USAFACS Historical Monograph Series

MODERNIZING THE KING OF BATTLE
1973-1991

By Boyd L. Dastrup



Office of the Command Historian
United States Army Field Artillery Center and School

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United States Army Field Artillery Center and School
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FOREWORD

To the 2003 Edition

During the two decades between the end of the Vietnam conflict and its first war with Iraq, the United States Army resurrected itself as a powerful fighting force capable of taking on the heavily mechanized armies of the Soviet Union and the Warsaw Pact. For Field Artillery, this meant a complete modernization. This process of redesign, with all its vicissitudes, is the subject of this valuable study by Dr. Boyd L. Dastrup, the Command Historian of the U.S. Army Field Artillery Center and School.

Central to the Army's post-Vietnam renaissance was the introduction of AirLand Battle, a doctrine emphasizing aggressive tactics and "fighting deep" to impede the enemy from effectively striking back. The United States sought the ability to "fight outnumbered and win" against the powerful Soviet bloc. Because conventional warfare in Europe was not the only possible strategic scenario as the Cold War waned, the Army also needed a force structure light and mobile enough to fight elsewhere in the world. Competing demands between heavy and light forces had serious implications for Field Artillery in terms of command, control, communications and the ability to deliver effective counterfire.

Operating under fiscal and manpower constraints, the Field Artillery successfully adopted new doctrine, force structure, and weapons—especially the Multiple-Launch Rocket System (MLRS)—that would enable it to fight across the full spectrum of conflict. The vindication of its modernization efforts came in the Persian Gulf War of 1991. American field artillery delivered such effective supporting fire that the Iraqis dubbed it "Steel Rain." There remained room for improvement, however. Target acquisition, for example, suffered from a lack of unmanned aerial vehicles for reconnaissance, a program that had been scrapped during budget battles in the 1980s.

Despite the emphasis on air power in modern warfare, recent events in Afghanistan and Iraq have demonstrated that Field Artillery is still a vital component of the contemporary battlefield. The modernization of the King of Battle continues, and those involved in this effort, as well as other interested parties, should benefit greatly from a careful reading of the historical background that Dr. Dastrup provides. This book was first published in the U.S. Army Field Artillery Center and School Monograph Series. It is now our pleasure to join with the Field Artillery Center and School to make the book available through the Center of Military History's distribution channels as well.

Washington, D.C.
5 June 2003

JOHN S. BROWN
Brigadier General, U.S. Army
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U.S. ARMY FIELD ARTILLERY CENTER AND SCHOOL

Major General John A. Dubia	Commanding General
Brigadier General Leo J. Baxter	Deputy Commanding General-Training
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U.S. Army Field Artillery Center and School Monograph Series

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Cover Photo: An Army Tactical Missile System being launched, courtesy of LTV Missiles and Electronic Group Missiles Division

BOYD L. DASTRUP

Boyd Lawrence Dastrup, a native of Ogden, Utah, received his B.S. from Weber State College, M.A. from Utah State University, and Ph.D. from Kansas State University. Dr. Dastrup has served as Center Historian for the Sheppard Technical Training Center, Sheppard AFB, Texas, and is currently the Command Historian at the U.S. Army Field Artillery Center and Fort Sill, Fort Sill, Oklahoma. He has written *The U.S. Army Command and General Staff College: A Centennial History* (1982), *Crusade in Nuremberg: U.S. Military Occupation, 1945-1949* (1985), *King of Battle: A Branch History of the U.S. Army's Field Artillery* (1992), and *The Field Artillery: History and Sourcebook* (1994).

PREFACE

Over a period of almost twenty years, the Army aggressively modernized so that it could fight effectively across the entire spectrum of conflict. Early in the 1970s, the Army shifted its attention back to Europe after neglecting its forces on that critical continent through the last half of the 1960s and the first part of the 1970s because of the Vietnam War. Much to its dismay, however, the Army faced a numerically superior and well-equipped Soviet and Warsaw Pact military force with the ability to defeat readily the armed forces of the North Atlantic Treaty Organization (NATO) of which the United States was a member. Influenced by the dire military situation in Europe as well as by the Arab-Israeli War of October 1973 that had convincingly demonstrated the high lethality and rapid attrition of modern weapons, the Army stepped up its pace of modernization. For the field artillery as well as the Army as a whole, this meant gearing for the intimidating challenge of a high-intensity conflict in Europe.

By the end of the 1970s, threats to the United States' national interests throughout the world led the Department of Defense and Department of the Army to look beyond the narrow European orientation increasingly to a global perspective. The Army no longer could focus almost exclusively upon fighting in Europe but had to organize and equip light forces for worldwide contingency operations. Faced with that requirement, the Army had to develop light forces, including the appropriate field artillery, during the 1980s as it simultaneously modernized its high priority heavy forces.

In the midst of this extensive modernization effort, a quick succession of international events shook up the U.S. strategic stance. The sudden disintegration of communism in Eastern Europe in 1989, the political and economic collapse of the Soviet Union in 1990, the reunification of Germany that same year, the signing of the Conventional Forces Europe Treaty between NATO and the Warsaw Pact in November 1990, and the breakup of the Warsaw Pact altered the political scene in Europe and simultaneously reduced the threat of war on the continent. The end of the Cold War and ensuing U.S. force reductions, coupled with the United States' growing concern with the proliferation of modern armaments throughout the world and the volatile Middle East, led the U.S. Army to abandon its strategy of forward deployment in Europe backed by reinforcements in the United States that had existed for over forty years and to shift to a new strategic posture of force projection primarily from the United States.

Just as this change in strategic reorientation was unfolding, Iraqi military forces invaded Kuwait in August 1990. Initially, the United States and United Nations resorted to diplomatic and economic initiatives to compel Iraq to leave Kuwait. When it appeared that they were insufficient, the United Nations under United States leadership turned to military force. Ultimately, Operation Desert Storm of 1991, validating the modernization efforts, drove Iraqi forces from Kuwait. During the ground war against Iraqi armed forces that lasted one hundred hours, U.S. Army field artillery matched and exceeded all expectations.

This monograph is the story of that aggressive U.S. Army program of the 1970s and 1980s to modernize the field artillery. Under pressure to support worldwide American national interests, the U.S. Army transformed the field artillery by introducing new equipment, tactics, doctrine, and organization.

I would like to thank Dr. L. Martin Kaplan, Mr. John L. Romjue, and Mr. Ernest Dublisky for taking time to read and critique the manuscript. As a civilian and military officer,

Mr. Dublisky worked many years in the U.S. Army Field Artillery School's Directorate of Combat Developments and played a role in the modernization effort of the 1970s and 1980s. I would also like to thank former commandants of the U.S. Army Field Artillery School, Major General Raphael J. Hallada, Major General Eugene S. Korpal, Lieutenant General David E. Ott, General Jack N. Merritt, and General Donald R. Keith, for reading the draft manuscript and offering, as participants in the process of modernization, their invaluable insights. Any errors of fact are mine alone.

I would also like to thank Ed Stiles for producing the fine graphs and charts that accompany the narrative and Donna Covert for helping reproduce photographs located in the files of the *Field Artillery Bulletin*.

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CHAPTER I

LAYING THE FOUNDATION: THE 1970s

The sobering possibility of fighting a high-intensity conflict in Europe and the unprecedented lethality of military weaponry that was starting to appear early in the 1970s prompted the Army to speed up modernizing its forces. As a part of that intensive effort to improve the Army's fighting capabilities, the field artillery rewrote doctrine, reorganized its force structure, and started acquiring new weapons and equipment.

NEW DOCTRINE AND ORGANIZATIONS

While the United States was involved in the Vietnam War in the 1960s and early 1970s, the Soviet Union and Warsaw Pact dramatically strengthened their armed forces. The Soviet Union added five tank divisions in Eastern Europe, increased the number of tanks in its motorized rifle divisions, and introduced new tanks, armored personnel carriers, and self-propelled artillery to give its ground forces highly mobile armored and motorized combined arms formations. Of equal importance, the Soviet Union and Warsaw Pact moved their military forces closer to the borders of North Atlantic Treaty Organization (NATO) countries to suggest the adoption of a preemptive, conventional strike strategy. Modernizing equipment, adding new units, and redeploying units represented a bold assertiveness and significantly tipped the balance of power between the Warsaw Pact and NATO in favor of the former.[1] On the basis of this vast destabilizing military buildup, the Army, already weakened by the devastating and demoralizing effect of the Vietnam War, occupied an unenviable position early in the 1970s if called upon to fight such an overwhelming threat as a vital part of NATO.[2]

For the Army the Arab-Israeli War of October 1973 further underscored the necessity of modernizing. Following American involvement in the Vietnam War, many Army officers were discussing the changes in doctrine, organization, and equipment that were necessary for success in a high-intensity conflict in Europe, but the Arab-Israeli War provided them a better comprehension of modern warfare and gave rise to a sense of urgency to step up the pace of modernization. While the fast tempo of the war led the Army to conclude that success in future wars would depend upon the results of the first battles, the staggering materiel losses of approximately fifty percent in two weeks of combat to both sides simultaneously highlighted the tremendous lethality of modern conventional weapons beyond imagination. The destruc-

tiveness of antitank and air defense missiles and tanks was particularly impressive to Army observers. Reflecting upon the war, the Commandant of the U.S. Army Field Artillery School, Major General (later Lieutenant General) David E. Ott (1973-1976), wrote early in 1976, "The Oct Arab-Israeli War provided us a window into the future conflicts. The lethality and mobility of modern weapons inflicted very high losses to both sides during short intense battles."[3] If the Arab-Israeli War — the perceived prototype of modern war — were any indication, the Army faced an extremely dangerous future because the introduction of high technology to the battlefield made war more lethal than ever before.[4]

Concerned about such a war in Europe, the Army set out with the firm determination to build an effective combat force and to overcome the debilitating influence of the Vietnam War.[5] The reformulation of doctrine during 1974-1976 that was more suited to battlefield conditions of the 1970s and the future played a key role in preparing the Army for war in Europe and simultaneously led to a new edition of Field Manual (FM) 100-5, *Operations*, in 1976. Written by the U.S. Army Training and Doctrine Command (TRADOC), which was established in July 1973 to oversee training and preparing the Army for war, the manual acknowledged the great increase in the lethality of modern weapons and the numerical superiority of Soviet and Warsaw Pact military forces and simultaneously outlined a concept for fighting outnumbered and winning. According to the manual, the commander would organize his forces into the covering force, the main battle area, and the rear area. The covering force had the responsibility of inflicting heavy casualties to help reduce the force ratios, to conceal the location of the main defensive positions, and to attempt to compel the enemy to reveal the strength and direction of its main attack. When the opponent entered the main battle area, the commander would orchestrate economy-of-force operations by maneuvering his forces to concentrate them at the right place and time to squeeze the most out of them and their weapons and counterattack with direct and indirect fire weapons. This would force the enemy to mass and make him more vulnerable to the Army's firepower.[6]

Confronted by such an intimidating threat in Europe and influenced by a sharp appreciation of the new lethality of modern weapons, the Army devised a cautious tactical doctrine, commonly known as the active defense. It emphasized violent defensive actions of moving from battle position to battle position and huge quantities of firepower at the expense of maneuver and offensive thrusts. The destructiveness of the weapons of the 1970s and the promise of those to be fielded in the near future would enable the defender to conduct successful operations against the attacker by destroying a major portion of its forces before turning to the offense. If the Arab-Israeli War of 1973 were any indication of the future, the Army could not sustain high casualties in the first battle of the next war and win against a numerically superior and well-equipped foe. Surviving the first attack was paramount, and the active defense would allow doing just that.[7] In describing the implication of the new FM 100-5, the Commanding General of TRADOC, General William E. DePuy, wrote, "This manual takes the Army out of the rice paddies of Vietnam and places it on the Western European battlefield against the Warsaw Pact."[8]

Besides shifting the Army's attention back to Europe and serving as a capstone for an entire family of doctrinal manuals that would make a wholesale replacement of tactical doc-

trine, FM 100-5 served another valuable purpose. Repeatedly, the manual stressed that winning was a major objective even though the Army would be fighting a numerically superior and well-equipped Warsaw Pact military force. Such a rallying cry was critical given the recent morale shattering experience in Vietnam in which the United States had suffered an ignominious strategic, if not a battlefield defeat, against a supposedly inferior opponent and given the military situation in Europe. With such a strong emphasis on winning, FM 100-5 was pressing to build confidence and create a positive attitude within the Army. A less assertive and constructive approach would have been counterproductive and equally as important would have done nothing to promote morale.[9]

To serve as a companion piece to FM 100-5, *Operations*, 1976, the U.S. Army Field Artillery School, which was one of TRADOC's service schools and had the responsibility for modernizing the field artillery, in the meantime, aggressively revised FM 6-20, *Fire Support for Combined Arms Operations*, in 1974-1976. After extensive coordination with TRADOC's other combat arms schools, field artillery officers serving in tactical units, and other Army officers, the school published the manual early in 1977. Written for maneuver commanders, their staffs, and fire support coordinators, the manual was the field artillery's capstone "How to Fight" manual and the basic reference source for fire support planning and coordination.[10] Unlike previous editions of FM 6-20, this one was not a tactics manual. It furnished "the first comprehensive treatment of the maneuver commander-fire support coordinator (FSCOORD) relationship and [explained] how to integrate all fire support into combined arms operations," the Commandant of the Field Artillery School, Major General (later General) Donald R. Keith (1976-1977), explained in 1977.[11]

In mid-1977, just before the manual was officially published, General Keith wrote the Deputy Chief of Staff for Operations and Plans, Department of the Army, Lieutenant General (later General and Chief of Staff) Edward C. Meyer, about the manual's revolutionary consideration of fire support. General Keith pointed out:

> This approach to illustrating fire support, the FSCOORD's role, and his link with the maneuver commander's forces and fires, has proved to be a best seller in the December 76 coordinating draft. It has been recognized as a major step forward in the doctrinal literature effort to truly integrate fire support and the FSCOORD into combined arms training and operations.[12]

As General Keith astutely noted, improved combined arms operations was a key for success in Europe against a numerically superior opponent. The Army had to find a better way to fight in order to place combat power at the decisive time and place and to impose its will upon the enemy.

