by AAF/AGF, and later USA/USAF competition for roles, missions, and operational control of air defense hardware. Within this context, ARAACOM was the product of Army disagreement with the extent of the USAF ADC's role in air defense. CONAD resulted from an ADC desire for complete control over air defense roles and missions.

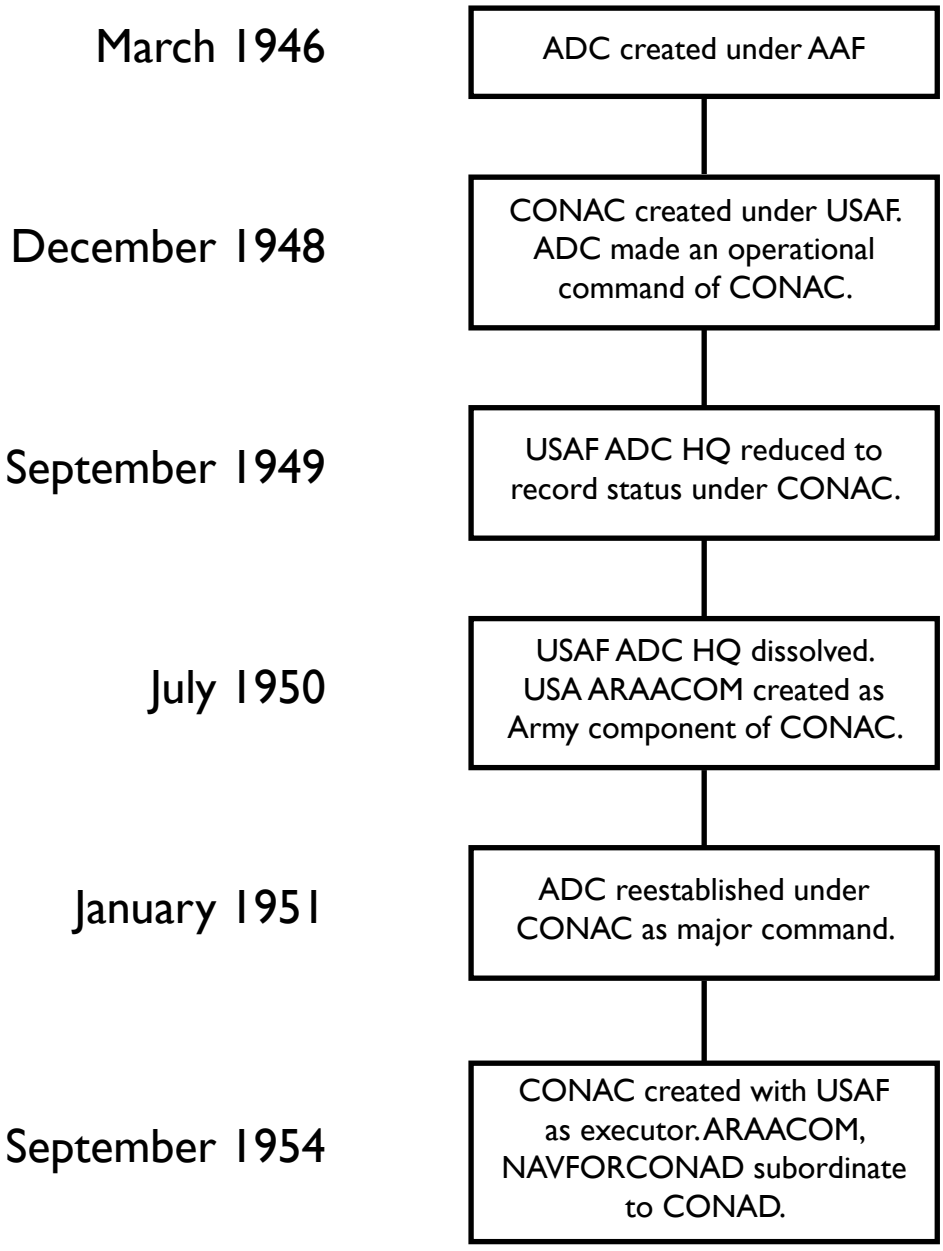
Command and control organizations were first constrained, and later assisted, by budgetary considerations. CONAC grew out of a budgetary austerity program under President Truman; ADC, ARAACOM, and later CONAD became flush with larger monetary allocations. The impact of the defense budget level on air defense efforts should not be underestimated, for it proved to be a more potent factor than external threats in determining the size of these efforts during the 1948–1950 period.

Finally, although it is guesswork to assess the efficiency of these air defense organizations in actually countering the then-existing threats, it does appear ironic that shortly after CONAD came into existence the first significant reference was made to the obsolescence of air defense because of the increasing sophistication of long-range missiles.[308]

The following chart (Figure 6) depicts major changes in U.S. organization for air defense in the 1945–1955 period.

[308] Murdock, pp. 34–35 on the November 1954 statement by Secretary of the Air Force Harold Talbott.

Figure 6—Major Changes in Air Defense Organization, 1945–1955



Chapter V

Soviet Systems

A. Introduction

From the Soviet perspective, "The development of antiaircraft defense after the Second World War may be divided into two periods: the first, from 1946–53, and the second, from 1954 to the present."[1] The break between the two periods is delimited by the formation of PVO (Strany) as a co-equal with other services of the Soviet armed forces in May of 1954. Coincidently, the 1953 date conforms to more general Soviet military histories, which acknowledge 1953 as the year of Stalin's death and the year in which the Soviet Union demonstrated its first thermonuclear weapon. A third stage seems also to be doctrinally accepted which acknowledges "the revolution in military affairs." This last phase is marked by the formation of the Rocket Forces as another service in 1960 and the adjustment of military doctrine to nuclear and missile weapons. Within these divisions, Soviet writers usually characterize the first period as one in which Soviet air forces were equipped with modern jet aircraft. The second period is generally characterized by the deployment of missiles for both ground and aviation air defense components. The third period might be characterized by attempts at ABM defense. In keeping with the Soviet view of the earliest period, this history will focus on the decisions involved in the process of aircraft modernization and the development of jet technology. Subsequent volumes will focus on surface-to-air missiles and Soviet ABM programs in turn.

Not only does the focus on jet aircraft accord with the Soviet view of early post war history, it also takes advantage of unique insights into the Soviet process of decision making. Aircraft designers and test-pilots occupy a special status among Soviet heroes. They write and they talk more freely about their activities than other segments of the society and they appear somewhat open about their activities with members of the aviation press—that is if a decent period (about 20 years) has passed to preclude possible disclosure of military secrets. In addition to the remembrances of key figures in the Soviet development community, there are also a number of defectors who round out the picture of Soviet aviation, particularly in the areas of applied research and aircraft production. Thus, in retrospect, a fair picture emerges as to how decisions were made with regard to aviation in the late Stalinist period; it is a picture which is substantially corroborated by intelligence of the period and by more recent Soviet official documents.

From the standpoint of historiography, the focus on aircraft developers and development decisions may be dangerous. It may distort conclusions drawn with the benefit of a wider focus. This potential bias is acknowledged, but discounted, for several reasons:

(1) The personal role of Stalin in military decisions, particularly aviation matters
(2) The purge and politicization of air force leadership in 1946

[1] Dzhordzhadze, "The Role of Historical Experience," p. 41.

(3) The subordination of the air forces to ground forces requirements and leadership
(4) The continuing pattern of political domination of the military establishment and military force structure decisions which persisted after the death of Stalin
(5) The exclusion of members of the military and political leadership from weapons decisions made among Stalin and his principal advisors.

These factors lend credence to the picture of Soviet decision makers portrayed in the following materials. A further, and compelling, reason is that few data exist to develop alternate foci. Therefore, the following materials approach aviation decisions through the designers and include additional data which broaden the perspective.

Rather than detail what strategic defense forces developed, or how, the intent is to ask "why?" It is the contention here that design activities provided a menu of weapons from which a number were chosen for production and deployment. It is in this context, that one gains a grasp of "why?"

By extension, understandings gained from a study of aviation decisions can be applied to developments in the realm of antiaircraft artillery, surface-to-air missiles, and radar systems. In two major respects, however, decisions related to complementary defensive systems differ. First, it seems they did not involve Stalin as frequently. Second, they took place in a framework where domestic institutions were less well developed and where reliance on foreign technology was higher. This chapter thus discusses the observable developments within these other categories of systems. It closes with a discussion of civil defense developments to complete an overall appreciation of the strategic defense effort.

B. History of Fighter Aircraft of PVO

1. Pre-War Experience

Patterns of organization, institutional behavior, and decision making in Soviet aviation derive from the pre-WWII formation of the Peoples Commissariat for Aviation Industry and from the emergence during the late 1930's of a group of young and competent designers who since have been sustained in their independent development activities. The industry was *highly competitive* in the process of designing alternative prototype aircraft, *political* in the allocation of resources and *centralized* in the exchange of information.[2] It became an establishment in which the designers played a key role protected by a ministerial-level institution along with key producer industries. Within this establishment, the user organization, the air forces, did not necessarily have the predominant voice.

The character of the Soviet aviation industry was much influenced by the purges of scientists and engineers during 1927–1929. In effect, these purges, which culminated in the Industrial Party (Promparty) Trial of 1930, virtually wiped out the entire technician class of that generation.[3] The principal designers of the thirties—Nikolai Polikarpov, in fighters, and Andrei Tupolev, in bombers—fell into disfavor in 1929 and Polikarpov was imprisoned for industrial sabotage or "wrecking."[4] During this period, the Central Design Bureau was organized under the State Political Administration (GPU or Secret Police). Among its facilities was the "Seventh Hangar" organized under the "internal prison" (Vnutrennaya Turma), where Polikarpov

[2] See Institute for Research in Social Science, and Alexander R&D for detailed description.
[3] Solzhenitsyn, pp. 377–399. Of approximately 30–40,000 engineers in the U.S.S.R., Solzhenitsyn estimates that 5,000 were arrested (p. 387).
[4] "Prolific Pioneer," Flying Review International, July 1968, p. 405.

and other aviation notables lived and worked under heavy guard.[5] During that period, Alexander Yakovlev, Sergie Iluyshin, and probably Artem Mikoyan received their training in this same Central Design Bureau Complex. In 1933, after the successful flight of his I-5 prototype, Polikarpov was released. By 1934, it was Tupolev's turn. He received a ten-year sentence for sale of military secrets to Germany, but worked his way out after two years with the design of the gargantuan eight-engine "Maxim Gorky" propaganda and passenger craft.[6] He was returned to prison on two later occasions in 1937 and in 1940.[7] In 1937, another name in Soviet aviation gained prominence—that of Semyon Lavochkin. The design of the LAGG-I and the team of Lavochkin, Gorbunov, and Gudkov emerged, again from prison.[8]

a. Structure of the Aviation Industry

Four basic functions were organized under the Commissariat and the Ministry of Aviation which succeeded it. They were and (in 1975) still remain:

(1) Basic Research
(2) Prototype Design
(3) Testing and
(4) Production.

Basic research is conducted within the Central Aerohydrodynamics Institute (TsAGI) for airframe problems and within the Central Institute of Aviation Motor Building (TsIAM), the All Union Institute of Aviation Materials (VIAM), and the Scientific Institute for Aviation Equipment for related subjects. Design activities are the province of the Central Design Bureau (TsKB) and of semi-autonomous Experimental Design Bureaus (OKBs) which operate under it in the fields of airframes, engines, and armament. Testing is conducted by centralized testing establishments, most notably the Flight Test Institute (LII) and the Scientific Testing Institute of the air forces (NIIVVS). Production is organized among individual factories responsible to the Ministry.[9]

b. Elites

Within Soviet air forces, there are two parallel series of ranks; one for the operational side and another for the technical. The operational ranks range up to Chief Marshal, but the engineering ranks stop at the next-lower Colonel-General rank. Notably, only Army officers are eligible for the highest rank, Marshal of the Soviet Union. This, however, does not indicate that officers of the Aviation Engineering Services carry less weight; quite to the contrary:

> It is more difficult to obtain an engineering rank than an executive one, as the prefix "engineer" is only given to those who have received the highest technical air education, and is usually reserved for those who have passed through the Zhukovski Military Engineering Academy. Exceptions are occasionally made for distinguished inventors. In the schools and experimental stations of the Soviet Air Forces, the technical side outranks the non-technical. For example, an Engineer-Major may even hold a post which would normally be filled by a non-technical Major-General.[10]

[5] Ibid. and Yakovlev, *Target*, p. 84.
[6] "Chief U.S.S.R. Aircraft Designer," *Air Intelligence Digest*, Jan. 1950, p. 16 CONF.
[7] "Soviet Big Five Aircraft Designers," *Air Intelligence Digest*, Feb. 1954, p. 32 CONF.
[8] "Lavochkin" *Air Intelligence Digest*, Mar. 1950, p. 36.
[9] Institute for Research in Social Science, and Alexander, *R&D*.
[10] Tokaev, *Soviet Imperialism*, p. 42.

The Zhukovski Academy is a centralized post-graduate institution devoted to aviation studies (and Marxist-Leninism of course). Its students and graduates are distinguished by special pay, privileges, social access, uniforms, and bearing. Its senior staff members frequently enjoy direct access to the Politbureau and some relief from political imperatives which are imposed on the remainder of the Soviet population. Alumni of the academy share a "scientific" ethic and generally recognize each other on the basis of individual competence. ". . . We are therefore school-mates. A strong comradely friendship binds us. We frequently consult with each other and help each other solve complicated problems."[11] Among names frequently mentioned in this study, Yakovlev, Mikoyan, Iluyshin, Lavochkin, and Tokaev were Zhukovski graduates. Tupolev, Polikarpov, Klimov, and Yakovlev were at one time staff members. Those who do not fare as well, Sukhoi, for example, appear to be graduates of other technical institutes.

The ethic which binds the technical elite extends, in part, to their subordinates. The open literature contains several examples of direct appeals as high as Stalin[12] for review of sentences on behalf of technical staff and of confrontations with political officers to allow individuals to continue with competent work with less interference.[13] This "backing up" of personnel may explain the strength and loyalty of design teams.[14]

c. Design Competition

The tradition of design competition evolved during the 1930's as a number of designers began working independently of the major institutes. In 1936, a requirement was issued for a light multipurpose fighter. Four designers responded with development programs. Later that same year, the specification was revised to favor the light bomber role and a Sukhoi prototype (the Su-2), developed independently of his mentor Tupolev, was accepted.[15]

The epitome of design competition was that held in late 1939. Over 20 designers were given assignments to provide prototypes against two or three basic requirements. A fairly detailed account of that competition is resorted to because it is prologue to the decision patterns and criteria that prevailed until Stalin's death in 1953.

The competition derived from a conference in the Oval Hall of the Kremlin. Among those present were "all who had proved themselves to be aviation designers or inventors and who had in recent years made some contribution to aviation."[16] The meeting was presided over by Stalin, V. M. Molotov (Premier), and K. Y. Voroshilov (Minister of Defense), with Molotov moderating. What ensued was a general review of the status of Soviet aviation and a debate over the utility of four-engined bombers. Subsequently 20–25 engine and airframe designers were again called to the Kremlin for personal interviews before a panel of Stalin, M. M. Kaganovich (Commissar for Aviation), Molotov, Voroshilov, F. A. Agal'Tsov (Assistant Director of the Air Force), and another member of the Politburo.[17]

Among Yakovlev's recollection of his interview is the following dialogue:

[11] Yakovlev, *Target*, p. 416.
[12] Ibid. p. 420.
[13] Takaev, *Comrade X*, pp. 112–115.
[14] "Tupolev," *Air Intelligence Digest*, Jan. 1950, p. 15.
[15] Nemecek, Feb. 1966, p. 373.
[16] Yakovlev, *Target*, p. 163.
[17] Ibid.

> [Stalin] ". . . Are you aware that we have ordered this kind of fighter from several other designers, and the winner will be the one who not only gives the best fighter in terms of flight and combat qualities but also delivers first, so that we can get it into series production sooner?"
>
> [Yakovlev] "I understand, Comrade Stalin."
>
> [Stalin] "It's not important if you understand. You've got to produce it sooner."
>
> [Yakovlev] "What time limit?" [the key question!]
>
> [Stalin] "The sooner the better. By New Year's?"
>
> [Stalin] "We ourselves are very much aware that we don't need that many planes. But, the good Lord willing, out of all these we'll get five or six that can be put into series production. And that many new aircraft won't confuse us."[18]

Yakovlev states that he left the meeting "inspired with the spirit of creative competition and with unwavering intentions of beating our rivals."[19] Eleven other designers were competing against the same requirement, but Yakovlev produced before his counterparts—by the New Year's deadline. The first three available prototypes (YAK-1, MiG-3, LAGG-3) were committed to production before testing was completed. On January 9, 1940, Yakovlev was appointed by Stalin to be Assistant Commissar for Aviation Industry at age 35.[20]

Several points are illustrated by this vignette which characterize subsequent aviation decisions during the Stalinist era. The points are underscored because they represent a pattern repeated in post war decisions:

(1) The dominant role and personal involvement of Stalin
(2) The weight of *political* and *technical* representation in the process as opposed to the one representative of the air forces general staff
(3) The importance of the design community in the process
(4) The official encouragement of the competition concept
(5) Compressed lead times and the importance of arbitrary and seldomly explicit dates
(6) The rewards, both in terms of production commitment and of other honors, which attend the design of the first prototypes fielded (reinforced by the negative rewards of Hanger Seven)
(7) The continuity of the key figures in the decision pattern. Yakovlev remained Assistant Commissioner until 1948, and the competing bureaus are, for the most part, still active.

d. Information Flows

Among Yakovlev's innovations in 1940 were the design handbooks and reorientation of the TsAGI. The design handbooks amounted to a standardization program for the aviation development community. The multiplication of independent design activities necessitated a common code of procedures. An initial version was produced in 1940. The second edition which appeared after the Soviets entered WWII consisted of 11 parts:

(1) Aerodynamics
(2) Hydromechanics
(3) Strength of materials
(4) Flight tests of aircraft and equipment
(5) Engines
(6) Aircraft equipment

[18] Ibid., p. 165.
[19] Ibid., p. 166.
[20] Ibid., p. 169.

(7) Aircraft armament
(8) Landing gear and mechanisms
(9) Standard systems
(10) Materials
(11) Semiproducts[21]

Among contributors to the handbooks were the foremost Soviet authorities on aviation science and design with a leavening of test pilots. The second edition was intended to incorporate construction and combat experience gained from the immediate pre-war generation of fighters. The design handbooks became a virtual encyclopedia of Soviet aviation and the principal means of communicating research results to the practical engineering level. They also provided a medium for reconciling conflicting perspectives of the military, scientists, engineers, production specialists, and maintenance people. The handbooks are a feature of Soviet aviation today and are thought to be a principal source of continuity and conservation in Soviet aviation technology.[22]

e. Use of Foreign Technology

In its early years, the Soviet aviation establishment relied heavily on foreign technology, but with the express aim of freeing itself from dependence on such assistance as soon as possible. Before 1925, Italy, France, England, and the Netherlands had supplied the Soviet Union with most of her planes and as late as that year a German-directed Junkers Company produced 500 aircraft in Russia.[23] Independent Soviet airframe designs began to emerge during the mid-1930's with independent engine designs emerging somewhat later. Purchases of foreign aircraft were not completely stopped and a concentrated effort to obtain U.S. technology followed the resumption of U.S.S.R./U.S. relations in 1933. As late as 1936, U.S. aircraft were purchased under license.[24]

During the pre-war period, a diversified program to exploit foreign technology accompanied the reorganization of design activities. Emphasis was placed on legitimate procurement of equipment and information, along with official visits and student exchanges. Generally, material was open for sale one year after it began production.[25]

During the war, the United States and Britain sent about 18,000 aircraft to Russia. These are compared by the Soviets to approximately 126,000 Soviet-produced craft to demonstrate that "the Soviet Union fought with its own strength."[26] It is the opinion of Robert Kilmarx that of these thousands of these lend-lease craft were held back to conserve them for use during the later period of transition to jet aircraft.[27] According to General John R. Dean, head of a U.S. military mission to the U.S.S.R., "we never lost an opportunity to give the Russians equipment, weapons, or information which we thought might help our combined war effort."[28]

The overt Soviet effort was supplemented by covert and grey activities. Toward the end of the war, the Soviet Purchasing Commission in Washington numbered over 1,000 people and high priority was given to

[21] Yakovlev, *50 Years*, p. 40.
[22] Alexander, *R&D*, pp. 15–16. Declining influence of the handbooks is discussed in Alexander, 1973 Trip Report, p. 9.
[23] Institute for Research in Social Science, pp. 58–59.
[24] Ibid.
[25] Kilmarx, pp. 165–166.
[26] Yakovlev, *50 Years*, p. 97.
[27] Kilmarx, p. 208.
[28] Ibid.

collection of information on jet aircraft. An effort to obtain information on America's first jet (the P-59) and on General Electric and Westinghouse jet engine developments is well documented.[29] Andrei Schevchenko, a legal representative to Bell Aircraft and later of Amtorg who engaged in espionage, reportedly mentioned a Lenin prize of 500,000 rubles for a jet aircraft design by the end of 1945.[30] Another report of the 1945 deadline is attributed to a Russian in this country.[31]

2. Performance of Soviet Aviation During WWII

In its simplest, the story of Soviet Air Forces during WWII is one of initial debacle and remarkable recovery aided by the overextension of German power. Despite the massive destruction of Soviet aircraft in June of 1941, a credible local defense began to be marshaled around Moscow in that same autumn. The winter-enforced lull in the air war, coupled with increasing numbers of new Soviet fighters, changed the momentum of the air battle. Stalingrad appears to have been the turning point where German aviation operated with impunity during the early stages of the siege, but suffered increasing losses as the campaign wore on. German losses exceeded resupply, while the Soviets were rapidly increasing their air forces based on industrial capacity, recovering from relocation to the east of the Urals.

In January of 1943 USAAF daylight raids combined with RAF night attacks on Germany to force the build-up of Luftwaffe homeland defenses at the expense of forces supporting the Eastern Front. As this homeland air front began to absorb over half of Germany's air resources, the balance shifted overwhelmingly in favor of the Soviets. By late 1943, a Soviet force of from 12,000 to 15,000 thoroughly modern aircraft faced a German Eastern Front air strength of from 2,000 to 3,000. During the Kuban and the Kursk-Orel campaigns in the summer of 1943, Germany did mass to contest the air, but at heavy cost in aircraft and crews. The Soviets could absorb losses; the Germans could not. Thereafter, local Luftwaffe commanders came to regard unfavorable odds of 12:1 as routine.[32]

a. Lessons Learned—Fighter Aviation

Despite Western historians who credit Soviet successes to improved airbase attack, the following emerged in 1949 as doctrine distilled from WWII experience. It relates to the relevance of fighter combat as opposed to other techniques of air defense or air superiority[33]:

(1) The experience of the past war showed that fighter aviation is the decisive factor in the struggle for air superiority. It also showed that the outcome depends mainly on air combat, which is the most effective way of destroying enemy aircraft.

(2) The experience of the war undermined the theory of German-fascist military circles about destroying an enemy air force by lightning war consisting mainly of strikes against enemy air bases.

(3) It also undermined the theories of Anglo-American military circles about gaining air superiority through air strikes at the military economy of the enemy, especially against his aircraft industry, his fuel reserves and his air training establishments. (Concentrated actions against the centers of the enemy's aircraft industry are certainly useful in gaining air superiority and they can hasten the

[29] Hearings, Un-American Activities, Jet Propulsion, p. 121.
[30] Ibid., p. 120.
[31] Ibid., p. 121.
[32] Lee, 1959, p. 70.
[33] Volkov, Col. A., "Fighter Aviation in Contemporary War," Voennaya, Mysl', Feb. 1949, pp. 55–69. From extracts. Note that a separate doctrine of "Air Defense Operations" was emerging among PVO troops during this period. See above Chapter V.

defeat of the enemy air force, but this can be only a supplementary means of winning air superiority. The main method must be destruction of enemy aircraft in the air and on air bases.)

(4) The struggle for air superiority and with it the main efforts of fighter aviation should be centered primarily about the ground effort. The reason for this is that only by means of ground action can the strategic aims of the war be attained. No independent air action can achieve results equal in importance to those air actions carried out in the interest of the success of the overall effort. In this context, air combat becomes as a rule extremely savage and calls for the greatest pressure and energy. Both belligerents can expect to suffer heavy losses as new air reserves are brought into action in the effort to secure freedom of action for the ground forces.[34]

From the contemporary U.S. perspective of "strategic," these lessons appear to relate to "theater" applications. However, from the Soviet experience, the Wehrmacht was Germany's strategic instrument. From the Soviet view:

> . . . Soviet military science considers that the outcome of war under contemporary conditions is decided on the field of battle by means of the annihilation of the armed forces of the enemy and that one of the most important tasks of aviation is active assistance to the ground and naval forces in all forms of their combat activity. This definition of the fundamental mission of aviation is not contradicted by the need to employ part of its forces to strike the deep rear of the enemy, or his military-industrial targets, but our military science does not consider such blows an end in themselves, but only a helpful means of creating favorable conditions for the success of the combat operations of the ground and naval forces. The structure of our military air forces is established on the basis of the scientific definition of the role and significance of aviation in contemporary war.[35]

In the context of early post war decisions these doctrinal statements are interesting in that they obscure the difference between frontal and defense aviation. The perception of an integrated air superiority mission epitomized by fighter-versus-fighter battles simplified potentially conflicting priorities by way of establishing a single set of interceptor requirements. Such a perception was not without foundation until 1957 when SAC released its fighter wings to the Tactical Air Command; U.S. B-36 doctrine called for fighter escort.[36]

b. Lessons Learned—Institutional

Beside the sanctification of fighters as the primary instrument of air power, the WWII experience confirmed the "correctness" of institutional arrangements in Soviet aviation. During the war years the Soviets produced 126,000 to 157,000 aircraft[37] of a quality comparable to those operational anywhere in the world—the German jets excepted. The Soviet perception was that "Our aircraft surpassed the enemy's in both quality and quantities."[38] While this perception of Yakovlev was self-serving since he was then Deputy Commissar for Aviation Industry, it is nevertheless important because he continued in that position through the period of significant postwar decisions. Moreover, it soon became a test of loyalty among the Soviet population at large to put down everything that was foreign and to proclaim the superiority of Soviet technology.[39]

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[34] Nikitin, Col. Gen. of Avn. A., "Soviet Aviation," Voennaya Mysl', Feb. 1949, p. 62. Quoted in Garthoff, p. 173–174. An early post war attempt to define a strategic doctrine more in line with Douhet's theories was unsuccessful. (Ibid., p. 172.) This does not deny that an extremely high priority was given to long range developments which would lead to an intercontinental "strategic" weapon. See Tokaev, Stalin Means War, pp. 91–121.

[35] 85th Cong. 1st Sess. DoD Appropriation for 1958, HR, Hearings, pp. 917–918. Quoted in Futrell, Ideas, Concepts Doctrine, p. 465.

[36] From Soviet figures, Yakovlev, 50 Years, p. 97. These figures are slightly conservative when compared with U.S. intelligence estimates circa 1949. The range is accounted for by the addition of Jan.–June 1941 (pre-war) production to the lower figure.

[37] Yakovlev, *Target*, p. 286.

[38] Tokaev, *Stalin Means War*, pp. 107–108.

[39] Lee, 1959, pp. 143–144.

The perception of design and industrial success on the part of the Soviets was appropriate in many regards. From the design standpoint, Asher Lee summarizes a widely held respect for the machines that were produced after 1943:

> . . . Their own YAK, MiG and LAGG fighters were more than equal in performance to the British Hurricanes and American Aerocobras and Kittyhawks—even the improved versions which they were getting in hundreds every month under Lend-lease. Indeed, the technical gap between the German and Soviet single-engined fighters had virtually closed by the end of 1943. French pilots who have flown the YAK, the Spitfire and the Messerschmitt 109 declare that the Soviet plane was the equal of its German and British counterparts. . . . [40]

From the production standpoint, the Soviet perception of success also is justifiable when compared with the production of its enemy. By 1944, Soviet monthly aircraft production was running ahead of the German industry. Despite the fact that over half of the Soviet aviation industry was relocated in 1941, production recovered within the year. In 1944, the last full year of the war, Soviet production reached 40,300 and German production was 40,953.[41] (No less remarkable than the Soviet recovery, however, was the German success at maintaining such a production rate in spite of allied air attack by dispersed use of underground facilities and other expedients.) The Soviet 1944 monthly production rate of 3,300 compares with a peak wartime U.S. rate of 7,100 although such comparisons ignore the large proportion of bombers in U.S. production which would reflect on an alternate measure of airframe weight. Despite qualifications, the perspective of institutional success appears justified. The Soviet aviation establishment had fielded a force roughly equivalent to that of its primary enemy; on the other hand, that enemy had other battles to fight. On the Eastern Front the Soviets had a rough 6 to 1 numerical superiority toward the end of the war.[42]

c. Lessons Learned—Design

A primary effect of the war was to emphasize the producibility of Soviet designs and modifications:

> The designer cannot forget for an instant that any improvement, no matter how necessary for increasing the quality of a piece of armament, must be introduced only with the consideration that it be reflected minimally in fulfillment of quotas. Therefore, the designers were in closest contact with the series production plants. Prior to introducing any innovation into an existing piece of armament, they had to anticipate in their own minds in minute detail what difficulties this improvement might entail in the mechanical processes. The designers had to effect their changes in such a way that they might be put into series with only a minimal loss in the daily output quota of aircraft sent to the front. This was an extremely difficult task, especially difficult when a new type of aircraft entered into series production. Under war-time conditions, the designer must also consider this fact in developing a new aircraft and his new product must make maximum use of existing technology in a given series factory.[43]

Another basic lesson was that of a relation between simplicity and utility in combat. Simplicity affected predictability but it also affected how fast weapons were available at the front. To train for the use of simple weapons was easy.[44]

The over-riding lesson was the necessity for technical capability. "To the designer, war is a difficult school. However, the lessons he learns stay with him throughout his life and serve as the motto: 'Be ahead!'"[45]

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[40] Kilmarx, p. 318.
[41] Lee, 1959, pp. 69–74, passim.
[42] Yakovlev, *Target*, p. 337.
[43] Ibid., p. 357.
[44] Ibid., p. 358.
[45] Ibid., p. 357.

d. The Commitment to Jet Interceptors

The Soviet aviation establishment was left in an uncomfortable position during later stages of the war. Work on advanced designs was discouraged in order not to divert resources from the production effort.[46] However, as Soviet forces penetrated Eastern Europe, the aviation community became aware of the array of weapons its enemy had in prototype and on the drawing boards. In late 1944, Soviet forces captured a quantity of Junkers JuMO-004 and BMW-003A jet engines and a number of these were provided to Soviet designers for experimentation.[47] Later when the German plants were occupied, they were returned to production as Soviet plants tooled up to produce the engines also. About the same time, a program was initiated to copy U.S. B-29 bombers, four of which began to fly into Soviet hands in August of 1944.[48] In November of 1944 with these precedents, a special committee under the Council of People Commissars, headed by Malenkov, was created to oversee the exploitation of the German economy.[49] This appears to have coincided with the focusing of intelligence collection efforts on U.S. jet designs.[50]

It was not until 1945 that a jet aircraft design effort was given official sanction by Stalin. The date may have been either in February[51] or in May when, with the German surrender, aircraft production was sharply curtailed.[52] In June, a party of about ten senior officers was dispatched to Berlin to organize the exploitation of German aeronautical science. By August 15, a Soviet program was initiated for flight testing the German Me262 jet. Meanwhile, during the autumn of 1945, the Aviation Commissariat had developed a detailed review of the "dangerous situation" in advanced technology and design.[53]

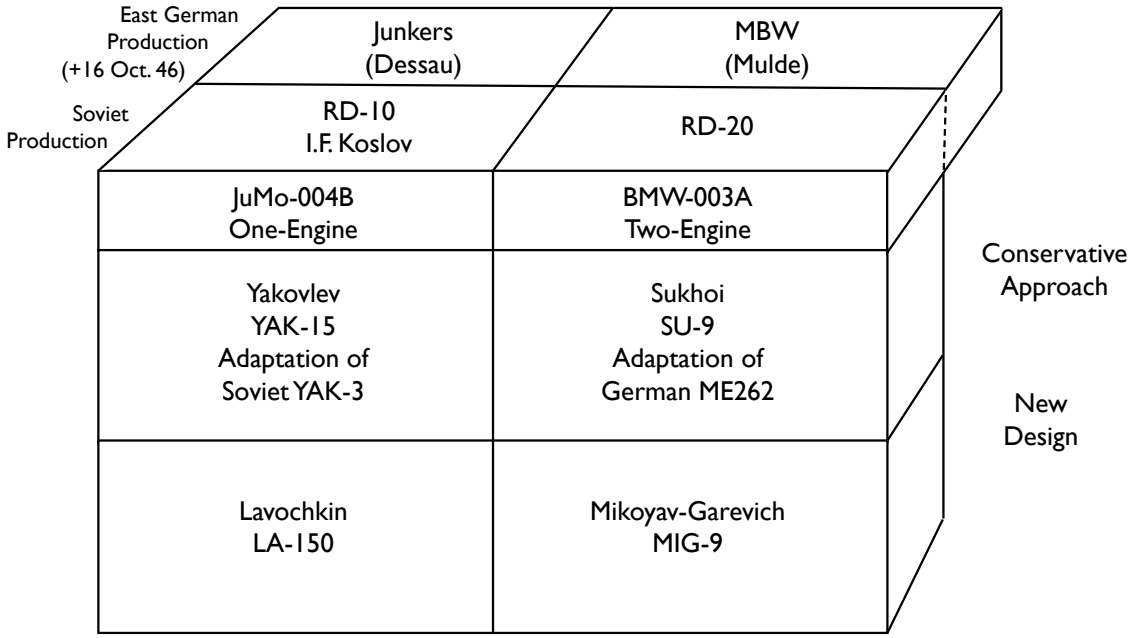
Among proposals surfaced in conjunction with the Commissariat review was one to commit the Me262 to production. During the presentation of the Commissariat's proposals to Stalin, however, Me262 production was opposed by Yakovlev on the basis that the aircraft was unstable and unsafe, that such production would divert resources from native designs and that more advanced prototype would soon be forthcoming from both his own and the Mikoyan-Gurevich design teams.[54] The proposal was rejected and a tentative deadline, the August 46 Tushino air show, was set for the new prototypes. Detailed project designs were approved for Lavochkin, Mikoyan, Sukhoi, and Yakovlev at about the same time. Concurrently, the Commissariat was reorganized as the Ministry of Aviation Industry and M.S. Krunichev was appointed as Minister replacing Kuznetsov. The name and the appointment accompanied a general realignment of Defense Ministries. Nonetheless, it would be Krunishev's responsibility to give concrete form to the Party commitments.

In all, four designer teams were involved in building fighter prototypes around the captured Junkers and BMW jet engines. Those which received the more powerful Junkers engines of 2,000 lbs. thrust, Yakovlev and Lavochkin, focused on a single engine design. Those which received the 1,800 pounds of thrust BMW engines, Sukhoi and the Mikoyan/Gurevich team, would focus on a two-engine design. Within both the single- and double-engine approaches, divergence emerged as to the conservatism of

[46] Lee, 1959, pp. 231–232.
[47] Green, "Billion Dollar Bomber," July 1971, p. 105.
[48] Kilmarx, p. 213.
[49] Hearings, Jet Propulsion, p. 121.
[50] Air International, "First of Many," p. 233.
[51] Yakovlev, *Target*, p. 362.
[52] Ibid., p. 363.
[53] Yakovlev, *50 Years*, p. 102, and *Target*, pp. 363–364.
[54] Air International, "First of Many," p. 233.

design. On the single-engine side, Yakovlev took the more conservative approach of fitting the new engine to an established airframe—that of the YAK-3 fighter. Meanwhile, the Lavochkin team committed itself to a new design. Among the two-engine competitors a like phenomenon was observed. The Sukhoi design focused on a refinement of the general concepts of the Me262 while the Mikoyan-Gurevich collective attempted a new design. Meanwhile, the aircraft engine establishment attempted to bring both the engine types into series production—the Jumo as the RD10 and the BMW as the RD20. Although the intention does not appear to have been documented, the program decisions for a successful jet were well hedged. Should either engine prove unworkable, an alternative was available. Should either the MiG or the Lavochkin designs fail, a more conservative back-up design was in progress using either engine. Should either domestic engine program fail, East German factories were kept in operation. A matrix of this hedging effect appears in Figure 7. Predictably, Yakovlev's re-engined version of the established conventional aircraft was the first of the four ready for testing in October of 1945. Not predictably, all four prototypes were basically successful.

Figure 7—Hedging Effect of Initial Jet Prototype Design Decisions



The claims about which Soviet jet aircraft was first to fly are[55] in dispute. Supposedly it was settled by the toss of a coin. Full flight of Yakovlev's aircraft had been delayed pending wind tunnel tests during the winter of 1945, while airfield conditions delayed both Yakovlev and Mikoyan until April 24, 1946.[56] With the coin toss, Mikoyan's air craft flew first and Yakovlev's followed. Both aircraft were supposedly demonstrated at the Tushino show on August 19, although only the MiG-9 was reported by USAF intelligence. The Su-9 flew in August and the La150 in September.

[55] Yakovlev, *Target*, p. 365.
[56] Ibid., p. 371.

3. Post–World War II Developments

a. The Ministry of Aviation Production Plan

In December of 1945 the status of Soviet aviation had come under debate in the Party Central Committee. The Aviation Commissariat proposals debated at that time culminated in a comprehensive program to eliminate any lag in the field of aircraft design or research. In March of 1946 a party of senior aviation personalities, Yakovlev among them, visited Germany to assess first-hand what could be obtained there. By April 2, a long-range plan for the development of jet fighters was laid before Stalin.[57]

The strategy for post war development of jet fighters was based on the rapid achievement of superior jet engine capability. Although the Soviets had some background in jet turbine design dating back to 1937, the work of its most experienced jet technician, Arkhip Lyulka, had been interrupted during the war. After working on an unheralded rocket aircraft project, Lyulka returned in 1942 to jet turbine work. By the end of the war he was bench testing an experimental engine of 1,543 pounds thrust and had initiated work on a 2,866 pounds thrust engine intended for flight testing.[58] It was apparent, however, that these engines were behind the world standard and would require extensive development while German engines were already available. The Commissariat plan would allow attention to be given to advanced engine design while native designed aircraft would be based on engines of foreign derivation. Key to the strategy was the purchase of British Rolls Royce centrifugal compressor engines—the Nene and the Derwent. In reacting to this strategy, Stalin is said to have remarked, "Just what kind of fool would sell his own secrets!"[59] Nevertheless, the Russians had had considerable experience with the British unclassified lists during the war and were aware that licenses for production of these engines were being sold in a number of countries. The successful attempt to purchase these engines would proceed.

The 1946 Plan addressed three stages of engine development with associated design activities[60]:

(1) Transitional aircraft based on 1,800–2,000 pounds thrust German engines. This stage was nearing fruition as the YAK-15 and MiG-9 were already in preliminary testing.
(2) Combat capability based on British Nene and Derwent engines of 3,500–4,850 pounds thrust. A requirement for such aircraft would emerge concurrently with the plan.[61] All four fighter design teams would submit prototypes which evolved to the MiG-15, the YAK-23, Su-II, and the La-15.
(3) Advanced aircraft based on engines by Klimov, Mikhulin, and Lyulka in the range of 6,600–17,600 pounds thrust. It was planned that these would be available in 5 to 6 years. Eventually, the Klimov VK-1 would power the MiG-15 bis, and the MiG-17; the Mikhulin AM-5 would drive the MiG-19 and YAK-25; the Lyulka AL-7 eventually powered the Su-9 and Su-11 of the late fifties.

The 1946 plan coupled with the December 1945 commitment of resources by the Central Committee would allow the Soviets to achieve superiority in jet engine technology in the early 1950's.[62] It facilitated early emphasis on advanced technology by leap-frogging intermediate stages of development with adapta-

[57] Air Enthusiast, "Lyulka," pp. 297–298.
[58] Yakovlev, *Target*, p. 372.
[59] Ibid., and Yakovlev, *50 Years*, p. 103.
[60] Flying Review International, "Mikoyan Quarter Century," Nov. 1965, p. 159.
[61] A regression analysis of Soviet and U.S. jet engine characteristics, conducted by RAND, concludes that Soviet jet engine technology led U.S. technology until roughly 1950–1953 depending on whether U.S. or Soviet forecasting equations were used. See Alexander and Perry, 1972, pp. 30–32.
[62] U.S. evolution from British technology is described Ibid., pp. 11–19.

tions of foreign designs. In effect, the Soviets would be mastering British jet technology almost concurrently with the United States.[63] In the meantime, native airframe designs would continue on a par with those of other countries. One consequence of the resulting engine allocations, however, was that available power may have prejudiced the success of early prototypes in the program. It appears that early success may have prejudiced later success.

b. The Debate Over Use of German Technicians

Among issues addressed in conjunction with the April plan was the question of how to use German personnel:

> During the meeting the question arose relative to the possibility of using German specialists who were working in East Germany in aircraft factories. Khrunichev and I expressed doubts of the wisdom of such steps. We felt it unwise to expose our newest research institute secrets. However, with a wide-spread research experimentation at the base of our Soviet institutes, the activities of the German specialist would be fruitless. They would be able to create nothing.
>
> However, this consideration was paid no heed. I was looked upon not so much as Assistant Minister as a designer and it was obviously assumed that in fearing competition from German scientists and designers, I might not be sufficiently objective on this question.
>
> As is well known, German specialists arrived in the Soviet Union, but attempt to use them were unsuccessful, although costing a great deal.[64]

During the summer of 1946, Germans who had been working with the Soviets were transported to the U.S.S.R. in a well-coordinated surprise movement. On October 21, 1946, dozens of trains in one night moved some 40,000 Germans under a five-year "contract" to various Soviet locations. Some 3,000 of these were aviation specialists.[65] The program was not without difficulties, however, as a conversation five months later between Col. G. A. Tokoev and Stalin discloses:

> " . . . we certainly need more German specialists. There are a great many who are being wasted at present, through being given completely unsuitable jobs."
>
> "But why should that be. Why can't you rope in all the Germans you need?"
>
> "Principally because the Germans fear to enter our service more than anything, Comrade Stalin," I answered. "Since German specialists were removed wholesale to the U.S.S.R. in 1946, whether they wanted to go or not, the whole population are afraid of us. And some of our own officials, for their part, are prejudiced against employing Germans. For instance, Doctor Kurt Tank, who was chief designer during the war for the firm of Focke Wulf, offered of his own free will to join us. He was turned down by General Kutsevalov, and General Lukin, on the grounds that he had been a member of the Nazi party."
>
> "And what are your own feelings on that point?"
>
> "I don't agree with the Comrades concerned."
>
> "Where is Tank now?"[66]

What ensued was a comic-opera effort to kidnap Tank, involving the Dictator's son Vassily Stalin, and the then Deputy Chief of the KGB Ivan Serov. Added to this duo, the main task of which was to pursue the exploitation of remaining German aviation talent, was the same General Lukin who had a notorious reputation among Germans for the pillaging and deportation of their aviation industry and technicians in the

[63] Yakovlev, *Target*, p. 371.
[64] Stockwell, pp. 42–45, from German press accounts.
[65] Tokaev, *Stalin Means War*, p. 116.
[66] Tokaev, *Comrade X*, p. 316.

previous year.[67] Notably, serious efforts to improve voluntary cooperation were lacking. Tokaev, the senior Soviet technical advisor on aviation matters in Berlin, by his admission, discouraged a member of potential collaborators by his honest portrayal of the reality of their service.[68] The upshot of the story is that Tokaev defected and Kurt Tank eventually designed jet aircraft for the Peron government in Argentina.

The same General Lukin (by Tokaev's account)[69] and Vasily Stalin (by Solzenitzn's account)[70] were the source of denunciations which eliminated the top echelon of the post war Soviet air forces. In March 1946 the Commander-in-Chief of Soviet air forces Chief Marshal of Aviation Alexander Novikov was arrested and imprisoned along with his Deputy, Colonel-General Repin, the senior officer of the Aviation Engineering Services.[71] Although reasons for the arrests vary, the purge accompanied a reorganization and a tightening of political controls within the armed services. Marshals Vershinin and Sudets took their places in the high command. So it was that Sudets had a role in the formalization of the requirements for the MiG-15[72] and the date of the Air Forces requirement is placed at the time of the April plan. More importantly, the Air Forces leadership was in a state of upheaval while the future of its capabilities was being decided by the Ministry of Aviation Industry.

c. Success of First Prototypes (YAK-15 and MiG-9)

Although the political and strategic implications of the April date of the first jet flights are unclear, the implications on fighter characteristics were. A month after its first flight, the initial prototype nosed into the ground killing its pilot. Another prototype was made available in July to continue the test program. Mark Gallai, the test pilot, relates that during his baptism with the second machine, the trim controls were reversed, the engines would not throttle back fully, and the nose-wheel collapsed.[73] Nevertheless, both the YAK and MiG aircraft were ready for the Tushino show on 19 August 1946. Stalin demonstrated his jets in the first post war Aviation Day flying display. If haste was evident in the construction of the prototypes, what followed demonstrated even more vividly the priority attached to the program.

The day following Tushino, Mikoyan and Yakovlev were summoned to the Kremlin. There Stalin directed that 10–15 aircraft of each type be prepared for the October Revolution Parade 80 days thereafter. Both designers were dispatched to production plants with an Assistant Minister of Aviation to act as expediter. Despite the obvious enormity of the task, 15 MiGs and 15 YAKs were ready by 7 November. In spite of all the effort, the November parade was weathered in—the scheduled fly-by was grounded.[74]

Curiously enough, U.S. intelligence only observed the MiG-9 at the August show.[75] However, 50 YAK aircraft were observed during the following May Day celebration while only 40 MiGs were seen. The MiG being the more difficult of the two aircraft to build suggests the MiG and YAK were concurrent programs. Nonetheless, the above landmarks are standard features of more recent Soviet aviation history.[76]

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[67] Ibid., pp. 347–361, passim.
[68] Ibid., p. 317.
[69] Solzhenitsyn, p. 447.
[70] Tokaev, *Soviet Imperialism*, p. 43.
[71] Gurevich, p. 17.
[72] "First of Many," Flying Review International, p. 237. Also in Gallai.
[73] Ibid.
[74] "Soviet Air Shows," Air Intelligence Digest, Oct. 1949, p. 4. passim. thru 1955. CONF.
[75] Izmaylov (Ed.), p. 630.
[76] Flying Review International, "First of Many," p. 237.

The MiG was the more successful of the two aircraft owing mainly to the greater power available from the two-engine configuration and to its all-metal construction. Its 560-knot speed compared favorably with its contemporaries, the U.S. Shooting Star and the British Vampire. Gallai recounted recently:

> In the air the MiG-9 turned out to be unexpectedly simple to fly—its characteristics were modest and unassuming. One might even go so far as to term them agreeable. I say 'unexpectedly' advisedly, as before the service introduction of jet aircraft, there was a certain fear among [Soviet] fighter pilots that these novelties would be difficult to handle in the air; it was widely believed that jets could be flown only by 'extra special' pilots and then only after protracted training. In the event, reality proved very different—the MiG-9 could be flown by the average fighter pilot. Indeed, it was easier to fly than its contemporary, the YAK-15.[77]

Sometime afterward, Yakovlev was to explain that the YAK-17, a refinement of the YAK-15, intentionally designed as a transition aircraft with the specific purpose of allaying fears of the new technology. "We made up our minds to create an aircraft in which only the engine would be new and everything else possible would remain the same as in a piston aircraft. The flier . . . would find himself in a familiar setting and not feel the difference between jet and piston aircraft."[78]

Despite its lack of performance, the YAK was a notable step forward. It made lesser demands of the airframe industry used to working in mixed wood and metal designs and the single-engine arrangement caused less demand on engine production. As later modified, it would provide training aircraft and early combat aircraft for the Soviets, the Chinese, and the East Europeans.

d. The Unsuccessful Prototypes

A similarity between Sukhoi's SU-9 and the Messerschmidt 262 was to serve him poorly. A number of modifications were incorporated into the German concept, including the retrograde return to tapered as opposed to slightly swept wings, but the SU-9 was doomed by two characteristics. First, it was later than the YAK and MiG; it first flew on 18 August, only two days before its predecessors were committed to production by Stalin. Secondly, by following the basic architecture of the ME262, it appeared to contradict Stalin's December decision. Following Yakovlev's argument, the political mind was probably loath to support a Soviet design which appeared to copy that of the former enemy.

Nevertheless, the basic design was sound. Due to a higher surface (wetted) area, the craft was inherently somewhat slower than the similarly engined MiG and it had a slightly lower ceiling. Nevertheless it had a comparable climb rate and was notably superior to the MiG-9 in endurance and ammunition capacity.[79] Indeed Yakovlev, himself, would resort to similar underwing-pod engine mountings four years later.

The Lavochkin aircraft suffered as did Yakovlev's from lack of power from the single Jumo engine. First flying in September of 1946, it was late for the production decision. Although more advanced in concept than Yakovlev's plane, it was too complex a design for the performance it promised. Various alternate prototypes (the LA-152, 154, and 156) were attempted which compromised somewhat with the YAK concept. Anticipating the more powerful British engines, the LA-152 was rebuilt with 35° swept wings in 1947.[80]

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[77] Yakovlev, *Target*, p. 365.
[78] Nemecek, "Turbojets and Tribulations," pp. 489–490.
[79] Green, "Last of Lavochkins," p. 220.
[80] Gurevich, pp. 19–42. The design achieved a ceiling of 40,000+ feet.

Although the design (LA-160) was little more than an experimental adaptation, its early testing served to assuage the reluctance with which the Soviets (among other nations) approached swept-wing designs.

e. The MiG-15

The YAK-15 and MiG-9 were obsolete before they flew. In March or April 1946, before the first jet flights, an air force requirement was probably incorporated in the Aviation Ministry Plan brought before Stalin on April 2, 1946. According to an account attributed to Gurevich, the specifications envisioned "aircraft to climb rapidly to a height of ten kilometers [38,000 ft.] and to maneuver quickly at that altitude at a good speed and with a heavy cannon . . . . We were to provide for only one pilot and to stay aloft for one hour. Otherwise we were not restricted in our design besides the usual strength requirements and the need for close attention to metal working."[81]

The requirement was based on a 4,400 pound thrust engine that was to be available within a year.[82] In fact the British granted permission to export ten of the 4,800 pound Nene engines to the Soviets in September of 1946. In all, 55 Nene and Derwent engines were shipped to the U.S.S.R. in 1947.[83] At the time the design started, however, all that was available was the RD-21, a slightly improved version of the BMW-003 rated at about 2,200 lbs. In effect, reliance on British engines facilitated a design based on twice the power then available from native engines.

It has been common to erroneously attribute the MiG-15 to a design by Kurt Tank, who had been chief designer for Focke-Wulf during WWII. Although the fuselage arrangement bears a superficial similarity to Tank's later Pulqui II aircraft, the wing planform is decidedly different. Further, Tank himself went through a straight-wing configuration in 1947 before producing his Argentine swept-wing prototype in 1950.[84] In fact, the Soviets may have understood theoretical aspects of transonic flight some three years before the West.[85] An effort began in 1942 to develop a unified general theory of supersonic wings. Results of the coordinated inquiry were published in 1946 and 1947. Among the contributions was an exploration of the application of conical flow theory to delta wings; it was written by Mikhail J. Gurevich. Therefore, it seems appropriate that one consider the theoretician Gurevich and the production expert Mikoyan perfectly capable of developing an impressive machine. The apparent similarity between the U.S. F-86 Sabre, the MiG-15, and Tank's designs derives from a common reliance on the 1940's technology and from the principles of aerodynamics as given practical meaning by extensive German wind tunnel testing available to all competing post war nations.

The MiG-15 had several faults, most notably its dangerous spin. It was found necessary to send air force test pilots to units converting to the aircraft in order to demonstrate proper spin recovery measures. For a period spinning was banned, pending the investigation of a number of accidents; even afterward, special clearances were required for the maneuver.[86] Early attention was given to a trainer version and use of YAK-17 trainers, but numerous pilots graduated directly to the MiG from conventional aircraft.

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[81] Ibid., p. 19.
[82] Nemecek, "Turbojets and Tribulations," p. 492.
[83] *Janes All the World's Aircraft 1956–57*, pp. 39–40.
[84] "Soviet Aerodynamics Research," *Air Intelligence Digest*, Nov. 1955, pp. 9–11. CONF.
[85] "From Cambodia to Cuba," *Air Enthusiast*, p. 303. Per memoirs of the test pilot Pyotr Stefanovsky.
[86] Opinion of Kilmarx, p. 239. Summaries of pilot opinion appear in Stockwell, pp. 50–54. See chart on comparative characteristics, Section III.

Beside the spin problem, the aircraft was poorly armed. It mounted two 23-mm. and one 37-mm. cannon. The 23-mm. lacked punch and the 37-mm. lacked firing rate. All three lacked sophisticated ranging devices.

That the MiG-15 was a brilliant accomplishment became apparent in Korea. It had put Soviet aviation ahead of European rivals and nearly equal with the United States. It out-climbed, out-maneuvered, out-accelerated, and flew higher than its principal opponent, the North American Sabre. It maintained a speed advantage until the F model of the Sabre appeared late in the Korean war. Its record was marred by poor guns and bad pilots.[87]

The MiG-15 first flew on December 30, 1947, barely three months after the American F-86.[88] The Gurevich account talks of an initial prototype, however, which flew on July 2 and was to have been ready for the Tushino show—a plausible objective.[89] This otherwise undocumented prototype purportedly crashed soon after its first flight. (This portion of the account may be intentionally confused with the first MiG-9 prototype.) Nevertheless, the MiG-15 as we know it flew only some 20 months after the first Soviet jets and confirmation of the requirement. The design was thought to be so successful that a production commitment was made in March 1948—before aircraft tests were half through. This rather drastic step is a measure of the importance attached to the MiG-15 program.

f. MiG-15 Competitors

The same type of hedging pattern observed in the program for the first jet prototype can also be seen, to a lesser degree, in the program which resulted in the MiG-15. Yakovlev continued to upgrade the YAK-15 straight-wing configuration with the Derwent engine as opposed to the Nene engine used in the MiG-15. Lavochkin was also allocated the less-powerful and wider Derwent but would work both swept and straight wings. Eventually, he too would proceed to a Nene-based prototype.[90] Meanwhile Sukhoi re-engined his two-pod SU-9 to produce a multipurpose fighter capability, the SU-11, with Derwent engines.

1) The YAK-23

Yakovlev had improved the basic YAK-15 with a tricycle landing gear, a slightly improved version of the Jumo engine (the RD l0A), and more metal components. The result was the production version of the YAK-17 which appeared in mid-1947. Before the YAK-17 entered production, however, another aerodynamic and all-metal improvement, the YAK-19, appeared. Although the YAK-19 was not produced, a second prototype proved useful as a flying test platform for the Derwent engines and as an experimental predecessor for the YAK-23.

The YAK-23 was the Derwent-powered MiG-15 competitor or, possibly, back-up. The first prototype flew in June of 1947 and conformed to a possible pre-Tushino deadline. Notably, the successful flight nearly coincides with the ill-fated MiG prototype referred to in the Guervich account. Yakovlev's incremental approach again assured that he would be first to fly, but even though a production decision was favorable,

[87] First F-86 prototype first flew October 1, 1947. First production model flew May 20, 1948. Janes All the World's Aircraft 1956–57.
[88] Gurevich, p. 42.
[89] "How Russian Stormed Sonic Barrier," *Aviation Week*, Sept. 12, 1965, p. 22. From the Soviet Journal Ogonyok, and Green, "Last of the Lavochkins," April 1968, pp. 221–222.
[90] "Yakovlev's Lightweight—the Yak-23," *Air Enthusiast*, May 1973, p. 230.

the bolder design of the MiG-15 drew more attention, offered more promise, and was produced in greater number. The YAK-23 was ordered into production with minor modifications in March of 1948 after a complete and successful test program.[91] The MiG was ordered to production about the same time without complete tests.

A common contention is that the YAK was an intentionally tapered wing back-up to the more risky MiG design. It is equally likely that both were in response to the same air force's requirement, with Yakovlev adopting the more conservative approach to ensure meeting an implied, if not specific, Tushino deadline. This strategy had worked successfully in 1939 and 1946. It did not work in 1947. The divergence in designs probably became apparent when a preliminary MiG concept known as the "pre-project" was submitted for Ministry of Aviation and Air Force approval. If this logic holds, it explains when and why a YAK-25 swept-wing design was abandoned and why that number was also assigned to a later and more important aircraft.[92]

In its own right, the YAK-23 was a successful machine in a league with the British Gnat. It was used widely as a transition lightweight fighter for many of the Warsaw Pact forces. Even ten years later, in 1957, it would set world climb-to-altitude records for 3,000 and 6,000 meters.[93]

2) The La-15

While Yakovlev had taken an incremental approach, and MiG a bold one, Lavochkin's efforts scattered. Despite his experience with the swept-wing La-160, his treatment of airframes for the British engines was hedged by an additional retrograde straight wing, but thin-wing, design. Given the more powerful Nene engine, he then committed himself to the swept-wing which he himself had popularized. His timing and the engine allocation were against him. It appears he spent too much time with the advanced swept-wing mated with the German technology engine. The La-160 flew only three months before the MiG-15. By the time his Derwent-powered prototype came out, the MiG had been committed to production. Nevertheless, the resulting La-15 was produced in limited numbers after state acceptance in June of 1948. Because of a lower ceiling than the MiG (incurred as a result of the Derwent-type engine) the aircraft was used as a ground-support, rather than interceptor, aircraft. Subsequently, Lavochkin did receive a Nene engine and the prototype which carried it was credited with being the first Soviet aircraft to break the sound barrier in a dive.[94] While this event of 26 December 1948 is marked in Soviet aviation history, interceptor development was by then focused on the MiG-15 and its successors.

3) The SU-11

In the meantime, Sukhoi had become involved in a multitude of programs which diverted him from the mainstream of interceptor development. Among these were a conventionally powered two-engine reconnaissance plane, and a four-engine light bomber. Both designs were powered by Derwents.[95] As in the MiG-15 case, the bomber with the more powerful Nene engine was produced, in this instance the IL-28. Nonetheless, the Sukhoi Bureau did participate in interceptor development with the British engine, again

[91] Ibid., p. 231.
[92] Ibid., p. 229.
[93] Green, op. cit., May 1968, p. 291.
[94] Nemecek, "Turbojets and Tribulations," pp. 491–492.
[95] "From Cambodia to Cuba," *Air Enthusiast*, p. 203.

the Derwent. Apparently he had not learned from the SU-9 experience and again reverted to the unpopular "German" twin-pod configuration. Although the prototype SU-11 flew before the MiG-15, it lacked the speed and maneuverability of all its rivals.

g. Soviet Engines

The 1946 plan for native designed engines met with fruition at the turn of the decade. In 1950, Vladimir Ya Klimov produced a much improved centrifugal flow engine. Although it was based on his early experience with the Nene, the RD-45 copy and some of its minor improvements, the VKl was generally larger but also lighter. The result, with water injection, was thrust improved from 5,952 pounds to 6,750. With a 200-pound weight reduction it contributed significantly to the performance of the MiG-15.[96]

Meanwhile, Arkhip Lyulka was testing a design for the AL-5 in the realm of 10,000 pounds of thrust. This engine continued to be associated with unsuccessful prototypes until much later it reached production status with Tu-110. By that time it had been upgraded to 12,000 pounds thrust.[97]

Most of the Soviet jet engine designs concentrated on centrifugal compressors focused on mass of the airflow. This resulted in engines with large frontal areas which were difficult to incorporate into efficient fighter designs. It seemed this basic technology would not support supersonic flight.[98]

For the Soviets, the breakthrough came about 1950 with Mikhulin designs based on axial compressors. The first of these was a low-pressure, single-rotor configuration believed to have powered the prototypes of the Mya-4 and Tu-16 bombers which appeared in 1954. While the engine was large compared with Western standards, the technology promised improvements with multiple rotors, higher pressures, and higher heats. The effect would be higher thrust-to-weight ratios, improved fuel consumption, and, especially important in fighter designs, smaller sizes and weights with a much improved thrust-to-frontal area ratio. Pending the development of such engines the design of suitable all-weather area interceptors was frustrated as the 1948 attempts demonstrate.

h. 1948 Attempts at an All-Weather Capability

Among Sukhoi's ill-fated activities was a 1948 attempt at an all-weather interceptor, the SU-15. It featured a curious staggered fuselage arrangement of the production version of the Nene engine, the RD-45. The SU-15 would have been a heavy machine with a radome to house an Air Intercept scanner mounted over a common opening which served both engines. The aircraft would have featured a good 750-mile radius and transonic speed, but unfortunately it disintegrated in one of its first flights.[99]

Lavochkin in 1948 also attempted to create an all-weather fighter. As with the Sukhoi aircraft, it featured two engines, probably RD-45's, mounted in the fuselage. A radome would have been housed inside a large circular intake which served both engines.[100]

Likewise, Mikoyan and Gurevich participated in the all-weather interceptor design activity. The MiG prototype, the I-320, had similar features and performance as the other two aircraft. Of three aircraft the MiG

[96] "Lyulka," *Air Enthusiast*, p. 299.
[97] Inferred by USAF Intelligence, *Air Intelligence Digest*, "Mikhulin," Nov. 1954, p. 21. (CONF.)
[98] Nemecek, op. cit., p. 499.
[99] Green, "Last of Lavochkins," June 1968, pp. 349–350.
[100] "Plane Facts," *Air Enthusiast*, March 1973, p. 140.

was the first to successfully fly. The SU-15 crashed in 1949, the MiG performed successfully in the winter and the Lavochkin flew in February. But the Mikoyan designers also resorted to another approach.[101]

It is likely that none of the three models were passed after it was found that the rather primitive Izumrud radar could be fitted to the MiG-15. The fuselage mounting of two large centrifugal engines in the fuselage was an ungainly, inefficient and expensive arrangement without compensating advantages in range. Further, the short acquisition range of the Izumrud may have made greater demands on maneuverability than either aircraft seemed to offer, especially when compared with the MiG-15. Nevertheless, the SU-15, the La-200, and the I-320 do indicate the order of Soviet priorities. Attention was first focused on the achievement of a world standard day interceptor. Then, and only then, did the focus shift to an all-weather capability. The requirement appears to have been dropped when it was found to be technologically inconvenient; a simpler expedient was adopted instead.

The failures of the SU-15 with the post war purges did cast a long shadow through Soviet aviation history. Sukhoi's post war record, to those who did not appreciate a number of his technical innovations, appeared to be a series of disasters. Judged by a more objective standard, he was the only major designer who had failed to create a jet prototype suitable for series production.

During the post war period when it seems that every sector of the Soviet society required a ritual "cleansing"[102] Sukhoi's was the obvious target among the design bureaus. Although Sukhoi does not appear to have been imprisoned, his design bureau was disbanded in 1949.[103] The long shadow is this. On the Sukhoi drawing boards was a design, the SU-17, which might have been the first totally supersonic Soviet aircraft.[104]

Such was the success of Sukhoi's 1956-version SU-9 and SU-11 that he is sometimes credited for breaking the sound barrier with the earlier design that never flew. Advanced aircraft concepts such as were seen in 1956 might have been available to the Soviets three or four years earlier had it not been for the purge of the Sukhoi bureau.[105]

i. Improvement of the MiG-15

Such was the perceived success of the MiG-15 that alternative fighter designs stagnated at the turn of the decade. Although the Soviets were aware of its failings quite early—the spin proclivity, for example—it was a thoroughly capable aircraft in well-trained hands. Early attention was given to a two-seat trainer version to ease the earlier mentioned difficulties of conversion training. Moreover, the basic configuration accommodated an improved engine and a rudimentary air intercept radar. During 1950, these modifications appeared in two separate adaptations of the basic aircraft: the MiG-15 bis clear weather fighter which featured the improved native-designed VK-1 engine accompanied by a general trimming of weight and the MiG-15P which added the Izumrud radar to the improved single seat model.[106]

The MiG-15, however, remained a poor transonic airframe aerodynamically.

[101] Alternate translation to "purge."
[102] Nemecek, op. cit.
[103] Green, "Sukhoi," p. 353.
[104] Assuming availability of Mikhulin engines—an assumption which would have required a somewhat earlier emphasis on smaller axial-flow configurations.
[105] "From Cambodia to Cuba," *Air Enthusiast*, pp. 304–306.
[106] Ibid., pp. 307–311.

j. The MiG-17

In parallel with the above programs, a general reworking of the design was undertaken to extract full advantage of the improved power plant in speed regions near Mach 1. The result was the MiG-17. While changes in the fuselage were minimal—a lengthening by 41 inches—the MiG-17 featured an entirely new wing and modified tailplane. The new wing was larger, thinner, and more swept with parallel but rounded tips, while the tailplane was also more swept. The result was a transonic design which retained the maneuverability of the MiG-15 for subsonic combat.

The MiG-17 evolved to a limited all-weather variant as did its immediate predecessor. The Izumrud radar was fitted along with two beam-riding missiles.[107] The nose was extended somewhat to accommodate the radar equipment. This MiG-17P was available in 1953, but production was limited. By that time, more effective all-weather aircraft were in development.

k. Stagnation of Development

The period from 1950 until 1955 is marked by a dearth of significant interceptor prototypes except for the 1953 appearance of the MiG-17. Several reasons for this may be apparent:

(1) Production of the MiG-15 which continued until 1954 occupied a great deal of Soviet production capacity. This consumption of capacity had been sparked by the Korean War. The transfer of this capacity to the similarly constructed MiG-17 represented a least disruptive means of modernizing the force.

(2) The attention of the aviation industry may have turned to bomber aircraft which were nearing production.

(3) Two technological constraints seemed to prohibit major advances. The first was the lack of an efficient axial flow engine and the second was the size of Soviet second generation air intercept radars. The extent to which these factors constrained an effective all-weather design was apparent in the 1948 prototypes.

(4) On a more speculative point, it had become apparent that other elements of the air defense system, particularly the control and warning system, required attention before better interceptors could be effectively utilized. Likewise, the Korean War had emphasized the necessity of adequate pilot training. This coincides with the evolution of PVO Strany between 1948 and 1954.[108]

(5) The political leadership was satisfied with the Mikoyan-Gurevich product. As in WWII, production focused on great quantities of a standard design once it was proven. The Korean war and the necessity of equipping the newly formed Warsaw Pact forces emphasized the production commitment. It is also apparent that minor changes in the MiG-15 were adopted in favor of the more disruptive change to the MiG-17. The 20-month development cycle observed in the generation between MiG-9 and MiG-15 indicates that such a rework of a basic design as the MiG-17 could have been available in 1950 or 1951 had it been wanted. Instead, development proceeded at a more leisurely pace.

(6) Of ultimate importance, Stalin did not want new designs; he had become committed to Mikoyan.

l. The Decision to Develop the YAK-25

The first all-weather area interceptor of the Soviets, the YAK-25, did not appear until 1955. Its designer explains the stagnation of the design process and claims credit for the innovation. Since his story is fairly

[107] See Chapter IV above.

[108] Barrage aircraft—one which patrols in the air, defending objectives from air attack (Trans). Roughly translated "area interceptor."

complete, concise and essentially correct in its fit with observable facts, it is quoted in its entirety. Possible controverting evidence from other participants—Stalin, Beria, Mikoyan, and Mikhulin—is not available:

> In 1951 the MiG-15 fighter was in series production and used as armament in the Air Force. It was our Army's basic swept-wing jet fighter, and a fine machine.
>
> At that time we were developing several types of new swept-wing fighters, but all our proposals met with Stalin's objection: "We have the fine MiG-15, and I have no intention of creating new fighters in the immediate future. It would be better to continue improving the MiG. . . . "
>
> I was highly upset by the situation, which was arising in our Design Bureau. Behind me there were several hundred people who might lose faith in me as a design team leader. I also understood that if all our experimental works were limited to modernizing existing series aircraft and not creating new more advanced models, this would inevitably lead to a lag in the shortest possible time. And so, day and night I was tormented with the questions of what stand to take.
>
> I felt that we had to create something new in quality. At that period I got close to the engine designer Alexander Alexandrovich Mikulin. I felt then and I feel to this day that he was our foremost and most perspicacious aircraft engine designer. His AM-3 and AM-5 jet engines were for a long while the power source basic to Soviet aircraft.
>
> In 1950 and 51, he and I had the idea of creating an economical light jet engine. Mikulin had formulated the idea that a jet engine with small dimensions would be more effective from the viewpoint of economy, reliability and other aspects. I supported him in this.
>
> Mikulin began work on a light-weight small-size jet engine with a thrust of 2000 kg. I decided to develop an aircraft for this engine which in addition to good, simple flight qualities would have great endurance and flight range—qualities enjoyed by no other jet fighters of that period, either in the Soviet Union or abroad. It was then felt that jet engines were very uneconomical in terms of fuel consumption and therefore although we might talk of fairly long endurance and range for heavy aircraft such as bombers with large fuel reserves, for jet fighters an increase in range and endurance seemed an insurmountable obstacle. With two of Mikulin's engines subsequently designated the AM-5, we succeeded in designing an aircraft which had double the MiG's flight range and endurance. It would require a crew of two, and would carry heavy armament—two 37-mm. cannons with large supplies of ammunition.
>
> For its time, this was an innovative aircraft in the fullest sense of the word. With my idea for this aircraft, I decided to skip the usual steps of going through the Ministry and Air Force, and wrote directly to Stalin. I had no other recourse: I was afraid that my proposal might get bogged down in going through normal channels.
>
> Three or four days after I sent my letter, Aviation Industry Minister M. V. Khrunichev called me. Mikhail Vasik'yevich well understood the difficult, complicated situation and attempted to ease my position, but could not do much.
>
> I went to him at his office. He was alone. He stood up from behind his desk with a kind smile.
>
> "Stalin just called. He got your letter and has read it. He said that your proposal is quite interesting. He is surprised that you can promise a fighter with such range and endurance. He also asked whether it would be possible to use your aircraft as an all-weather barrage[109] interceptor and supports your proposal. He said that you should keep working on your idea, and he'll contact you in a few days."
>
> And in two days Stalin did call in Khrunichev, Artem Mikoyan and me.
>
> In Stalin's office we found Bulganin, Beria and Malenkov. Stalin took my letter from the table and read it aloud.
>
> "Well?" he asked. "Does this mean we can make a fighter with this jet engine that will have great flight range and duration? That's very important. At what expense will you achieve it?"
>
> I explained that the idea might be achieved only if we were able to work together with Mikulin, whose engine would, in combination with several structural features of the aircraft, be a success. Stalin was completely in favor of the idea in principle, but said that we would have to be able to put out such an aircraft in a barrage fighter-interceptor version.

[109] Sukhoi was a nonperson at the time of the conversation. This is a possible explanation of omission of Su-15.

> "We need this kind of interceptor, which could stay in the air a long while and search out the enemy not only during the day, but at night as well, and in bad weather. We ordered Mikoyan and Lavochkin to develop such a fighter, but something didn't work out, and their flight endurance is less than you propose."
>
> Not long before this, heavy fighter-interceptors had in fact been developed and tested under the designation La-200 and I-320.[110] I do not know precisely or, more accurately, I don't remember the reasons why both these fighters failed their test flights. However, it's not a questions of what the reasons were—what was important was that the country was lacking a much-needed all-weather night fighter-interceptor.
>
> I replied that Mikhail Vasil'yevich had already given me authorization and that we were working in this direction and would probably encounter no difficulties. It should especially be remembered that the engines in my aircraft were located under the wings and in this way the nose of the fuselage allowed a great deal of area for installing a powerful radar unit which had previously been created by our designers working in radar.
>
> At this point Stalin raised the point of whether this aircraft would be capable of use as a high-speed observation aircraft. I found no objection to this.
>
> Satisfied in principle with these questions, in conclusions Stalin said that he had received an offer from Artem Mikoyan as well, who wanted to use Mikulin's same engines in creating a long-range fighter model based on the MiG-17 series aircraft.
>
> "Well, we'll have both an interceptor and a high-speed observation plan. Yakovlev will make this one, and Mikoyan will give us our long-range fighter," concluded Stalin.[111]

As is the procedure in the Soviet Aviation R&D, Yakovlev returned for formal approval of the "pre-project,"[112] a more or less formal proposal submitted for technical evaluation of the design concept. The pre-project is used to establish the priority for a project and for assigning its place in the overall Soviet system of industrial planning; it differentiates required designs from the ongoing development work of the Design Bureau. It is at this stage that the politics of Yakovlev's design activities were laid bare:

> On July 30th [1951] and in the same company we again gathered with Stalin to examine and evaluate placing Mikulin's AM-5 engine in both the YAK-25 two-seat all-weather barrage jet night interceptor with its YAK-25R modification serving as an observation aircraft as well as the fighter which was serving as the basis for the well-known MiG-25 [*sic* MiG-19].
>
> The project was sent to Stalin in short time. He was already familiar with it and, with almost no notes, he indicated that he had no objection.
>
> At this point Beria opened his briefcase and withdrew some sort of document.
>
> "Comrade Stalin," he said, "here is another proposal by the designer Lavochkin."
>
> "What proposal?" asked Stalin irritatedly. "I don't know anything about any proposal by Lavochkin."
>
> To this Beria replied in an intentionally indifferent tone, attempting to emphasize his objectivity:
>
> "He sent it in a long time ago . . . Some sort of unusual interceptor. And it's equipped for night and blind flying. Everything's here on three pages . . . ." And he started to read: "Radar, radio, radio compass, instrument landing system, etc., etc . . . ." The whole list. "He proposes building it on the basis of the La-200."
>
> All the instruments which Beria had listed are basic requirements on any interceptor, including the one I had proposed. But Beria had to play out this entire scene and give Stalin the impression of a long list of equipment only to destroy my proposal and reverse the decision which had been taken—in a word, to stab me.
>
> Stalin blazed up.
>
> "Why didn't you report this to me?" he asked Khrunichev.
>
> Khrunichev at first started to lose his temper, but then he replied that the La-200 had already been rejected once as a complete failure and therefore there could be no basis for using it as the source of a new aircraft. Besides, the entire list of equipment was also on the YAK-25.

[110] Yakovlev, *Target*, pp. 394–396.
[111] Alexander, *R&D*, pp. 17–18.
[112] Yakovlev, op. cit., pp. 396–399.

Stalin wanted to hear none of this, but simply repeated, becoming more heated:

"Why didn't you report it? Why didn't you report it?"

Finally, Mikhail Vasil'yevich succeeded in clarifying that Lavochkin's proposal had been examined in the Ministry and that it had received no approval basically because Lavochkin had planned on using his own unsuccessful fighter, which had already been rejected. Subsequently Lavochkin succeeded in gaining permission to pursue this work, but his aircraft never did materialize.

I was terribly frightened both for my own concern and for Mikhail Vasil'yevich. In those days nothing was worse than being looked upon as a fraud in Stalin's eyes. Meanwhile he, without quieting down, continued demanding of Khrunichev:

"Why didn't you report it?"

It would seem that Khrunichev had purposely concealed Lavochkin's proposal. Finally Stalin understood what the situation was and said:

"We will not go back on the decision we've already made, but we'll look at Lavochkin's proposal separately."

The proposal was accepted, but in signing it Stalin suddenly turned to me:

"And why is this written here at the end: 'Upon construction of the aircraft, to allow you overtime and piece-work pay and set aside money as a prize?' Why should you have such an advantage? You know what they're saying behind your back? They tell me your self-seeking."

"They have misinformed you," I replied.

"What do you mean, misinformed?" Stalin again flew into a rage.

"Well, prize money and overtime and piece-work money are at the disposal of all the designers: Tupolev, Ilyushin, Lavochkin and Mikoyan. This is no exception to the rule. On the contrary, the exception to the rule is that our design team has for the last two years not had this privilege, while all the others have had it and continue to."

"And how is this so?" Stalin asked, surprised.

Khrunichev verified that this was in fact so. Then Stalin, still irritated, came back to me:

"I want you to know what they're saying behind your back."

"Thank you for telling me. What complaints have there been against me?"

"They tell me that you have been using your position as Assistant Minister to build yourself the largest factory."

"That's slander. I have the smallest factory."

Stalin turned to Khrunichev:

"Is this so?"

Khrunichev pulled from his pocket a notebook which he always kept on him and in which was written all necessary information concerning the production areas of the different factories, the amount of equipment, the number of workers, etc., and said:

"That's true Comrade Stalin, Yakovlev has the smallest factory."

"They say that you've grabbed a lot of machine-tools."

"That's also untrue. I have fewer machine-tools than any other designer," I replied.

Again Khrunichev verified that I was telling the truth. Mikhail Vasil'yevich quoted the number of machine-tools in our Design Bureau and, for comparison gave the number in Tupolev, Mikoyan, Ilyushin and others' experimental Design Bureaus.

"They say you've gotten hold of laboratory equipment like no one else has."

"That, too, is untrue. I have nothing the others don't have."

And again Khrunichev proved the veracity of my words.

> "How can this be so?" said Stalin, gradually calming down. "I had completely opposite information. Strange. . . . "
>
> "It's unobjective and made-up information to weaken faith in me. Incidentally, I anticipated the possibility of such accusations and so doing my eight years of work, first at the Narkomat, then in the Ministry, I have done nothing which might subsequently justify even one of the reproaches which you have been throwing at me."
>
> "And you haven't received any prizes in recent years?"
>
> "That's precisely right, I haven't."
>
> "I don't understand a thing," Stalin voiced his amazement and, to the amazement of those present, turned to Khrunichev and Bulgarin and said:
>
> "Well, if this is so, we have to create conditions for him no worse than for the others. He's done a great deal for our aviation and will do more."[113]

From the 1955 May Day fly-by, U.S. observers reported two new types of fighters. One appeared to be a twin-jet clear-weather fighter capable of supersonic speeds—the MiG-19. The other was identified as a Yakovlev designed all-weather interceptor. Both were displayed in sufficient numbers to indicate they had been committed to serial production.

The YAK-25 featured two engines carried in underwing pods in a configuration similar to that of Sukhoi's early SU-9 and 11 and of the Me-262 which Yakovlev himself had much maligned. Further, the wing bore a striking resemblance to that which appeared on the 1950 Pulqui II design by Kurt Tank. The fuselage featured a large radome which housed a radar much improved over the Izumrud. The remainder of the fuselage allowed sufficient fuel for a much extended range.

Lavochkin did produce the prototype mentioned in the Yakovlev account. The La-200B features a nose radome of similar dimensions to that on the YAK-25. However, he retained the VK-1 centrifugal-flow engines which were fed by intakes on both sides of the radome for the forward engine and a larger lower scoop for the rear engine. Somehow the nosewheel was housed among the lower ducting. Range was extended by two large underwing fuel tanks and two crew members sat abreast. Not surprisingly, the YAK-25 was chosen with the more efficient engine, serviceable installations and stable wheel positioning, not to mention greater speed, range, and altitude. If for no other reason, the La-200B deserved to die from sheer ugliness.

The YAK-25 was committed to series production and eventually some 580 were produced.[114] Meanwhile, Pavel Sukhoi had been reestablished following the death of Stalin in 1953. Already in progress was an aircraft which would fill out the PVO all-weather force.

4. Observations Based on the Evolution of Interceptor Designs

a. Introduction

The foregoing material provides a basis for some generalizations about the nature of Soviet force-posture decisions particularly as they relate to the aviation element of early post war air defenses. Although the generalizations are inherent within the foregoing material, supplemental evidence will be drawn upon to round them out.

[113] See production data, Section III.
[114] Izmaylov (Ed.), p. 631.

b. Perception of Strategic Defense

From the outset, it is essential to disregard the contemporary U.S.-conceived dichotomy between strategic and theater defense. It seems clear that the Soviet aviation establishment in the early post war period conceived of fighters and bombers. Fighters were further broken down into interceptors and ground attack. Among interceptors there was a separate category of "barrage" or area defense aircraft. Otherwise, an interceptor was an interceptor whether it was assigned to PVO Strany or to the forward area. As is conveyed in the strategy chapter, PVO Strany and the integrating concept of air defense operations evolved some 15 years and a world war after the patterns of weapons creation were established. A dichotomy between frontal and defense aircraft evolved as PVO Strany evolved, but that was well after the program of post war aviation modernization was well under way.

c. The Role of Planning

It is clear that there was a plan, such as Yakovlev documents, which governed the development of jet aircraft. Such a plan would have coincided with the decision cycle of the Fourth Five-Year Plan. Despite what may seem to Westerners to be virtual obeisance to "the Communist Party's and Soviet Government's concern and attention for aviation,"[115] a high priority was set for aviation development and a political consensus supported it. Throughout the period of the Fourth Five-Year Plan (1946–1950), either three or four programs were instituted to compete against each interceptor requirement. In addition, a multitude of prototypes continued to be developed in the course of ongoing design bureau activities—these aside from the formalized requirements cycle. It is no coincidence that Stalin's attitude changed to "no intention of creating new fighters in the immediate future" at the same time as the Fifth Five-Year Plan.

It is clear also that this type of long-range plan evolved in the industrial and design establishment. Military participation was negligible except within the Central Committee. Military participation came in the formal requirements cycle which gave priority to certain specific types of aircraft already being developed. In the case of the MiG-19, La-200B, and YAK-25, it is evident that the requirements were formalized between Stalin and the designers, with pernicious participation by Beria and separate perfunctory staffing by the air force.

d. The Role of Institutions

The perception of two categories of aircraft, bombers and fighters, was reinforced by the structure of the Ministry of Aviation. Of ten bureaus, three design-oriented bureaus were devoted to fighters, bombers, and engines. Thus, categories of aviation were conceived in this manner. This division parallels the 1930's institutionalization of bomber design activities in the Zhukovski Academy under Tupolev and of fighter design activities in TsAGI under Polikarpov. Major Designers schooled under either of these two men basically remained working in either one category or the other. Sukhoi was the exception of a Tupolev protégé who worked in fighters. But the exception supports the rule somewhat. His aircraft tended to be heavy fighters more appropriate to ground attack and he mixed fighter and light bomber design activities with a lack of success. Only in the late 1950's did his heavy aircraft come into vogue.

e. The Flow of Information

Although the pre-war centralization of basic research in the TsAGI infers a common downward flow of basic aerodynamic findings, it is clear that the sharing of information did not work very well. Somehow,

[115] Tokaev indicates that it was the Mikoyans' influence that saved him from expulsion from the party in 1937. *Comrade X*, p. 72.

during the development of the MiG-15, Mikoyan and Gurevich knew much more about swept wings than did Lavochkin. One suspects that the MiG bureau had better access to wind tunnels and to German test results. (Alternately, the MiG team might have acquired its own test facilities.) Likewise, Lavochkin appears to have been ill-informed about the capabilities of the Derwent engines he was to work with. Although a partial explanation of the MiG-15 success can be attributed to the theoretical talents of Gurevich, better information also seemed to support the MiG collective's single-minded pursuit of a bold design. The system includes competition for information.

f. Allocation of Engines

One is struck by the manner in which engine allocations prejudiced the success of a particular prototype. The double JuMO configuration had an obvious power advantage over a single-engine BMW-powered design. Likewise the Nene engine's greater thrust and smaller frontal area offered advantages of a similar magnitude over the Derwent engine. Both allocations favored Mikoyan and Gurevich.

g. Intelligence, Risk, and Luck

A great deal was at stake for the Soviets to base their long-range planning for aviation on the assumption that British engines could be obtained. To be sure, back-up programs were under way, but the weight of development effort appears to have been committed to third-generation engines while lengthy negotiations were ongoing. This is risky policy behavior, but the payoff was enormous. In light of the outcome, it was quite a reasonable risk based on good intelligence about British commercial procedures and about British Labor Government politics.

h. Rewards and Incentives

As the Yakovlev account reveals, there was a competition among design bureaus for personnel, equipment, and facilities. There was also a system of materialistic rewards in the form of overtime pay, bonuses, and state prizes which operated in the aviation industry. All of these things flowed from "successful" designs. Successful designs were those which were committed to serial production. There was also a system of negative rewards. It can be represented by Hangar Seven of the internal prison which operated during the 1930's. In the post war years it was represented by the fate of the Sukhoi bureau.

i. Conflict of Objectives

Between the Stalinist criteria which prevailed until 1950 ("the winner will be the one who gives us the best fighter . . . and also deliver first") is a very real conflict. One with a mathematical bent will point out that either delivery time or performance can be optimized. Yakovlev made his reputation by delivering first; Mikoyan made his by delivering best. In the post war period, Mikoyan and Gurevich played the better mixed strategy between these two objectives. Lavochkin also played a mixed strategy, but his timing appears to have been out of cycle.

j. Personal Politics

Soviet wartime and post war fighter aviation was dominated by two men: Alexander Yakovlev and Artem Mikoyan. These two represented the foremost among a very small group of heroes, the Design Bureau Chiefs, after whom aircraft were named. These men were literally "Heroes of Socialist Labor." Among this

group was a collegial relationship supported by a similar education, the same mentors, common work experience, and intramural competition. These men shared a common ethic with the Aviation Engineering Service of the air forces.

One of these men—Yakovlev then Mikoyan—was Stalin's personal advisor on aviation. Their influence extended beyond fighter aviation matters. Yakovlev held a favored position because of his two-hat assignment as Deputy Commissar (later Minister) of Aviation. Mikoyan held a favored position because he was the brother of Anastas Mikoyan, an even closer associate of Stalin generally in charge of the consumer goods area in the post war period. An active area of Anastas' interest was foreign trade; he had been charged with responsibility for foreign aid during the war, and he was later to be foreign policy advisor to Khrushchev.

The Mikoyan relationship worked in at least two ways during post war aviation development. First it clarified the opportunities inherent in British technology to both the design and trade portions of the government. Second it allowed Artem Mikoyan a separate channel to the Politbureau—one that he used for political relief on behalf of others in the aviation establishment as early as 1937.[116] Stalin's preference among designers changed in 1946 after the success of the MiG-9, when Yakovlev resigned his position as Deputy Minister. Thus Mikoyan was in a favored position in the competition for information and resources from the time of the first jet prototypes on. In addition, he used his favored position well. His were the best of the post war designs. Thus, securing himself in this favored position, his design objectives, which emphasized speed and altitude, predominated over alternate design approaches which might have favored range or improved supporting systems. Personal politics helps explain why the MiG-15 was a success and how Stalin came to be committed to improvement of the MiG as the route of aviation development.

k. Design Objectives Versus Requirements

A recent Soviet text for industrial engineers in the aviation industry states the following: "The basic task of the technical preparation of production is the creation of designs . . . whose quality is *not worse than the best world models*, and the period of their development and introduction into series production is minimum" (emphasis added).[117] Yakovlev's personal motto was "Be Ahead."[118] Mikoyan's Bureau slogan is said to be, "Speed and Altitude."[119] Stalin, at the 1947 Tushino Show enjoined the aviation industry to create aircraft which would "fly higher, faster, and farther" than any in the world.[120] This slogan harks back to a speech to the Eighteenth Party Congress (1939) which stated: "We will henceforth fight to increase quantity, improve quality and decrease the cost of our aircraft so that our pilots can fly higher, farther, and faster than anyone in the world."[121] An even earlier precedent is a July 1929 Party Central Committee Decree which includes: "We consider the greatest challenge in building the Red Air Force to be the improvement of its quality as fast as possible to the level of the foremost bourgeois countries . . . "[122] While the list of these slogans can be extended, it is evident that throughout postwar interceptor decisions they represent a set of lenses through which the Soviet aviation industry sees the world and which "color" their perceptions. It is the contention that these perceptions profoundly influenced the menu of weapons from which Soviet plan-

[116] Tikhomirov and Paramonov, p. 152.
[117] Yakovlev, *Target*, p. 357.
[118] Green, "Mikoyan Quarter-century," p. 156.
[119] "Soviet Air Shows," *Air Intelligence Digest*, Oct. 1949, p. 5.
[120] Yakovlev, *Target*, p. 153.
[121] Ibid., p. 147.
[122] AID, "Soviet Bloc AAA: An Interim Solution," April 1957, p. 34.

ners built their post war strategic defensive force. Such a contention goes a long way toward explaining that Soviet interceptor aircraft were *not* designed against the early U.S. bomber threat. Instead, they were designed in technological competition with foreign interceptors.

On the other hand, the 1948 attempt at an all-weather prototype confirms that there was a perceived need among the air forces for an all-weather interceptor and that it had matured to the point of a "requirement." That the requirement resulted in a less-than-satisfactory weapon is evident. An interim solution was arranged, the MiG-15P, and the design process continued without regard to the night and all-weather threat. A more appropriate weapon awaited an engine design breakthrough and Yakovlev's initiative. The 1948 requirement also coincides with the emergence of PVO Strany as an independent force. It is inferred that this type of two-engine, long-range aircraft is what the PVO wanted. Instead, it got the short-range MiG-15P. Either aircraft would have been equipped with a short-range radar. Thus, planning attention in aviation was directed to the engine and the airframe; other element of a weapons system were added on—if it was technically convenient.

C. Antiaircraft Artillery and Surface-to-Air Missiles

1. World War II Experience

During World War II, antiaircraft artillery was the basic element of the static air defense of the important centers of the country. Other related ground-operated systems included antiaircraft machine guns, barrage balloons, and antiaircraft searchlights. The primary systems used by the Soviets were the 25-mm., 37-mm., 76-mm., and 85-mm. antiaircraft guns. These guns were further supplemented by 90-mm. and a few 120-mm. U.S. guns which were supplied under Lend Lease and by captured German 85-mm., 105-mm., and 128-mm. guns.[123] According to Marshal Batitskiy, the medium caliber guns were completely replaced with 85-mm. guns during the war.[124]

In the tactics of antiaircraft artillery general principles were worked out for the construction of a powerful, deep-echelon antiaircraft defense for large objectives with the use of systems of weapons of various calibers, and on the basis of the control of rather large groupings of antiaircraft forces. So that antiaircraft defense would be flexible, and equipped to respond quickly to any changes in the nature of the air enemy's actions, mobile groups were established which included small units of antiaircraft artillery, antiaircraft machine guns, and searchlights. These groups were used for battle with aircraft on their flight routes (operating from ambush), for temporary cover of small individually important objectives, and for strengthening the defense on the exposed operational axes of enemy aircraft. Extensive use was made of armored antiaircraft trains which were assigned the missions of protecting railway communications and objectives primarily in the pre-frontal sector.[125]

The scale of Soviet use of antiaircraft artillery grew steadily throughout the war. For example, the Soviets in 1941 had some 1000 antiaircraft guns defending Moscow. By 1945 the number had risen to over 2,000.[126]

Lessons learned from World War II included the need to increase the range and effectiveness of the guns, to improve the lethality of the antiaircraft shells, and to provide better fire control. In addition, it was

[123] Batitskiy, *Voyennaya Mysl'*, p. 35.
[124] Ibid., p. 36.
[125] Batitskiy, *Voyska Protivovozdushnoy Oborony Strany*, pp. 101–102.
[126] Ibid., p. 327.

also necessary to improve their tactical employment, mainly through the achievement of better concentration of fire.[127]

2. Post War Development (1945–1955)

During the period from 1947 to 1954, the Soviets introduced three new antiaircraft artillery guns of larger caliber (57-, 100-, and 130-mm.). Gun-laying radars were included in the composition of antiaircraft artillery batteries.[128] In order to improve the concentration of fire, the batteries were equipped with eight guns rather than four as before, and the individual guns were positioned more closely together. In order to increase the defensive depth, antiaircraft batteries were deployed along concentric perimeters around the areas being defended.[129]

Thus, throughout the first decade after the war, the Soviets continued to improve the technical characteristics and tactical concepts of their antiaircraft artillery. At the same time, the Soviets were also working on a new weapons system, the surface-to-air missile, which would take over and greatly expand on most of the role of antiaircraft artillery.

By the end of the war, the Soviets had captured a considerable number of German missile scientists. One group which had been working on surface-to-air missiles was put to work at Scientific Research Institute 88. Under projects R-113, these scientists were directed to design a surface-to-air missile utilizing the design principles of the German World War II Wasserfall missile as a point of departure. The missile was to be effective from 16,000 to 98,000 feet and was to carry a 500 Kilogram warhead. The German scientists worked by themselves in isolation from any Soviet counterparts. They apparently were being tasked to develop specific missile system components, although the project encompassed the total missile system. The work was conducted from 1947 to 1951. Four units were delivered for testing; the first in 1948, the last in 1950. In 1951, the group was disbanded.[130]

In 1951, construction was begun on a network of surface-to-air missile launch sites and associated radar installations surrounding Moscow. This was the SA-1, a missile with an effective maximum altitude of 60,000 feet and an effective minimum altitude of 3,500 feet. The first sites became operational in 1954 with deployment continuing into the next period (post 1955).

Deployment of the SA-1 was limited to the area around Moscow. It apparently was designed to counter the perceived threat of mass bomber formations flying at what was then considered to be a high altitude (i.e., up to about 50,000 feet). The SA-1 lacked mobility, a 360 degree radar capability for each site, and autonomous control for each site. These factors probably led to the decision not to deploy the SA-1 more extensively and to begin the development of the SA-2, a mobile system, probably in the 1950–1952 period.

3. An Evaluation

Antiaircraft artillery, as the Soviets deployed it and continued to modernize it, was a large and costly system. Still, the decision was made to expend the resources on a system which would soon be largely

[127] Batitskiy, *Voyennaya Mysl'*, p. 37.
[128] Yakimanskiy, p. 70.
[129] CIA/SI 17-56, 1 December 1956, "Contribution of German Scientists at Branch 1 of Scientific Research Institute (NII) 88 to the Soviet Guided Missile Program," pp. 5–6, (S).
[130] Research and Development Associates, "Comparison of U.S. and U.S.S.R. Land-Based Battlefield Air Defense Systems."

replaced. The 130-mm. antiaircraft gun actually began deployment after the first SA-1's had become operational. Concern for defense was such that even new guns were about to become obsolescent within about three years after their deployment. The rationality of the final antiaircraft artillery deployments was even more questionable in light of the problem of defending a target area against the mass destruction capabilities of nuclear bombs.

As the first decade ended, the SA-1 was setting the pattern for the future in which surface-to-air missiles would largely replace antiaircraft artillery and would also assume ascendancy over fighter aviation as the premier arm of the national air defense system.

The story of Soviet air defense missiles and also of antiballistic missiles belongs essentially to the period after 1955. The early developments will therefore be retraced as the post-1955 period is analyzed.

D. History of Early Warning Systems

1. Pre-1945 Developments

The Soviet early warning systems prior to and during World War II were heavily dependent on visual and sonic methods. Radar, although somewhat developed, was not deployed and was used only to a very limited extent. In 1941, the Soviets had, in its completed state, their first known radar. The development for this radar took place at the University of Kharkov and later relocated to the Red Army Signal Labs at Hytischi. At this time, another Soviet group, the Leningrad Development Group, was working on a C-W Doppler operating at about 50 MHz.

The later years of World War II found the Soviets in the position to receive samples and/or significant information concerning nearly all of the major operational radars in the United States and United Kingdom. The sets of primary significance were the U.S. SCR-584 fire control radar, which in turn became the Soviet Son-2; the British searchlight control radar "Elsie"; and the U.S. types SCR-545, 527/627, 582/682, 602.[131] The control or knowledge of these radars proved to be the means for the late wartime and post war Soviet radars.

2. Assessment of Post War Requirements

The Soviets, as a result of World War II, were well aware of the limitations of their offensive and defensive systems. This, combined with the known offensive potential of the West, dictated that the Soviets attach a high priority to air defense. The Soviets decided that their wartime approach to early warning was clearly inadequate.[132] Indeed, it was necessary to greatly expand the use of radar equipment of various kinds. A particular concern, during World War II, was how to combat massed enemy flights at night under the conditions of the use of radio and radar interference.

In their post war analysis, the Soviets noted that the need for early warning was a lesson which should have been learned from observing the German offenses against Poland, Norway, and France. But it was a lesson which they did not heed sufficiently. This was evidenced by the German surprise air attack on June 22, 1941, in which the Soviets lost some 1,200 aircraft while simultaneously sustaining many losses to all other border air defense forces. In relation to the defense of so vast an area (U.S.S.R.), the efforts of

[131] Ibid.
[132] Batitskiy, *Voyska* . . . , p. 333.

interceptors must obviously be closely coordinated with a highly efficient early warning system. Russia saw this flaw in her defenses and made strenuous efforts to improve the situation. From the evidence which has so far come to light, it is apparent that Soviet planners sought to cover the whole of the U.S.S.R. by a comprehensive air warning organization.

3. Developments After 1945

Throughout the 1945–1955 period, the early warning systems of sonic and visual sighting remained extremely important. This system continued to maintain an active role in the detection, tracking, and primarily the identification of aircraft due to the system's invulnerability to electronic jamming and direct air attack. The short-range limitations of this system were not important enough to phase it out; therefore it continued to serve not only as a secondary means of warning and a supplement to radar systems but also as a gap filler.

Organizationally, in order to establish control, the country was subdivided into regions with each region administratively subordinate to the PVO Headquarters in Moscow. Direct communication links were established between each region and Moscow headquarters.

The responsibility for air defense of each region was placed on the Military Commander of each area.[133] The Military Commander had at his disposal tactical air forces, aircraft artillery, and an air warning system. (Satellite countries are set up on a similar basis even though it appears cruder and less effective.) From 1950 to 1952, there appears to have been considerable expansion and reorganization of the air warning system in both the PVO and the Field Armies. One important change was the increasing use of radar. In conjunction with this, Air Defense Centers were set up at Air Army, Air Corps, and Air Division levels and these ensured a much greater degree of coordination of existing facilities.

Technologically, progress after 1945 was deeply dependent on Western knowledge, acquired by three means: first by lend-lease; second by capture; and third through post war German scientific assistance. One of the most significant events, as far as U.S. knowledge is concerned, was the publication of the MIT Radiation Laboratory series of books, which in effect became the Soviet developmental "Bible" for some time to come. Western knowledge provided the core of Soviet Air Defense prior to 1951.

With respect to lend-lease, the growth of mutual distrust between the U.S. and U.S.S.R. prompted the end of the Lend-Lease Policy to the Soviet Union and others in 1945. However, by this time, the Soviets had enough knowledge to manufacture copies of Western radars, through the assistance of German scientists and engineers. Certain foreign radars were adapted to Soviet requirements and placed into production.

During 1945–1946 and later, we find that Germans were apparently being forcibly evacuated and taken from East Germany. As far as this forced work on radar systems was concerned, these Germans were primarily put to[134] work in the Scientific Research Institute 160, about 22 miles from Moscow. This was primed for the exploitation of German scientists who were prominent in the electron-tube field. Before 1950, the German group had completed the development of X-band and S-band tubes for radar jamming purposes. The department was evidently still engaged in development of jamming the KU-band, which is the region in which practically all U.S. airborne and U.S. ground radar operated. This and other works indicates that the Soviets knew what they needed for effective electronic countermeasures.

[133] SRI, "An Analysis of the U.S.-Soviet Strategic Interaction Process."
[134] "Soviet Electronic Countermeasures," *Air Intelligence Digest.*

By 1950, the extension and development of air warning network had been most marked. By then they afforded continuous coverage in fair depth and density for the entire country with the exception of the least vulnerable portions of the national frontier. However, it was obvious that these systems were not confined to the Soviet Union. The zone extended to Eastern Europe, to Poland and likewise to other satellite countries.

The air warning networks had the following characteristics:

(1) Their performance was still unimpressive by Western standards
(2) Restricted range necessitated their use in great numbers to give continuous coverage
(3) Russia's great size permitted radar positioning far in advance of the area to be defended
(4) The system was simply built and easily maintained
(5) Most of the equipment was mobile and extremely easy to conceal (no high concrete towers; thus recognition was difficult from the ground and almost impossible from the air).

There were three primary sets in use by 1950: RUS-2, Pegmatit, and Dumbo. RUS-2 was a highly mobile ground radar developed early in the World War II period. The complete equipment consisted of two trucks or one truck and a trailer. One vehicle contained the radar equipment and its operators, the other housed the generators. In addition to its high degree of mobility and aptness for concealment, the RUS-2 was a very simple form of radar and already obsolete by Anglo-American standards during the 1945–1950 period. The primary disadvantages of the RUS-2 were its inaccuracy in measurement of range and bearing, its lack of height-finding capability, and its poor range against low-flying aircraft.

The Pegmatit was the first relatively static radar installation; although a trained team should be able to dismantle and reerect it on another site in a matter of days.[135] The radar was generally placed inside of a building or house with an aerial array protruding through the roof or nearby ground.

Dumbo was the third major radar system at this time. The Dumbo radar was first reported in 1946 and represented an improvement over the RUS-2 (1943) in range and accuracy. Although not mobile the set was easily transportable. This set was also easily concealable and was often erected in wooded areas with only aerials clear of the tree tops. Dumbo proved to be the primary post–World War II early warning radar. However, this system was quickly followed by a family of radars characterized by metric frequency, the use of Yagi antenna, goniometric techniques and nearly identical transmitters.

By late 1951 Token, the next radar system to develop, stood out as the beginning of a generation of Soviet-built radars. This generation consisted of two subgroups, V-beam radars, and multisearch radars. By mid 1952, at least 50 V-beam radars, were spread across the U.S.S.R. and surrounding satellites from East Germany to Vladivostok.[136] This radar was obviously inspired by the U.S. AN/CPS-6 V-beam set. Although not provided for or available under the lend-lease program, it was contained in the MIT series. This set was constructed with IAGC and FIC circuitry: basic ECCM features which produced a limited capability against long pulse jamming and jamming with low modulation frequencies.

During the post-1950 period, Scan Odd was developed with German technical assistance. This was the first Soviet AI radar with limited all-weather capability. This set became field operational and was deployed in 1954.[137]

[135] "The Use of Radar in Soviet Antiaircraft Defense," Air Ministry Secret Intel. Summary.
[136] Background Intelligence Data for Posture Statement on Strategic Initiatives.
[137] Ibid.

Knife Rest A and GAGE, a Soviet designed EW and surveillance radar mounted on a bunkered building, made their appearance in 1952. The oldest radar in the Soviet inventory with the strict purpose of early warning, Knife Rest A had limited accuracy and detection capabilities, but was inexpensive and easily maintained. Knife Rest A has been found to operate in the 70–80 MHz frequency range. Gage proved to be the first really permanent radar of any significance that was employed by the Soviets as a search finder.

In 1953, a height finder was produced by the Soviets. This radar (Patty Cake) did not follow the usual Soviet development pattern—because it was uniquely Soviet in design—not a copy of Western technology. This, as stated, was contrary to the pattern followed in the V-beam early warning radar (Token) and fire-control radar (Whiff) which were directly derived from Western radar technology. Patty Cake remained the sole Soviet operational height finder from 1953 to 1956. Although the Soviet Union and the Soviet satellites were still using U.S.-made and British-made radars, in addition to the Soviet-made copies of U.S. and British radars.

In 1954, the number of Token radars increased markedly. Soviet technicians were clearly more successful at maintaining them at an operational level than the U.S. had initially anticipated. The difficulties that the United States had expected the Soviets to encounter were based on U.S. experiences with the AN/CPS-6, a similar radar. It was found, however, that the basic design of the Token radar was considerably simpler.

Observations during the 1954 time period showed that the Soviets were developing a radar system that made concurrent use of two sets as a single unit. The most commonly used sets were GAGE (search finder) and Patty Cake (height finder). The advantages of this system, in relation to Token, proved to be:

(1) Less complicated installation
(2) Simpler maintenance and operation
(3) Increased range and height finding capabilities.

The Soviets took this one step further by building radar installations with four radars. These radars were situated in pairs with Gage and Patty Cake comprising each pair. This appeared to represent a movement away from the mobile V-beam, Token, to a static system of radar defense.

By 1955, the Scan Can radar system was developed for use on missile armament. It is believed that this system was developed from Scan Odd. The nodding height finder was also introduced in 1955, apparently to provide reasonably accurate altitude readings on modern manned aircraft.

4. Summary

At the end of World War II, the Soviets found themselves in an outdated position regarding offensive and defensive war systems. They chose to place high priority on development of their defensive system. Development of radar systems was obtained through lend-lease, capture of wartime radars, German scientific assistance, and Soviet developments.

Throughout the 1945–1955 period, the Soviets primarily worked to reduce surprise, increase coordination, and increase the capabilities of their early warning system. The introduction of jet aircraft and tactical bombers increased the necessity for early warning and low altitude capabilities. By the end of 1955, radar systems were deployed and in the development stage to counter these problems.

Although advance raid warning was now primarily dependent on radar, visual reporting was still highly organized in 1955 with 750 visual reporting posts in active operation.[138]

E. History of Civil Defense in the Soviet Union, 1945–1955

1. Introduction

Civil defense in the Soviet Union played a key role in defense measures after the 1920's, but the destruction suffered during World War II and the advent of weapons of mass destruction prompted a new emphasis on Civil Defense shortly after the war.

Reconstruction and other problems surrounding immediate postwar recovery took priority until 1948; thereafter, and especially after the outbreak of hostilities in Korea, new civil defense programs and policies emerged.

Since the Bolshevik Revolution ended in 1917, the Soviets have nurtured the expectation of an impending attack by capitalist powers. During the 1920's, cities and other targets were prepared for protection against chemical and conventional attack. In 1927, OSOAVIAKHIM, a paramilitary training organization, was established with Civil Defense training as one of its prime functions.[139] During the 1930's, as concern over air power and the German threat began to grow, the first nationwide civil defense program was begun. However, it was not until World War II, when old civil defense programs proved inadequate, that shelter construction and compulsory training programs, designed mainly for civil defense workers, actually began.

2. Post-War Developments: General

Immediately after the war, interest in civil defense declined, primarily because of the precedence given to reconstructing the nation's social, economic, and military complex. However, around 1948, reports were filtered to the West from returning German POWs of a shelter construction program in all new buildings.[140] In 1949, basic radio communications designed to improve defense command and control was ordered. A call, in 1950, for "tens of thousands" of instructors preceded the formation of DOSAAF in 1951.[141] This organization, a paramilitary group cooperating with the Army, Navy, and Air Force, replaced OSOAVIAKHIM and became the principal civil defense training group. In the next two years, as DOSAAF took on more responsibilities, mandatory study circles began, followed by a 20-hour compulsory civil defense training program for all members, then numbering approximately 16 to 20 million.[142] The XIXth Party Congress, meeting in 1952, called for "all out" defense measures, to include civil defense. In 1953, an antiaircraft general, Nikolay F. Gritchin, was made DOSAAF chairman, indicating the growing importance of this group in relation to the military, and air defense in particular.[143]

Although the Soviets were aware of the existence of nuclear weapons at the end of World War II, little or no mention was made of these in public literature until 1954, nine years after Hiroshima and five years

[138] "Air Warning System of the Soviet Union," RCAF Intel. Summary.
[139] "Civil Defense of the U.S.S.R.," *Intelligence Review*, p. 15.
[140] Goure, *The Soviet Civil Defense Program*.
[141] CIA, "Civil Defense in the U.S.S.R."
[142] Goure, *The Soviet Civil Defense Program*.
[143] CIA, "Civil Defense in the U.S.S.R."

after the U.S.S.R. exploded its first atomic bomb. The turning point in civil defense thinking occurred at this time when civil defense literature publicly announced a growing concerning with nuclear and bacteriological weapons. This awareness precipitated changes in policy and eventual debate in the late 1950's over the effectiveness of civil defense programs, shelters, evacuation and dispersal procedures, and various other aspects of the existing system. More immediate results involved, in 1955, the assignment of Colonel General of Aviation O. Tolstikov, a First Deputy Minister for Internal Affairs, as head of Civil Defense and the onset of a 10-hour compulsory training program for the adult population.[144]

3. Organization

Civil defense, until 1961, was an integral part of the Soviet Antiair Defense (PVO) and was supervised by the Main Directorate of Local Antiair Defense, or GU MPVO. This controlling body operated under the Ministry of Internal Affairs (MVD) and was responsible for planning and assisting the Council of Ministers in developing civil defense policy and cooperating with the Defense Ministry's Main Directorate of Antiair Defense of the Country. Also, under the jurisdiction of the Council of Ministers was the principal civil defense training organization, DOSAAF.

Subordinate to the GU MPVO were Republic, Region (Oblast), District (Rayon), and City MPVO organizations. Within these areas, the civil defense structure paralleled that of the civil administration and employed administrative and managerial personnel from government and industry in its own commands and staffs.[145] For example, the Council of Workers Deputies of the City maintained responsibility for civil defense in their area. The chairman of their Executive Committee was the Chief of the MPVO in the city, and he directed the program through the MPVO staff. His duties included staff and personnel training, planning, financial and materiel coordination, and organizing civil defense training programs for the population. In addition, the MPVO controlled the services of fire fighting crews, emergency engineers, medical personnel, the sanitary processing and decontamination groups, the security groups, those involved in warning and communications, transportation personnel, shelter and cover service, and various other facilities that could assist in any facet of civil defense.[146]

Several aspects of the city or point concept indicate that the Soviet Union had not yet modified its civil defense structure to accommodate a nuclear threat. The existing system was geared towards a World War II or conventional bomber mode of attack. It was not until the early 1960's that the need for a state-wide, rather than city-wide, system of civil defense was evolved.[147] In addition, there was not, as yet, significant cooperation with the military, indicating that the actual integration with the air defense contingent of the U.S.S.R. had not been fulfilled.

4. Training

Comments on the organizational concept of civil defense between 1945 and 1955 would be incomplete without some attention to the birth and rise of DOSAAF, the paramilitary organization with responsibility for Civil Defense training of the entire population.

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[144] Goure, *The Soviet Civil Defense Program*.
[145] "Civil Defense of the U.S.S.R.," *Intelligence Review*, p. 16.
[146] Ibid., p. 17.
[147] CIA, "Soviet Civil Defense: Policies and Priorities," p. 13.

Paramilitary organizations have always handled Civil Defense training, beginning in 1927 with OSOAVIAKHIM. In September 1951, DOSAAF succeeded OSOAVIAKHIM as the "Volunteer Society for Cooperation with the Army, Air Force, and Navy" with Colonel General Vasiliy I. Kuznetsov as its head.[148]

Kuznetsov's leadership of DOSAAF was uneventful and he was replaced in 1953 by Lt. Gen. Nikolay F. Gritchin, a former World War II antiaircraft artillery officer. This appointment caused various analysts to note that there may have been increasing emphasis on the cooperation of civil and air defense at this time because of Gritchin's background. In any event, Gritchin initiated a successful campaign to urge new KOMSOMOL recruits into DOSAAF and to integrate DOSAAF with the trade unions and their various enterprises. In July 1954, a plenary session of the Central Committee of DOSAAF was held, emphasizing its roles and calling for a sports competition which would measure such abilities as marksmanship, grenade throwing, and PVKho (antiair and antichemical defense) to be held the next month.[149]

The PVKho section of DOSAAF retained the main responsibility for supervision of civil defense training, beginning with the study circles which originated prior to the formation of DOSAAF. Members of these circles who passed various civil defense examinations were awarded the badge of "Ready for Antiair and Antichemical Defense." In 1948, the stated goal of the mass training program was the preparation of 4 to 5 million persons a year to qualify for the badge. The Soviet press placed considerable emphasis on this program, evidenced in a *Pravda* item noting that in 1951, 21,434 persons from Tadzhik SSR were trained and received the badge and that the number of such trainees was growing "yearly by the hundreds of thousands."[150]

These various reports made civil defense and DOSAAF progress look effective, at least on paper. The three civil defense manuals of 1952, in particular the "Handbook for Exercises," reaped praises of civil defense excellence on "heroic people contributing to Civil Defense during the Great Patriotic War" and to DOSAAF and its work.[151] The contents of the manual included sections on means of attack against the rear and antiaircraft defense, protection against bombs and their consequences, protection against gases, and rules of conduct for the population in antiaircraft defense. However, the outlined procedures did not demonstrate that the Soviets had achieved any profundity in civil defense that could not be achieved in any other country subject to aerial attack. Surprisingly enough, they lacked any significant reference to atomic or thermonuclear warfare and its consequences, a matter which seemingly should have been assuming more importance as the Cold War was taking shape. One of the few references to atomic weapons appeared in the Soviet press in 1947, before OSOAVIAKHIM was disbanded: "The present program of civil defense includes the training and protection of the population against atomic air raids. OSOAVIAKHIM aims only at the discipline of the people; the preparation of such defenses as 'insulation layers' is being left to the scientists. At present, sham maneuvers are held for those people in strategic areas who would have to be moved away rapidly, and personnel are being trained in the detection of radioactivity. The training is similar to that for chemical warfare."[152]

[148] "Military Notes: U.S.S.R.," *Intelligence Review*, p. 16.
[149] CIA, "Civil Defense in the U.S.S.R."
[150] "DOSAAF Trains Soviet Civil Defense," *Air Intelligence Digest*, p. 14.
[151] Ibid., p. 14.
[152] Ibid., p. 13.

Whether this statement indicated that the press was merely naive or was printing what it was authorized to print is unknown. As a propaganda move, it could have been intended to reassure the population regarding any knowledge they might possess of nuclear threat. The mention of "scientists" handling problems related to civil defense indicates that the Soviets may have been awaiting technological developments in shelter capabilities before either publicizing a problem they could not yet counter or making any massive changes in the existing system.

Guards Colonel General P. A. Belov became the new commander of DOSAAF in 1955 and perhaps initiated the first drive for better cooperation between the military and the civil defense organs when he stressed the need to use demobilized reserve officers and soldiers for leadership and instruction in areas of civil defense.[153] Eventually, not reserve but high-ranking active duty officers became a part of the directorate. Various sources have mentioned that, after 1955, civil defense was endorsed by the Soviet leadership.[154]

5. Shelters, Evacuation, and Dispersal

Although some sources refer to basement shelters constructed in new apartment buildings as early as 1946,[155] the general consensus puts the year around 1948 when German POWs reported sighting shelter buildings being inspected and supervised in recent construction. It was believed that civil defense officials had authority to conduct these inspections to insure that construction was meeting certain regulations. However, it was also noted that priority was given to shelter protection for industrial, administrative, and economic facilities and to major cities, thus disregarding a greater part of the population,[156] particularly the agrarian community. The most prevalent shelters, those of World War II vintage, were not capable of protecting more than 10 to 15 percent of the population against fallout,[157] and new shelters were designed merely to withstand the collapse of the building. This did not account for the thermal and blast effects of nuclear explosion. The advantage of existing underground structures was demonstrated in 1954 when shelter construction was begun in subways.

The preceding data were partly responsible for spurring the civil defense debates of the late 1950's over the cost-benefits of updating present shelters to withstand nuclear attack.[158] It was not until then that a massive evacuation program was promoted to compensate for both the shortage and inadequacy of the existing shelters. Very little emphasis was accorded to a formal evacuation program prior to 1958.[159] Although one source said there was "fairly reliable evidence" that industrial evacuation plans were updated in 1950, an interview in 1953 with Moscow citizen did not yield any evidence of a city-wide air raid drill during the two-year period the interviewer had been a resident there.

A summary of rules the population was to follow during a "critical situation" involved learning the location of the nearest air raid shelters, and *when none exist* to "prepare trenches, dugouts, and similar facilities,"[160] indicating the inefficiencies of the shelter program. Also, implied is the Soviets' reliance on early warning of attack. Civil defense elements maintained close communications with the "local elements

[153] CIA, "Civil Defense in the U.S.S.R."
[154] "Civil Defense of the U.S.S.R.," *Intelligence Review*, p. 20.
[155] SRI, Soviet Strategy, Objectives, and Force Postures in Response to U.S. BMD, 1968–1980.
[156] Goure, *The Soviet Civil Defense Program*.
[157] CIA, "Soviet Civil Defense: Policies and Priorities," p. 7.
[158] Ibid.
[159] CIA, "Changing Soviet Civil Defense Concepts."
[160] "Civil Defense of the U.S.S.R.," *Intelligence Review*, p. 20.

of the air defense command . . . especially VNOS," the ground observation early warning service.[161] This approach may have been appropriate when bomber attack was the primary threat, but dependence on such a primitive early warning system (which later improved with more advanced radar technology) in order to prepare the population, was hardly an efficient and secure plan.

According to observations during a 1961 trip, which could easily apply to this early period, Leon Goure theorized that the population was indifferent to civil defense, possibly because of the effects of World War II destruction. He noted that the general fear of war and feeling of helplessness against the weapons of war left the people with little confidence in shelter programs. "Mere physical survival was not reassuring when they knew the great damage brought by war: and were still recovering from World War II."[162] If this is true and if the leadership of the Soviet Union considered the civil defense programs as a propaganda tool in boosting the morale and nationalistic altitudes of the population, then they were unsuccessful in attaining this goal.

Uncertainty exists concerning the relationship of industrial dispersal in the Soviet Union and civil defense activities. However, it seems that the reasons for relocation of industry to the Ural regions during the 1930's and from 1941–1945 were attributed primarily to both protection from conventional military invasion and the discovery of new locations of resources,[163] from which air and civil defense would only indirectly benefit. Budgetary considerations alone would make such a transfer impractical except in extreme cases. Although one source assigns to the MPVO the peacetime functions of "town planning" (and thus the ability to *ensure* proper dispersal of plants and provisions for air raid facilities in new building construction),[164] it is doubtful that it was able to do more than recommend guidelines for such purposes.

6. Summary

It would seem that, as the Soviets were recovering from World War II damage and beginning their strenuous drive to gain technological and military parity with the West, they also found time to reassess and begin improvements on other internal programs. Civil defense acquired renewed attention by 1948 and paralleled the growth of air defense in the Soviet Union.

Beginning with lessons learned from World War II, including the effects of German air attack on their homeland and the accounts by returning Soviet military of U.S. bomber damage in Germany, Soviet leaders realized the need for a stronger, more organized civil defense program. Not only did they realize that the ability to protect their military/economic/social complex would be a more difficult mission with the development of new weapons technology, but perception of immediate threats such as the proliferation of the United States' Strategic Air Command, the establishment of NATO in 1949, and the Korean conflict of 1950–1953 (when it was possible to actually witness and assess the new aircraft technology developed since the war) reinforced the Soviet's early views concerning adequate defense. The following changes within the Soviet Union after 1950 had a profound effect on defense posture:

(1) Development of strategic weapons of mass destruction;
(2) Increasing vulnerability due to urbanization and industrialization;
(3) Polarization of the global struggle into an East/West power bloc;

[161] Ibid., p. 20.
[162] Goure, *The Soviet-Civil Defense Program: A Trip Report*.
[163] Cole and German, A Geography of the U.S.S.R., The Background to Planned Economy, p. 75.
[164] "Civil Defense of the U.S.S.R.," *Intelligence Review*, p. 20.

(4) Cold War intensification;
(5) The feeling that civil defense can contribute to the overall military posture of the Soviet Union.[165]

Thus, it could be claimed that the Soviet civil defense program was a result of mere common sense, of the recognition of the need to protect not only the military-industrial segment of the society but also to maintain the morale of the population, now considered a prime factor in effective recovery from mass attack.

Of course, the success of such a vast institution relies heavily on popular support. As stated earlier, considerable apathy has been reported, and one sources mentioned that "pressure is being applied by the Communist party and other groups" to promote membership and participation.[166] The advent of a compulsory training program in 1955 probably came as a result of little success with "voluntarism." Therefore, again it must be that the program at least looked "good on paper," but to the extent it was successful is not known. By 1955, with the acknowledgement of nuclear weapons, civil defense appeared to be more heavily endorsed by "those who can make a difference"; also, the impressive leadership status of such organizations as DOSAAF, and Tolstikov's appointment as Chief of Civil Defense in 1955 implied a trend toward greater integration with the military and air defense components.

A quote from a 1953 article states: "Today, the Soviet Union is reasonably well prepared in civil defense matters to cope with air attack."[167] The key words here seem to be "air attack," because Soviet civil defense preparations were certainly keyed to a World War II–type of aerial threat through 1958. Even the publicized awareness in 1954 of a nuclear threat did not immediately change civil defense thinking, although it precipitated greater military/political concern with civil defense and the eventual transition of the system from a civilian-administrated/city-oriented program to a military-directed/nationwide institution.

[165] Goure, *Civil Defense in the Soviet Union*.
[166] "Civil Defense of the U.S.S.R.," *Intelligence Review*, p. 20.
[167] Ibid., p. 15.

Appendix A

Concepts of Air Defense Before 1945

A. The U.S. Heritage of the Interwar Period

1. Early Premises

U.S. concepts for air defense during the 1920's were strongly influenced by various developments in U.S. national policies, the perception of the threat and technological advances. These were supported by "lessons" drawn from World War I operational experience and subsequent developments.

U.S. national defense policies rested on the premise that attack by a potential enemy was unlikely. Indeed, during the decade of the 1920's, Army and Navy planners found it difficult to determine *any* enemy or enemies who might be *capable* of threatening the United States. After the 1922 Washington Disarmament Treaty and the termination of the Anglo-Japanese alliance, the United States seemed to have little to fear either from hostile air attack launched from carriers (because of tonnage limitations in the Washington Treaty of 1922) or from land-based aircraft (because of their inherent range limitations). As a consequence, the conclusion was general that the United States was in no danger from air attack. This conclusion was not reinforced by prevailing service doctrine but still became the conventional wisdom.

2. Origins of Air Force Doctrine: Early Air Defense Concepts

Air officers in the Army were convinced from the end of World War I that the best defense was a good offense. Many who held this view felt that the Army General Staff was primarily interested in the "defensive use" of aircraft and had neglected the "fighting side." General Mitchell carried on an extraordinary effort for a separate aviation department while arguing the need for a defined role for an expanded Air Service in the Army. Mitchell's paper entitled "Tactical Application of Military Aeronautics," proposed in January 1920, defined the principal mission and secondary employment of aeronautics. "The principal mission of Aeronautics is to destroy the aeronautical force of the enemy and after this, to attack his formations, both tactical and strategical, on the ground or on the water. The secondary employment of Aeronautics pertains to their use as an auxiliary to troops on the ground for enhancing their effect against hostile troops."[1]

Based upon a visit to France, Italy, Germany, Holland, and England in the winter of 1921–1922, Mitchell advocated unity of "air command." The air commander, he wrote "should control not only the observation aviation but also all antiaircraft weapons, searchlights and barrage balloons."[2]

Two years later, General M.M. Patrick, who had headed the Air Service with the AEF in France, proposed a reorganization and expansion of the Air Service within the War Department to give the Air Service

[1] Futrell, *Ideas, Concepts, Doctrine: USAF*, pp. 32–33.
[2] Ibid., p. 37.

a status analogous to that held by the Marine Corps within the Navy Department. He wrote on 19 December 1924, "I am convinced that the ultimate solution of the air defense problem of this country is a united air force . . . . Future emergencies will require at the very outset . . . the maximum use of air power on strategic missions . . . ."[3] Such views were disputed by some critics.

In early autumn of 1925, the Secretaries of War and Navy jointly requested President Coolidge to support a board to study the best means of developing and supplying aircraft in U.S. national defenses. The President appointed a board, The Aircraft Board, headed by Dwight W. Morrow. After extensive hearings, this board published a report on 25 November 1925 stating: "We do not consider that air power, as in some of the national defense, has yet demonstrated its value—certainly not in a country situated as ours—for independent operations of such a character as to justify the organization of a separate department."[4]

The board concluded that the United States was in no danger from air attack and stated that the "belief that new and deadlier weapons will shorten future wars and prevent vast expenditures of lives and resources is a dangerous one, which, if accepted, might well lead to a more ready acceptance of war as the solution of international difficulties."[5]

Over the next decade, advances in aircraft range, speed, and altitude persuaded the Air Corps to urge upon the War Department the development of interceptor aircraft with at least 20 percent greater speed than proposed bombardment planes. In addition, the Air Corps recommended steps to provide a ground observer corps and aircraft warning and reporting unit in the United States and its overseas possessions.

While the Air Corps was seeking a better interceptor capability, it was also urging an improvement in early warning systems.

Detection research had progressed deliberately after World War I. By the 1930's, increased concern for defense (i.e., a growing U.S. desire for effective warning of a hostile approach either by sea or air) caused existing programs of visual and sonic research to broaden and include other radio-optical research for detection. That area showed promise and progress. Both the Army and the Navy reported success in detecting and tracking aircraft by reflected infrared rays. The Army, in 1926, had detected an aircraft, and, in 1932, the Navy had tracked a blimp using reflected IR means. The Army's Signal Corps experimented in tracking ocean liners in the early 1930's using a thermo locator. From a location at Fort Hancock, the Mauretania was tracked to a distance of 23,000 yards in 1934. A year later, the Normandie was tracked to 30,000 yards and, a few months later, the Aquitania to a distance of 18,000 yards through a fog.[6] Radio location soon took over, however, from heat locating and ranging.

May 1937 is often cited as a principal turning point in Army technical history, based upon the successful demonstration of a short-range AA radio locator, the SCR-268, developed for searchlight control.[7] Designed to locate aircraft at night in range, elevation, and azimuth accurately enough so that searchlights would instantly illuminate them when they were turned on, the SCR-268 was a mobile item of equipment. Designed for AA use, it did not provide continuous tracking and could not be brought to bear against low-flying aircraft. With relatively limited range, the SCR-268 provided only about five minutes' warning.

[3] Ibid., p. 43.
[4] Ibid., pp. 48–49.
[5] Ibid., p. 49.
[6] Terrett, *The Signal Corps: The Emergency*, pp. 38–39.
[7] Ibid., p. 46.

Although it was obviously not immediately useful for interceptors, the new locator was impressive enough to prompt the Army Air Corps to seek development of an early warning radio locator to provide warning at ranges up to 120 miles. Following further development and testing during 1938, the SCR-268 mobile radar for AA was standardized and put into production in the winter of 1939. Concurrently, development of early warning radars for the Air Corps progressed until the SCR-270 was established as basic equipment for the purpose. With these developments, the United States, as well as the British and the Germans, had radar for air defense when World War II began.[8]

In addition to these developments in the doctrine and technology of early warning and interception, the Army fostered improvements in antiaircraft artillery.

3. U.S. Army AAA Developments

AAA developments during the 1930's in the U.S. Army advanced to the degree that appropriations permitted. In 1938, the 90-mm. gun development project was completed and by 1940 was standardized as a replacement for the 3-inch AA gun M-3 which had been adopted in 1928. The 3-inch gun began to phase out as the 90-mm. AAA gun was adopted as standard in February of 1940. By the fall of 1940, the 90-mm. requirement called for more than 1,000 guns; yet during 1941 only 171 complete units were produced. The 37-mm. AA gun was adopted as standard in 1939 but this automatic weapon was just getting into production in 1940, when 170 were produced. By January 1941 this weapon was being produced at a rate of 40 per month. In the following month the 40-mm. Bofors AA gun was approved for standardization, although it took more than a year to get production rolling on the Americanized version of the 40-mm. AA gun.[9] The caliber .50 AA machine gun remained a low-altitude defense weapons from its adoption as standard during the early 1920's.

The U.S. Army AAA regimental organizations at the time were of two basic types: mobile and semi-mobile. Mobile regiments consisted of two battalions; the first battalion (guns) contained three gun batteries, each having four 3-inch guns and one searchlight battery of 15 searchlights. The second battalion was made up of automatic weapons, with those batteries of 37-mm. automatic weapons each having eight 37-mm. guns with one .50 caliber machine gun battery or, as was the case earlier, four .50 caliber machine gun batteries. The semi-mobile regiment consisted of three battalions; the first two battalions were gun battalions, each with the armament of the mobile battalion; the third was an automatic weapons battalion of four batteries.

At the outbreak of World War II in September 1939, the U.S. Army included seven skeletonized active AA Regiments, plus a number of National Guard and Organized Reserve AA Regiments, in the inactive forces.

4. Expansion Program

Keeping pace with increased performance of military aircraft, AAA developments influenced U.S. Defense planning. In addition to greater interest in AAA, in June 1939, the Army began an "Aviation Expansion Program" which authorized a three-fold increase in the combat strength of the Air Corps. That branch planned to attain within two years an overall strength of 24 groups—including seven pursuit

[8] Ibid., p. 127.
[9] Green, et al., *The Ordnance Department: Planning Munitions for War*.

interceptor groups. As the war in Europe developed, the U.S. Army Air Corps looked more closely at air combat operations in that theater for their implications concerning air power theories which stemmed from Douhet's thesis that airpower and command of the air would enable the destruction of an enemy nation. Increasingly the Army Air Corps argued that the air defense of the United States was best served by having strong offensive air capabilities. The best defense was a strong offense.

U.S. air officers generally agreed in the fall of 1939 that the Luftwaffe had substantiated American theory in its essentials because, although German air operations in Poland were mainly in support of ground fighting, the Luftwaffe had established control of the air by destroying the Polish Air Force on the ground on its air fields. German victories over British and French forces in the west further underscored the theory and increased pressure for meeting U.S. bomber requirements. Recommendations for increases in U.S. long-range bomber forces were pressed with the view that, rather than investing heavily in interceptors for defense, strong U.S. bomber forces could carry destruction to an enemy homeland or destroy his air power.

Development and success of the B-17 and B-18 gave rise to the Air Corps Tactical School 1938 teaching: "The possibility for the application of military forces against the vital structure of a nation directly and immediately upon the outbreak of hostilities in the most important and far reaching development of modern times."[10]

5. U.S. Air Defense Planning and Organization for CONUS

Thus, as early as 1938 U.S. planning had to include the possibility of attack on the continental United States. Because of the prospect that this possibility would involve air attack, air officers became more deeply involved in U.S. defense planning. "Indeed, they tended to feel that the problem was exclusively theirs and to attach slight importance to collaboration with ground troops. . . ."[11]

An Air Defense Command was organized on 26 February 1940, with headquarters at Mitchell Field, Long Island, New York, under GHQ, Air Force. It was a planning body with authority to organize combined air-ground operations but it had no territorial responsibility over either aircraft or antiaircraft artillery. Directly subordinate to the GHQ Air Commander, the Air Defense Command's organization and operations were greatly influenced by lessons from the Battle of Britain and the growing autonomy of the Army Air Corps. The Air Corps, for example, established an intermediate echelon between its wings and the GHQ Air Force in 1940 by dividing the United States into four air districts. Ostensibly organized for training and administration, these districts were later proposed to have, within each of them, a bombing command and an air defense command, the former to conduct offensive operations, the latter defensive operations, "within the theater of the Air District."[12] In other parts of the Army, it was held that the air districts should not be identified as theaters of operations.

In March 1941, the War Department ordered the establishment of four defense commands in the United States—Northeastern, Central, Southern, and Western. Each defense commander would be responsible for planning all measures against invasion of the area of his command. The commanding general of each of four armies was designated as the commanding general of the defense command within which his head-

[10] Futrell, op. cit., p. 84.
[11] Greenfield, et al., *Army Ground Forces: The Organization of Ground Combat Troops*, p. 116.
[12] Ibid., p. 117.

quarters was located and the Army staffs were used as the staffs of the defense command. This same War Department order replaced the previously announced four air districts with four numbered air forces. Each air force included a mobile echelon comprising a bomber command and an interceptor command, the name chosen to replace the "air defense" command. The four air forces remained directly under GHQ Air Force and were not subordinate to the defense commands.[13] The directed organization appeared somewhat similar to the basic British structure which had been set up for UK air defense under the RAF.

By June 1941, the Army Air Forces became an autonomous element in the War Department and direct responsibility for Army aviation matters was given to the Chief, Army Air Forces. Within his staff, the Air War Plans Division was charged with preparing "overall plans for the control of the activities of the Army Air Forces."[14] In effect, the AAF would make aviation plans for the numbered air forces in the defense commands. But the War Department order of 17 March 1941 establishing the defense commands stated explicitly: "When the War Department, to meet an actual or threatened invasion activates a Theater of Operations (or similar command) in the United States . . . the commander of the theater (or similar commander) will be responsible for all air defense measures in the theater."[15]

This same order provided that antiaircraft artillery, searchlights, and barrage balloons be attached to interceptor commands during operations.[16]

How these ground elements would be controlled, however, was not clear. Experience in the Battle of Britain had shown that tactical coordination was needed and that rapid, reliable communications and intelligence were essential, among other reasons, to clarify responsibilities and to avoid possible harm to friendly aviation. In the summer of 1941, the AAF proposed that the fire of all AAA be controlled by regional officers of the interceptor command. This was deliberated through the spring-summer of 1941, first, by an Air Defense Board made up of the Chief of Coast Artillery, Chief Signal Officer and the Commanding General of the GHQ Air Force which concluded that an exception should be made for combat zones. This view was personally contested by General McNair (first commander of Army Ground Forces) who pointed out that coordination of air defenses was just as necessary in the combat zone as elsewhere. He urged unity of command for all air defense forces and suggested that all antiaircraft units should be assigned or attached to interceptor commands.[17]

6. Early Air Defense Doctrine

During the following months, the AAF prepared a draft Field Manual, entitled "Air Defense," which included doctrinal concepts which integrated pursuit/interceptors, AAA, barrage balloon units, and Signal air warning units into a coordinated air defense establishment. This draft manual which drew heavily on British air defense experience in the Battle of Britain, distinguished for the first time between the term "air defense," which was a direct defense against enemy air operations and "counter air force operations," which were said to be not properly within the scope of air defense. While not officially approved and published,[18]

[13] Ibid., p. 119.
[14] Futrell, op. cit., p. 100.
[15] Greenfield, op. cit., p. 123.
[16] Ibid.
[17] Ibid.
[18] FM 1-25, *Air Defense*, was finally published by the War Department on 24 December 1942, but it was substantially revised from this draft.

this draft manual strongly influenced U.S. air defense training and organization. Much of its substance was incorporated into War Department Training Circular No. 70, 16 December 1941, which implicitly reflected some of the lessons drawn from the attack on Pearl Harbor and the need for unified command as it stated: "All antiaircraft artillery and pursuit aviation operating within the same area must be subject to the control of a single commander designated for the purpose." Two days later, War Department Training Circular No. 71, 18 December 1941, set forth the concept of "antiaircraft commands" to operate under the "command" of interceptor commanders.[19]

In addition to these concerns with the proper organization for air defense, the Army Air Forces newly established Fighter Command School in the summer of 1942 also contributed to the evolution of air defense doctrine. The Air Defense Directorate of that school set about to develop air force doctrines, tactics and techniques of air defense, to test air defense equipment and operational procedures and to recommend measures for the organization of air defense for the Unites States and overseas theaters.

7. Organizing AAA Combat Units

The concept of an arm of one of the Army's branches to be configured for operational employment as part of a larger integrated fighting force was new and pointed up the growth of specialization and new techniques and interdependence of U.S. combat forces. Within the Army Ground Forces the Coast Artillery Corps, which was traditionally responsible for ground-based air defense, confronted a number of problems in meeting demands of a great and rapid expansion. Gradually a new antiaircraft branch emerged within the Coast Artillery Corps and the new element exceeded the importance of the coast defense functions.

The requirement for operational air defense units grew amazingly, and the antiaircraft operational function became increasingly technical. As an indication of growth, during the three years after the fall of 1940, when the President declared a national emergency and U.S. defense efforts accelerated, Infantry increased by 600 percent; Field Artillery by 500 percent; but Antiaircraft Artillery jumped by 1750 percent.[20] Only a small part of this expansion resulted from the call to active service of Antiaircraft Artillery units from the National Guard and original reserves. Thus, there was an immediate and difficult job of organizing, training, and equipping substantial numbers of AAA units.

To build required, new AAA units became an important, pressing task. No other ground areas had to ship units—organized, trained, and equipped for combat—as rapidly as antiaircraft. In the early phases of the defense buildup and initial period of the war the demand for AAA was exceptionally heavy both in overseas theaters and bases and in the defense commands in the United States. Units had to be put together and deployed quickly. The effort was built on the base of available active units which, by 30 June 1941, included 43 mobile AAA Regiments, 6 semi-mobile Regiments, 13 separate AAA Battalions, and 1 Barrage Balloon Battalion.[21]

As an early step to facilitate rapid organization and training, the AAA regimental structure was replaced by designating the battalion as the fundamental unit, making it self-contained tactically and administratively. In addition, the number of different kinds of units was reduced. As the Army moved to eliminate the

[19] Greenfield, op. cit., p. 126.
[20] Ibid., p. 418.
[21] Cibula, *History of the Antiaircraft Command*.

AA regiments, a new tactical organization, the group, was set up to provide a means of having a flexible composition of AA battalions. As groups would have a number of battalions, varying with the situation, so would brigades constitute a varied number of groups with attached battalions. At the same time, the Coast Artillery designation of AAA units also was dropped.

As part of a major reorganization of the Army in March 1942, the Antiaircraft Command was set up within the Army Ground Forces and made responsible for readying any required AA forces needed for operations. Many handicaps attended the organization and training of new units by the Antiaircraft Command. Combat experiences were not available to pre-test or guide the effort. There was no proven doctrine and much to learn from on-going operations. To regularize training policies was difficult in the face of heavy demands for more complete training.[22]

8. Lessons from the Battle of Britain and American Combat Experience

The Battle of Britain clearly influenced U.S. thinking about coordinated air defense. The British experience impressed itself in various ways on U.S. organization and operations. First, that experience seemed to discredit the U.S. concept that a hostile air force could be destroyed on the ground. The RAF not only showed that a well-dispersed air force was a difficult bombing target, but also argued that it was effective and efficient to destroy hostile aircraft in the air by fighter attack. Second, fighter tactics used by the RAF were proved effective because of electronic early warning and fighter control established on the recommendations of a special committee for the scientific survey of Air Defense under the chairmanship of Sir Henry Tizard, Rector of the Imperial College of Science and Technology.

U.S. Army Air Corps observers attributed severe losses taken by the Luftwaffe in the Battle of Britain to the firepower volume of British fighters, poor rear defenses of the German bombers, vulnerability of dive-bombing tactics, large formations, and poor air discipline. Yet the growing significance of radar was implicit in the basic report of the RAF victory submitted by General Spaatz on 29 February 1941 when he said: "A numerically inferior air force has been phenomenally successful in stopping the unbroken chain of victories of the world's strongest air power." That same month, General Arnold, while commenting on U.S. air defense deficiencies, wrote: "During daylight in good weather, when pursuit aviation is present in strength in an area, it can pretty near bar the air to the bomber."[23] (Within a few years, senior U.S. air officers would claim that bombers could overwhelm any defense.)

The British experience soon stimulated conceptual planning for a U.S. continental warning system. From the spring of 1941, GHQ Air Force had responsibility for organizing and training for air operations and defense against air attack in the continental United States. Many other War Department agencies were actively engaged in different aspects of the development of U.S. air defense capabilities. Under the AF GHQ, the Army Air Force organized interceptor commands to carry out air defense operations. It was anticipated that these commands would exercise operational control of AAA units of the Coast Artillery Corps and air warning units of the Signal Corps.

[22] During 1942, the SCR 268 was the only gun-laying radar available for AA units although it had not been designed for that purpose. Since these radars were also needed overseas, very few were available for units in AA training center in the United States. Target practice against airborne targets was difficult because of limitations on availability of Air Force aircraft for tow target missions. AA Command pioneered expedients such as the rocket target and other training devices.
[23] Futrell, op. cit., p. 97.

"When war came [radar warning] sites had been picked for thirteen radar stations along the East Coast and eight of the stations were approaching completion."[24] On the West Coast at the outbreak of war 10 radar sites were scheduled to be set up to provide coverage of the 1200 miles between Seattle and San Diego.[25] Each radar chain was to be complemented with ground observers; the East Coast was to have 4,000 ground observer stations and 2,400 were supposed to be active along the Pacific coast.

But, while progress had been made, the air defense system of the United States was still in a formative stage when the war broke. There was no GCI (Ground Controlled Intercept) capability and it was "not until late 1943 that the continental defenses were generally equipped with VHF radio and a workable system for controlling interceptions at night."[26] While radar siting activity was "feverish" during 1942 and 1943, by the fall of 1943, the danger of air attack had decreased to the point that the numbered Air Forces which had been assigned to the defense mission were then reassigned to the control of the Army Air Force.

Early in 1942, the Army was reorganized into three principal elements: Army Ground Forces, Army Air Forces, and Army Service Forces. None was directly responsible for air defense combat operations. Under the Army Ground Forces, the Antiaircraft Command was given the mission of organizing, training and equipping AAA units for assignment to operational commands. In addition, AA Command was responsible for developing AA materiel and equipment. Major General Joseph A. Green, then Chief of Coast Artillery, headed the AA Command and his headquarters were staffed by personnel from the Office of the Chief of Coast Artillery. From April 1942 to September 1945 the AA Command trained and sent overseas 451 separate AAA units; the balance of a total of 613 AAA combat units were trained for use within the continental U.S. Under the Army Air Forces, four numbered air forces based in the U.S. not only organized and trained air units but shared air defense activity at home. The Army's Chief of Ordnance and Chief Signal Officer had significant roles in the procurement, delivery, and maintenance of air defense equipment under the Service Forces.

Since operational activity in continental air defense never actually involved active combat, the growing overseas experience of U.S. units increasingly affected organizational and training activity in the zone of interior and also influenced equipment developments for air defense. From the Philippines, Panama, the Antilles, Alaska, and the Central and South Pacific reports of operations during 1942 began to build a varied body of operational experience which was looked upon as a validation and extension of existing U.S. doctrine, organization, and equipment for air defense.

Because it was the first major air-ground offensive in World War II, operations in North Africa beginning in November 1942—with new theories being expounded and tested there and greater emphasis given to armored warfare—soon gave rise to demands for more effective close air support and air defense tailored to the needs of mobile, widely dispersed combat formations. These demands also led to concepts of increased centralization of air power.

General Montgomery wrote in January 1942 that the greatest asset of air power was its flexibility and maintained that this flexibility could be realized only when air power was centrally controlled by an air officer who maintained close association with the ground commander. The following month General Spaatz

[24] *History I Fighter Command, 1941–1944*, p. 104ff, cited by Sturm, et al., *The Air Defense of the United States*, p. 21.
[25] Ibid.
[26] Ibid., p. 22. GCI involved U.S. commitments to air defense improvements for many years after the war. Considerable effort and money have gone into improving the potentials of GCI, including adding to the speed and altitude of interceptors, and to the lethality of their armament. Much effort has been given to improving the coverage and sophistication of ground based radar nets. Yet the war time role of GCI was never really clarified with respect to possible theaters.

organized the Northwest Africa Allied Air Force and gave it command over a Strategic Air Force, a Coastal Air Force and a Tactical Air Force. Writing to General Arnold the next month, General Spaatz said: "the air battle must be won first . . . Air units must be centralized and cannot be divided . . . among several armies or corps. . . . When the battle situation requires it, all units, including medium and heavy bombardment must support ground operations."[27] Within a few months, the Army Air Forces published Field Manual 100-20, "Command and Employment of Air Power," which said:

> The inherent flexibility of air power is its greatest asset. This flexibility makes it possible to employ the whole weight of the available air power against selected areas in turn; such concentrated use of the air striking force is a battle-winning factor of the first importance. Control of available air power must be centralized and command must be exercised through the Air Force commander. . . . Therefore, the command of air and ground forces in a theater of operations will be vested in the superior commander charged with the actual conduct of operations in the theater, who will exercise command of air forces through the air force commander and command of ground forces through the ground force commander.[28]

Published by the War Department, but without the concurrence of the Army Ground Forces, FM 100-20 was greeted with mixed reactions. In the Army Ground Forces, it was viewed with "dismay" and described as the "Army Air Forces' Declaration of Independence." Among U.S. air officers, too, there was some reserve; for example General Orvil Anderson considered the division of air power, as represented by a tactical air force, to be wrong and it was suggested that the Air Force had "swallowed the RAF solution to a local situation in Africa hook, line and sinker without stopping to analyze it. . . ."[29]

In effect, relatively new and essentially untried principles were being applied on the battlefield to the needs of the war. Trial and error experience in the field did not offer American schools adequate time for thoughtful development of doctrine. Nevertheless "trained" units had to be deployed with the latest "doctrine." With incidental changes, the previously developed draft on air defense, which had originated in the Army Air Forces in October 1941, became War Department Field Manual 1-25 on 24 December 1942. But little actual operational experience could validate the manual.

In North Africa, the Luftwaffe remained active and contested with the several allied air forces for local air superiority. The demands for air defense capabilities, therefore, intensified and the rate of growth for antiaircraft units continued high throughout 1943. This continually expanding requirement for AAA combat units not only consumed programmed manpower, but increasingly sophisticated and varied technical demands developed as a result of combat experience and the growing capabilities of improved weapons, ammunition, and material.

Within the Army Ground Forces, AAA was viewed primarily as a "defensive" capability, required and useful only so long as U.S. air power could not provide air superiority. Air defense requirements for resources were of less concern to the AGF which felt that the AAA represented priority and specialized requirements for support in men, equipment and facilities. AAA was useful and worthwhile if it supported ground combat forces but otherwise air defense artillery was of lesser interest.

Command arrangements in overseas areas governing air defense frequently were deficient for coordination of operations; long periods of inaction limited operational proficiency because of lack of arrangements and facilities for continued training. AAA units needed target practice and this entailed Air Force support, to

[27] Futrell, op. cit., pp. 121–122.
[28] Ibid., pp. 122–123.
[29] Ibid.

fly the tow-target missions. Such conditions fostered a proposal for the transfer of the AA Command to the Army Air Forces. The issue first came to a head in February 1943. Originated within the War Department General Staff, by the G3, General Edwards, who was an Air Corps officer, the proposal was supported by General Arnold, Commanding General, Army Air Forces.[30] The main reason for the proposal, according to the memorandum setting it out, was that AAA and fighter aviation should be trained together because they should operate as a team in combat.

General McNair, the AGF commander, agreed with the need for training of AAA units with Air Force units but he also believed there was a need to train AAA units with mobile ground units, despite the fact that few ground troops had, up until that time, engaged in mobile operations.[31] He could not see how branch or unit training of AAA, a necessary preliminary to combined training of any kind, would be improved by a transfer of the Antiaircraft Command to the Army Air Forces.[32] The Operations Division of the War Department General Staff agreed, and the proposal for AAA to be shifted to the AAF was dropped.

By the summer of 1943, however, the issue surfaced again.[33] Reflecting the growing significance of AAA as part of active air defense operations overseas, a substantial body of antiaircraft officers were assigned to duty at various Air Force headquarters throughout the world. Their assignments ranged from instructing at the School of Applied Tactics at Orlando, Florida, to flak analysis for operational Air Forces overseas. Many AAA units were actively committed to air field defense. AAA officers on duty with the Air Force had a kind of functional headquarters in the office of the Special Assistant for Antiaircraft to General Arnold, headed at the time by Major General Homer R. Oldfield, who was named to the post after having served for several years as the Commanding General, Panama Coast Artillery Command. In that assignment, General Oldfield had commanded the antiaircraft defense of the Panama Canal with more than 600 operational positions manned in an extensive deployment throughout Panama for defense of the canal.

In September 1943, General Oldfield was named to head a War Department Board to survey the antiaircraft problem, following the shooting down of U.S. aircraft by friendly antiaircraft in the Sicilian Campaign. That board submitted a number of findings, including the following:

(1) Air commanders, in the defense of fixed installations in the theaters of operations, should exercise command over their supporting antiaircraft units,
(2) Air commanders should control the allocation of all antiaircraft units,
(3) Army Ground Forces regarded AAA as a defensive weapon,
(4) Combined training of AAA had been bad, and
(5) The dissemination of technical knowledge and training doctrine in the theaters had been inadequate.

[30] War Department Memo, 9 February 1943, subj.: "Integration of AAA with AAF," cited by Greenfield, op. cit., p. 420.
[31] In the North African campaign, the utility of self-propelled AAA had been demonstrated effectively and spurred the requirement for this special type of automatic weapons battalion. One AAA unit in the initial landings had been equipped as a self-propelled battalion for test of the concept. Organized with a headquarters and, each consisting of two platoons, one an automatic weapons platoon, the other a machine gun platoon, AAA SP battalions were standardized in 1943 to provide the AW platoon with nine M-15 gun carriages, consisting of one manually operated 37-mm. gun coaxially mounted with two air-cooled .50 caliber AA machine guns. The M-15 was a lightly armored, half-track carrier. The machine gun platoon was equipped with eight M-16 carriages; each consisting of four air-cooled .50 caliber AA machine guns on a power-operated revolving turret mounted on a lightly armored half-track carrier. Subsequently, each platoon was organized to have an equal number of M-15 and M-16 mounts.
[32] Memo, General McNair for G3, WD, 19 February 1943, subj.: as above, cited by Greenfield, p. 421.
[33] OPD Memo for G3, WD, 23 February 1943, same subject, cited by Greenfield, Ibid.

As a remedy, the Oldfield Board recommended the transfer of antiaircraft training to the Army Air Forces.[34] The War Department disregarded the Board's recommendation.[35]

9. Contribution of the SCR-584

By the summer of 1943, improved gun-laying radars, the SCR-584 and SCR-545, were being reproduced in quantity to equip AAA gun units. The SCR-584, a microwave development, proved to be an outstanding piece of equipment and came into great demand because the SCR-268 was increasingly vulnerable to German jamming. Everyone wanted the SCR-584. The Air Force commanders in North Africa complained that their 268's were being jammed and could not satisfactorily direct either searchlights or night fighter operations.

U.S. AA searchlight units had been trained in cooperative tactics with fighter aircraft; one searchlight in each platoon was designated as an orbit beacon and the U.S. standard 60-inch searchlight, with a beam of 800 million candle power, capable of illuminating targets to 19 miles under normal atmospheric conditions, had been adapted to spread the focus of the beam. While decreasing the intensity of the beam and lessening effective range by this focus change, the wider beam made it ideal for use against high speed targets at close range as well as being useful against night-time parachute attack and raids and providing artificial "moonlight" for friendly night operations or surveillance.

With the advent of the SCR-584, however, field commanders increasingly called for AAA which could defend effectively against hostile air attack by day or night. Air Force commanders and principal staff officers saw the improved AAA capability as lessening demands for night fighters and for airborne intercept radars. Such factors helped to sustain continuing requirements for more AAA units.

10. Strategic Factors and Related Influences on AAA Developments in World War II

Despite the popularity of AAA units for defense, strategic factors soon brought a decline in their training and overseas deployment. Toward the end of 1942, estimates of the limits of U.S. capacity to produce materiel and ceilings on the manpower available to the Army had come sharply into view. Limitations on shipping capacity were also felt as the submarine menace continued. These, combined with the evolution of changed Allied strategic concepts, constrained the fuller development of the ground army.

From 1 April 1942 to 2 September 1945, 451 separate AA units were trained and shipped overseas by the AA Command. Included among them were: 80 AAA Gun Battalions, 176 AW Battalions, 18 Searchlight Battalions, 6 Airborne AAA Battalions, and 83 additional separate AA units, such as airborne AA MG batteries, AW batteries and operational detachments. Such units were largely organized, trained and equipped during the period that manpower and logistical limitations in the Army were becoming of great concern. Indicative of this, the proposed organizational structures (TO&Es) for these kinds of units were critically reviewed by the War Department in late 1942 to justify the personnel and equipment needed to carry out the AAA mission. As a result of this review, the organization of AAA units, as proposed by the AA Command, was cut from 10 to 15 percent in personnel and equipment. Still, the War Department requirement for AAA

[34] Memo, Major General Oldfield and others for G3, WD, 27 Sept. 1943, subj.: AAA, cited by Greenfield, Ibid.
[35] WD Memo, WDCSA 351.17 (13 Oct. 1943), Gen. McNarney for Gen. McNair, 13 Oct. 1943, same subject., cited by Greenfield, Ibid.

units in 1943 continued to rise. At the end of 1942, AAA troop strength in the Army approximately 7 percent; the following year, the same percentage held true.

By the end of 1942, however, the basic outline of U.S. strategy seemed pointed to an even greater development of air power for offensive purposes, substituting for defensive AAA resources. The strategic factors included the following:

a. Allied Strength

By late 1942, it appeared that the Soviet had passed from a strategic defense to the offense. Massive ground forces (400 divisions by 1945) engaged the bulk of German ground forces and helped to neutralized Japanese forces along the Manchurian Border.

b. Allied Naval Strength

Naval successes by this time enabled the employment of U.S. forces at advantageous times and places.

c. Increasing Allied Air Power

Reduced effectiveness of the Luftwaffe and increasing effectiveness of Allied air would permit employment of ground forces under conditions of favorable, local air superiority. In this light, and because of shipping constraints, U.S. strategy began to allocate a larger proportion of U.S. resources to naval and air power and to support of U.S. allies. AA equipment furnished the U.S.S.R., for example, included more than 250 90-mm. guns, 5,500 40-mm. guns, 2,200 multiple mount AW, including 100 self-propelled M-15 sets, and many different radars, and, of particular importance, 49 SCR-584 sets.[36] The War Department therefore revised its 1943 mobilization troop basis to emphasize a basic preferences for light, easily transported units having offensive combat capabilities. This emphasis promoted a lighter, flexible, more interdependent ground army with its main strength in infantry, backed by significant fire support and with armored divisions designed to exploit breakthroughs. Such an emphasis on the ground offensive meant that the proportions of armored and AAA units in the ground army would gradually be reduced. While more than 800 AAA battalions had been planned, in October 1943 the War Department reduced the planned figure to 575 and checked what had been a continuing AA expansion.[37] By the spring of 1945, AAA constituted less than 4 percent of the strength of the Army. At the same time, it was 11.5 percent of the strength of the Army's ground combat forces.[38]

Other undulations also affected the organization, training, and equipment of AAA units during World War II. For example, by the end of 1943, every item of primary armament and equipment—guns, radars, automatic weapons, and searchlights—then being issued to AAA units either did not exist at the time of Pearl Harbor or had been considerably modified and improved. (A comparable situation existed among Army Air Forces units.) To realize these improvements and modifications, however, required a great variety of tests and a considerable analysis of suggestions, devices, and prototype equipment. While a number of advanced developments were contemplated, the basic strategic approach formalized by the War Department in late 1942 may have tended to slow or impede development of AA guided missiles during World War II.

[36] Jones, *The Roads to Russia*.
[37] Greenfield, op. cit., p. 423.
[38] Ibid., pp. 203, 395.

The 120-mm. AA gun (Ml) was standardized by 1944 as a result of development begun in 1939 for a gun with greater range than the 90-mm. gun. A need for guided missiles to reach very high flying aircraft or high rockets, such as the rumored German "V" weapons, however, was stated by Headquarters AA Command in 1943. The 120-mm. gun was a high-velocity weapon with a muzzle velocity of 3100 fps, able to fire a 50-pound projectile to 56,000 feet using semi-fixed ammunition and employing a power-operated ammunition tray and rammer. Excessive barrel wear was anticipated and this fact, together with technological progress, prompted a stated need for an AA missile.

11. Guided Missile Development

In January 1944 the Antiaircraft Artillery Board outlined the military characteristics for a controlled antiaircraft rocket projectile and recommended that AA Command initiate a development program using those characteristics. The Commanding General, Army Ground Forces quickly forwarded these recommendations to the Commanding General, Army Service Forces, and on 9 February 1944 requested that a project for the development of an antiaircraft rocket weapon with associated control mechanism and directing radar be initiated immediately and be given the highest priority.

The development of the missile itself would be an Ordinance responsibility; but the guidance package would be electronic and therefore a concern of the Signal Corps. The latter took the stand that until Ordnance determined the kind of missile and its flight characteristics, work on a control system would not be pursued, "due to limitations of personnel."[39] Thus, in April 1944, the Signal Corps saw the project "to be desirable for LONG range investigation but one which the Signal Corps should not attempt at the present time. . . ."[40] When the German V-1 and V-2 weapons began to hit the UK in the summer of 1944, U.S. research in rockets and guided missiles quickly accelerated.

In the meantime the Army also began other projects to meet future requirements. In May 1944, Army Service Forces awarded the California Institute of Technology a contract involving an estimated $3,900,000 for research and development work on long-range rocket missiles, ranjets, and launching equipment. The resulting "ORDCIT" Project was to focus on propellants, control mechanisms, and materials involved in missile design, as well as aerodynamics. The overall aim of the program was to gather research information on which to base the design of future missiles.

Later in 1944, the Ballistic Laboratory at the Aberdeen Proving Ground, which was assigned responsibility for all external ballistic missile work in connection with guided missile development, successfully performed the necessary tracking and computation of trajectories for testing the first missile developed by the California Institute of Technology.

While these development activities got under way, a struggle grew within the Army concerning control over the development of missile weapons.

In an attempt to clarify areas of responsibility, on 2 October 1944, Joseph T. McNarney, the Deputy Chief of Staff, issued a policy directive to the Commanding Generals, Army Ground Forces, Army Air Forces and Army Service Forces. That directive established responsibility for research and development in the field of guided missiles as follows:

[39] Thompson and Harris, *The Signal Corps: The Outcome*, p. 464.
[40] Ibid.

(1) Army Air Forces would have research and development responsibility, including designation of military characteristics, for all guided or homing missiles dropped or launched from aircraft.
(2) Army Air Forces also would have research and development responsibility for all guided or homing missiles launched from the ground which depended for sustenance primarily on the lift of aerodynamic forces. The Army Air Forces and Army Ground Forces would designate military characteristics when and as these affected their interests.
(3) Army Services Forces had research and development responsibility for guided or homing missiles launched from the ground which depended for sustenance primarily on missile momentum. The Army Air Forces and Army Ground Forces would designate military characteristics when and as these affected their interests.[41]

12. Continued Utility of AAA

A revolution in AA gunnery, stemming from the introduction of radar, helped to make very substantial contributions to the toll of enemy aircraft attacking areas defended by AA guns. In addition, by their volume of fire, AA guns forced aircraft to take evasive action which reduced the effectiveness of air attack. Concentrations of guns forced bombers to seek altitudes above effective zones of AA fire, and bombers flying above 20,000 feet lost considerable bombing accuracy.

U.S. AAA proved particularly effective against the German "long-range" bombardment weapon, the V-1. This relatively small, automatically controlled, jet propelled monoplane carried a ton of high explosives at a speed between 300 and 400 mph at altitudes from 600 to 10,000 feet for 250 miles.[42] The V-1 missile attacks against the United Kingdom began during the night of 13 June 1944 and ended 29 March 1945.[43]

V-1 activity against the United Kingdom occurred in three periods. The first from 13 June to 5 September; the second, when the V-1 was air-launched, from early September to mid-January 1945; and the third, from 3 March to the end of the month. A combined U.S.-British air defense, including fighters and AAA, was setup against this new weapon.

At the start AA guns were formed in an inland belt between the Channel and London, the prime target of attacks. AAA was restricted from firing whenever RAF aircraft were over the area. Their success was limited. Soon the defense shifted, based on a desire to destroy V-1's over the ocean. To lessen the danger to personnel and property from falling V-1's and to eliminate mutual interference between AAA and fighters, the defense was realigned after a month. AAA was moved to the coast and set up in a 5,000-yard belt along the Channel coast which permitted guns to fire 10,000 yards out to sea. The fighters were to intercept further out in the channel and beyond the belt of guns. Over the gun belt fighters were restricted; they had to fly over 8,000 feet in that area and AAA guns could fire up to 6,000 feet. Following this, and with the proximity fuze available and authorized for use, AAA quickly reached a high order of effectiveness against the V-1.

On the continent, the capture of Antwerp and the opening of port facilities there saw the rapid growth in importance of that city as an Allied supply base. Germany made a determined, large-scale effort to neutralize Antwerp and its port facilities beginning on 24 October 1944 and maintained nearly continuous V-1 attacks against the area until 30 March 1945. Of nearly 5000 V-1 missiles launched by the Germans against Antwerp only 211 (4.3 percent) fell within the area which was designated to be vital. AAA provided the principal defense against the V-1 attacks on Antwerp. About 12,000 personnel participated in the AA defenses.

[41] Letter, C/S USA, to CG AGF, et al., subj.: "Guided Missiles," 2 October 1944.
[42] General Board, ETO, *Tactical Employment of AA Units, Including Defense Against Pilotless Aircraft (V-1)*, Report No. 38.
[43] Welborn, *V-1 and V-2 Attacks Against the UK*, Tech. Memo ORO-T-42, p. 1.

In the early days of the Antwerp defense, the effectiveness of the defense was degraded considerably by restrictions placed on AA fire in order to protect friendly flight activity. A number of airfields in the vicinity of the city complicated control and protection of friendly aircraft from AA fire. Because of adverse weather in the fall season, visual recognition was difficult and to eliminate the mutual interference problem, a "Inner Artillery Zone" (IAZ) was established. Friendly aircraft continually violated the IAZ; during the period 26 November–11 November 1944 available records reportedly indicate 375 friendly aircraft in 129 flights violated the prescribed zone.[44] Nevertheless, while large amounts of AA equipment, ammunition, and personnel were required, the AA defense of Antwerp essentially made the V-1 obsolete as a tactical weapon.

In the various theaters of operations, AA units provided defense against air attack on friendly forces and installations both in the combat zone and in the rear areas. Allocation of AAA for the defense of specific units or vital areas was established on the basis of priorities directed by the U.S. forces or area commander. No AAA units were assigned as organic or integral elements to other combat organizations; generally AAA units provided air defense protection and, on occasion, especially during later stages of the war, ground fire support to U.S. ground combat forces. But no organic AAA was provided U.S. divisions.

13. Anomalies in Command and Control Air Defense Resources

In the European theater the requirements for U.S. AAA units were derived from British organizational allocations of antiaircraft artillery. This situation stemmed from a combination of factors that included U.S. deference to British sovereignty and experience, U.S. adherence to the British pattern of action, and the functional air defense planning and operational responsibility among U.S. forces being vested with U.S. Army Air Forces. In turn, this raised a question concerning the control of organically assigned AAA units. If AAA units were not specifically assigned to a parent unit or organization, functional command of a "coordinated" air defense might require an Air Force command of these units.

Several anomalies were apparent in the general situation, reflected by the allocation of U.S. AAA units in the ETO in October 1944. At the time, AAA units either were assigned or attached as follows:

	Armies					
	First	Third	Ninth	6th Army Group	12th Army Group	IX ADC
Gun Battalions	5½	5	7	1	1	7
Automatic Weapons	17	13	11	2	2	20
Searchlight	—	—	—	—	—	3
Self-Propelled AW	6	6	3	1	2	—

Noteworthy is the fact that the Army group and Army elements had: 19½ gun battalions versus 7 for IX Air Defense Command; 45 AW Battalions versus 20; and all 18 self-propelled AW battalions were with the operational combat forces. Yet none of these AAA units was organic to any of these field forces.

[44] *The Flying Bomb: The Defense of Antwerp and Brussels*, par. 33–40; U.S. Army Hq Antwerp X, "Infringement of IAZ, 26 November–11 December 1944" (Air University Archives, 539.667B, Folder 33) cited in Chapter 4, *Air Defense Historical Analysis*, U.S. Army Air Defense School, p. 148.

As the flow of Allied operations moved east, these field forces were increasingly dependent upon AAA for effective local defense yet could neither effect nor cause the reassignment of any AAA units under the IX Air Defense Command to help provide air defense protection. In contrast, Air Force units under IX Air Defense Command could be reassigned, and be relieved from responsibility for any active air defense role. This actually happened. With a reduced threat, fighters were withdrawn from IX AD Command and only AAA was actively committed to the air defense mission. Accordingly, it was questioned whether IX AD command, the principal theater element for air defense had either been tested for or demonstrated then current air defense "doctrine."

The Air Force Commander in the ETO, with responsibility for the U.S. air defense mission (CG, Ninth Air Force), could deputize a subordinate Air Force command (IX Air Defense Command) to discharge the air defense responsibility and either authorize or direct that command to disengage Air Force units which were assigned air defense missions. Theoretically, at least, the situation could have developed that an Air Force commander could carry out air defense missions with only AAA units, thus exclusively using ground based air defense systems to provide the protection of rear areas. This appeared to violate the "doctrine" of coordinated, integrated air defense and rankled further because AAA units believed the air warning service in the IX Air Defense Command inadequately performed its air defense mission, being used more to control tactical air operations. At the same time, the Air Force component commander could also limit the use of AAA assigned to Army field forces by asking for augmented or more intensive ground-based air defense efforts for the defense of airfields located forward of army group rear boundaries.

Essentially, the Air Force element could dictate the scale of the AAA allotment needed for rear areas, citing the factors of British experience and the need for an Air Force command over any AAA resources committed in order to coordinate the several means being employed for air defense. With the authority that attended that responsibility, the Air Force commander could also scale down the commitment of air resources given to the task while limiting the transfer of ground AA units critically needed by ground force commanders in the field.

In Europe, all Air Force capabilities were considered to be available for support of the surface campaign. "Although the Ninth Air Force stood ready to maintain friendly air superiority, it was routinely committed to interdiction and close support operations."[45] Thus, Allied air resources, without being obliged to extended, static commitments for air defense because of the general decline of the Luftwaffe and the availability of AAA for protection, were free to pursue offensive operations against the enemy, including counter-air operations against airfields.

Nonetheless, it remained evident that air defense from AAA units was still valuable and significant in protecting forward areas against air attack. Anzio, Remagen, and Bastogne all provided apt illustrations of that fact. Between 18 and 23 December 1944 at Bastogne, for example, the U.S. 406th Fighter-Bomber Group was responsible for close air support to the 101st Airborne Division. The group flew 529 close air support sorties into the area; out of 60 operational P-47's at the beginning of the period, the group lost 17 shot down and had more than 40 damaged by German AA in the area.[46]

In a two-week period in March 1945, the Remagen Beachhead became the most heavily defended vulnerable area since Normandy. Normally, on a single day, 67 jet aircraft attacks were made on the bridge

[45] Futrell, op. cit., p. 162.
[46] Ibid.

which was defended by U.S. AAA. A total of 142 German aircraft were destroyed by AAA fire and 59 probably destroyed there from 8 March to 21 March 1945.

14. Interest in New, Improved Air Defense Weapons

As the war drew near its close, interest in the potential of new defensive weapons grew and greater expectations of effectiveness took hold with the prospects of maneuverable defensive missiles or projectiles. Gun developments had proved capable of handling high-speed targets and, with improved fire control, the defense could contemplate the prospect of jet aircraft without undue concern. The Army had begun work in 1944 on an improved fire control system, the M-33, to link a computer with guns, a tracking radar, plotting boards and communications equipment. (As developed, the M-33 system could compute, for the 90-mm. and 120-mm. guns, firing data for targets with speeds up to 1,000 mph.)

In February 1945, Bell Telephone Laboratories was given a contract, co-sponsored by the Office, Chief of Ordnance and the Army Air Forces, to explore the possibilities of a new antiaircraft defense system to combat future bombers invading friendly territory at such speed and altitude that conventional artillery would be unable to defend against them effectively. Bell completed a research plan to develop a practical weapon system of this type six months later. The plan promised such a system within a few years. To have a system available by the time an enemy could have high-speed, high altitude bombers in operation, it was recommended that the equipment be derived insofar as possible from devices, methods, and techniques already known and understood. By this time, however, the AAF had pulled out of the joint effort. The proposed project was named Nike and marked the beginning of the development of a series of missiles bearing that name and which eventually led to the antiballistic missile system known as Safeguard.

At about the same time the Army Ground Forces Equipment Review Board submitted a report on postwar equipment for the Army. Among its findings the Board concluded that high velocity guided missiles, preferably of the supersonic type capable of intercepting and destroying aircraft flying at speeds up to 1,000 miles per hour at altitudes up to 60,000 feet or of destroying missiles of the V-2 type, should be developed at the earliest practicable date.

Air defense remained a subject of high level attention for a variety of reasons. Prominent among them was the violent and growing use of Japanese suicide air attacks in the closing campaigns in the Pacific. Beginning as a reaction to U.S. landings in Luzon, the Japanese attacks, later known as Kamikaze attacks, grew in frequency and intensified. In effect, they proved very costly, decimating Japanese air strength but posing serious problems for U.S. leaders. While causing only relatively minor damage to U.S. ships at Luzon, the Kamikaze attacks on Okinawa in April 1945 helped the Japanese to sink 20 U.S. ships and to damage 157 others. Most of the sinkings (14) and damages (90) resulted from the suicide attacks. During May and June, these attacks continued. In all, Kamikaze attacks accounted for 26 of 28 U.S. ships sunk and 164 of the 225 ships damaged at Okinawa.[47] Destroyers, cruisers, battleships and carriers were all hit; some of the large ships suffered great damage and loss of life.

The Japanese objective sought to disable the U.S. fleet offshore to disrupt supply. In addition, Japanese air attacks were directed against U.S. airfields. During the operation Japan launched nearly 900 air raids. Nearly 4,000 Japanese aircraft were destroyed in combat including 1,900 Kamikaze planes. The intensity

[47] Appleman, *Okinawa: The Last Battle*, pp. 362–364.

and serious threat of Kamikaze attacks helped to promote a crash program for a shipborne air defense guided missile.

15. The Termination of World War II

Barely three years after denouncing the Japanese air attack on Pearl Harbor, President Roosevelt in early 1945 contemplated an "intensive bombing" campaign against the Japanese homeland to destroy Japan and its army. Admiral William Leahy, the President's wartime chief-of-staff, recorded in his diary in February 1945: "The President [Roosevelt] said that with the fall of Manila the war in the Pacific was entering a new phase and that we hoped to establish bases on the Bonins and to make plans for additional bombing of Japan . . . he hoped by intensive bombing to destroy Japan and its army and thus save American lives."[48]

The following month, the most destructive bombing raid in history took place when U.S. B-29's raided Japan and, according to the U.S. Strategic Bombing Survey, killed at least 83,000 people, injured 102,000 others and left 1,000,000 homeless.[49] Within six months, General LeMay's 20th Air Force could deliver 8,000 tons of bombs per raid.[50] During July 1945, LeMay's B-29's dropped 40,000 tons of bombs on Japan.[51] Navy carrier aircraft strikes against the home islands added substantially to that total. And, as part of the deliberate preparation to the planned invasion that was scheduled later that year, U.S. military power being redeployed from Europe to the Pacific would include the B-17's and B-24's that had been pounding Europe with mass bombing attacks. The U.S. capacity to bomb Japan was growing on a vast scale. Despite the fact that many primary targets in Japan were so badly burned they no longer represented useful targets, the U.S. program of putting 1,051,000 tons of bombs on Japan during 1945 moved ahead on schedule.[52]

Nonetheless, a unique "rain of destruction from the air, the like of which had never been seen on the earth" and "utter destruction" of Japan was spoken of by the United States in the summer of 1945 unless the Japanese surrendered immediately.[53] Propaganda leaflets dropped on Japan said: "You should take steps now to cease military resistance. Otherwise we shall resolutely employ this [atomic] bomb and all our other superior weapons to promptly and force fully end the war."[54] U.S. leaders clearly wished to avoid an invasion of Japan.

President Truman wrote in his memoirs that "General Marshall told me that it might cost half a million lives to force the enemy's surrender on his home ground."[55] Secretary of War Henry L. Stimson, soon after the war, recalled: "As we understood in July, there was a very strong possibility that the Japanese government might determine upon resistance to the end, in all areas under its control. In such an event the allies would be faced with the enormous task of destroying an armed force of five million men and five thousand suicide aircraft, belonging to a race which had already amply demonstrated its ability to fight literally to the death."[56]

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[48] Leahy, *The Leahy Papers*, "Diary of William Leahy, 8 November 1947."
[49] Craven and Cate, *Matterhorn to Nagasaki: June 44 to August 45*, p. 617.
[50] Miller, *Men of the Contrail Country*, p. 39.
[51] Knebel and Bailey, *No High Ground*, p. 2.
[52] Arnold, *Global Mission*, p. 595.
[53] Truman, *Memoirs: Year of Decisions*, p. 422.
[54] Knebel and Bailey, op. cit., p. 170.
[55] Truman, op. cit., p. 416.
[56] Stimpson, "The Decision to Use the Atomic Bomb," *Harpers*, Feb. 47, p. 102.

Vannevar Bush had no doubt about the desirability of using the atomic bomb; he reportedly "knew it would end the war."[57] And, while a number of scientists opposed the use of the bomb only a relative minority of U.S. government officials opposed its use.[58]

Thus, the terrible retribution of Hiroshima and Nagasaki in early August 1945 when U.S. strategic aircraft delivered atomic weapons there, appeared as a capstone to the war which began for the United States as a result of a Japanese air attack. In effect, there seemed to have been demonstrated the overwhelming potential of strategic forces wielding nuclear weapons. The image portrayed was colored and given added dimension by other events and technical milestones of World War II. Taken together, there was projected a new security environment which would profoundly challenge conventional wisdom and "operational experience." This challenge elicited little recognition or response as the United States sought a transition from war to peace and failed to arouse notable interest even as the country's leaders began an exhaustive inquiry into the questions of Pearl Harbor where surprise air attack had brought America into the war.

The Pearl Harbor investigation saw lessons in that bitter experience centering on the need for better coordination among U.S. armed forces and improved intelligence. But the question of measures to defend against surprise attack by air were essentially ignored. Nonetheless, air and missile defense were a central security issue for the next twenty-five years. In the face of technological changes and advances in offensive capabilities operational procedures, tactics, techniques, and command and control procedures for air defense had to be adapted and fitted to the bounding development of new weapons and their projected potentials. Changes in the established pattern and structure of air defense concepts was inherent in the situation at the end of World War II.

B. Growth of Soviet Air Defense

1. The Interwar Years (1918–1941)

The origins of Soviet air defense can be traced to the first years of the regime when the Soviets had to defend against air attacks by the forces of foreign intervention and internal counterrevolution. During this period (1918–1920) small numbers of antiaircraft batteries and fighter aircraft were assigned to the defense of important centers such as Petrograd and Moscow. Because of the limited means which were available, the air defense had an "objective" or "point" character. The tactical approach of the time had the combat units of antiaircraft artillery spread out around the objective in such a fashion as to improve the mutual cover of a firing zones of adjacent batteries. Machine guns were placed on the roofs of buildings in order to do battle with low-flying enemy planes. Fighter aircraft assigned to defend an objective, as a rule, were based at the edge of the city and carried out combat operations up to the zone of antiaircraft artillery fire.[59]

The detection of enemy aircraft was the responsibility of a special air observation service which included nets of visual observation posts spread around the defended points to distances of 100–200 kilometers. Observers at these posts, upon visually or by sound detecting enemy aircraft, reported the information immediately to the air defense headquarters and the nearest airfield. The command of the air defense forces was concentrated in the heads of the chief of the air defense point. But because of inadequate

[57] Giovannitti and Freed, *The Decision to Drop the Bomb*, p. 324.
[58] Feis, *The Atomic Bomb and the End of World War II*, pp. 190–191.
[59] Batitskiy, *Voyennaya Mysl'*, p. 28.

communications the air defense commander could provide only initial direction. After which each unit commander acted independently in accordance with his own situation. Some centralized control did exist during battle, particularly in the linking of individual antiaircraft batteries in groups with each battery having its own sector of defense.[60]

Such were the origins of the Soviet national air defense system. The system is frequently identified as Soviet PVO. The term "PVO" is an abbreviation for two Russian words, "Protivovozdushnaya Oborona," which literally mean "Antiair Defense." Another term which is frequently encountered in transliteration from Russia is "PVO Strany," meaning "Air Defense of the Country," or, more conveniently, "National Air Defense."

In 1930, the Soviet air defense system began to come into much sharper focus. On 15 April 1930, a directive of the Revolutionary Military Council of the U.S.S.R. called for the Headquarters of the Red Army to prepare a national air defense plan and to present it to the Council of Labor and Defense for approval.[61] Specifically the plan was to encompass the following:

(1) identification of the most important state regions and points and specification of the means for their defense;
(2) presentation of measures which would secure the uninterrupted operation of industry during wartime;
(3) determination of measures of passive (local) air defense.

The commanders of military districts were then called upon to develop district air defense plans within the framework of the general air defense plan. The directive from the Revolutionary Military Council indicated that direct control of the air defense service in the districts was the responsibility of the chief of air defense of a district who was also designated an assistant chief of staff of the district.[62]

Within the Headquarters of the Red Army there was a Sixth Section which had been formed in 1927 and which handled matters of national air defense. This section was then upgraded in 1930 to the level of a directorate. It developed the General Plan for National Air Defense for 1930–1933.[63] Another document which was produced was the "Regulations on the Air Defense of the U.S.S.R." Under these regulations population centers and state installations of strategic, economic, or political importance which had to be defended against possible enemy air attack were designated air defense points or objectives. An air defense point encompassed all objectives located within its territory. The points were further distinguished according to whether they were to support the operations of the active army or were in the interior of the country.[64]

In accordance with the new regulations the air defense service of a point was organized and conducted on the basis of the involvement of all local military and civilian organs and also of public organizations. All resources were responsive to the chief of air defense of the point.[65]

During the period 1930–1932, the Headquarters of the Red Army organized and conducted several exercises in order to work on problems of the tactics of the air defense of the major centers and rear area objectives of the country. In the military districts special exercises were conducted with respect to the air

[60] Ibid., p. 29.
[61] Batitskiy, *Voyska Protivovozdushnoy Oborony Strany*, p. 43.
[62] Ibid.
[63] Ibid.
[64] Ibid.
[65] Ibid., p. 44.

defense at major points, the protection of rail movement against air attack, and the employment of barrage balloons. This latter step coincided with the formation of the first barrage balloon regiments.[66]

The gradual improvement of Soviet air defense continued apace until 1937 when the Soviet Government, noting the increasing danger of hostilities in Europe, implemented a new series of measures to strengthen air defense. Air defense corps were organized for the defense of the largest centers of the country, including Moscow, Leningrad, and Baku. These corps contained antiaircraft artillery divisions (the first such divisions had been formed only a few years earlier), antiaircraft search light regiments, observation, warning, and communication regiments, barrage balloon regiments, and machine gun regiments. Air defense divisions of similar but scaled-down composition were formed for the defense of certain other centers such as Kiev. The results of these and similar unit creations was to bring all air defense forces except fighter aviation together in combined arms formations. The fighter aviation which was assigned to the defense of the major centers of the country was subordinated to the air force commanders of the military districts. The basing of fighter aviation was accomplished under general air defense plans within a radius of 20–100 kilometers from the defended objectives. Fighter aviation participated in all general air defense exercises. In case of war, the fighter aviation was to come under the operational control of the air defense corps and division commanders for the performance of joint operations.[67]

As World War II drew nearer and then erupted in the West, additional changes were made. Practical experience was gained in the war against Finland and this was reinforced by observation of the pattern of operations in the West. The territory of the Soviet Union was divided into air defense zones (which coincided geographically with the military districts). In turn the zones were divided into air defense districts, and air defense points were identified within the districts. The zones were headed by air defense commanders who at the same time were deputies to the military district commanders.[68] At the national level, air defense was further upgraded with the establishment of the Main Directorate of Air Defense of the Red Army in accordance with a Defense Commissariat directive of 27 December 1940. The head of the main directorate was directly subordinate to the People's Commissar of Defense of the U.S.S.R.[69]

On the doctrinal side Soviet air defense concepts were put into a structured and balanced framework which contained the following basic points[70]:

(1) The massed employment of all air defense forces and means in order to combat enemy air action through the close coordination of all arms of air defense, avoiding the one-sided development of any single arm of air defense at the expense of the others;
(2) The grouping and concentration of air defense forces in those areas which were in the greatest danger of enemy air attack;
(3) The consistent implementation of the principle of the massed employment of air defense forces for the defense of the strategically most important points and objectives of the country;
(4) The maneuvering of air defense forces during the course of combat operations in accordance with the specific situation in order to reinforce the most threatened approaches and objectives;
(5) The close cooperation of National Air Defense Forces with the ground forces in accomplishing air defense in the frontal area.

[66] Ibid.
[67] Ibid., pp. 46–47.
[68] Ibid., p. 47.
[69] Ibid., p. 48.
[70] Ibid., p. 52.

2. Experience During World War II[71]

The Soviet Union's air defense forces began deployment and the taking of combat positions in a situation where the German had already initiated an invasion and where enemy air attacks were being mounted against major objectives in the border air defense zones. While the antiaircraft artillery units located along the western border were fully deployed and had taken their firing positions by the morning of 22 June 1941, many units located in the heartland were in camp and began moving out to defense objectives at a considerably later date. The Moscow alert batteries were combat-ready by about noon on 22 June. By that evening 102 out of 137 available batteries had taken their firing positions. The entire Moscow system was ready to repulse enemy air attacks by the morning of 23 June.

Full deployment of the air defense system to a combat-ready status took a considerably longer time. For example, the 18th separate Antiaircraft Artillery Battalion, which had the mission of defending the railroad bridge across the Dniester River near the city of Rybnitsa, did not reach its deployment position from camp until the sixth day after the war began. The aircraft warning service battalions stationed at the border continued their deployment during the first 2 days of the war with arriving reserve personnel. The second-line aircraft warning service battalions were not fully deployed until 25 June. As a whole, the antiaircraft defense of objectives located in zone up to 500–600 kilometers from the border, as well as Moscow and Baku air defense, was essentially deployed and ready to repulse an attack from the air by the evening of the second day of the war.

During the initial phase of the war the most important task of Soviet air defense forces was defense of major population and industrial centers; this involved utilization of the bulk of available fighter aircraft and medium and small-caliber antiaircraft artillery. Defense of lines of communication on the front occupied a secondary position during the initial phase. In addition to performing their immediate missions of repulsing mass enemy air strikes against airfields, personnel, cities, and lines of communication, air defense troops were compelled to take part in action against enemy tank and mechanized units. The brunt of the effort was handled by antiaircraft artillery, since fighter aviation was weakened by losses sustained during the initial days of the war.

The Germans were making a desperate effort to disrupt rail operations in the vicinity of the front. During the course of 1941 the Germans conducted approximately 6,000 air strikes against rail objectives. In spite of this effort only 1,504 raids (or 25 percent) succeeded in disrupting rail traffic as long as 6 hours.

At the end of 1941 major changes were made in the air defense system. By decision of the State Defense Committee a commander of National Air Defense Forces designated, and corresponding control entities were established: an Air Defense Fighter Aviation Directorate and Headquarters, and office of the Chief of Antiaircraft Artillery, etc. The air defense forces were removed from the jurisdiction of the military districts (fronts) and placed under the Commander of National Air Defense Forces and his command elements, with the exception of the forces defending Leningrad, which were left under the command of the Commander of Troops of the Leningrad Front. At the same time the previously existing air defense zones were replaced by the Moscow and Leningrad corps and a number of air defense divisional regions.

[71] The following account is based on an article by Soviet authors Dzhordzhodze and Shesterin, who summarize a much more detailed account by Marshal P. F. Batitskiy, op. cit.

The fighter aviation corps and divisions detached for air defense missions were operationally subordinate to the Commander of National Air Defense Forces, and locally to the corps and division air defense region commanders. Soon thereafter, at the beginning of 1942, aviation regiments and divisions engaged in air defense were placed entirely under the Commander of Territorial Air Defense Forces. In accordance with an order issued by the People's Commissar of Defense of the U.S.S.R., 56 airfield service battalions were assigned during this period to support air defense fighter aviation. These battalions were placed under the commanders of the corresponding fighter aviation corps, divisions, and detached regiments. This signified that one of the basic air defense arms—National Air Defense Forces Aviation—was organizationally constituted, but also that conditions had been created for organizing unified control of all air defense forces and securing more effective coordination of these forces.

The heaviest fighting involving air defense forces in the summer–fall campaign of 1941 was in the defense of Moscow and Leningrad. Actions in the defense of these cities essentially constituted air defense operations, as a result of which enemy air power sustained heavy losses. The following figures indicate the scale of these operations. From July through December 1941 a total of 18,000 German sorties were recorded in the coverage areas of the air defense forces defending Moscow and Leningrad. The troops of two air defense zones (Northern and Moscow) took part in action against enemy aircraft; these operations included the participation of more than 1,800 medium and small-caliber antiaircraft guns and 600–700 fighters. In the course of these actions air defense forces destroyed more than 1,700 enemy aircraft.

An important place in improving national air defense was occupied by matters pertaining to change in the organizational forms of the air defense troops, since these forms exerted a direct influence on combat activity, and on the efficiency of utilization of available manpower and hardware. This was linked in large measure with the over strategic situation, with the nature of enemy air and ground actions, as well as the nation's economic potential for the establishment and equipping of new air defense units. At the beginning of 1942 the Moscow Front and the Leningrad Air Defense Army were established on the basis of the former Moscow and Leningrad air defense corps. Development of an enemy air threat against the Baku oil fields led to the establishment of the Baku PVO Army.

Further development of air defenses and the art of employment of air defense forces came with changes in the character of the war. The Soviet Army, after the Battle of Stalingrad, retook two-thirds of the enemy-occupied territory. This fact had a definite influence on the character of air defense. It was reflected first and foremost in the maneuvering of units in the wake of the advancing forces, in organization of closer coordination with front and army air defense as well as change in the structure of national air defense control.

In June 1943, another reorganization took place in the air defense forces. This reorganization consisted essentially in the following. Two air defense front directorates were established—Western and Eastern. The Office of the Command of National Air Defense Forces was abolished, and supervision of the activities of the air defense fronts and zones, weapons planning and supply was transferred to the Red Army Commander of Artillery. The following elements were established under that commander: Air Defense Forces Central Headquarters, Air Defense Fighter Aviation Central Headquarters; Air Defense Main Inspectorate; Air Defense Forces Combat Training Directorate; Aircraft Warning Service Center. The fighter aviation defending Moscow was unified into the First Air Defense Fight Army.

As the gap increased, however, between the units of the advancing Western Air Defense Front, which were moving ahead in the wake of advancing forces, and the units of the Eastern Front, which had remained

in place, the drawbacks of this reorganization became more and more obvious. While the Western Front, which was operating along the front lines, was heavily engaged against enemy aircraft, the troops of the Eastern Air Defense Front were rather idle, in view of a lack of regular enemy air operations.

Another reorganization took place in the spring of 1944: the Western Air Defense Front was changed into the Northern Front, while the Eastern Front was changed to the Southern Air Defense Front; this eliminated the above-mentioned drawbacks of the previous organization. At the same time a Transcaucasian Air Defense Front was established, based on the Transcaucasian Air Defense Zone.

After the Battle of Kursk the Germans lost their control of the air, which resulted in a change in the basic utilization of their air power. The Germans almost totally stopped bombing objectives deep in the rear areas, shifting their main efforts to action along the line of the front. In some cases the German command was able, by maneuvering units, to concentrate heavy air power to carry out major missions. For example, the Germans were successful in maintaining a fairly high level of air activity in the Ukraine and Belorussia in 1944, as well as on the approaches to Berlin in the winter of 1944–1945. An indicator of German air activity during this period is the fact that in February 1945 alone the Germans flew 18,000 sorties to prevent the crossing of the Oder River by the forces of the First Belorussian Front and to provide support for counterattacks by German ground troops.

In addition to maneuvering its available air power, the German command began employing other air attack weapons to destroy objectives in the front area: radio controlled bombs and aircraft, heavily loaded with explosives. The explosive force of such an aircraft exceeded that of a simultaneous strike by 10 to 12 bombers. For this reason they were employed chiefly against major crossing points, railroad junctions and other important objectives in the area of the front.

Protection of lines of communication along the front became particularly important in the third phase of the war; the Germans considered disruption of these lines of communication to be one of the principal missions of their air power. Large-scale strikes were employed. For example, in the winter of 1944, 1,200–1,450 combat aircraft were concentrated in the zone of action of the Ukrainian fronts; this comprised 53–56 percent of total German aircraft on the Soviet-German Front.

The Soviet command had concentrated more than 2,000 antiaircraft guns, 1,650 antiaircraft machine guns, approximately 450 fighters, and 300 antiaircraft searchlights for the purpose of protecting rail objectives in the south. The Soviet command countered massed utilization of enemy air power with massed utilization of air defense forces. As a result, in 1944 German aircraft succeeded in flying only 1,161 raids on rail objectives, while in 1943 the figure had been approximately 7,000. There were also considerably fewer cases of rail traffic disruption. There were 1,039 disruptions in 1943, while in 1944 there occurred only a few brief stoppages in a few rail traffic areas.

In addition to protecting lines of communication and immediate rear area objectives, the air defense forces were called upon to carry out other missions in close coordination with other armed forces branches. They took part in encirclement operations, provided protection for friendly troops in attack position and protected crossing areas, airfields, and supply trans-shipment facilities. Air defense forces were continuously redeployed behind the advancing forces in connection with occupation of new areas and entire countries. This was a distinctive feature in air defense forces utilization in the third phase of the war. For example, in order to strengthen the defense of rail centers and other important objectives in the area of the First and Second Ukrainian Fronts, two fighter divisions and more than 40 antiaircraft artillery regiments were rede-

ployed in May–June 1944 from the rear areas of the Southern Air Defense Front to the front. In the summer and fall of 1944 five air defense corps were moved from the heartland beyond the Soviet borders to protect objectives in the vicinity of the front. The continuous redeployment of air defense capabilities did not cease until the war came to an end.

The changes in the grouping of National Air Defense Forces manpower and equipment, the continued Soviet Army advance westward, and the movement of new air defense units behind the advancing troops caused certain control difficulties. The Southern and Northern air defense fronts proved unable to maintain efficient control over their units, which were dispersed over a large, deep area. In connection with this, in December 1944 the Northern and Southern Air Defense fronts were transformed into the Western and Southwestern air defense fronts respectively, while a new, Central Air Defense Front, with headquarters in Moscow, was established to control the units protecting objectives in the deep rear areas.

Development of the air defense system took place on a foundation of steady technological advances and the equipping of the Armed Forces with increasingly sophisticated weaponry. Important qualitative changes occurred, for example, in air defense fighter aviation. By 1944, there were mostly new types of aircraft (LA-5fn, LA-7, YAK-3, YAK-9). Radar came into extensive use for intercept vectoring. The equipment and weapons of the other arms of National Air Defense Forces also underwent improvement and modernization during the course of the war.

With these organizational changes, the basic principle of employment of air defense forces as a whole did not undergo major changes during the war. Antiaircraft defense remained essentially point defense, which was dictated by the technical level of available resources. At the same time improvement in the quality of air defense weapons and combat equipment particularly fighters, improvement in utilization techniques, the adoption of radio communications for control purposes, and improved communications reliability made it possible gradually to transition to new principles of PVO organization, from the defense of individual objectives to defense of entire areas and zones.

The development of the concept of zone defense can be illustrated with the example of the Moscow air defense during the first year of the war. In particular, the fighters defending Moscow were at the same time defending a number of cities and objectives in the Moscow industrial region. Deployment of radar facilities on the distant approaches to Moscow (the Rzhev, Sychevka, Vyaz'ma line) and the redeployment to that area of a number of air regiments greatly enlarged the Moscow air defense boundaries and made it possible to intercept any aircraft at some distance from Moscow. Fighters based in the immediate vicinity of Moscow were used to repulse major air attacks on objectives in the Moscow industrial region. In addition, the deployment of aircraft warning observer posts a considerable distance from Moscow and the establishment of a solid-coverage aircraft spotting zone, and organization of reliable control and warning communications which cover the entire area were testimony to the fact that the air defense system of such a major center as Moscow had developed beyond the framework of defense of a separate, although very important objective.

This air defense principle did not become the basic principle of the overall national air defense system. Examples of this type of defense, however, did occur even after the Battle of Moscow. Fighter units based within a radius of up to 200 kilometers from Kursk were used to repulse mass German air attacks on Kursk (June 1943), in spite of the fact that they had the mission of defending other objectives. In 1944, fighter regiments protecting the cities of Kiev and Zhitomir were used to repulse night air attacks on the Korosten'

Rail Center. During the defense of lines of communication along the front in 1943–1944, fighter units were assigned to protect not only major rail centers, bridges, and river crossing areas, but also entire main rail lines.

This experience demonstrated the feasibility of employing fighter aviation for the purpose of simultaneous protection of many objectives located within fighter effective radius of action. This principle made it possible to utilize the maneuver capabilities of fighter aircraft vigorously and fully, when necessary concentrating large numbers of fighters in a threatened area to repulse enemy air attacks. This utilization of fighter aviation became possible because of qualitative improvements and the extensive adoption within the air defense system of radio and radar equipment for fighter control and guidance.

Appendix B

A Chronology of American Air and Ballistic Missile Defense Systems

1944

2 October	Army issues directive to AGF, AFF, and ASF (the McNarney letter) allocating responsibility for R&D. AAF has responsibility for all guided or homing missiles dropped or launched from aircraft. AAF also has responsibility for all GM and homing missiles launched from ground that depend on the lift of aerodynamic forces. AGF and AAF will designate characteristics when and as they affect their interests. ASF has R&D responsibility for all GM and homing missiles launched from ground which depend for sustenance primarily on missile momentum. AGF and AFF designate characteristics of interest.

1945

31 January	A letter from Office, Chief of Ordnance to BTL authorizes negotiations for a formal study of an antiaircraft guided missile.
8 February	Project Nike-I is initiated.
May	AAF signs its initial development contract for P-86, formerly Navy XFJ-1.
20 June	Army Ground Forces Equipment Review Board (Cook Board) submits its report on equipment for the postwar Army. "High velocity guided missiles, preferably capable of intercepting and destroying aircraft flying at speeds up to 1,000 miles per hour at altitudes up to 60,000 feet or destroying missiles of the V-2 type, should be developed at earliest practicable date."
July	BTL furnishes written report AAGM Report (Study of an Antiaircraft Guided Missile System). Signal Corps formally establishes Air Defense Fire Distribution System (ADFDS) Project 414A which will lead to development of AN/FSG-1 (Missile Master).
August	With the ending of World War II, early warning radar stations still operational in CONUS are inactivated.
14 August	Subcommittee Number 4 of the Guided Missile Committee recommends the services include in their R&D programs studies covering: (a) A system for control of SAM missiles against simultaneous attacks from all directions. (b) An effective short range SAM to replace the 40-mm. (c) A guided missile for defense against other supersonic GM and aircraft.

(d) An experimental program to determine the optimum warhead characteristics of surface-to-air missiles.

28 August — AAF makes initial design request for a propeller driven interceptor to replace the P-61; the request ultimately results in development of the jet-powered F-89.

13 September — Ordnance Technical Committee initiates a project for development of SAM based on military characteristics outlined by Antiaircraft Artillery Board in March 1945.

18 October — Patch Board submits its recommendations for an AAA organization which will effectively counter a future air threat incorporating rockets and guided missiles as major weapons.

November — The idea of a jet-powered interceptor as a replacement for the P-61 is accepted by AAF; military characteristics for the plane approved.

1946

4 January — CG, AGF in letter to CG, ASF requests a high priority study on defense against the V-2 and similar GM.

February — Boeing begins design studies for GAPA Project, a ram-jet vehicle capable of reaching an altitude of 60,000 feet at a range of 35 miles at supersonic speed. This will lead to development of Bomarc.

13 February — Army Deputy Chief of Staff requests major commands to review McNarney instructions of 2 October 1944 and recommend modifications to obtain most efficient performance.

27 February — CG, AGF in response to Army DCS 13 February letter recommends:

(a) The GM Committee of JCS Joint Committee on New Weapons be disbanded.

(b) A joint Army-Navy GM Board empowered to coordinate and guide or control GM development for Armed Forces be organized without delay.

(c) A revised directive on the development of GM within the Army be published.

(d) A directive be published establishing the division of responsibility between AAF and AGF for operational employment of GM. This would give seacoast defense, surface-to-air, and surface-to-surface to AGF.

March — AAF awards contract to GE for the study of interceptor weapons for ballistic missile defense. The first program of its kind and is designated the Thumper Project. It will parallel the University of Michigan Wizard Project initiated the following month.

Six manufacturers submit designs in interceptor competition, most are for jets, a few are for conventional planes. One of four Northrop designs is accepted (ultimately the F-89).

27 March — HQ ADC activated at Mitchel Field, New York.

April — AAF awards University of Michigan a contract to study possibility of developing supersonic missile capable of reaching 500,000 feet (Project Wizard).

17 April — AGF submits to the GM Committee a summary of its program which includes requirements for both an antiaircraft GM with a range of at least 50,000 yards and an interceptor GM with a range of at least 100,000 yards, for engaging very high altitude supersonic missiles of the V-2 type.

14 May — WD Circular 138 stipulates the AAF, ADC will provide for the air defense of CONUS and will control and train such AAA units as may be assigned to it. AGF and AAF to cooperate in developing AAA tactics, deciding on types of weapons required, and

drawing up manning and equipment documents for AAA units. AAF will recommend to WD the means, including AAA, required for defense.

25 May — ASF, in connection with the Proposed National Program for guided missiles, outlines existing ordnance projects: ORCIT, HERMES, Nike-I.

29 May — The WD Equipment Board (Stilwell Board) establishes the following requirements:

(a) An antiaircraft missile capable of destroying aircraft traveling 1,000 miles per hour at altitudes up to 60,000 feet at a horizontal range of 50,000 yards.

(b) An interceptor guided missile with a range of 100,000 yards, capable of intercepting aircraft and guided missiles of the V-2 type traveling at speeds greatly in excess of the sonic.

4–6 June — At an Air Board Meeting, the decision is taken to propose integration of antiaircraft artillery into the Army Air Forces.

14 June — CG, AGF sends CG, AAF an AGF study of the air defense problem proposing:

(a) Division of the air defense mission.
  (1) Local air defense to AGF.
  (2) AAF defenses beyond reach of ground weapons.

20 June — P-86 letter contract of May 1945 superseded by definitive R&D contract; three prototypes to be built.

26 August — CG, AGF informs Army CoS that a point has been reached in the development of certain missiles at which assignment of operational responsibility is possible. AGF position is that any missile launched from the ground is the responsibility of the Ground Forces as a part of their logical mission.

September — AMC dissatisfied with XP-89 mockup; many changes suggested.

18 September — In a summary sheet this date, WD expresses its agreement with AAF that air defense mission should be unitary but withholds decision as to the future role of guided missiles in air defense. It announces the AAF ADC will be integrated, incorporating AAA elements. ADC will ensure that assigned AAA units are trained in the ground combat role, and AGF will continue to provide technical training.

26 September — Army Ordnance, In OCM 31055, establishes the priority of the Nike-I System as 1-A.

7 October — Army CoS rescinds the McNarney Directive of 2 October 1944 and directs CG, AAF assume responsibility for R&D activities pertaining to GM and associated items of equipment.

15 October — AGF requests authority to establish military characteristics of those missiles of which it is the ultimate user and recommends an early decision on operational responsibility for guided missiles.

20 December — With P-86 prototypes still under construction, the first production order for 33 planes is issued.

1947

13 January — As a result of WD decisions in the field of R&D of GM, AGF undertakes a study to determine policy, particularly with respect to operational employment and concludes that AGF should be assigned responsibility for operational employment of all ground-launched missiles.

February — Fifteen YP-84A's delivered to AAF.

21 May	First postwar AC&W organization, the 505th AC&W Group, is activated at McChord AFB, Washington.
20 June	Army Ordnance Department establishes, as part of the HERMES Project, development of a two-stage missile with the code name Bumper.
July	AGF and AAF agree on air defense procedures prior to designation of overall theater commander.
25 July	Congress passes the National Security Act of 1947 creating three separate services, making permanent the JCS organization and creating the National Military Establishment.
19 August	CG, AAF and CG, AGF disagree over GM development priorities.
September	In extension of National Security Act of 1947, the JCS formulate a functions paper which defines Army and Air Force roles and missions.
15 September	The National Security Act of 1947 becomes law. Paragraph 3, Section IV, includes the following matters agreed between AGF and AAF with respect to SAM GM: (a) Security missiles designed for employment in support of Army tactical operations will be assigned to the United States Army. (b) Missiles designed for employment in area air defense will be assigned to the USAF.
18 September	The USAF is established.
23 October	A flight of 48 Soviet TU-4 (Bull) bombers is observed in the U.S.S.R., establishing a presumptive capability to bomb the continental United States by flying one-way missions.
21 November	USAF CoS approves Plan Supremacy for construction of an elaborate postwar radar network. The plan is withdrawn in 1948 in favor of a more modest initial program.
17 December	USAF grants ADC authority to use fighter and radar forces of SAC, TAC, and ANG in an emergency. The ANG would constitute a major source of air defense units.

1948

	Testing of the pilot model 75-mm. AA gun, Skysweeper, is begun.
February	An Air Defense Policy Panel recommends that AAA be integrated into the Air Force.
11–14 March	Secretary of Defense rejects demand for integration of AAA into USAF at Key West Meeting with JCS. The Army will organize, train, and equip AAA units and provide them "as required" for air defense.
16 March	CG, AFF recommends that existing agreements concerning employment of GM be reworded to indicate that USAF has primary interest in the command and employment of air-launched GM and the Army in ground-launched GM.
21 April	Secretary of Defense order assigns primary responsibility for air defense of CONUS to USAF.
13 May	The Bumper missile is fired successfully for the first time.
9 June	The Committee on GM of the Research and Development Board recommends that SAM be the responsibility of Army Ordnance if designed to be launched from the ground.
8 October	GOR for new all-weather jet interceptor issued. Early availability given precedence over capability against aircraft more advanced than Tu-4.

25 October — The first air defense division organization, the 25th Air Division, is established at Silver Lake (Everett) Washington.

16 November — The 26th Air Division, the first division on the East Coast is activated at Mitchell Field.

1 December — The Continental Air Command (ConAC) is established with Headquarters at Mitchell AFB. ADC and TAC made into subordinate "operational" headquarters.

1949

Army and Air Force Authorization Act of 1949 authorizes the Secretary of the Army "to procure materials and facilities, including guided missiles, necessary for the maintenance and support of the Army."

January — Army establishes a formal requirement for a SAM system to combat ballistic missiles.

13 January — ADO for "1954 Interceptor," to have a capability superior to that anticipated for Soviet intercontinental jet bombers, is issued. Coordinated development of the plane as an integrated system is planned.

February — A Panel on Air Defense recommends to General of the Army, Omar Bradley, Chairman, JCS, that an AAA staff section be added to HQ ADC and that ADC be given operational control of AAA units allocated to air defense by JCS.

19 February — Chief, AFF, establishes a requirement for a long range, surface-to-air GM capable of intercepting and destroying missiles of the V-2 type.

1 March — The six numbered air forces of CONAC are relieved of air defense responsibilities which are assigned to Eastern and Western Air Defense Liaison Groups.

21 March — Congress approves a permanent postwar radar net for CONUS and Alaska. The President signs a bill authorizing the Secretary of Air Force to construct a "permanent" aircraft control and warning system for CONUS and Alaska.

24 March — AFF states its position on GM responsibility as follows:

(a) The Air Force has paramount interest in the command and employment of air-launched guided missiles and units.

(b) The Army has paramount interest in the command and employment of ground-launched GM and units.

1 April — The 25th and 26th Air Divisions are transferred to ADC.

May — $48 million contract issued for modification of F-89 and 48 production models of F-89A.

Procurement of F-86D recommended.

16 May — Secretary of Army recommends to Secretary of Defense that operational responsibility for all land-launched guided missiles be assigned to DA and that a National Military Establishment research and development program for GM be jointly undertaken and supported with each service being assigned primary cognizance for RED as follows:

(a) Army — Land-launched SAM and SSM.

(b) Navy — Ship-launched SAM and SSM.

(c) Air Force — AAM and ASM.

31 May — F-86 enters service.

8 August	The Joint Strategic Plans Group, in a "split" paper, advises JCS on the assignment of responsibility for major categories of GM. View "A," which the Group recommends for approval, assigns all land-launched missiles to Army, ship-launched to Navy, and air-launched to Air Force. View "B" advises postponing a decision on the basis that the missile art has not yet advanced sufficiently to make determination possible.
26–29 August	USAF detects a nuclear detonation "somewhere on the Asiatic mainland."
19 September	27 more F-89A's ordered.
23 September	President Truman announces an atomic explosion has taken place in the U.S.S.R.
October	Procurement order for F-94 raised to 288 following Soviet atomic explosion; later raised again to 368.
7 October	Initial procurement order for F-86D issued: 2 prototypes and 122 production models.
29 October	Congress appropriates $85.5 million for construction on a "permanent" aircraft control and warning system for CONUS and Alaska.
17 November	In JCS 1620/12 the JCS conclude that "it is impracticable at this time to assign the several services, in accordance with their assigned functions, responsibility for the entire guided missile field. As a general rule, GM will be employed by the Services in the manner and to the extent required to accomplish their assigned functions. Development in certain categories has progressed to the point where the fields of their normal employment may be recognized." GM supplanting antiaircraft artillery are assigned to the Army as are surface-launched GM which supplant or extend the capabilities of artillery.
December	Construction is ordered on 24 priority radar stations of the "permanent" aircraft control and warning system of CONUS and Alaska.
December	The missile tracking portion of the Nike ground system is successfully tested at White Sands Proving Ground.
December	F-86D chosen as backbone of interceptor force.
8 December	The 32nd and 28th Air Divisions are activated at Stewart and Hamilton AFB.
16 December	30th Air Division activated at Selfridge AFB.
22 December	F-86D makes first flight. During late 1949, the F-86A has been replacing the P-80 and P-84.
27 December	Eastern Air Defense Force publishes rules of engagement for Fourth Army.

1950

January	Joint Defense Planning Committee informs CONUS armies that joint agreements with air forces will be drawn up on the basis provided by the rules established 27 December 1949 by Eastern Air Defense Force. However, ConAC disapproves, especially the EADF/Army position that aircraft should be fired upon unless identified as friendly. ConAC assumes that no AC&W system, current or future, can undertake to warn AAA when friendly aircraft enter its area. The ConAC position, never abandoned, is that AAA must be in constant "hold fire" status until released by the air commander to fire at a particular aircraft. This controversy will be ended by the Collins-Vandenberg agreement of 1 August 1950.
January	ConAC Operations Plan 1-50, "Air Defense of the United States" is issued to Eastern and Western Air Defense Forces. It contains a listing of targets to be defended by AAA.

	HQ USAF, authorizes around-the-clock air defense operations over the Atomic Energy Commission works at Hanford, Washington. HQ USAF, assigns units of the Air Defense Forces equal personnel priority with SAC and overseas units.
March	Construction of the "permanent" aircraft control and warning system begins.
March	Battery C, 518th AAA Battalion (120-mm. gun) becomes operational at Hanford, Washington. The remainder of the BN arrives on site 1 May.
	An ad-hoc interservice committee recommends sixty critical locations to be defended by AAA. The Army and Air Force finally agree on twenty-three which are to be defended by a federalized Army National Guard Force.
	Army Ordnance initiates development of a tactical Nike system (Nike-I).
	ADA study of AAA C^2 problems concludes that a AAA command is essential. This study is under review when South Korea is invaded.
May	Provisional HQ, Albuquerque Air Defense Sector, is established by USAF, ADC, at Kirtland AFB, New Mexico, to exercise operational control over the radar and fighter forces defending the Los Alamos and Sandia areas.
May	F-94 enters service.
15 May	AFF directs its Board Number 4 to study and formulate military characteristics for countermeasures against air-to-surface and surface-to surface missiles.
1 June	The Lashup radar network of 44 radar stations is completed. This network is to operate with World War II radar equipment until the "permanent" AC&W system is completed.
	The first Canadian-U.S. Emergency Air Defense Plan is approved.
	ConAC is formally authorized to establish a Ground Observer Corps.
25 June	North Korea invades South Korea.
27 June	Around-the-clock operations begin in United States air defenses.
July	Air Force puts electronics and control system for "1954 Interceptor" under development contract.
1 July	Army Antiaircraft Command (ARAACOM) is established with HQ in Washington, D.C. per DA, CO 20, 29 June 1950.
	CAA establishes Air Defense Identification Zones (ADIZ) in vital areas of the United States.
11 July	MG Willard W. Irvine is directed to assume command of ARAACOM and "to support the CG, ConAC, on basis of joint agreements between DA and DAF pertaining to policies and procedures for joint air defense of CONUS." When so directed by the JCS or in case of air attack on the United States, CG, ARAACOM, is to assume command of AAA units allocated to air defense.
15 July	ConAC recommends that 20 squadrons of the Air National Guard be called to federal service to buttress the air defense system.
19 July	The three armed services issue regulations establishing Air Defense Identification Zones.
August	F-94B begins to reach operational units.
1 August	A Memorandum of Agreement signed by General J. Lawton Collins, CoS, Army and General Hoyt S. Vandenberg, CoS, USAF, provides for joint decision at departmental

	level on targets to be defended by AAA, mutual Army/USAF agreement on locations of defenses (except that tactical dispositions are to be determined by AAA commanders), Army staff representation at each echelon of USAF command structure charged with air defense, and operational control of AAA by USAF division commanders "insofar as engagement and disengagement of fire is concerned."
7 August	A provisional Southern California Air Defense Sector is established with headquarters at Fort MacArthur, California, and given operational control of radar and fighter forces in the area.
14 August	AFF Board Number 4 informs Chief, AFF that DA has no projects to fulfill the requirement for an AMM and recommends that it be directed to prepare military requirements for search and tracking radar. Also, that certain Signal Corps projects in radar search and tracking research be provided funds and be pursued to completion.
18 August	Description of "pure interceptor" for 1954 issued for design competition.
24 August	President Truman authorizes interception and engagement of unidentified aircraft anywhere in the United States.
September	Public Law 778 gives the Civil Aeronautics Authority (CAA) power to regulate civil air traffic in peacetime.
	In reply to a proposal by LT General Whitehead, CG, ConAC, to establish a third Air Defense Force, LTG Norstad, Acting VCoS, USAF, suggests deferring change until current consideration by the JCS concerning a unified command for air defense reaches a conclusion.
1 September	Eastern and Western Army Antiaircraft Commands are established with HQ at Stewart AFB, New York, and Hamilton AFB, California. USARAACOM G03, 28 August 1950.
20 September	27th Air Division is activated at Norton AFB, California, to replace provisional Southern California AD Sector.
28 September	First production model of F-89 delivered.
8 October	31st Air Division activated at Fort Snelling, Minnesota. The seventh division of ConAC is without area responsibility in EADF and will be reassigned to Central ADF on 20 May 1951.
November	A revision of DA Ops Plan for 1950 (DA-OP-US-1-50) includes a list of 23 targets, listed in alphabetical order, to be defined "to the extent appropriate units are available." The list has been jointly prepared and is the first approved list of vital objectives.
1 November	HQ ARAACOM, is moved from Washington, D.C. to Mitchel AFB, New York where it initially serves as the AAA element of ConAC staff.
December	By Executive Order, the CAA is empowered to require filing of flight plans by civilian aircraft operating within coastal, domestic, or international boundary ADIZ's. This gives the air defense system its first real control over peacetime air traffic.
December	The Committee on Guided Missiles of the Research and Development Board recommends that fiscal support for air defense be increased to permit initiation of new projects to fill serious gaps. A homing-all-the-way missile is specifically recommended. The HAWK Project is initially to be limited to development of a short-range, SAM to be effective against aircraft and guided missiles attacking at speeds up to 600 knots and from altitudes of 30,000 feet to 1,000 feet at 10 miles range and 500 feet at 6 miles range.

1 December — CG ARAACOM, assumes responsibility for planning all AAA defenses within CONUS.

6 December — CG ConAC requests authority to call up 15 Air National Guard squadrons to federal service and to place 23 other squadrons on call.

1951

January — Airframe proposals for "1954 Interceptor" submitted.

1 January — ADC is reestablished as a major command of USAF with HQ Ent AFB, Colorado. Eastern and Western ADF, air divisions and other organizations with primary missions related to air defense are reassigned from ConAC.

5 January — 34th Air Division activated at Kirtland AFB replacing the provisional Albuquerque Sector.

8 January — LT General Ennis C. Whitehead is appointed CG of the reestablished Air Defense Command.

10 January — General Collins, Army CoS, directs G-3 to prepare a study of "Preferential Treatment of Selected National Guard (AAA) Units" with a view to future employment of state-commanded AAA units.

10 January — Director of Guided Missiles for the Secretary of Defense, Mr. K. T. Keller, informs Secretary of Defense that immediate acceleration of production processes for Nike-I is necessary in order to get the missile system out of R&D into the tactical weapon stage at the earliest practicable date. The objectives of this effort are:

(a) Production of 1,000 missiles by 31 December 1952.

(b) Production facilities capable of producing 1,000 missiles per month by 31 December 1952.

(c) Production by 31 December 1953 of sufficient ground support equipment for twenty tactical battalions.

(d) Production facilities by 31 December 1953 capable of producing ground support equipment for three tactical battalions per month.

15 January — HQ, ARAACOM is moved to Colorado Springs, Colorado. The office of the CG is at Ent AFB, the remainder of the staff is located initially in the Antlers Hotel.

23 January — ConAC receives authority to call 15 National Guard Squadrons into federal service and to place other squadrons on call as requested 6 December 1950.

1 February — 15 ANG fighter squadrons are federalized and assigned ADC.

19 February — The first production contract is initiated for Nike-I. A letter order is issued to the Western Electric Company effective until such time as a definitive contract is written.

March — 341 F-86D's on order; number increased to 979 two months later. First F-86D delivered and tested. Plane targeted for production before fire control and engine systems proven.

1 March — Central Air Defense Force is activated at Kansas City.

29th Air Division is activated at Great Falls, Montana.

2 March — Another six ANG fighter squadrons are federalized.

15 March — MG Maxwell D. Taylor, Army G-3, requests that Chief, National Guard Bureau, assure prior G-3 approval of further allocations of nondivisional Army National Guard AAA

	gun battalions, in order to preclude their federal recognition in locations far removed from planned vital objectives of air defense.
19 March	33rd Air Division activated at Tinker AFB, Oklahoma.
29 March	Committee on Guided Missiles approves Hawk as a SAM project for Army and requests that the Technical Evaluation Group study and make recommendations on optimum conduct of the program.
4 April	ARAACOM forwards the first master deployment plan: "Operations Plan for Antiaircraft Defense of the United States (AA-OP-US-1-51)."
10 April	CG, ARAACOM, assumes command of all AAA units allocated to CONUS air defense—six AW, nine 90-mm. and eight 120-mm. battalions plus four Bde and seven Gp HQ, eight AAA Ops Det and 15 Signal radar detachments.
24 April	Central ARAACOM established with HQ at Kansas City, Missouri. Organized 1 May 1951.
May	DA approves conversion of ARAACOM's AW battalions to Skysweeper by end of 1953.
	McDonnell XF-88 wins long-range escort fighter competition over six rivals; procurement delayed.
June	F-89 delivered to operational units.
	176 F-94B's accepted in FY 1951.
	Ten federalized Army National Guard gun battalions are assigned to ARAACOM—the first accession of such units during the Korean action.
14 June	AFF forwards to DA the Army military characteristics for a low-altitude, short-range, SAM guided missile.
20 June	Secretary of Army requests AFF to study a report published by Boeing and University of Michigan entitled "Preliminary Study of a Missile Defense System" and comment on the extent to which Bomarc fulfills the Army's requirement for an antimissile missile.
22–24 June	The first nationwide joint air defense exercise is conducted.
July	Convair gets prototype development contract for "1954 Interceptor." Republic and North America also receive contracts for their designs; soon afterward, Republic program terminates, North American design (F-103) kept only as "experimental aircraft."
1 July	35th Air Division is activated at Kansas City, Missouri. This is the eleventh division in ADC.
18 July	Secretary of Defense notified Chairman, R&D Board of his desire for Army to proceed with the Hawk Project and that funding is approved.
1 August	An exchange of notes constitutes formal United States–Canada agreement for building the Pinetree radar net extension in Canadian territory.
25 August	LT General Benjamin W. Chidlaw succeeds LT General Whitehead as ADC commander.
28 August	ARAACOM conducts its first unilateral exercise; 75 percent of its batteries occupy tactical positions for seven weeks until 18 October. *The exercise, planned to last only 30 days, is extended because of intelligence indications.*

September	When it becomes clear that the "1954 Interceptor" with the specified characteristics will not be ready by 1954, the construction of an interim version (F-102) by Convair is automated.
September	HQ, 35th Air Division is moved to Dobbins AFB, Georgia.
5 September	Secretary of Defense notified Secretary of Army that Army is authorized to proceed with implementation of Hawk Program.
October	ARAACOM 25 percent Rotation Program initiated. All AAA battalions within six hours' travel of tactical sites are required to maintain one battery on-site at all times. Major Commanders are authorized to order deployment of other batteries under specified emergency conditions.
18 October	AFF, after reviewing Boeing–University of Michigan study of Bomarc missile, concludes that the missile will only partially fulfill Army antimissile requirements. AFF withdraws a Board 4 recommendation that Army give no consideration to support of Bomarc project, but agrees that the missile would only partially meet the need for a defense missile and would not affect the Army's responsibility in air defense in the foreseeable future.
30 November	ARAACOM submits to DA its first deployment plan for SAM.
	ARAACOM submits to DA its plan for the exploitation of ARNG antiaircraft potential.
	Designation of McDonnell Voodoo changed from F-88 to F-101.
December	The President orders procedures established for the control of electromagnetic radiations in an emergency.
31 December	ARAACOM includes 6 Bde HQ, 13 Gp HQ, 13 AAA Ops Det, 6 AW battalions, 24 90-mm. battalions, 15 120-mm. battalions, and 23 signal radar maintenance units.

1952

	F-86D program delayed because of difficulties in fire-control and engine system.
	F-89 has seven accidents, resulting in eight fatalities, in first six months of 1952.
January	180 F-94B's were accepted in first seven months of FY 1952.
	Convair's original letter contract for "1954 Interceptor" expanded to include start of production engineering and tooling program. Convair later authorized to proceed with building of two YF-102 prototypes and seven production aircraft for 1954.
15 January	McDonnell accepts F-101A contract.
18 January	ADC proposes a requirement for small, unmanned radars (gap fillers).
1 February	HQ 25th Air Division is moved from Silver Lake to McChord AFB, Washington.
15 February	HQ 32nd Air Division is moved from Stewart AFB to Hancock Field, New York.
	ARAACOM resubmits its 30 November 1951 plan for SAM deployments.
26 February	DA authorizes ARAACOM to coordinate planning for utilization of ARNG units.
	USAF withdraws delegated responsibility for development of ground-based electronic countermeasures against missiles from Army. Tendered by USAF on 18 February 1948 and accepted by Army on 3 April 1948.

10 March	The first Multiple Corridor System for identification of traffic arriving from overseas is placed in operation outside San Francisco.
31 March	Chief of Ordnance directs Picatinny Arsenal to study the feasibility of an atomic warhead for the Nike-I missile.
April	DA approves an ARAACOM recommendation concerning allocation of 32 Nike-I battalions to 14 defended areas within the United States.
	DA approves ARAACOM's basic concept for the integration of ARNG units into the Air Defense System.
	Phase-out of ARAACOM's 47 assigned ARNG AAA gun battalions is begun. By end 1952, 27 battalions, three brigades, seven groups, and eight operations detachments will be phased out and Active Army units activated in their stead.
1 April	The Multiple Corridor Identification System is made an integral part of the 28th Air Divisions' Identification System.
10 April	In early tests of warheads, a Nike-I destroys a maneuvering B-17 drone at a range of 17 nautical miles and an altitude of 10,000 feet.
10 April	ADC and ARAACOM draw up a "Mutual Agreement for the Air Defense of the United States." AAA units are to pass to the *operational control of appropriate USAF commanders* when deployed to tactical positions, but such control is to be exercised through local AAA Commanders. Defended areas are to be determined by mutual agreement between DA and USAF. ARAACOM's responsibilities include ascertaining ADC's AAA requirements and attempting to fulfill them, preparing detailed plans, providing AAA advisors, and prescribing conditions of readiness. ADC is responsible for all identification, prescribing alerts, establishing gun-defended areas—to be "prescribed as soon as practicable" and, establishing in coordination with ARAACOM, the basic rules of engagement.
17 April	On the basis of reported unknowns ADC declares an actual command-wide condition of Air Defense Readiness. This is a first.
24 April	Complete system test of Nike-I is concluded with round 92 whose live warhead instantly destroys a large bomber.
28 April	Major General John T. Lewis succeeds Major General Irvine as CG ARAACOM.
9 May	Office, Chief of Ordnance requests BTL to make a study of the feasibility of an anti-aircraft guided missile carrying an atomic warhead using the Nike-I ground guidance system.
27 May	The original construction program for the "permanent" aircraft control and warning net is completed.
Summer	F-89F program cancelled.
	In view of the possibility of future wars resembling the Korean War, the development of a cheap mass-produced lightweight tactical fighter is suggested within the Air Force.
2 June	Separate AAA staff sections within HQ ADC and its major subordinate command headquarters are abolished in favor of coordination between counterpart staff elements of collocated HQ at appropriate echelons.
19 June	Assistant, Chief of Ordnance informs Assistant, Chief of Staff, G-4, that the following studies are being conducted:

(a) A study of the relative effectiveness of atomic warheads against bomber formations.

(b) A preliminary study of an antiaircraft GM carrying an atomic warhead using the production Nike-I ground equipment.

(c) A preliminary study of the feasibility of adapting the Corporal missile to a surface-to-air missile with an atomic warhead.

20 June — Undersecretary of the Army, Mr. Karl R. Bendetsen, in a memorandum states that USAF is undertaking an overall campaign to usurp the Army's responsibility in the entire GM field and takes the position that the Army should undertake to secure assignment of responsibility for all ground-launched guided missiles regardless of range, provided they do not require manned aircraft to launch, guide, or home. The Army G-3's position does not go as far with respect to the ICBM but considers that in the SAM field the Army must be responsible for research, test, procurement, and operations of those systems required to protect Army ground installations in a theater of operations. To avoid duplication of effort, the Army would also provide such weapons for the zone of interior.

1 July — The Federal Civil Defense Agency (FCDA) takes over operation of Civil Air Raid Warning net.

14 July — AFF Arms Board recommends that 15.61 percent of the Army's M-Day combat troop strength be allocated to nondivisional AAA.

15 July — Plan for Security Control of Air Traffic is signed by the Secretaries of Defense and Commerce.

22 July — The first production-line Nike-I makes a successful flight.

10 September — The first Bomarc test launching takes place at Cape Canaveral.

3 October — All F-89's grounded pending correction of major structural defects.

17 October — In a letter to Lincoln Laboratory, the Assistant Chief of Ordnance describes the lack of defense against ballistic missiles carrying atomic warheads and requests the laboratory to investigate and evaluate possible methods of defense utilizing and extending Projects Wizard and Thumper, considering defense against large missiles of the 50–400 mile range and ICBM.

20 October — At a conference sponsored by DA, G-4, it is decided that the antimissile system for the Army should be pointed toward the development of a system for use in a theater of operations. AFF is tasked to supply the following information:

(a) The relative priority of competing characteristics appearing in currently approved military characteristics for the Army's antimissile requirement.

(b) The minimum acceptable altitude coverage necessary for an interim antimissile surveillance radar.

(c) A description of the types of missiles with flight paths that could be encountered in a theater of operations before 1960.

1 November — The first hydrogen bomb is exploded at the AEC Eniwetok Proving Ground.

31 December — President Truman approves a National Security Council policy statement calling for a strengthening of continental defense.

1953

January — 2,500 F-86D's on order, of which fewer than 90 have been accepted.

1 February	The 29th and 34th Air Divisions are reassigned from Western to Central Air Defense Force. The 29th Air Division area is expanded to include North and South Dakota and Nebraska.
	Work on the development program for Nike-I-B is initiated by Western Electric who estimates that the system can be experimentally demonstrated in approximately three years.
16 February	ARAACOM region boundaries are changed to conform with ADC boundary changes of 1 February.
18 February	ADC promulgates instructions to all commanders to employ simultaneous engagement as necessary to effect maximum destruction of the attacking force. This follows testing in Western ADF which demonstrates the feasibility especially with the M-33.
March	The AW battalion at Castle AFB, California is converted to Skysweeper. The other three battalions in ARAACOM will be converted in October 1953.
3 March	Military characteristics of Nike-I-B (Hercules) are established.
9 April	Ordnance Technical Committee formally establishes a Hawk RED Project.
10 April	USAF adopts the Lincoln Transition System later to be renamed the Semi-Automatic Ground Environment (SAGE) System instead of the rival Air Defense Integrated System (ADIS) sponsored by the University of Michigan.
30 June	USAF reports only 66 active F-89's out of 164 first-line aircraft.
6 July	DA publishes criteria for designating ARNG AAA units as Special Security Force units.
22 July	The Continental Defense (Bull) Committee appointed by the National Security Council reports that continental defense programs, current and future, are inadequate.
27 July	An armistice is signed in Korea.
12 August	A thermonuclear explosion takes place in Russia.
21 August	USAF approves, in principle, as an interim measure, establishment of Inner Defense Areas (IDAs) around those targets in the United States which have effective AAA defenses. This has long been ADC and ARAACOM's recommendation, except that both considered IDAs to be necessary over the long as well as short term. IDAs differed from Gun Defended Areas in that all weapons would be used for defense.
25 September	The President approves a statement calling for increased emphasis on continental defense.
July	F-89 procurement accelerated in second half of year.
October	First YF-102A delivered.
	Last AW battalion phased out of CONUS Air Defense.
1 October	Secretary of Defense issues a revision of "Functions of the Armed Forces and the Joint Chiefs of Staff" commonly known as the "Key West Agreements."
	The first airborne early warning squadron is activated at McClellan AFB, California.
8 October	The Canada–United States Military Study Group recommends establishment of a Mid-Canada Line of early warning radar along the 55th parallel.
28 October	A Nike-I missile is fired for the first time by a tactical unit, Battery A, Package Number 2, 1st Guided Missile Group, at Red Canyon, New Mexico.
3 November	Canada agrees to construction of Mid-Canada Line.

9 November	DA publishes a policy directive for the AAA defense of CONUS, including provision for ARNG participation.
December	Second YF-102A delivered.
17 December	The first Nike-I-Ajax missile unit is moved on-site at Fort George G. Meade, Maryland: the 36th AAA Battalion, later to be redesignated 1st Battalion 562nd Artillery.
21 December	The first meeting of the Joint ADC-ARAACOM Planning and Coordination Committee results in the creation of a new, jointly approved objectives list.
24 December	USAF and United States Navy reach agreement on the seaward extension of radar for the contiguous system and Distant Early Warning (DEW) Line.
31 December	Phase-out of the 47 federalized ARNG AAA battalions assigned ARAACOM is complete.
	Ninety-one percent of ARAACOM units are on-site. Conversion to Nike-I will reduce the figure to 80 percent in the first quarter of 1954.

1954

	Tests in early months of the year indicate that YF-102 will be subsonic and will have a combat ceiling below 50,000 feet.
January	The Joint Strategic Plans Committee of the JCS is directed to prepare terms of reference for a joint air defense command.
11 January	USAF approves construction of five sea-based radar platforms known as "Texas Towers."
	USAF approves low altitude gap-filler radar program.
22 January	JCS agree to the establishment of a joint command for Continental Air Defense.
February	First flight of XF-104.
19 February	Air Force requirement for a two-place long-range jet interceptor outlined.
24 February	The President approves the recommendation of the National Security Council that a Distant Early Warning (DEW) Line be built.
March	All six Skysweeper battalions replacing the AW battalions are on-site.
25 March	ARNG on-site participation in AAA defense of CONUS is begun with deployment of Btry A, 245th AAA Bn (120-mm. gun) in New York City defense.
May	F-101 moneys delayed pending second flight test (expected in 1955); mass production postponed as a result of relaxation of tension following Korean armistice. "Fly-before-you-buy" policy instituted.
1 May	U.S.S.R. displays a jet bomber for the first time.
June	Following a controversy within the Air Force, decision to build the F-104 with a more powerful engine is made in mid-1954.
	Air Research and Development Command recommends the F-101 to fill USAF requirement for two-place long-range interceptor (stated on 19 February).
	263 F-94C's assigned to ADC.
2 June	The Canada–United States Military Study Group recommends that the two governments agree in principle to establishment of the DEW Line.

28 June	Raytheon is awarded a contract for design, development, and test of a complete Hawk weapon system.
1 August	Airborne early warning operations are begun off the West Coast.
2 August	JCS direct establishment of the Continental Air Defense Command (CONAD) as a joint command under the JCS.
September	52 out of 55 ADC squadrons equipped with all-weather interceptors; 38 of them have the F-86D.
1 September	HQ CONAD is established under command of General B. W. Chidlaw who is given operational control of ADC, ARAACOM, the Navy forces of the contiguous radar coverage system and augmentation forces of all services when made available during periods of emergency.
	NAVFORCONAD is established at Ent AFB, Colorado under command of RADM Albert K. Morehouse.
28 September	Development is initiated for a T-46 cluster warhead for Nike-I-B.
1 October	Major General Stanley R. Michelsen succeeds LT General Lewis as CG ARAACOM.
7 October	AFF indicates a requirement for a surface-to-air missile system capable of defeating a ballistic missile of all classes. The requirement will be restated by AFF successor CONARC on 12 November 1955.
8 October	9th Air Division is activated at Geiger Field, Washington, the 12th to be assigned to ADC.
8 November	Secretary of Army informs Secretary of Defense that studies performed in the Nike-I-B Program have concluded that the Nike-I System can be modified to control the Nike-I-B (Model 1810) missile at extended ranges in excess of 50 miles and up to 80,000 feet altitude without affecting the ability of the system to fire unmodified Nike-I missiles.
19 December	First flight of F-102.

1955

14 January	The first Nike-I-Hercules flight test missile is launched.
10 February	CoS Army directs CG, ARAACOM to initiate a study of possible substitution of civilian or reserve component personnel for military personnel.
March	BTL initiates a feasibility study for a weapon system to replace Nike-I and Nike-I-B about 1965. Emphasis is placed on defense against long-range ballistic missiles.
14 April	A Nike-I missile is accidentally launched by Btry C, 36th AAA Bn during an alert drill at Fort Meade, Maryland. Fragments of the missile fall in Barbersville, near Laurel, and on the Baltimore-Washington Parkway.
5 May	Agreement is reached with Canada reflecting establishment of the DEW Line in Canadian territory.
31 May	Eastern Army Antiaircraft Command is discontinued. Personnel are assigned the 1st AAA region.
	General Chidlaw retires. Major General Smith becomes acting Commander, ADC; LT General Michelsen becomes acting CINCONAD pending the arrival of CONAD and ADC designated Commander General Earl E. Partridge.
June	Construction begun on land portion of DEW Line.

21 June — The Technical Advisory Panel on Aeronautics concludes that the existing antimissile program lacks cohesiveness and direction and recommends that a special high level task group be appointed and responsibility be vested in a single service with a higher level of support.

29 June — First successful Nike-I-B firing takes place at White Sands Proving Ground.

Secretary of Defense states his conviction that the earliest practicable atomic capability for the Nike-I System can be achieved by priority development of the atomic warhead for Nike-I-B.

July — Army critically evaluates Project LAMPLIGHT, exhaustive study conducted by MIT, which omits the missile defense problem as "outside the LAMPLIGHT field of study" and "currently in the hands of a special committee of the USAF Scientific Advisors Board."

ARAACOM initiates a program request to improve the AN/TPS-1D. From this came the AN/FPS-36, -54, -61, -69, and -71 series of radars.

5 July — Chief, R&D, DA directs Chief of Ordnance to modify the requirements of BTL study concerning weapon systems to replace Nike-I and Nike-I-B so as to focus on the ICBM as the prime target of the Nike-I-Zeus.

14 July — ARAACOM submits comments to DA on the feasibility of "integrating reserve troops with Regular Army troops in a dual (Nike-I) Battery."

16 July — CONARC in a letter to G-3, DA concurs with AA&GM School's objection to the 50 mile range limitation of Army SAM:

(a) Maximum effective engagement of enemy aircraft.
(b) Destruction of enemy aircraft carrying nuclear weapons at a safe distance from the defended area.
(c) Improvement of antiaircraft effectiveness compatible with the increase in enemy aircraft speeds.
(d) Exploitation of the flexibility of antimissile missile in the antiaircraft role.
(e) Maximizing the surface-to-surface capability of Army antiaircraft guided missiles.

20 July — General Earle E. Partridge assumes command of CONAD and ADC.

August — ARAACOM submits to DA its own concept of military characteristics for an antimissile defense weapon.

16 August — The first HAWK missile is successfully fired at White Sands Proving Ground to determine flutter and drag characteristics of the missile airframe.

September — HQ 7th AAA Group is activated at Thule AFB, Greenland. It is assigned to First Army and attached to Northeast Air Command for operational control.

8 September — The 85th, 58th, and 37th Air Divisions are activated at Andrews AFB, Wright-Patterson AFB, and Truax Field, Wisconsin, respectively. These activations bring the total number of divisions assigned ADC to 15.

9 September — The number of Nike-I batteries deployed (136) equals the number of gun batteries (90-mm. and 120-mm.).

22 September — Nike-I becomes the dominant weapon of ARAACOM as conversion of the 602nd AAA Battalion of the Baltimore Defense increases Nike-I-l batteries to 140 and reduces gun batteries to 132.

8 October	The 20th Air Division is activated at Grandview AFB, Missouri, the 16th to be assigned ADC.
December	F-102A scheduled for production.
	DA authorizes the United States Army member of the Canadian–United States Permanent Joint Board on Defense to seek Canadian Army participation in the overall defense of Detroit. Under consideration is the relocation of two Nike-I batteries to Canadian sites, to be manned by Canadian personnel, in order to provide a balanced defense of Detroit.

1956

	Performance tests on lightweight, "ideal body" F-102A conducted in early 1956. F-102A becomes operational in mid-1956.
February	First flight of F-104A.
26 December	First flight of F-106A. The two-place F-106B first flies on 9 April 1958. In FY 1957, the F-106 goes into quantity production, while F-102 production is closed out.

Appendix C

A Chronology of Soviet Air and Ballistic Missile Defense

1941

First known Soviet Radar completed.

1943

Soviets receive significant information or samples concerning most of the operational radars in the United States and United Kingdom, including the U.S. SCR-584 fire control radar, which became the Soviet SON-2, the British "Elsie," a search light control and other U.S. types including the SCR-545, 527/627, 582/682, 602.

Development of RUS-2 radar.

1944

June	Reorganization of PVO Troops; Eastern and Western directorates established; Office of The Commander of Territorial PVO Troops abolished; supervision over the activities of the PVO fronts and zones, weapons planning and supply—transferred to the Red Army Commander of Artillery.
Spring	PVO Western and Eastern fronts eliminated, PVO Northern and Southern fronts established; improved control resulting.
	(Late) Soviet VRD3 (jet) bench testing begun.
	(Late) Capture of German jet engines.

1945

	Emphasis on Civil Defense lessens.
February	Stalin orders designs based on German jet engines.
8 May	Cancellation of Lend Lease Policy; decision reversed after strong protest by Soviets.
19 August	Recancellation of Lend Lease Policy—no reversal.
August–November	Flight tests of Me 262.
	Pre-prototype approval of native jet designs of 4 contenders.
October	Ground tests of YAK-15, wind tunnel testing.
December	Decision not to produce Me 262.

1946

	Reorganization of armed forces—unified defense establishment under the Ministry of Armed Forces; previously had Commissariats. Dumbo, early warning radar, the first post–WWII system, quickly followed by a family of radars characterized by metric frequency, the use of Yagi antenna, goniometric techniques and nearly identical transmitters. The Ministry of the Communications Equipment Industry (MCEI) organized. Included production of radar, radio-engineering equipment, telephone and telegraph apparatus, electro-vacuum equipment, storage batteries and electro-carbon articles.
March	Aviation industry mission to Germany.
March–April	Validation of MiG-15 requirement.
2 April	Stalin confirms aviation ministry plan for jet development.
24 April	First flights of MiG-9/YAK-15.
18 August	SU-9 first flight.
19 August	Aviation day MiG/YAK prototypes fly at Tushino.
29 August	Stalin orders 20–30 jet aircraft in 80 days.
September	La-150 first flight.
September	British permit export of 10 Nene jet engines.
7 November–December	30 aircraft delivered for October Revolution Parade.
	MiG-9 committed to production.

1947

25 February–May	State trials of YAK-15.
May	YAK-15 ordered to production with Lyulka RD10 engine.
March	Last of 25 Nene and 30 Derwent British jet engines received.
April	La-150 M first flight.
June	YAK-23 first flight.
2 July	MiG-15 predecessor flies.
August	YAK-15 U (tricycle gear version) passes state tests.
30 December	First flight of MiG-15.

1948

	Subordination of National Air Defense Forces to the Artillery Commander of the Soviet Army eliminated.
June	Ministry of Armed Forces establishes a Chief Directorate of Air Defense and establishes National Air Defense Forces as a distinct type of troops. Civil Defense interests renewed; self-defense leaders reported in training. Plans emerge for training 4–5 million in Civil Defense.
	Electronic experiments on the SA-1 for development of guidance subsystem.

March — MiG-15 to production.

Three designs of all-weather, radar-equipped, transsonic aircraft are unsuccessful, the SU-15, MiG I-320, and Lavochkin 200A.

1949

IZUMRUD AI radar modified for MiG-15.

German POWs report basement shelter construction program; basic radiofication of U.S.S.R. ordered, training of CD instructor(s).

MiG-15 bis modification with Soviet VK-1 engine.

Sukhoi design bureau closed; had begun SU-17 supersonic design.

Phase out of MiG-9 production.

1950

Industrial evacuation plans updated; call for "tens of thousands" of instructors.

Initiation of an Adcock-type radio direction finder; series provided HF/DF monitor coverage between 1.5 and 15 MHz.

January — MiG-17 first flight.

Trials of 2-seat MiG-15 with AI radar.

February — Claim of Mach 1.0 for MiG-17.

MiG-15 bis—to production with VK-1 and improved cannon.

November — German scientists tasked to study guidance problems of the SA-1.

1 November — First combat with F-51D Mustang in Korea.

8 November — First all-jet combat.

1951

Border Air Defense Line established; organizational part of the air defense system; Marshal of Aviation, K. A. Vershinin, named Commander of Border Air Defense Line Forces.

Token, V-beam radar, built by the Soviets; a major accomplishment; based on the U.S. AN/CPS-6 V-beam set, not released under the Lend Lease Policy but documented in the MIT Series reports.

SCAN ODD developed with German engineering assistance; the first Soviet radar with limited all-weather capability.

DOSAAF established.

Czechs and Polish licensed to manufacture MiG-15.

30 July — "Pre-project" approval of YAK-25 and MiG-19 design efforts.

MiG-15 bis to Korea.

Series production of MiG-17 as day interceptor.

1952

Colonel General N. N. Nagornyy named Commander of National Air Defense forces.

Production of a height finder, Patty Cake; not typical of Soviet Radars as it was an original design.

Early warning and surveillance radar on a bunkered building, GAGE; first static radar of significance employed by the Soviets; never achieving widespread deployment nor production in great numbers.

KRUG—the only Soviet ground-based Wallenweher wide aperture HF/DF system known to be in use; considered best of its kind; designed through German assistance.

Compulsory DOSAFF study circles begun; Civil Defense manuals published.

1 July — SA-1 prototype system tested.

November — SA-1 initial system test begun.

1953

Site construction for the SA-1 SAM system started; first site operation in 1954.

Antiaircraft General (Gritchin) made head of DOSAAF; 20-hour compulsory training program for DOSAAF members.

5 March — Stalin dies.

July — Sukhoi receives Hero of Soviet Labor; his bureau reinstated.

Border Air Defense Line Forces joined to National Air Defense Forces. Marshal Vershinin named Commander of National Air Defense Forces with Marshal of Artillery N. D. Yakovlev his first deputy.

1954

First Civil Defense publications mentioning atomic, bacteriological, and chemical weapons; Central Committee session of DOSAAF held, emphasizing its roles.

SCAN CAN deployment initiated; first Soviet AI system to use missile armament exclusively, developed from SCAN ODD.

May — Position of Commander-in-Chief of National Air Defense Forces established. Marshal of the Soviet Union, L. A. Govorov, named to the position.

1955

May Day—YAK-25 all-weather fighter and MiG-19 supersonic fighter are first observed.

First compulsory training program for adult population (10-hour); Tolstikov appointed Head of Civil Defense; Belov head of DOSAAF; beginning emphasis on using military as trainers and instructors.

Appendix D

Figures

D-1. Soviet and American Air Defense Systems

D-2. U.S. EW/GCI/ACO Radar

D-3. U.S. Fighter Aircraft Development

D-4. U.S. AAA and Surface Air Defense Missile Systems Chronology

D-5. U.S. Civil Defense Key Characteristics

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D-7. U.S. Air Defense Deployments by Year

D-8. Post-1954 Soviet Air Defense Organization

D-9. Soviet Aircraft Control and Warning Radar Development

D-10. Estimated Soviet Fighter Production 1946–1955

D-11. Soviet Fighter Prototype Maximum Speed

D-12. Development of Soviet Antiaircraft Artillery 1945–1960

D-13. U.S.S.R. Civil Defense Key Characteristics

D-14. Chronology of Soviet C^3 for Air Defense

D-15. Typical Soviet Air Defense District, 1955

Figure D-1. Soviet and American Air Defense Systems

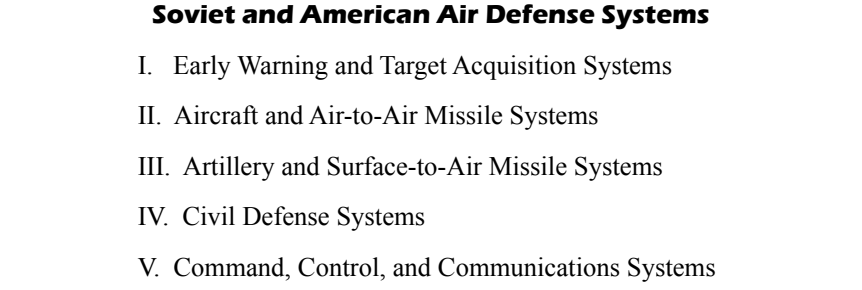


Figure D-2. U.S. EW/GCI/ACO Radar

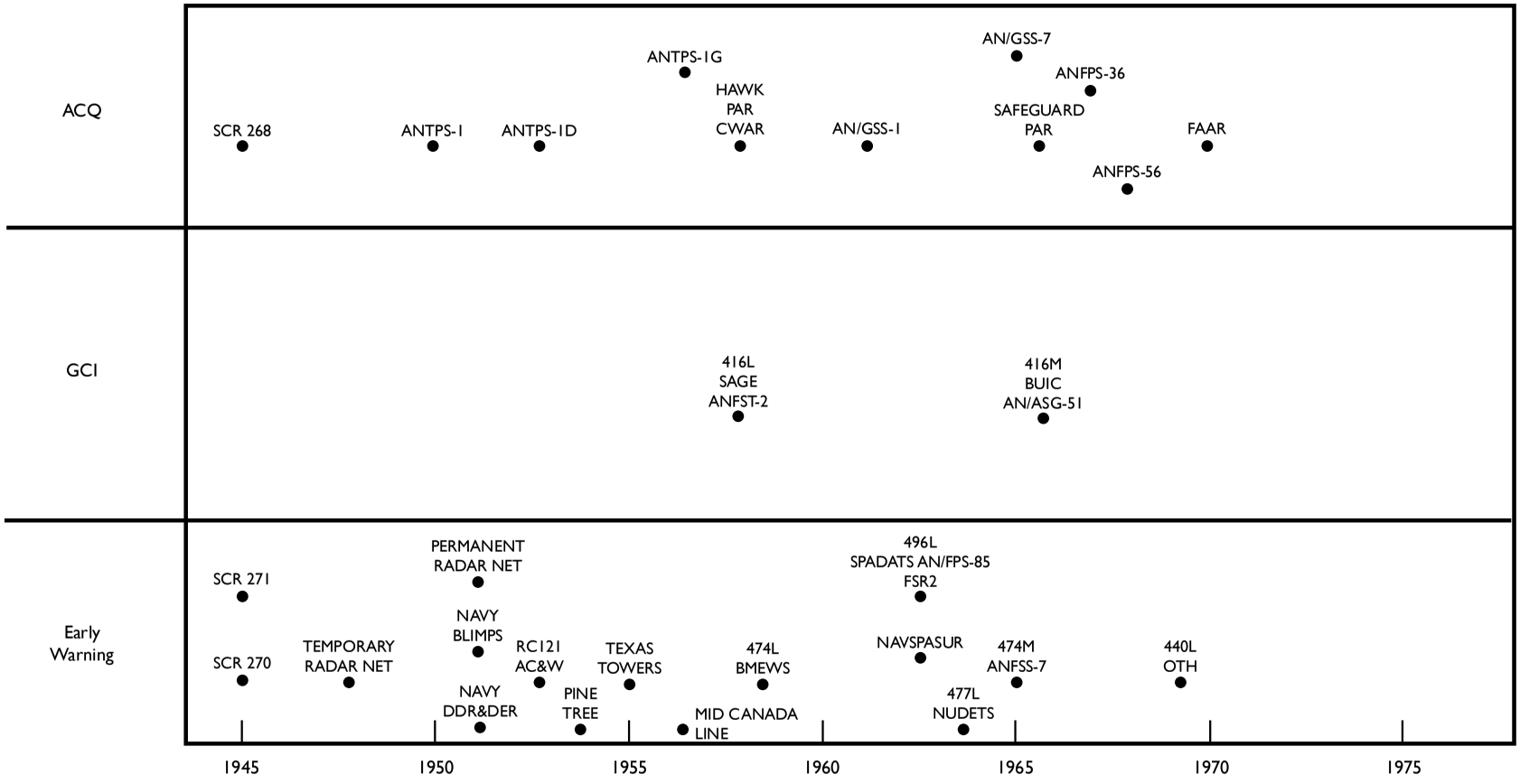


Figure D-3. U.S. Fighter Aircraft Development

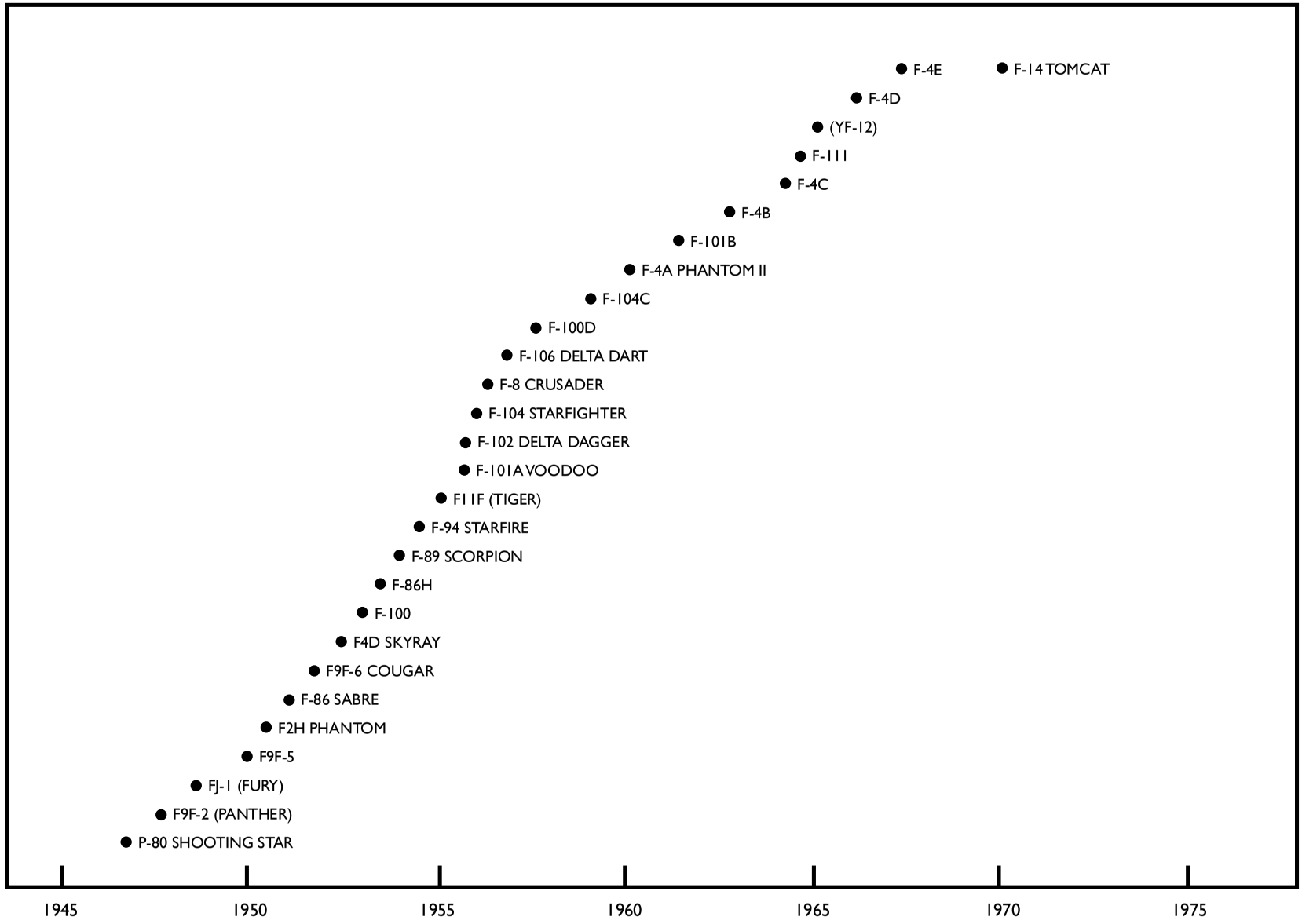


Figure D-4. U.S. AAA and Surface Air Defense Missile Systems Chronology

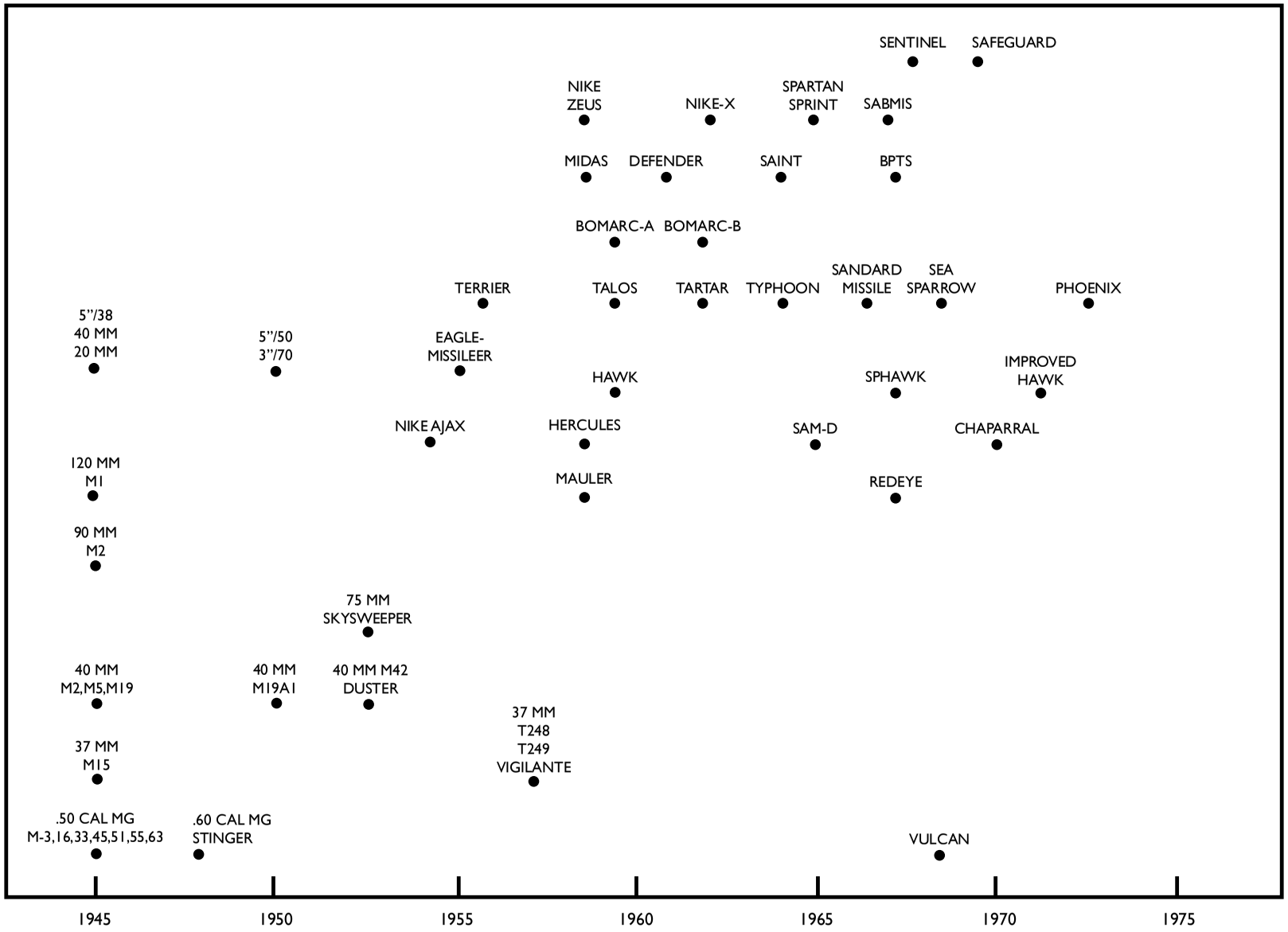


Figure D-5. U.S. Civil Defense Key Characteristics

1945–1950

- WARTIME OCD ABOLISHED
- WD STUDIES AND PLANS
- NSRB ACTIONS
- FWA RESPONSIBILITIES

1950–1955

- NSRB CD PLAN
- FCDA, OEM ESTABLISHED
- ODM RESPONSIBILITIES

1955–1960

- ODM, FCDA OCDM
- PL 85-606 INSTITUTED

1960–1965

- OCDM OEP
- CD TO SEC DEF
- ASD (CD) ESTABLISHED
- DAGR, DHEW RESPONSIBILITIES
- $250M CD APPROPRIATION
- OCD TO OSA
- CIV/MIL STRENGTHENED
- FALLOUT SHELTER PROGRAM

1965–1970

- PRESIDENTIAL SUPPORT
- CD WITH GEN NUC FORCES
- SHELTER PROGRAM CONTINUES

Post 1970

- MEASURED CD REDIRECTION
- CD REMAINS STATE ORIENTED
- CDPA ESTABLISHED
- ASSIST TO STATE AND LOCAL GOVERNMENTS

Figure D-6. Abbreviated Chronology USAD C³

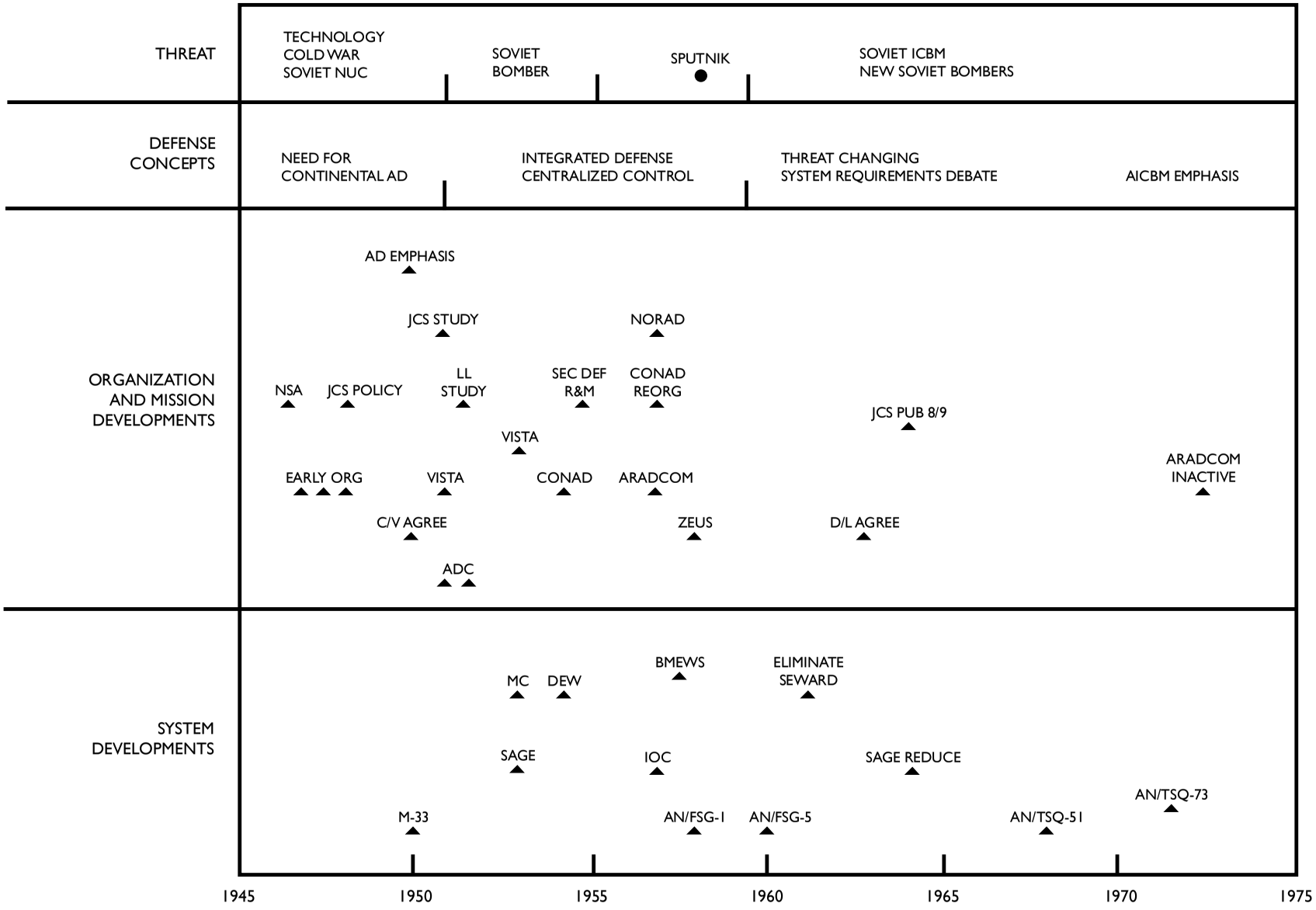


Figure D-7. U.S. Air Defense Deployments by Year

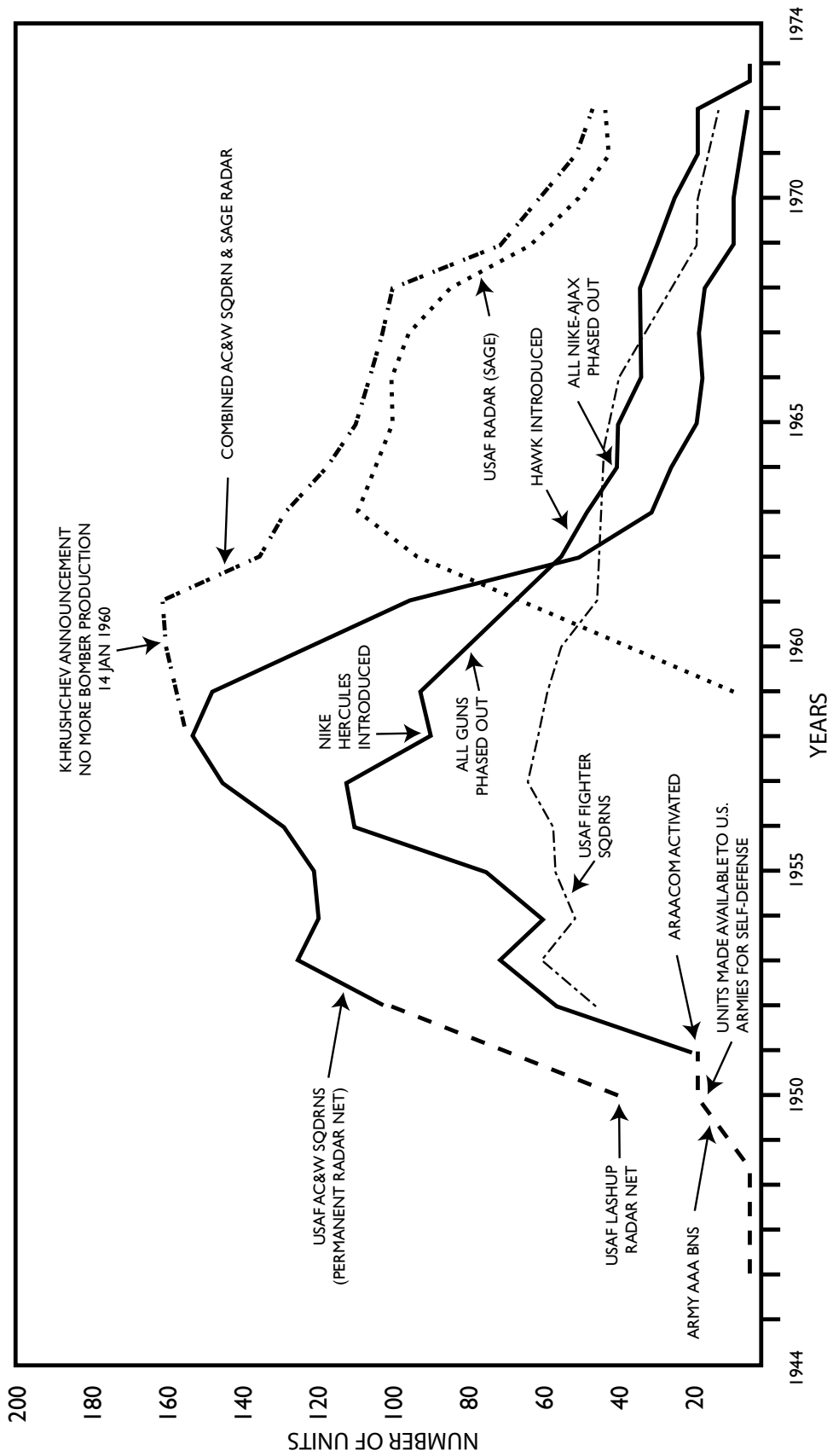


Figure D-8. Post-1954 Soviet Air Defense Organization

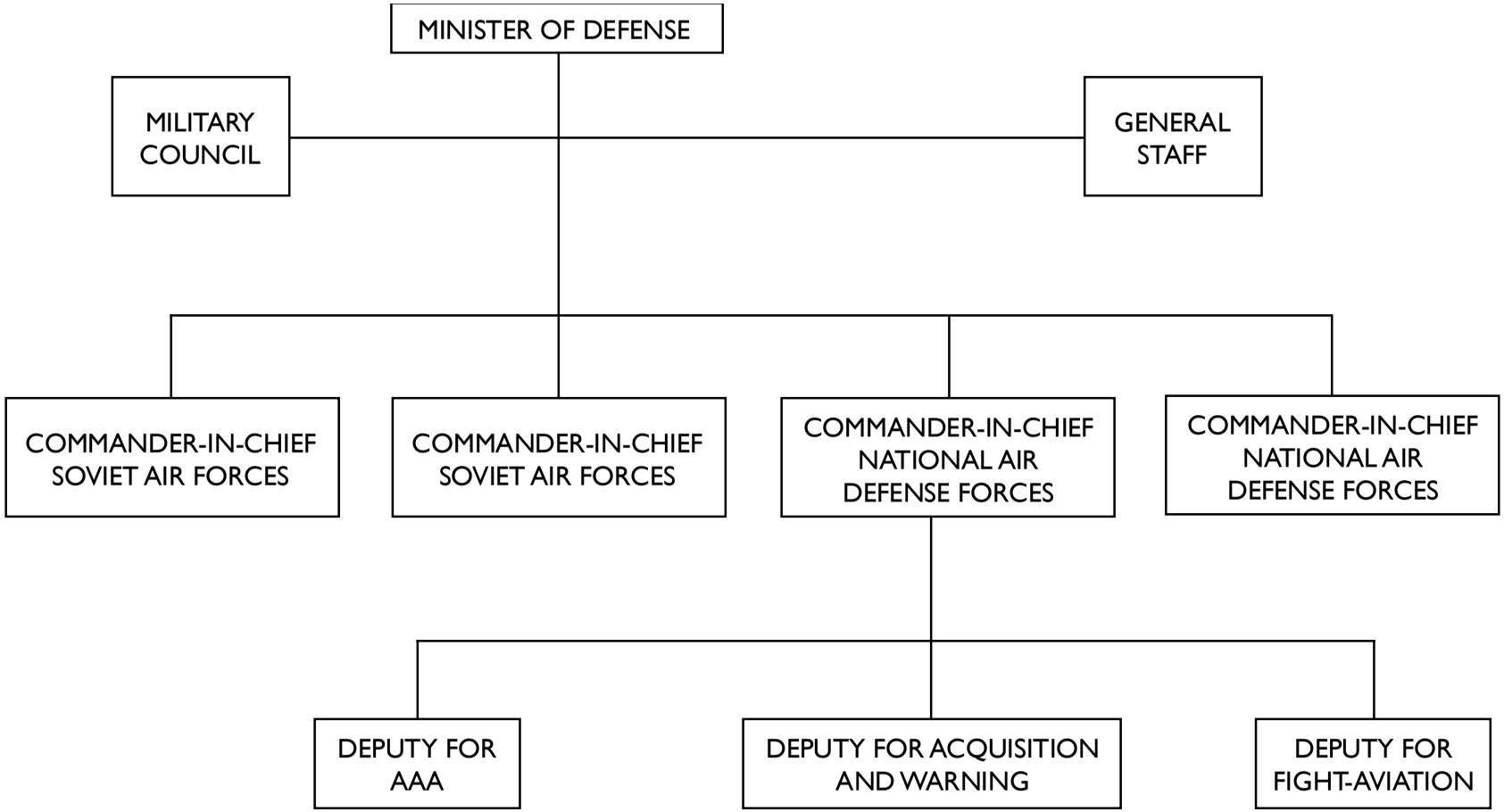


Figure D-9. Soviet Aircraft Control and Warning Radar Development

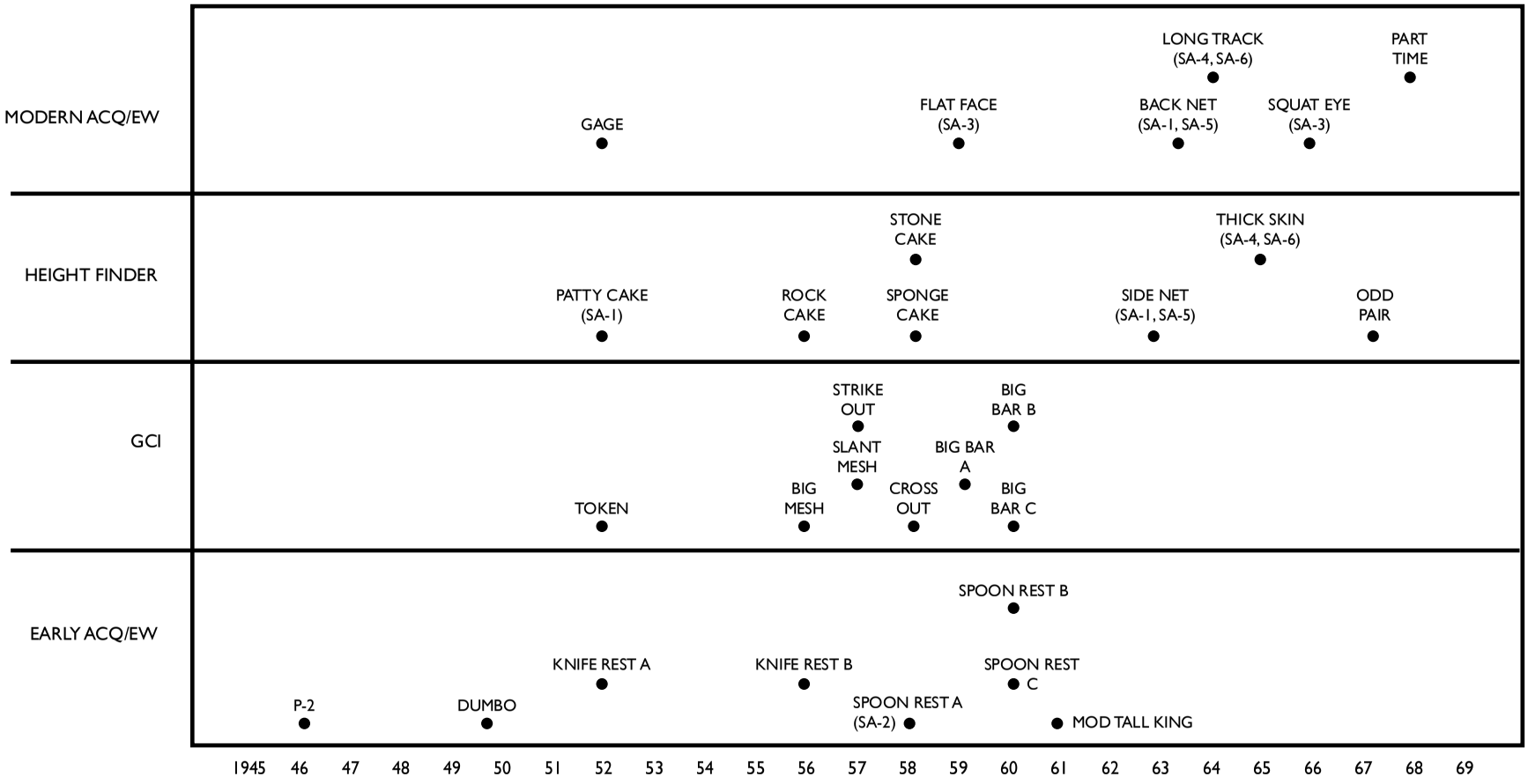


Figure D-10. Estimated Soviet Fighter Production 1946–1955

Designation	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	Total
Soviet NATO Propeller											
YAK-3	1400	300									1700
YAK-9 Frank	1300	650	650	300							2900
LA-7 Fin	1300	30									1330
LA-9/11 Fritz/Fang	15	700	1300	450	200	5					2670
Total Prop.	4015	1680	1950	750	200	5					8600
Jet											
YAK-15	15	250									265
MIG-9 Fargo	15	400	400								815
YAK-17 Feather		10	300	300							610
MIG-15 Fagot			60	850	2700	4200	3600	1100			12510
LA-15 Fantail			20	100							120
YAK-23 Flora				10	550	370					930
MIG-17 Fresco							400	3200	3500	2700	9800
MIG-19 Farmer									10	250	260
YAK-25 Flashlight									50	200	250
Total Jet (45)	30	660	780	1260	3250	4570	4000	4300	3560	3150	25560
Total Fighter	4045	2340	2730	2010	3450	4575	4000	4300	3560	3150	34160

Figure D-11. Soviet Fighter Prototype Maximum Speed

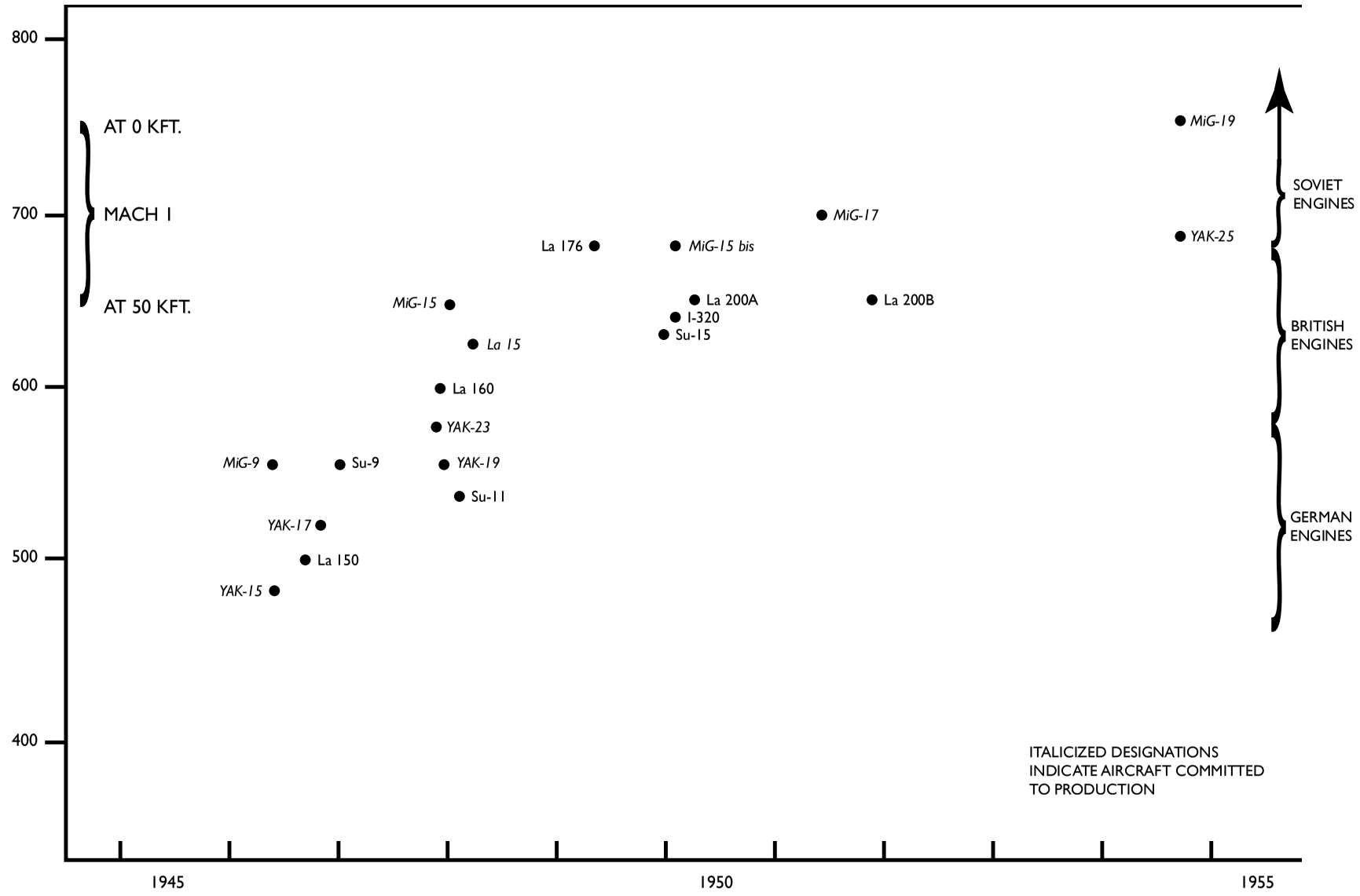


Figure D-12. Development of Soviet Antiaircraft Artillery 1945–1960

Caliber	Year of Introduction	Maximum Vertical Range (Ft)	Rate of Fire (Rds/min)
85 mm	1939	34,450	15–20
85 mm	1945	38,060	12–15
100 mm	1949	47,560	15
130 mm	1955	72,000	10–12

Figure D-13. U.S.S.R. Civil Defense Key Characteristics

1945–1960

- CD UNDER MINISTRY OF INTERNAL AFFAIRS (MVD)
- CD DIRECTED BY COL TOLSTIKOV
- CD ORGANIZED AROUND LOCAL AAA (MPVO)
- CD ORIENTED TOWARD CITY AND POINT DEFENSE
- ROLES AND FUNCTIONS EXECUTED BY COMPLEX OF CIVIL POLICE, FIREMEN, MUNICIPAL TEAMS AND PLANT TEAMS

1960–1972

- CD UNDER MINISTRY OF DEFENSE
- CD DIRECTED BY MARSHAL CHUIKOV WITH FIRST DEPUTY COL GEN TOLSTIKOV
- MILITARY INFRASTRUCTURE DEVELOPING THROUGHOUT CIVIL GOVERNMENT
- MILITARY CD OCS ESTABLISHED
- CD BECOMES BASIC ELEMENT OF SOVIET ARMED FORCES
- CD DEPUTIES PLACED ON MILITARY DISTRICT STAFFS
- MIL/CIV CD UNITS IN JOINT EXERCISES
- CD TRAINING TOWNS BUILT
- CD TRAINING PERVADES ENTIRE CIV/MIL STRUCTURE

Figure D-14. Chronology of Soviet C³ for Air Defense

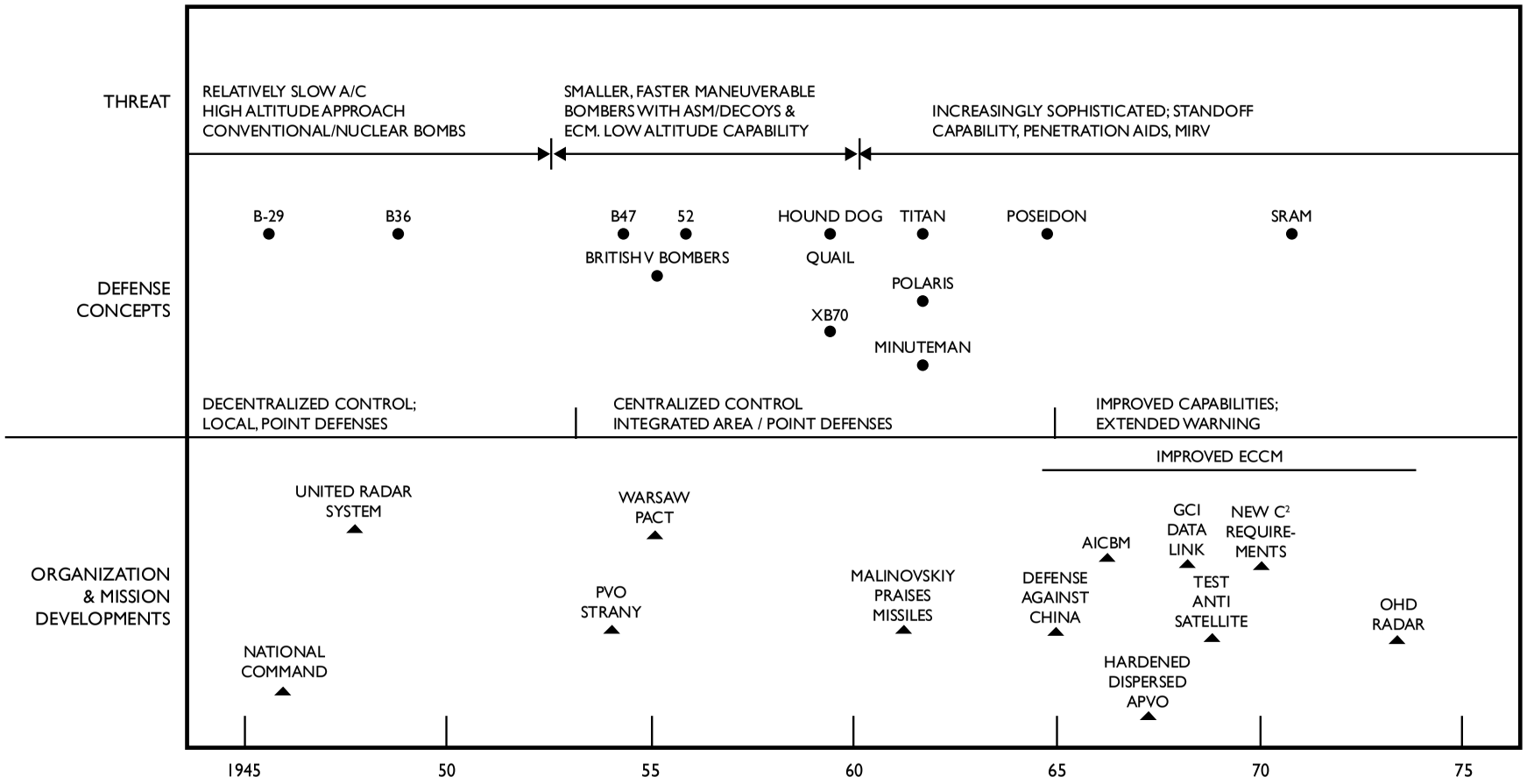
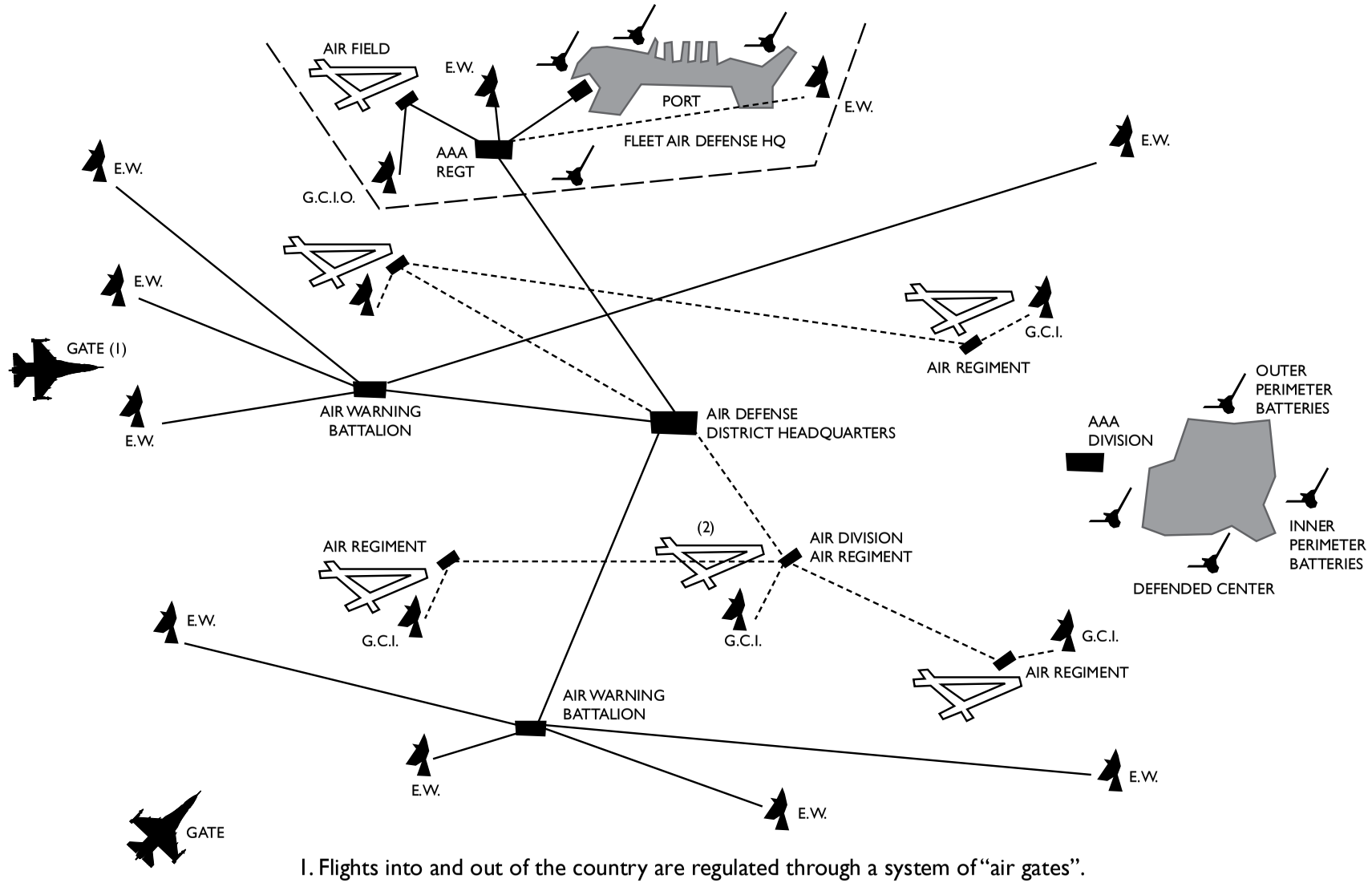


Figure D-15. Typical Soviet Air Defense District, 1955



1. Flights into and out of the country are regulated through a system of "air gates".
2. Each airfield defended normally by an independent AAA battalion.

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HISTORY OF STRATEGIC AIR AND BALLISTIC MISSILE DEFENSE

VOLUME II
1956–1972









Executive Summary

A. Introduction

This is the second of two draft volumes on the history of strategic air and ballistic missile defense from 1945 to 1972. It covers the 1955–1972 portion of the larger period, and is organized into five interrelated and progressively more detailed chapters. Chapter I provides a comparison of U.S. and Soviet strategies, Chapters II and III deal with U.S. strategy and Soviet strategy, while Chapters IV and V cover U.S. systems and Soviet systems.

This Executive Summary is drawn directly from, and highlights critical judgments of, these five chapters. As such, it outlines the substance of the much larger body of primary evidence contained in the separate books in this draft volume which was gathered to address the reasons underlying policy formulation and decision making for strategic defense and the relationship between the superpowers within that highly complex security policy arena. Results of research concerning factors influencing attitudes of policy/decision makers at critical times appear in Chapters II and III.

This Executive Summary has three major groupings: one, to reflect the contextual setting of decision-making, circa 1955; the second, to highlight strategic air defense policy comparisons and contrasts, 1955–1972; and a third, to present judgments and conclusions about the results of the play of factors and perceptions which molded air defense decisions during these years. These three sections derive from and are firmly tied to an evidential base; however, time and documentation constraints have limited the effort to develop that base. Consequently, important elements of the story may appear to be slighted. The essential and significant, however, are here.

Central questions faced the U.S. and Soviet defense planners. Fundamentally they asked: "How to defend the country?" and "How may we be attacked?"

B. The Setting

1. Influential Factors

During this period, U.S. and Soviet perceptions of strategic air and missile defense requirements were strongly influenced by (1) science and technology, (2) uncertainties in the future environment as to the continuity of the other's policies and nuclear strategies, and (3) the growing wish to move toward some limitations on arms.

2. Context in 1955

a. U.S. Strategy and Policy

U.S. national policy called for a strong and effective security posture with emphasis on strategic retaliatory forces and an integrated continental defense system. U.S. continental defense policy called for

intensification and acceleration of programs in order to be prepared against a Soviet threat anticipated to be grievous by 1957. Disarmament arrangements, if practicable, would be sought.

b. Soviet Strategy and Policy

Soviet strategy in the Spring of 1955 built on a fundamentally changed doctrine of preemption designed to frustrate an enemy attack. This provided the basis for having strategic forces not only for offensive employment but also to disrupt a Western surprise attack. In addition, the Soviets had an active defense system to help secure a growing strategic deterrent force and to defend the homeland. A missile development program was being pushed.

3. General Overview

a. Factors Influencing Deterrence

Concern over a perceived vulnerability to a surprise nuclear attack led both nations to develop powerful deterrent forces and supporting postures. Technology was the predominant factor influencing the character of the strategic choice made during this extended period for national defense. Deterrent strength was basic to national security.

The United States and the Soviet Union shared the basic choice that was made. Both looked to an integrated national air defense system as one element of deterrence. The weighted emphasis of the U.S. choice went to the strategic offensive element of the deterrent; the Soviet deterrent inclined to a more balanced posture between offensive and defensive components.

As the deterrent force of the two nations evolved, threat perceptions influenced their character. Based upon a perspective of the mid-1950's, the United States decided that the deterrent strategy required the high priority development of long-range missiles. The equivalent level of priority did not attend programs for strategic air and missile defense although the threat projected distinctive needs for active defense.

A reversed set of priorities guided the Soviet effort; response to the threat of U.S. strategic offensive power emphasized the need for an active defense throughout this period while building up strategic forces.

b. Factors Influencing Air and Missile Defense Decisions

In the context of the existing basic national security policy, U.S. strategic air and missile defense contributed to the U.S. deterrent posture while the threat changed and new technological developments appeared to challenge various aspects of the established strategy. Prime factors bearing on the U.S. strategic decisions concerning air and missile defense during this period included the threat, technology, and budgetary constraints.

Soviet strategic concepts and planning for a continuing, upgraded air defense structure and ABM deployment were influenced by the same factors and this accounts for obvious similarities in the pattern of basic trends. The nature and rationale of Soviet decisions, however, involves speculation although the available evidence clearly shows that the political leadership set priorities for strategic defense and regularly allocated a substantial resource commitment to that effort.

C. Strategic Actions

1. Parallel Decisions During the Period

Actions of consequence to the U.S. and Soviet strategic air and missile systems are detailed in Chapters II and III. Among those actions, certain decisions stand out. Noteworthy for their relative significance, these decisions have added dimension because the U.S. and Soviet Union each chose parallel routes in their approaches to security.

a. Mid-1950's Build-Up

The United States and the Soviet Union each decided early in the period to build up the strategic air defense structure existing at the time based upon perspectives of the current and anticipated manned bomber threat. In effect, these decisions extended and reinforced earlier decisions to establish the national air defense systems. Given added impetus in the mid-1950's by decisions for build-up, each of the national systems generated a momentum for a continuation of the established pattern of action with respect to air defense. Each acquired a self-sustaining dimension.

In the Soviet Union this influenced subsequent decisions involved in the revamping of the National Air Defense Forces which took place as part of Khrushchev's general reorganization of the armed forces (Section C, Chapter III, "Major Decisions"). Reductions in fighter aircraft and the virtual elimination of antiaircraft artillery were noteworthy elements of this restructuring. These actions coincided with the availability of a new surface-to-air missile system, the SA-2, and the advanced development of the SA-3.

1) Factors Related to Soviet Decision

The availability of these missile systems and new fighters and improved early warning and communications links, it is presumed, enabled Khrushchev to accomplish resource savings within the strategic air defense force in keeping with his larger, basic reorganization of the armed forces. Thus, it can be inferred that the availability of the products of technology—the new SAMs, fighter aircraft, radars and communication links—resulting from decisions and action taken earlier facilitated this Soviet decision. The economic situation remained generally poor despite a rise in military budgets about the time. Soviet threat perceptions had to take into account about 1,500 U.S. strategic aircraft, including the recently introduced B-52. U.S. naval aircraft, the RAF and an embryonic ballistic missile threat were added problems. Confidence among the Soviet leadership, however, was high as a direct result of the stunning achievement of the Sputniks; Khrushchev's authority was accepted; he was respected as the principal leader and he had already made the larger strategic decisions on offensive missiles. To upgrade the national air defense structure was therefore, a natural progression.

2) Factors Related to U.S. Decision

a) Threat Perceptions

Threat perceptions and decision processes appear to be the prime factors in this decision. An updated special intelligence estimate current at the start of this period held that by 1957 the U.S.S.R. could develop the capability of launching approximately 1,000 aircraft in an initial air operation against the United States. While it considered it more likely that the U.S.S.R. would elect to commit substantially fewer, this estimate

believed that 550 mission aircraft would constitute the maximum initial effort (Chapter I and Annex V, Chapter II).

Essentially limited progress had been made in the air defense programs already directed by President Eisenhower. There was concern because of revised intelligence estimates concerning the Soviet nuclear stockpile and fear aroused by the prospects of the fallout hazard. (Annex V, Chapter II deals with estimates, assessments and key decisions at the time.) There also was growing Canadian concern. The Killian report, "Meeting the Threat of Surprise Attack," pointed up Soviet capabilities in early 1955, and indicated critical U.S. targets were relatively few saying that "200 nuclear bombs . . . would decisively defeat us and . . . a first attack could be fatal if we were surprised and unprepared." The Killian report specified a number of deficiencies of the U.S. air defense system. WSEG Report No. 15, "Continental Defense," which circulated during the summer of 1955, contained a variety of recommendations on the subject. Many separate groups were urging high level U.S. Government action for improved air defense.

b) Decision Process

In the highly structured U.S. national security organization, the policy process was institutionalized, but dependent on various ad hoc groups for technical assessments and evaluations. Decisions resulted from the evidence such groups developed concerning the need for action on strategic programs. In 1953, President Eisenhower's Reorganization Plan No. 6 had revised the functions of the U.S. Armed Forces and the chain of command, abolished the Munitions Board and Research and Development Board, established seven Assistant Secretaries of Defense, and, in the National Security Council, major policy questions and security issues had become the purview of the Planning Board, made up of representatives drawn from the Departments of State, Defense, and Treasury; the Office of Civil and Defense Mobilization; and the Bureau of the Budget.

This Board, which included advisors from the JCS and CIA, had members personally appointed by the President upon nomination of the designated departments and agencies and the approval of the President's Special Assistant for National Security Affairs, Robert Cutler, a prominent Boston banker. The Planning Board, while only a small part of the NSC system under President Eisenhower, constituted the heart of the U.S. security structure since it had the central task of formulating policy for the consideration of the Council and the approval of the President. Board consideration of an issue began with the preparation of a preliminary study and discussion. Following this a draft would be prepared, modified, and cleared through inter-agency coordination. Special studies of air defense problems abounded.

b. Long-Range Missile Development—Deployment—Mid-1950's

The Soviet Union and the United States each decided early in the period to pursue accelerated development and deployment of long-range offensive missile systems. These decisions were significant because of their direct consequences with respect to the choice of basic strategy and because of the added dimension they gave to the evolution of threat perspectives.

1) Factors Related to Soviet Decision

The promise of technology appears to have been a primary factor in this decision. The Soviets needed a deterrent to neutralize U.S. strategic air and missile bases in Europe, to hold Europe hostage against a U.S. threat of action, and to support strategic concepts for the operations the combined arms against Europe.

A strong Soviet security position was needed; a deterrent force contributed directly to the defense of the homeland. Technology offered the prospect of an impressive solution to the threat. Khrushchev would boast that the strategic attack aircraft was obsolete. He had decided not to produce a large bomber force. Rockets and missiles were manifestations of a growing Soviet emphasis on these new means for wielding nuclear power.

Nuclear power had already proven useful for Soviet strategic purposes. The United States had shown interest in detente during 1955 and, despite its commitment to "massive retaliation," events in Suez and Hungary the following year indicated that the pattern of power in world politics was changing. Events in the fall of 1956 showed that efforts to impose political change by force at the expense of another major power could induce great risk in the nuclear era. Soviet nuclear threats, however, were blatant at the time; their diplomatic success now seems incredible.

2) Factors Affecting the U.S. Decision

Concern over the Soviet bomber program and the ICBM threat combined to make threat perception a principal factor relating to this U.S. decision. Technology also was of great significance, and related to this decision was an intense, bitter wrangle over roles and missions and bureaucratic politics. The Soviet ICBM test and later successful launch of Sputnik, however, acted as a catalyst which fused several separate factors and impelled the decision. U.S. decision making also felt the pull of other influences. Disarmament proposals provided one of these.

2. Contrasts in Choice

a. U.S. Choice

U.S. strategic thinking gave primary emphasis to the employment of offensive forces to defend U.S. interests as part of a desired strong security posture. That concept was reaffirmed by the strategic decisions made early in this period. Effectively, air defense was secondary. In keeping with the strategic concept that it was desirable to destroy an attacker as far from the target as possible, the United States, over this period, emphasized massive strategic offensive forces—both aircraft and missiles—to meet the perceived threat. U.S. strategy, however, included an integrated continental air defense system. That system grew in keeping with the scale of the anticipated Soviet bomber capabilities and contracted as the Soviet missile threat intensified. From the beginning of this period, U.S. policy and strategy sought to explore the possibility of reaching practicable arrangements for arms limitations with the Soviet Union. To maintain a credible retaliatory deterrent in the face of the growing Soviet missile threat the U.S. strategy looked to adequate warning and a declared concept of sufficient strategic strike capacity to be able to absorb a massive Soviet attack and to have surviving residual capabilities adequate enough to permit penetration of Soviet defenses to deliver unacceptable damage to the Soviet Union.

From an initial objective of improved active defense as part of its deterrent strategy, the U.S. subsequently shifted to concepts of assured destruction and later, to sufficiency. By the mid-1960's, with the shift to assured destruction, U.S. continental air defense had effectively run its course. Decisions made in the twilight years of the Eisenhower Administration, however, were significant to the outcome. Earlier decisions, moreover, appear to demonstrate that the basic U.S. strategic choice involved a technological race.

b. Soviet Choice

The Soviet strategy sought to provide a secure deterrent through active air defense in order to lessen the extreme vulnerability of deterrent forces. Concurrently, however, the Soviets also pursued the development and deployment of improved strategic capabilities, including missile systems, for offensive and defensive employment, and a coordinated civil defense program. Contrary to the general belief that the Soviets routinely adhered to a predilection for defense, Chapter III shows a substantial and sustained Soviet commitment to the strategic offensive component, greater than the priority given to defense of the homeland. (Table 19 contains comparative budget data.) Complementing and extending the strategy, Soviet bombers were widely displayed and advertised. Nuclear blackmail was also used to support fundamental Soviet objectives; threats were carefully timed against action on disarmament goals.

It is difficult to extrapolate Soviet strategic plans from the operational force deployments and related evidence of resource commitments for defense. No official presentation of decisions is available. After the fact judgment concerning Soviet strategic decisions, based upon the appearance and deployment of weapon systems, permits inferences to be made about the Soviet approach to strategic planning. Relevant intelligence and the growing volume of Soviet literature dealing with questions of doctrine and strategy, also enable specialists in Soviet affairs to demonstrate that Soviet strategic doctrine reflected a "classic" war strategy focusing on the relative outcome and the need to come out best rather than to achieve specified levels of destruction. Active air and missile defense could help to survive a nuclear attack. The Soviet position from the mid-1950's however, also openly stressed the utility of nuclear strike forces as a deterrent to Western attack. From that time, increased emphasis was given to the importance of Soviet nuclear forces as a major factor restraining aggression against the U.S.S.R. Continuing concern for their security, however, is demonstrated by the extended commitment to active air defense. The evidence is mixed with respect to the actual goal in the development of Soviet strategic forces; whether "superiority" was the goal, air defense was prominent.

3. Tactics—U.S.-Soviet Air and Missile Defense Strategy

a. From the Beginning to Sputnik (1955–1957)

Impelled by technology and the prospect that effective defense against the perceived bomber threat was practicable, both the United States and the Soviet Union augmented their existing strategic air defense structures in the mid-1950's. Specific objectives for the U.S. included an increased "kill" potential for air-to-air and surface-to-air missiles. Operational concepts recognized the desirability of destroying an attacker as far from the target as possible; however, attrition of the attacking force remained the basic U.S. concept. Each side had already begun surface-to-air missile deployments; these would accelerate during the following period.

b. The Early Missile Era (1958–1961)

The Soviet Union and the U.S. proceeded with the deployment of first generation long-range, surface-to-surface missile systems during this period although the Soviets held back on substantial deployment of the ICBM system which had launched Sputnik. However, each side now had missile strike capabilities as part of a growing deterrent strength. Vulnerabilities of first generation systems caused changes in the characteristic of the missile force.

By the end of this period the Soviets transferred responsibility for civil defense to the Ministry of Defense and emphasized this function. Accelerating Soviet ABM development provided for extensive test-

ing and, in the air defense field, a nationwide deployment of SAM missile defenses gave added evidence of the growth of PVO capabilities. Soviet decision makers also approved a new generation of all-weather fighters. The Soviet programs for air and missile defense provide a sharp contrast to the U.S. effort.

As President Eisenhower's second term approached its end, a number of U.S. air defense programs felt the effects of decisions for their cancellation. Thus, in the period of this relatively short span of years, the NORAD system was first augmented during 1958 with the deployment of new, longer range Nike-Hercules missile units and the DEW line and SAGE system commenced operating; however, between the summer of 1959 and 1960, the F108 program was cancelled; the SAGE Super Combat Center was cancelled; DEW line radar improvements were cancelled; programmed Bomarc sites were cut to 10; U.S. Navy ships were withdrawn from operating a sea barrier; a number of programmed, radars, prime and gap-filler were reduced; and the requirement for a new aircraft early warning and control (AEW&C) aircraft was cancelled.

Coincident with this pattern of cancellations and reductions NORAD strategy appeared to shift when, in January 1959, the North American Air Defense Objectives Plan (59–69) included the statement:

> Attrition of the enemy's forces no longer constitutes defense. . . . The air defense must be capable of virtually destroying the enemy's total offensive force on its first missions. . . . Complete and absolute protection of the entire North American continent will not be possible within the resources of Canada and the United States. Therefore defense forces must be deployed to defend the vital elements which animate our national structure.

c. 1961–1968, McNamara Years

As this period began, the Soviet threat to the United States increasingly reflected ICBM developments; U.S. air defense planning, therefore, required consideration of possible attack by a mixed Soviet nuclear force, probably to consist of initial missile strikes followed by manned bomber attacks. That planning was measured against the developing doctrines of flexible and controlled response.

Controlled response closely involved damage limitation; air and missile defense were as natural complements to the basic doctrine. With the shift from damage limitation to assured destruction by the mid-1960's, however, the U.S. air defense structure underwent significant reductions. From 1965 to 1968 fighter-interceptor strength went down 50 percent. The Navy first reduced and then ceased all operations on the DEW line extensions. In May 1965, the mid-Canada line ceased operations. By late 1965, Nike-Hercules defenses at SAC bases were being eliminated. By 1967, a reexamination of the role that Nike-Hercules would play in a mixed missile/bomber threat environment led to further eliminations. The Sentinel program foundered in the face of a concert of varied opposition.

Soviet air defense emphasized a continued program of modernization to meet the threat posed by increased speed, higher altitude, and electronic countermeasures capabilities of manned aircraft and cruise missiles. The transition to improved organization and operation of PVO Strany included action to begin deployment of the SA-5 missile system, probably designed to counter a high-velocity, medium- to high-altitude aerodynamic threat. A Soviet ABM defense was operationally deployed at Moscow.

d. 1968–1972

The sharp contrast already evidenced between the U.S. and Soviet air defense systems received increased emphasis during this period. CINCNORAD's reduced mission in covering critical areas would

be "partially" satisfied with forces available. A threat assessment by the Office of the Secretary of Defense, built on a new and greatly reduced threat, believed NORAD's reduced forces had the "capability to defend against a small attack (about 10 bombers) after one day of warning…." (Section E, Chapter IV details this.)

Soviet air and missile defense developments in this period underscored the growing coherence of that system, and its impressive strengths, which now included integration of the system with the Warsaw Pact countries. As the period closed, the Soviet anticipation appeared to be pointed to active defense consisting mainly of antimissile defenses.

D. Conclusions

1. Summary Judgments

Technological changes were the predominant factor affecting air and missile defense strategy during the period primarily as they related to the developing offensive threat. Their scope and pace introduced considerable uncertainty and greatly strained the stability of the U.S.-Soviet relationship. By their pace and the nature of the changes projected, technological innovations raised fundamental challenges to previous concepts of how to defend the United States.

U.S. strategy, in turn, built on the variety of new weapon system developments; Soviet strategic air and missile defense trends, dating from the mid-1950's, demonstrated Soviet anticipation, awareness and response to developments in U.S. strategic offensive forces. The scale and character of the threat varied over the period from bombers to missiles which complicated the choice of strategies.

Basic functions remained unchanged; the defense had to detect, identify, intercept, and destroy the attacker. Science and technology helped greatly but, as the period progressed, the time available for reaction grew less. This became of increasing consequence from the beginning of the nuclear era. To be instantly ready, the defense had to have a high order of competence, dedication, and vigilance. No longer could planners depend on a long mobilization period.

2. Conclusion

The basic patterns of action were set by initial, and early, strategic choices. Thereafter, the strategic problem centered on technological development. Threat perceptions increasingly involved possible application by the Soviets of new technologies in order to define or delimit future threats. Perceptions of future threats were influenced by the view of available technologies, whether or not the Soviets had demonstrated the capacity to apply them. Available or known technologies were extrapolated to assess future threats. It is difficult from this research to conclude whether "worst case" assessments, built on mirror-imaging, influenced U.S. strategic choices.

Interaction was inherent in the premises; however, a direct action-reaction cycle was not a factor in the development of U.S. and Soviet strategic air and missile defense systems, although tactical and operational considerations necessarily influenced developments and deployments.

Chapter I

U.S. and Soviet Strategies Strategic Air and Missile Defense 1955–1972

A Comparison

A. Introduction

During this period, U.S. and Soviet perceptions of strategic air and missile defense requirements were strongly influenced by (1) science and technology, (2) uncertainties in the future environment as to the continuity of the other's policies and nuclear strategies, and (3) the growing wish to move toward some limitations on arms.

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Basic functions remained unchanged; the defense had to detect, identify, intercept, and destroy the attacker. Science and technology helped greatly but, as the period progressed, the time available for reaction grew less. This became of increasing consequence from the beginning of the nuclear era. To be instantly ready, the defense had to have a high order of competence, dedication, and vigilance. No longer could planners depend on a long mobilization period. Warning grew in importance, soon it would be measured in minutes.

B. What Was Different from the First Decade?

1. 1955 Environment

a. Strategic Interaction in the General Situation

By 1955 Soviet nuclear capabilities and the potentials of science and technology directly challenged the chosen U.S. security policy instrument, massive retaliation. Hard realities and uncertainty confronted the basic U.S. policy of deterrence and affected its continuity.

As it originated earlier and later buttressed U.S. national security, deterrence was set in the context of U.S. global responsibilities projected into the indefinite future. While the two super-powers could engage in

a strategic dialogue, other factors limited freedom of choice. Throughout this period, surprise became a factor of vital concern in developing strategy. Advances and advantages in the technological race led directly to critical evaluations and assessments of U.S. security policy and recommendations for action. (Annex V, Chapter 2 treats U.S. 1954–1956 assessments and impacts on the U.S. continental air defense system.)

A perceptible shift in the strategic balance appeared evident at the start of this period, one which no longer favored America. Already a direct interaction was taking place between Soviet and U.S. bomber and air defense forces. The future prospect, however, pointed to a marriage of megaton weapons and intercontinental delivery means by the Soviets. Significant policy planners saw U.S. national survival seriously and suddenly jeopardized with the prospect that several hundred Soviet aircraft or ICBMs could devastate the industrial and population centers of the nation. An initial resulting shock in U.S. Government circles intensified because of the growing U.S. appreciation of nuclear weapons effects resulting from U.S. Pacific tests, the plethora of studies and analyses of U.S. vulnerabilities, and changing estimates of Soviet strategic capabilities, adding up to greater danger and difficulty for the United States. The ocean barriers no longer provided protection and the developing continental air defense system was then essentially ineffectual against this threat. There was a need to secure the deterrent.

By the mid-1950's Soviet policy clearly aimed at deterring U.S. nuclear attack. Following the contest for power in Stalin's succession, critical Soviet assessments of Stalin's policies emerged quickly. Post war Soviet foreign policy under Stalin's leadership had caused an active military alliance to develop in the West. Soviet actions had failed to tip the strategic balance in Europe in favor of Moscow. By hardening the division of Europe, Stalin had committed the U.S.S.R. to a political-military confrontation with the West and the economic and military resources of the United States had become increasingly involved in the cause of European security. While a prime Soviet objective in the early 1950's had been to forestall inclusion of West Germany in NATO or NATO defense arrangements, the 1955 Western coalition included a rearming West Germany. There was a growing awareness of an expanding U.S. military might; notwithstanding Soviet nuclear developments, the U.S.S.R. remained vulnerable and strategically weak. The developing deterrent had to be secured.

b. Reducing "International Tensions"—"Peaceful Coexistence"

The new Soviet leadership, therefore, sought to improve relationships with other nations and to reduce "international tensions" while improving its own security position. The Soviet leadership stressed the "Leninist policy" of dealing with capitalist countries on a businesslike, more peaceful basis. Khrushchev emphasized "peaceful coexistence." Khrushchev claimed that the Soviet bloc and the Western nations could "coexist" without major war; at the same time he moved to redress the strategic imbalance and made it clear that renunciation of the use of violence by Communists was not excluded by "peaceful coexistence." In essence, the Soviet leaders hoped "peaceful coexistence" would deter U.S. action in areas of interest to the Soviet Union and provide a framework in which to pursue the struggle against the capitalists. The goal was obvious: to maximize Soviet effectiveness in the struggle while minimizing danger to the U.S.S.R. Active air defense would be a prime element of Soviet strategy; however, research on missile defense also received attention. A distinctive feature of Soviet policy would be to advertise strategic weapon achievements while pressing arms limitations and encouraging hopes and expectations for stability and peace.

c. Broad U.S. Security Goals

Peace was the long-term, constant U.S. security goal. More than the mere absence of war was sought; the Soviets had raised U.S. apprehensions and laid down a competitive relationship through the "peaceful coexistence" line that governed the U.S.-Soviet interaction for "peaceful" relations. Pursuit of peace was difficult and integrating the pursuit of peace with more immediate and pressing security goals more difficult primarily because of the distinctive threat of imminent attack. U.S. policy built heavily on mutual security pacts; however, allies were of little immediate help against a direct Soviet threat against the U.S. As the U.S.-Soviet strategic interaction progressed, deterrence had greater political dimension. Political-psychological factors in the strategic interaction were significant. Quantitative and qualitative changes in the threat directly impacted U.S. security policy.

Broad goals of U.S. policy were:

(1) *Neutralization of the military threat*. This remained a primary goal for U.S. national security throughout the period. It received the highest priority in U.S. security thought and action. The priority obtained from the beginning. Soviet military power confronted the U.S. planners with the strategic reality of ready forces with nuclear strike capabilities directly threatening the United States. Estimates saw a growing threat to deter Soviet nuclear attack against the United States in a context of changes affecting U.S. global security interests entailed deliberations on priorities. Deterrence had a continuing urgency. That urgency sustained the high priority given to deterrence but generated requirements for decisions and choices on how to carry it out. The importance of deterrence also emphasized other U.S. policy themes and goals.

(2) *Stability in international relations*. Desire for stability made this a major theme of U.S. security policy. Alliances were seen as a means to further the containment doctrine and an effort to get a stable world balance resulted. Alliances would become increasingly involved in U.S. strategic questions of significance to the strategic interaction would be various attempts to establish practical limits on decisions and actions relating to strategic forces in order to maintain stability. Soviet boast, bluff and bluster would increase with greater strategic capabilities. Efforts at stability would attempt to avoid direct confrontations, to ensure "fail-safe" procedures and to develop and gain Soviet acceptance of other restraints to improve the chances that U.S.-Soviet controversies could be safely managed and concluded. With stability, U.S. policy could also advance another, related theme—reduction of tensions—in pursuit of its basic security goals.

(3) *Lowering overall tension level*. This theme animated different aspects of U.S. foreign policy. Long term in its implications, it pointed toward support of deterrence by removing the causes of conflict situations which might bring about a direct confrontation, or their escalation.

2. The 1955 Problem—Where To Go Next

a. U.S. Strategy and Policy

U.S. strategy, already based on deterrence, now had to take steps to defend against surprise attack. The Soviets obviously took seriously the possibility of U.S. strategic attack and had developed a strong, active air defense force. The situation pointed up a basic fact concerning defense applicable to U.S. and Soviet strategists: the essential nature of defense is to react. A threat must appear before the need for defensive measures is established.

The growth of Soviet strategic offensive capabilities in 1955 seemed to be an acute threat to the U.S. retaliatory force and to the North American continent. Pressure therefore quickly grew to install and extend required early warning based upon revised, updated intelligence and appraisals such as the early 1955 Killian report which stressed the consequences of surprise.

U.S. policy called for a strong security posture emphasizing strategic retaliatory forces and an integrated continental defense system. The threat was seen to be grievous by mid-1957. Disarmament arrangements, if practicable, also would be sought.

b. Soviet Strategy and Policy

Soviet strategy in the spring of 1955 built on a fundamentally changed doctrine of preemption designed to frustrate an enemy attack. This provided the basis for having strategic forces not only for offensive employment but also to disrupt a Western surprise attack. In addition, the Soviets had an active defense system to help secure the growing strategic deterrent force and to defense the homeland. A missile development program was being pushed. The threat was changing and technology a factor of promise.

3. Options—More Defense or More Offense

a. For the United States

In the light of the mid-1950's threat, the basic and feasible U.S. options appeared to be (1) augmented, sustained defense or (2) increased deterrent capacity.

A capability for active defense could contribute to the U.S. deterrent posture by reducing the chances that a Soviet planned attack could succeed; additionally, an active air defense system and civil defense program could help to limit damage. The defense option could also generate capabilities useful to defend against countries other than Soviet Union and among these capabilities, proven weapon systems and equipments and follow-on systems in advanced development were, or could be expected soon to be, available for employment against a bomber threat. Against a Soviet long-range missile threat, priority development of an antimissile system offered the possibility of an active defense against that eventuality, assuming U.S. bombing would be unable to prevent Soviet missiles from being launched. An antimissile research and development program begun in 1955 might be expected to progress as rapidly as an ICBM development.

The active defense option had been exercised earlier following the initial U.S. perception of a Soviet direct threat to the United States. That earlier choice was neither impelled nor required; nonetheless, urged by civilian scientists, it represented a deliberate strategic decision. Currently, the Soviet threat was real and the U.S. retaliatory capability was vulnerable to that threat.

b. Soviet Strategy

Analogous options were available for Soviet consideration with the threat perceived at the time including (1) U.S. strategic forces, (2) forward deployed bomber and carrier forces, or (3) likely U.S. missile development.

c. Commonalities

Each side needed to secure the deterrent force, initially against air attack; later, against missile attack. Possible measures to accomplish that included (1) active defense, (2) alert measures, and (3) first-strike capability, i.e., "superiority."

C. Contrasting Responses

1. Importance of Air Defense Strategy

a. U.S. Strategic Choice—Deterrence

U.S. strategic thinking gave primary emphasis to the employment of offensive forces to defend U.S. interests as part of a desired strong security posture. That concept was reaffirmed early in this period; air defense was secondary. In keeping with the strategic concept that it was desirable to destroy an attacker as far from the target as possible, over this period the United States emphasized massive strategic offensive forces—both aircraft and missiles—to meet the perceived threat. While emphasizing strategic offensive forces, U.S. strategy included an integrated continental air defense system. That system grew in keeping with the scale of the anticipated Soviet bomber capabilities and contracted as the Soviet missile threat intensified. From the beginning of this period, U.S. policy and strategy sought to explore the possibility of reaching practicable arrangements for arms limitations with the Soviet Union. To maintain a credible retaliatory deterrent in the face of the growing Soviet missile threat the U.S. strategy looked to adequate warning and a declared concept of sufficient strategic strike capacity to be able to absorb a massive Soviet attack and to have surviving residual capabilities which would be adequate enough to permit penetration of Soviet defenses to deliver unacceptable damage to the Soviet Union.

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b. Soviet Choice

The Soviet strategy sought to provide a secure deterrent through active air defense in order to lessen the extreme vulnerability of deterrent forces. Concurrently, however, the Soviets also pursued the development and deployment of improved strategic capabilities, including missile systems for offensive and defensive employment, and a coordinated civil defense program. Contrary to the general belief that the Soviets routinely adhered to a predilection for defense, Chapter III shows a substantial and sustained Soviet commitment to the strategic offensive component, greater than the priority given to defense of the homeland. (Table 19 contains comparative budget data.) Complementing and extending these steps, Soviet bombers were widely displayed and advertised. Nuclear blackmail was also used to support the fundamental Soviet strategy; threats were carefully timed against action on disarmament goals.