While the writing of doctrine moved forward, TRADOC became convinced that the existing Reorganization Objective Army Division (ROAD) that had been introduced early in the 1960s was obsolescent and could no longer harness the combat power of modern weapons even though it had been reorganized over the years. In view of this, TRADOC conducted the Division Restructuring Study for a new heavy division in 1976. Through the study the Army planned to design a division for the 1980s with the capability of optimizing the employment of weapon systems scheduled to enter the inventory in the near future.[13]

The study outlined a conceptual heavy division of three brigades, combat support units, and combat service support units. To meet the increased demands for counterbattery fire to neutralize or destroy enemy field artillery and other fire support systems that heavily outnumbered the Army's and NATO's, the study drew extensively upon the Legal Mix IV Study conducted by the Field Artillery School earlier in the 1970s. The Division Restructuring Study proposed forming a division artillery that would be made up of a target acquisition battery, three direct support battalions (ninety-six 155-mm. howitzers), eight-gun batteries, and one general support battalion of four batteries of four 8-inch howitzers each (sixteen). Such an organization would improve target acquisition for counterbattery fire by providing each division with a target acquisition battery, furnish more flexible fire support, enhance firepower by increasing the number of artillery pieces in the division from 66 to 112 howitzers, and upgrade survivability. Equally as important, the restructured division artillery was consistent with the new doctrine of exploiting firepower to win.[14]

Although the Division Restructuring Study's heavy division experienced mixed reviews throughout the Army, support from Chiefs of Staff kept work on the project alive. In July 1976 the Chief of Staff of the Army, General Fred C. Weyand (1974-1976), and the Army staff endorsed the study's heavy division in a briefing presented by TRADOC. Later in January 1977, Weyand's successor, General Bernard W. Rogers (1976-1979), approved using the 1st Cavalry Division at Fort Hood, Texas, to test the study's conceptual heavy division in 1977-1979.[15]

Besides outlining a drive for more firepower and a modernized division, the Division Restructuring Study reflected the significant recent changes in division and corps artillery missions, especially counterbattery doctrine. Many field artillerymen of the early 1970s argued that corps artillery seemed to fight its own battle at times, while division artillery fought its own. Both practices dated back to World War II. Corps artillery and division artillery did not seem to coordinate their efforts effectively and acted relatively independently of each other. For example, this occurred frequently in Vietnam where corps artillery simply "was not fully responsive to division needs" and diluted fire support. In the view of General Ott, placing all cannon fire under the division would help make better use of cannon assets and would coordinate the corps' and division's battles better.[16]

As field artillerymen noted, existing counterbattery doctrine had evolved from lessons learned in World War I, World War II, and the Korean War and was based on small frontages, the linear disposition of enemy units, and a relatively static battlefield. However, corps and division artillery organizations had not kept pace with the changes rendered by the technology introduced during the 1960s and early 1970s. The expected intensity of modern warfare, the highly mobile and powerful enemy armored forces, the distance of the corps artillery commander from the battle, extended communications requirements, and the high density of targets, especially field artillery, mortars, and rockets, stretched the field artillery's ability to furnish counterbattery fire. Equally important, frontages had grown significantly larger since World War II, while cannon ranges had not increased that much. This meant that cannon ranges could not cover the new corps frontages.[17]

Just as important, doctrine did not clearly designate any single agency with responsibility for counterbattery fire but based it on the premise that the most appropriate means available would be employed. Corps artillery and division artillery were considered the only echelons with the capability of providing effective counterbattery fire, with the corps having the overall responsibility for the supervision and coordination of the fire. However, the direct support battalion could also provide limited counterbattery fire if needed. This shared responsibility among three echelons of command often produced confusion because command and control was decentralized, and it simultaneously led some field artillerymen to insist that the corps artillery group had a vague role in combat.[18]

As compelling as the above reasons were for revamping counterbattery work, "the real selling point" for restructuring counterbattery and division and corps artillery missions hinged upon fighting outnumbered, according to General Ott. In a badly outnumbered situation, there would be times when counterbattery work had to be the top priority, and other times, such as a threatened rupture of the defense, when close support would have the highest priority. In either situation, General Ott recalled in 1993:

> We would need all the cannons involved in the highest priority battle. To achieve this we needed a single manager of all cannon fire and it needed to be someone close to the situation at hand. We [field artillerymen at the Field Artillery School] suggested the division commander as the individual best able to identify priorities and the division artillery commander as the person to execute his directive.[19]

As General Ott convincingly articulated, centralizing command and control even more would permit the field artillery to manage its resources more effectively and help overcome the numerical superiority of the threat.[20]

On the basis of the defined enemy, modern combat, the requirement to manage fire support better, and decentralized command and control of counterbattery fire, the Army had to reform corps artillery and division artillery. Addressing the conditions of combat at the time and the need for improved counterbattery fire, General Ott wrote in mid-1976 that the next war "will take all the combat power and skill we can muster. It will require the best use of available tanks, air defense weapons, artillery, TAC air [tactical air], communications, engineers and infantry to concentrate sufficient combat force ratios at the critical time and place." Division and brigade commanders would have to survive deadly enemy artillery barrages while destroying large numbers of tanks and mechanized vehicles at the same time. "Against this attacking enemy, the commander will count on his tanks [and] TOWs [tube-launched, optically-tracked, wire-guided heavy antitank missile systems] . . . to knock out the motorized forces," General Ott explained.[21] In the meantime, the Army would have to suppress enemy artillery fire and antitank guided missiles, harass attacking tanks with artillery fire, and attack antiaircraft defenses to permit the use of tactical air. In short, the field artillery would have to furnish close support to the maneuver arms and concurrently suppress the enemy's field artillery. The key, however, was combining the various fire support systems into an effective team.[22]

According to the Field Artillery School, suppressing enemy artillery, including air defense artillery, at the appropriate time and place "may be the determining factors of whether we win or lose that first battle."[23] Heavy enemy artillery fire would prevent friendly maneuver forces from moving, would simultaneously support advancing enemy units, and could render some of the friendly antitank weapons ineffective, and it had to be neutralized for the Army to win. If enemy field artillery was not suppressed, defeat would occur.

After months of studying the problems associated with counterbattery organization and doctrine, the Field Artillery School and TRADOC recommended in 1976 moving the overall supervision of counterbattery fire from corps artillery to division artillery. Essentially, this involved placing the corps general support field artillery group in a reinforcing role to give the division the first priority in the use of corps artillery fire and the authority to position corps artillery units where the division felt that they could best contribute to the battle. Doctrine also assigned the group the function of acting as an alternate division artillery headquarters or assuming a direct support role to make it responsive to the needs of the division and habitually associated the group and its assigned battalions with the division.[24]

Wanting the most efficient employment of field artillery, most division and corps commanders in U.S. Army Forces Command (FORSCOM) and U.S. Army, Europe (USAREUR) favored making counterbattery work a division responsibility. To designate the division's new arrangement the Field Artillery School renamed counterbattery fire "counterfire" and the corps field artillery group the brigade to bring the name in line with the designation of maneuver units. As outlined, counterfire involved suppressing or neutralizing all of the enemy's indirect fire systems. It optimized the employment of limited firepower assets to fight more effectively by centralizing command and control, and it was directly responsive to the maneuver commander's needs.[25] Approved by the Army Chief of Staff on 30 April 1976, counterfire doctrine not only moved the "counterbattery mission to division artillery" but also reorganized "target acquisition and corps arty [artillery] assets to optimize field artillery fires for counterfire, air defense suppression, and maneuver support missions."[26]

Although the new counterfire doctrine eliminated much of the ambiguity associated with fighting enemy indirect fire systems, it did not hurt the corps artillery commander's ability to influence the corps battle as many field artillerymen had feared. Organizationally, the brigade would consist of a headquarters, a headquarters and headquarters battery, and a variable number of attached battalions and could be tailored as required for flexibility. General Keith explained in June 1977, "It is not the intent of the new doctrine to have all of the FA [field artillery] assets at the corps parceled out in every situation. By task organizing to meet a given tactical situation, the corps commander can . . . retain under corps control those cannon units required to fulfill corps needs, be they brigades or battalions."[27] The new counterfire doctrine simply did not threaten the corps artillery commander's ability to carry out his mission and various responsibilities.

The increased emphasis on the enemy's indirect fire systems as well as the drive to improve the performance of fire support systems concurrently generated changes with forward observation. On 25 June 1975 General Ott wrote General DePuy a lengthy letter that outlined the necessity of reforming forward observation. Because of the growth in the size of the

battlefield, forward observer teams simply did not have the ability to provide observed fires throughout the supported unit's sector. Moreover, the Army required a more effective method of shifting and massing fires rapidly from mortars, field artillery, attack helicopters, and tactical aircraft. On the basis of these needs, General Ott strongly advocated reorganizing the forward observer team to take better advantage of the new technology that would be appearing and to improve fire support further.[28]

Agreeing with General Ott, General DePuy directed the Close Support Study Group (CSSG) that was formed on 29 July 1975 to examine ways of improving forward observation. After careful consideration of the various options, the study group recommended creating a fire support team (FIST) in its final report of 21 November 1975 that would transfer responsibility for fire support coordination at the company level from the maneuver company commander to the fire support chief. Called the FIST chief, the coordinator would handle all fire support tasks for the company and would command, train, and supervise all observers on the fire support team, including 81-mm. and 4.2-inch mortar observers. The study group also urged making the fire support chief as well as battalion and brigade fire support sections organic to the supported maneuver units. This would ensure that fire support experts would train with the maneuver unit, would provide experienced fire support personnel at all times throughout the chain of command, would increase the flexibility of the field artillery battalion, and would coordinate tactical air strikes, naval gun fire, field artillery, and mortars.[29]

Although the fire support team concept and the recommendation of assigning fire support sections to the maneuver elements were opposed by some senior field artillery officers because of training considerations, the former Director of the Gunnery Department in the Field Artillery School, Brigadier General Paul F. Pearson, explained the significance of the organization in mid-1976. It would permit the maximum indirect fire support because the chief would pick the best weapon for the job and make the combined arms team more potent than before. By giving the combat arms more effective coordinated support from the various fire support systems to help compensate for numerical inferiority, the fire support team, which was implemented late in the 1970s, helped revolutionize fire support in the Army and complemented moving counterfire from the corps to division.[30]

REARMING AND REEQUIPPING THE FIELD ARTILLERY

As most field artillerymen understood, fighting in Europe on the modern battlefield required more than rewriting doctrine and revamping organization. It also demanded acquiring new field artillery systems (command, control, and communications; target acquisition; weapons; and support) to provide faster response, more flexible employment, better accuracy, and more efficient use of resources. To make the FIST concept for the heavy division work effectively called for a track vehicle that would provide the necessary communications and laser designation capabilities to conduct all types of missions. As General Keith explained, the field artillery wanted a Bradley Fighting Vehicle-based system, but there was no chance of getting Bradleys until all of the infantry's and cavalry's needs had been satisfied. Unfortunately, that

meant waiting at least ten years. In view of this, General Keith decided in 1976 "to piggy-back on . . . M113-based Improved TOW Vehicle production" for the near-term with the intention of getting a Bradley-based FIST vehicle in the future.[31]

Meanwhile, the field artillery's interest in computerized gunnery heightened. The Tactical Fire Direction System (TACFIRE), adopted during the 1970s after years of development, promised to revolutionize fire direction even more than the Field Artillery Digital Automated Computer (FADAC) had done in the 1960s because it could be tied to other computers to give sophisticated command and control to enhance fire support.[32]

As essential as automated fire direction was, General Ott made obtaining new target acquisition systems the most important priority upon becoming commandant of the Field Artillery School in June 1973. In view of his experience in Vietnam, he thought that target acquisition was the weakest field artillery system. Given the threat, inadequate target acquisition was even more critical than in Vietnam. To help counter the Warsaw Pact's massive artillery barrages, the field artillery introduced the AN/TPQ-36 countermortar radar and the AN/TPQ-37 counterbattery radar late in the 1970s after years of work to replace the AN/TPS-4A radar. The Q-36 and Q-37 radars located weapons by tracking a projectile's trajectory with a radar beam and then providing the location automatically to TACFIRE by means of a data link to compute firing data. In fact, the Q-36 and TACFIRE combination was so effective that gun crews could shell an enemy mortar battery before its first rounds landed on friendly positions.[33]

Work on remotely piloted vehicles (RPV) progressed at the same time. Although the Army had experimented since the 1950s with various RPV programs for over-the-hill reconnaissance and target acquisition, the work never produced fully satisfactory or cost effective systems. In view of the negative experience with RPVs in the 1950s and early 1960s, the Army's interest in them was waning by 1966 just as the technology to produce a functional unmanned aircraft was beginning to appear. Although work on RPVs continued after 1966, it was fragmented and primarily oriented towards the development of technology rather than user requirements.[34]

However, dramatic events soon jolted the Army out of its complacency regarding RPVs. During the Vietnam War, the American experience with manned aircraft performing aerial reconnaissance over North Vietnam demonstrated the difficulties of penetrating sophisticated air defenses. Subsequently, the Arab-Israeli War of October 1973 reaffirmed the low survivability of manned reconnaissance aircraft in conflicts in which highly-developed air defenses existed. Along with these two wars, the Warsaw Pact's imposing air defenses with their ability to prevent manned reconnaissance flights beyond the line of contact during the initial stages of a war with NATO impressed the Army. This led the Army to abandon the notion that it did not require a RPV and to start orchestrating a coordinated RPV developmental effort early in the 1970s. The Army no longer had the luxury, as it had in the past, of relying on manned aircraft, loitering near or over enemy territory for reconnaissance and target acquisition roles. RPVs were vital because they were less expensive and vulnerable to hostile air defenses than manned aircraft, because human lives would be spared, and because the field artillery could acquire the locations of hostile indirect fire systems before they began shooting.[35]

In the meantime, the rise of precision munitions (often called precision-guided munitions) provided another reason for obtaining a RPV. In 1974 the Army Scientific Advisory Panel Ad Hoc Committee on RPVs indicated that real-time target acquisition for field artillery operations was imperative and that RPVs had a real potential for this as well as other essential uses. Reinforcing the panel's conclusion, the Field Artillery School enthusiastically defended the target acquisition and laser designation role of a RPV. Without a RPV to designate targets with a laser, the Cannon-Launched Guided Projectile, commonly known as Copperhead, an early precision munition that was under development, would be limited to attacking targets approximately one to five kilometers in front of friendly troops because of line-of-sight restrictions for laser-equipped ground observers. The real value of Copperhead was its ability to destroy tanks and self-propelled artillery before they started moving and reached the ranges of other antiarmor weapons. A RPV was critical for exploiting the capabilities of Copperhead. As a result, the Field Artillery School actively campaigned for a RPV because it would permit the field artillery to engage enemy armor with Copperhead projectiles before the attacking armor could arrive in the close combat area.[36]

Based upon the need for over-the-hill acquisition and target designation requirements and the high cost of employing manned aircraft against an enemy with strong air defenses, the Army initiated the Aquila System Technology Demonstrator Program in December 1974 and stopped work on other RPV systems. Equipped with television and laser systems to identify targets for precision munitions, the Aquila also could detect enemy movements and gun positions. Although tests in the mid-1970s dictated making technological refinements before deployment, further testing by 1978 had proven the Aquila's ability to provide reconnaissance, to acquire targets, and to designate targets for precision munitions at ranges and under conditions where ground observers or manned aircraft could not operate. On the basis of such favorable test results, the Army awarded a contract to the Lockheed Missile and Space Company in 1979 for full-scale development of the Aquila with a completion date of 1981.[37]

Notwithstanding the significance of TACFIRE, the AN/TPQ-36 and AN/TPQ-37 radars, and the Aquila, the Army also had to modernize munitions and weapons to stop a massed Soviet and Warsaw Pact armor attack. Two primary options existed. First, the Army could increase the number of weapons. Second, it could develop field artillery munitions that were more deadly than existing high-explosive fragmentation munitions that had not been improved in hitting power or accuracy much since 1945. These weaknesses were critical because armored vehicles had become more difficult to hit and destroy since World War II. The first alternative would be expensive, but it would not resolve the field artillery's inherent inaccuracy. Because of this, the field artillery would have to expend huge amounts of ordnance to destroy targets and would have problems even hitting a moving target.[38]

Specifically, the Fire Support Mission Area Analysis Study of 1974 outlined the field artillery's difficulties of hitting moving armor targets. In candid language it pointed out that an average of fifty conventional high-explosive 155-mm. howitzer rounds was required to hit a stalled tank at eight kilometers and that an even greater number of rounds would be needed to destroy a moving tank. "If the field artillery is to have an indirect fire anti-tank [sic] capability, it must have weapon systems that are relatively insensitive to error contributed by

target motion and to small target location errors," the study determined. After careful consideration the Army reasoned that qualitative improvements in munition accuracy had a higher priority than increasing the number of weapons and employing high rates of ammunition because it would permit exploiting resources more efficiently and destroying armored vehicles more effectively.[39]