It is difficult to extrapolate Soviet strategic plans from the operational force deployments and related evidence of resource commitments for defense. No official presentation of decisions is available. After-the-fact judgment concerning Soviet strategic decisions, based upon the appearance and deployment of weapon systems, permit inferences to be made about the Soviet approach to strategic planning. Relevant intelligence and the growing volume of Soviet literature dealing with questions of doctrine and strategy, also enable specialists in Soviet affairs to demonstrate that Soviet strategic doctrine reflects a "classic" war strategy focusing on the relative outcome and the need to come out best rather than to achieve specified levels of

destruction. The Soviet position from the mid-1950's has openly stressed the utility of nuclear strike forces as a deterrent to Western attack. From that time, increased emphasis has been given to the importance of Soviet nuclear forces as a major factor restraining aggression against the U.S.S.R. Continuing concern for their security, however, is demonstrated by the extended commitment to active air defense, further evidence of Soviet unwillingness to subscribe to a concept of mutual assured destruction. The evidence is mixed with respect to the actual goal for the development of Soviet strategic forces.

Soviet ABM development may have been motivated by the prospect of a U.S. breakthrough which, combined with MIRV, could incline the U.S. to consider a first-strike. In this light, Soviet calls for vigilance and readiness to "frustrate" a possible enemy surprise nuclear attack and for intensified efforts to develop better active and passive defense capabilities, evidenced the Soviet desire for defense in order to survive a nuclear war. While the resource data contained in Chapter III show only a relative commitment, the data make it clear that concepts for active defense had a significant role in Soviet strategy.

2. Impact of Technology on Strategic Options

Action on the 1955 Killian report seems effectively to have established the direction of U.S. strategy. Based upon relative priorities, offensive forces would carry the U.S. defense burden against the Soviet Union. In addition to recommending a priority U.S. missile development program, the Killian report included suggestions for several specific air defense measures including the use of nuclear warheads with air-to-air and surface-to-air missiles.

While calling for accelerated air defense measures, the Killian report emphasized particularly the significance of the growth of Soviet progress in long-range missiles. That development would greatly change perspectives on the worth of maintaining active air defenses against bombers and pose a series of difficult questions concerning U.S. strategic options as later technological innovations challenged established strategy. This progression further influenced air and missile defense because technological advances several times during this extended period underscored the vulnerability of the deterrent force.

The properties of range, speed, payload, accuracy, and readiness of offensive missiles were of great consequence to the fundamental strategies being pursued by each side. As ICBMs were perfected, vast improvements resulted from various technologies. As one example, the technology of fuels progressed very rapidly and, by making it possible to maintain missiles in readiness for extended periods, also permitted their emplacement in underground silos, hardened against explosion. The vulnerability of the nuclear deterrent was ensured thereby, it seemed. The parallel development of missiles for firing from submarines greatly increased the U.S. capability to survive a first strike. The first generation missiles, however, were soft because they had to be fueled regularly to be made ready, and were deployed above ground. They represented a vulnerable deterrent.

The principal impact of the initial ICBM had appeared to be the capability to make surprise attack much easier. Soft targets were tempting. Quickly the need for some warning against the Soviet ICBM threat gave rise to the U.S. radar warning systems BMEWS, Ballistic Missile Early Warning System. Since BMEWS could "see" a missile about 15–20 minutes before that missile would arrive in the United States, SAC bombers could be on ground alert or airborne and the U.S. retaliatory force,

which was then vulnerable to attack, would be protected against destruction through adequate warning. (BMEWS was oriented to the north and would not provide warning against the submarine-launched missile attack.)

Radar warning of an attempted Soviet missile attack would permit SAC aircraft to become airborne although warning would pose the difficult question of whether ICBMs of the U.S. retaliatory force should be launched on the basis of radar warning alone. The aircraft could be recalled if necessary; the missiles could not. To make it possible for the U.S. retaliatory force to survive a first strike attack, ICBMs—Minuteman and Titan and some Atlas—therefore came to be put in hard silos. With the advent of Polaris, the chances of a successful Soviet counterforce first strike diminished very greatly.

As hardening progressed and Soviet counterforce appeared impracticable, the United States faced the fact that it had no method of defense feasible once offensive missiles were launched. At the time no effective form of active defense against nuclear missile attack was available.

Improvements in accuracy then threatened to make the fixed ICBM vulnerable to preemptive first strikes, and, about the same time, the development of MIRVs raised the possibility of attack ratios which greatly favored the attacker. Passive protection soon became less competitive with improvements in accuracy and weapon yields. Since exclusive reliance on a single element of the U.S. deterrent (Polaris/Poseidon) appeared imprudent, increased attention then turned to the possibility of active, hard point defense. A U.S. ballistic missile defense program appeared to be a requirement; it would be useful as a means of helping to maintain stability, i.e., deterrence. In marked contrast, the Soviet actions of the 1960's to deploy an ABM pointed directly to damage limitation, i.e., defense.

3. Summary—U.S.-Soviet Air and Missile Defense Strategy

a. From the Beginning to Sputnik (1955–1957)

Impelled by technology and the prospect that effective defense against the perceived bomber threat was practicable, both the United States and the Soviet Union augmented their existing strategic air defense structures in the mid-1950's. Specific objectives for the U.S. included an increased "kill" potential of air-to-air and surface-to-air missiles through use of nuclear warheads. Operational concepts recognized the desirability of destroying an attacker as far from the target as possible; however, attrition of the attacking force remained the basic U.S. concept. Each side had already begun surface-to-air missile deployments; these would accelerate during the following period.

b. The Early Missile Era (1958–1961)

The Soviet Union and the United States proceeded with the deployment of first generation long-range, surface-to-surface missile systems during this period although the Soviets held back on substantial deployment of the ICBM system which had launched Sputnik. However, each side now had missile strike capabilities as part of a growing deterrent strength.

By the end of this period the Soviets transferred responsibility for civil defense to the Ministry of Defense and put a highly respected senior officer, Marshal Chuikov, a Deputy Minister, in charge. Accelerating Soviet ABM development provided for extensive testing and, in the air defense field, their nationwide deployment of SAM missile defenses gave added evidence of the growth of PVO capabilities. Soviet decision makers

also approved a new generation of all-weather fighters. The Soviet programs for air and missile defense also provided a sharp contrast to the U.S. effort.

As President Eisenhower's second term approached its end, a number of U.S. air defense programs felt the effects of decisions for their cancellation. Thus, in the period of this relatively short span of years, the NORAD system was first augmented during 1958 with the deployment of new, longer-range Nike-Hercules missile units and the DEW line and SAGE system commenced operating; however, between the summer of 1959 and 1960, the F108 program was cancelled; the SAGE Super Combat Center was cancelled; DEW line radar improvements were cancelled; programmed Bomarc sites were cut to 10; U.S. Navy ships were withdrawn from operating as a sea barrier; a number of programmed radars, prime and gap-filler, were reduced; and the requirement for a new aircraft early warning and control (AEWAC) aircraft was cancelled.

The SAGE Super Combat Center would have had a hardened facility and improved computers. When it was cancelled, the decision was made to proceed with the existing SAGE program which was to be 80 percent effective by the end of 1961 and complete by 1963.

Coincident with this pattern of cancellations and reductions, NORAD strategy appeared to shift when, in January 1959, the North American Air Defense Objectives Plan (59–69) included the statement:

> Attrition of the enemy's forces no longer constitutes defense. . . . The air defense must be capable of virtually destroying the enemy's total offensive force on its first missions. . . . Complete and absolute protection of the entire North American continent will not be possible within the resources of Canada and the United States. Therefore defense forces must be deployed to defend the vital elements which animate our national structure.

c. 1961–1968, McNamara Years

As this period began, the Soviet threat to the United States increasingly reflected ICBM developments; U.S. air defense planning therefore required consideration of possible attack by a mixed Soviet nuclear force, probably to consist of initial missile strikes followed by manned bomber attacks. That planning was measured against the developing doctrines of flexible and controlled response.

Since controlled response closely involved damage limitation, air and missile defense could be seen as natural complements to the basic doctrine. With the shift away from damage limitation to assured destruction by the mid-1960's, however, the U.S. air defense structure underwent significant reductions. Major reductions from 1965 to 1968 brought fighter-interceptor strength down 50 percent. The Navy first reduced and then ceased all operations by ships and aircraft on the DEW line extensions in May 1965, the mid-Canada line ceased operations. By late 1965, Nike-Hercules defenses at SAC bases were eliminated. By 1967, a reexamination of the role that Nike-Hercules would play in a mixed missile/bomber threat environment led to further eliminations. The Sentinel program foundered in the face of a concert of varied opposition and policy choices.

Soviet air defense emphasized a continued program of modernization to meet the threat posed by increased speed, higher altitude, and electronic countermeasures capabilities of manned aircraft and cruise missiles. The transition to improved organization and operation of PVO Strany included action to begin deployment of the SA-5 missile system, probably designed to counter a high-velocity, medium- to high-altitude aerodynamic threat. A Soviet ABM defense was, by now, operational at Moscow.

d. 1968–1972

The sharp contrast already evidenced between the U.S. and Soviet air defense systems received increased emphasis during this period. CINCNORAD's reduced mission in covering critical areas would be "partially" satisfied with forces available. A threat assessment by the Office of the Secretary of Defense, built on a new and greatly reduced threat, believed NORAD's reduced forces had the "capability to defend against a small attack (about 10 bombers) after one day of warning. . . ." (Section E, Chapter IV details this.)

U.S. intelligence dealing with Soviet air and missile defense concerning this period underscores the growing coherence of that system, details its impressive strengths, including integration of the system with the Warsaw Pact countries and holds up a view of the Soviet anticipation of active defense consisting mainly of antimissile defenses.

4. Judgments

The basic trends in this summary highlight weapon system developments and deployments which reflect strategic choice. Showing a steady decline in U.S. strategic air defense—during a period marked by the advent of the ICBM and the resulting renewed U.S. emphasis on deterrence for defense—these trends contrast with the sustained, improved, and continuing Soviet national air defense effort. Interaction is implicit in the record. It is basic that U.S. and Soviet commitments to active air defense represent reactions to a perceived threat. The technological factor weighs heavily in any interaction assessment, however, because technological advances provided an essential stimulus for the threat perceptions developed during this period.

While the appearance of Sputnik represents a watershed event to key the reality of the Soviet ICBM threat, earlier U.S. judgments on the basic strategic course needed to meet forthcoming challenges to U.S. security had already anticipated that development. The essential disposition to these decisions probably existed at the start of this period.

In the context of the existing basic national security policy, U.S. strategic air and missile defense developments contributed to the U.S. deterrent posture while the changing nature of the threat and further technological developments challenged various aspects of the established strategy. Prime factors bearing on the U.S. strategic decisions concerning air and missile defense during this period included the threat, technology, and budgetary constraints. These factors do not exclude others but represent those which had substantial influence. (Disarmament policy is a strand which runs through the period but research accomplished for this study merely permits an acknowledgment and an example.)

Soviet strategic concepts and planning for a continuing, upgraded air defense structure and ABM deployment have been influenced by the same factors. This accounts for obvious similarities in the pattern of basic trends. The nature and rationale of Soviet decisions, however, involves speculation although the available evidence clearly shows that the political leadership set priorities for strategic defense and regularly allocated to that effort a substantial resource commitment.

The pattern of action reflected by the basic trends outlines the substance of choices made; consideration of the influences for these choices appears in the following section.

D. Reasons and Influences

1. Parallel Decisions During the Period

a. Mid-1950's Build-Up

The U.S. and the Soviet Union each decided early in the period to build up the strategic air defense structure existing at the time based upon perspectives of the current and anticipated, manned bomber threat. In effect, these decisions extended and reinforced earlier decisions to establish the national air defense systems. Given added impetus in the mid-1950's by the decisions for build-up, each of the national systems generated a momentum for a continuation of the established pattern of action with respect to air defense and each acquired a self-sustaining dimension.

In the Soviet Union this contributed to subsequent decisions involved in the revamping of the National Air Defense Forces which took place as part of Khrushchev's general reorganization of the armed forces (Section C, Chapter III, "Major Decisions"). Reductions in fighter aircraft and the virtual elimination of antiaircraft artillery were noteworthy elements of this restructuring. These actions coincided with the availability of a new surface-to-air missile system, the SA-2, and the advanced development of the SA-3.

1) Factors Related to Soviet Decision

The availability of these missile systems and new fighters and improved early warning and communications links, it is presumed, enabled Khrushchev to accomplish resource savings within the strategic air defense force in keeping with his larger, basic reorganization of the armed forces. Thus, it can be inferred that the availability of the products of technology—the new SAMs, fighter aircraft, radars, and communication links—resulting from decisions and action taken earlier facilitated this Soviet decision. The economic situation remained generally poor despite a rise in military budgets about the time. Confidence among the Soviet leadership, however, was high as a direct result of the stunning achievement of the Sputniks; Khrushchev's authority was now accepted and respected as the principal leader and he had already made the larger strategic decisions on offensive missiles. To upgrade the national air defense structure was, therefore, a natural progression.

2) Factors Related to U.S. Decision

a) Threat Perception

Threat perceptions and decision processes appear to be the prime factors in this decision. An updated special intelligence estimate current at the start of this period held that by 1957 the U.S.S.R. could develop the capability of launching approximately 1,000 aircraft in an initial air operation against the United States. While it considered it more likely that the U.S.S.R. would elect to commit substantially fewer, this estimate believed that 550 mission aircraft would constitute the maximum initial effort.[1]

Essentially limited progress had been made in the air defense programs already directed by President Eisenhower.[2] There was concern because of revised intelligence estimates concerning the Soviet nuclear

[1] Record Group No. 319, Records of Joint Actions, Department of the Army, Army Staff, DCSOPS, JCS Papers, National Archives Building (hereafter RG 319), *Annex to Appendix A*, (par 2 d, p. 1152) JCS 1899/162, 2 Nov 54 quotes SNIE 11-7-54 paragraphs 8–9.
[2] RG 319, *Memorandum to Secretary of Defense Subject: Continental Defense (NSC 5408)*, 11 June 1954 (JCS 1899/117).

stockpile and fear aroused by the prospects of the fallout hazard.[3] (Annex V, Chapter 2 deals with estimates, assessments and key decisions at the time.) There also was growing Canadian concern.[4] The Killian report, "Meeting the Threat of Surprise Attack," pointed up Soviet capabilities in early 1955, and indicated critical U.S. targets were relatively few saying that "200 nuclear bombs . . . would decisively defeat us and . . . a first attack could be fatal if we were surprised and unprepared."[5] The report specified a number of deficiencies of the U.S. air defense system.[6] WSEG Report No. 15, "Continental Defense," which circulated during the summer of 1955, contained a variety of recommendations on the subject.[7] (Many separate groups were prominent in urging high level U.S. Government action for improved air defense.)

b) Decision Process

In the highly structured U.S. national security organization, the policy process was institutionalized, but dependent on various ad hoc groups for technical assessments and evaluations. Decisions resulted from the evidence such groups developed concerning the need for action on strategic programs. In 1953, President Eisenhower's Reorganization Plan No. 6 had revised the functions of the U.S. Armed Forces and the chain of command, abolished the Munitions Board and Research and Development Board, established seven Assistant Secretaries of Defense, and, in the National Security Council, major policy questions and security issues had become the purview of the Planning Board, made up of representatives drawn from the Department of State, Defense, Treasury, the Office of Civil and Defense Mobilization, and the Bureau of the Budget.

This Board, which included advisors from the JCS and CIA, had members personally appointed by the President upon nomination of the designated departments and agencies and the approval of the President's Special Assistant for National Security Affairs, Robert Cutler, a prominent Boston banker. The Planning Board, while only a small part of the NSC system under President Eisenhower, constituted the heart of the U.S. security structure since it had the central task of formulating policy for the consideration of the Council and the approval of the President. Board consideration of an issue began with the preparation of a preliminary study and discussion. Following this a draft would be prepared, modified, and cleared through inter-agency coordination.

The evolution of an NSC policy paper under this process might take weeks and ". . . all points of view were represented, heard, explored and contested."[8] The policy formulation process under President Eisenhower has been described by Mr. Cutler as one side of the "policy hill." Policy moved up the side of the hill through the Planning Board to the Council at the crest where it was "thrashed out" and submitted to

[3] RG 319, Appendix to Enclosure, JCS 1899/130, 9 July 1954, contains observations and recommendations by Robert C. Spraque to NSC on 1 July 1954.
[4] RG 319, JCS 1899/156, August 1954.
[5] RG 319, *Memorandum to Secretary of Defense*, JCS 1899/200, 18 April 1955; "Report of Technological Capabilities Panel, ODM, to the President"—14 February 1955, and NSC Action 1355, 17 March 1955 as cited in *Chronology of Significant Events and Decisions Relating to U.S. Missile and Earth Satellite Development Programs May 1942–October 1957*. Historical Section, JCS, 22 November 1957; and "History of Strategic Arms Competition," *Chronology—U.S. Volume I 1945-60*, Office of OSD Historian, October 1974, (OSDH-74-0001), p. 445, quotes from Killian report.
[6] Ibid.
[7] Ibid.
[8] "Organizing for National Security, The National Security Council," Study submitted to Committee on Government Operations, U.S. Senate by the Subcommittee on National Machinery, pp. 9 and 51, Government Printing Office, Washington, D.C., 1960.

the President for decision. Once the President approved the policy, it went down the other side of the hill to the departments and agencies the President charges with carrying it out.[9]

In one sense, the JCS were critical of the NSC policy process. The formation of the many ad hoc groups formed to perform technical evaluations of military capabilities, jeopardized the security of war plans since under the various NSC ad hoc committee arrangements, representatives of various civilian agencies scrutinized operational details of war plans.

Fundamentally, another concern of the JCS bearing on the NSC strategic policy process involved the possibility that established defense priorities would be set aside by the NSC in favor of changed programs. With respect to air defense, the JCS attempted to discourage "corner cutting" in order to accelerate air defense programs at the expense of established programs for offensive systems. Deterrence appealed as a concept both to the NSC and the JCS, apparently to a greater degree than defense measures, particularly in the light of budgetary limitations; however, the JCS preferred to determine questions of balance between U.S. offensive and defensive forces through their own deliberations. The questions of balance between offensive and defensive forces remained vexing and even within the defensive category, there were highly substantive questions on what would be a proper "balance."

b. Long-Range Missile Development—Deployment—Mid-1950's

The Soviet Union and the U.S. each decided early in the period to pursue accelerated development and deployment of long-range offensive missile systems. These decisions were significant because of their direct consequences with respect to the choice of strategy and because of the added dimension they gave to the evolution of threat perspectives. (There are numerous consequences; this discussion attempts to focus on air/missile defense considerations.)

1) Factors Related to Soviet Decision

The promise of technology appears to have been a primary factor in this decision. The Soviets needed a deterrent to neutralize U.S. strategic air and missile bases in Europe, to hold Europe hostage against a U.S. threat of action, and to support strategic concepts for the operations of the combined arms against Europe. A strong Soviet security position was needed; a deterrent force contributed directly to the defense of the homeland. Technology offered the prospect of an impressive solution to the threat. Khrushchev would boast that the strategic attack aircraft was obsolete and he had decided not to produce a large bomber force. Rockets and missiles were "the thing"; the SA-2 and the FROG were other manifestations of a growing Soviet emphasis on these new means for wielding nuclear power.

Nuclear power had already proven useful for Soviet strategic purposes. The United States had shown interest in detente during 1955 and despite its commitment to "massive retaliation," events in Suez and Hungary the following year indicated that the pattern of power in world politics was changing. Events in the fall of 1956 showed that efforts to impose political change by force at the expense of another major power could induce great risk and would weigh heavily on future credibility. Soviet nuclear threats were blatant at the time; their diplomatic success now seems incredible.[10] A threat to initiate a nuclear war, especially from

[9] Ibid., p. 54.
[10] Arnold Horelick and Myron Rush, *Strategic Power and Soviet Foreign Policy*, University of Chicago Press. Chicago, 1965, pp. 31, 212, 216, 218; Adam Ulam, *The Rivals: America and Russia Since World War II*, Viking Press, New York, 1971, pp. 258–259.

the Soviet position of strategic inferiority, appears incredible because of the existing balance. Nonetheless, during the Suez crisis ". . . from their prime minister down to a lowly consul, the Soviets were cheerfully accounting that they were going to visit destruction of the United States ally where America still enjoyed a huge superiority over the U.S.S.R. both in nuclear weapons and in means of delivery. On any rational count the Soviet threats were ridiculous."[11]

Horelick and Rush see this particular period as a threshold because

> . . . the failure of the United States to intervene in Hungary was probably a key to the Soviet leaders as decisive confirmation that the West meant to employ its strategic preponderance defensively and would not make it the basis for a far reaching political or military offensive against the Soviet Union. At the same time, the Suez crisis demonstrated that the emergent Soviet nuclear capability, though still far inferior to that of the United States, could be fashioned into a potent instrument of Soviet foreign policy. The Soviet attempt to intimidate Britain and France by alluding to the possibility of a rocket attack against them proved to be the forerunner of a series of more direct efforts to exploit Soviet strategic power politically in the later years.[12]

2) Factors Affecting the U.S. Decision

Concern over the Soviet bomber program and the ICBM threat combined to make threat perception a principal factor relating to this U.S. decision. Technology also was of great significance, and related to this decision was an intense, bitter wrangle over roles and missions and bureaucratic politics. The Soviet ICBM test and later successful launch of Sputnik, however, acted as a catalyst which fused several separate factors and impelled the decision.

U.S. decision making also felt the pull of other influences. Disarmament proposals provided one of these.

Harold Stassen, named by President Eisenhower as his Special Assistant for Arms Control, had proposed in May 1955 that the United States try to reach an initial arms control agreement with the Soviet Union and other major nations because he judged that a leveling off in armaments by 1957 would stop the United States and Soviet Union short of achieving the nuclear capabilities which estimates indicated to be sufficient for mutual annihilation.[13] Stassen's proposal drew on the Killian report. Stassen's proposal also reflected developments in the UN Disarmament Commission meetings in London during February 1955 when the Soviet representative called for a freeze on armaments and armed forces and proposed the destruction of all nuclear systems.

A prime consideration in the growing Soviet-Western exchange on disarmament involved the effort to guarantee both sides against surprise attack by the other. Negotiations focused largely on the issue of surprise attack by strategic forces because, while the strategy of each side sought to deter nuclear attack, surprise attack against strategic forces was not likely to be deterred if those forces were significantly vulnerable. Special action was needed to secure the deterrent force.

Most Soviet proposals for disarmament/disengagement implicitly included a reduction of NATO's importance or strength. Differences of opinion developed within the NATO concerning action to be taken on such Soviet proposals. In general, the British favored limitations on forces and weapons; the Germans were strongly opposed. The U.S. tended to side with the British, while France was inclined to

[11] Ulam, op. cit., p. 258
[12] Horelick and Rush, op. cit., p. 311 (The authors cite Hans Spier, "Soviet Atomic Blackmail and the North Atlantic Alliance" (RM-1837, 10 Dec 1956) as providing a useful contemporary analysis of Soviet threats during the Suez crisis.)
[13] JCS Chronology as in OSD Chronology, Vol. I, op. cit., p. 209.

support the German view. The Soviet campaign helped to promote division in NATO. Anthony Eden, for instance, proposed a notably softer line with the Soviets at Geneva in July 1955. Stating that "we should be ready to examine the possibility of a demilitarized area between East and West," he went on in some detail: "There is suggestion of a mutual security pact. There is the prospect of agreement about the total of forces and armaments of the two groups both in Germany and in the countries neighboring Germany. This would be subject to reciprocal supervision. There is the concept of a demilitarized area."[14]

U.S. disarmament officials had been meeting in London in the summer of 1957 with the Soviets when the announcement of the Soviet ICBM test was made. The attitude of the Soviet representative, shown by a violent rejection of Western disarmament proposals in a presentation at the meeting of the Disarmament Subcommittee on 27 August, included a boast about the Soviet ICBM achievement. (In April, Ambassador Zorin, the Soviet representative in London, told Harold Stassen that U.S. overseas bases and the possibility that the U.S. would give nuclear weapons to states around the U.S.S.R. constituted a threat. At the time the U.S. was active in negotiating possible bases for Jupiter and Thor.)[15]

President Eisenhower reacted to the Soviet announcement the next day by issuing a special statement expressing his deep disappointment. He noted that the Soviet attack on the Western disarmament position had included their ICBM boast and called on the Soviet Union to reconsider its disarmament view.[16] The disarmament session adjourned almost immediately after the Soviet ICBM test; following the session in London, Walter Lippman referred to Soviet actions there as a "diplomatic coup" and added: "They have identified themselves first with the idea of abolishing nuclear weapons, and then with the idea that they are superior in nuclear weapons. There are a lot of people in the world who like to be on the side of a winner."[17]

By the end of September, the state of U.S. missiles had become a larger issue. The U.S. Atlas, which had exploded on its first test in June, blew up in a second attempt at a 650-mile launch in late September. Senator Symington, in mid-September, charged the Eisenhower Administration with "misleading" the American people with half-truths about the danger of Russia's development of an ICBM. But American attention then centered on Little Rock, Arkansas, where the civil rights issue had come into sharp focus. On 2 October 1957, however, Secretary Wilson formally submitted his resignation and, at a press conference at the Pentagon that day the facts of budget ceilings showed up in two announcements he made: the Air Force would temporarily limit its progress payments to major aircraft manufacturers in an effort to keep expenditures down and the JCS felt economy cuts had brought our combat capabilities down to a dangerous minimum.

In the aftermath of the Soviet ICBM launch and Sputnik, U.S. threat perceptions of Soviet capabilities dominated the pattern of response. An increased appreciation for the impact and future potentials of technology was obvious and became another factor to reinforce the long-term U.S. commitment to strategic nuclear forces for deterrence.

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[14] Eugene Hinterhoff, *Disengagement*, Stevens and Sons, London 1959 (Appendix 3, pp. 389–390).
[15] JCS Chronology, as in OSD Chronology, op. cit., p. 272.
[16] Ibid., p. 285.
[17] *Washington Post*, 29 August 1957, p. A. 19.

2. Corollaries and Consequences

a. Post-Mortem to Sputnik

The U.S. post-mortem following the Soviet ICBM test and Sputnik launch quickly identified the scapegoat for the shock and the fear that was in the back of everyone's mind. Walter Lippman wrote: "The fact that we have lost the race to launch the satellite means that we are losing the race to produce ballistic missiles. . . ."[18] The day after Sputnik II was launched, Senator Lyndon Johnson said that the U.S. missile program had "been the subject of constant bickering among the three services. It has meant inter-agency battles fought with all the fierce intensity. . . of war itself. . . . The independence that was accorded the three branches was not included to be an invitation to waste motion."[19] As the search expanded for the cause of the Sputnik technological setback to the United States, inter-service rivalry was made to explain the technological failure.

b. Reorganization Act of 1958

Concurrently, the President forwarded recommendations to Congress that resulted in the Defense Reorganization Act of 1958 which greatly increased and centralized authority over the Services in the Secretary of Defense and his office. The chain of command was changed; executive agency responsibilities essentially done away with; staff support for the JCS doubled and reorganized; and authority over the research and development of new weapons and weapon systems centralized under a new Director of Defense Research and Engineering. The increasingly centralized control by the Secretary of Defense obviously diminished the role of the Services.

c. Close Congressional Security

Not quite so obvious, but of great consequence, the Congress began to take a hard, close look at costly plans and programs which involved competing or duplicating demands for Congressional support. Congress recognized the Soviet threat for what it was and had taken steps to provide what had been recommended and needed for U.S. national security. Reflecting the national mood, Congress suffered a loss of confidence as a result of the Soviet technological achievements of 1957. It appeared that, despite sustained Congressional support to meet U.S. defense needs, something was wrong. While the basic issue might concern overall costs, at the heart of the Congressional concern was the soul searching question of the longer term implications of U.S. security: What did the nation really need for its defense? The new missile systems to be part of the required U.S. strategic offensive force involved the Congress. The growing capacity of defensive missile systems and their operational deployment by the Soviets made aircraft attrition a factor that would bear on their deliberations about the size and composition of other U.S. strategic offensive forces. Soviet defensive missile capabilities stimulated consideration of the variety of penetration aids, improved electronic countermeasures, defense suppression measures and projected future requirements for manned strategic bombers. Following the demonstration of a Soviet ICBM, therefore, the Congress took a harder look at requests for fiscal support for air defense systems development and deployment and the several related actions which were said to be required because of the growing Soviet missile threat, offensive and defensive.

[18] Ibid., 10 October 1957, p. A. 15.
[19] *Aviation Week*, 4 November 1957, p. 33.

d. Other Congressional Concern

The basic issue involved costs. Congress was equally concerned, however, with the implications of the developing threat for U.S. long-term security. Conditioned by the informed testimony of the Executive Branch, the Congressional leadership had a good appreciation for the Soviet bomber threat which recent intelligence estimates gave impressive capabilities. While the Soviet bomber threat was somewhat eclipsed after Sputnik by concern for their missile threat, Congress remained conscious of Soviet bomber capabilities. Deliberations about measures to support Defense Department programs for air defense found, among a number of influential Congressional leaders, an established predisposition for backing them. Opposition to sustained support for active defense, however, showed along several lines.

e. Opposition to Air Defense

One, even among air defense supporters, concerned what appeared to Congress to be the Defense Department's credit card approach to the problem. The costs of separate and apparently duplicating air defense measures and programs in the late 1950's bothered Congress, among other reasons, because of interest in overall air defense costs. This came into sharper focus when opponents of continued expenditures for air defense argued these funds were better committed to support new strategic offense requirements. They argued that there was no defense against missiles and, in the light of new Soviet threat capabilities, believed air defense was an anachronism. They felt that air defense could not prevent Soviet bombers much less missiles, from achieving great destruction. Accordingly, they favored U.S. defense through a strategic offensive strategy. Another element of Congressional opposition developed and grew as part of the larger and continuing Congressional concern for security issues. This opposition focused on the specific question of "stability," looking to the possibility of the United States achieving some agreement with the Soviets to advance a diplomatic detente. This opposition took on added dimensions as the continuing advance of weapons technology intruded on the concept of stability either as a way toward disarmament or to prevent a war. As it developed, this Congressional opposition shared in the ABM debate and closely monitored activity bearing on mutual deterrence.

f. Hope for "Stability"

Stability as an issue, however, regularly found challenges in the variety of technological change and operational deployments taking place before SALT. As these progressed, improvements in warhead yield and accuracy and the advent of the new type warheads again raised questions of the vulnerability of the deterrent force. With the safety of those retaliatory elements as well as the bomber element threatened by further advances in weaponry, increased pressure arose for consideration of active missile defenses, a concept that now appeared practicable.

In the U.S. deliberation about ballistic missile defense, budget considerations and longstanding opposition to the ABM worked against a U.S. operational commitment. The Soviets however, continued to stress active and passive defense measures, and moved to deploy an ABM defense system which implied a concern for the imagined threat of a U.S. first strike. While the United States had developed "immense" strategic offensive forces, the substantial elimination of the Soviet retaliatory force was beyond their capabilities. Therefore, the Soviet ABM deployment did not directly affect U.S. action to develop strategic forces, but it did help to give rise to the later announcement of U.S. action to provide a "thin" ABM deployment, coupled

with the assertion there was a "mad momentum" to the "arms race" in nuclear weapons. Subsequently, the "mutual vulnerability" of U.S. and Soviet strategic forces became caught up in the Soviet attainment of admitted nuclear equality with the United States at the Moscow Summit in 1972 which dramatically altered the status of the Soviet Union in the world.

3. Implications for U.S. Air/Missile Defense

As the 1950 decade closed, U.S. planners still had the urgent task of providing answers to the basic question, "How to defend the country?" Planners also sought information concerning a related basic question: "How will the United States be attacked?" They knew that a missile gap existed; a general election campaign made that a slogan; however, it was difficult to get information on the missile threat or details of how it might be applied. Available air defense units and forces could counter the air breathing threat but no capability existed for defense against missiles.

U.S. threat perceptions recognized the relative importance of the bomber threat to be decreasing. The size of that threat, however, plus the advent of Soviet air-to-surface missiles and the prospect of a new Soviet bomber justified continuation of an active air defense system. How long the air defense system might be required or how much resource support it should receive was indefinite and contentious. Critical congressional inquiry could be expected and within the Defense Department the relative priority given to air defense was falling. If the NORAD system faced reductions, would the concepts of "area defense" and "defense in-depth" remain valid?

Potentially more contentious was the question of emphasis to be given to antiballistic missile programs. Should an active system be planned? When would it be required to have an active antimissile defense for the United States? How would it be funded? What about submarine launched attack? Who would support an accelerated, intensified program? Antimissile defense might be feasible, but wouldn't the growth of the Soviet ICBM force permit a massive attack against the U.S. to overwhelm the antimissile defenses? Was it really feasible seriously to contemplate that the United States could be defended by AICBM systems? (Section III, Chapter IV and Chapter II reflect the problems inherent in such questions.)

As the Soviets demonstrated in the 1960's growing capabilities in ICBMs, and later, hardened ICBMs and submarine launched missiles, deterrence could be seen to be dependent on the restraint of the adversary.

Crisis situations in Berlin and Cuba brought new focus to the status of deterrence. The mutual opposition of the "superpowers" had generated security measures for deterrence whereby the threat of nuclear weapons had become "indispensable" but their use was "unthinkable."

E. Conclusion

U.S. and Soviet concern over a perceived vulnerability to a surprise nuclear attack led both nations to develop powerful deterrent forces and supporting postures. Technology was the predominant factor affecting the character of the strategic choices which were decided upon during this extended period to realize the established strategic goal: deterrence.

The United States and the Soviet Union shared the basic choice that was made. Both looked to an integrated national air defense system as one element of deterrence. The weighted emphasis of the U.S. choice went to the strategic offensive element of the deterrent; the Soviet deterrent inclined to a more balanced posture between offensive and defensive components.

As the deterrent force of the two nations evolved, threat perceptions influenced their character. Based upon a perspective of the mid-1950's, the United States decided that the deterrent strategy required the high-priority development of long-range missiles. The equivalent level of priority did not attend programs for strategic air and missile defense although the threat projected distinctive needs for active defense.

A reversed set of priorities guided the Soviet effort; response to the threat of U.S. strategic offensive power emphasized the need for an active defense throughout this period while building up strategic forces.

The basic patterns of action were set by initial, and early, strategic choices. Thereafter, the problem centered on technological development. Threat perceptions increasingly involved intelligence judgments of possible application by the Soviets of new technologies. These judgments represented efforts to define or delimit future threats. Perceptions of future threats were influenced by various views of available technologies, whether or not the Soviets had demonstrated the capacity to apply them. Available or known technologies were extrapolated to assess future threats. It is difficult from this research to conclude whether "worst case" assessments, built on mirror-imaging, influenced U.S. strategic choices.

Interaction was inherent in the premises; however, a direct action-reaction cycle was not a factor in the development of U.S. and Soviet strategic air and missile defense systems, although tactical and operational considerations necessarily influenced development and deployment.

Chapter II

Blue Air Defense Strategy, 1955–1972

A. Administrative Note

In large part, this chapter consists of public statements by U.S. Presidents and Secretaries of Defense, classified and unclassified offensive and defensive weapons inventories, and budgetary allocations by program categories and military services. It is postulated that these materials by themselves serve to tell a major part of the story of critical decisions about U.S. air defense strategy in the 1955–1972 period. This supposition is consonant with the notion expressed in the following quotation: "Administrations are fully committed only when they are publicly and explicitly committed."[1]

Since primary source material was readily available on these public and explicit commitments, a basic decision in the research strategy was made to pursue the story of strategy through them (and classified statements when available) rather than relying mainly on secondary, judgmental sources. Also regarding the use of secondary sources, it was anticipated that Professors May (see paragraphs 6 and 7 of his critique of BDM Vol. 1) and Steinbrunner would be more able to provide the requisite judgments about the course of strategy for the overall project if they were provided with a firm evidential base rather than with secondary assessments. Further, the use of primary sources allowed the major historical actors to speak for themselves about threat perceptions, policy plans, and other variables which impinged on the continental defense effort. The lack of access up to the present to many intelligence documents which may provide a flavor for the interaction of bureaucratic groups on air defense strategy truncates the story which is told here, but since this working paper is under continual revision new elements of the story will be added as they are accessed.

B. Introduction and Abstract

Driving American air defense decisions in the 1955–1972 period was the desire to detect, identify, and destroy threats to the continental United States as far away as possible. The fulfillment of this desire became more and more complex as time passed during these years, for as the Soviet threat changed in character from solely manned bombers to ICBMs with manned bombers in a supporting role, the U.S. defense problem itself changed.

The beginning of this historical period found U.S. strategy based on the primacy of our manned bomber offensive force as the major deterrent to Soviet manned bomber attack, with a secondary but nevertheless major role for a defensive system to destroy Soviet bombers if such an attack were launched. By evolution, this strategy came increasingly to rely on our ICBM force for prime deterrence of the Soviet ICBM threat,

[1] Samuel P. Huntington, *The Common Defense: Strategic Programs in National Politics*. Columbia University Press, New York, 1961. p. 339.

with defensive efforts concentrated on early warning of ICBM attack and drastically reduced emphasis on defense against a manned bomber attack.

Several factors directly influenced the manner in which this changed emphasis came about. These factors include (1) the perceived and actual threat to CONUS, the anticipated application of that threat, and the changing nature of that threat; (2) the importance of air defense strategy to overall national security policy goals (including strategic offensive and general purpose force commitments); (3) the impact of technology on the capabilities for air defense; and (4) the policy goal of detente with the Soviet Union.

The relative degree of importance of these factors on major air defense decisions is addressed in the summary portion of this chapter. Conspicuous by absence from the above list are two other factors which might have been expected to be crucial to air defense strategy—namely, budgetary constraints and interservice competition. It is the judgment of this research effort that while these two factors may have been influential in decisions about air defense systems (see Chapter IV) they had much less impact on the *overall* strategy than did the four factors above. For example, even under the fiscal austerity of Eisenhower's balanced budget concept, air defense flourished and in fact systems inventories grew to all-time highs. While it can be argued (as it is in some of the Congressional testimony in this chapter) that air breathing threat defense systems declined in the late 1950's and early 1960's because of monetary constraints, this reality was stimulated by an even larger context and a more important appreciation for a newly perceived Soviet ICBM threat and our inability to destroy that incoming threat. Regarding interservice pursuit of roles, missions, and new systems in fresh areas of the air defense effort, it is judged that such service actions did not significantly impinge upon strategic thought and assessments. Some of the Congressional testimony in this chapter reflects the strategic thinking of various presidents and secretaries of defense, and points clearly to two judgments: (1) service "competition" was probably based on serious and very real debate about alternative "best" ways of doing the *same* job, so that it was "competition" only in one sense—the desired end was the same; and (2) strategy about the ebb and flow of air defense, made at the highest decision-making levels, was likely not based on *relatively* insignificant choices between competing weapons systems.

Instead, the more fundamental strategic question which governed the situation was this: "Can the job of an adequate defense be done?" The answer to this question when asked regarding defense against the manned bomber was a definite "yes." The answer to this question by various Secretaries of Defense about ballistic missile defense was a highly qualified "maybe," an answer which meant that ballistic missile defense was never a truly serious element of air defense strategy. It is in the answers to these two questions and in the salience of the four factors already listed that the story of air defense in the 1955–1972 period lies. These questions and factors will be related to five major decisions affecting air defense strategy during this period. These decisions are:

(1) Decision to build up the air defense system January 1955 (result of earlier decisions)[2]
    Reason: The Soviet manned bomber threat (primarily)
    Results:
        – CONAD SAM battery peak—244 In FY 1959
        – USAF interceptor squadron peak—96 in FY 1957

(2) Decision to deploy 1st generation ICBM/IRBM CY 1958

[2] It should be noted that these five decisions are not of equal importance to the course of air defense strategy. The degree of importance attached to each is discussed in the chapter summary.

Reason: The predicted Soviet ICBM threat (primarily)
Concurrently,
- – Air breathing threat would therefore be less important in the future
- – A strong R&D impetus was provided on advanced programs
- – Major defense reorganization took place to move programs ahead

(3) Decision to refine existing air breathing defense systems (not to develop new systems) circa 1959–1963
Examples:
- – No super combat centers
- – SAGE refined to BUIC 1/11/111
- – Ajax to Hercules and no further—SAM-D a development project
- – 101/102/106 interceptors refined with avionics—no follow-on IOC
- – Continual deployment cutbacks 1961–1972

(4) Decision not to deploy a BMD system 1958–1967
Ramifications:
- – Offensive forces carried the defensive burden against Soviet ICBMs
- – Continental air defense against the existing ICBM threat was null and void

(5) Decision for detente (begun under Eisenhower-culminated in SALT)
Ramifications:
- – Leveling off of offensive forces began CY 1966
- – Continued reduction in existing air breathing defense—AWACS/F-106X/OTH told how much was "enough"—just a little.

This presentation on U.S. continental air defense strategy 1955–1972 is subdivided into four fairly distinctive periods of time. The notion of "fairly" distinctive periods is emphasized because the division of years in the manner below in no way indicates a belief that a single date can be selected on which a new strategic thrust began to hold sway over decision-makers; the data on which this chapter is based are simply not precise enough to make such an assertion, even if possible.

Nonetheless, some distinctive trends in the period are evident. The first subdivision is January 1955 to the launching of Sputnik I on October 4, 1957. While an air defense system existed before 1955, as did the major impetus for it, that year is crucial because never again in the military posture briefings and associated testimony during the 1955–1972 period were the President and the Secretary of Defense more adamant about the need for a better air breathing threat defense system than they were in early 1955. The realization of this desire was reflected in the inventories of major air defense systems peaking at all time highs for the overall 1955–1972 period in the FY 1957–1959 years. The more general build up of all air defense forces was also reflected at about this time, specifically in the FY 1956–1958 period. The ending date of this period is less definite, for upon examination it will be noted that CONAD air defense SAM batteries, for example, did not crest until FY 1959, after the Sputniks. However, the remarkable difference in military posture statements before and after Sputnik I reflects the importance of that event as one which marks a convenient dividing line, with a more-or-less concurrent major switch in strategic emphasis.

The second period begins with Sputnik and ends with the entrance of Robert McNamara as Secretary of Defense in 1961. The dramatic emphasis on U.S. missile programs after Sputnik was coupled with a slow redefinition of the Soviet threat in these years—by the time of posture briefings in early 1960, the "missile gap" issue had sprung up as the critical strategy problem of the day, although this was no doubt partially caused by the presidential election of that year. Also during these years, a gradual reevaluation of the need for an air breathing threat defense system took place as perceptions of the Soviet threat changed to emphasize the predominant role of the ICBM as the major offensive weapon. The lack of an adequate active defense against the ICBM, coupled

with this newly perceived threat, lead to serious questions throughout these years about the need for the expensive antibomber defense system which had been created. Air defense system weapons inventories began to show declines in these years at the same time that great emphasis was placed on rapidly deploying the first generation U.S. IRBMs and ICBMs. While the selection of Sputnik is somewhat arbitrary, since the U.S. missile program was active well before that time, the selection of 1961 as the ending data for this period is less arbitrary than it is a reflection of a new way of looking at defense problems instilled by a new Secretary of Defense.

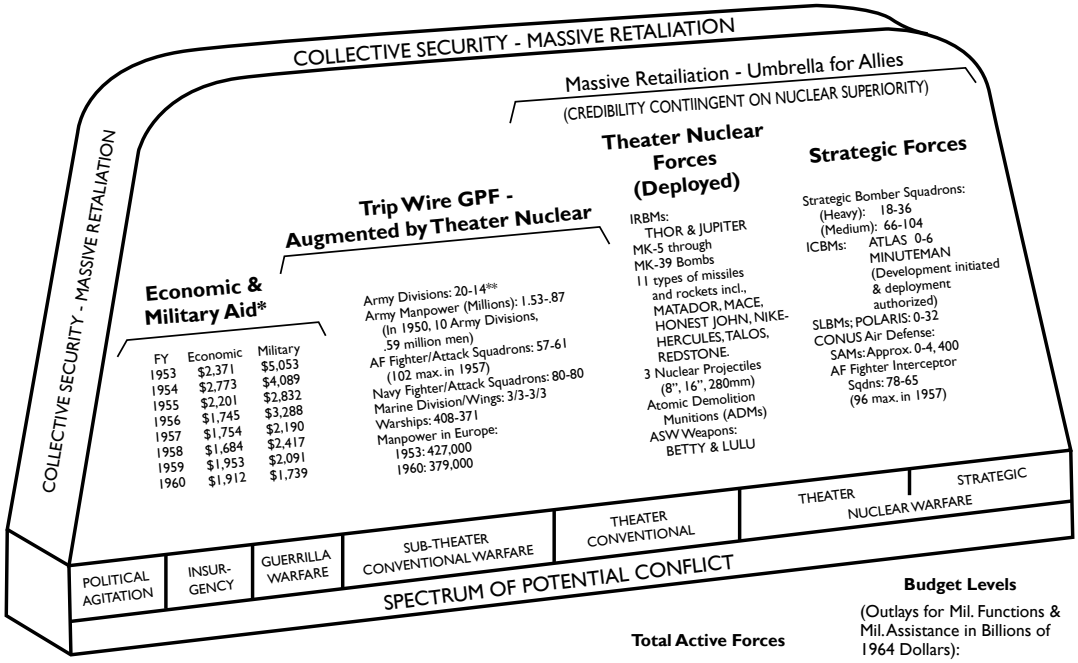
The third period begins with McNamara as Secretary of Defense and ends with Clark Clifford taking that position. The new amount of light shed by McNamara about the defense posture and some dramatic and early decisions about the changing nature of defense during his tenure mark this as the beginning of the third time period. While the decreasing need for a bomber defense was made fairly clear by Secretary of Defense Gates in 1960, Robert McNamara was even more adamant about the changing need in April 1961 with his first major address. The general downward trend in air defense weapons systems inventories which began during the second period continued through the McNamara years at the same time that the U.S. ICBM inventory began to show the fruits of the post-Sputnik initiatives in missile development. The concepts engraved on granite for the McNamara years which affected air defense were: the increasing Soviet ICBM threat, the lack of an active ICBM defense, the need for a second-strike capability, hardening, dispersal, and adequate warning. Interceptors came to be viewed as inherently soft; the need for them and for Ajax and then Hercules SAMs declined as the Soviet bomber force leveled off and the Soviet ICBM force built up. The soft ground control environment was hardened progressively by refinement, not by major revision. Warning time was increased, second generation ICBMs entered the inventory, and SLBMs became a (if not the) most significant component of offensive weaponry. By the calendar year 1966, McNamara had consistently put off deployment of the Nike Zeus/X ABM system (see Chapter IV, Section III), and offensive force levels began to stabilize at prescribed ceilings. Continental air defense became a very small wave in the very big ocean of strategic interaction by this time, with the exception of the decision to deploy an ABM system in September 1967 (which appears to have been primarily a bargaining chip to be used for detente rather than a strictly militarily defensive move). As Vietnam took over the predominance of Congressional attention on defense, this period comes to a close with a McNamara-inspired plan for air defense which was to serve as the mainstay of the fourth period.

The fourth period covers McNamara's departure from the DOD scene to the end of 1972. The beginning of this period is an approximation, for the heritage of military posture on air defense which Robert McNamara left Clark Clifford carried on specifically through at least FY 1970 and then generally throughout the end of the period. Air defense had waxed strongly under Eisenhower and had waned ever since, with continual decline during these last years reflected in weapons inventories. The proposal which McNamara advanced for FY 1969 included several elements of a neatly tied package designed for the first time since at least 1961 to substantially replace the existing air defense system. McNamara's proposal called for a new air defense interceptor, a system to fully replace SAGE/BUIC, and new OTH B radars, The proposal was later modified to include a SAM-D to replace the existing Hawk-Hercules force. This "new" package carries the air defense story through the end of the period, for it describes the story well—a realization late in these years that what existed needed replacement if air defense was to be a serious undertaking with the almost immediate reply that it could not be a serious undertaking with the existing policy on ABM deployment, punctuated by the ABM treaty of May 1972.

Figure 1 is a graphic portrayal and Figure 2 is an abstract of the Eisenhower strategy 1953–1960. These figures help to set the stage for the discussion of U.S. air defense strategy in the 1955–1960 period. While the period of

time portrayed on these figures does not overlap perfectly with the time construct employed in this chapter, these summary displays are still useful in suggesting the major offensive and defensive force highlights of these years.

Figure 1—Eisenhower Strategy, 1953–1960



* Deliveries, excluding Military Assistance, Service funded (Converted to constant dollars using same index as that for total DoD Budget).
** Includes three training divisions that did not have a combat assignment.

Figure 2—Abstract of the Eisenhower Strategy, 1953–1960

Eisenhower Administration

Strategy Concepts: Strategic superiority; limited general purpose forces deployed well forward with a potential tripwire function for possible nuclear response; strong regional and bilateral alliances with a dominant U.S. air, sea, and ground role; allied ability to handle low intensity conflicts; and substantial economic and military aid. Eisenhower strategy and forces were deterrence-oriented with emphasis on nuclear umbrella.

Forces: Emphasis on development of new systems. Many nuclear systems deployed today were initially developed including IRBMs and Atlas, Titan, Polaris, and Minuteman ICBM/SLBM systems. Work on ABN was also initiated. A notable decline in General Purpose Forces was evident from Korean War levels. Military manpower dropped by more than one million men. The number of Army divisions and Navy warships declined. Tactical air squadrons increased.

Budgets: In constant FY 1964 dollars, the budget came down sharply from the Korean peak in the first two years and remained relatively stable thereafter. The post-Korean mean average was about $46 billion.

Foreign and Military Assistance: The trend was down from post–World War II peaks but a rough balance was struck between military and economic assistance and the dollar levels remained relatively high.

Manpower: Emphasis was placed on Reserve call-ups for augmentation requirements.

C. Prelude to 1955

While many of the major decisions and significant events affecting continental air defense strategy in the middle 1950's have already been detailed in Volume I of this study, it is useful to reflect on the course of some of the events just before 1955 to set the stage for the military posture which would characterize U.S. efforts at that time.

Samuel P. Huntington has suggested that *the* critical decision in the innovation of continental defense was made by the Eisenhower Administration in the fall of 1953, when it approved a series of recommendations made by the Lincoln Laboratory Summer Study Group in 1952.[3] The Summer Study Group had, as Indicated in Volume I, called for a major U.S. defense system based on a projected Soviet bomber threat to the continental United States. The Soviet explosion of a hydrogen bomb in August 1953 served to trigger this renewed consideration of the Summer Study Group report. Additionally, a series of recommendations and considerations during this period by independent consultants and the JCS fed into approval of NSC 162 on 6 October, which called for the expenditure of $20 billion over 5 years for continental defenses.

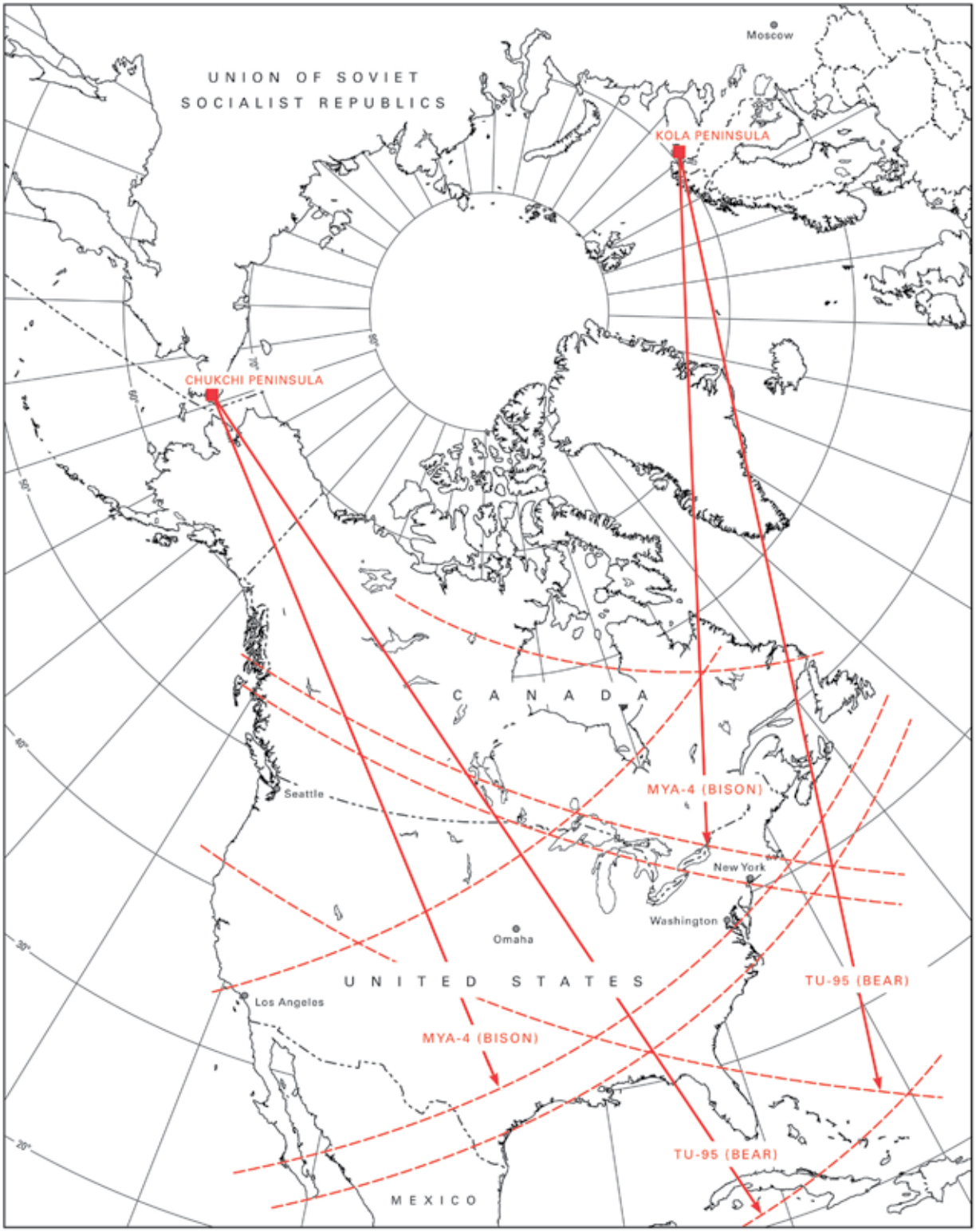
But the tremendous size of the commitment suggested by NSC 162 was not to come about—the actual difference between the FY 1954 and FY 1955 budgets for continental defense was only about $1 billion, although still a sizable amount. Continued budgetary and strategic reservations tended to detract from the defense effort. Nevertheless, increased emphasis on continental defense made NSC 162 a major turning point in policy. The "New Look" paper submitted by the JCS in December 1953 stressed the importance of the continental defense effort, and in conjunction with it, calendar year 1954 saw the continued deployment of many major air defense hardware and command and control systems.

At the same time that these events were occurring, the Soviet threat was undergoing a dramatic change in intensity as new offensive weapons phased into their inventory. During these years and through most of 1954, the Soviet Union was equipped with the TU-4 aircraft as the primary element of its strategic offensive forces. Capable at best of one-way missions against the United States, the TU-4 was thus a more major threat for the much closer Western European nations than it was for the United States. Nonetheless, the United States would be threatened by the TU-4 in a WWIII scenario where one way missions would likely be all that were necessary when coupled with deliverable atomic weapons. That TU-4 threat was reinforced in late 1954, when the Soviet Union first publicly displayed the "Bear" long-range turboprop bomber, judged as the first of a series of Soviet aircraft capable of striking U.S. targets and then returning to recovery bases. The Bear was closely followed by the display of jet-engined Bison in May 1955, an intercontinental bomber that appeared to be in a class with the U.S. B-52. The U.S. air defense systems response to this threat is discussed in Chapter IV, Section II. These significant new weapons provided grist for the mill of strategic debate—the so-called deterrent and bomber gaps developed as hotly debated questions by the time of the highly publicized Symington Air Power Hearings in the Senate in April 1956. The capabilities of these new Soviet aircraft in an attack on the continental U.S. are shown in Figure 3.

This carries the story somewhat beyond the first events during 1955, however. President Eisenhower, faced with self-established budgetary policy strictures and the burgeoning need for a continental defense system in light of the Soviet Bear threat, had major policy decisions to make in early 1955.

[3] Ibid., p. 328.

Figure 3—Soviet Bomber Capabilities



Russian long-range bombers could reach any targets in the U.S. and return to bases in the U.S.S.R. if they were launched from the Kola or Chukehi peninsulas. The polar routes illustrated are the shortest. Solid lines show maximum ranges for bombers flying round-trip missions without refueling; broken lines show the radii for round-trip flights in which the planes are refueled once.

D. Blue Strategy 1955–1972

1. 1955–October 4, 1957: Emphasis on the Air-Breathing Threat Defense System (The decision to build up the air defense system)

The post–Korean War years were to allow the United States time to reappraise its strategic doctrines with the ending of a major conventional-conflict. The Eisenhower Administration took office in 1953; and by 1955 had consolidated a distinctive approach to foreign affairs and defense matters. By 1955, most of the so-called "free world" regional alliances had been formed; the New Look defense policy had become part of the lexicon of national security; and "massive retaliation" was the enunciated method for dealing with Soviet incursions worldwide. The New Look policy had ramifications for the status of continental air defense, and so deserves some scrutiny.

It should be noted, however, that in these early years of the period being covered it is more difficult to show a ready link of over-arching policies to continental air defense than in later years; in particular, Robert McNamara's posture statement breakdown of offensive and defensive forces during the 1962–1965 fiscal year period sheds a much greater deal of light upon such considerations. This type of problem during the earlier years encourages the emergence of a disjointed picture.

The New Look was generally characterized by an emphasis on the role of strategic airpower as the predominant military tool of U.S. policy; conventional forces were de-emphasized at the expense of Army manpower. These general guidelines were to be conducted within the parameters of reduced defense spending and an attempt to balance the federal budget. A variety of statistics tend to bear out this pattern, although in an imprecise way. Regarding the budget, the post–Korean War years show a downward trend in defense expenditures in the post-war force reduction period, as indicated in Table 1. These actual appropriation figures include inflation but an adjusted expenditure level shows the same general pattern, as illustrated in Table 2.

Table 1—Defense Appropriations, Fiscal Years 1952–1958

FY 1952	$56,939,568
FY 1953	46,610,938
FY 1954	34,371,541
FY 1955	28,800,125
FY 1956	31,882,815
FY 1957	34,656,727
FY 1958	33,759,850

Note: These amounts do not include any supplemental estimates or appropriations not considered or made in the regular annual Defense Appropriations Acts. This is a particularly important caveat for FY 1958 in post-Sputnik quarters.

Source: *Congressional Quarterly*, October 28, 1972, p. 2840.

A summary of the Defense budgets by program during these years would be instructive in showing the allocations between strategic forces and general purpose forces, but such figures for the FY 1952–1955 years are not comparable by category compared to later years.[4] More interesting (and available) are alloca-

[4] Don R. Brazier, Acting Assistant Secretary of Defense (Comptroller), Statement before the Defense Subcommittee of the House Committee on Appropriations in connection with the FY 1974 budget estimates of the Department of Defense, May 31, 1973, Table 18.

tions by military service, which show the increasing slice of the budgetary pie which the Air Force received during these years, shown in Table 3. Available information for Army and Air Force force levels in selected areas also generally tend to bear out the supposed direction of the New Look, as shown in Table 4.

Table 2—Budget Levels
(military functions and military assistance in billions of 1964 dollars)

FY 1953	$60.7
FY 1954	56.3
FY 1955	46.6
FY 1956	44.7
FY 1957	45.5
FY 1958	45.8

Source: "Statement of Secretary of Defense Melvin R. Laird Before House Armed Services Committee on the FY 1972–1976 Defense Program and the 1972 Defense Budget." March 9, 1971, GPO, p. 155.

Table 3—Defense Budget Summary by Branch of Service
(in millions of current [1975] dollars)

FY	Army	Air Force	Navy/Marines
1953	$16,242	$15,085	$11,875
1956	8,702	16,749	9,744
1957	9,063	18,363	10,398
1958	9,051	18,435	10,906
FY	9,468	19,084	11,728

Source: U.S. Congress, House, United States Defense Policies in 1965. House Document No. 344. 89th Congress, 2nd Session. Washington, U.S. GPO, 1966, p. 192.

Table 4—Selected Army and Air Force Forces

FY	1950	1951	1952	1953	1954	1955	1956	1957	1958
Regular Army Divisions	—	—	—	20	19	20	19	18	15
Reserve/National Guard Divisions	—	—	—	51	51	45	37	37	37
FY	**1950**	**1951**	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**
Strategic Air Force Wings/ Squadrons									
Heavy Bomber	3/	3/	4/	6/	6/	7/	11/	11/	11/33
Medium Bomber	12/	18/	22/	22/	24/	23/	28/	28/	28/84

Source: Defense Management Summary CY 1973 Directorate for Information Operations, Office of the Secretary of Defense, Washington, D.C. Army forces from Table 125, Unclassified; Air Force Forces from Table 135, Secret RD, Except for FY 1950–FY 1974 Forces.

Thus, the general pattern of the New Look policy as characterized earlier seems to have made its way intact to the actual deployment of, and expenditures on, forces during these years. For a discussion of the factors affecting the New Look, see Chapter IV. The opposite side of the strategic offensive coin was clearly defense against the Soviet offensive threat. The impetus for defense against this threat was stated both clearly and strongly in a letter from President Eisenhower to Secretary of Defense Wilson at the very beginning of 1955:

> The White House, Washington, January 5, 1955
>
> The Honorable Charles E. Wilson
>
> The Secretary of Defense, Washington, D.C.
>
> (excerpted by author)
>
> ". . . due to the destructiveness of modern weapons and the increasing efficiency of long-range bombing aircraft, the United States has reason, for the first time in Its history, to be deeply concerned over the serious effects which a sudden attack could conceivably inflict upon our country.
>
> Our first objective must therefore be to maintain the capability to deter an enemy from attack and to blunt that attack if it comes—by a combination of effective retaliatory power and a continental defense system of steadily increasing effectiveness. These two tasks logically demand priority in all planning."[5]

With this statement, President Eisenhower established a link which was both to remain and to become more and more clear as time passed between strategic offensive and defensive efforts. The "why" for Eisenhower's desire for a continental defense system of increasing effectiveness was clearly tied to the perceived threat posed by strategic bombers. Secretary Wilson's response to Eisenhower's tasking on continental defense was made clear in his Briefing on National Defense to the House Committee on Armed Services, presented in January 1955. The presentation is interesting because of the degree of detail offered about the continental defense system, and the explicitly stated urgency of the program. Wilson began his presentation with a reiteration of Eisenhower's message to him: "Therefore, our primary objective must be to maintain the capability, first to deter an enemy from such an attack; and second, to blunt any such attack if it comes. Both purposes require a combination of effective retaliatory power and a continental defense system of steadily increasing effectiveness. These two tasks logically demand high priority in our security planning."[6]

"The continental defense program is being pushed with all practical speed," said Wilson; he then detailed the existing elements of the system: (1) warning net—land, sea, and air—both electronic and a Ground Observer Corps of 13,000 posts; (2) weapons systems—manned interceptor aircraft, AAA, SAMs; and (3) command and control system, the link between the first two elements.[7]

He went on to say that "while continental defense is the primary responsibility of the Air Force, the continental defense system is a joint undertaking of all the services. . . ."[8]

He specified the assignment of responsibilities in air defense in this fashion:

(1) USAF and ANG: land warning net, Texas towers, interceptors, and early warning aircraft.
(2) Army and National Guard: AAA and Nike
(3) Navy: picket ships, early warning aircraft, harbor defense, and submarine surveillance.

[5] Hearings before House Armed Services Committee, 1955, p. 198.
[6] Ibid., p. 203.
[7] Ibid., pp. 204–205.
[8] Ibid., p. 205.

For a more detailed discussion of these elements, see Chapter IV, Section II. The aircraft control and warning net was being implemented at that time, and was to consist of several key elements: (1) a CONUS permanent radar net with augmentation; (2) the Pinetree radar line, now "virtually complete"; (3) ". . . an early warning line across middle Canada"; (4) "the distant early warning line. . . ."[9]

On the future air defense effort, Wilson was both specific and bold:

> A comprehensive and vigorous research and development effort is directed toward the future air defense system which will encompass radars of increased range- and height-finding capability; high performance, long-range, medium-range, and short-range, piloted and pilotless Interceptors; more versatile surface-to-air guided missiles; improved devices for submarine detection; and nuclear weapons applications to continental defense.
>
> While our air defense system is already formidable, we must devote our efforts to a steadily improving air defense system phased to cope with growing Soviet capabilities and make maximum feasible use of new weapons and techniques as they are developed.[10]

Secretary Wilson's clear intentions on improving the existing air defense system were to be reflected in a dramatic rise in the numerical amount of deployed hardware to support that system. Selected major equipment items portray this increasing air defense effort, as shown in Table 5.

Table 5—Selected Air Defense Systems, FY 1954–1958

	1954	1955	1956	1957	1958
Army Forces					
Nike Ajax batteries/launchers	5/	26/	151/	240/	241/
Nike Hercules batteries/launchers, CONAD	—	—	—	—	1/
Hawk batteries/launchers, CONAD	—	—	—	—	—
Total SAM Batteries/Launchers, CONAD	5/	26/	151/	240/	241/
RA Air defense battalions	117	122	133	119	86
Reserve/NG Air defense Bns	128	127	137	142	136
Air Force Forces					
Wings/Squadrons					
Air Defense Forces Interceptors	28/84	29/80	32/96	32/96	28/83
ANG Forces					
Wings/Squadrons					
Interceptors (all weather)	6/21	6/21	8/23	9/29	10/43
Interceptors (day)	—	—	15/50	16/48	10/26

Sources: For Army Forces: Table 125, Defense Management Summary, op. cit.; For Air Force Forces: Table 135, Defense Management Summary, op. cit.

In addition to the dramatic rise in these deployed forces through at least the end of FY 1957, the transfer of responsibility for some of the air defense effort to reserve/national guard forces was beginning to take place. It should also be noted that there was a "leveling off" in the force levels for all portrayed systems by the end of fiscal year 1958. This is of particular interest in conjunction with Secretary Wilson's Military Posture Briefing for FY 1958, where a second thread of the pre-Sputnik air defense policy becomes clear. Air Defense Command interceptor squadrons for FY 1958 were reduced by two previously planned but never activated squadrons; the FY 1957 status quo was thus retained in this area.[11] Similarly, heavy strategic

[9] Ibid.
[10] Ibid., p. 206.
[11] Hearings before House Armed Services Committee, 1957, p. 227.

bomber wings were retained at the 1957 level of eleven (three B-36's, eight B-52's).[12] This posture briefing, in addition to being considerably shorter than the FY 1956 statement made by Wilson, was also very different in approach.

While it is judgmental to suggest that a policy decision was made sometime in 1956 (prior to submission of the FY 1958 budget) that the existing air defense system was "enough," it can at least be pointed out that Wilson's approach to the defensive effort was considerably less vigorous than it had been earlier. Where the FY 1956 message was a comprehensive, organized statement of purpose, force levels, and future direction, that for FY 1958 is characterized by a great deal of questioning from the committee members over the size of the requested budget and manpower ceilings. Wilson's predilection to accept the status quo is clear in his interchange with the Committee Chairman Carl Vinson:

> [Vinson] "So you are satisfied that the defense that we have today is adequate for the security that the Nation requires in an era of peacetime?"
>
> [Wilson] "That is correct."[13]

Standing as an example of the lack of specificity which Wilson used under direct questioning is this interchange on the last page of his Posture testimony:

> [Mr. Gubser] "As one considers this $38.5 billion request for new obligational authority, you get the impression, probably erroneously, that the great emphasis is on offensive striking power. Now, would you say that this is an erroneous impression, and that a balance has been achieved between offensive striking power and defensive weapons?"
>
> [Wilson] "The very best balance that we can work out is what we have striven to have. There may be some difference of opinion in any particular case between the men who are charged with responsibility for the striking power, like the SAC bases, for instance, as against the men that are charged with the defense, continental defense. Each of them would like maybe to see the thing slide a little bit in their own direction. Admiral, what would you say about it, as an overall balance between offense and defense?"
>
> [Admiral Radford] "I think that it represents the best balance that we can estimate at this time."
>
> [Mr. Gubser] "Thank you."[14]

This interchange is curious for several reasons. During the FY 1956 hearings (in early 1955), Wilson introduced his briefing with the strongly worded statement from the President on the need for an improved continental defense system. Yet by early 1957, similar initiative seems to have deserted his effort; by the end of his testimony a committee member wonders aloud about what Wilson *really* said about the balance between offensive and defensive forces during the briefing he just gave. The overall military effort for FY 1958 seems to be "marking time" during 1957 although this is certainly not to say that the effort was small: previous figures suggest the major commitment which existed for both offensive forces and continental defense. Nonetheless the continental air defense effort initiated during 1955 does not receive the same degree of attention that it did earlier; the system was in being by early 1957, and Secretary Wilson professes that the defense is "adequate" at that time.

The winds of change which blew across American strategic thinking at this time may have also contributed to the lack of emphasis on air defense. The Gaither Committee report (commenting for the first time on the possibility of a "missile gap") and the Rockefeller Brothers Fund report (which made similar recom-

[12] Ibid.
[13] Ibid., p. 112.
[14] Ibid., p. 132.

mendations) were completed late in 1957 but were indicative of the reexamination which was going on over the direction of strategy.[15] Then too, the possibility of a Sputnik launching was known to segments of the intelligence community well before it occurred; the implications of this Soviet missile technology (albeit crude) may well have begun greater emphasis on strategic forces to counter the threat given the realization that no system of defense then existed which could counter the ICBM.

And then with the launching of Sputnik on 4 October 1957, policy direction changed drastically—the pendulum swung dramatically back in the affirmative direction on continental defense it had begun on during 1955, but with a different twist since the character of the threat was changing.

2. 4 October 1957–January 1961: Reevaluation of the Strategic Threat (The decision to deploy first generation IRBMs/ICBMs)

Secretary of Defense McElroy took over from Charles Wilson on 10 October 1957, less than a week after the first Sputnik was launched. By early January 1958, the reverberations from that dramatic event had crystallized into a policy shift within defense strategy, a shift on which McElroy was clearly willing to comment for the Congress. When queried about the importance of the U.S. missile and satellite program at that time, McElroy's view was forthright:

> [Mr. Brooks] "How important do you know it to be now?"
>
> [McElroy]"Well, as far as I am concerned, there is nothing more important in the defense operations."[16]

The importance attached to developments in the missile and satellite field clearly overshadowed air defense in McElroy's testimony. The first objective of the Defense Department program for FY 1959 was offensive weapons of retaliation; it was there that most of the emphasis was placed. He did go on to say, however, that:

> A coldly calculating enemy would consider not only our power to retaliate but also our ability to defend ourselves against him in his attempt to destroy us. We must, therefore, build defenses of such strength that it will be obvious to such an enemy that he cannot, through a sudden and vigorous attack, destroy the military capability of this Nation and knock it out of further combat. This is a second major objective of the Defense Department program; and our continental air defense, our Naval Forces, and the alert and dispersal program of our Strategic Air Command are our principal safeguards here.[17]

Clearly then, continental defense was secondary to the offense and was but one of several constituent elements of the defense program. McElroy himself was apparently on the offense in the FY 1959 message, for he dramatically portrayed the spending and developmental initiative he saw as required:

> . . . while we are maintaining our ability to meet the war of today, we must at the same time be pushing rapidly forward in the development and procurement of new advanced weapons which may not be operational for 2, 3, or even as many as 10 years, and of means of defense against such weapons in the hands of others. . . . We must not only support a full military capability in being, but must also invest billions of dollars in the development of weapons which will not add to our strength until they are fully deployed some years later. . . . It is clear that the need for maintaining present and future military capability in a period of rapid technological change exerts an upward pressure on the Nation's defense budget.[18]

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[15] Morton H. Halperin, *Contemporary Military Strategy*, Little Brown and Co., Boston 1967, pp. 50–51.
[16] Hearings before House Armed Services Committee, 1958, p. 3992.
[17] Ibid., p. 3976.
[18] Ibid.

The need was clear, and the requested expenditures supported the verbiage: $39.8 billion was requested, with a direct obligation of $41.1 billion even though total manpower was declining by design. Under the budgetary umbrella, missiles were the topic of the day. McElroy's comments are instructive about the state-of-the-art in the field, and about planned programs:

> Surface-to-air missiles have proved their reliability and effectiveness, and are replacing antiaircraft artillery. . . . They constitute an important part of our present defense against invading aircraft. . . .
>
> Missiles in each of these categories [Author's Note: surface-to-air, air-to-air, and air-to-surface] are here and in operation. Some of them are rapidly being made obsolete by the second generation weapons coming along in the same class but that is the nature of such weapons. It is important that we continue to improve them.
>
> The intermediate range ballistic missile and the intercontinental missile fall into the category of those which are in the later stage of development, but not yet operational. This is a critical area. We do not have positive evidence that Russia is ahead of us in these long range missiles, but the only basis on which we can properly operate is to assume that they are. We are going ahead, as you know, with production of both the Jupiter and the Thor in the IRBM field. Both weapons are promising; neither has been completely tested. We would have preferred to wait until one or the other had successfully completed its tests and fully proved itself, and then go ahead with that one. We would have saved some money by doing so. But time is critical in this program. Since we have high hopes that both will prove to be satisfactory, we decided to avail ourselves of the existing production facilities behind both of them, and thus push forward the date on which we could have the IRBM deployable in larger quantities.
>
> We are somewhat farther from an operational ICBM. This program is advancing with the highest priority.[19]

Organizational changes were brought about to meet the shifting priorities:

> To make certain that these programs move forward, and to administer the development and production of the short-range and long-range missiles, I have established the office of Director of Guided Missiles, and have appointed William Holaday to that position. . . . He is the man to whom I look for the direction of our missile program, and l am prepared to back him with the full authority of the Secretary's office. . . .
>
> Such long-range programs as the antimissile missile and the military satellite programs are in the research and exploratory development stages. They are important and must be pursued, but they must not detract us from the speedy development of our other missile systems. To handle them, I am establishing within the Department of Defense an Advanced Research Projects Agency, which will be responsible to the Secretary of Defense for the unified direction and management of the antimissile missile program and for outer space projects.[20]

McElroy was also clear about areas within the defense budget which deserved special attention:

> Let me now turn to a brief review of the budget. As you know, the fiscal 1959 budget is being transmitted to the Congress today. In preparing this budget, we found a number of highly important areas in which progress could be significantly accelerated if sufficient funds were made available early in 1958. The major areas involved include ballistic missiles, a ballistic missile detection system, and dispersal and alert facilities for the Strategic Air Command.[21]

A single major addition to the existing continental defense system (and a harbinger of things to come) was his request for "construction of a new ballistic missile detection system to augment the existing continental defense warning network. This is essential to our security in view of Soviet missile programs."[22]

For a further discussion of this detection system, see Chapter IV, Section II.

The thrust of this immediately post-Sputnik presentation was on the importance of offensive weapons, IRBM and ICBM development, and missile defense and warning systems. Organizations were created to

[19] Ibid., p. 3980.
[20] Ibid., p. 3981.
[21] Ibid.
[22] Ibid., p. 3982.

handle new responsibilities in the missile field; R&D was to receive a shot in the arm from an infusion of funds for long-term development projects. Although the Soviet missile threat was dealt with only indirectly in this statement, the clear emphasis on speeding up U.S. missile programs was implicitly tied to the problem posed by Sputnik. The threat of Soviet missiles was something which would become increasingly clear within the next several years and would motivate U.S. programs in offensive missilery and defensive warning and attack systems.

The immense portent of this missile threat is seen in the following dramatic quotation from 1958:

> The prespective [sic] Soviet achievement of an ICBM capability has brought into the minds of statesmen and peoples for the first time, a general sense of U.S. vulnerability to Soviet attack, and consequently a sense that a major change in the world-military situation is impending. It is now generally believed that the U.S.S.R. will, during the next year or two rather than at some time in the distant future, be able to inflict instant and crippling damage on North American [sic], with a consequent deterrent power as effective as that which the U.S. has exercised.[23]

This fearful appraisal of the impending Soviet ICBM achievement was coupled with ". . . the belief, recently induced, that the U.S. will not achieve an effective ICBM capability until a year and a half or more after the U.S.S.R. has done so."[24]

Whether or not the appraisal was correct, the feeling of the times was plainly that the U.S. was behind the Soviet Union in ICBM capabilities and that we were threatened by an offensive power soon to be greater than our own. This threat and the motivation it provided will be dealt with as evidence is presented to support the contention.

A variety of measures support the general pattern of policy reflected in the FY 1959 testimony. Adjusted dollar figures show the increased level of spending for strategic forces and R&D during these years (illustrated in Table 6). The bias introduced into this set of figures by adjusting it to 1973 dollars is shown in Table 7 by the actual appropriations for defense during those years.

Table 6—Defense Budget Summary by Program
(in Millions of 1973 Dollars)

FY	Strategic Forces	General Purpose Forces	Research and Development
1958	10,514	14,223	2,029
1959	11,283	13,329	2,682
1960	9,828	12,775 (LO)	2,905
1961	11,521 (HI)	14,234	3,433

Note: "HI" and "LO" indicate those levels for the FY 1956–1973 period

Source: Dan R. Brazier, Acting Assistant Secretary of Defense (Comptroller) Statement before the Defense Subcommittee of the House Committee on Appropriations In connection with the FY 1974 Budget estimates of the Department of Defense, May 31, 1973, Table 18.

[23] "Available Information in Answer to BDM Corporation Questions by Years," OACSI, DA, Washington, D.C. 1975. No pages are given; material is from year 1958.
[24] Ibid., 1958.

Table 7—Defense Budgets and Appropriations
Fiscal Years 1958–1961 (no supplements included)

FY	Budget Estimate (Administration)	Appropriation
1958	36,128,000	33,759,850
1959	38,196,947	39,602,827
1960	39,248,200	39,228,239
1961	39,335,000	39,996,608

Figures shown in thousands of dollars.
Source: *Congressional Quarterly,* October 28, 1972, p. 2840.

While these last several of the Eisenhower years were to be the years of the political issue of arbitrary defense budget ceilings, the fact was not yet in the Congressional fire in early 1958. It was not until 1959 that Eisenhower was to make public denials of the charge that he was subordinating defense to budgetary considerations; it was not until 1959 that Maxwell Taylor resigned to publicize his disagreement with the Eisenhower Administration over the confines of budgetary ceilings.[25] Similarly, Congressional testimony does not reflect sharp queries over the low level of requested funds until somewhat later. The more general point is, however, that even within the confines of budget ceilings, expenditures for strategic forces and R&D show a fairly distinctive rise in the face of falling expenditures for general purpose forces.

Nineteen fifty-eight was also the year of the Department of Defense Reorganization Act and several major systems decisions such as resolution of the Nike Zeus/Wizard controversy in which the Air Force was reduced to a support role for the Army Zeus effort. For a further discussion of this controversy, see Chapter IV. Some of the more important elements of the reorganization have been shown in McElroy's testimony. While the system decisions were clearly important for the daily conduct of the defense effort, the overall impression is that they had little impact on the basic strategy of air defense. Such system decisions were probably a miniscule part of Secretarial and Presidential fare; and it was at this level that responsibility for overarching strategy remained. The high level of such strategic considerations is reflected by this exchange on another matter in 1958:

> [Mr. Price] "Referring now to your airborne divisions, how many airborne divisions do you have?"
>
> [McElroy] "Well, you are getting into the kind of thing where I need General Twining."
>
> [Mr. Price] "Well, it wouldn't be necessary—"
>
> [McElroy] "It may be two or three."[26]

The fact that the Secretary did not know how many airborne divisions the United States had at that time is suggestive of the generalized nature of his deliberations on the force structure. Clearly, the reduction of strategic postures to the ability to fight "1½" or "2½" wars is more indicative of the level of his considerations than is enumeration of debates about particular weapons systems or R&D activities. It is with this thought in mind that the presentation on strategy continues.

[25] Paul Y. Hammond, *The Cold War Years: American Foreign Policy Since 1945.* Harcourt, Brace and World, New York, 1969. p. 103.
[26] 1958 Hearings, op. cit., pp. 4050–4051.

How did U.S. force levels reflect the strategic emphasis during these years? Data on selected systems indicate the actual allocations which existed, as shown in Table 8. These figures reflect a phase-out of Nike Ajax batteries as Nike Hercules batteries were deployed during these years, but a reduction overall of about 20 percent in CONAD SAM batteries. For more detailed information on these reductions, see Chapter IV, Section II. Both Air Force and Air National Guard interceptor forces declined over these years, with ANG interceptor forces peaking in FY 1958 and Air Force interceptor forces peaking in (not shown) FY 1957. While medium bomber forces began to decline during these years, heavy bombers continued to increase and Atlas and Shark missiles entered the inventory in FY 1960.

Table 8—Selected Systems, FY 1958–1961

	1958	1959	1960	1961
Army Forces				
Nike Ajax batteries/launchers	241/	202/	122/	76/
Nike Hercules btry/lnch, CONAD	1/	42/	88/	114/
Regular Army Air Defense Bns	86	88	78	*
Reserve/NG Air defense Bns	136	106	95	*
Total SAM btry/lnch, CONAD	242	244	210	190
Air Force Forces				
Air Defense Interceptor Wings/Sqds	28/83	27/80	22/65	17/42
Air Defense Missile Bomarc Wg/Sqds	—	—	**	**
Strategic Missile Wings/Sqds				
Atlas	—	—	–/1	–/4
Shark	—	—	–/1	–
Total ICBM Launchers	—	—	**	**
Strategic Air Force Wings/Sqds				
Heavy Bombers	11/33	11/33	12/36	13/39
Medium Bombers	23/84	28/111	23/100	21/86
Air NG Interceptor Wings/Sqds				
All Weather Interceptors	10/43	12/43	11/40	8/33
Day Interceptors	16/48	10/26	—	—

* No comparable figures available

** Deleted to protect sensitive data

Source: Defense Management Summary, op. cit. Army Forces: From Table 125. Air Force and Air NG Forces (including strategic missile wings/squadrons): Table 135. Total ICBM launchers: Table 170. All figures unclassified except those from Table 170, which are SRD.

Less significant changes included the introduction of Bomarc in FY 1960 and the final conversion/replacement of Air National Guard day interceptors during FY 1959. Thus, the very strong emphasis on strategic offensive forces and missile development in the FY 1959 hearings was indeed reflected in the force development pattern for the years considered. It should naturally be noted that attempting to directly compare these systems as to the importance of their respective roles in the defense effort is like comparing apples to oranges—"importance" is highly ambiguous. Clearly, commitment to air defense (by way of force levels) declined somewhat during these years while ICBMs began to enter the inventory and heavy strategic bombers continued to increase. Secretary McElroy's Military Posture Briefing for FY 1960 was to reflect this general direction even more markedly, and additionally available material offers a window on the service-level view of the decision making process at the Secretary's level.

In McElroy's Posture Briefing for FY 1960 in early 1959, the trend of the importance of the offense coupled with recent events combined to make air defense a third priority item in the Defense package. As McElroy said:

> The basic policy of the Department of Defense continues to have the following principal elements:
>
> 1. We consider our first responsibility to be that of protecting the ability of this country to retaliate with large weapons in case of an outbreak of general war.
>
> 2. We consider as our second but equally pressing responsibility that of providing a capacity to apply military force promptly in various local conflict areas of the free world similar to Lebanon and Taiwan of the past year.
>
> 3. We seek these objectives without in any way overlooking the need for continental air defense and for maintenance of open sealanes.[27]

How important was air defense within this context? McElroy had this to say: ". . . We recognize air defense as an important adjunct to the retaliatory capability which supports deterrence. We must make the enemy know that an attack on us would be costly to his attacking force and that he cannot obliterate our ability to retaliate."[28]

And the Soviet threat against which our forces would have to be directed (including the adjunct of air defense) was also made clear:

> So they presumably might rely very heavily on the intercontinental ballistic missile. They, of course, do have some long-range aircraft, but they apparently did not decide to go into long-range aircraft to the extent that we have. It is our firm belief that our heavy bomber capability is substantially greater than theirs and that our medium bomber capability is appreciably greater than theirs. . . .
>
> Thus, their combination of feasible attacking weapons against the United States would appear to be: the ICBM, some submarine launched limited range air-breathing missiles, and heavy bombers.
>
> We, on the other hand, have a superior heavy bomber position and a superior medium bomber position, launched from this country, with adequate tankers to extend their range.[29]

The perceived threat during 1959 was thus heavily weighted toward Soviet ICBMs, yet according to the Secretary we did not have an air defense system capable of defeating such a threat.

Even in these early years, controversy over the advisability of deploying an ABM system was beginning to build up. NIE 7-58 had confirmed the need for a system like Nike Zeus, and CINCNORAD favored deployment of the system. In November 1958, the DOD Ballistic Missile Defense Committee, headed by Dr. Skifter, recommended that an immediate decision be made to put Zeus into production. This recommendation went to the Secretary of Defense, who referred it to the JCS. The JCS issued a split paper on the Skifter Committee recommendation with the Army favoring production and all other services opposed to it. This was not the end of NORAD support for Zeus—the January 1959 North American Air Defense Objectives Plan recommended an inventory of 29 Zeus batteries by the end of FY 1962, and 120 batteries by the end of FY 1963.[30] However, from the level of Secretary McElroy, the future success of a ballistic missile defense looked bleak—bleak enough to explain reservations about funding production with massive sums of money. While commenting on the program status of the Nike Zeus in 1959, McElroy said: "We

[27] Hearings before House Armed Services Committee, 1959, p. 792.
[28] Ibid., p. 794.
[29] Ibid., p. 819.
[30] "Summary of Major Events and Problems, FY 1959, Deputy Chief of Staff for Operations." DCSOPS, DA, Washington, D.C., Item 3.

will, in all probability, even with this kind of defense, have the same kind of problem we have on aircraft, that if there is a mass attack on a given target you are not going to be able to head them all off."[31]

Pregnant with meaning for the type of debate which would take place during the McNamara years on ballistic missile defense was his additional comment on Zeus: "So the kind of question we will have to decide is whether with the resources of our country we can provide this for the proportionate deflection of these, which is the optimum we can hope to achieve against this very tough [sic] intercontinental ballistic-type of weapon."[32]

A more detailed discussion of this problem can be found in Chapter IV, Section III.

The clear thrust of the testimony during early 1959 was about the controversial "gap in missiles." Whatever the merits of various arguments about Soviet ICBM capabilities in the near future, it became increasingly clear that the Soviet heavy bomber threat was a lesser part of the overall threat. Regardless of whether the Soviets had more or roughly the same number of missiles as the United States, the existence of the missile threat was most crucial to the size and type of defense system employed since there was no known defense against the ICBM. Given this technical defense problem and the composition of the threat, the system of defense against the air-breathing threat could be reduced—a position which was made clear the following year.

Even while the threat was being reassessed at the Secretary's level, various governmental elements continued to interact over the direction of air defense activities. Offered in Annex l is a case study of interaction during the 1958–1959 period, drawn from the "Summary of Major Events and Problems, FY 1959, Deputy Chief of Staff for Operations," Department of the Army. This case study, albeit from a single service source, reflects on the interrelationships among Congress, the Secretary of Defense, the JCS, and the military services at this particular point in time. Since similar vignettes are not available for many other decisions on air defense, this particular study takes on added importance although generalizations from it are not necessarily possible. The story told by it of the interplay of actors, however, suggests a divergence of opinion which is interesting.

The Decision to Refine Existing Air Defense Systems

The year 1960 found Thomas Gates as Secretary of Defense. In his February testimony on defense matters he seemed to refute the existence of a "missile gap" although John Kennedy would exploit the issue that failed in his Presidential campaign.[33]

Surely, Gates had reason to double any major gap—it was estimated that by 1 January 1960 that there would be a Soviet initial ICBM operational capability of only ". . . a few—say 10—series produced missiles. . . ."[34] And this small capability was coupled with the assessment that "what is known of Soviet strategic ideas suggests that the ICBM is thought of primarily in terms of deterrence . . . rather than primarily in terms of the deliberate initiation of general way."[35]

Gates began his testimony on an affirmative note regarding America's military strength:

[31] 1959 Hearings, op. cit., p. 857.
[32] Ibid.
[33] Paul Hammond, op. cit., p. 140.
[34] OACSI, op. cit., 1960.
[35] OACSI, op. cit., 1960.

> An aggressor's destruction must be so inevitable that initiating war is tantamount to suicide. That strength I believe we have now. . . .
>
> 1. Some of the facts which support this judgment are:
>
> (a) Our total strength . . . is so great that any surprise attack upon us would result in unacceptable destruction to the attacker. . . .
>
> (b) The establishment of early warning systems, the capability for an airborne alert at the time and on the scale needed, and the deployment of mobile, hardened and concealed missiles are progressing as planned. Our defense programs are under continuous review to insure that we maintain a long-range program of military strength.[36]

The nature of American response to the threat was thus changing. Early warning (of impending ballistic missile attack), hardened and hidden forces, and an airborne alert system had become crucial to the defense effort. The nature of the response was changing in relation to the changing threat, which is reflected in Table 9, showing numerical estimates of selected systems. "Alert" was becoming increasingly important not as a prelude to "defense" but as a signal for retaliatory "offense."

Table 9—Estimates of Selected Systems

	Mid-1965	Mid-1964	Mid-1963	Mid-1962	Mid-1961	Mid-1960
Bombers and Tankers						
Heavy	135	150	140	130	120	100
Medium	1,100	950	800	800	800	750
Ballistic Missiles						
Operational Inventory (700 mi.)	250	350	450	450	450	450
Launchers (700 mi.)	110	150	150	150	150	150
Operational Inventory (1,100 mi.)	80	160	240	300	300	300
Launchers (1,100 mi.)	50	100	100	100	100	100
Missile Subs						
Z Class	4	4	4	4	4	4
G Class	9	14	18	18	18	18
Nuclear	0	0	2	6	10	14

Each "Z" Class submarine would probably carry 2 missiles
Each "G" Class submarine would probably carry about 6 missiles
Each nuclear-powered submarine would probably carry 6–12 missiles

Source: "Available Information in Answer to BDM Corporation Questions by Years." OACSI, DA, Washington, D.C. 1975. From: Year 1960.

A variety of cutbacks in the air defense effort took place during fiscal year 1960 (see table on Selected Forces FY 1958–1961, previously shown) and Gates' testimony offered the reasoning behind them. While the testimony is linked to a specific reduction in the air defense system (discussed more extensively in Chapter IV), Gates' response is far-ranging:

[36] Hearings before Subcommittee of Committee on Armed Services, 1960, pp. 441–442.

> [Mr. Weisl] "In your opinion, do Soviet-manned bombers pose a current threat to the United States?"
>
> [Gates] "Yes, sir."
>
> [Mr. Weisl] "In view of this threat, will you be kind enough to explain the abrupt removal of 15 ships from the seaward extension of the DEW line over the objections of the commander in chief of the North American Air Defense Command? Was this done for military or budgetary reasons?"
>
> [Gates] "While the Soviet-manned bomber remains a threat, again, it is a matter of balance and degree. This extension of the DEW line was contemplated—I believe it was 1955—and I believe it was put into being in 1957. After a review of the continental defense picture again, and after consultation with the Joint Chiefs of Staff, it was considered that we could reduce somewhat the effort in connection with both Air Force tactical fighter squadrons and Navy ships in supporting this concept that was, as I say, devised five years ago. Those ships are not going out of existence in total."[37]

The Secretary's answer seems to suggest that the cutback was a reaction to the lessening bomber threat (". . . a matter of balance and degree.") rather than for budgetary reasons. However, Congressman Weisl questioned Secretary Gates closely on the exact reason for this cutback at length, and then submitted a Memorandum of Record from the Chief of Naval Operations which suggested that the cutback was motivated by budgetary considerations (see Annex 2). As 1960 was an election year, the issue of arbitrary budget ceilings affecting the military posture may well have motivated the type of questions which were raised. Nonetheless, the following interchange regarding cancellation of the F-108 long range air defense interceptor (described as such in testimony) adds weight to the argument that air defense was effected by budget priorities as well as the changing nature of the threat:

> [Mr. Weisl] "But that weapons system has been cancelled, has it not?"
>
> [General White] [Author's Note: General White was then Chief of Staff, USAF] "That weapons system was canceled [sic] because we simply could not carry it along with many of the other programs we had."
>
> [Mr. Weisl] "I believe you testified further that the F-108 was cancelled and certainly in your mind it was cancelled in the main on the theory that you would get the B-70; isn't that right?"
>
> [General White] "That is exactly right. 1 was informed, though I can't prove it, that the Air Force could have only one of the two systems under development for the future, and I was forced from where I sat in the problem to make a choice between the F-108 and the B-70. . . . The final analysis I think that caused me to go for the B-70 in this respect is that I cogitated what constituted—what would worry the Russians the most, and I came up without much doubt that the B-70 was the one that would worry the Russians more than the F-108 and that does not downgrade the F-108's capabilities in its field."[38]

In summarizing the deliberations of early 1960, the safest conclusion that can be drawn about the relative importance of the changing Soviet threat versus DOD budgetary considerations on reducing the air defense effort is that both had a major impact. The degree of importance assigned to each depends very much on a judgment about the available and imprecise evidence. At any rate, Senator Stennis neatly summed up much of the thinking at that time when he said: ". . . we are pouring these many hundreds of millions of dollars into ground-to-air defenses, some of which it seems to me is already obsolete."[39]

As illustrated in Table 10, changes in the deployed forces of NORAD and USAF ADC during this period also reflect the general reduction which was occurring. Comments on similar reductions can be found in Chapter IV.

[37] Ibid., p. 454.
[38] Ibid., p. 126.
[39] Ibid., p. 156.

Table 10—Summary of Force Changes, 31 December 1959–1 July 1960		
	31 December 1959	1 July 1960
NORAD Interceptor Sqds	67	55
NORAD Nike Batteries	258	270*
USAF ADC Interceptor Sqds	56	44

* This number had declined to 143 batteries by 1 July 1964.

Source: "NORAD/GONAD Historical Summary," January–June 1960. Directorate of Command History, Office of Information, Headquarters, NORAD/GONAD; p. 70. Figure for 1964 from same Basic Source, January–June 1964, p. 62.

3. January 1961–January 1968: The McNamara Years

The Kennedy Administration brought with it Robert McNamara as Secretary of Defense, and the years during which McNamara held that office were somewhat different from what had gone before. The air-breathing defense system continued to decline during this period, but McNamara's style of forthright information made the open and official reasons for this decline more clear than they had ever been. Technological innovations for improving the defense system came to the forefront of attention early in the McNamara years, and included such possibilities as Hawk 11, Mauler, alternatives to the Zeus system, super combat centers, advanced BUIC systems, and more sophisticated versions of the manned interceptor. These concepts, however, were waylaid or restricted. Although cost-effectiveness analysis was first mentioned in conjunction with the Polaris and Regulus systems decision in 1959,[40] it really came to the center of decision-making as a technique with McNamara and was then used to justify some of the decisions on the continental defense system. McNamara's comments on the changing nature of the Soviet threat are also instructive in determining reasons for the cutbacks in the defense system. All in all, the evidential base on continental defense becomes more rich with the McNamara years, at least until defense policy is overtaken by Vietnam in 1966–1967. Figures 4 and 5 help to portray overarching offensive and defensive strategy during these years.

McNamara's first Military Posture Briefing to the House Committee on Armed Services on February 23, 1961, was not reflective of his thinking since the new administration had just barely taken office and had not yet had time to make its mark on the course of national policy. At that time, McNamara repeated his tasking from President Kennedy to ". . . reappraise our entire defense strategy—our ability to fulfill our commitments—the effectiveness, vulnerability and dispersal of our strategic bases, forces and warning systems— . . . efficiency and economy . . . adequacy . . . in light of present and future dangers."[41]

McNamara's response was to appoint task forces to delve into several major areas of defense, one of which was to ". . . examine our requirements for strategic forces and continental air defense."[42] By the time of the House hearings to authorize appropriations for FY 1962 in April 1961, these task force reports had been completed and McNamara was at the helm of the Defense Department. His comments then are instructive about the perceived direction of the defense effort. The character of the changing threat was made clear immediately in his presentation: "The problem of deterring an all-out nuclear war has been greatly complicated by the introduction of intercontinental ballistic missiles into the arsenal of our major adversary in the world struggle. Only a year or so ago the principal general war threat to our security was a surprise attack

[40] 1959 Hearings, op. cit., p. 796.
[41] Hearings before House Committee on Armed Services, 1961, p. 633, February 23, 1961.
[42] Ibid.

by large number of nuclear armed manned bombers. A year or two from now our principal concern will be surprise attack by large numbers of nuclear-armed ICBMs."[43]

Figure 4—Kennedy-Johnson Strategy, 1961–1968

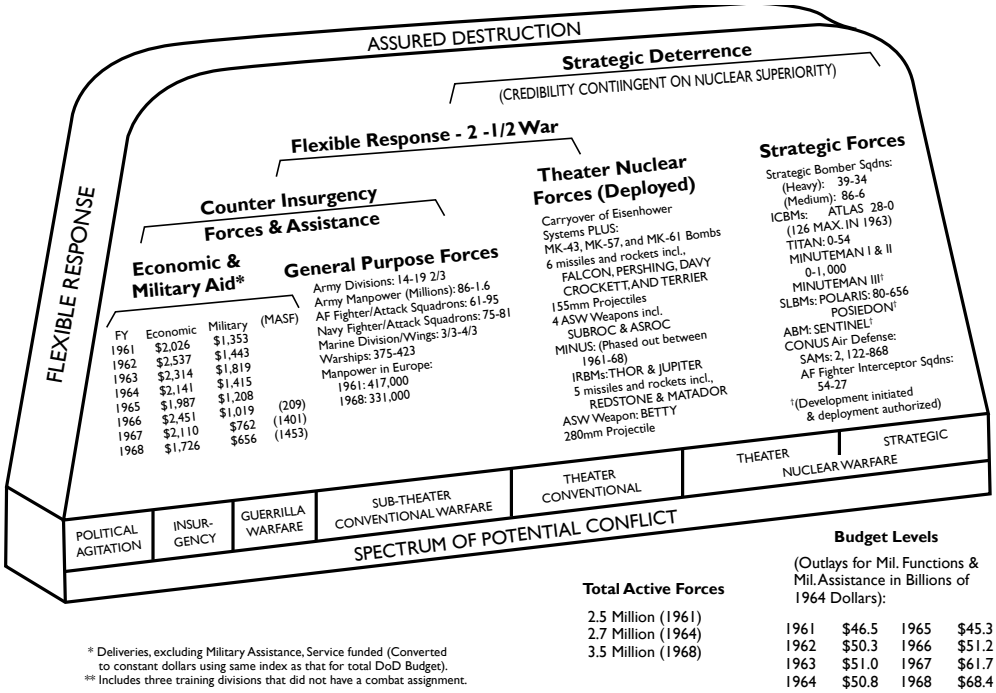


Figure 5—Abstract of the Kennedy-Johnson Strategies, 1961–1968

Kennedy-Johnson Administration

Strategy Concepts: Emphasis on "assured destruction" by strategic forces; "flexible response" for NATO strategy; a planning goal (never attained) to gain capability for fighting large Asian and European. conflicts simultaneously; pursuit of a capability for fighting and training others to fight limited wars and insurgencies; and large but declining foreign and military assistance programs. Significant change in strategy was the. shift in emphasis to greater orientation for U.S. toward bearing the principal Free World burden in non-nuclear conflict.

Forces: Strategic force buildup in early years until leveling off in the mid-1960's. Research and Development effort primarily emphasized refinements rather than conceptually new systems; notable exceptions: MIRV, battlefield sensors, F-II1, C-5A. In general Purpose Forces, divisions, warships and tactical air squadrons, except fighter-interceptors, increased substantially. Manpower increased by over one million men, due largely to Vietnam. Special Forces were expanded.

Budgets: Trend up, with pre-Vietnam (1962–1964) mean average $50.7 billion in constant FY 1964 dollars. Significant planning innovation: initiation of the Planning-Programming-Budgeting System (PPBS).

Foreign and Military Assistance: Trend toward roughly stable and large economic aid with military assistance down significantly. With general aid levels going down, there was shift from military to economic aid.

Manpower: Heavy reliance on use of the draft for conflict, rather than available Reserve forces. When Reserves were called up, it was largely for crisis-management requirements.

[43] Hearings before House Committee on Armed Services, 1961, p. 1238, April 11, 1961.

Secure, non-vulnerable forces which were controllable and could survive a first strike from the other side were the order of the day. In this regard McNamara desired a rapid shift from the Atlas and Titan programs to the Polaris and Minuteman, with no additional bomber procurement beyond the then-existing force of about 1,500 heavy and medium bombers. About 1/2 of these bombers, however, would be placed on ground alert status for launching within 15 minutes (compared to 1/3 then on ground alert status) to increase the effectiveness of the strategic offensive forces while missile forces were built up during fiscal years 1962–1963. Snark was to be phased out by December 1961 instead of the previously planned date of June 1963, with an "early" (unspecified) phase-out of the B-47 medium bomber. Development funds were requested for the Skybolt program, and the Hound Dog penetration aid missile was then being delivered, pending the acquisition of "adequate" ICBMs; the clear emphasis here was on refinement of the existing bomber force capability. Both the B-70 and the nuclear-powered aircraft project were dropped from full-scale weapons system development; the former primarily because of its cost, complexity, and outmoded capabilities, the latter because of its doubtful value and cost.[44] The clear emphasis within offensive forces was on an effective second-strike capability, to counter the expected Soviet ICBM force.

This threat was supported by the estimate at this time that ". . . ballistic missiles are clearly intended to become the dominant weapons . . ." of the Soviet long-range striking force.[45]

U.S. solid fuel, hardened, second generation missiles helped in this regard. Advanced strategic bomber programs were not necessary, nor were additional procurements of existing bomber systems because ICBMs would soon take over an increasing share of the offensive role. Continental defense received a small measure of attention compared to these major decisions on offensive systems with final FY 1962 strategic defensive expenditures of $2.0 billion and strategic offensive expenditures of $8.9 billion.

This degree of emphasis was justified by the judgment that "the large Soviet manned bomber forces will probably decline gradually in numerical strength, but five years hence the Soviets will probably still supplement their missile forces with medium and heavy bombers for both weapon delivery and reconnaissance."[46]

Since BMEWS could provide only about 15 minutes of warning time, development funds were requested for MIDAS which might be able to provide about 30 minutes of warning. The decision on Nike Zeus for FY 1962 was characteristic of many later comments about ballistic missile defense:

> The system, itself, is vulnerable to ballistic missile attack and its effectiveness could be degraded by the use of more sophisticated ICBM's screened by multiple decoys. Saturation of the target is another possibility, as ICBM's become easier and cheaper to produce in coming years. Finally, it is a very expensive system in relation to the degree of protection that it can furnish.
>
> Weighing all the pros and cons, it is our conclusion that we should continue the development, test, and evaluation phase of this program on an urgent basis, but we should not at this time take any steps for the production and deployment of the system.[47]

Two other air defense improvements included modifications to the ground control intercept system and Hawk radars, but the larger emphasis in continental defense was on the status of anti-ICBM programs such as Zeus and ARPA's exploratory Project Defender. Further information on the ARPA work can be found in Chapter IV. The new direction of the Kennedy administration on defense was reflected clearly in McNamara's

[44] Ibid., pp. 1238–1247.
[45] OASCI, op. cit., 1961.
[46] OASCI, op. cit., 1961.
[47] 1961 Hearings, op. cit., pp. 1248–1249.

remarks. While it was in fact the case that adjusted expenditures on strategic forces during FY 1962 were to decline somewhat from those of the previous fiscal year (which were the highest for the FY 1956–1973 period), those expenditures were still the second highest for the FY 1956–1973 years. Additionally, R&D expenditures rose from FY 1961 to FY 1962 by roughly $600 million. The changed policy on fiscal constraints from Eisenhower to Kennedy is also seen in defense appropriations for those years: while appropriations remained at about $39 billion for fiscal years 1959–1961, they increased sharply in fiscal year 1962 to about $46.5 billion. These figures and general trends for the McNamara years are reflected in Table 11. Within these rising defense budgets, the changing emphasis during the McNamara years from strategic to general purpose force expenditures because of Vietnam and almost continually rising R&D costs is shown in Table 12.

Table 11—Defense Budgets and Appropriations, FY 1961–1969
(in thousands)

FY	Budget Estimate	Appropriation
1961	$39,335,000	$39,996,608
1962	42,942,345	46,662,556
1963	47,907,000	48,136,247
1964	49,014,237	47,220,010
1965	47,471,000	46,752,051
1966	45,248,844	46,887,163
1967	57,664,353	58,067,472
1968	71,584,000	69,936,620
1969	77,074,000	71,869,828

Note: No supplemental estimates or appropriations not considered or made in the regular annual Defense Appropriation Acts are included in the above amounts.

Source: *Congressional Quarterly,* October 28, 1972, p. 2840.

Table 12—Defense Budgetary Summary by Program
(in millions of 1973 dollars)

FY	Strategic Forces	General Purpose Forces	Research and Development
1961	$11,521 (HI)	$14,234	$3,433
1962	10,876	16,691	4,069
1963	9,822	16,545	4,812
1964	8,509	16,497	4,857
1965	6,353	17,731	4,644
1966	6,128 (LO)	27,283	4,708
1967	6,293	29,986	4,620
1968	7,236	30,375 (HI)	4,277
1969	8,497	29,442	4,568

"LO" and "HI" Indicate those levels for the FY 1956–1973 period.

Source: Don R. Brazier, Acting Assistant Secretary of Defense (Comptroller), Statement before the Defense Subcommittee of the House Committee on Appropriations in connection with the FY 1974 Budget estimates of the Department of Defense, May 31, 1973, Table 18.

The last two fiscal years show a rise in expenditures for strategic forces and a decline in expenditures for general purpose forces, both trends which were to continue after McNamara's departure.

The military force inventories during these years show some of the same trends exhibited during the immediate post-Sputnik years, as well as some distinctive characteristics, as shown in Table 13.

These figures show the total conversion of CONAD Ajax batteries to Hercules batteries by the end of fiscal year 1964, with continued reduction in CONAD Hercules batteries through the end of the period. CONAD Hawk launchers rose by the end of fiscal year 1965, and then stabilized at 288 for the remainder of the period. The sharp reduction in CONAD-committed SAM batteries during these years is seen in the drop from the FY 1962 high of 208 to the FY 1969 low of 60. Secretary McNamara's comments regarding strategic bombers and ICBMs during his FY 1962 presentation are reinforced by these figures, and interceptor squadrons show a general decline throughout the period.

More reasons for the changing nature of the air defense system are provided in a Senate inquiry into the collapse of one of the so-called "Texas tower" early warning radar stations (discussed in Chapter IV). Held in May 1961 (at about the time Secretary McNamara expounded on the changing nature of the air defense threat), the inquiry was motivated by the destruction of Texas tower No. 4 in a gale on 15 January 1961. Tower No. 4 was one of three such installations off the northeastern U.S. coast whose annual maintenance cost had averaged around $10–11 million. This exchange suggests the Air Force position on the towers at that time (Mr. Charyk, below, was then Undersecretary of the Air Force):

> [Senator Stennis] "Well, we can argue about this a long time, Mr. Secretary; but how are you getting along without Texas tower No. 4 now? As I understand it, you have no plan to replace it."
>
> [Mr. Charyk] "We have no plans to replace it, Mr. Chairman, because the time period for reactivation of such an installation would be a matter of several years. With the changing nature of the threat, it is felt the investment would not be worth it at this time.
>
> There is also a new development which is pertinent here. We are proceeding to install a new radar aboard the early warning and control aircraft. . . . We are installing a new transistorized airborne long-range input system in these aircraft. . . . And so in a sense these aircraft will perform the type of a function that was previously performed by these Texas towers.
>
> . . . If the Installation of the APS 95 radar and the ALRI equipment on our early warning aircraft proves out as we expect at the present time, we would anticipate that we would abandon the operation of Texas towers 2 and 3 at that time."[48]

Thus, the official position for the decline in the Texas tower system cited: first, the changing nature of the threat; and secondly, the combination of technological innovations which would serve a similar purpose as that of the towers. It would seem that the relatively high cost of the tower system may have also been a factor, but since comparative costs for the early warning aircraft are not provided, the impact of the cost factor is not clear.

In reviewing Secretary McNamara's annual presentations through calendar year 1967, it becomes evident that the general pattern set by his comments during the April 1961 appropriations authorization hearings holds true through the 1966 presentation. That general pattern consists of increased emphasis on the offensive missile inventory (and its technological sophistication); increased emphasis on the enemy missile warning system; increased emphasis on the survivability of retaliatory forces after attack; and decreased emphasis on the necessity for a major active defense system against the air-breathing threat. It is also clear that reductions in some systems moved even more rapidly than was projected in the early McNamara years. Tables 14 and 15 show these unanticipated declines.

[48] Senate Inquiry into the Collapse of Texas tower No. 4, May 1961, p. 11.

Table 13—Selected Forces, FY 1961–1969									
	1961	1962	1963	1964	1965	1966	1967	1968	1969
Army									
Nike Ajax batteries/launchers, CONAD mission	76/	69/	34/						
Nike Hercules batteries/lnch, CONAD	114/	139/	127/2316	107/1926	95/1500	73/1194	73/1194	73/1194	
Hawk batteries/launchers, CONAD	—	—	8/576	8/576	8/288	8/288	8/288	8/288	
Total CONAD SAM batteries	190	208	169	115	103	81	81	81	
Total Regular divisions	14	16	16	16	16	17	17	18	
Air Force Wings/Squadrons:									
Heavy Bomber/Strat. Recon.[1]	13/39	14/42	14/42	14/42	14/42	13/40	12/38	11/35	10/30
Medium Bomber[2]	21/86	18/54	13/39	11/33	7/21	2/6	2/6	2/6	2/6
Titan	—	–/2	–/7	–/12	–/6	–/6	–/6	–/6	–/6
Minuteman	—	—	–/3	–/12	–/16	–/18	–/20	–/20	–/20
Atlas	–/4	–/7	–/13	–/11	—	—	—	—	
Air Defense Interceptors	17/42	16/42	16/42	12/40	11/39	9/33	7/30	6/26	5/19
Bomarc	2/7	2/8	2/8	2/8	2/6	2/6	2/6	2/6	–/6
ANG									
All-Weather Interceptor Wings/Squadrons	8/33	7/28	8/27	6/24	5/22	5/22	5/22	5/22	5/22

[1] Includes one heavy recon. squadron (RC-135) in FY 1967 and 1968.
[2] Medium bombers are B-58 through FY 1969; the FB-Ill is used during FY 1971, 1972, and 1973.

Sources: For Army Forces: Defense Management Summary, Table 125 “Selected Army Forces”; for Air Force Forces: Defense Management Summary, Ibid., Table 135

Explanatory Note, Tables 14 and 15

While some of the categories on the next two tables are not identical from one table to the other, and figures for the same categories are not identical (perhaps because of a changed accounting method in the intervening period), it is interesting to note the difference between projections in 1962 and the retrospective look of 1967. Many forces declined more rapidly than had been anticipated earlier, or declined although build-ups had been predicted.

Specifically, phasedowns not projected in CY 1962 but which were true by CY 1967 included those in: DEW aircraft, DEW stations, Gap filler radars, SAGE direction centers, and DEW extension ships (under Picket Ships in 1962).

Therefore, although the tone of McNamara's presentation in 1961 indicated a revised threat and cutbacks in air defense systems, projections for some future air defense hardware needs remained high in the early years of his term as Secretary of Defense.

Estimates of the Soviet threat in some of these years help to portray the reason for these declines:

> [1962] . . . limited bomber capability against North America will be tailored increasingly to conduct missions supplementary to ballistic missile attack.
>
> In the mid-1960's the principal Soviet forces for attack on North America will be increasing numbers of ICBM launchers, supplemented by increasing numbers of nuclear-powered missile submarines and decreasing numbers of bombers.
>
> [1963] In the later 1960's they would probably employ bomber forces in follow-on rather than initial attacks, and for increasingly specialized missions.
>
> [1964] By the end of the decade, Soviet intercontinental attack capabilities will rest primarily upon an ICBM force of some hundreds of launchers, supplemented by a sizable missile submarine fleet and a large but reduced bomber force.[49]

4. The Decision Not to Deploy a Ballistic Missile Defense System

A somewhat different and truncated pattern is observed in his treatment of the active defense system against ballistic missiles as it evolved from the Nike Zeus to the Nike X (and then the Sentinel system). By the time of McNamara's 1967 presentation on FY 1968, he was obviously overtaken by the enormity of events in Vietnam and so in that year did not perform his normally detailed review of strategic offensive and defensive forces. Because of these characteristics of the calendar year 1962 through 1967 presentations on defense posture, the record detailed here about them will differ considerably from what has gone before. McNamara provides a singularly concise summary of the 1961–1966 continental defense effort in 1966, and this presentation coupled with the selected weapons inventories and budgetary figures already offered will complete the picture for those years. Ballistic missile defense will be portrayed somewhat more closely since several changes in posture took place on it during this time.

First then, the nature of the 1961–1966 continental defense effort. On strategic defensive forces, McNamara had this to say on 8 March 1966: "As I have pointed out in previous years, the elaborate defenses which were erected against the Soviet's bomber threat during the decade of the 1950's, no longer retain their original importance. Today, with no defense against the major threat of Soviet ICBM's, our antibomber defenses alone would contribute very little to our damage limiting objective and their residual effectiveness after a major ICBM attack is highly problematical."[50]

[49] OASCI, op. cit., 1962, 1963, 1964.
[50] Hearings before House Committee on Armed Services, 1966, p. 7353.

Table 14—Continental Air and Missile Defense Forces
(End of Fiscal Year)

							Actual	Projected				
Surveillance Warning and Control[a]	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**	**1968**	**1969**	**1970**	**1971**	**1972**
NORAD COC	1	1	1	1	1	1	1	1	1	1	1	1
SAGE Combat Centers	8	8	8	7	7	6	6	6	6	6	6	6
SAGE Direction Centers	20	21	18	16	16	14	14	12	12	12	12	12
BUIC II Control Centers	—	—	—	—	—	14	12	2	—	—	—	—
BUIC III	—	—	—	—	—	—	—	7	19	19	19	19
Search Radars	182	179	169	168	162	158	154	154	149	149	149	149
GAP Filler Radars	112	103	96	100	92	91	91	91	91	91	91	91
DEW Radar Stations	67	67	67	39	39	39	39	39	39	39	39	39
DEW Extension Aircraft	50	44	45	43	20	—	—	—	—	—	—	—
DEW Extension Ships	5	5	—	—	—	—	—	—	—	—	—	—
AEW/ALRI Aircraft	60	60	67	67	67	67	67	67	67	67	67	67
BMEWS Sites	2	2	3	3	3	3	3	3	3	3	3	3
OTH Forward Scatter Trans/Receiv.	—	—	—	—	2/4	2/5	3/6	3/6	4/6	4/6	4/6	4/6
SPASUR Trans/Receiver	—	—	—	3/6	4/7	4/7	3/6	3/6	3/6	3/6	3/6	3/6
SPACETRACK Sites	—	—	—	—	3	3	3	4	4	4	4	4

[a]Includes CONUS, Alaska, Greenland, Iceland, and Canada

Source: Selected systems from p. 262 of "Statement of Secretary of Defense Robert S. McNamara before a Joint Session of the Senate Armed Services Committee and the Senate Sub-Committee on Department of Defense Appropriations on the Fiscal Year 1968–72 Defense Program and 1968 Defense Budget." January 23, 1967 (SRD) GPO.

Table 15—Continental Air and Missile Defense Forces
(End of Fiscal Year)

	Actual		Projected				
	1961	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**
Surveillance, Warning, and Control							
SAGE Combat Centers	3	3	3	3	3	3	3
SAGE Direction Centers	20	22	22	22	22	22	22
COC	1	1	1	1	1	1	1
Manual Combat Centers	1	1	4	4	4	4	4
Manual Control Centers	5	3	—	—	—	—	—
Radar Stations	165	160	163	162	162	161	161
AEW and Control Aircraft	60	60	68	68	68	68	68
GAP Filler Radar	112	114	124	143	143	143	143
DEW Stations	63	67	67	67	67	67	67
Airborne DEW Extension							
Atlantic	18	18	18	18	18	18	18
Pacific	25	25	25	25	25	25	25
Picket Ships							
Radar Picket Escort	11	11	11	11	11	11	11
Radar Picket	16	16	16	16	16	16	16
Missile Masters	10	10	10	10	10	10	10
BMEWS	2	2	3	3	3	3	3

Source: Selected systems from p. 126 of "Statement of Secretary of Defense Robert S. McNamara before the Senate Committee on Armed Services The Fiscal Year 1963–1967 Defense Program and 1963 Defense Budget." January 19, 1962. GPO.

A number of changes reflected this emphasis. The soft SAGE system was initially modified with a manual BUIC, with IOC for the semiautomatic BUIC II in the fall of 1965 (see a related discussion of this in Chapter IV). By the end of FY 1968, planning called for all BUIC IIs to be converted to BUIC IIIs; thus, the hardening program initiated in 1961 was carried on with IOC for the related COC at Cheyenne Mountain during FY 1966. Based on the revised threat, radars were continuing to be phased down, along with the phasedown of interceptors and Nike Hercules batteries. The radar reorientation would ". . . leave a system of 151 search radars, 275 height finders, 91 gap fillers, 39 DEW radars and 67 AEW/ALRI offshore radar aircraft. All of the DEW line extension radars (ships and aircraft) have now been phased out."[51]

A major phasedown of the active fighter interceptor force was begun the year before, with no significant change projected through FY 1971; 22 Nike Hercules batteries would be phased out during FY 1967 as well.[52] While BMEWS was being improved and the over-the-horizon radar was being developed, the clear picture on the air defense scene was one of cutback and decreased emphasis. Initiatives that were taken consisted of refinements or experimental developments; air defense had ceased to be the burning issue it was in earlier years for lack of a pressing need. By that time, the Nike Zeus system had become the Nike X system, but as in previous years deployment of an antiballistic missile system was not foreseen as necessary for a variety of reasons. After discussing the problems, uses, and technical characteristics of the Nike X system, McNamara summarized the likelihood of deployment:

> Considering all of the uncertainties involved, including the nature and consequences of the Soviet reaction, the technical problems yet to be solved and the great cost of such a deployment, I do not believe that a decision should be made now to undertake an all-out damage limiting effort against the Soviet threat. Nevertheless, this issue should be kept under continuous reassessment, and the deployment [sic] effort on all elements of the system should be pursued with the greatest urgency. . . .
>
> With regard to Communist China, the timing of a U.S. light ABM deployment should be linked to the pace at which the threat actually evolves. Since we do not know [sic] believe the Chinese Communists could deploy any significant ICBM force before the mid-1970's, no production decision on that account is needed at this time.[53]

The latter comment regarding the possibility of deployment against a Chinese ICBM threat is particularly interesting in light of the September 1967 decision to deploy just such a system; for further information on this policy reversal see Chapter IV, Section III.

At the same time that air defense was on the decline and antiballistic missile defense was being held back, strategic offensive forces projections were beginning to decline and then level off. The impetus of 1961 had created by 1966.

In a sense, this "leveling off" was curious given the estimations about Soviet forces made at about this time. In 1965, it was indicated that "over the next 10 years it is estimated there will be considerable strengthening of Soviet strategic attack forces particularly in retaliatory capabilities, with chief emphasis on ICBMs. It is not believed, however, that the Soviets will expect to achieve, within the period of this estimate, forces which would make rational the deliberate initiation of general war, but that they will continue to adhere to the concept of a deterrent force."[54]

[51] Ibid., p. 7354.
[52] Ibid.
[53] Ibid., pp. 7356–7357.
[54] OACSI, op. cit., 1965.

Clearly, it was not anticipated that the Soviets would be following the U.S. pattern on offensive forces in the mid-term future. A hint of the "why" for U.S. action in this regard is seen in projections from 1966:

> The Soviets are building forces which will given them, in the next year or two, greatly increased confidence that they have a retaliatory capability sufficient to assure the destruction of a significant portion of U.S. industrial resources and population.
>
> . . . it is not believed, however, that the Soviets will expect to achieve by the mid-1970's strategic capabilities which would make rational the deliberate initiation of general war.[55]

It was estimated that the Soviets had about 335 operational ICBM launchers, compared to 954 total ICBM launchers for the U.S. at that time. The threat was therefore not numerically large, and the future projection called for 670–765 Soviet operational launchers in mid-1968.[56] Even given consideration of throw-weight for the missiles per launchers, it probably seemed likely that a rough parity might be developing in ICBMs between the two major powers. The "why" for the leveling off consequently seems tied to a real determination at that time that the arms race could be cooled down if the U.S. took the initiative in restricting growth in hardware.

The proposed U.S. bomber force, although to be modified in the medium bomber category, also reflected this direction, as depicted in Table 16.

Table 16—Proposed Bomber Force
(number of aircraft)

	FY 1967	FY 1971	FY 1957
B-52	600	255	255
B-58	80	0	0
FB-111	0	210	210

Source: 1966 Hearings, p. 7350.

While Poseidon was to be accelerated as an engineering development program, other directions on ICBMs were reflective of the completion of a basic trend begun in 1961 to build up missile forces:

> . . . There is now general agreement that a force of about 1,000 Minuteman missiles is appropriate in context with the total strategic offensive forces programmed and in light of the expected threat. . . .
>
> We still plan to continue the 54 Titan II missiles in the force throughout the program period. . . . [Author's Note: through FY 1975]
>
> . . . by the end of the first quarter of fiscal year 1968, the entire planned force of 41 submarines (656 missiles) will be operational.[57]

Both the decreasing emphasis on defense and the leveling off of the offensive commitment are reflected in Table 17.

[55] OACSI, op. cit., 1966.
[56] OACSI, op. cit., 1966.
[57] 1966 Hearings, op. cit., pp. 7350–7351.

Table 17—Financial Summary FY 1962–1967
(In Billions Per Fiscal Year)

	FY 1962 Original	FY 1962 Final	FY 1963 Actual	FY 1964 Actual	FY 1965 Actual	FY 1966 Estimated	FY 1967 Proposed
Strategic Offensive Forces	7.6	8.9	8.3	7.3	5.3	5.1	5.1
Strategic Defensive Forces	2.2	2.0	1.8	1.9	1.5	1.6	1.3

Source: 1966 Hearings, p. 7361.

By the time of McNamara's 1967 presentation on the FY 1968 program, the clear impact of Vietnam had exerted its influence over the type of policy statements made. In adjusted dollar figures, fiscal years 1967 and 1968 showed the highest expenditure levels for general purpose forces during the FY 1956–1973 period (see previous figures from the statement of Don Brazier, 1973). This expenditure level correlates strongly with the amount of program emphasis found in the FY 1968 statement. Programs where new direction and emphasis was lacking included both strategic offensive and defensive forces. A few examples describe the general pattern[58]:

Missile forces: "Last year I told this committee that . . . This is essentially the program we now propose to pursue."

Strategic bomber forces: "The manned bomber forces we propose to maintain through fiscal year 1972 are the same as those I presented here last year for the fiscal year 1967–1971 period."

Strategic reconnaissance: "The strategic reconnaissance force is the same as that presented a year ago."

Surveillance warning, and control: ". . . with two exceptions author's note: activation of BUIC II to slip, 5 more search radars than planned to be operated until FY 1969 because of technical transition problems) . . . the same as those I presented last year."

Manned interceptors: ". . . generally the same as those presented last year."

Surface-to-air missiles: "The Nike Hercules and Hawk missile forces are the same as planned a year ago. . . ."

Ballistic missile warning: ". . . the same as shown last year."

Antisatellite defense: "As described in previous years. . . ."

Civil Defense: "Same in content and objectives as that approved for the current year."

The very clear message of this testimony is the overarching problem of Vietnam. The briefing is introduced by the Secretary with comments about the then-current Vietnamese tactical situation, and discusses the need for general purpose forces in terms of worldwide deployments to meet the Vietnam requirements for U.S. troops. Congressional inquiry was not particularly pointed about the Vietnamese situation, but since the Posture Briefing was given in March 1967, public and Congressional antipathy toward the war was not yet prevalent at the time. Clearly, the previously decreasing emphasis on continental air defense had ground itself to a complete halt by this period.

5. Calendar Years 1968–1972 Plans for the Future of Air Defense

"Now that the antiballistic missile defense issue has been resolved," suggested Robert McNamara in January 1968 in his FY 1969 posture statement, "we are in a position to move forward intelligently on

[58] Hearings before Committee on Armed Services, 1967, pp. 875–880.

the solution of the antibomber defense problem."[59] The resolution he referred to was the Sentinel ABM deployment decision of September 1967 (see discussion in Chapter IV), which brought about a budget request for FY 1969 of $1.232 billion for ABM defense of which $651 million was for deployment.[60] While this decision to deploy a thin ABM system against the nascent Chinese ICBM threat thus seemed to break the calendar year 1967 logjam on the future of air defense, which has already been described, weapons inventories during these years did not reflect any upward trend compared to the area air defense concepts which were advanced to solve the defense "problem." Quite the contrary is actually true: air defense hardware for the most part continued the downward spiral on which it had begun for all practical purposes in 1961.

The reason for this spiral seemed patently obvious; an estimate from 1968 suggested the Soviet threat we faced at the time: "While they have only begun to narrow the gap in submarine launched ballistic missiles and remain inferior in heavy bombers, the Soviets will shortly overcome the U.S. lead in number of intercontinental ballistic missile (ICBM) launchers."[61]

Recalling the previously cited expectation of 1966 that the Soviets would have 670–765 operational ICBM launchers by mid-1968, it now (in 1968) seemed that the Soviets actually had 900 such launchers. This increasing threat, coupled with the comment that "attrition and retirment [sic] of older models will gradually reduce the Soviet heavy bomber force. The medium-bomber force will probably also decline as Badgers are phased out. . . ." meant that defense against the air-breathing threat would continue to decline as the composition of the threat changed.[62]

As depicted in Table 18, selected systems show the U.S. offensive and defensive force trends which had begun during the previous period. Additionally, Figure 6 helps to portray the overarching offensive and defensive strategy during these years. Coupled with these decreasing force levels was McNamara's proposal for a substantively new air defense system in his FY 1969 Posture statement (see Chapter IV). The key element of this new system was to be AWACS (Airborne Warning and Control System) which required development of a downward-looking airborne radar; this would have little vulnerability compared to the existing ground-based systems. McNamara then proceeded to sketch three alternatives which were considered for the future of air defense. While such alternative postures had been used on many other systems in the past, the approach was something new for air defense—a change was in the wind.

Previously, air defense had one posture since 1961—slight modification or reduction. McNamara had this to say about the alternatives:

> The first alternative would be to continue the current air defense forces at least through the mid-1970's. The second would be to modernize the forces with AWACS for warning and control and the F-12 for interception. The third alternative lies midway between the other two, and would provide for AWACS and the upgrading of the F-106 with an enhanced fire control system (including a "look-down" capability to engage low-altitude targets) and a new air-to-air missile. . . . Under alternatives 2 and 3 the entire SAGE/BUIC ground environment would be phased out, leaving only the FAA operated radars for peacetime air surveillance. However, some over-the-horizon (OTH) "back-scatter" radars would be added to provide an aircraft early warning capability . . . on balance, the AWACS/F-106X force seems to be the proper choice at this time.[63]

[59] McNamara FY 69 Posture statement (paperback), 1968, p. 66.
[60] Ibid., p. 75.
[61] OACSI, op. cit., 1968.
[62] OACSI, op. cit., 1968.
[63] FY 1969 Posture Statement, op. cit., pp. 68–69.

Table 18—Selected Forces, FY 1969–1973					
	FY 1969	FY 1970	FY 1971	FY 1972	FY 1973
Army Forces					
Hercules btry/lnch, CONAD	52/891	40/	21/	21/	N/A
Hawk btry/lnch, CONAD	8/288	8/288	8/288	8/288	N/A
Total CONAD SAM btry/lnch	60/1179	48/288	29/288	29/288	N/A
USAF Wings/Squadrons					
Heavy Bombers	10/30	9/31	–/29	–/26	–/26
Medium Bombers[1]	2/6	—	–/4	–/4	–/4
ICBM					
Titan	–/6	–/6	–/6	–/6	–/6
Minuteman	–/20	–/20	–/20	–/20	–/20
Air Defense Interceptors	5/19	4/14	–/11	–/9	–/7
Bomarc	–/6	–/5	–/5	–/5	–/3
AWACS	–/7	–/3	–/2	–/2	–/2
ANG					
All-Weather Interceptors	5/22	5/17	5/16	5/17	5/20

[1]B-58's were used in FY 1969 while FB-111's were used in 1971–1973.
Source: Defense Management Summary, op. cit. Army Forces: Table 125; USAF Forces: Table 135.

If the third alternative were completed, ". . . we could phase out all but one of the SAGE Combat Centers, all the SAGE Direction Centers, about half of the search radars, all of the Gap Filler and DEW Line radars, and all of the AEW/ALRI aircraft. . . .[64]

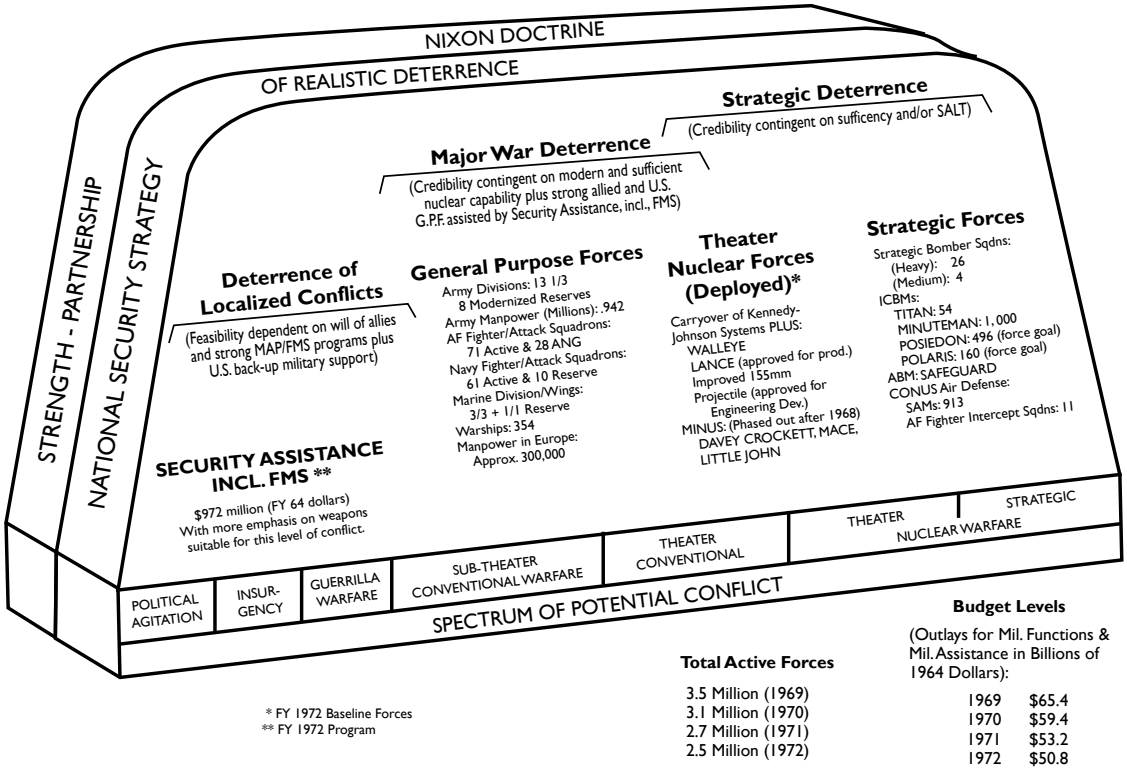
In addition, the F-106X would replace all existing air defense interceptors except for one ANG F-102 squadron in Hawaii; while most of the existing Hercules and all of the Hawks would be retained, all Bomarc forces would be phased out. Missile warning through BMEWS and OTH forward-scatter radars would remain basically the same pending completion of the OTH-B study proposed for that fiscal year.[65] Taken together, the elements of this proposal indicated a new direction for the air defense effort, and one which was to be restated almost verbatim by Clark Clifford in his presentation on the FY 1970 defense budget.

Congressional response to the McNamara proposal was not all that was hoped for: none of the $28 million for F-106X development requested was appropriated; AWACS received about $40 million, but OTH-B only received $1 million.[66] The only significant addition to the proposed new air defense system which Clark Clifford added in 1969 was a realization which had been stated less clearly earlier and which would

[64] Ibid., p. 72.
[65] Ibid., pp. 73–74.
[66] Clifford FY 70 Posture statement (paperback) 1969, p. 63.

summarize U.S. air defense capabilities in the post-ABM agreement period of 1972. Clifford had this to say about the effectiveness of antibomber defense: "No air defense system can provide a significant 'Damage Limiting' capability against the Soviet Union unless accompanied by a strong, effective ABM defense."[67]

Figure 6—Nixon Strategy for Peace



While the ABM system Clifford referred to was the Sentinel system designed against the Chinese threat, shortly thereafter Sentinel became Safeguard with the new Nixon Administration. Clifford's presentation was prepared by mid-January, 1969; by mid-March of that year President Nixon had redesignated the system and had redirected it, this time against *both* the Soviet and the Chinese threats rather than the Chinese threat alone. Safeguard is discussed more extensively in Chapter IV. Other elements of the continental defense system received less attention in these years, basically retaining the modernization posture which had been suggested by McNamara for the FY 1969 budget. Secretary Laird's presentation on the transitional FY 1971 defense budget is reflective of this fundamental stagnation of the air-breathing threat defense system: "The current bomber defense system, as the Congress is aware has a limited combat effectiveness and is expensive to operate. Accordingly, while research and development on a modernized system progresses, we plan to continue in FY 1971 the phase-down of the existing system in such a way as to make the best use of the remaining forces."[68]

The continual phasedown of the existing system is reflected in the previously presented figures, and the modernization program had not produced any significant results by then. Continued development funds

[67] Ibid., p. 58.
[68] Laird FY 71 Posture statement (paperback) 1970, p. 116.

were requested for AWACS and OTH-B, with additional studies on a revised manned interceptor switching from the F-106X to consideration of the F-14 or F-15 since again the Congress had not appropriated funds for the former program.[69] Both NEWS and the OTH forward-scatter systems continued in their missions with the addition during FY 1970 of the 474N system designed specifically to warn of SLBM launch.[70] The FY 1972 budget statement of Secretary Laird first mentioned the ongoing SAM-D development project of the Army in conjunction with planned strategic forces, as a possible replacement for Hercules and Hawk, but SAM-D as with other modernization efforts remained in the development stage. Maintenance of the status quo established in 1968 regarding air defense is reflected in the FY 1973 budget message by Secretary Laird in February 1972:

> Our air defense systems have not in the past been able to meet all of the objectives assigned to them. Command and control systems have been vulnerable, warning systems have been unable to detect all incoming aircraft using low-level penetration tactics, and our interceptors are too few in number and lack the "look-down shoot down" capability required against low-flying bombers.
>
> Because of this vulnerability and the reduced effectiveness of parts of our present air defense forces, we have decided to make some selected reductions in the current force levels, accepting some additional risks in the near term while pursuing development of more effective air defense components for the future.[71]

This vulnerability and limited effectiveness of our system was coupled with a general consensus on the existing and projected Soviet air-breathing threat which made even more clear the perception of a declining usefulness for our air defenses. That there was some disagreement about this perspective is also seen in a 1972 description of Soviet capabilities: "The Soviet force of intercontinental bombers and tankers consists of 110 Bears, 70 of which carry air [sic]-to-surface missiles, and 85 Bisons, including 50 tankers. The first units of a new strategic bomber—the Backfire—could become operational by late 1973. All but the Air Force continue to believe that it is best suited for use against Europe and Asia. The Air Force believes that it is suitable for a variety of missions including intercontinental attack."[72]

Although there had been no phase out or major attrition in these existing 195 heavy bombers over several years, they were characterized as "rapidly aging" and the earlier suggestion that a bomber attack would serve as a follow-up to an initial ICBM attack was not changed. The glitter, it seems, had gone out of the air defense business.

Previously mentioned consideration for a new solution to the interceptor was named the improved Manned Interceptor (IMI) program (although no funds were even requested for it for FY 1974) with design of a new satellite warning system ongoing.[73] The Safeguard ABM system was then (February 1972) in testing, with procurement initiated for some elements of the system; this activity would of course be restricted by the ABM Treaty of 26 May 1972 which limited deployment to two national sites per signatory.

The drastic change which had taken place in U.S. objectives regarding continental air defense during the 1955–1972 period is reflected clearly in Secretary Richardson's FY 1974 presentation:

> Planning of the CONUS air defense system has undergone a number of major changes during the last decade. The current objectives are to provide a defense of the U.S. against a small bomber attack, assuming a rela-

[69] Ibid., p. 119.
[70] Ibid.
[71] Laird FY 73 Posture statement (paperback) 1972, p. 74.
[72] OACSI, op. cit., 1972.
[73] FY 1973 Posture Statement, op. cit., p. 75.

> tively short period of strategic warning, and as a minimum a SAM defense of Washington, D.C. Forces which can satisfy these objectives will also be capable of performing peacetime surveillance and identification functions to protect the sovereignty of U.S. air space.[74]

Air defense had not moved full circle since 1955, but had changed direction 180 degrees instead. The defense system against the manned bomber threat had declined ever since the late 1950's when perceptions of the future Soviet threat foresaw the ICBM as the major element of that threat. An effective defense against the ICBM threat was never deployed, negating the value of a less important continental defense system which could significantly diminish U.S. losses in the face of a manned bomber attack. Offensive forces took on an increasing share of the burden of providing deterrence to attack in this situation, but their strategic employment moved from assured destruction and second-strike capability to sufficiency with the advent of substantive detente negotiations. Where earlier efforts had tried to increase warning time with radar nets strung further and further away from the United States, by the end of the period a short warning time was sufficient. Where earlier efforts had been bent on constructing a SAM defense system for all major U.S. population centers, by the end of the period a SAM defense of the capital was sufficient. Truly, the era of strategic emphasis on continental defense was over.

E. Summary

The introduction to this chapter suggested a set of factors which are considered to be crucial to the evolution of air defense strategy. Before investigating how these factors are related to the critical decision periods portrayed here, some general observations need to be made. First, this effort was incredibly constrained by time and the inability to access a great many primary sources which would have fleshed out the story which is told here. In particular, three areas come to mind which deserve further research as discussed below.

1. The Politics of Congress as it Affected Air Defense

It is interesting to note, for example, that both the bomber and missile "gaps" received especially great emphasis during Presidential election years—1956 and 1960, respectively. Was there any significance to this timing for the changing air defense strategy? Only a greater research effort can provide an answer. In another instance, an interesting case can be made for a method of decision making involving Congress which may have influenced air defense strategy. Prior to the DOD reorganization of 1958, the lack of OSD control over service budgets meant that a great many competing weapons system controversies were "bucked" to Congress for its participation in the resolution of them. That reorganization and the changes it brought about in centralizing DOD control over expenditures meant that such controversies came to be resolved in a substantively different way, within DOD. Another element of the story is that Congressional scrutiny of air defense in the post-Sputnik years (1958–1960) was much greater than it had been before, with many congressmen asking DOD "What kind of defense have you given us for our money?" While the Sputniks and the Soviet ICBM were one set of factors stimulating this inquiry another set *might* have been generated by the fact that Congress was tired of participating in the resolution of weapons system disagreements. It may have seemed to Congress that neither the Chiefs nor the services were united in the defense effort—publicized bones of contention had been such things as the SAM area versus point defense

[74] Richardson FY 74 Posture statement (paperback) 1973, p. 1961.

range limitations the Zeus-Wizard controversy, the Nike-Bomarc "disagreement," and the Thor-Jupiter "dispute." Such differences occurred both before and immediately after the DOD reorganization, but a case can be made for the argument that the reorganization was largely stimulated by the DOD desire to reduce the visibility of such system decisions and thereby reduce Congressional pressure. The DOD house became more orderly, and it may have been that the extent to which Congress could wield the budget as a whip over defense was reduced even though scrutiny had increased in the post-1958 period. *No* evidence was uncovered which would lend credence to this case; nonetheless it seems to deserve investigation because of its coincidence with the beginning of phasedowns in air defense systems in the 1958–1961 period. Did centralized OSD control over service budgets impact on system cutbacks? Did Congressional scrutiny stimulate a reassessment of air defense needs? Primary evidence is not available at the present time to comment substantively on these questions.

2. JCS/Service Participation in Air Defense Strategy

Here, clearly, are important elements of the strategic picture that are not explored in this chapter (although they are covered in Chapter 1). The picture of strategy portrayed by Congressional testimony often tends to make the decision-making process look consistently like a rational model in which a unitary state makes a single strategic decision about the external environment to respond to a stimulus. Enough evidence is available here to disagree with the simplicity of this model, but the real interaction of various bureaucratic groups on even the major decisions selected here is not known.

For example, it seems fairly certain that the Army stood as the only major institutional advocate of the Nike Zeus and then Nike X System. (See Chapter IV, Section 3 for a further discussion of this.) For many years, the Chiefs split on advocacy of this system and the flavor of that disagreement (through secondary sources) appears to stem from doubts about the capabilities of the system and its costs. Were these disagreements actually driven more largely by the desires of other services for a role in ballistic missile defense? Did the centralized OSD control in the post-1958 DOD reorganization period detract from the Army's argument because advocates for the system did not exist at OSD level? Were the Congressional debates of 1969 on the ABM sparked by the clear military disagreements which previously existed over it? These questions are not answered here, because primary source evidence is frankly lacking. The more general point is that such bureaucratic group interaction may have affected the course of strategy on ICBM defense because of the divergence of opinion over U.S. capabilities to defend against the threat. Surely the issue deserves further exploration.

3. The Impact of Detente on Air Defense

A subject treated briefly here (although also covered in Chapter I) is the impact of U.S. efforts toward rapprochements with the Soviet Union. Such efforts run throughout the years covered here, and are particularly crucial in the post-Sputnik years regarding U.S. resolve to pursue an effective missile defense, and strategic offensive superiority. Was a decision made early in the McNamara years that the Soviet Union would *not* attempt strategic superiority over the U.S. and so ceilings could be placed on our defensive and offensive forces? If so, it would explain the way the ABM seemed to be used as a bargaining chip for the SALT talks (although even this conclusion is an assessment drawn from a secondary source). If so, it would explain the leveling off of our offensive forces in the mid-1960's even given the type of Soviet threat

estimate divergences suggested in Annex 4 to this chapter. Khrushchev's enunciation of support for wars of national liberation in 1960 and the subsequent U.S. strategy of flexible response and our emphasis on the ability to fight brushfire wars also serve as major elements of the consideration of detente. With these changes, the strategies of the superpowers addressed a "new" potential area of conflict—no longer was nuclear war the professed predominant military arena. In such a changed perspective, nuclear weapons and defense against them became strategic tools of lesser importance than they had been—general purpose and special forces took on an increasing significance in perceived superpower competition. If this assessment is correct, it may have seemed only logical to decrease emphasis on air defense and strive for offensive and defensive limitations since control over territory could be gained in less traumatic and more effective ways than by the delivery of nuclear weapons to the opponent's homeland. Clearly, as with the first two points, this aspect of air defense deserves further consideration.

With these general comments in mind, the decisions and factors earlier enumerated can be put in perspective. We have noted that there were five major decisions affecting air defense during these years:

(1) The decision to build up the air defense system stated publicly in January 1955
(2) The decision to deploy first generation U.S. IRBM/ICBMs of 1958
(3) The decisions not to develop new air defense systems in the 1959–1963 period
(4) The decision not to deploy a ballistic missile defense system through September 1967
(5) The decision for detente, begun under Eisenhower and which culminated in SALT in 1972.

Of these five decisions, the most crucial for air defense strategy were decisions 1, 2, and 5. The implications of this prioritization will be discussed as the selected factors are related to the decisions.

4. Decision I: The Build-up of the Air Defense System, January 1955

The most salient factors in the decision to increase U.S. air defense efforts were the Soviet threat and our belief that the technological capability existed to counter that threat. Shortly before the beginning of this period the TU-4 manned bomber threat was supplemented with the Bear and the Bison, providing a great stimulus to the U.S. to do something about the U.S.S.R.'s growing offensive capability. Our reaction was two-fold: to increase our offensive forces and provide for a better defense. It had already been demonstrated before 1955 that the major elements of the air defense system could be developed; the new Soviet threat required refined technology, but the job could be done. Air defense was relatively important to overall U.S. strategy at the time, and so this factor is ranked concurrently with the threat in stimulating the build up of the system. Although the U.S. began rapprochement efforts with the Soviet Union during the same time at which air defense systems were built up, the effort produced no substantive conclusions and hence this factor had little impact on defense strategy. Neither budgetary constraints nor interservice competition were important to the decision, for the threat was clear and President Eisenhower was adamant about the need for a more effective system. This was clearly an important decision for air defense since it stimulated activity in the field in a way never seen again in the following years.

5. Decision II: The Decision to Deploy First Generation IRBM/ICBMs of 1958

This decision is important for air defense because of the major implications it had *for* it, rather than as a decision *on* it. The decision was largely a result of a single factor: the changing Soviet threat as evidenced by the Sputnik and ICBM launchings of late 1957. Because of the threat which was perceived from these

events, U.S. strategy changed to account for the new offensive weapons anticipated as shortly to be entering the Soviet inventory. Projections of Soviet reliance on ICBMs rather than on manned bombers as their major means of delivering nuclear weapons meant that our manned bomber air defense system would be less important than it had been. Since there were serious questions about the technical feasibility of an anti-ICBM defense, the defense effort came to rest more and more on offensive might to counter a threat which could not be handled defensively. Air defense became less important in the face of the revised threat and the inability to directly counter aspects of it. This decision ranks in importance with the first decision, for it marks the end of serious strategic concern with an air defense system. It was "all down hill" for air defense after the threat changed at this time; while the system continued through the rest of the years in revised form, it was clearly an adjunct to other, more important, systems and strategic considerations.

6. Decision III: The Decisions Not to Develop New Air Defense Systems in the 1959–1962 Period

These decisions were much less important than the second one because they are basically a continuation of it. Nonetheless, a lag of time between the two marks them as a separate series of events. The same factors which were influential in the second decision are operant here: decreased emphasis on the manned bomber threat, increased emphasis on the ICBM threat and our technological inability to counter it, and the subsequent limited importance of air defense. While the technology existed to improve the capabilities of a manned bomber defense and to harden it somewhat against an ICBM attack, the decreased priority afforded to air defense meant that innovations in that field had to take lesser priority to more important problems. Phasedowns and lack of funding for R&D programs were phrased in terms of budgetary constraints, but it is judged that had there been a perceived threat of major proportions which could be handled by our air defense systems, this argument would not have constrained air defense. The fact that "decision III" is really a series of lesser decisions is characteristic of its limited importance: there was no single decision not to develop all new systems or cut back all existing ones for the die had been cast earlier on the general problem. It was only a matter of carrying out the new strategy.

7. Decision IV: The Decision Not to Deploy a Ballistic Missile Defense System Through September 1967

This is clearly a continuing decision over a period of years, and one which was plainly stated in refined versions from 1958 through 1967. The single most important factor affecting it was probably the perception that although the Soviets had a burgeoning ICBM capability they would not use it to initiate general war and the likelihood of nuclear war was small. This is a conclusion drawn from estimates presented in this chapter. Closely following this perception in importance is the impact of technology, for at least in a strategic sense the ABM system capability was in doubt throughout these years. From 1958 through 1963 the feasibility of intercepting a "bullet with a bullet" was suspect although trial demonstrations had been held by the end of those years. From 1963 to 1967, technological questions revolved around the issues of an ABM system coping with penetration aids, chaff, decoys, radar blackouts, and a panoply of factors related to the effects of atmospheric ICBM destruction on our own systems and other soft targets. Did we have a sure-fire defense against these problems of the near-term threat? The answer was a resounding "no" from the level of the Secretary of Defense and the President. That there may have been other important factors is

also possible (such as an idiosyncrasy of McNamara against an ABM) but it is believed that a reduction in the fear of nuclear war and the suspect technology of the ABM were the prime elements in this decision.

8. Decision V: The Decision for Detente

This "decision" is more an element of U.S. foreign policy than it is a specific part of the air defense story, so it has been treated only incidentally in Chapters II and IV. Nevertheless it had great impact on the course of air defense strategy, for it set the mood of policy under which our strategic offense and defense stabilized. If, as in decision IV, the Soviets would not deliberately initiate general nuclear war, we could attempt to build bridges to them. If, as suggested in the estimates presented in the body of this chapter, the Soviets would not attempt to surpass the U.S. in an "arms race" but would instead seek parity, we could strive for limitations beneficial to both sides. This "decision" carried with it the fact that large defensive systems and continued growth in offensive forces were provocative—they ran contrary to the overall goal of detente. Since detente was more important than increasing weapons inventories, air defense strategy was affected by it and its goals came to be judged in light of more important concerns. As with the other major decisions affecting air defense strategy, this last crucial "decision" reduced the importance of the defense effort even more.

In summary, there were three major sets of decisions during these years which affected air defense—the decision to build up the air defense system in 1955, the decision to deploy first generation U.S. missiles in 1958, and the decisions throughout these years to pursue detente with the Soviet Union. The factors which most greatly affected these decisions were the existing and perceived Soviet threat, changes in that threat, our estimates of the use of that threat, and the state of offensive and defensive technology which existed at the time those decisions were made. Air defense strategy was thus clearly tied to a much larger set of ever-changing strategic decisions and assessments.

Annex I

CONUS Air Defense "Master Plan"

Source: "Summary of Major Events and Problems, FY 1959, Deputy Chief of Staff for Operations" DCSOPS, DA, Washington, D.C. Item 1, pp. 1–3.

ITEM 1

The JCS on 15 April 1958, in considering CINCONAD's CADOP 56–66, approved for service planning and programming guidance the deployment of 15 Bomarc squadrons, 80 Nike Ajax/Hercules battalions, and 26 Hawk Battalions by end FY 62 (JCS 2245/45). The Congress, in considering the FY 59 military construction program, viewed Nike Hercules and Bomarc as competing weapons systems and applied a 20 percent reduction in construction funds to force a decision by the Secretary of Defense between these two systems. The Secretary of Defense on 13 August 1958 requested (enclosure to JCS 2277/36) the recommendations of the JCS on how the reduction should be applied. Based on the subsequent JCS "split," the OSD solution resulted in the release of Nike Hercules funds for 13 2-battery SAC base defenses and 9 additional SAC base defenses contingent on the Army's ability to fund this program. This amounted to a total reduction of 3 SAC base defenses In the FY 59 program of 25. Funds for 1 Bomarc A and 2 Bomarc B squadron sites were released, and funds for the remaining 7 squadrons were withheld pending a review of the program. On 4 May 1959, the Senate Military Appropriations Subcommittee, in considering the FY 60 funding for CONUS air defense, criticized the failure of DOD to settle the Nike Hercules—Bomarc duplication and directed the Secretary of Defense to present a "Master Plan." On 19 May 1959, the Secretary of Defense requested (enclosure to JCS 1899/475) the JCS to prepare a "Master Plan" for CONUS air defense. The JCS could not agree and on 2 June 1959 the JCS forwarded (JCS 1899/481) to the Secretary of Defense the divergent Army, Navy, and Air Force Master Plans for CONUS air defense. The Air Force and Navy Master Plans were essentially short-range plans which terminated at 1963. The Army Plan was [based on a look at the 1965–1970 threat] calling for Zeus against the ballistic missile threat and the second generation Hawk against the aerodynamic threat, augmented by a LRAWS (long-range attrition weapon system) if feasible. Specifically, the Army Master Plan called for the following:

(1) Deployment of the 80 Nike Battalions and 26 Hawk Battalions which had been approved by the JCS in their consideration of CADOP 56–66. These weapons were to be phased out as second-generation Hawk became available.
(2) The 5 Bomarc A sites for which buy out funds had been authorized were to be completed in order to get a return for the nearly $2 billion invested in the program.
(3) Bomarc B would be terminated on the basis of its high cost, late availability, and limited capabilities.

On 19 June 1959, the Secretary of Defense forwarded (enclosure to JCS 1899/486) his decision on CONUS air defense subject to Congressional action, to the JCS, Secretary of the Army, Secretary of the Air

Force (Memo for Secretary of the Army and Secretary of the Air Force, subject: "Continental Air Defense Programs," OSA 19 June 1959). The decision provided for the following:

(1) No Hawk in fixed CONUS sites;
(2) 126 batteries of Nike Hercules for CONUS (30 to 15 SAC bases, 76 to convert existing Ajax sites, 20 at new city defenses) plus production of 50 Improvement Kits;
(3) 2 Bomarc A, 3 Bomarc A/B, and 11 Bomarc B squadrons;
(4) Improved SAGE only on the perimeter of the United States and a consequent reduction in direction centers, super combat centers and prime radars, with some increase in Gap Filler radars;
(5) Zeus funding increased $137 million for production feasibility studies.

Annex 2

DERs and the DEW Line

Department of the Navy, Office of the Chief of Naval Operations, Washington, D.C.

OP-03: jec
8 March 1960

Memorandum

Subject: Withdrawal of radar picket ships (DERs) from the seaward extensions of the DEW line.

1. During the review of the fiscal year 1961 budget in November, it became apparent that unless the Navy fiscal year 1961 budget was significantly increased over fiscal year 1960 budget it would be necessary to reduce naval personnel levels and naval force levels. During a budget review with Secretary of Defense in November, decision was made to reduce both forces and personnel. It was pointed out that reductions in force levels could not be made without reducing commitments. A reduction of 47 ships was made in the Navy and decision was made with the knowledge of the Secretary of Defense that the commitment to maintain picket ships on the Atlantic and Pacific extension of the DEW line would be eliminated.
2. The Chief of Naval Operations notified the Joint Chiefs of Staff of this decision and impending action, who in turn notified the commander in chief, North American Air Defense Command (General Kuter, USAF).
3. General Kuter notified the Joint Chiefs of Staff that he recommended against this action, in that removal of the picket ships would degrade the warning capability of the seaward extension of the DEW lines, and that the WV-2 aircraft which would remain flying these extension lines would not have as good detection capability as would the ships.
4. The Joint Chiefs of Staff presented this matter to the Secretary of Defense informing him of the intention of the Chief of Naval Operations to withdraw the radar picket ships (DERs) from the DEW line extension and notified the Secretary of Defense that NORAD (General Kuter) had expressed his opposition to the planned withdrawal of these ships.
5. Subsequently, the Secretary of Defense replied to the Joint Chiefs of Staff that he had taken cognizance of the withdrawal of the radar picket ships from the seaward extensions of the DEW lines during the fiscal year 1961 budget decisions.
6. There were a total of nine stations, four in the Atlantic and five in the Pacific, occupied by the DERs. These ships also acted as navigation check points and safety vessels for the aircraft flying the DEW LINE extensions out of Midway and Argentina. Two ships will probably be retained in the Pacific as safety vessels and navigation check points. They will, of course, contribute somewhat to the early warning on this line, but this will not be their major mission. In the shorter Atlantic line, the normal ocean station ship provided by the Coast Guard will provide the navigation check point and rescue services.
7. We have 36 DERs in the active fleet, 16 in the Atlantic and 20 in the Pacific; 8 Atlantic and 7 Pacific DERs will be decommissioned for a total of 15.
8. The decision to eliminate the ships from the seaward extension of the DEW LINE was made after careful deliberation. Force reductions had to be made. The ships having the least effect on the

fighting capability of the Navy were selected to be decommissioned. Eight of the oldest destroyers were put out. Only 15 of the 36 DERs were selected for decommissioning since these remaining ships have an ASW capability and can be used in other duties. One each of the DERs will be assigned to each of the inshore warning lines (contiguous lines) to rotate with the ships already assigned these duties in order that they may have better upkeep and ASW training.

Source: "Hearings before the Preparedness Investigation—Subcommittee of the Committee on Armed Services in conjunction with the Committee on Aeronautical and Space Sciences, United States Senate, 86th Congress, Second Session, on Missiles, Space, and other Major Defense Matters." GPO 1960. pp. 455–456.

Annex 3[1]

Phasedown of C² Systems, 1958–1963

The material in this annex is drawn exclusively from Thomas A. Sturm's "Command and Control for North American Air Defense 1959–1963," USAF Historical Division Liaison Office, January 1965 (Secret). The decision was made to include this material in an appendix rather than the main text since it is from a secondary source. As such, it tells a judgmental story about events and decisions which this author has not personally surveyed from primary sources, and is hence not viewed as part of the main story that can be told. Nonetheless, Mr. Sturm describes crucial decisions about the phasedown of air defense systems during the period of time when those phasedowns first began, and the detail of that story plus its author's careful work and reliance on primary sources makes it worth repeating here. A similar phasedown story can be found in Chapter IV.

The text of the appendix comes from pages 17–39 of the Sturm document. Restrictions on direct reproduction of the document have led to its appearance here in paraphrased and quoted fashion; Mr. Sturm granted permission for quotation from the document on 7 May 1975.

An ADC plan of 1958 was intended to increase SAGE quality and survivability by installing new solid state computers in hardened Super Combat Centers (SCCs). While this plan was approved by the Air Staff in February 1959 and in principle by OSD shortly thereafter, the *changing nature of the threat* to CONUS because of the ICBM led Congress to question the existing balance between antimissile and antibomber programs.[2] In response to this changed threat, Secretary of Defense McElroy asked the JCS and some of his own staff to propose revisions to existing plans. By 19 June 1959 service disagreements had been reconciled over changes, and Secretary McElroy presented the resultant Master Plan for Continental Defense which stated that *for economy reasons* three of the proposed SCCs would not be hardened.[3] By the end of the year the Air Force cancelled two of these three SCCs *because of Master Plan ceilings and other air defense commitments*.[4]

Several factors then combined to cancel the SCCs completely:

(1) The hastily prepared Master Plan needed revision;[5]

(2) Congressional inquiries about the changed threat had not yet been fully answered;

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[1] Unless otherwise noted, the documents cited in this annex are located in the Records Branch Files of the Directorate of Plans, Headquarters USAF and in the Correspondence Control Division, Office of the Secretary of the Air Force (OSAF).

[2] House Committee on Government Operations, 11th Report, 2 Sep 1959, Organization and Management of Missile Programs (cited in ADC Hist, Jan–Jun 1959, p. 2).

[3] Memo, SOD to JCS, 19 May 1959, subj: Continental Air Defense Program, in RL (59) 25; JCSM-211-59, 2 Jun 1959, subj: Continental Air Defense Program, in RL (59) 25; memo, B/G G. W. Martin, Actg D/Plans, to CSAF, 21 May 1959, subj: Air Defense Master Plan, in RL (59) 25; memo, SOD to JCS, 19 Jun 1959, subj: Continental Air Defense Program, in RL (59) 25; memo, SOD to Secy/Army & AF, 19 Jun 1959, subj: Continental Air Defense, RL (59) 25; Hitch Statement.

[4] Hist, D/C-E, Jul–Dec 1959, p. 98; memo, M/G J.K. Hester, DCS/O, to AF Ofc/Leg Ln, 12 Apr 1961, subj: Recapitulation of Readjusted Air Defense Program, in OSAF 777-61.

[5] Skifter Study, 25 Jan 1960.

(3) The 1958 DOD reorganization decreased former service control over C^2 budgets. JCS and OSD scrutiny of service recommendations subsequently to increase;

(4) The cost of improvements such as the SCCs would play an increasingly important role in budgetary considerations.

As a result of these factors,

> In November 1959, OSD advised the Air Staff that it was re-examining the Master Plan in the light of a recent revision of the missile threat. Intelligence credited the Soviet Union with having, by 1963–1965, a 60-megaton ICBM capable of striking within a mile or less of North American targets. As a result of this and other new estimates of requirements, the President's Scientific Advisory Committee had asked its Air Defense Panel to reassess the terms and objectives of the Master Plan. The panel, in turn, had asked OSD's Director of Defense Research and Engineering. (DDR&E) to assist. Pending completion of the project, OSD placed a hold order on SCC procurement.[6]
>
> One result of these investigations was DDR&E's recommendation to cancel the SCC program. Hardening the SCC's would not insure their survival against ballistic missiles of the potency which the Soviets could hurl against them by the time the centers became operational. The NORAD commander protested, labeling the move "a decided step backward in our limited capability for air defense." But OSD approved, and the Air Force and JCS concurred. On 26 March 1960, Acting Secretary of Defense James H. Douglas officially cancelled the program, allowing only the soft SAGE program of 3 CC's and 21 DC's (plus the training DC at Kansas City). As for Canada, the CADIN plan for replacing the manual center at St. Hobert with an underground CC/DC at North Bay and expanding and converting the Canadian radar system to SAGE would continue. However, since no solid state computers would now be ordered, the North Say center would be furnished with a modified AN/FSQ-7.[7]
>
> In summary, the expense of constructing underground centers and of purchasing the improved computers figured importantly in the decision to cancel the SCC plan. Equally important, the planners feared that even if the money were spent on the project—at the expense, perhaps, of other vital programs—the ability of the system to function after a missile attack remained in doubt. For one thing, they felt the SCC's could not be dug in deeply enough to prevent their destruction: for another, hardening the SCC's alone would not assure overall system survival. Since it would be too costly and time-consuming to harden every element of the system, it was better just to scrap the SCC project entirely before construction started.[8]

The cancellation of the SCCs meant that an alternative had to be devised to harden the existing system. The plan chosen was offered by NORAD and was subsequently described by President Kennedy and Secretary McNamara in the spring of 1961 (see p. 25 of Main Chapter text on McNamara's April testimony). The plan called for "…re-equipping certain radar stations and allowing them to assume manual control of weapons upon the destruction of their parent DC's."[9] In addition to this manual backup plan, a major assessment of SAGE was requested by McNamara. DDRSE was tasked with this evaluation, and in its report of May 1961 recommended that "…the Air Force divert much of the money allocated for improving antibomber sensors to backup command and control and other survival systems. SAGE should continue to be viewed only as a pre-battle system."[10] On 5 June 1961 McNamara notified the Air Force and the JCS that he agreed with DDR&E's concept of SAGE and emphasized that current and future air defense funds should be concentrated on the backup control system, missile early warning, and interceptor dispersal.

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[6] Memo, B/G J.A. Dunning, Dep Dir/War Plans, D/Plans, 9 Nov 1959, subj: Re-examination of Air Defense Program, in RL (59) 25; memo, Dr. H.R. Skifter, Asst DDR&E, to U/SAF, 28 Nov 1959, subj: Computers for the SAGE SCC's, in RL (60) 25.

[7] Memo, M/G H.T. Wheless, D/Plans to CSAF, 7 Jan 1960, subj: SAGE SCC's, with atch, subj: Talking Paper on SAGE SCC's, in RL (59) 25; memo for record by Col. A.R. Shiely, Jr., Dir/Ops, 29 Dec 1959, subj: OSDRCAF Air Defense Meeting, in RL (59) 25; memo, CSAF to JCS, 17 Mar 1960, subj: SAGE SCC's, in RL (59) 25; JCSM-113-60, 18 Mar 1960, subj: SAGE Super Combat Centers, in RL (60) 25; Actg SOD to JCS, 26 Mar 1960, subj: SAGE SCC's, in OSAF 153-60; ltr, CINCNORAD to JCS, 29 Jan 1960, subj: Super Combat Center, in RL (59) 25; ltr, CSAF to CINCNORAD, 30 Mar 1960, subj: Revised Air Defense Program, in RL (60) 25; CSAF to Air Staff, 31 Mar 1960, subj: Revised Air Defense Program, in AFCHO files; Erwin paper.

[8] Memo, Hester to SAF Ofc/Leg Ln, 12 Apr 1961.

[9] STURM (APPENDIX SOURCE), p. 24.

[10] DDR&E Rpt on Project No. 23, 1 May 1961, in RL (61) 3; Decision on JCS 1899/649, 26 May 1961, subj: Staff Study for SOD Project No. 23, in RL (61) 3; memo, SAF to SOD, 21 Apr 1961, subj: Questions Relative to the Future of the SAGE System, in RL (61) 3.

In a request for a major air defense review, McNamara asked the JCS to list alternate methods for a system which could *absorb a missile attack and then counter a small (300–500) follow-on bomber attack*.[11] This review was delegated to NORAD, which issued a final report in August 1961 calling for the equipment of 70 radar stations with their own computers—a small, dispersed SAGE system.[12] OSD agreed to this concept of a backup (BUIC) system, but bucked the plan back to the Air Force in its service budget submission phase directing that funding for it would have to come from other existing projects. The Air Force reduced purchase orders on items such as improved radars to compensate for BUIC funding, and the plan was approved on 13 March 1962 by Deputy Secretary Gilpatric. The character of the new plan is clear below:

> JCS summarized the rationale of the new plan in a reply to the NORAD commander after he had asked for reconsideration of center hardening. Let the BUIC program continue as planned, the NORAD commander had proposed, but only as a "stepping stone" to a hardened form of SAGE. JCS replied that cost and length of time to complete a hardened system militated against such action: "Since time is of the essence, the only feasible and timely solution available appears to be a dispersed back-up system which together with the primary SAGE control facilities, provides a degree of redundancy that will insure some survivable command and control capability.[13]

McNamara desired consideration of the closing of C^2 stations whole value was limited by the changing nature of the threat. To this end he asked CINCNORAD General Gerhart in the summer of 1962 to consider phasing out some of the early warning stations to reduce operating costs without degrading system capabilities.[14] The CINCNORAD plan in response to this tasking, submitted in September 1962, suggested the closing of 10 SAGE Direction Centers and 20 radar stations by June 1964 to purchase 12 squadrons of an improved manned interceptor (IMO and a mobile BUIC system, the "transportable control environment (TRACE)." The Air Staff agreed with a trade-off for the IMI, but disagreed with the amount of equipment proposed to be phased out.[15] The Air Force proposal was for reduction of five DCs and six radar stations during FY 1964.

McNamara's response to these proposals was more drastic than the phasedown of either of them. On 13 November 1962 he sent the military departments his decision on air defense planning for the next 5 years asking for their comments. The bomber threat, he suggested, was in the form of a small follow-on attack to an initial missile attack. The air defense system needed major reorganization since it cost $2 billion a year to operate but could not destroy more than a few percent of the follow-on bombers. The IMI would not be funded for FY 1964 because by its design it could not survive a defense suppression attack; TRACE would not be funded because the control needs of a future interceptor were not known.[16] He also recommended the

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[11] Memo, SOD to Mil Depts & JCS, 5 Jun 1961, subj: SAGE Reorientation, encl to JCS 1899/654, in RL (61) 3; memo, Mil Asst, Dep SOD to JCS, 14 Jun 1961, subj: Continental Air Defense Study—Project 126, encl to JCS 2101/434, in RL (61) 3; JCS 1899/660, 5 July 1961, in RL (61) 3; JCS 2101/434/2, 10 Aug 1961, subj: Continental Air Defense Study (Project 126), in RL (61) 3; memo, SOD to Mil Depts, 22 Sep 1961, subj: FY 1963 Program Package Guidance, encl to JCS 1800/471, in RL (61) 3.

[12] NADOP 63–73, 27 Jul 1961 (Supplement to NADOP 63–67); memo, D/Plans to DCS's, Dirs et al., 26 Sep 1961, subj: Project 126, NORAD Ten-Year Alternative Air Defense Plans, in RL (61) 3; memo, JCS to SOD, 18 Aug 1961, subj: Continental Air Defense Study (Project 126), in RL (61) 3; msg XPD-4, ADC to CSAF, 22 Jul 1961, in RL (61) 3.

[13] Memo, CINCNORAD to JCS, 30 Aug 1961, subj: Survivability of SAGE, in RL (61) 3; JCSM-1239-61, 16 Nov 1961, subj: Survivability of SAGE, in RL (61) 3.

[14] Memo, SOD to CINCONAD, 16 Aug 1962, subj: Improved Manned Interceptor, in RL (62) 3; memo, SOD to CINCONAD, 22 Aug 1962, subj: Actions Stemming from the 14 August Conference, Headquarters NORAD, in RL (62) 3.

[15] Memo for Record by D/Plans, 27 Sep 1962, subj: RCAF/USAF Meeting re NORAD Report on Manned Bomber Effectiveness, in RL (62) 3.

[16] Memo, SOD to JCS, 13 Nov 1962, subj: Continental Air Defense, with atch, 12 Nov 1962, subj: Draft Memo of SOD to President, in RL (62) 3.

closing of 22 long-range radar stations and 10 SAGE DCs by the end of FY 1965. He gave three reasons for these closings: (1) the system effectiveness would not be impaired; (2) his desired posture would be more closely approximated; (3) funding requirements would be eased.[17]

NORAD, the JCS, and the Air Force disagreed with the McNamara position. The JCS warned against making such severe reductions before introducing the IMI; in this situation the system would not be effective. The Air Force submitted an official "reclama" stating that a substitute for the SAGE elements was necessary before they could be phased out, else a "militarily unsound" situation would result. NORAD protested the "premature" closings.

Regardless of these protestations, Presidential approval was gained for the McNamara plan in early 1962 and an initial close down of 6 QCs and 17 radar stations occurred by the end of FY 1964.[18]

The general course of the air defense system was thus clear; continuing study of the system was directed, to evaluate future needs. In December 1962 Secretary of the Air Force Zuckert was charged with undertaking a study of the ". . . orderly phase down of the NORAD ground environment . . ." by DDR&E.[19] In January 1963 Secretary McNamara expanded the scope of this Continental Air Defense Study (CADS) to include air defense weapons and control systems through 1975. On 13 May 1963 the Study was submitted, calling for a phase down of SAGE centers as programmed BUIC centers were expanded from 34 to 46. An airborne warning and control system (AWACS) of 42 aircraft would be established to replace Navy aircraft and picket ships, and FAA and air defense operations would be merged to reduce radar stations.[20]

The response to CADS was that:

> OSD did not comment officially on the CADS report or on the NORAD, USAF, and JCS commentaries concerning it. As he had done the year previously, McNamara in early October 1963 circulated a draft of the recommendations he planned to send the President on the fiscal year 1965 air defense budget. Again, he elected to defer decisions on major improvements to the system, observing that he could not make them until, there were firm plans on such programs as civil defense and antiballistic missile defense. At the same time, he stated that he was considering further cuts in the antibomber defense during the coming year, among them the closing down of more SAGE centers and radar stations.
>
> The Air Staff and JCS recommended that McNamara postpone further reductions in weapon and warning and control systems until he had approved the Improved BUIC, AWACS, and Integrated DOD/FAA radar operation proposals and they were functioning. He subsequently modified his decision on the closings, directing on 27 November 1963 that only four additional SAGE DCs be closed in fiscal year 1966 and two SAGE CCs in fiscal year 1968.[21]

While the phasedown was therefore to occur more slowly than anticipated earlier, the direction was still very much downward. The same phenomenon is, of course, reflected in the Congressional testimony of the main text. While it is not clear that all service (including Army and Navy) interaction on the phasedown is shown by this appendix, it does suggest the substantive disagreement which existed over the possibility of degrading system capabilities without replacements for them. Congress, OSD and DDR&E favored cut-

[17] Ibid.; Hitch Statement, memo, OSD Compt to SAF, 4 Dec 1962, subj: Improved Manned Interceptor, cited in Hist, D/Plans, Jul–Dec 1962, pp. 37–8.
[18] JCSM-933-62, 21 Nov 1962, subj: Continental Air Defense, in RL (62) 3; memo, L/G G.P. Disosway, DCS/O, to DCS/P&P, 17 Nov 1962, subj: Operations Position on the Proposed Memo for the President on Continental Air Defense, in RL (62) 3; Hist, D/Plans, Jul–Dec 1962, pp. 42–3; memo, B/G R.F. Worden, Dep Dir/Plans, DCS/P&P, to CSAF, Jan 1963, subj: Background Paper on Phase-Down of 6 SAGE Centers and 17 Long Range Radars, in RL (63) 3.
[19] Memo, DDR&E to SAF, 13 Dec 1962, subj: Reductions of the NORAD Ground Environment, in RL (62) 3.
[20] Rpt by CADS Gp, 10 May 1963, Continental Air Defense Study, in RL (63) 3; msg 77938, CSAF to CINCONAD, 11 Jul 1963, in RL (63) 3; ltr, L/G D.A. Burchinal, DCS/P&P, to CINCONAD, 19 Aug 1963, subj: Transmittal of Conclusions and Recommendations, Continental Air Defense Study (CADS), in RL (63) 3.
[21] Talking Paper, as in n 44; Hist, D/Plans, Jul–Dec 1963, pp. 119, 93–94; USAF Current Status Rpt, Jan 1964, p. 3–25.

backs in the existing system: the JCS, CINCNORAD, and the Air Staff disagreed to varying degrees about the cutbacks unless expenditures were made at the same time on more efficient replacement components.

Several factors can be listed which served as the "why" for the phasedown which occurred:

(1) The composition of the Soviet threat changed;
(2) System costs and budgetary constraints were linked;
(3) Other programs had higher priority;
(4) Congress scrutinized air defense expenditures because of the changed threat;
(5) After the 1958 DOD reorganization, the services had less control than did OSD over the budget;
(6) Hardening existing components won out as a concept over building new components;
(7) The lead time for new components was too long given the changed threat;
(8) The existing system was not effective according to Secretary McNamara, for it could destroy only a "few percent" of the incoming bombers.

Annex 4

Threat Assessments in a Secondary Source

Perhaps one of the most interesting aspects of threat definition and its impact on U.S. defense is the extent of agreement and/or disagreement among major actors in the intelligence community over the actual and expected threat posed by the U.S.S.R. Evidence recently made available suggests some of these divergent opinions on specific aspects of the threat and offers a real insight into the complexity of decision-making in the face of soft evidence. While the exact impact of these divergent opinions on American air defense strategy is not clear, the general impact seems to be that precise phasing of the defense effort is impossible because of the lack of hard empirical evidence about aspects of the threat.

Several examples are presented here to show the substantive differences of opinion which have existed as well as the rationales for them.

In 1961, Soviet ICBM strength was assessed at a range of 10–25 launchers; it was expected that this force level would increase with the introduction of a new missile in the latter half of 1962 to a level of 75–125 operational launchers in mid-1963.[1] A graphic portrayal shows several opinions which diverged from this estimate:

Table 4-1—Operational Soviet ICBM Launchers, 1961–1964

	Mid-1961	Mid-1962	Mid-1963	Mid-1964
Director of I&R, DOS	75–125	150–300	200–450	N/A
ACSI, DA, and ACNO(I)	"a few"	50–100	100–200	150–300
ACSI, USAF	120+	300	550±	850

Table Source: See Footnote 1

From information available to us, the Director of Intelligence and Research, Department of State, believed that the launcher estimate should include an estimate of the largest ICBM force which the U.S.S.R. could have in mid-1961, which could be 200 launchers. While no evidence was available for his reasoning on other projections, it may be inferred that this was at least one factor in them. ACSI, DA, and ACNO(I), believed that the actual rate of increase would be particularly determined by ". . . the point in time when the Soviets have developed a new and less cubersome [sic] ICBM that can be more easily deployed."[2] ACSI, USAF, believed that the major determining factor in the development of Soviet force goals was that the ultimate elimination of the United States required a ". . . clear preponderance in military capabilities."[3] This

[1] "Available Information in Answer to BDM Corporation Questions by Years." OACSI, DA, Washington, D.C. 1975. No page numbers exist in the document, information is from 1961.
[2] Ibid.
[3] Ibid.

motivation also probably affected his estimate of Soviet Long-Range Aviation: where the suggested figure was about 150 heavy bombers and tankers, the ACSI USAF figure was 175; where the number of bombers which could be placed over the U.S. in two-way missions was suggested to be 200, his figure was 300.[4]

Other examples exist of the differences in estimates between one set and those of ACSI USAF. In 1963 it was suggested that 90–115 Soviet heavy bombers could be put over the U.S. on two-way missions, with another 150 medium bombers over several target areas including portions of the Northwestern U.S. From our information, ACSI USAF reasoned that this perception seriously underestimated the manned aircraft threat to CONUS and believed that a total of all such aircraft ". . . could exceed 500."[5] Where another estimate in the same year was that the Soviet heavy bomber strength would decline to about 130–175 by 1969, his figure was ". . . at about 200 or somewhat larger."[6] He also believed the Soviets would introduce a follow-on heavy bomber where the other estimate did not, and that instead of a projection of 400–650 medium bombers and tankers for 1969, the figure would be 900. Other differences can be portrayed graphically:

Table 4-2—Estimated Soviet Heavy and Medium Bombers over the U.S.

	1964	1966
Projection 1	250+[a]	100+[a]
ACSI, USAF	500+[b]	400[c]

[a] Two-way missions
[b] One and two-way missions
[c] Type of mission not clear

Table Source: See Footnote 1

Evidence exists of similarly divergent opinions among key intelligence personalities over the Leningrad "ABM" system in 1962. The Director, DIA, ACSI, DA, ACNO(I), ACSI, USAF, and the Director for Intelligence, Joint Staff, believed that the system should not be characterized as one with an operational anti-ICBM capability since this fact could not be substantiated.[7]

All of these examples point to the complexity of reasonably assessing the existing threat posed by various Soviet systems. While other reasons surely existed for the divergent opinions expressed in these cases, our available evidence does not offer an insight into what they might be. It can at least be said that a major variable in dissimilar perspectives was the lack of definite information on the threat, and varying interpretations of that information which existed.

[4] Ibid.
[5] Ibid., 1963.
[6] Ibid., 1963.
[7] Ibid., 1962.

Annex 5

Changing Threat Estimates, 1954–1956

This annex provides a "snapshot" of changing U.S. estimates of the Soviet strategic threat during the 1951–1956 period. The time frame is particularly crucial because of the previously described impetus given to the U.S. air defense system during these years; it also shows early precedents which contributed directly to the post-Sputnik step-up of the U.S. IRBM/ICBM programs. Because of the sources of these estimates, they offer a very real insight into the outlook of the estimators at the time, unbiased by retrospective reflections which may tend to color the salience and potency of the ascribed threats. A total of six major descriptive vehicles are used in this annex to portray the threat:

(1) NSC 5422/1, approved by President Eisenhower on 7 August 1954;
(2) The Robert C. Sprague estimates of July 1954 and their interface with the NSC Net Capabilities Evaluation Subcommittee estimates of fall, 1954;
(3) A USAF-RCAF estimate of fall, 1954;
(4) The Killian Report, spring, 1955;
(5) WSEG Report No. 15 of fall, 1955; and
(6) NSC 5606, June 1956.

Conclusions about the judgments reflected in these documents are assembled in summary fashion at the end of the annex.

1. NSC 5422/1

In the summer of 1954, U.S. Basic National Security Policy (NSC 162) took specific account of the perceived improvements in Soviet strategic capabilities. Approved by the President on 7 August 1954, NSC 5422/1 contained a statement of policy guidelines under NSC 162/2 which appears, in retrospect, to have set the tone and ordained the framework of subsequent U.S. national strategy. These 1954 guidelines built on the view that:

> There have been substantial changes in the intelligence estimates of certain current and future capabilities since the adoption of NSC 162/2 particularly in regard to estimates of increased Soviet nuclear capabilities in weapons and delivery systems. . . .
>
> It is estimated that . . . an increasing fear of Soviet nuclear capabilities will continue to influence adversely the cohesion of our alliances for the foreseeable future. . . .
>
> With the growth both in Soviet nuclear capabilities and in the power of nuclear weapons themselves, in the period 1956–1959, a total war involving the strategic use by both sides of nuclear weapons would bring about such extensive destruction as to threaten the survival of Western civilization and the Soviet regime.
>
> Under the circumstances, the freedom of either side to initiate the use of strategic nuclear bombing against the other may be circumscribed by:
>
> a. The fear of the effects of retaliatory use of such strategic bombing.
> b. The possibility that neither side would gain a decisive military advantage from such an exchange of nuclear blows.
>
> This situation could create a condition of mutual deterrence. . . .

Projected Soviet strategic capabilities for attack caused substantial U.S. efforts to reduce the vulnerability of strategic forces overseas. Concepts of basing changed. SAC mobility plans were put aside in favor of increased procurement of B-52's; basing aircraft in the United States; and providing augmented capabilities for prestrike air refueling and post-strike recovery and staging overseas. The estimated threat foreseen in the capabilities of Soviet Long-Range Aviation also prompted the subsequent development of a counterforce strategy and an effort to reduce SAC vulnerability in the United States by increasing emphasis on, and defense programs for, improved warning, dispersal, ground alert, reflex, and airborne alert. (Section 11, Chapter IV refers to active defense of SAC bases.)

Paradoxically, as the vulnerability of the U.S. strategic deterrent grew as a function of Soviet capabilities, the Eisenhower Administration made strategic air power central to U.S. security policy and strategy. NATO strategy was, in the mid-1950's, made dependent upon the early availability of nuclear weapons in a major military conflict. The burden of European defense shifted and NATO's defensive posture depended less on the U.S. mobilization base than on in-being nuclear ready forces. The credibility of the U.S. guarantee of NATO security became linked to the vulnerability of American strategic forces.

These developments gave rise to an increasing need for judgments on the relative military balance. In the early summer of 1954, the NSC called for preparation of a report assessing the net capabilities of the U.S.S.R., in the event of general war, directly to damage the continental United States and key U.S. installations overseas (NSC 5423). The report, due to be submitted to the NSC on 1 November 1954, was to cover the period through 1 July 1957. Among other factors bearing on the development of the report of the Net Capabilities Evaluation Subcommittee[1] of the NSC was a concern for U.S. second-strike capabilities derived from substantial tornado damage to SAC aircraft in Texas the year before and a recently completed report to the NSC (NSC 143/1) concerning the estimated effects of a Soviet surprise attack on SAC, which had been prepared by a group headed by retired Air Force General Idwal H. Edwards.

2. The Sprague Estimates and the NSC Net Capabilities Evaluation Subcommittee

While the existing U.S. continental defense policy (NSC 5408) built on and repeated earlier intelligence judgments which held that although the Soviets had "a growing capability to launch an aggressive attack on the United States," it was "unlikely that the Kremlin will deliberately initiate general war during the period covered by current estimates," in the spring of 1954, revised Intelligence on Soviet bomber production and special estimates developed for the Net Capabilities Evaluation study caused Robert C. Sprague, a special consultant to the NSC Net Capabilities Evaluation Subcommittee to drastically revise his estimate of the threat to the United States. Sprague considered the continental defense policy inadequate for U.S. security; in July 1954, as a consultant to the NSC, he recommended changes in the current continental defense program (NSC 5408), intended to achieve by 1957 a U.S. air defense objective of 95 percent kill capability against attacking aircraft. Sprague, who was close to Senator Saltonstall, James Killian, and Robert Cutler, visualized the only alternative would be preemptive action by the United States against the U.S.S.R. before 1957. He, therefore, recommended to the NSC in July 1954 that the Net Capabilities Evaluation Subcommittee be directed to include in its November report an estimate of

[1] Subcommittee established by NSC would consist of chairman, JCS; Director of Central Intelligence; Chairman of the Interdepartmental Intelligence Conference; Chairman of the Interdepartmental Committee on Internal Security; Director of Defense Mobilization, the Director of the Federal Civil Defense Administration; and the Chairman, Atomic Energy Commission.

the overall maximum acceptable damage to U.S. cities and key target areas based on assessments of the maximum acceptable number of U.S. deaths and other casualties and the maximum acceptable damage to U.S. military installations and war Industries. He urged adoption of one basic assumption for use in the Subcommittee's evaluation: viz., by 1 July 1957, the Russians will probably be able to attack the continental United States with bombers carrying as many as 80 ten-megaton bombs and 400 sixty-kiloton bombs. (Soviet bombers would include not only the TU-4s, but Type 37 [heavy jet] and Type 39 [medium jet] aircraft in approximately equal numbers.) Sprague recommended that, since it was probable that an adequate U.S. defense against such capabilities could not be obtained by 1 July 1957 without the use of nuclear warheads on air-to-air and surface-to-air missiles, the NSC might wish to direct the Department of Defense to provide for the development of such warheads, to be operational by 1 July 1957. Sprague looked to the possibility of greatly improving U.S. air defense capabilities and visualized very high kill probabilities to result, particularly if the planned U.S. 1957 fighter-interceptor force were equipped with air-to-air missiles with atomic warheads.[2] (While Sprague had been nominated to be Undersecretary of the Air Force in 1953, he turned down the position because it would have required him to give up substantial stock in his company, the Sprague Electric Company.)

Complementing and extending Sprague's thinking, the Killian report in early 1955 also urged adoption of nuclear warheads as the major armament for U.S. air defense systems (already approved by the JCS) and the development, procurement, and deployment of sufficient weapons to provide high kill probabilities by U.S. air defense systems. Killian, like Sprague, stressed the need for more effective defense at low and very high altitudes. Their views conceivably derived from, or were influenced by, the detailed analysis, review, and critique of the "probable Soviet strategy and plan of attack as of mid-1957" which was developed and used during the fall of 1954 by the NSC Net Capabilities Evaluation Subcommittee.

In summary, as the Subcommittee then visualized it the Soviet plan of attack would include the following principal elements:

a. Probable Soviet Strategic Concept

(1) By 1957, strategic air capabilities have increased but not enough to permit the U.S.S.R. to rely on decisively defeating the United States by direct attack. The main weight of Soviet military capabilities (in quantitative terms) would still be geared to a continental strategy.
(2) Highest priorities in timing and allocation of resources, though not in weight of effort, would go to the attack of U.S. and Allied strategic retaliatory power, secondarily to attack other targets in the U.S.
(3) Soviets would be willing to delay mobilization and assembly in forward areas to avoid Allied detection of preparations.
(4) The Soviets would prefer non-nuclear war, but regarded surprise attacks with nuclear weapons against Western strategic installations and forces as a vital first move in any war plan.

b. Soviet Objectives

(1) Protecting the warmaking capabilities of the U.S.S.R. and the Soviet Bloc from Allied attack
(2) Preventing or neutralizing U.S. warmaking potentials
(3) Driving U.S. and Allied forces back from proximity to the Communist power center to the extent that a successful counter offensive would be extraordinarily difficult.

[2] Record Group No. 319, Records of Joint Actions, Department of the Army, Army Staff, DCSOPS, JCS Papers, National Archives Building (hereafter RG 319), JCS 1899/245, 28 September 1955.

c. Soviet Allocation of Resources

Aircraft—Estimated operational long-range air strength 1,400 aircraft. Of these, 900 aircraft would be launched from the Chukotski-Leningrad-Kola areas, backed by 300 refueling tankers launched from the Moscow area. (Light bombers would be committed to a maximum effort against Eurasian targets with range.)

Nuclear—Total Soviet stockpile—800 Crits[3] of fissionable material. Allocations:

(1) D-Day attacks on the United Kingdom and Canada—80 Crits (10%)
(2) D-Day attacks on U.S. overseas installations—100 Crits (16.5%)
(3) D-Day attacks on the continental United States—540 Crits (67.5%)
(4) Reserve for reattack on the United States—40 Crits (5.0%)
(5) Reserve for reattack and support of land battle—20 Crits (2.5%)
(6) Reserve for "political" targets—20 Crits (2.5%)

d. Probable Soviet Plan of Attack on Continental U.S. (Excludes Canada)

Aircraft Launched	Aborts and Gross Errors	Interceptor Kills	AA Kills	Aircraft on Target
763	189	251	245	62 Atomic Bombers
	(25%)	(33%)	(32%)	6 ECM (10%)

Data used by the NSC Net Capabilities Evaluation Subcommittee provided a basis for review by the JCS and military Services because they had furnished much information and input. Mr. Sprague also commented to the NSC on the Soviet strategy and plan envisaged by the Subcommittee. He was increasingly concerned with:

(1) The probability that the Soviets soon would have a significant stockpile of 5–10 MT bombs;
(2) The devastating hazard to unprotected persons of radioactive fallout resulting from ground bursts of multimegaton nuclear weapons;
(3) The growing problem of providing the U.S. air defense system with adequate early warning, interception, and kill of Soviet Type 39 (medium) jet bombers at high altitude.

He had analyzed the Subcommittee data and noted among other basic assumptions used that U.S. GCI, AEWC, and Texas Tower radars and picket ships were expected to have good range capabilities at 50,000 feet against Type 39 aircraft. He pointed out, however, that while the Subcommittee report assumed a 250 NM range capability for those radars at 50,000 feet as of mid-1957, the actual capability would approximate 120 NM at 40,000 feet. He observed that U.S. B-47s regularly overflew U.S. defenses at altitudes above 40,000 feet and were undetected. Sprague also questioned the Subcommittee's assumption that, by mid-1957, 1,400 of 1,725 fighter interceptors programmed to be operational with the Air Defense Command would have the capability for "fighting effectively" at altitudes between 50,000 and 60,000 feet, noting that while the defensive fighters F102A and F86D could reach 50,000 feet and the F89H about 45,000 feet, the latest U.S./UK intelligence assumed that the Type 39 bomber could arrive over the United States at 50,000 feet. Sprague then pointed out that a fighter performing a high altitude maneuver to accomplish an intercept

[3] Assumed to mean "critical masses."

could be expected to lose 8–12,000 feet in attitude. He conceded the possibility that low altitude deficiencies in the U.S. air defense system could be corrected by 1957. Such critiques emphasized the need for detailed analyses of a variety of technical capabilities in net assessments and encouraged the development of different groups for the purposes.

3. The USAF-RCAF Estimate

U.S.-Canadian defense planning also stepped up with the revised 1954 estimates of Soviet capabilities. An approved basis existed in a U.S.-Canadian "Basic Security Plan" (MC 100/9) dating from the summer of 1951. Under it, two recurring documents were called for. These were:

(1) Canada-U.S. Emergency Defense Plan which was a capabilities plan for the employment of such defense forces as were currently allocated. (As of mid-1954, the approved plan was MCC 300/5—-i.e., Military Cooperative Committee 300/5.)
(2) Canada-U.S. Future Defense Analysis, a continuing study of desirable measures for defense of the warmaking capacity of Canada and the U.S. in the period beyond presently approved national defense policy.

During the summer and fall of 1954, the Canadians demonstrated particular interest and concern for continental defense. Based upon the 3rd interim report of the Canada-U.S. Military Study Group dated 23 June 1954, the Canadians proposed the DEW line be established. In addition, they called for seaward extensions for the developing U.S.-Canadian radar nets in order to provide more adequate early warning for Southeastern Canada and the Northeastern United States.[4] Canada showed specific concern for fallout problems associated with active defense against Soviet attack and, in October 1954, called for a joint U.S.-Canadian study of the matter.[5]

During the fall of 1954, the U.S. and Canadian Chiefs of Staff agreed that current intelligence estimates used in 1954 in preparing "Future Defense Analysis," and contained in ACAI, 18 February 1954 ("Agreed Canadian American Intelligence 31 Soviet Capabilities and Possible Courses of Action Against North America in a Major War Occurring in Mid-1958"), had underestimated the Soviet capacity for conducting an air offensive against North America.[6]

To determine the required military characteristics of the DEW line, a reevaluation was needed and they noted that current estimates, in addition, covered the situation only to 1958. They felt it would be necessary to extrapolate the most recent, agreed intelligence, using the best information available, on future Soviet capabilities, and to project these through at least 1965 in order to assist in the development of the DEW requirement and to determine the characteristics needed in that system.

On the basis of the latest U.S. Air Force estimate of the Soviet threat, a combined U.S.-Canadian committee (USAF-RCAF Military Characteristics Committee) soon concluded in the fall of 1954 substantially that:

> High performance jet bombers were available in Soviet operational units. Performance characteristics of these aircraft and numbers available by 1957 would provide a capability for conducting large-scale opera-

[4] RG 319, Enclosure "A," Memo for the Director, WSEG, Subject: WSEG Report No. 15, JCS 1899/251, 15 February 1956.
[5] RG 319, JCS 1899/248, 7 February 1956.
[6] Ibid. This estimate, which included no thermonuclear weapons in its statements of the Soviet nuclear weapon stockpile, provided no data other than mid-1954 and mid-1955 estimated weapon totals and possible yields. It qualified these with the remark ". . . the specified models assumed may be as low as one-third less or as high as twice the figures stated."

> tions with atomic and thermonuclear weapons against all critical target areas in North America. Radar cross-section (head-on) would approximate one square meter. Altitude capability would approach 55,000 feet and the aircraft would have a speed near Mach 1.
>
> Cruise missiles would be available to the Soviet Union in the 1960–1965 period which could threaten North America. Performance characteristics would approximate those of the U.S. missile Navaho. A warning requirement was to have a detection capability against this weapon system up to 100,000 feet.
>
> Soviet intercontinental ballistic missiles would be operational by 1960 and be a major threat by 1965.[7]

4. "Meeting the Threat of Surprise Attack," Technological Capabilities Panel (Killian) Report

Early in 1955, the Science Advisory Committee of the Office of Defense Mobilization submitted a report to the President which had been prepared at his suggestion to consider, from the point of view of science and technology, steps which could be taken to reduce the danger of surprise attack on the United States. A panel, headed by Dr. James R. Killian, Jr., prepared the report, which examined the relative technological capabilities of the U.S. and Soviet strategic attack and homeland defense systems. A specific feature of this report was the provision of a time table which compared anticipated future relative strengths of the United States and Soviet Union. This time table evolved into a period of technological stalemate which might occur as early as 1965 during which both the Soviet Union and the United States would have essentially the same capabilities, in that attack by either side would result in mutual destruction. Both the United States and the Soviet Union would be in a position from which neither could derive a winning advantage. Circulated in the Executive Branch during the first half of 1955, this report influenced U.S. security policy which then closely focused on the question of U.S. vulnerability to surprise attack. The Killian report, entitled "Meeting the Threat of Surprise Attack," stated:

> . . . Clearly the consequences of surprise are so great that every effort to eliminate it is justified.
>
> For the first time in history, a striking force could have such power that the first battle could be the final battle, the first punch a knockout. Thus, surprise takes on a wholly new significance.[8]

The Killian report pointed up current Soviet capabilities for intercontinental attack, stated that critical U.S. targets were relatively few and that "200 nuclear bombs of megaton and kiloton yield . . . could decisively defeat us and . . . a first attack could be fatal if we were surprised and unprepared."[9] After underscoring SAC vulnerabilities, the report specified deficiencies of the U.S. continental air defense system saying:

> The system now sketched out for continental defense is the largest integrated system ever conceived to perform a specific task. It is, unfortunately, not yet being planned as an integrated entity. There exists no agency with both the competence and the authority to do this planning. There is inadequate coordination between operating and development agencies. The development of specific weapons and equipments is often spread through a number of laboratories and contractors with insufficient attention to overall system needs. The procurement and operational introduction of already-developed equipment is slow and cumbersome. Promptness and decisiveness are lost through wide dispersion of the decision-making process.[10]

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[7] RG 319, Tab "A," Background, DCSOPS, Memo for: Chief of Staff, U.S. Army, 11 June 1956, Subject: Continental Defense (NSC 5606) (JCS 1899/272).
[8] RG 319, JCS 1868/584, 3 April 1956.
[9] U.S. intelligence estimates of the Soviet nuclear weapons stockpile at the time generally credited the U.S.S.R. with this level of capability.
[10] RG 319, JCS 1899/278, 1 August 1956.

The Killian report included in its recommendations the development of: (a) U.S. ICBM, and (b) IRBM—(both ship-based and land-based versions), (c) nuclear warheads for air defense weapons, and (d) through intensified efforts, effective low-level and high-altitude defenses. Specific U.S. air defense measures recommended provided for:

(1) Further development of air-to-air and ground-to-air missile systems.
(2) Drastic revision of the function and traditional form of interceptor aircraft in order to fit them as launching platforms for guided missiles.
(3) Strong, balanced programs of theoretical and experimental investigation of problems in the interception and destruction of ICBMs.

The NSC noted and discussed the report on 17 March 1955 and referred it to Executive Branch departments and agencies for study and requested their reports and recommendations by 15 May 1955.[11]

Killian's recommendations for rapid development of strategic offensive missile systems echoed in part the 1954 report of the "Teapot Committee," officially known as the Strategic Missiles Evaluation Committee set up by the Secretary of the Air Force, Harold Talbott, who had been asked by the Secretary of Defense, Charles E. Wilson, to review all U.S. missile programs with the idea of eliminating duplication and determining which systems should be accelerated and which should be dropped. The group was to "prepare a combined comparable analysis of the results of the individual Services' efforts to date in the development of the guided missile."[12] Talbott gave the job to his special assistant for research and development, Trevor Gardner, who decided to get an eminent scientific panel to carry out the missile study. The group set up included scientists of repute like Millikan, Kistlakowsky, and Wiesner plus a number of others under Von Neuman. This panel, using data on weight reduction prepared earlier for the Air Force by Von Neuman, had stated that the ICBM was feasible in the light of the thermonuclear breakthrough and urged a greatly expanded ICBM program. Von Neuman's figures on weights and yields were confirmed in the 1954 U.S. nuclear tests in the Pacific and, the month before Killian's report was submitted, the Air Force awarded Convair a contract for detail design and development of the reconfigured Atlas.

Killian's report, however, appeared to emphasize more the growth of Soviet strategic capabilities and projected a rapid rate of Soviet progress in long-range missiles. Its circulation in early 1955, therefore, gave added impact to the increasing number of intelligence reports and estimates indicating a growing Soviet threat. The Killian report provided another instance of a high-level ad hoc group proposing a variety of priorities for DOD programs and calling for specifically accelerated air defense measures.

5. WSEG Report No. 15—"Continental Defense"

On 4 May 1955, the JCS asked the Weapon Systems Evaluation Group to study the field of continental air defense.[13] Specifically, WSEG was asked: (a) to compare the basic assumptions, conclusions, and recommendations of five recent studies in the air defense field; (b) to analyze the conflicts between these studies and define areas not adequately covered by any of them; (c) to identify "hot spots" requiring special

[11] DOD Report RD 302/4, Subject: Report of the Ad Hoc Group on Low Altitude Aircraft Systems, July 1956, p. 6; Manuscript, Office, Chief of Ordnance Light AA Development Program, 1957, OCMH.
[12] RG 319, Enclosure to JCS 1899/263, 7 May 1956.
[13] RG 319, Enclosure A, JCS 1899/265, 5 June 1956.

action; and (d) to provide the Secretary of Defense and the JCS with WSEG's findings and recommendations, including a proposed continuing program of research and analysis in continental defense.

In its action on this JCS request, in addition to the Killian report, WSEG considered:

(1) A study by MIT, "Defense of North America" (Project Lamplight), 15 March 1955, which looked at the problems of extending outward the continental defense system including the probable role of the U.S. Navy
(2) A RAND study, "Active Air Defense of the U.S. 1954–1960," (R-250), 1 December 1953, which dealt with the attrition the defense system could inflict on a vigorous Soviet air attack carried out during the period 1954–1960
(3) A study by ORO, Johns Hopkins University, "Air Defense of the United States 1956–1965" (ORO-5-534) June 1955, which concerned the Army's contribution to continental air defense during the period with emphasis on the role of surface-to-air missiles in that defense
(4) A study by the USAF Air Defense Command, "Air Defense Requirements, 1954–1960" (ADR54-60), 1 July 1954 which developed requirements in manpower, logistics, intelligence, and research and development and proposed deployments of various weapon systems to defend the United States.

WSEG Report No. 15, "Continental Defense," concluded that the plans to extend the U.S. protective combat zone several hundred miles would be effective only if accompanied by realistic rules of engagement.[14] WSEG noted the need for both operations and requirements plans and pointed out that a formalized, established, and rehearsed air defense decision structure was required to meet the sudden needs of war and to make immediate decisions to initiate defense measures. WSEG also noted the existing disagreements on the location of the seaward extension of the DEW line and called attention to the air defense requirements for rapid handling of peak loads of warning and combat information in the face of possibly sudden surges, system failures, and enemy jamming.[15]

WSEG's report stressed the need for an effective, secure identification (IFF) system and concluded that guided missiles with atomic warheads were the only practicable air defense weapons to destroy, or nullify the fallout from, megaton weapons. The report called for increased high-altitude capabilities for fighters and improved low-attitude capabilities. WSEG considered the U.S. air defense system to be extremely vulnerable to enemy electronic countermeasures and indicated that, because the ICBM threat would be serious by 1960, supporting research for measures to deal with that problem was a particular requirement.[16]

The JCS reviewed the WSEG report, circulated summaries of the five basic documents considered by WSEG, and their comparative analysis as carried out by WSEG. However, the JCS concluded that their objective of establishing a continuing program of research and analysis by WSEG for the purpose of evaluating the distribution of the U.S. national effort and resources between defensive and offensive programs still remained to be realized.[17]

The mid-summer Department of Defense response to the NSC on the Killian report indicated agreement by the JCS and the Secretary of Defense with the ICBM development being made a national effort of the highest priority. The DOD noted the great increase in that program during the preceding year, with an

[14] NSC 5408, the U.S. national policy on continental defense, provided (paragraph 180, revised page 17) ". . . all possible efforts should be made to expedite the equipping of adequate forces with aircraft and missiles which will achieve a high 'kill ratio' before the enemy attack reaches our borders."
[15] RG 319, JCS 1899/281, 23 August 1956 with Note to Holders, and JCS 1899/283, 4 September 1956.
[16] RG 319, Enclosure A to JCS 1899/286, Subject: "Air Defense Requirements for U.S. Overseas Installations," 12 October 1956.
[17] RG 319, SM-902-56, dated 10 November 1956, and CM-400-56, 7 November 1956.

augmentation in planned funds for FY 1955 growing from $32 million to $180 million. DOD also agreed with the proposal for an IRBM program to include both land- and sea-based versions. The DOD response, however, evidenced some concern for the concept of nuclear warheads for air defense weapons. In part, at least, this reflected the Navy and Air Force view that this would affect established priorities; in particular, they believed that provision of nuclear warheads for Nike Ajax, because it would use the gun-type warhead, would be inefficient and reduce the atomic stockpile. (Implicitly the primacy of the offensive requirement for nuclear weapons may have been involved.) The Navy and Air Force indicated in the Spring of 1955 that providing nuclear warheads for Nike Ajax which was then operationally deployed, would compete for critical materials with "more efficient missiles" such as Nike B (Hercules) and Talos.

WSEG Report No. 15 had provided the JCS a variety of conclusions and recommendations that were technical in nature and wide-ranging in their implications for U.S. continental air defense programs. But, despite its evident focus on unresolved potential problems, WSEG 15 did not induce significant action. "Hot Spots" identified by WSEG 15 included (1) the organization of the continental defense effort; (2) defense deployment concepts; (3) information handling and weapons control; (4) weapons performance; (5) countermeasures for enemy ECM; (6) defense against ballistic missiles; and (7) supporting research for air defense.

One specific recommendation proposed that WSEG make an independent evaluation of the SAGE system including its capabilities, vulnerabilities, and its expected role within the overall continental defense structure.

While the review of WSEG Report No. 15 was going on, the Director, WSEG, also submitted a schedule of major studies to the JCS recommending, as a first priority effort, evaluation of the 1960 threat and the SAGE system. In February 1956, they informed the Director, WSEG, of their review and distribution of WSEG 15 and separately, requested WSEG to study the 1960 threat to CONUS and the SAGE system as a first priority and later to analyze:

(1) The effectiveness of surface-to-air and air-to-air missiles;
(2) The implication of fall-out from enemy atomic weapons on defensive weapon systems;
(3) The tactical employment and effectiveness of defense weapons against air-to-surface and intercontinental ballistic missiles; and
(4) Operational degradation of defense weapons by the use of ECM by an attacking force.

Thus, another in a continuing series of U.S. studies and assessments on continental air defense, both in and out of the Defense Department, got under way. Reasons for the continuing pattern and study of and revisions to "approved" programs included the changing intelligence, technological developments and differing interpretations of basic roles, functions and missions.

6. NSC 5606

Current intelligence (Annex D-NIE 11-56) on Soviet nuclear capabilities indicated that the U.S.S.R. might be able to strike a crippling blow at the United States by 1958, even earlier than was recognized to be significant during the course of the NSC Planning Board's 1956 revision of NSC 5408. Structuring from that estimate, the President asked the NSC Net Evaluation Subcommittee to prepare a statement on the effect which the new intelligence might have upon the conclusions contained in the 1955 net evaluation report.

The NSC Planning Board draft statement of policy (NSC 5606) was reviewed and commented on by the JCS in the light of the requirement it posed for an updated national policy statement on continental defense. NSC 5408 was being revised for the "long pull" and would, according to the Planning Board, no longer reflect details but constitute a fundamental policy. In the Planning Board draft, NSC 5606 delimited continental defense more narrowly than before to include only those elements of the U.S. national security structure, essentially defensive in nature, contributing directly to the defense of the North American continent and to the protection of U.S. capabilities to retaliate. Essential elements of U.S. continental defense considered by the JCS to be necessary included:

(1) Protection of U.S. retaliatory capabilities
(2) Improved strategic and tactical warning of enemy attack
(3) Development of an antiballistic missile capability
(4) Establishment of measures to deter covert nuclear attack
(5) Continuity of essential Government and industrial functions, and
(6) Improved and strengthened civil defense programs.

Summary

The central thrust of each of these various estimates can be summarized briefly for an overview of the perceived changing threat during these years. NSC 5422/1 (summer, 1954) revised upward both Soviet nuclear capabilities and available delivery systems. It bespoke the fear of Western allies of these capabilities, and suggested the possibility of an emerging mutual deterrence. If these factors indeed constituted the perception, it was surely not far from this portion of the estimate to its later indication of a U.S. desire for mutually beneficial arms limitation discussions and consideration of means to reduce the likelihood of holocaust.

The Sprague estimates (which received high level support in the summer of 1954) drastically revised his previous threat assessment based on: (a) an increasing Soviet bomber capability, (b) expectations of a large Soviet nuclear weapons stockpile by l July 1957. Sprague's call for a 95 percent kill capability against aircraft was likely a result of the perceived havoc which could be caused by delivery of even a small number of nuclear weapons to CONUS. Thus the concept of an "unacceptable loss" resulting from Soviet attack was different than what would follow later—a small loss was "too much" in this estimate, whereas the loss of millions became acceptable during years to follow because there was no adequate defense against the ICBM threat. While one of Sprague's solutions to the defense problems was nuclear warheads for air-to-air and surface-to-air missiles, the "solution" itself engendered complex population protection problems the likes of which would later plague ballistic missile defense.

The USAF-RCAF estimate (fall, 1954) reinforced the bomber threat to CONUS by anticipating a Soviet capability of attacking all critical U.S. targets with bomber-delivered nuclear weapons by 1957. Since it also suggested that a Soviet ICBM IOC would not occur until 1960 and that these ICBMs would become a threat only by 1965, the midterm threat was primarily an air-breathing one.

The Killian Report of spring, 1955 virtually picked up a ball that had not been successfully carried earlier. While seconding Sprague's estimates of our air defense deficiencies and the need to correct them, it also called for the rapid development of strategic offensive missiles (which had been judged feasible by other efforts listed here). Thus Killian portrayed *both* offensive might and an efficient defense as necessary to counter a rapidly growing Soviet threat.

WSEG 15 (fall, 1955) continued the appreciation for the complex problems of defense against the air-breathing threat in conjunction with the desire for early warning and rapid identification of the enemy. It upgraded the Soviet ICBM threat from that of the USAF-RCAF estimate by proclaiming it as a "serious threat" by 1960, suggesting the shortening distance between 1955 and an ICBM threat.

NSC 5606 (June, 1956) furthered this direction by describing the general threat as even closer downstream than had been anticipated. The focus of air defense was further honed to specific problem areas within it; continued reassessments were thus seen in this chain of estimates.

Four factors characterize these estimates and suggest antecedents to the topics covered in the body of this chapter. First, the Soviet manned bomber threat was revised and enlarged in light of changing intelligence. Secondly, the massive destruction engendered by nuclear weapons suggested the need to provide as close to a 100% defense against delivery systems as possible. Third, ICBMs/IRBMs came to be given the highest priority because of the anticipated threat; and fourth, the drive for detente was strongly impelled by the potential seriousness of nuclear holocaust.

Chapter III

Soviet Air and Defense Strategy

A. Introduction

The evidence which defines the nature and rationale of Soviet air and missile defense strategy is neither specific nor comprehensive. At the same time there is a question as to whether the Soviets themselves are completely clear on the what and why of their strategy. Still, this chapter attempts to define and analyze the what and why. In doing this it successively treats: (1) Soviet behavior in two of the more detailed records which exist; (2) major Soviet decisions in strategic defense to determine the extent to which they reflected or shaped strategy; (3) the major factors, based on the foregoing evidence, which appeared to shape strategy; and (4) a synthesis of the strategy.

B. Studies of Behavior

1. Introduction

The factual record for the period from 1955 to 1972 as to why the Soviets behaved as they did in developing their air and ballistic missile defenses is painfully thin. There are, however, several kinds of records which can be examined to see how the Soviets behaved. Three records, in particular, lend themselves to analysis, and in each case the data base is drastically different from the others.

The first record is the series of issues of the Top Secret Soviet journal *Military Thought* which was provided by Col. Oleg Penkovskiy. This record spells out the details of a major debate among the Soviet military on the conduct of modern war and the organization for it. The second record is the open press and radio account of Soviet public statements with regard to the question of antiballistic missile defense. We will examine these two sources in turn for the purpose of drawing tentative conclusions about the decisive factors that dictated Soviet air defense behavior. The third record, related in detail in Chapter V, draws upon most diverse sources and is the account of what the Soviet did physically in shaping each component of their air and missile defense forces.

2. The Great Debate In Military Thought

a. Introduction

The Penkovskiy reports provided a unique window for examining the Soviet military establishment of the 1960–1962 time frame. One of the more interesting parts of the reports from Penkovskiy consisted of a special Top Secret series of issues of the Soviet military journal *Voyennaya Mysl'* (Military Thought). The series served as a forum for debating the current and future needs of the Soviet Armed Forces and the doctrine for their employment. The authors of the articles were mostly in the grade span from colonel through general, although some marshals (for example, Chief Marshal of Artillery S. Varentsov and Marshal of the

Soviet Union R. Malinovskiy) also participated. Thus, those involved in the debate were clearly prestigious high-ranking officers of broad experience. The time was also a critical one. The Soviet Armed Forces had experienced heavy cuts and were undergoing major organizational changes. Missiles and nuclear warheads were being distributed throughout all of the offensive forces. The extensive deployment of surface-to-air missiles was changing the face of air defense. The problem of combating offensive ballistic missiles with defensive antiballistic missiles was adding the dimension of missile defense to what had previously been simply a requirement for air defense. The Berlin issue, stewing since 1958, had reached crisis proportions in 1961. Khrushchev had loosened up things in the military with his changes. If ever there was a time in Soviet history for debate over military roles and missions, this was it. If ever there was a time for thoughtful and innovative approaches which would help in the assimilation of the new weapons and concepts and save resources in the process, this was also it. But, as will be evident, with respect to air and missile defense the great debate was mostly a non-debate.

No single article of the series dealt comprehensively with the subject of the air and missile defense of the country. Two articles discussed antimissile defense in general, but did so mainly in light of foreign sources. Most of the attention devoted to air defense went to problems of air defense of theater forces. For these reasons, problems of national air and missile defense received mostly tangential treatment.

b. Main Issues

Four main issues were drawn:

(1) The future requirement for fighters in light of surface-to-air missile capabilities;
(2) Delineation of zones of operation for fighters and surface-to-air missiles;
(3) The possibility of gaps upon the movement of air defense elements of field forces out of the country;
(4) Gaps in defense against low altitude targets and targets in the stratosphere and space.

c. Fighters or SAMs?

Some controversy occurred over the future role of aircraft and surface-to-air missiles, and it started with an article by Col. Gen. A. Gastilovich in the first issue of the special series. In this article, he stated the case for missiles briefly and bluntly:

> The principal antiaircraft defense of troops and the country must be an automatic system of antiaircraft missile installations of various ranges which could cover, not installations, but separate large areas, and could resolve the task of protecting both the troops and the territorial installations of the country (in these areas). Separate antiaircraft defense of troops, except for the self-defense of small subunits mentioned above, appears to us to be an antiquated tradition. Fighter aircraft aviation within the system of antiaircraft defense will also become archaic in the near future. It is needed only until antiaircraft missiles have achieved the necessary technical perfection.[1]

On the other hand, there were also the defenders of fighter aviation who saw a continuing, but not exclusive, role for it. Lt. Gen. of Aviation N. Ostroumov and Maj. Gen. of Aviation M. Kozhevnikov, although speaking of frontal aviation, made a point which applies equally to the fighters of the National Air Defense Forces: "The role of Front Fighter Aviation is increasing even more with the delivery of the newest types of supersonic fighters armed with air-to-air missiles. In essence, these aircraft represent flying antiair-

[1] Gastilovich, A. "The Theory of Military Art Needs Review," *Voyennaya Mysl'* (Military Thought), Top Secret First Issue, 1966, p. 19.

craft guided missile batteries capable of executing a deep maneuver into enemy dispositions and destroying enemy missile delivery aircrafts before they release 'air-to-surface' missiles."[2]

Another defender of the fighter aircraft was Col. Gen. of Aviation S. Mironov. After a detailed discussion of the shortcomings of the air defense missiles at the time (short range, comparatively weak protection against jamming, and large limitations of a design nature in the launching of missiles),[3] he noted that:

> Modern fighter aircrafts armed with missiles of the "air-to-air" type also possess a high probability of target destruction (0.8 to 0.9) and can destroy one aircraft or one cruise missile of any type in one attack. Thus, the modern fighter, in essence, has become a highly maneuverable flying air defense guided missile launching mount, while retaining its most valuable and most important quality—the high probability of target destruction.[4]

Such was the general tenor of the debate over fighters versus SAMs. The arguments were not too deep and not well buttressed. Missiles at this early stage clearly had their limitations and, regardless of their potential, did not offer the possibility of immediate replacements of fighter aircraft. Subsequent events have reflected a practical, albeit expensive, solution to the problem. The number of aircraft in fighter aviation has gradually declined, while the number and kinds of air defense missiles have continued to increase. The supporters of fighter aircraft did not suggest the decline, although they might very well have done so. The subsequently realized possibilities for improved range, avionics, and armament could have been suggested with the admission that improved destructive power and capability for massing would mean a requirement for fewer aircraft.

d. Zones of Operation

The problem of closely coordinating the use of surface-to-air missiles and fighter aircraft can be an emotional one in which the missile personnel feel they are being unnecessarily restricted in their employment because of fighter safety procedures, whereas the pilots can feel their lives are in danger from friendly but inadequately controlled missile defenses. Actually, the debate in the special series centered not on whether there should be close coordination but rather on how it should be accomplished. One article by Lt. Gen. V. Razuvayev and Col. M. Yegorov took a positive approach, noting that experience gained from exercises conducted by the National Air Defense Forces had confirmed the feasibility of coordinating use of antiaircraft missile troops and fighter aviation in the same zone. They pointed out that in exercises of the North Caucasus Air Defense Army in 1960 such coordinated operation was safe and feasible if certain conditions were observed, namely: "radar stations for target detection and direction of antiaircraft guided missiles must provide identification and separate observation of fighters and targets, while fighters must terminate their attacks against air targets at distances exceeding . . . several times over the lethal radius of antiaircraft missiles (not less than 1,000 meters)."[5]

A more critical view was expressed by Marshal of the Soviet Union V. I. Chuykov and Gen. M. M. Popov. They wrote:

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[2] Ostroumov, N., and Kozhevnikov, M., "Aviation Operations in an Initial Front Offensive," *Voyennaya Mysl'* (Military Thought), Secret Fifth Issue, 1961, p. 3.
[3] Mironov, S., "Several Questions on Evaluating the Effectiveness of the Basic Means of Antiair Defense of a Front," *Voyennaya Mysl'* (Military Thought), Top Secret First Issue, 1962, p. 8.
[4] Ibid., p. 8.
[5] Razuvayev, V. and Yegorov, M., "On Zonal Protection of Troops and Installations in the Operational Rear Area by the Forces of Antiaircraft Missile Units of a Front," *Voyennaya Mysl'* (Military Thought), Secret Third Issue, 1962, p. 14.

> The coordination . . . was carried out essentially by distributing their efforts [of a front's air defense troops and the fighter aviation air army] through the zones of operation. . . . However, three of the four zones of operation in the air were located within the limits of the killing divisions of the antiaircraft missile units covering the first operational echelon. In a combat situation such organization of coordination would have led to the destruction of our own fighters. Furthermore, it is not advisable because of the small capabilities offered by the limited fighter forces assigned to duty in these zones.[6]

e. Gaps in Capabilities During Movement

The problem of possible gaps in air defense coverage during the initial phase of a war was brought up in a number of articles. Although the point was not expressed, it seems that there was some confusion over the extent to which tactical air defense forces were needed to contribute to the national air defense system and to what extent their presence, even temporarily, represented a bonus to national air defense.

In reviewing the Carpathian Exercise of July 1961, Marshal Chuykov criticized the lack of planning which allowed the development of a gap in air defense: "In planning the operation, it should . . . have been taken into account that when the troops turn to the offensive, the air defense means of the armies and of the divisions will go forward together with the troops, and the antiaircraft defense of the front rear area will weaken."[7]

In another article, Maj. Gen. Yu. Novikov pointed out the contradictory views of high-ranking officers, noting that Marshal of the Soviet Union S. Biryuzov "considers that toward the end of an offensive operation, a significant gap may occur between organic air defense and National Air Defense," whereas Marshal of Artillery V. Kazakov, "indicated that in reality no gap arises."[8]

Still another writer saw the problem of providing air cover for tactical forces during movement as being mainly the task of the National Air Defense Forces.[9] Although this writer was reflecting the normal concern of an army commenter for his formations, at the same time the likelihood that aircraft attacking strategic targets inside the U.S.S.R. would strike at columns of troops moving along a highway would have to be considered very remote.

f. Altitude Gaps in Coverage

At a time when the Soviet SAM capabilities consisted mainly of the SA-1 and SA-2, there were obvious high and low altitude gaps in coverage which were identified by some authors. The requirement for low altitude SAMs was not pushed very strongly. One author, Lt. Col. Ye. Ryvkin, noted the need for antiaircraft missile systems for use against low altitude targets; however, he did not discuss the problem in any detail.[10] Another pair of officers, Lt. Gen. of Aviation S. Sinyakov and Maj. Gen. of Aviation M. Kozhevnikov, examined the employment of aviation in the new stage of development of the Soviet's Armed Forces and came up with some conclusions regarding the employment of Soviet strategic bombers which led to parallel conclusions with respect to air defense:

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[6] Chuykov, V. I. and Popov, M. M. "Critique of the Front Two-Stage Operational-Rear Area Exercise Conducted in July 1961," Top Secret report of the Ministry of Defense, Moscow, 1961, p. 90.
[7] Ibid., p. 89.
[8] Novikov, Yu., "Defense of the Operational Rear," *Voyennaya Mysl'* (Military Thought), Top Secret First Issue, 1962, pp. 10–11.
[9] Stepshin, P. "On Regrouping a Combined Arms Army from the Depth of the Country," *Voyennaya Mysl'* (Military Thought), Secret Sixth Issue, 1961, pp. 21–22.
[10] Ryvkin, Ye., "Some Pressing Problems of Antiair Defense of the Country," *Voyennaya Mysl'* (Military Thought), Secret Sixth Issue, 1961, p. 4.

> One of the main conditions for fulfillment of tasks by long-range and strategic bombers, as regards the destruction of targets in the enemy rear areas, is their successful overcoming of enemy air defense means. Wide use of low flight altitudes by bombers and the use of passive and active jamming are highly effective. It was determined during training exercises that the percentage of aircraft attacked by enemy fighters in daylight at high altitudes was 5 or 6 times greater than at lower altitudes and at night it was quite insignificant. Destruction of aircraft by guided antiaircraft missiles during low altitudes flights is limited by the combat characteristics of the antiaircraft missiles. Thus, absolutely clear-cut determination was made of the direction of the use of existing long-range and strategic bombers against targets located in theaters of military operations—at night and at low altitudes. Low altitudes are becoming the basic operational altitudes for long-range and front aviation. [For this reason] It is advisable to assign low altitudes to [air defense] fighters wherever guided missiles are still limited in their operation.[11]

In the stratosphere and in space a different kind of problem was identified. In an article on the organization of antimissile defense, Col. N. Maksimov and Col. V. Savko noted that "the ability of modern attack weapons to deliver strikes from low levels, from the stratosphere, and in the near future, from space has produced a need for broadening the scope of air defense. Air defense is developing into air defense and space defense."[12]

g. Other Possible Issues

Numerous other issues suggest themselves as logical candidates for treatment in the debate, and the fact that they were not examined reflects the shallowness of what was actually done. The basic problem is that despite the long Soviet history of having a national air defense organization, there was a lack of an overall perspective in the way in which the problem of strategic defense was treated. This was true with respect to air defense, the combined problem of air and missile defense, and the even larger problem of the coordination of strategic offense as an active offensive means of strategic defense and of civil defense as a passive means of strategic defense.

There was little discussion of specific foreign strategic offensive capabilities and what was needed to cope with them. Here there was an obvious need to understand the strengths of the foreign offensive systems and the related weaknesses of the Soviet defenses. Instead, the Soviet analysis was primarily internally oriented and was focused on the improvement of the functioning of strategic defense.

There was little analysis of the future threat to strategic defense as reflected in the trends and possibilities for the development of strategic offensive capabilities, a subject which could have been examined both in terms of foreign and Soviet programs.

There was no discussion of the proper mix of surface-to-air missiles and fighter aircraft. This was despite the fact that the deployment of the SA-2 was still in progress during the period of the debate—which meant that there was only limited practical experience from exercises on how well the two kinds of weapons systems were complementing each other. Future projections of developments in surface-to-air missile range and in the range, avionics, and armaments of fighter aircraft could easily have suggested forthcoming shifts in the SAM/fighter mix.

h. An Assessment of the Debate

Several hypotheses suggest themselves as explanations for the shallowness of the debate:

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[11] Sinyakov, S. and Kozhevnikov, M., "The Air Forces in the New Stage of Development of the Soviet Armed Forces," *Voyennaya Mysl'* (Military Thought), Top Secret Third issue, 1960, pp. 18–19.

[12] Savko, V. and Maksimov, N., "The Organization of Antimissile Defense," *Voyennaya Mysl'* (Military Thought), Top Secret Issue, 1962, p. 2.

(1) Serious debate was not a customary thing for the military and therefore was not something which was easily joined even when authorized and encouraged;
(2) No real debate was desired and the exercise was simply a pro forma thing;
(3) Soviet strategic defense concepts and capabilities were so well defined and established that there was no need to debate them;
(4) Inadequate information hampered the conduct of debate;
(5) It was not intended that strategic defense receive much attention in the overall debate.

Which of these hypotheses or others might have been the explanation is difficult to say. One fact is that there has not been any evidence of any prior or subsequent debate with such extensive involvement of high-ranking officers. There could have been some concern about criticizing the system although such a concern apparently did not reside in Gen. Gastilovich. At the same time, Gen. Gastilovich was advocating solutions which could well have been popular with Khrushchev—which would allow him to be a bit more outspoken than his fellow debaters. From the nature of the participants and the demands of the time it seems likely that the debate was supposed to be sincere. The points which were made in the debate, limited as they were, suggest that Soviet strategic defense concepts did need some sharpening and that this fact was recognized. Some of the writers were able to buttress their arguments with hard facts which suggests that many facts were available for those who sought them out. At the same time, some issues—for example, ABMs—were apparently sensitive from a security viewpoint, and few hard facts were presented. Much more attention was devoted to air defense of the front than to national air defense, although the latter subject was by no means ignored. In any case, there is no clear-cut explanation for why the debate was no better than it was.

i. Conclusions

The conclusions which derive from the unique window which the special series provided for examining classified Soviet military writings relate more to what was not said than to what was said.

Based on the lack of serious debate over air defense roles and missions at what should have been a time of searching for solutions to a host of new problems, it seems unlikely that there is much tradition of meaningful debate among the Soviet military. There was also little sense of a strong push from the military for the improvements of military capabilities.

There was little indication of an awareness on the part of the military of a strong interaction with the United States in relation to air and antiballistic missile defense capabilities. Although there was some identification of U.S. weapons systems, there was little indication of difficulties to be anticipated in coping with either then current or future U.S. capabilities. In fact, a security device which was frequently used was to discuss problems—ballistic missile defense, for example—in terms of U.S. efforts, with a thinly veiled implication that Soviet programs, although too sensitive to discuss, were substantially better.

There was a lack of concern over resource limitations. Issues were debated in light of their merits in terms of requirements and capabilities and not with respect to possible resource constraints.

3. Public Statements on Antiballistic Missile Defense Capabilities

a. Introduction

Soviet public statement on their antiballistic missile defense capabilities provide an interesting record of behavior in which public assertions frequently diverged from reality. Prior to the U-2 incident of May 1960, the Soviet public statements dealt primarily with the impossibility of defense—specifically by the

U.S. and implicitly by the Soviet Union as well—against strategic offensive missiles, which had been incorporated into the Soviet military arsenal.

The public record of Soviet antimissile program statements traces back to 1956 when the prominent Soviet physicist Peter Kapitsa argued in *New Times* against the development of antimissile weapons on grounds of their exorbitant cost and the inevitable stimulus it would give to the arms race. While granting that the technological prospects for creating an antimissile program were favorable, Kapitsa called for the establishment of international conventions to prohibit the possibility of the creation of effective means of defense.[13]

Triggered by a Khrushchev remark at the Rumanian party congress in June 1960,[14] Soviet statements fell into three periods of increasingly greater claims and then subsided as the practical accomplishments fell short of what were probably the initial expectations and Soviet policy moved in the direction of negotiation. The first period after the Khrushchev remark involved a series of intimations that the Soviet Union was engaged in an antiballistic missile defense program. The next period was initiated by Defense Minister Malinovskiy's assertion at the 22nd Party Congress in October 1961 that the Soviet Union actually possessed an antimissile defense capability.[15] The third period was highlighted by Malinovskiy's statement in late October 1962 that the U.S.S.R. had now deployed an operational antiballistic missile defense system.[16]

Each of the major Soviet disclosures either coincided with or closely followed periods of heightened tensions in East-West relations—periods during which the credibility of Soviet military capabilities was brought into question. Khrushchev's statement in June 1960 was in direct response to the U-2 incident the previous month. Malinovskiy's claim at the 22d CPSU Congress was made during a period of aggravated international tensions connected with the Berlin crisis and closely followed official U.S. statements that the strategic power balance was overwhelmingly in favor of the United States. And Malinovskiy's claim on 25 October 1962 regarding operational deployment of an antimissile defense system was made at the height of the Cuban missile crisis.

Since the latter part of 1962, the Soviet public discussion of an antimissile defense capability has been characterized on the one hand by allegations that an antimissile system is currently operational but limited in scope, and on the other hand by assertions that only prototypes of an antimissile weapon have been developed.

b. Initial Allusion to an Antimissile Weapon

As in other Soviet claims to the development of new types of weapons, the early claims to possession of an antimissile weapon seemed couched in terms intended for maximum psychological effect. Following the destruction of the American U-2 aircraft in May 1960, Khrushchev for the first time publicly alluded to a Soviet antimissile capability. Speaking at the Rumanian party congress on 21 June 1960, he commented at length on the downing of the U-2 and declared that "if other methods of espionage are applied, they also will be paralyzed and rebuffed." Khrushchev's vague remark was translated into more specific military terms in an article by legal expert G.P. Zhukov in the October issues of *International Affairs*. Zhukov recalled the

[13] Kapitsa, Peter in *Novoye Vremya* (New Times), No. 39, September 1956, translated in *FBIS Propaganda Report*, 10 February 1967, pp. 1–2.
[14] *FBIS Propaganda Report*, 10 February 1967, p. 7.
[15] *FBIS Propaganda Report*, 10 February 1967, p. 9.
[16] *Krasnaya Zvezda* (Red Star), translated in *FBIS Propaganda Report*, 10 February 1967, p. 20.

remark and asserted that the U.S.S.R. possessed the capability to "paralyze U.S. military espionage both in the air and in outer space."[17]

Contradictory Soviet statements made before and around the time of Khrushchev's remark and the Zhukov article suggested that Zhukov's language was contrived to imply a capability that did not in fact exist. At the January 1960 Supreme Soviet session, Marshal Malinovskiy stated categorically that it was as yet "impossible" to destroy ballistic missiles in flight.[18] In an off-the-cuff remark to reporters in New York later that year, on 25 September, Khrushchev in effect confirmed Malinovskiy's statement by conceding that "there is as yet no way to control outer space."[19]

In the fall of 1960, at about the time Soviet spokesmen began modifying their description of strategic rocket weapons from "invulnerable" to "practically invulnerable," there were signs of a serious attempt to incorporate the concept of an antimissile defense into Soviet military doctrine. Writing in *Red Star* on 18 November 1960, in what appeared to be one of the first Soviet statements on the importance of antimissile weapons in a future rocket-nuclear war, military theorist S. Krasilnikov emphasized the "Extremely great significance" of "antimissile defenses" in combating the enemy's "nuclear-missile and rocket-carrying forces."[20]

On 5 September 1961, Khrushchev publicly disclosed that Soviet scientists had been engaged for some time in the development of an antimissile defense capability. In an interview with Sulzberger of the *New York Times*, Khrushchev answered a question on Soviet antimissile capabilities with the guarded statement that "at the time we told our scientists and engineers to develop intercontinental rockets, we told another group to work out means to combat such rockets." As for successes achieved in rocket technology, Khrushchev expressed "great satisfaction" with ICBM development but stated simply that he was "very satisfied" with progress made in the development of an antimissile weapon.[21]

c. Claims to an Antimissile Capability

Marshal Malinovskiy's statement at the 22nd CPSU Congress on 23 October 1961 that "the problem of destroying rockets in flight has also been successfully solved" was the first direct Soviet claim to the achievement of an antimissile weapon. Seemingly calculated to imply a more advanced operational system than could be claimed in fact, this statement became the standard official formulation on Soviet antimissile capabilities for the next year. At the same time, during the course of 1962, new elements began to appear in the propaganda which suggested the perfection of a fully operational system, now referred to by military spokesmen as antimissile "systems" or "complexes." Another new element was the designation of the "antiair and antimissile defense forces" as an independent "type" of the armed forces—nomenclature which implied the reorganization of the former antiair defense forces to reflect an enhanced role for the antimissile forces.[22]

In a *Kommunist* article detailing Soviet defense capabilities in the spring of 1962, Malinovskiy referred to the "armament" and "combat training" of the "antimissile defense forces," which, he claimed, guaranteed

[17] Zhukov, G. P., in *International Affairs*, No. 10, October 1960, translated in *FBIS Propaganda Report*, 10 February 1967, p. 7.
[18] *FBIS Propaganda Report*, 10 February 1967, p. 5.
[19] *FBIS Propaganda Report*, 10 February 1967, p. ii.
[20] Krasil'nikov, S. *Krasnaya Zvezda* (Red Star), 18 November 1960, translated in *FBIS Propaganda Report*, 10 February 1967, p. 7.
[21] *FBIS Propaganda Report*, 10 February 1967, p. 8.
[22] Ibid., p. 9.

"a successful repulse of an attack of an adversary from the air."[23] Several months later, in a speech to the World Congress on General Disarmament and Peace on 10 July, Khrushchev cited Soviet possession of an antimissile weapon in the context of ridiculing the ongoing U.S. reevaluation of the U.S.-Soviet strategic power balance that had been initiated the previous October. Khrushchev said that any reassessment of the balance of forces must take into account not only the high megaton yield of Soviet nuclear warheads and the Soviet Union's possession of ICBMs and "practically" invulnerable "global" rockets, but also Soviet development of an "antimissile missile." Elaborating on the newly claimed antimissile capability to American journalists a few days later, Khrushchev declared that the Soviet "antimissile means" can "hit a fly in outer space." Only concern about world public opinion, he said, prevented him from showing a "documentary film of an antimissile in action" to the world disarmament congress.[24]

d. Operational Deployment of ABM Claimed

At the height of the Cuban missile crisis on 25 October 1962, *Red Star* published an account of Malinovskiy's speech to a military ideological conference which contained the first explicit Soviet claim to operational deployment of an antimissile defense system. Malinovskiy stated that "complexes of numerous means" for defense against rocket attack had been "developed" and "built."[25]

Subsequent propaganda treatment of antimissile defense capability was inconsistent and on several occasions seemed to diverge from Malinovskiy's claim. Writing in *Red Star* on 4 December 1962, strategic rocket troops commander Marshal Biryuzov reiterated Malinovskiy's 22d CPSU Congress formulation on successfully solving the problem of destroying rockets in flight, but stopped short of claiming the actual deployment of antimissile weapons. Biryuzov simply stated that "complexes of numerous means" for defense against rocket attack had been "worked out."[26] In an article on 22 February 1963, however, Biryuzov repeated Malinovskiy's October 1962 formula.[27]

An Armed Forces Day statement by Marshal Rotmistrov on 23 February 1963 not only placed in question the credibility of assertions regarding the deployment of an antimissile system, but implicitly challenged existing Soviet technological capabilities. Playing on Malinovskiy's congress formulation, Rotmistrov asserted that the "successful solution of the problem of destroying enemy rockets in flight is of the greatest importance." Rotmistrov implied that while the problem of developing an effective antimissile capability was of the "greatest importance," it had yet to be solved.[28]

While some military spokesmen during 1963 and 1964 professed confidence in Soviet antimissile capabilities by citing Malinovskiy's claim to an operational system, others implied that only a prototype of an antimissile weapon had been developed. Commenting on the military hardware display during the October anniversary parade in November 1963, Marshal Biryuzov intimated that the antimissile weapon that was publicly viewed for the first time was simply one in a "family" of antimissiles still in a developmental stage and requiring further "perfection."[29] Another military commentator, Major General Baryshev, writing in *Red*

[23] Malinovskiy, R. Ya. in *Kommunist* (Communist), No. 7, translated in *FBIS Propaganda Report*, 10 February 1967, p. 17.
[24] *FBIS Propaganda Report*, 10 February 1967, p. 18.
[25] Malinovskiy, R. Ya. in *Krasnaya Zvezda* (Red Star), 25 October 1962, translated in *FBIS Propaganda Report*, 10 February 1967, p. 20.
[26] Biryuzov, S. S. in *Krasnaya Zvezda*, 4 December 1962, translated in *FBIS Propaganda Report*, 10 February 1967, p. 21.
[27] *FBIS Propaganda Report*, 10 February 1967, p. 25.
[28] Ibid., p. 26.
[29] Ibid., p. 27.

Star on 13 November 1963, implied the same thing by invoking Western views on the problems connected with developing an antimissile weapon. He quoted one observer as noting that it was the "system," not the antimissile itself that was involved, and he implied that the U.S.S.R. had accomplished the technological feat of creating the system.[30]

Diverging from these carefully qualified statements on Soviet antimissile capabilities, other prominent military spokesmen claimed that the deployment of an "invulnerable net" of antimissile weapons "reliably protected" the entire country from missile attack. In an article in *Izvestiya* on 5 January 1964, PVO commander Marshal Sudets implied that the Soviet antimissile capability was based on the detonation of nuclear devices in the atmosphere: "Rockets with nuclear warheads of various strengths have considerably increased the combat capabilities of the antiaircraft rocket troops."[31] By its emphasis on increased U.S. budgetary outlays to antimissile development programs, the Sudets article could also be read as a special-interest argument for preferential treatment of similar programs in the Soviet Union.

A major two-part theoretical article in *Red Star* in late August 1964 by Marshal Sokolovskiy and Major General Cherednichenko suggested that, at least for the present, the most effective defense against missile attack was the threat of an effective retaliatory capability. Citing Defense Secretary McNamara's statement to the effect that ICBMs must be "fired in salvoes" to penetrate enemy defenses, Sokolovskiy and Cherednichenko countered with the claim that there would be a "no less powerful salvo" of Soviet strategic rockets. And in discussing the methods of conducting the armed forces under nuclear war conditions, they implied that while Soviet antimissile forces would play a definite role in intercepting and destroying enemy rockets in "various sectors of their trajectories," this capability had yet to be translated into operational terms: "Even now the development level of antimissile means makes it possible to pose and successfully solve complex problems such as the destruction of the enemy's attacking ballistic rockets."[32]

e. More Restrained Claims

Since early 1965, the statements of Soviet military spokesmen have reflected a greater effort to define more precisely the scope of the alleged antimissile defense capability. In contrast to the expansive and open-ended claims of earlier years, the statements of military leaders during the past few years have suggested that antimissile weapons have been deployed only in certain areas of the Soviet Union. In his Armed Forces Day speech on 22 February 1965, Malinovskiy asserted that the U.S.S.R. possessed antimissile weapons capable of destroying "any" enemy ballistic rockets "at immense distance" from "defended installations."[33]

Statements alluding to a limited deployment of antimissile weapons have been accompanied by other references to "recent" but unspecified developments which are said to have enhanced the defense capabilities of the antimissile forces. In his speech to military graduates on 3 July 1965, Brezhnev became the first top Soviet political leader to refer directly to an antimissile capability. Pointing to Soviet achievements in developing an antimissile weapon, Brezhnev stated that "it has been possible recently to make important steps which sharply increase their effectiveness."[34]

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[30] Baryshev, I. in *Krasnaya Zvezda*, 13 November 1963, translated in *FB1S Propaganda Report*, February 1967, pp. 28–29.
[31] Sudets, V. A. in *Izvestiya*, 5 January 1964, translated in *FBIS Propaganda Report*, 10 February 1967, pp. 31–33.
[32] Sokolovskiy, V. and Cherednichenko, M. I. in *Krasnaya Zvezda*, 28 August 1964, translated in *FBIS Propaganda Report*, 10 February 1967, p. 35.
[33] *FBIS Propaganda Report*, 10 February 1967, p. 39.
[34] Ibid., p. 43.

Both Malinovskiy's claim to a limited antimissile defense system and Brezhnev's assurance of recent successes in that field became the standard propaganda formulations until the 23d CPSU Congress. In his congress speech on 2 April 1966, Malinovskiy introduced yet another qualifier regarding Soviet antimissile capabilities that tended to obscure earlier claims. He asserted that the U.S.S.R.'s antiaircraft defenses insured the "reliable" destruction of "any" aircraft and "many" rockets.[35] Whether Malinovskiy's statement was intended as a clarification of earlier claims to a limited deployment of antimissiles or whether it was designed to imply that even areas within the antimissile network were vulnerable to missile attack remains unclear. It is noteworthy, however, that shortly after the congress and in his last public statement as commander of the PVO, Marshal Sudets returned to the unqualified claim characteristic of the earlier period. Writing in *Soviet Russia* on 19 April 1966, Sudets stated that Soviet antiaircraft defenses ensure the destruction of "all" means of air attack under any conditions. In the same context, however, Sudets emphasized that only certain "protected areas" and "objectives" were defended by an antimissile system.[36]

An unusually explicit acknowledgment of the vulnerability of Soviet territory to missile attack was contained in an October 1966 interview of Marshal Chuykov, head of Soviet Civil Defense. Seemingly on behalf of his own institutional interests, Chuykov asserted that despite the high level of preparedness of the Soviet Armed Forces, "there is no complete guarantee that a portion of the enemy's means of mass destruction will not reach the target."[37]

f. A Period of Reticence

In contrast to numerous references to the U.S.S.R.'s antimissile defense capability which continued in a restrained form until early 1968, a two-year period ensued in which there were very few public comments on the subject. This was undoubtedly part of Soviet preparations to engage in strategic arms limitation talks and a reflection of concern not to disrupt matters once the talks had begun.

A brief flurry of statements occurred in February 1970 on the occasion of Soviet Armed Forces Day when several military spokesmen referred to Soviet antimissile defense capabilities. After this the reticence to speak on the subject resumed and continued through 1972.

g. Conclusions

The record of what the Soviets actually did in developing and deploying antiballistic missile defenses (see Chapter V.B.3 on ABM Systems) bears but limited relationship to the public statements. The public declarations had a high propaganda content and were designed to convey to both foreign and domestic audiences an image of Soviet strength and inviolability.

C. Major Decisions

1. The Role of Major Decisions

On the surface it would seem appropriate to ask what were the main decisions which shaped Soviet air defense strategy. The problem is that the Soviet strategy did not really change during the period from

[35] Ibid., p. 50.
[36] Sudets, V. A. in *Sovetskaya Rossiya* (Soviet Russia) 19 April 1966, translated in *FBIS Propaganda Report*, 10 February 1967, p. 50.
[37] Chuykov, V. I. in *Sovetskaya Moldaviya* (Soviet Moldavia), 28 October 1966, translated in *FBIS Propaganda Report*, 10 February 1967, p. 54.

1955 to 1972. Instead, Soviet decisions on strategic defense reflected a technologically more sophisticated continuity of Soviet strategy rather than the change of its direction. The setting, therefore, for an examination of the role of "decisions" is the strategy which existed at the beginning of the period.

By 1955 the strategy which had emerged was typically Russian. It was to defend in depth with the use of massive forces. Geography and technological limitations had combined with the nature of the perceived threat to dictate the solution. The area to be defended was huge; the border to be protected was long; and there were no overseas bases from which forces could be committed, offensively or defensively, to frustrate an attacking force before it could approach the Soviet frontier. The limited range of the available fighter aircraft also meant that it was not possible to use them to achieve a significant outward extension of a defensive barrier and that any attempt to create a barrier force along the frontier would fail because of an attacker's ability to mass his forces and penetrate the frontier at selected points. And, the threat, since it could come from virtually any direction, dictated that the defense be focused on protecting key centers and facilities.

A commitment had been made to the development and deployment of technologically more and more advanced weapons systems and this had become institutionalized in Soviet industry. The rate of introduction of the new weapons systems was extremely rapid, the conversion to jet fighters being accomplished completely in about five years.

The concept of an integrated defense had also been institutionalized with the creation of the National Air Defense Forces as a separate major component of the armed forces, although at this stage there was still much emphasis on decentralized execution of operations.

In concept the desirability of zonal or area defense had been accepted although the limited capabilities of the available weapons systems and the dispersion of many of the targets to be defended dictated that in practice a point defense would still be frequently employed.

The massive commitment of resources to strategic defense also signified acceptance of the idea that defense was useful and that the possession of a deterrent offensive capability alone would not be enough. At the same time the commitment of huge resources to theater forces for employment in Europe signified a joint strategy of holding Europe hostage to the theater forces in conjunction with strategic defense of the homeland.

Against this backdrop there were six major strategic defense decisions which ensued. They were:

(1) The decision to deploy surface-to-air missile extensively;
(2) The decision to revamp the National Air Defense Forces and achieve a quick and drastic restructuring of the forces;
(3) The decision to upgrade the importance of civil defense and strengthen its integration into the overall strategic defenses to the country;
(4) The decision to continue a major role for fighter aviation;
(5) The decision to deploy an ABM force;
(6) The decision to negotiate an ABM treaty.

2. The Decision to Deploy SAMs Extensively

The decision to deploy surface-to-air missiles extensively was bypassed in the case of the SA-1, presumably because of the limitations of the system, especially in terms of altitude coverage, the flexibility and maneuverability of the system, and cost. Although there was a difference of some four or five years between the IOCs of the SA-1 and SA-2, the time from the completion of the deployment of the SA-1 to the start of

the deployment of the SA-2 was only two or three years. Thus the imminent availability of the SA-2 was apparent at the time of the stopping of the SA-1 deployment, if indeed it ever had been intended to deploy the SA-1 much more extensively than around Moscow and possibly Leningrad.

With the SA-2 a different situation existed. The weapons system was simple, flexible, reliable, and—in terms of the tactics being employed at the time by U.S. strategic bombers—effective. Thus, as long as new tactics and technological aids and improvements were not considered for an attacking force, the SA-2 was a promising system.

Given the previous deployment rates for the MiG-15 and MiG-17 and even for the SA-1, the rate of introduction of the SA-2 became a consistent manifestation of an already established weapons and resource strategy. In terms of its replacement of antiaircraft artillery, the SA-2 represented a quantum improvement in the capabilities needed to cope with the individual high-flying strategic bomber, but at the same time its deployment pattern followed that of the antiaircraft artillery and thus its deployment was a continuation of past patterns rather than something new.

The SA-2 still had significant weaknesses in terms of low attitude capabilities and the range to cope with stand-off air-to-surface missiles. These deficiencies necessitated the deployment of the SA-3 and SA-5, although again the same pattern of point and zonal defense underlay their deployment. Thus, the entire sequence of surface-to-air missile deployments represented a continuation of a strategy which existed in its basic outlines before 1955.

3. The Decision to Revamp the National Air Defense Forces

The decision to revamp the National Air Defense Forces and achieve a quick and drastic restructuring of them was part of Khrushchev's general reorganization of the armed forces. The principal elements of the restructuring were the reduction in the number of fighter aircraft and the virtual elimination of antiaircraft artillery from the strategic defense system. These two steps led to a reduction in the commitment of resources to strategic defense which persisted from 1961 through 1967. This savings in resources was one of Khrushchev's major goals in the overall reorganization. Thus, this goal was achieved in strategic defense as well as in the armed forces as a whole. And in this respect performance was better for strategic defense than for the armed forces as a whole. The total budget dropped only from 1959 to 1960 and then began to rise again. The strategic defense budget dropped slightly at the same time and then continued lower for the next seven years.

In terms of capabilities the strategic defensive system improved substantially and thus met Khrushchev's other goal which was to weed out obsolescent capabilities while improving overall military capabilities. This improvement in capabilities was manifested almost immediately in the case of surface-to-air missiles with the bulk of the SA-2 deployment having been completed by 1962. At the same time the introduction of new fighters with improved capabilities, especially for all-weather operations, was resumed in 1960 after having been in a state of hiatus since 1955.

Again, the revamping of the National Air Defense Forces which was accomplished from 1959 to 1961 did not represent a break with previous concepts but rather their reinforcement and enhancement.

4. The Decision to Upgrade Civil Defense

The decision to upgrade the importance of civil defense and strengthen its integration into the overall strategic defenses of the country occurred almost simultaneously with the restructuring of the armed forces

as a whole, lagging by only a year or two. The context of this decision included not only the indicated restructuring of the armed forces but also the substantial deployment of strategic offensive missiles by both the United States and the Soviet Union, the Soviet "solution" of the ABM problem, and the persistent tension over Berlin.

Against this backdrop the upgrading of civil defense which was entailed in putting it under the Ministry of Defense and generally increasing the attention paid to it was a natural step, deriving both from the review of organizational relationships and the need to take prudent steps in times of heightening capabilities and tension.

In a country in which the transfer of civil defense from outside the military establishment into it would be of no significance to the general public, this step had no political constraints. And even though civil defense had been under the Ministry of Internal Affairs, its leadership had been military since the early 1950's. In fact, the transfer of the function to the Ministry of Defense can be viewed as simply a logical sequel to the previous naming of military personnel to head civil defense.

5. The Decision to Continue a Major Role for Fighter Aviation

The decision to continue a major role for fighter aviation was made despite some voices asserting that the surface-to-air missile was making fighter aviation unnecessary. This was an issue which received some attention in the special *Military Thought* series; however, the arguments which were advanced to indicate the rapid demise of fighter aviation were more theoretical than practical.

Marshal Sokolovskiy in *Military Strategy* indicated in 1962 that "fighters will evidently play a considerable role in the National Air Defense system in the coming years."[38] He went on to note that "by increasing their speed, altitude, and range and by improving their range, fighters can continue to combat enemy bombers successfully."[39] Given the then existing and still persisting shortcomings of surface-to-air missiles, the decision to continue a major role for fighter aviation followed easily, if indeed the issue was ever seriously raised.

Actually, to have initiated a phase-out of fighter aviation from the National Air Defense Forces would have been a departure from previous practice in that it would thus have been a retrogressive step. In no case since 1945 have the Soviets decreased their strategic defense capabilities, even temporarily.

On the surface it might appear that the decrease in the number of fighter aircraft in the National Air Defense Forces (about a 35 percent drop from 1959 to 1972) would represent a decrease in capabilities. But this is the same time frame during which the fighter force was converted from one with practically all such fighters and the range, avionics, and armament were all improved along with the speed and altitude. Thus the smaller force of 1972 had individual aircraft of substantially better combat characteristics, to include a much better capability to maneuver and mass aircraft, of itself a major factor in compensating for smaller numbers. Given the fact that the capabilities of U.S. strategic bombers were improving at the same time the Soviet fighters were being improved, it is difficult to say whether the fighter aviation of the Soviet National Air Defense system is relatively better off with its smaller number of better aircraft. In any case, the fighters continued to play a significant role throughout the period and at the end of the period were helping to make the long-standing Soviet desire for a zonal air defense much more of a reality than it had ever been before.

[38] Sokolovskiy, V. D. (ed.), *Voyennaya Strategiya* (Military Strategy), Moscow, Voyenizdat, 1962, translated as *Soviet Military Strategy* by H. S. Dinerstein, L. Goure, and T. W. Wolfe, Englewood Cliffs, N. J., Prentice-Hall, Inc., 1963, p. 345.
[39] Ibid.

6. The Decision to Deploy ABMs

The decision to deploy an ABM system was consistent with previous Soviet approaches, both in strategic defense and also in other parts of the Soviet military system. Up until this time the Soviets had not been satisfied with a position of strategic inferiority or vulnerability and had sought persistently to eliminate such inferiority or vulnerability. In other words, in the interaction with the United States the comfortable feeling which derives from strategic superiority was a goal which was pursued without concern for the economic impact. Even Khrushchev's cut-back in the size of the Soviet Armed Forces was to be accompanied by an increase in capabilities rather than their weakening.

The need for an ABM system was manifest and had been recognized upon the appearance of the V-2 during World War II. The Soviet commitment to an ABM system had been publicly avowed with Khrushchev's 1960 assertion that the problem of ABM defense had been solved and subsequent statements conveyed the image of a steady march toward the deployment of an ABM system. Although the limited ABM deployment around Moscow was eventually accomplished in fact rather than just in rhetoric, it remains unclear whether cost, technological limitations, or political considerations of U.S.-Soviet detente were more significant in the decision to halt further ABM deployment.

In any case the decision to deploy ABMs was consistent with the overall Soviet approach to strategic defense. The decision to limit ABM deployment was not. Whether the Soviets would have resumed their ABM deployment within the timeframe to 1972 if there had not been SALT negotiations is another question, one which cannot be answered. If the decision to stop ABM deployment was based at least in part on recognition of technological limitations, the decision would, of course, have been consistent with previous actions. In such a case additional deployment would have followed elimination of the shortcomings in the system.

7. The Decision to Negotiate an ABM Treaty

The decision to negotiate an ABM treaty represented the single real departure from the Soviet behavior with respect to strategic defense. It took an area of clear military vulnerability and, rather than pursue the creation of the military capability to eliminate the vulnerability, went the route of negotiation.

This decision had a further impact in that it undercut the rationale for continuation of much of the defense against the air-breathing threat. But rather than lead to a decrease in the size of air defense (as contrasted to missile and space defense), there was a continuation of the strengthening of the air defenses; especially with the additional deployment of SA-3 and SA-5 sites, right to the end of the period and the signing of the ABM treaty. It should also be noted that the further deployment of the SA-3 and SA-5 has continued into 1975.

D. Major Factors Shaping Soviet Strategy

1. The Factors

If behavior is difficult to analyze in terms of the actions of individual players and institutions, and major decisions did not shape strategy but rather reflected it, what were the major factors which conditioned the nature, evolution, and rationale of Soviet strategy? Aside from the political dynamics of the country which were discussed in Volume I in their relation to the history of Soviet strategic defense, five factors merit analysis:

(1) The perceived threat posed by U.S. and other offensive weapons systems and their deployments;
(2) The Soviet capacity and penchant for reaction to the perceived threat and interaction with U.S. forces and programs;
(3) Soviet perceptions of the likelihood of attack, expressed in responses to various international events, crises, and conflicts;
(4) The relative importance, within the context of overall military strategy and posture, attached to national air and missile defense by the Soviet leadership; and
(5) Budgetary constraints.

2. Threat Perception

The general Soviet strategy for strategic defense derived from a threat perception which had six main elements:

(1) The growing and adapting threat, especially from U.S. strategic offensive forces, necessitated continuing vigilance and a strong commitment of forces to strategic defense;
(2) The multidirectional nature of the threat necessitated an all-around point and area defense, especially in view of the ease with which any kind of barrier defense could be penetrated;
(3) The omnipresent air-breathing bomber threat was real and close at hand and had to be dealt with;
(4) The United States was constantly pushing the state of the art in new technology which meant that the appropriate countering technology had to be obtained somehow and had to be adopted and deployed quickly;
(5) The missile threat could not be handled effectively with the capabilities of the National Air Defense Forces; therefore, it was necessary to target MR/IRBMs and strategic bombers and then ICBMs against the missile launching sites.
(6) Targeting the U.S. means of strategic attack still did not guarantee defense against the missile threat and therefore necessitated acquiescence in strategic arms limitation talks.

3. Reaction and Interaction—the APVO Case

a. Introduction

On the surface, it might appear that Soviet strategic defensive forces were engaged in a constant reaction to or interaction with U.S. strategic offensive forces. In actual fact the case for such an assertion is more superficial and intuitive than it is ingrained and demonstrable. The problem is that while the Soviets were clearly aware of most U.S. strategic offensive capabilities, the evidence of reaction and interaction depends more on correlation than on documented demonstration of cause and effect. Because of the inconclusive results which derive from looking at individual weapons systems for specific reaction or interaction, the approach here is to look at fighter aviation as a whole to determine all of the major factors which have driven its development, but with particular concern for identifying the occurrence of reaction and interaction and their significance.

Throughout the inquiry into the postwar history of Soviet interceptor design, a picture emerges of dedicated and extremely competent people united in "socialist competition"[40] to relieve the constraints of technology. The impression is one of great continuity and sustained effort well supported by the Soviet

[40] The role "socialist competition" in the aircraft industry should be interpreted with equal emphasis on "socialist." See V.I. Tikhomirov, *Organization and Planning of an Aircraft Construction Enterprise* (FTD Trans) p. 14 and Section V. B.2. below.

government. To some extent, such a picture is accurate. The design bureau system does produce a series of prototypes which represent both an advanced technology and an intended compatibility with mass production processes. However, one must view the design process in a broader context than technology or "socialist competition."

The following section looks at three possible alternative contexts which might illuminate the patterns of Soviet force building and strategic decisions as they apply to fighter aviation. The first context is time; the second is capability; and the third is quantity. The first effort arranges data in a sequence of interest for historical inquiry. The other two array that data against the U.S. bomber force to develop some hypotheses about the APVO force which relate to the "threat" of U.S. strategic power.

b. Design Cycle Decisions

Figure 7 illustrates the design cycles of post war Soviet jet interceptors. The figure illuminates some aspects of "competition" among aircraft design teams.

First, "competition" has been less frequent as time has passed. That this is in part a product of the increasing lead times required for more complex designs is also indicated by the figure.

Second, the evidence of the designs themselves is that major competitions coincide with significant changes in technology. At least six such advances are implied which impact on the interceptor force: (1) jet engines, (2) swept wings, (3) long-range and AI radar, (4) Delta wing design (tailed delta), (5) side inlets, (6) variable geometry wings, and (7) lift engines.

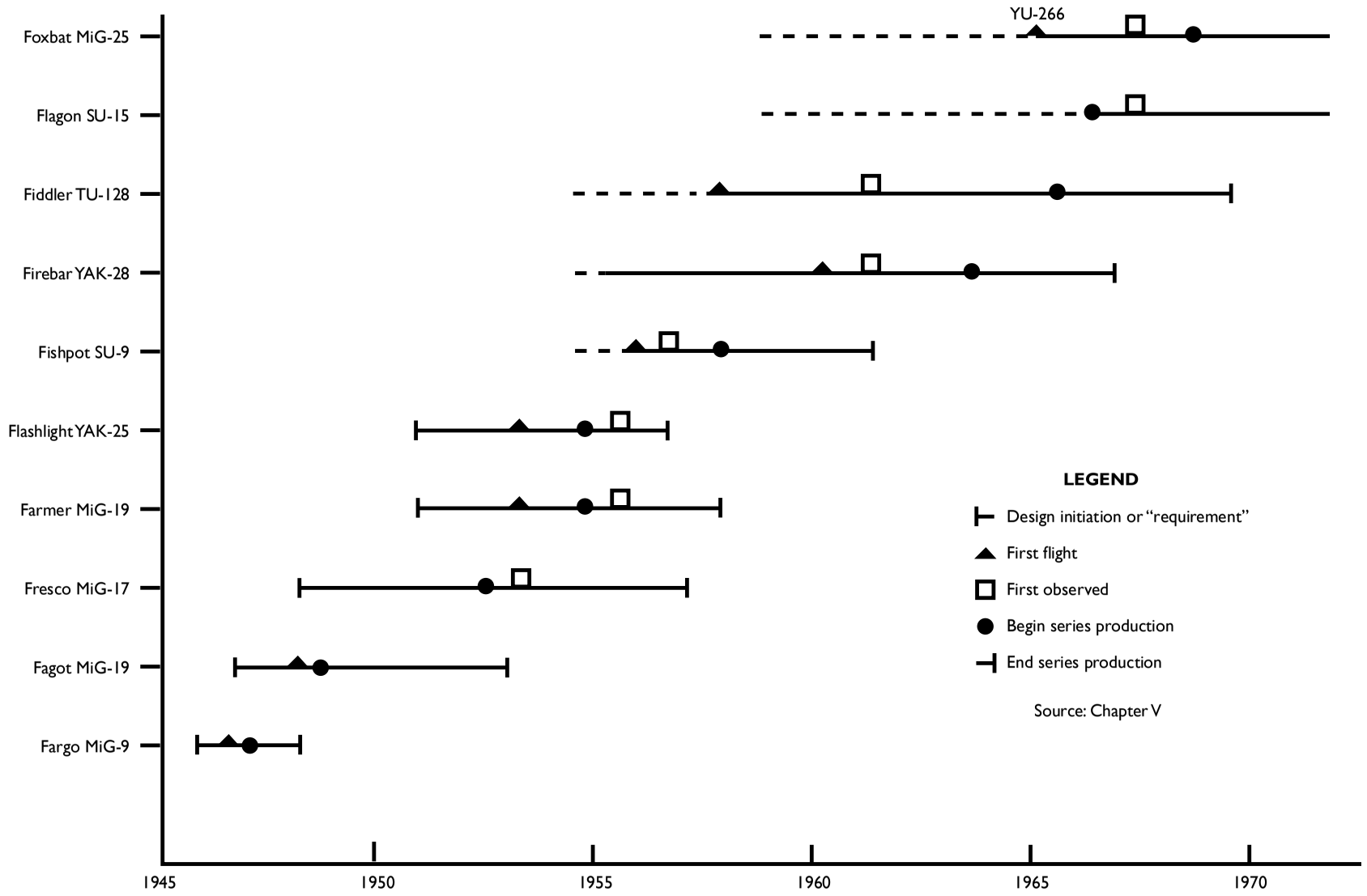
While the last two advances, thus far, appear not to be directly relevant to PVO Strany, they illustrate how design resources may be diverted from APVO priorities.

Third, a requirement—competition—selection cycle is not the universal rule. In the case of the MiG-19 and YAK-25 complementary design efforts were the product of a direct negotiation with Stalin. In the case of the SU-7/SU-9, "competition" was between two designs of the same bureau. That there might have been some confusion about a "requirement" is indicated by the fact that the SU-7, predominantly deployed as a ground support aircraft, appears in the APVO order of battle. This anomaly raises the possibility that the aircraft that entered the force were the product of a set of engine production and allocation decisions. The SU-7 swept-wing aircraft designed around the heavier Lyulka engine may have become merely a convenient aircraft to assign to the tactical force. Further, of the eleven aircraft types known to have been active in the APVO force, only the MiG-9, MiG-15, and TU-128P seem to have been the product of a straight forward fly-off competition. In these cases too an engine allocation prejudiced two of the outcomes. One other example is relevant. In the 1948–1950 competition for a long-range, radar-equipped interceptor, none of the aircraft were selected for production. The requirement was evidently cancelled due to technological considerations.[41] Thus, it appears that both the "requirement" and "competition" are rather flexible concepts as they apply to APVO decisions.

In summary, the Soviet design process includes a number of technological and production considerations which are unrelated to the "requirement." If the "requirement" represents the "decision" to design a new aircraft of specific characteristics, the process of aircraft design as it is practiced in the Soviet Union modifies the decision substantially.

[41] Book I, Vol. I, Chap. V of this study discusses the 1948–1950 unsuccessful attempts at an all-weather interceptor.

Figure 7—Design Cycle of Major APVO Aircraft



c. Requirements Reactions

Figure 8 arrays data to examine some hypotheses about the relationship between the "threat" and the "requirement" for a new aircraft. The vertical lines represent the ostensible issuance of a requirement; their width indicates the degree of uncertainty associated with the estimated requirement data. Taking a period immediately before the requirement issuance, milestones of the U.S. bomber development cycle appear which may have triggered a reactive design. At least three hypotheses are widely held among experienced intelligence analysts about such reactions:

(1) The MiG-15 was a reaction to the B-36[42]
(2) The TU-128P was a reaction to the AGM28 (Hound Dog)[43]
(3) The MiG-25 was a reaction to the XB-70.[44]

It would appear that at the time of the MiG-15 requirement, the intelligence, planning, and technological forecasting elements of the Soviet hierarchy had more to consider than the B-36. The B-47 and B-52 were sufficiently well under way to create a fairly accurate estimate of future U.S. strategic capabilities. Among those capabilities the B-36 was only the most proximate. Likewise, the hypotheses about reactive designs of the TU-128P and MiG-25 are viable in this context, but the point remains that multiple considerations about the "threat" may have entered the decision.

d. Qualitative Interactions[45]

Although more sophisticated indices of aircraft capability exist in both the Soviet Union and the U.S., the prevalence of speed and altitude in Soviet design thinking make these two factors useful indices of bomber and fighter capability.[46] Moreover, they are somewhat relevant to the tactical problem of interception, especially in the early post-war era when sophisticated air-to-air and air-to-surface missiles were not a consideration.

1) Speed

Figure 9 illustrates the relationship between the speeds of U.S. offensive and Soviet defensive strategic aircraft. The horizontal lines indicated the maximum speed represented in the operational force. In this form of interaction, the interceptor should have the natural advantage. The bomber must trade speed for payload and range. However, the interceptor needs a speed advantage to close on the target and to position itself for attack. The comparison is useful for examining the hypothesis of XB-70/MiG-25 qualitative interaction. Although the AA-6 missile serves to compensate for the hypothetical disadvantage in speed, the comparison shows that the MiG was both late and slow. It could as well be an imitative reaction to the SR-71 or a late attempt to cope with the AGM-28.

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[42] CIA, *National Intelligence Survey, Vol. 26, Section 83,* October 1957.
[43] By implication from DIA, *Fighter Aircraft (Trends) (ECC)*, ST-CS-09-006-75. pp. 104–112.
[44] Interviews with a former Assistant Air Attache to Moscow, 11 November 1974; a DIA aircraft industry analyst, 21 April 1975; and a CIA aviation industry analyst May 5, 1975. Only CIA provided a reference to detailed rationale, but the document was made available too late for consideration in this report. It is understood that the CIA document is now available; it will be considered in the final report of this study.
[45] Definitive data to support this analysis are contained in DIA, *Aircraft Characteristics and Performance Handbook (ECC)* 1968 with changes. (SECRET/Controlled Dissemination). Updates to individual systems books are contained therein. Although BDM formally requested this document in June 1974, October 1974, and March 1975, it has not been made available. Despite CMH arrangements to access the document at DIA, access continued to be denied as of the week of 5 May 1975. Likewise, U.S. data on the B-29, U-2, YF12A, and SR-71 are from unofficial sources.
[46] DIA, *Fighter Aircraft Trends (ECC)*, ST-CS-09-006, November 1974, pp. 94–97. Also see Section VB below.

Figure 8—Design Interactions

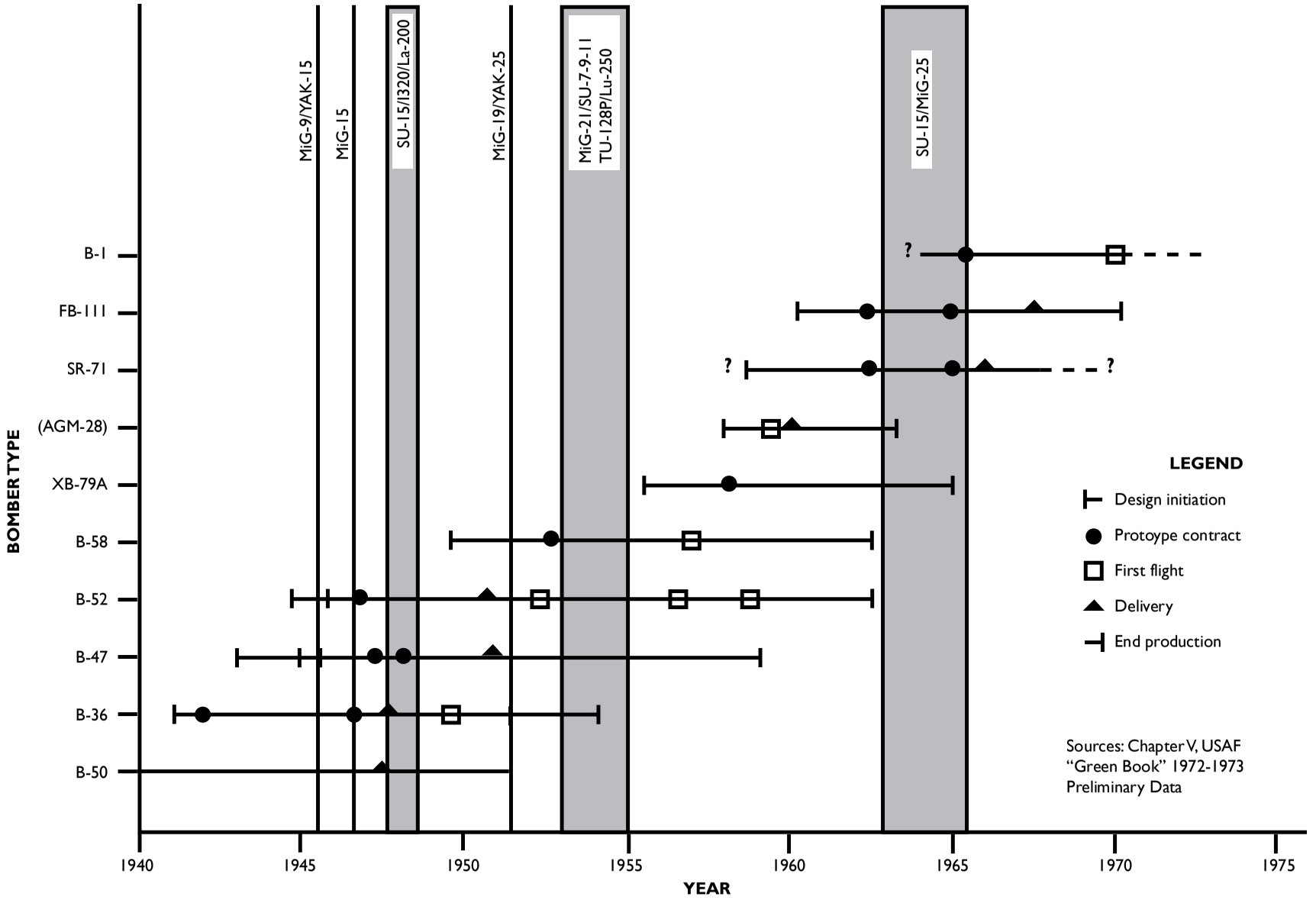
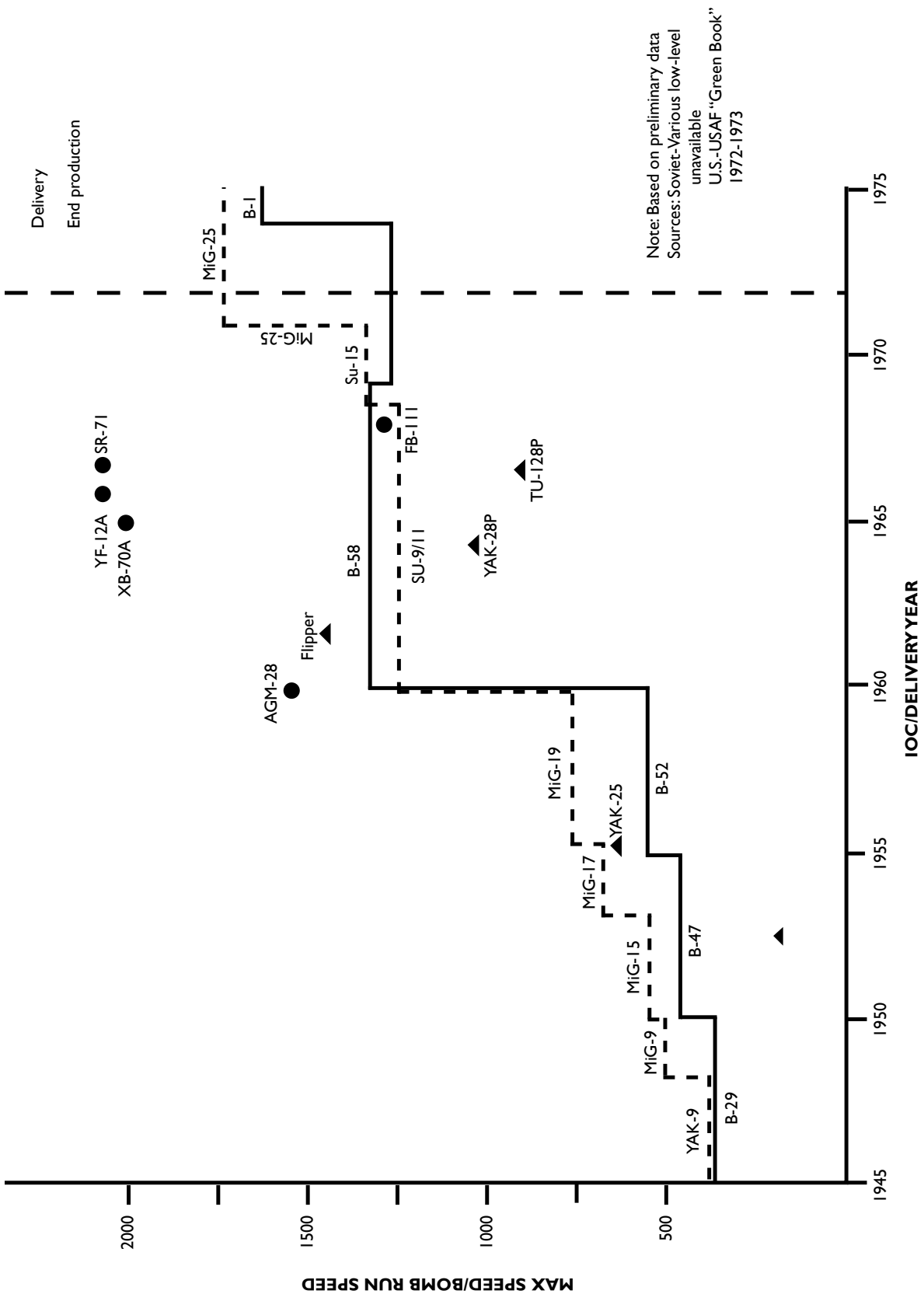


Figure 9—Speed Interactions



2) Altitude

A similar comparison (Figure 10) applied to altitude serves to confirm the MiG-15/B-36 interaction and further confuse the relationship between the MiG-25 and the XB-70. The illustration serves to introduce a most important aspect of possible qualitative interaction. The Soviets, in the first decade after the war, attained a capability to contest the high altitude regime. However, the change of U.S. tactics which emphasized low-level penetration rendered their capability largely obsolete. To contest the low-level regime required a competence in electronics which found them at an extreme disadvantage. Thereafter, the predominant Soviet operational objectives, speed and high altitude, became largely irrelevant.

3) Range

The quality of range (Figure 11) has been of lesser importance in Soviet interceptor design than speed or altitude. Whereas deployed aircraft have shown steady progression in the latter two qualities, range shows no trend. It is for this reason that range is of interest; it segregates technology considerations from mission considerations among the design criteria. Thus, the TU-128P stands out as a special aircraft. The explanation that it is designed to counter the B-52/Hound Dog combination is quite credible in this context. The MiG-25/XB-70 relationship remains confused, however. As discussed in Section V.B.2.c., the MiG-25 may well represent a state of technology where severe trade-offs among range, speed, and altitude are avoided.

The tactic of low-level penetration radically altered the basis of qualitative interaction. For twenty years the Soviets have had the "requirement" to cope with the low-level threat. By 1973 the requirement had not been met. From what is known about Soviet avionics, the requisite Doppler radars and moving target indicator circuitry had not emerged to enable a Soviet interceptor to look down on a penetrating bomber against the clutter of radar returns from the ground. While some measures were taken,[47] the qualitative interaction ceased to be clear.

e. Quantitative Interactions

Figure 12 illustrates the numbers of aircraft associated with the active U.S. offense and U.S.S.R. defense inventories. It would appear that a correlation exists between the two trends. It can be observed that the Soviets, since 1955, have maintained from 2.4 to 6.0 interceptors in their inventory for each U.S. bomber. While no one who is serious about numbers would contend that there is causation implied by the declining trends in both offensive and defense aircraft, the concurrence of the decline implies that both sides are responding in a like manner to some external variable.

The assertion of too simple a correlation is preempted by the trend in Soviet surface-to-air missiles, however. One is limited to an observation that both the offense and defense reduced the emphasis on numbers of aircraft at about the same time. To extend the statement, one would point out that the Soviets embarked on a program of surface-to-air missiles in the early fifties that sustained itself until 1973.

[47] The Moss aircraft represents a limited "Look-down" capability over calm water or smooth ice.

Figure 10—Altitude Interactions

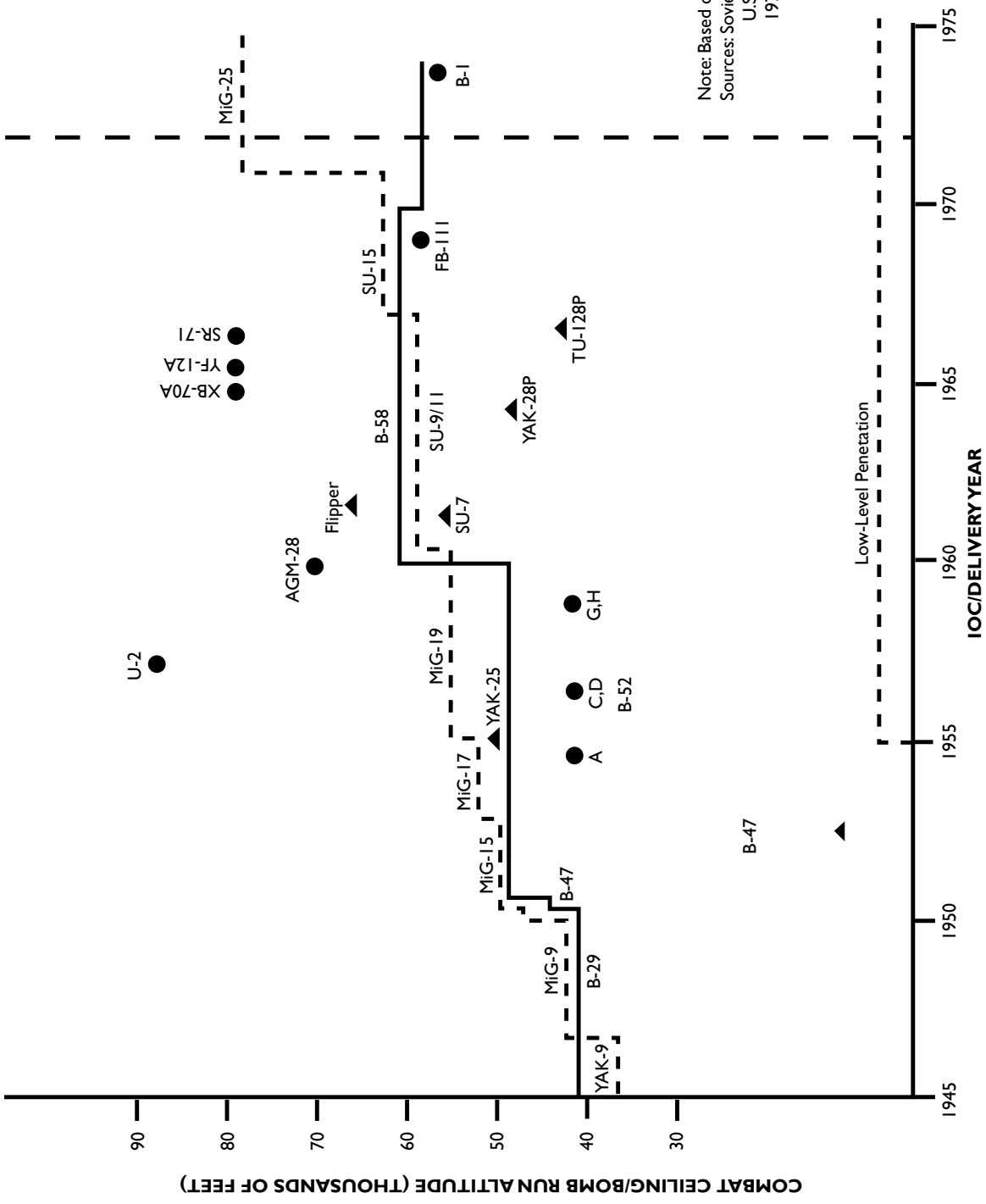


Figure 11—APVO Fighter Ranges

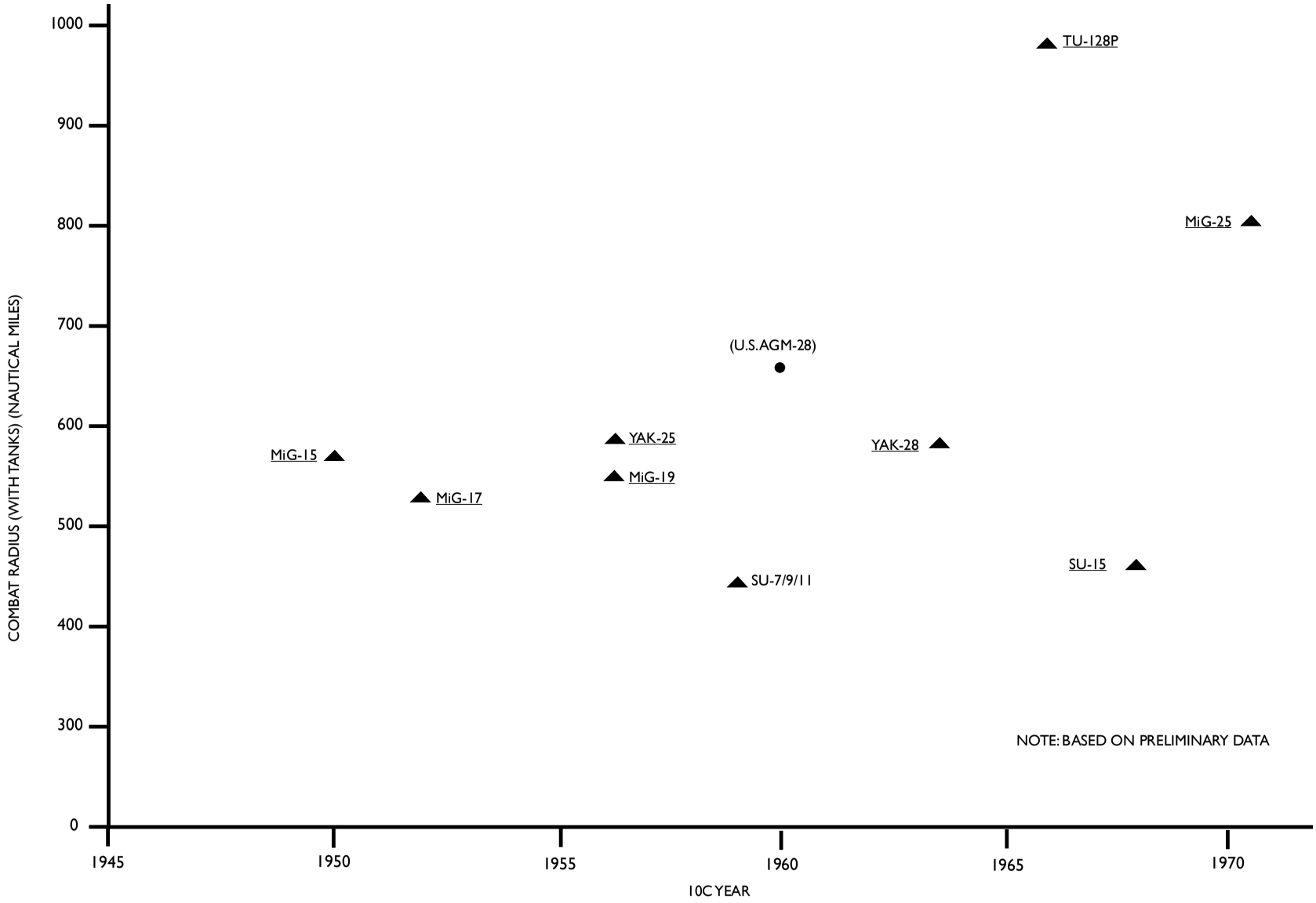
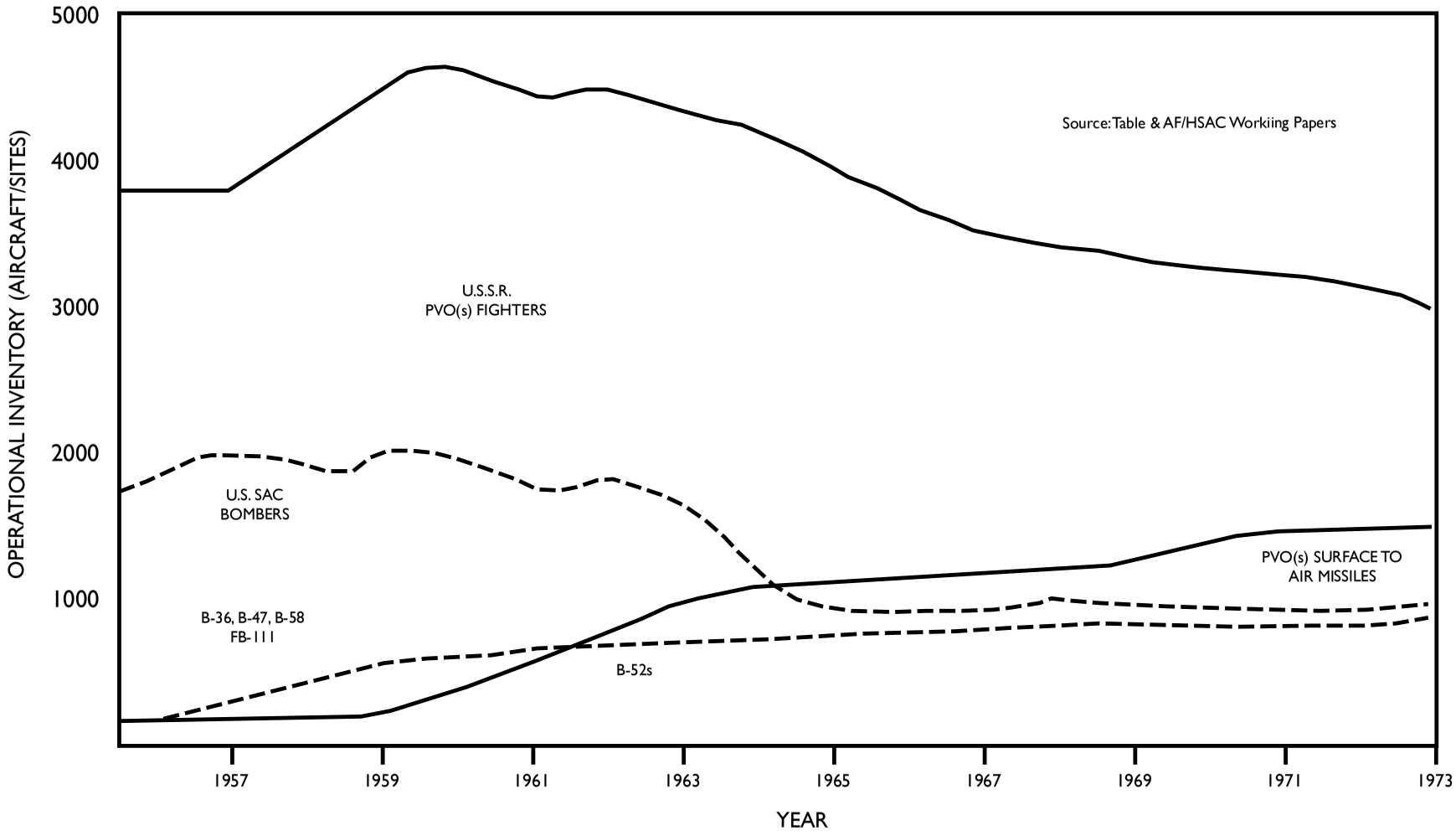


Figure 12—Defense/Offensive Comparison



f. The Nature of Soviet Reactions

The above formulations of interaction generate more questions than they answer. Viewed over the whole post war period, however, several generalizations emerge. They will be discussed, as in the previous exposition, in the contexts of time, capability, and quantity.

In the context of time, there is a recurring Soviet design cycle that is affected by technological considerations at least as much as by U.S. strategic programs. Within the cycle, the requirements decision takes place earlier than may have been generally expected and in an environment where several "threats" may be apparent. In the absence of a "stop decision" the cycle will produce prototypes that appear to be inappropriate to the strategic environment. Whereas jet technology and airframe design were well synchronized in the cycle (facilitated by central management in the Ministry of Aviation Industry), electronics and weapons (not under MAP control) were not.

In the context of comparative quality, the traditional Soviet objectives of speed and altitude were followed after the war with some success—at least until the B-58. Thereafter, American technology, as demonstrated in the XB-70-and SR-71, proved superior to the Soviets' own performance (as opposed to mission) objectives. The cause of this is generally traced to different design priorities which evolved from British technology acquired in 1947. The Soviets focused on the air mass and the U.S. focused on temperatures. The Soviet approach led to early success and greater producibility. But early success prejudiced later success at a higher technological level where temperatures became critical. In the meantime, the U.S. changed the rules of qualitative competition with low-level penetration tactics. The Soviet pursuit of altitude and speed, became inappropriate. Electronics, already a constraint on weapon effectiveness, became a particularly critical technology. Thus, earlier decisions, which appeared successful, prejudiced later decisions.

In the context of quantity, production of fighter aircraft sustained a large part of the momentum gained in WWII Khrushchev's shake-up of the aviation industry in 1953, and reorganization of the economy in 1957 slowed the production momentum and reoriented it. A part of that momentum was transferred to non-combat aircraft. Another part was transferred to surface-to-air missile development in line with Khrushchev's general themes about modernization and missile armament. The familiar pattern of cyclical mass production then appeared in the SAM program.[48]

4. Response to Major Events and Crises

a. Introduction

Various events from 1955 to 1972 reached crisis proportions or in other ways served as possible stimuli for the Soviets to strengthen or otherwise shape their strategic air and ballistic missile defenses. Such events would include the Hungarian Revolution, the Berlin crisis, the Cuban missile crisis, the 1967 Middle East War, the Sino-Soviet rivalry, and the invasion of Czechoslovakia. Acting as a possible stimulus in the opposite direction were events such as the U.S. preoccupation with Southeast Asia—although this situation also had a substantial element of tension because of Soviet support of and identification with Hanoi—and the initiation of SALT.

[48] Attributed to Krushchev is the remark: "We started turning them [missiles] out like sausages at our aircraft plants." *Khrushchev Remembers, The Last Testament*, p. 51. Pending official verification of the origins of this document, it is used sparingly in this study. The cycle of SAM deployments is observed in Figure 44.

b. The Pattern of Response

Referring to the analysis of budgetary constraints in section 6 below, there is little which suggests that the Soviet air defense strategy reacted to any of these events. Nor does an examination of the detailed deployment data which underlie the tables and figures of section 6 reveal any patterns which can link to these events. The successive crises of 1961 and 1962 over Berlin and Cuban missiles were clearly major confrontations which could well have stimulated the Soviets to take drastic steps to improve their strategic defensive capabilities. But even as the Cuban crisis was brewing the Soviets were reducing their commitment to strategic defense from what it was in 1961. By 1963 the commitment of resources to strategic defense had fallen to its lowest level for the entire 1955–1972 period. From 1964 through 1967 the same low pattern continued with resource allocations remaining below the 1962 level. This period did witness the deployment of an ABM system; however, the deployment was limited and the resource allocation to the system peaked in 1967, never having reached a very high percentage of the strategic defense budget.

In 1968 new deployments were initiated and there was a sharply higher level of resource allocation which persisted through 1971, before declining somewhat in 1972. The 1967 Middle East War obviously just preceded this spurt and the invasion of Czechoslovakia coincided with its onset. The bulk of the new costs was for actual weapons systems on which the developmental work had been occurring for a number of years beforehand.

5. The Relative Importance of Strategic Defense

a. General Patterns

The relative importance of strategic defense is reflected in the overall Soviet resource strategy for the armed forces as a whole. As is evident from Table 19, the Soviets maintained a large, stable commitment of resources to the armed forces as a whole and relatively stable commitments to each of the components. The overall strategy was thus to maintain a large, balanced force with both offensive and defensive capabilities. The element of stability was particularly strong. Once a good capability was established, it was not reduced. At the same time the Soviets did not rush to create strong capabilities in every area, in particular not mirroring U.S. capabilities in the areas of heavy bombers and aircraft carriers. These areas received limited resources or none at all.

The share of resources going to strategic defense remained roughly at the level of 10 percent of the military budget. As a percentage of the total budget this was not a large figure. But in absolute terms an annual commitment of 1.6 to 2.7 billion rubles provided a large strategic defense establishment.

This was a share of resources which was relatively uninfluenced by events. The analysis below in section 6 reveals no significant change in resource allocation in response to major events or crises. An examination of the resource allocations in comparison with the starting years of the five-year plans reveals no associated surges or declines.

What emerges is a pattern of behavior in which a certain substantial amount of strategic defense is viewed as a good thing. There is no apparent continuing quest to save resources at the cost of less defense. There are no institutional voices which are attacking the level of strategic defensive effort. In fact, for a good Communist it is more in character to argue for defense than for offense (until the point is made that the

best defense is a good offense). A moralistic tone and a basic insensitivity to costs are evident in a statement which Kosygin made in London in 1967:

> What weapons should be regarded as a factor making for tension—offensive or defensive? I believe that the defensive systems, which prevent attack, are not the cause of the arms race, but constitute a factor preventing the death of people. Some argue like this: What is cheaper, to have offensive weapons which can destroy towns or whole states, or to have defensive weapons which can prevent this destruction? At present the theory is current somewhere that the system which is cheaper should be developed. Such so-called theoreticians argue as to the cost of killing a man—500,000 dollars or 100,000. Maybe an antimissile system is more expensive than an offensive system, but it is designed not to kill people but to preserve human lives.[49]

Within the general Soviet strategy the use of strategic offensive systems to strike enemy strategic offensive systems while they are still on the ground is a basic concept. This would suggest the possibility of resource shifts between strategic offensive and defensive programs. Here again no conclusive patterns exist. The lower resource allocation pattern of 1962–1967 for strategic defense does coincide with the highest period of resource allocation to strategic offense. But this was a period which began as the SA-2 deployment was being completed and ended as the SA-5 deployment started. Thus it was not a period during which more resources could necessarily be assimilated in order to produce a substantial improvement in capabilities. At the same time the resource commitments to the strategic offensive program was yielding a significant enhancement of capabilities.

A major challenge to the Soviet resource strategy began in the middle 1960's with the deployment of an ABM system. Although the limited deployment which was accomplished required less than 8 percent of the strategic defense budget even in the peak year of 1967, the cost of full deployment would have drastically altered the size and structure of the budget. In turn, this could have been a significant factor in the Soviet decision to sign the ABM treaty.

b. Budgetary Analysis

In terms of size of budget allocation, strategic defense has one thing in common with both the overall military budget and most of its component elements—the relative stability of the allocations. This can be seen in Table 19. The overall budget is extremely stable. Taking 20.53 billion rubles as the median for the 1955 to 1972 period, the deviation from the median is only 13.3 percent, with the low swing in 1960 and highs in 1970 and 1971. For a strategic defense median budget of 2.13 billion rubles the deviation is 23.9 percent, although if the years 1963 and 1969 are ignored (they represent an unusual low and high respectively), the deviation becomes only 13.8 percent, which makes it almost exactly in line with the deviation figure for the total budget.

A further examination of Table 19 reveals the relative positions of strategic defense and strategic offense. In only one year (1957) is the allocation to strategic defense (2.27 billion rubles) greater than that to strategic offense (2.08 billion rubles). In several years (1962, 1963, and 1967) strategic offense received more than twice as much as strategic defense. Finally in 1972 the two allocations are almost equal again after having diverged sharply all throughout the 1960's. This illustrates the fact that although the Soviet commitment to strategic defensive has been a massive and continuing thing, its priority, at least in terms of its claim on resources, has been less than for strategic offense.

[49] *Izvestiya*, February 11, 1967.

Table 19—Strategic Defense Share of the Soviet Military Budget

(billion 1970 rubles)

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Strategic Defense	2.14	2.33	2.27	2.41	2.30	2.25	2.16	2.00	1.62	1.88	1.88	1.89	1.97	2.32	2.65	2.48	2.42	2.21
Strategic Offense	2.83	2.48	2.08	2.53	2.97	3.29	3.62	4.07	3.85	3.34	2.91	3.70	4.06	3.84	3.78	3.59	2.90	2.39
Ground (including Tactical Aviation)	7.21	6.09	5.51	5.19	4.92	3.69	3.56	3.67	3.77	3.98	4.24	4.30	4.27	4.60	4.33	4.65	4.78	5.03
Naval	2.91	2.68	2,28	2.17	2.14	2.10	2.09	2.19	2.22	2.15	2.30	2.19	2.35	2.27	2.29	2.21	2.15	2.13
Military Transport Aviation	0.36	0.57	0.66	0.76	0.80	0.85	0.99	0.93	0.85	0.74	0.72	0.69	0.70	0.73	0.76	0.83	0.88	0.92
Military RDT&E	0.87	1.09	1.36	1.63	1.92	2.42	2.85	3.18	3.40	3.41	3.36	3.45	3.43	3.36	3.80	4.67	5.18	5.44
Command and Support	2.68	2.81	2.79	2.62	2.52	2.19	2.35	2.48	2.56	2.76	2.98	3.09	3.30	3.53	3.69	3.75	3.84	3.87
DOSAAF	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Military Security Forces	0.70	0.62	0.54	0.53	0.46	0.46	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Reserve and Retired Personnel	0.44	0.45	0.47	0.48	0.49	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.59	0.61	0.63	0.65	0.67	0.69
Total	20.19	19.16	18.00	18.36	18.57	17.80	18.58	19.49	19.25	19.24	19.38	20.32	21.11	21.72	22.36	23.26	23.26	23.10

6. Budgetary Constraints

a. Introduction

The Soviet commitment to national air and missile defense has involved the creation of extensive inventories of deployed weapons systems and the fielding of large numbers of personnel to man them. For the timeframe under consideration the accuracy with which the physical parameters of Soviet resource management are known has become increasingly good. Thus, while there is substantial room for debate over the methodologies by which the cost of Soviet air and missile defense is determined, there is little basis for debate over the numbers of weapons systems which are involved. In turn, because the numbers of weapons systems are so large and because the numbers themselves drive much of the costing, analysis of Soviet resource expenditures provides useful insights into the question of whether budgetary considerations significantly constrained the development of strategic defense.

b. Resource Patterns

The discussion of individual air and missile defense systems in Chapter V provides details of Soviet resource management procedures, especially with respect to fighter aviation. A comparative analysis reveals that there is considerable consistency with respect to procedures within force elements (for example, within fighter aviation) and substantial variations in practices between force elements (for example, between fighter aviation and air defense missile forces).

Tables 20 and 21 reflect deployment patterns for fighter aircraft and surface-to-air missiles (more detailed data are given in Tables 36 and 35). From the fighter portion of Table 20 it is evident that new fighters were introduced with great regularity throughout the bulk of the period and that maximum deployments were normally achieved in four to seven years. At the same time, some fighters, as evidenced by higher maximum deployment numbers, were more successful than others, although mission also dictated the numbers to be procured. Also, because the total number of fighters was declining, some models reached fairly high figures in terms of maximum percentage of the force, although their maximum numbers still did not approach the earlier highs for the MiG-15 and MiG-17. Thus, the pattern for fighter aircraft has been one of the regular development and deployment of new fighters which have gradually grown to maximum deployment while many of the older models were still retained in the active inventory. Essentially the pattern has been one of replacing older models with new ones which have better capabilities and doing so on a regular basis.

Although mass missile deployment began substantially after mass jet fighter deployment (1959 for the SA-2 versus 1948 for the MiG-15). Soviet surface-to-air missiles have nevertheless been in operation for what is now a prolonged period of time. Despite this fact, each new SAM system has served to complement rather than replace earlier ones (only in 1971 is there the first cut in the number of sites and launchers as a gradual cutback in SA-2 deployment was begun). In another sense, however, there has been a certain amount of replacement as the SA-1, SA-2, and SA-3 have all undergone various modifications which have improved their capabilities. The continuous and clear-cut thickening of SAM defenses is depicted in Table 21. On the surface, it would appear from the same table that the density of fighter deployments is decreasing. Here the true picture is less certain because of the qualitative changes which have been occurring, namely improvements in range, avionics, and armament and the metamorphosis of the fighter force from one which had less than 15 percent all-weather aircraft in 1960 to one with more than 90 percent in 1972.

Table 20—Comparison of Fighter and SAM Deployment to 1972

Fighters	Year of Introduction	Maximum Number in Force	No. of Years to Maximum Deployment	Maximum Percent of Total Force	Remarks
MiG-15 (FAGOT)	1948	2000	4	100.0	
MiG-17 (FRESCO)	1952	3000	3	78.9	
MiG-19 (Farmer)	1955	750	6	19.8	Maximum percent of force in 1975 is 28.8
YAK-25 (Flashlight)	1955	400	4	9.5	
SU-9/11 (Fishpot)	1960	780	7	24.7	
SU-7 (Fitter)	1962	35	3	1.0	
YAK-28P (Firebar)	1964	360	4	11.7	
TU-128P (Fiddler)	1966	162	6	5.3	
SU-15 (Flagon)	1968	530*	8	17.3	Deployment continuing, 26.0 percent in 1975
MiG-25 (Foxbat)	1971	63*	5	2.1	Deployment continuing, 7.0 percent in 1975
SAM Launchers	**Year of Introduction**	**Maximum Number in Force**	**No. of Years to Maximum Deployment**	**Percent of Force in 1972**	
SA-1 (Guild)	1954	3360	3	26.5	
SA-2 (Guideline)	1959	4650	6	34.2	Decline in deployment began in 1971
SA-3 (GOA)	1961	908*	5**	7.1	Deployment resumed in 1968, still continuing in 1975
SA-5 (Gammon)	1966	4086*	—	32.2	Deployment began in 1966, still continuing in 1975

* Total in 1972
** For initial deployment, 1961–1965

Table 21—Numbers of Weapons Systems in Soviet National Air Defense Forces

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Fighters	3800	3800	3800	4200	4675	4600	4400	4380	4180	3980	3785	3580	3476	3406	3350	3278	3213	3071
SAM Launchers	1800	3360	3360	3360	3540	4320	5588	7232	7980	8362	8394	8466	8628	8954	10,308	12,010	12,384	13,004
ABM Launchers	—	—	—	—	—	—	—	—	—	—	—	—	—	24	48	64	64	64

c. Resource Allocation to Air Defense Elements

Turning from simple numbers of aircraft and launchers to the cost of the overall Soviet air and missile defense establishment and of its components, a pattern emerges which reflects a strong, continuing allocation of resources to this field with occasional peaks and valleys occurring as major weapons systems procurements are Initiated and completed. Figure 13 and Table 22 present the story, graphically and quantitatively, of Soviet expenditures on National Air Defense Forces. The amounts are given in billions of 1970 rubles.

As is evident, the budget for the National Air Defense Forces has been quite stable since 1955, starting the period at 2.14 billion rubles and ending up at 2.21 billion rubles in 1972. Here the use of constant rubles makes it possible to present a consistent picture in which the impact of inflation has been eliminated but the transition from simpler systems to more complex ones is still reflected.

The pattern of expenditures starts with an early spurt in the SAM area as the SA-1 was deployed, a continued role for antiaircraft artillery, and heavy expenditures for fighters. With the completion of the SA-1 deployment SAM expenditures drop sharply but then pick up again sharply in 1958 as the extensive deployment of the SA-2 begins. In the meantime then is an abrupt drop in antiaircraft artillery costs which finally end by 1961. After reaching a high of 1.27 billion rubles in 1957, fighter costs begin a precipitous slide which does not end until a low of 0.57 billion rubles is reached in 1963. This 1963 figure is the lowest allocation to fighters during the entire period and, interestingly enough, occurs during the second year in which Marshal of Aviation Sudets served as Commander-in-Chief of National Air Defense Forces. It also occurs in a year after the Cuban missile crisis. And, finally, this was Khrushchev's last full year as leader of the Soviet Union and thus his last opportunity to shape military force structure throughout the full course of a year. The overall 1963 budget for strategic air defense is also at the lowest level for the period.

The above figures for 1963 illustrate a basic problem in analyzing the Soviet commitment to strategic defense. The facts of what was done fly in the face of other events which logically could have led to a different course of action. It seems a bit incongruous to have Marshal of Aviation Sudets associated with the smallest fighter budget and to have the lowest figure for overall strategic defense occur during the year after the Cuban crisis. Explanations for this include, on the one hand, the possibility that strategic defense was cut in order to free additional resources for building offensive missiles or, on the other hand, the possibility that this was a transitional period during which the Soviets were waiting for the completion of the development of their ABM system and the SA-5 while simultaneously restructuring their fighter force to reduce the percentage of older models.

Except for the sharp dip in 1963, the strategic defense budget for 1962 through 1967 was very consistent, remaining just at or somewhat below 2.0 billion rubles. This coincides with a period of limited new systems deployment—not much in the way of SA-2 or SA-3 deployments during these years, while the YAK-28p low altitude interceptor was the only new aircraft being deployed during most of this period (even its numbers were small—a total of 360 aircraft in four years).

In 1967, however, a sharp upturn was launched as the SA-5 was deployed, deployment of the SA-3 was resumed, and first the Tu-128p and then the Su-15 fighters were introduced into the force. By 1969 the strategic defense budget peaked at 2.65 billion rubles, the highest figure ever, and then went into a slow but steady decline to 1972.

Figure 13—Estimated Soviet Expenditures for National Air Defense Forces By Element

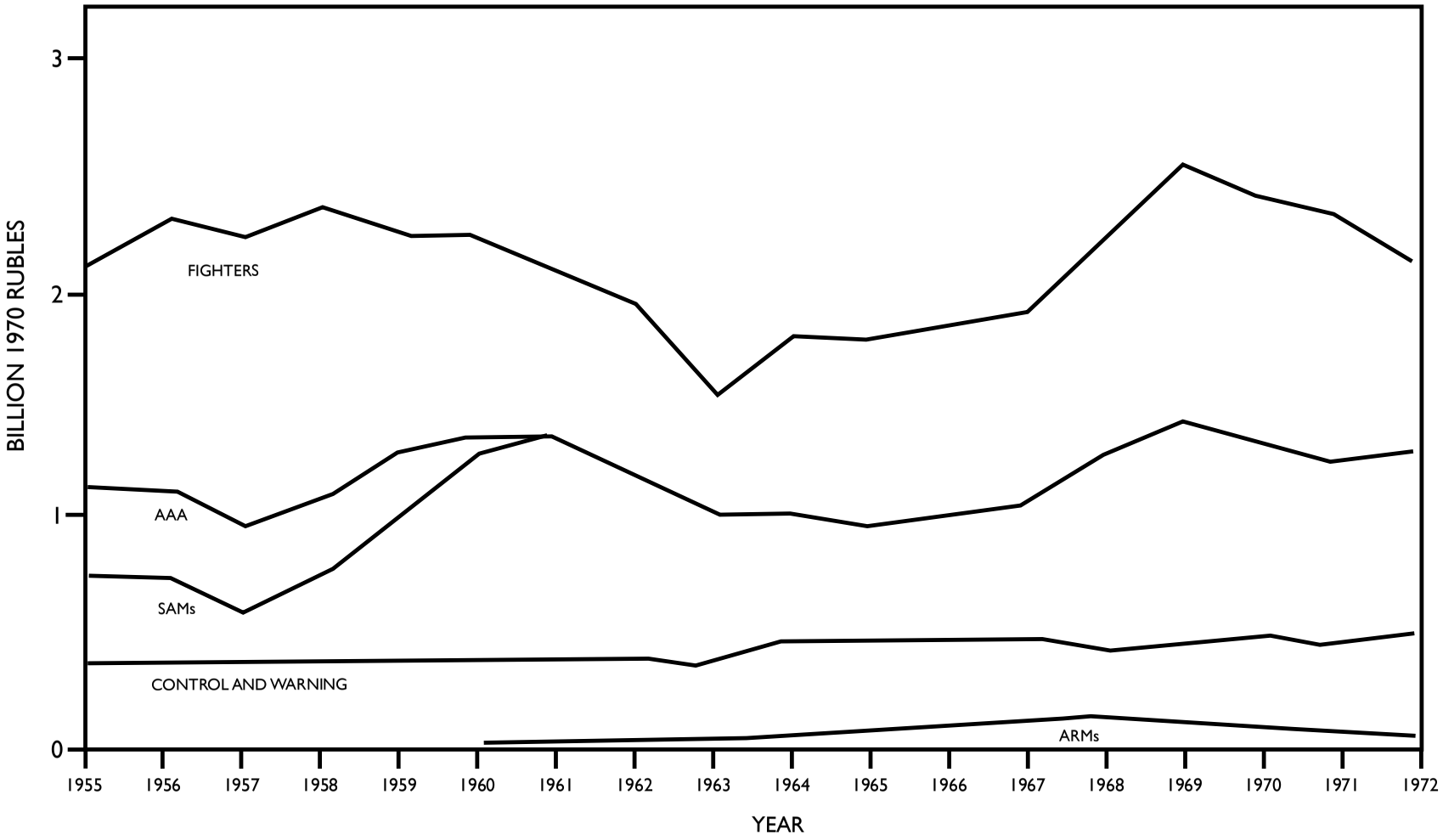


Table 22—Estimated Soviet Expenditures for National Air Defense Forces by Element

(billion 1970 rubles)

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Fighters	0.99	1.18	1.27	1.25	0.93	0.81	0.74	0.74	0.57	0.82	0.86	0.82	0.86	0.95	1.13	1.06	1.07	0.84
AAA	0.37	0.36	0.39	0.37	0.30	0.08	—	—	—	—	—	—	—	—	—	—	—	—
SAMs	0.37	0.38	0.20	0.37	0.65	0.94	0.98	0.82	0.60	0.57	0.51	0.54	0.59	0.89	1.03	0.91	0.84	0.83
Control & Warning	0.41	0.41	0.41	0.41	0.41	0.41	0.43	0.43	0.43	0.44	0.42	0.41	0.37	0.37	0.39	0.40	0.44	0.47
ABMs	—	—	—	—	—	—	0.01	—	0.01	0.06	0.09	0.11	0.15	0.12	0.10	0.11	0.07	0.07
Total	2.14	2.33	2.27	2.41	2.30	2.25	2.16	2.00	1.62	1.88	1.88	1.89	1.97	2.32	2.65	2.48	2.42	2.21

Once the current force structure had been basically established in 1960 with the substantial deployment of the SA-2 and the virtual elimination of antiaircraft artillery from the strategic defense system, there was substantial stability in the share of resources going to each element of strategic defense. The control and warning function actually had the greatest stability (extending even back to 1955), especially in absolute terms, since the annual resource allocation to it varied by no more than 60 million rubles over the entire period. But because of fluctuations in the resources going to other elements of strategic defense, its relative share of the total ranged from 15 to 26 percent. From 1960 the share for fighter aviation was also stable, ranging from 34 to 46 percent. The fluctuation in resources going to SAMs, however, was almost twice as large, running from 27 percent to as high as 45 percent, with the highs occurring during periods at major deployments and the lows occurring when deployments had been completed. ABM defenses garnered only a small share of the budget, receiving less than 8 percent of the total in the year of maximum spending for ABMs.

It is noteworthy that the Soviet expenditures for control and warning have been substantial, amounting to one-fourth of the budget at one point. At the same time this is in sharp contrast with the U.S. pattern where, in the U.S. system which has emphasized warning to alert strategic offensive systems more than to support strategic defense, control and warning have accounted for about one half of the much smaller U.S. budget for strategic defensive forces.

Upon examining the Soviet National Air Defense Budget in terms of expenditures by resource category (Figure 14 and Table 23), one can see a slow rise in the cost of pay and allowances, a sharper rise in the amount spent on operations and maintenance, and fluctuations in investment expenditures which coincide with the fighter and missile deployment programs which have been described.

E. Soviet Strategy—A Synthesis

1. The Basic Thrust of Soviet Strategy

Seemingly regardless of events, regardless of fluctuations in the threat, regardless of other demands which might exist for resources, the basic thrust of Soviet strategy has been that it is a desirable thing to have and continually maintain a strong strategic defensive posture. This posture has three basic elements: a massive air defense capability; a coordinated civil defense system; and a limited ABM system. It also has a parallel in an approach to strategic offensive forces, which emphasizes being able to strike enemy offensive forces before they can be committed.

2. The Rationale of Soviet Strategy

Two statements serve to underscore the rationale of Soviet strategy. One is by Col. Gen. A. Gastilovich: "The superiority of the socialist structure with its economic potential and the political unity of the people will enable the countries of the Socialist Camp to withstand the first nuclear strikes of the enemy. This is further favored by the enormous territory, the inexhaustible human resources, and the relatively great dispersion of industrial and administrative centers."[50]

[50] Gastilovich, A., op. cit., p. 4.

Figure 14—Estimated Soviet Expenditures for National Air Defense Forces by Resource Category

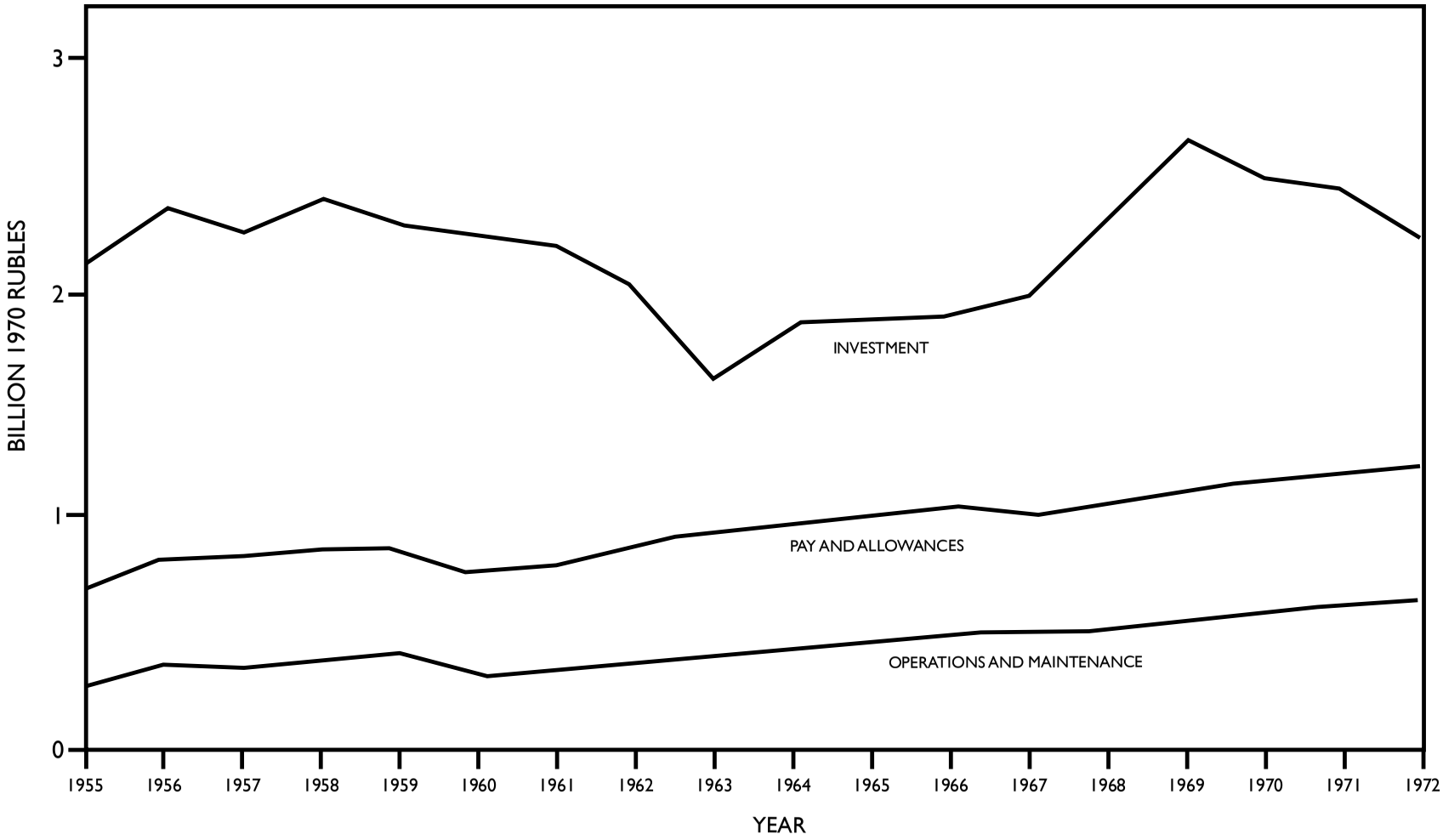


Table 23—Estimated Soviet Expenditures for National Air Defense Forces by Resource Category

(billion 1970 rubles)

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Investment	1.41	1.51	1.40	1.52	1.42	1.48	1.37	1.08	0.63	0.84	0.84	0.87	0.95	1.27	1.52	1.27	1.19	0.96
Pay and Allowances	0.41	0.45	0.47	0.48	0.46	0.45	0.45	0.53	0.55	0.56	0.55	0.55	0.54	0.54	0.58	0.60	0.61	0.61
Operations and Maintenance	0.32	0.37	0.39	0.41	0.42	0.33	0.34	0.38	0.44	0.47	0.49	0.48	0.48	0.51	0.55	0.60	0.63	0.64
Total	2.14	2.33	2.27	2.41	2.30	2.25	2.16	2.00	1.62	1.88	1.88	1.89	1.97	2.32	2.65	2.48	2.42	2.21

Three elements here are particularly significant to the Soviet approach to strategic defense: the will of the people, the enormous territory, and the relatively great dispersion of industrial and administrative centers. These three elements signify a readiness to accept substantial destruction in expectation that they will make is possible to survive. Based on this the strategy becomes one of limiting damage rather than one of having a very high assurance that there will be no significant damage. The inexhaustible human resources also have significance. Numerous cities can be destroyed, but the human resources with which to carry on are virtually inexhaustible. These thoughts are a combination of Communist attitude, Russian history, and World War II experience, and for that reason they are ingrained and not necessarily logical. But they do condition the Soviet approach to strategic defense.