Prompted by the success of precision munitions in the Vietnam War and Arab-Israeli War of 1973 and recommendations in the Fire Support Mission Area Analysis of 1974, the field artillery turned to such munitions to make qualitative enhancements in accuracy. Late in the Vietnam War, the United States had employed electro-optical guided and laser-guided "smart bombs" to give unprecedented accuracy and the capability of hitting a target, especially a high-value one, with the first round. The former guided themselves to their targets by the means of a small television camera in the nose that the operator (aerial or ground) locked onto the target before releasing the bomb. The latter utilized a laser sensor to guide the bomb to a target illuminated with low-powered laser energy from a laser-emitting device and an optical viewing system aimed by the operator. However, it was the Arab-Israeli War in which precision antitank munitions along with improved air defense weapons demonstrated their staggering lethality really for the first time.[40]

During the late 1970s, the Army's first precision munition programs for field artillery began producing results after years of research and development. First conceived in 1970, Copperhead, a fin-stabilized projectile fired from a 155-mm. howitzer and guided to the target by a laser designator from either an aerial or ground observer, began initial production in 1978. During the flight of the projectile, the forward observer would designate the target with a laser beam, and the Copperhead's electro-optical seekers would lock onto the target. However, guidance only occurred during the final portion of the trajectory. For most of its flight, Copperhead behaved like a conventional projectile by following a ballistic trajectory, but it had the potential of destroying an armored target with one or two rounds.[41]

Another precision munition being developed during the mid- to late-1970s, the Sense-and-Destroy Armor munition (SADARM), shot by the 8-inch howitzer, also promised to achieve first-round accuracy and to decrease the number of rounds required to neutralize an armored vehicle. Unlike Copperhead, SADARM would not need a laser designator to hit a target and was, therefore, called a fire-and-forget munition or smart munition. As envisioned, SADARM would contain three to four submunitions that would be dispensed above the armored targets. A specially designed parachute would then open to stabilize each submunition, control the rate of descent, and cause it to rotate. Each submunition would carry a millimeter-wave sensor and a slug of metal. Upon detecting a target, the sensor would transmit an electronic impulse to detonate the charge and send a slug hurling towards the target.[42]

Although SADARM and Copperhead were still in varying stages of development as the 1970s drew to a close, field artillery officers clearly understood their implications. Upon being fielded, the munitions would provide pinpoint accuracy for the first time in the history of the field artillery, the capability of stopping enemy armor without excessive ammunition expenditures at ranges beyond other antiarmor weapons, and unprecedented lethality with conventional warheads that infantry, armor, and aviation would have difficulty rivalling. Yet, precision

munitions would be expensive, would require careful husbanding, and would take many more years of development before they could be fielded.[43]

Modernizing field pieces, missiles, and rockets complemented work on precision munitions. Concerned with Soviet and Warsaw Pact field artillery with their greater ranges, field artillery officers pushed to replace the towed M114 155-mm. howitzer of World War II origins with the towed M198 155-mm. howitzer. Introduced in 1979 after eleven years of development, the M198 had a range of thirty kilometers with rocket-assisted projectiles, which was more than double that of the M114, and could be airlifted by a CH-47 Chinook helicopter or carried by an Air Force C-130. In the meantime, the Army increased the range of the self-propelled M109 155-mm. howitzer from 18.5 to 23.7 kilometers in 1979 and boosted the range of the self-propelled M110 8-inch howitzer from twenty kilometers to twenty-four kilometers with most munitions and twenty-nine kilometers with rocket-assisted projectiles by the 1980s.[44]

The appearance of new rockets and missiles accompanied the improved ranges with tube artillery. During the 1970s, the field artillery supplanted the Honest John rocket and Sergeant missile, both introduced in the 1950s, with the Lance missile that was more mobile than its predecessors and could carry a nuclear or high-explosive warhead, fielded the nuclear Pershing IA, and started work on the nuclear Pershing II in 1975 in response to the introduction of the Soviet SS-20 missile early in the 1970s.[45]

Perhaps, the most revolutionary aspect of modernizing weapons involved adopting a totally new multiple rocket launcher. Although the Army had employed multiple rocket launchers in World War II, they possessed relatively short ranges (five thousand yards) and were inaccurate. Based upon these deficiencies and the appearance of more glamorous nuclear and conventional ballistic rockets and guided missiles during the 1950s and 1960s, the Army did little to improve its multiple rocket launchers and did not see them as essential weapon systems. In view of this, World War II multiple rocket launchers were still in the inventory in the 1960s.[46]

Although a complacent attitude towards multiple rocket launchers existed, several factors late in the 1960s and early in the 1970s revitalized the Army's interest in them. Conducted in the 1960s and early 1970s, numerous studies raised the necessity of a multiple rocket launcher to offset the enemy's firepower superiority and outlined a requirement for an all-weather, conventional area fire support weapon system. Also, the Israeli Air Force lost thirty-five aircraft to aggressive Arab air defenses during the first afternoon of the Arab-Israeli War of October 1973, which was about one third of all of its aircraft losses during the war. To neutralize Arab air defenses the Israelis then employed multiple rocket launchers effectively and reduced their aircraft losses drastically during the remaining days of the war. Just as important, the Soviet Union and Warsaw Pact were introducing modern multiple rocket launchers with ranges between nine and thirty kilometers.[47]

As convincing as these reasons were, only after a vigorous debate within the Army over the merit of adopting a new multiple rocket launcher did the Field Artillery School initiate a requirement for one — the General Support Rocket System (GSRS) — in March 1974. As outlined by the school, the General Support Rocket System would neutralize and suppress the enemy's indirect fire support and air defense systems by delivering a tremendous volume of fire

at long ranges. Such employment would free direct and general support cannon artillery for close support missions. From General Keith's perspective, the system's chief value was counterfire to break enemy field artillery's ability to wreak havoc with friendly maneuver arms.[48]

Aware of the General Support Rocket System's potential, the Army took action to get its NATO allies involved with development. Before the Army System Acquisition Review Council of 1976 had even initiated engineering development of the system, General Keith and General DePuy visited Europe in 1976 to seek participation of the Federal Republic of Germany, the United Kingdom, and France in the program. After lengthy and involved negotiations the United States and the above countries reached an agreement. Besides each country contributing funds to the system's development, the rocket system would be produced in Europe and the United States. As a part of this cooperative effort, the Army renamed the General Support Rocket System the Multiple-Launch Rocket System (MLRS) in 1980, the name already established by its NATO allies.[49]

Even though new field artillery systems, such as the Multiple-Launch Rocket System, were acknowledged as key elements of modernization, they did not rank high on the Army's list of priorities. Influenced by constrained budgets, the Army decided at the end of the 1960s and the beginning of the 1970s that an advanced heavy attack helicopter, a new utility helicopter, a heavy infantry antitank weapon, a service-wide digital tactical communications system, improved conventional munitions, a new heavy tank, a new surface-to-air missile system, and an integrated command and control and intelligence-gathering system were the most vital acquisition programs for the years of 1975-1980. Of these "Big Eight" as the priorities were known, only improved conventional munitions represented the field artillery.[50]

Over the next several years, the Army fought to keep its developmental programs alive, but shrinking military budgets forced adaptation. By 1974 the "Big Eight" had been reduced to an advanced attack helicopter, a new main battlefield tank, a mechanized infantry combat vehicle, a modern utility and transport helicopter, and a versatile sophisticated air defense system. These systems were identified as the "Big Five." This would make sure that sufficient resources were allotted for development and procurement and that the systems would be available in adequate quantities at the earliest reasonable time at rational costs.[51]

Even though work on new field artillery systems continued, the Army did not see them as being as vital as the "Big Five." According to Lieutenant Colonel Jack Goldstein of the Office of the Assistant Vice Chief of Staff, the "Big Five" represented a composite capability that the smaller Army of the future had to have if it were to achieve a qualitative edge on the battlefield. An absence of any of these would lower the overall effectiveness of the Army to an unacceptable level, while a lack of new field artillery systems would not have the same impact.[52]

The new field artillery systems, nevertheless, promised to help the Army to fight more effectively even though they did not rate high on the priority list. Once the systems, doctrine, and force structures were integrated so that they functioned together effectively, the field artillery would be able to fight a high-intensity conflict better than it could have at the beginning of the decade and could continue playing a critical role in combined arms warfare.

CHAPTER II

FIGHTING AIRLAND BATTLE

During the late 1970s and the 1980s, modernizing the field artillery continued unabated. Recognizing the inadequacies of the active defense doctrine that was not suited for fighting Soviet and Warsaw Pact echeloned forces, the Army developed AirLand Battle doctrine and had to introduce field artillery systems designed specifically to support the new doctrine.

DEALING WITH ECHELONED FORCES

Drawing upon his experience as commander of V Corps in the Federal Republic of Germany in 1976-1977 as well as on General William E. DePuy's ideas, the Commanding General, U.S. Army Training and Doctrine Command (TRADOC), General Donn A. Starry, believed that actions taken so far to modernize the Army were insufficient even though he had played a key role in rewriting the recently published doctrine. From General Starry's vantage point, commanders had to do more than just defeat the Soviet's and Warsaw Pact's first echelon. To be successful against the threat's echeloned and numerically superior armored forces, commanders had to see deep to disrupt or delay the second and third echelons before they could join the first to help overpower the defense. For this to be accomplished, the Army had to exploit all available surveillance and target acquisition systems to locate and track the enemy's movements and detect its command, control, and communication centers. Simultaneously, the Army had to employ tactical air and long-range field artillery to attack the second and third echelons before they could reach the battlefield.[1]

By taking this approach General Starry acknowledged, as others at the time were also doing, that the active defense, outlined in Field Manual (FM) 100-5, *Operations*, 1976, did not adequately address a vital aspect of Soviet doctrine. The active defense helped to organize battalions, brigades, and even divisions for the initial battle because it was designed to stop a breakthrough attack, but it failed to deal with the second and third echelons that were a major concern for the corps.[2]

By advocating a concept of attacking in depth, General Starry shared a serious concern raised by others throughout the United States defense community. In the mid-1970s the Defense Science Board, the senior advisory body of prominent scientists, engineers, and managers in the Department of Defense that served under the Undersecretary of Defense for Research and

Engineering, argued that the North Atlantic Treaty Organization (NATO) had to have an effective long-range conventional weapon. It would prevent the Soviets and Warsaw Pact from employing their follow-on forces effectively and overwhelming the defense. Concurrently, the board advised the Secretary of Defense and United States military that it was technologically feasible to develop a conventional weapon with the range of more than one hundred kilometers and with the ability to attack the second and third echelons effectively to slow down and weaken them before they arrived within direct-fire range of the main line.[3]

In the meantime, the Army and Air Force initiated programs to engage the follow-on forces. While the Army was working on a Standoff Target Acquisition System to acquire distant moving targets for its field artillery to attack, the Air Force sought an airborne radar system to detect moving targets. As the Department of Defense's, the Army's, and Air Force's programs suggested, a flurry of action was underway during the latter years of the 1970s to counter the threat's echeloned forces. This effort focused not only on preventing from being overpowered by a numerically superior enemy but also on avoiding nuclear holocaust. If NATO could disrupt the second and third echelons and reduce their impact on the main battle, the necessity of employing nuclear weapons could be reduced or even avoided.[4]

For the Army's field artillery, fighting the first, second, and third echelons concurrently that eventually evolved into the close battle (often called central battle) and deep battle of AirLand Battle, outlined in Field Manual 100-5, *Operations* (1982), had grave implications. The field artillery had to provide fire support for units already fighting the close battle and simultaneously conduct the deep battle by attacking the follow-on forces. Addressing the importance of the latter mission, the U.S. Army Field Artillery School reaffirmed in 1979 what many Army officers had already been saying for several years. It wrote that advancing follow-on echelons would overwhelm the defense at some point with sheer numbers, even though the first echelon had been defeated, by closing before the defense could recover from its initial engagements. Because of the potential adverse impact of the follow-on forces, disregarding them would be foolish.[5]

Encouraged by the Defense Science board, the Department of the Army, and General Starry, TRADOC started working to develop doctrine for reducing the blow of the follow-on forces, as private industry labored to produce the requisite technology. In its Fire Support Mission Area Analysis of January 1981, the Field Artillery School explained the importance of interdicting the second and third echelons. Historically, interdiction meant interrupting the flow of enemy combat power from the rear to the front lines by hitting lines of communication, logistics, and replacements. For the most part, this kind of interdiction had a relatively low payoff because of the difficulty of finding deep targets and the inability to attack them in a timely manner. Notwithstanding the existing limitations on interdiction because of the state of the technology, the Field Artillery School insisted that interdiction was the only way to defeat Soviet and Warsaw Pact armored forces.[6]

From the Field Artillery School's perspective, American and NATO forces had to shape the close battle by interdicting the follow-on echelons with corps support weapon systems. In "Battlefield Interdiction: Old Term, New Problem," *Field Artillery Journal*, January-February 1980, the Assistant Commandant of the Field Artillery School, Brigadier General Edward A.

Dinges, and Major Richard A. Sinnreich of the Planning Coordination Office/Modern Battlefield Techniques Committee in the school outlined the essence of interdiction or force generation as envisioned in the Fire Support Mission Area Analysis of January 1981. "In short, we [the Army] must 'shape' the central battle," they wrote.[7] "By canalizing enemy forces as they move into the division's area of influence, by opening or widening the gaps between successive attacking formations, and by fixing or delaying the reaction of enemy reserves, interdiction can help turn the attacker's momentum into a vulnerability."[8] To dispel any notion that the close battle and deep battle were not complementary, General Dinges and Major Sinnreich emphasized, "We must stop thinking about the central battle and force generation [deep battle or interdiction] as if they were independent problems. There is only one battle, and everything done to injure the enemy before he joins the fight will influence . . . the way that battle is conducted."[9] The Army had to develop an executable doctrine and the technology for fighting echeloned forces so that NATO could fight on its own terms and win.