The second statement, this time in *Military Strategy*, puts strategic defense in a large strategic context:

> Protection of the country's rear areas and formations of armed forces from nuclear strikes by the enemy has, as its aims, to preserve the vital activity of the state, to secure the uninterrupted functioning of the economy and transportation, and to safeguard the combat potential of the Armed Forces. These alms will be achieved primarily by destroying the enemy's nuclear weapons where they are based. However, there is no guarantee that significant aircraft and missile forces can be destroyed at their bases, especially at the outset of a war, if the enemy attacks by surprise. Therefore the necessary forces and weapons must be available to destroy large numbers of enemy aircraft and missiles in flight in order to prevent nuclear strikes against the country's most important targets. This can be done by conducting military operations to defend the country from enemy air and missile attack.[51]

Thus, according to *Military Strategy*, the strategic defensive forces have as their mission the destruction of attacking enemy strategic offensive air and missile forces which are not destroyed first at their bases. Here the problem is not one of cooperation between strategic offensive and defensive forces. The missions are complementary but not susceptible to integration. As *Military Strategy* implies, if the Soviet strategic offensive forces were to destroy all potential attackers, the strategic defensive forces would be unnecessary. But because this cannot be relied on, especially in the case of a surprise attack, the strategic defensive forces are necessary.

In the larger scheme of things the Soviet National Air Defense Forces receive related assistance from two sources: (1) the air defense forces of the East European countries which are coordinated under the Warsaw Pact and thus provide a western extension of the Soviet defenses, and (2) the air defense elements of Soviet theater forces which normally fall under the operational control of the National Air Defense Forces until they leave the country.

Strategic defense is thus a total commitment of all available resources—Soviet and East European, military and civilian, national and theater—to the defense of the country.

3. Weapons and Resource Strategy

a. The Basic Theme of Soviet Weapons Strategy

A statement in *Military Strategy* captures the basic theme of Soviet weapons strategy:

> The distinguishing feature of weapons development under current conditions is the appearance of qualitatively *new types of weapons and equipment* and their rapid and massive introduction into the armed forces. This has led to a pronounced improvement in the latter's capabilities and a radical change in the organiza-

[51] Sokolovskiy, *Soviet Military Strategy*, p. 417.

> tional forms of the armed forces and methods of conducting military operations on every scale. Military strategy and the art of waging war as a whole have undergone a revolution.[52]

Every point in this statement merits emphasis, including: (1) appearance of qualitatively new types of weapons and equipment; (2) their rapid and massive introduction into the armed forces; (3) the pronounced improvement in capabilities; (4) the radical change in organizational forms and methods of conducting military operations; and (5) the occurrence of a revolution in military strategy and the art of waging war. Each of these points applies to strategic defense.

b. Development of New Weapons

A basic question with respect to the development and introduction of new weapons and equipment concerns what drives the effort. This effort itself is analyzed in considerable detail in the Chapter V studies of fighter aircraft and surface-to-air missiles. Of the various possible influences the one which is most difficult to document specifically is the reaction to U.S. offensive weapons systems and operational concepts and tactics. As was noted in the analysis of Soviet behavior in the 1960–1962 debate on military concepts and operations, even in the records of secret deliberations which have been available there has been little in the way of specific linkage of U.S. capabilities and individual Soviet weapons developments.

As much as anything, the driving force behind new weapons development seems to be the fact that design bureaus have been created to turn out new weapons systems. They have this mission and with it there is an expectation that periodically they will turnout a new system which will represent a qualitative improvement over previous systems. At the same time they are aware through open source and espionage of what the U.S. currently has in the way of weapons systems and often of what is being developed for the future. How this knowledge impacts specifically cannot be determined, although a few cases can be made, as indicated in Chapter V, in the systems studies of fighter aircraft. One example, in this case a very slow reaction, was the deployment of the TU-128P fighter which incorporated an apparent new capability to combat the Hound Dog. Other inputs which could influence the designers would include knowledge of developments in Soviet strategic offensive systems and the practical experience from air defense operations and exercises. The latter would serve, in particular, to indicate deficiencies in existing systems.

c. Rate of Introduction

The rate of introduction of new weapons systems would be expected to depend on the criticality of the need and the availability of additional resources. In actual fact a case cannot be made for either of these factors being the determining criterion. Fighter aircraft were deployed at a rate which was consistent with the previous production record of the producing plants, unless, of course, the deployment pattern was shortened because of deficiencies of the aircraft. SAMs, on the other hand were deployed at a very rapid rate and in massive numbers.

One basic feature should be noted in these deployment patterns. The new fighters were replacing old ones; thus there was a capability already present which was simply being upgraded qualitatively rather than being increased quantitatively. In fact, the numbers of aircraft in operation were declining. In contrast, each successive SAM deployment were adding a new capability, although the SAM was also replacing anti-

[52] Ibid., p. 295.

aircraft artillery. And each successive SAM deployment added on quantitatively as well as qualitatively to that which was already there.

d. Improvement of Capabilities

The desirability of improving capabilities of weapons and equipment is obvious. The institutionalization of capability improvement so that new systems of improved capabilities, are turned out on a regular basis, regardless of whether an incremented improvement is needed in order to cope with a potential threat, is another matter. This essentially has been the pattern in Soviet strategic defense.

e. Change in Organizational Forms and Operational Methods

The new Soviet air defense weapons have had their impact on organization and on operational methods and the changes have been quite radical, although fare from complete. The most significant changes stem from the fact that constantly improving range and accuracy of the weapons have moved defensive concepts from a point approach to an area approach with the area in which weapons systems are integrated in the operation constantly growing larger.

f. The Revolution in Military Strategy and the Art of War

This theme is dear to Soviet military theoreticians because it parallels the politically desirable line that a communist approach to problems can revolutionize their solution. In this connection the improving weapons systems are the basic vehicle for accomplishing the revolution, and, since a continuing positive revolution is a desirable thing, those who can effect further improvements in weapons are acclaimed for their service to the state.

4. Summary

Despite the questionable logic of continuing to strengthen defense against the air threat while limiting defense against the ballistic missile threat, this is exactly what the Soviets were doing in 1972 (and have continued to do into 1975). Once set in the early post war years, the basic thrust of Soviet strategic defense continued without significant alteration throughout the period. Many details changed, but the emphasis on qualitative and quantitative improvement of strategic defense did not. The political leadership set priorities for strategic defense and allocated a steady and substantial amount of resources for their realization. A foreign threat—primarily U.S.—was omnipresent but difficult to trace in its impact on Soviet strategy. A system had been created—in industry and in the military—which continued with much interest to assimilate its allocated share of resources.

Chapter IV

American Systems

Section I. General

A. Limitations

The guidelines for preparation of supporting studies to the over-all effort, "History of the Strategic Arms Competition 1945–1972," indicate that historical "treatment will tend to be selective rather than exhaustive."[1] This guidance has been applied in this chapter so as to bring the expository problem regarding American air, ballistic missile, and space (antisatellite) defense systems within manageable bounds. There is no effort made to prepare a narrative history of *all* such systems, although mention of each major system is included in the air defense and ballistic missile and space defense chronologies (Appendices A and B, Volume II, "History of Strategic Air and Ballistic Missile Defense, 1956–1972").

B. Purpose

In the discussions of American systems for the period 1956–1972 the purposes have been to (1) outline the specific defense goals to be achieved by specific system development, production, and deployment; (2) indicate at selected times the system deployments that have resulted; (3) indicate significant modifications in system capabilities, production schedules, and deployments that have occurred; and (4) throughout all of the above considerations, focus on the question of *why*.

C. Approach

The analyses contained in this chapter are based on the following general approach:

(1) The situations in American air and ballistic missile defense systems at the end of 1955 are taken as points of departure.[2]

(2) Sequential system histories are included in Appendices A and B, A Chronology of American Air Defense Systems and A Chronology of American Ballistic Missile and Space Defense Systems.

(3) Significant events in system development, deployment, or modification are selected for narrative discussion and are included in this chapter.

D. Chapter Organization

American air, ballistic missile, and space defense systems since 1955 appear best considered as three separate functional subjects. Although slightly at variance with the format utilized in Chapter IV, Volume I,

[1] "Guidance for Preparation of Supporting Studies for History of the Strategic Arms Competition 1945–1972, Historical Office, Office of the Secretary of Defense, October 1944, p. 7.

[2] For details concerning American systems for the period 1945–1955, the reader is referred to Chapter IV, American Systems, Book I, Volume I, 1945–1955, "History of Strategic Air and Ballistic Missile Defense", and to Book II, Volume I, Appendix B, A Chronology of American Air and Ballistic Missile Defense Systems and Appendix D, Figures.

air defense, ballistic missile defense, and space defense will be discussed in separate sections of this chapter. The three sections will be supported by the chronologies, Appendices A and B.

E. Analysis Factors

In the analyses of why various events, decisions, and developments concerning the air, ballistic missile, and space defense systems occurred, certain categories of factors suggest themselves as important considerations. One factor of vital importance is the threat that is perceived to exist. This perception of the threat, however, must be tempered with an appreciation of the reliability of the intelligence on which the threat assessment is based and on the decision-maker's interpretation of that intelligence. At any given period, there may well be differing evaluations of the specifics of an air, ballistic missile, or satellite threat.

There may not be universal acceptance as to what the threat actually is. However, considerable uniformity on the subject is implied if a national strategy for air, or ballistic missile, or space defense is formally and officially established. Unfortunately for the historian such clear "guide posts" are rarely available. The national strategy often must be inferred from a variety of decisions and events, which in turn had been influenced by numerous other, frequently conflicting, considerations.

One of these additional factors which often was crucial in the matter of defense systems was that of the national defense budget. Decisions on which system to develop, how many to produce and deploy, what modernization modifications were to be applied were often based on their costs.

Quite apart from considerations of threat, national strategy, or costs is that of technological capability. The need for a system, its performance characteristics, even a national willingness to pay for it, were, in the final analysis, subordinated to the technological capability of industry to produce such a system. Advances in technological capability (e.g., development of solid state electronics) brought associated requests for defense system modifications which were not given impetus by threat, or strategy, or cost considerations. In fact, cost provided a "dampening" effect on many modernization proposals.

The threat received some modifications that were primarily technological rather than quantitative in nature. For example, the impact of ECM on established air defense systems was not initially appreciated by system planners. The need for improvements both to existing and developmental systems to facilitate operation in an ECM environment resulted. Understanding of the effects of EMP from a nuclear explosion is a relatively recent development. However, with this understanding came a costly and complex requirement for hardening. There are undoubtedly other examples of the impact of technology on both evaluating and countering the threat.

A hazy area that probably had some influence on development and deployment of American systems subsequent to 1955 was that of inter-Service rivalry stemming from disagreements over Service roles and missions. Whereas this was a primary issue in both air and ballistic missile defense during the earlier period, the effects of the occasional differences of opinion during the period 1956–1972 were of less overall significance and will, therefore, receive correspondingly less emphasis in this chapter.

An obvious point that merits mentioning is that all or most of the above factors operated simultaneously in the consideration of any American system. The final decision regarding system development, deployment, or modification was a compromise or adjustment of the influences of the various factors. Indeed for historical consideration, it is difficult—if not impossible—to ascribe with certainty a paramount importance to any one of the factors.

F. The Status End 1955

1. Approach

The status of the strategic air defense of the United States at the end of 1955 is summarized below to establish for the reader a point of departure for the consideration of American systems during the period 1956–1972 as covered in Section II of this chapter. Since there was no ballistic missile or space defense in existence in 1955, *all* coverage pertaining to those subjects is addressed in Sections III and IV this chapter.

2. Organization and Command

By the end of 1955 the United States had reached the threshold of its maximum commitment to air defense in terms of numbers of units and deployed systems since the close of World War II. Since September 1, 1954, a joint command, Continental Air Defense Command (CONAD), responsible for the air defense of the United States, had been in existence at Colorado Springs.[3] Forces for the CONAD mission were provided by the component commands: USAF Air Defense Command (ADC), USA Antiaircraft Command (ARAACOM),[4] Naval Forces CONAD (NAVFORCONAD), and various augmentation forces of all services made available to CINCONAD during periods of emergency. As an indication of the magnitude of the air defense effort, the authorized or programmed personnel strengths of ADC and ARAACOM, the two major component commands, were 93,120 and 42,552, respectively.[5]

Responsibility for air defense was assigned to ADC and ARAACOM subordinate commands on a geographic basis, with boundaries between commands influenced by operational principles and requirements such as span of control, air traffic density, and possible enemy air approach routes. In 1955 ADC was organized geographically into Eastern, Central, and Western Air Defense Forces (EADF, CADF, and WADF), each consisting of four air divisions.[6] ARAACOM was similarly organized geographically, except that the EASTARAACOM was further subdivided into three antiaircraft regional commands to facilitate logistical coordination with the First, Second, and Fifth ZI armies.[7]

Planning to accommodate the soon-to-be-available Semi-Automatic Ground Environment (SAGE) system was an important feature of late 1955. From point of view of geographic subdivision of the Continental United States for air defense purposes, the SAGE system would require eight divisions/sectors and thirty-four wing/subsector areas.[8]

By the end of 1955, problem areas in a field closely related to that of command and control, i.e., the Service roles and missions pertaining to air defense, had been largely resolved. During the previous decade the Army Air Force (AAF)—Army Ground Force (AGF) controversy over responsibility for air defense, the ADC-ARAACOM efforts to clarify and define operational control and rules of engagement, and the USAF-USA competition to develop the surface-to-air missile (SAM) system had raged and waned. With

[3] USAF was the executive agent for this joint command. Initially and until September 17, 1956, command of both CONAD and ADC rested with the same individual.
[4] On March 21, 1957, ARAACOM was redesignated U.S. Army Air Defense, Command; thereafter the acronym ARADCOM was used.
[5] "Continental Air Defense Command and Air Defense Command History, July–December 1955," Headquarters CONAD, p. 10.
[6] Ibid., p. 2.
[7] Ibid., p. 3.
[8] Ibid., p. 12.

few exceptions, the period subsequent to 1955 would be characterized by component awareness that their tasks were the provision and deployment of forces for air defense, and a generally cooperative pursuit of common air defense goals.

3. Surveillance and Early Warning

The earliest possible detection and identification of air traffic approaching the United States was essential to the adequate provision of early warning. Three to six hours warning of attack was an initial prerequisite to both active and passive defense response. This early warning and interceptor control were achieved primarily by electronic means (radar), supplemented by volunteer ground observers.

At the end of 1955, the active electronic surveillance network operated by ADC within the U.S. is shown partially by Figure 15 and consisted of 75 radar stations of the Permanent System, 15 radar stations of the Mobile Program, and 6 Lashup stations.[9]

Additionally, 375,000 Ground Observer Corps (GOC) volunteers were engaged in a program which resulted in manning 7,918 active posts.[10]

The primary search radars utilized at the stations of the permanent system included 64 AN/FPS-3, 7 AN/CPS-6B, and 4 AN/FPS-10. A variety of models of the height finder radars were in use.

The 1955 CONUS surveillance system was, not highly effective against low altitude targets. To compensate for this known weakness, a concept of "gap filler" radars was developed. This was a supplemental system of small, unattended radars (AN/FPS-14) specifically to provide detection of aircraft down to 500 feet. Initial planning had generated a requirement for 323 of these radars in the United States; new siting criteria reduced this number to 111.[11] The first increment of 22 gap filler radars was programmed to be operational by June, 1956.[12]

The radar surveillance network was integrated into the air defense system through 12 control centers. The GOC accumulated, evaluated, and updated their data through 53 filter centers.

Since the early warning generated by the surveillance system was a function of radar range, in addition to other factors, an important strategic concept was to locate radar surveillance stations as far from the vital areas of the United States as possible. With the dedication of defense planners of the period to the polar approach from the U.S.S.R., this meant locating ground radar stations north, on the continent and into Canada and Alaska and seaward off both the East and West Coasts of the CONUS.

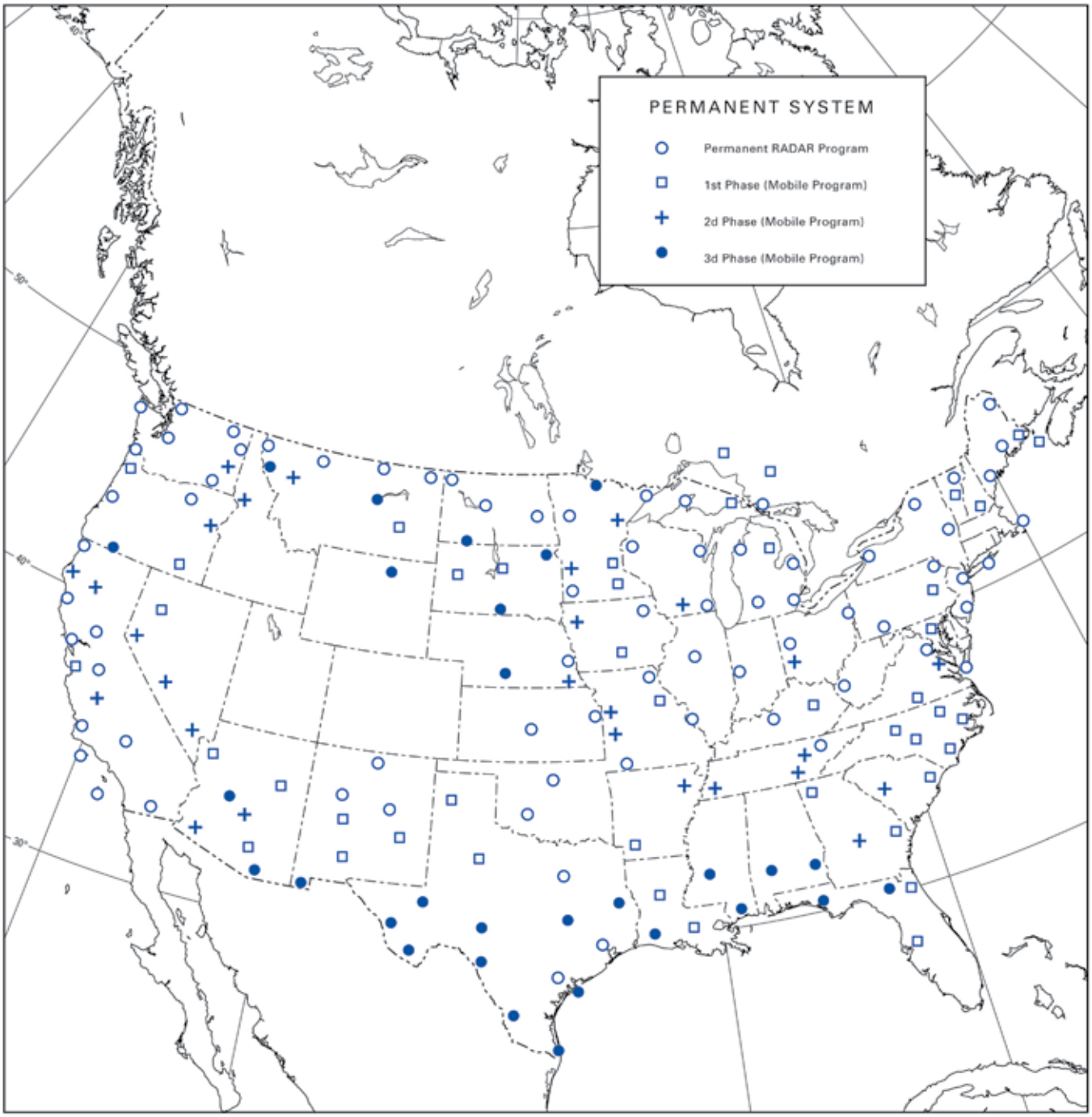
By joint agreement with Canada in 1951, a northward extension of the CONUS permanent system was initiated. This project, called Pinetree, resulted in programming 33 radar sites in Canada, all of which were operational by December 1955.[13] Twenty-two of these stations were manned by USAF personnel.

Construction of a line of detection stations, unmanned and telemetered, crossing Canada at about the 55th parallel, was begun in October 1952. This system, the Mid-Canada Line, utilized the AN/FPS-503 CW Doppler radar, and consisted of 90 detection station and eight section control stations. All sections were operational by December 31, 1956.[14]

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[9] Ibid., p. 17.
[10] A post was considered active if it were equipped with communications and manned at least two hours per day. 1,365 of these posts were manned 24 hours per day under the SKYWATCH program. Ibid., p. 50.
[11] Continental Air Defense Command and Air Defense Command History, July–December 1955," Headquarters CONAD, p. 45.
[12] "Continental Air Defense Command and Air Defense Command History, January–June 1956," Headquarters CONAD, p. 28.
[13] Ibid., p. 74.
[14] Ibid., p. 74.

Figure 15—ADC Electronic Surveillance Network, 1955*



*This figure has also been utilized in Volume I, titled as Figure 4—Permanent System.

A detection line at the 70th parallel (virtually the northern extremity of the continent), the Distant Early Warning (DEW) Line, was approved in January, 1955, and was, at that time, projected to be operational by July 1957. The land portion of the DEW Line was to run from Cape Lisburne, Alaska, to Cape Dyer, Baffin Island. Involved were 58 separate stations of three types—main stations, auxiliary stations, and intermediate stations.

The approximate locations of the Pinetree stations and the Mid-Canada and DEW Lines are shown by Figure 16.

There were several methods visualized for extending radar coverage seaward. The USAF program for Texas Towers involved construction of five tower-mounted radar stations on shoals at locations approximately 100 miles off the northeast coast of the U.S. The first of these Texas Towers (No. 2) achieved beneficial occupancy in December, 1955. Two more towers were programmed for FY 1956, and the final two of the program for FY 1957. A Texas Tower radar site constituted a limited ground controlled intercept (GCI) station.[15]

USAF also utilized an airborne early warning capability. Three AEW&C squadrons were stationed at each McClellan AFB, California, and Otis AFB, Massachusetts. These squadrons were equipped with RC-121 aircraft. Their mission was to fill low and medium altitude gaps in the radar coverage between shore based radars and the picket ships.[16]

The extension seaward of the continental radar coverage also involved the Navy and led to the requirement for NAVFORCONAD. One Navy involvement was the provision of picket ships off both coasts as a means of extending the "contiguous radar coverage." The program called for five picket ship stations off each coast, to be manned 24 hours per day. The East Coast had priority; all five stations had been manned since July 1955. Only the first station in the Pacific was manned by that date.[17] CONAD programmed a requirement for 19 picket ship stations—six more off the East Coast and three off the West Coast.[18] The exact locations of the picket ship stations varied. However, as a generality, the line of stations was located about 300 miles off coast; the distance between ships was approximately 150 miles.

The approximate locations of the elements contributing to the contiguous radar coverage system are shown by Figure 17.

Planning, not yet implemented during this early period, involved the Navy further. Both eastern and western sea extensions of the DEW Line, under the command of CINCLANT and CINCPAC, were planned. Additionally, the use of Navy lighter-than-air blimps on electronic surveillance missions as a part of the contiguous radar coverage was planned.

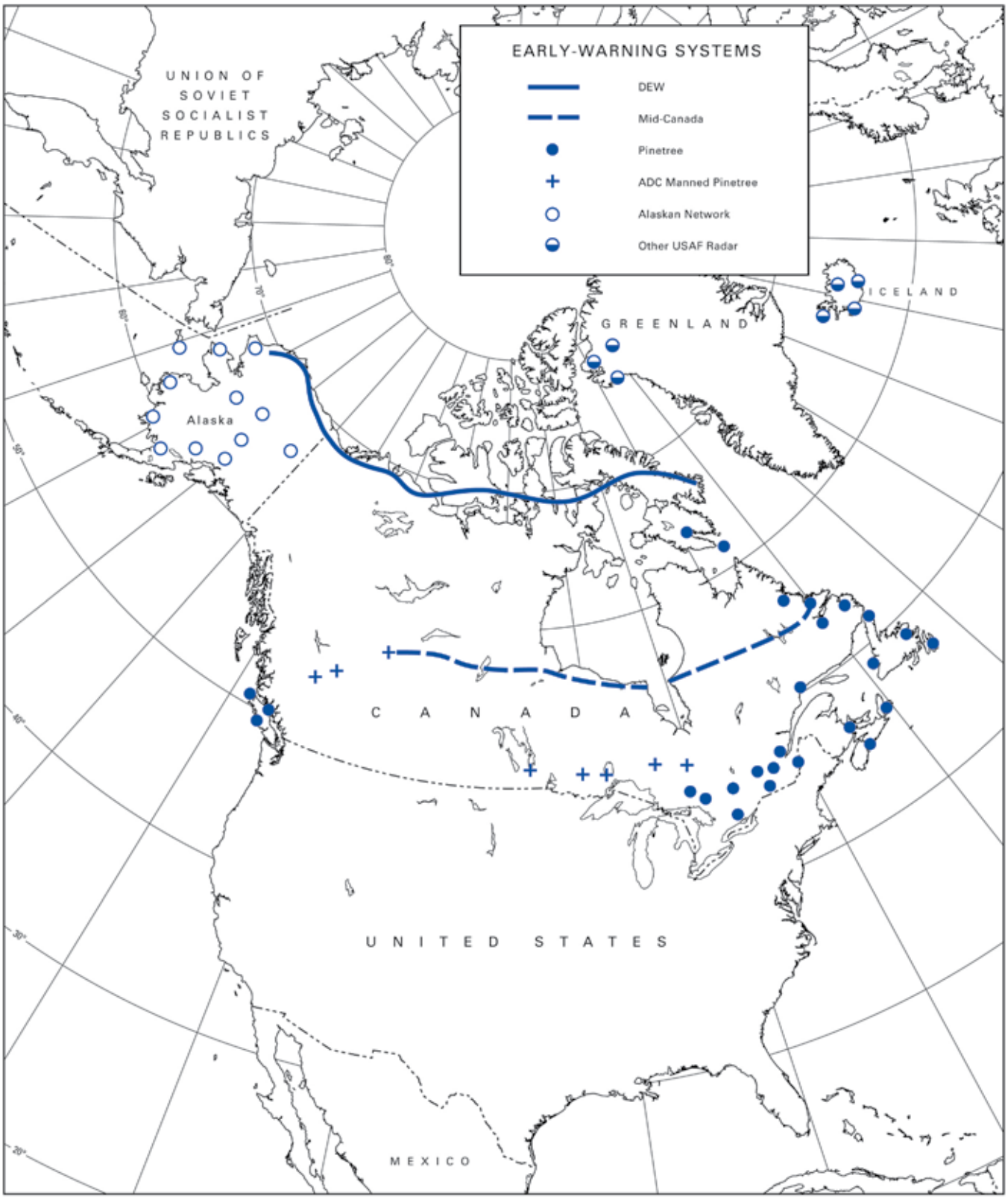
4. Fighter Interceptors

Whereas the USAF interceptor aircraft in the early 1950's were "day jets," an all-weather jet capability was general prior to 1955 with the appearance of the F-86D, F-89D, and F-94C. Pilot reflexes were soon too slow to control these sophisticated aircraft and their associated radar and weapons systems. SAGE provided an electronic command and control network. Air-to-air guided missiles and atomic rockets were added to the interceptor arsenal. Spectacular though these aircraft system developments were, they but presaged the appearance in 1956 of the first of the USAF "century series" of interceptors, the F-102A.

By the end of 1955, ADC had a total of 61 all-weather squadrons as follows[19]: 41 F–86D, 11 F–89D, and 9 F–94C.

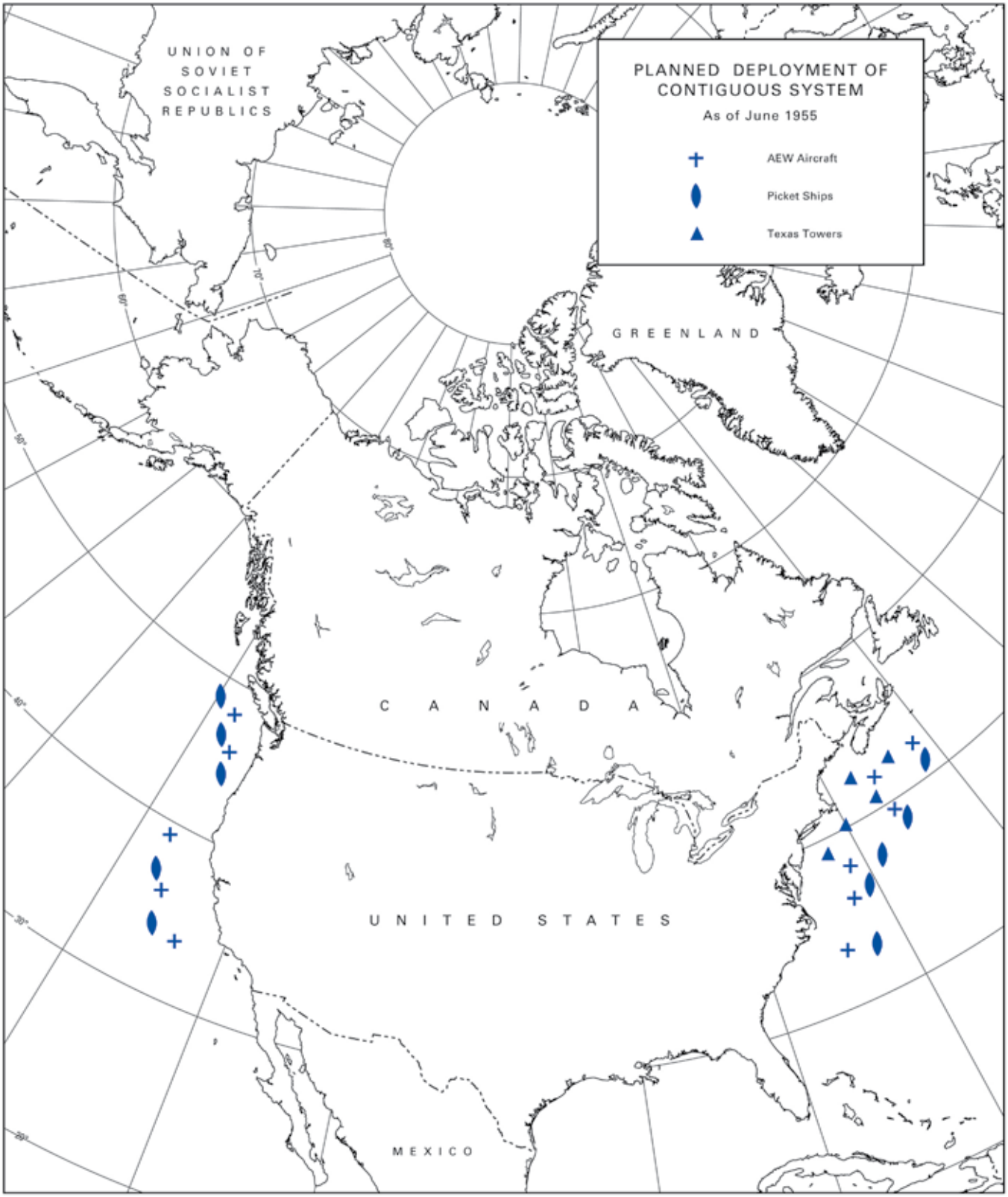
[15] Ibid., p. 37.
[16] Ibid., p. 36.
[17] Ibid., p. 32.
[18] "Historical Summary, July 1956–June 1957", Continental Air Defense Command, p. 60.
[19] "Continental Air Defense and Air Defense Command History, July–December, 1955," Headquarters CONAD, p. 80.

Figure 16—Early-Warning Systems



This figure has also been utilized in Chapter IV, Volume I.

Figure 17—Planned Deployment of Contiguous System (As of June 1955)



This figure has also been utilized in Chapter IV, Volume I, titled as Figure 19.

There were 1,490 operational aircraft assigned to the squadrons. They operated from 44 bases, 27 of which were controlled by ADC. Fighter interceptor squadron deployment at the end of 1955 is shown by Figure 18.

Plans were in existence for the augmentation of ADC in its air defense mission in the event of emergency. Approximately 4,000 additional aircraft were earmarked for this purpose from other USAF commands (SAC, TAC, and ATC), the Navy, the Air National Guard, and the Air Force Reserve.

In 1955 requirements for ADC interceptors projected to 1959 called for 69 squadrons. The current inventory of aircraft—the F-86D, F-89D, and F-94C—were to be converted to F-89H, F-89J, F-101B, F-102A, and F-102B.

5. Ground-Based Antiaircraft Defenses

By the end of 1955 the Army had established full-time antiaircraft defenses of designated targets, utilizing 75-mm. guns (Skysweeper), 90-mm. guns, 120-mm. guns, and the surface-to-air missile, Nike-Ajax. These deployments are shown by Figures 19 through 21. Distribution, by weapons types, of the ARAACOM battalions was[20]:

Battalion	BN December 1955	BN Projected March 1957
Nike-Ajax	38	61
75-mm. gun	8	13
90-mm. gun	29	{26
120-mm. gun	4	

On September 9 a milepost in antiaircraft defense was reached. The Nike SAM became the principal antiaircraft weapon when the number of Nike batteries (136) equaled the number of gun batteries.[21] Another point of significance is that, by the end of 1955, the number of antiaircraft batteries, the preponderance of which were SAM, exceeded the number of interceptor squadrons.

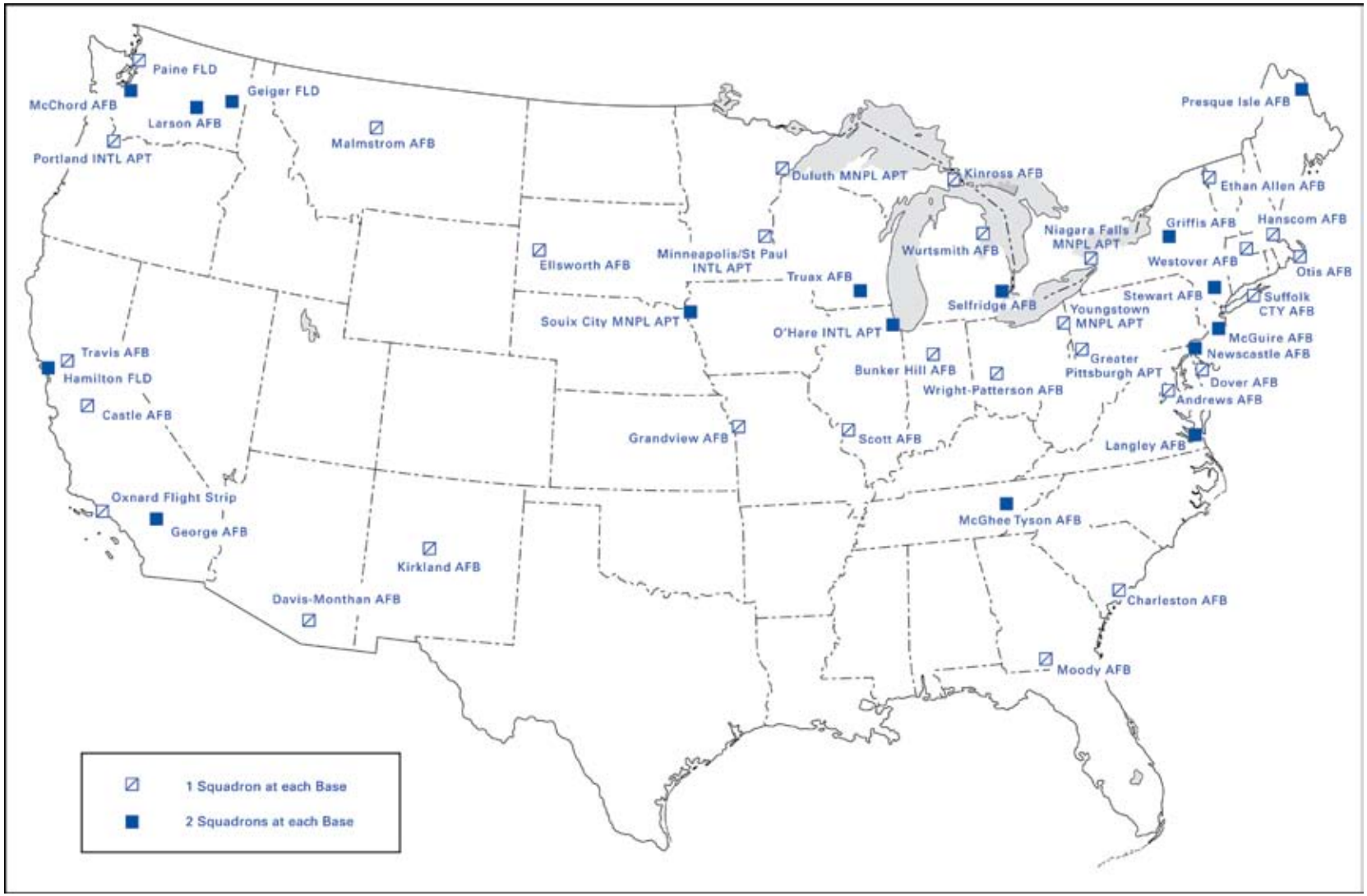
As had been true of the USAF, the army utilized augmentation forces to supplement the active units. Army National Guard batteries were incorporated into established defenses. By September, 1955, 53 batteries were so used. Additionally, NG battalions, after achieving proficiency and designation as "special security forces," would, upon proper notification, move to on-site positions under the command of CG ARAACOM.[22]

6. Strategy

Since there has been a general continuity in the locations within the United States receiving antiaircraft protection, historical inquiry may suggest the strategy applicable to this phase of air defense. In many cases units providing SAM protection had been converted "in-place" from an earlier deployed antiaircraft gun unit. A priority for defense can be inferred from the order of defense closing.

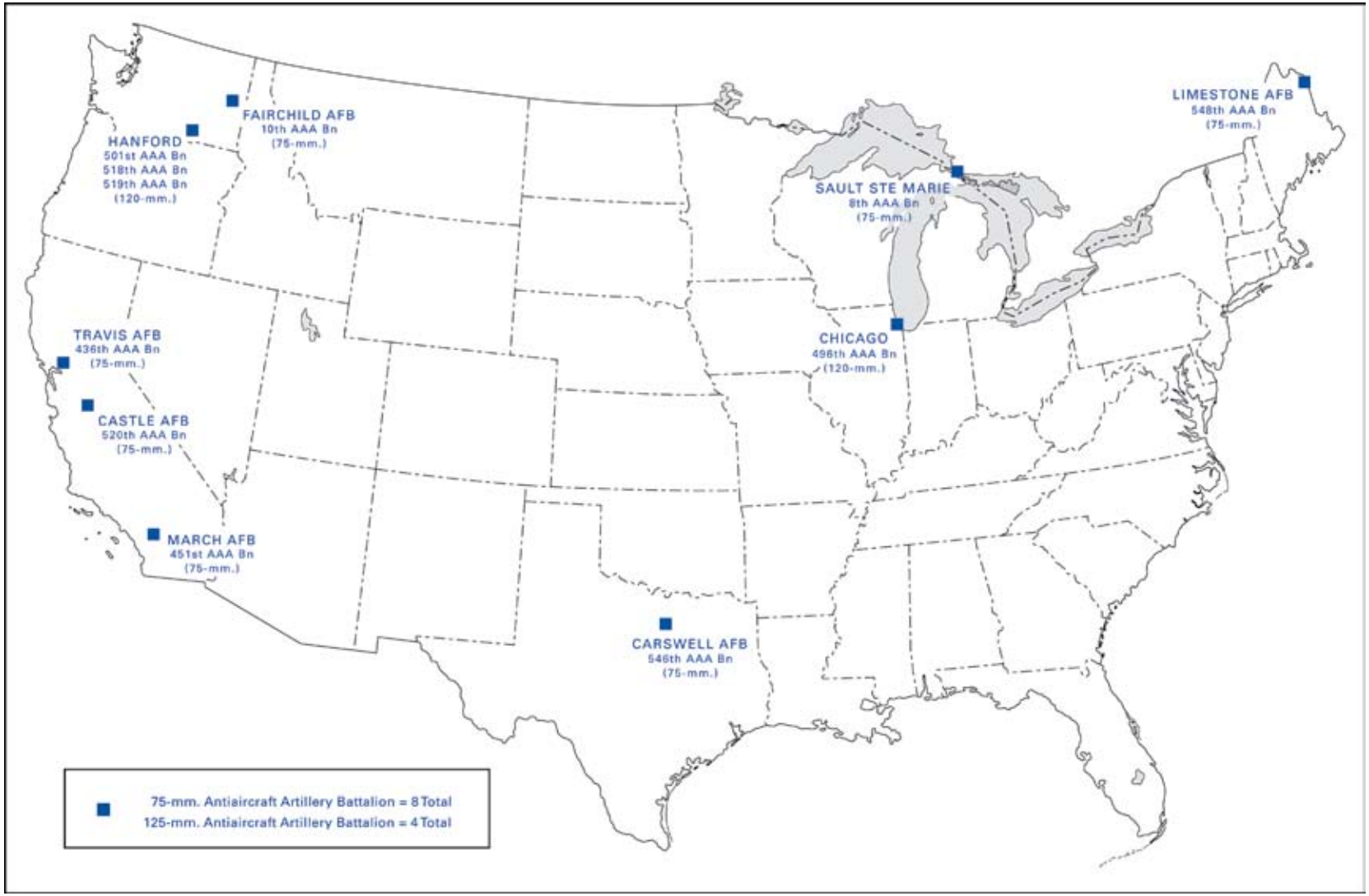
[20] Ibid., p. 114.
[21] Ibid.
[22] "The History of ARADCOM, Volume 1, The Gun Era, 1950–1955," Historical Project Number 5M-I, Headquarters, ARADC0M, p. 145.

Figure 18—ADC Interceptor Deployment (As of 31 December 1955)



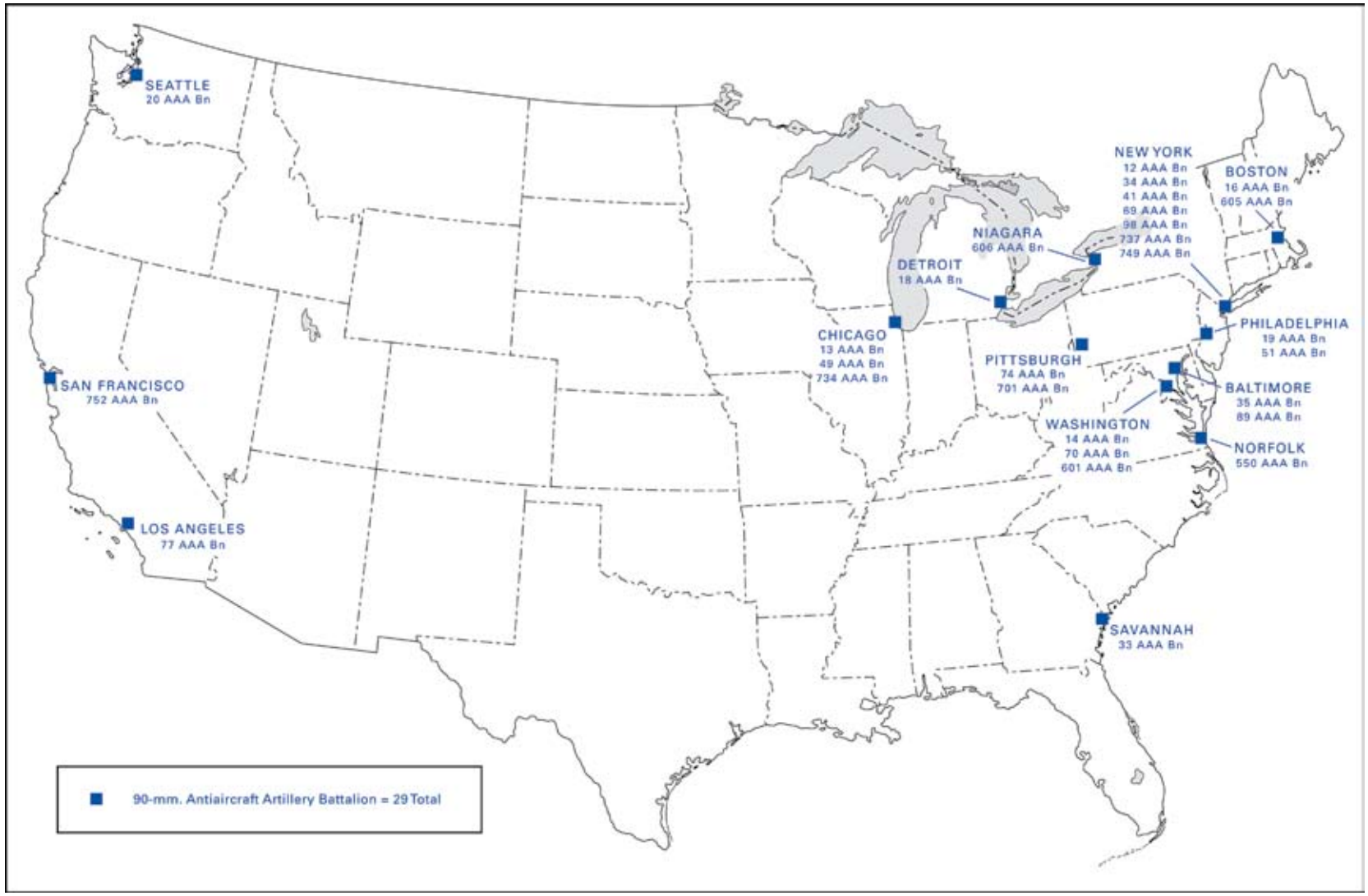
This map is based on tabular data from "Continental Air Defense Command and Air Defense Command History, July–December, 1955," Headquarters CONAD, 81, and map, ADC Statistical Book, Aircraft and Missiles, 33.

Figure 19—ARAACOM 75 ε~ 120-mm Deployment, 31 December 1955



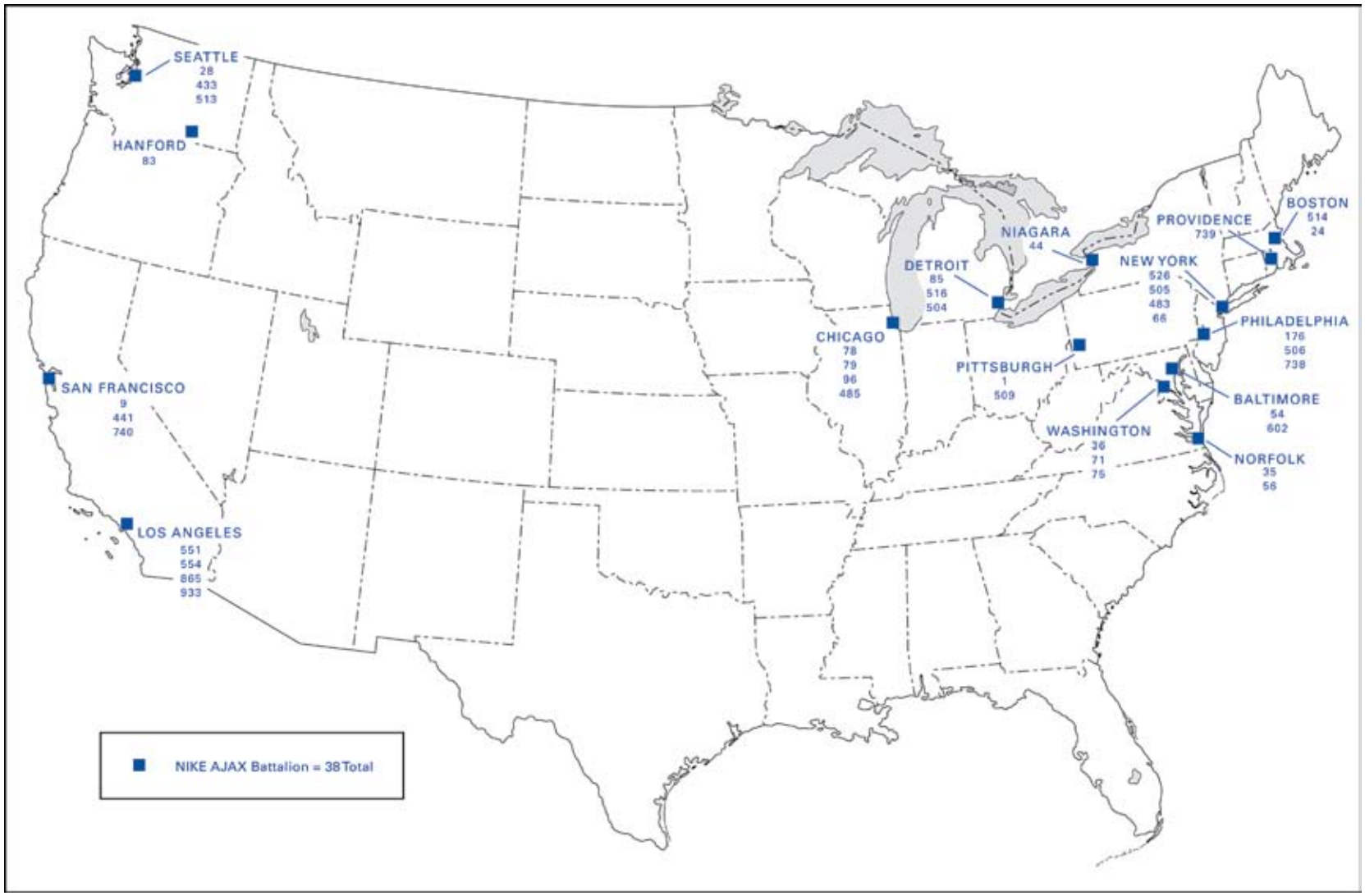
Taken from Map 24, "The History of ARADCOM, Volume 1, The Gun Era, 1950–1955," Historical Project Number ARAD 5M-1, Headquarters ARADCOM, 180.

Figure 20—ARADCOM 90-mm Deployment, 31 December 1955



Taken from Map 25, "The History of ARADCOM, Volume 1, The Gun Era, 1950–1955," Historical Project Number ARAD 5M-1, Headquarters ARADCOM, 181.

Figure 21—ARADCOM Nike-Ajax Deployment, 31 December 1955



Taken from Map 23, "The History of ARADCOM, Volume 1, The Gun Era, 1950–1955," Historical Project Number ARAD 5M-1, Headquarters ARADCOM, 179.

Since the early antiaircraft gun deployments provided a strategic antecedent, let's consider this aspect briefly. The initial defense and deployment directives from JCS in early 1950 specified antiaircraft protection for Washington, D.C.; AEC installation at Hanford, Washington, Sault Ste. Marie locks; and other areas to the extent units are available.[23]

Within that guidance, ARAACOM established the initial gun or automatic weapons defenses as follows[24]:

EASTARAACOM	WESTARAACOM
Washington, D.C.	AEC Plant, Hanford, Washington
Locks, Sault Ste. Marie	Sandia AEC Base-Kirtland AFB
Baltimore	Los Angeles
Boston	San Francisco
Chicago-Gary	Seattle
Detroit	Castle AFB (SAC)
New York City	Fairchild AFB (SAC)
Niagara Falls	March AFB (SAC)
Philadelphia	
Pittsburgh	

This listing, although changed occasionally as years passed,[25] clearly suggests the strategy for antiaircraft defense within the continental United States. The specific locations to be provided defense were the national capitol, Sault Ste. Marie locks, some atomic installations, some SAC bases, and some of the largest and most highly industrialized cities. Another feature of the strategy was an application of the principle of defense in depth. USAF interceptors also provided air defense for the areas in which the facilities provided antiaircraft defense were located.

Section II. Air Defense, 1956–1972

A. Approach

The previous section discusses in general terms the status at the end of 1955 of the United States strategic air defense in terms of systems, units, and deployments. Changes since that date are suggestive of modifications in the threat assessment and the associated national defense strategy, but they are also strongly influenced by budgetary, technological, and other constraints. Regardless of cause, frequently difficult to ascribe, characteristics of United States air defense strategy may be inferred from:

(1) Strategic decisions concerning the general means selected for defense, i.e., area defense or point defense? fighter interceptor or SAM? etc.?
(2) Research and development (R&D) decisions concerning desired or required individual system performance capabilities, as influenced by cost, technological, and tactical employment considerations.

[23] Ibid., p. 100.
[24] Ibid., pp. 98, 100, and 104.
[25] Ibid., p. 151. For example, four additional SAC bases (Carswell AFB, Texas; Ellsworth AFB, South Dakota; Limestone AFB, Maine; and Travis AFB, California) were designated for antiaircraft defense in 1953–1954.

(3) Decisions regarding procurement and production, i.e., how many units of a given system will be added to the defense inventory and when? what is the national defense budget?
(4) Decisions concerning the locations at which the units will be deployed, i.e., specifically what is to be defended and to what level of defense?
(5) Decisions to modernize or improve existing materiel to enable better performance against aspects of the threat not initially perceived or coincidentally made possible by technological advance.

The approach of this Section on United States air defense systems, 1956–1972, will be to emphasize deployments as implying or supporting the national air defense strategy, although there will be brief references to other significant events in system modernization and R&D objectives. As a means of highlighting the changes in air defense posture as defined by unit deployments, "snap-shot" years of 1960, 1964, 1968, and 1972 have been selected.[26]

B. 1956–1960

1. Organization, Command, and Control

There were several occurrences of major significance concerning organization for and command and control of air defense resources during this five-year period. One was an international development and was oriented towards continental rather than national defense. As early as January, 1956, the JCS approved in principle a USAF recommendation regarding "the need for peacetime integration of the operational control of Canadian-United States air defense forces."[27] This was followed by a similar recommendation by a joint Canada-United States study group in December of that year, and in August, 1957, by a joint governmental announcement concerning an international agreement for air defense of the two countries. From point of view of military organization, the international agreement was to be implemented by the establishment and functioning of Headquarters North American Air Defense Command (NORAD) at Colorado Springs, Colorado, effective September 12, 1957. Applicable Terms of Reference for NORAD were issued on June 10, 1958. Although the manner of military participation by Canada in continental air defense is beyond the scope of this study, the reader should be aware that such participation was present—both in terms of provision of joint-use facilities and provision of surveillance and early warning, fighter Interceptor, and SAM forces.

Several events of the period also had important consequences for CONAD. On July 3, 1956, JCS issued a revised unified command plan, the results of which were to give CONAD new Terms of Reference on September 4 and extra-CONUS air defense responsibilities for Alaska and the Northeast Area. Separation of CONAD, the joint command and USAF ADC, the component command, was also part of this action.

Presidential signature on August 6, 1958, of the Department of Defense Reorganization Act brought further changes to the CONAD concept. This act led to a new unified command plan from JCS on September 8, 1958, and the associated Terms of Reference on the 31st of December. CONAD was changed from a joint command to a unified command.

On March 18, 1959, a new, hardened survivable Combat Operations Center (COC) in Cheyenne Mountain, near Colorado Springs, was approved for NORAD/CONAD.

[26] These years also coincide with national presidential elections, times when air defense postures may be most affected by shifting foreign policy and national strategies.
[27] For this and other similar entries, see Appendix A, A Chronology of American Air Defense Systems.

Development and deployment of more sophisticated component weapons control means was extensive during this period. Preceded by extensive planning and testing of almost three years, the first SAGE air defense sector (New York) became operational on June 26, 1958.[28] Other SAGE sectors would be incorporated into the air defense system as they reached operational status. The first SAGE division (New York) became operational on January 1, 1959. At the end of 1958, the NORAD plan included eight SAGE divisions, seven of which were in CONUS.[29] A major divisional boundary reorganization was necessary to convert from the manual weapons control system to SAGE. This boundary reorganization was not completed until July 1, 1960.[30]

Two events complicated the SAGE picture before the system was fully in the field. First was the technological advance to solid state electronics; the other was an awareness that the SAGE system was not, in its current configuration, survivable in a nuclear attack environment. A solid state computer for SAGE (AN/FSQ-7A) in a hardened combat center came to be termed a Super Combat Center. Although nine of these facilities were planned in 1959, the project was cancelled by USAF on March 30, 1960.[31] SAGE in a six-division CONUS organizational plan was retained.

The Army's automated weapons control system, the Missile Master (AN/FSG-1), preceded the AF SAGE in operational use. The first Missile Master, a prototype, became operational in the Washington-Baltimore defense in December, 1957. The first production model was operational at Fort Lawton, Washington, (Seattle defense) in January, 1960. A total of 10 Missile Masters were programmed. The last one became operational on December 14, 1960. A need had been demonstrated for a smaller, less costly automated fire control system for the smaller Army defenses. The Battery Integration and Radar Display Equipment (BIRDIE) system was selected in December, 1959, with the initial set, of a total of 18, scheduled for completion in April, 1961.

A desire by CINCONAD to ensure an optimum of uniformity and cohesion in his exercise of operational control or operational command over component forces led in June, 1956, to an approved plan to collocate the Army Missile Master and the pre-SAGE AN/GPA-37, and eventually SAGE. This program was later extended to include collocation, to the maximum feasible extent, of Army Air Defense Command Posts (AADCP) and the USAF Air Defense Direction Centers (ADDC). The first collocation not involving Missile Master was at Geiger AFB, Washington, (Fairchild AFB defense) on May 15, 1958.[32]

2. Surveillance and Early Warning

The surveillance network remained relatively constant, except in the categories of radar stations of the Mobile Program and gap filler radars, both of which were increasing in numbers during the period. For example, by mid-period (June, 1958), Mobile Program radars had increased to 42 and the number of gap fillers had increased to 54,[33] whereas one year earlier only eight gap fillers had been operational. The gap filler radars were found to be deficient in range and altitude capabilities to cope with the high speed, very high altitude threats. These features, plus a vulnerability to ECM, necessitated plans for equipment

[28] "NORAD/CONAD Historical Summary, July–December, 1958," Headquarters NORAD/CONAD, p. 14.
[29] Ibid.
[30] "NORAD/CONAD Historical Summary, July–December, 1960," Headquarters NORAD/CONAD, p. 6.
[31] Ibid.
[32] "NORAD/CONAD Historical Summary, July–December, 1957," Headquarters NORAD/ CONAD, pp. 17–28; and "NORAD/CONAD Historical Summary, January–June, 1958," Headquarters NORAD/CONAD, pp. 11 and 21.
[33] "NORAD/CONAD Historical Summary, January–June, 1958," Headquarters. NORAD/CONAD, p. 28.

modification. Due to improved coverage from the AEW&C, the GOC contribution was reduced and then eliminated during the period. In January, 1958, the GOC was reduced from 24-hour to ready reserve status. One year later the GOC was inactivated.

Contiguous radar coverage from the Texas Towers was begun in August, 1956, when the first tower became fully operational. A second and a third Texas Tower reached operational status in October, 1958, and April, 1959, respectively. The remaining two Texas Towers programmed were eliminated from the program by mid-1957 due to budgetary problems.[34]

Construction of the land-based portion of the DEW Line was completed by June 30, 1957, and the system was deemed "technically ready for operations" on July 15th. The Mid-Canada Line became fully operational in January, 1958.

Early in the period, Navy participation was increased. As had been true earlier in the Atlantic, all five of the picket ship locations in the Pacific were manned since July 1, 1956.[35] The chapter on use of Navy blimps for airborne early warning was completed during the period. A squadron, ZW-l with two airships, was commissioned at Lakehurst NAS, New Jersey, in January, 1956, to man a station off the East Coast, by July, 1957. Manning of a station off the West Coast was programmed for July, 1959.[36] The Navy experienced budget cuts as early as 1957 which reduced the number of aircraft manning AEW&C stations on the sea barriers and reduced the number of squadrons for that duty by one on each coast.[37] By mid-1960 Navy participation was virtually eliminated because of cuts in the Navy budget. By April 1, 1960, the ships were withdrawn from both the Atlantic and Pacific DEW Line sea barriers. On July 1, ZW-1 terminated its air defense mission and manning the Atlantic station.

3. Fighter interceptors

The number of fighter interceptor squadrons available to ADC "peaked" at 72 in June, 1957,[38] and then declined to 41 squadrons at the end of 1960.

Major changes occurred in the aircraft inventory. Whereas in 1956 the F-86D, supported by the F-89D and F-94C, constituted the bulk of the fighter interceptor force, these aircraft were being modified or replaced by mid-1957. The F-86L provided electronic and aerodynamic improvements over the "D" model. The F-89H and J were model improvements to fire the Falcon missiles (infrared seeking) and MB-1 rockets (nuclear warhead), respectively. Although the F-89J had the advantage in its armament of a nuclear rocket, the aircraft had serious performance limitations. By 1960, all models of the F-86, F-89, and F-94 were gone from ADC; in their places were the F-101 (17 squadrons), F-102A (9 squadrons), and F-106 (14 squadrons).

4. Antiaircraft Gun and SAM Defenses

The five-year period, 1956–1960, saw the end of the "gun era" in strategic antiaircraft defense of the United States. On December 20, 1957, the final 90-mm and 120-mm gun battalions assigned to active air defense in CONUS were inactivated. The final 75-mm (Skysweeper) battalion in ARADCOM was

[34] "Continental Air Defense Command Historical Summary, July, 1956–June, 1957," Headquarters CONAD, p. 61.
[35] "Continental Air Defense Command and Air Defense Command History, January–June, 1956," Headquarters CONAD, p. 32.
[36] Ibid, p. 37.
[37] "CONAD/NORAD Historical Summary, July–December, 1957," Headquarters CONAD/NORAD, p. 44.
[38] "Continental Air Defense Command historical Summary, July, 1956–June, 1957," Headquarters CONAD, p. 38.

inactivated on June 15, 1960. In general, the inactivations of the gun battalions were accompanied by conversions on-site to Nike.

Further modifications to the Army's weapons system were underway to replace the Nike Ajax with the nuclear-capable Nike Hercules. The last Nike Ajax battalion to be deployed was on-site by June 30, 1957.[39] The initial Nike Hercules battery was operational in the Chicago defense on June 30, 1958. By December, 1958, the number of Hercules batteries (generally four firing batteries or fire units per battalion) had increased to eight; Ajax batteries numbered 236.[40] By the end of 1960 the number of Hercules fire units had increased to 88; the number of Ajax had been reduced to 174. The 1960 total of 262 Nike fire units was the greatest number employed under ARADCOM command.[41]

Two features concerning deployment deserve mention. First, by 1960 all ARADCOM fire units were located on-site. Second, primarily as a result of JCS approval in late 1957 of additional Nike defenses, at the end of 1960 CONUS Nike defenses were provided to[42] AEC Plant, Hanford, Washington; Washington–Baltimore; Seattle; San Francisco—Travis AFB; Los Angeles—March AFB; Dallas–Fort Worth; Kansas City; Minneapolis–St. Paul; Milwaukee; Chicago–Gary; St. Louis; Detroit; Niagara Buffalo; Cleveland; Pittsburgh; Boston–Providence; Hartford–Bridgeport; New York; Philadelphia; Norfolk; Fairchild AFB, Washington; Ellsworth AFB, South Dakota; and Loring AFB, Maine.

The initial strategy of a decade earlier in terms of locations to be provided dedicated air defense had not changed. Defense still was accorded to a critical AEC installation, the national capitol, some SAC bases, and an expanded number of the most populated and highly industrialized areas of the country.

The Army continued to rely heavily on air defense augmentation forces from the Army National Guard (NG). On June 30, 1957, 100 NG batteries were on-site.[43] On October 8 of that same year, however, the National Guard was relieved of its on-site gun battery tactical mission in anticipation of conversion to Nike and utilization in the on-site missile program. The first NG Nike Ajax battalion was deployed to on-site positions on September 14, 1958. By end 1960, 52 of the 174 Nike Ajax fire units on-site were National Guard.[44]

USAF deployed a surface-to-air missile system, Bomarc, in September, 1959. The Bomarc had a stormy history. The system was one of the issues of the AAF-AGF disagreements of the late 1940's and the later USAF-Army interservice rivalry of the 1950's. Funding for the Bomarc program was weakly and inconsistently supported by the Defense Department and challenged by a vacillating Congress repeatedly during the FY 1957 to FY 1961 budget hearings.[45] Initial ADC estimates of requirements for 53 Bomarc squadrons were successively scaled down until by 1960 the Bomarc program had to be reduced to 10 squadrons, eight of which were deployed in CONUS. The initial squadron became operational with one missile at McGuire AFB, New Jersey on September 1, 1959. By the end of 1960 all eight CONUS Bomarc squadrons had been activated, and four were operational. Bomarc squadrons were equipped with either "A" missiles (IM-99A)—an interim development, "B" missiles (IM-99B)—the ultimate Bomarc capability, or some combi-

[39] "Continental Air Defense Command Historical Summary, July, 1956–June, 1957," p. 46.
[40] "NORAD/CONAD Historical Summary, July–December, 1958," Headquarters NORAD/CONAD, p. 100.
[41] The *Argus*, U.S. Army Air Defense Command, June, 1974, p. 20.
[42] Ibid.
[43] "CONAD/NORAD Historical Summary, July–December, 1957," Headquarters CONAD/NORAD, p. 67.
[44] The *Argus*, U.S. Army Air Defense Command, June, 1974, p. 20.
[45] "An Overview of ADC Weapons, 1946–1972," Headquarters Aerospace Defense Command, April, 1973, pp. 104–29.

nation, of the two missiles. At the end of 1960, 210 "A" missiles and 252 "B" were programmed. Further problems for Bomarc were strongly suggested by the following quotation from an official 1956 command history: "As to the trend beyond 1960, ADC was convinced that USAF was putting too much dependence on ground-to-air missiles of the Bomarc type."[46]

5. Operational Problems

Of the many operational problems to confront air defense commanders during the period 1956–1960, one of the most complex was that of electronic countermeasures (ECM). The matter was aptly presented in 1956 by some developments in Strategic Air Command (SAC). ". . . a general ECM 'rearmament' on the part of SAC in recent months revealed to ADC how little was needed to improve SAC's ECM capability sufficiently to neutralize the air defense system."[47] Mutual interference from friendly electronic emissions was also troublesome. Solution to the latter problem lay in coordination with CAA and the Navy on dividing the frequency spectrum. Solution to the U.S.S.R. ECM threat, however, required system modifications to add antijamming circuits, frequency diversity, and rapid frequency tuning capabilities. The Army Nike system, in particular, underwent major system improvements to improve the capability against small, high-speed targets in an ECM environment.[48]

A second problem resulted from the equipping of fighter interceptors with the MB-1 nuclear rocket. As will be noted from Figure 18, several of the squadrons at the end of 1955 were located at civil or municipal airports. Because of the availability of atomic weapons, relocation of these squadrons to military bases became a matter of priority.[49]

A third problem illustrated the woes of a joint commander, CINCONAD. Until JCS had approved the CONAD force requirements and made such approval directive on the Services, little action resulted. Further, Service actions in response to budget cuts were often unilateral and occasionally impacted adversely on the CONAD mission. The CONAD frustration at the end of 1957 is stated as: "Lack of JCS approval made it impossible for CONAD to obtain many of the force levels it desired from the services. At year's end, CONAD had no recognized or approved program for the air defense of North America."[50]

C. 1961–1964

1. Organization, Command and Control

Since the initial SAGE direction center and the initial SAGE division became operational during the summer of 1958, progress toward completion of the SAGE program was steady. By December 15, 1961, when the final SAGE direction center became operational, the SAGE installation in CONUS was essentially completed. At the end of 1964 four of seven regional control centers and 16 of 18 sector direction centers were SAGE.[51] Those facilities not SAGE were either manual or remoted.

[46] "Continental Air Defense Command and Air Defense Command History, January–June, 1956," Headquarters CONAD, p. 43.
[47] Ibid., p. 21.
[48] Nike system modifications included new HIPAR and Range Only Radar (ROR), and Target Tracking Radar (TTR) improvements.
[49] "Continental Air Defense Command and Air Defense Command History, January–June, 1956," Headquarters CONAD, p. 50.
[50] "CONAD/NORAD Historical Summary, July–December, 1957," Headquarters CONAD/NORAD, p. 97.
[51] "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters NORAD/CONAD, p. xiii.

However, a lack of survivability of SAGE against a missile attack was recognized. This led to a concept of the Super Combat Center, a hardened SAGE, a program cancelled by USAF in March of 1960. The Secretary of Defense in June, 1961, noting that a missile attack against SAGE and other vital NORAD command and control elements "could delay NORAD's ability to carry out its mission," terminated further SAGE funding. The need for a survivable, back-up system to SAGE was obvious. From this need came a back-up interceptor control (BUIC) system which was approved in March, 1962, for implementation in two phases.[52]

Phase I (BUIC-I). A manual back-up system, similar to pre-SAGE, to be completed by the end of CY 1962.

Phase II (BUIC-II). A system to provide semi-automatic control at 34 selected radar sites to be completed by the end of CY 1965.

BUIC-I, the first phase of the SAGE decentralization, was actually completed in May, 1963. The initial BUIC-II was installed in September, 1964; its projected operational date was one year later.

With the goal of "a saving in funds and manpower spaces," in late 1962 DoD directed major reductions in the programmed-to-be-replaced SAGE system.[53]

Plans for CONAD and ADC command and control changed again in December, 1964, when the Secretary of Defense approved a system wherein SAGE would remain primary, supplemented by an improved BUIC (BUIC-III) as back-up.[54] Completion of this program was projected for the period FY 1966 to FY 1969.

Army control systems were in a similar state of flux. For example, the end of 1963 saw Army defenses equipped with 10 Missile Masters (AN/FSG-1) and 18 BIRDIEs (AN/GSG-5 or 6). However, a December, 1963, decision involved the phase-out of both of the control systems and their replacement with 26 AN/TSQ-51s during the period FY 1966 to FY 1968.[55]

Excavation of the new NORAD/CONAD Combat Operations Center (COG), to be built in Cheyenne Mountain near Colorado Springs, was begun on May 18, 1961, and on October 30, 1964, it was ready for initial manning.

Strategic air defense was still a large commitment in terms of personnel at the end of 1964. Command strength figures show NORAD and its components at 154,971 and National Guard and Reserve Forces at 28,744.[56]

2. Surveillance and Early Warning

In August, 1961, the Greenland-Iceland-United Kingdom (G-I-UK) Line became operational to replace the former Atlantic barrier (Argentina, Newfoundland, to the Azores).[57] Radar coverage on this Line was achieved by two Iceland-based radars and two AEW&C stations. An additional favorable development was an ambitious program, conceived to begin in late 1962, to improve the gap filler capability by substitution of 182 of the new AN/FPS-74 radars.

[52] "NORAD/CONAD Historical Summary, January–June, 1963," Headquarters CONAD/NORAD, p. 41.
[53] Ibid., p. 1, and "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters NORAD/CONAD, p. 1.
[54] Ibid., p. 23.
[55] Ibid., p. 26.
[56] Ibid., p. xiii.
[57] Ibid., p. 40.

However, the dominant characteristics of developments in the surveillance and early warning systems during the period 1961–1964 were *reduction* and *curtailment*. In March, 1963, the last Texas Tower radar was shut down. In May, 14 long-range radars and 10 gap fillers ceased operation. In June, the last of the USAF-manned Pinetree sites were turned over to the RCAF. In July, 28 DEW Line intermediate stations were closed. In January, 1964, five of eight Mid-Canada Line section control stations closed. Also, in that month, the AN/FPS-74 gap filler radar improvement program was cancelled. In July, the final AN/FPS-3 long-range radar was phased out of the ADC inventory.[58]

A 1964 year-end DOD decision programmed the deletion of an additional 16 CONUS prime radars, 32 height finder radars, and 9 gap fillers.[59]

Navy participation was still considerable at the end of 1964. USN was manning 10 picket ship stations in the contiguous radar system, five stations off each coast. Four Navy EC-121C aircraft were on patrol at all times on the Pacific barrier. Two Navy aircraft manned stations on the G-I-UK Line. However, funding restrictions brought efforts to reduce Navy activity. In April, 1960, early warning as a primary mission was withdrawn from the ships on the extension barrier stations—over CINCONAD objections. Later in 1960 the Navy proposed to discontinue the Pacific extension entirely because of fund limitations, but no action was taken on the proposal. In December, 1964, a Navy proposal to phase-out its forces both on the DEW Line extensions and on the contiguous radar picket ship stations were approved by the Secretary of Defense.[60] Termination of the Navy participation was again objected to by CINCONAD, but to no avail. The value of the DEW Line, about to be emasculated, in keeping U.S.S.R. bombers at stand-off position, and thus preclude a simultaneous missile and bomber attack was the principal argument.[61] The Navy phase-out was to start during FY 1965 and be completed during FY 1966.

The end of 1964 data shows the following status of the surveillance and early warning system[62]:

Prime Radars	183
Gap Filler Radars	96
Distant Early Warning Line (Land-Based)	
Main Stations	6
Auxiliary Stations	23
Aleutian Segment	
Main Stations	1
Auxiliary Stations	5
Greenland Segment	
Auxiliary Station	4
Mid-Canada Line	
Section Control Stations	3
Doppler CW Detection Stations	39
AEW&C Stations[63]	
Off East Coast	4
Off West Coast	5

[58] The date entries contained in this paragraph are extracted from Appendix A, A Chronology of American Air Defense Systems.
[59] "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters NORAD/ CONAD, p. 45.
[60] Ibid., p. 40.
[61] "NORAD/CONAD Historical Summary, January–June, 1964," Headquarters NORAD/CONAD, p. 16.
[62] "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters NORAD/CONAD, p. xii.
[63] 30 percent manning on a random rotating basis.

3. Fighter interceptors

Early in 1961 the fighter interceptor force had generally completed conversion to the "century-series" all-weather aircraft—the F-101, F-102, and F-106.

At the end of 1964, 42 squadrons, with 870 aircraft, were assigned to NORAD.[64]

Aircraft	Squadrons
F-101	18
F-102	9
F-104	2
F-106	13
	42

This was a decrease of three squadrons and approximately 100 aircraft over the previous 18 months.[65]

The augmentation forces were important to ADC. In July, 1961, 25 of the 29 AF National Guard squadrons with M-day missions to ADC began standing constant 24-hour, 5-minute alert requirements. Although somewhat reduced by the end of the period, a major augmentation force of 468 aircraft from 21 squadrons of the AF National Guard was identified.[66]

As a measure to improve the prospects, of the fighter interceptor force surviving a missile attack on the United States, in April, 1963, dispersal plans for 100 ADC fighter interceptors were formulated.

An ominous note for the future fighter interceptor air defense capability was sounded in December, 1964, when OSD set the FY 1970 USAF interceptor force level at 20 squadrons.

4. Surface-to-Air Missile (SAM) Defenses

At the end of 1964, the SAM missile inventory available to NORAD was as follows[67]:

Weapon System	Active Units	Augmentation Units
Bomarc "B" (IM-99B)	8 squadrons	
Nike Hercules	97 fire units	46 fire units
Hawk[68]	9 fire units	

The above status resulted from a combination of factors operating during the period 1961–1964. First, as pertains to Bomarc, the first squadron equipped with the more capable "B" missiles became operational on June 1, 1961. By December, 1962, the 10 squadron Bomarc program was completed. Two years later, in July, 1963, the "A" interim missiles were phased-out, as were two Bomarc squadrons equipped solely with those missiles.

The principal Army development involved the Nike Ajax—Nike Hercules conversion programs. The Ajax was phased-out of the ARADCOM inventory during this period. The final Ajax unit of the active

[64] Ibid., p. xi.
[65] "NORAD/CONAD Historical Summary, January–June, 1963," Headquarters NORAD/CONAD, p. 57
[66] "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters NORAD/CONAD, p. xi.
[67] Ibid.
[68] Deployment of Hawk will be addressed in the following paragraph, *Operational Problems*.

Army was inactivated in December, 1961. The first National Guard Hercules battalion became operational in an ARADCOM defense in December, 1962, and by May, 1964, the final National Guard Ajax fine unit left the ARADCOM missile inventory.

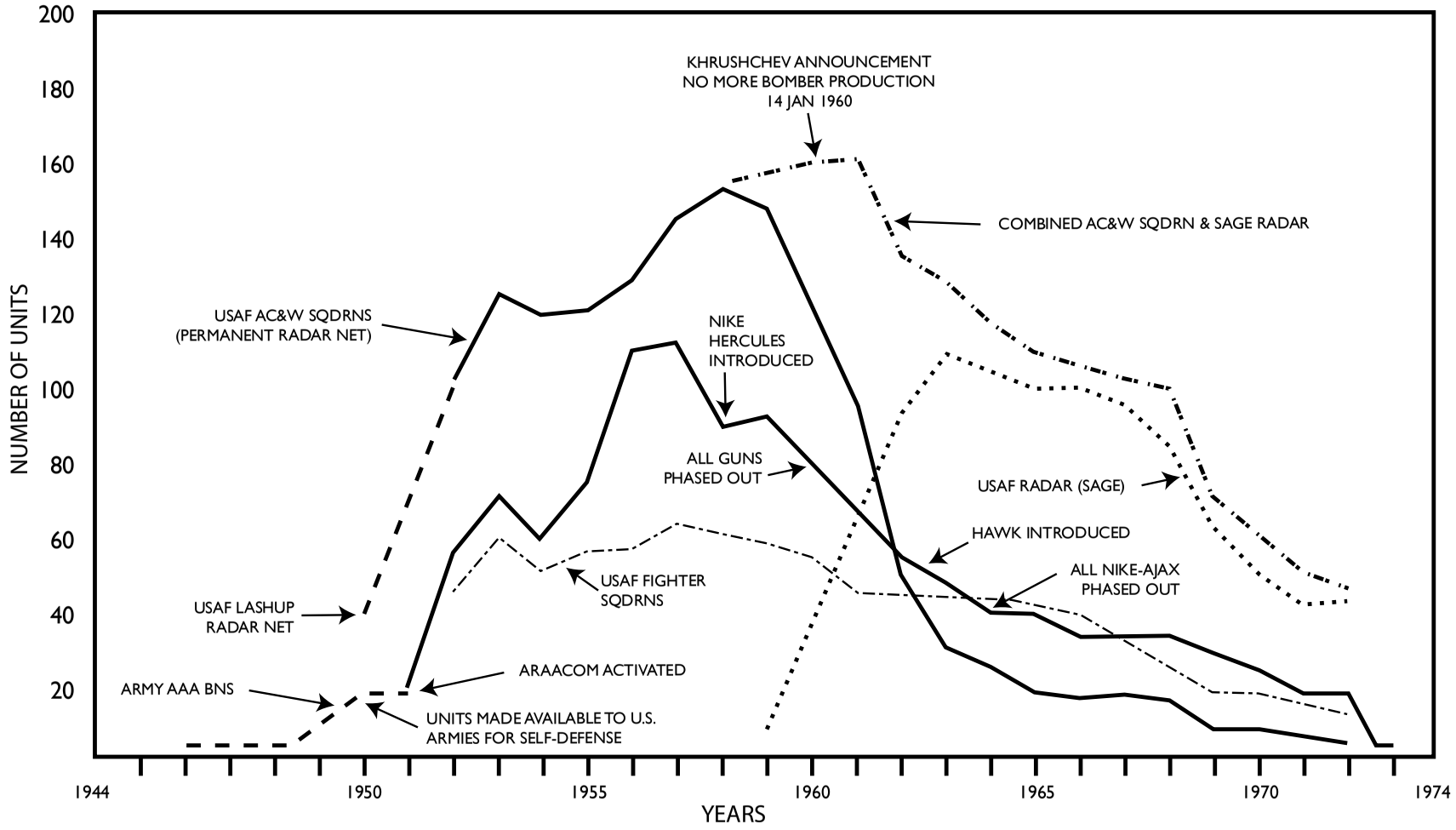
5. Operational Problems

The principal operational problem faced by air defense commanders during 1961–1964 was the reduction in means in terms of air defense units which were available to perform the air defense mission. These reductions have been described in previous paragraphs concerning command and control facilities, surveillance and early warning, fighter interceptors, and SAM units. The reduction will not be commented on further here. However, a pictorial summary of the years 1944 to 1974 is shown by Figure 22. Some reductions in total units by categories were possible due to changing defense criteria and substitution of units of improved capabilities (e.g., Nike Hercules for Nike Ajax). However, a major influence to the reductions was most certainly budgetary. Cuts in the national air defense budget were associated with an assessment of a much reduced U.S.S.R. bomber threat. On January 14, 1960, Khrushchev announced that the U.S.S.R. was ceasing the development of manned bombers and would, in the future, rely on ballistic missiles as strategic offensive weapons. The inevitable question concerning the wisdom of proceeding with expensive air defense weapons in light of a lessened manned bomber threat provided a military "explanation" for the budget cuts. However, CINCNORAD remained concerned about his undiluted mission of air defense of the United States and Canada and the significant U.S.S.R. inventory of heavy bombers. The military dilemma of enemy capabilities versus enemy intentions reared its head.

The presence of an unfriendly government in Cuba posed a thorny problem for air defense planners. With the traditional United States orientation generally to attack from the north, air defenses to the south were weak. As early as January 5, 1961, CONAD had prepared a Contingency Plan for Augmenting the Air Defenses of Southern Florida.[69] Implementation of the plan was tested occasionally. However, the "Cuban missile crisis" of late 1962 necessitated an operational reaction from the air defense system. CINCONAD declared DEFCON 3 on October 22 and continued that advanced readiness status until the 27th of November. Antiaircraft and SAM units were redeployed to Florida, the CONUS area closest to Cuba. One battery of 40-mm self-propelled, automatic weapons, was the first to deploy, followed shortly by a Nike Hercules battalion of three fire units, and two Hawk battalions.[70] AF Bases in Florida were alerted. Fighter interceptor and radar units also deployed to Southern Florida. Within 40 hours, two additional Fighter Interceptor squadrons had been deployed to Patrick AFB (F-106A) and two squadrons to Homestead AFB (F-102A), in addition to 22 aircraft at Tyndall.[71] Part of the CONUS fighter interceptor force was dispersed on October 22. In seven hours 167 fighter interceptors from 26 squadrons had been dispersed to 17 bases.[72] For the first time in United States history, the interceptors carried their nuclear armament. By the end of 1964 a full-time AEW&C station had been established off Key West.[73] In March, 1963, DOD directed the establishment of

[69] "The Fighter Interceptor Force, 1962–1964," ADC Historical Study No. 27, Headquarters Air Defense Command, November, 1964, p. 8.
[70] This constituted the sole use of Hawk in continental air defense during the period of this study.
[71] "The Fighter Interceptor Force, 1962–1964," ADC Historical Study No. 27, Headquarters Air Defense Command, November, 1964, p. 8.
[72] Ibid., p. 10.
[73] "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters NORAD/CONAD, p. xii.

Figure 22—U.S. Air Defense Deployments by Year



This figure also appears in Volume 1, titled as Figure D-7

permanent defense on the Florida peninsula. A continuous all-weather interceptor alert capability at Key West was a common defense requirement.

Fighter interceptors from ADC were deployed outside of CONUS for air defense purposes on two occasions in 1963 and 1964.[74] In March, 1963, 10 F-106A's were deployed to Alaska because of Soviet incursions into United States airspace. The following January, 18 F-102A's were sent temporarily to the Panama Canal Zone because of the situation in Cuba and the Caribbean.

The presence of potentially hostile fighter aircraft in Cuba (MiG-21) generated a special requirement for CONAD. Whereas the ADC fighter interceptors were primarily to combat bomber-type aircraft, needed was "a high performance interceptor capable in (the) fighter-versus-fighter role."[75]

In early 1964 it appeared that a decision was imminent to discontinue the Nike defenses of SAC bases. The SAC base was itself inherently soft and difficult to defend to a sufficiently high level so as to insure survival of the aircraft and the continued operability of the base. SAC developed plans to flush their aircraft on receipt of early warning, or, as a contingency for any inadequacy of early warning, a portion of the SAC force was maintained on airborne alert. Area defense by the fighter interceptors was considered adequate for SAC bases. ARADCOM proposed using any Nike units gained by terminating SAC base defenses to defend hardened ICBM fields[76] and selected hardened command, control, and communications facilities. Both CONAD and SAC nonconcurred in the ARADCOM proposal.[77] To employ these same 18 fire units from the SAC bases, plus four more expected to accrue from closing the Thule AFB, Greenland, defense, CONAD preferred that air defenses of the following six additional CONUS metropolitan areas be planned: Charleston, South California; Houston; San Diego; Portland, Oregon; New Orleans; and Olympic peninsula area, Washington.[78]

Under the concept of either a joint or a unified command, CONAD was dependent upon the Service components for the provision of systems for the air defense mission in the appropriate numbers and possessing the required performance characteristics. This arrangement did not always produce optimum results. This problem was illustrated to some extent in October, 1963; when OSD directed creation of a means "for ensuring that unified . . . commanders could achieve adequate influence over the development, acquisition, and operation of their command and control systems."[79]

Except as reflected in the annual defense budget submissions and in testimony in support of the budget, there was a general paucity of comprehensive national plans indicating the goals and requirements for national air defense. And the budget process was suspect as the sole means of reflecting air defense requirements. In June, 1959, Congress, experiencing difficulty in making its decisions on the Bomarc program, had directed that DOD prepare a master Air Defense (MAD) plan to demonstrate what air defense resources were believed to be required and why. A second major effort in air defense planning, Continental Air Defense Study (CADS), 1966–1975, was required of USAF by the Secretary of Defense in early 1963.[80] The primary concern of this study, completed by ADC, was the evaluation

[74] "The Fighter Interceptor Force, 1962–1964," ADC Historical Study No. 27, Headquarters Air Defense Command, November, 1964, pp. 27–35.
[75] "NORAD/CONAD Historical Summary, January–June, 1963," Headquarters NORAD/CONAD, p. 57.
[76] It is interesting to note that this was the first definite proposal involving forces-in-being for air defense of ICBM.
[77] "NORAD/CONAD Historical Summary, January–June, 1964," Headquarters NORAD/CONAD, p. 70.
[78] Ibid., p. 67.
[79] Ibid., p. 8.
[80] "NORAD/CONAD Historical Summary, January–June, 1963," Headquarters NORAD/CONAD, p. 45.

of the effectiveness of several possible combinations of air defense system elements; its principal recommendation was the "tentative" support for 12 squadrons equipped with an improved manned interceptor (IMI).[81]

D. 1965–1968

1. Status of the Air Defense System, January, 1965

Because of the extensive adjustments to the various major elements of the continental air defense system which occurred during the period 1965–1968, or which were programmed during that period to be effective soon after the period's end, a pictorial presentation of the status at the beginning of 1965 is useful. Figures 23 through 25 show the NORAD/CONAD air defense warning system, the fighter interceptor squadron deployment, and the NORAD/CONAD SAM missile deployment and coverages. Figures 24 and 25 also show the geographical division of the NORAD area of responsibility into subordinate regional commands.

2. Organizations Command and Control

The BUIC system achieved several important milestones during this four-year period. On September 1, 1965, the first BUIC-II site at North Truro, Massachusetts, was accepted by ADC. On April 1 of the following year the last four BUIC-II sites became operational. In the area of future BUIC programming, 19 BUIC-III sites were approved by the Secretary of Defense in August, 1965. On December 1, 1968, the first BUIC-III site became operational.

The scheduled Army control system replacement also was progressing rapidly. At the end of November, 1966, the first of the AN/TSQ-51 fire distribution systems (Missile Mentor) became operational in the New York–Philadelphia defense. Three months later the last of the programmed Missile Mentors was operational in early February, the last of the older Missile Master systems was phased-out.

The NORAD/CONAD Combat Operations Center (COC), under construction in Cheyenne Mountain (Colorado Springs) since May, 1961, was completed in early 1966. On April 20, the NORAD COC moved from Ent AFB, Colorado Springs, to the new location in Cheyenne Mountain.

A Canada–United States agreement was reached to extend the NORAD agreement for five years, effective May 12, 1968.

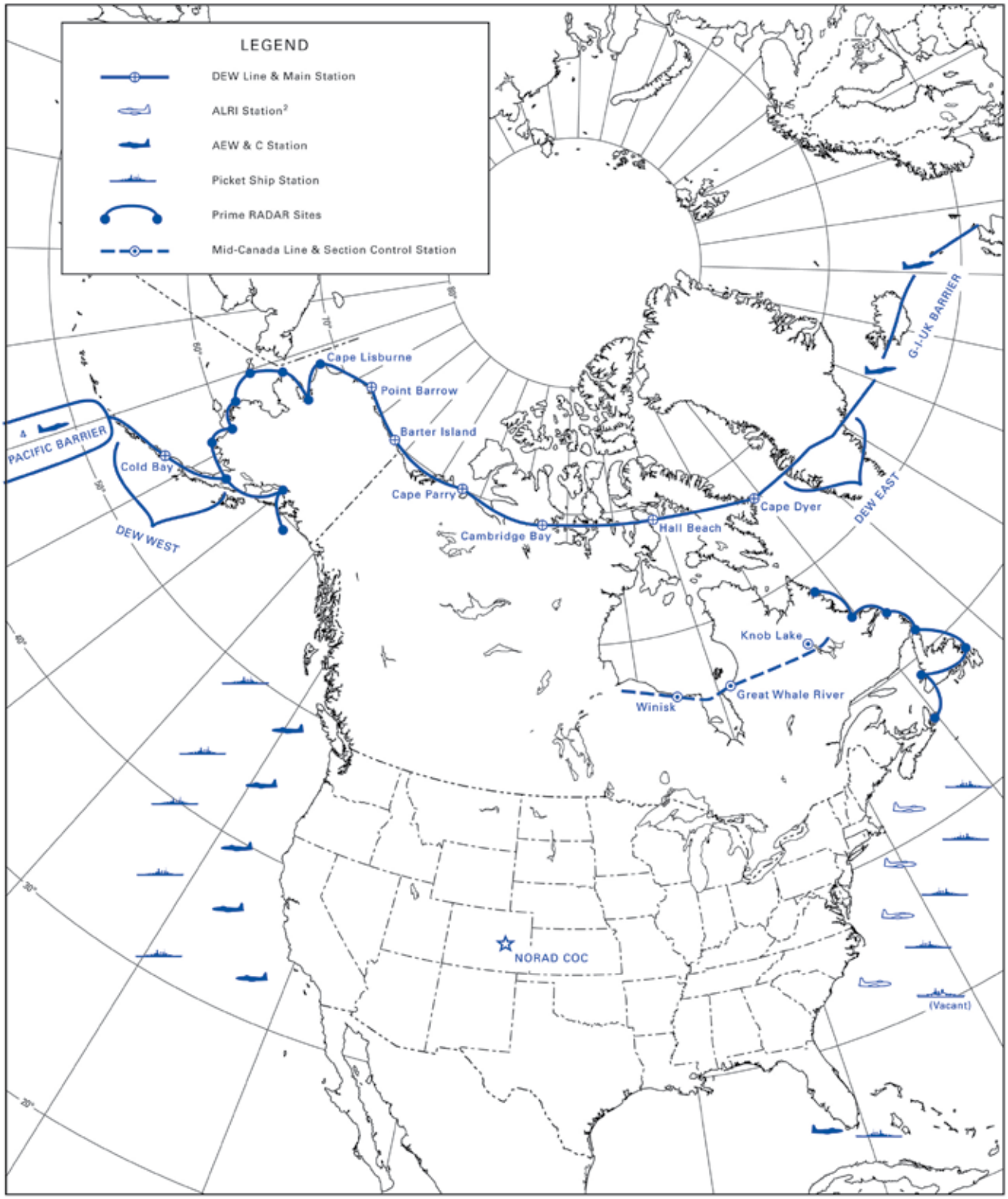
By the end of 1968, although down considerably from earlier periods, command personnel strengths were still significant: Regular forces were at 100,789; Augmentation forces (NG and Reserve) were at 25,153.[82]

3. Surveillance and Early Warning

Reductions and eliminations of surveillance and warning facilities became hallmarks of this period. During the first six months of 1965, the Navy first reduced and then ceased all operations by both ships and aircraft on the DEW Line extensions and in the contiguous radar system. With these reductions came the disestablishment of NAVFORCONAD on September l, 1965.

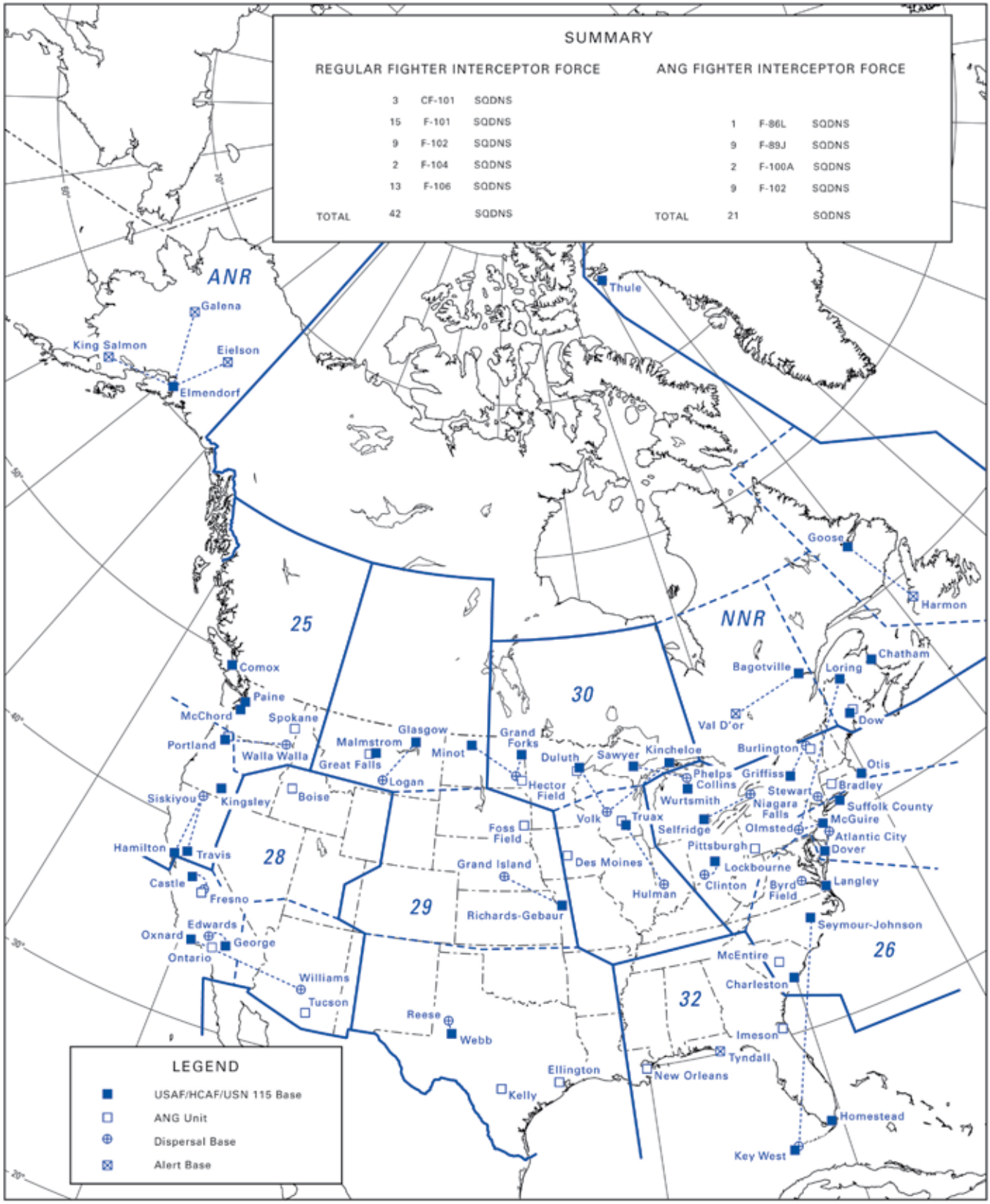
[81] "Air Defense and National Policy, 1958–1964," ADC Historical Study No. 26, Headquarters Air Defense Command, p. 69.
[82] "Continental Air Defense Command History, 1968," Headquarters CONAD, 1 May 1969, p. 1.

Figure 23—NORAD/CONAD Air-Defense Warning System, December 1964[1]



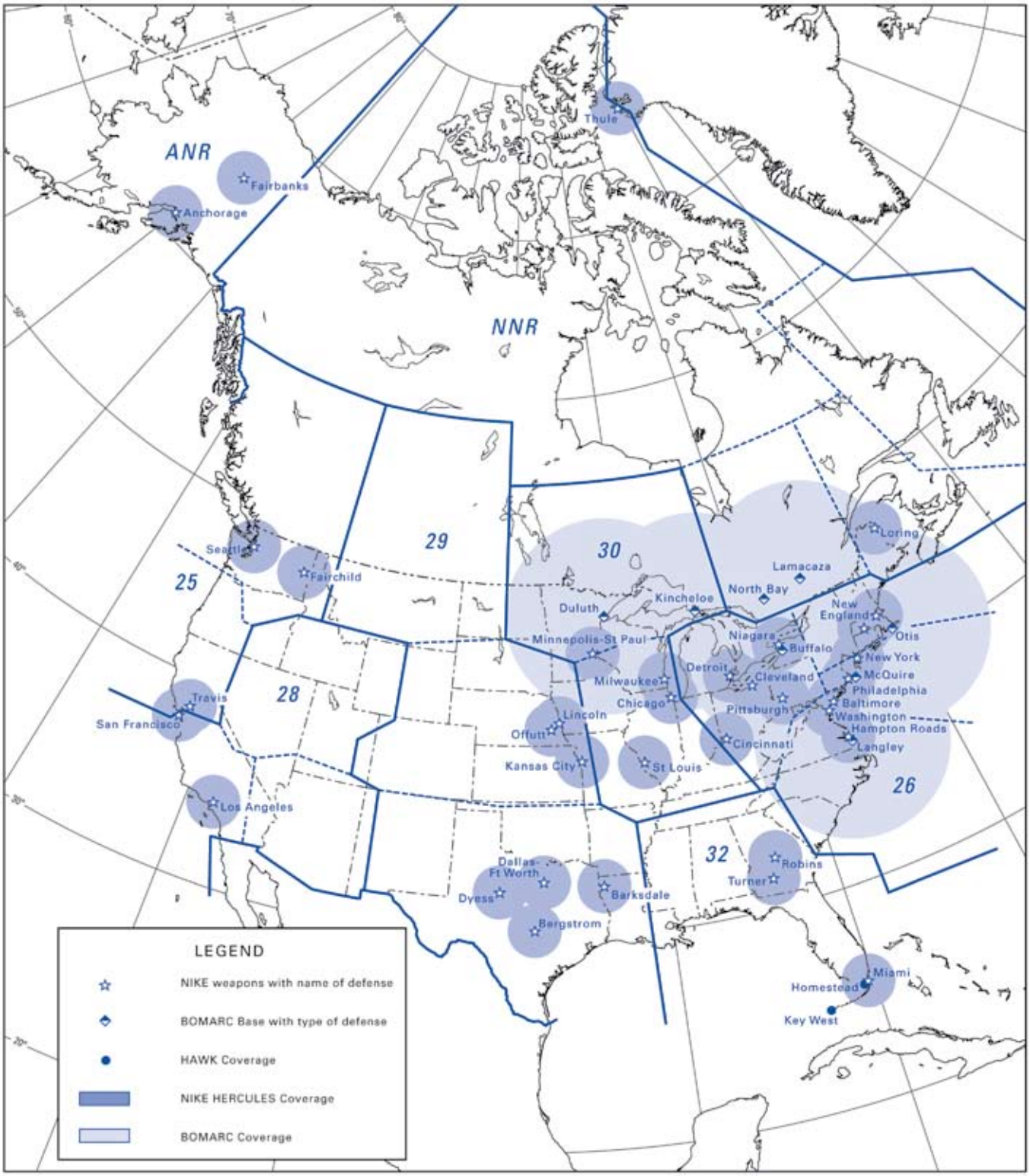
[1] This map is taken from "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters CONAD, p. 43.
[2] Airborne Long-Range Input (ALRI)—a modification for AEWBC aircraft intended to extend SAGE operational area 250 miles to sea.

Figure 24—NORAD/CONAD Fighter Interceptor Deployment, 31 December 1964



This map is taken from "NORAD/CONAD Historical Summary, July–December, 1964," Headquarters CONAD, p. 70.

Figure 25—NORAD/CONAD SAM Missile Deployment, 31 December 1964



This map is taken from "NORAD/CONAD Historical Summary, July-December, 1964," Headquarters CONAD, p. 79.

In May, 1965, the Mid-Canada Line ceased operations. The land-based portions of the DEW Line remained intact.

The 1st of September, 1965, saw an ending of AEW&C aircraft flight operations on the Greenland–Iceland–United Kingdom barrier.

Reductions in surveillance means also occurred within CONUS. Starting in March, 1965; closures of long-range and gap filler radars commenced. Three years later 16 prime radars had been closed, and all gap fillers, except 17 in the southeast corner of CONUS, were gone.

4. Fighter Interceptors

Major reductions were also felt in the number of fighter interceptor squadrons, down almost 50 percent during the period 1965–1968. However, these figures, distressing to an air defense commander, did not present the whole bleak story. No fighter interceptor aircraft had been built since 1961; attrition was having its influence, and the number of aircraft per squadron was gradually being reduced[83]—as were the number of squadrons.

On December 1, 1968, NORAD possessed 20 regular forces fighter interceptor squadrons, comprised of 351 aircraft.[84] The ADC portion of this total, plus augmentation forces, is shown below:

	Regular Forces		ADC Air National Guard	
Aircraft Type	Squadrons	Aircraft	Squadrons	Aircraft
F-89	—	—	2	40
F-101	6	102	—	—
F-102	1	31	19	318
F-104	1	18	—	—
F-106	9	153	—	—

Progress in aircraft conversion continued. On November 6, 1967, the Air National Guard completed its programmed conversion to F-102. Only two squadrons of F-89 remained in the NG at the end of 1968; all other NG squadrons were equipped with the F-102.

5. Surface-to-Air Missile (SAM) Defenses

The status of the NORAD SAM missile force at the close of 1968 was[85]:

Weapon	Squadrons or Batteries/Missiles	
Bomarc	8/216 "B" missiles	
Hercules		
Regular Army	52/	}1,590
National Guard	44/	
Hawk	8/288	

[83] "The Fighter Interceptor Force, 1962–1964," ADC Historical Study, No. 27, Headquarters Air Defense Command, November, 1964, Foreword and p. 41.
[84] "Continental Air Defense Command History, 1968," Headquarters CONAD, p. xv.
[85] Ibid.

As had been true of the other air defense forces, the end-of-period status in 1968 of SAM units was down considerably from 1964. The Commanding General of ARADCOM noted that "since 1963 ARADCOM had been reduced 35 percent in its fire power."[86] The reductions had significant impact on the locations provided Hercules defense. On December 8, 1965, the Secretary of Defense directed the elimination of Nike defenses of SAC bases and of the Thule, Greenland, defense and the inactivation of the 22 Nike batteries concerned. On December 22nd the defenses at Barksdale, Texas; Robins and Turner, Georgia; and Fairchild, Washington AF Bases were declared non-operational. This group of four bases was followed in non-operational status on March 1, 1966, by Loring, Maine; Lincoln-Offutt, Nebraska; Dyess and Bergstrom, Texas AF Bases. The Nike batteries associated with all of these defenses were inactivated soon after the defenses became non-operational.

The budget axe fell again during 1967–1968. On August 3, 1967, OSD proposed the elimination of 15 additional Hercules sites. DA and ARADCOM were directed to consider this proposal and the earlier Nike HERA study[87] was used to assist in identifying the 15 Hercules sites to be eliminated. DA and ARADCOM proposed resisting of a major portion of the 15 batteries to improve their defense effectiveness in lieu of elimination. The discussion ended on August 10, 1968, when DOD announced what appeared to have been a predetermined decision for major inactivations. Discontinuance of three interior defenses was directed, along with the inactivation of the 12 associated Hercules batteries. The defenses affected, to be phased-out by March 31, 1969, were St. Louis, Kansas City, and Dallas-Fort Worth.

An additional reduction of five Hercules batteries, effective 1st Quarter, FY 1970, also emanated from OSD in December, 1968. These batteries, two RA and three NG, were identified by OSD as of "marginal effectiveness."[88]

6. Modernized Air Defense Concept

The major force reductions which have dominated the discussions of the preceding paragraphs resulted from adoption, announced by DOD on December 16, 1967, of a concept that visualized acquiring a modernized manned bomber defense system and the phasing-out of the current system. The principal elements of the modernized air defense force were identified as[89]:

A modernized F-106 (referred to as F-106X).

Airborne Warning and Control System (AWACS).

Over-the-Horizon Radar (OTH), backscatter.

NORAD COC in Cheyenne Mountain.

Limited number of current system long-range radars (LRR).

Joint military-FAA surveillance and control structure.

Some BUIC-III centers (15 by FY 1970).

Some Hercules and Hawk fire units.

Phase-out of the current force, beginning in July, 1968, would achieve an "intermediate force level" by mid-1970, but ultimately would eliminate[90]:

[86] Ibid., p. 48.
[87] The study, which came to be known as Nike HERA, was initiated in September, 1966, at the direction of the Secretary of Defense to reexamine the role of Nike Hercules in continental air defense, "particularly in light of the declining bomber threat."
[88] Ibid.
[89] "Continental Air Defense Command History, 1968," Headquarters CONAD, 1 May, 1969, p. 1.
[90] Ibid.

All interceptors, except F-106X.
All Bomarc
Much of the LRR force.
AEW&C force.
Gap filler radars
DEW radars
Most current region control centers and direction centers.

The planned status, shown in tabular form below[91] was applicable to achieve the "intermediate force level."

Squadrons/Fire Units/Installations

System	End FY 67	FY 68	FY 69
F-101	15	13	6
F-102	1	1	1
F-104	1	1	1
F-106	11	11	11
F-89 (Air NG)	2	2	2
F-102 (Air NG)	19	19	19
Bomarc[92]	8 (227 missiles)	8 (219)	8 (212)
Hercules			
RA	73	73	52
NG	48	48	44
LRR	170	155	126
Gap Filler Radars	88	17[93]	17
Combat Centers	6	6	5
Direction Centers	16	14	13

There were several problem related to adherence to the "modernized air defense force" concept. First, the decision regarding the F-106X resulted in cancellation of the USAF F-12 program[94] and USAF was denied a major aircraft development. Second, the phase-out of the current system seemed premature, in the absence of the capability to field the follow-on, modernized system. Although a need to conserve funds committed to the current system to be able to buy the future, modernized system was generally recognized,[95] CINCNORAD registered strong objection on April 2, 1968, to the carrot-at-the-end-of-the-stick approach by recommending "no further cuts until follow-on systems were operating."[96] History validates CINCNORAD's concern. State-of-the-art technology did not support an early operational capability of

[91] Ibid., p. 5.
[92] Reduction of generally eight missiles per year was programmed, rather than reduction in the number of squadrons.
[93] Gap filler radars would be retained for the Florida area only.
[94] Ibid., p. 10.
[95] Ibid., p. 7.
[96] Ibid., p. 8.

either the AWACS or the OTH, nor did Congress fund either program sufficiently to advance the technological capability dramatically.

As an additional problem, the time interval between the phase-down of the current system and the expected availability of the modernized elements required (or was based on?) a major shift in air defense strategy. Reductions in forces suggested the necessity of a strategy of thin perimeter defense. Specific USAF and Army units and facilities identified for elimination were located in central CONUS. With their elimination little remained in terms of surveillance, interceptor, or SAM forces. The response from the Secretary of Defense in February, 1968, to CINCNORAD's objection to this situation brought an incredible observation that the items/units identified for elimination "were located in the interior of the country and did not appear to contribute in any significant way to the reduction of damage to this nation in event of an attack."[97] The simultaneous reductions in fighter interceptors (area defense) and SAM (terminal defense) were particularly faulty from a military point of view. Weakening the area defenses permitted "leakage" of the system to enemy attackers, and the potential for such leakage made effective terminal defenses appear to be absolutely essential.[98]

The broad strategic impact of the overall reduction in air defense forces was to make the Soviet Long-Range Aviation relatively more and more effective. The U.S.S.R. was given attack options not available so long as an effective continental air defense system remained in being.

E. 1969–1972

1. Organization Command and Control

Activities in the category of organization, command, and control were relatively minor during the period 1969–1972. In November, 1969, NORAD again reorganized geographically; an eight-region, configuration (including Alaska) was adopted and NORAD divisions were eliminated.

The BUIC-III radar system became fully operational on January 5, 1970.

2. Surveillance and Early Warning

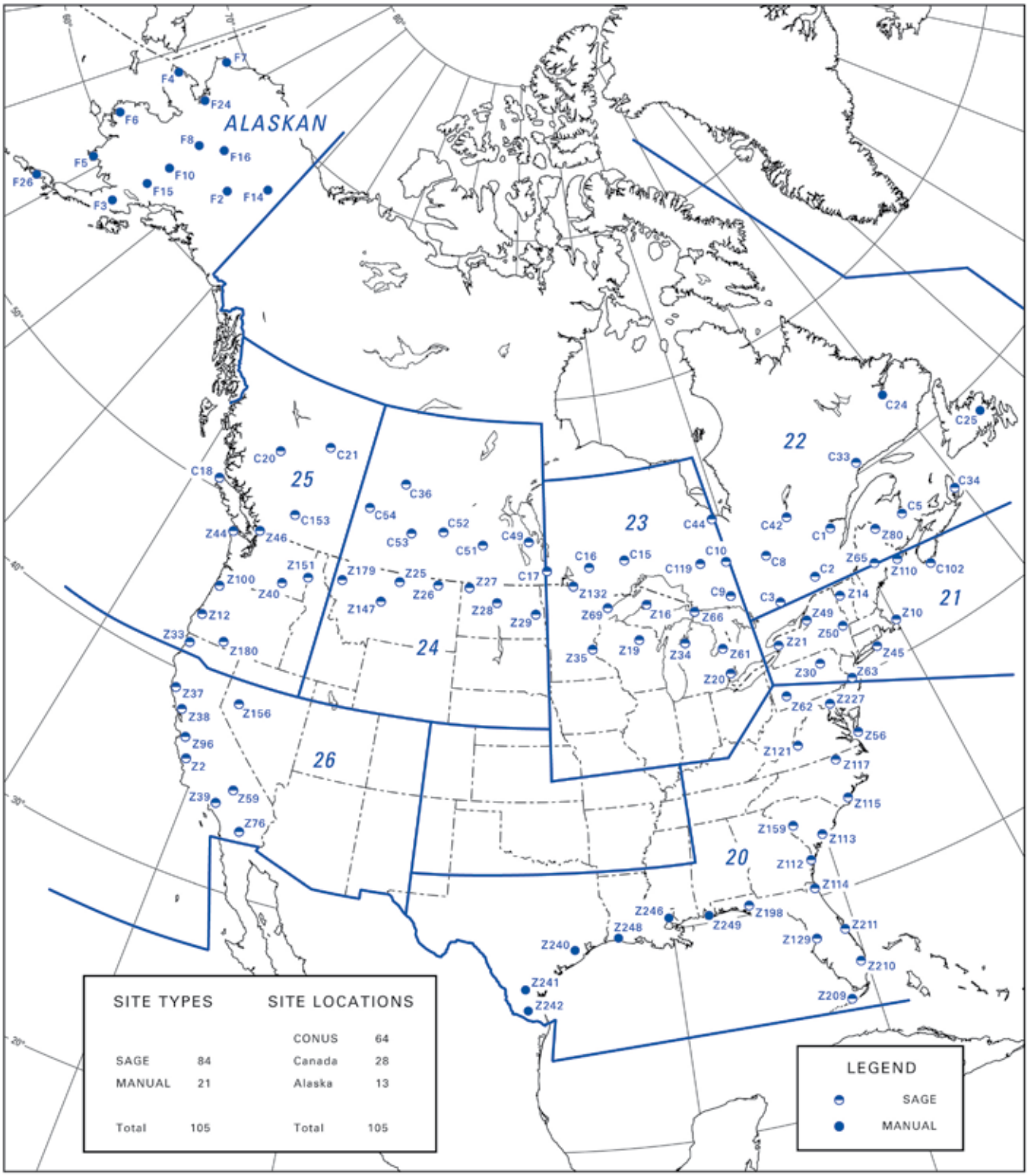
At the end of 1972, there were 105 long-range radar (LRR) sites an increase of six added in the southern United States over the past year. Sixty-four LRR were located in CONUS. Of those, 41 were ADC sites, five were FAA, and 18 were ADC/FAA joint use radars.[99] Locations of the NORAD LRR sites are shown by Figure 26.

The DEW Line remained in full operation with 31 ground-based radars.

Airborne surveillance and early warning was very meager by the end of the period. On November 14, 1969, the final AEW&C mission was flown off the East Coast. In December, 1972, the total AEW&C capability was represented by one EC-121 wing of two squadrons located at McClellan AFB, California. Detachments of this wing were also located at McCoy AFB, Florida, and overseas in Iceland and South Korea.[100] Additionally, an AEW&C reserve squadron, located at Homestead AFB, Florida, was identified for ADC upon federal mobilization.

[97] Ibid.
[98] Ibid., p. 9.
[99] "CONAD Command History, 1972," Headquarters CONAD, p. 44.
[100] Ibid., p. 59.

Figure 26—NORAD Long-Range Radar Sites, 31 December 1972



"CONAD Command History, 1972," Headquarters CONAD, p. 45.

3. Fighter Interceptors

The status of NORAD fighter interceptor squadrons at the end of 1972 was[101]:

	Regular Forces	Air National Guard
F-4	1	—
F-101	—	6
CF-101	3	—
F-102	—	9
F-106	9	2

During CY 1972 there had been a decrease of two squadrons of F-106's from the Regular Forces, but the two squadrons were transferred to the Air National Guard.

Deployment of the NORAD fighter interceptor squadrons on December 31, 1972, is shown by Figure 27.

4. Surface-to-Air Missile (SAM) Defenses

Adjustments of the NORAD SAM force levels, were extensive during the period 1969–1972. Whereas at the end of CY 1971 there were seven Bomarc squadrons (five in CONUS), one year later all had been phased-out of the NORAD inventory.[102] A Canadian decision in August, 1971, to eliminate Bomarc was followed four months later by a similar United States decision. Four United States Bomarc squadrons ceased operations in April, 1972; the final United States Bomarc squadron was inactivated on October 31st.

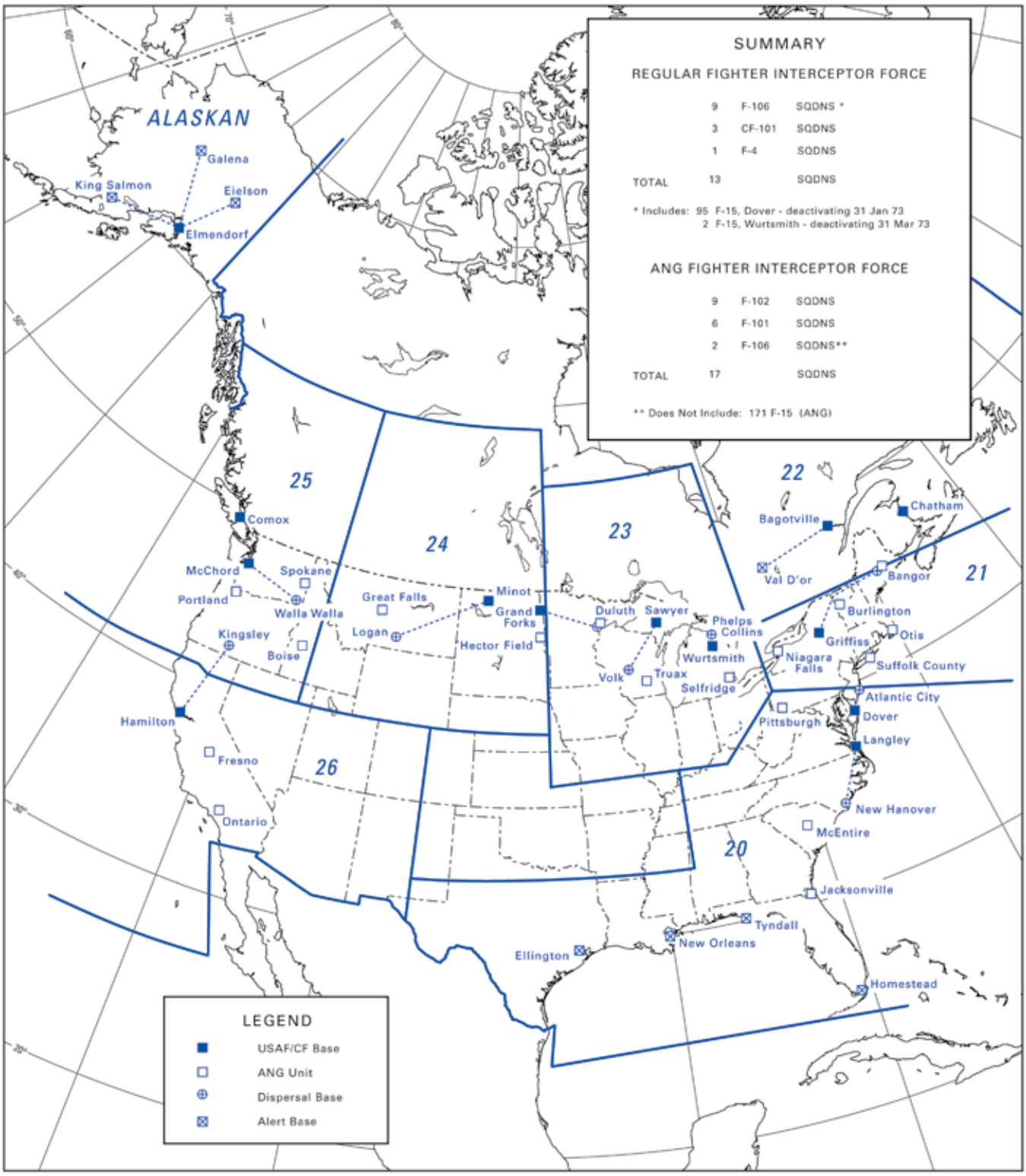
The Army's Nike Hercules deployment was greatly curtailed during these four years. In January and February, 1969, the St. Louis, Kansas City, and Dallas–Fort Worth defenses were discontinued in accordance with a decision of late 1968. On June 18 and August 1, 1969, five more Hercules batteries were inactivated, also in accordance with a December, 1968, directive. In October, 1969, additional reductions were programmed for ARADCOM batteries.

	FY 1970	FY 1971
Nike (RA)	43	40
Nike (NG)	41	39
Hawk	0[103]	

To implement the programmed reductions, ARADCOM was directed in December to discontinue the Niagara Falls–Buffalo and Cincinnati–Dayton defenses by March 31, 1970. Six Hercules batteries became non-operational on the 10th of December. In June 1971, 24 more Hercules batteries were phased out, and the Minneapolis–St. Paul, Cleveland, and Milwaukee defenses were closed. The Norfolk and Washington–Baltimore defenses were combined.

[101] Ibid., p. 64.
[102] Ibid., p. 98.
[103] Programmed Hawk reductions were not implemented because of a subsequent requirement for air defense of the southern United States.

Figure 27—NORAD Fighter Interceptor Deployment, 31 December 1972



"CONAD Command History, 1972," Headquarters CONAD, p. 65.

Some statistics will illustrate the rapidity of the Nike reductions. In March, 1970, there were 76 ARADCOM Hercules batteries. Compared to the peak year, 1963, the reduction was 44 percent. In June, 1971, 52 ARADCOM Hercules batteries remained. Using the previous comparison with 1963, the reduction was then 61 percent.

The status of the NORAD SAM squadrons/batteries at the end of 1972 was[104]:

Bomarc	2
Hercules	55
CONUS	52
RA	(25)
NG	(27)
Hawk	8

The NORAD SAM deployment at the end of 1971 (prior to elimination of Bomarc) is shown by Figure 28.

5. Air Defense of the Southern United States

Concern over Cuba and reaction measures of the air defense system in 1962 have been discussed earlier in this chapter. However, several events in late 1969 and early 1970 again forced the attention of the air defense planners to Cuba. On October 5, 1969, the inadequacies of radar and interceptor coverage to the south were dramatically illustrated when a Cuban pilot, flying a MiG-17 from Cuba, was undetected and unchallenged before landing at Homestead AFB, Florida. In May of the following year, a task force of Soviet TU-95 bomber aircraft arrived in Cuba after flying nonstop from bases in northern U.S.S.R. And in October, 1971, the weakness of air defense to the south was again demonstrated when an AN-24 transport from Havana, Cuba, arrived undetected and landed at New Orleans.[105]

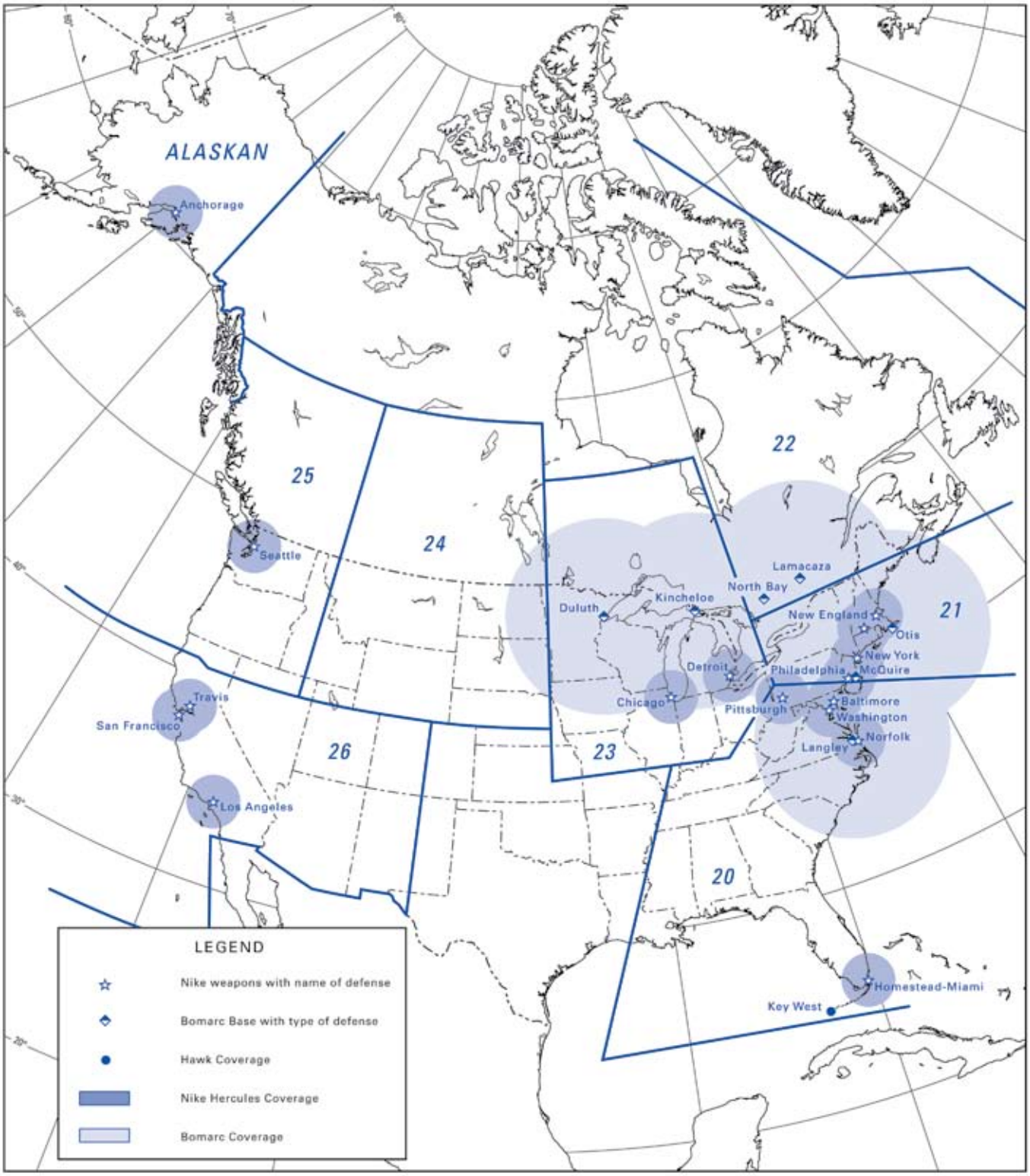
Enough was enough. On May 26, 1972, JCS directed that a detection, interception, and identification capability be provided by June, 1973, which was designed to restrict the unauthorized penetration of United States' airspace by unsophisticated type aircraft.[106] To carry out the directive, CONAD established a Manual Control Center, deployed additional military LRR and height finder radars on the Gulf Coast to supplement existing FAA coverage, and placed eight fighter interceptors on five-minute alert.[107] On October 6, 1972, the initial increment of the Southern Air Defense System became operational.

6. Air Defense With Reduced Forces

The air defense system which remained in being at the end of 1972 was obviously grossly ineffective against the type of bomber threat which had initially caused the deployment of the system. A new and greatly reduced threat was assessed by OSD. ". . . forces remaining after this cut would provide the capability to defend against a small attack (about 10 bombers) after one day of warning. . . ."[108] CINCNORAD's

[104] "CONAD Command History, 1972," Headquarters CONAD, p. 98.
[105] Landing at New Orleans was especially significant; the chairman of the House Armed Services Committee was from the state of Louisiana.
[106] "CONAD Command History, 1972," Headquarters CONAD, p. 53.
[107] Alert was provided by two ADC F-106's at Tyndall AFB and by two NG F-102's at each of three bases.
[108] "CONAD Command History, 1972," Headquarters CONAD, p. 39.

Figure 28—NORAD SAM Deployment, 31 December 1971



"CONAD Command History, 1972," Headquarters CONAD, p. 103.

utilization of the forces provided to him was to cover critical areas, plus the northern and coastal approaches to the CONUS. He believed that his forces "provide a credible though limited air defense that only partially satisfies the stated objectives."[109]

7. Planning Directives

A feature long missing from air defense planning was a national statement of air defense objectives. A bold effort to fill this void was advanced by Deputy Secretary of Defense Packard on April 20, 1971, in a Memorandum to the Secretaries of the Army and the Air Force and to the JCS.[110] In summary, Packard's directive was that there be no further reductions in the capabilities of the air defense system, and that for that system the following objectives of CONUS air defense were established:

(a) Contribute to maintaining realistic deterrence against Soviet attack by:
    (1) Defending strategic retaliatory forces.
    (2) Defending the National command authorities and key command and control centers.
    (3) Defending deployed ballistic missile defenses against air-supported threats.
(b) Restrict unauthorized overflight of U.S. airspace.
(c) Limit damage from deliberate or unauthorized small air attacks against any United States target.
(d) Deter Soviet air attacks by defending key military and urban/industrial targets.

Unfortunately for stability in air defense force structure, new CONUS air defense objectives were announced from OSD on March 9, 1972.[111] These objectives were specified for "force sizing." The threat was indicated to be "a small bomber attack with one or two days strategic warning." The "other" air defense objectives stated in 1971 (the Packard Memorandum) "should be given a secondary role in planning these forces."

The OSD statement of force sizing objectives of March, 1972, generated a requirement from JCS to CONAD for a study of the modernized CONUS air defense force. The study, based on wargaming and analysis, was completed on August 14, 1972. Of importance at this stage of our narrative was the conclusion. "Current systems are not capable of denying damages from a small sophisticated attack in the 1977–1985 time frame."[112] Compensating requirements in terms of future systems and deployments are discussed in Paragraph F, below.

8. Air Defense of ABM Facilities

It will be recalled that one of the Packard air defense objectives was that of defending deployed ballistic missile defenses against the air-supported threat. At the time when the Safeguard five-site deployment was planned, ARADCOM had planned to utilize 15 or 16 Nike Hercules air defense batteries. The exact number dependent on the specific Safeguard configuration selected.[113] These plans were, of course, never implemented because of curtailments in both the Safeguard and Nike programs.

[109] Ibid., p. 30.
[110] "CONAD Command History, 1971," Headquarters CONAD, pp. 29–30.
[111] "CONAD Command History, 1972," Headquarters CONAD, p. 31.
[112] Ibid., p. 32.
[113] Ibid., p. 30.

F. The 1972 View of Future System Requirements

1. Performance Characteristics Deficiencies in the 1972 Air Defense Force System

The mix of elements which constituted the air defense system in 1972—the radars, the fighter interceptors, the surface-to-air missiles, and the command and control facilities—provided less than desired effectiveness against an anticipated future, sophisticated threat, because of limitations of the individual systems.

Generalities in system performance characteristics will suffice to illustrate the problem. Fixed command and control facilities, however hardened, were considered highly vulnerable. Mobility and survivability appeared to go hand-in-hand. Operational radars of that date operated on line-of-sight principles, and were, therefore limited in range. The fighter interceptors needed more speed, more range, and an improved fire control system for target location and engagement. Further, any new fighter interceptor capabilities should complement gains in air defense effectiveness expected from development of a longer range, land-based radar. If, with improved radar and fighter interceptors, the air battle was expected to be conducted at greater ranges from the defended area, the new command and control means should be mobile and be in the vicinity of the air battle, i.e., the new command and control facility should be airborne and must carry radar for interceptor control and for warning from advanced patrol locations. Optimum improvement to the efficiency of the air defense air battle would be realized from the complementary contributions of an airborne warning and control system, an improved radar of vastly greater range capability, and an improved manned interceptor aircraft. In the weapons area of surface-to-air missiles (SAM), improvements were required in system detection and engagement ranges, in the capability to operate in an intense ECM environment, and in the target handling capacity of the system. This latter feature was of particular importance to minimize the possibilities of saturation of the defense by multiple attackers.

2. New System Development

Provision of types of systems for the strategic air defense mission is primarily the responsibility of the individual Services, although NORAD/CONAD attempted to influence the nature of new system developments by publication of Qualitative Materiel Requirement (QMR) documents.[114]

Four new system developments are of importance to this narrative—three USAF and one Army. As early as December, 1968, USAF had issued a request for proposal for an airborne warning and control system (AWACS). In July, 1970, the initial contract for AWACS was awarded to Boeing. By March, 1972, the development had proceeded to the point of airborne testing to determine the system capability under operational conditions.

In 1949, USAF initiated work on the detection of aircraft beyond the line-of-sight capability of current radars. The backscatter technique concerning over-the-horizon (OTH) radar propagation was endorsed by USAF in November, 1961.[115] A production release decision was projected for September, 1970. Two CONUS sites were initially planned to be operational in FY 1973. Each site—one east and one west—was visualized as being located approximately 500 miles in-land with a coverage arc of 160 degrees.

[114] These QMR documents related a specific threat to desired system performance characteristics against that threat. A separate QMR was, in general, published for each *type* of system visualized as being required.
[115] "History of the Air Defense Command, January–June, 1964," Volume 1, Headquarters ADC, p. 16.

The improved manned interceptor (IMI) had been one of the most urgent and long sought requirements of CONAD and ADC. In 1968, CINCONAD, General Reeves, is quoted in the command history as stating: "With regard to the interceptors for air defense, I consider it imperative that the Improved Manned Interceptors be developed."[116] The F-12 program, until cancelled, was considered potentially beneficial in meeting this requirement. In 1972 there was no developmental replacement for the F-12, although the F-14 (USN) and F-15 (USAF) were competing candidates, either capable of meeting the CONAD requirements.

SAM development (SAM-D), was contracted by the Army to Raytheon for "advanced development" in May, 1967. The SAM-D, ultimately to replace the aging Nike system and Improved Hawk in air defense, gave the promise of improved range, ECCM capability, an target handling capacity, in addition to other improvements.

Technological and manufacturing problems, and, above all, system costs combined to result in the non-availability of any of the improved systems—AWACS, OTH-B, IMI, or SAM-D—for deployment in operational quantities in 1972 and in the several years thereafter.

3. The Modernized Air Defense Concept

The CONAD modernized air defense force study of August 1972 concluded that the current systems were not capable of denying damage against the study threat directed. (See paragraph E7, above.) The need for modernized and survivable system components was asserted.[117] In addition, certain other more specific conclusions concerning air defense systems were reached[118]:

(1) Early tactical warning is essential to trigger the defense forces in order to defend effectively against the attack threat specified (i.e., small bomber attack).
(2) The most significant increase in total effectiveness is achieved with the introduction of AWACS.
(3) Current interceptors do not have the capability to exploit fully the introduction of AWACS. The IMI is needed.
(4) The SAM-D contribution is in direct proportion to attackers that "leak through" the area air defense.
(5) OTH-B, AWACS, IMI, and SAM-D provide essential complementary capabilities.
(6) A vigorous research and development program is supported for air defense components other than those under development, but no reorientation of programs currently under development is required.

4. Recommended Force Levels, Modernized Air Defense Force

A tabulation of the CONAD recommended and the JCS approved composition of the modernized air defense force follows[119]:

Force Element	Date Available	CONAD Recommendation	JCS Recommendation
OTH-B radars	by FY 1978	4	4
AWACS UE a/c	by FY 1978	35	25
IMI squadrons	by FY 1980	11	6–8
F-106 squadrons	by FY 1980	10	10
SAM-D fire units	by FY 1983	54	48
AABNCP [120]	by FY 1977	3	—

[116] "CONAD Command History, 1968," Headquarters CONAD, p. 11.
[117] This "modernized air defense force" was an evolutionary development of a similarly titled force first conceived in 1969.
[118] "CONAD Command History, 1972," Headquarters CONAD, pp. 32, 33.
[119] Ibid., p. 34.
[120] Advanced Airborne Command Post, a NORAD/CONAD concept comparable to the National and SAC airborne command posts.

Even with the JCS reductions to the CONAD recommendations, it was the JCS Judgment that the modernized forces proposed would be "able to counter a small, sophisticated attack during the 1977–1985 period *at a prudent level of risk*."[121] [Emphasis added.]

To anyone generally familiar with recent trends and developments in air defense, it is common knowledge that, in no case, have the force structure goals of the modernized air defense force been realized. Of concern to this study, however, was the fact that the promise of a modernized air defense force was the rationale for major force reductions in current systems starting as early as July, 1968. (See paragraphs E6 and E7, above.)

G. Characteristics and Strategic Implications Deduced from the Development, Deployment, Modification of the Air Defense System, 1945–1972

1. General

The intent of this paragraph is to summarize in the form of conclusions the salient points of preceding discussions around which the history of United States strategic air defense is structured.

2. The Significant Events

a. A series of international events (e.g., the Berlin blockade [1948], the attack on South Korea [1950], and the Soviet thermonuclear explosion [1953]) caused a defensive reaction in the United States to deploy a significant air defense, the system elements and command and control procedures of which were copies of those used in World War II.

b. The influence of a body of informed scientific opinion on air defense, emphasized by the new defense strategy inherent in NSC 162/2, October 30, 1953, brought the approval of a vastly improved air defense system.

c. Although a focus on system costs from 1956 to 1959 resulted in some curtailment of planned system developments and deployments, basically the concept of air defense of the early 1950's was the guiding force until approximately 1960.

d. Under this policy, the numbers of air defense units (surveillance and warning, interceptors, SAM) "peaked" during the period 1957–1961.

e. Following 1960–1961 a need to modernize or replace current air defense systems was constrained by: (1) a reevaluation downward of the U.S.S.R. bomber threat; (2) an increasing emphasis by defense planners on the increasing Soviet ICBM threat, against which air defense means had no capability; and (3) budgetary limitations.

f. By mid-1968 further curtailments in current air defense forces were directed toward a "graduated phase-out" of the current systems enroute to reequipping with costly new systems (AWACS, OTH-B, IMI, and SAM-D) of greatly increased capabilities.

g. Since the new systems were not, for a variety of reasons, ready by programmed dates, the 1968–1972 reductions in the current systems, in effect, constituted a virtual dismantling of the continental air defense capability.

3. Air Defense in a Continental Perspective

Several factors in combination—intelligence, materiel limitations, and tactical considerations—produced an important concept of continental, rather than national, air defense.

Canada–United States cooperation in continental air defense was achieved formally with the establishment of North American Air Defense Command in 1957. Additionally, CONAD exercised air defense responsibilities in Alaska and Greenland under terms of the United States unified command plan.

[121] "CONAD Command History, 1972," Headquarters CONAD, p. 34.

4. System Deployments

Strategic air defense is based on the complementary utilization of area defense (fighter interceptors) and terminal defense means (AAA guns and SAM).

Based on locations provided terminal defense during the period 1951–1972, CONUS air defense strategy may be inferred. From the beginning, the national capitol was protected. AEC installations, although of vital importance in the earlier years, became less vital to defend as their number increased. Twenty-four of the most populated and most highly industrialized cities were eventually provided defense, as were seven SAC bases. As necessitated by inactivation of Nike units, defenses were withdrawn first from the SAC bases (1965) and then from 12 cities located in the interior of the nation (1969–1971).

Coincident reductions in surveillance and early warning and fighter interceptor units and their withdrawal from the central CONUS forced CONAD into a thin perimeter air defense strategy.

When made necessary by international developments, CONUS air defense means were redeployed—temporarily or permanently—to meet the new threats (e.g., to Florida [1962], to Alaska [1963], to Panama [1964], and to the southern United States [1969–1972]).

5. Significance of the Threat

The initial period of build-up of United States strategic air defenses (1951–1960) was a direct response to the air attack threat perceived to exist from the U.S.S.R.

The first Soviet-launched satellite (1957) and the Soviet announcement of the primacy of ICBM as their strategic offensive weapons system (1960) resulted in progressive reassessments downward of the Soviet bomber threat.

Even though the Soviet bomber threat was being deemphasized, the continued presence of significant numbers of heavy bombers in the Soviet inventory was of concern to CINCNORAD. To ignore this element of the Soviet capability appeared to place an unwarranted reliance on an ability to interpret Soviet intentions.

The threat assessed during the period 1968–1972 as being one of "a small attack (about 10 bombers)" after a lengthy period (1–2 days) of strategic warning was for the purposes of force sizing and defense effectiveness studies; it was not correlated with Soviet heavy bomber *capability*.

Reductions in the CONUS air defense system starting in mid-1968 in expectation of achievement of a new, modernized air defense force were inconsistent with realities of the threat. A limited and decreasing bomber threat could not logically be used to justify reductions in air defense and simultaneously to justify a new, modernized air defense system. Budgetary and ABM strategic considerations appeared to have replaced the Soviet bomber threat in the minds of defense planners. Air defense and ballistic missile defense went hand-in-hand—and both were being deferred, except for token forces.

Section III. Ballistic Missile Defense

A. Approach

In preparing this section an attempt has been made to follow the guidelines established by the Historical Office, OSD, to treat the history of United States ballistic missile defense in a selective rather than exhaustive manner. There has been no attempt to provide an exhaustive description of BMD systems and their

characteristics. In fact, except for work conducted under the auspices of The Advanced Research Projects Agency, the United States, after 1957, pursued only one ballistic missile defense concept, and the story of the attempts to develop and deploy that system is only indirectly related to its characteristics. The fact is that the systems that evolved from that concept were able to intercept the missiles which they were designed to counter. As it turned out, their technical feasibility, which was an argument used against them, was fairly well demonstrated before the decisions to deploy or not deploy were made. Consequently, technical feasibility became more or less synonymous with system effectiveness which, in turn, was directly related to the threat, the deployment and the cost. The effectiveness was also well demonstrated—at least in the minds of the Soviets.

The history of ballistic missile defense in the strategic arms competition is a strange one and had a marked impact on United States goals, (if not on its strategy), and the arms competition itself. It was conceived when there was no threat and essentially abandoned at a time when the quantitative and qualitative threat was the greatest and was continuing to grow. It had a marked influence on bringing the Soviets to the Strategic Arms Limitation Talks and was the subject of the only treaty that evolved from SALT I.

The struggle against BMD was conducted on the basis of its technical feasibility, its effectiveness, its impact on the arms race, its cost and even its impact upon the environment—but mostly on its effectiveness and its impact on the arms race. The struggle was between the Administration and Congress with support on both sides from time-to-time from the scientific/academic community and almost all segments of the American society. There was divisiveness on both sides. Within the Administration there was a conflict between the Secretary of Defense and the Joint Chiefs and indeed between the Services themselves. In Congress there was conflict between the so-called hawks and the doves. The approach, in writing this history has been to highlight and analyze these events with the objective of determining why certain decisions were made. There has been no intent to make a judgment as to which side was right or wrong or to reflect on the integrity of any person or group. It has been accepted that each side and person was acting in good faith according to his own conscience and the good of the country.

Since the history of BMD encompassed such a wide spectrum of the American society, it has been necessary to go outside the Government files for reference material to present a reasonably well-balanced history. As a result, open literature has been used rather extensively. The extent to which balance has been achieved is left to the sense of the reader.

B. The New Dimension

The New Look strategy of the Eisenhower Administration hardly had time to experience the first blush of success before it was overtaken by events. The Administration, of course, had anticipated that the Soviet Union would eventually counterbalance the American strategic superiority but not before the end of the decade at the very minimum. Yet in 1955, the first year of the New Look budget, the Soviets demonstrated that they were far advanced in the production of long-range bombers and that they were qualitatively abreast of the United States in aircraft design and development. About the same time newly installed radar systems picked up evidence that the Soviets were testing large numbers of medium range ballistic missiles. The Killian Committee warned that unless the United States made additional efforts the Soviets would achieve a decisive lead in strategic missiles by 1960. Then, in August of 1957, the Soviets announced the successful firing of an intercontinental missile and followed the announcement a few months later with the Sputnik launchings to dramatize their capabilities. Thus, a new dimension was introduced.

Whereas the United States possessed the ability to destroy the war-making capability of the Soviet Union in 1954, with little likelihood of serious reprisal, by 1957 this was no longer the case. The new dimension, termed the "balance of terror" by one writer,[122] was considered the decisive military fact in the mid-1950's.

The "balance of terror" was the product of the development of a significant stockpile of thermonuclear weapons by both the United States and the U.S.S.R. and the development of a substantial delivery capability in both bombers and ballistic missiles by the Soviet Union. It undermined the New Look's two key assumptions i.e. that the 1953 ratio of Soviet to American power would not begin to change drastically, before the late 1950's and that American nuclear retaliatory forces could deter both large and small aggressions.

In addition to the growing number of thermonuclear weapons there was a growing awareness of their awesome destructiveness. The United States carried out its first thermonuclear explosion in November, 1952, the Soviets theirs in August 1953. The accumulation by both sides of substantial stockpiles of these weapons by 1956, marked a drastic change in the military situation. A general war in which hydrogen weapons were used would be disastrous for all participants. In 1950 and 1951 the Administration had prepared for what seemed like an imminent conflict with the Soviet Union. In 1953 and 1954 a different Administration not only placed reliance upon the ability of nuclear airpower to deter major and minor aggressions but also had indicated that it would not hesitate to use nuclear weapons where they would be militarily effective. Two years later, however, willingness to use nuclear weapons required also a willingness to face the possibility of thermonuclear devastation.

C. Nike Zeus Development

1. The Early Years

The impact of the new dimension, so aptly demonstrated by the Soviet Union with Sputnik I in 1957, was not lost upon the military. As early as 1955 the Army was contending that inadequate attention, as reflected by the amount of funds appropriated, was being given to the antimissile missile program. In December of that year the Army requested $7.7 million in supplemental FY 1956 funds for the ballistic missile defense program and expressed an opinion that early assignment of responsibility in the ballistic missile defense area would ensure a more coordinated effort.

Undoubtedly this request resulted from the fact that all three services, Army, Navy, and Air Force, were involved in some degree or another in ABM development. As early as 1944 the Army had contracted with the General Electric Company for research and development on a long-range surface-to-surface missile and a high altitude antiaircraft missile. The surface-to-surface program was Project Hermes while the antiaircraft program became Project Thumper.

Project Hermes began in November 1944 as technical intelligence teams, following the American advance in Germany, scoured the country collecting parts, documents, photographs, blueprints, notes, and scientists involved in the German rocket program. All this material was bundled together and shipped to the United States. About 130 scientists were also assembled and shipped to America under contract in a program known as Project Paperclip. In all 100 V-2 rockets were eventually assembled and fired under Project Hermes, the results of which provided a wealth of data for later use by U.S. ICBM and BMD development

[122] Huntington, *The Common Defense*, p. 88.

programs. An outgrowth of this program was the initiation of the high-altitude and upper-atmospheric research programs which were essential to missile defense and understanding the offensive warhead reentry phenomena.

In 1945, the Army also initiated Project Nike under a contract with the Bell Telephone Laboratories and the Western Electric Company. In the beginning the Army Air Force was a co-sponsor of this program with the Army Service Forces, but subsequently withdrew. This project led to the development of a whole family of antiaircraft missiles and subsequently a series of ABM systems.

The Navy's problem was the defense of carrier task forces from Kamikaze and high-speed aerial threats. To study this problem a contract was let with John Hopkins University Applied Physics Laboratory. The project was known as Bumblebee and from its research a whole family of surface-to-air missile systems—Talos, Terrier, and Tartar—was developed for shipboard use. In 1959, the Navy recommended Talos as a candidate for ABM defense.

The Army Air Forces, like the Army Service Forces, gained a great deal of knowledge from the Hermes project and the V-2 firings. In 1945, however, after withdrawing from the Nike project it initiated a contract with the Boeing Company for research on a ground-to-air pilotless aircraft in consonance with the McNarney directive of 1944 which assigned responsibility for guided missile development, for vehicles depending upon aerodynamic lift, to the Air Force. The project became known as the GAPA project. GAPA was a supersonic research vehicle using both rocket and ramjet propulsion. The program was later merged with G.E.'s Thumper program to develop the "collision intercept" method for destroying a ballistic missile. Due to budgetary constraints these programs were later merged with the University of Michigan's Aeronautical Research Center Wizard program to become the Air Forces Bomarc[123] system. The Wizard program, continued to be funded and like Talos was a candidate for the ballistic missile defense role in 1955 when the Army expressed the opinion that early assignment of responsibility in the ballistic missile defense area would ensure a more coordinated effort.

It has been reported[124] that antimissile design technology grew out of: (1) antiaircraft missile projects, (2) the high-altitude research carried out at White Sands, and (3) the upper-atmosphere nuclear tests carried out by the United States between August 1958 and September 1962. As early as February 1955 the Army had concluded, however, that the state of missile technology had advanced sufficiently to warrant a feasibility study for a system to combat ICBM. In March the Western Electric Company and Bell Telephone Laboratories undertook an 18-month feasibility study of "a new forward looking ground-to-air guided missile system capable of effectively engaging the target threats within the Continental United States during the period 1960–70."[125] Primary emphasis was to be placed on defense against long-range ballistic missiles.[126] In addition to the Bell Telephone and Douglas study, the Army was also looking into a ballistic missile defense system for the Field Army. In response to a query, the Chief of Ordnance informed the Chief of Research and Development on 16 November 1955 that the ongoing Ordnance Corps studies having reference to ICBM defense included the Nike II study being conducted by Bell Telephone and Douglas, and a

[123] Bomarc was an acronym for Boeing Michigan Aeronautical Research Center.
[124] Benson D. Adams, *Ballistic Missile Defense*, (New York: 1971) p. 18.
[125] "Nike ZEUS Guided Missile System," Volume I, System Study Report, prepared by BTL and Douglas Aircraft Company on behalf of Western Electric Company, Inc., 1 Mar 1957, p. vii, Foreword.
[126] Memo, Dir R&D, OSA, for Asst Sec Def, 1 April 1956, sub: Antiballistic Missile Program.

Plato study being conducted by Cornell Aeronautical Laboratories and the Sylvania Corporation.[127] Plato was to be a mobile system for defense of the Army in the Field, and was to use the Nike II (Zeus) missile. Effort on this project was subsequently discontinued in 1958.

The Bell-Douglas idea, the Chief of Ordnance reported, was to defend strategic points in depth so as to engage incoming missiles at several points. It would be a logical outgrowth of the Nike rings currently being installed. Fan-beam radars would be used to track the missiles, and computers would automatically command the launching of the missile or missiles closest to the incoming reentry vehicle (RV). Nuclear warheads would be used. Intercepts could be started at 300,000 feet altitude and continue down the line of descent until the "last resort" missile was fired from the area of the target.[128]

At about the same time that the Army was contracting with the BTL-Douglas team for a feasibility study, the Air Force contracted with the General Dynamics Corporation to study its proposed Wizard system to provide an area defense against ICBMs.[129]

As these studies got under way the Killian Committee (Technological Capabilities Panel) completed its deliberations finding that an ABM system was feasible but that accelerated research and development was required in certain areas, particularly radars. As a result of the recommendations of this committee, the Department of Defense approved release of $4 million of FY 1956 appropriated research and development funds for component development and experimental work on antimissile missiles. These funds were made available from a larger amount requested by the Army, which were temporarily withheld by the Bureau of Budget pending results of the Administration appointed Killian Committee reports.[130] Of these funds, $3.4 million would go to Ordnance for component design and system development. While it was realized that the money involved would not fund an ideal antimissile program, the Chief of Research and Development desired that "it be used to initiate studies and development for an aggressive program that would lead to the earliest practicable availability date of an Army antimissile missile capability."[131] The first contract for component hardware development for the Nike Zeus system was let in February of 1956.[132]

The increased Soviet activity in the development of ballistic missiles, as observed by the newly installed radar systems around the Soviet periphery, coupled with the lead time required to build and deploy a completely new system, caused the Chief of Research and Development in March of 1956 to direct the Chief of Ordnance to include in the Nike Zeus studies a study of the feasibility of obtaining an early anti-ICBM capability in 1960 or 1961 with a modified Nike-Hercules system.[133] Although pursued for some time this idea was subsequently dropped in order to concentrate all effort on the Zeus program.

The remainder of 1956 was a crucial one in the area of antimissile missile development. In June the final report of the Skifter Committee (Department of Defense Ad Hoc Group on Anti-ICBM) concluded that an anti-ICBM system was feasible of development. The committee recommended that research and development on acquisition radars should be conducted and that quick fixes should not be further considered. The Assistant Secretary of Defense (Research and Engineering), the following month, authorized the

[127] Memo, OCO or Chief of Ordnance to R&D, OCS, 16 November 1955, sub: ICBM Defense.
[128] Ibid.
[129] *ABM*, edited by Abram Chayes and Jerome B. Wiesner (New York Signet Books, 1969) p. 227, Chronology of U.S. ABM Deployment Decisions.
[130] CRD, *Chronological History of Army Surface-to-Air Missiles Through 1957*, Nike ZEUS, 10 January 1958.
[131] Memo, C of R&D for C of Ord, 31 January 1956, sub: Antimissile Missile Program.
[132] Memo, Dir R&D, OSA, for Dir GM, OSC, 24 April 1958, sub: (Incl 1) Report on Nike ZEUS.
[133] CRD, *Chronological History of Army Surface-to-Air Missiles Through 1957*, Nike ZEUS.

obligation of FY 1957Army research and development funds in the amount of $9 million for Project Nike Zeus. The program execution was to be in accordance with the recommendations of the Skifter Committee. In February 1957, the Army requested the apportionment of an additional $10.7 million from the FY 1957 Department of Defense emergency funds to raise the FY 1957 Nike Zeus effort to maximum rate. This level of funding was required to assure a 4th quarter 1962 operational availability date, provided maximum rate funding could be provided in the following years. This request for emergency funds was denied and in effect delayed the operational availability of Nike Zeus for one full year.[134]

2. Assignment of Responsibilities

In August of that same year the Special Assistant for Guided Missiles to the Secretary of Defense constituted a committee to review the overall anti-ICBM program. This was the first effort to coordinate the activities of the Services in the antimissile field. The first meeting was held on 17 September 1956, at which time the Army and the Air Force summarized their programs.[135] On 2 October the Special Assistant for Guided Missiles informed the Secretaries of the Army and the Air Force that in the antimissile field the Air Force would have responsibility for developing the early warning system and the Army would have responsibility for the active defense system. The assignment to the Army was justified on the grounds that major targets were already defended by Nike sites. In addition, the Nike II program appeared to be the only project beyond the study stage which was capable of accomplishing the mission. Further, there was a basic similarity between the anti-ICBM problem and the antimissile missile for field army use.[136]

This memorandum obviously did not resolve the controversy as to which service would have responsibility for antimissile missile development for the subject was addressed the following April by the Department of Defense Anti-ICBM Committee. That committee recommended on 25 April 1957, with Secretary of Defense approval, that the Army continue anti-ICBM missile system development at a level about as planned. In addition, the committee report confirmed the Special Assistant for Guided Missiles' assignment of responsibilities as issued in August the year before. The committee's report provided that the Air Force develop the anti-ICBM early warning system and carry out research and development on advanced acquisition radars required by the active anti-ICBM system and study the communications between these radars and the active portion of the system. The Army was to develop the local acquisition and target tracking radars required by the active portion of the anti-ICBM defense system and the defensive missile itself. The committee also recommended that an anti-ICBM Coordinating Agency be established to coordinate the Army and Air Force efforts in this field.[137] The Secretary of Defense approved the findings of the committee the same month. In January 1958, however, his successor Secretary McElroy issued the directive ordering the Air Force to discontinue all development work on Wizard.[138]

3. Early Plans

On 30 September 1956, the Nike Zeus feasibility study (originally termed the Nike II study) was completed. The results of the study were briefed to the Army General Staff on the first of October by representa-

[134] Ibid.
[135] Memo, Air Defense Branch, OCRD, 20 Dec 1956, sub: Antimissile Missile Statement of the Problem.
[136] Memo, Special Asst for GM, OSD, for Sec Army, Sec Air Force, 2 Oct 1956, sub: Anti-ICBM Systems.
[137] CRD, *Chronological History of Army Surface-to-Air Missile Through 1957*, Nike ZEUS.
[138] Chayes and Wiesner, *ABM*, p. 227.

tives of the Western Electric Company. The study defined the threat expected to confront the air defenses of the United States between 1960 and 1970 and described the proposed system for confronting it. The study included discussions of the guidance problem, the equipment that was recommended for its solution, a summary of the exploratory development work performed, and a proposed schedule for a development program.

The study concluded that it was feasible to provide an anti-ICBM defense with the Nike Zeus system. If development of the system was funded at the maximum rate, the first operational capability could be obtained in late calendar year 1962 under a normal production program.[139]

Later that same month the Army notified the Department of Defense Anti-ICBM Committee that following a phased program it would be possible to attain the operational capabilities with Nike Zeus as shown in Figure 29.

As a result of the successful completion of the feasibility studies and the successful component and experimental work conducted on Nike Zeus the decision was made in early November to initiate system development. Accordingly, the Army directed full system development in a phased program similar to the program outlined to the DOD Anti-ICBM Committee in October. At this same time the study on the feasibility of attaining an early anti-ICBM capability with Nike B (Nike Hercules) was terminated since the attainment of a Hercules capability would interfere with attainment of a much greater capability in nearly the same time frame with Nike Zeus.[140] On 1 December the existing contract with Western Electric Company was supplemented to include active development of the Nike Zeus system.

To meet this schedule the Army required $19.7 million in FY 1957. This was $10.7 million more than had been appropriated. Accordingly, the Army requested on 4 February 1957 the apportionment of $10.7 million from the Department of Defense emergency funds. This request was denied. However, in developing the FY 1958 budget the Army had planned a total of $26 million for Zeus ($12 million for R&D and $14 million for Production and Procurement). Unbeknownst to the Chief of Research and Development, the Deputy Chief of Staff for Logistics on 1 February 1957 had unilaterally programmed $25 million for Production and Procurement in support of R&D activities. This latter amount remained in the budget thus making a total of $37 million available for the Zeus program in FY 1958. This funding would permit an initial operational availability in the third quarter of CY 1963 instead of 1965 as had been the case with the reduced FY 1957 funds.

Shortly after the Soviet announcement of the successful launching of an ICBM in August of 1957, the Secretary of the Army recommended that the Secretary of Defense support a national priority for the anti-ICBM development program equivalent to the priority accorded the ICBM development. In keeping with this priority, he also recommended that additional funds be made available to the Army to accelerate research and development of Nike Zeus. Under an accelerated program, Army studies indicated, an early operational on-site defense of CONUS could be provided with 3 batteries[141] by the end of CY 1961 and

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[139] CRD, *Chronological History of Army Surface-to-Air Missiles Through 1957*, Nike ZEUS.
[140] Ibid.
[141] A Nike ZEUS battery comprised all the elements required for carrying out the engagement of an assigned target: radars for tracking and discrimination, defensive missiles, and related computer equipment. The organizational concept envisioned in 1957–1958 for deployment consisted of two major elements besides the weapons batteries: the Local Defense Center (LDC), consisting of the Local Acquisition Radar (LAR) and tactical control equipment for one to five batteries associated with the LDC, and; the Forward Acquisition Radar (FAR) which was to be deployed forward of the defended area, in the direction of possible ICBM attack. The FAR was to acquire target data and transmit it to the LDCs.

Figure 29—Nike Zeus Operational Availability Schedule as Furnished DoD Anti-ICBM Committee, 25 October 1956

Operational Capability	Date	
	Maximum Rate Funding	Budget Limited Funding
1. Early anti-ICBM capability (75 NM range, 130,000 feet altitude)	4th Qtr CY 62	3rd Qtr CY65
2. Full high altitude ICBM capability (75 NM range, 500,000 feet altitude)	4th Qtr CY 63	2nd Qtr CY67
3. Extended range antiaircraft (manned and unmanned) capability	4th Qtr CY 64	1st Qtr CY69

30 batteries by the end of CY 1962 at a cumulative cost of $2.0 billion. A full capability with 100 batteries could be provided by the end of CY 1965 at an estimated cost of $4.0 billion and an extended range capability with the 100 batteries could be achieved by mid-CY 1966 at an estimated cost of $6.0 billion.

In November the Chief of Research and Development notified Dr. H. R. Skifter, Chairman of the Department of Defense Anti-ICBM Coordinating Agency, the Assistant Secretary of Defense (Research and Engineering), and Dr. Killian, Special Assistant to the President for Science and Technology, of the Army FY 1959 funding requirements. Included was a statement of the FY 1958 and FY 1959 required research and development funding for the Nike Zeus accelerated program.

4. Conflicting Factors

As the Army struggled to attain the earliest operational availability with Nike Zeus several factors were to influence the program—not the least of which was the Eisenhower fetish for stability in military programs and stability in dollars. Under the New Look an annual goal of $34 billion in expenditures was established. During the same period, however, inflation was working against this goal. In July, 1956, the wholesale price index was 114.0. A year later it was 118.2. The costs of goods and services required by the Defense Department reportedly rose more rapidly than those in the economy in general; Secretary Wilson estimated that between January and August, 1957, the overall price tag on Defense Department programs had jumped 5 percent.[142] Obviously, it would be impossible to stabilize both programs and dollars under these circumstances. If the dollars remained the same, programs would have to be reduced. This led to a strategy of sufficiency. Whereas, under the New Look the United States had an overwhelming superiority in air and nuclear power, this virtual monopoly was no longer valid in the context of the new dimension. The question now became one of how much is enough? How large should the deterrent force be to achieve the national goals? And what should our defensive posture be should deterrence fall?

The Gaither Committee was one of several agencies assigned the task of addressing this problem.[143] As a result of this assignment the committee undertook an examination of active and passive defenses as they

[142] Huntington, *The Common Defense*, p. 94.
[143] This section is based upon a discussion in Benson D. Adams, *Ballistic Missile Defense*, p. 26.

contributed to deterrence and what protection they afforded the country in the event deterrence failed. One of the recommendations of this committee, to be given the highest priority, was ballistic missile defense protection of SAC bases against a possible future Russian missile attack.

Another factor was reorganizations within the Department of Defense and reassignments of responsibilities. Early in 1956 Defense Secretary Wilson reestablished the Office of the Director of Guided Missiles in DoD but gave it the new designation of Office of the Special Assistant for Guided Missiles. By 1957, the BMD program was a joint Army-Air Force effort monitored by the AntiBallistic Missile Committee of the Department of Defense. Each service was working its own solution to the problem. Despite several reorganizations and appointment of various advisory and coordinating committees, it was difficult to determine who had responsibility for various aspects of the developmental work and whether the military service or Department of Defense had overall coordinating responsibility for all R&D projects of a joint or interdepartmental level.

In November of 1957 the new Secretary of Defense Neil H. McElroy, redesignated the Office of the Special Assistant for Guided Missiles, the Office of the Director of Guided Missiles. The function of the new director was to guide all activities in the Department of Defense relating to research, development, engineering, production, and procurement of guided missiles. This office was Short-lived in that the Department of Defense Reorganization Act of 1958 created the Office of the Director of Defense Research and Engineering (DDR&E) with a subordinate facility, the Advanced Research Projects Agency (ARPA) with a charter to direct all ballistic missile defense and satellite development efforts. ARPA had a mandate to issue instructions to the military; to eliminate duplicate or unpromising programs; and to approve, modify, or disapprove programs and projects in the military.

Part of ARPA's charter included a program to investigate all possible defenses against space vehicles and ballistic missiles. It did this through its Project Defender. The Project's formal task called for research, experimentation, and systems feasibility studies to determine the technological possibilities of advanced defenses against exoatmospheric offensive vehicles. Its aim was to explore fundamental phenomena, develop new concepts, and apply new techniques. It was divided into five working parts: (1) general research and development (lasers, atomic and nuclear physics); (2) techniques and devices (radar, optical, infrared); (3) missile phenomenology (launch, mid-course, terminal); (4) systems and concepts (BAMBI, GLIPAR, ARPAT); and (5) penetration aids.

Another factor which tended to diffuse the Army's efforts to attain an early operational availability with Nike Zeus had to deal with service roles and missions. There is some evidence to indicate that the Air Force was concerned with the impact of a defense system on its strategic offensive posture. As early as June 1956, Lieutenant General James M. Gavin, the Chief of Army Research and Development had stated that missile defense would replace strategic air power as the nations chief deterrent factor.[144] The Air Force was opposed to the Army's ballistic missile defense concept arguing that the best defense was a strong offensive retaliation. Additional rationale included arguments that the Nike Zeus could be deceived, it was good only against unsophisticated RVs, it would cost as much as the whole ICBM program, it was technically infeasible, it would lead to the creation of a Maginot Line complex, and it could not be deployed before 1961, the period of the anticipated "missile gap." They also argued that a deterrent to war must be based

[144] *New York Times*, 13 June 1956.

upon an offensive capability and the Soviets would probably not remain idle in creating additional offensive capabilities if a defense against the ICBM was developed.[145] These same arguments were to appear over and over again during the next decade any time that a deployment decision seemed likely.

At the time that it was espousing these arguments the Air Force was still involved in developing its own BMD system, the Wizard, and while it exhibited a solid front to the other services and Congress, there was evidence of cleavage within its own ranks. The proponents for strategic offensive forces objected to any system that might reduce the magnitude of their effort while the strategic defenders were anxious to retain and exercise the air defense responsibilities so tenaciously pursued and won in the late 1940's and early 1950's.

To stop the interservice conflict on 16 January 1958 Secretary of Defense McElroy sent directives to the Army and the Air Force much similar to that issued in October 1956 by the then Special Assistant for Guided Missiles and the Department of Defense Anti-ICBM Committee in April the previous year. The directive limited the Air Force to a continuation of its current development effort in the Wizard program to that part which pertained to early warning radars, tracking and acquisition radars and the communications links between the early warning radars and the active defense systems as well as the data processing components required to form an integrated system. This work was to be conducted as a matter of urgency.[146]

The Army was to continue its development effort in the Nike Zeus program as a matter of urgency, concentrating on system development that would demonstrate the feasibility of achieving an effective active anti-ICBM system in an electric countermeasure and decoy environment.

Two months after the Secretary of Defense's January 1958 decision the Air Force appealed, claiming that the Army's Zeus did not have growth potential to handle possible enemy evasion, decoy, and countermeasure tactics. Agreeing with an earlier Senate Preparedness Committee resolution, the Air Force urged that more effort be put into developing antimissile missiles and that the Air Force be allowed to continue the Wizard program. Wizard it argued would be a complementary back-up system to Zeus.[147]

In the meantime, several events were taking place that would tend to both support the Nike Zeus program on the one hand and undermine it on the other. In March 1958, Dr. Richard C. Raymond[148] of General Electric TEMPO, speaking at the Annual Air Power Symposium in Salt Lake City predicted that both a long-range area defense antiballistic missile defense system and a short-range system would eventually be developed. The short-range system would be similar to the Army's Zeus, but, he argued, the Zeus in its then present configuration would become obsolete before it became operational because of foreseen ICBM improvements and the new detection methods. Undoubtedly he was speaking of penetration aids with respect to ICBM improvements. In 1958, Department of Defense had convened a committee to investigate the possible penaids that would be available to the offense in the 1960–1970 time frame. This committee reported on the feasibility of decoys, chaff, tank fragments, reduced radar reflectivity, nuclear blackout, and multiple warheads.[149]

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[145] U.S. House of Representatives, Committee on Armed Services, *Investigations of National Defense Missiles, Pursuant to House Resolution 67*, 85th Cong, 2nd Sess, 1958, p. 4196.
[146] Memo, Sec Def for Sec Air Force, 16 Jan 1958, sub: Program for Defense Against the Intercontinental Ballistic Missile.
[147] Adams, *Ballistic Missile Defense*, p. 29.
148 It is interesting to note that the new director of ARPA was Mr. Roy W. Johnson, a former vice-president of the General Electric Company.
[149] Herbert F. York, "ABM, MIRV, and The Arms Race," *Science* 3942 [1970] 257, 17 July 1970.

Dr. Raymond argued that for point defense, particularly for hard targets, the atmosphere could be used to filter warheads thus permitting identification of the warhead and engagement before the attacking warheads detonated. With soft targets, such as cities, an area defense was absolutely necessary. An area defense, he asserted, would require the ability to discriminate warheads from decoys beyond the atmosphere.[150]

Later in the year, Dr. Richard Holbrook, a scientist in ARPA's missile defense group, in a speech before the Atlantic Chapter of Sigma Delta Chi, said that the then currently envisioned Zeus would not provide an effective defense against multiple RVs, decoys, penaids, and radar jammers unless many interceptors were bought.[151] It is interesting to note that the United States at that time had its hands full trying to solve the problem of reentry and survivability of the warheads on its own IRBMs and ICBMs. There was no doubt of the feasibility of penaids in future years, but in 1958, there was no evidence that the Soviets were working on them, nor was the United States. In other words, they were, at that time, hypothetical. There were more immediate problems requiring concentrated effort in the development of both the ICBM and ABM systems.

While the scientists from ARPA were hypothesizing the future threat, the Argus series of high-altitude nuclear explosions was producing a generally shared opinion among scientists, in the fall of 1958, that an area ABM defense was technically impossible. Earlier, it had been suggested that high yield, high-altitude nuclear explosions would form patches of charged neutrons and electrons along the lines of flux of the Earth's magnetic field and that these charged particles would destroy the incoming warheads as they passed through. By mid-1959, however, the Defense Department had rejected this possibility on the ground that the patches would leak particles sufficiently fast to reduce the lethality to a level insufficient to produce a warhead kill since the earth's magnetic field was too weak to maintain the "Patches."[152]

5. Accelerated Deployment

Based upon the directive from the Secretary of Defense to pursue the development of Nike Zeus "as a matter of urgency," the Army had developed plans for an accelerated Zeus program. These plans included a statement of the necessary funds to achieve this capability. In late 1957 the funding requirements were incorporated into the FY 1959 Army budget. They included $136 million additional FY 1958 funds, and a total of $613 million in FY 1959 funds. It was the Army's opinion that the Zeus system should be deployed immediately because the risk of not doing so was becoming greater with each passing year. In November 1957 Army Chief of Staff, General Maxwell Taylor had urged an "all-out effort" at the earliest possible date to counter the threat represented by Sputnik type vehicles.[153]

About this same time the Chairman of the House Armed Services Committee, Carl Vinson became concerned about the matter of operational control of BMD. Perhaps he was remembering the earlier hassle over the Thor and Jupiter IRBM systems and wished to avoid a similar one over BMD. At earlier House hearings concerning this matter, Deputy Secretary of Defense Donald Quarles had indicated that no decision had been made. Apparently this answer had not satisfied Mr. Vinson for on 29 January 1958 he addressed a letter to the Secretary of Defense recommending that the Army be assigned operational responsibility for Nike

[150] "Dual Missile Defense Predicted," Aviation Week and Space Technology, 13 [1958] 27.
[151] "Nike ZEUS May Be Inadequate, Top Defense Scientist Warns," *Aviation Week and Space Technology*, 19 [1958] 33.
[152] *The New York Times*, 20 March 1959, p. 1.
[153] *The New York Times*, 21 November 1957, p. 1.

Zeus. In the same letter he also recommended that the Secretary make available to the Army $136 million in FY 1958 funds for the accelerated deployment of Nike Zeus.[154]

Subsequently, the Army briefed the Deputy Secretary of Defense on the need for the FY 1958 additional fund requirements and recommended that the requested $136 million be made available for the accelerated Zeus program. On 14 February 1958, the Secretary of Defense, the Director of Guided Missiles, OSD, the Secretary of the Army, and the Vice Chief of Staff of the Army met with Mr. Vinson regarding his recommendations for operational control of Nike Zeus and the accelerated deployment. No promises were made; however, the Secretary of Defense promised to respond to Mr. Vinson's recommendations by 15 April 1958.

Several months later at a Senate Defense Appropriations hearing Deputy Secretary Quarles said that the Army was in complete charge of ballistic missile defense development and operation.[155] Mr. McElroy, however, did not support the Army with its request for preproduction and development funds stating that such an act would "be premature at this time." He did, however, report that the system had been given top priority[156] and that the funds allocated would accelerate development of the systems readiness for production. The funds were to be devoted to research and engineering.

The remainder of 1958 was devoted to system research and development with a few possible exceptions. Early in the year the Chief of Research and Development noted that analysis of air defense systems in the Nike Zeus time era indicated that a companion surface-to-air missile might be required. As originally conceived, Zeus was to have a dual capability: the first, of course, an anti-ICBM capability; the second a long-range air defense capability. The latter capability had an impact on the design of the missile as well as other elements of the system. As conceived, however, it would also have a limited capability against low flying aircraft. The analysis had highlighted these deficiencies and detailed the specifications for the companion antiaircraft system. That system, the analysis indicated, should have a high rate of fire, a low altitude capability, improved homing-on-jamming techniques, and extended altitudes and ranges.[157] This analysis was the forerunner of a later recommendation to delete the antiaircraft requirement from the Nike Zeus specifications. This recommendation was accepted later that year.

The second significant action occurred in late January when the Director of Guided Missiles, OCRD, forwarded to the Director of Guided Missiles, Army, recommendations regarding the question of attaining an early defense against ballistic missiles with systems other than Nike Zeus. Essentially, the memorandum recommended that further consideration for accelerated development of all systems other than Nike Zeus and Talos be dropped. It also recommended that Nike Zeus be funded as a first priority and that Talos be funded as a second priority but be limited to a procurement program of 25 detachments.[158] These recommendations were subsequently briefed to an Ad Hoc Anti-ICBM Study Group appointed by the OSD, Director of Guided Missiles and chaired by Dr. H. R. Skifter, Special Assistant to the Assistant Secretary of

[154] CRD, *Chronological History of Army Surface-to-Air Missiles Through 1957*, Nike ZEUS.
[155] Adams, *Ballistic Missile Defense*, p. 28; CRD, *Chronological History of Surface-to-Air Missiles Through 1957*, Nike ZEUS. On l2 February 1958 the Director of Guided Missiles had dissolved the anti-ICBM Coordinating Agency since the Army, by the 16 January 1959, Sec/Def memorandum, had been given development responsibility for the active portion of the ABM system. This may have been the basis of Quarles statement.
[156] On 22 Jan 1958, the National Security Council had assigned a national priority to the anti-ICBM effort equivalent to the priority assigned to the ICBM and IRBM effort.
[157] Memo for Record, OCRD, 9 January 1958.
[158] Memo, C of R&D FOR CoS, 27 March 1958, sub: Antimissile Missile.

Defense for Research and Engineering. The Study Group had been formed to consider means for attaining an early defense against ballistic missiles.

In spite of these recommendations it became necessary for the Army to reverse its position regarding Talos. In a memorandum dated 23 April 1958, the Director of Research and Development, Department of the Army informed the Director of Guided Missiles, OSD that the Army would no longer be able to support the Talos program beyond a minimum industrial effort and a limited evaluation at White Sands Proving Ground. The Army had been trying to develop a program for establishing approximately 25 operational units of the missile since assuming responsibility for development, procurement, and manning of land-based Talos on 26 November 1956 but had been unable to do so because of funding limitations.[159] Presently available funds were being expended at a rate which would require termination of the industrial effort on 1 May 1958.

Development work on Nike Zeus continued through 1959. Following Deputy Secretary Quarles statement that the Army was responsible for the development and operation of the Nike Zeus, the Army assigned responsibility for preliminary Nike Zeus site selection to the Army Air Defense Command (ARADCOM) in January. This was consistent with the responsibilities of that command and would better insure close coordination with the Commander-in-Chief Continental Air Defense Command since ARADCOM was the Army component command of CONAD. In July a new missile configuration was approved, simplifying and strengthening the missile airframe by removing the large wings from the sustainer section. This design increased the range of the missile as well as its maneuverability and greatly simplified handling, maintenance and launching. The first three Nike Zeus missiles were fired in August, October, and December.

While the Army was proceeding with the development of Zeus, other events were working that were to affect its deployment. The Eisenhower Administration was still striving for a balanced budget, stability, and reduced taxes. The goal was to limit the defense budget to $40 billion which meant that the introduction of any new major system as expensive as Zeus would either have to be accomplished at the expense of other forces or the defense budget ceiling would have to be raised, something the Administration was reluctant to do.

Under this arrangement the Army was competing with the other services for defense funds. The Air Force was engaged in developing the Ballistic Missile Early Warning System (BMEWS) and doing additional ballistic missile defense work under Project Defender[160] for ARPA. In its FY 1960 budget request the Army recommended $1.3 billion for the Zeus program. This program included $300 million for research and development and $700 million for tooling, production facilities and some Zeus facilities. This figure was eventually reduced by the Administration to $300 million before it was submitted to Congress.[161] This reduction constituted a decision by the Administration not to deploy Nike Zeus. The stated reason for this reduction was the same as that given the year before but undoubtedly was influenced by budgetary considerations. As 1960 was an election year and, although it was possible that ballistic missile defense along with

[159] When the Air Force was directed to transfer responsibility for the land-based Talos to the Army, it initially refused to transfer the supporting funds. Eventually, a part of the funds were transferred but never the full amount.
[160] Under Project Defender the Air Force examined unorthodox means of missile defense such as antimatter, antigravity, radiation weapons, "death ray guns," and other exotic means to supplant the ground-to-air antimissile missile. BMEWS and the MIDAS and SAMOS intelligence satellites were the only successful ones.
[161] Adams, *Ballistic Missile Defense*, p. 34.

the "missile gap" might be a political issue, the Administration felt that a balanced budget and, perhaps, reduced taxes would get more votes.

The Army continued to press for deployment and requested additional production funds to speed the program toward a 1962 operational date. General Taylor, Army Chief of Staff, in a statement before a Congressional Joint Preparedness Committee stated the Army's position this way: "My reservation in this area arises from the unopposed ICBM threat and my conviction that the importance of obtaining this unique antimissile weapon at the earliest possible date out-weighs the possible financial risks inherent in initiating selective production."[162]

In the end Congress approved the $300 million requested by the Administration and voted an additional $137 million to begin production of Zeus. The Administration, however, refused to allow the Army to spend the $137 million, feeling that the system was not ready for deployment and questioning whether a workable defense was feasible.[163]

The "premature" judgment was probably influenced by opposition the Army was getting from certain parts of ARPA, DoD, the Air Force, and the Navy. The Air force and the Navy agreed with the administration contending that additional funds for production would be premature, claiming that some of the new approaches being investigated for ballistic missile defense would make Zeus obsolete. During the FY 1960 budget hearings the Air Force position on ballistic missile defense was clarified. Richard Horner, the Air Force Assistant Secretary for R&D told the House Appropriations Committee that a careful analysis of the Wizard system had indicated that it would not be cost effective. The Air Force, he said, felt the same way about Zeus, arguing that it could easily be overwhelmed by attacking missiles. It was the opinion of the Air Force that money being spent on missile defense might better be spent on increased offensive capability.[164]

In presenting ARPA's program to the same committee, Roy W. Johnson said that any BMD system should be technically feasible, capable of reacting to all missile threats in all types of environments, economical, and operational at the earliest possible date. Since all of these terms are relative, and since maintenance of a modern military establishment is not inexpensive, it could be expected that he would relate these criteria to Zeus. This he did not do. Instead, he said that ARPA's advanced efforts were designed to "leapfrog" the weaknesses of Zeus which were the inability to discriminate the warhead from other objects and decoys and the lack of a satisfactory positive mechanism for destroying the reentry vehicles.[165]

The Army felt compelled to counter these attacks on Zeus. It argued that Zeus could provide adequate point defense to vital installations and prevent the United States retaliatory forces from being destroyed on the ground. The deployed system would increase the costs to the Soviets by making them invest more and more funds in additional missiles and sophisticated penaids while at the same time complicating their targeting problem. Whereas the assured damage from a specified number of missiles could be readily computed for undefended targets, computation of the number required to produce the same damage of a defended tar-

[162] U.S. Senate, Joint Hearings Before the Preparedness Investigating Sub-committee of the Committee on Armed Services and the Committee on Aeronautical and Space Sciences, *Missile and Space Activities*, 86th Cong, 1st Sess, 1959, p. 23, as quoted in Adams, *Ballistic Missile Defense*, p. 32.
[163] Adams, *Ballistic Missile Defense*, p. 34.
[164] U.S. House of Representatives, Committee on Appropriations, *Department of Defense Appropriations for Fiscal Year 1960*, Part 6, 86th Cong, 1st Sess, 1959, pp. 164–174.
[165] Ibid., pp. 108–110.

get was not as straightforward and indeed was fraught with doubt since the full capability of the defensive system was unknown. This might cause the Soviets to overtarget some areas and undertarget others or even raise sufficient doubt in the minds of Soviets to question whether any attack would succeed.

Zeus as it was presently configured, the Army contended, had the capability to counter Soviet decoys albeit in limited numbers. A Zeus Acquisition Radar (ZAR) was being added to the system to replace the Forward Acquisition Radar (FAR) and Local Acquisition Radar (LAR). The ZAR would have increased power and an effective acquisition range of 1,000 nautical miles. Also planned was a Decoy Discrimination Radar (DDR). Besides these improvements Zeus had additional growth potential.

It was true, the Army agreed, that Zeus was less than perfect. It could be saturated and it was possible that the blast from the Zeus warhead at low altitudes could destroy the target, or parts of the target being defended. However, improvements in these areas could also be made in time. In the meantime, it was necessary to consider the entire target array. If the Soviets elected to saturate one point defense, the number of missiles available to attack other points would be fewer. As far as low altitude intercepts were concerned, the damage caused by the Zeus warhead would have to be compared to that which would be caused by the much larger warhead on the RV.

By the end of 1959 the deployment of Zeus was no nearer than it had ever been. The reasons given, in official testimony, were the technical uncertainties of the program; yet, the economic and political factors could not be denied. Zeus was expensive. If it could have been deployed at a third of the estimated cost, Army's chances of success would have been much greater. As it turned out, the question evolved: could more deterrence be bought by a dollar spent to destroy Soviets than one spent to defend Americans? As 1960 began, the controversy over the missile defense program focused on whether to produce and deploy the system before the results of the research and development tests were known.

During 1960 research and development were continued on Nike Zeus. It was a campaign year and the candidate of the Democratic Party made the "missile gap" a major campaign issue. In June he outlined his approach to foreign policy in a 12-point agenda in a speech to the United States Senate.[166] The first point of his 12-point agenda concerned the strengthening of our nuclear retaliatory power by increased production, hardening bases, and improving continental defenses.[167]

During the year the Army-appointed, Nike Zeus Ad Hoc Advisory Committee, chaired by Mr. Richard S. Morse, considered the problem of early production and deployment of the Nike Zeus system. On 21 November the committee submitted its recommendations to the Chief of Staff. In essence the committee recommended that a production rate of four batteries of Nike Zeus equipment be initiated immediately and that the units produced be deployed in consonance with the antimissile defense plans of the North American Defense Command (NORAD). As far as present Nike Zeus research and development was concerned, the committee recommended that the program be continued with the primary objectives of determining the system effectiveness against various types of threats and for improving its effectiveness consistent with the state-of-the-art.[168]

In December the Secretary of the Army recommended an interim production and development program to the Secretary of Defense. This program called for the production of four batteries, two defense centers,

[166] John F. Kennedy, *The Strategy of Peace*, (New York: Popular Library Edition, 1961) p. v.
[167] Ibid., p. ix.
[168] Chronology of the Development of Ballistic Missile Defense (1955 to Present), Safeguard System Command, Huntsville, Alabama.

and 200 missiles a year. The Secretary recommended that the production program be initiated immediately and that $73.3 million in FY 1961 funds be provided to permit letting the production contract by 31 March 1961. Deployment of units would be as recommended by CINCNORAD. At the time this request was made the fiscal 1961 budget year was half over so the Secretary of the Army was really asking for additional or supplemental funds.[169]

Earlier in the year both the Secretary of Defense and the Director of DDR&E in appearing before the House Appropriations Committee had indicated that a careful and painstaking review had been made of the Nike Zeus program and that it was decided to press forward as rapidly as possible with the research, development, test, and evaluation of the system but not to place it into production. As Dr. York, Director of DDR&E stated, "It is expected that these tests will provide the basis for a final decision. . . ."[170] The request for additional funds by the Secretary of the Army in December for a March contract was also denied.

In August of 1960 the Army had indicated that with the new improvements (increased radar range, greater power, and increased ability to discriminate) the Zeus program was ahead of schedule.

In October a report in *The New York Times* indicated that the Soviets were deploying a ballistic missile defense system similar to Zeus around Leningrad.[171]

In October ARPA announced that a series of contracts had been let with TRW, Convair, Boeing and others to investigate the feasibility of a satellite-born anti-ICBM defense system. The concept was to have orbiting armed satellites detect ICBM launches and destroy the missile during its boost phase before booster burn-out. Several orbits for the satellites were considered. TRW recommended numerous satellites with random orbits, Convair proposed a polar orbit system, but they all had basically the same drawbacks, long development times (approximately 15 years), tremendous costs in building and maintaining large numbers of satellites in orbit, and international political problems associated with having armed satellites orbiting over foreign countries.

The Army request for additional funds from the FY 1961 budget in December of 1960 may have been a trial balloon. After the November elections, the Army began a major campaign to sell the Zeus program and prepare for the upcoming legislative battles. Large ads began appearing in popular magazines throughout the country promoting Zeus. Special emphasis was placed on the prime and subcontractors showing where they were located and the distribution of the funds already expended among them.[172] In all some 37 states had firms involved in the program with California and New Jersey being the front runners. These ads were run by the contractors, prime and sub, and, in general, depicted the part that each was playing in the program.

That the ads had effect was attested by Jerome B. Wiesner, Kennedy's science advisor: "In 1961, when President Kennedy first began to survey his military problems, his attention was drawn forcefully to an anti-missile system, the Nike Zeus. He began to get a flood of mail from friends, from Congress, from people in industry. The press pointedly questioned him about his plans to deploy the Nike Zeus system. . . ."[173]

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[169] Ibid.
[170] U.S. Congress, House, Hearing Before the Subcommittee of the Committee on Appropriations, *Department of Defense Appropriations for 1961*, Part 1, 86th Cong, 2nd Sess, 1960, pp. 30–31, Part 6, p. 14.
[171] Jack Raymond, "U.S. Says Russians Plan Antimissile," *The New York Times*, October 15, 1960, p. 3.
[172] Adams, *Ballistic Missile Defense*, p. 39 and Jerome B. Wiesner, "Against," a Center Occasional Paper 2 (February 1969): 177 as quoted in Clark A. Murdock, *Defense Policy Formation*, (Albany State University of New York Press, 1974) p. 118.
[173] Ibid., p. 118.

All was not in favor of the Zeus program, however. Zeus had its opponents both inside and outside the Administration. By 1960 it was becoming increasingly clear to some individuals, particularly in the scientific community, that technical and economic resources were being expended by both the United States and the Soviet Union on weapons but that no additional security was being achieved. Technology was not capable of developing a defense against the ICBM. The most important task was to slow down the arms race, allow both sides to acquire equalized invulnerable deterrents and then eliminate the danger of nuclear war by deemphasizing advanced technology which might upset the stable situation.[174] A ballistic missile defense system came under the heading of "advanced technology." This was made quite clear by Weisner, soon to become President Kennedy's science advisor, in December of 1960, when he delivered a paper to the Sixth Pugwash Conference in Moscow: "It is important to note that a missile deterrent system would be unbalanced by the development of a highly effective antimissile defense system and if it appears possible to develop one, the agreements should explicitly prohibit the development and deployment of such a system."[175]

Inauguration of President Kennedy in January 1961 was followed by an extensive evaluation of ongoing United States defense policies. Zeus was among the items evaluated. It appeared that the Kennedy Administration was interested in answering two questions about Zeus: (1) was it technologically feasible? and (2) would it be cost effective?

The Army had prepared well for the FY 62 budget hearings. The Nike Zeus Ad Hoc Advisory Committee, chaired by Dr. Richard S. Morse, Assistant Secretary of the Army for Research and Development, in 1960 had members from both the Department of Defense and the White House. It had recommended immediate initiation of production. The Joint Chiefs of Staff agreed that Nike Zeus should be committed to immediate production if the United States was to avoid losing the ballistic missile defense race—Soviet efforts had been going on for along time. Nevertheless, the Eisenhower Administration had not included production funds in the FY 1962 budget.

It was the Army's hope that this decision could be overturned. The BMD system was necessary, the Army argued, for enforcing a disarmament agreement—it would provide security against cheating—and security against inadvertent accidental launches. In January 1961 the Army developed and forwarded the "Nike Zeus Defense Production Plan" to the Secretary of Defense for approval. The plan provided for the production and deployment, over a period of eight years, of 29 defense centers, 70 batteries and supporting equipment, and 3,610 missiles.[176]

The Army's hopes were dashed in April when the new Administration decided to go along with the old. The opposition, both within the new Administration and without, was too great. The Air Force in conjunction with the Aerospace Corporation (using ARPA furnished funds) were actively pursuing the boost intercept (BAMBI) program and several other concepts for intercepting ICBMs using satellites while at the same time advocating the superiority of their concepts over Zeus. Resistance was also building in DDR&E which was against any production decision before questions regarding the systems technical feasibility were answered.

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[174] From the Foreword by Jerome B. Wiesner in the Special Arms Control Issue of *Daedalus*, 4 [1960] 678 as quoted in Adams, *Ballistic Missile Defense*.

[175] Jerome Wiesner, *Comprehensive Arms Limitations Systems*, text of paper prepared for and delivered at the Sixth Pugwash Conference, Moscow, November 29, 1960; p. 247 of the *Conference Proceedings*.

[176] Safeguard Command, *Ballistic Missile Defense Chronology*.

On 4 April 1961, the new Secretary of Defense, Robert S. McNamara appeared before the Senate Armed Services Committee to announce the decision. In that appearance and others before Congress, he reviewed the Zeus progress and outlined the advantages that would accrue to the nation by successful development of Zeus. These included many of the arguments previously advanced by the Army—it would "force an aggressor to expend additional resources to increase his ICBM force. It would also make accurate estimates of our defense capabilities more difficult . . . and complicate the achievement of a successful attack. Furthermore, the protection that it would provide, even if for only a portion of the population, *would* be better than none at all."[177] He also reviewed the uncertainties to include the technical feasibility of developing the system, the vulnerability of the system to ballistic missile attack, system degradation by sophisticated ICBMs screened with decoys, and saturation of the defense. He also stated that the system was expensive in relation to the defense it could provide.[178] As a result, he concluded, he and the President were recommending: ". . . that we not undertake Zeus production at this time, but that we proceed do develop Zeus as rapidly as money will permit it to be developed and we are recommending, as you have seen, $270 million for that purpose in fiscal year 1962."[179]

Several members of Congress were active in promoting Nike Zeus in 1961. Senator Strom Thurmond (R-S.C.) was the leading spokesman in the Senate while Representative Daniel Flood (D-Va.) was the leader in the House. Their efforts along with the Secretary of the Army, the Chairman of the Joint Chiefs of Staff and the Chief of Staff of the Army were of no avail in getting the release of production money. Neither were arguments that the Soviets were producing a ballistic missile defense system effective. When asked whether evidence of a Soviet deployment would affect his decision, Mr. McNamara replied, "I do not believe it would affect my decision in anyway because I have assumed that we must take account of the possibility that they will have such a system."[180] In arriving at the decision not to deploy Zeus, Mr. McNamara said that he had discussed the matter with the JCS, the Service Secretaries, and the scientific community. The latter he pointed out were sharply divided. He had also spent two or three hours discussing the matter with the five senior Bell Laboratory executives working on the problem and had gone into the Zeus system in some detail.[181]

In the meantime development of Zeus continued. In June the prime contract was extended to cover work on the Zeus Multifunctional Array Radar (ZMAR). This was an advanced radar study for determining the feasibility of having an electronically scanned radar perform the multiple functions of acquisition, discrimination, and tracking in an ICBM defense system. The proposed system would feature a phased array arrangement with no moving parts and no necessity for a rotating antenna. Four faces at 90 degree intervals would be required to cover 360 degrees in azimuth. A feasibility model was to be installed at WSMR at a later date.

In December Zeus made its first successful intercept of a live missile.

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[177] U.S. House of Representatives, Hearings before a Subcommittee of the Committee on Appropriations, *Department of Defense Appropriations for 1962*, Part 3, 87th Cong, 1st Sess, 1961, pp. l6–17.
[178] Ibid.
[179] U.S. Senate, Hearings Before the Committee on Armed Services, *Military Procurement Authorization, Fiscal Year 1962*, 87th Cong, 1st Sess, 1961, p. 14.
[180] Op. cit., p. 112.
[181] Ibid., Part 3, p. 31.

The most startling thing of the year occurred on 1 September when the Soviets broke the unofficial nuclear test moratorium by testing a nuclear weapon in the atmosphere. These tests continued through October. There was conflicting opinion over the purpose of these tests, some contending that part of the test series was for the express purpose of developing a kill mechanism for a missile defense system. Others believed that the Soviets were developing a warhead for a smaller missile which indicated that the Soviets were building an invulnerable deterrent similar to the United States Minuteman which when complete, and in conjunction with the United States invulnerable deterrent, would lead to stability.[182]

Whatever the purpose[183] the Administration was concerned. President Kennedy announced resumption of atmospheric tests and on 22 September the Secretary of Defense approved the first two phases of a three phase Nike Zeus deployment.[184] Twelve metropolitan areas were included: Washington/Baltimore, New York, Detroit, Ottawa/Montreal, Boston, San Francisco, Los Angeles, Pittsburgh, St. Louis, and Toronto/ Buffalo. (This decision was to be reversed in presenting the FY 1963 budget to Congress.) In December, however, unofficial reports were being circulated in the press that President Kennedy and Secretary of Defense McNamara had asked for production funds for Zeus in the new military budget. Army hopes were soaring.

With an approved deployment plan the Army requested $401 million for Zeus in fiscal year 1963. The Department of Defense reduced this to $235 million.[185] In his House budget testimony in 1962 McNamara reiterated his previous position. There were significant and serious questions as to the practicality of Zeus. Therefore, ". . . we are not recommending funds for its procurement and deployment at this time, but we are requesting the maximum amount of funds which can be effectively used in 1963 in the research and development program to continue development and testing on a top priority basis."[186]

From a system standpoint, 1962 was a year of tests for Nike Zeus. In late January the Zeus Acquisition Radar on Kwajalein received its first signal returns from an ICBM. In February this same ZAR successfully acquired an Atlas missile fired from Vandenberg Air Force Base and transferred it to the TTR. In April this ZAR acquired and tracked a Soviet satellite and transferred the target to the TTR. As a result of this latter success, the Secretary of Defense placed a requirement on the Zeus program to demonstrate by May 1963 the capability to intercept a satellite at Kwajalein. The project was assigned the code name MUDFLAP.

On 19 June Nike Zeus successfully intercepted an Atlas nose cone over Kwajalein. Subsequently a series of intercepts was attempted in which 10 out of 14 missiles achieved successful intercept. Out of the series at least three shots were attempts at salvo firings with two missiles per salvo. In all three cases the first missile successfully intercepted the target while the second aborted for one reason or another. On 22 December Zeus successfully intercepted an Atlas RV carrying two decoys.

In all, the tests of 1962 could be considered highly successful. The Army in the meantime continued to achieve a greater capability with the system. In March a feasibility study was completed on a fast reaction missile which because of its fast reaction time and speed would maximize the time available to a defense

[182] Adams, *Ballistic Missile Defense*, p. 50.
[183] In later years it was generally accepted that at least one of the purposes of these tests was the development and test of an antimissile missile warhead. In an article in the *New York Times*, 5 February 1967, Hanson Baldwin reported that during one of the Soviet atmospheric nuclear tests, two Soviet ICBMs were simultaneously destroyed.
[184] ARADCOM, *Ballistic Missile Defense Chronology*.
[185] U.S. House of Representatives, Hearings Before a Subcommittee of the Committee on Appropriations, *Department of Defense Appropriations for FY 1963*, 87th Cong, 2nd Sess, 1962, Part 2, p. 348.
[186] Ibid., p. 46.

for atmospheric discrimination between warheads and decoys. This system would later be designated the Sprint and would become a subsystem of Nike X. Later in the year the Martin Company was awarded a contract for the missile development.

Although the tests of 1962 had been very successful, and the Army would continue to push for the early deployment of Nike Zeus, by mid-1962 it had become quite apparent that Nike Zeus was dead. In his testimony before the Senate Armed Services Committee that year McNamara had sounded the death note when he said, "A 100 percent effective system of military defense against ICBMs and submarine launched missiles is technically impossible. At least during the period 1963 through 1967 we will rely for our survival on a combination of military and civil defense measures."[187] Later he was to tell the Congress that he would never recommend an anti-ICBM program unless a fallout program accompanied it.[188] He was sure that the public and Congress would not approve the fallout shelter program—after all, several previous attempts had died in Congress.

D. Nike-X Is Born

The successful intercepts by Nike Zeus did little to convert the skeptical and unconvinced opponents of the system, particularly those in the Administration. Too much was still unknown about reentry phenomena and the environment in which a ballistic missile intercept would occur. The problems of saturation and decoy discrimination were still very real. In the opinions of these people the Zeus system could not cope with the advanced ICBM threats expected in the late 1960's. By mid-1962 these officials had concluded that four major improvements were needed in the system: (1) a new radar capable of detecting, acquiring, evaluating, and tracking a large number of targets simultaneously; (2) a capability to intercept targets at greater altitudes; (3) a new fast-reaction, high-acceleration missile, and (4) use the discrimination radar as a target track radar.[189]

Several alternatives were examined including one to continue development of Nike Zeus with a separate development of an advanced radar. A second alternative considered was development of the four improvements listed and the deployment of a system which would initially incorporate part of these improvements. The third alternative was to turn to the development of a more advanced system with more advanced missiles and radars and to defer a deployment decision.

The Army appears to have favored the second approach. In 1963 it recommended an initial deployment of Zeus and the phase-in of new equipment (i.e., Sprint) and phased array radars, as they became available. Eventually the new equipment would dominate the system. The advantages would be an early deployment and the provision of a defense to meet the current threat with the ability to grow and stay abreast as the threat became more sophisticated. Even at a cost of $2.8 billion, Army chief of Staff Earle Wheeler told the Senate Armed Services Committee, it is worth something to protect a large number of people and a large segment of the economy.[190] By so doing we would also have a technological triumph over the Soviets—by being the first to deploy an operational antimissile missile system.

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[187] U.S. Senate, Hearings Before the Committee on Armed Services, *Military Procurement Authorization FY 1963*, 87th Cong, 2nd Sess, 1962, p. 206.
[188] Benson D. Adams, "McNamara's ABM Policy, 1961–7," *Orbis* 12 (Spring 1968), p. 206.
[189] Adams, *Ballistic Missile Defense*, p. 55.
[190] U.S. Senate, Hearings Before the Committee on Armed Services, *Military Procurement Authorizations Fiscal Year 1964*, 88th Cong, 1st Sess, 1963, p. 131.

The Army was strongly supported by Senator Strom Thurmond who, on 11 April 1963 requested and received permission to hold a closed session of the Senate, the first since World War II. His purpose was to try and retain $196 million in the military procurement bill to begin production of Nike Zeus. This bill had been favorably reported out of the Armed Services Committee. The closed session was necessary to permit discussion of classified material which Senator Thurmond wished to introduce in his argument against an amendment to eliminate the Zeus funds for production. His attempt, as did the Army's, failed. The Senate vote 58 to 16 passed the amendment and eliminated the funds.

The decision to not deploy Nike Zeus had in fact been made by DOD in late 1962. In a memorandum to the Secretary of the Army, dated 5 January 1963, the Secretary of Defense stated emphatically that there would be no deployment, current or future, of the Nike Zeus system. Further, it stated that no decision had been made as to whether the Nike-X system would eventually be deployed. The memorandum then went on to direct the Army to reorient the Nike Zeus effort toward a new system approach, to be called Nike-X. The Nike-X system consisted of the following components: the Multifunctional Array Radar (MAR), the Missile Site Radar (MSR), the Sprint missile, the Zeus missile, and the necessary data processing equipment. The Nike Zeus testing program at Kwajalein and Ascension Islands, and at WSMR, were to be continued but reoriented to support the Nike-X system. Thus with one breath one system was buried and another born.

It is interesting to note that in all the debates that went on there was little mention of the threat that Nike Zeus would have faced had it been deployed as originally planned. Nor was there much discussion of the ability of Zeus to handle that threat. Instead, technological feasibility was always directed at a hypothetical threat some 10 to 15 years in the future. Perhaps this was a natural reaction having been so thoroughly deceived in estimating the Soviets ability to produce the atomic bomb, the hydrogen bomb and the ICBMs. In the words of one analyst that participated in the review of the Army's proposal to deploy the combined system in late 1962 and early 1963, "The Army didn't handle the proposal very well . . . But the timing was good. They sent it in right after a series of successful Nike Zeus shootings. Also, the Soviets did not have much of a missile force at this time—the missiles they did have were big and crude, cruder than those that Nike Zeus had intercepted."[191]

There was considerable talk about the destabilizing influence of a United States ballistic missile system but little about the destabilizing influence of a Soviet ballistic missile defense system. Mr. McNamara had indicated that news of a Soviet deployment would in no way affect his decision not to deploy Zeus. He did admit that steps were under way to improve the United States ICBM force, however, and that these steps were directly related to the Soviet ABM deployment. Still, there was a strong argument by both the Army and members of Congress to be the first to deploy. On the surface these arguments could be related to personal pride, to be number one, to demonstrate our scientific and technological superiority. But they in fact had a much deeper meaning that was designed to enhance our deterrent posture. The proponents of early deployment could not see how any defensive system could be considered to threaten the other side. To them the capability of causing mutual destruction was not an acceptable basis of deterrence. Since the United States, on record, was committed to a no first strike policy, we would have to accept the first strike and then retaliate. A defensive system would enhance our retaliatory capability.

[191] Quoted by Clark A Murdock, *Defense Policy Formation*, p. 121.

As the deployment debates continued in 1963 the Army reoriented the Nike Zeus program to Nike-X as directed by the 5 January memorandum. In March the Martin Company began a full development of the Sprint missile. That same month construction was begun on the MAR I radar at WSMR. In December design and development of the Missile Site Radar (MSR) was initiated. This radar, as the MAR, was to be a phased array radar with the capability to track several missiles and targets simultaneously.

Several live firing tests were also conducted, the most significant of which were conducted on 30 March and 23 May. In the 30 March test a Nike Zeus missile was fired against an ICBM target launched from Vandenberg Air Force Base. Intercept occurred at an altitude of 261,000 feet, the highest ever achieved until that date. This was the first successful intercept in which reaction controlled steering was employed. There were no equipment malfunctions during the test.

On 23 May 1963 a satellite intercept was successfully accomplished at Kwajalein by a Nike Zeus launched against an Agena D satellite. This successfully demonstrated the Mudflap capability as directed by the Secretary of Defense in April 1962.

Perhaps one of the most significant events of 1963 was the signing of the Partial Nuclear Test Ban Treaty in August. This was the culmination of 17 years effort in arms control beginning in 1946 with the Baruch Plan. The treaty banned nuclear testing in the atmosphere, underwater and in space. Two Senate committees held hearings on the treaty; the Foreign Relations Committee and the Preparedness Investigating Subcommittee of the Senate Armed Services Committee. Many of the same witnesses appeared before both committees. Whereas the Preparedness Committee called witnesses only from the military, the Atomic Energy Commission, and the Arms Control and Disarmament Agency, the Foreign Relations Committee called high-ranking government civilian and military personnel, scientists, private citizens, union officials, peace and disarmament advocates, and political scientists. The Preparedness Committee concluded that the disadvantages to the United States, military and technical, were not outweighed or counterbalanced by the claimed military advantages.[192] The Foreign Relations Committee concluded that "the treaty represents a net advantage to the United States; that the risks it contains are acceptable. . . ."[193]

The most significant aspect of the treaty with respect to ballistic missile defense was that the system could never be fully tested short of an actual war. The consensus of the witnesses was, however, that the United States had the capability to develop the necessary warheads and design around the remaining uncertainties without further testing.

E. Assured Destruction and Damage Limitation

1. McNamara's Inconsistency

Failure to support the Army's composite deployment proposal in 1963 meant the effective death of Nike Zeus. As one analyst with the Systems Analysis Office said, "It was ready to deploy and it wasn't deployed."[194] By this time it had become apparent to many that Secretary McNamara was really not interested in deploying a ballistic missile defense system. The main reasons advanced were technical yet, according to one analyst in the Systems Analysis Office:

[192] U.S. Senate, Interim Report by Preparedness Investigating Subcommittee of the Committee on Armed Services, *Military Implications of the Proposed Limited Nuclear Test Ban Treaty*, 88th Cong, lst Sess, 1963, p. 11.
[193] U.S. Senate, Report of the Committee on Foreign Relations, *The Nuclear Test Ban Treaty*, 88th Cong, 1st Sess, 1963, p. 9.
[194] Murdock, *Defense Policy Formation*, p. 124.

> McNamara didn't feel confident of himself on technical matters. He relied heavily on Brown [Dr. Harold Brown, DDR&E] and Perrini [Brown's assistant] and did not draw on any other sources for technical information. Brown was making the technical argument that Zeus would be easily overcome by simple penetration aids and it wouldn't make any sense to go ahead on a composite system because the Soviets could easily overcome it. But there was no evidence that the Soviets would actually buy offsets.[195]

Perhaps Mr. McNamara was only playing the part of a "good soldier" and implementing the guidance of his Commander-in-Chief. At any rate there is no doubt of the influence of Dr. Jerome B. Wiesner, Science Advisor to the President, in this area. His opinion of the effect of an ABM deployment on international stability and arms control has already been mentioned. The quality of his input into the policy debate was not always popular and was bitterly resented by at least one analyst:

> Only Wiesner could write memos to JFK without staffing them, without exposing them to anyone else. He sent a couple of memos to JFK that were wildly wrong on technical and arms-race questions. These arguments have set the tone of debate ever since: the same arguments persist now—cost-exchange ratios, arms-race implications, inherent advantage of defense and the idea that technology has reached a plateau.[196]

Whatever his motive, by 1963 Mr. McNamara was hard pressed for reasons not to deploy Zeus. In 1962 the Systems Analysis Office conducted a study of the trade-offs between active and passive defense which had concluded that from a cost-effective point of view, initial spending for missile defense should be solely for the construction of blast and fallout shelters—fallout shelters were a necessary complement to a terminal defense system. In the words of one of the authors of the study:

> . . . when he [McNamara] saw the study on the trade off with civil defense, he saw a way to put off the military. My feeling was that he never did want to deploy ABM but this had little to do with the study. It was for many other reasons: for example the arms race. . . . The analysis did not affect decisions, but supported his position and provided ammunition. Since he knew that Congress did not want to build fallout shelters and he did not want to either, this provided a good way to put off ABM. . . .[197]

McNamara used this argument before Congress in 1963 when he said that he would "never recommend an anti-ICBM program unless a fallout shelter program does accompany it." He reiterated this statement before the House Appropriations Subcommittee in 1966 and continued by saying: "The Congress, and in a very real sense I think the people, have turned down the program on a number of occasions. We have recommended it in at least three of the past five years. In every year, it was turned down."[198]

Although he was to continue to use the civil defense argument, it became apparent in early 1964 that he was merely using it as an excuse to prevent a ballistic missile deployment. When the 1963 shelter program was under consideration by the Senate Armed Services Committee in February 1964 an attempt was made to obtain assurances from McNamara as to whether he would procure and deploy an ABM system if the civil-defense bill was passed. The assurance never came and the shelter program died in committee.

The facts are that McNamara was willing to use analysis and data that supported his position, whether the purpose of the analysis were related to that position or not. Conversely, he was unwilling to acknowledge analysis that was contrary to that position. He was also willing to use technological arguments to support his position not to deploy the ABM while at the same time, he was willing to state that the technological

[195] Quoted in Murdock, *Defense Policy Formation*, p. 120.
[196] As quoted in Murdock, *Defense Policy Formation*, p. 121.
[197] Ibid., p. 122.
[198] Ibid.

problems were solved if it suited another purpose. This inconsistency was noted by Benson D. Adams in McNamara's treatment of the ABM issue in 1963:

> During the previous six months, before the House Appropriations Committee and the Senate Armed Services Committee, McNamara had stated that a great deal of knowledge was still needed about the effect of nuclear detonations in the atmosphere; that indeed this knowledge could only be obtained by high attitude testing. But, testifying on behalf of the Test Ban Treaty, McNamara said that we had gained sufficient knowledge and data from prior atmospheric nuclear tests to allow us to design an ABM.[199]

2. Back to the Drawing Board

It appeared that the decision not to deploy Zeus in 1963 would give Mr. McNamara at least four to six years before the deployment stage would be reached again. This respite, however, was relatively short-lived. By the end of 1964 interpretations of the United States 1962–1963 atmospheric nuclear test series began to raise the possibility of high yield explosions in space releasing a tremendous surge of thermal X-rays that would flash over thousands of miles in the near-vacuum. The lethal radius of these X-rays increased by a factor of 100 according to one scientist and gave a new lift to the Nike Zeus concept. It appeared that the discarded Nike Zeus system was better than anyone had thought. These interpretations were widely accepted by mid-1965 and McNamara's breathing spell which he had envisioned lasting until at least 1967, had suddenly disappeared.

The Army in 1964 requested no funds for deployment in the FY 1965 budget. For the first time there was no disagreement between the Army and the Secretary of Defense. As General William Dick, Chief of Army Research and Development said in testifying before Congress, there could be no real production decision made until at least 1966. This decision would have to wait on the MAR test results, since the MAR was the most critical component of the proposed Nike-X system, and these results would not be available until late 1964. Barring any unforeseen developments, a deployment decision was at least one or two years away.[200] He of course was not aware of the hot X-ray kill mechanism at that time. Mr. McNamara indicated that several problems still had to be solved before sufficient information would be available to make a judgment about the systems feasibility. These problems included technical, strategic and economic considerations. If these and the discriminations problem were surmounted, the system could be deployed starting in late 1964.[201] "The continued testing of Nike Zeus and preliminary studies of the Nike-X system's characteristics and effectiveness," Mr. McNamara told the House Armed Services Committee, "provide grounds for believing that the technical problems of at least a partial defense against a ballistic missile attack may be solved within the next several years."[202]

The tests of which Mr. McNamara spoke included those being conducted on the MAR I at WSMR and those being conducted using Zeus equipment on Kwajalein. Power was turned on at the MAR I radar on 15 June. Thereafter a series of tests were initiated to demonstrate its multifunction capability. By the end of the year the radar had tracked a variety of targets to include a Pershing missile. Successfully demonstrated were the radar's automatic search, verification track, and precision track features. In the meantime, the Zeus

[199] Adams, "McNamara's ABM Policy," p. 206.
[200] U.S. House, Committee on Armed Services, Hearings on Military Posture and H. R. 9637, No. 36, 88th Cong, 2nd Sess, 1964, p. 7698.
[201] Ibid., p. 7016.
[202] Ibid.

radars on Kwajalein participated in the advanced ballistic reentry system, low observable, reentry vehicle test, a part of the Air Force penetration aids program. On 18 June the discrimination radar accepted ZAR designation, identified the reentry vehicle and successfully transferred the target to the TTRs. Good radar and optical data were obtained.[203]

The preliminary studies, of which McNamara spoke, presumably included the Threat Analysis Study ordered by the Department of Defense in July 1963. The object of the study was to provide the broadest possible base upon which to make a decision to produce and deploy the Nike-X system. The study was headed by the then Major General Austin W. Betts and was completed in October 1964. It covered every conceivable aspect of the ballistic missile defense problem and was contained in 23 volumes when completed. It addressed the strategic implications of a ballistic missile defense deployment, the Soviet ICBM threat, and Soviet BMD progress. It also considered whether Nike-X would be destabilizing, if deployed. Also considered was the value of a ballistic missile defense for arms control and as a hedge against the Nth-country threat. In an arms limitation agreement, the report concluded that Nike-X could provide protection against cheating and provide a defensive nuclear umbrella while the number of ICBMs was being reduced. The report considered NATO and even suggested deploying a ballistic missile defense of Western Europe.

In general, the study was as comprehensive as possible and presented a strong argument for a ballistic missile deployment. It was presented to the Secretary of Defense in December but had little impact on a decision to deploy Nike-X. In 1963 the Army had been told to plan for an initial operational capability in 1969. After the briefing, it was later learned from a document signed by Secretary McNamara that the deployment decision was to be postponed for another year and the Initial Operating Capability date would be extended to October 1970. The FY 1966 RDT&E program was recommended at $390 million which included $20 million for the follow-on reentry measurement program and $10 million for production planning/engineering.

The Nike-X deployment that was proposed to McNamara in the fall of 1964 was designed to defend urban-industrial complexes against a potential Soviet attack. The Systems Analysis Office, however, proposed to McNamara a small defense concept—one being able to defend against several mixes of moderate attacks with various combinations of civil defense, air defense, and ballistic missile defense. Whether this was an original idea or one derived from the threat Analysis Study is not known; but there was a strong similarity. In addition to countering a prospective Chinese threat, it was suggested, a "light" or "thin" defense could be classified as an arms-control move because it would ensure against premature offensive responses to an accidental firing or an attempt by a third power to "trigger" wars between the super powers. As reported by Clark A. Murdock, the Systems Analysis proposal upset McNamara. The day after the report was submitted, the Chinese exploded their first nuclear weapon. Whereas he had hoped to avoid making a deployment decision for at least two years, "here was his own Systems Analysis Office forcing him to look at it now."[204] Nevertheless, McNamara discarded the idea at that time. The small defense idea achieved greater prominence in the immediate future and provided the basis for the Sentinel deployment decision in 1967. The focus on small attacks reduced some of the objections to a deployment such as saturation which required a large attack and the arms limitation objection. It was hypothesized that a small deployment would not be destabilizing because the Soviets would not need to respond to it since it represented no threat to them.

[203] *Ballistic Missile Defense Chronology (1957 to Present)*, Safeguard System Command.
[204] Murdock, *Defense Policy Formation*, p. 127.

In his Posture Statement of 1965, McNamara presented for the first time his strategic concepts of assured destruction and damage limitation which were to provide the framework for future decisions on ballistic missile defense:

> The strategic objectives of our general nuclear war forces are: to deter a deliberate nuclear attack upon the United States and its allies by maintaining a clear and convincing capability to inflict unacceptable damage on an attacker, even were that attacker to strike first; in the event such a war should nevertheless occur, to limit damage to our populations and industrial capabilities.
>
> The first of these capabilities (required to deter potential aggressors) we call "Assured Destruction," i.e., the capability to destroy the aggressor as a viable society, even after a well-planned and executed surprise attack on our forces. The second capability we call "Damage Limitation," i.e., the capability to reduce the weight of the enemy attack by both offensive and defensive measures and to provide a degree of protection for the population against the effects of nuclear detonations.[205]

In light of this strategy any future weapon system would have to be evaluated in terms of both its assured-destruction and damage-limiting capability.

Discovery and acceptance of the thermal X-ray phenomenon in late 1964 and early 1965 made considerable impact on the Nike-X system configuration. With the Sprint missile and an improved Zeus missile, both a terminal and area defense could be provided. To provide this capability a long-range acquisition radar would be required. This would necessitate some modification in the MAR capabilities and would also require some augmentation of the MSR. A meeting with Dr. Harold Brown, DDR&E, on 23 April 1965 resulted in the necessary redirection. As a result of that meeting, the Army was directed to:

(1) Install a tactical MAR (TACMAR), the modified MAR, on Kwajalein.
(2) Proceed with the development of an augmented MSR.
(3) Conduct cost and schedule studies on installing the originally planned MSR and then the augmented MSR, or only the augmented MSR on Kwajalein.s
(4) Proceed with the development of the new long-range interceptor missile.
(5) Continue design studies of a Very High frequency radar—to provide early acquisition of the targets and permit utilization of the maximum range and altitude capability of the new long-range missile. The radar would eventually become known as the Perimeter Acquisition Radar (PAR).

While reorienting the Nike-X program in 1965, the Army continued with component development and the Nike Zeus test program. This latter program, along with the ARPA advanced research in ballistic missile defense, had provided much of the technology for the new Nike-X system. As Mr. McNamara had told the Democratic Platform Committee in August 1964: "The new Nike-X, which will give us the option to deploy—if the national security requires it—is the most advanced antiballistic missile yet conceived by any nation."[206]

Several "firsts" were also achieved in the program during 1965. In January two Nike Zeus missiles were launched from Kwajalein in salvo against a simulated submarine-launched ballistic missile. The test was the first completely successful salvo firing, with miss-distances of both missiles well within the lethal blast radius. In November the first guided Sprint launching was successful at WSMR.

In October the Army completed the DEPEX II study and presented the results to the Secretary of Defense. This was the first of several annual studies directed by the Secretary of Defense to address many of the complex problems associated with a ballistic missile defense deployment. The study considered the

[205] Robert S. McNamara, "Excerpts from 1965 Posture Statement, Smith and Johns, *American Defense Policy*, p. 98, as quoted in Murdock, *Defense Policy Formation*, p. 128.
[206] *The New York Times*, August 18, 1964, p. 18.

threats that the United States ABM would face—both Soviet and Nth country, the deployment configurations required to meet these threats to include the number of Sprint and Zeus missiles, and the number of shelters necessary to complement each deployment. An attempt was also made to assess the impact of an American ABM deployment upon Soviet strategy. In all several deployments were considered and each evaluated from a standpoint of cost and effectiveness. In the final analysis a 25-city defense deployment against a Soviet threat was recommended.

F. *Limited Nike-X: The Chinese Threat*

Based upon the DEPEX study, the Army in preparing the FY 1967 budget had included $188 million for preproduction funds for long lead-time items for Nike-X. The Joint Chiefs of Staff supported the Army in this request. The Army did not believe that the ballistic missile defense modular concept, fall-out shelters and air defense were so irrevocably linked together as McNamara[207] and the Joint Chiefs. The Army argued that a start on defense had to be made at some point and this was the time to do it.

McNamara deleted the Army request for preproduction funds. His reasons were essentially the same as those used in the past: the necessity for a shelter program, an improved air defense program, the expense, and the inability to provide 100 percent protection against a Soviet attack. His argument for the shelter program was based upon the damage that would result from low altitude Sprint intercepts. This argument was already undermined by the stress, with the new Zeus missile, on an exoatmospheric intercept and by the fact that the Sprint warhead was a low-yield enhanced radiation device that would cause little damage to the defended area (he dropped this argument in 1967). He acknowledged the effectiveness of Nike-X against a small uncomplicated attack such as might be launched by the Chinese but postponed any decision on a deployment to counter such an attack based upon the then present knowledge of Chinese Communist nuclear progress which didn't warrant such a deployment.[208]

He again reiterated that he would never sanction a deployment against the Soviet threat because the Soviets could offset the defenses at lower costs than the U.S. deployment; a defense against the Soviets would cost between $25 billion and $30 billion to deploy and between $1 billion and $2 billion per year to maintain; and the United States would still suffer upwards of 50 million fatalities. On the basis of this rationale he recommended $447 million for research, development, and testing programs for Nike-X. In addition he recommended $119 million for ARPA to continue its missile defense studies which included the Hibex missile, the hard-point defense radar (HAPDAR), reentry measurements, penetration aids, and satellite defense.

The Congress did not agree with the Secretary's position. In 1963 the Soviets had announced that they had designed an effective antimissile missile and a year later had displayed the GALOSH antimissile missile in a Moscow parade. By 1966 there was considerable evidence that the Soviets were accelerating their

[207] In his statement to the House Armed Services Committee in 1965 McNamara had stated that the Soviet Union with its bombers, submarine-launched missiles, and ICBMs could inflict severe damage against the United States. Therefore, he, went on to say, a very good defense against only one form of attack would have limited value. "A meaningful capability to limit the damage of a determined enemy attack, therefore, requires an integrated, balanced combination of strategic defensive forces, area defense forces, terminal defense forces and passive defenses." He thus tied to the ballistic missile defense costs, the cost of both a shelter program and an air defense system. See U.S. Department of Defense, *Statement of Secretary of Defense Robert S. McNamara Before the House Armed Services Committee on the Fiscal Year 1966–70 Defense Program and 1966 Defense Budget*, 1965.

[208] U.S. Department of Defense, *Statement of Secretary of Defense Robert S. McNamara Before the House Armed Services Committee on the Fiscal Year 1967–71 Defense Programs and 1967 Defense Budget*.

ABM deployments. In addition to the GALOSH system around Moscow, there was evidence of another system, the Tallinn system, being deployed in, an arc several hundred miles long along the northwest border. Evidence indicated that this was an area defense weapon with characteristics resembling Nike Zeus. McNamara believed that it was an advanced air defense system, perhaps procured to counter the advanced man bomber which he had refused to sanction. The Joint Chiefs were unanimous in their conviction that it was an ABM system. Regardless of McNamara's belief there was sufficient uncertainty to cause the Secretary to take countermeasures. In announcing the new system in November, he said that the United States would procure and deploy a new submarine-launched ballistic missile, the Poseidon, to counter this capability. By his actions it would appear that Mr. McNamara might have believed that this system was more likely designed as an SLBM system than either an anti-bomber or anti-ICBM system.

In April the Senate Armed Services Committee recommended the appropriation of $167.9 million to buy long lead-time items for Nike-X, to shorten the time to initial operational capability and to spur the Administration into deploying Nike-X. Early in May the House Armed Services Committee announced unanimous support of the Senate committee's Nike-X appropriation recommendation. Eventually the House Armed Services Committee authorized $153.3 million for long lead-time item procurement.[209] This figure was approved by the Senate but not without some opposition. In fact, during this debate it became apparent that opposition to the deployment of Nike-X system was not confined to the Administration, its advisors, and certain civilian scientists. By 1966 a very vocal minority had developed in the Congress against BMD. By 1968 this group had enlarged considerably in both Houses.

The announcements of new Soviet offensive and defensive missile deployments and China's explosion in May and December of two hydrogen devices (at least a year before expected) did not provoke a deployment decision. It did, however, spark a renewed congressional effort to achieve a deployment. Opposition grew because of a fear of an accelerated Arms race. Late in the year Congress was startled to learn that the Administration was considering asking the Soviet Union for a moratorium on ballistic missile deployments. This recommendation had been suggested in 1965 by the Arms Control and Disarmament Committee of the National Citizens Commission of the White House Conference on International Cooperation, chaired by Wiesner and Gilpatric. Believing that the Soviet BMD effort was a limited one and that a costly upward spiral of the arms race would be started if either side deployed an extensive system, the Administration sought to prevent such a race by seeking a moratorium. An answer to this proposal was not expected until after the first of the year. A decision to deploy a BMD system would be contrary to this request. Therefore the Administration decided to withhold any decision until the Soviet answer was received. It was expected that this action would forestall increasing Congressional pressure to deploy Nike-X.[210]

While 1966 did not produce a decision to deploy Nike-X, optimism mounted during the year. Within the Army several reorganizations and responsibility assignments were made in preparation for the anticipated favorable decision. On 28 January an Army Chief of Staff memorandum established the Nike-X System Office as a Class II Activity. Lieutenant General A. W. Betts, Chief of Research and Development was appointed Nike-X System Manager (acting). The Nike-X Project Office was designated an Army Materiel Command Class II Activity under the operational control of the Nike-X System Manager. The Army Air Defense Command as the ultimate user of the system was assigned the normal combat develop-

[209] Adams, *Ballistic Missile Defense*, p. 131.
[210] Adams, *Ballistic Missile Defense*, p. 138.

ment activities for the system. These activities included development of firing doctrine and system operating logic, communications doctrine, logistics doctrine, and operational security doctrine. Also, ARADCOM was assigned responsibility for site selection, on-site training, development of Tables of Organization and Equipment, Tables of Allowance, and Tables of Distribution, as well as the conduct of Operational Acceptance Testing.

In May the Joint Chiefs of Staff directed the Commander-in-Chief, Continental Air Defense Command to conduct a study to determine the operational impact of a Nike-X deployment on other offensive and defensive systems within CONUS. Authority was granted to utilize personnel from other commands to the extent considered necessary. As a result a team was assembled which included members from CONAD, ARADCOM, ADC, SAC, Nike-X Project Office and other commands and agencies operating forces within CONUS. The final report was submitted to the Joint Chiefs in February 1967 with the general conclusion that the Nike-X system could be deployed and operated within the CONUS without serious impact on the operation of other DoD systems.

In June 1966, the Continental Air Defense Command published its concept for the operational employment of Nike-X within the CONAD command and control structure. Operational command of the system would be vested in CINCONAD. He would exercise this command through CG ARADCOM who would command Nike-X through his Ballistic Missile Defense Center and his subordinate Region Commanders and their supporting Fire Direction Centers. Interfaces would be provided for the exchange of information between the CONAD Region Commanders and the Nike-X Commanders at the Region Control Center and Fire Direction Center level.[211]

By December the Army was prepared to present the results of its 1966 "Nike-X Deployment Model Study 1-67 (DEMOD 1-67)" to the Secretary of Defense. This was one of the studies directed by the Secretary earlier that year. Other studies were being conducted by DDR&E and a special group of the Defense Department's Defense Science Board. These studies were designed to ensure continued advances in ballistic missile defense technology, pending an Executive decision to deploy.[212]

The defense objectives of DEMOD 1-67 were specified by the Secretary of Defense and were directed against the potential threat from both the Chinese People's Republic and the U.S.S.R. through the 1970's. Defenses were specifically designed and evaluated to defend United States industrial and urban centers against a deliberate Chinese Communist attack (called a counter value attack) and a deliberate U.S.S.R. attack against United States offensive forces—a counter-force attack. Additional analysis was conducted with respect to the ability of the deployments to protect the Continental United States against inadvertent or unauthorized ICBM launchings by an Nth country. The problem of providing a defense to our Allies was also addressed in this study. Deployments for the defense of Europe and Japan were designed and analyzed. The light defense of urban-industrial centers against a deliberate Chinese attack was approved by the Secretary of Defense on 20 December for planning purposes. With minor modifications this deployment would become the Sentinel deployment in 1967.

In the meantime, on 5 December the Assistant Secretary of the Army for Research and Development was briefed on the work that the Army was conducting on a low-frequency radar and relating the applicability of that work to the DDR&E requirement to develop a VHF/UHF radar for Nike-X. The Project Manager requested

[211] "CONAD Operational Employment Concept for the Nike-X Terminal BMD System," 20 June 1966.
[212] Adams, *Ballistic Missile Defense*, p. 136.

authority to proceed with the program. Dr. O'Neal verbally gave that authority at the briefing. Subsequently the Nike-X System contractor was directed to proceed using the General Electric Company as a subcontractor for design and development of the radar. This was the beginning of the Perimeter Acquisition Radar program.

By the middle of 1966 it appeared that a trend was developing favoring a limited Nike-X deployment against the Chinese. The system then being discussed would cost between $5 billion and $8 billion. The deployment would encompass about 12 MSR sites each with a complement of both the improved Zeus (DM15X2) missile and Sprint, and about six Perimeter Acquisition Radars. The system would provide a thin area defense tailored to the Chinese threat. It would have limited growth potential so as not to influence or provoke a Soviet reaction.

G. Sentinel Decision

Based upon the Secretary of Defense's approval of the DEMOD 1-67 deployment for planning purposes in December 1966, General A. W. Betts, the Nike-X System Manager, requested ARADCOM in early January to conduct preliminary site selection for the DEMOD 1-67 deployment. He also requested ARADCOM to prepare the Command and Control Supplement to the Nike-X Qualitative Materiel Requirement (QMR) and document the firing doctrine and communications requirements for the system.[213]

Later the same month in his State of the Union Message, President Johnson announced his decision to seek an agreement with the Soviet Union to halt BMD employment. "We have the solemn duty," he said, "to slow down the arms race between us, if that is at all possible, in both conventional and nuclear weapons and defenses . . . any additional race would impose on our peoples, and all mankind, for that matter, additional waste of resources with no gain in security on either side."[214] In his Budget Message, still later that same month, he stated that the United States would initiate discussions with the Soviet Union on the limitation of antiballistic missile (ABM) deployments (indications had been received that the Soviets might be interested in talks). Pending the outcome of those talks, the United States would continue intensive development of Nike-X but take no action to deploy an antiballistic missile defense. Should the discussions prove unsuccessful, he would reconsider the deployment decision. To provide for actions that might be required at that time, approximately $375 million were included in the FY 1968 budget for the production of Nike-X for such purposes as defense of our offensive weapons systems.[215] This latter statement would indicate that the rationale for the deployment had shifted from the previously considered Chinese threat to the Soviet threat.

Secretary of Defense McNamara went into much greater detail about ballistic missile defense in his Annual Posture Statement. In response to the Soviet strategic buildup, particularly the deployment of ballistic missile defenses, the United States would produce and deploy Poseidon SLBMs, increase the number of Minuteman III missiles and provide them with an improved third stage, provide improved penaids, and initiate development of new RVs specifically designed to penetrate BMD-defended targets. He expressed concern that the Soviets might be developing a first-strike (counterforce) capability to attack hardened targets and indicated that Nike-X might provide a partial solution to that problem.

[213] Personal letter LTG Betts, Nike-X System Manager, to LTG Hackett, CG ARADCOM, dated 6 Jan 1967.
[214] Text of President Johnson's State of the Union Message, *The New York Times*, January 11, 1967, p. 6.
[215] Adams, *Ballistic Missile Defense*, p. 146.

With respect to the prospect of defending cities he spoke of two possible deployments (similar to two contained in the Army's DEPEX II study of 1965). The first deployment, he called Posture A. It would provide a light area defense and a terminal defense of the top 25 United States cities at a cost of $9.9 billion. The second deployment, Posture B provided for the defense of the top 50 United States cities at a cost of $19.4 billion. He then illustrated the savings in lives that each deployment would provide under various conditions. With no United States ABM, the Soviets would kill 120 million people. If the Soviets struck first against a Posture A deployment 40 million lives would be lost; with Posture B, 30 million. If the United States struck first: 100 million lives would be lost with no ABM defense, 30 million with a Posture A deployment, and 20 million with a Posture B deployment. However, if the Soviets responded to our ABM deployment with improvements to their strike force to maintain their assured destruction capability—which he was sure they would do—the Soviets would inflict 120 million fatalities, if they struck first, whether the United States had either a Posture A or Posture B defense.[216] His argument was designed to prove that no defense regardless of its cost would buy anything as far as saving. American lives was concerned. The argument was fatalistic.

He then went on to point out that there would be a number of other problems associated with an ABM deployment. The first was the need for proper integration of the system and the associated computer programming problem. (The Army Air Defense Command had recognized this problem as early as 1964 and had been working on a solution since that time. A preferential defense firing doctrine had been derived along with a command and control structure and associated computer programs.) The second problem concerned the ability to manufacture the equipment without extensive reengineering. The third problem concerned the reaction of the taxpayers. Unprotected taxpayers would demand protection to the same degree as those in large cities. He then went on to point out that an initial small deployment would eventually expand to a $40 billion or $50 billion 10-year cost system. Further, a decision to deploy a ballistic missile defense system would require a new bomber defense to prevent the Soviets from end-running the Nike-X deployments using improved aircraft. Associated with the deployment would also be the cost of a shelter program. Adding the cost of the bomber defense and shelter programs to the Posture A and B deployments would increase their costs to $12.2 billion and $21.7 billion respectively.[217]

Based upon these arguments Mr. McNamara proposed $440 million for RDT&E and $375 million for preproduction of Nike-X to be used if the negotiations with the Soviets regarding ABM deployments were unsuccessful. As far as a deployment against the Chinese threat was concerned, he felt that there was plenty of time to make that decision before the Chinese developed a significant offensive force. In this regard, as it turned out, he was probably correct.

The Joint Chiefs disagreed with Secretary McNamara's deployment decision. General Wheeler, speaking for the Chiefs stated: ". . . we believe we should go ahead now and start to deploy a light defense as a first step in moving toward a possible Posture A, which the Secretary outlined in his statement."[218]

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[216] U.S. Department of Defense, *Statement of Secretary of Defense Robert S. McNamara Before a Joint Session of the Senate Armed Services Committee and Senate Subcommittee on Department of Defense Appropriations on the Fiscal Year 1968–72 Defense Program and 1968 Defense Budget*.
[217] Ibid.
[218] U.S. Senate, Committee on Armed Services and the Subcommittee on Department of Defense of the Committee of Appropriations, *Military Procurement Authorization for Fiscal Year 1968*, 90th Cong, 1st Sess, 1967, p. 249.

General Wheeler then went on to present a lucid argument for an ABM deployment. In summarizing, he said, "the basis of the recommendation of the Joint Chiefs . . . is based fundamentally on the requirement to maintain the total strategic nuclear capability or balance clearly in favor of the United States. Specifically, we believe that deployed Nike-X would do one or more of the following:

> First, provide a damage limitation capability by attrition of a Soviet attack.
>
> Second, introduce uncertainties which would inhibit Soviet leaders from concluding that the United States could not survive a Soviet first strike or that the United States would not pre-empt under any circumstances.
>
> Third, stabilize the nuclear balance.
>
> Fourth, demonstrate to the Soviets and our allies that the United States is not first-strike minded; in other words, that we don't put all of our eggs in the offensive basket.
>
> Fifth, continue to deny to the Soviets an exploitable capability. And by this I mean to continue the Cuba power environment in the world.
>
> I think that in regard to this last point, and to explain it a bit, I should point out that by this we mean that at the time of Cuba, the strategic nuclear balance was such that the Soviets did not have an exploitable capability, because of our vastly superior nuclear strength. And to bring this forward into the present context, it's also the view of the Joint Chiefs that regardless of anyone's feelings about the situation in Vietnam, we think it quite clear that we would have had even more hesitation in deploying our forces there, had the strategic nuclear balance not been in our favor.[219]

While not agreeing with the Defense Secretary, the JCS did agree with the President to postpone an ABM deployment temporarily "while exploring with the Soviet Union the possibilities of arms control implementation of one kind or another."[220]

A survey of the Secretaries of the Army, Navy, and Air Force during this same period found unanimous agreement for deploying a light ABM if the proposed negotiations were unsuccessful.

The apparent nearness of a deployment decision kicked off a series of debates in the Senate and House of Representatives during the late spring and summer of 1967. True to Secretary McNamara's prophecy, one of the issues was the question of why some cities were provided defenses while others were not. Other debates got into the area of international politics, while others concerned the issue of the Arms Race. Opposition was voiced to including the $375 million for Nike-X preproduction but both houses overwhelmingly passed the bill.

While these debates were underway several events occurred that indicated that the Soviets were not as anxious to discuss a moratorium on ABM defenses as first thought. While visiting London, on 9 February 1967, Premier Kosygin was asked the question, "Do you consider it possible to agree on a moratorium on the development of antimissile defense systems and, if so, on what conditions?" His answer:

> This is an important question in the military sphere. I should not like to answer it directly, but want in turn to ask the person who submitted this question—I understand that he represents the British Institute of Strategic Research Studies—the following: Which weapons should be regarded as a tension factor—offensive or defensive weapons? I think that a defensive system, which prevents attack, is not a cause of the arms race but represents a factor preventing the death of people. Some persons reason thus: Which is cheaper, to have offensive weapons that destroy cities and entire states or to have defensive weapons that can prevent this destruction? At present the theory is current in some places that one should develop whichever system is cheaper. Such "theoreticians" argue also about how much it costs to kill a person—$500,000 or $100,000? An antimissile system may cost more than an offensive one, but it is intended not for killing people but for

[219] Ibid., pp. 251–252.
[220] U.S. Senate, *Armament and Disarmament Problems*, pp. 86–87.

> saving human lives. I understand that I am not answering the question that was put to me, but you can draw appropriate conclusions yourselves.
>
> There are other, far more dependable, ways of solving the security problem, ways that really could suit mankind. You know that we advocate discontinuing nuclear arming altogether and destroying reserves of nuclear weapons. We are ready for this, and not because we have few such weapons, but precisely because we have many, and mankind does not need nuclear weapons. And if the representatives of the press, those who influence the minds of people, treated this question along such lines, it seems to me that there would be far greater results than from talk about which weaponry is cheaper, offensive or defensive. The best thing is to seek renunciation of nuclear armament and the destruction of nuclear weapons.[221]

It would appear that the Premier was interested in talking of more than just an ABM moratorium.

On 26 June 1967 it was reported in the *Washington Post* that the Soviets had ruled out any negotiation on ABM limitations, for the present. As reported in the article, this position had apparently been communicated to the President by Mr. Kosygin during the Glassboro Conference. It was also reported in this article that Soviet Foreign Minister Gromyko had privately told other diplomats that the Soviets rejected the kinds of talks proposed by the United States on the grounds that the United States wanted to negotiate on the technical level, while the Soviets wanted broad political talks on the implication of nuclear weaponry.[222] In a television interview at the United Nations after the Glassboro talks, Kosygin was asked essentially the same question as he was asked in London and gave essentially the same reply.

By late summer 1967 the pressure for an ABM deployment, from all sides, was increasing. The upcoming year was a presidential election year and evidence indicated that the Republicans were going to make ABM a campaign issue. Nixon and Reagan had both discussed the ABM issue in political speeches. The Republican Party had issued a pamphlet entitled, *The Missile Defense Question, Is LBJ Right?* The JCS evidenced more and more concern over the growing Soviet strategic capabilities and the lack of a decision to deploy Nike-X. The Soviets adopted a harder line than had been evidenced at Glassboro. In addition, it was reported that the Soviets were developing multiple warheads for their large ICBMs. On 8 September Secretary of State Rusk warned the Soviets that time was running out, if they did not agree to start talks soon the United States would be compelled to begin an ABM deployment. The mounting pressure on the President made it imperative that the policy of non-deployment be reexamined.[223]

On 18 September 1967, Secretary of Defense McNamara made the announcement that the United States would begin deployment of a missile defense against China, in a speech to the United Press International in San Francisco.[224] The speech was originally intended to be a policy statement on ballistic missile defense and the first 22 of 25 pages are devoted to that subject. The last three pages deal with the deployment decision. This had led many to believe that McNamara was forced to change his speech from an argument against deployment to announce the President's decision. Whatever the case, the United States was committed.

Early in the year the Army was directed to develop plans for deployments to counter several different threats. On 5 July Mr. McNamara was briefed on these deployment concepts. Topics covered included the DEMOD 1-67 deployments, expanded deployments for Hardsite Defense, modifications to the DEMOD

[221] As quoted in Adams, *Ballistic Missile Defense*, p. 154.
[222] Ibid.
[223] Adams, *Ballistic Missile Defense*, pp. 158–161.
[224] Speech by Secretary of Defense Robert S. McNamara, on 18 September 1967, San Francisco, California, before United Press International Editors and Publishers.

1-67 deployment to counter the Fractional Orbital Bombardment System (FOBS) threat, and an anti-Soviet defense deployment DEMOD 2-67. At the conclusion of the briefing Mr. McNamara directed that a 30-day study be performed of the evolving Chinese threat and the necessary modular growth to the 1-67 deployment to counter that threat. It seems apparent that, while still opposing deployment, Mr. McNamara was correctly assessing the pressure being applied. Murdock reports that Phil G. Goulding, Assistant Secretary of Defense (Public Affairs) recalls the pressure being so intense in the summer and fall of 1967 that the "choice in the Pentagon . . . was not a small ABM versus none at all, but rather a small ABM versus a big one."[225] The summer deployment study was probably used to help him resist a thick anti-Soviet deployment and force acceptance of a "thin" system against the Chinese "which would not provoke Soviet reaction."[226]

In the middle of the deployment debates in the summer of 1967 a new concept for missile defense was announced by the Navy. The system, called SABMIS (Sea Based AntiBallistic Missile Intercept System) was to be composed of elements similar to those of the Nike-X system mounted on large ships. With the ability to move these ships forward to positions around the periphery of the Soviet Union, it would be possible to detect the launch of enemy missiles and intercept them during the boost or mid-course phase of their flight trajectory. While receiving some attention, the studies were eventually discontinued due to the vulnerability of the ships in the forward basing areas.

Immediately after the announcement of the intent to deploy a ballistic missile defense system, the Department of Defense appointed a Design Review Committee headed by Dr. Daniel Fink, Deputy Director of Research and Engineering, to review the DEMOD 1-67 deployment. In October the Committee had completed its review. Basically, the deployment as originally designed was accepted. The only exceptions were the deletion of the site at Minot AFB and addition of the defense of Washington, D.C., and movement of the site from Anchorage to Fairbanks, Alaska.

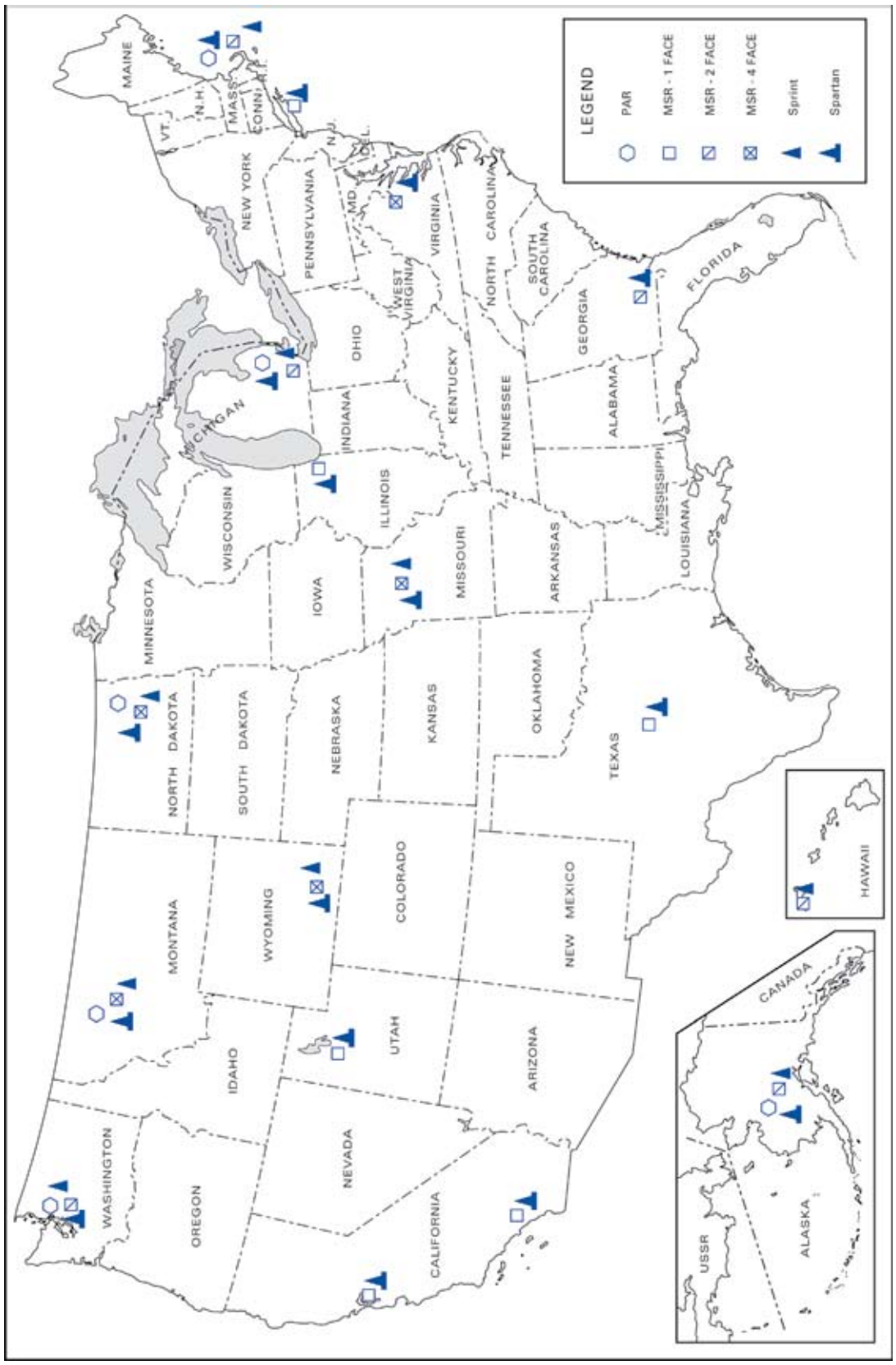
On 3 November the deployment was officially named Sentinel and the Department of Defense announced the location of the first ten sites. The Corps of Engineers obtained entry rights to the first five sites and began core drilling and radio frequency testing by the end of November. Plans were also developed for briefing the communities nearby the selected sites on the effect of the sites on their communities. These briefings were accomplished under the direction of the Commanding General ARADCOM during the period 20–24 November. By the end of the year much had been accomplished but much remained to be done.

H. Sentinel Deployment

The Sentinel deployment (Figure 30) would consist of 17 sites: 15 in the Continental United States (CONUS) and one each in Alaska and Hawaii. All sites would have an MSR and Spartan missiles except the site in Hawaii which would have only Sprint. There were six PARs, five of which were deployed along the northern border of CONUS. The sixth was to be located at Fairbanks, Alaska. Each PAR was to be deployed in the vicinity of an MSR and would be protected with Sprint missiles. All MSRs were to be one faced (have 90 degrees coverage in azimuth) except those located in the vicinity of PARs which would have two faces, and those in Minuteman fields which would have four faces. The MSR programmed for Washington, D.C. would also have four faces. In addition to the sites defending PARs, the sites in the Minuteman fields and

[225] Murdock, *Defense Policy Formation*, p. 137.
[226] Ibid.

Figure 30—Sentinel Deployment



the one in Hawaii would have Sprint missiles. The deployment would provide a light area coverage over the entire CONUS. Terminal defense was also provided to a portion of four Minuteman Wings. An option was included to add additional Sprint missile farms at the Minuteman Wings at a later date should this be considered necessary. Table 24 lists the location of the Sentinel sites and the equipment planned for each.

In November 1967 the Secretary of Defense announced the location of ten sites as a first increment of the Sentinel deployment. These sites were Albany, Georgia, Chicago, Dallas, Grand Forks, New York City, Oahu, Salt Lake City, Seattle, Boston, and Detroit. By the end of the month briefings were conducted and meetings held with the civic leaders and residents of the communities nearby these sites. The reaction was almost immediate. Protests were staged in Boston, Chicago, and New York and by the end of 1968 had increased in such magnitude that they, along with other objections, forced the newly elected President to review the entire Sentinel deployment as one of his first acts after taking office.

The fact that 12 of the 17 sites were located at or near major population centers led many of the opponents of an ABM deployment to the conclusion that Sentinel was merely the first step towards a heavy defense against the Soviet threat. The Joint Committee on Atomic Energy, headed by Senators Jackson and Pastore, decided to refocus the hearings from the need to deploy a ballistic missile defense against the Chinese threat to the need for a defense against the Soviets.

Table 24—Sentinel Equipment[227]

Location (Vicinity)	Equipment			
	PAR	MSR	Spartan	Sprint
Fairbanks, AK	1	1-2 Faces	Yes	Yes
Seattle, WA	1	1-2 Faces	Yes	Yes
San Francisco, CA	No	1-1 Face	Yes	No
Los Angeles, CA	No	1-1 Face	Yes	No
Salt Lake City, UT	No	1-1 Face	Yes	No
Malmstrom AFB, MT	1	1-4 Faces	Yes	Yes
Warren AFB, WY	No	1-4 Faces	Yes	Yes
Grand Forks AFB, ND	1	1-4 Faces	Yes	Yes
Whitman AFB, MO	No	1-4 Faces	Yes	Yes
Dallas, TX	No	1-1 Face	Yes	No
Chicago, IL	No	1-1 Face	Yes	No
Detroit, MI	1	1-2 Faces	Yes	Yes
Albany, GA	No	1-2 Faces	Yes	No
Boston, MA	1	1-2 Faces	Yes	Yes
New York, NY	No	1-1 Face	Yes	No
Washington, D.C.	No	1-4 Faces	Yes	No
Honolulu, HI	No	1-2 Faces	No	Yes

[227] "CONAD Command History, 1968," Headquarters CONAD.

The reaction to the announced decision throughout the world was generally negative. The British were irritated at not being consulted and warned that the deployment would set off a new round in the arms race. The United States, they implied, would have to break the Nuclear Test Ban Treaty to perfect the system. The Chinese asserted that the system was not designed for defense but to provide a nuclear threat to them. The Canadian Government declined any participation, although the Prime Minister said that he regretted the decision. The Soviets blamed pressure from Pentagon Hawks and munitions makers for the decision.[228]

In Congress the reaction was mixed. Representative Craig Hosmer of California and Senators Stennis, Tower, Hichenlooper (La.), and Anderson (NM) supported the decision unequivocally. Senators Church and Fulbright did not like it. Senator Jackson was unwilling to accept the Chinese rationale. Senator Clark called it an "expensive toy."

By 1968 Sentinel was beginning to encounter concerted opposition in Congress, in the academic and scientific community, and from the public, particularly in those areas where Sentinel sites were to be located. The opposition had not reached sufficient magnitude at the beginning of the year, however, to warrant any change to the Administration's plans. In his final Posture Statement McNamara recommended: $651 million of FY 1969 funds plus $229 million FY 1968 funds for Sentinel deployment; $313 million for Sentinel development; $165 million for Nike-X; and $103 million for Project Defender. The Army continued site selection and survey activities. In May, the Defense Department announced three new areas, San Francisco, Los Angeles, and Whiteman Air Force Base, for Sentinel deployment. Briefings for the adjacent communities were scheduled for 4 June 1968 at Sedalia, Missouri, 5–6 June at Los Angeles, and 21 June at San Francisco. The 5–6 June briefing at Los Angeles was cancelled due to Senator Kennedy's assassination and rescheduled for 17 June. A second briefing was held in San Francisco on 2 August because of non-attendance of high-level officials at the first briefing. In September the Real Estate Subcommittee of the House Armed Services Committee approved acquisition of land at Camp Curtis Guild and Sharpner's Pond near Boston for the first MSR and PAR sites respectively. In November, Department of Defense announced the last two sites at Warren AFB in Wyoming and Malmstrom AFB in Montana (the planned locations at Washington, D.C. and Fairbanks, Alaska never were publicly announced).

In May the prime contractor authorized the General Electric Company to proceed with Phase II of the PAR development. Phase II was the design and manufacture of a prototype PAR to be installed and tested on the first tactical PAR site (Boston). This same month, while the new sites at San Francisco, Los Angeles, and Whitman AFB were being announced, the contractors (Boeing, Martin-Marietta, and McDonald-Douglas) were selected by the Advanced Ballistic Missile Defense Agency (ABMDA) to conduct analytical studies to establish promising methods for upgrading the Sentinel system performance by modification or new design of the Spartan missile third stage to meet evolving threats. Earlier in April an ad hoc committee under the chairmanship of Dr. H. W. Augustadt of Bell Telephone Laboratories had been appointed to make similar studies of Sprint and make recommendations for improving its performance. In late May the committee's recommendations were accepted and the contractor was directed to implement the improvements immediately.

[228] This paragraph is a summary of actions as reported in Adams, *Ballistic Missile Defense*, pp. 178–179.

In the meantime opposition to Sentinel continued to mount. From a timing standpoint a more turbulent environment could not have been selected to announce the decision and initiate the deployment. The United States had announced the development of the Multiple Independent Reentry Vehicle (MIRV) as a means of overcoming the Soviet ballistic missile defense. There was evidence that the Soviets were developing multiple RVs for their ICBM force. The United States was at the height of its involvement in Vietnam: the draft lottery was unpopular; the Tet Offensive was in progress. There was unrest on the campus and attacks on the military-industrial complex and on military research activities. Former President Eisenhower, who had warned against the military-industrial coalition in an interview reported in *The New York Times*, said that he doubted the success of a thin ABM, saying the best defense was a good offense, and we had that.[229] In addition, the Administration had announced a $6 billion cut in the Federal Budget which would affect many domestic programs. All of these factors reflected a growing disillusionment and disenchantment with the Government, its Foreign Policy, the military, defense spending, and, above all, Vietnam. To add to the disillusionment, the Chinese threat was rather tenuous in the first place and the Secretary of Defense had just recently announced that there had been a slippage in the Chinese threat of at least a year. On 1 July 1968, at the signing ceremonies of the Non-Proliferation Treaty, President Johnson announced that agreement had been reached with the Soviets to begin talks in the near future to limit both offensive and defensive nuclear weapons.[230]

As the year progressed opposition grew. By the middle of the year the United States Defense Policy and budget were being attacked vigorously in the House and in the Senate and Sentinel was in the middle of the controversy. Several amendments were made to delete Sentinel deployment funds from the FY 1969 budget in both Houses—all of which were defeated. Several members of the scientific/academic community led by Dr. Jerome Weisner and Dr. Hans Bethe published articles opposing Sentinel. During the debate on the Cooper-Hart Amendment to delete $387.4.million from the Appropriations Bill for Sentinel deployment, they sent a telegram which was read into the record by Senator Hart, supporting the Amendment. Their main argument was that important domestic priorities were being sacrificed for the deployment of a ballistic missile defense which would not add to United States security.[231] The amendment was defeated 25 to 45 and concluded the attempts to defeat Sentinel in the Congress in 1968.

I. Demise of Sentinel[232]

While urging the Congress to stop the deployment of Sentinel in 1968, the opponents were organizing a grass roots movement with the public. In November, five scientists including Dr. David Inglis, former chairman of the Federation of American Scientists formed the "West Suburban Concerned Scientists Group" dedicated to stopping Sentinel site construction in Chicago and its suburbs. The thrust of the approach adopted by these scientists was to acquaint the community with the configuration of the site and to emphasize its impact on the local ecology and safety of the community. Points stressed included the size of the buildings and indeed the size of the installation, the harmful aspects of the high powered radar, nuclear weapons in their backyards, and the undesirability of having soldiers in their neighborhoods. To this they added tactical implications—suggesting that deploying a ballistic missile defense in Chicago would make

[229] "Eisenhower Doubts 'Thin' Missile Plan Can Be Successful," *The New York Times*, January 16, 1968, p. 13.
[230] Carroll Kilpatrick, "U.S., Russia Plan Talks on Restricting Missile," *Washington Post*, July 2, 1968, p. Al as reported in Adams, *Ballistic Missile Defense*, pp. 183–184.
[231] U.S. Congressional Record, November 1, 1968, p. E9645.
[232] Much of this section is based upon personal experience and observation of the author during the period.

the City a target for ICBMs while at the same time introducing the possibility of a nuclear explosion at the site or, in an attack, the possibility of a low altitude intercept wherein the Sentinel missile would destroy the city it was defending. In no way did they address the fact that in an assured destruction strategy the population centers were the targets of the attack, whether they had ballistic missile defense or not. Neither did they address the fact that Nike Hercules units had been deployed within and around their city with nuclear weapons for over ten years. Nor did they mention that soldiers had been their neighbor's for over 15 years. The five scientists were asking the Army to hold hearings before acquiring any more land for test drilling so that concerned individuals could state their reservations on the proposed sites. In the meantime, these scientists were being joined and supported by the Federation of American Scientists to alert congressmen, other scientists and the public to Army ballistic missile activities in and around urban areas.[233]

The effect of these scientists was remarkable. Shortly, a whole series of debates were touched off throughout the country. Articles calling for open hearings and public debate began appearing in periodicals and newspapers throughout the country. The "New England Citizens Committee on ABM," formed by Abram Chayes, a former State Department legal advisor, indicated that it would sponsor a national conference on ballistic missile defense.[234] At a town meet in Reading, Massachusetts the Army was strongly opposed by a group organized by Dr. Jerome Wiesner and Dr. George Rathjens who immediately implored Senator Edward M. Kennedy to oppose the deployment. This request resulted in a letter to Defense Secretary Laird urging a freeze on the deployment of Sentinel pending a thorough investigation and review of the whole program. Such a review he said would be conducted by the Congress in fiscal 1970. He cited five reasons against the deployment: (1) technical questions on its effectiveness, capability and feasibility; (2) its impact on the Soviet strategic force structure by heightening the arms race and making arms limitation talks more difficult; (3) site locations near urban areas, chances of accidents, and the possibility of the site itself becoming an attractive target; (4) costs, inflation, and overruns as well as the compulsion to expand to a thick defense; and (5) distortion of federal funding priorities.[235]

Rumors and conflicting reports were also circulating during this period as to whether the new Administration would go ahead with the deployment on the basis of the Chinese threat. By reorientation to the Soviet threat it might become a bargaining point in the upcoming SALT in Vienna.

On 4 February 1969, Senator Kennedy was joined by other Senators opposed to Sentinel when they requested a delay, fearing it would start a new arms race.

On 6 February Secretary of Defense Laird ordered a halt to all land acquisition, and construction pending a month-long review of the Sentinel system. At a news conference that same day, the President indicated that Sentinel was more than a defense against the Chinese threat, it had considerable damage-limiting capability.

J. Safeguard

The Department of Defense immediately undertook an extensive review of the ballistic missile defense problem. On 14 March 1969, Mr. Nixon announced his new BMD plan. In explaining his decision he said that it appeared that three alternatives were open to him: (1) a deployment that would attempt to defend United States cities against an attack by the Soviet Union; (2) a continuation of the Sentinel program

[233] Adams, *Ballistic Missile Defense*, p. 187.
[234] Ibid., p. 191.
[235] Ibid., p. 191.

approved by the previous administration; or (3) an indefinite postponement of deployment while continuing research and development.[236]

The President rejected all three alternatives on the basis of the growing Soviet threat. It was still not feasible or practical from a political, military or economic standpoint, to defend cities from a heavy Soviet attack but, there were too many risks in halting all work. Only operational experience could provide answers to certain problems which research and development could not. As a result he thought the Sentinel program had to be modified. The security of the country demanded a deployment but that deployment would be phased and reviewed annually from the viewpoint of the threat, technical aspects, and arms control considerations.

The purposes of the new system would be: (1) protection of land-based retaliatory forces against a direct attack by the Soviet Union; (2) defense of the American people against the kind of nuclear attack which Communist China is likely to be able to mount within the decade; and (3) protection against the possibility of accidental attacks from any source.[237]

The Department of Defense noted that the plan also: (1) protects the National Command Authority, (2) preserves options to curtail or reorient if arms control agreements are reached, (3) rejects a thick defense system, (4) moves sites away from major cities, and (5) strengthens our R&D efforts.[238]

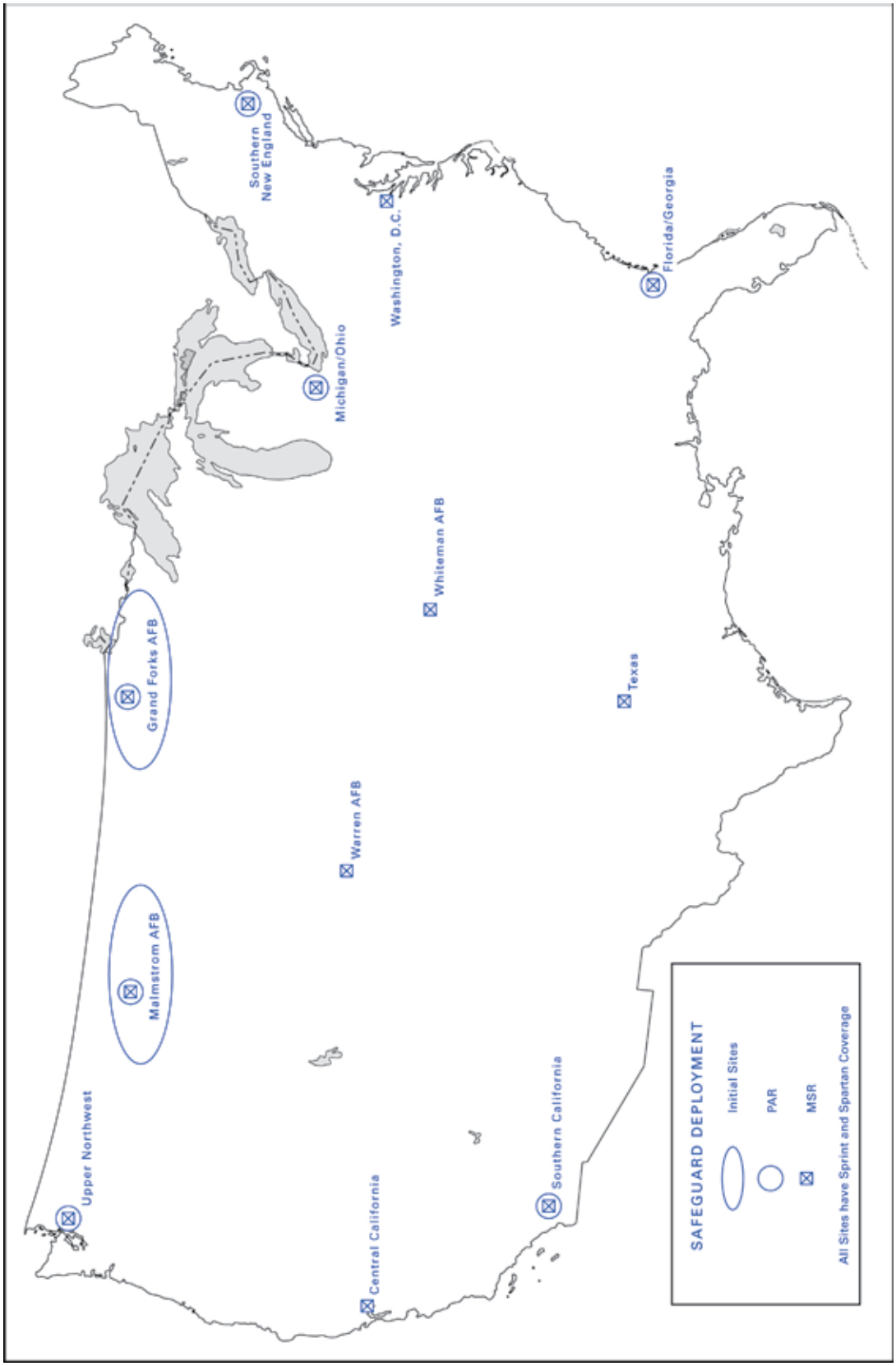
The new deployment, Safeguard (taken from the President's speech) was to consist of 12 sites (Figure 31). There were to be seven PARs located around the perimeter of the Continental United States to provide greater detection against the SLBM threat. All sites would have both Sprint and Spartan missiles. Two sites could be added to provide area coverage of Alaska and Hawaii. Table 25 indicates the location and equipment to be at each site.

Table 25—*Safeguard* Locations and Equipment

Location	Equipment			
	PAR	MSR	Spartan	Sprint
Northwest	Yes	Yes	Yes	Yes
Central California	No	Yes	Yes	Yes
Southern California	Yes	Yes	Yes	Yes
Malmstrom AFB	Yes	Yes	Yes	Yes
Warren AFB	No	Yes	Yes	Yes
Grand Forks AFB	Yes	Yes	Yes	Yes
Whiteman AFB	No	Yes	Yes	Yes
Texas	No	Yes	Yes	Yes
Michigan/Ohio	Yes	Yes	Yes	Yes
Southern New England	Yes	Yes	Yes	Yes
Washington, D.C.	No	Yes	Yes	Yes
Florida/Georgia	Yes	Yes	Yes	Yes

[236] "Text of President Nixon's Announcement of Revised Proposals for Sentinel Antiballistic Missile Program," *The New York Times*, March 15, 1969, p. 17.
[237] Ibid.
[238] Safeguard System Manager's Office, Fact Sheet, 1969.

Figure 31—Safeguard Deployment



The deployment was to be accomplished in phases. Phase I would be a deployment of two PARs and two MSRs with associated missiles at Grand Forks AFB, North Dakota and Malmstrom AFB, Montana. These two sites would have a Sprint and Spartan missile farm collocated with the MSR and remote Sprint missile farms located through and around the Minuteman silos. At least one Sprint farm was to be so located as to provide protection of the PAR. Phase I would provide a limited protection to Minuteman and would provide operational experience to the crews. It would require an investment of approximately $2.1 billion.

Phase II would have three options which could be selected in response to a number of threats. Phase IIA was designed to respond to an increased Soviet ICBM threat to Minuteman. Two more sites would be added to defend Minuteman at Warren and Whiteman Air Force Bases and a third site would be added to defend Washington, D.C. This option would not increase the number of PARs deployed. Increased Minuteman survival would be afforded by this deployment plus, additional time would be provided the National Command Authority in which to make an assessment of an attack and a calculated decision.

Phase IIB was designed to respond to an increased Soviet SLBM threat to SAC bomber bases. The response would be the full 12-site deployment. Phase IIC was designed to respond to an increased Chinese ICBM threat, in which case a full 12-site deployment would be initiated to provide an area defense of heavily populated areas. The costs of Phase IIB and IIC would be $6.3 billion and $6.0 billion respectively. The threat and the objective of the deployment would determine the exact location of the sites as well as their composition. For instance, a Soviet SLBM threat would require radar coverage in all directions whereas a Chinese ICBM threat could be oriented toward China. This could reduce the number of radar faces required as well as the number and type of missiles. Table 26 illustrates the Safeguard phases and options.

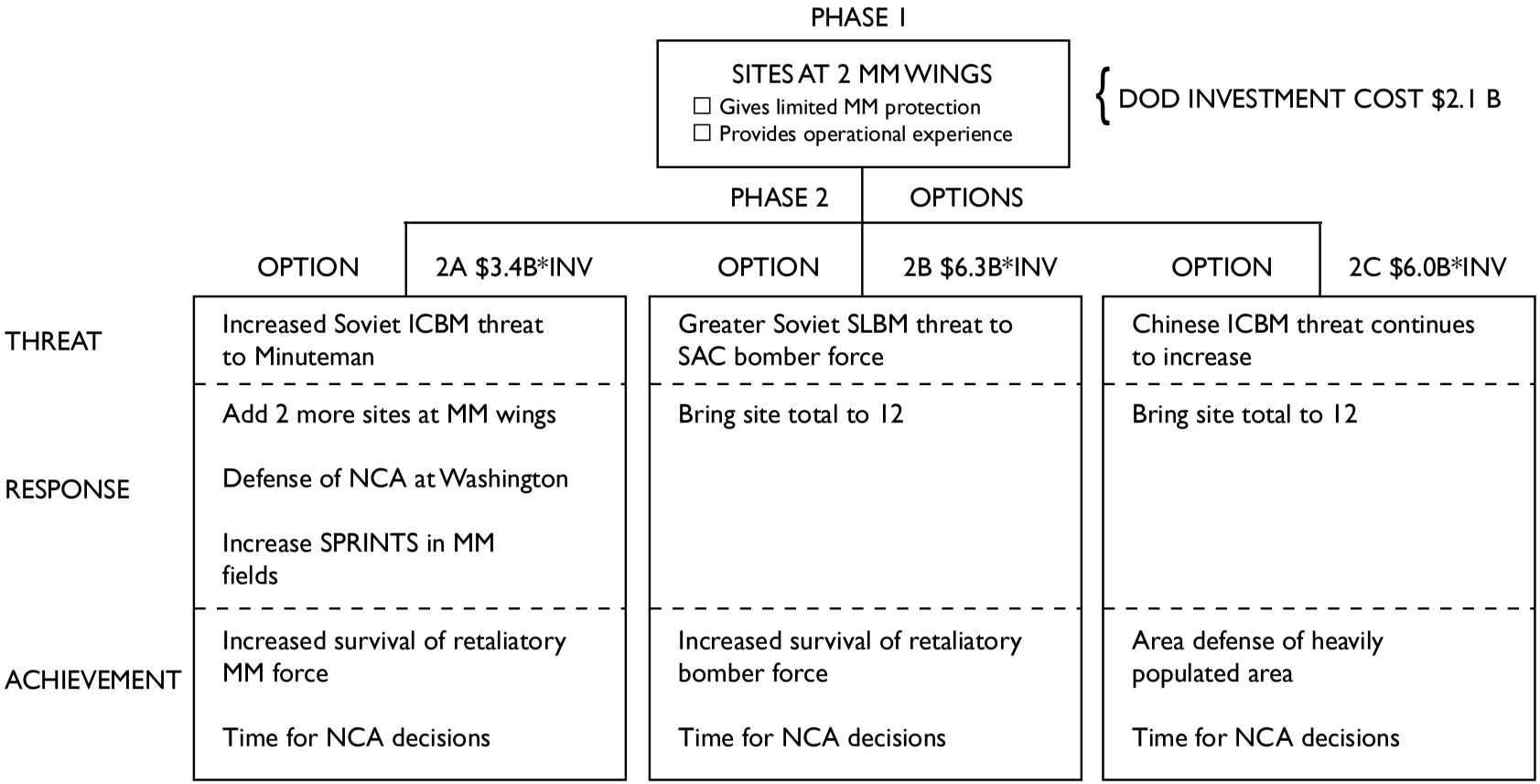
The Administration began a campaign to gain acceptance of the Safeguard plan immediately after the decision was announced. The President met with his Scientific Advisory Council, Vice-President Agnew talked with freshman senators about supporting the decision. The opposition responded. Senator Kennedy sponsored a book edited by Drs. Abram Chayes and Jerome B. Wiesner entitled *ABM: An Evaluation of the Decision to Deploy an Antiballistic Missile System*. It was thought that "it might be useful, in the forthcoming Congressional debates over the decision to deploy an antiballistic missile system, if the Congress had available to it an independent, non-government evaluation of the ABM issue."[239]

There is no intent to cover the debate that followed in this chapter. It is covered well in open literature. The Administration based its case on the increasing Soviet threat: the new SS-9 ICBM which would provide the Soviets a first strike capability; the Fractional Orbit Bombardment System (FOBS); evidence of a new ballistic missile defense system being tested. It also argued that Safeguard was needed to provide a strong bargaining hand at SALT. The opposition attacked the deployment on the basis of its need, feasibility, desirability, effectiveness, and wisdom of deploying Safeguard.

The intense struggle continued through the summer until on 6 August 1969 by a vote of 51 to 49 the Senate endorsed the President's proposal by defeating a bipartisan amendment sponsored by Senators Cooper and Hart to permit research and development of Safeguard to continue but bar deployment or site acquisition. The vituperation began to subside. Almost every element of our society was involved. Polls

[239] *ABM: An Evaluation of the Decision to Deploy an Antiballistic Missile System*, edited by Abram Chayes and Jerome B. Wiesner, Signet Books, May 1969, p. xi.

Table 26—Safeguard Phases and Options



Possible additions to the above full deployment—Alaska, Hawaii

*Note: For fully equipped 12-site deployment (Phase 2), DOD investment cost is $6.6B.

were taken of public opinion. Professional integrity was abandoned to make a point. There was no formal or regulated discussion of a proposition or motion according to parliamentary procedure. As Claude Witze, Senior Editor of *Air Force* magazine said:

> To begin with, there was no debate about the ABM issue. Some people called it a debate. In truth, it was a verbal orgasm staged by frustrated critics of all that is military, who saw in ABM a "war figure." Their flagellation of this image brought out the worst in otherwise calm and sensible men. For sheer unreasonableness, the things they said have had no equal in this capital since attorney Joseph Welch, moved to tears during the so-called Army-McCarthy hearings, asked Senator Joseph McCarthy if he had no shame.[240]

On 8 December the House of Representatives approved the $69.9 billion Defense Department appropriation bill which included $359.5 million deployment funds for Safeguard and $400.9 million for research and development. By a vote 78–25, the House rejected an amendment that would have eliminated deployment funding. The Senate, on 16 December, approved by a vote 85–4 the $69.9 billion appropriation after defeating a move to delete almost all of the $760 million for the Safeguard[241] system.

In October the Army opened field offices in Great Falls, Montana and Grand Forks, North Dakota. In November the Omaha District, Corps of Engineers conducted Community Impact Studies in the Grand Forks and Malmstrom areas. The studies included surveys of all towns within a 50-mile radius of the planned Safeguard sites, and all cities of 10,000 or more population within a 100-mile radius. The objectives of the studies were to evaluate the impact of Safeguard on the local area and to identify programs available to assist in community planning.

As the big debate began to wind down, the Soviets on 24 October 1969, accepted President Nixon's invitation to discuss arms limitation. Thus, ballistic missile defense was formally linked to SALT. The talks were to begin in Helsinki on 17 November 1969. There was considerable evidence that the Soviets were concerned with the BMD decision. They had blamed Pentagon Hawks and munitions makers for the Sentinel decision. After the program was switched to Safeguard, in March of 1969, they accused the United States of stepping up the arms race by initiating the ballistic missile deployment and asserting a Soviet first-strike buildup.[242] In April, the Soviets claimed that while the Safeguard Phase I deployment was not too large or aggressive, it was the prelude to a larger deployment. They also indicated that they were no more eager to start SALT than the United States.[243] In June they voiced displeasure with the United States' defense policies, which would upset the current arms balance, and with the Administration's failure to set a date for the start of SALT.[244]

By December 1969, the Administration had decided that Safeguard should be expanded. In arriving at that decision the Administration had to weigh the risks of another fight in Congress, where the money would come from—non-defense or defense, and the impact on SALT. Those in favor of the expansion favored a complete 12-site expansion because of the rapidly growing SS-9 deployment and Soviet strategic threat and the steady progress in the Chinese threat. Failure to expand, they felt, would result in a two year delay of full operational capability, and less incentive for the Soviets to negotiate seriously at SALT. The opponents

[240] Claude Witze, "Fight over the ABM: Debate or Witch Hunt?," *Air Force and Space Digest*, April 1969, p. 34.
[241] *Ballistic Missile Defense Chronology (1957 to present)*, Safeguard System Command.
[242] Bernard Gwertzman, "Nixon ABM Plans Arouse Soviet Press Critics," *The New York Times*, March 28, 1969, p. 15.
[243] Henry Kamm, "Moscow Scores Arms-Talk Foes," *The New York Times*, April 20, 1969, p. 27.
[244] Bernard Gwertzman, "Pravda Voices Soviet Displeasure with U.S. over Missile Policies and Delay on Arms Control Talks," *The New York Times*, June 11, 1969, p. II.

were concerned with expenditures and whether expansion would be viewed by the Soviets as an act of bad faith.[245]

On 30 January 1970, President Nixon announced his decision for further deployment of the Safeguard. The recommended expansion would consist of a new site at Whiteman Air Force Base for additional defense of Minuteman sites, and advanced preparation for five additional sites in the Northeast, Northwest, Washington, D.C., Warren Air Force Base, and in the Michigan-Ohio area, with no deployment commitment at these sites.[246] It was obvious that this was a step toward a full 12-site deployment. The fiscal FY 1971 budget included $1.5 billion for Safeguard.

On 24 February, Secretary of Defense Melvin Lai rd presented the Administration's proposal for the expanded deployment to a Joint Session of the Senate Armed Services Committee and Defense Appropriations Subcommittee.[247] In supporting the expansion he indicated that if the Soviet strategic buildup continued, the United States could find itself a second-rate power by the mid-1970's. Without a SALT agreement, the United States would be compelled to rush into development and production of a new series of offensive systems. However, the proposed Safeguard program would allow the Administration to postpone for a year, any decision for increasing and improving strategic offensive forces. By expanding Safeguard to hedge against a moderate threat and the option to meet a heavy threat, the United States would be able to pursue SALT without exacerbating the arms race.[248]

In his presentation Mr. Laird also recommended construction for increased Sprint farms in the Grand Forks and Malmstrom areas. He also suggested that the Soviet threat might turn out to be greater than the proposed Safeguard deployments could handle. The Defense Department was pursuing several courses to reduce the vulnerability of Minuteman should this happen, rather than expanding Safeguard. If Minuteman defenses had to be expanded, a new and smaller radar which would be less costly than the MSRs could be placed in ICBM fields. A program to determine the optimum radar for such a defense was provided in the Fiscal 1971 budget.[249]

Mr. Laird estimated that the cost of the expanded deployment program in FY 1971 would be $920 million or less than $100 million more than that needed for Phase I work already approved by Congress.[250]

The Strategic Arms Limitation Talks opened in Vienna on 16 April. Earlier in February, the Soviets had proclaimed in a *Pravda* article that they could hit attacking missiles at any speed at great distances from the defended target.[251] A week later on 7 March they criticized United States weapons development and deployment plans as potentially damaging the chances of reaching an arms control accord.[252] Whether the first statement was designed to assure Soviet citizens or provide a basis for SALT bargaining is not clear, but the second article was clearly aimed at the United States ABM program and at influencing the United

[245] Adams, *Ballistic Missile Defense*, p. 222.
[246] *Ballistic Missile Chronology (1957 to Present)*, Safeguard Systems Command.
[247] *Chronology of Ballistic Missile Defense (1957 to Present)*, Safeguard Systems Command.
[248] Adams, *Ballistic Missile Defense*, p. 223.
[249] Mr. Laird was undoubtedly referring to the Hard-Site defense system. This system would use the improved Sprint missile and a smaller phased array radar. It would be deployed in cells of three mutually supporting radars each with a collocated missile farm and up to six remote Sprint farms. Each radar would be capable of launching and guiding the missiles from any farm. The system would be essentially unmanned with only one manned Tactical Operation Center per Minuteman Wing. The name has been changed to the Site Defense System, which is still in R&D.
[250] *Ballistic Missile Defense Chronology (1957 to Present)*, SAFSCOM.
[251] Bernard Gwertzman, "Soviet Says Its ABM Can 'Reliably Hit' Attacking Missiles," *The New York Times*, February 24, 1970, p. 1.
[252] William Beecher, "Soviet Criticism on Arms Dismays Top U.S. Aides," *The New York Times*, March 9, 1970, p. 1.

States bargaining strategy for the second round of SALT. In the second article they had implied that they were just attaining parity, were willing to accept this new balance, and were not seeking superiority over the United States.

As the Congress began debates over the FY 1971 budget the national climate was one of concern with MIRV, SALT, military spending and influence, and Vietnam. As far as Safeguard was concerned, there were indications that Congress was willing to fight any further expansion. The reasons were cost and the thin area deployment rationale.[253]

The Congressional hearings in 1970 were a repeat of those in 1969 but much less vitriolic. On 24 February the House Armed Services Committee approved the funds requested by Secretary of Defense Laird for the expanded Safeguard deployment, and on 11 June the House of Representatives approved by a vote of 307 to 57 the FY 1971 Defense Procurement Authorization Bill (HR17123). However, on 17 June, by a vote of 11 to 6, the Senate Armed Services Committee approved funds for Safeguard construction at Whiteman AFB and preliminary work at Warren AFB but refused appropriation of funds for preliminary work at all other sites including Washington, D.C.

The 1970 ABM debate reached its climax in mid-August when the Senate defeated three amendments to restrict Safeguard. The first amendment offered by Senator Hughes, would eliminate all funds from the Defense Procurement Authorization Bill for Safeguard procurement and deployment. The amendment was defeated by a vote of 62–33. The second amendment, offered by Senators Cooper and Hart, would have denied funds for construction at Whiteman AFB and preliminary work at Warren AFB. The vote was 52 against, 45 for. The third amendment, sponsored by Senator Brooke, would have deferred all work on the Whiteman and Warren sites and diverted $320 million to strengthening the two sites already under construction.

By 7 October the House, Senate and Administration had reconciled their differences agreeing to the expansion as restricted by the Senate Armed Services Committee. On that date the President signed the Defense Procurement Authorization Bill. The agreed version authorized $1.3 billion for continued development, production and construction but limited that work to the four Minuteman sites.

The year 1970 demonstrated the fickleness of the American public. In 1969 almost every element of it was involved in the missile defense debate. By the end of 1970 that involvement had diminished to almost zero. The Senate Foreign Relations Committee with its familiar witnesses of Wiesner, Rathjens, Chayes, Weinberg et al., remained the hard core opposition to Safeguard. By the end of 1970, if there were any questions pertaining to BMD policy, they were related more to SALT and to providing a strong bargaining position for the United States than with the Soviet threat, which continued, and still continues, to grow.

Development and testing of the Nike-X components of the Safeguard deployment continued during 1970 and 1971. The Spartan missile made its first intercept of an ICBM nose cone over Kwajalein in August of 1970. In June CINCONAD forwarded a letter to the Joint Chiefs of Staff outlining his concept (agreed to by CG ARADCOM) of the role of Subordinate Unified Commanders in ballistic missile defense. In November 1971, after some public debate, underground nuclear test, CANNIICAN, was successfully completed on Amchitka Island in the Aleutians. This test was identified as necessary in developing the warhead

[253] In his February 29, 1970 Posture, Statement, Laird had stated that the Administration had decided to continue Safeguard deployment because the additional cost to defend Minuteman was small "if the full area defense is bought."

for the Spartan missile. The widespread destruction predicted in the unsuccessful legal actions aimed at preventing the tests, failed to occur.

The FY 1972 Defense Procurement Authorization Bill presented to Congress in January 1972 contained $1.267 billion for Safeguard, $60 million less than the FY 1971 bill. In November, in a joint House-Senate Conference, a compromise version was approved providing $1.106 billion for Safeguard. The bill limited construction to that already authorized for Malmstrom and Grand Forks. Activities at Whiteman and Warren were limited to advanced site preparation.

K. SALT

By the time the second round of SALT got under way on 16 April 1970 the President had decided that the United States should push for a comprehensive limitation on strategic weapons rather than attempting to approach the issue on a weapon-by-weapon basis. This had been Kosygin's position in his 9 February 1967 statement in London. As the spring ended, reports[254] began to circulate that the shape of a possible arms accord could be a freeze at present levels of sea- and land-based missiles plus the acceptance of ABM systems to protect Washington and Moscow. In contrast to United States SALT proposals which provided three alternatives (no ABMs or MIRVs but on-site inspection or, a joint offensive weapon launcher freeze with no on-site inspection and freedom to switch from land to sea and visa versa within agreed numbers, or a current level freeze on ICBMs and SLBMs without regard to MIRVs) the Soviets had proposed either a total ABM ban or ABM around national capitals only and a freeze on the current number of ICBM launchers. The Soviets had argued that a curb on the arms race would only occur if no area ABM was deployed, it was reported. The Soviets contended that the United States ABM deployment would lead to an area defense and they would have no choice but to deploy more SS-9s. From these reports it appeared that Safeguard was a prime target of the Soviets at SALT. *The New York Times* reported that the Soviet proposals had put the United States on the defensive but that it appeared, from statements in congressional hearings, the Administration would be willing to scrap, the whole ABM system if necessary.

By the end of the second SALT conference in Vienna it was reported that the United States had indicated a willingness to scrap ABM completely if the Soviets agreed to a limitation on the numbers of SS-9 ICBMs and scrapped their ABM around Moscow. As a compromise the United States was willing to accept ABMs around the national capitals with a corresponding freeze on SS-9s. In December 1970 the Soviets proposed a separate agreement to limit deployment of ABMs to an unspecified number of interceptors within an unspecified radius of Washington and Moscow. This was rejected by the United States. The United States ABM system was being deployed around Minuteman sites and more money was being asked to continue that deployment in the FY 1972 budget. That entire deployment would have to be scrapped if the Soviet proposal was accepted. However, the United States was willing to do this if the Soviets were willing to scrap their system and limit the number of SS-9s.

Negotiations continued through 1971 and into 1972. There has been much written about the dissatisfaction of our negotiators with the conduct of the Soviets during these negotiations and the lack of a cohesive, unified approach by the United States and the unilateral actions of the President and the Secretary of State.

[254] Chalmers Roberts, "Shape of Arms Pact Emerges, with 50-50 Chance of Accord," *Washington Post*, May 21, 1970, p. A1; "State Hits Post Story on SALT," *Washington Post*, May 22, 1970, p. A2; John Finney, *New York Times*, May 22, 1970, p. 5, as reported in Adams, *Ballistic Missile Defense*, p. 227.

On 26 May 1972, however, the President of the United States and the Secretary General of the Central Committee of the Communist Party of the U.S.S.R. signed a treaty on the limitation of antiballistic missile (ABM) systems and an interim agreement on the limitation of strategic offensive weapons. The ABM treaty limited deployment of ABM defenses to two sites: one for the defense of an ICBM site, and another for the defense of the national capital. This treaty has subsequently been extended to reduce the ABM deployments to one site only.

On 2 August 1972 the Senate ratified the ABM treaty by a vote of 88 to 2. And on 13 September 1972 Congress approved the FY 1973 Defense Appropriation Bill but banned the use of funds in connection with a ballistic missile defense of Washington.

Thus the 17-year debate over ballistic missile defense came to an end. The system that would accelerate the arms race played the most significant part in bringing the Soviets to the negotiation table. Whether the United States negotiators were as adept as the United States engineers and scientists who were able to build and prove the technical feasibility of the system—at least to the satisfaction of the Soviets—is yet to be seen. As General Wheeler said deterrence exists in the forces in-being and in the minds of men. Since the signing of SALT there has been indiscernible decrease in world tensions and the Soviets continue to increase their strategic offensive forces and are experimenting and testing advanced ABM systems. The United States continues to maintain the forces it had in 1971. How long will our deterrence be credible in the minds of the rest of the world?

Section IV. Space Defense

A. Approach

Like the other sections in this chapter, the approach in writing the history of the United States' effort in space defense had been selective rather than exhaustive. Whereas air and ballistic missile threats have been extensive, the space threat is generally limited to the Fractional Orbit Bombardment System (FOBS), which has been considered more of an ICBM type threat because of the similarity of terminal trajectories, and reconnaissance or communication satellites at various altitudes. There have only been two space defense systems developed during the 17 years covered by this volume although several others have been postulated and proposed. In the main, United States space defense efforts have been directed toward detecting, identifying, and keeping track of objects in space. In this connection, the sensors developed and deployed to provide early warning against ballistic missile attack have been major contributors to the space defense programs. The need for these systems, their development and deployment were never controversial, as were the ballistic missile defense systems. As a result, procurement and deployment have been rather orderly with the biggest problems lying in competing with other systems and programs for the necessary dollars within the constraints of rather tight defense budgets.

The dual role played by the ballistic missile defense early warning sensors, and the non-controversial role they had in development and deployment posed a rather interesting problem with respect to where they should be covered in the overall history of United States systems. It was finally decided to include them in this section. Insofar as it has been able to be determined, they have had no major impact on strategic arms competition.

In view of the fact that space defense and ballistic missile early warning systems have been relatively non-controversial and contributed little, if any, to the strategic arms competition, this section presents the history of these systems in a chronological order culminating with a tabulation of the systems in operation in 1972.

B. Missile and Space Surveillance and Warning Systems

1. Authority

The Air Force was initially assigned responsibility for developing the ballistic missile early warning system on 5 October 1956 when the then Special Assistant for Guided Missiles to the Secretary of Defense informed the Secretaries of the Army and Air Force of their Services' responsibility in the antiballistic missile field.[255] This was subsequently confirmed by Secretary of Defense Charles E. Wilson on 25 April 1957 when he directed the Air Force to develop the anti-ICBM early warning system, to carry out research and development on the advanced acquisition radars required by the active anti-ICBM system, and to study the communications between these radars and the active portion of the system. Soviet announcement of a successful ICBM launching in August of 1957 followed shortly thereafter by Sputnik I, added impetus to the program.

2. Composition

The missile and space surveillance and warning system currently consists of five systems and a space computational center located in the NORAD Cheyenne Mountain complex. The five systems are: the Ballistic Missile Early Warning System; the Defense Support Program (DSP) formerly called Project 647; the Forward Scatter over the Horizon Radar (440L) system; the Sea-Launched Ballistic Missile Warning System; and the Space Detection and Warning System. Each of these systems is discussed in some detail in the following paragraphs.

3. BMEWS

By 14 January 1958, eight months after being assigned responsibility for ballistic missile early warning and four months after the Soviet announcement, the Air Force presented the results of a feasibility study on a ballistic missile early warning system to the Secretary of Defense. This system called for three radars located in Alaska, Greenland and the United Kingdom directed toward the Soviet Union in such a manner as to cover all northern great circle trajectories from the U.S.S.R. to the United States. The Alaska and Greenland radars would project two fan shaped beams—one high and one low—in a sector of about 120 degrees in azimuth and out to a range of approximately 2,000 miles, toward the Soviet Union. ICBMs launched from the Soviet Union would pass through these beams during the boost phase and provide the alarm of a ballistic missile attack. By measuring and recording the point that each missile penetrated each beam an approximate area of impact (an ellipse about four hundred miles wide and 800 miles long) could be computed. To assess the validity of each event a threshold, based on probabilities of false alarm, was established and reflected as alarm level. Alarm level one was the lowest indicating very little probability of an actual attack while alarm level five—the highest—indicated a high probability. Later, tracking radars were to be added to these radars to reduce the Impact area prediction error and to assist in validating events.

[255] Memo, Special Asst for GM, OSD, for Sec Army, Sec Air Force, 2 October 1956, sub: Anti-ICBM Systems.

The third site, to be located in the United Kingdom was to be equipped only with three tracking radar. Initially, it was to be jointly manned and eventually solely manned by the British.

After the briefing on 18 January the Secretary of Defense authorized the Air Force to proceed with the development of the system. A contract was let with the Radio Corporation of America and on 1 October 1960 the first BMEWS site became operational at Thule, Greenland and achieved an automatic capability on 1 February 1961. On 30 September 1961 BMEWS site Number 2 became operational at Clear, Alaska. In the meantime, a Memorandum of Agreement between the United States and the United Kingdom authorized construction and operation of the third BMEWS site at Fylingdales Moore, Yorkshire, England. This site became operational in 1962 to complete the BMEWS system.[256]

4. SLBM Warning System

In July 1964 the USAF Air Defense Command notified USAF Headquarters that it supported the minimum cost SLBM system pending design and deployment of a more permanent system to provide early warning of this threat. The proposed minimum cost system would be composed of the Moorestown radar on the East Coast, which would be diverted from its Spacetrack mission to the SLBM mission at the appropriate DEFCON, the AN/FPS-85 radar at Eglin AFB, Florida which already had a secondary mission of providing warning of an SLBM attack from the south, and two AN/FPS-35 radars on the West Coast, one at Baker, California and the other at Boron, Oregon.[257] At the same time ADC established a requirement for an over-the-horizon, backscatter radar to provide maximum warning against this threat.

At best the minimum cost system provided a very limited capability against the SLBM. Further, approval for development of the OTH backscatter radar was slow in coming. As a result it was decided to develop an interim system using modified air defense height finder radars. Seven sites were planned at Mill Valley, California; Charleston AFB, Maine; Mount Laguna, California; Mt. Hebo Air Force Station, Oregon; Fort Fisher Air Force Station, North Carolina; McDill AFB, Florida; and Laredo, Texas. The new system, designated 474N by the Air Force, was to become operational in December 1970. At that time, however, it was determined that, as then configured, the modified radars, newly designated the AN/FSS-7, would be unable to detect the Soviet SS-N-6 SLBM, which was a longer range missile that could be launched from beyond the range of the radar and overfly the radar search envelope. It was therefore decided to make further modifications to the radar to increase its range to 750 NM, and to postpone the operational date to December 1971. The system finally became operational in Mid-1972.[258] In the meantime, it was decided to increase the coverage provided by the system by reactivating the Moorestown, New Jersey radar for the SLBM role. This radar had originally been a part of the Space Detection and Tracking System but had been inactivated in 1969, probably for budgetary reasons.[259] After reactivation it was designated the AN/FPS-49.

5. Over-the-Horizon, Forward Scatter Radar (440L)

At the same time that the Air Force was constructing the BMEWS ICBM warning system, it was recognized that that system provided only limited coverage to the north and that launches to the south could go

[256] USAF Air Defense Command, Historical Study # 19.
[257] Ibid.
[258] "Continental Air Defense Command History, 1968," and "Continental Air Defense Command History, 1971," Headquarters CONAD, May 1969 and May 1972, respectively.
[259] Ibid.

undetected. To cover this possibility, it was decided to install a forward scatter over-the-horizon radar net around the Soviet Union. The net would consist of four transmitters located in the Philippines, Okinawa, and Japan (2) and five receivers in Cypress, Italy (2), Germany, and England, with a correlation center in Aviano, Italy connected to the NORAD Combat Operation. Center in Cheyenne Mountain.[260] The system was to be designated 440L. Using the ionosphere and the earth as a gigantic wave guide over the Soviet Union, the transmitters would generate a continuous radar signal which would be constantly monitored by the receivers in Europe. Interruptions in the signal caused by ballistic missile launches would be detected by the receivers which would pass this information to the correlation center in Aviano, Italy, where the data would be processed to provide the time and inclination of launch. Processed data would then be flashed to NORAD.

The 440L system became operational on New Year's Eve 1965 but for a time was beset with operational difficulties which impacted upon its ability to detect launches. By 1968 these problems were not all solved and the detection rate was very low. For instance during one period 7–14 June 1968 the system was only able to detect 20 percent of the launches that actually occurred.[261] As a result, extensive revision of the operating procedures was undertaken which resulted in a significant improvement in the number of launches detected.

6. Space Detection and Tracking System

The Space Detection and Tracking System (SPADATS) was placed under the operational control of CINCNORAD on 1 December 1960, by the Joint Chiefs of Staff. In July of 1961, the National Space Surveillance and Control. Center (NSSCC) was discontinued as the new SPADATS Center became operational at Ent AFB, Colorado. Officially, this marked the beginning of aerospace operations by CINCNORAD.[262]

SPADATS consists of a Space Defense Center in the NORAD Cheyenne Mountain Complex (NCMC) and three systems provided by the Air Force, Navy, and Canadians. The Air Force contribution is the SPACETRACK system which is composed of three radars at Shemya, Alaska; Dyabikur, Turkey; and Eglin AFB, Florida, and four Baker-Nunn cameras located at strategic places throughout the world. The Canadian contribution is one Baker-Nunn camera in Canada. The Navy contribution is the NAVSPASUR system which is a radar fence consisting of three transmitters and six receivers extending from Charleston, South Carolina to San Diego, California, across the Southern United States. Headquarters for the NAVSPASUR system is located at Dahlgren Island, Virginia, where all NAVSPASUR data is processed before forwarding to the Space Defense Center in the NCMC.

7. Defense Support Program (DSP)

The DSP traces its origins to the Air Force 949 program which was conceived in late 1967 or early 1968. This program called for placing synchronous orbiting satellites equipped with short and long wave infrared sensors along the equator to overlook the eastern and western hemisphere. The exhaust fumes of launched missiles would be detected by the infrared sensors on the satellites and data concerning numbers

[260] Ibid.
[261] "Continental Air Defense Command History, 1968," Headquarters CONAD, 1 May 1969.
[262] *Ballistic Missile Defense Chronology (1957 to Present)*, SAFCOM.

of launches and their inclinations would be flashed to ground stations where it would be processed and flashed to NORAD, SAC and the NCA. The system would increase the warning time from 15 minutes as provided by BMEWS to approximately 30 minutes—the ICBM time-of-flight.

DSP is a somewhat less sophisticated version of the original concept but involves the same principles. Its purpose is to provide tactical warning of missile attacks, ballistic missile defense alerting, origin of attack, attack assessment, raid description, nuclear test ban monitoring, nuclear diagnostic and intelligence data. The system was to be deployed in two phases. Phase I called for two synchronous orbital satellites, one to cover the eastern hemisphere and one to cover the western hemisphere. The purpose of the latter is to provide early warning of SLBM attack. The first satellite, covering the eastern hemisphere, was launched on 5 May 1971. The second was launched in February 1972.

C. Space Defense Systems

With the launch of Sputnik I a requirement was generated for a system to intercept satellites in space. Although various requirement papers have been developed for such a system and, indeed, concept and feasibility studies have been conducted, the United States has only had two actual systems for this purpose—and only one of these was specifically deployed for this purpose.

As early as April 1962, the Secretary of Defense placed a requirement on the Nike Zeus program to provide the capability for a satellite intercept demonstration by May 1963. The demonstration was to be conducted from Kwajalein Atoll and was assigned the code name Mudflap. On 21 March 1963, the first Mudflap test was conducted with limited achievement of objectives. Neither the missile nor ground equipment had performed as required. On 23 May a second test was conducted when a Nike Zeus missile launched from Kwajalein successfully intercepted an Agena D satellite. All test objectives were achieved within the time frame specified by the Secretary.[263] Shortly thereafter, the Nike Zeus program was assigned a mission of maintaining a satellite intercept capability to engage designated satellites within 24 hours from the time directed. From then until relieved in late 1968, several missiles were maintained on hand for this purpose.

About the same time that the Nike Zeus program was assigned the satellite intercept mission, the Secretary of Defense directed the Air Force to achieve a similar capability from their installation on Johnston Island, in the mid-Pacific, using a Thor, IRBM. The project was designated the 437 SIS (Satellite Intercept System). The Thor was to be launched using satellite ephemeris data and launching data generated in the Space Defense Center in the NORAD Combat Operations Center. The 437 SIS became operational in May 1964. Four Thor missiles, each equipped with a 1.45 MT warhead were maintained for this purpose—two on launchers on Johnston Island and two at Vandenberg AFB, California. The system was capable of intercepting satellites at altitudes between 100 and 700 nautical miles and at ranges from 100 to 1,150 nautical miles.[264] The Thor missile provided a much larger intercept envelope than the Nike Zeus and Johnston Island was more advantageously placed for the intercept of satellites launched on inclinations to pass over the United States. The much larger warhead on the Thor was used to compensate for system inaccuracies. Successful demonstration launches were made on 21 November 1968 and 25 April 1970. The

[263] Ibid.
[264] "Continental Air Defense Command History, 1968," Headquarters CONAD, 1 May 1969.

latter was the first Special Defense Program Launch at Johnston Island.[265] On 1 October 1970 the 437 SIS alert requirement was reduced from 24 hours to 30 days. All missiles and personnel were transferred back to the Continental United States.

As mentioned, several Required Operational Capability (ROC) documents were written by the Aerospace Defense Command and NORAD/CONAD for Satellite Intercept Systems. None came to fruition. Similarly, several system concepts were developed. One such system called the Orbital Inspection and Negation System was proposed by the Lockheed Aircraft Corporation in 1968. Although the system showed promise funds were not available for development and no further effort was expended on it.[266]

D. Status—1972

By 1972 the United States defense forces had no space defense systems in operation. Ballistic Missile defenses were restricted to the one site then in construction and air defense forces were rapidly being phased out of the inventory. The mission of the Continental Air Defense Command and its components was gradually shifting from one of defense to one of surveillance and early warning. To accomplish this mission for space and ballistic missile attack CONAD had the forces shown in Table 27.

Table 27—Missile and Space Surveillance and Warning Systems[267]

31 December 1971

System	Number Operational
BMEWS	3
DSP	1
OTH (440L)	
Transmitters	4
Receivers	5
SLBM Warning	
AN/FSS 7	7
AN/FPS 49	1
SPADATS	
Spacetrack	
Radar	3
Baker-Nunn cameras	4
Canadian	
Baker-Nunn camera	1
NAVSPASUR	
Transmitters	3
Receivers	6

[265] ADC Historical Study # 19.
[266] "Continental Air Defense Command History, 1968," Headquarters CONAD, 1 May 1969.
[267] "Continental Air Defense Command History, 1971," Headquarters CONAD, May 1972.

Section V
Civil Defense 1955–1972

A. Introduction

In contrasting Soviet and U.S. defense systems, one key point emerges: Whereas there were a number of cases in which Soviet strategy could be analyzed in terms of what the Soviets *did* in response to international tensions or U.S. actions, the U.S. strategy was more often analyzed in terms of what the Americans *did not* do in these action-reaction situations. This was particularly true regarding civil defense efforts. It has been sufficiently established among observers that the Soviets have been consistently more defense-oriented, but this hypothesis was too general to explain intricate philosophies dictating active and passive defense postures.

During the period 1955–1972, the U.S. Civil Defense programs experienced two significant changes—the first in 1958 when President Eisenhower issued Reorganization Plan No. 1, transferring civil defense duties to the Executive Office of the President. This was followed by the enactment of Public Law 85-606 expanding the responsibility for organizing and administering civil defense activities to the Federal level, in addition to the State and local groups already in existence. The second modification to civil defense organization occurred in 1961 when, under the authority of President Kennedy, civil defense was placed under the auspices of the Secretary of Defense. Although reasons for both events can be determined—in 1958 the changing strategic posture and the gradual emergence from the "massive retaliation" policy to "mutual assured destruction" may have prompted Eisenhower to take some action in passive defense areas. However, the "reorganization plan" was a "paper command," changing titles, locations of offices, and directorships, but the true test lay in its acceptance and support by the public and the administration. Promoting civil defense programs, by actively providing up-to-date protection for the population, continued in a state of limbo. Kennedy's 1961 successes in promoting a closer interaction between civil defense and the Department of Defense was precipitated by both his growing interest in improving civil defense programs and the Berlin Crisis of that same year. The public awareness and support was at an all-time high following the activities in Europe, but they were short-lived. Again it was an example of the American attitudes towards remedying immediate needs, in this case an immediate perceived threat; other national priorities soon regained precedence.

B. History

Between 1955 and 1957, U.S. civil defense programs experienced little attention. Frederick V. Peterson continued as the Administrator of the Federal Civil Defense Administration (FCDA), a position he had held since 1953. Civil defense duties continued to be divided between the Office of Defense Mobilization (ODM) and FCDA. Early pressures were surfacing within the Department of Defense for additional military support of civil defense programs, but they did not reach fruition until the early 1960's.[268] Sputnik I on 4 October 1957 and the earlier TASS announcement of an ICBM capability[269] prompted some interest in civil defense, primarily in the form of contracted studies and Congressional hearings. Among these studies were the Gaither Committee Report, two McKinsey and Company reports, a Rockefeller Brothers Fund

[268] DCPA. *The Development of Civil Preparedness in the United States,* p. 5.
[269] SRI. *An Analysis of the U.S.-Soviet Strategic Interaction Process*.

panel report and a RAND "Study of Nonmilitary Defense." The consensus of these studies was that civil defense programs were outdated in light of the new strategic environment and needed improvements in areas ranging from shelter protection to a modification of the existing organizational structure. The most significant proposals appeared in the classified Gaither Committee report on national preparedness and the McKinley and Company finding.[270]

Between November and December of 1957, McKinsey and Company, a private consulting firm commissioned by the Bureau of the Budget to examine existing civil defense programs, produced Part I of a two-part report. In emphasizing the President's role, the "Framework for Improving Non-military Defense Preparedness" recommended that he issue a message acknowledging the importance of non-military defense and the need to remedy the duplicity in the overlapping organization then in existence. Part II, the "Organization for Non-military Defense Preparedness," submitted in March 1968, advocated the abolishment of FCDA and ODM and the establishment of a new agency in the Executive Office of the President. It also called for greater coordination between Federal, State, and local governments.[271]

President Eisenhower requested a study in 1957 which was carried out by H. Rowan Gaither, a former chairman of the board of the Ford Foundation.[272] The Gaither Committee, as it was known, was to review active and passive defense plans against nuclear attack. The results, classified Top Secret for the next 15 years, emphasized the growing Soviet Air Defense capabilities and the vulnerability of U.S. SAC forces. In response to FCDA's 40 billion dollar request for blast and fallout shelters, the Committee recommended a $22 billion long-term fallout shelter construction program, as well as additional funding for civil defense research and planning.[273] Eisenhower followed the advice of the McKinsey report but did nothing to promote the shelter program.

In addition to these recommendations, the Military Operations Sub-committee of the House Committee on Government Operations, chaired by Congressman Chet Holifield, began hearings in 1956 on the inefficient operations of the existing civil defense structure, noting the overlap of FCDA's and ODM's responsibilities.[274] The Committee was motivated in part by a 1955–1956 report in which FCDA officials recommended that FCDA and ODM be consolidated under the administration of a Cabinet Department. Holifield and his followers, in agreement with the unpublicized FCDA proposal, made similar recommendations but did not receive Congressional approval.[275]

Eisenhower took action on these recommendations in April 1958 by requesting that Congress approve Reorganization Plan No. 1, transferring responsibility for all non-military defense functions to the President. In addition, ODM and FCDA were to be consolidated into the Office of Defense and Civilian Mobilization (ODCM) with offices in the Executive Offices of the President. The Plan received approval during the 85th Congress in August, the only alteration in Eisenhower's request being the name change to Office of Civil and Defense Mobilization (OCDM). Public Law 85-606 was also approved, which added responsibility for

[270] Gessert, et al., *Federal Civil Defense Organization*, *The Rationale of Its Development*, p. II-31, 32.
[271] Ibid., pp. II-24, 26.
[272] Wigner, *Who Speaks for Civil Defense?*, p. 40.
[273] Cooling, *The Army Support of Civil Defense 1945–1966: Plans and Policy*, p. V-49.
[274] Gessert, et al., op. cit., p. II-24.
[275] Maxam, William Pierce, *Federal Civil Defense 1946–1963*, p. 162.

civil defense at the Federal level in the form of assistance to the numerous State and local agencies.[276] Leo A. Hoegh took over as Director of the new OCDM and was simultaneously given a seat on the National Security Council as a consequence of the new developments. Presidential responsibility for the new organization was redelegated to Hoegh.[277]

OCDM prepared a National Plan for Emergency Preparedness as well as a National Shelter Policy during Hoegh's tenure.[278] The National Plan attempted to establish a civil defense doctrine on survival plans and assign responsibilities for the various operations at all levels, the guidelines of which were accepted within State and local jurisdictions. However, the Plan was criticized from the start for its "lack of definitiveness within the national strategy."[279] The Shelter Policy urged private citizens to provide their own shelter facilities, approving building loans for the purpose, but public stimulation was not sufficiently strong to motivate excessive construction.[280]

As Frank B. Ellis took over the Directorship of OCDM in March 1961,[281] tensions were growing between the Soviet Union and the United States. The new Kennedy administration faced the end of the "missile gap" scare,[282] an American U-2 spy plane was shot down over the U.S.S.R. in 1960,[283] and in 1961 Khrushchev began threatening to sign a peace treaty with East Germany.[284] In May 1961, prior to the Berlin Crisis, Kennedy publicly endorsed a shelter program. By the time of the Berlin Crisis in July, he was more urgently supporting shelter construction and the education of the public concerning civil defense preparedness.[285] A five-year shelter program was requested by Kennedy in November, with a projected cost of $700 million the first year and $3.5 billion over the remaining years.[286]

In addition to these efforts, Kennedy announced in May that he was assigning responsibility for civil defense to the Secretary of Defense. As a consequence, the Office of Civil Defense was constituted in August under Executive Order No. 10952, OCDM was made a small staff agency under the name Office of Emergency Preparedness (OEP), and Stewart L. Pittman was named by President Kennedy to be the first Assistant Secretary of Defense (Civil defense).[287] Civil defense headquarters which had been moved to Battle Creek, Michigan, in 1954 were transferred back to Washington,[288] allowing for more continuity within the organization. This reorganization, brought on by threatening international situations, denoted a closer relationship between the military and civilian aspects of civil defense. As a result of the 1961 developments and the 1962 Cuban Missile Crisis, the civil defense administrators requested and received their largest budget to date—$207.6 million plus an additional $49.5 million from unexpended OCDM funds.[289]

[276] DCPA, op. cit., p. 6.
[277] Gessert, et al., op. cit., p. II-27.
[278] Ibid., p. II-19.
[279] *Basic Report of Civil Defense and Defense Mobilization*, p. 66–67.
[280] Ibid., p. 71–74.
[281] DCPA, op. cit., p. 6.
[282] SRI, op. cit.
[283] Gessert, et al., op. cit., Appendix – p. 72.
[284] Cooling, op. cit., p. VII-2.
[285] Wigner, op. cit., p. 54.
[286] Ibid., p. 55.
[287] DCPA, op. cit., p. 7.
[288] Gessert, et al., op. cit., Appendix – p. 74.
[289] Cooling, op. cit., p. VII-5.

Pittman, between 1962 and 1964, set about identifying shelter spaces and locations in public buildings for stocking supplies.[290] Although he located as many as 121 million spaces and stocked over 23 million of them by 1964 (Table 28), political support was waning. Congressional hearings on Kennedy's 1961 "Shelter Bill" began in 1963, chaired by Edward Hebert.[291] Secretary of Defense Robert McNamara's efforts to link ABM deployments with an effective shelter program were failing as early as 1964.[292]

Coincident with Pittman's 1964 resignation and the appointment of William P. Durkee as his successor, OCD responsibilities were transferred to the Secretary of the Army,[293] a move considered by some to promote greater military interaction but by others to be politically motivated within the Department of Defense.[294]

McNamara continued voicing his endorsement of civil defense programs and blamed Congress in 1966 for the failure of Kennedy's 1961 five-year shelter program.[295] Although he publicly proclaimed that strategic offensive and defensive forces, including civil defense, constituted the general nuclear war forces of the country,[296] his pro-shelter efforts appeared to have been a ploy to prevent an ABM program.[297]

Durkee resigned his position in December 1966 and Joseph Roam, another advocate of a low-key civil defense program predicated on a fallout shelter system, was appointed the new Director. In 1969 following President Nixon's successful Presidential campaign, John E. Davis was named to succeed Romm.[298]

As those before it, with the exception of Kennedy, the Nixon administration took little more than a token interest to civil defense. In 1969, Nixon combined a number of 1962 Executive Orders which had delegated various emergency preparedness activities to different Cabinet posts and agencies into one Executive Order No. 11490.[299] In the same year, following a press conference query concerning civil defense and ABM systems and at the urging of Congressman Holifield, Nixon ordered General George A. Lincoln, Director of the OEP, to prepare a study, for presentation to the NSC, of civil defense and its costs in relation to a Safeguard system and other force and arms control decisions.[300] A National Security Study Memo (NSSM #57) was submitted by the OEP in mid-1970. Two years later, as OCD was being renamed the Defense Civil Preparedness Agency and reinstated under the Secretary of Defense, a National Security Decision Memo (NSDM #184), signed by Henry Kissinger, relayed President Nixon's decisions on civil defense. The decisions were later publicized in a letter from General Lincoln to Walter Murphy, Editor of the American Journal of Civil Defense, *Survive*, quoting the administration's policy to "maintain the current overall level of effort in its civil defense efforts."[301] These indications persisted in reminding the public and civil defense officials that the political leadership was not taking any steps to improve the existing civil defense structure.

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[290] Wigner, op. cit., p. 43.
[291] House of Representatives, Subcommittee No. 3, Committee on Armed Services, 1963.
[292] See Murdock, *Defense Policy Formation: a Comparative Analysis of the McNamara Era*, p. 123, and Wigner, *Who Speaks for Civil Defense*? p. 44, for a discussion of the Congressional hearings.
[293] DCPA, op. cit., p. 7.
[294] Murdock's discussion of the relationship between McNamara and the Assistant Secretary of Defense (CD), p. 123, hints at political disagreements. This was further substantiated in an interview on May, 1975, with Dr. W. K. Chipman of the DCPA.
[295] See excerpts from House Appropriations Committee transcript in Wigner, *Who speaks for Civil Defense*? p. 55–56.
[296] See, for example, Wigner, *Who Speaks for Civil Defense*?, p. 44–45. and Leonard, *Civil Defense—Its Role in Nuclear Deterrence*.
[297] Murdock, *Defense Policy Formation: a Comparative Analysis of the McNamara Era*, p. 123.
[298] DCPA, op. cit., p. 7–8.
[299] Ibid., p. 8.
[300] Davis, *U.S. Strategic Defensive Concepts, Part II—Passive Defense Measures*, p. 12.
[301] Chipman interview, May, 1975.

C. Threat Perceptions

Other than the "threat to the Homeland" imposed by Soviet missiles in Cuba and Kennedy's July 1961 speech on the intensity of the Berlin Crisis, the United States' public had never experienced a direct threat to their survival. Some may even doubt that these two events were actual threats to the U.S. population. In the mid-1950's, as the U.S.S.R. was steadily gaining in the field of offensive nuclear weapons, the Eisenhower administration resorted to a tight budget and the "massive retaliation" policy of John Foster Dulles. Post-Korean attitudes leaned toward meeting Soviet economic competition rather than preparing for future conventional wars.[302] It was not until 1955, following an explosion of a nuclear device on Bikini Atoll in 1954, that public demands forced the Atomic Energy Commission to release fallout information on a multi-megaton thermonuclear device.[303] Such changes in the strategic environment and pressures on the administration for shelter programs eventually prompted Eisenhower to commission the Gaither Report in 1957, though he largely ignored its recommendations for improved civil defense and shelter programs. This was best explained by Eisenhower's acceptance of Dulles' policy: "For our security we have been relying above all on our capacity for retaliation. From this policy we should not deviate now. To do so would imply we are turning to a 'fortress America' concept."[304]

Other proponents of civil defense were more harsh in their analysis of Eisenhower's contributions to future civil defense programs, claiming his decision to keep the Gaither Report from the public was the beginning of a "deliberate, unpublicized national policy that nuclear defense is hopeless and that reliance should be almost entirely on deterrence."[305] Public awareness of the status of civil defense programs continued to be minimal except in small circles. The Army Mobilization Capabilities Study (AMCS-61) of 1959 was the first of these studies to include bomb damage assumptions and civil defense as an appendix.[306] An official OCDM report in 1961, which estimated casualty figures from a nuclear attack, assumed 60 percent of American lives would be lost compared to the Soviet's 20 percent.[307] Foreign policy analysts expounded their views on the subject: "As the increasing power and speed of delivery vehicles multiply the difficulties of active defense, ever greater importance should be attached to civil defense. While active defense seeks to destroy the largest possible proportion of the enemy attacking force before it reaches its target, civil defense strives to blunt the enemy offensive by reducing as much as possible the damage which it can inflict."[308]

Such statistics, coupled with the Soviet actions in Germany, most likely influenced President Kennedy's civil defense speeches of May and July 1961. In addition, Kennedy was aware of many of the inconsistencies in the existing civil defense structure. His decision to incorporate civil defense into the DOD infrastructure was prompted by desires to integrate civil defense and DOD budgets, take advantage of better management which he felt existed in DOD, and to accelerate the shelter program under DOD's auspices.[309]

The reactions to Kennedy's July 1961 speech informing the public of the Berlin problem further exemplified the public's naiveté concerning nuclear threats:

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[302] *Basic Report* . . . op. cit., p. 36–37.
[303] Gessert, et al., op. cit., Appendix – p. 68.
[304] Eisenhower, *Waging Peace*.
[305] Wigner, op. cit., p. 47.
[306] Cooling, op. cit., p. IV-17.
[307] *Basic Report* . . . op. cit., p. 28.
[308] Kissinger, *Nuclear Weapons and Foreign Policy*, p. 112.
[309] Maxam, op. cit., p. 164–165.

> In the event of an attack, the lives of those families which are not hit in the nuclear blast and fire can still be saved—if they can be warned to take shelter and if that shelter is available. We owe that kind of insurance to our families—and to our country . . . the time to start is now. . . . In the coming months (I will) let every citizen know what steps he can take without delay to protect his family in case of attack. I know that you will want to do no less.[310]

In suggesting that the public take steps to protect themselves, without knowledge that civil defense organizations had no guidelines, Kennedy precipitated a chaotic situation. There was "general panic" at the thought that the U.S. might be attacked. Others took advantage of the situation by attempting to "get rich quick" on "do it yourself" shelter plans, the results of which inaugurated an anti-civil defense constituency.[311] However, by the end of the year, when OCD issued the pamphlet, *Fallout Protection*, and Khrushchev ended his campaign to sign a treaty with East Germany, public apathy was returning[312] and civil defense programs "stepped out of the limelight."

Whatever renewed interest was stirred by the Cuban Missile Crisis the following year was transcended in Congress when Representative Albert Thomas of Texas, a civil defense opponent, was given control of civil defense appropriations and denied funds for additional shelter spaces.[313] Thus, Kennedy's proposed shelter program and the temporary support for civil defense measures the preceding year met with early defeats.

Other than depleting the budget, indirect threats, such as tensions in the Mid-East and Vietnam, did not influence U.S. perceptions regarding civil defense needs. The formal detente overtures of the late 1960's have served to further undermine U.S. funding for civil defense. The perceived Chinese threat, following their firing of a nuclear weapon in 1964, served to initiate civil defense discussions relating to ABM systems, but no significant steps were taken in the area.