The Commandant of the U.S. Army Field Artillery School, Major General (later General) Jack N. Merritt (1977-1980), also elucidated upon the importance of interdiction. Force generation, he explained, "will concentrate on acquiring and attacking the second echelon formations before they get into the main battle and become a force the division must worry about."[10]

As the field artillery existed in 1979-1980, it required extensive reforms before it could fight the deep battle effectively, and high-ranking field artillery officers knew this. The field artillery needed longer range weapons; better target acquisition systems; precision munitions; better command, control, and communications systems; and better organization to implement emerging AirLand Battle doctrine. In effect, programs started earlier in the 1970s to modernize the field artillery were moving the right direction, but they were not going far enough because they did not provide an effective way to manage the second and third echelons.[11]

Engaging the enemy's echeloned formations successfully underscored the necessity of Army-wide force structure and material modernization efforts. Believing that the Division Restructuring Study had been done too hastily, knowing that the evaluation of the Division Restructuring Study division at Fort Hood by the 1st Cavalry Division in 1977-1978 had raised serious concerns about its suitability for modern combat, and agreeing with others within the Army that the Reorganization Objective Army Division (ROAD) had to be abandoned, General Starry initiated a new study of a heavy division. In the Division 86 Study Directive of October 1978, which formed a portion of the Army 86 effort for modernizing force structure, he tasked TRADOC combat developers to design a heavy division with the capability of fighting the close battle and the deep battle. To defeat Soviet and Warsaw Pact armies, the Division 86 Study sought to create a heavy division that integrated new and advanced materiel systems, operational concepts, and human resources. Its solutions had to extend beyond increasing firepower and be more innovative.[12]

After digesting the findings of the Division Restructuring Study of 1976-1978 and considering several different heavy division designs, TRADOC finally settled on one. Approved by the Army Chief of Staff General Edward C. Meyer in August 1980, the new heavy division would be manned by approximately twenty thousand personnel and have six tank and

four mechanized battalions in its armored version or five tank and five mechanized battalions in its mechanized infantry version along with combat support and combat service support units. The division's field artillery would be made up of three direct support battalions of self-propelled M109 155-mm. howitzers (seventy-two howitzers divided into nine batteries) and one general support battalion of self-propelled M110 8-inch howitzers (sixteen howitzers divided into two batteries) and one battery of nine General Support Rocket System (GSRS) launchers. Along with the projected new munitions and target acquisition systems, Division 86 dramatically improved the field artillery's ability to furnish responsive fire support to the maneuver forces. It increased the number and lethality of field artillery pieces (sixty-six to eighty-eight howitzers) in the tables of organization and equipment as compared to ROAD but had fewer artillery pieces than the Division Restructuring Study division. Along with improved fire support, Division 86 promised to provide enhanced command and control and better combined arms operations than ROAD.[13]

With the realization that personnel resources upon which Division 86 had been based would not exist in the 1980s and 1990s as initially forecast, the Army reexamined its heavy division as a part of the Army of Excellence effort. During the midst of making the transition to Division 86 organizations, the Army tasked TRADOC in 1983 to streamline Division 86 to form Army of Excellence divisions by reducing the number of personnel spaces. Even though the Army of Excellence reforms provided 2,300 fewer personnel for the heavy division, they still gave the armored division ten maneuver battalions (six tank and four mechanized infantry battalions) and the mechanized infantry division ten maneuver battalions (five tank battalions and five mechanized infantry battalions).[14]

For the field artillery, the Army of Excellence reforms supplied the division with three battalions of M109 howitzers (seventy-two howitzers divided into nine batteries) and one general support battery of nine Multiple-Launch Rocket System (MLRS) launchers, formerly called the General Support Rocket System. Because the M110 8-inch howitzer had a low-rate of fire and low survivability, TRADOC moved it from the division to the corps and replaced it with the MLRS that provided greater firepower and survivability. At the corps the M110 8-inch howitzer could still furnish nuclear missions as required. Army of Excellence reforms simultaneously signalled that future field artillery systems had to be operated by fewer personnel than their predecessors because the lean force structure would not support personnel intensive systems. As with the Division Restructuring Study and Division 86, the Army of Excellence effort also built an organization around a weapon system rather than integrating a new weapon into an existing organization as had been the practice for over two hundred years. This would make the organization and weapon system more compatible than ever before and would utilize the capabilities of the new weapons better.[15]

The Army of Excellence field artillery organization for the heavy division reflected earlier recommendations to improve firepower, survivability, and the man-to-equipment ratio. Supported by the Legal Mix V Study of 1978, conducted by the Field Artillery School, the field artillery abandoned the six-gun battery in 155-mm. howitzer battalions and the four-gun battery in 8-inch howitzer battalions in favor of an eight-gun battery for both weapons. This reorganization gave a direct support battalion three, eight-gun batteries (known as the 3X8 battalion

force structure) rather than three, six-gun batteries (known as the 3X6 battalion force structure) and expanded the number of tubes in a battalion from eighteen to twenty-four for a thirty-three percent increase in firepower. Eight-gun batteries also allowed creating two, four-gun platoons in each battery that could operate semi-independently to enhance survivability. In June 1986 the first field artillery units began converting to the 3X8 force structure with the last scheduled for early 1993.[16]

As TRADOC was developing new doctrine and the various heavy division designs, the Field Artillery School closely examined the field artillery's ability to provide fire support. In a critical article in the *Field Artillery Journal* early in 1980, the school explained that existing field artillery systems were nothing more than evolutionary products of World War II technology and could be improved only so much. Providing fire support as envisioned by AirLand Battle involved more than modifying existing weapons to give them longer ranges and more mobility. The field artillery required totally new weapon systems as well as new command, control, and communication systems; munitions; target acquisition systems; and support systems. If materiel solutions did not accompany organizational and doctrinal reforms, the field artillery would be unable to support AirLand Battle effectively.[17]

Strategically, the rationale for modernization — fighting Soviet and Warsaw Pact armed forces — had not changed since the early 1970s, but with AirLand Battle the pattern of modernization had. AirLand Battle outlined a concept of how the Army would fight and served as the basis for systems acquisition. Fighting AirLand Battle effectively required field artillery systems with greater capabilities than existing modernization programs would produce and with specific characteristics. In comparison, the active defense did not drive system acquisition in the field artillery. It acknowledged the existence of new technology that was in varying degrees of development and the need to integrate it with doctrine, tactics, and organization, but it did not form the basis for obtaining new materiel.[18]

With the Vietnam War experience fresh in the minds of many field artillerymen, the Field Artillery School pointed out in its Fire Support Mission Area Analysis of January 1981 the concurrent requirement to reorient thinking to support AirLand Battle. Overwhelming fire support, the virtual absence of a counterfire threat, and the extreme sensitivity to friendly casualties had turned the traditional relationship of maneuver and fire support (naval gunfire, tactical air, mortars, and field artillery) on its head in the Vietnam War. Classic descriptions of firepower opening the way for maneuver had given way during the war to locating the enemy with the maneuver arms, especially the infantry, and then destroying it with indirect fire or close air support. In many cases, indirect fire in Vietnam had replaced maneuver rather than supported it. After being preoccupied with supporting a predominantly infantry force, the field artillery faced the task of supporting heavily armored forces in Europe against a well-trained and well-equipped opponent. Because of the threat's air forces, the field artillery also had to "move, shoot, communicate and survive in a hostile and increasingly lethal air environment."[19]

As the Fire Support Mission Area Analysis also pointed out, restoring the field artillery to its role as a supporter of the maneuver arms would be difficult. The appearance of more lethal weapons, digital communications, self-locating, self-loading, and self-aiming systems, improved ground and air mobility, the proliferation of electronic sensors, multiple-source target

acquisition systems, automated data processing, and precision munitions during the 1970s had led many Army officers to wonder whether the preeminence of firepower over maneuver was a pattern of future warfare. Despite this reasoning by some Army and field artillery officers, the Field Artillery School still saw field artillery in its traditional role of supporting the maneuver arms. Maneuver was still a critical aspect of doctrine.[20]

With this in mind and the need to overcome the Warsaw Pact's numerical advantage, the Field Artillery School had to improve counterfire so that the maneuver arms could advance. To deal with the huge numbers of enemy armored vehicles and aircraft, the Army was developing antitank and antiaircraft precision missiles. However, managing the enemy's indirect fire systems with their large number of multiple rocket launchers and cannon systems and tactics of massing huge quantities of firepower remained a significant obstacle to surmount. Aware that improving the rates of fire of tube artillery would be impractical and that personnel figures would decline in the future, the Army had to have weapons with high rates of fire for counterfire, but they could not be personnel intensive systems. Billed as the Army's "most spectacular new weapon system," the Multiple-Launch Rocket System, which had been under development since the mid-1970s, therefore, occupied the "heart of our [the field artillery's] effort to redress the counterfire problem" and was a top developmental priority for the field artillery and the Army as the 1980s opened.[21]

As the tests during the latter years of the 1970s had indicated, the Multiple-Launch Rocket System fulfilled its promise of being a survivable, highly mobile, rapid-fire, surface-to-surface indirect fire system. With a launcher of twelve rockets, the weapon system had the ability of firing all of its rockets within sixty seconds at a range of thirty kilometers. It could also saturate an area of six hundred square meters with approximately eight thousand submunitions and complemented tube artillery by destroying, neutralizing, or suppressing high-payoff, soft enemy targets, such as field artillery, air defense artillery, personnel, and materiel. Compared with a 155-mm. howitzer, one MLRS launcher, firing twelve rockets, was the equivalent of 3.6 howitzer battalion volleys. One battery of nine launchers, firing 108 rockets, was comparable to thirty-three battalion volleys by tube artillery. The rocket system gave the field artillery an unprecedented ability to mass huge amounts of fire on a target rapidly and accurately with fewer people than any field artillery weapon system in the Army's inventory. Equally important, the MLRS was designed for hitting area targets and rapid emplacement, engagement, and displacement (shoot-and-scoot tactics) to protect it from hostile field artillery fire and had some second echelon strike capability.[22]

After successful developmental testing the field artillery adopted the Multiple-Launch Rocket System. In August 1982 the Field Artillery School received the first production models for training. Seven months later in March 1983, the Army formed its first operational unit, a battery of nine launchers. Following the deployment of a MLRS unit to the Federal Republic of Germany in September 1983, the Army fielded approximately three batteries a year between 1983 and 1987 to give it twenty-five batteries.[23]

Because the Multiple-Launch Rocket System only partially fulfilled the counterfire and deep battle requirements, the Army, meanwhile, conducted the Enhanced Self-Propelled Artillery Weapon System (ESPAWS) Study of 1979. The study determined that tube artillery

systems had to be capable of continuous operations and possess high rates of fire to support emerging AirLand Battle doctrine. Although the self-propelled M109A2/A3 155-mm. howitzer would have better range and increased ammunition carrying capabilities than earlier M109 models when modifications were completed in 1984, the Army still required an entirely new system of howitzers, ammunition vehicles, and command and control vehicles. They had to generate greater firepower at reduced personnel costs and have greater speed to keep up with the new armored vehicles (the Abrams tank and the Bradley infantry fighting vehicle) scheduled for fielding early in the 1980s.[24]

Although costs led the Army to abandon fielding a new self-propelled 155-mm. howitzer, the ESPAWS Study's disturbing conclusions, nevertheless, generated action to modernize the M109 howitzer once again so that it could support AirLand Battle and be in service through the 1990s. A U.S. Army Materiel Command and TRADOC initiative, known as the Howitzer Extended Life Program (HELP), began in 1980 and focused on improving reliability and adding nuclear, biological, and chemical protection as mandated by Congress.[25]

In its efforts to find the appropriate howitzer for the division, in the meantime, the Army chartered the Division Support Weapon System (DSWS) Special Study Group in 1980 to pick up where the Enhanced Self-propelled Artillery Weapon System Study had left off. Upon concluding its work, the study group issued the Division Support Weapon System Study in July 1983. It questioned the Howitzer Extended Life Program howitzer's maintainability and air transportability, among other issues. Maintenance functions were still personnel intensive and physically stressful. Moreover, the howitzer would require an Air Force C-5A for air transportation and would have to compete with other high-value assets for space on the aircraft.[26]

Like the Mission Element Needs Statement of 1980 and Fire Support Mission Area Analysis of 1981, the Division Support Weapon System Study also found the Howitzer Enhanced Life Program howitzer's mobility to be unsatisfactory. During the 1960s and 1970s when doctrine did not require field artillery to match the speed of maneuver vehicles, the M109 had sufficient mobility. AirLand Battle coupled with the Abrams tank and the Bradley infantry fighting vehicle, however, necessitated introducing more mobile field artillery to furnish reliable close support. Without improved mobility the howitzer could not keep up with the maneuver forces. In strong language the study emphasized, "No improvement to tactical mobility will result from HELP."[27] In view of this, the Army had to obtain a new, more mobile self-propelled 155-mm. howitzer.

The Division Support Weapon System Study outlined three options for acquiring such a howitzer. The Army could obtain improved versions of the Howitzer Extended Life Program howitzer, develop a new self-propelled 155-mm. howitzer, or adopt the self-propelled SP70 155-mm. howitzer being developed jointly by the United Kingdom, Italy, and the Federal Republic of Germany. Even though none of the howitzers represented a quantum improvement in capability, each choice offered sufficient promise to warrant development. Of the three alternatives, purchasing a foreign howitzer and developing a new system were too costly. On the basis of these findings, the Division Support Weapon System Study proposed a less expensive two-part solution. The Army could continue improving the M109 to obtain an adequate

fire support system for the 1990s. Simultaneously, work should begin on a new self-propelled howitzer with leap-ahead technology to replace the product-improved M109 in the 1990s.[28]

In the meantime, the Army reached a similar conclusion. After conducting a cost and operational effectiveness analysis in April 1983, the Army found product improvements to the M109A2/A3 to be the least expensive option, while purchasing the SP70 was the most exorbitant.[29]

Based on the Army's conclusion and the Division Support Weapon System Study's two-part recommendation and directed by the Army Vice Chief of Staff, TRADOC initiated action in 1984 to develop the Howitzer Improvement Program (HIP) howitzer, the fourth in a series of product improvements to the M109 and a follow-on to the HELP howitzer. The program outlined upgrading the M109 by including Howitzer Extended Life Program enhancements and addressing deficiencies pointed out by the Mission Element Need Statement and Division Support Weapon System Study to produce a howitzer with the capabilities of furnishing close, continuous fire support at the turn of the century. Comprising the latest technology, the Howitzer Improvement Program howitzer would reduce crew size, have the ability to stay abreast of the maneuver arms, make small moves, quickly emplace, fire a number of missions, and then displace rapidly to improve survivability. Aware that the Howitzer Extended Life Program and the Howitzer Improvement Program were concurrent M109 projects, the Army Vice Chief of Staff, General Maxwell R. Thurman, combined the two early in 1985 so that only one howitzer — the HIP howitzer — would be produced. In doing so, he acted harmoniously with the Army decision memorandum of November 1984 that directed the aggressive procurement of the HIP howitzer. As a result, acquiring the Howitzer Improvement Program howitzer became a high acquisition priority within the field artillery.[30]

As tests in 1989 with four prototype Howitzer Improvement Program howitzers revealed, the howitzer, which was typed classified the M109A6 Paladin in February 1990, had the capabilities of operating within a broad spectrum that ranged from semi-autonomous use of a single howitzer to a group of howitzers. Normally, a howitzer would be deployed in a platoon of four guns and operate three to fifteen kilometers behind the forward line of troops within a position that was two square kilometers. Within the platoon the howitzers could be employed in pairs. If conditions warranted, the howitzer could operate individually within a one square kilometer position. The ability to disperse over a wide area and operate semi-autonomously, freedom from wire communications and some of the survey requirements, and increased range made the howitzer a significant improvement over the M109A2/A3. Furthermore, the HIP howitzer had greatly enhanced survivability because it could employ "shoot-and-scoot" tactics, a capability already in the Multiple-Launch Rocket System.[31]

While work on the Howitzer Improvement Program howitzer, moved forward, the Army, TRADOC, and the Field Artillery School pressed to introduce a totally new self-propelled 155-mm. howitzer. After exploring various options, combat developers in the school explained in 1984 that the Advanced Field Artillery System (AFAS) would replace the Howitzer Improvement Program howitzer sometime in the 1990s. This would satisfy the Army Vice Chief of Staff's direction of 1984 and Division Support Weapon System Study's recommendation for developing a next-generation, self-propelled howitzer. The decision of 1984 to acquire a new

self-propelled 155-mm. howitzer instantly made the Howitzer Improvement Program howitzer an interim system because its replacement was already being conceived.[32]

With the need to reduce procurement and sustainment costs and crew size because of a declining personnel pool and to overcome Soviet modernization activities, the Army examined the possibility of incorporating the Advanced Field Artillery System and other proposed field artillery systems (Elevated Target Acquisition System, Fire Support and Combat Observation Lasing System, and Rocket and Missile System) into a family of armored vehicles. In 1984 the TRADOC Special Study Group Armor arrived at the conclusion that a family of armored vehicles based upon commonality was feasible and highly desirable to cut costs. The following year, the Armored Combat Vehicle Science and Technology Working Group at Army level validated the findings of the TRADOC effort. The Defense Science Board 1985 Armor/Anti-Armor Summer Study Report subsequently supported producing a family of armored vehicles to fight on the turn-of-the-century battlefield. In light of these recommendations, the Army formed the Armored Family of Vehicles Task Force in 1986 under Major General Robert J. Sunell to develop an armored family of vehicles based on commonality that would provide sufficient combat effectiveness to defeat the projected threat, with the first vehicles projected for fielding in the mid-1990s.[33]