One of the greatest threats to U.S. stability since the late 1950's has been the possible failure of deterrence. In 1955, the U.S. Army, in conjunction with State and local civil defense organizations, participated in "Operation Alert," to test the vulnerabilities of the system in the event of a nuclear bomber attack. During the simulation, Eisenhower declared martial law to curb the "hysteria" in the cities, an action that evoked considerable criticism because of the unforeseen demands imposed on the military. However, the act was the crisis toward which civil defense had been building since 1951—that of a conflict between "civil defense planning and American deterrent needs." The Army realized that civil defense should be an "integral part of military strategy,"[314] and the emphasis shifted toward "mutual deterrence" and atomic parity. That same year, Secretary of Defense Charles E. Wilson directed the JCS to change the military role in civil defense.[315]

The Rand and Rockefeller Brothers Fund reports in 1958 found the strategic posture of deterrence to be dependent on civil defense.[316] The Holifield Subcommittee determined that civil defense "must be considered in a strategic sense . . . to be an integral part of the Nation's ability to deter war. . . ."[317] Although the Gaither Committee's shelter recommendations were shelved, the report was used to strengthen areas of the

[310] Wigner, op. cit., p. 41–42.
[311] Ibid., p. 42.
[312] Cooling, op. cit., p. VII-10.
[313] Wigner, op. cit., p. 43.
[314] Cooling, op. cit., p. IV-46.
[315] Ibid., p. V-2.
[316] Gessert, et al., op. cit., p. II-32.
[317] Cooling, op. cit., p. V-25.

strategic deterrent. This prompted General Maxwell Taylor to dispute its findings that the Army was incapable of handling certain eventualities, and he reemphasized the Army's role in civil defense "emergency missions."[318] Major General Earle G. Wheeler, Director of Plans for DCSLOG, felt that the "Army should assume some responsibility for civil defense."[319]

Taylor's attitude had changed considerably since 1956 when, as the new Army Chief of Staff, he had testified: "First I am not responsible for civil defense, I don't want to be responsible for civil defense, and if the Army had to take over any role of this sort, every additional function would have to be paid for in terms of new men and new dollars."[320]

At that time, as he told the Subcommittee, he was still under the impression that the U.S. would not be threatened on her own soil and therefore the Army would be deployed overseas and would not be available in sufficient numbers to participate in civil defense.[321] Air Force General Nathan Twining and Navy Admirals Arthur Radford and Arleigh Burke refuted Taylor, arguing more realistically that atomic offensive operations would not allow such troop movement.[322]

Ten years later deterrence, military capabilities, and civil defense remained a problem. Although civil defense had been made a responsibility of the Secretary of the Army after 1964, the position served little purpose other than cutting civil defense budgets by utilizing Department of the Army personnel in such services as communications and supply.[323]

The Soviets were rapidly approaching parity with the U.S., not only in weapons deployment and expanding technology, but in population growth, economic endeavors, and political stabilization.[324] A 1962 report cited the major threats as "airplane bombing, missiles fired from sub-marines, long-range ballistic missiles, sabotage and espionage, chemical and biological warfare, and propaganda."[325] Although the United States had reacted to Soviet strategic offensive forces, with improvements to their own active defense stockpiles and air defense activities, they had not devoted comparable time to civil defense efforts.[326] Despite the claims of some U.S. civil defense opponents that an improved shelter program would threaten detente, the Soviets continued with shelter construction and increased emphasis on other civil defense activities.[327]

The U.S. military's exaggerated views on the power of offensive measures over defensive measures substantiated the belief that little or nothing could protect the population from the effects of nuclear weapons.[328] The U.S. refused to admit that deterrence could fall. However, if the theory of deterrence and "mutual assured destruction" is based on the idea that no power would ever attack or threaten the U.S. because our retaliatory ability would completely destroy them, then the theory is a myth insofar as Soviet civil defense preparations negate this possibility.[329]

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[318] Ibid., p. V-52.
[319] Ibid., p. V-53.
[320] Subcommittee of the Committee on Government Operations, Testimony by General Maxwell D. Taylor, 1956.
[321] Cooling, op. cit., p. V-21.
[322] Ibid., p. V-22.
[323] Wigner, op. cit., p. 44.
[324] *Basic Report* . . . op. cit., p. 13–14.
[325] Mitchell, *Civil Defense: Planning for Survival and Recovery*, p. 7.
[326] SRI, op. cit.
[327] Schnieder, *Survive*, May–June 1972, p. 11.
[328] Wigner, "The Myth of 'Assured Destruction'", p. 2.
[329] Ibid., p. 4.

D. Congress, Shelters, and the ABM

The mid-1950's and the advent of thermonuclear weapons necessitated a shelter program in the United States. After Sputnik and the ICBM capability in 1957 cut the warning time from six hours to 30 minutes,[330] it was realized evacuation was anachronistic. Under Hoegh's leadership, the newly organized OCDM in 1958 proclaimed a National Shelter Policy. Although a similar policy in 1951 had been initiated, it was felt that the new plan's emphasis on providing shelters in non-target areas to protect against fallout and the desire to be independent of massive Federal funding would insure a successful program.[331] However, the "penny-pinching" Eisenhower Administration, combined with general apathy, never gave the program its needed boost. There were no demands for funds, no requirements for good performance on the part of the Federal agencies involved, and no endorsement by the President in his messages as compared with his push for military defense.[332]

The Army and other DOD elements saw the fallacy in U.S. employment of air atomic strategies without an effective civil defense.[333] However, there was internal disagreement within the Army as to the feasibility of a shelter program. Opponents saw increased shelter protection as a "Maginot line" mentality and feared it would detract from military appropriations.[334] Others, DCSLOG in particular, cited that shelters would lower the responsibilities of the Army as well as allow more of the population to survive. There was also the ever present emphasis on funds for offensive capabilities rather than defensive measures.[335] The military did agree by 1960, however, to promote plans for shelter facilities for air defense units and other military installations.[336]

Frank Ellis, the last Director of OCDM, brought the shelter problem to the attention of President Kennedy in 1961. He cited the need for identifying and equipping shelters in existing structures and suggested that more research and development be done to improve their efficiency.[337]

Kennedy's speech in May 1961 advocating federally funded fallout protection for the population in the form of family and group shelters was not in response to a threat, although two months later the Berlin Crisis further supported his proposals. His decision to place civil defense under Secretary of Defense McNamara's jurisdiction was the turning point in the shelter program controversy. The appointment of Stewart Pittman to head OCD further attempted to accord shelter programs the attention they deserved.

Kennedy's proposed 5-year shelter plan touched off Congressional debates within the Armed Services Committee which lasted through the 1960's. One of the arguments voiced by Congressional opponents against the shelter program claimed there, was inadequate public support. This theory was substantially abrogated by Pittman's 1962–1964 efforts to gain cooperation in locating and stocking shelter spaces. He was able to obtain the commitment of 105,000 building owners (97 percent of those contacted) and 75 percent cooperation from homeowners in identifying basement spaces.[338] In addition, a survey on missile defense, conducted in 1965 by the National Opinion Research Center of the University of Chicago for

[330] *Basic Report* . . . op. cit., p. 35.
[331] Gessert, et al., op. cit., p. II-19.
[332] Maxam, op. cit., p. 163.
[333] Cooling, op. cit., p. V-8.
[334] Ibid., p. V-42.
[335] Ibid., p. V-43.
[336] Ibid., p. VI-38, 39.
[337] *Basic Resort* . . . op. cit., p. 75.
[338] Wigner, op. cit., p. 58.

General Electric TEMPO and ARPA, disproved the "lack of support" theory. It indicated a public acceptability and desire for shelters, therefore disproving the views, of Congress.[339]

The most profound impact on civil defense programs under McNamara was his insistence on the interdependence of ABM deployments and an adequate shelter program. It was the general consensus that an ABM program, with its fallout potential in target areas, was useless without concurrent shelter protection. According to one source:

> Secretary McNamara has indicated in 1965 that he is reluctant to embark on an operational deployment of the Nike-X ABM. He and most of his advisors are logically convinced that an ABM system must be accompanied by an adequate civil defense shelter program, i.e., without fallout shelter programs there is no apparent point in deploying or preparing to deploy a ballistic missile defense of urban areas.[340]

In the 1964 hearing, when Congress was unable to obtain a commitment from McNamara that he would procure an ABM system if shelter appropriations were approved, the "Shelter Bill" was killed.[341] However, the ABM-shelter controversy continued, involving arguments during the Johnson administration on a "thin versus thick" ABM system for use against new Chinese nuclear arms. Since the JCS and Congress advocated a "thick" system, and McNamara was a proponent of a "thin" ABM, agreements were never reached—a result of McNamara's refusal to endorse ABM and the Congress' refusal to endorse a shelter program.[342]

Speculation exists as to McNamara's sincerity in promoting shelter programs. He was known as an advocate of "assured destruction" through offensive measures, subordinating defense to this goal: "Once sufficient forces have been procured to give us high confidence of achieving our Assured Destruction objective, we can then consider the kinds and amounts of forces which might be added to reduce damage to our population and industry in the event deterrence fails."[343]

Pittman has labeled this philosophy the "doctrine of assured vulnerability." Sensing that Congress would appropriate little or nothing to civil defense and shelter programs, McNamara used them as a ploy to prevent ABM deployment. Although ABM and civil defense could be considered alternate means for achieving the same end, it seemed a mistake to neglect the Soviet approach on the same problem and, therefore, the effects on deterrence.

Since these debates, little has been done in this area. The OCD and DCPA have continued to locate and identify existing facilities which might be used for shelter space (see Table 28) but no funds have been requested for stocking these spaces since 1965.[344] Budgets have dropped considerably since 1962, causing the most frustration to OCD officials in 1969 when, because of increased spending in South East Asia it dipped to $61 million (see Figure 32). McNamara, in his budget requests, explained that civil defense requests were being held at "the lowest possible sustaining rate, pending the end of the Vietnam Conflict."[345]

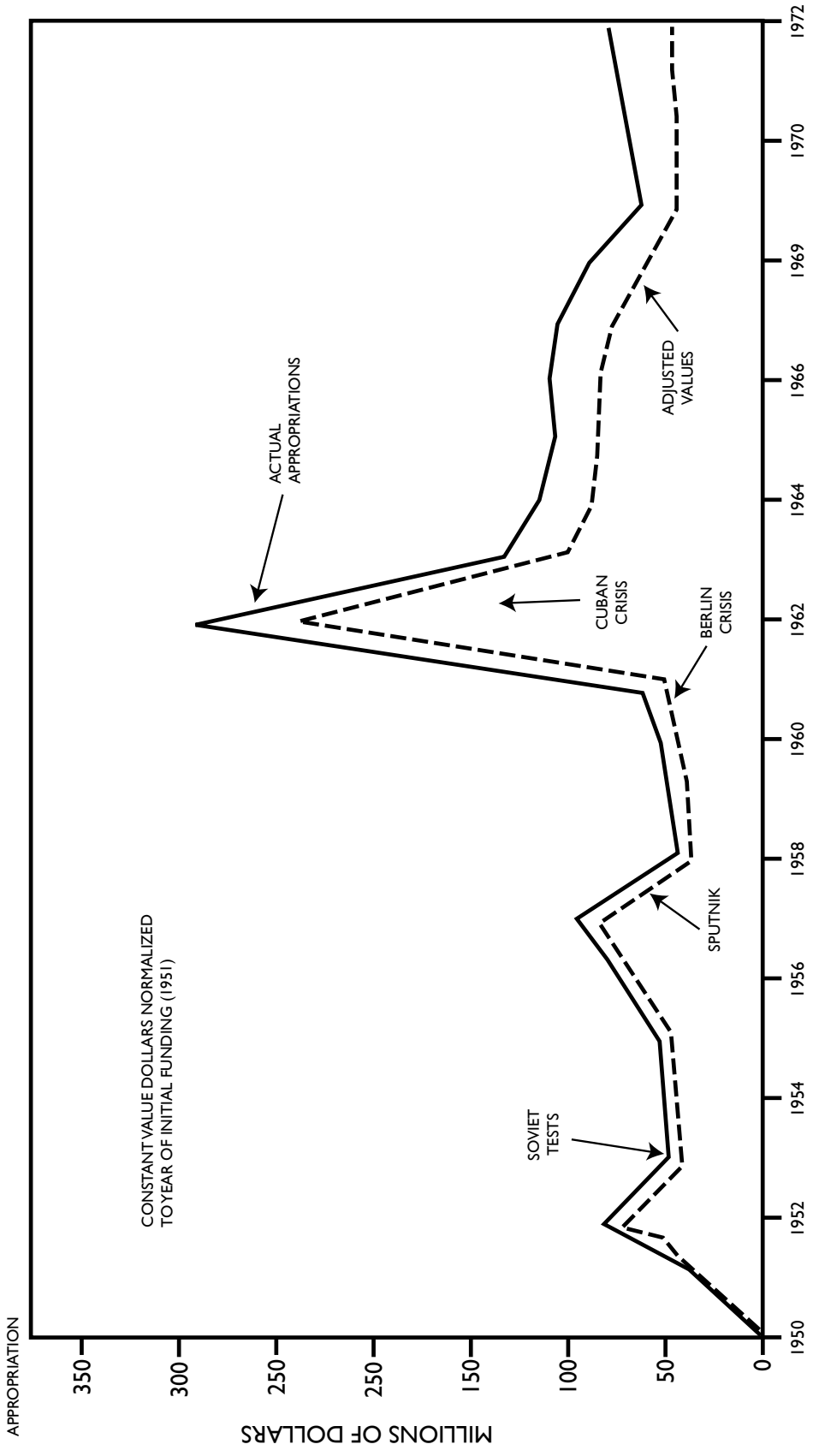
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[339] Adams, *Ballistic Missile Defense*, p. 117.
[340] Kintner, et al., *Alternative U.S. Strategies and America's Future*, p. IV-25.
[341] Murdock, op. cit., p. 123.
[342] Wigner, op. cit., p. 99.
[343] Ibid., p. 45.
[344] Chipman interview, May, 1975.
[345] See McNamara, *The Fiscal Year 1969–73 Defense Program and the 1969 Defense Budget (1968)*, p. 76, and Clifford, *The 1970 Defense Budget and Defense Program for Fiscal Years 1970–74 (1969)*, p. 66.

Table 28—U.S. Total Standard Shelter Space Located, Licensed, Market, and Stocked

Year	Located		Licensed		Marked		Stocked		
	Facilities	Spaces (000)	Facilities	Spaces (000)	Facilities	Spaces (000)	Facilities	Spaces	
								Rated Capacity (000)	Stocked Capacity (000)
1963	125,445	103,680	50,046	47,426	53,839	42,771	20,894	16,985	9,715
1964	143,653	121,390	70,724	62,783	79,777	63,761	45,663	36,082	23,800
1965	155,064	135,640	81,789	77,219	87,886	75,894	63,041	56,248	33,814
1966	165,839	149,624	93,032	89,268	95,419	85,286	74,667	68,782	41,294
1967	175,496	160,237	100,468	98,697	101,018	92,664	83,042	78,424	47,066
1968	189,053	176,539	109,725	108,883	107,456	101,053	91,075	88,058	52,748
1969	195,751	188,181	117,221	119,689	108,952	105,082	98,445	96,589	58,489
1970	202,298	194,774	124,533	127,812	110,235	107,501	104,491	103,414	63,837
1971	210,382	203,517	127,957	132,352	117,601	114,388	106,398	106,701	65,630
1972	217,171	212,617	129,149	135,234	118,264	116,448	105,722	107,542	65,431

Figure 32—Civil Defense Appropriations



Between 1945 and 1966 approximately $50 billion were spent on air defenses, with only $1.5 billion allocated to civil defense.[346] It is an established fact that per dollar expanded, more lives could be saved by a fallout shelter system than by ABM or blast shelters.[347] According to Eugene P. Wigner, a civil defense research, the average expenditures per person in the U.S. had dropped from 50 cents in 1967[348] to 35 cents in 1970,[349] not a bright outlook for the future of civil defense.

E. Conclusions

Why has civil defense always been a secondary priority? It was true that it suffered most of the time from insufficient funds, but why was there not sufficient political and public support for civil defense appropriations? Was it the fault of the administration or the public themselves that they were never totally aware of decisions being made and their implications, that they were uninformed and apathetic? Did they actually prefer not to face the reality of the threat or were they not aware that any threat existed?

Civil defense has never achieved a level high enough to change the nation's economy, government budget, or lives and attitudes of the citizens. Only after public pressures and direct enemy threat's were any actions taken, and those resulted in name changes and reorganization from one virtually inconsequential arrangement to another. The history of civil defense in the U.S. has been marked with a series of statements, studies, and proclamations as to what *should* be done, but was not. A multitude of well-meaning persons have drawn up numerous plans for shelters, civil defense education, evacuation, mobilization and post-attack recovery, and other civil defense operations, in attempts to stress the importance of civil defense, but the system has remained grossly inadequate.

Walter Cronkite, in the introduction to Eugene Wigner's book on civil defense, cites cost priorities, political maneuvering, public relations and psychological impacts, and the potential for atomic blackmail as reasons for the inadequate civil defense program, as explanations for the public's concern with immediate threats which quickly abates as other immediate needs supersede these threats.[350] There is an accepted unspoken belief on behalf of the public that the government, or some "abstract being," will protect them from the ravages of nuclear war.[351]

From the standpoint of the less naive, of those involved in the administrative and political aspects of civil defense, there is a feeling, perhaps as an excuse for their personal disinterest, that the public could not accept the impact of an active civil defense program. The constant reminders of the possible horrors of a nuclear war was not a pleasant thought for the spoiled, pampered American public which more often than not has viewed the U.S. as invulnerable.

The trends of the 1970's have not dissipated this eternal apathy. Davis' directorate[352] is focusing on evacuation plans once more, a mode of protection not considered practical since the advent of missile technology. This alternative to the unsupported fallout shelter program and the lack of blast shelters was in accordance with the more recent attempts to relate civil defense to Soviet targeting doctrine and to concentrate on evacuating metropolitan areas and strategic military complexes.

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[346] Wigner, op. cit., p. 95–96.
[347] Ibid., p. 98.
[348] Wigner, op. cit., p. 13.
[349] Wigner, "The Myth . . ." op. cit., p. 4.
[350] Wigner, op. cit., p. 9–11.
[351] Chipman Interview, May, 1975.
[352] Davis, *Strategic Defensive Concepts*, op. cit., p. 9; Schlesinger, *Annual Defense Dept. Report* (1975); and notes from the interview with Dr. W. K. Chipman, May, 1975, further substantiate this trend.

Davis has also supported the de-emphasized role of the Federal administration, delegating more authority and responsibility to the State and local levels. The emphasis on civil defense preparations for natural disasters has placed additional weight on the State and local levels. Whether this increasing lack of Federal assistance is attributable to budgetary or attitudinal problems in the higher echelons is not known. Perhaps their Sisyphean efforts have frustrated them to a feeling of incompetence.

Many civil defense administrators, however, never doubted the effects of or the possibility of a nuclear war. Pittman's 1963 speech to the House Armed Services Committee said it best:

> Those of us who have responsibility for the safety of others cannot brush this responsibility aside with an intuitive feeling that nuclear weapons would never be used just because it would be suicidal, insane, and irrational. This is an easy out, not just for civil defense, but for many other defense activities which we are pursuing as a Nation.
>
> The men at the top of our Government—I am referring to the President and those who were his executive committee during the Cuban Crisis—have had the experience of looking down the wrong end of a gun barrel during the summer of the last Berlin threat, and again during the Cuban threat. They are persuaded that the vast destructive power of nuclear weapons is no adequate assurance that they would not be used. They do not think it likely that these weapons would be used, but they have concluded that there is enough uncertainty to justify moderate steps to reduce potential damage and improve the base for recovery.[353]

In a 1970 speech by Davis, at which time he quoted population losses at 35 to 45 percent and industrial losses at 35 to 55 percent (optimistic figures compared to later quotes), he reminded his audience that neither of these losses can assure destruction if the nation has the "will to survive and adequate preparedness measures."[354] The former does not pose a dilemma for most sane individuals, but the latter has remained the problem of U.S. civil defense since its inception.

[353] Subcommittee No. 3., Committee on Armed Services, House of Representatives, testimony of Steuart Pittman, 1963.
[354] Davis, *U.S. Strategic Defensive Concepts*., op. cit., p. 7.

Chapter V

Soviet Systems for Strategic Defense

A. Introduction

Objectives, slogans, and myths which prevailed in postwar Soviet aviation can be summarized in the phrase, "Further, faster, higher," which traced back to the 1920's. In the course of making a reality of this mythology after World War II, the Soviets were confronted with technological constraints. In 1946, a program was set in motion which would expand the tightest of those constraints—jet engine technology.[1]

Geography confounded the technological constraints. While Stalin wanted an advanced-technology intercontinental bomber,[2] he could not have it. No Soviet engine could support such a design. Tupolev apparently acknowledged the limitation and lost his "Chief Designer" status temporarily because of his honesty. Myasishchev was less forthright and committed himself to a marginally capable engine; the Mya-4 (Bison) resulted.[3] The aircraft was less than successful. An alternative approach used counter-rotating propellers driven by a jet turbine engine was produced by Tupolev eventually with more success. A producible engine to drive either aircraft was not available until 1953 or 1954. Engine technology combined with geography to deny the Soviets an intercontinental jet bomber force until the mid-1950's. Meanwhile, on the order of 1300–1400 TU-4S (Bull) were built as an interim measure. It was not a question of either defense or offense. They did both. With the TU-4 and later the TU-16 (Badger), the lack of a visible and viable system of forwarding basing made the offensive effortless impressive. The aircraft were in capabilities and numbers comparable to our B-29's and B-47's and they effectively projected Soviet offensive, power over the entirety of Western Europe.

The same level of engine technology which produced an unimpressive bomber force, supported an impressive fighter force. By 1955, Soviets had produced 10,000 jet fighters. While technology caused the Soviets to sacrifice range for speed and altitude, geography required large numbers to defend the vast area of the country. Also affecting the number of MiG's was the fact that Mikoyan and Gurevich had molded technology to provide a machine better adapted than that of any competitor to the needs of all potential customers—Soviet Naval Aviation, Frontal Forces and PVO Anti-air Defense. There were a number of additional factors, however, that related to the character and capability of actual aircraft chosen for strategic defense. In the first volume of this study, eight factors were related to the designs produced between 1945 and 1955. In broad terms; they were: (1) perception of air defense, (2) central planning, (3) aviation institutions, (4) preferential information flows, (5) engine allocations, (6) a system of rewards and incentives, (7) incompatible objectives, and (8) personal politics.

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[1] The Post-War Ministry of Aviation Industry Plan is discussed in Book l of the earlier draft of this study, pp. V-20–V-21.
[2] Tokaev, G.A. *Comrade X*, Chapter 27.
[3] [Khrushchev, N.S.] *Khrushchev Remembers: The Last Testament*, pp. 38–39.

The focus of the section that follows is on the process of Soviet decisions and not on the decisions themselves. The focus is one of necessity. U.S. intelligence and the academic community understand a great deal about the process and very little about the decisions themselves. Further, direct access to "critical" decisions is rare, so rare that it should not be used as a channel for routine reportage that forms the basis of analysis. The reason is simple. Spies are shot. Complicating the understanding of decisions are three other considerations. First, Russians are noticeably more reticent about discussing security policy than are Americans. Second, what Russians do say frequently tends to distort rather than illuminate—occasionally it is intended to do so. Khrushehev's statements on the ABM are a classic example. Third, Russian memoirists, few in number, allow a decent time to elapse before telling their version of a decision. Further, changes in administration are not so frequent in the U.S.S.R. and while departing officials sometimes have the opportunity to reflect on their deeds, their access to publishers is by an awkward channel.

The task of analysis is not hopeless though. It is suggested that the process of decision affects the decision itself. The following section examines three aspects of the processes of Soviet forces structure decisions—design, production, and deployment—as they apply to the components of the Soviet strategic defense force. In addition to the major systems of the Soviet defensive structure, an associated area, that of civil defense, will be addressed. Each of the following sections will endeavor to relate observable evidence about the process and the outcome of decisions in order to reflect on the nature of the decisions themselves.

B. The Systems of PVO Strany

PVO Strany, Protivovozdushnaya Oborona Strany or Anti-air Defense of the Country, is the branch of the Soviet military structure concerned with strategic defense. It is distinguished from PVO Voysk which is its counterpart organization assigned to the protection of field forces. Because PVO Strany consists of functional organizations and their associated systems, the following will be addressed in turn:

(1) Aviation of Anti-air Defense—Aviatsiya PVO (APVO)[4]
(2) Anti-aircraft Missile Troops—Zenitno-raketnyye Voyska (ZRV)
(3) Anti-Missile Defense—Protivoraretnyye Obornoa (PRO)
(4) Radio-Technical Troops—Radio-rekhnicheskiye Voyska (RTV)

Although the formal existence and composition of the third, PRO, function is subject to mixed evidence, an organizational structure is perceived to control the Moscow ABM function and to oversea antisatellite capabilities. Each of the following sections will relate how the forces associate with these functions emerged.

1. Systems of Anti-Aircraft Defense Aviation (APVO)

The first volume of this study relates how post war developments in engine design, airframe design and production influenced the composition of the fighter forces which provided the backbone of PVO Strany while it emerged as an independent branch of the Soviet armed forces. In particular the earlier study examined the design process and focused on the decisions which led to the Soviet's first all-weather fighter, the

[4] Formerly identified as IAPVO (Istrebitelnaya Aviatsiya) or Fighter Aviation of Air Defense. The term has been modified since 1970 presumably to account for the role of MOSS (TU-144) Aircraft in PVO Strany.

YAK-25. The following section will continue the examination of the design process and introduce evidence which relates to aircraft production and deployment.

a. Engine Developments

The 1946 Ministry of Aviation Industry plan to achieve technological superiority in jet engine design met with success in the early 1950's. The Mikulin AM-3 axial-flow engine represented a break from dependence on German and British Innovations. The huge engine produced approximately twice the thrust of western engines of the early 1950's.[5] It also represented a lower drag configuration necessary to long-range jet bomber designs. Eventually the AM-3 would power the TU-16 and MYA-4 bombers as well as the Soviets first jet airliner, the TU-104—all aircraft that are still flown today.

The smaller axial flow AM-5 engine available in 1952 made possible the development of the Soviets' first supersonic interceptor, the MiG-19, and their first all-weather area interceptor, the YAK-25. From 1952–1957 Mikulin and his deputy, S. K. Tumansky developed five prototype engines which entered production: the AM-3, RD-3M, AM-5, RD-9B, and the R37F. It was two years after the RD-9B became operational in 1954 that the United States had its first comparable transonic compressor turbojet in production. The RD37F, which was first qualified for production in 1957 has powered numerous generations of the MiG-21. The Foreign Technology Division of the U.S. Air Force Systems Command judges that "the overall performance [of the RD37F], developed in the 1952–1957 period, was found to be superior to currently [1974] operational Western engines for moderate duration, high altitude, and air superiority missions."[6] This FTD finding was based on the exploitation of the actual Soviet engine. Tumansky, the man credited with the design of the RD-37, seems justified in claiming in 1967 that "I particularly value the jet engine installed in the MiG-21 aircraft. Its parameters —weight, dimensions, and specific thrust—have not been excelled in the world practice of engine construction. . . ."[7]

Another bureau had been established in 1947 to pursue axial-flow designs—that of A.M. Lyulka. The most notable success of the Lyulka effort was the 19,850-lb. thrust Mach 2.0 engine that powered the Sukhoi Su-7 and Su-9. Successors of the 1955 AL-7F were eventually rated at 15,432 lbs. and at maximum thrust of 22,046 lbs. with afterburner. The Lyulka contribution, although it represented a significant advantage in size (thrust/volume) when compared with the trend of western development did not exhibit the thrust/weight advantages of the Tumansky engines. Thus, it was destined to be associated with heavier interceptors and attack aircraft.[8]

Although both the Tumansky RD-37 and the Lyulka AL-7 were developed in the late 1950's, they exhibit sufficient differences in technology to allow the conclusion that Soviet engine designers worked quite independently and that they were permitted a rather large degree of freedom in design concepts within manufacturing, material and maintenance constraints.[9]

Hard data are scarce concerning Soviet military engines which entered production subsequent to 1960.[10] It is believed that five engines have been derived from the 1957 Tumansky concepts. These now

[5] DIA, *Air Breathing Propulsion Technology*, ST-CS-04-009-74, p. 7.
[6] DIA, *Fighter Aircraft (Trends) ECC*, ST-CS-09-006-75, p. 8.
[7] DIA, ST-CS-04-009-74, p. 18.
[8] Ibid., pp. 18–20.
[9] DIA, ST-CS-09-006-75, p. 9.
[10] DIA, ST-CS-04-009-74, p. 9.

power the MiG-25, the MiG-23, and the YAK-28. The Mikoyan and Yakovlev association with the Mikulin collective's engines dates back to the 1952 Stalin decisions on the MiG-19 and YAK-25. Sukhoi, however, appears to have maintained his ties with Lyulka, the Su-l5 being powered by an AL-21-F3 engine.[11]

Despite the lack of hard data on engine performance derived from captured equipment, it is known that jet engine development activity has progressed at a nearly constant rate. Between 1947 and 1967 some 22 new turbine engines were qualified—a fairly constant rate of better than one per year.[12]

Soviet jet engines are frequently faulted for their fuel consumption, slow acceleration and short engine life. The short time between overhauls (frequently less than 300 hours as compared, with 1500 hours in U.S. military applications) may be a reflection of high reliability standards which trade frequent overhauls for minimizing field maintenance.[13] Likewise, fuel consumption seems to reflect the lack of Soviet insistence on long-range systems as does the lack of emphasis on the more economical turbo-fan technology. A continuing reliance on the turbojet probably reflects a concentration on maneuverability and high altitude performance (particularly afterburner performance) in favor of fuel economy or range.[14] It appears that the Soviets basic indexes of evaluating engine effectiveness are the "given expenditures per kgf of thrust of the engine per hour"—an index most easily resolved by designing for higher thrust.[15] Likewise a more comprehensive design index which involves a hypothetical aircraft seems most easily resolved by designing for a high thrust/weight ratio. A more general objective also seems clear.

> The basic planning of scientific research work in aircraft engine building is the scientific-technical forecast of aeronautical developments for 10–15 years or more. The scientific-technical forecast determines the basic features and the type of aircraft engines of the future which, by the time of their placement into operation, should considerably surpass the engines of our country and those abroad.[16]

Given such a clear design objective and sustained resources, it follows that engine technology should support an aggressive program of aircraft design. Further, given indices of progress toward this objective which favor thrust in relation to other mission requirements it follows that Soviet engine development has favored advanced fighter design more than advanced bombers.

b. Aircraft Developments

At the 1956 Tushino Air Show, the U.S.S.R. introduced at least four prototype fighters. Two were of a swept-wing design and two were delta-wing aircraft. As in earlier major advances into jet aircraft and into swept-wing designs, a competition cum hedging activity was evident. Two aircraft by Mikoyan employed Tumansky engines, the Ye-2A having a wing swept to 55 degrees and the Ye-5 having a delta wing. These aircraft were respectively dubbed Faceplate and Fishbed by the Air Standards Coordinating Committee. (Another Mikoyan aircraft, the Ye-50, was apparently shown at Tushino. It featured the Faceplate configuration with a rocket motor exhausting above the main jet exhaust.[17]) Two other aircraft by Sukhoi used

[11] Ibid., p. 10.
[12] DIA, ST-CS-09-006-75, pp. 12–14. Although the FTD report mentions a rate of 3 engines every two years, i.e., thirty engines, only twenty-two are discussed.
[13] Ibid.
[14] Ibid., pp. 20–21.
[15] Tikhomirov, V. I. and Paramonov, F. I., *Organizational Planning of Production at Aircraft Engine-Building Plants*, (FTD Trans), p. 180.
[16] Ibid., p. 155.
[17] Green, W. F. and Stroud, J., *Observers Soviet Aircraft Directory*, p. 52.

Lyulka engines in heavier adaptations of the same two major design configurations. The Su-7 with wings swept at 62 degrees and the Su-9 with a 57-degree delta wing.

In 1957, it became apparent that the round of new fighter designs included an area interceptor development effort also. As in the case of the YAK-25 it appears that a multiple application airframe was envisioned, a two-seat, extended-range interceptor or a reconnaissance aircraft. Tupolev's OKB, normally associated with bombers, produced the TU-28P which employed the Lyulka engines. A competitive design, the Lavochkin La-250, was apparently abandoned in 1958.[18] Meanwhile Yakovlev adapted the YAK-25 to improved Tumansky engines and provided a separate model, the YAK-27R (Mangrove), for the reconnaissance requirement. A diagram of these competitive and complementing programs of the 1956–1958 period appears in Figure 33.

Within the Soviet aircraft industry, there is the criterion of design inheritance.

> Design inheritance consists in the fact that the maximum possible number of components, subassemblies and assemblies, taken from previously elaborated and similar designs is used in the new design.
>
> The production of a new product having a high degree of design inheritance does not require the assimilation of an entire new series of components, subassemblies and assemblies and thus shortens the time necessary for its manufacture and assimilation and also lowers the net cost and decreases the volume of production design planning work.
>
> The indicator of the degree of design inheritance is the importance of components taken from previously elaborated and similar designs within the total number of the components of the newly elaborated design.
>
> The design inheritance method also has a negative side; the dogmatic utilization of this method can result in slowing down of the rate of progress of aviation technology. Thus, upon reaching a certain, as a rule high, stage in the development of a given type of aviation design, it is necessary to forsake the design inheritance method and to look for new solutions with the object of substantial improvement of the quality of aircraft equipment.[19]

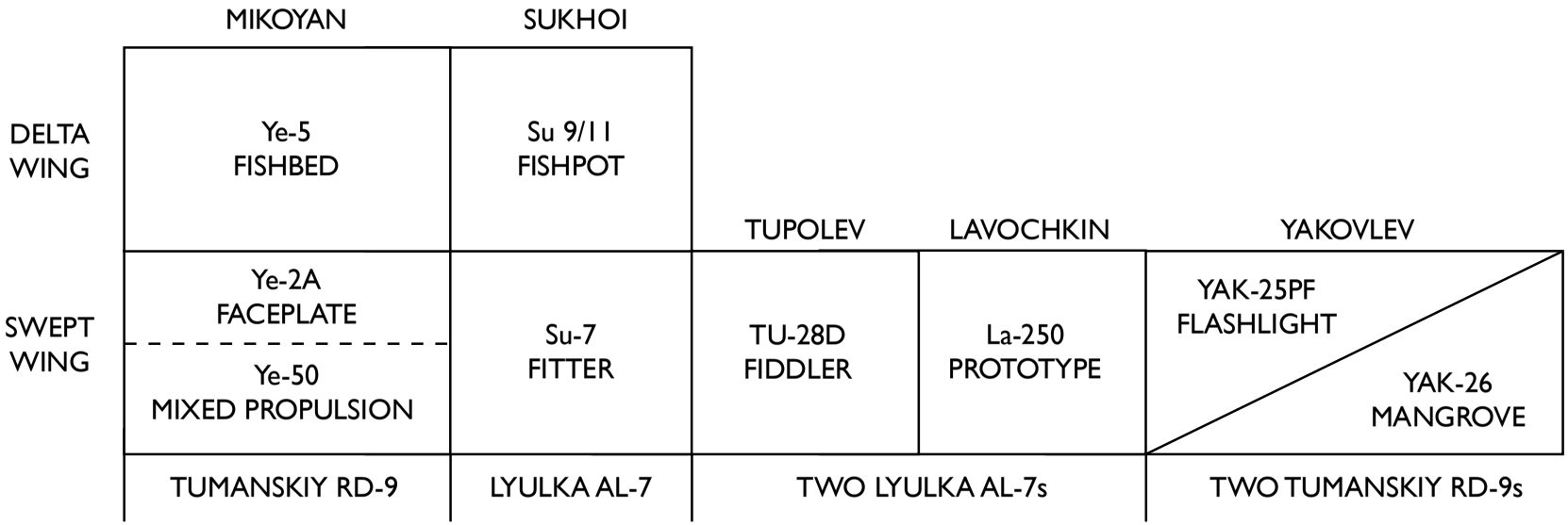
Perhaps the best examples of design inheritance occur in this period of Soviet aviation development. The Su-7 and the Su-9 had essentially the same engines, fuselages, and tail surfaces. The wing structures differentiated capabilities for supersonic interception or for lower speed ground attack, the swept-wing being more suitable for the latter role. The Su-7 was assigned to frontal aviation and the Su-9 to IA-PVO as the Su-11 with some modifications for a nose radome. As a curious and unexplained anomaly, one regiment of the Su-7 appears in the PVO order of battle from 1962 to 1970.

Yakovlev provides other examples of design inheritance. The most notable would be the 1945 adaptation of the YAK-3U to accommodate a jet engine. More relevant to this point in the discussion of Soviet defense capability is the evolution from the YAK-25 to the YAK-28P. The commonality between the YAK-25 area interceptor and the associated reconnaissance aircraft of 1953 was the genesis of at least seven years of design activity. In 1955 the YAK-25 was upgraded with RD-9 engines as the YAK-27P. Again a reconnaissance version was produced on the same concept as the YAK-26 (Mangrove). The design was thoroughly reworked to take advantage of yet another generation of Tumansky engines and lengthened somewhat to provide the YAK-28B tactical bomber (Brewer) and the YAK-28P long-range interceptor in 1960.

At the 1961 Tushino show, an aircraft was introduced which appeared to be an enlarged MiG-21 which mounted two engines and large air-to-air missiles. It was designated Flipper in the West while the Mikoyan

[18] Ibid., p. 66.
[19] Andrianov, D. P., et al., *Management, Planning and Economics of Aircraft Production*, (FTD Trans.) pp. 295–296.

Figure 33—Fighter Design Activities, 1956–1958



designation is thought to be I-75F. Four months later, the Soviets claimed a world speed record of 1,492 mph for an aircraft designated the Ye-166. However, the record setting aircraft was claimed to have but one engine. Not until the Ye-166 was displayed in 1967 did it become evident that it and the two-engine Flipper were single and twin-engine versions of the same basic design. Conjecture is that the Flipper was abandoned because the missiles proved too difficult to develop or that the size of the supporting radome justified a change of design approach toward jet inlets on the side of the fuselage. It is also possible that the exploitation of U.S. Sidewinder technology in the Atoll missile allowed the Flipper mission requirement to be satisfied by a modification of the MiG-21.[20]

In 1967, nine new fighters were demonstrated to westerners at the Domodedovo show. Competitive designs were apparent among a number of variable-geometry wing and VSTOL aircraft. Most of the new designs had high speed capabilities in excess of Mach 2. However, two complementing designs appeared which had potential application to strategic air defense—the Su-15 and the MiG-25.

The Su-15 appears to be the earlier of the two designs to fly, probably in 1964 or 1965. It appears to have been intended for replacement of the aging fleet of Su-9/11 aircraft. As such it is a short-range interceptor having a moderately high altitude capability. It features side engine inlets which facilitate a large radome and a sufficient size to accommodate the electronics associated with an advanced automated data link system. As another example of design inheritance, it featured stabilizers, wing sections, canopy, missiles, and radome from the predecessor Su-11. The engine derived from late-model MiG-21's.[21]

The MiG-25, also first shown in 1967, has the characteristics of an aircraft designed for intercepts at extremely high altitudes and speeds. It had speed and altitude characteristics in excess of any aircraft then operational in the world with the notable exception of the U.S SR-71. The interceptor is generally associated with the Ye-266 experimental craft which set sustained speed records of 1,411 mph in April of 1965.[22]

Although there was an initial argument that such a capable aircraft would be assigned to an air superiority role with Frontal Aviation, it has since become clear that the MiG-25 in its interceptor version has been deployed with the APVO. A high-speed reconnaissance version has been deployed with Frontal Aviation.[23]

It is noteworthy that, thus far, there appear to have been no competing aircraft prototypes associated with either the Su-15 or the MiG-25 requirements. The tradition of design competition was much in evidence in 1967 with respect to variable-geometry wing and VSTOL aircraft, but the two PVO aircraft were evidently developed in complementary, non-competitive programs. Competitive designs, if there were any, were abandoned before prototype construction—possibly at the stage of design approval or mock-up.

c. Aircraft Design Trends

The MiG-25 closes a significant gap in aircraft performance between the mainstream of Soviet fighters and the performance of long-range interceptors. Since WWII each successive generation of Soviet fighters has demonstrated increased speed and altitude compared to its predecessor. The YAK-25, in 1955, departed from this overall trend, however. It represented a distinct sacrifice of performance to gain range

[20] Green, W. F. and Stroud, J., op. cit., p. 72.
[21] FTD, *U.S.S.R. Aerospace R&D Overview*, FTD-CW-01-05-74, page unnumbered.
[22] Green, W. F., and Stroud, J., op. cit., p. 19.
[23] DIA, DI-3 Working Papers.

and to accommodate the bulky accouterments of an all-weather capability. Successive modifications of the Yakovlev aircraft maintained this trend while the Tupolev fighter epitomized it. The MiG-25, however, represents a merger of the two trends of development. It apparently signifies the increased importance of range and avionics equipment. Likewise it represents heavier designs required for higher and higher speeds. The very light short-range vehicle of the MiG-21 genre is eliminated in this progression. Meanwhile improvements in propulsion technology have provided engines which allow heavier aircraft to achieve higher speeds and altitudes.

The neglect of range and avionics requirements may be illustrated by the Soviets reluctance to abandon nose inlets. These require that a large proportion of the fuselage be used for ducting which obviated internal space for fuel and electronic gear. One alternative, initiated by Yakovlev was to mount engines under the wings in pods, but such an approach results in drag as a result of both frontal and surface (wetted) area. It was not until the Tupolev fighter that the Soviets resorted to side inlets to release a large volume for fuel and electronics in the fuselage. Notably, both the Su-15 and MiG-25 also feature side inlets.[24]

d. The Aircraft Industry

The aircraft industry retained its WWII character through the regime of Stalin. With his death on 5 March 1953, however, the industry was caught up in the wave of party and government reorganization. On March 15, Malenkov announced to the Presidium a consolidation of eight manufacturing ministries in two ministries. Concurrently, the Ministry of Armaments Production and the Ministry of Aviation Industry were merged to form the Ministry of Defense Industry. The former head of Armaments, D. F. Ustinov, would head the merger. The rejection of M. V. Krunichev, the former aviation chief, prompted speculation that the aviation industry had lost its special status. The reorganization was short-lived, however. The Ministry of Aviation Industry was reinstituted as a separate entity on 15 September 1953 with Peter Dementyev, Krunichev's long-time deputy, as its head. Thus, the aviation industry retained its status through the early post-Stalin changes.[25]

The verbiage which accompanied the political shuffles of 1953 aimed at increased efficiency throughout Soviet industry.

> The Plenum of the Central Committee Communist Party U.S.S.R., in September 1953, uncovered a number of serious shortcomings in the work of the administrative apparatus. It stated that the major shortcoming in the administration of production was the official-bureaucratic style of management, in which the administrative apparatus spends most of its time, not in improving production and in organizational work among the workmen, but in composing, and filling out numerous technical, planning, statistical, and other papers, in holding meetings and conferences, thus losing its initiative and failing to notice shortcoming.[26]

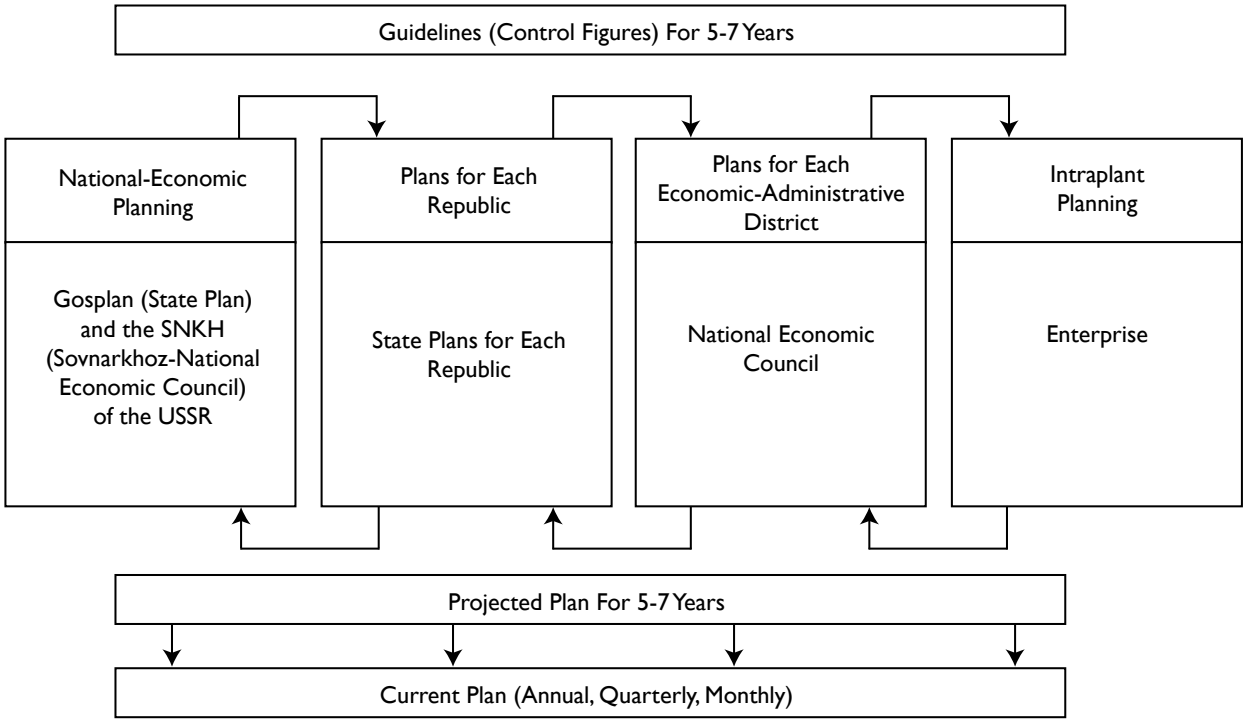
Among the necessary responses was a demand for reduced paperwork. Four years later it was claimed that documentation in the aviation industry had been cut by four-fifths.[27]

It was not until December of 1957 that another reorganization affected aviation in the wake of the decentralization campaign which began earlier that May. Dement'yev was named Chairman of the State Committee on Aviation Technology. The change indicated that the ministry, reconstituted as a commit-

[24] DIA, ST-CS-009-006-75, p. 37.
[25] CIA, *The Aircraft Industry of the U.S.S.R.*, RR-50, January 1955, p. 10.
[26] Tikhomirov, V. I., *Organization and Planning of an Aircraft Construction Enterprise*, (FTD Trans.) p. 162.
[27] Ibid., pp. 162–163.

tee, would have more responsibilities for technological coordination[28] while the State Planning Committee (Gosplan) and the newly formed Councils of National Economy (Sovnarkhozy) assumed a role in aviation production planning. The most important effect of the reorganization was that it expanded the authority of plant managers and put the industry on a cost-accounting basis within the context of annual technical-industrial-financial (Techpromfin) plans. The web of planning activities which subsequently involved individual aviation plants is diagrammed in Figures 34 and 35. Notably, within the context of the 1957 reorganization, the design bureaus (OKB's) remained directly subordinate to the State Committee on Aviation Technology. The OKB's and their associated fabrication facilities were in large part exempted from the profit standards of the accounting system as "State-budgeted development enterprises."[29]

Figure 34—The Basic Links of the Socialist Planning System, 1957–1965

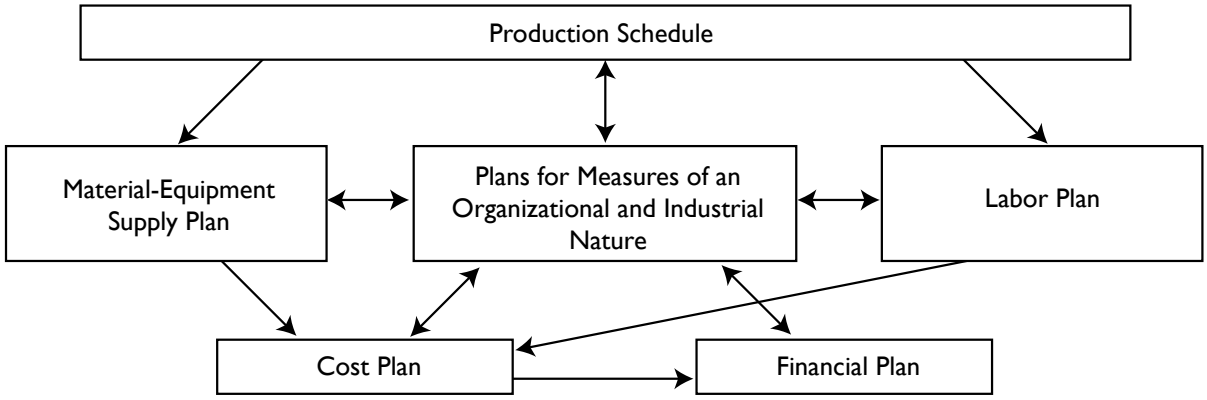


SOURCE: D.P. Audrianov, et al., Management Planning and Economics of Aircraft Production, Moscow, 1963 (FTD Trans.) pp. 556–57.

The aircraft industry was modernized somewhat between 1953 and 1957. New construction was not prominent prior to 1950 and a lack of planning was evident. The production of bombers and transports had been frequently limited by the size and height of assembly buildings. For example, to produce the 11–18 (Coot) at the Moscow 30 plant, portions of the roof trusses were cut out to allow installation of the vertical stabilizer and holes were made in the wall to allow wings to protrude. Aircraft were produced in batches and disassembled for removal.[30] New construction during the period was primarily aimed at relieving such limitations at bomber and transport plants. In conjunction with modernization, a number of plants were deactivated after 1955.

[28] CIA, *The Aircraft Industry of the U.S.S.R.: 1954–59*, RR ER 60-9, May 1960, p. 10.
[29] Tikhomirov, V. I., op. cit., p. 24, and Andrianov, D. P., et al., op. cit., p. 292.
[30] CIA, ER 60-9, p. 7, and interview with CIA aircraft production analyst, 28 April 1975.

Figure 35—Organization and Interrelationship Between Basic Sections of the Industrial Financial Plan of an Aircraft Plant



SOURCE: D.P. Audrianov, et al., Management Planning and Economics of Aircraft Production, Moscow, 1963 (FTD Trans.) pp. 556–57.

The aircraft industry, despite modernization and some increase in floor space, declined precipitously in production after 1955. Numbers of aircraft produced declined from an estimated 6,800 in 1955 to 2,200 in 1959—a decline of 68 percent. Airframe weight declined an estimated 81,000,000 to 28,000,000 lbs. a decline of 74 percent.[31] Fighter production declined 90 percent, from 3150 to 305 aircraft, during the same period. The year 1959 represents the bottom of the trend as the new generation of MiG-21 and Sukhoi fighters were just beginning production.

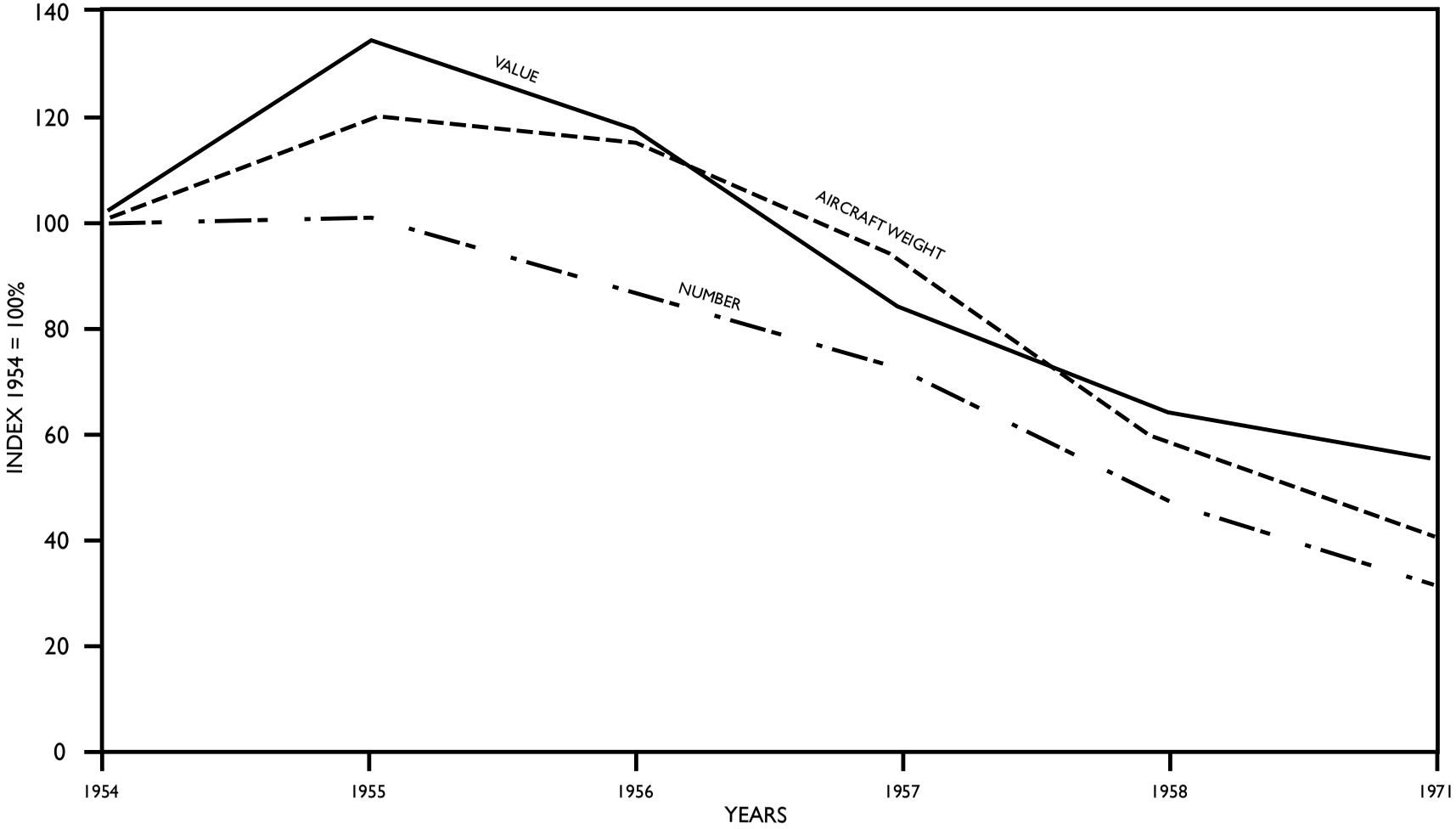
The character of the industry changed during the late 1950's. Sometime during the period it appears that one shift was adopted instead of two-shift operations as a standard for the industry.[32] Guidance for the industry which included an emphasis on the variability of defense requirements and the maintenance of a mobilization capacity gave way to guidance which omitted such emphasis.[33] More importantly, the emphasis of the industry shifted from combat aircraft to civilian and military transports. Figures 36 and 37 represent the decline in production and the shift in the application of production.

In a wider context, there was a world-wide decrease in fighter production during the same period. U.S. production declined 64 percent between 1955 and 1958 while the production of other nations (except U.S.S.R.) also declined by about 72 percent.[34] The world-wide trend points to some general factors which affected aircraft production of the time. They might be summarized by the term "complexity." Aircraft approaching Mach 2 required finer tolerances, better electronics, and new production techniques. Contrasted with the MiG-15 which was put in production 3 months after it first flew, the MiG-21 did not enter production until more than two years after the prototype appeared in 1956. Complex aircraft required more time to develop and to produce. Complexity and time also reflected in costs. Costs of basic fighters doubled or tripled during the early 1950's.[35]

Several factors were peculiar to Soviet fighter production, however. First were the forthcoming Sukhoi and MiG fighters which only began production in 1958 and 1959. The Mikoyan and Yakovlev aircraft of

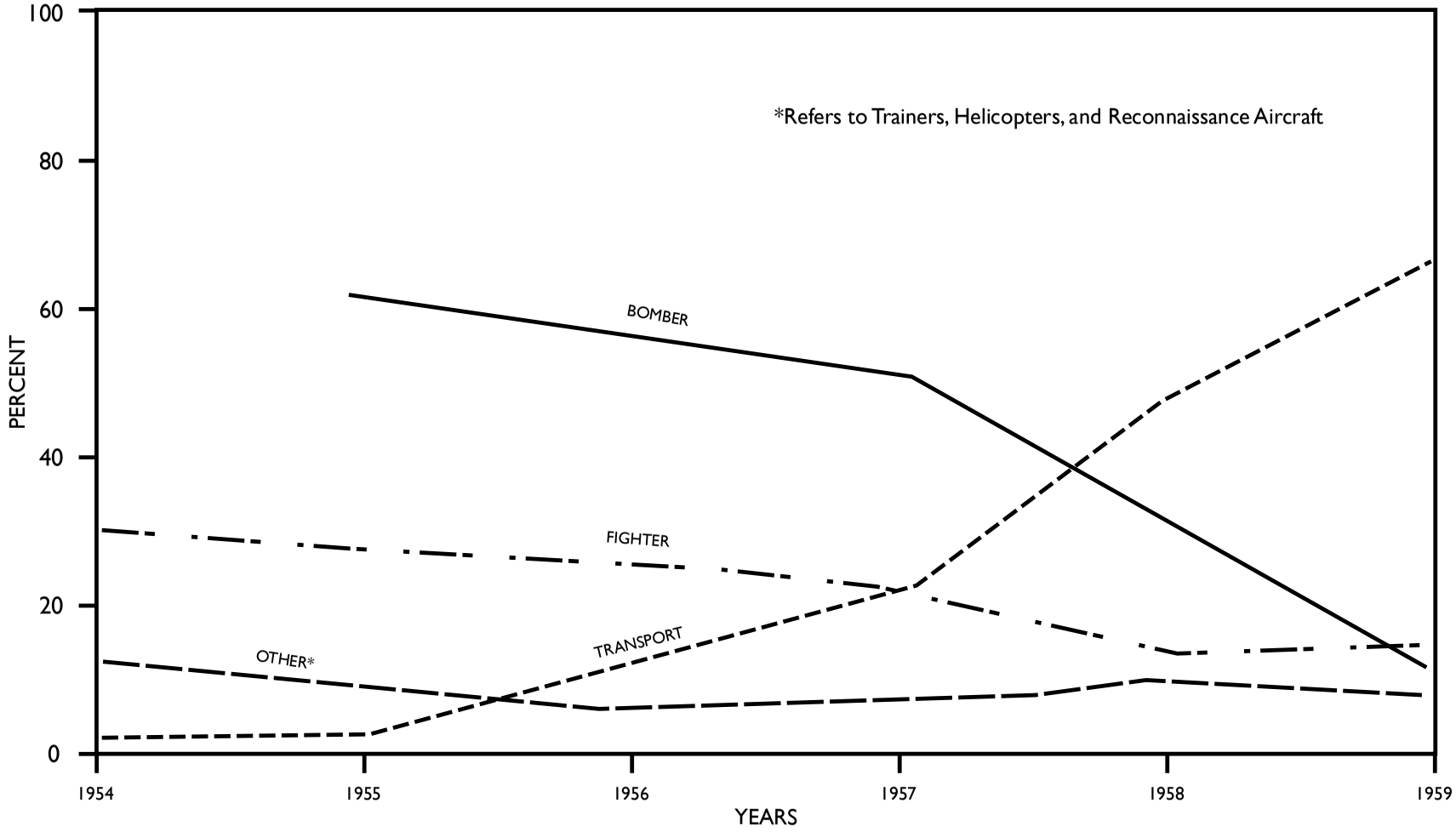
[31] CIA, ER 60-9, p. 47.
[32] Interview with CIA Production analyst, 28 April 1975.
[33] Tikhomirov, V. I., op. cit., pp. 19–21, versus Andrianov, D. P., et al., passim.
[34] "Soviet Fighter Production Shows Sharp Decline," *Air Intelligence Digest*, April 1959, p. 25.
[35] The Price of the F-84 was about $500,000, while the price of the later F-100 was about $1,500,000. Ibid., p. 13.

Figure 36—U.S.S.R.: Indexes of Estimated Production of Aircraft by Number, Airframe Weight, and Value,* Including Initial Spares, 1954–1959



*Value is defined as the expenditure for the procurement of the aircraft based on dollar figures.
Source: The Aircraft Industry of the USSR, 1954–1959, CIA, May1960.

Figure 37—U.S.S.R.: Distribution of Estimated Expenditures for Procurement of Aircraft, Including Initial Spares, 1954–1959



the late fifties suffered from extraordinarily quick obsolescence. Second was the relatively unspectacular improvement of the YAK-25 and MiG-19 aircraft over their predecessors. Although the axial engines were a breakthrough, the real payoff of the new technology did not come until the late 1950's. Likewise, the performance of the YAK-25 air intercept radar system would be obsolescent by 1960. A third factor was that air-to-air missiles were a proximate technology which had not then been incorporated into earlier production designs. The political necessity of such designs will be discussed later.

The decline of bomber production may be more easily explained. It would seem that bombers were in direct competition with missiles for the strategic offensive mission. In August 1957, the Soviets experienced their first fully successful ICBM test. In September, Mya-4 (Bison) production, which had peaked at three per month, began to decrease. During 1958, production averaged only one aircraft per month. Although the production of the Mya-4 resumed at the rate of two per month in 1959, the curtailment of the program is correlated too closely with missile success not to presume some causality. Likewise it is believed that Tu-16 (Badger) production stopped at two of three producer plants in 1958 and ceased altogether in 1959.[36]

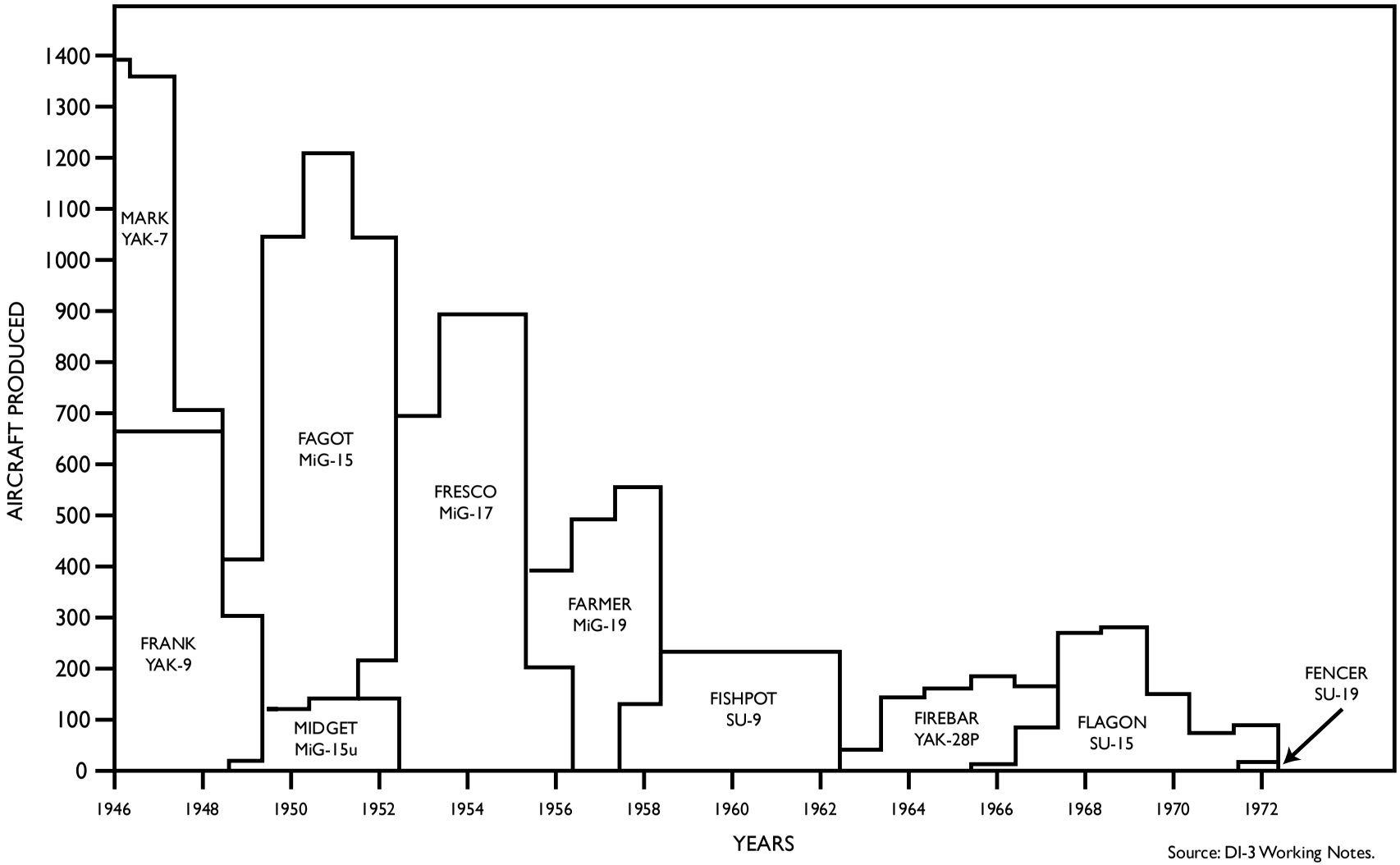
In the mid 1960's, the aviation industry regained its organizational strength. In 1965, subsequent to Khrushchev's deposition, the Sovnarkozy were divested of their functions in aviation production planning and the Ministry of Aviation Industry resumed its traditional authority over the industry. This reorganization, appeared to have such little impact that it might be assumed the system of regional economic councils had had little real effect on aviation production activities. Usefulness of the system was probably limited to assuring the flow of materials to the industry from regional sources. Otherwise the Sovnarkozy represented an additional layer of bureaucracy which ultimately relied on the Gosplan and Ministry of Defense for relevant decisions.

During the 1960's aviation procurement remained stable. Within the overall procurement budget, Ministry of Aviation Industry products consistently occupied between 45 and 50 percent of the overall budget for acquisition of major military systems.[37] This stability is reflected further by a regularization of the source of APVO aircraft. One plant, Novosibirsk 153, provided the majority of PVO aircraft during the decade. Only the Tu-128P, of a size comparable to a bomber, was produced in facilities which accommodated other Tupolev bomber and transport activities. The Su-7 was basically a Frontal Aviation aircraft and the 35 aircraft deployed to PVO were apparently drawn from the tactical force production series. The one apparent deviation from a stable pattern of APVO investment occurs in 1963 as Novosibirsk changed from Su-11 to YAK-28 production.[38]

Even the more recent MiG-25 production is notable for its leisurely pace and lack of impact on the industry.[39] The MiG-25 does depart from the pattern of Novosibirsk production for PVO; it is manufactured at Gorkiy plant 21 which has produced only, Mikoyan aircraft since 1948. Meanwhile, at Novosibirsk, a tactical fighter, the Su-19 (Fencer), has started production to maintain that plant's tie with Sukhoi.[40] Novosibirsk production is detailed in Figure 38.

[36] CIA, ER 60-9, pp. 14–16.
[37] See resource allocation discussion Chapter III.
[38] Figure V-6.
[39] Interview with DIA Aircraft Production Analyst, 21 April 1968.
[40] Figure V-6.

Figure 38—Estimated Production Novosibirsk Plant 153



Source: DI-3 Working Notes.

e. Competition Between Aircraft and Missiles

In the fall of 1957, Khrushchev stated that "Mankind [is] at the threshold of a technological development when fighter and bomber planes [are] relegated to the museums and rockets, against which there is no defense, [take] their place."[41] That same year he said of manned bombers, "You might as well throw them into the fire."[42] a more revealing statement was offered by Marshal Vershinin, in September of 1957:

> Bombers are, of course, still being built. . . . But rocket weapons today make questionable the wisdom of developing bomber forces because the former are more dependable and surer weapons.
>
> From the history of World War II, we know how many bombers returned from their missions and how many failed to reach their target areas. For a rocket to fail to reach the target is practically out of the question. None of the modern anti-aircraft means are effective against these rockets.[43]

Although the competition for a strategic mission affected bomber production, it seems clear that the competition for resources did not. Design and fabrication of offensive missiles took place within the Ministry of Defense Industries. Later in 1964 the Ministry of General Machine Building was established as a separate entity for ballistic missile and spacecraft development and production. Despite the similarity between aircraft and missile production resources there does not seem to have been a significant transfer of people or plants from one activity to the other. Curtailment of bomber production left the aviation industry with surplus resources.[44]

A similar competition for a mission seems to have taken place between missile and aircraft air defense weapons. The clearest statement of the conflict was that of Col. General Gastilovich writing in the first of the classified volumes of Military Thought: ". . . [F]ighter aviation within the system of anti-aircraft defense will become archaic in the near future. It is needed only until anti-aircraft missiles have achieved the necessary technical perfection."[45] A number of self-serving arguments were produced in the context of the classified discussion by representatives of aviation on the one hand and of artillery on the other. The latter were to dominate both the strategic Rocket Forces and the PVO missile units (ZRV) which replaced antiaircraft artillery. Thus a consensus arose on the appropriateness of replacing AAA where the same individuals would assume the more modern mission. Conflict did arise on the appropriateness of deleting the aviators' mission, however. Eventually, a formulation arose in which the air forces embraced the missile and promoted air defense aircraft as a mobile launch platform. ". . . [T]he guided missile weapon of the air-to-air class is acquiring increasing significance and is becoming the main type of weapon of modern fighters."[46]

In the same context, a more blatant, but less successful case was made for the bomber. "As a matter of fact, the mother aircraft becomes the missile carrying aircraft and the commonly used term 'bomber' will obviously disappear with time from our military lexicon and be replaced with the term 'missile-carrier.'"[47]

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[41] FBIS, *Soviet Statement on Antimissile Defense Capability*, RS. 83, 10 February 1957, p. 3. From a ADN news account of East German Embassy Reception 8 October 1957.
[42] CIA, RR 60-9, p. 34.
[43] FBIS, op. cit., p. 2. From Pravda, 8 September 1957.
[44] CIA, RR 60-9, pp. 33–34. Previously ICBM production had been in the Ministry of Defense Industries.
[45] Gastilovich, A. I., "The Theory of Military Art Needs Review" *Military Thought*, Top Secret First Issue, 1960. Also see Chapter III for detailed discussion.
[46] Sinyakov, S. and Kozhernikov, M., "The Air Forces in the New Stage of Development of the New Soviet Armed Forces". *Military Thought*, Top Secret Third Issue, 1960 (CSDB3/649, 109) p. 7.
[47] Ibid., p. 6.

In reality, the classified argument was somewhat a sham. By the time these discussions took place in 1960, Novosibirsk 153 was producing Sukhoi fighters at its peak rate. The associated air-to-air missiles had also been committed to production. Although the Tupolev long-range interceptor, the Tu-128P, may have also been selected for production, a recognition of the need to kill "missile carriers" before the launch of their weapons may have been considered in the eventual commitment to a 1966 deployment of the large Tupolev interceptor. Likewise, SA-2 deployment was underway at its peak rate. The discussion of the relative merits of aircraft versus missiles appears to have been resolved earlier, at least as far as PVO Strany forces were concerned.

As the outcome of competition between fighters and missiles for a mission is less than clear cut, neither is the competition for resources as easily resolved. Both fighters and aerodynamic missiles fell to the Ministry of Aviation Industry for development and production. Some aviation industry personnel, the Lavochkin design team for example, were involved in air defense missile programs. Likewise, some aviation production facilities were converted to surface-to-air missile construction. In some cases missiles and aircraft were produced in the same plant.[48] In face of the 75 percent drop in industry productivity (measured by weight) during the period when missiles were being introduced to quantity production, it appears that aerodynamic missiles may well have been a useful activity with which to absorb the surplus of productive capacity resulting from curtailed aircraft programs. A resource constraint appears unlikely.

The suggestion that considerable slack existed in the aviation industry during the late fifties raises the question of how excess capacity was employed if not applied to missile programs. It seems that a significant portion of the industry turned to the manufacture of consumer goods. Such a tradition was of long standing in the industry. In addressing excess (mobilization) capacity, a textbook on aviation construction states: "All this creates reserve capacity at the aircraft construction plants, which is used in peacetime mainly for the production of a widely varying line of civilian goods."[49] A later text states:

> The achievement of mobility and maneuverability at various levels of production and at various periods of time results in unavoidable reserves of production capacity on the part of the aircraft industry (in terms of production space, plant, equipment, etc.). Therefore, for the total utilization of existing production capacity the aircraft industry produces ship engines, refrigerators, vacuum cleaners, etc., in addition to the output of aviation equipment.[50]

The production of consumer goods appears to have persisted into the 1960's. In 1967, according to Ministry spokesman, plants of the aviation industry produced 411 types of civilian products: Among those were half of the country's total production of vacuum cleaners. Goals for 1968 were for 585,000 vacuums, 300,000 refrigerators, 240,000 washing machines, and 65,000 tape recorders.[51] One of the reasons for this application of resources may be that the skilled manpower pool built up during the huge production runs of the early 1950's may have been one of the few sources that Khrushchev and his successors could turn to for a reasonable quality of consumer production. The result was that toy horses were built on a parallel line to the production line for Il-18 transports.[52]

[48] Interview with DIA Aircraft Production Analyst, 21 April 1968.
[49] Tikhomirov, V. I., op. cit., p. 19.
[50] Andrianov, D. P., et al., op. cit., p. 18.
[51] Gregory, W. H., "Soviet Union Seeks Balance in Technology" *Aviation Week*, 18 March 1968, p. 85.
[52] Ibid.

f. APVO Deployment

1) Quantity Versus Quality

The number of aircraft assigned to strategic defense of the Soviet Union has ranged from a peak of 4,675 aircraft in 1959 to 3,071 in 1972. The decline in numbers should not mask the overall size of the force, it represents a sustained commitment to strategic air defense.[53]

The force has improved in quality throughout the period of declining numbers. Aircraft withdrawn from the force have been replaced with better armed, all-weather aircraft. As an index of quality, the proportion of the force representing an all-weather capability is displayed in Figure 39. The MiG-15 aircraft were phased out in 1964 and thereafter essentially the same rate of attrition was applied to the MiG-17.

The apparent peak in 1959 is a quantitative illusion caused by the reorganization of Soviet Naval Aviation in 1956 and 1957.[54] Prior to that time, designated naval fighters were assigned the PVO function but remained under naval control. Operationally, these aircraft protected the areas of naval facilities and were a segment of PVO perimeter defense. Their actual operations were coordinated by Air Defense Districts and like other APVO units working through subdistrict filter centers. In 1956, these defensive aircraft were subordinated to PVO Strany. The organizational transfer resulted in 500 additional aircraft appearing in the APVO order of battle during 1958 and 1959. In reality, these had been performing the same PVO function prior to the transfer.[55]

2) Defense Priorities

The order of Soviet defense priorities is demonstrated by the deployment pattern of APVO aircraft. Since World War II, Moscow, Leningrad, and Baku have been the most prominent areas of Soviet defense concern. In general, new systems have been deployed to these areas in the stated order. Reference to the deployment of the medium range YAK-28P, Figure 40, indicates the general areas of priority defense.[56] Aircraft with shorter range than the YAK, concentrate in these same areas but somewhat more to the periphery of the country. Figure 41 displays the Tu-128 deployment to illustrate how its long range has been used to cover awkward eastern approaches to Moscow and to cover gaps toward the interior of the country. The Tupolev fighter has also been equipped to work with the Tu-114 (Moss) Airborne Warning and Control System. In effect, the radar-equipped AWACS extends the coverage of ground-based control radars. Activities of the AWACS indicate that it was deployed primarily to provide extended coverage of the Northern ocean approaches to the Western U.S.S.R. In general, these deployment patterns conform to the distribution of population and industrial capacity in the Soviet Union. Defense of peripheral areas with overland approaches, for example the China Border and the Western periphery, is supplemented by interceptor aircraft assigned to tactical air forces. Under the integrating concept of air defense operations, however, these tactical aviation aircraft would be under operational control of PVO Strany in the event of an attack on the U.S.S.R.

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[53] Figure V-7.
[54] CIA, *National Intelligence Survey, Volume 26, Section 83*, April 1961.
[55] See Book I, Vol. I, Chap. III of earlier draft for PVO Command Relationships.
[56] See "U.S.S.R.'s Best-Defended Areas," *Air Intelligence Digest*, April 1957, pp. 21–25.

Figure 39—Estimated APV0 Aircraft

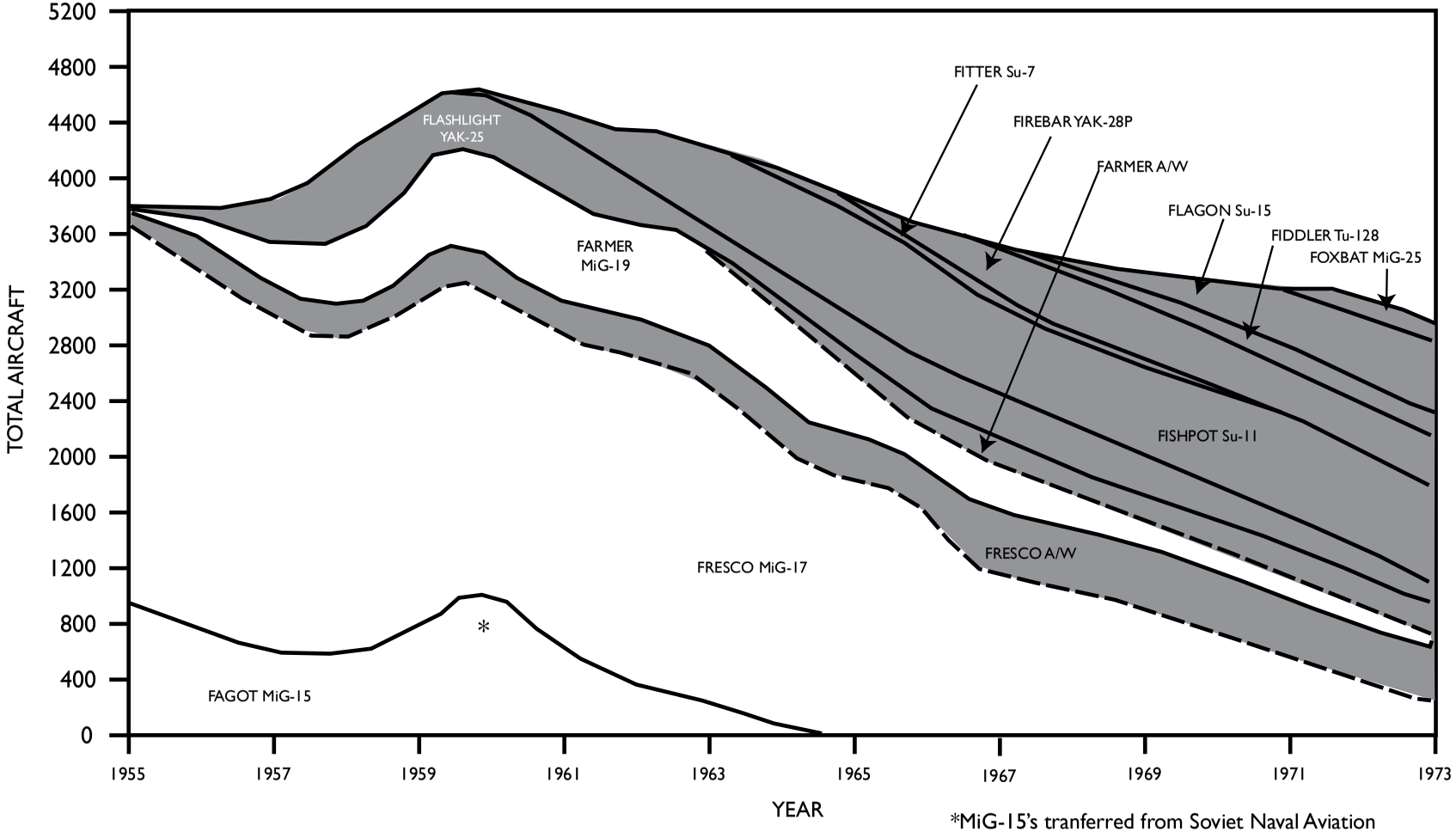
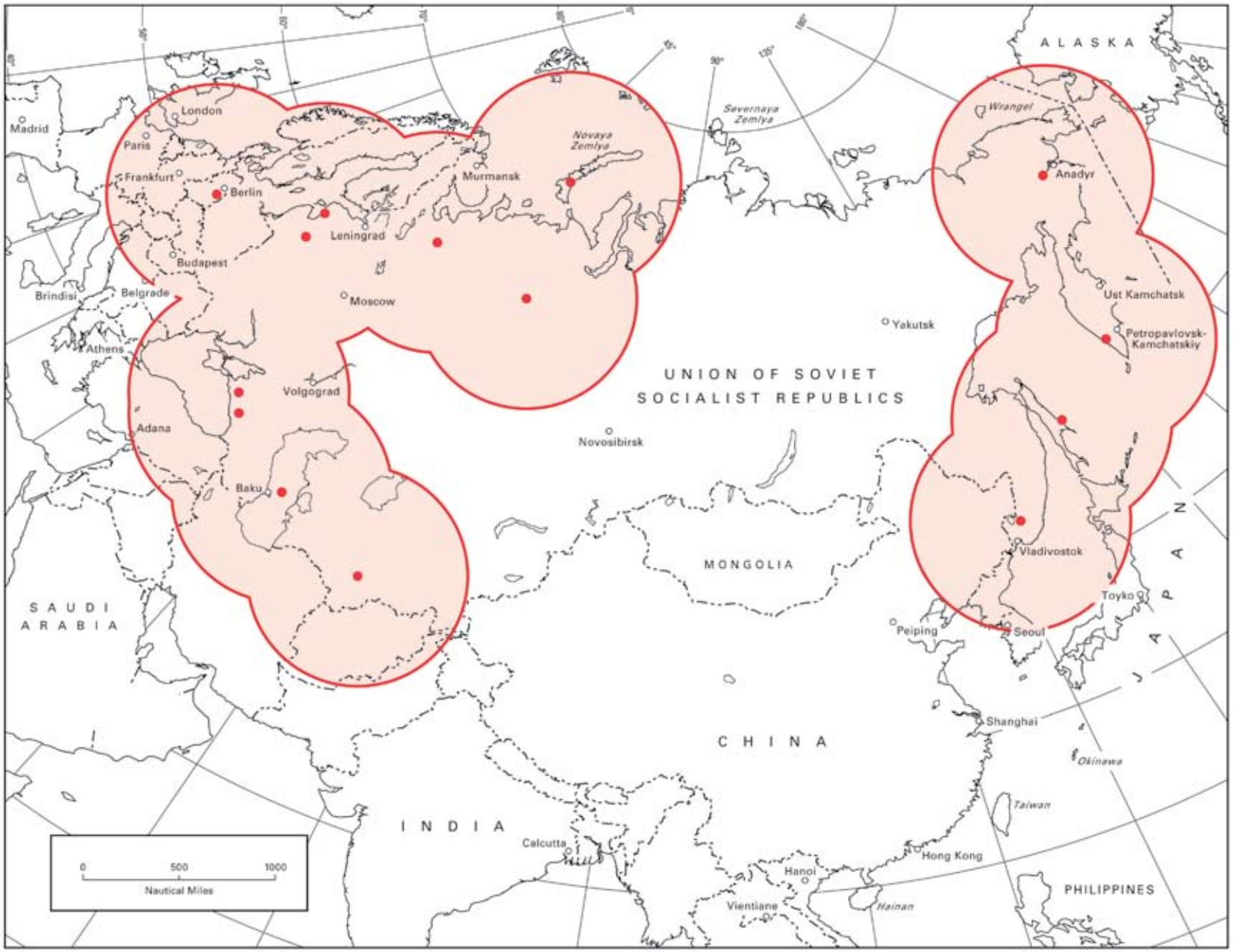
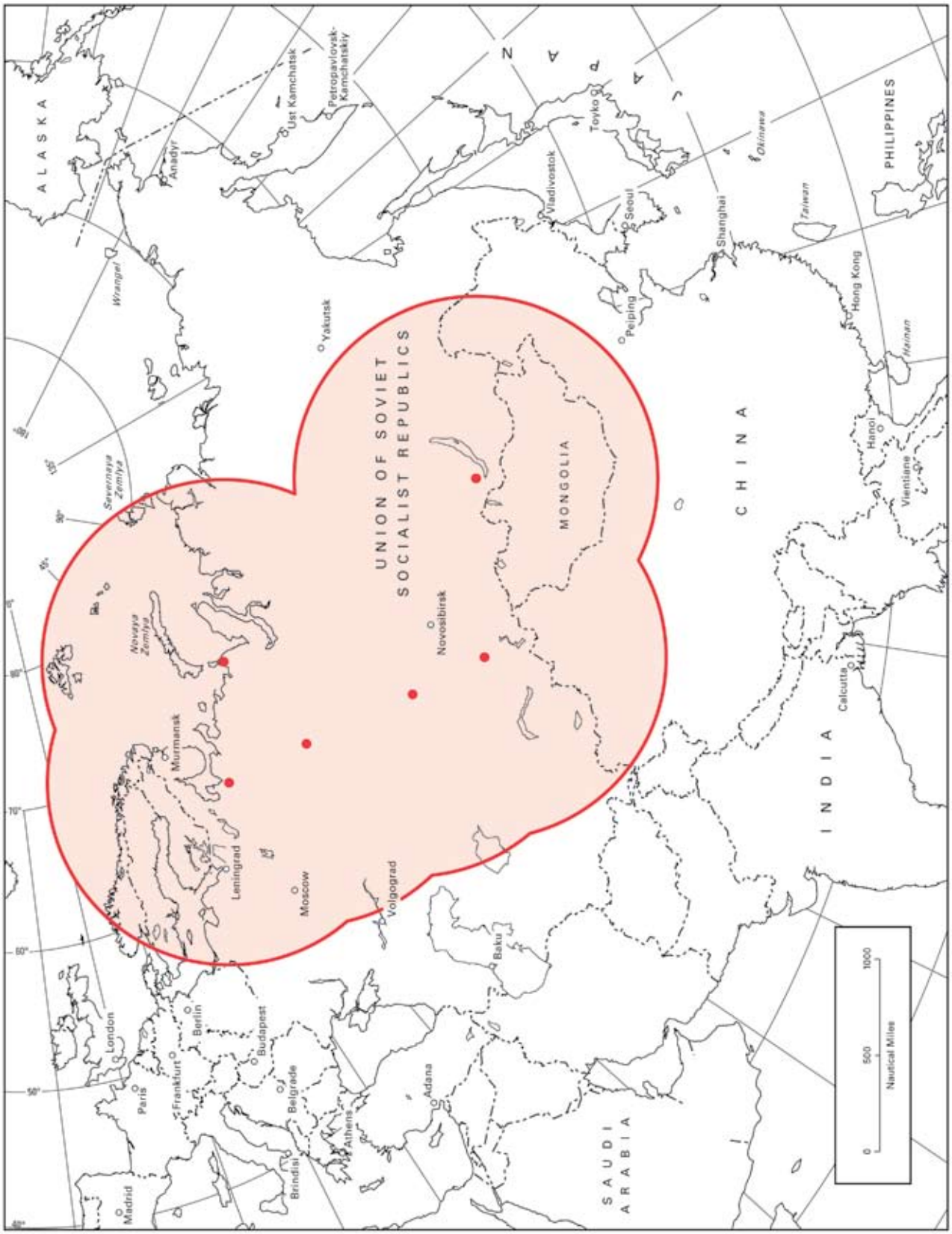


Figure 40—YAK-28P (Firebar) Deployment



Note: GDR deployment is detached to Frontal Aviation PVO.

Figure 41—Tu-128P (Fiddler) Deployment



A comparison of the geography of more recent deployments with a late-1956 deployment indicates a shift of PVO resources to the north. The more recent YAK-28P basings near Murmansk and on Novaya Zemlya are an example. Again understanding of the deployment pattern is complicated by the transfer of Soviet Naval Aviation aircraft. In 1956, defense of the Murmansk and Chukotsk Peninsula areas was the responsibility of naval interceptor forces, but with short-range aircraft.

A 1965 deployment, Figure 42 demonstrates a pattern similar to that of 1972. The exception is that a greater number of short-range aircraft supplemented coverage along the Trans-Siberian Railroad and the Kurile Islands—areas covered by the Tu-128P and the YAK-28P in 1972.

2. Systems of Anti-Aircraft Defense Missile Troops (ZRV)

The patterns of design, development, and deployment of surface-to-air missile systems show a striking similarity to patterns which apply to APVO fighter systems. The sources of similarity are evident in the fact that development and production of both aerodynamic missiles and aircraft are the responsibility of the Ministry of Aviation Industry. Likewise, early development of SAMs appears to have been directed by a design bureau, Lavochkin's, previously devoted to fighter development efforts. Deployment similarities result from the administration of both SAMs and fighter aircraft by PVO Strany as well as from tactical necessity.

The following sections outline the evolution of SAM systems and the pattern of design, production, and deployment processes.

a. Surface-to-Air Missile Design

The design of Soviet surface-to-air missiles has followed an orderly evolutionary pattern. Unlike the design of aircraft, a pattern of competitive design activities and multiple prototypes is not apparent. There is, however, the same separation of research and development activities from production that exists elsewhere in the Soviet aviation industry. In the early 1950's, prior to the repatriation of German technicians who assisted in the exploitation of World War II systems, it is apparent that Semyon Lavochkin transferred from fighter design activities to the support of the SAM program. Likewise, a set of reactive engine designers evolved from within the group of aircraft engine design activities to work with the missile groups. Two other design bureaus associated with V.N. Chelomey and P. D. Grushin came to support the aerodynamic missile design effort. Lavochkin's OKB is credited with the design of the SA-1 and SA-2 while Grushin's has been associated with ABM development. Chelomey, on the other hand, seems not to have been involved in defensive missile work.[57]

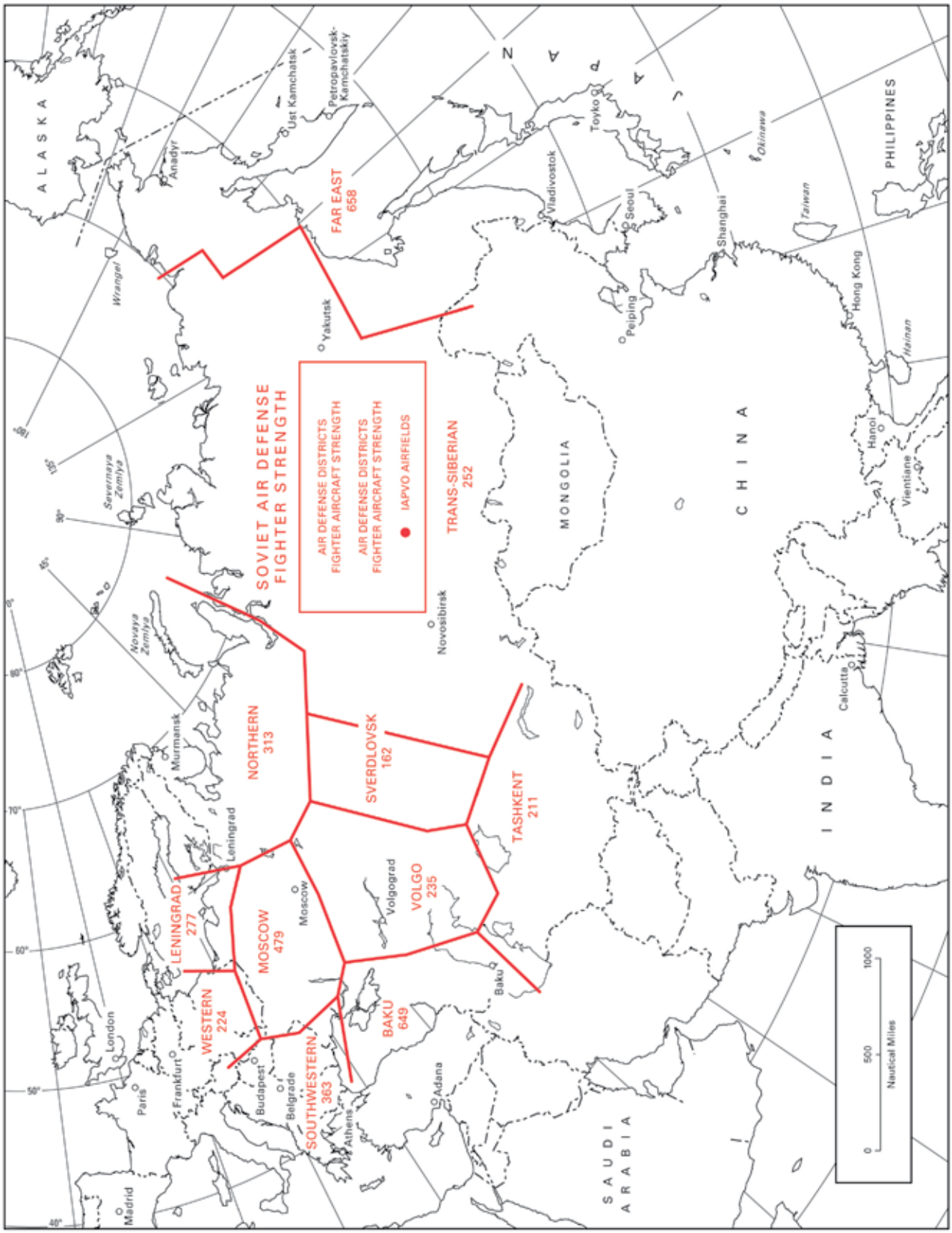
Among recent estimates of R&D expenditures, aerodynamic missiles represent about 24 percent of the aviation industry effort. The rate of growth over the decade of the 1960's was large in comparison with aircraft R&D, however. The three missile design activities grew at the estimated rate of 13 percent annually while airframe, engine, and testing activities expanded at about half that rate.

b. Surface-to-Air Missile Systems

The development of Soviet missiles for defense against strategic aircraft followed an orderly pattern between 1950 and 1960. Since 1960, attention has shifted to air defense missiles which support PVO

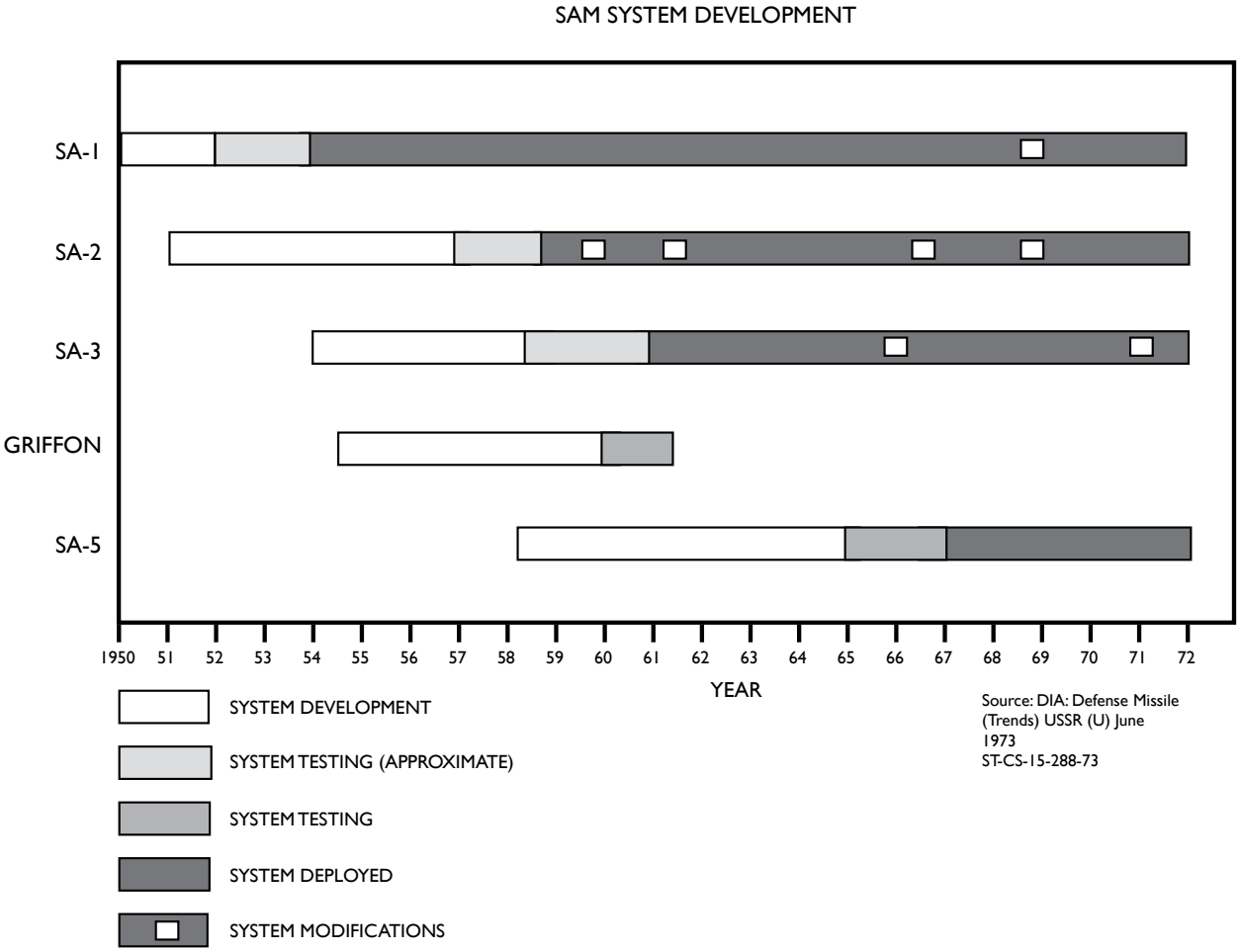
[57] DIA, *Soviet R&D Expenditures in the Ministry of Aviation Industry*, DI-450-2-6-INT, p. 5. FTD-CW-01-05-75 also mentions a Babakin design bureau.

Figure 42—APVO 1965 Deployment



Voysk—those on mobile carriers and hand-held weapons. Four air defense missile systems serve PVO Strany. The SA-1 system around Moscow (discussed in the previous draft report), the SA-2 system for high level point defense, the SA-3 low-level system, and the SA-5 high altitude, area defense SAM. Another area defense system nicknamed the Griffon was, developed during the late fifties, but was abandoned in 1964. The development chronology of these weapons is displayed in Figure 43.

Figure 43—Strategic Defensive Missile Development Cycles



1) SA-1 Guild

The SA-1 system had a capability for engaging large formation of aircraft up to 60,000 feet. The system was, however, limited by its high cost, fixed positions, and limited (54^{02} per site) sector coverage. Moreover, its extensive fixed installations and its vulnerability to ECM rendered it unsuitable for widespread deployment during the late fifties. Despite the fact that deployment of the SA-1 was limited to Moscow, the program was an enormous one. Some 3,624 launchers were emplaced around Moscow in 56 sites. It has been

estimated that, for each launcher, four missiles provided a reload capability. Thus, some 14,000 missiles were involved in the production program. With such a large sunk cost, it is understandable that the Soviets were reluctant to abandon the system. It is believed that the system was modified as recently as 1969 to improve its capabilities to engage aircraft at speeds up to Mach 2.[58]

2) SA-2 Guideline

Development of the SA-2 system began in 1951 with application of the technology used in the SA-1 associated with a solid-fuel booster engine. Elements of the system were to be moveable. A full SA-2 firing unit consists of a Fan Song guidance radar, six individual missile launchers for Guideline missiles and related support equipment housed in seven wheeled vans. The guidance system was modified four times during the 1960's. Modifications have improved accuracy, range, electronic counter-countermeasures (ECCM) and low altitude capabilities. Recent modifications include an optical tracking device and moving target indicator circuitry both of which improve low-level capabilities, reportedly down to 300 feet under optimum circumstances. Five modifications to the Guideline missile have increased its range and its maneuverability against high-speed targets. The most modern SA-2 variant can engage small targets (1 meter^2 radar cross section) at speeds up to Mach 3 to an altitude of 90,000 feet. While the range of this system is up to 27 nm, range against low-level targets is limited by terrain features and the curvature of the earth.[59]

The SA-2 was first operational in 1958 with major modifications being fielded in 1959, 1960, 1962, and 1968. Limitations in the maneuverability of the earlier versions of the Guideline missile indicate that it was initially designed for defense against a high-altitude sub-sonic threat.[60]

3) The SA-3—Goa

The SA-3 was specifically designed for improved operation against low-level attack. Included in its basic design is moving target indicator (MTI) circuitry which suppresses the effect of ground clutter on the tracking radar. There is also a special low-level tracking mode that is not yet fully understood.[61] A 1971 modification of the system added a television system to facilitate tracking during jamming or to avoid attacks by anti-radiation missiles.

A SA-3 firing unit consists of four launch positions each containing a dual launcher, a fire control radar nicknamed Low Blow, a control van, three support vans, and eight missile transporters. An early-warning and target acquisition radar is located outside the launch area. The system is capable of operating between 300 and 55,000 feet in altitude and from 3 to 12 nm in ground range from the site. Intercepts between maximum and minimum values are a function of target altitude and speed while the MTI, if required, degrades performance within this envelope.[62]

Work on the SA-3, and thus a theoretical appreciation for the necessity of defense against low-level attacks, began as early as 1954. Possible testing was detected in 1958 and the initial deployment began in

[58] Ibid., pp. 48–49.
[59] DIA, *Electronics (Surface-to-Air Associated)-ECC*, Vol. I, ST-HB-05-008-74, September 1974, pp. II-1–II-4.
[60] Ibid., p. II–15.
[61] Ibid., p. II–9.
[62] Ibid., p. II–24.

1961. An initial deployment of 100 sites was completed in 1964. Further deployments did not follow until 1967.[63]

4) The Griffon

Soviet writings have emphasized zonal defense missiles as a complement to missile defense of points. Although evidence to this effect dates from 1960, the emphasis is a rational outgrowth of the doctrine of "air defense operations" that evolved during the formation of PVO Strany.

It is believed that work on a long-range defense missile, nick-named Griffon, began in the mid-1950's. In 1960 or 1961, construction work was begun on three defensive missile sites around Leningrad. However this construction work ceased in 1961 or 1962, and further work on the system appears to have been abandoned. In 1964, however, new construction was observed around the Estonian city of Tallinn.[64]

For some time, it was believed that the reason for abandoning the Leningrad system was that it was intended as a dual capable SAM/ABM and that changes in the program related to its lack of capability against a more sophisticated threat as represented by the faster reentry speeds of Minuteman missiles then coming into the U.S. inventory. An extension of this argument is that the Tallinn deployment represented a satisfactory solution to whatever problems may have been encountered with the dual capable system.

More recently, another line of argument has been used to explain the cancellation of Griffon. During the period 1957 to 1961, data on the British Bloodhound long-range air defense system became available to the Soviets through their espionage activities. Existing evidence about the SA-5 Soviet long-range SAM suggests that a number of features of the Bloodhound were incorporated into the SA-5 system which amended the trend of Soviet missile design philosophy. Thus, an explanation of the Griffon cancellation derives from a major redesign which incorporated the British technology.[65] This second argument becomes more likely as more is known about the SA-5.

5) The SA-5 Gammon

The Tallinn construction continued to completion and an initial operational capability for the SA-5 was achieved in 1967. The system consists of the Gammon missile, the Square Pair tracking radar, and the Back Net and Side Net radars used for warning and acquisition. The system is currently estimated to have a range capability of 105 miles and an altitude capability up to 100,000 feet. Although detailed knowledge of SA-5 maneuver capabilities is unavailable, it is assessed to have a capability against high altitude, high speed aerodynamic threats including air-to-surface missiles—specifically the Hound Dog in its high-level profile.

As an ABM, the SA-5 has some residual capability, a point continuously stressed by U.S. Air Force Intelligence. Because the missile is of aerodynamic design, however, it loses its ability to maneuver during terminal stages of an ICBM intercept at high attitude. Thus, the missile has to be accurately aimed at a point in space during early stages of its trajectory. As currently constituted the SA-5 radars and computational equipment are not capable of performing the requisite aiming task. The argument continues that such radars

[63] Ibid., pp. II–22–II–24.
[64] AF/INAP Working Papers, CIA Working Papers.
[65] DIA, *Defensive Missile System (Trends) U.S.S.R.*, June 1973, ST-CS-15-288-73, p. 15.

associated with ABM terminal guidance could be added in a "SA-5 upgrade" program, or that the SA-5 could be linked to existing facilities which support the Moscow ABM system. A counter-argument is that existing ABM tracking radars communication and computational procedures would be saturated by such a requirement. On the other hand, proliferation of such supporting systems would be easily observed. Thus, an argument about covert "upgrade" became significant among SALT verification issues.[66]

During the SALT negotiations, the Soviets were made aware of U.S. concerns about possible improvements in the Tallinn system. They took some pain to explain the limitation of the system in terms which agreed with U.S. intelligence about its design and capabilities.[67] Within the context of the ABM treaty, the divergent views about SA-5 resulted in the following provision:

> Article VI
>
> To enhance assurance of the effectiveness of the limitations on ABM systems and their components provided by this Treaty each Party undertakes:
>
> (a) not to give missiles, launchers, or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and not to test them in an ABM mode; and
>
> (b) not to deploy in the future radars for early warning of strategic ballistic missile attack except at location along the periphery of its national territory and oriented outward.

c. Surface-to-Air Missile Deployments

1) Cycle of Deployments

The cycle of SAM deployments can be described in four periods:

(1) The defense of Moscow—1953–1956
(2) High altitude defense—1959–1964
(3) Low-level defense—1961–1964
(4) Long-range defense—1966–
(5) Additional low-level defense—1967–

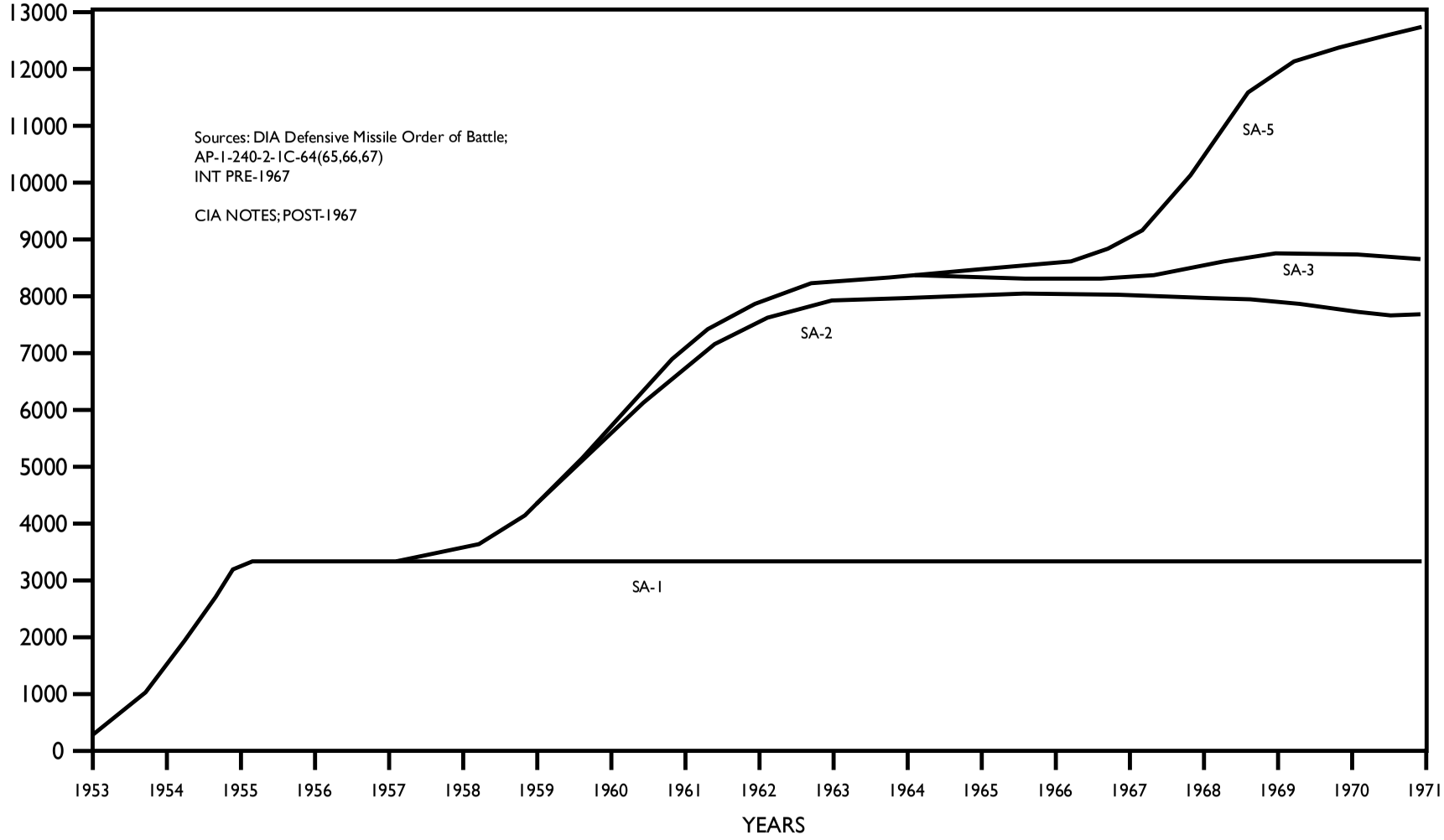
The magnitude of these deployments is illustrated in Figure 44. The break in deployment of the SA-3 system is sometimes related to a reemphasis on low-level defense following the 1967 Middle East War.[68]

2) Deployment Pattern

The SA-2 is the most widely deployed Soviet surface-to-air missile system. It provides high-altitude terminal defense for most of the important targets in the Soviet Union.[69] Both SA-2's and SA-3's are deployed as point and perimeter defenses. Gaps between complexes on the periphery of the U.S.S.R. are filled in by SA-2 sites which appear to be unrelated to specific targets. "Barriers" of SA-3's have been deployed along the Baltic seacoast, a portion of the Soviet-Polish border, and in areas along the Black Sea. About 10 percent of the SA-2 and SA-3 deployments appear to be related to such perimeter defenses. In general, SAM deployments are related to the general pattern of population and the distribution of industry in the coun-

[66] Ibid.
[67] Interview with CIA Surface-to-Air Missile Analyst, 3 May 1975.
[68] Ibid.
[69] AF/INAP Working Papers.

Figure 44—Soviet Strategic Defensive Missile Launcher Deployment



try. Military installations and military-industrial facilities are similarly distributed. The pattern of defense seems to reveal a national program which has not been altered by arbitrary assignment to Military or Air Defense Districts.[70]

In addition to the deployment of operational sites there appears to have been a program for the construction of dummy sites applied to PVO units. Although there are a number of legitimate training and redeployment sites most of the dummy sites, because of poor construction, appear unsuitable for operational equipment. Almost all such dummy sites, numbering in the hundreds, are located within the vicinity of an operational installation.

3) Effects of Surface-to-Air Missiles

While the USAF developed low-level penetration tactics prior to the deployment of the SA-2, one of the effects of widespread deployment has been to assure that such tactics were adopted. Because extended low-level flight increases fuel consumption, the potential effectiveness of the SA-2 became one of a number of factors in determining the eventual size of the U.S. tanker aircraft fleet which in 1972 numbered 660 aircraft.[71]

The extent of SAM deployment poses a potential problem for PVO Strany. Soviet doctrine calls for coordinating SAM and fighter defenses by zones of operations, by designating corridors for fighter movement and by time intervals.[72] Within the western U.S.S.R., however, there are few large areas which are not within SAM coverage. Therefore, SAM operations must be closely coordinated with fighter operations. Although early Soviet literature spoke of ground operators observing fighters break off the attack on SAM radars, such a system poses certain dangers to the fighter force.[73] That such problems existed was observed during U-2 operations when SAM's were believed to have brought down at least one of the fighters attempting intercepts.[74]

3. ABM Systems

a. System Evolution

Much of the confusion about SA-5 capabilities can be attributed to the parallel timing of the Soviet program of ABM development, to the Soviet's manipulative public pronouncements of a vague capability, and to a common location of SA-5 and ABM development testing.

The program of Soviet ABM development is thought to have began in the early fifties. Intimations of early efforts were made by Khrushchev in 1961. In an interview with Sulzberger of the New York Times he stated "at the same time we told our scientists and engineers to develop intercontinental rockets, we told another group to work out means to combat such rockets."[75] The early stages of ABM development were not without notice and some hesitation among the Soviet technical elite. As early as 1956, before the announcement of a successful Soviet ICBM, the prominent Soviet physicist Peter Kapitsa argued against

[70] Ibid.
[71] Interview with CIA Surface-to-Air Missile Analyst, 3 May 1975.
[72] Refer to U.S. Air Force submission for a detailed exposition of tanker fleet decisions and the effect of the SA-2.
[73] Resnichenko, V. D., *Tactics (The Officers Library)* (FTD Trans.), p. 128.
[74] Miranov, S., "Several Questions on Evaluating the Effectiveness of the Basic Means of Antiair Defense of a Front. . . .," *Military Thought*, Top Secret First Issue, 1961.
[75] "Flaws in U.S.S.R.'s Air Defenses Highlighted by U-2 Incident," *Defense Intelligence Digest*, December 1964, p. 5.

the development of an ABM on the grounds of cost and the destabilizing influence such a system would have on international relations. In his words: "If countries which are disposed to conduct their foreign policy from positions of strength are the first to discover an effective means of defense against nuclear weapons, they may forget any pledges they may have given. They may either launch atomic war or, at any rate, utilize their advantage to impose their will upon other countries."[76]

Technical evidence on early ABM development is marked by the closing of the area of the Sary Shagan Missile Test Range to foreign travelers in 1953. Such security precautions indicated development of facilities but they also reduced the information available on early testing activities. In 1957, a number of firings into the test range from the Kapustin Yar Missile Test Center indicated a program unrelated to the ICBM program which was nearing fruition in full-range testing at the time. The distance from Kapustin Yar, 1,100 miles, indicated either further study of IRBM reentry characteristics or ABM development research.[77] In April 1960, a clear picture, literally, emerged of the Sary Shagan facilities.[78] Two enormous radars (498 ft. and 918 ft. long) associated with ballistic early warning and acquisition functions were identified as externally complete. Moreover, construction was noted at what later proved to be two R&D launch facilities. The early warning radar, however, did not become operational until October 1962.[79]

During the period from 1962–1967, construction was observed at eight launch sites around Moscow; but construction on four of these was halted by 1967. By 4 March 1967 two early warning radars were operational and in 1968 another radar (Dog House), capable of ICBM tracking functions, became operational.

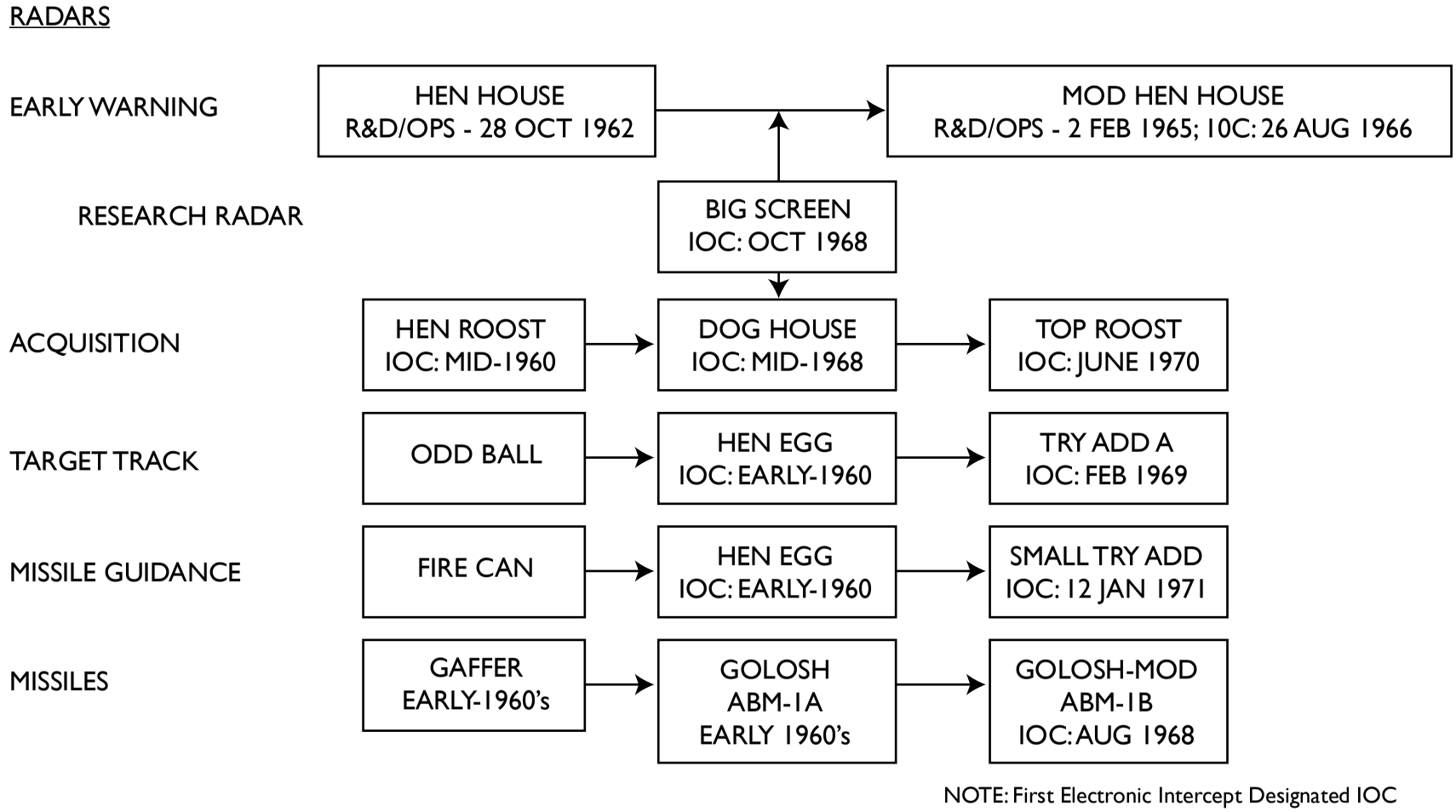
From August of 1968 to September of 1973 there were 31 recorded development tests of an ABM system at Sary Shagan. Of these, 10 involved the intercept of live targets and 9 involved the launch of two defense missiles. Although some testing of the Griffon and SA-5 in an ABM role may have occurred, the only operational ABM in the Moscow system.[80] A chronology of various elements of the Soviet ABM is described in Figure 45.

Although detailed studies of ABM tests have evolved a well-documented impression of the capabilities and of alternative firing doctrines for the Moscow ABM,[81] the outstanding fact is that it is numbers limited. With 64 launchers and four or five guidance complexes (one may be inactive) 69 reliable weapons exhaust and destroy operational elements of the system. While uncertainty exists about a possible reload capability, even most conservative offensive doctrine finds the impact of the system relatively small in the context of a reasonably-timed mass attack. While this discussion does injustice to the uncertainties involved in suppressing the Moscow ABM in a retaliatory attack, the system can be negated with a manageable number of weapons (in the realm of 100). The rationale of coping with the Moscow ABM did affect U.S. offensive planning and decisions to deploy numerous U.S. multiple-reentry vehicles, sophisticated warheads, decoys, and chaff systems. These effects will be addressed within the offensive forces section of this study effort.

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[76] FBIS, RS 83, p. 8.
[77] Ibid., p. 2. From *New Times* 39, September 1956.
[78] "A Soviet Anti-ICBM System. . . ?", *Air Intelligence Digest*, August 1960, pp. 4–5.
[79] *DIA, Electronics Associated with Antiballistic Missiles and Anti-satellite Systems—U.S.S.R.*, ST-CS-05-239-747 December 1973, p. 4.
[80] Ibid., p. 5.
[81] DIA, *The Moscow ABM System*, ST-CS-02-68-INT, July 1968, p. 7. Note: Material on predecessor systems requested 2 April 1975 has yet to be received for inclusion in this report. Ref. DIA Documents ST-CS-15-01-66 and ST-CS-15-02-66.

Figure 45—Moscow ABM Evolution



Source: DIA: Defensive Missile Systems (Trends) U.S.S.R., June 1973, p. 20.

b. The Non-Decision to Deploy the Moscow ABM

The process of developing the Moscow ABM was set in motion in the mid-1950's, certainly before the 1957 firings into Sary Shagan. A useful landmark (unavailable at this writing) would be the date of designation of the "General Designer"—probably P. D. Grushin. Within the Soviet R&D system, such a process implied a commitment to a working prototype and, usually, to pre-series production. In a system, where, relative to the U.S., the development process in highly independent of "customer," political, and, in particular, public review, the development program obtained its own momentum. Thus, the decision process reversed; a non-decision allowed the process to continue to a token deployment.

There is little evidence to support the opinion that a closer review of the program would have resulted in the process being stopped anyway. First the higher levels of review were by their nature sympathetic to the technological impetus of the program. About 50 percent of the membership of the Politburo and 75 percent of the Council of Ministers have technical backgrounds.[82] Further, the ABM program, in its very early stages became a symbol of strategic prowess at psychologically useful intervals—following the U-2 incident, during American debates over strategic policy and with foreign audiences.[83] Thus the ultimate reviewer, Khrushchev, committed his prestige to the program. The momentum of the program was not impeded.

There was evidently some resistance to the program, however, as represented by the Kapitsa statement of 1956. Likewise Marshal Chuykov in his 1966 role as leader of the Soviet civil defense effort acknowledged the impossibility of a "complete guarantee."[84] Such sources of resistance, though, were not in a channel where an ABM "stop" decision would be made.

Among the Soviet military, there was a theoretical appreciation of the techniques for overcoming an ABM. Such a general impression dates at least back to a widely disseminated review of American ABM development efforts published in 1962.[85] Practical appreciation of the difficulties was also apparent in the numerous modifications to developing ABM radars and in the Soviets own program to produce a MRV warhead for the SS-9.

In the chronology of the Moscow ABM there appears to be one stop decision—the halting of construction on four sites to the South of Moscow in 1966 or 1967. This partial step may have represented an attempt to influence the impending U.S. decisions to test MIRVs. Likewise, it may have been associated with a technical fix which allowed the system to defend against Mediterranean-launched SLBMs. The signal, if it was a signal, was too late. The system's development had created a "capability" and American development of an improved offense had justification.

On the whole, the process of developing the Moscow ABM appears to have been little influenced by considerations of the American response or by the thought that the system might be "destabilizing." During critical stages of American decisions relating to offensive force structure, the ABM was treated as a development "problem." Khrushchev's handling of information about the development had the effect of increasing uncertainty and created a perception of a greater capability than really existed. The circumstances of such statements and the silence that reigned after 1966 are evidence that their calculated effect had more proximate goals than long range strategic relationships with the U.S.[86]

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[82] FTD, FTD-CW-01-05-74, page unnumbered.
[83] See discussion Chapter III and FBIS, RS 83, passim.
[84] Ibid., p. 54. From TASS interview in Sovetskaya Moldaviya, 28 October 1966.
[85] Podgornyy, I., "The Fundamentals of Antimissile Defense," *Military Thought*, Top Secret First Issue, 1962.
[86] FBIS, *Soviet Statements on Antimissile Capability*, 1969 to date, RS 299, 13 March 1970, RS 93, 31 January 1969, RS 303, 22 January 1971.

In the end, the Moscow ABM system appears to have been overwhelmed by technology and shear numbers. During the period that the system was under construction from 1962 to 1967, the U.S. deployed in the realm of 1,000 warheads against which the Moscow system had marginal capabilities. By 1968, U.S. systems were in testing that could carry 3 to 14 effective warheads each. Two years after the Moscow ABM system was operational, U.S. systems were committed to deployment which against a Soviet planner's conservative estimate of future capability (meaning a high U.S. capability) promised up to 26,000 objects entering defense. The Moscow ABM while it might reduce an attack by up to 100 warheads had played some role in increasing the potential threat by nearly 11,000 weapons.[87]

4. Systems of the Radiotechnical Troops (RTV)

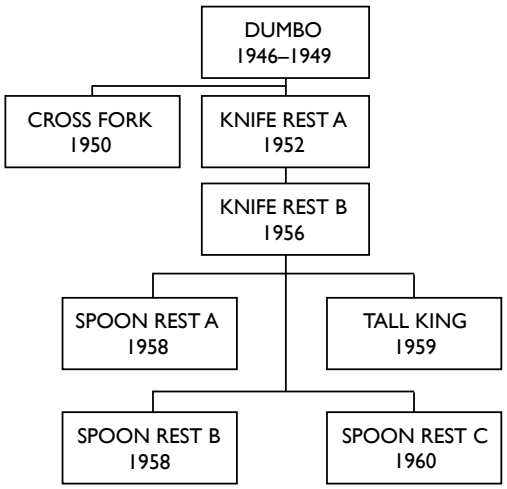
a. Introduction

The Soviets during the first ten years of the post-war period were concerned with development and deployment of an operational radar system. For the most part, supporting radar designs were derived from information gained through lend-lease, the capture of foreign systems and from German assistance. There appeared little overall structure to Soviet radar development during the first post-war decade. However, when the 1945–1955 period is considered in conjunction with the 1956–1972 period, four basic families of air control and warning can be delineated.

These four families (Metric Radars, Ground Controlled Intercept Radars, Height Finders, and Modern Acquisitioned/Early Warning) provide a basic structure for the following section. In order to illustrate the genealogy of the families, radar systems developed and deployed prior to 1955 will also be contained in the section. Further, not all Soviet radars will be contained in these four groupings, but the main trends will be portrayed. The discussion of these four families will be basically fact with Sections f and g concerning themselves with an overview.

b. Metric Radars

Metric Radars[88] (Early ACQ/EW)



[87] Based on maximum (and mutually exclusive) loadings of penaids and warheads in Titan, Minuteman, and Polaris launchers. Uses conservative assumption of all Minuteman launchers being Minuteman III and all Polaris launchers being Poseidon. Relevant maximum loadings, range and operational readiness factors excluded, would be 25,940 warheads and penaids or 10,528 warheads. See U.S. Air Force and U.S. Navy submissions for detailed loadings constrained by launcher and SLBM configurations.
[88] DIA, *Defensive Missile Systems (Trends) U.S.S.R.*, ST-CS-15-288-73, DIA, Task No. T72-15-02, June 1973 p. 23.

The first family is that of the post war acquisition and early warning group or metric radars. This family was made up of relatively simple instruments characterized by metric frequency, Yagi antennas, gonimetric techniques and nearly identical transmitters giving range, azimuth, and a crude altitude capability. During the middle to latter phases of this family, limited anti-jamming capabilities began to emerge.[89]

1) Dumbo

The P-1, developed prior to World War II, and the P-2 radar, developed late in World War II were the forerunners of the P-3 or Dumbo radar. This radar proved to be the mainstay of the Soviet early warning defensive system prior to 1951. The design of the Dumbo radars was derived, to a large extent, from the publication of the MIT Radiation-Laboratory series of books as were a number of other Soviet radars.[90]

Dumbo was designed for stationary installation and although during its deployment Dumbo was considered obsolete by U.S. standards, it represented an important capability when deployed in great numbers and well forward of the area to be defended. The Dumbo radar, when situated on a high ground, gave improved low altitude coverage, but was also more vulnerable to attack.[91] Rough height-finding capabilities were possibly attained through main-lock switching. While the secondary arrays, believed to be used for receiving, may have provided a facility for better directional fixing.

2) Cross Fork

Cross Fork, designated an acquisition radar, was usually situated with a fire control radar, Whiff, at an AA battery site. Cross Fork was either a British AAMK3 or a Soviet copy of it. Cross Fork operated on a different frequency from that of Whiff thus benefiting simultaneous operation. Cross Fork had good range capabilities, far greater than that of Whiff, but its resolution was much too poor for gun laying purposes.[92]

3) Knife Rest

The Knife Rest radar is one of the oldest in the Soviet early warning inventory and although it had limited accuracy and detection capabilities, Knife Rest was inexpensive and easy to maintain. Knife Rest A, first assembled in 1952, operated in the 70–80 frequency range and Knife Rests B and C, observed in 1956, operated in the 85–88 MHz frequency range. Knife Rest C differed from B only in the height of the antenna mast. The Knife Rest radar has been maintained as an effective gap filler in the Soviet EW system.

Knife Rest B was introduced as a highly mobile version of the A model. The antenna was mounted on a 33 foot mast atop a ZIL 151 van. While it never provided high performance, Knife Rest B became a work horse (heavily deployed) in the Soviet EW/GCI systems and also proved to be an effective gap filler.[93]

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[89] Ibid., p. 22.
[90] Air Force/INAP, Working Papers, 31 October 1973.
[91] Round-up of Red Radars, *Air Intelligence Digest*, August 1954, pp. 20–32.
[92] Six Typical Red Radar Stations, *Air Intelligence Digest*, July 1955 p. 24.
[93] OSD Historians Office, History of Strategic Arms Competition (1945–1972) Chronology U.S.S.R., Vol. III, December 1974.

4) Spoon Rest

Spoon Rest as nicknamed by Westerners was first observed in April 1958. Spoon Rest was widely deployed in the Soviet Bloc and although first believed to have been a component of the SA-2 (Guideline) surface-to-air missile system it was later found to be used independently as an early warning and acquisition radar for conventional antiaircraft defense.[94] The antenna was a six-bay, two-stack arrangement of 12 horizontal Yagi arrays. Each array was comprised of a rectangular reflector, an active element, and four directors. The complete array was approximately 41 feet long and 11 feet high. Spoon Rest, operating in the 155 to 157 megahertz range, provided additional frequency diversity for the Soviet air defense system. Spoon Rest was effective to 110 NM range and 50,000 feet altitude.

The A version of Spoon Rest was the first version observed. The construction of Spoon Rest A was simple but the system was widely deployed as the VHF radar afforded a high degree of probability in detecting targets. Mast extension sections were available for use when greater antenna height was required.

A later model, Spoon Rest B, was also widely deployed. This radar was believed to have been ready for deployment in 1958. The Spoon Rest radars had limited ECCM circuitry but continuous efforts were made to improve ECCM capabilities and overall performance.[95] Spoon Rest C illustrates this as the C version provided higher frequency and more sophistication than its predecessors.

5) Tall King

Tall King was a permanently mounted, high powered early warning radar introduced in 1959 for use against high performance, high altitude aircraft, specifically in answer to the high altitude U-2 threat.[96] Since Tall King was primarily used as a high altitude, long range initial detection radar and would turn its targets over to conventional GCI radars as the threat comes within GCI range, there appeared to be no need for an altitude-determining facility to be used with Tall King. Continued interest in high altitude aircraft by both the West and the Soviets resulted in a reconsideration of the last point and Side Net (HF) was synchronized with Tall King.

Rapid deployment of this radar was observed as Tall King was considered the most important new Soviet radar. It was a very large VHF radar and operated in the ranges of 162 to 175 megacycles per second. This radar used a huge lightweight parabolic reflector measuring about 115 feet by 41 feet with heating wires for deicing. Icing has been found to be a serious problem on some of the older Soviet radar antennas. The antenna was supported by a tall mast which extended above the reflector. The feed was composed of a pair of horizontal cylindrical dipoles with parabolic cylindrical reflectors behind them.

Tall King, believed to have been high powered, was probably the longest range operational Soviet air-defense radar.[97] Tall King had a unique mechanical design in that the antenna was mounted on a high rotating tower like structure that rested on a pedestal bearing located about 20 feet above the ground. The top of the structure extended above the antenna to a height of about 80 feet above the ground. A bearing at the top of the antenna tower was supported by six guy wires. Although most Soviet radars have been mobile, Tall King because of its size, was designed for fixed sites.

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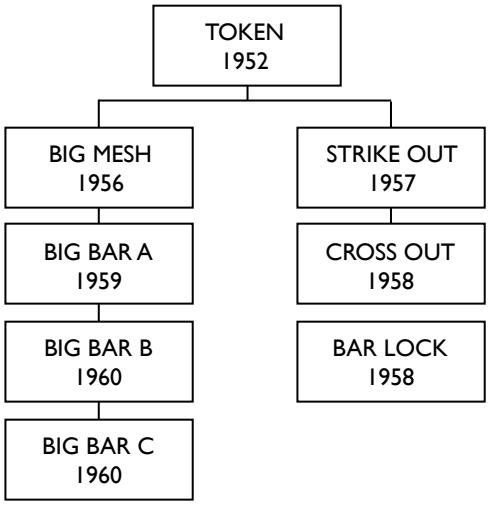
[94] OSI, Soviet Advanced Radar Techniques Applicable to Ground Radar, 24 October 1963, OSI, RS/62-29
[95] AF/INAP Working Papers.
[96] OSD Historians Office, History of Strategic Arms Competition III.
[97] OSI, Soviet Advanced Radar Techniques Applicable to Ground Radar.

By deploying Tall King in strategic areas, the Soviets significantly increased their early warning and high altitude detection capabilities. Tall King was an example of Soviet development and improvement of then current techniques through the use of more power, a larger antenna, and additional frequency diversity.[98] Although Tall King delivered higher power, its transmitting circuitry was very similar to that of Spoon Rest and their receivers are essentially identical.

At the very onset a Rock Cake or Stone Cake height finder was collocated with Tall King, however, more recently, the newer Side Net height finder took their places as it offered improved GCI capabilities. The IFF equipment associated with Tall King was Scoreboard B.

c. GCI Radars

GCI RADARS[99]



The second family to be considered is that of the ground controlled intercept (GCI) radars. Although the primary function is for ground controlled intercept, these radars have been found to be quite similar to the U.S. AN/CPS-6 and tended to use the basic V-beam technique for obtaining azimuth, range and altitude. These radars developed in two directions—the V-beam and multisearch radars were the results.[100]

1) Token

Token was the first of the V-beam generation of radars to make its appearance. Token was deployed in late 1951 or early 1952. By mid-1952 at least 50 Token radars had been deployed across the U.S.S.R. from East Germany to Vladivostok, and by 1 July 1953 the figure reached 115.[101]

The large increase in the number of Token radars lead the U.S. to believe that Soviet technicians were more successful at maintaining them than had been anticipated on the basis of U.S. experience with the AN/CPS-6.[102] Token however, did have a simpler design. Although Soviet V-beam radars were inspired by the U.S. AN/CPS-6 the AN/CPS-6 was not supplied under the lend-lease policy but contained in the M.I.T. series.

[98] Ibid.
[99] DIA, *Defensive Missile Systems*, p. 23.
[100] Ibid., p. 22.
[101] Growth of Soviet Token Radar, *USAFE Air Intelligence Study*, August 1954. pp. 27–30.
[102] The Soviet Air Defense System, *USAFE Air Intelligence Summary*, 1954.

As of 1954, Token was considered to be the best Soviet radar. It has been found that radars of older design (i.e., Knife Rest, RUS II and Dumbo) are deployed near many of the Token sites to serve as gap fillers and traffic controllers. Token with longer range but a height capability of only 45,000 feet was aided by these older radars of shorter range but a height capability of nearly 60,000 feet.

The Token, and in general the V-beam radars, represented a vast improvement over prior Soviet capabilities. This was true to such an extent that one of the most important implications of the V-beam radars was the high degree of electronic capability attained by the Soviet scientists.

2) Big Mesh

In 1956 the second Soviet V-beam, Big Mesh, was observed. Big Mesh is larger than the V-beam Token, and was believed to have higher power capabilities than Token. The duty factor of Big Mesh was found to be more than three times that of Token. Big Mesh not only has the five beams in the S-band frequency as does Token, but also has been found to have an L-band frequency.[103] This indicates an acknowledgement by the Soviets of the ECCM advantages of the diversification of frequencies.

3) Strike Out

The Strike Out radar was the third radar of this family and was first observed in 1957. The ECCM capabilities proved to be quite similar to those of Token while Strike Out had the two large antenna reflectors positioned horizontally. Since Strike Out had no height finding capabilities, it was used with a separate height finder for GCI purposes.[104] For example, this radar, when used in conjunction with the conventional single-dish Rock Cake radar, provided a better GCI capability than was provided by Token. This grouping had limited ECCM capabilities as the high side lobes reduced its effectiveness to operate in an ECCM environment.

4) Cross Out

Cross Out was introduced in 1958 and was observed to have physical characteristics similar to those of Big Mesh except that both reflectors were positioned horizontal, similar to that of Strike Out. With the introduction of Cross Out and Bar Lock into the Soviet inventory of GCI radars, a height finder (HF) having greater range capability was required to capitalize on the higher performance of these two radars. Stone Cake, a height finder, was designed to fulfill this role.[105]

5) Bar Lock

Bar Lock, first sited in late 1958, represented a major modification in Soviet early warning/GCI radar. The early multi-frequency, multi-beam Token was the forerunner for Big Bar in 1959. Bar Lock was found to have evolved away from these radars. Bar Lock is similar to Cross Out and Strike Out in that it has two horizontal reflectors, but the structural details were found to be entirely different. The power is believed to have been much higher than that for previously developed Soviet radars and it apparently had better capabilities for aircraft detection and tracking than previous Soviet EW/GCI radars.

The introduction of Bar Lock again evidenced that the Soviets were continuously increasing their ECCM capability with each new member of the GCI family. Bar Lock provided the capability to shut

[103] OSI, Soviet Advanced Radar Techniques Applicable to Ground Radar.
[104] Ibid.
[105] Ibid.

off individual beams in order to overcome the effects of spot jamming and retained all ECCM circuitry incorporated in Big Mesh.

Bar Lock proved to be the primary, long range, high performance radar in use by the Soviets at GCI sites.[106] Bar Lock's van mounted antennas were comprised of truncated parabolic mesh reflectors with clipped corners measuring 10 x 32 feet. These reflectors were also used in configuring the Big Bar radar system in 1959. Four beams emanated from the lower reflector and two from the upper.

Bar Lock was one of the more capable EW radars in the Soviet inventory and when collocated with height finders such as Side Net it was highly functional in a GCI role. It was put to wide spread use and was most likely the primary EW component at EW/GCI sites.

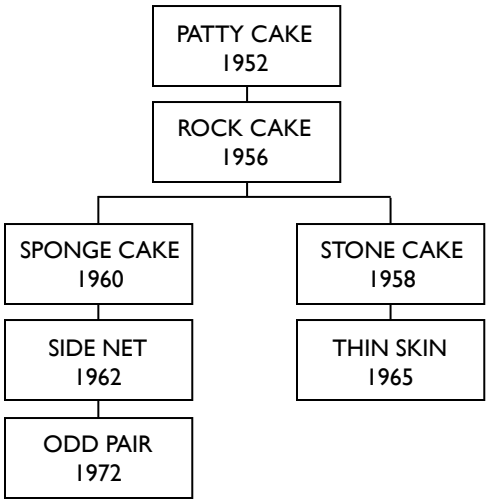
6) Big Bar

With the introduction of Big Bar and Big Mesh, the Soviets improved, to a limited extent, their radar ECCM capabilities. A modification of Big Bar (designated Big Bar B) eliminated the c-band frequency, indicating the possible ineffectiveness of its use for search or as an ECCM feature. Big Bar B was a mobile V-beam with a limited height-finding capability, used as an early warning/GCI radar. Big Bar radar information was usually supplemented by data supplied by collocated height finders such as Rock Cake and Stone Cake. Within the Big Bar family, the B variant was identified by its "clean" appearance. This was created by the absence of both Witch Four IFF and End Box side-lobe suppressors and the lack of large full horns associated with the A and C variants.

Big Bar showed a reversal in a trend, as Big Bar had a V-beam configuration, as opposed to the Strike Out and Bar Lock early warning radars, which had two large horizontal reflectors. The most commonly deployed radar of this family is the Bar Lock radar. This radar was improved to provide higher transmitting power, stability and service-ability. The lack of a moving target indicator (MTI) to aid in tracking targets in chaff and rain was the principal weakness of Bar Lock and earlier GCI radars.

d. Height Finder Radars

Height Finders[107]



[106] OSD Historians Office, History of Strategic Arms Competition III.
[107] DIA, *Defensive Missile Systems (Trends) U.S.S.R.*, p. 23.

The third set of radars is comprised of the height finders. These radars were primarily designed to supplement other radars by providing accurate height data. The later height finders (Sponge Cake, Side Net, and Thin Skin) have exhibited good mobility, high power, tuneability, MTI, and sophisticated scan control.[108]

1) Patty Cake

Deployed late in 1952, the U.S.S.R.'s initial height finder, Patty Cake, did not follow the usual Soviet development pattern. Contrary to the pattern followed in the V-beam early warning/GCI radar Token and the fire control radar Whiff which were derived directly from Western radars, Patty Cake was the sole Soviet operational HF from 1953 to 1956 and was generally installed with the Gage (EW) radar.[109]

Observations during 1954 found the Soviets developing a radar system that employed two radars as a possible means of improving upon Token. These two sets would be combined to function as a single unit. The most commonly used sets are found to be Gage and Patty Cake. This combination provided less complicated installations, simpler maintenance and operation and increased range and height finding capabilities.[110]

Other radar installations were noted in the U.S.S.R. in which each installation was equipped with four radars. These radars were situated in pairs, with Gage and Patty Cake again comprising each pair. These represented the first known Soviet attempt to establish a static system of radar defense. It was first thought to mean a trend away from the mobile V-beam Token.

2) Rock Cake

The nodding height finder, Rock Cake, was introduced in 1955 and first deployed in 1956. It was apparently designed to provide accurate altitude readings on modern manned aircraft. Rock Cake was deployed quite rapidly in 1956 as it was found that when used in conjunction with an early warning radar it would provide better GCI capability than was provided by Token.

3) Stone Cake

Stone Cake, introduced in 1958, was designed to fulfill the requirement to capitalize on the higher performance of Cross Out and Bar Lock. Stone Cake appeared to be essentially a Rock Cake radar using a higher gain antenna with reduced side and back-lobe emission and possibly an improved receiver. These changes were thought to have increased range capabilities by approximately 33 percent. Another change from the Rock Cake radar was the use of a larger and lighter weight reflector. However, there appears to have been no change in the capability for Stone Cake to operate in an ECCM environment over that of Rock Cake.

Stone Cake was observed to be a mobile, fixed-feed rocking reflector, nodding-beam height finder.[111] Stone Cake was usually operated in conjunction with a Bar Lock, Big Bar, or Big Mesh.

4) Sponge Cake

In 1960, Stone Cake was modified by the introduction of a new antenna Sponge Cake. It was lighter in weight, conforming to the Soviet trend toward reduced weight and smaller structural members, which in

[108] Ibid., p. 22.
[109] DIA, A Decade of Soviet AC&W Height Finder (HF) Radar Development, *Defense Intelligence Digest*, May–December 1963.
[110] Round-up of Red Radars.
[111] OSD Historians Office, History of Strategic Arms Competition III.

turn reduced the wind resistance of the antenna. Otherwise, Sponge Cake was equivalent to Stone Cake in performance. It was found that Sponge Cake was highly susceptible to spot jamming.

5) Side Net

Side Net when initially deployed in 1962 was sited with Tall King to provide a long range GCI capability. This was first observed in East Germany. It was later found that Side Net was deployed at other EW radar sites. When Side Net and Back Net were deployed together, they were found to form an excellent GCI network. During the 1963–1964 time period, these two radar sets developed into the backbone of the GCI air force program.

6) Thin Skin

Thin Skin, the first Soviet H-band height finder was first seen in the U.S.S.R. in late 1965, although it had been observed much earlier under development testing near Moscow. It was deployed at a number of GCI sites apparently to increase low altitude and target handling capabilities. The antenna was mounted above the radar van whereas previous antennas had been mounted on the side or end of the van. In the Thin Skin configuration the van itself rotated.

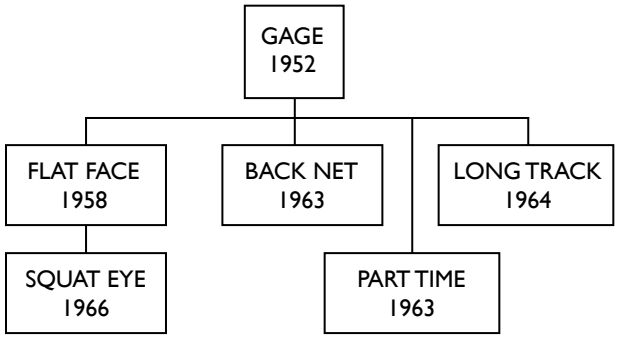
Thin Skin was observed in both truck and trailer mounted configurations. (Thin Skin B and Thin Skin A, respectively). It is believed to have had greater accuracy and better low altitude coverage than previously deployed Soviet height finders. Operating on the little-used H-band, it added frequency diversity to Soviet radar sites.

7) Odd Pair

Little is known about the Odd Pair radar but it was first observed in the U.S.S.R. at an SA-5 site near Murmansk and at two locations in the vicinity of Sevastopol—an early warning site and an SA-2 site. Odd Pair has replaced Side Net at a few sites and wider deployment is suspected since the radar provides the Soviets with increased angle accuracy and range.

e. Modern ACQ/EW Radars

Modern ACQ/EW[112]



[112] DIA, *Defensive Missile Systems (Trends) U.S.S.R.*, p. 23.

The fourth group to be studied is basically a continuation of the first ACQ/EW group but these are used in direct support of the SAM systems. These radars are also quite useful for ACQ purposes.[113]

1) Gage

Gage, initially deployed in 1952, was a Soviet designed early warning and surveillance radar mounted on a bunkered building. This was the first static radar, of any significance, employed by the Soviets.[114] There were numerous sightings of Gage and Patty Cake being situated to function as an integrated system.

Gage's antenna is quite similar to the horizontal reflector of the U.S. AN/CPS-6 and its length is estimated to be 27 feet and its height 10 feet.

2) Flat Face

Flat Face was first intercepted in 1958 in East Germany and was capable of performing many roles. At first it appeared only at antiaircraft artillery sites, but subsequently it was reported as being used as a low-altitude surveillance radar possibly for the SA-3 SAM system and a gap filler at EW/GCI sites.[115] Flat Face has also been used as an acquisition radar for the SA-2 SAM System. Flat Face has two elliptical parabolic reflectors, each 18 feet wide by 7 feet high, mounted one above the other on a mast atop a box-bodied ZIL-151 van, thus making it a highly mobile EW radar. The reflectors were rotated with the ends of the reflectors folded down. Because of the size of its two antennas, this radar could not operate satisfactorily at wind velocities exceeding approximately 32 mph.

Flat Face was stated to have two units of ECCM equipment, one for use against passive jamming, and the other against active jamming. Flat Face also contained an unknown type of anticlutter circuit to reduce the effects of ground and cloud return and of jamming.

Flat Face was introduced as being capable of shifting the pulse repetition frequency (PRF) and operating frequency rapidly and possibly used pulse position coding as a correlation method.[116] The dual antenna configuration may indicate that Flat Face was a monopulse radar, but there has been little other evidence to substantiate this.

3) Back Net

In 1963, the newest and largest radar in the EW/GCI network, Back Net, began replacing the Gage system in direct support of the SA-1 system. Back Net had a much improved tracking accuracy, anti-jamming capability, mobility and frequency diversity. Evidence during this 1963 time period indicated that the Back Net (which was most likely the best Soviet early warning and acquisition for medium to high altitude threats) was being modified to give it a dual frequency capability.[117]

Back Net has two large reflectors mounted back-to-back on a trailer van. It has good EW range and an azimuth capability. In collocation with Side Net, it has been rapidly becoming the principle system of the Soviet Air Force GCI program.[118]

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[113] Ibid., p. 24.
[114] OSD Historians Office, History of Strategic Arms Competition III.
[115] DIA, *Defensive Missile Systems (Trends) U.S.S.R.*, p. 24.
[116] OSI, Soviet Advanced Radar Techniques Applicable to Ground Radar.
[117] DIA, *Defensive Missile Systems (Trends) U.S.S.R.*, p. 24.
[118] Ibid., p. 25.

From the rapid deployment of Back Net around Moscow it was apparent that the Soviets were satisfied with its capabilities. Back Net B is quite similar to Back Net A except that the Back Net B has a smaller reflector with three feed horns fed by 20 wave guides, instead of the 2 horn single-wave guide found on Back Net A. The modified feed was most likely designed to improve the low-altitude performance.

4) Long Track

Long Track was first observed at Soviet EW/GCI sites in East Germany and subsequent observations showed that this radar was also deployed in the U.S.S.R. Long Track was a completely self-contained system mounted on a heavy tracked modified AT-7. The 2,000 to 2,500 MHz frequency range of Long Track was consistent with Soviet policy to expand the use of available R.F. frequencies. This radar is believed to have been ready for field operation in 1964.

5) Squat Eye

Squat Eye, operational in 1966, was an alternative antenna for Flat Face. The antenna was mounted on a 90–100 foot tower and provided better low altitude coverage than the original Flat Face. In addition to the high antenna it has been observed that Squat Eye was generally situated on high ground.

6) Part Time

Part Time radar signals were first intercepted in the Northern Soviet Air Defense District. A number of unique or unusual characteristics were demonstrated by this radar.

(1) Only Soviet (EW) associated radar that is invariably enclosed by a radome
(2) Integral data transmission mode
(3) Complex radar signal
(4) Comparatively low transmitter peak power.

Part Time was basically designed as a remote operations aircraft early warning radar. It features around-the-clock surveillance capability minimum operator attention and automatic transmission of target detection to a filter center.

f. Technological Progression

The U.S.S.R. has achieved well defined advancements in the field of radar technology. This is evidenced by a comparison of the U.S. and U.S.S.R. technology gap in this field. In 1945 when the U.S.S.R. radar program was in its infant stage the Soviets were rated seven years behind the United States.[119] However, by 1956 the U.S.S.R. had achieved parity in fielded gun directing radars and in 1972 the Soviets were placed ten years ahead of the United States.[120] Likewise, the U.S.S.R. achieved equality to the United States in fielded air defense acquisition and surveillance radars for a relatively short period during the late 1950's. It has been calculated, however, that the U.S. regained an eight-year technical lead by 1972.[121]

[119] Root, L. W., United States vs. U.S.S.R. Ground-Based Air Defense Radar Comparison, December 1971, U.S. Army Missile Command, p. 15.
[120] Ibid., p. 15.
[121] Ibid., p. 15.

The actual operational advantage of the U.S. may not be so great as estimated as the comparison is made on a one to one basis, thus not allowing for the overall effect of the large number of radars fielded by the U.S.S.R.

In relation to the tracking radars for SAM systems, parity was achieved in the mid 1950's and by 1972 the U.S.S.R. was estimated to be about four years ahead of the U.S.[122]

However, the radar system of either the U.S. or the U.S.S.R. is not as concerned with how it relates to the radar system of the other country but how capable it is in detecting and handling incoming enemy aerospace vehicles whether they be airplanes or missiles.

The Soviets had virtually no electronic capabilities in this area prior to WWII and relied extremely heavily on visual and sonic methods. This visual and sonic method although widely utilized was inadequate. The maintenance of this system continued but the Soviets delved into the creation of a "complete" radar system. Although ultimately occupied with the problem of early warning the Soviets had to deal with the problem of once an incoming vessel was noted what do we do with it? Is it friendly or alien and further, where exactly is it?

g. Development Cycles

It can be seen through the illustrated families and the introduction of their members that the Soviets were indeed concerned, first, with early warning—knowing that something was coming. Figures 46 and 47 show a graphical, more vivid, picture of this. From this table it is obvious that the push by the Soviets to develop and field a completely operational system did not reach fruition until 1952.

An assessment of radar capabilities apparently took place during the 1953 to 1956 period. Soviet needs, in relation to their radar system, were not the same as they were when the Soviets embarked on the fielding of a complete radar system. The previous discussion of the families and Table 29, a technical abbreviation of many members of these families and others, will help to understand the reassessment.

In many instances Table 29 outwardly appears to show a drop in requirements on radar capabilities. For instance, in 1956 a height finder, Rock Cake, was deployed with a maximum altitude of 180,000 feet and in 1965 another height finder, Thin Skin, was deployed with a maximum altitude of 100,000 feet. However, the attitude capability is irrelevant and one can see the great increase in range capabilities. The associated frequency ranges show that Thin Skin has a much higher frequency range than Rock Cake and therefore, requires a smaller disk and less power. This, in turn, has the advantages of reduced weight and smaller structural members and as the Soviet trend is not to discard old systems, complementary systems creating frequency diversity can be placed in simultaneous operation. The development of radars of reduced weight and smaller structural components enhances the mobility capabilities—a trend the Soviets have long been concerned with.

There was a drop in peak power output for the height finders and a general maintenance of peak power in GCI and acquisition radars in conjunction with an overall decrease in range and altitude requirements. This ends power wastage searching regions too high for planes and improves the signal to noise ratio. The trend toward frequency diversity is obvious and it is quite effective as a countermeasure against jamming and may also provide improved detection and tracking of a target. It is also possible to discern a move toward more varied and a greater number of anti-jamming devices. A reaction to the U.S.'s and others' ability to counter their radar systems.

[122] Ibid., pp. 1 and 6.

Figure 46—Chronology of Soviet Radar Development*

YEARS 1945										
1946	DUMBO									
1947										
1948										
1949										
1950	CROSS FORK									
1951										
1952	GAGE	KNIFE REST A	TOKEN	PATTY CAKE	FISH NET	KRUG				
1953	WITCH EIGHT									
1954										
1955										
1956	KNIFE REST B	BIG MESH	ROCK CAKE							
1957	SLANT MESH	STRIKE OUT	BIG NET	WITCH FIVE						
1958	BAR LOCK	CROSS OUT	FLAT FACE	STONE CAKE	SPOON REST A	SPOON REST B	WITCH FOUR	SCORE BOARD		
1959	TALL KING	BIG BAR A	HEAD NET	MOON FACE						
1960	BIG BAR B	BIG BAR C	SPOON REST C	SPONGE CAKE	TOP TROUGH					
1961										
1962	SLIDE NET	SCORE BOARD B								
1963	BACK NET	PART TIME								
1964	LONG TRACK									
1965	THIN SKIN									
1966	SQUAT EYE									
1967										
1968	FLAT JACK	TOP SAIL								
1969										
1970	HEN HOUSE									
1971										
1972	ODD PAIR									
	1	2	3	4	5	6	7	8	9	10

NUMBER OF RADARS PER YEAR

*Estimates were made when more than one deployment date, for a single system, was found.

Figure 47—Types of Soviet Radar in Chronological Order*

YEARS 1945										
1946	EW									
1947										
1948										
1949										
1950	EW									
1951										
1952	EW	EW	EW/GCI	HF	IFF	HF/DF				
1953	IFF									
1954										
1955										
1956	EW	EW	HF							
1957	GCI	EW	EW	IFF						
1958	EW/GCI	EW/GCI	EW	HF	EW	EW	IFF	IFF		
1959	EW	EW	EW	EW						
1960	EW	EW	EW	HF	EW					
1961										
1962	HF	IFF								
1963	EW/ GCI	EW								
1964	EW									
1965	HF									
1966	EW									
1967										
1968	EW	EW/ GCI								
1969										
1970	EW									
1971										
1972	HF									
	1	2	3	4	5	6	7	8	9	10

NUMBER OF RADARS PER YEAR

*Estimates were made when more than one deployment date, for a single system, was found.

Table 29—Widely Deployed Soviet ACW Radars

Year	Radar Designation	Use	Frequency Range	Peak Power	Range (NM)		Maximum Altitude (ft)	Anti-Jamming Devices
					$1M^2$	$50M^2$		
1952	Knife Rest A	EW	70–75	100 KW	90	90	55,000	FTC, IAGC, RPD, PWD
1956	Knife Rest B	EW	81–91	100 KW	103	103	75,000	FTC, IAGC, RPD, PWD
1959	Tall King	EW	160–180	700 KW	380	380	200,000	FS, IAGC, SPRF, JPRF
1963	Back Net	EW	2084–2470	2 MW	175	250	130,000	FTC, IAGC, RPS, PRF, STAG
1963	Part Time	EW	561–630	500 KW	185	185	50,000	UNKNOWN
1958	Spoon Rest A/B	ACQ	149–161	250 KW	110	100	53,000	FTC, IAGC, RPD, PWD, AGC
1958	Flat Face	ACQ	815–900	250 KW	125	125	42,000	FTC, IAGC, RPD, PWS, AGC, SPRF,TT
1964	Long Track	ACQ	2085–2423	1 MW	65	65	105,000	FTC, IAGC, PWD,MF, FS, IRF, AGC
1966	Squat Eye	ACQ	815–900	250 KW	75	75	42,000	UNKNOWN
1956	Rock Cake	HF	2610–2650	2 MW	60	60	180,000	FTC, IAGC
1962	Side Net	HF	2560–2710	1.5 MW	115	240	120,000	FTC, IAGC, SPRF, TT
1965	Thin Skin	HF	6460–6600	1 MW	80	200	100,000	FTC, IAGC, SPRF, TT
1956	Big Mesh	GCI	565–3130	1 MW	100	212	60,000	FTC, IAGC
1958	Bar Lock	GCI	2990–3120	1 MW	124	212	100,000	FTC, IAGC, RPS
1959–1960	Big Bar	GCI	565–3130	1 MW	100	212	60,000	FTC, IAGC

Not only did the Soviets concern themselves with faster and higher flying planes and missiles. Their concerns included low flying vehicles that could fly "under" their system. In this respect the visual and sonic stations were still of great use (visual reporting was still highly organized in 1955 with 750 visual operating posts in active operation)[123] but in this case the actual early warning is not much farther reaching than the station itself. Therefore, the push for production of radars capable of detecting low flying objects was begun in 1956.

The overall assessment culminated in the larger number of radars during the 1956 and 1960 period. This larger number of radars is partially due to differing functions associated with the individual radars and also to means of capitalizing on improved performance of a new radar. Cross Out, a GCI radar, is a prime example of this. In order to capitalize on its greater range capabilities, a greater range height finder had to be developed.

Most often newly deployed radars are slightly modified old versions. This had been found to be advantageous in many ways: (l) similar operation and training, (2) maintenance requirements are nearly the same, (3) parts for old radars are readily available and, (4) little change in production requirements.

The Soviet method of deployment, that of deploying a radar system and then deploying more advanced versions without removing the first, as compared to the U.S. method, which replaces a fielded system with that which is believed to be a better system, has much to show. First, the U.S.S.R. has a great quantity of systems at different frequencies, pulse width, etc. This must be considered in the threat analysis as compared with one or two systems to be considered in the defense of the U.S. And secondly, the U.S. aircraft must carry numerous jammers in order to counter this varied U.S.S.R. air defense system.