With the evolution of the Armored Family of Vehicles program after 1986, the field artillery's part of the project changed. Budget restrictions forced the Army to cancel work on the Elevated Target Acquisition System in 1988 and to move the Fire Support and Combat Observation Lasing System and the Rocket and Missile System into Package II of the Armored Family of Vehicles to keep work on these two vehicles in the technological base. In 1989 the Army transferred management of the Armored Family of Vehicles program to the U.S. Army Combined Arms Combat Developments Activity at Fort Leavenworth, Kansas. As a part of this change, the program was renamed the Heavy Force Modernization Program with six systems (the Tank, Combat Mobility Vehicle, the Future Infantry Fighting Vehicle, the Line-of-Sight Antitank Vehicle, the Armored Rearm Vehicle, and the Advanced Field Artillery System-Cannon with its resupply vehicle, the Future Armored Resupply Vehicle-Ammunition) being placed in the first package of variants for production.[34]

In 1988-1989 the Field Artillery School reemphasized the requirement for the Advanced Field Artillery System-Cannon. Although the Howitzer Improvement Program howitzer would make significant enhancements over the M109A2/A3, the Advanced Field Artillery System-Cannon with its resupply vehicle would incorporate leap-ahead technology to address deficiencies in lethality, availability, survivability, mobility, agility, and tactical and strategic deployability. In addition, the howitzer would be served by four to six personnel, would have automated loading to increase the rate of fire and reduce crew tasks, and would have automated resupply to reduce personnel requirements, while the cannon would have a range of forty kilometers with the new propellants under development.[35]

As combat developers in the Field Artillery School explained, the Advanced Field Artillery System-Cannon and its resupply vehicle would alter organization and tactics. Because of sophisticated technology, the cannon system would be able to defeat moving and stationary enemy field artillery and armor of the leading and follow-on echelons and a variety of high-

value targets, such as air defense systems and engineer vehicles, and would be able to fight the counterfire battle, the close battle, and the deep battle. Equally important, the weapon system could operate as an individual firing unit, a platoon, or a battery because dispersion was critical for protection from enemy counterfire and would help offset the threat's numerical advantage in fire support systems.[36]

Although the Multiple-Launch Rocket System and new howitzers assured greatly improved fire support, they lacked the ability to offset the threat's firepower superiority alone because of numbers and not capabilities. Although Copperhead was effective and gave the field artillery the potential of hitting a moving armored target, it only partially fulfilled the need for precision munitions. It required a line-of-sight for the laser designator to identify the target. As a result, the number of laser designators available and their ability to get within the line-of-sight of a target determined the munition's utility.[37]

This deficiency reinforced the need for the Sense-and-Destroy Armor Munition (SADARM) that was already under development. Rather than pursuing an antitank role for SADARM, the Army announced its intention in 1985 to employ the munition primarily in a counterfire role and secondarily against other armored targets for close support, interdiction, and suppression of enemy air defenses. Studies in 1987 reaffirmed the requirement for SADARM for counterfire. The rapid growth in the quality and quantity of Soviet and Warsaw Pact self-propelled artillery systems that were rapidly replacing towed artillery made their field artillery less vulnerable to counterfire with conventional munitions.[38]

Yet, a dispute arose over the proper weapon to fire the munition. In April 1987 a cost and operational effectiveness analysis indicated that the munition was a force multiplier and that the combination of the 155-mm. howitzer SADARM and Multiple-Launch Rocket System SADARM would furnish the most cost-effective mix. However, an 8-inch SADARM that the Secretary of Defense and Congress had directed the Army to develop would not improve counterfire. The 8-inch howitzer had a slow rate of fire, took excessive time to emplace, and had poor survivability when tasked to perform counterfire missions. If the Army exposed the 8-inch howitzer to large amounts of counterfire, its ability to survive to perform its nuclear mission would be questionable.[39]

Based upon this line of thought, the Army and Field Artillery School encouraged stopping work on 8-inch SADARM. At an Army Systems Acquisition Review Council in November 1987, they explained their intention of ceasing procurement of the munition even though this position was contrary to guidance from the Secretary of Defense and Congress. Given the logic of the argument against an 8-inch SADARM, the council approved limiting SADARM to the 155-mm. howitzer and Multiple-Launch Rocket System.[40] Coupled with Copperhead, SADARM, upon being fielded in the 1990s, would furnish the field artillery with unparalleled lethality and accuracy and the capability of first-round hits. However, both munitions' employment would be expensive and restrict their use to high-value targets.[41]

In the meantime, efforts to engage hard-moving targets of the second and third echelons with field artillery to end the Army's dependence upon tactical air to deliver munitions at targets up to one hundred kilometers had begun. In 1977 the Defense Advanced Research

Projects Agency requested private industry to outline a concept of a deep interdiction weapon system that would compensate for NATO's numerical inferiority. This led the following year to the initiation of the Department of Defense's Assault Breaker program to design surface-to-surface and air-to-surface missiles with the ability of carrying terminal-guided (precision) submunitions or smart bomblets for employment against follow-on forces. Upon reaching the target, the missile would release the submunitions to find the target and then destroy or neutralize it. As envisioned by the Defense Advanced Research Projects Agency, such a missile system would help disrupt the flow of the follow-on forces and delay their arrival at the main battle.[42]

Assault Breaker development lasted about four years. During that time the contractor actually fired ten Assault Breaker missiles. The final firing included five terminal-guided submunitions. In that final shoot of December 1982, the target consisted of a company of main battle tanks that were positioned nearly one hundred kilometers from the launch point. The system performed well with each submunition hitting a different tank to prove that a weapon could be built with the capabilities of engaging armor formations at long ranges with submunitions.[43]

Despite its success, the Assault Breaker program lapsed at the end of 1982 because of costs, and other programs emerged to replace it. In light of the findings of the Fire Support Mission Area Analysis and Corps Support Weapon System Study, the Army created the Corps Support Weapon System program. As intended, the program would field a missile with nuclear, biological, and chemical capabilities as well as Assault Breaker characteristics to replace the aging Lance missile that was fielded in the 1960s.[44]

With the goal of eliminating a duplication of effort and saving money, the Department of Defense soon merged the Army's Corps Support Weapon System Program with the Air Force's Conventional Standoff Weapon System Program in 1982. However, the Army and Air Force could not reconcile their divergent requirements. The Army wanted a missile with sufficient propulsion for ground launch, while the Air Force desired an air-launched missile. After investigating various candidates, the two services finally agreed in May 1984 to pursue separate but complementary Joint Tactical Missile System programs. The Army would develop a short-range, ground-launched missile armed with terminal-guided submunitions. It would strike at enemy forces that were not yet engaged and destroy enemy capabilities that would have an immediate impact on the close battle. The Air Force, in comparison, would build a long-range, air-launched missile that would carry terminal-guided submunitions.[45]

Following this decision, the Army initiated action to introduce its Joint Tactical Missile System, renamed the Army Tactical Missile System (ATACMS or Army TACMS) in 1985, to replace the Lance missile. The Army Tactical Missile System would be shot from a MLRS launcher and would have a bigger payload, a better guidance system, and a longer range than the Lance missile to permit hitting second and third echelon forces. Equally as important, the Army Tactical Missile System would dispense terminal-guided submunitions over the target area to attack the enemy armor. As announced in 1987, the Block I Army Tactical Missile System for engaging soft targets (command posts, air defense artillery, surface-to-surface missile sites, and helicopter forward area rearming and refueling points) would be introduced early

in the 1990s. Later in the decade, a Block II missile with precision munitions for defeating hard-moving targets (armored combat vehicles) would be fielded. Together, both blocks would permit the field artillery to attack high-payoff targets, disrupt the tempo and efficiency of the enemy's operations, and play a key role in AirLand Battle by allowing the Army to fight the deep battle effectively.[46]

After several years of engineering and development, the Army tested the Army Tactical Missile System at White Sands Missile Range in New Mexico in 1989. Tests demonstrated that the Block I missile was ready for operational testing early in 1990 with the Block II missile being developed at a later date.[47]

Even though the Army hoped to employ the Army Tactical Missile System in conventional and nuclear roles, congressional legislation late in 1983 restricted it to carrying conventional munitions. In view of the fact that the decision left the field artillery without a modern, tactical nuclear missile, the Army devised the Service Life Extension Program for the Lance to lengthen the missile's life through the mid-1990s for nuclear missions. Although prolonging the life of the missile was technologically possible, the costs of maintaining it would be prohibitive, while obtaining spare parts would also become more difficult with the passage of time.[48]

These problems led Army Vice Chief of Staff, General Thurman, to decide in 1986 to replace the Lance with a weapon with better accuracy and greater range to deliver a nuclear warhead. In the search for the missile, the Army explored the possibility of adapting a foreign missile, modifying an existing missile, or developing a new missile. Based upon an analysis of three options, the Army rejected a foreign missile because existing ones did not satisfy the Army's requirement for an accurate, deep attack nuclear missile. It also meant changing force structure and increasing the potential of inadvertently disclosing nuclear weapon design, employment, and control data.[49]

Employing an existing Army missile posed equally challenging questions. Insufficient accuracy and range and the absence of nuclear certification and ballistic protection eliminated the Army Tactical Missile System. The Army rejected the Lance with Service Life Extension Program because it lacked survivability, had a limited range, was antiquated 1960s technology, required too many personnel to operate, and was expensive to maintain. Concurrently, the Army opposed employing the Patriot surface-to-air missile in a surface-to-surface role. Utilizing it involved expensive software modifications. Also, its lengthy reloading time, time at the firing point, and limited range failed to satisfy the Army's requirements.[50]

Aware of the inability of foreign technology and existing American missiles to meet its requirements, the Army opted to develop a new missile with nuclear capabilities. The Army had no other choice because it required an organic means of influencing the battle beyond the range of direct fire and direct support artillery. Even though close air support provided this capability, the limited numbers of aircraft, response times, and time-on-station were insufficient to ensure the timely engagement of all targets that might be found. In addition, the density of air defense weapons in Central Europe restricted the use of air power against targets beyond the line of contact. Also, the Intermediate-range Nuclear Forces (INF) Treaty of 1987 demanded the withdrawal of the controversial Pershing II nuclear missile that had upset the

nuclear balance in Europe upon being introduced in 1983 to counter the Soviet SS-20 missile and of the Ground-Launched Cruise Missile from Europe. The treaty also meant that a modern, extended-range, nuclear-capable missile was essential. As a result, the Army decided to utilize a MLRS launcher with a new nuclear missile to replace the Lance missile. The Office of the Secretary of Defense subsequently concurred with the Army's findings and in December 1988 approved developing the Follow-on To Lance missile with fielding in the 1990s.[51]

Backed by the Army Vice Chief of Staff's guidance, the Field Artillery School began writing plans for the Follow-on To Lance missile late in the 1980s. The missile would be a corps weapon, provide long-range nuclear fires, and furnish the corps commander with a nuclear capability to hit high-priority targets. Primary targets would be maneuver battalions, field artillery units, and support units in static positions, while secondary targets would include airfields, rail yards, and storage sites. Despite the missile's potential, it never got out of the conceptual stage of development because of tactical nuclear disarmament developments in Europe. In response to this, President George Bush terminated work on the system in May 1990.[52]

Over the years, the concept of "system of systems" in which each field artillery system would fit harmoniously together into one coherent fire support system confirmed that the new weapons alone lacked the ability to fight the deep battle and provide counterfire without other commensurate total system development. For effective fire support the field artillery required better target acquisition and command, control, and communication capabilities. Even though the Firefinder AN/TPQ-36 and Firefinder AN/TPQ-37 radars were adopted in 1979 and were more responsive and accurate than their predecessor (AN/TPS-4A), both were too heavy, slow, and large for rapid movement on the mobile battlefield envisioned by AirLand Battle.[53]

This situation caused the Army Vice Chief of Staff to direct TRADOC and the Field Artillery School in 1984 to improve the Firefinder Q-36 to replace the Q-36 and Q-37 radars in the 1990s. Through product improvements the Army outlined a plan to develop an enhanced Firefinder radar with better target detection, mobility, and survivability and faster emplacement and displacement than its predecessors. Besides being able to locate enemy fires up to thirty-six kilometers in range, the radar would be able to pass target and command control data while moving.[54]

Several years into development, Congress deleted $26 million from the Firefinder program for Fiscal Year (FY) 1990 because the Army could not adequately justify it. This effectively halted work. In view of the pressing requirement for new radars for AirLand Battle and strategic deployability, the Army was able to get Congress to reinstate some of the funds for FY 1991. With the restoration of some money, the Army modified its plans of mounting the radar on a five-ton truck for the heavy division and placing the radar on a trailer and towing it with a High Mobility Multipurpose Wheeled Vehicle (HMMWV) for the light forces. Rather, the Army chose to place the Q-36 on a trailer and tow it with a HMMWV. This would be less expensive and provide a radar for both light and heavy forces.[55]

Other target acquisition systems encountered similar problems with funding. As the 1980s opened, the field artillery had ambitious plans for the Aquila RPV. Although trials

conducted from November 1986 through March 1987 demonstrated that the Aquila could function in an operational environment, furnish timely intelligence, and provide target designation for precision munitions, they also pointed out critical problems. During the trials, the Aquila failed to meet the standard for detecting moving and stationary targets. Based upon this test and its own findings, the General Accounting Office sent a recommendation to the Secretary of the Army late in 1987 that production of the Aquila should be postponed until it could satisfactorily detect targets. More work was required before fielding could take place.[56]

Before this could be done, spiraling costs and declining budgets influenced Congress to restructure the military services' RPV programs in December 1987. To reduce costs Congress stopped funding the Aquila and consolidated the military services' RPV programs. At the same time, Congress created a joint program to develop a low-cost, expendable Department of Defense family of unmanned aerial vehicle systems sometime in the 1990s. This occurred although the Commandant, U.S. Army Field Artillery School, Major General Raphael J. Hallada (1987-1991), fought to keep the Aquila program going.[57]

As the field artillery struggled to introduce new radars and the Aquila, the Army worked to acquire a new helicopter for fire support missions. Calls for a new scout helicopter had arisen early in the 1970s when the Army began developing a concept for an advanced attack helicopter to offset the numerically superior Soviet and Warsaw Pact threat in Europe and to rely upon high technology in the face of diminishing personnel.[58]

In the October 1979 the Advanced Scout Helicopter Special Study Group identified the requirement for a real-time information, reconnaissance, security, aerial observation, and target acquisition/designation system with the ability to operate day and night in all kinds of weather. Based upon those needs, obtaining the Advanced Scout Helicopter was mandatory. The following month, the Army System Acquisition Review Council concurred with the group's assessment but recommended following a different course because that helicopter was too expensive. The council advocated incorporating Advanced Scout Helicopter equipment into an existing Army helicopter and in 1981 adopted the Army Helicopter Improvement Program (AHIP) as a near-term solution, although some Army aviators disagreed by insisting that the recommended solution would not meet their needs. In the meantime, work would continue on acquiring a future family of light helicopters.[59]

After tests had proven that Bell Helicopter's OH-58D helicopter was better than Hughes Aircraft's OH-6 helicopter, the Army directed the former to serve as the AHIP helicopter. As planned, OH-58D helicopter would carry a laser rangefinder-designator for first-round fire-for-effect and for designating targets for Hellfire, Copperhead, and other precision munitions. Although the Army planned to obtain 578 OH-58D helicopters, only thirty-three would be dedicated to field artillery fire support missions because attack and air cavalry units had a higher priority.[60]

Following testing of the OH-58D in 1984-1985, the Defense Systems Acquisition Review Council reversed fielding priorities late in 1985. Test results did not support employing the helicopter to lase targets for attack helicopter antitank missiles and to scout the battlefield for air cavalry units. However, the test demonstrated the helicopter's ability to perform field artillery missions satisfactorily. In view of this, the council directed limited production of the

aircraft for field artillery missions. This action saved the system from possible cancellation and gave the field artillery top priority.[61]

Based upon this new fielding priority, the Field Artillery School saw a bright future for the Army Helicopter Improvement Program helicopter in its fire support role. The OH-58D would give the aerial fire support officer the capability of shifting indirect fires rapidly around the battlefield with an extremely high degree of accuracy and lasing targets for precision munitions. Such capabilities would make the helicopter a critical system for a high-intensity conflict in Central Europe, a mid-intensity conflict against a Soviet surrogate armored force, and a low-intensity conflict against insurgency forces in the Third World.[62]

Although the OH-58D could fight at all levels of conflict, combat against Soviet and Warsaw Pact forces provided the strongest reason for adopting it. As the Commanding General, U.S. Army Combined Arms Center, Fort Leavenworth, Lieutenant General Gerald T. Bartlett, explained in May 1987, the OH-58D would enhance "the commander's ability to execute AirLand Battle doctrine."[63]

A close look at the results of further OH-58D testing, budget cuts, Operation Prime Chance in the Persian Gulf in 1987-88, and the decision to arm all OH-58Ds and reconfigure some as multipurpose light helicopters undermined the field artillery's position. Testing between January and May 1987 validated the OH-58D's suitability for supporting attack and air cavalry units and raised the question of retaining the field artillery role as the number one priority. Also, from July 1987 through January 1988, fifteen OH-58Ds from the XVIII Airborne Corps deployed to the Persian Gulf. There, they helped provide aerial cover for merchant convoys in Operation Prime Chance and further confirmed the viability of the helicopter in an aeroscout role.[64]

Nonetheless, the Field Artillery School's plans for the helicopter did not appear to be jeopardized because the Army's Aviation Modernization Plan for FY 1988 called for purchasing 477 helicopters. This number would satisfy fire support, attack helicopter, and air cavalry requirements. In view of the pressing need for the helicopter for attack and cavalry missions, the U.S. Army Aviation Center, Fort Rucker, Alabama, nevertheless, warned the Field Artillery School about its position on the OH-58D. In a blunt message in May 1988, the Aviation Center wrote that attack and cavalry units had priority over division artillery and that all of the helicopters should go to those missions.[65]

Budget cuts, not the Aviation School's stance on the helicopter, raised the specter of revising priorities. In January 1989 budget reductions decreased procurement of the helicopter to 207. On the basis of a purchase of fewer aircraft and a new requirement for an armed multipurpose light helicopter for contingency operations identified in an operational needs statement in mid-1988, the Army had to reexamine its distribution plans for the OH-58D. It also faced the possibility of arming it. In June 1989 the Army, as a result, directed TRADOC to develop an aircraft distribution plan and consider transferring OH-58Ds allotted for field artillery missions to other ones.[66]

In September 1989, just a month before the field artillery was to complete the fielding of its allotted OH-58Ds, the Army's revised fielding plan drastically undercut the fire support

mission. It removed OH-58Ds from all but one division artillery. Faced with the prospect of losing seventy-five of the field artillery's eighty-one aircraft, General Hallada strenuously objected. He argued that such action "would seriously degrade the Division commander's ability to engage the enemy with indirect fires and maintain a current intelligence picture of the enemy situation."[67] A compromise was reached in September 1989 when the Aviation School announced that the aircraft distribution plan would allocate 51 of the total 207 OH-58Ds to the fire support role, 131 to air cavalry and attack units, and 25 to the training base/float.[68]

The Army's aviation modernization plan of September 1989 clearly gave the top priority to the air cavalry-reconnaissance mission. Because the Army had to balance its requirements and deficiencies within available assets, a consensus of senior Army commanders agreed with the Aviation School that the inability to see the battlefield at night was the greatest aviation battlefield deficiency. Even though the future of the OH-58D for fire support remained uncertain, the Aviation School pointed out the system's importance in this role. This mission should influence the final decision on fielding priorities.[69]

With the appearance of another revised fielding plan in October 1989, the future of the OH-58D as a fire support system reached its nadir. The plan threatened to redistribute all of the field artillery's helicopters. Although the Field Artillery School strongly objected to this, TRADOC responded that arming the OH-58D, using it as a multipurpose light helicopter for contingencies forces, and cutting back the number to be purchased made fielding adjustments imperative. In addition, the Army was also considering optimizing the use of scarce OH-58Ds by examining the feasibility of expanding the system's combat role to include scout and armed reconnaissance.[70]

The revised Army Helicopter Improvement Program plan of October 1989, approved by the Secretary of the Army, reordered OH-58D priorities. The top priority now went to fielding armed OH-58Ds to air cavalry units for armed reconnaissance, then to satisfying critical multipurpose light helicopter requirements for the XVIII Airborne Corps and 82nd Airborne Division, and then to allocating the remaining aircraft for division between corps target acquisition reconnaissance companies and training commands. All field artillery OH-58Ds would be supplanted by OH-58A/C model aircraft. With this division artillery lost its organic aerial capability to lase over-the-hill targets. For the foreseeable future the field artillery would have to depend upon another branch's aerial assets for lasing over-the-hill targets. This meant that it would also be restricted to lasing targets with ground observers unless future events caused the helicopter to be employed in a field artillery role. The field artillery would still have organic aerial observation, but it would not be state-of-the-art and capable of lasing targets for precision munitions.[71]

Budget cuts brought the field artillery's efforts to introduce modern target acquisition systems to a standstill at the end of the 1980s. The field artillery lost the Aquila RPV, the OH-58D, and critical target acquisition radars. Although new howitzers were in various stages of development, budget reductions left target acquisition still weak despite determined actions during the 1980s to eliminate deficiencies. Without new target acquisition systems, engaging targets deep behind enemy lines would be limited, would force the field artillery to rely upon other sources for vital target information, and would seriously hinder the field artillery's ability to support AirLand Battle.[72]

To coordinate the employment of the weapons and target acquisition systems being acquired, the field artillery also required effective command, control, and communications systems. Otherwise, the cohesiveness of the field artillery would be seriously eroded. At the close of the 1970s, the field artillery had the Tactical Fire Direction System (TACFIRE) for command, control, and communications. The Fire Support Mission Area Analysis of December 1980 and the Mission Element Needs Statement of March 1981 pointed out that the system was large, heavy, and based on obsolete 1950s and 1960s technology. Convinced of the requirement for improved command, control, and communications for the field artillery by these two studies, the Army and the Department of Defense in 1981 approved developing the Advanced Field Artillery Tactical Data System (AFATDS) to supplant TACFIRE and to be part of the Army Tactical Command and Control System, a family of computers, peripherals, operating systems, utilities, and applications software.[73]

Shortly afterwards in 1984, the Army began serious efforts to acquire AFATDS. After delays caused by software and technical problems and a Congressional funding cut, the TRADOC Test and Experimentation Command Field Artillery Board evaluated the status of the AFATDS program early in 1989 rather than in 1987 as originally planned. Analysis of the test results, observations, comments by participants, questionnaires, and experience validated the AFATDS concept. This optimistic assessment led General Hallada to write the Commanding General, TRADOC, General John W. Foss, in July 1989 about AFATDS's ability to satisfy the Army's need for automated fire support command, control, and communications and to recommend entering full-scale development. Based upon General Hallada's favorable recommendation and test results, TRADOC, the Office of the Assistant Secretary of the Army, the Army System Acquisition Review Council of July 1989, and the Defense Acquisition Board of September 1989 subsequently endorsed full-scale development.[74]

Upon completion and fielding in the mid-1990s, the Advanced Field Artillery Tactical Data System would represent a complete departure from the Tactical Fire Direction System. Whereas AFATDS offered distributive (decentralized) processing that used Army common hardware and networking of computers and employed menus from which to pick tasks, TACFIRE depended upon centralized command and control, was a format-driven system, and was not user-friendly. This taxed training because the operator had to memorize many formats and had to use them frequently to remember them. As such, the Advanced Field Artillery Tactical Data System was more user-friendly than its ancestor.[75]

Despite intensive efforts in the 1980s to obtain new field artillery systems to support AirLand Battle, the Defense Science Board of the summer of 1988 reached striking conclusions that field artillerymen had known and been advocating for years. Comparing the number of Soviet and Warsaw Pact fire support systems to NATO's, the board found a shocking disparity in firepower in favor of the former that represented "an extremely dangerous situation for the alliance."[76]

This situation loomed particularly critical for the field artillery. In fire support systems the Warsaw Pact had an advantage of three to one and had developed concentration tactics to achieve a local numerical superiority of ten to one in breakthrough areas. With such an advantage Warsaw Pact fire support could effectively shut down NATO's antitank forces and

neutralize its fire support. In view of this dire possibility, the Commander in Chief of U.S. Army, Europe, General Glenn K. Otis, rated fire support as his command's number one deficiency and concern in 1987.[77]

To reverse the deplorable situation with the Army's field artillery, the board made specific recommendations. The Army had to improve target acquisition by upgrading Firefinder radars and by fielding an unmanned aerial vehicle. Concurrently, the Army had to speed up the fielding of the Advanced Field Artillery Tactical Data System, had to expedite the introduction of the Howitzer Improvement Program howitzer, had to accelerate the fielding of SADARM, and had to increase production of the Multiple-Launch Rocket System.[78]

From the Defense Science Board's perspective, the modernization of the field artillery was proceeding too slowly, but this was certainly not solely the fault of the field artillery. This unsatisfactory condition came as a result of years of insufficient funding and management attention by the Army to this vital area of conventional warfare. Also, the inherent difficulties associated with producing new technology had hampered modernizing the field artillery. As a result, the Army found itself in a precarious position in 1988 because of decisions made since 1973 that had persistently ranked field artillery developments low on the list of priorities. If war broke out in 1988, although it was unlikely, NATO could not stop the onslaught of Soviet and Warsaw Pact military forces because of inadequate fire support, especially field artillery.[79]

Prompted by the Defense Science Board's findings and its own apprehensions about helping defend NATO countries, the Army stepped up production of the Multiple-Launch Rocket System. In the fall of 1988, the Army Chief of Staff decided to expedite fielding the system so that the 8-inch howitzer would be out of Europe by 1998, out of the active component by 2000, and out of the Army by 2013. To accomplish this meant purchasing eighty-seven Multiple-Launch Rocket System launchers a year, which was almost fifty percent more than planned in 1985.[80]

Aware of the difficulties that the field artillery would have supporting AirLand Battle and defeating Soviet and Warsaw Pact fire support systems, the Field Artillery School amplified upon the reasoning behind the Army's decision of 1988 to increase the production of the Multiple-Launch Rocket System. During the past fifteen years, the Soviet Union and Warsaw Pact had introduced nineteen new fire support systems with more nearing production, while the Army had added one new towed howitzer, one multiple rocket launcher, and one counterfire radar. The results of this impressive rearmament by the Soviets and Warsaw Pact permitted their armies to wage war in Europe as never before in history with technology that equalled or surpassed in quality much of the Army's and NATO's equipment. Increasing production of the Multiple-Launch Rocket System would help mitigate the difference.[81]

Supported by the Defense Science Board's conclusions and its own, the Field Artillery School simultaneously urged speeding up the pace of modernization. In the Fire Support Master Plan of 1988, the school outlined ways to overcome the threat's fire support advantage. Near-term solutions consisted of adopting systems with the greatest war fighting payoff, modifying existing systems where possible, and achieving greater force structure efficiency. Far-term solutions involved developing leap-ahead systems, staying ahead of the threat's research and development cycle, and supporting future doctrine (AirLand Battle-Future). Without taking

these steps, the field artillery would be personnel intensive; have outdated cannons, rockets, and missiles; have target acquisition systems with low survivability and limited abilities to detect deep targets; and have 1960s command, control, and communications technology.[82]

The keystone of an effective modernization program revolved around developing "a system of systems." Because of the threat's activities, the field artillery could not permit modernization to slow down or be fragmented. This would be disastrous because it would permit the Soviet Union and Warsaw Pact to maintain their lead in field artillery systems and could give the Army field artillery systems that might not function together effectively. To prevent this the plan outlined a coordinated, prioritized effort to tie disparate developmental projects into a rational modernization effort.[83]

International events during the last two years of the 1980s, however, had the potential of removing some of the urgency behind modernizing the field artillery and even preventing it from continuing. After a decade of building up conventional forces in Europe by NATO and the Warsaw Pact, the concentration of military forces in West and Central Europe in 1988 was the highest ever known in peacetime and represented the greatest conventional destructive potential ever assembled on the continent. The Warsaw Pact had three times more tanks and field artillery than NATO and two times more armored troop carriers. Although NATO had recognized that such extreme differences in conventional forces had existed for years, the Warsaw Pact refused to acknowledge the situation until the late 1980s. Pressured by the need to divert resources from military to urgent domestic uses, the Warsaw Pact finally expressed a desire in 1988-1989 to reduce the amount of conventional forces in Europe. In fact, several Warsaw Pact countries, including the Soviet Union, announced plans to cut their military forces unilaterally. Yet, these reductions would still leave the Warsaw Pact with a two to one advantage in tanks, field artillery, and armored personnel carriers.[84]

Even though these actions represented a gigantic step toward reducing tensions and the possibility of war, NATO and the Warsaw Pact needed to take additional steps to cut back the high concentration of military forces in Europe and prevent domination by any one country on the continent. In March 1989 Conventional Forces Europe Force Reduction negotiations that were held by twenty-three NATO and Warsaw Pact countries led to an agreement to reduce conventional forces, to abolish military disparities between the two alliances, and to eliminate the capability of launching a surprise attack and initiating a large-scale offensive. Participating countries established limits on military equipment and weapons by individual countries, while the Soviet Union and the United States agreed to reduce their military forces to 275,000 for each.[85]

A decade that had started with a clear focus on what was needed for combat in Europe and set modernization priorities ended ambiguously for the field artillery. Although the Conventional Forces Europe Force Reduction negotiations of 1989 did not mean that modernizing the field artillery would come to a halt, they raised the serious question about future requirements and presented the potential of altering priorities. In 1990 the unification of Germany, the disintegration of the Warsaw Pact, and the incipient democratization of Eastern Europe further challenged the necessity of a large American military commitment in Europe. At the same time, they questioned the justification for modernizing the field artillery even more than the Conventional Forces Europe Force Reduction talks had done.[86]

Without visualizing the requirement for a large military force to defend Europe in view of international events there, Congress outlined a plan to reduce the Army's manpower and budget between 1990 and 1994 even though a hostile world was still a reality. To offset the projected personnel cuts, the Army turned to technology. The Field Artillery School explained, "Selected technologies while expensive give a smaller force overwhelming capability — the smaller the force, the more important the technology." As the Army shrank in size, it would have to depend more heavily on technology.[87]

Exploiting new technology, however, demanded effective doctrine and organization. In the midst of the profound political changes occurring in Europe, TRADOC performed a series of studies, collectively known as AirLand Battle-Future, to determine doctrine, organization, equipment, training, and leader requirements for the future. Conducted between 1988 and 1990, the studies pointed out the emergence of a nonlinear battlefield, especially in Europe, because gaps in lines would be created by using smaller forces to defend territory formerly defended by larger ones. According to TRADOC commander, General Foss, long-range, precision fire from fire support systems would have to cover the gaps and destroy the enemy force, while sophisticated technology would enable the Army to find and track the enemy. Fire support would engage the enemy with destructive long-range fires to destroy him. Then, the maneuver forces would attack the enemy's flanks and rear to avoid frontal assaults. From the Field Artillery School's perspective, AirLand Battle-Future was tailored to take advantage of the American superiority in fire support technology.[88]