The trend of complementary radars is even more clearly evidenced when in 1963 two early warning radars were produced with different frequency ranges, peak power, range and latitude capabilities. The higher frequencies also illustrate a move toward greater resolution. In addition, the Soviets have an interest in antenna design. They have been devoting substantial effort to parabolic surfaces with high gains and arrays that are capable of electronic beam shaping and scanning.

C. The Soviet Civil Defense System

1. Overview

It was not until the mid-1950's, several years after the Soviets exploded their own atomic and hydrogen bombs, that actual recognition of the threat imposed by these devices was publicly acknowledged. Ensuing events propagated military-political debates between 1958 and 1961 over adequate protection against an attack from these weapons and the relevance of the civil defense programs. In the end, because of budgetary and other constraints, it was realized that a heavy blast shelter program capable of protecting the entire population was infeasible and the emphasis turned to plans for mass urban evacuation. In 1961, culminating these events, a new civil defense resolution was enacted and the responsibility for civil defense was shifted from the Ministry of the Interior to the Ministry of Defense.

The next milestone event occurred in 1966 at the 23rd Party Congress when Secretary Leonid Brezhnev cited the need to "perfect civil defense," and thus became the first major political leader to publicly endorse civil defense. The significance of this statement and subsequent adoption by the Congress of a new civil defense amendment indicated that civil defense in the Soviet Union had reached a position of prime impor-

[123] AF/INAP Working Papers.

tance in the "defense of the Homeland." The contribution of specific external and internal factors to this new policy on civil defense is difficult to ascertain in subsequent literature or speeches. Nonetheless, Soviet civil defense has continued to rank high on the defense priority list since 1966, despite the SALT I agreements and other detente overtures.

2. Post-1955 Developments (1955–1962)

The years between 1955 and 1958 were marked by an increased emphasis on compulsory civil defense training for the Soviet population and an emerging trend toward mass evacuation as an alternative to a shelter program. DOSAAF, the paramilitary organization responsible for the greater part of civil defense training, expanded its services to schools, collective farms, industry, and other public institutions.[124] In 1955, the first course in chemical/biological/radiological warfare was introduced. This instruction, intended to be a ten-hour course, eventually reached approximately 85 percent of the adult population.[125] There were estimates in 1969 that no other citizens of any country were as well informed on the effects of CBR weapons.[126] A second compulsory training course of 22 hours was completed between 1956–1958; a 14-hour course also began in 1958 followed by an 18-hour course in 1960 which focused on post-attack recovery.[127] DOSAAF also attempted to promote the relationship of civil defense to the military defense structure as indicated in their literature: "The possession of atomic, chemical, and bacteriological warfare in the hands of the imperialists, and the threat of their use, force us actively to prepare civil defense."[128]

Although these attempts at mass participation seemed impressive on paper, there were reports that the courses were not completed on schedule, and that public apathy and skepticism concerning the feasibility of civil defense abounded. This mood existed in spite of Soviet efforts to avoid "defeatism" and related morale problems by orienting civil defense literature and training towards the small-yield Hiroshima-type weapon.[129] It was not until 1961 that the effects of fallout and weapons in the megaton range were published.[130]

There is evidence that negative attitudes stemmed in part from the inadequate shelter facilities in existence during this time. Although basement shelters had been constructed in new apartment buildings since 1946,[131] they could accommodate only 35–40 percent of the urban population[132] and did not protect against blast effects. By 1958, there was evidence of a shift to free-standing heavier shelters, indicating a lack of confidence in the lighter shelters. In addition, existing structures which could be used as shelters, such as the numerous subways in Moscow and Leningrad, were equipped with blast doors.[133] However, these heavier shelters had a maximum capacity for two to three million persons and were primarily planned for the accommodation of command and control and key administrative/industrial/economic personnel.[134]

[124] "Reds Stepping Up Civil Defense Program," p. 26.
[125] NORAD, "Soviet Civil Defense," p. 5.
[126] CIA, "Civil Defense in the Soviet Union."
[127] "Reds Stepping Up Civil Defense Programs," op. cit., p. 26.
[128] Miroshnikov, et al., *Zashchita Naseleniia* . . . , p. 3.
[129] NORAD, "Soviet Civil Defense," op. cit., p. 5.
[130] "Reds Stepping Up Civil Defense Programs," op. cit., p. 24.
[131] SRI, *Soviet Strategy, Objectives, and Force Postures* . . .
[132] Goure, *The Soviet Civil Defense Program: a trip report*.
[133] "Soviet Civil Defense Construction," p. 11.
[134] "Reds Stepping Up Civil Defense Program," op. cit., p. 25.

Not only was public interest at a low level in the late 1950's, but the military and political elements of the Soviet Union voiced disenchantment and pessimism regarding civil defense. In February of 1959, the Norwegian ambassador queried Premier Khrushchev on the status of civil defense. Khrushchev replied that it had been discussed with the Council of Ministers and they had decided that "nothing effective could be done."[135] Shortly after this remark, Anastas Mikoyan noted that the vast expenditures needed for bomb shelters did not seem to be justified in light of the hopelessly excessive destruction brought by a nuclear attack.[136] Khrushchev went so far as to halt the shelter building programs during 1958–1959.[137]

These systems' inadequacies led to the need for alternative measures of protection for the population against a nuclear attack, as well as the need to redefine the Soviet philosophy on civil defense. In line with these requirements, the idea of mass evacuation emerged between 1958–1960.[138] Prior to this time, it was felt that pre-attack evacuation would lessen control, and control was an essential part of the Soviet governing philosophy.[139] Debates on the civil defense program ensued, attracting comments from the military and political leadership in the country. These debates encompassed numerous controversies affecting both civil and military defense, including degree of early warning necessary for adequate preparations, capabilities and costs of shelters, weapon sizes and targeting doctrines, and various evacuation procedures. Although the article did not appear until 1962 when the arguments had more or less been decided, Colonel General O. V. Tolstikov, the Commander in Chief of civil defense, wrote:

> However, at the present time, the problems of protecting the population are not solved in our country to a fully perfected manner. The development of new super-powerful weapons of mass destruction has given rise among some comrades to mistaken views on the problem of protecting the population, to a skeptical attitude towards the possibility of solving this problem. They are especially doubtful about the (value) of the engineering-technical (shelter) measures. They incorrectly assumed that the defensive measures consisted only in building shelters, and ignored other ways and means of defense. It is clear that such views cannot be accepted as being correct.[140]

In addition, Tolstikov pragmatically suggested that existing facilities such as underground garages, movie houses, and pedestrian tunnels could serve the dual purposes of both providing shelters during attack and economic use in peacetime.[141] These arguments suggest that an adequate shelter program was not necessarily the only way to protect the population. Other evidence also exists favoring a valid civil defense program without reliance on heavy shelters. In a 1962 *Voyennyye Znaniya* article, Lieutenant General Ye. Leoshenya is quoted as saying, "incompetent personnel think that the only reliable means of defense against nuclear weapons is special, durable shelters . . . this viewpoint is entirely erroneous."[142]

The basic dilemma in these debates was the problem of coping with the growing threat of thermonuclear weapons. Civil defense literature as late as 1960 was not fully appreciative of the characteristics of modern weapons. This was evidenced in the training programs concerning incendiary bombs and blackout procedures.[143] In addition, there were more generalized threats to national security, including the polarization of the East/West struggle, the political/propagandist implications within the Soviet Union to support

[135] CIA, "Changing Soviet Civil Defense Concepts," p. 9.
[136] Ibid., p. 11.
[137] SRI, *Soviet Strategy: Objectives, and Force Postures* . . . , op. cit.
[138] Goure, *The Soviet Civil Defense Program*.
[139] "Reds Stepping Up Civil Defense Programs," p. 24.
[140] *Voennye Znaniya*, No. 2, pp. 21–22.
[141] *Izvestila*, January 18–20, 1962.
[142] *Voennye Znaniya*, No. 2. op. cit.
[143] Goure, *The Soviet Civil Defense Program*, op. cit.

claims of aggressive intentions of the West, the increased vulnerability of the country's economy due to growing urbanization and concentration of industry, and the concern for political and economic manpower, as World War II had considerably decreased the population and a decline in the birthrate also plagued the Soviets.[144]

Changes in the existing civil defense programs may have been slow because the Soviet decision-making apparatus found it difficult to change a program as large as civil defense in a short period of time,[145] especially if military defense took precedence. Thus, when the benefits of existing shelters were in doubt and support turned to the alternative source of protection that evacuation measures offered,[146] this implied a reorganization of procedures and functions of the entire civil defense organization. The solution to many of the problems was solved in October 1961, at the 22nd Party Congress when civil defense received the attention of the Congress and a new law was enacted. The significance of these actions was exemplified by the name change from Local Anti-Air Defense (MPVO) to Civil Defense (Grazhdanskaia Oborona),[147] indicating an impact on the overall structure as well as attitudinal changes. Early the next year, Tolstikov explained the change:

> If earlier, our cities could solve the problem of protecting the population and economic installations from enemy air attacks, and deal with the damage caused by the bombardment with their own resources; under contemporary conditions, this will require the use of far greater forces and resources. . . .
>
> This is why the Local Anti-Air Defense had ceased to be local and has become a state-wide system and is therefore now called Civil Defense, since it requires the active participation of each citizen of the U.S.S.R.[148]

This new era of civil defense focused on increased control efforts, urban evacuation, and improvised shelters to reduce casualties.[149] The old program (MPVO) now became a part of the Ministry of Defense (MOD), implying greater interaction with the military. Soviet Marshal V. I. Chuykov was appointed as Chief of Civil Defense, with Colonel General of Aviation, O. V. Tolstikov as First Deputy Chief and Chief of Staff.[150]

Although the new act quelled some of the controversy, numerous speeches and editorials continued to appear during 1962, some revolving around the need for stronger shelter protection, others downplaying civil defense altogether. However, it has been hypothesized that these comments were primarily a Western-directed propaganda attack on new U.S. programs and the McNamara-inspired civil defense debates during 1961–1962.[151] For example, the Soviet Minister of Defense, R. Ya. Malinovskiy, expounded the view that "no shelter can save one from a nuclear bomb," and went on to label the shelters "ready-made coffins and graves." He condemned the U.S. construction of shelters as a front for "making capital out of the fear of people."[152] It appears that Malinovskiy was lashing out at shelters in general. His comments also risked the possibility of undermining DOSAAF's training programs and squelching whatever public interest in

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[144] Ibid.
[145] Goure, *Civil Defense in the Soviet Union*.
[146] *SRI, Soviet Strategy, Objectives, and Force Postures* . . . , op. cit.
[147] Goure, *The Resolution of the Soviet Controversy* . . . , p. 11.
[148] *Voennye Znaniya*, No. 2, op. cit.
[149] "Soviets Decentralize Government Control System," p. 21.
[150] CIA, "Soviet Civil Defense: Policies and Priorities," p. 16.
[151] Goure, *The Resolution of the Soviet Controversy* . . . , op. cit., pp. 9 and 14.
[152] *Pravda*, 24 January 1962.

civil defense existed at the time.[153] However, it is more likely that the statement was a propaganda technique for the benefit of the United States, since this and similar sentiments managed to find their way to the Western press but not to the Soviet press.[154] Malinovskiy, himself, several months prior, declared that because of the constant danger of attack, ". . . we must prepare our armed forces, the country, and the *entire people* to withstand the aggressor, mainly under conditions of a nuclear war,"[155] indicating an endorsement of civil defense. Other statements attempting to de-emphasize Soviet civil defense efforts emerged from such personalities as Mrs. Khrushchev, "we are not building shelters, because we are not getting ready for war"[156]; and Soviet Ambassador Menshikov, "we are building no bomb shelters . . . we need peace to build communism."[157] Internally, however, the number of pro-civil defense articles in the Soviet press and radio broadcasts steadily increased after 1961, as well as a renewed emphasis within DOSAAF and its training operations.[158] Some statements spelled out the importance of the new civil defense plans, such as a September 1961 broadcast:

> The most important civil defense measures for the protection of the population are: Timely warning to the public of an impending air attack, provision of shelters, dispersal and evacuation of the population, timely medical assistance for the injured, and rapid recovery from damage. . . . Shelters are usually prepared ahead of time; therefore, it is necessary to know where they are located and how to reach them. . . . Therefore, after the warning is sounded, the public must immediately take shelter.[159]

This statement indicates the continuing reliance on some kind of shelter. Although it might have been intended as reassurance for the Soviet public, later developments tend to substantiate the view that such pronouncements were more likely the official position.

In December 1961, the Fifth Plenum of the Central Committee of DOSAAF met in Moscow. Speaking primarily on the importance of civil defense training and DOSAAF were General Tolstikov, Chief of the Civil Defense Administration of the Central Committee of DOSAAF, I. Varennikov, and Chairman of the Central Committee of DOSAAF, General of the Army, D. D. Leliushenko.[160] Only the DOSAAF press carried reports of the meeting.[161] However, in May of 1962, the disputes concerning the importance of civil defense to the overall defense strategy were resolved at the Fifth All-Union Congress of DOSAAF, reports of which appeared in abundance in both *Pravda* and *Red Star*. Numerous military notables were in attendance, including the Chief of Aviation, K. A. Vershinin, and the Marshal of Aviation, V. A. Sudets, who had been recently appointed as Commander in Chief of the National Air Defense Forces (PVO Strany).[162] Several representatives of the Communist Party were there, the most significant of whom was A. N. Shelepin, Secretary of the Central Committee of the Communist Party of the U.S.S.R., whose role it was to extend greetings in the name of the Party.[163]

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[153] Goure, *The Resolution of the Soviet Controversy* . . . , op. cit., p. 15.
[154] Ibid., p. 9.
[155] *Pravda*, 25 October 1961.
[156] *The New York Times*, 7 October 1961.
[157] *Los Angeles Times*, 12 December 1961.
[158] Goure, *The Resolution of the Soviet Controversy* . . . , op. cit., p. 6.
[159] FBIS, *U.S.S.R. and Eastern Europe*, 16 October 1961.
[160] Goure, *The Resolution of the Soviet Controversy* . . . , op. cit., p. 12.
[161] Ibid., p. 13.
[162] Ibid., pp. 21–24.
[163] Ibid., p. 22.

The greatest achievement at the May Congress was the public endorsement of DOSAAF by the Central Committee of the Communist Party. Their resolution called for a strengthening of the defense of the U.S.S.R. utilizing the entire population and stressed the importance of DOSAAF.[164] Concerning civil defense, the Party's resolution stated: "DOSAAF *must* continue to actively propagandize among the population the heroic traditions of the Soviet people and of its Armed Forces, widely disseminate military-technical knowledge, *train the population in ways and means of defense from contemporary means of mass destruction*, and assist the economic organizations in the preparation of cadres of technical specialists."[165]

This was the highest official public endorsement of Soviet civil defense up until this time. It indicated that civil defense programs would receive continued support from the Party.[166]

Both Chuykov, speaking for the armed forces, and Malinovskiy, the Minister of Defense, proclaimed that civil defense must be a part of the national defense structure and must be accompanied by a viable shelter program.[167] This tendency to link civil defense with the entire defense conglomerate implied a closer relationship with the military than had existed prior to the DOSAAF Congress. This trend was to continue to flourish through the sixties, experiencing an even greater control between active and passive defense after the 23rd Communist Party Congress in 1966. The need for this relationship was best explained in a reliable military journal in 1962. The author stated that the defense apparatus was in need of a "new type of force not designated for direct command." These "troops" would be used for "rescue-rehabilitation" work during a "nuclear missile war." They would be similar to the civilian formations of MPVO (civil defense) but that these "formations exist mostly on paper, are not supported from a materiel-technical standpoint, are semi-voluntary organizations, and are not properly directed by anyone." These new "troops" would concern themselves with problems of government authority and would be under the "leadership of organs of military control."[168]

3. 1962–1968

The years following the reorganization of civil defense under the Ministry of Defense experienced a more closely directed national system of area defense, as opposed to the former local point defense system.[169] Military civil defense forces were operating in certain areas such as communications, engineering, and rescue work, often overlapping with the civilian administrative organizations.[170] The significance of this interaction among civilian and military components was best explained by Chuykov: "Civil Defense alone is not capable of assuring the protection of the population and material resources." Such protection must be "achieved only through the *joint efforts of civil defense and the armed forces*…neither is success in these areas possible without civil defense; in the event of nuclear attack, civil defense is vital to the achievement of victory."[171] Although the total size of the civil defense composition was not known, Khrushchev was to have boasted at one time of some 20 million persons involved in the program.[172] Compulsory training of

[164] Ibid., p. 25.
[165] *Krasnaia Zrezda*, 23 May 1962; *Pravda* 23 May 1962.
[166] Goure, *The Resolution of the Soviet Controversy* . . . , op. cit., p. 26.
[167] CIA, "Changing Soviet Civil Defense Concepts," op. cit.
[168] Gastilovich, "The Theory of Military Art Needs Review," pp. 19–20.
[169] Goure, *Soviet Civil Defense Revisited* . . . , p. 10.
[170] Ibid., p. 12.
[171] Chugkov, *Civil Defense in Nuclear Missile War*, p. 30.
[172] Goure, *Soviet Civil Defense Revisited* . . . , op. cit., p. 15.

all adult males between 16 and 60 years old and females between 16 and 55 years old was still directed by DOSAAF, with added assistance from the Red Cross, the Komsomol (Communist Youth Organization), and other organizations.[173]

It was not until 1966, however, at the 23rd Congress of the CPSU, that civil defense got its highest public endorsement thus far. General Secretary Leonid Brezhnev said, "We must perfect civil defense . . ."[174] and was subsequently backed in this announcement by Minister of Defense Malinovskiy who declared: "The interests of strengthening the defense capability of the country demand continuous attention to the military-patriotic education of the Soviet people, especially the youth, to a wide dissemination of military knowledge among the population of the country, attracting it to active participation in the entire system of civil defense."[175]

The Congress ordered a resolution stating: "The perfecting of civil defense, improving military-patriotic work among workers, especially the youth . . . must be the constant concern of the entire Party and of the whole Soviet society."[176]

The coverage by the media of these developments further indicated the impact of such a high-level endorsement. The principal national Soviet press organs, *Pravda*, *Izvestiya*, and *Red Star* devoted considerable space to publicizing this new concern of the Communist Party.[177]

Although civil defense organization has heavily relied on the endorsement and the Resolution in promoting their programs and in justifying further development in the passive defense area, the exact reason for the support rendered civil defense by the Party is not known.[178] A number of reasons stand out, not the least of which was the desire to stimulate morale and patriotism.[179] However, with the knowledge of the great efforts expended on civil defense and the expanded budget it had to receive in order to function, it is likely that it is much more than a "morale booster."[180]

Alternative explanations include (1) the fallout problems generated by ballistic missile defense systems; (2) the combined effects of limited confrontations such as the Berlin Crisis, Vietnam, Cuba, and China; (3) actual perceptions of the Western nuclear threat as compared to their own military capabilities; and (4) the psychological-ideological benefits of a civil defense program.

4. Civil Defense and the ABM

There have been no Soviet public statements connecting civil defense and ballistic missile defense, as in the United States when Secretary of Defense Robert McNamara argued that an ABM program would be illogical without an extensive shelter program.[181] It is believed that the Moscow ABM system intercepts its target outside the atmosphere and, therefore, does not pose the problem of fallout in the defended area. There is also speculation that the shelter programs have remained relatively unchanged because the ABM system is not yet sufficiently reliable nor widespread to warrant a massive change in urban evacuation

[173] Ibid., p. 28.
[174] *Pravda*, 30 March 1966.
[175] *Red Star*, 2 April 1966.
[176] *Eto Dolzhen Znat Kazhdyi*, p. 3.
[177] Goure, *Soviet Civil Defense Revisited . . .* , op. cit., p. 7.
[178] Ibid., p. 8.
[179] See Goure, *Soviet Civil Defense Revisited . . .* ; Scott, *Survival in the Nuclear Age* and *New Trends in Kremlin Policy*, Georgetown University, for a discussion of this theory.
[180] Goure, *The Soviet Civil Defense Program*, op. cit.
[181] *Voennye Znaniya*, No. 1.

plans.[182] It should also be kept in mind that the Soviets have the potential for evacuating approximately 70 percent of the urban population whereas the U.S. has no such plans.[183]

Therefore, the civil defense program and the ABM program appear to be relatively independent of each other, perhaps because Brezhnev and other top leaders feel that ABM and antiaircraft systems have limited effectiveness, and thus promote measures to strengthen other Soviet defensive capabilities.[184]

Of course, the internal propaganda aspect cannot be neglected. Just as in the late 1950's when the U.S.S.R. did not wish to alarm the population with the knowledge of the effects of thermonuclear weapon, they may have again wished to avoid the controversy which could arise when active defense threatens passive defense. Khrushchev's earlier exaggerations on Soviet ABM capabilities may have had a detrimental effect on civil defense training,[185] and they did not want to negate their civil defense efforts thus far.

5. Civil Defense and Limited Conflicts

Enough of disputes, limited conflicts, and other crises have occurred since the early sixties to give the Soviets the impression that their civil defense program was a worthwhile "venture." Among these were the 1961 Berlin Crisis and a demonstration of NATO's strength and determination; the Cuban Missile Crisis at which time the Soviets were forced to back down; the threat of atomic weapons in NATO countries, especially the possibility of such weapons in West Germany; the growing Vietnamese war which enabled both the U.S.S.R. and the U.S. to examine each other's latest weapons technology; growing tensions in the Mid-East; and the Sino-Soviet border disputes. Other than the major threat imposed by the U.S., China, with its acquisition of a nuclear capability in 1963 coupled with the Sino-Soviet split in 1958–1960 on Communist ideologies, probably posed the greatest threat to national security. This was indicated in the statement, by a Soviet civil defense spokesman, that civil defense efforts are put "within a framework of imperialist aggression . . . the threat from Communist China notwithstanding."[186]

Not only did Vietnam serve to split the world into a number of destabilizing alliances, it offered the Soviets a propaganda tool with which to lash out at the "imperialist aggressors." They were able to experience a period of internal growth and development, not the least of which was the development of new technology and defense programs, while observing the turmoil and unrest occurring in the U.S. as a result of the war. The Soviets were also able to gain some insight into U.S. evolving strategies and existing tactical defense power—aircraft, chemical and bacteriological weapons, and tactical missiles, to name a few. Such knowledge gave the Soviets a better grasp on methods of protecting their population from modern weapons.

6. Perceptions of the Western Threat

After the 22nd Congress of the CPSU in 1961, the U.S. came to realize that they were superior in ICBM technology and that the Khrushchev claims to a perfected Soviet ICBM force were a bluff. Thus, the Soviets were faced with the problem of their own missile gap[187] and the fear that the U.S. possessed a first-strike

[182] CIA, "Soviet Civil Defense: Policies and Priorities," op. cit., p. 8.
[183] Suta, *Evaluation of U.S. Capabilities* . . . .
[184] Goure, *Soviet Civil Defense Revisited* . . . , op. cit., p. 6.
[185] CIA, *Civil Defense in the Soviet Union*, op. cit.
[186] Akimov, et al., "Civil Defense—Moscow 1969."
[187] SRI, *An Analysis of the U.S.-Soviet Strategic Interaction Process*.

capability. The theory, expounded by Khrushchev in the early 1960's, that the "Soviet Union would suffer less damage than the West because of its greater territorial size and lower concentration of population and industry" soon changed to the awareness that no part of the country was immune to attack.[188] Since 1966, most civil defense writing has included the statement, ". . . there is no guarantee that some of the enemy's weapons will not reach their targets. . . ."[189] Hence, the need for an effective civil defense program was reinforced.

The *Soviet Civil Defense Manual*, 1966, in explaining the role and place of civil defense, stressed "imperialist aggression." The idea that the U.S. was inclined towards "unleashing a new war to restore capitalism over the world" was the predominant theme. As the U.S. and U.S.S.R. were strengthening their nuclear capabilities, civil defense in the U.S.S.R. was to play the role of strengthening the defense of the country.[190]

Especially significant in the Manual was the Soviet concept that the U.S. relied on surprise attack.[191] It is the contention of a number of analysts that this theory played the greatest role in Soviet evacuation procedures and the philosophy around which a successful civil defense program was built, more specifically the plans to blunt attacks by preventive or preemptive strikes and an effective air defense.[192] Though this philosophy does not appear in Soviet literature, it is a feasible method of ensuring sufficient warning time for urban evacuation, estimated to require at least three days.[193]

Obviously there are deficiencies in these procedures. For example, if the Soviets began evacuation preparations in accordance with plans for attack, the activity would most likely be observed by the opponent, thus nullifying the preemptive value.[194] If nuclear attack is to be inevitable, the ideal situation, enabling last-minute evacuation measures to be carried out would be a scenario in which tensions between the two countries precipitated a slowly escalating situation.[195]

Though public announcements focus on the threat from the "imperialist" countries, this is evolving into more of an ideological threat than an actual attack. As previously mentioned, Vietnam did much to weaken the position of the United States. The American attitudes toward the military and subsequent cuts in defense spending somewhat limited the ability of the U.S. to pose a credible threat as in the early 1960's. In contrast, Soviet defense budgets grew by as much as four to five percent after the 1965 Five-Year Plan.[196] By 1967, Moscow had its own ABM system.[197] Soviet ICBM capabilities soon filled the "gap" of the early 1960's—the SS-9 and the SS-11, both reactions to the U.S. Minuteman, both hardened and dispersed, and both targeted on urban centers and key military industries, reached IOC in 1965 and 1966, respectively. The IRBMs and MRBMs geared towards Western Europe in the late fifties were superseded by the ICBMs targeted on the United States in the mid-1960's.

Although the Soviets continued to emphasize the need to protect the industrial and economic sectors of the country, there is evidence that dispersal of new facilities alleviated part of the problem: "In discussing

[188] Goure, *Soviet Civil Defense Revisited . . .* , op. cit., p. 5.
[189] CIA, *Civil Defense in the Soviet Union*, op. cit.
[190] CIA, "Soviet Civil Defense: Policies and Priorities," op. cit., p. 28.
[191] Ibid., p. 29.
[192] Goure, *The Soviet Civil Defense Program*, op. cit.
[193] Suta, *Evaluation of U.S. Capabilities . . .* , op. cit.
[194] Goure, *The Soviet Civil Defense Program*, op. cit.
[195] CIA, "Soviet Civil Defense: Policies and Priorities," op. cit., p. 13.
[196] SRI, *An Analysis of the U.S.-Soviet Strategic Interaction Process*.
[197] DIA, *The Moscow ABM System*.

the dispersal of industry, it must be kept in mind that historically many industrial installations were established and located at a time when no one thought of nuclear attack. Therefore, we are now speaking primarily of the proper distribution of newly built installations and the partial and gradual dispersion of existing ones."[198] Other attempts at post-attack recovery, such as the provision of hard shelters for the industrial workers,[199] and the hardening of industrial plants,[200] also lessened the threat of economic collapse.

Regardless of these military and non-military improvements, the Soviets continued to promote their civil defense programs, and neither the impending detente nor the lessened U.S. threat altered their objectives.

7. Psychological/Ideological Implications

There should be no doubt as to the effectiveness of civil defense as a morale builder. After all, a country cannot be expected to recover from an attack without first convincing the population that survival, and thus recovery, is possible. According to one report relating military considerations to civil defense, the principal motives and objectives behind Soviet civil defense are to "prevent a complete collapse of public *morale*, government control, and economic output in wartime . . . the military's ability to continue would depend on popular support and a continuous flow of resources."[201]

The significance of the morale of the people and their will to survive was contrasted between the socialist and capitalist camps: "The imperialist states will not be able to bear the hardships of modern war against the countries of the socialist commonwealth. . . . In the event of war the morale-political potential of the world socialist system will be vastly superior to the morale capabilities of the imperialist aggressor. This will determine to a considerable extent the outcome of the struggle in favor of socialism."[202]

Here, of course, the ideological differences are made to play a part. It was pertinent that the Soviet population felt that they, as a Communist people, were superior to all other societies and that the Communist doctrine of "guiding history in its course" could only be attained by ultimate survival over the opponent.

Psychology directed at the opponent also plays a role in "perfecting civil defense." If the population and economy of the Soviet Union were as adequately protected as claimed, then there was no way to predict to what extent the Soviets would use this state of readiness to "blackmail" or threaten Western powers with war.[203] In any case, civil defense has significantly reduced the capability of the United States to provide deterrence, especially if the number of fatalities is considered an element of assured destruction.[204] Deterrence, essentially a matter of psychological manipulation in that it depends entirely on convincing the opponent that one possesses adequate military strength with which to destroy him, does not afford much bargaining power if the opponent is convinced that he could not only withstand an attack but maintain sufficient cohesiveness so as to retaliate in force. Granted, this retaliation relies on a second-strike capability, but it also depends heavily on the desire and ability of the population to recover quickly and initiate such a response.

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[198] Goure, *The Role of Civil Defense in Soviet Strategy*, p. 20.
[199] CIA, "Changing Soviet Civil Defense Concept," op. cit.
[200] Goure, *The Role of Civil Defense* . . . , op. cit., p. 19.
[201] CIA, "Civil Defense in the Soviet Union," op. cit.
[202] Goure, *The Role of Civil Defense* . . . , op. cit., p. 22.
[203] Goure, *The Soviet Civil Defense Program: a trip report*, op. cit.
[204] Suta, *Evaluation of U.S. Capabilities* . . . , op. cit.

8. 1968–1972

The basic organizational structure of civil defense did not change again after the 1961 reorganization. However, the October 1972 appointment of Colonel General A. Altunin to succeed Chuykov as Chief of Civil Defense indicated a more prestigious position for the organization since Altunin was a Deputy Minister of Defense of the U.S.S.R., a position Chuykov did not hold.[205] Civil defense appeared to have taken a secure position alongside the other defense elements, and a greater emphasis was placed on military control within the programs. In addition, a series of forest fires, floods, and other natural disasters motivated the decision to place the responsibility for handling such disasters among the existing missions of military civil defense units.[206]

Although civil defense continued to receive recognition and support, this is not to say that deficiencies in the system did not exist. These shortcomings appeared to be mainly attributed to a combination of "competing needs and public apathy,"[207] this disinterest being a special concern of the Soviet leadership following the detente and greater harmony with the United States in the early 1970's.

Civil defense budgetary estimates are difficult to make because of the numerous activities involved and their close interaction. Overlaps and indirect costs, such as those which go for shelter modifications, civilian administration, or time off for training, further complicate the procedure. However, a number of reports have cited budgetary and economic constraints are a major problem within the civil defense administration, especially regarding shelter programs.[208] This theory is further advanced by the Soviet dependence on evacuation for the greater part of the urban population. It is a fact that basic shelter designs have not been altered significantly since 1950,[209] disallowing sufficient blast protection in most areas. Comments by civil defense personnel further substantiate the resource problem: "At present, there are required shelters and cover with better protective factors (than was the case in World War II). To create them for the entire population of the country requires enormous resources and many years of intensive work. As yet, this is not within the capability of any, even the most developed country, to do."[210]

Therefore, it is reasonable to assume that the Soviets are still relying on evacuation procedures as an adequate defense for the population, as evidenced in a 1969 statement: "To evacuate the people as quickly and as orderly as possible from the zone of immediate attack and to save them from destruction is the most important task of civil defense under conditions of war."[211]

Training programs continued—a new 21-hour course which began in 1967 was completed in 1969.[212] Compulsory training was introduced into the 5th–7th grades in 1967 and extended to the 2nd grade in 1970.[213] There were indications in 1968 that three divisions of civil defense troops had been created, probably a product of the recently established civil defense school which trained junior officer candidates for future command of civil defense units.[214] Training duties had already changed after Brezhnev's 23rd

[205] Goure, *The Current State of the Soviet Civil Defense Program*, p. 7.
[206] Ibid., p. 7.
[207] *Voennye Znaniya*, No. 1, op. cit.
[208] See *Voennye Znaniya*, No. 1, January 1969; CIA, "Soviet Civil Defense: Policies and Priorities" 1967; CIA, "Civil Defense in the Soviet Union," 1969; and Goure, *The Current State of the Soviet Civil Defense Program*, pp. 8 and 25; for a discussion of budgetary constraints and shelter facilities.
[209] Goure, *Soviet Civil Defense Revisited . . .* , op. cit., p. 24.
[210] Beliavskil, *Brazhdanskaia Oborona-Vsenarodnoe Delo*, p. 9.
[211] *Pravda Ukrainy*, 13 May 1969, quote from Lt. Gen. Ikachenko.
[212] Goure, *Soviet Civil Defense Revisited . . .* , op. cit., p. 25.
[213] *New Trends in Kremlin Policy*, p. 79.
[214] CIA, "Civil Defense in the Soviet Union," op. cit.

Congress speech in 1967, shifting responsibility for technical expertise, coordination, and direction from DOSAAF to the military.[215]

However, an interview[216] with Chuykov in 1968 revealed several failures within the system and left the impression that they were not as successful as they seemed on paper. Although he implied that key civil defense personnel had received adequate training, he was less enthusiastic about the training of manual and office workers and considerably less optimistic about the results of the 1967 21-hour course. The fact that the article appeared in a civil defense journal and not a Communist party publication suggests that civil defense may have suffered a decline in prestige, at least during this time. However, it is the opinion of at least one analyst that civil defense training "may at least in part serve to stimulate discipline and patriotism, whose decline, and that of the martial spirit among the postwar generation, has become a concern to the leadership."[217] It would seem that as the 1970's approached, bringing with them a greater sense of urgency for maintaining peaceful relations between the two super-powers, civil defense would become subordinated, if only as reassurance to the U.S. that the Soviets planned to "abide by the rules." This was not the case, however. The formal proclamation of detente issued at the May 1972 Moscow Summit did not lessen the interest in civil defense. Although detente may diminish the possibility of war, in Soviet eyes it does not negate war.[218] According to a U.S. publication which appeared prior to the detente: "It appears quite possible that, if the Soviet leaders reach or negotiate a detente with the United States, the Kremlin may wish to control or minimize the internal impact that a relaxation of international tensions may have in dulling the vigilance of the general populace and encouraging the disruptive impulses of the intelligentsia."[219] Although this theory was related to the rehabilitation of Stalin and the Chinese threat, it could apply most readily to promoting a renewed interest in civil defense.

Attempting to associate Communist ideology and detente, one civil defense analyst asserts that Soviet views on the concept of detente differ from those of the West. According to his hypothesis, the Soviets see this period as one of "peaceful coexistence," a result of the *historical* necessity for opposing systems to experience phases of peace and resistance—eventually leading to a shift of East-West forces in favor of the Soviet Union.[220] Just how much this rather dogmatic approach applies to Soviet thought today is not known.

The same analyst stated two years earlier that it was "not possible to ascertain how serious Soviet leaders actually believe the threat of war to be." It was assumed that the leadership certainly realized political benefits by claiming a threat existed, if only to justify massive defense spending. If these expenditures motivated the West to "follow suit" then it also served to "confirm" the threat of U.S. aggression.[221]

Civil defense interacted closely with the SALT I agreements signed in 1972. The limitations placed on ballistic missile defense leave the cities of both countries vulnerable to offensive forces. However, the Soviets maintain the capability to evacuate the majority of the urban population which the U.S. cannot do.[222] Therefore, civil defense offers the Soviets some advantage in the SALT talks. Perhaps this provides

[215] *Soviet Civil Defense Programs Continued*.
[216] *Voennye Znaniya*, No. 1, op. cit.
[217] Goure, *Soviet Civil Defense Revisited* . . . , op. cit., p. 8.
[218] Goure, *The Current State* . . . , op. cit., p. 2.
[219] Goure, *The Military Indoctrination of Soviet Youth*, p. 19.
[220] Goure, "The Soviet View: We are Realists."
[221] Goure, *Recent Developments in Soviet Civil Defense*.
[222] Suta, *Evaluation of U.S. Capabilities* . . . , op. cit.

part of the explanation for Altunin's appointment as Chief of Civil Defense several months after the SALT I decision.

Some analysts, however, see the ABM limitations imposed by SALT I, added to the capability provided by the MIRVed nuclear warheads in the possession of the super-powers, as negating civil defense preparations. Others consider civil defense programs instituted by either of the super-powers as a threat to detente. The Soviet response to this theory is unequivocal:

> Soviet civil defense does not incite, does not promote and does not provide impetus to war. Its substance is influenced in a decisive manner by the peaceful foreign policy of the socialist state. For this reason, there is no basis for the "forecasts" of Western experts that a strengthening of Soviet civil defense will lead to greater "inflexibility" of Soviet foreign policy and even to serious aggravation of international tensions. Improvement of Soviet civil defense and an increase in its effectiveness constitutes one more major obstacle in the way of the unleashing of a new world war by the imperialists. Consequently, Soviet civil defense intensifies the peaceful actions taken by our state and strengthens international security as a whole. Herein lies one of the most important features of its socio-political essence.[223]

Thus, the era of "assured destruction," which precipitated the need for detente and the SALT talks, has given way to the era of "assured survival," in the Soviet Union, through an ever-expanding civil defense program. Chuykov, in emphasizing the need for a well-organized civil defense system which could reach the entire population, best explained the objectives: ". . . mass weapons . . . with modern defense measures, . . . will not injure the masses . . . only those who neglect the study, mastery, and use of these measures."[224]

[223] Scott, *Survival in the Nuclear Age*, quote from A. S. Milovidov.
[224] "Civil Defense as a Common Concern," *Nauka i Zhizn*, pp. 43–47.

Table 30—Estimated APVO Aircraft Mid-Year

Aircraft	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
MiG-15/MiG-17 FAGOT/FRESCO	3725	3450	3100	3200	3579	3275	3040	2965	2675	2200	1920	1715	1572	1488	1284	1104	912	756
Farmer/MiG-19	50	225	450	600	700	750	750	750	750	750	675	600	534	438	390	378	366	348
Flashlight/YAK-25	25	125	250	400	400	400	380	350	325	300	300	215	190	202	202	178	154	84
Fishpot/SU-9/11						175	230	300	415	675	755	775	780	768	768	768	768	768
Fitter/SU-7								15	15	35	35	35	20	20	15	12		
Firebar/YAK-28P										74	100	235	360	360	360	360	360	360
Fiddler/TU-128P												5	20	60	81	108	162	162
Flagon/SU-15												s		70	250	370	470	530
Foxbat/MiG-25																	21	63
Total	3800	3800	3800	4200	4675	4600	4400	4380	4180	4054	3785	3580	3476	3406	3350	3278	3213	3071

Source: DI-3 Working Papers.

Table 31—Soviet Strategic Defensive Missile Deployment (Number of Sites)

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
SA-1	5	30	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56
SA-2						30	160	370	620	720	775	775	775	775	775	775	775	740	725
SA-3								2	38	75	88	96	96	96	101	143	190	210	227
SA-5													4	13	30	96	180	208	227
MOSCOW ABM															1	3	4	4	4

Sources: DIA: Defensive Missile Order of Battle AP-1-240-2-1C-64 (65,66,67) NT Pre-1967 CIA Notes Pst-1967.

Table 32—Fighter Aircraft Production, 1955–1972

Designation \ Year	Pre-1955 Production	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	Total Production
MiG-17 Fresco*	9800	2000	1050																12850
MiG-19 Farmer*	260	550	600	450															1860
YAK-25 Flashlight*	250	300	30																580
SU-9/11 Fishpot*			5	130	240	240	240	15											1110
SU-7 Fitter*			5	45	85	95	130	185	200	105	85	160	190	190	100	75	70	70	1790
SU-20 Fitter B															10	30	85	65	190
MiG-21 Fishbed				5	80	240	285	380	480	525	630	720	595	430	390	420	420	480	6080
YAK-28P Firebar*									40	147	159	180	75						601
Tu-128P Fiddler*											10	30	35	35	35	35	30		210
SU-15 Flagon*												5	90	175	180	150	75	80	755
MiG-25 Foxbat*														5	25	30	45	55	160
MiG-23 Flogger															5	30	75	150	260
SU-19 Fencer																		5	5
Total Per Year	10310	2850	1690	630	405	575	655	805	735	777	884	1095	985	835	745	770	800	905	26451

* AIRCRAFT DEPLOYED WITH PVO

Sources: DI-3 Working Papers

Table 33—Composite of Soviet Radar Systems

Radar	Function	Year Entered Service
Back Net	EW, GCI	1963
Bar Lock	EW, GCI (when used w/HF)	1958
Big Bar A	EW	1959
Big Bar B	EW	1960
Big Bar C	EW	1960
Big Mesh	EW	1957
Big Net	EW	1957
Cross Fork	EW	1950
Cross Out	EW/GCI	1958
Dumbo	EW	1946
Fish Net	IFF	1952
Flat Face	EW, acq. for SA-3 & AAA	1958
Flat Jack	Airborne EW	1968
Gage	EW	1952
Head Net A	EW, Surface Search	1959
Hen House	EW	1970
Knife Rest A	EW	1952
Knife Rest B	EW	1956
Krug	HF/DF	1952
Long Track	EW	1964
Moon Face	EW, may be GCI	1959
Odd Pair	HF	1972
Pagmatit	EW	1942
Part Time	EW	1963
Patty Cake	HF	1953
Rock Cake	HF	1955
RUS-2	EW	1943
Scan Odd	AI	1954
Scan Can	AI	1954
Score Board A	IFF	1958
Score Board B	IFF	1962
Side Net	HF	1962
Slant Mesh	GCI	1957
Sponge Cake	HF	1958
Spoon Rest A	EW	1959
Spoon Rest B	EW	1960
Spoon Rest C	EW	1960
Squat Eye	EW & Acq. SA-3 & AAA	1960
Stone Cake	HF	1958
Strike Out	EW	1957
Tall King	EW	1959
Thin Skin	HF	1965
Token	EW, GCI	1951
Top Sail	EW, GCI	1968
Top Trough	EW	1960
Witch Four	IFF	1958
Witch Five	IFF	1957
Witch Eight	IFF	1953

[1] Deployment of Hawk will be addressed in the following paragraph, *Operational Problems*.
[2] Reduction of generally eight missiles per year was programmed, rather than reduction in the number of squadrons.
[3] Gap filler radars would be retained for the Florida area only.
[4] Programmed Hawk reductions were not implemented because of a subsequent requirement for air defense of the southern United States.
[5] Advanced Airborne Command Post, a NORAD/CONAD concept comparable to the National and SAC airborne command posts.

Appendix A

A Chronology of American Air Defense Systems[1] (1956–1972)

1956

3 January	Navy lighter-than-air blimp squadron (ZW-1) commissioned.
11 January	The Department of the Army assigned ARAACOM responsibility for supervising the training of Army National Guard AAA units of the Special Security Force which have specific CONUS defense missions.
22 January	JCS approved in principle a recommendation of USAF Chief of Staff that there was a need for peacetime integration of the operational control of the Canadian-U.S. air defense forces.
February	The USAF approved both extensions to the DEW Line: Western, from Alaska to Midway, and Eastern, from Greenland to the Azores.
March	Initial version of the radar-controlled air-to-air missile (GAR-1) became operational with 445th FIS.
2 March	The Assistant Secretary of Defense for Research and Development approved a program to integrate the U.S. Marine Corps ground-based Sparrow III program with the Hawk program.
8 March	First airborne test firing (from F-89D) of MB-1 nuclear rocket took place at Holloman AFB, New Mexico.
April	First F-102A received by ADC FIS. This was the initial supersonic, century-series aircraft.
9 April	Seven squadrons of RC-121 (AEW&C) aircraft deleted from USAF program because of aircraft problems. Seven squadrons remain in the program.
18 April	Bell Telephone Laboratories requested to initiate studies to determine the feasibility of improvements to enable the Nike Hercules system to have a greater capability against small high-speed targets and in an ECM environment.
7 May	Texas Tower No. 2 began limited operations with FPS-3L (later converted to FPS-20A) search radar and two FPS-6 height finder radars. This was the first Texas Tower to become operational.

[1] This chronology has been prepared by selection of occurrences listed in the following documents. Classification of entries has, in all cases, been taken from the source document.

(1) "Aerospace Defense Chronology of Events, 1946–1968," Headquarters NORAD, 1 June 1968,

(2) "A Chronology of Air Defense, 1914–1972," Historical Study No. 19, ADCHO 73-1-4, Headquarters Aerospace Defense Command, March 1973.

(3) "Historical Data Book" Headquarters U.S. Army Air Defense Command, 26 September 1969, with changes through 11 October 1973.

21 May	The first airborne H-bomb was dropped. A B-52 bomber released the bomb at 50,000 feet over Bikini Atoll.
13 June	The Chief of Staff, Army, informed Senator Chavez, in connection with testimony given 11 June, that his position on Nike was as follows: (a) Nike I provides the most effective air defense for the United States in the period 1956–1958 and the only defense at the maximum altitudes at which Soviet bombers are capable of operating. (b) Nike B will provide a better and cheaper antiaircraft defense two years earlier than any other surface-to-air missile. (c) The Nike program is the only program which naturally leads to an antimissile capability. (d) Any delay to the Nike program will lessen the protection from air attack of the people, cities, and vital installations of the United States.
20 June	The Special Assistant for Guided Missiles to the Secretary of Defense constituted a committee to investigate the relative merits of the Nike Ajax, Nike Hercules, and Talos weapons.
22 June	In its first fully guided flight against a drone target (F-80), the Hawk missile scored a direct hit.
1 July	For the first time, an Air Force Reserve unit having an M-day assignment with ADC began standing five-minute alerts with two aircraft for 14 hours per day. Limited operations on the Newfoundland-Azores extension of the DEW Line began. Five Navy picket ships on station off West Coast.
3 July	JCS revised unified command plan issued; provided for abolition of the U.S. Northeast Command and assignment of responsibility for air defense of the Northeast and of Alaska to CINCONAD, effective 1 September 1956.
26 July	The first firing test of the Nike B was conducted in a demonstration. A Nike B missile under complete system control was fired at a 650-knot moving space point at a range of 50 nautical miles and an altitude of 50,000 feet. The missile and ground equipment performance was excellent, and the test objectives were completely realized.
August	USAF recommended removal of USA Skysweeper battalions from defenses of SAC bases as too expensive for defense achieved, unless conversion to Nike was programmed.
7 August	Texas Tower No. 3 launched and subsequently turned to Nantucket Shoal, approximately 100 miles southeast of Rhode Island.
9 August	GAR-2A (infrared guidance) Falcon missile successfully fired at Holloman AFB, New Mexico.
23 August	The Department of Defense directed the Army to proceed with construction of Nike sites at Thule AB, Greenland.
1 September	CINCONAD assumed responsibility for air defense of Alaska and Northeast area.
4 September	The JCS published new terms of reference for CONAD, authorizing separation of headquarters and staffs from those of ADC. CINCONAD's authority was strengthened and clarified to include centralized operational control of forces, including assignment of individual antiaircraft batteries to designated targets. CINCONAD was assigned responsibility for the air defense of Alaska and the Northeast area.
10 September	ADC submitted to USAF a plan for deployment of 40 Bomarc squadrons.

13 September	The Air Defense Command was informed by USAF that "the present . . . Bomarc program cannot be funded." From September 1955 to September 1956, the estimated cost of 40 squadrons less shelters had risen from $2 billion to nearly $3.5 billion. 22 squadrons suggested.
17 September	A new staff structure was established for Hq, CONAD, leading to its physical and functional separation from Hq, Air Defense Command, on 1 October.
	CONAD and Air Defense Command were formally separated.
19 September	The Army stated a requirement for an atomic warhead for Hawk.
	CINCONAD recommended to JCS the collocation at 10 locations of Army Missile Master and AF ADDC.
21 September	Twenty-three Special Security Force Army National Guard gun battalions were on-site as of this date.
October	First F-86L delivered to ADC FIS.
30 October	Office of the Secretary of Defense concurred in CINCONAD's recommendation to collocate the Army Missile Masters and Air Force direction centers.
November	USAF ruled out development of a Medium Range Interceptor (MRIX) for air defense use.
8 November	The Secretary of the Army proposed a memorandum to the Secretary of Defense asking for a revision to the surface-to-air assignment. The limitation of 50 nautical miles was established in 1954 when the Nike had a range of 25 miles. The Nike B, with a range of 80 miles, was to be initiated in 1958. He proposed to request that the range limitation be removed.
26 November	An Army element is established within Hq, CONAD.
	The Secretary of Defense transferred responsibility for the Talos land-based system from the USAF to the Army and issued a directive clarifying the roles and missions of the Services.
December	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*
14 December	In its final report, the committee appointed to investigate the relative merits of the Nike and TALOS weapons recommended that further development work be carried out by the Army on both the Nike Hercules and Talos systems, that more permanent installations be developed for the Nike Hercules, and that development work on applying a seeker to the Nike Hercules be carried out.
19 December	The Canada-U.S. Military Study Group recommended to the JCS and the Canadian Chiefs of Staff Committee the integration of operational control of Canada-U.S. air defense forces.

1957

15 January	CONAD replaced its joint air defense forces and joint air divisions with three CONAD regions and 16 CONAD divisions. In the absence of manning authorization, CONAD directed ADC to assign its defense force and division commanders the additional duty of commanding CONAD regions and divisions.
February	The contractor completed the Nike Hercules prototype installation at White Sands Proving Ground and began testing ground guidance and control equipment.

4 February	A request was forwarded to the Assistant Secretary of Defense (Research and Development) for $6.2 million for initiation of the Nike Hercules improvement program. This request was never approved or returned to the Army.
	The Commandant, U.S. Marine Corps, requested Department of Defense approval for termination of the Hawk-Sparrow project and combined participation with the Army in the Hawk program.
5 February	The final plan for a training program to support the Nike Hercules program approved, which will allow the first converted Hercules units to be operational on-site by June 1958.
13 February	The first fully automatic tactical launching of the Bomarc was successful.
26 February	A Hawk missile physically intercepted an F-80 Jet drone flying at 500 feet above the terrain at a range of eight nautical miles.
27 February	A JCS requirement for an atomic warhead for Hawk was established.
4 March	Troop tests of Nike Ajax initiated to determine the suitability of the system to accomplish its tactical mission with a field army, the adequacy of TOE, and the validity of current operational and tactical doctrine.
7 March	ARAACOM reaffirmed the validity of the 1 August 1950 Collins-Vandenberg Agreement under the 4 September 1956 CINCONAD Terms of Reference.
13 March	A Nike Hercules missile with solid-propellant sustainer motor was flight-tested at White Sands. Performance was satisfactory.
17 March	The Department of the Army directed on-site deployment in 1959 of an Army National Guard antiaircraft battalion with Nike Ajax equipment for the purpose of evaluating the National Guard capability to man Nike units in the on-site air defense program.
21 March	Army Antiaircraft Command redesignated the U.S. Army Air Defense Command (USARADCOM).
27 March	The U.S. Marine Corps Informed the Army of the military characteristics it desires in the Hawk system.
3 April	At a Nike Hercules Coordinating Committee meeting, Picatinny Arsenal and Douglas Aircraft indicated that all production of liquid-sustainer motors has ceased and all future missiles produced at the Douglas Santa Monica plant would use solid propellants as fuels.
9 April	The Department of the Army approved a cellular concept for a fixed on-shore Hawk battery installation.
15 April	ADC assigned operational control of DEW Line with inactivation of NEAC.
24 April	The Department of the Army published a plan that established the concept, organization and responsibilities for the support of atomic warheads employed with *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]* missiles in CONUS.
26 April	California National Guard accepted the mission of testing the Army National Guard capability for full-time manning of Nike Ajax battalions.
16 May	Bomarc IM-99B ordered into production.
28 June	The contractor authorized to proceed with development of a cellular launching system for Nike Hercules on an 18-month schedule.
	Texas Tower No. 4 towed to New York Shoal and subsequently erected.

July	First FPS-20 for ADC became operational at Palermo, New Jersey.
1 July	The Atlantic DEW Line sea barrier became fully operational.
15 July	The DEW Line from Cape Dyer, Baffin Island, to Cape Lisburne, Alaska, became technically ready for operations.
25 July	A Hawk missile without warhead scores a direct hit at a range of 7.5 miles on an F-80 jet drone flying at 410 feet above the terrain.
1 August	East and west portions of DEW Line placed under operational control of ADC and AAC, respectively.
	The Canadian Minister of National Defense and the U.S. Secretary of Defense jointly announced the agreement of their governments to establish integrated operational control of the air defense forces of the two countries.
13 August	DEW Line received formally by USAF from prior contractor, Western Electric.
26 August	The U.S.S.R. announced the successful testing of a missile capable of hitting any target "in any part of the world."
September	The last Nike Ajax tactical ground set came off the production line. A total of 350 Nike Ajax ground sets had been produced.
5 September	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*
12 September	The North American Air Defense Command (NORAD) was established at Ent AFB, Colorado Springs, Colorado, with General Earle E. Partridge as Commander in Chief, following agreement by the Canadian Chiefs of Staff Committee and the JCS to General Partridge's recommendation that an integrated command be established and that, effective 12 September 1957, operational control of the Royal Canadian Air Force Air Defense Command (RCAF ADC) be assumed by the integrated headquarters.
16 September	First launching of Bomarc IM-99A missile at a AF-80 target was successful.
4 October	Sputnik I, the first man-made earth satellite, launched by U.S.S.R.
8 October	The Department of the Army terminated the Army National Guard AAA gun mission.
23 October	A USAF Bomarc missile, in two minutes from the beginning of an alert, successfully intercepted and knocked down a B-17 drone at a distance of 100 miles over the Atlantic.
28 October	The Department of Defense Comptroller released to the Army an FY 1958 procurement and production appropriations apportionment increment which includes funds applicable to the Nike Hercules program. He directed that Nike Hercules funds not be obligated pending resolution of the point-defense versus area-defense problem, and the problem of supporting the Talos industrial program.
31 October	All eight sections of Mid-Canada line reached a limited operational status.
13 November	As of this date, 91 Nike Hercules missiles had been fired in the system evaluation program at White Sands Proving Ground. Of these, 20 have been solid propellant missiles. No failures had been attributed to the propulsion system itself. The percentage of successes to-date approximately 62 percent. The Nike Hercules evaluation program to be completed in June 1958.
20 November	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*

5 December	The Army's first AN/FSG-1 Fire Distribution System (Missile Master)—a prototype—became operational in the Washington-Baltimore defense, at Fort Meade, Maryland.
20 December	The last (thirteen) 90-mm and (four) 120-mm gun units assigned to active air defense in CONUS inactivated. USARADCOM retained one 90-mm battalion at Thule AB, Greenland.
26 December	Department of the Army published a policy directive on the full-time participation of Army National Guard Nike Ajax units in the air defense of CONUS. The CG, USARADCOM was directed to "negotiate mutual agreements (with the states) . . . for the alerting, assembling, manning, and ordering to fire" of ARNG on-site missile units pending orders into federal service.
31 December	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*
Late 1957	The JCS approved Nike Hercules deployments for Dallas, Fort Worth, Kansas City, St. Louis, Cleveland, Minneapolis, and St. Paul.

1958

1 January	The Mid-Canada Line declared fully operational.
	U.S. Ground Observer Corps reduced from 24-hour to ready-reserve status.
3 January	Office of the Deputy Chief of Staff for Military operations recommended that, in view of the Army's requirement to provide the earliest maximum air defense capability, the Army should concentrate its currently available dollar resources on Nike Hercules and Hawk. Continuance of the Talos program under existing Department of Defense directives would require reprogramming of Nike Hercules funds.
9 January	Agreement reached between the Department of Defense and the Department of Commerce on integration of air traffic control and air defense radar facilities.
	The Chief of Research and Development noted that analysis of air defense systems in the Nike Zeus era indicated that a companion surface-to-air missile may be required. It should have a high rate of fire, low altitude capability, improved homing-on-jamming techniques, extended ranges and altitudes. On 2 January 1958, the Raytheon Corporation, in a feasibility study, proposed a Superhawk system with those capabilities, including ranges to 100 miles and altitudes to 80,000 feet.
26 January	First F-104 delivered to ADC FIS.
31 January	Explorer I, first U.S. earth satellite, launched by Jupiter-C missile.
15 February	The Air Defense Command given operational control and contract administration of all of the DEW Line, except the Aleutian extension.
19 March	The DEW Line East (Greenland) extension approved by Denmark.
20 March	NORAD assigned the Air Defense Command primary responsibility for furnishing surveillance radars in the U.S. and also designated the ADC as coordinating agency responsible to NORAD for the U.S. portion of the surveillance system.
April	F-86D interceptors phased out of ADC inventory.
23 Apri1	The Director of Research and Development, Department of the Army, informed the Director of Guided Missiles, Department of Defense, that, since assuming responsibility for development, procurement, and manning of the land-based Talos on 26 November 1956, the Army had been attempting to develop a program for establishing approximately 25 operational units of the missile. Because of funding limitations, the

	Army was unable to support the program beyond a minimum industrial effort and a limited evaluation at White Sands Proving Ground. Available funds were being expended at a rate which would require termination of the industrial effort on 1 May 1958.
12 May	An exchange of notes between Canada and the United States constituted formal agreement for the establishment of NORAD, which has been in existence since 12 September 1957.
15 May	The first NORAD Control Center, located at Geiger Field, Washington, became operational.
10 June	Agreed terms of reference for CINCNORAD became effective. NORAD was an integrated command, including as component commands the RCAF ADC, USARADCOM, NAVFORCONAD, and the USAF ADC, having the mission of defending CONUS, Canada, and Alaska against air attack. CINCNORAD was responsible to the JCS and the Canadian Chiefs of Staff Committee. NORAD was to operate within an agreed Canadian-U.S. concept of air defense and in accordance with agreed joint intelligence. Operational control was defined as the power of directing, coordinating, aid controlling the operational activities of available forces.
23 June	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*
	F-89D interceptors phased out of ADC inventory.
26 June	The SAGE (Semiautomatic Ground Environment) System became operational for the first time, in the New York NORAD Sector direction center, McGuire AFB, New Jersey.
30 June	The first USARADCOM Nike Hercules unit became operational in the Chicago Defense.
July	Construction of four Greenland DEW Line sites along 67th parallel began.
1 July	The Pacific sea barrier became fully operational, with an initial force of four radar-equipped destroyer escorts (DER) and four AEW&C aircraft (WV-2) patrolling from Midway Island to Kodiak, Alaska.
7–30 July	In "Operation [Brig. Gen. John T.] Snodgrass," two Nike Hercules batteries, following their movement from Fort Bliss to Eglin AFB, Florida, completed six successful firings in six attempts, to demonstrate the system's reliability, accuracy, and suitability for deployment.
1 August	The USAF approved inactivation of the Ground Observer Corps, effective l January 1959.
6 August	The Department of Defense Reorganization Act signed by the President. This act changed the status of joint commands to that of unified commands, eliminating the "executive agency" channel together with other single service prerogatives.
7 August	For the first time, a Bomarc missile was launched from Cape Canaveral on a signal sent by a SAGE control center, located in Kingston, New York.
8 August	The Air Defense Command designated its first SAGE division, the 26th at Syracuse Air Force Station, New York.
15 August	The first successful SAGE control of Bomarc results in a direct hit on a QB-17 drone at 78 miles range and 30,000 feet altitude.
17 August	Texas Tower No. 2 became fully operational.

8 September	The JCS published a new unified command plan with new terms of reference for CONAD, to become effective 1 January 1959. As a unified command, CONAD is to be under JCS rather than USAF executive agency control.
14 September	The Los Angeles defense sites of the active Army's 4th Missile Battalion (Nike Ajax), 62d Artillery, were turned over to the 720th Missile Battalion, the first Army National Guard unit to assume full-time manning responsibility for air defense missile sites.
18 September	A Nike Ajax missile launched by Battery C, 1st Missile Battalion, 56th Artillery, successfully intercepted a rocket-powered RP-76 drone target in the first such engagement.
October	Texas Tower No. 3 became operational.
November	The Department of Defense proposed legislation to solve the problem of command and control of Army National Guard air defense units, empowering CINCONAD to order to active duty involuntarily those units assigned to air defense, when waiting for Presidential declaration of emergency would seriously limit operations.
6 November	A Nike Hercules successfully engaged a "Pogo-Hi" balloon target at an altitude greater than 150,000 feet.
10 December	A Nike Hercules destroyed a rocket drone flying 2,100 miles per hour at an altitude of 73,000 feet.

1959

1 January	The first SAGE division, the 26th, became operational, at Syracuse AFS, New York.
	New terms of reference for CINCONAD as commander of a unified command became effective, marking the termination of USAF executive agency control of CONAD and the assumption of control by the JCS.
5 January	Canada and the United States agree in principle to a cost-sharing arrangement for a joint air defense program in Canada: the Continental Air Defense Integration North (CADIN) program.
31 January	U.S. Ground Observer Corps units inactivated.
February	F-94C interceptors phased out of ADC inventory.
1 February	The Mark X IFF, with SIF, became operational in the U.S.
	The Royal Canadian Air Force assumed responsibility for manning operational positions in the DEW Line.
12 March	The first Nike fire unit in Alaska, one-half of Battery A, 4th Missile Battalion (Nike Hercules), 43d Artillery, became operational near Elmendorf AFB.
18 March	The JCS approved locating a new NORAD Combat Operations Center (COC) in Cheyenne Mountain, south of Colorado Springs, Colorado.
28 March	The last 90-mm battery in USARADCOM was inactivated at Thule AB, Greenland.
April	Texas Tower No. 4 became operational, competing the Texas Tower program.
	The DEW Line West (Aleutian extension) became operational.
May	First F-106A delivered to FIS of ADC.
June	DOD Master Air Defense Plan reduced manned interceptor units to 44 squadrons and Bomarc sites to 18.

19 June	SECDEF provided new air defense program, Continental Air Defense Program, which included cuts in Bomarc (to 18 sites) and SAGE program.
1 July	USAF cancelled requirement for DEW Line radar improvement.
1 August	The Eastern NORAD/CONAD Region discontinued, and the 26th, 30th, and 32d Air Divisions designated regions, a start toward replacing geographically designated regions with numerically designated regions under the SAGE reorganization.
September	F-89H phased out of ADC inventory.
	SAGE Combat Center No. 2 became operational.
1 September	The first Bomarc squadron became operational at McGuire AFB, New Jersey.
3 September	Bomarc IM-99A made its first successful interception of a supersonic target—a Regulus rocket.
17 September	USAF cancelled requirement for a follow-on AEW&C aircraft.
23 September	USAF stopped development of the F-108 long-range interceptor.
11 December	The Department of Defense initiates action to procure the Battery Integration and Radar Display Equipment (BIRDIE) for small air defense artillery (ADA) defenses not equipped with Missile Master, thus permitting integration with SAGE.

1960

6 January	President Eisenhower issued rules for the safe handling of the MB-1.
12 January	ADC commanders authorized to scramble one aircraft, instead of two, to perform identification intercept of unknown.
21 January	The first production model AN/FSG-1 (Missile Master) dedicated at Fort Lawton, Washington.
29 January	A Hawk destroyed an Honest John in flight.
21 March	The Martin Company contracted with the Department of the Army to produce Birdie systems for 18 ADA defenses. The first system was scheduled for completion in April 1961.
26 March	Navy picket ships withdrawn from the Atlantic DEW Line barrier.
30 March	USAF announced extensive cuts in the program for air defense equipment to meet the manned bomber threat, including reduction of Bomarc squadrons, and cancellation of hardened SAGE combat center program (Super Combat Center).
1 April	Navy Picket ships withdrawn from the Pacific DEW Line barrier.
13 April	The first successful test of a Bomarc B missile (IM-99B) is conducted at Santa Rosa Island.
June	Congress restored Bomarc B program.
	F-86L interceptors phased out of ADC inventory.
3 June	A Nike Hercules destroyed a Corporal missile. This is the first known instance in which one guided missile has intercepted another.
15 June	The last gun battalion in USARADCOM, the 2d Gun Battalion (Skysweeper), 68th Artillery, inactivated at Camp Lucas, Michigan. Of the 262 operational fire units within USARADCOM, 88 were Nike Hercules and 174 Nike Ajax. Of the latter, 52 were manned by Army National Guard organizations.

20 June	The Office of the Secretary of Defense approved a NORAD recommendation to relocate programmed Nike Hercules units from Strategic Air Command bases in the interior of CONUS to important populated areas.
1 July	The last NORAD/CONAD Region discontinued. This established a seven-region structure in CONUS—the original goal of reorganization for SAGE.
	The Air Defense Command reached a seven SAGE division structure, completing the SAGE region reorganization.
	Navy blimp squadron ZW-1 stopped manning a station in the Atlantic and dropped air defense as a primary mission.
8 July	Bomarc IM-99B intercepted a supersonic target (Regulus); first time IM-99B had been launched at any target.
26 July	USARADCOM added a sixth region to its structure. Department of the Army approval of the redeployment of 15 Nike Hercules fire units to metropolitan defenses instead of Strategic Air Command bases and the Hanford AEC installation obviated an earlier requirement for a seventh region. This would have produced conformity with the NORAD seven-region structure.
September	F-104 interceptor withdrawn from ADC inventory, rejoined in 1963.
30 September	An improved Nike Hercules destroyed another Nike Hercules in an interception approximately 19 miles above the earth and at a closing speed in excess of Mach 7.
22 September	The Strategic Air Command and USARADCOM signed a Joint Training Agreement to provide increased training opportunities for both SAC and USARADCOM units through electronic scoring of SAC simulated bomb runs, exercising Nike fire units and SAC bombers on a mutually agreeable basis.
December	F-89J phased out of ADC inventory.
1 December	Air National Guard squadrons selected by NORAD and ADC for Category I (24-hour ready) role approved by JCS.
14 December	The last of ten planned Missile Master sites dedicated at Fort MacArthur, California.
	The first above-ground Nike Hercules site became operational at Byron, Georgia, near Robins AFB.

1961

Early 1961	ADC's regular fighter-interceptor force completed transaction to century-series all-weather interceptors (F-101B, F-102A, and F-106A).
15 January	Texas Tower No. 4, located on a shoal 80 miles southeast of New York City, collapsed with a loss of 28 lives.
1 March	Conversion of Army National Guard units from guns to Nike Ajax completed. 76 Nike Ajax N6 batteries in CONUS, plus six in Hawaii.
8 March	President Kennedy directed the Administrator of the FAA to review air traffic control in the U.S.
20 March	Bomarc IM-99B intercepted a subsonic QB-47 at a range of 205 miles.
17 April	Bay of Pigs invasion of Cuba by anti-Castro forces began.
18 May	Excavation of NORAD COC in Cheyenne Mountain began.
23 May	First completely successful triple launching of Bomarc IM-99B made.

	[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]
1 June	First squadron equipped with Bomarc IM-99B became operational.
5 June	SECDEF directed that further SAGE air battle augmentation be stopped and the money saved and subsequent funding be used to provide a survivable backup control system (BUIC-Back-Up Interceptor Control).
26 June	Initial surveys conducted at various airfields for purpose of selecting bases for ADC regular interceptor force.
1 July	Twenty-five of 29 ANG fighter-interceptor squadrons assigned M-day mission with ADC began standing constant 24-hour, 5-minute alert vigils.
	Basic Mark X IFF was discontinued in the continental aircraft control and warning system.
1 July	Installation of the first Nike Hercules improvement kit completed at Barksdale AFB.
9 July	U.S.S.R. unveiled bombers in the Mach 2 class at air show, Moscow.
1 August	Greenland-Iceland-UK Line became operational.
September	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*
November	ARADCOM achieved its program of 139 Nike Hercules RA fire units.
15 December	The last of 22 programmed SAGE Direction Centers became operational at Sioux City, Iowa, completing the SAGE program in CONUS.
	The last active Army Nike Ajax units inactivated.

1962

5 March	The Department of the Army published a policy directive regarding full-time participation in the air defense of CONUS by Nike Hercules units of the Army National Guard.
13 March	SECDEF approved two-phased BUIC implementation plan.
16 March	The Maryland Army National Guard became the first ARNG organization in CONUS to sign an agreement with ARADCOM concerning the assumption of operational control of Nike Hercules sites.
10 April	30th NORAD region, Truax Field, Wisconsin designated as secondary NORAD ALCOP.
30 June	The Nike Ajax elements of all Nike universal batteries relieved of their operational mission.
9 July	Operation Fish Bowl, a high altitude nuclear test shot series, began aver Johnston Island.
	[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]
3 August	SECDEF approved a limiting of military requirements for CONELRAD.
22 October	CONAD increased its weapons readiness status and declared DEFCON 3 because of Cuban crisis. Increased alert remained in effect until 27 November.

	CONAD increased radar and weapon forces in Florida area and dispersed part of interceptor force in U.S.
25 October	Battery B, 1st Battalion (AW), 59th Artillery, armed with 40-mm SP guns, air-lifted from Fort Bliss, Texas, to Homestead AFB, Florida. This was the first ADA unit moved during the Cuban missile crisis. By 14 November, two Hawk battalions, one Nike Hercules battalion, and one group headquarters had been deployed from other CONUS stations to Homestead AFB.
31 October	First radar station in U.S. powered by a nuclear sector turned over to ADC at Sundance, Wyoming.
23 November	Cuban crisis, which began on 22 October, 1962, ended.
1 December	Ten squadron NORAD Bomarc program completed.
11 December	Battery A, 1st Missile Battalion (Nike Hercules), 70th Artillery, Army National Guard, Maryland, became operational in the Washington-Baltimore defense. This marks the beginning of implementation of the Army National Guard Nike Hercules program.

1963

8 January	USAF announced decision to decommission Texas Towers.
22 March	NORAD revised its readiness and alert requirements (Regulation 55-3).
24 March	The Department of Defense decided to establish permanent defenses on the Florida peninsula.
25 March	Last of Texas Towers (Tower No. 3) shut down.
March–April	F-104 rejoined ADC (two FIS). Remained until November 1969.
1 April	NORAD Voice Alerting System went into operation replacing Readiness and Warning Network Number 1.
5 April	USAF announced dispersal plans for more than 100 ADC jet interceptors to reduce their vulnerability to missile attack.
19 April	JCS approved implementation of Mark XII IFF System.
May	BUIC-I, first phase of SAGE decentralization program, completed.
1 May	Fourteen long-range radars and ten gap-filler radars closed down in CONUS as part of OSD-directive 416L phase-down.
10 May	Continental Air Defense Study, 1966–1975, prepared by Air Force, issued.
15 May	First two (San Francisco and Minot) of six direction center closed down as part of OSD-directed 416L phase-down.
	Three Alaskan Air Command radars ceased operations.
11 June	CINCONAD directed continuous all-weather interceptor alert capability at Key West, Florida.
26 June	Last of 11 AF-manned sites of Pinetree radar system turned over to RCAF.
5 July	CINCONAD suspended “pop-up” criteria for Hawk fire units pending equipment modification to permit greater accuracy in determination of target altitude.
8 July	USAF informed ADC that OSD had recommended phase out of Bomarc IM-99A missiles.

21 July	Twenty-eight DEW Line intermediate stations closed down.
28 August	Last of four ALRI stations (Station 8) became operational.
26 September	Two ARADCOM Missile Masters phased out, leaving eight in the system.
3 October	NORAD/SHAPE Early Warning Voice Circuit became fully operational.
26 October	SECDEC memorandum issued providing for increased authority for unified and specified commanders over their command and control systems.
1 November	ARADCOM realigned region boundaries in keeping with the NORAD/CONAD regional boundary adjustment resulting from the OSD-directed 416L phase-down.
27 November	OSD directed that four SAGE direction centers and two SAGE combat centers be deleted in FY 1968.
December	DOD approved replacement of Missile Master with ten AN/TSQ-51 by FY 1966.

1964

12 January	Five of eight Mid-Canada Line Section Control Stations closed.
24 January	USAF cancelled AN/FPS-74 gap-filler radar program which had been intended to replace older radars.
20 April	SCAN and NORAD/ADC switched communications network combined into CONUS AUTOVON.
18 May	Nike-Ajax withdrawn from the ARADCOM missile inventory as the 4th Battalion, 111th Artillery, Army National Guide, at Churchland, Virginia, is relieved of its Nike-Ajax mission.
22 June	ADC submitted proposal for PAGE (Primary Automated Ground Environment) to USAF.
July	Last FPS-3 long-range radar phased out of ADC radar network.
23 July	Phase out of Bomarc A missiles and two Bomarc squadrons completed.
August	First U.S. bombing of North Vietnam occurred.
1 September	NORAD Automatic Attack Warning System became operational.
15 September	OSD directed establishment of DOD-FAA unit to resolve problems associated with the establishment of a National Surveillance and Control System.
22 September	First BUIC II installed, to be operational 1 September 1965.
October	The AADS-70 Project is redesignated SAM-D.
16 October	Chinese exploded an atomic device in western regions of China.
30 October	NORAD began manning the COC in Cheyenne Mountain.
2 December	SECDEF approved a plan for provision of BUOC III.
8 December	CINCNORAD advised JCS that he favored F-12A to fill the IMI requirement.
15 December	First of a number of long-range radars (LRR) scheduled for deletion as excess closed down.
December	OSD set USAF interceptor force level at 20 squadrons by FY 1970.

1965

January	Navy began phase-down of operations of its Pacific barrier to two aircraft and to eliminate three picket ship stations off the East Coast.
7 January	USAF approved 17 CONUS bases for use as dispersal bases and agreed to negotiate requirements in Canada.
26 January	CINCNORAD directed continuous all-weather interceptor alert capability at Key West, Florida.
27 January–3 February	Atlantic Sea Barrier cut to three picket ship stations.
February	OSD Announced the phase out of East and West Coast picket ship operations.
4 February	ADC fighter pilots scored first interception of Bomarc drone target (1,500 miles per hour at 50,000 feet).
7 February	President Johnson ordered air strike on North Vietnam. CONAD went to DEFCON 4.
1 March	Five of 16 long-range radars, scheduled for deletion from SAGE system as excess, closed down.
10 March	ADC and TAC concurred in near-term AWACS, but expressed disapproval of radar characteristics.
1 April	Nine gap filler radar closed—associated with LRR earlier closed as excess.
	First FIS relieved from alert in anticipation of OSD-directed reduction from 30 to 20 squadrons by FY 1970.
2 April	The Mid-Canada Line ceased operations.
14 April	Transfer of 48 RA Nike-Hercules fire units to Army National Guard completed, marking completion of ARNG Nike-Hercules program.
24 April	SECDEF ordered withdrawal by 1 June of four Nike-Hercules batteries from Thule AB. Ceased operations on 18 May.
May	YF-12A set four world speed and altitude records at Edwards AFB.
	DOD authorized prototype aircraft and overland radar AWACS programs. Airframe study contracts to Douglas, Lockheed, and Boeing.
	ADC deployed F-104 squadron and support contingency operation in Dominican Republic.
1 May	Pacific aircraft DEW extension flight operations ceased.
27–30 June	Pacific sea barrier picket ship stations vacated.
30 June	Last three Atlantic sea barrier picket ship stations vacated.
1 August	Last F-86 aircraft left Air National Guard; conversion of squadrons to F-102.
26 August	OSD authorized a total of 19 BUIC III facilities.
1 September	First BUIC site accepted by ADC at North Truro, Massachusetts.
	Flight operations on Greenland-Iceland-IK barrier ceased.
	NAVFORCONAD disestablished with phase out of DEW Line extensions and the sea barriers. Navy participation at HQ, NORAD, and regions, and the sectors was continued.

24 September	Initial withdrawal of FIS from ADC for move to SEA.
3 November	Radar site G-32, Thule AB, Greenland, closed.
9 November	Power failure in northeast U.S. caused only minor communication outages and did not affect ADC tactical air posture.
8 December	The Secretary of Defense announced Department of Defense action to "consolidate, reduce, or discontinue" 149 military installations in CONUS and overseas, including 18 Nike-Hercules batteries defending SAC bases. In addition, four Hercules batteries of Thule, Greenland, were to be inactivated.
15 December	Satisfactory performance test of basic NORAD COC in Cheyenne Mountain completed.
22 December	Nike-Hercules defenses of SAC bases at Barksdale, Robins, Turner, and Fairchild Air Force Bases declared nonoperational with the concurrence of NORAD.

1966

January	ARADCOM instituted Tests Against Targets Taking Evasive Maneuvers (TATTEM) in order to evaluate results of evasive tactics where employed against the Nike-Hercules. This effort was a result of the relative success of U.S. aircraft in evading Soviet-made missiles in North Vietnam, which had raised questions regarding capabilities and limitations of the Nike-Hercules system. The tests were initially a part of the Short Notice Annual Service Practice (SNAP) program.
1 January	425L portion of NCOC achieved initial operational capability and transferred from AFSC to NORAD. Manual NORAD NBC Warning and Reporting System went into operation
1 February	System of succession to NORAD command among region commanders established.
8 February	Final acceptance of NORAD Cheyenne Mountain Complex (NCMC).
1 March	Nike-Hercules defenses of the SAC bases at Loring, Lincoln-Offutt, Dyess, and Bergstrom Air Force Bases declared "nonoperational" with the concurrence of NORAD.
9 March–1 April	Four radars closed; portion of sites identified as excess.
25 March	The Barksdale, Robins, Turner, and Fairchild Air Force Base defenses inactivated.
31 March	Third Philco 212 computer became operational in Cheyenne Mountain.
1 April	The Air Defense Command restored its earlier (1951) structure of three field commands at the original headquarters sites of Stewart AFB, New York; Richards-Gebaur AFB, Missouri; and Hamilton AFB, California. Reconstituted as the 1st, 10th, and 4th Air Forces, they superseded the 26th, 29th, and 28th Air Divisions (SAGE). A fourth field command, the 14th Air Force, was added with headquarters at Gunter AFB, Alabama. CONAD discontinued its 25th and 30th Regions. The resulting four-regional structure paralleled the ADC four-air-force structure. Numerical designations were replaced by geographical regional designations. The 7th ARADCOM Region, McChord AFB, Washington, discontinued. ARADCOM redefined areas of responsibility for its 1st, 2d, 5th, and 6th Regions, coincident with discontinuance of the 7th Region. First Region was reconfigured to correspond to the Eastern CONAD Region, less the Washington-Baltimore and Hampton Roads defenses. Fifth Region was assigned a geographical area corresponding to

	the Southern CONAD Region, plus the Washington-Baltimore and Hampton Roads defenses. Second and 6th Regions were reconfigured to correspond to the Central and Western CONAD Regions.
	Last four BUIC II sites became operational.
	Two combat centers and two direction centers were closed.
20 April	The 425L system portion of the NORAD Cheyenne Mountain Complex (NCMC) became fully operational.
	NORAD COC moved from Ent AFB to Cheyenne Mountain.
	425L system portion of NORAD COC became fully operational.
20 May	NORAD Attack Warning System (NAWS) became operational.
25 June	Loring, Dyess, Bergstrom, and Lincoln-Offutt Air Force Base defenses inactivated.
1 July	One radar closed; part of sites identified as excess.
1 September	Revised NORAD interceptor alert requirements went into effect.
14 September	The Secretary of Defense instructed the Department of the Army to reexamine the role of the Nike-Hercules in the "overall continental air defense posture," particularly in the light of the "declining bomber threat" and "recent changes in the force levels to fulfill this role more efficiently." Air Force participation was to be confined to "assistance in evaluating the interactions with area air defense."
7 October	JCS approved a plan for the VLF/LF Minimum Essential Emergency Communications Net (487L).
17 November	The Department of the Army assigned study of the "Role of the Nike-Hercules in Continental Air Defense" to ARADCOM, projecting the missile's role in the 1968–1974 timeframe for purposes of the study. The study was titled Nike-Hera Study.
20 November	DOD reduced USAF interceptor squadrons programmed for FY 1969 from 20 to 18.
30 November	The AN/TSQ-51 Fire Distribution System (Missile Mentor) became operational in the New York-Philadelphia Defense.

1967

4 January	ARADCOM personnel commenced participation in the deliberations of the SAM-D Source Selection Board and SAM-D Source Selection Advisory Council, which will evaluate three contractor proposals concerning SAM-D.
8 February	The last AN/FSG-1 Fire Distribution System (Missile Master), at the Pittsburgh Defense, ceased operations. Pittsburgh converted to AN/TSQ-51.
28 February	Construction at ADC Dispersed Operating Bases (DOB) completed. Cost of program $30,000,000.
1 March	Final ARADCOM AN/TSQ-51 became operational (New England Defense).
17 March	OSD released $43,000,000 in development funds for YF-12A program.
15 April	Phase I of the Nike Hera Study, which examined the role of Nike Hercules in defense of CONUS at the end of FY 1969, submitted to the Department of the Army.
May	Last of 15 dispersed operating bases in the CONUS developed to a Phase III (m) capability, thus completing the program.

18 May	As a result of the SAM-D source selection evaluation of January–March 1967, the Raytheon Corporation was awarded an advanced development contract for SAM-D.
17 June	JCS granted authority to CINCONAD to designate CONAD regions as subordinate unified commands.
1 August	The SAM-D Weapons Family Cost Effectiveness Study (SAMWEPS) completed by the Air Defense Agency, USACDC, with CONUS input provided by ARADCOM.
3 August	In a supplement to Draft Memorandum for the President on Strategic Forces, the Office of the Secretary of Defense proposed that Department of the Army eliminate 15 Nike Hercules sites.
21 August	ARADCOM submitted a proposal to the Department of the Army for the use of Army National Guard technicians in the AADCP operations of six defenses.
5 September	The Department of the Army added to the requirements of the Nike Hera Study a further requirement to identify, from a suggested list of Nike Hercules batteries prepared by the Office of the Secretary of Defense, 15 sites for elimination in FY 1970.
6 September	Formal negotiations started for renewal of NORAD agreement.
16 October	Phase II of the Nike Hera Study, which examined the role of Nike Hercules in the FY 1970–FY 1977 period or until the Nike Hercules was replaced by a follow-on SAM system, submitted to the Department of the Army. In a Supplement to Phase II of the Nike Hera Study, responding to the additional DA requirement of 5 September 1967, ARADCOM recommended redeployment rather than elimination of units. It concluded that resiting of ten batteries in eight defenses would make redeployment of 13 batteries feasible, that further reduction of Nike Hercules sites beyond these 13 batteries would result in an unacceptable lowering of defense capability, and that any such further reduction should be accomplished by elimination of small interior defenses.
November	Twenty gap filler radars closed to meet USAF operating fund cut.
6 November	Last of 19 Air National Guard squadrons completed conversion to F-102.
18 November	Two direction centers closed. Last two of four as directed by DOD in November 1963.
11 December	The Department of the Army tasked the U.S. Army Combat Developments Command, assisted by ARADCOM and the U.S. Army Materiel Command, with preparation of a SAM-D Deployment Analysis (SAMDEP).
16 December	PCD approval by DOD provided for modernized manned bomber defense system and phasing down of current system.

1968

3 January	OSD approved ADC proposal to reconfigure bomber alarm system as an Attack Assessment System.
15 January	The Air Defense Command redesignated as Aerospace Defense Command.
22 January	The Department of the Army approved the ARADCOM proposal of 21 August 1967 concerning the use of Army National Guard technicians in AADCP's, but manning requirements were to be deferred pending approval of a program change affecting the FY 1970–FY 1973 ARNG budget.
28 February	In Program Change Request A-8-006, the Department of the Army presented a counter-proposal to the OSD proposal to eliminate 15 Nike Hercules sites. On the basis of the results of Phase II of the Nike Hera Study, this PCR proposed elimination of

	13 sites and resiting of ten batteries to compensate for consequent losses in defense effectiveness.
1 March	Guidance for preparation of SAM-D Deployment Analysis modified to respond to four requirements contained in DOD Development Concept Paper No. 50.
30 March	U.S.-Canada agreement to extend NORAD Agreement for five years from 12 May 1968.
1 April	Eight LRR deleted as part of DOD-directed phase down of current system for transition to a new system.
	As part of phase down, all gap filler radars, except 17 in southeast corner of the United States, phased out.
12 May	The formal agreement of 12 May 1968 between Canada and the United States concerning establishment of NORAD renewed for five years, with provision that either party may terminate it upon one year's notice.
14 May	Only active nuclear reaction power plant in AF, Sundance, Wyoming, closed.
1 June	In Program Change Decision A-8-006, the Department of Defense directed inactivation of six Nike-Hercules fire units by 30 November 1968 and seven more by 31 December 1968. The Army proposal to resite ten batteries was disapproved for seven sites and deferred for three others. Site improvement approved for three batteries.
1 July	Federal Electric Corporation awarded $22,342,357 contract to operate and maintain DEW Line during FY 1969.
	One FPS-7, two FPS-77, three FPS-67, and two FPS-91-A radars removed from service.
10 August	In Program Change Decision A-8-314, the Department of Defense directed discontinuance of the three interior defenses of Dallas-Fort Worth, Kansas City, and St. Louis by 31 March 1969. The action required inactivation of 14 Nike-Hercules fire units by the same date, as well as seven headquarters installations, in addition to the 13 fire units required to be inactivated by PCD A-8-006.
13 August	PL 90-486, National Guard Technicians Act of 1968 signed. Under this law, which became effective 1 January 1969, all national Guard technicians acquired status and benefits equivalent to those of civil servants of the Federal Government.
28 August	In response to Draft Memorandum for the President on Strategic Forces, Department of the Army submitted a reclama to PCD A-8-006, proposing to resite nine batteries and the fire control area of another in connection with the elimination of 25 batteries required by PCDs A-8-006 and A-8-314.
23 September	Radar at Kubusak Island off east cost of Greenland, destroyed by wind.
27 September	JCS approved use of ADC EC-121H aircraft to cover gap in radar coverage resulting from loss of Greenland radar.
11 October	In PCD RA-8-006, the Department of the Army's proposal to resite nine batteries and the fire control area of another disapproved.
1 December	First BUIC III site became operational.
9 December	Program Budget Decision 364 proposed elimination of Central NORAD Region and 2d ARADCOM Region. ARADCOM had previously submitted its reclama.
11 December	Program Budget Decision 436 required a further reduction in ARADCOM strength of five Nike-Hercules batteries effective in the first quarter of FY 1970. ARADCOM submitted a reclama.

Request for proposal for AWACS procurement issued to Boeing and McDonnell-Douglas.

18 December — ARADCOM's reclama to PBD 436 unsuccessful; PBD 436R maintained the five-battery reduction of PBD 436.

In PBD 364R, the earlier, tentative decision to eliminate 2d ARADCOM Region reversed.

1969

15 January — The St. Louis Defense discontinued.

10 February — The Kansas City and Dallas–Fort Worth Defenses discontinued.

1 April — Ten U.S.S.R. aircraft in four flights entered Alaskan NORAD Region radar coverage at low altitude at 0550Z.

2 April — Twenty more U.S.S.R. aircraft entered Alaskan NORAD Region radar coverage.

15 April — Navy EC-121M reconnaissance aircraft shot down by North Korea fighters over Sea of Japan. F-106A interceptors on combat air patrol in area from 15 April to 24 May, 1969.

30 April — The ARADCOM proposal concerning use of Army National Guard Technicians in AACDP operations, approved by the Department of the Army in January 1968, dropped as no longer desirable.

18 June — Four of five Nike Hercules batteries required to be inactivated by Program Budget Decision 436 assumed nonoperational status.

1 July — Twenty-seven ADC prime radar sites reduced from dual to single height finder status.

1 August — The last of five Nike Hercules batteries required to be inactivated by Program Budget Decision 436 assumed nonoperational status.

12 August — Regarding to OSD-directed FY 1970 budget cuts, ADC recommended systems be deleted in following order:

SLBM D&W

F-102 at Key West

F-104 squadron at Homestead AFB

SAGE DCs

Three F-101B squadrons

Bomarc

East Coast EC-121s

21 August — The Secretary of Defense announced that expenditures for national defense in FY 1970 will be cut $3 billion.

15 September — Central NORAD/CONAD Region discontinued. ARADCOM adjusted 6th Region/2d Region boundary to conform with new NORAD/CONAD regional boundary. Headquarters, Western NORAD/CONAD Region, transferred from Hamilton AFB, California, to Richards-Gebaur AFB, Missouri.

5 October — After an undetected and unchallenged flight from Cuba, a Cuban pilot landed a MiG-17 at Homestead AFB.

14 October — Program Change Decision Z-9-105-2 directed the reduction of Active Army Nike Hercules batteries in CONUS and Alaska to 43 in FY 1970 and 40 in FY 1971, Army

National Guard Nike Hercules batteries in CONUS and Hawaii to 41 in FY 1970 and 39 in FY 1971, and Hawk batteries to zero in 1970.

29 October — ADC required to inactivate units/facilities to meet budget cuts: First and Tenth Air Forces and their ADCCs; three air divisions and their ADCCs; six radar squadrons; three F-101B squadrons.

14 November — NORAD adopted an eight-region (including Alaska) configuration and eliminated NORAD divisions. ARADCOM adjusted regional areas of responsibility in partial conformity to the reconfiguration.

Final AEW&C mission flown off East Coast.

15 November — CINCLANT/CINCSTRIKE assumed responsibility for air defense of southern Florida.

5 December — The Department of the Army directed ARADCOM to discontinue its Niagara Falls/Buffalo and Cincinnati/Dayton Defenses by 31 March 1970.

10 December — The two group headquarters, two battalion headquarters, and six Nike Hercules batteries comprising the Niagara Falls/Buffalo and Cincinnati/Dayton Defenses assumed nonoperational status. AN-24 transport from Havana, Cuba, undetected, landed at New Orleans. This prompted reestablishment of air defense capability across southern United States.

1970

5 January — BUIC III radar system became fully operational.

31 January — The 2d Battalion (Nike-Hercules), 52d Artillery, reorganized as a mobile unit and assigned a dual STRAF/CONUS air defense mission.

31 March — ARADCOM forces, this date, included 76 Nike-Hercules fire units, representing a decline of more than 44 percent from the 1963 peak of 134 fire units.

16 April — The Strategic Arms Limitation Talks (SALT) opened in Vienna.

13 May — Task force of U.S.S.R. TU-95 bomber aircraft arrived in Cuba flying nonstop from bases in northern U.S.S.R.

1 July — Headquarters, 31st Artillery Brigade, reorganized as a mobile unit and assumes the dual STRAF/CONUS air defense mission.

5 July — First contract for AWACS awarded to Boeing.

4 September — CINCNORAD approved a recommendation to relocated the NORAD alternate command post and also those of ADC and ARADCOM to Malmstrom AFB.

1971

20 April — In a memorandum directing that there be no further reduction in the capabilities of the air defense system, the Deputy Secretary of Defense approved the following objectives of CONUS air defense:

(a) Contribute to maintaining realistic deterrence against Soviet attack by:
(1) Defending strategic retaliatory forces.
(2) Defending the National Command Authorities and key command and control centers.
(3) Defending deployed ballistic missile defenses against air-supported threats.

(b) Restrict unauthorized overflight of U.S. air space.
(c) Limit damage from deliberate or unauthorized small air attacks against any U.S. target.
(d) Deter Soviet air attacks by defending key military and urban/industrial targets.

30 June — ARADCOM forces reduced by 24 Nike-Hercules fire units and 11 headquarters units. The remaining Nike-Hercules force of 52 missile batteries—more than half (27) of them ARNG units—represented 39 percent of Nike-Hercules strength at its 1963 peak. As a consequence of this reduction, which was expected to cut annual operating costs by $31 million, ARADCOM closed the Minneapolis/St. Paul, Cleveland, and Milwaukee defenses, eliminated the 2d Region, and combined the Norfolk and Washington/Baltimore defenses.

3 August — ARADCOM initiated a second-phase Nike-Hercules Overhaul/Exchange Program made necessary by excessive deterioration in those systems having longest service since initial overhaul.

AN-24 transport from Havana, Cuba, undetected, landed at New Orleans. This prompted reestablishment of air defense capability across southern United States.

1972

21 March — AWACS test program began to determine technical capability under operational conditions.

1 April — Four Bomarc squadrons ceased operations.

15 April — Test squadron at Edwards AFB inactivated in view of ending F-12 test effort.

26 May — The President of the United States and the Secretary General, Central Committee of the Communist Party of the U.S.S.R. signed a Treaty on the limitation of Antiballistic Missile (ABM) Systems and an interim Agreement on the Limitation of Strategic Offensive Arms.

August — A new class of Russian submarine detected which resembles the Yankee class but is characterized by its larger size and higher missile bay area. The new class is given the designation Delta.

6 September — Four Soviet TU-95 Naval Bear aircraft deployed to Cuba.

15 September — Two F-102 aircraft from 57th FIS, Iceland, made 100th intercept of Soviet aircraft since F-102 deployment to Iceland in 1963.

6 October — Initial increment of Southern Air Defense System became operational.

31 October — Final Bomarc interceptor squadron deactivated.

Appendix B

A Chronology of Ballistic Missile and Space Defense (1955–1972)

1955

February	After the Army concluded that the state of missile technology had advanced sufficiently to warrant a feasibility study for a system to combat the ICBM, Bell Telephone Laboratories undertook such a study. When the study was concluded, the Army decided that the anti-ICBM missile was economically and technically feasible.
March	The Bell Telephone Laboratories initiated a feasibility study for a weapon system to replace Nike I and Nike B in about 1965. Emphasis was placed on defense against long-range ballistic missiles.
June	WECo and BTL began l8-month study of a "new forward looking ground-to-air guided missile system capable of effectively engaging the target threats within CONUS during the period 1960–70." Primary emphasis in the Nike II study was to be on defense against ICBM. The 18-month study was under Contract No. DA-30-069-ORD-1082. ("Nike Zeus Guided Missile System," Volume I, System Study Report prepared by BTL and Douglas Aircraft Co. on behalf of Western Electric Co. Inc., l March 1957, Page vii, Foreword.)
5 July	The Chief of Research and Development directed the Chief of Ordnance to modify the requirement of the feasibility study so as to consider the ICBM as the prime target of the Nike Zeus.
16 November	The Chief of Ordnance informed the Chief of Research and Development that Ordnance Corps studies having reference to ICBM defense were the following: Nike II by Bell Telephone and Douglas Aircraft and Plato by Cornell Aeronautical Laboratories and Sylvania Corporation. The Bell-Douglas idea was that strategic points should be defended in depth so as to engage incoming missiles at several points. It would be the logical outgrowth of the Nike rings currently being installed. Fan-beam radars would be used to track the missiles, and computers would automatically command the launching of the missile or missiles closest to the incoming missile. *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]* Intercepts could be started at 300,000 feet altitude and continue down the line of descent until the last resort missile was fired from the area of the target.

1956

27 January	As a result of the recommendations of the Killian Committee (Technological Capabilities Panel), Department of Defense approved release of $4 million of FY 1956 appropriated research and development funds for component development and experimental work on antimissile missiles. These funds were made available from a larger amount temporarily withheld by Bureau of Budget pending results of Killian Committee reports.

31 January — The Chief of Research and Development informed the Chief of Ordnance that of the supplementary funds recently released by the Department of Defense for support of the Army antimissile missile program $3.4 million would go to Ordnance for system development and component design. While it was realized that the money involved would not fund an ideal antimissile program, the Chief of Research and Development desired that it be used to initiate studies and development for an aggressive program that would lead to the earliest practicable availability date of an Army antimissile missile capability.

February — Component hardware development on Nike Zeus was begun.

2 March — The Chief of Research and Development directed the Chief of Ordnance to include in the Nike Zeus studies a study of the feasibility of obtaining an early anti-ICBM capability, in 1960 or 1961, with a modified Nike Hercules system.

13 June — The final report of the Skifter Committee (Department of Defense Ad Hoc Group on Anti-ICBM) concluded that an anti-ICBM system was feasible of development. The committee recommended that research and development on acquisition radars should be conducted and that quick fixes should not be further considered.

5 July — The Assistant Secretary of Defense (Research and Engineering), authorized the obligation of FY 1957 Army research and development funds in the amount of $9 million for project Nike Zeus. The program execution was to be in accordance with recommendations of the Skifter Committee. The study on the feasibility of attaining an early capability with Nike Hercules was to be conducted as a part of the Nike Zeus project.

28 August — The Special Assistant for Guided Missiles to the Secretary of Defense constituted a committee to review the overall anti-ICBM program. The Army representative was the Director of Research and Development. The first meeting was held on 17 September 1956, at which time the Army and the Air Force summarized their programs.

30 September — The Nike Zeus feasibility study completed. The study concluded that it was feasible to provide an anti-ICBM defense with the Nike Zeus system. If development of system were funded at maximum rate the first operational capability could be obtained in late CY 1962 under a normal production program.

2 October — The Special Assistant for Guided Missiles to the Secretary of Defense informed the Secretaries of the Army and the Air Force that in the antimissile field the Air Force would have responsibility for developing the early warning system and the Army would have responsibility for the active defense system.

The assignment to the Army was justified on the grounds that:

(1) Major targets were already defended by Nike sites.
(2) The Nike II appeared to be the only project beyond the study stage which was capable of accomplishing the mission.
(3) There was a basic similarity between the anti-ICBM problem and the antimissile missile for field army use.

25 October — The Department of Defense Anti-ICBM Committee was notified of the following possible schedules for Nike Zeus.

Operational Availability Date	Maximum Rate Funding	Budget Limited Funding
(1) Early anti-ICBM Capability (75 mm range, 130,000 ft altitude).	4th Qtr CY 62	3d Qtr CY 65
(2) Full high altitude anti-ICBM capability. (75 mm range, 130,000 ft altitude).	4th Qtr CY 63	2d Qtr CY 67
(3) Extended range antiaircraft (manned and unmanned) capability.	4th Qtr CY 64	1stQtr CY 69

1 November — As a result of the successful completion of the feasibility studies and of the successful component and experimental work conducted on Nike Zeus the decision was made to initiate system development. Accordingly, the Army directed full system development of Nike Zeus in a phased program. This program was to have three objectives:

(1) To develop an anti-ICBM capability to 30,000 feet altitude and 75 nautical miles range.
(2) To develop a full anti-ICBM capability to 500,000 feet attitude and 75 nautical miles range, and
(3) To develop an extended range capability against aircraft, manned or unmanned, to 200 nautical miles range.

The study on the feasibility of attaining an early anti-ICBM capability with Nike Hercules was terminated, since under contemplated budgets the attainment of a Nike Hercules capability would interfere with the attainment of a much greater capability in nearly the same time with Nike Zeus.

13 November — The following popular names were assigned to the Nike family of weapons:

Nike Ajax—Nike I
Nike Hercules—Nike B
Nike Zeus—Nike II

December — Contract DA-30-069-ORD-1082 was supplemented to include active development of the Nike Zeus System by WECo. This marks the beginning of the actual development work.

20 December — The Air Defense Branch, Office, Chief of Research and Development, interpreted the Secretary of Defense memorandum of 26 November as appearing to assign responsibility for the forward acquisition radar for Nike Zeus to the Air Force and as clearly assigning the missiles, launchers, battery control with necessary radars, and local defense center and local acquisition radars to the Army.

1957

4 February — The Army requested the apportionment of $10.7 million dollars FY 1957, Department of Defense emergency funds to raise the FY 1957 Nike Zeus effort to maximum rate. This level of funding was required to assure a 4th quarter CY 1962 operational availability date, provided maximum rate funding could be provided in the following years. The request for emergency funds was not honored.

19 February — The Department of Defense Anti-ICBM Committee was notified that planned funding for Nike Zeus would provide for operational availability in 1965. Planned FY 1958 funding, as of this date, was $26 million ($12 million R&D, and $14, million P&P, A.) (NOTE: Although $14 million P&P,A, in support of R&D was planned at the time of the briefing, the Deputy Chief of Staff, Logistics, on 1 February had unilaterally programmed $25 million of P&P, A funds for procurement of Zeus items. The $25 million is the money now in the FY 1958 Zeus program.)

April — Secretary of Defense (Charles E. Wilson) detailed areas of responsibility for the major services regarding antimissile missile and system development. He approved recommendations that the Air Force develop the early warning system and communications; that the Army carry out research and development on Local Acquisition Radar (LAR), Target Track Radar (TRR), and the missile for ICBM defense and that a joint Army-Air Force Committee be established (Skifter Committee) to monitor development.

6 April — *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*

25 April — The Department of Defense Anti-ICBM Committee recommended, with Secretary of Defense approval, that the Army continue anti-ICBM missile system development at a level about that planned.

Secretary of Defense approval of this Committee action required that the Secretary of the Army specifically approve the planned FY 1958 program. In addition this committee report provided that:

(a) The Air Force develop the anti-ICBM early warning system.
(b) The Air Force carry out research and development on the advanced acquisition radars required by the active anti-ICBM system and study the communications between these radars and the active portion of the system.
(c) That the Army develop the local acquisition and target tracking radars required by the active portion of the anti-ICBM defense system and the defensive missile itself, and
(d) That an anti-ICBM Coordinating Agency be established to coordinate Army and Air Force efforts in this field.

16 August — The Secretary of the Army approved the planned FY 1958 Nike Zeus program. This program required the obligation of $12 million FY 1958 R&D and $25 million FY 1958 P&P, A funds. This FY 1958 program was consistent with third quarter CY 1963 operational availability of Nike Zeus.

September — *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*

5 September — The Secretary of the Army recommended that the Secretary of Defense support a national priority for the anti-ICBM development program equivalent to the priority accorded the ICBM development, and that additional funds be made available to the Army to accelerate research and development of Nike Zeus.

16 September — *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*

4 October — Office Chief of Ordnance directed Picatinny Arsenal to begin development *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*

10 October — The Army studies indicated that under an accelerated program wherein the production of tactical Zeus equipment would be undertaken concurrently with the manufacture and test of the prototype that an operational on-site defense of CONUS could be provided on the following schedule:

	Estimate Cumulative Cost
Early Capability:	
3 batteries by end CY 1961. 30 batteries by end CY 1962.	$2.0 billion
Full Capability:	
100 batteries by end CY 1965.	$4.0 billion
Extended Range Capability:	
100 batteries by mid-CY 1966.	$6.0 billion

28 October — The Department of Defense apportioned to the Army $660 million of FY 1958 P&P, A funds. $25 million of these funds were for support of the Nike Zeus development, however, obligation of these funds was subject to the specific approval of the Special Assistant for Guided Missiles.

6 November — The Army requested that the Special Assistant for Guided Missiles authorize the obligation of $25 million FY 1958 procurement and production funds for support of the Nike Zeus development.

15 November — The Special Assistant for Guided Missiles authorized the obligation of $25 million procurement and production funds. At this time the Army was able to obligate the total $37 million required for the FY 1958 Nike Zeus program.

26 November — Dr. H. R. Skifter, Chairman of the Department of Defense Anti-ICBM Coordinating Agency, was notified of the schedules and costs of the accelerated Nike Zeus program.

27 November — The Chief of Research and Development informed the Assistant Secretary of Defense (Research and Engineering) of Army FY 1959 funding requirements for Research and Development. Included was a statement of FY 1958 and 1959 required Research and Development funding for the Nike Zeus accelerated program.

29 November — The Chief of Research and Development informed Dr. Killian, Special Assistant to the President for Science and Technology, of the Army FY 1959 funding requirements. This included a statement of the FY 1958 and FY 1959 required research and development funding for the Nike Zeus accelerated program.

Note:

(1) Budgetary limitations adversely affected Nike Zeus in FY 1957. $9 million of a required $19.7 million were expended in this development. This reduced rate effort delayed the operational availability of Nike Zeus, under a normal development and procurement program one year, from 4th quarter CY 62 to 4th quarter CY 63. A maximum rate effort in 1957 could have effected an advance in the proposed accelerated availability date.
(2) Overtime restrictions had no effect on Nike Zeus. The budgetary limitation in FY 1957 precluded effective use of overtime.

15 December — The Army informed the Weapons System Evaluation Group of the accelerated Zeus program schedule and costs for use by Weapons System Evaluation Group in their study of the Continental Air Defense objectives plan. These schedules and costs were later published in Weapons System Evaluation Group Report No. 33.

1958

9 January — The Chief of Research and Development noted that analysis of air defense systems in the Nike Zeus time era indicated that a companion surface-to-air missile might be required. It should have a high rate of fire, low altitude capability, improved homing-on-jamming techniques, extended ranges and altitudes. On 2 January 1958 the Raytheon Corporation in a feasibility study proposed a Superhawk system with those capabilities, including ranges to 100 miles and altitudes to 80,000 feet.

14 January — The Secretary of Defense authorizes the USAF to proceed immediately with development of a Ballistic Missile Early Warning System (BMEWS).

16 January — To insure coordination between the Army and Air Force in matters relating to the anti-ICBM program, pending the moment when the new Advanced Research Projects Agency would assume direction of this effort, the Secretary of Defense directed the Army to continue its development effort in the Nike Zeus program as a matter of urgency, concentrating on system development that would demonstrate the feasibility of achieving an effective, active anti-ICBM system in an electric countermeasure and decoy environment. The work was to be limited to the missile and launch system and

acquisition, tracking and computer components required for an integrated missile system.

By separate memorandum the Air Force was directed to continue that portion of its Nike Zeus program pertaining to early warning and acquisition and tracking radars and was also further directed not to continue its effort on the missile system proper.

22 January — The National Security Council assigned a national priority to the anti-ICBM effort equivalent to the priority assigned to the ICBM and IRBM effort.

27 January — By letter, the Chairman of the House of Representatives Armed Services Committee, was informed of the fund requirements for the Nike Zeus accelerated program. The funds included $136 million additional FY 1958 funds required and a total of $613 million FY 1959 funds.

28 January — The Director of Guided Missiles, OCRD, forwarded to the Director of Guided Missiles, Army, recommendations with regard to attaining an early defense against ballistic missiles. They were the following:

(1) Drop from further consideration for accelerated development and deployment for defense all of the active ballistic missile defense systems except Nike Zeus and the land-based TALOS.
(2) As first priority fund the Nike Zeus program.
(3) As second priority fund the TALOS program for procurement of 25 detachments.

29 January — The Chairman of the House Armed Services Committee, Repr. Carl Vinson, recommended to the Secretary of Defense that he:

(a) Assign to the Army operational responsibility for Nike Zeus, and
(b) Make available to the Army $136 million FY 1958 funds for the accelerated deployment of Nike Zeus.

3 February — The Deputy Secretary of Defense and the Director of Guided Missiles, Office, Secretary of Defense, were briefed on the FY 1958 fund requirements for the accelerated program. A recommendation that $136 million of FY 1958 funds be made available to the Army for the acceleration of Nike Zeus was made to the Deputy Secretary of Defense.

7 February — The Secretary of Defense established the Department of Defense Advanced Research Projects Agency for the direction and performance of certain advanced research and development projects. Mr. Roy W. Johnson, a vice-president of General Electric Company, was appointed as Director. The agency was to be activated 1 April 1958.

12 February — The Director of Guided Missiles dissolved the anti-ICBM Coordinating Agency since the Army, by the 16 January Sec/Def memorandum, had been given development responsibility for the active portion of the anti-ICBM defense system.

14 February — The Secretary of Defense; the Director of Guided Missiles, Office, Secretary of Defense; the Secretary of the Army; and the Vice Chief of Staff of the Army had a conference with the Chairman of the House of Representatives, Armed Services Committee, with respect to his recommendation for the accelerated deployment of Nike Zeus. At this conference the Secretary of Defense promised Chairman Vinson that he would give an answer to his recommendation by 15 April 1958.

20 February — The Director of Guided Missiles constituted an Ad Hoc Anti-ICBM Study Group under the chairmanship of Dr. H. R. Skifter, Special Assistant to the Assistant Secretary of Defense, R&E. This group was to study means to attain an early defense against ballistic missiles. The Army briefed this group on the accelerated Nike Zeus program and on the TALOS Anti-ICBM program. The Army recommended that as first priority the Nike Zeus deployment should be accelerated, and as second priority, an early limited capability with TALOS should be provided.

26 February	Army Ordnance and contractor personnel briefed the Department of Defense Decoy Discrimination Group on the anti-decoy capability of Nike Zeus and on Army supporting research projects in the decoy discrimination field.

1959

2 January	The U.S. Army Air Defense Command was assigned responsibility for preliminary selection of site for the Nike Zeus System.
12 February	The Ballistic Missile Committee of the Department of Defense approved a test plan for conducting Nike Zeus tests in the Kwajalein-Johnston Island complex using intermediate range ballistic missile (IRBM) targets.
1 March	The Army Ballistic Missile Agency (ABMA) was delegated responsibility for development of ballistic targets for the Nike Zeus test program. ABMA developed the criteria for the facilities at Johnston Island.
July	A new missile configuration was approved. The missile airframe was simplified and strengthened by removing the large wings from the sustainer section (small wings were later added for stability). This design increased range and maneuverability and simplified handling, maintenance, and launching. Initial flights of this design were to begin in mid-1960.
26 August	The first Nike Zeus missile was fired at WSMR. The results were partially successful.
14 October	The second Nike Zeus missile was fired at WSMR. Lift-off, boost phase, separation, sustainer ignition, and sustainer operation were successful. Missile fail-safe and loss of telemetry occurred at 35.3 seconds.
November	The Deputy Secretary of Defense approved use of 30 Jupiter missiles for IRBM-type targets to be fired from Johnston Island in the Nike Zeus test program. A contract was let by ABMA for fabrication of 15 of these targets. (This decision was later reversed.)
16 December	The third fixed fin winged Nike Zeus missile was fired at WSMR. Complete success was not achieved in that the sustainer did not ignite.

1960

25–26 May	An Ad Hoc Panel was appointed by the Special Assistant to the President for Science and Technology to resolve the controversy over which target missiles should be used to test the Nike Zeus System. The Army proposed use of the Jupiter IRBM targets launched from Johnston Island for intercept by Nike Zeus launched from Kwajalein Atoll. The Director of Defense Research and Engineering (DDR&E) advocated the substitution of Atlas ICBMs to be launched from Vandenberg AFB. After two days of hearings, the Panel ruled in favor of the latter.
29 June	A memorandum from the Secretary of Defense to the Secretaries of the Army, Navy, and Air Force directed that all Nike Zeus ICBM targets would be delivered by Atlas missiles launched from VAFB. Plans for development of launch facilities at Johnston Island, and production of all Jupiter missiles for use in the Nike Zeus testing were cancelled.
10 October	Ballistic Missile Early Warning System (BMEWS) Site No. 1, at Thule Air Base, reaches an initial operational capability.
21 November	The Nike Zeus Ad Hoc Advisory Committee, chaired by Mr. Richard S. Morse, transmitted to the Chief of Staff Army, the report of the committee relating to early production and deployment of the Nike Zeus System. The recommendations were:

(1) That a production of Nike Zeus batteries at a rate of four per year be immediately initiated.
(2) That the units produced be deployed in the defense of the North American Continent in consonance with antimissile defense plans of the North American Air Defense Command (NORAD).
(3) That present Nike Zeus research and development program be continued with the primary objectives of determining the system effectiveness against various types of threats and for improving this effectiveness consistent with the state of the art.

1 December — The JCS give NORAD operational control and CONAD operational command of the Space Detection and Tracking System (SPADATS).

4 December — Secretary of the Army recommended to the Secretary of Defense that:

(1) An interim program for production and deployment of Nike Zeus at the rate of four batteries, two defense centers, and 200 missiles per year be initiated without delay.
(2) FY 1961 funds in the amount of $73.3 million be provided to permit initiation of a production contract by 31 March 1961.
(3) Units produced be deployed as recommended by the Commander-in-Chief NORAD.

1961

January — The Army Rocket and Guided Missile Agency (ARGMA) submitted the "Nike Zeus Defense Production Plan" to the Chief of Ordnance. The plan provided for the production and deployment over a period of eight years, of 29 defense centers, 70 batteries and supporting equipment and 3,610 missiles. The Secretary of the Army approved the plan and it was forwarded to the Secretary of Defense for approval.

1 February — BMEWS Site No. 1, Thule AB, achieves an automatic capability.

June — The Zeus prime contract was extended to cover work on the Zeus Multifunctional Array Radar (ZMAR) System. This was an advanced radar study for determining the feasibility of having an electronically scanned radar perform the functions of acquisition, discrimination, and tracking in an ICBM defense system. The proposed system would feature a phased array arrangement with no moving parts and no necessity for a rotating antenna. Four faces at 90 degree intervals would be required to cover 360 degrees in azimuth. A feasibility model was to be installed at WSMR.

1 July — The National Space Surveillance and Control Center (NSSCC) is discontinued and the new SPADATS Center begins operation at Ent AFB, Colorado. This marks the beginning of aerospace defense operations by the Air Defense Command.

22 September — Nike Zeus R&D continued/deployment approved. The Secretary of Defense approved the first two phases of a three phase Nike Zeus deployment in defense of 12 metropolitan areas: Washington/Baltimore, New York, Los Angeles, Chicago, Philadelphia, Detroit, Ottawa/Montreal, Boston, San Francisco, Pittsburgh, St. Louis and Toronto/Buffalo. In January 1962 the Secretary of Defense informed Congress that only development funds, at a top priority level, would be expended during FY 1963. This decision resulted in continuation of R&D rather than deployment of an ABM system.

30 September — BMEWS Site No. 2, at Clear, Alaska, achieves full operational capability.

December — Unofficial reports circulated in the press implied that President John F. Kennedy and Secretary of Defense McNamara had decided to ask for production funds for Zeus in the new military budget. In presenting the FY 1963 budget to Congress in January

1962, however, President Kennedy indicated his decision to delay the production decision pending final Zeus firings against Atlas targets later in 1962.

December 1961–64 Zeus test program firings. Forty-eight Zeus missiles fired at Kwajalein Test Site (KTS).

1962

1962–65 Phased array radars. The ZMAR, Zeus Multifunction Array Radar, was conceived. As R&D continued, the ZMAR became the MAR I, to be built at WSMR. The MAR II was to be built at KTS. The various possible versions of the MAR were the LOMAR, HIMAR, and TACMAR. The latter was chosen and became the Missile Site Radar (MSR) and a decision was also made to deploy a Perimeter Acquisition Radar (PAR). These two radars, at considerably less cost than the much more powerful MAR, would be deployed. At first the PAR was to be in the VHF band; this was later changed to UHF. A MAR-type building was constructed at KTS, but (as of 16 April 1970, no radar had been installed).

24 January The Kwajalein Zeus Acquisition Radar (ZAR) received its first signal returns from an ICBM, the initial test of the ZAR against a real target.

17 February This same ZAR successfully acquired and transmitted the position of an Atlas missile to the TTR. This marked the first transfer of an ICBM target from one radar to the other.

30 March A feasibility study was completed on a fast reaction surface-to-air missile which by its rapid acceleration, would maximize the time available to a defense for discrimination between warheads and decoys. This missile, designated Sprint, would become a subsystem of the Nike X System.

18 April The ZAR at Kwajalein participated in a satellite tracking exercise—track was initiated and maintained on SPUTNIK 12. On 19 April 1962 the ZAR again tracked SPUTNIK 12 and successfully transferred the target to the TTR.

First satellite acquisition and tracking. The Nike Zeus Acquisition Radar (ZAR) and Target Tracking Radar (TTR), similar to but larger than the equivalent Nike Hercules radars at Kwajalein successfully acquired and tracked a U.S.S.R. satellite.

27 April The Secretary of Defense placed a requirement on the Nike Zeus program to provide the capability, by May 1963, for a satellite interception demonstration at Kwajalein. The project was assigned the code name MUDFLAP.

June The Deputy Commanding General, Guided Missiles, the Army Ordnance Missile Command, approved a staff study utilizing WECo/BTL as prime contractor for the Zeus and Hardsite Defense Systems* with the Government directing the selection of subcontractors. A pre-award survey of possible subcontractors would begin 11 June 1962, for the development and production of the Sprint missile.

*The Hardsite Defense System was defined at this time as, "a hardened system consisting of a Multiple Array Radar Subsystem, a Data Processing and Control Subsystem, a Sprint Missile Subsystem, and associated support equipment." Experimental models of the Multiple Array Radar (MAR) (or ZMAR, as it was known until January 1963) were to supply the basic technology for a multifunction radar to replace the current Zeus radars.

19 June First successful ICBM/Zeus intercept. First successful intercept by Nike Zeus of an ICBM ballistic nose cone flown at true speed and trajectory over Kwajalein. The target was an Atlas launched from Vandenberg AFB.

1 October	The government let four contracts for four-month studies of the program definition phase of the Sprint missile. Lockheed Aircraft Corporation dropped out, leaving North American Aviation, Douglas Aircraft Company, and the Martin Company as participants.
12 December	Nike Zeus Test K–6 involved two missiles in an attempt at salvo firing. The first missile (20066) successfully intercepted an actual ICBM and achieved all test objectives.
19 December	Zeus activity at Point Mugu ended, and the system equipment was moved to other Zeus sites and all buildings were returned to control of the Pacific Missile Range.
22 December	Zeus intercept of target vehicle and decoys. Zeus successfully intercepted an Atlas ICBM carrying a target vehicle and two decoys.

1963

January	Nike X system initiation. Nike Zeus System changed to Nike X. Program was reoriented from mechanical to phased array radar and second missile added (Sprint) (Gilpatrick Memo). See 1962–1965 entry on Phased Array Radars.
5 January	A memorandum dated 5 January from the Secretary of Defense for the Secretary of the Army stated that: (1) There would be no deployment; current or future, of the existing Nike Zeus System and (2) That no decision had been made as to whether or not the Nike X System would eventually be deployed. The memorandum directed the Army to reorient the Nike Zeus effort toward a new system approach, to be called Nike X. The Nike X System now consisted of the following components: the Multifunction Array Radar (MAR), Missile Site Radar (MSR), Sprint missile, Zeus missile, and data processing equipment. The Nike Zeus testing program at Kwajalein and Ascension Islands and at the WSMR were to be continued with reorientation to support the Nike X System.
30 January	NXPO. Nike Zeus Project Office redesignated as the Nike X Project Office and established as a separate Class II activity at RSA, Ala. Colonel Ivey Drewry designated Nike X Project Manager, reporting directly to CG AMC, and not through CG USAMICOM.
16 March	Sprint development. Martin Company, Orlando, Florida Division, given initial funding by Bell Telephone Laboratories (BTL) and directed to proceed with full development of Sprint. (See January 1963 entry on Nike X System Initiation.)
21 March	MAR I construction initiated. Construction began on MAR I at WSMR. (See 1962–1965 entry on Phased Array Radars.) The first MUDFLAP (satellite intercept) test at Kwajalein was conducted, with performance of the missile and ground equipment not as planned. There was limited achievement of objectives.
30 March	Nike Zeus Test K-17 (20114) was fired against an ICBM target from VAFB, the first successful ICBM intercept in which reaction controlled steering was employed. Intercept occurred at the highest altitude (261,000 feet) to date in the Kwajalein test series. No major equipment malfunction was noted during this test.
April	The Department of the Army directed the Army Materiel Command to plan for the first Nike X site to become operational in the first quarter CY 69.
13 May	Satellite intercept. First intercept of satellite from Kwajalein Test Site (KTS).

23 May	A satellite intercept was successfully accomplished at Kwajalein when Nike Zeus ZK-20 (20138) was launched against an AGENA D satellite. This demonstrated the Mudflap capability, as directed by the Secretary of Defense in April 1962. ZK-20 was the 100th missile to be fired in the Zeus research and development program.
5 June	The President of the United States witnessed a successful Nike Zeus missile firing conducted at WSMR. This was a non-jet-head firing from a cell. All test objectives were met.
December	Design and development of the MSR (the phased array radar for combined missile and target tracking) began.

1964

March	Site selection for antiballistic missile sites was started. No definitive deployment had been announced.
15 June	Test began on MAR I (power on date).
18 June	The Zeus radars at Kwajalein participated in the advanced ballistic re-entry system, low observable re-entry vehicle (ABRES-LORV-1) test, a part of the Air Force penetration aids program. Good radar and optical data were obtained. The discrimination radar accepted ZAR designation, identified the reentry vehicle, then transferred the target to the TTRs. This sequence of events was a notable first at Kwajalein.
September	Balloon successfully tracked by MAR I.
11 September	MAR I successfully tracked a real target for the first time. A balloon was tracked for 50 minutes with track being intentionally dropped and reestablished automatically several times. This balloon was successfully handed over in the automatic mode, which included transfer from search to verification, to acquisition track, and target lock-on.
30 September	MAR I continued to demonstrate its multifunction capability by successfully demonstrating “automatic search,” “verification track,” and “precision track” of real targets. Highball and Speedball type targets were automatically acquired on the upward leg and precision tracked on both track channels.
October	Threat analysis study for Secretary of Defense headed by CH, OCRD, LTG Betts, completed.
19 November	The MAR I at WSMR participated in a Pershing missile firing. Approximately 71 seconds of tracking data were obtained. This was a significant first for the MAR.
10 December	Secretary of Defense Robert McNamara was briefed on threat, strategic, and system analyses, and the status of discrimination techniques. Principal attendees were Deputy Secretary of Defense, Cyrus Vance; Mr. W. M. Hawkins, Jr., Assistant Secretary of the Army, R&D; Dr. Harold Brown, Director of Defense Research and Engineering; LTG W. W. Dick, Jr., Chief of Research and Development, DA; MG A. W. Betts, Deputy Chief of Research and Development, DA; and the Nike X Project Manager, Colonel I. O. Drewry. It was later learned from documentation signed by Secretary McNamara that the deployment decision was to be postponed for another year, and the Initial Operating Capability extended for an additional year, to October. 1970. The FY 1966 RDT&E program was recommended at $390 million, which included $20 million for the follow-on reentry measurement program and $10 million for production planning/engineering.

1965

30 January — Nike Zeus missiles ZK-50 and 51 (20155 and 20162) were launched on Kwajalein in a salvo-of-two mode against a simulated submarine launched ballistic missile. The test was the first completely successful salvo firing, with miss distances of both missiles well within the blast radius.

1 February — A Director of Defense Research and Engineering (DDR&E) memo of this date, subject, "Nike X Development" indicated that no change of plans was contemplated for the Missile Site Radar (MSR) and Sprint missile installations at Kwajalein. The Multifunction Array Radar (MAR) II plans, however, might require modification. Large procurement funds for the MAR II were to be delayed pending completion of a study to determine possible alternatives to the MAR and possible augmentation of the MSR capabilities and growth potential.

23 April — A meeting with Dr. Harold Brown, DDR&E, resulted in several decisions affecting the Nike X reorientation effort. The Army was directed to:

(1) Install a tactical MAR on Kwajalein;
(2) Proceed with the development of an augmented MSR;
(3) Conduct cost and schedule studies on installing the originally planned MSR and then the augmented MSR, or only the augmented MSR on Kwajalein;
(4) Proceed with a new long-range interceptor missile; and
(5) Continue design studies of a very high frequency radar.

May — New long-range interceptor missile. *[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*

15 June — A Secretary of Defense briefing was given to Dr. Harold Brown, DDR&E. Dr. Brown requested that the Army prepare a paper on sole source justification for the modified Zeus missile to be utilized in the barrage defense role. He stated that it was permissible to call the modified Zeus missile a DM15X2 with the understanding that a new name would be chosen later.

8 October — DEPEX 11 Study. DCSOPS DA presented results of Nike X (DEPEX) Study to Secretary of Defense, DEPEX II (25 city defense was recommended).

17 November — Sprint firing. First guided Sprint flight at WSMR.

December — The Secretary of Defense decided to defer production activities for at least a year. The Nike X Project Office issued new production/deployment planning guidance to all agencies concerned.

Setting of stage for ARADCOM CDC role in BMD. Nike X Command and Control and Firing Doctrine briefing for CG CDC (LTG Ben Harrell) by ARADCOM (BG Persons) and ESTO (Bob Williams). GEN Harrell informed GEN Persons after the briefing that CDC should not become involved in doctrinal development, etc., for Nike X.

1966

17 January — CDC requests relief from BMD role. CDC letter to C/S Army requested relief from responsibility for development of doctrine for BMD. (Ltr CDCCG, 17 January 1966, subject: USACDC Participation in Nike X Planning, signed by LTG Harrell, and personal letter, same date, on same subject from GEN Harrell to GEN Duff, CG ARADCOM.

22 January	Nike X manning decision. The CDC Maintenance Study for Nike X was briefed to V C/S Army, GEN Abrams, on 4 January 1966 by DCSLOG, DA. The CDC Study recommended mixed civilian/military manning for Nike X. ARADCOM also briefed V C/S on 4 January 1966 and recommended entirely military manning for Nike X. Supplemental supporting data for the ARADCOM position was provided to DCSLOG DA for further review and comment by DA Staff (reference AD CCD letter to DCSLOG, DA, subject: Nike X Manning, signed by LTG Duff). Vice C/S Army was not convinced and directed mixed military/civilian manning for Nike X on 26 January 1966.
18 May	Firing doctrine (ARADCOM CDC role). ARADCOM responsibility for firing doctrine defined in letter DA OCRD. ARADCOM had been actively involved in developing an adaptive preferential defense for over four years. (Letter CRD-S, OCRR, 18 May 1966, subject: Responsibility for Developing Nike X Firing Doctrine, signed by GEN Betts, FOUO.)
20 May	The Multifunction Array Radar (MAR)/WSMR Vas successful in its first attempt to track a satellite. U.S.S.R. Polynot II satellite was detected and verification tracked over the entire sector of expected track. This test was the first of a series of planned tracking missions to gain experience and knowledge with satellite traffic and high performance targets.
26 May	U.S. Continental Air Defense Command (CONAD) established a joint Nike X Impact Task Force, with Army Air Defense Command (ARADCOM) representation, to assess the effect of Nike X deployment on existing and programmed military systems.
June	*[Exempt from declassification under Executive Order 12958, as amended, section 3.3(b)(4)&(5)]*
20 June	CONAD COEC 1-66 published. From January–June 1966, CONAD prepared the "CONAD Operational Employment Concept for the Nike X Terminal BMD System"
28 September	Department of Army Chief of Staff—Memo No. 66-436 established the Nike X System Office as a DA Class, II Activity. LTG A. W. Betts was appointed Nike X System Manager (acting) in addition to his primary assignment as Army Chief of Research and Development. The Nike X Project Office was designated as an Army Materiel Command Class II. Activity, under the operational control of the Nike X. System Manager.
15 October	NXSO established. LTG Betts appointed acting Nike X System Manager (in addition to duties of Chief, R&D/DA) and system office established.
15 November	The U.S. Army Nike X Engineering/Service Test Office (ESTO) with station at WSMR, was established as a Class II Activity under the command of the U.S. Army Materiel Command and was concurrently placed under the operational control of the Nike X System Manager. This action was directed by DA General Order. No. 44, dated 10 November 1966.
25 November	ARADCOM Nike X missions established (ARADCOM CDC role). NXSM assigned Nike X system missions, functions, procedural relationships (via Letter of Instruction [LOI]) to ARADCOM. Functions and responsibilities include: Firing doctrine and system operating logic, Communications doctrine, Logistics doctrine, site selection, operational security doctrine, on-site training, TOE, TA, TDA, and OAT. Letter 25 November 1966, subject: Mission, Functions and Procedural Relationships Relative to Nike X System Development Planning, signed by LTG Betts, Nike X System Manager. Letter filed as Tab J, Nike X Management Plan, 13 September 1967 (FOUO).
5 December	A briefing was given Dr. O'Neal, Assistant Secretary of the Army, on aspects relating to the Low Frequency Radar and how the Nike X System would comply with the intent of the DDR&E memo, subject: "VHF/UHF Radar for Nike X." The Project Manager

requested authority to proceed with the program. Dr. O'Neal gave verbal approval and the system contractor was advised to proceed, with General Electric as the subcontractor for design and development.

20 December — Department of the Army presented Nike X Deployment Model 1-67 (DEMOD 1-67) to meet certain defense objectives specified by the Secretary of Defense. Defense objectives of this deployment model were directed against the potential threat from both the Chinese People's Republic and the U.S.S.R. through the 1970's. Major objectives were a defense against a deliberate Chinese Communist (CHICOM) ICBM attack against U.S. industrial and urban centers—a counter-value attack; and a defense against a deliberate attack on U.S. offensive forces—a counterforce attack. An additional objective was the protection of Continental United States against an inadvertent or unauthorized ICBM launching by a foreign nuclear power. Deployment Model 1-67 was approved by the Secretary of Defense for planning purposes and with minor modifications would become the Model 1-68, or Sentinel, Deployment.

1967

1 January — Zeus renamed Spartan. On 1 January 1967 the Zeus DM15X2 was renamed Spartan.

6 January — LTG A. W. Betts, Nike X System Manager, requested the CG, U.S. Army Air Defense Command (ARADCOM) to conduct preliminary site selection for the Model 1-67 deployment.

8 January — ARADCOM Nike X tasks. In response to a letter from LTG Betts, NXSM, ARADCOM initiated action to prepare the Command and Control Concept, the Command and Control Supplement to the Nike X. QMR, Firing Doctrine documentation, site selection for a thin defense and communications requirements. (Reference personal letter LTG Betts, Nike X System Manager, to LTG Hackett, CG ARADCOM, dated 6 January 1967, on file in Safeguard Library.)

February — CONAD, Nike X Study. Nike X Operational Impact Task Force submits recommendations to JCS (8 Volume study). (June 1966–February 1967.) Study concluded that Nike X System can be deployed into CONUS without serious impact (interference) with other DOD systems such as SAC bombers and ICBM's 30 problems recommended for additional study. (Copy on file Safeguard Library.)

March — Site selection team formed by ARADCOM comprised of representatives of ARADCOM, Office Chief of Engineers, NXPO, WSC, Mobile District (now HND) to select sites for DEMOD 1-67 deployment.

2 March — The first full test of the WSMR Multifunction Array Radar (MAR) Athena tracking mode was accomplished during the Athena mission. This mode provided autonomous target acquisition and handover to precision track to be maintained on the object closest in range through target separation.

27 April — In a multiplex tracking demonstration conducted at WSMR, the MAR successfully tracked five objects ejected from a Highball rocket. The test completed an operational demonstration milestone.

5 July — Secretary of Defense Robert McNamara was briefed on several different deployment concepts. The topics covered were the 1-67 deployment, expanded Hardsite Defense deployments, modifications to the 1-67 deployment to counter the Fractional Orbital Bombardment System threat, and an anti-Soviet defense deployment (2-67). Mr. McNamara directed that a 30-day study be performed of the evolving Chinese People's Republic threat and the modular growth of the 1-67 deployment to counter that threat. This study is to be made by a DOD appointed committee.

11 July	The Montgomery Committee, established by the Department of Defense to consider questions concerning the Chinese threat, held its first meeting.
18 September	Secretary of Defense deployment decision. Secretary of Defense announces his decision to deploy a "thin" antiballistic missile defense against the CPR threat that could materialize within a decade; and to include an option for further defense of Minuteman sites against a U.S.S.R. threat. (On 17 November 1967, Secretary of Defense McNamara announced the Sentinel deployment.)
20 September	C&C concept. Nike X Command and Control Concept DEMOD 1-67 completed by ARADCOM. Work on the concept was started in January 1967 (CONAD represented by LTC Evans J-5); draft concurred in by CINCONAD in a letter dated 14 April 1967. Based on this concept, the Nike X Command and Control Plan DEMOD 1-67 was prepared by a working group at SENSO (ARADCOM participated heavily), approved by DA, and submitted to JCS.
October	Sentinel design review. Fink Committee—DOD Design Review of Sentinel. Decisions made in 26 areas, e.g., site moved from Anchorage to Fairbanks, Alaska; Minot AFB deleted and equipment used to defend Washington, D.C.
November	On-site effort began on the Sentinel program. The Corps of Engineers obtained rights of entry for core drilling and radio frequency interference (RFI) testing at Boston, Detroit, Grand Forks and Chicago.
1 November	The Department of Defense announced the locations of the first ten Sentinel sites: Boston Perimeter Acquisition Radar (PAR) and Missile Site Radar (MSR); Chicago-MSR; Grand Forks-PAR and MSR; Salt Lake City-MSR; Detroit-PAR and MSR; Seattle-PAR and MSR; Hawaii-MSR; Dallas-MSR; New York-MSR; and Albany, Georgia-MSR.
3 November	Sentinel System established. DOD announces Nike X is designated Sentinel; Sentinel System Charter approved by Secretary of Army. The Department of Defense announced that Nike X was redesignated the Sentinel System. The Sentinel System consisted of the Sprint and Spartan missiles, a long-range detection radar designated the PAR, the MSR, and the data processing equipment.
15 November	DA General Order No. 48 was published, creating the Sentinel System Organization. The Sentinel System Manager (SENSM) was established within the Office of the Chief of Staff as Principal Assistant and Staff Advisor to the Chief of Staff and Secretary of the Army for all matters pertaining to Sentinel. Under the SENSM were: The Sentinel System Office (SENSO) at Washington, D.C.; the Sentinel System Command (SENSCOM) at Huntsville, Alabama; the Sentinel System Evaluation Agency (SENSEA) at WSMR, New Mexico. The personnel and resources of the NXPO were transferred to SENSCOM. The jurisdiction of Kwajalein Test Site was transferred from the Army Materiel Command to become a subordinate element of SENSCOM, but the test site was to be operated under the guidance and direction of the Office, Chief of Research and Development with respect to national range matters.
20–24 November	Affected communities briefed on proposed Sentinel sites. Briefings were held on 20 November in Boston (MG Coburn/LTC Doughtie), Chicago (BG Lilly/LTC Hutchinson), Dallas (MG Darnell/MAJ Boren), Salt Lake City (MG Winn/LTC McLaughlin); on 22 November in New York (MG Coburn/LTC Hutchinson), Grand Forks (BG Lilly/MAJ Boren), Albany, Ga. (MG Darnell/LTC Doughtie), Seattle (MG Winn/LTC McLaughlin; and on 24 November in Detroit (MG Coburn/LTC Doughtie) and Hawaii (COL Semmens/LTC McLaughlin).

1968

January — The budget message of the Secretary of Defense to Congress for FY 1968 contained the following recommendations in regard to Nike X:

(1) Vigorously pursue the development, test, and evaluation of the system (for which $386 million was included in the 1968 budget) but take no action now to deploy the system;
(2) Initiate negotiations with the Soviet Union to limit the deployment of the Antiballistic Missile System; and
(3) Reconsider the deployment decision in the event these discussions proved unsuccessful.

March — The Boeing Company, Seattle, was named to carry out a l4-month study of certain antiballistic missile sites.

April — An Ad Hoc Committee, under the Chairmanship of Dr. H. W. Augustadt of BTL, was appointed to investigate the Sprint program and make recommendations for improvements. The committee's recommendations were accepted in late May, and the CG, SAFSCOM, directed the contractor to begin implementation immediately. An estimated three to four week slip in the firing schedule was anticipated.

JCS approves BMD C&C levels. JCS approves three levels of control for BMD (BMDC, ACC, MDC), and establishment of subordinate unified command, and tasks CINCONAD to recommend specific arrangements and resource requirements. (This was JCS reaction to Nike X Command and Control Plan DEMOD 1-67. See entry, 20 September 1967.)

May — The Secretary of the Navy signed the Memorandum of Agreement between the Army and the Navy for the Sentinel System Test Target Program.

DOD disclosed three additional general areas to be surveyed as possible site locations for the Sentinel System: San Francisco and Los Angeles, California and Sedalia, Missouri.

Three contractors (the Boeing Company, Martin-Marietta Corporation, and McDonnell-Douglas Corporation) were selected by the Advanced Ballistic Missile Defense Agency (ABMDA) to conduct analytical studies to establish promising methods for upgrading Sentinel System performance by modifications to, or a new design of, the third-stage of the Spartan missile to meet evolving threats. The selection by ABMDA represented a consensus of the evaluators from both ABMDA and SENSCOM.

6 May — BTL authorized General Electric to proceed with Phase II of Perimeter Acquisition Radar (PAR) development. Phase II was the design and manufacture of a prototype PAR to be installed at a tactical site (Boston was scheduled to be the first site).

27 May — DOD announces additional areas for Sentinel sites. DOD announced areas for deployment of Sentinel at San Francisco, Los Angeles and Whiteman AFB. Briefings were conducted at Sedalia, Mo., on 4 June 1968 (BG Lilly/LTC Roan), LA on 17 June 1968 (AMG Winn/LTC McLaughlin), on 21 June 1968. The first briefing scheduled for Los Angeles on 5–6 June was cancelled due to Senator Kennedy's assassination. A second briefing for San Francisco was held on 2 August because of nonattendance of high-level officials at first briefing. Planned locations never publicly announced were Washington, D.C. and Fairbanks, Alaska.

30 August — CONAD submits study to JCS recommending data be remoted from ACC (FCC) to appropriate RCC (SAGE building)—Option 1. (See April 1968 JCS entry.) ("CONAD Report of Recommended Arrangements and Resource Requirements for CONAD Subordinate Unified Commands," dated 30 August 1968.)

5 September	Acquisition of the first Sentinel sites—Camp Curtis Guild (MSR) and Sharpner's Pond (PAR) at Boston—was approved by the Real Estate Subcommittee of the House Armed Services Committee.
13 September	Authorization for Boston land acquisition. Congressional authorization to acquire land in the vicinity of Boston for construction of the first Sentinel site was announced.
24 September	The advanced contract for construction of a portion of the Boston PAR was awarded to George T. Brox, Inc., Dracut, Mass., on 24 September. Notice to proceed was issued concurrently, effective 25 September. The contractor's bid of $727,242 exceeded the Government estimate by $4,467.
13 November	DOD announced additional Sentinel sites. DOD announced sites at Warren AFB and Malmstrom AFB as Sentinel sites. Briefings were conducted at Warren on 18 November 1968 (MG Lilly/LTC Roan), and Malmstrom on 19 November 1968 (MG Lilly/LTC Roan).
20 November	DOD announced the location of two additional Sentinel sites: Warren Air Force Base, Wyoming and Malmstrom Air Force Base, Montana. In response to JCS questions, CONAD submits letter to JCS delineating the functions of the Subordinate Unified Commander and the ACC (FCC) Commander. Reference letter CONAD (CPAP) 20 November 1968, to JCS, subject: Sentinel Command and Control (located in P&CD Administration Office, Tab M, CONAD Subordinate Unified Command/RCC-ACC Interface) Secret.
3 December	JCS asks CINCONAD to answer certain technical questions relating to placing ACC (FCC) in the SAGE Building with the RCC—Option 4. Reference memo JCS to JSIPS, 3 December 1968, Sentinel Command and Control (located in P&CD Administration Office, Tab J, Folder CONAD Subordinate Unified Command/RCC-ACC Interface) Secret.

1969

29 January	CONAD replies to JCS, further refuting Option 4, and again recommending Option 1. Remoting data from FCC to RCC in SAGE building. (Letter CONAD to JCS, 29 January 1969, subject: Nike X (Sentinel) Command and Control Plan (located in P&CD Administration Office, Tab A, CONAD Subordinate Unified Command/RCC-ACC Interface) Secret.
6 February	Sentinel System land acquisition and construction suspended. By order of Secretary of Defense, all site acquisition and construction was suspended, pending a review of the Sentinel System as ordered by President Nixon.
26 February	Packard Memo. ADCC to be in C-135 aircraft. RCC (less ADCC) to be in MSR building.
14 March	Safeguard System announced. President's announcement of Safeguard. The Sentinel System Manager directed SENSCOM to proceed with preparations to accomplish Phase I of the revised deployment plan and modify contracts as required (not announced during the Sentinel era were Washington, D.C., and Fairbanks, Alaska). (Reference Msg SENSM, DA 172312269, "Modified Sentinel Deployment Analysis" Unclassified.
6 August	After months of intense debate, the Senate endorsed President Nixon's proposal to deploy the Safeguard System, by two-votes. A bipartisan amendment, sponsored by Senators John Sherman Cooper (R-Ky) and Phillip A. Hart (D-Mich) to permit continued research and development of the Safeguard System but to bar deployment or site acquisition, was defeated by a 51 to 49 vote.

8 October	A field office was opened at Grand Forks, under the jurisdiction of the Safeguard System Command. On 7 November, responsibility for the field office transferred to U.S. Army Engineer District, Huntsville.
20 October	A field office was opened at Great Falls, Montana, under the jurisdiction of the Safeguard System Command. On 15 January 1970, responsibility for the field office transferred to U.S. Army Engineer District, Huntsville.
November	A community impact study was conducted by representatives of the Omaha District, Corps of Engineers, in the Grand Forks and Malmstrom areas. The survey included all towns within a 50-mile radius of planned Safeguard sites, and all cities of 10,000 or more population within a 100-mile radius. The two objectives of the study were to: evaluate the impact of Safeguard on the local scene; and identify programs available to assist in community planning.
20–25 November	A significant milestone was reached when satellite "targets of opportunity" were acquired and tracked by the MSR. This is the first automatic acquisition and tracking of high velocity targets by the MSR using the Meck-Zero Test Track software for radar control.
8 December	The House of Representatives approved $69.9 billion in appropriation for the Defense Department, which included $359.5 million in deployment funds for the Safeguard System and $400.9 million for research and development. By a 78–25 vote, the House rejected an amendment that would have eliminated deployment funding. The Senate, on 16 December, approved by a vote of 85–4 the $69.9 billion appropriation. A move to delete almost all of the $760 million for the Safeguard System was defeated by a vote of 49 to 36.

1970

30 January	President Nixon announced his decision for further deployment of the Safeguard Ballistic Missile Defense System beyond the previously approved two-site, Phase I program. The recommended new deployment would consist of a third site (Whiteman Air Force Base, Missouri) and advance preparation for five additional sites (in the Northeast, Northwest, Washington, D.C., Warren Air Force Base, Wyoming and in the Michigan-Ohio area) although with no deployment commitment at these sites.
24 February	Appearing before a joint session of the Senate Armed Services Committee and Defense Appropriations Subcommittee, Secretary of Defense Melvin Laird presents the Administration's proposal for second-phase deployment consisting of an MSR with missile fields at Whiteman AFB and preliminary work without commitment to actual construction at locations in the Upper Northwest, Southern New England, Michigan or Ohio, the Washington, D.C., area, and Warren Air Force Base. He also recommends construction for increased Sprint fields at the Grand Forks and Malmstrom sites. He estimates the cost of the expanded program in FY 1971 at $920 million, or "less than $100 million more than that needed for Phase I work already approved by Congress."
16 April	The Strategic Arms Limitation Talks (SALT) open in Vienna. The House Armed Services Committee approves funds requested by the Secretary of Defense on 24 February for second-phase Safeguard deployment.
11 June	The House of Representatives approves, 307 to 57, the FY 1971 Defense Procurement Authorization Bill (HR 17123). It defeats, 92 to 26, an attempt to block appropriations for Safeguard construction.
16 June	Role of Subordinate Unified Commanders. CINCONAD letter to JCS outlining his concept (agreed to by CG ARADCOM) for role of Subordinate Unified Commanders

in BMD, and recommending revision to Annex A, Volume III, NORAD 76, to realign functions states therein in accordance with the concept. (Reference letter CONAD—16 January 1970 (to JCS-J-5), "Ballistic Missile Defense Role of the CONAD Subordinate Unified Command" with one enclosure. Enclosure—Section 1, Subordinate Unified Commander's Functions.)

17 June — By a vote of 11 to 6, the Senate Armed Services Committee approves funds for Safeguard construction at Whiteman Air Force Base and preliminary work at Warren Air Force Base but refuses appropriation of funds for preliminary work related to sites in the Upper Northwest, Southern New England, Michigan or Ohio, and Washington, D.C. area.

11 August — The Senate rejects two amendments to the FY 1971 Defense Procurement Authorization Bill. The first, offered by Senator Hughes, would have eliminated all funds for Safeguard. The second, offered by Senators Cooper and Hart, would have denied funds for construction at Whiteman and preliminary work at Warren AFB. Votes are 62–33 and 52–47.

19 August — The Senate rejects an amendment to the FY 1971 Defense Procurement Authorization Bill. Sponsored by Senator Brooke, this amendment would have deferred all work on the Whiteman and Warren Safeguard sites and diverted $320 million to strengthening the two sites already under construction. Vote is 53–45.

28 August — First Spartan intercept of ICBM nose cone, over Kwajalein.

7 October — The President signs the FY 1971 Defense Procurement Authorization Bill following reconciliation of differences between the Senate and the House of Representatives. The agreed version authorizes $1.3 billion for work on the Whiteman and Warren sites but restricts expansion to those sites only.

1971

29 January — The FY 1972 Federal budget is presented to the Congress. Proposed funding for Safeguard, at $1.267 billion, is $60 million less than in 1970.

22 October — General Orders 354 and 355, Headquarters ARADCOM, direct organization of a Safeguard command and a Safeguard surveillance battalion, effective 1 September at Grand Forks, North Dakota.

6 November — An underground nuclear test, identified by the code name Cannikin and reportedly an essential step in developing a warhead for the Spartan missile, is successfully completed on Amchitka Island in the Aleutians. The widespread destruction predicted in unsuccessful legal actions aimed at preventing the test fails to occur.

10 November — The Defense Procurement Authorization Bill is approved in Congressional conference. Included are Safeguard funds in the amount of $1.106 billion. Construction is limited to that already authorized for the Malmstrom and Grand Forks sites. Activities at the Whiteman and Warren sites are limited to advanced site preparation.

1972

26 May — The President of the United States and the Secretary General, Central Committee of the Communist Party of the U.S.S.R. sign a Treaty on the limitation of Antiballistic Missile (ABM) Systems and an Interim Agreement on the Limitation of Strategic Offensive Arms. The treaty limits ABM deployment to two sites, one for defense of an ICBM site and one for defense of the national capital. The immediate effect is to limit Safeguard

	deployment to the Grand Forks site now under construction, with an option to defend the National Command Authority.
2 August	The U.S. Senate ratifies the ABM Treaty by a vote of 88 to 2.
13 September	Congress approves the FY 1973 defense appropriations bill but bans the use of funds in connection with a ballistic missile defense of the National Command Authority.

Appendix C

A Chronology of Soviet Air Defense Systems (1956–1972)

1956

July	MiG-21 (Flashlight), Su-7 (Fitter), Su-9 (Fishpot) and Faceplate prototypes shown during Tushino air show.
	Formation of the Military Command Academy of Air Defense which began to train command cadres for all branches of the National Air Defense Forces.
	A 22-hour compulsory program of civil defense training instituted; the nationwide program was to be completed by 1958.
	Civil Defense interest turns to evacuation as alternative to shelters.
	Myachora Test Center Operational—foremost world jet engine testing facility.
	Deployment of RS-lU (Alkali) air-to-air missile begun
	Rock Cake (HF) and Knife Rest B&C (EW) radars first observed.
	MiG-17 PFU (Fresco E) first observed.

1957

March	Production of YAK-25 stopped. Approximately 500 built.
May	Campaign begun to decentralize Soviet Industry.
August	First successful ICBM launch.
October	Soviets launch artificial earth satellite
14 December	Ministry of Aviation Industry reorganized as State Committee on Aviation Technology.
	IRBM firings from Kapustin Yar to Sary Shagan indicate preliminary ABM R&D.
	Su-7 and Su-9/11 enter production.
	Non-combat (transport and utility) aircraft production exceeds combat (fighter and bomber) aircraft production.
	The following radars reach operational status:
	Big Mesh-EW Big Net-EW Slant Mesh-GCI Strike Out-EW Witch Five-IFF
	SA-2 (Guideline) surface-to-air missile reaches operational status.

	An aircraft, identified by PVO units as a Canberra reconnaissance aircraft, penetrates U.S.S.R. as far as Voronezh.
1957–58	U.S. Sidewinder air-to-air missile technology comprised through Swedish attaché in New York.

1958

Khrushchev temporarily suspends shelter construction. Debates begin over effectiveness of civil defense.

MiG-21 enters production; MiG-19 ceases production.

First deployed SA-2 was observed.

The following radars operational:

Bar Lock-GCI
Cross Out-EW/GCI
Flat Face-SAM acquisition
Stone Cake-HF
Sponge Cake-HF
Score Board A-IFF
Witch Four-IFF

1959

January	Soviets launch first lunar probe.
January	Khrushchev states "Air Force has lost its previous importance."
May	E-66 aircraft with Tumansky engine establishes world speed record of 1290 knots.
September	Su-9 (Fishpot) first sighted at operational airfield.
17 December	Strategic Rocket Forces were formed.

SA-3 SAM system first tested.

The following radars were first operational:

Big Bar A-EW
Head Net-EW
Tall King-EW

Spin Scan AI radar in prototype.

1960

14 January	Khrushchev proposes to Supreme Soviet that armed forces be reduced by one-third. Proposal was adopted.
April	Reconnaissance of Sary Shagan Missile Test Center indicates Hen House BMEW type radar externally complete.
1 May	U-2 piloted by Gary Powers shot down in vicinity of Sverdlovsk.

Initiation of an 18-hour civil defense program.

The following radars became operational:

Big Bar B & C-EW
Spoon Rest B & C-EW
Top Trough-EW

1960–61	Construction on long-range SAM facilities (Griffon) began at Leningrad.

1961

April	E-66 aircraft achieves world altitude record of 113,800 feet.
July	MiG prototype (Flipper) observed at Tushino; armed with AWL missiles. System not produced. July Carpathian operational-rear area exercise conducted.
October	Marshal Malinousky declares to XXII Party Congress that "the problem of destroying missiles in flight has been successfully solved."
October	XXII Congress CPSU shifts responsibility for Civil Defense to Ministry of Defense from Ministry of Interior, Marshal V.I. Chuykov is Chief of Civil Defense, Col. Gen. of Aviation O.V. Tolstlkov is First Deputy.
December	Fifth Plenum of the Central Committee of DOSAAF meets in Moscow. Re-emphasizes civil defense.
	Effects of megaton weapons published. Initial Deployment of SA-3.

1962

May	Fifth All-Union Congress of DOSAAF meets. DOSAAF endorsed by Central Committee. Congress attended by V.A. Sudets, CINC PVO Strany and A.N. Shelepin, Secretary of Central Committee CPSU.
July	Khrushchev in interview with C.L. Sulzberger claimed that U.S.S.R. had a missile which could "hit a fly in outer space."
September	New 19-hour civil defense course announced for population.
28 October	Hen House R&D BMEW Signal received.

1963

November	Griffon displayed in October Revolution parade and claimed as having a ballistic missile defense role.
	YAK-28P enters production.
	U.S. Falcon air-to-air missile technology found to be compromised.
	The following radars become operational:
	Part Time-EW
	Sack Net-EW/GCI

1964

October	Death of Marshal Biryuzov, Chief of General Staff.
November	Galosh ABM system displayed in October Revolution parade.
	Dog House ABM associated radar first observed.
	Long Track (EW) radar operational.

1965

2 February	Revised Hen House signal received.
May	Soviet TV showing of Gaffer (predecessor of Galosh) ABM.
	Thin Skin (HF) radar operational.
	Tu 128P (Fiddler) enters production.

1966

April	Marshal Malinovskiy declares to XXIII Party Congress that Soviet air defenses guarantee certain destruction of all aircraft and "many" missiles.
April	Brezhnev endorses civil defense to XXIII Congress; highest level endorsement received.
19 May	Sary Shagan modified Hen House signal received.
July	Marshal P. F. Batitskiy named Commander-in-Chief of National Air Defense Forces to succeed Marshal Sudets.
26 August	Olenogorsk operational Hen House signal received.

1967

4 March	Skrunda operational Hen House signal received.
June	Middle East War
November	Su-15 (Flagon) and MiG-25 (Foxbat) displayed at Domodedovo air show.
	Civil defense training shifted from DOSAAF to military.
	A 21-hour compulsory civil defense training program instituted for grades 5 through 7.
	Renewal of SA-3 deployments in the Soviet Union and East Germany.

1968

June–July	Dog House ABM associated radar signals received.
August	Galosh ABM-IB signals received; last essential component of current Moscow ABM.
August	Invasion of Czechoslovakia.
	Operational testing of Moss Airborne Warning and Control System using Flat Jack EW radar.
	MiG 25 (Foxbat) enters production.
	Top Sail EW/GCI radar operational.
	School established to train junior officers as civil defense commanders.

1969

Mishelevka modified Hen House signal received.

1970

9 December	Artem Mikoyan, General Designer, dies.
	Civil defense training extended down to 2nd grade.

1971

20 October	Skrunda operational Hen House signal modification received.

1972

26 May	Signing of treaty on the Limitation of antiballistic missiles in Moscow.
	Col. Gen. A. Altunin succeeds Chuykov as chief of civil defense. Altunin also a Dep. Minister of Defense. Civil defense duties include natural disaster recovery.

Glossary

AABNCP	Advanced Airborne Command Post
AADCP	Army Air Defense Command Posts
AAF	Army Air Force
ABM	Antiballistic Missile
ABMDA	Advanced Ballistic Missile Defense Agency
ACQ	Acquisition Radar
ACW	Aircraft Control & Warning
ADA	Air Defense Artillery
ADC	Air Defense Command
ADDC	Air Defense Direction Centers
AEC	Atomic Energy Commission
AEW&C	Airborne Early Warning And Control
AGC	Automatic Gain Control
AGF	Army Ground Force
AI	Air Intercept
ANG	Air National Guard
APVO	Aviation of Anti-Air Defense
ARAACOM	Army Antiaircraft Command
ARADCOM	Army Air Defense Command
AWACS	Airborne Warning And Control System
BAMBI	Ballistic Missile Boost Intercept
BIRDIE	Battery Integration And Radar Display Equipment
BMEWS	Ballistic Missile Early
BMD	Ballistic Missile Defense
Bomarc	Boeing-Michigan Aeronautical Research Center
BUIC	Back Up Interceptor Control
CAA	Civil Aviation Administration
CADF	Central Air Defense Forces
CADIN	Continental Air Defense Integration North
CADS	Continental Air Defense Study
CINCLANT	Commander-In-Chief, Atlantic

CINCNORAD	Commander-In-Chief, North American Air Defense Command
CINCONAD	Commander-In-Chief, Continental Air Defense Command
CINCPAC	Commander-In-Chief, Pacific
COC	Combat Operations Center
CONAD	Continental Air Defense Command
CONUS	Continental United States
DC	Direction Center
DCSOPS	Deputy Chief Of Staff For Operations
DDR	Decoy Discrimination Radar
DEMOD	Deployment Model
DER	Destroyer Escort Radar
DEW	Distant Early Warning
DSP	Defense Support Program
EADF	Eastern Air Defense Forces
EASTARAACOM	Eastern Army Antiaircraft Command
ECCM	Electronic Counter Countermeasures
ECM	Electronic Counter Measures
EMP	Electro-Magnetic Pulse
EW	Early Warning
FAA	Federal Aviation Administration
FAR	Forward Acquisition Radar
FOBS	Fractional Orbit Bombardment System
FS	Frequency Shift
FTC	Fast Time Constant
GAPA	Ground-To-Air Pilotless Aircraft
GCI	Ground Controlled Intercept
G-I-UK	Greenland–Iceland–United Kingdom
GOC	Ground Observer Corps
HAPDAR	Hard-Point Defense Radar
HF	Height Finder
IAGC	Instant Automatic Gain Control
ICBM	Intercontinental Ballistic Missile
IFF	Identification Friend Or Foe
IMI	Improved Manned Interceptor
IRBM	Intermediate Range Ballistic Missile
IRF	Image Rejection Filter

JCS	Joint Chiefs Of Staff
JPRF	Jittered PRF
LAR	Local Acquisition Radar
LDC	Local Defense Center
LRR	Long Range Radar
MAD	Master Air Defense (Plan)
MAP	Ministry of Aviation Industry
MAR	Multifunctional Array Radar
MF	Multiple Frequencies
MIRV	Multiple Independent Reentry Vehicle
MRI	Medium Range Interceptor
MSR	Missile Site Radar
MTI	Moving Target Indicator
NAVFORCONAD	Naval Forces Continental Air Defense Command
NAWS	NORAD Attack Warning System
NCA	National Command Authority
NCMC	NORAD Cheyenne Mountain Complex
NG	National Guard
NM	Nautical Miles
NORAD	North American Air Defense Command
NSSCC	National Space Surveillance And Control Center
OKB	Experimental Design Bureau
OSD	Office of the Secretary of Defense
OTH-B	Over The Horizon—Backscatter
PAR	Perimeter Acquisition Radar
PRO	Antimissile Defense
PVO STRANY	National Air Defense
PVO VOYSK	Troop Air Defense
PWD	Pulse Width Discriminator
QMR	Qualitative Materiel Requirement
R&D	Research And Development
ROC	Required Operational Capability
ROR	Range Only Radar
RPD	Random Pulse Discriminator
RTV	Radio-Technical Troops
RV	Reentry Vehicle

SABMIS	Sea-Based Antiballistic Missile Intercept System
SAC	Strategic Air Command
SAGE	Semi-Automatic Ground Environment
SALT	Strategic Arms Limitations Talks
SAM	Surface-To-Air-Missile
SAM-D	Surface-To-Air-Missile Development
SAMDEP	SAM-D Deployment Analysis
SAMWEPS	SAM-D Weapons Family Cost Effectiveness Study
SCC	Super Combat Center
SIS	Satellite Intercept System
SLBM	Submarine Launched Ballistic Missile
SNAP	Short Notice Annual Service Practice
SPADATS	Space Detection And Tracking System
SPRF	Staggered PRF
TAC	Tactical Air Command
TATTEM	Test Against Target Taking Evasive Maneuvers
TACMAR	Tactical Multifunctional Array Radar
TRACE	Transportable Control Environment
TT	Tunable Transmitter
TTR	Target Tracking Radar
WADF	Western Air Defense Forces
WSMR	White Sands Missile Range
ZAR	Zeus Acquisition Radar
ZMAR	Zeus Multifunctional Array Radar
ZRV	Antiaircraft Missile Troops

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