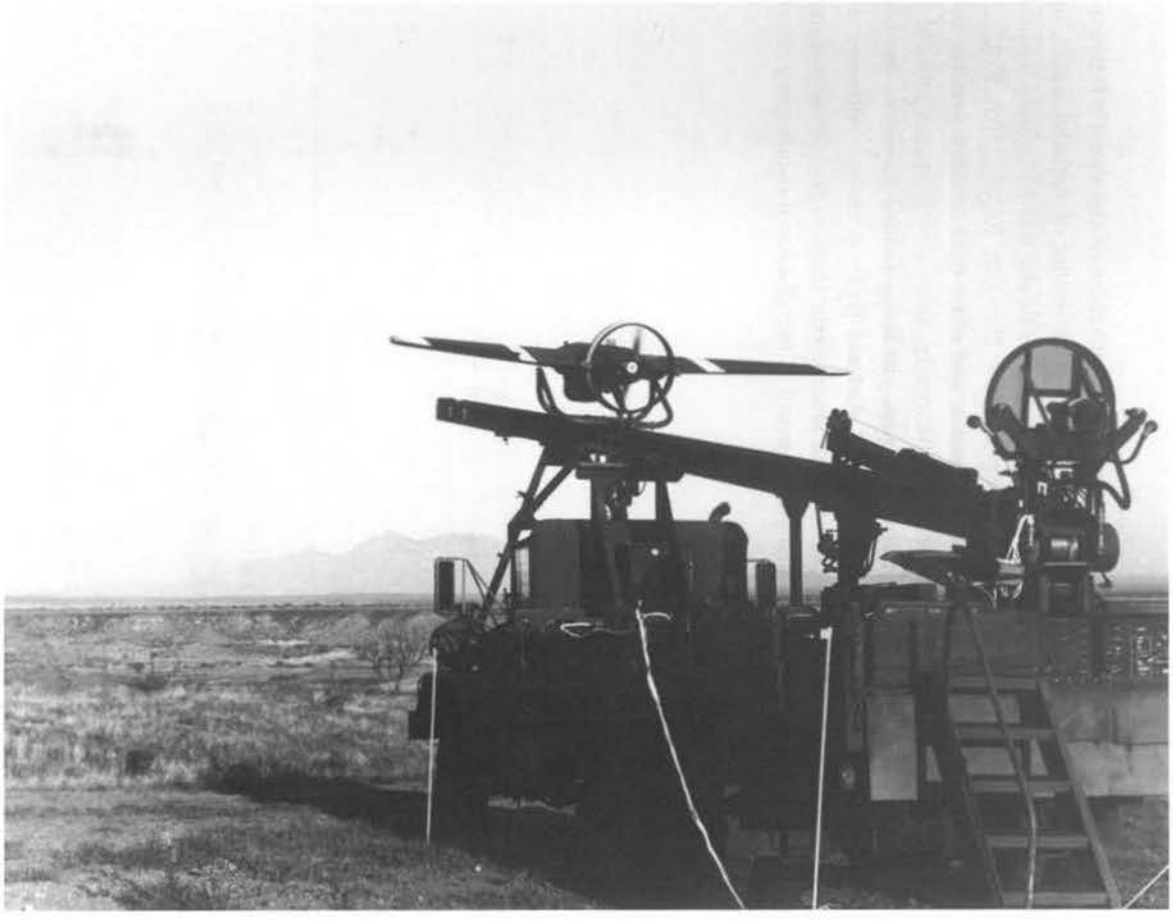
As envisioned during the latter years of the 1980s, long-range fires would become the major killer on the battlefield. Once the long-range fires from Multiple-Launch Rocket Systems with their precision munitions, the Army Tactical Missile System, and other weapons being developed had destroyed the enemy sufficiently to minimize casualties, the division's direct support artillery would support the maneuver forces by delivering the final blows with assistance from corps artillery.[89]

Providing effective long-range fires on the nonlinear battlefield, however, rested upon the continued modernization of the field artillery. The Army had to field the MLRS family of munitions (Ground-Launched Tacit Rainbow, the MLRS Sense-and-Destroy Armor, and Terminal Guidance Warhead), the M109A6 Paladin, the Advanced Field Artillery System-Cannon, the Advanced Target Acquisition Counterfire System, the Guardrail Common Sensor, the Advanced Field Artillery Tactical Data System, and unmanned aerial vehicles. These systems would give the field artillery the ability to reach deep into the enemy's territory to destroy forces before they encountered friendly forces and to shape the maneuver battle. As one combat developer in the Field Artillery School wrote, long-range fires would be a reality only with the new technology. Fielding these new systems was critical because the key to success on future battlefields was long-range, precision fires to destroy the enemy before committing maneuver forces.[90]

As developments in the 1970s and 1980s suggested, modernizing the field artillery for combat in Europe occurred in two compatible but successive waves. The first began when the Army returned to Europe after fighting in Vietnam and was significantly influenced by the Arab-Israeli War of 1973. At that time the Army's modernization concentrated upon overcom-

ing the firepower and numerical inferiority caused by the Soviet and Warsaw Pact military buildup of the 1960s and early 1970s and sought in some instances to exploit systems that had their genesis in the 1960s. For the field artillery this involved increasing the number of field pieces in the division, restructuring division artillery, introducing high-technological weapon systems to reduce personnel requirements, revamping counterfire responsibilities, and writing new doctrine.

During the late 1970s, the push to decrease the effectiveness of the threat's follow-on echelons led to the second wave of modernization. Under the banner of AirLand Battle, the Army consciously determined to obtain materiel to support a particular way of fighting whereas the first wave did not. This caused work to begin on the Howitzer Improvement Program howitzer, the Advanced Field Artillery System-Cannon, and other field artillery systems that were compatible with the accepted doctrine. Simultaneously, those developments influenced the Army to upgrade or replace some systems that were just being fielded as part of the first wave because they would not satisfy the demands of AirLand Battle doctrine. Although the second wave was built upon the first, the former soon absorbed the latter to give the appearance of only one push for modernization even though the record of two discrete if overlapping efforts was clear.



An Aquila Remotely Piloted Vehicle in launch position



A self-propelled M110 8-inch howitzer of Battery B, 1st Battalion, 13th Field Artillery, at Fort Stewart, Georgia



A Multiple-Launch Rocket System of the 1st Armored Division



An M109A2/A3 self-propelled 155-mm. howitzer of Battery A, 4th Battalion, 41st Field Artillery, during Desert Shield.



An M109A6 self-propelled 155-mm. howitzer (Paladin) of the 2nd Battalion, 17th Field Artillery, 212th Field Artillery Brigade, Fort Sill, Oklahoma

CHAPTER III

FIELD ARTILLERY AND THE LIGHT FORCES

As the Army pushed to introduce new doctrine, force structure, and equipment for fighting a high-intensity conflict in Europe, it simultaneously pursued building light forces for contingency operations throughout the world. This involved creating suitable organizations, writing applicable doctrine, and acquiring the appropriate equipment.

BUILDING A FORCE STRUCTURE

Although the possibility of fighting low- to mid-intensity conflicts existed during the 1970s, the Iranian Islamic fundamentalist revolution of 1979 and the Soviet invasion of Afghanistan that same year encouraged the United States to broaden its strategic interests again beyond a primary focus on Europe to a global perspective. Out of this emerged a quicker preparedness to deploy military forces around the world and the creation of the Rapid Deployment Joint Task Force (the forerunner of the U.S. Central Command), composed of all of the armed services, at MacDill Air Force Base, Florida, for Persian Gulf contingencies. Convinced that the Army would play a vital role in the new global orientation beyond its participation in the Rapid Deployment Joint Task Force, the Army Chief of Staff, General Edward C. Meyer, and U.S. Army Training and Doctrine Command (TRADOC) Commanding General, General Donn A. Starry, met in September 1979. At that time they discussed initial concepts for a strategically deployable light division. By taking this step, they concurred that national interests had to be broadened, given recent international events, and were willing to enlarge the Army's mission.[1]

Based on this thinking, General Meyer directed TRADOC to design a light division to meet the Army's future strategic requirements. This tasking effectively reversed the trend during the 1970s towards converting the Army's existing straight infantry active component divisions, with some exceptions including the 82nd Airborne Division and 101st Airborne Division, to heavy ones for employment in Europe. Yet, unlike its heavy counterpart, the light division would have to be prepared to fight anywhere in the world, which gave it a broad mission.[2]

To satisfy the Chief of Staff's guidance, TRADOC set out in 1979 to devise three different light divisions — airborne, air assault, and infantry with the latter being "Infantry

Division 86," as a part of the Army 86 modernization effort to create divisions capable of fighting in the 1980s and beyond. With its focus on the straight or nonmechanized infantry division, TRADOC designed a "light" infantry division of 14,400 personnel late in 1979 and early in 1980. The division consisted of three infantry brigades, an air cavalry attack brigade, and support units and was to take advantage of future high technology to reduce personnel requirements. Reflecting an European orientation, division artillery had three direct support battalions of three towed M198 155-mm. howitzer batteries of eight weapons each and a general support artillery battalion of M198s, self-propelled M110 8-inch howitzers, and Multiple-Launch Rocket Systems (MLRS).[3] Because this division was too heavy and deviated too much from the original concept of a light, deployable division outlined by General Meyer and himself, General Starry rejected it.[4]

At General Starry's direction TRADOC subsequently designed another one. After going through several different versions, TRADOC finally settled on a light division force design late in 1980. With the understanding that the Army's end strength would increase in the 1980s and 1990s, TRADOC developed Infantry Division 86 with 17,773 personnel, eight motorized infantry battalions, two mobile protected gun battalions, and field artillery, air defense, antiarmor, and support units. The division's field artillery consisted of a headquarters and headquarters battery, a target acquisition battalion, three direct support M198 battalions of three batteries of eight guns each (seventy-two), and a general support battery of nine Multiple-Launch Rocket System launchers. Equally important, the division's field artillery would rely upon precision munitions, the Tactical Fire Direction System (TACFIRE), and the Battery Computer System to make fire support responsive to the needs of the maneuver arms. As a whole, the division would depend upon high-technological equipment to make it a potent combat force to offset its small size. In doing so, it would satisfy General Meyer's guidance for a deployable light division with the ability to kill enemy tanks and light armor and to perform traditional light division missions.[5]

Although the Army conditionally endorsed Infantry Division 86 as the objective light infantry division in December 1980, the mission of fighting across the spectrum of conflict (low-, mid-, and high-intensity) created a dilemma. To fulfill its deployability mission for contingency operations throughout the world that would generally involve fighting in a low- to mid-intensity environment, the division required light equipment, and that would restrict firepower. In comparison, fighting in a high-intensity conflict demanded firepower and heavy equipment that in turn would hinder deployability. In short, the broad mission placed Infantry Division 86 in an awkward position of trying to serve diverse functions and not being ideally suited for any of them. Yet, as its organization and equipment, especially field artillery, suggested, the light division was more appropriately organized and equipped for heavy division missions in Europe than for light missions and was not strategically deployable.[6]

Notwithstanding Infantry Division 86's inherent contradictions, plans moved forward to test it, using the 9th Infantry Division at Fort Lewis, Washington, as a "test bed." The High Technology Test Bed, a united effort to test Infantry Division 86 by TRADOC, the U.S. Army Materiel Development and Readiness Command, and U.S. Army Forces Command (which commanded the 9th Infantry Division through I Corps) quickly went astray. Whereas TRADOC thought that the test bed was to test Infantry Division 86 concepts and organizations and to

infuse high technology into the 9th Infantry Division, the division under, first, Major General Robert M. Elton and, later, Major General Robert W. RisCassi understood that it was to come up with its own high-technology light infantry division design unhampered by Infantry Division 86 concepts. After General Meyer sided with the 9th Infantry Division's interpretation in April 1981 to resolve the dispute, the 9th Infantry Division's effort took its own independent course supported by General Meyer and soon absorbed and submerged the Infantry Division 86 effort to become the focus of light infantry division design until 1983.[7]

Influenced by the Army's personnel cap of 780,000 mandated by Congress, the growing possibility of fighting low- to mid-intensity conflicts throughout the world, and a shortage of Army aircraft, General Meyer's successor, General John A. Wickham, Jr., changed the direction of the light division effort upon becoming Chief of Staff in June 1983. After rejecting his predecessor's high-technology orientation, he immediately set a new force design effort in motion. A white paper of April 1984 summarized General Wickham's thinking by outlining the requirement for a light division of approximately ten thousand personnel. The division had to be equipped with light materiel for strategic and tactical mobility and had to have the ability to fight anywhere and anytime. From bases in the United States, light divisions would be deployed to the North Atlantic Treaty Organization (NATO) or the Far East, the paper explained. The paper might have emphasized light operations, but the broad mission of fighting across the spectrum of conflict still remained a vital aspect of strategic thinking. Yet, equipping the division with light equipment to make it deployable would not make it suitable for high-intensity conflict either.[8]

At General Wickham's direction TRADOC designed a light division as a part of the "Army of Excellence" effort. Lacking tanks, heavy equipment, and organic transport, the division could be deployed on approximately five hundred Air Force C-141 sorties and provide the Army with the versatility and strategic flexibility to deter Third World aggression that Infantry Division 86 did not offer. Specifically, the Army of Excellence light infantry division was composed of ten thousand personnel, three maneuver brigades, division artillery, a combat aviation brigade, a division support command, and division troops that consisted of an engineer battalion, air defense artillery battalion, signal battalion, military intelligence battalion, military police company, and band. Division artillery had a general support battery of M198 howitzers (eight) and three direct support battalions of towed M102 105-mm. howitzers (fifty-four). This mix of field artillery was more strategically deployable than was in the Infantry Division 86 design but sacrificed firepower to accommodate the light division's mission.[9]

Aside from operations in less-developed countries, the Army of Excellence light division had the capability of reinforcing areas where the Army already had troops, such as in Europe, if necessary. Light forces could augment heavy forces in terrain and scenarios, such as cities, forests, and mountains, where they could be employed more effectively than heavy forces. Even so, the Army preferred employing the division in low- to mid-intensity conflicts because it was foot mobile and lacked heavy equipment for fighting armored forces. Although deploying the light infantry division in a high-intensity conflict in Europe was not ruled out, such action was not likely, at least in the mid-1980s, because combat there was still viewed as clashes between armored forces and because supplementing heavy divisions with light ones was only in the early stages of serious consideration in 1984.[10]

THE DILEMMA OF DOCTRINE

While TRADOC was designing different light divisions in 1979-1984, progressive thinkers in the Army zealously pursued the possibility of employing elements of heavy divisions and light divisions together on an European battlefield, even though the latter alone were no match for heavy armored forces. In July 1982 the Commanding General, 24th Infantry Division (Mechanized), Major General (later General) John R. Galvin, wrote in *Armed Forces Journal* that light forces could move quickly over strategic distances by air but that they were not the first choice "to stand up" against enemy armor.[11] However, from General Galvin's perspective, trained and employed as a team, heavy and light forces possessed the inherent possibilities of achieving new dimensions in deployability, combat power, agility, and sustainability. In a perceptive passage in that article, General Galvin noted, "If war comes [in Europe], we will fight with the forces that we have, and with those we can mobilize. Under any conditions the forces will be a heavy-light mix — because that is what's available."[12]

As his article indicated, General Galvin clearly understood that heavy and light forces had the potential of working together and that the Army had to develop doctrine to foster such cooperation. The Army simply could not avoid writing doctrine for employing heavy and light divisions together in Europe on the basis that it preferred to use light divisions in low- to mid-intensity conflicts in other parts of the world. A Soviet and Warsaw Pact attack would demand committing everything available to stop it and would not permit the luxury of reserving the light divisions solely for low- to mid-intensity employment. Yet, using heavy-light force combinations in Europe flew in the face of existing experience. Command post exercises with light forces without troops conducted by the U.S. Army, Europe (USAREUR) late in the 1970s had demonstrated their limited utility in heavy force scenarios and challenged the validity of Galvin's argument.[13]

Several years later, in 1984, as the emphasis on strategic deployability for contingency operations in Third World countries and light equipment continued to mount and after he had assumed command of the VII Corps in the Federal Republic of Germany, General Galvin reemphasized the need for heavy and light divisions to work together harmoniously. The emergence of light divisions gave the Army the opportunity of reconsidering the question of a heavy-light mix in Europe. Although many Army officers still discounted the utility of light divisions in Europe, General Galvin staunchly opposed that position. By insisting that light divisions had a role on the continent in armored warfare, he became one of the leading advocates of heavy-light mixes. After discussing various ways of employing light divisions in Europe in an article in *Infantry* in the Summer of 1984, General Galvin concluded that they would be excellent candidates for early deployment because they could rapidly reinforce the heavy divisions already positioned in the Federal Republic of Germany. Yet, they had to be specially trained to work with heavy divisions.[14]

The Commanding General, 3rd Infantry Division (Mechanized), Major General Howard G. Crowell, Jr., and the Assistant Chief of Staff, G-3 (Operations), 3rd Infantry Division, Lieutenant Colonel Jared L. Bates, shared similar thoughts. In the summer of 1984, they wrote in *Infantry* that the development of heavy and light divisions abolished the traditional concept of combined arms warfare of infantry, armor, and field artillery. Combined arms also meant

heavy and light forces fighting as a team. Even so, Crowell, Bates, Galvin, and most Army opinion conceded that light forces would have difficulties fighting in Europe against armored and mechanized units unless they were properly augmented to strengthen their combat power and sustainability. By advocating the use of light divisions in Europe, however, they pushed to stem the drift towards employing them exclusively in low- to mid-intensity conflicts, as many Army officers advocated, in their efforts to ensure the defense against a Warsaw Pact invasion.[15]

Despite increased attention focused on heavy-light mixes between 1982 and 1988, the Field Artillery School moved cautiously to develop field artillery doctrine for such combinations. After all, using light units in Europe with heavy units was not readily accepted throughout the Army even though light forces had the mission of engaging everything from light infantry to armor. As the former Commandant, U.S. Army Field Artillery School, Major General Raphael J. Hallada, recalled, heavy-light mixes evoked strong opposition from many field artillerymen, especially those serving in combat units. For the most part, they advocated either heavy or light forces and did not want to combine them because of the great differences between the two, while those who did support heavy-light mixes could not agree upon doctrine. Thus, the school did not visualize any urgency to develop doctrine and even encountered active resistance throughout the field artillery when it tried to open a dialog on the issue of heavy-light mixes.[16]

Realizing that field artillerymen lacked guidance for heavy-light operations, the Field Artillery School, nevertheless, pursued action to produce the appropriate doctrine. A draft paper on heavy-light forces in 1988-1989— the first real, concrete effort to formulate doctrine for heavy-light operations by the school — explained that the fire support coordinator had to consider the limitations and vulnerabilities of each type of force as he planned. For example, field artillerymen had to create a link between light and heavy artillery units. Because the field artillery in the light division depended upon voice communications, light field artillerymen had to be trained to use TACFIRE, or specialized liaison requests had to be established. At the same time, the fire support coordinator had to design a plan to distribute TACFIRE equipment to key positions to facilitate sharing information between light and heavy divisions. Otherwise, command, control, and communications would be difficult and perhaps would break down.[17] Upon viewing the great disparity between the fire support capabilities of light and heavy forces, the Field Artillery School recognized that much work was required before the two could work as a team.[18]

The growing possibility of heavy-light operations simultaneously kindled a debate over responsibility for counterfire, an issue that had been smoldering for several years. Acknowledging that the Warsaw Pact and Soviet Union had numerical superiority in fire support systems and that heavy-light operations might be a reality, several Army general officers challenged placing the counterfire mission in the division.[19]

Although the Commanding General, I Corps, Lieutenant General William H. Harrison, accepted placing counterfire in the division, he concurrently pointed out the light division's inability to perform the mission effectively. Adding a target acquisition detachment in each light division as planned in the near future would provide some help by permitting the division to identify targets. However, the ultimate solution would be to create a target acquisition

battalion for the light division. Because of limited target acquisition assets in the light division, the corps, especially those with light divisions, should have responsibility for counterfire. After all, it had the capacity for this mission, according to General Harrison.[20]

Several other reasons bolstered General Harrison's position. First, the light division's range of direct support artillery and its limited number of general support weapons would not permit effective counterfire. Second, division artillery in his corps' light divisions and even heavy divisions repeatedly turned over counterfire to the reinforcing brigade and conducted close support.[21]

Written in the Fire Support and Combined Arms Operations Department in the Field Artillery School in response to the General's argument, a fact sheet of 28 September 1988, provided an explanation of why the light infantry division had few target acquisition capabilities. Although the fact sheet did not represent an official school position, it elucidated the light division's requirement to be deployable to areas that would most likely involve a low-intensity conflict where counterfire threats would be minimal. Consequently, long-range counterfire acquisition capability would not be required. Also, eliminating counterbattery radars, moving-target locating radars, and the targeting element from division artillery's tactical operational center saved personnel spaces as well as weight. If these things were not done, deploying the light division in five hundred Air Force C-141 sorties would be impossible. As the author of the fact sheet carefully noted, the light division's primary function was to fight in low- to mid-intensity conflicts. Moreover, the light division did not have a vital role in a high-intensity conflict even though some prominent Army officers advocated employing it to support heavy divisions in Europe and even though its mission was to fight across the spectrum of conflict.[22]

Notwithstanding the cogent reasoning for restricting counterfire capabilities in the light division as the fact sheet explained, General Harrison understood the light division's dilemma and the inherent contradictions of its broad, sweeping mission. If heavy-light operations were to become a reality, provision for counterfire in the light division had to be made. Otherwise, the light division could be a drain on the corps' counterfire resources. At the same time, improving counterfire capabilities in the light division had the potential of reducing the division's deployability.[23]

The 3rd Infantry Division held a position diametrically opposed to General Harrison's. In a letter to the Directorate of Training and Doctrine in the Field Artillery School in April 1988, the 3rd Infantry Division artillery commander, Colonel John J. O'Keefe, attached a provocative issue paper. It stated that counterfire was inextricably tied to the scheme of the maneuver commander and the division commander's intent. As such, the fire support coordinator of the division, the division artillery commander, had to orchestrate the counterfire battle within the division's sector. "Any counterfire solution that places the division counterfire battle solely [in] the hands of a headquarters other than that of the DIVARTY [division artillery] Commander's contradicts clearly stated and time tested doctrine," the issue paper related. On the basis of this line of thought, the 3rd Infantry Division artillery commander urged the school to continue teaching that counterfire was a division artillery mission.[24]

Several months later, the 3rd Infantry Division's new artillery commander, Colonel Thomas W. Karr, wrote the Assistant Commandant of the Field Artillery School, Brigadier

General (later Major General and Commandant of the Field Artillery School) Fred F. Marty, about the dilemma posed by counterfire being in the division. Because the division's fire support assets constantly changed in a recent field exercise, counterfire assets fluctuated. Even though the division managed counterfire, with direct support battalions providing it as necessary, corps artillery furnished the bulk of counterfire when it was available. This led Colonel Karr to comment about the division's inability to come to grips with how the counterfire battle should be fought. In light of this, using reinforcing corps artillery to execute the counterfire mission was a viable option from the colonel's perspective. This would reduce the confusion and delineate the responsibility more clearly. In other words, counterfire doctrine had to be modified. Making it a division responsibility was not working.[25]

With pressure mounting to revise responsibilities for counterfire, the Field Artillery School acted to defend its position. In March 1989 the school explained that doctrine still assigned counterfire to the division because most of the threat's indirect fire systems were two to ten kilometers beyond the forward edge of the battle, which was normally the division's responsibility, and because the division had the organic assets to conduct counterfire. However, the corps could influence the counterfire battle by attacking targets beyond the division's zone and helping the division furnish counterfire by task organizing. Although establishing a command or a support relationship between division and corps artillery was permissible, it did not relieve the division of its responsibility for counterfire.[26]

In response to further concerns from artillery commanders, the school distributed a draft white paper to the field for comments. By June 1989 remarks on the paper began flowing into the school. One general officer vehemently supported positioning counterfire in the corps. Taking a less doctrinaire approach, the Commanding General, III Corps, Lieutenant General Richard G. Graves, advocated centralizing counterfire at the level that could most readily respond. In other words, counterfire did not have to be a division responsibility. It could be in the corps. This position harkened back to the pre-counterfire days when counterbattery fire was divided among three echelons of command and presented the potential of confusing command and control of the mission. Continuing, General Graves explained his intention of centralizing counterfire at the corps during the initial stages of an attack because the corps had the ability to synchronize all fire support assets and had the intelligence gathering functions, to name just a few reasons. Despite this dissenting voice, most commanders still endorsed positioning counterfire in the division.[27]

Some general officers, who responded to the draft white paper, especially liked the concept of assuming the initiative on the battlefield. This involved massing fire on threat fire support systems before they started firing. Corresponding with General Hallada, the Commanding General, 9th Infantry Division (Motorized), Major General (later General) John M. Shalikashvili, wrote, "I don't think it [is] possible for the White Paper to overstate the importance of massing on the counterfire targets we do acquire, whether proactively [before they fire] or through their own exposure by firing."[28] Supporting the concept of being proactive in counterfire, General Harrison likewise pointed out that his corps could not let the enemy fire first and that he was "firmly convinced that we will lose if we direct our counterfire in a revenge or reactive mode only."[29]

After carefully considering the comments from the field, the Field Artillery School published a white paper on counterfire in November 1989. The paper explained that counterfire consisted of fires targeted throughout the battlefield to attack the total enemy fire support system of mortars, helicopter forward operating bases, vector target designation points, field artillery, rocket, air defense, and missile systems, and support and sustainment installations. Because of the Soviets' and Warsaw Pact's overwhelming numerical fire support superiority, friendly fire support had to attack with counterfire before the threat employed its fire support systems. Otherwise, friendly forces would be overwhelmed and would be unable to respond.[30]

With the debate raging over responsibility for counterfire, the school took action to end the controversy. While the mission was shared by the division and corps, it might not be equally shared. The location of targets and the capabilities of acquisition and weapon systems determined ultimate responsibility. In most instances, the corps was accountable for the attack at depth and deep counterfire, while the division executed the counterfire effort within its area of responsibility.[31]

As the Field Artillery School's Counterfire White Paper of November 1989 indicated, the corps and division had to fight the counterfire battle as a team. By taking this position, the school backed down from its previous rigid doctrinaire stance in favor of one more flexible by allowing the division and corps to share the counterfire battle. In doing so, the school accommodated the field artillery of the light division by recognizing its requirement for corps artillery support. The light division lacked the systems to fight counterfire effectively, especially in a high-intensity conflict, as the Army's training exercise, Centurion Shield 1990, reinforced. At the same time, the white paper acknowledged the inability of field artillery in heavy divisions to fight the counterfire mission alone because it also lacked sufficient numbers of appropriate weapon systems.[32]

While the Field Artillery School labored to modify counterfire to fit the realities of division artillery fire support, it also pressed to develop doctrine for light field artillery operations. During 1987, the school circulated a coordinating draft of Field Manual 6-20-50, *Fire Support for Brigade Operations (Light)*, to active and reserve units and published it in January 1990. Using input from light division field artillerymen, the school refined fire support for the light forces. Like the fire support system in the heavy division, that for the light forces depended upon mortars, tactical air, naval gunfire, field artillery, target acquisition systems, munitions, and command and control systems and provided one of the most rapid means of placing accurate fire on moving forces in a low-intensity conflict.[33]

Even with the publication of the manual, the role of field artillery in low- to mid-intensity conflicts remained ambiguous. Low-intensity conflicts presented the possibility for field artillerymen to serve as advisors to train indigenous forces as they had done in Vietnam or even to fight, while a mid-intensity conflict would actually mean employing units in combat. As one particular writer in *Field Artillery* in April 1990 suggested, the field artillery had to address seriously its roles in low- to mid-intensity conflicts with light forces, examine doctrine, and change it as needed. Although high-intensity conflict in Europe could not be ignored, even with the Conventional Forces Europe Force Reduction talks in progress, the Field Artillery School had to develop doctrine for combat outside of Europe. It had to take a more balanced

approach to combat than in the past by writing doctrine that would permit fighting across the spectrum of conflict, since each level posed different problems.[34]

EQUIPPING THE FORCE

Creating light divisions also involved obtaining the appropriate weapons and equipment if they were to function effectively. At a minimum, the weapon system for the field artillery had to include a lightweight, long-range howitzer, improved munitions, and a highly mobile prime mover. Based upon wargaming of towed 105-mm., 155-mm., and 5-inch systems at the U.S. Army Combined Arms Center at Fort Leavenworth, Kansas, and at Fort Sill, Oklahoma, the Field Artillery School concluded that a 105-mm howitzer was the near-term weapon of choice for a direct support weapon. As the Field Artillery School wrote in 1985, however, the light forces required lightweight towed 155-mm. howitzers for direct support for the long-term. Unfortunately, the technology did not exist at the time to make a 155-mm. howitzer strategically and tactically mobile, while fiscal constraints prevented establishing a new 5-inch ammunition line for a 5-inch howitzer, even though it would be effective.[35]

This situation led the U.S. Army Armament Research and Development Command to analyze eighteen American and allied towed 105-mm. howitzers for possible adoption. After an extensive investigation that command narrowed the field to the towed M204 howitzer (a soft-recoil weapon developed and type classified in the 1970s but never produced), a modified towed M102 howitzer, and towed L118 and L119 British Light Guns. At the same time, the new system had to be compatible with developmental dual-purpose improved conventional munitions (DPICM) and high-explosive rocket assisted (HERA) projectiles and had to have growth potential. It also had to have tactical and strategic mobility, had to be available, and had to be cost-effective.[36]

Although the M102 was mobile, the Army and Field Artillery School questioned its suitability for the new light division. During the course of 1984, the school explored the possibility of retaining the M102. Addressing the M102's future, the Assistant Commandant, U.S. Army Field Artillery School, Brigadier General Raphael J. Hallada, doubted its potential for growth. Even though the weapon's range of 11.5 kilometers with conventional munitions and 15.1 kilometers with rocket-assisted projectiles could be increased by lengthening the tube, the piece still represented 1960s technology. On the basis of this, the Field Artillery School and Army rejected the M102 for the light infantry division.[37]

The Army also challenged employing the M204 in the light division. Besides having a soft recoil, the M204 had a single box trail with no trails extending to the rear and a range of 14.3 kilometers. Although the range was superior to the M102's, the M204 weighed five thousand pounds, was too heavy for strategic mobility, and often tipped over when it misfired. These drawbacks caused it to be discarded in 1984 as a serious candidate.[38]

In contrast, the British light guns offered greater possibilities than the other two did. Design work on the L118 had begun in 1965 with test and evaluation being conducted three years later. With British Abbot Mark II ammunition the L118 had a range of 17.2 kilometers. Equally important, it weighed a little over four thousand pounds. Although the L118 demon-

strated its reliability and ease of operation during the British Falkland Island Campaign of 1982, its inability to use American ammunition caused the Army to look at the L119, which the British were employing for training at the time.[39]

Examination of the L119 in 1984 quickly revealed attractive characteristics. The piece had a range of fourteen kilometers, weighed approximately four thousand pounds, and could fire American ammunition. Rather than developing any of the other three howitzers, the Army Chief of Staff approved further evaluation of the L119 because it had the longest range of the three with the current stockpile of American ammunition, was available at low risk, had a significant potential for growth, and was an inexpensive alternative. Based upon this reasoning, the Army renamed it the XM119 in May 1984.[40]

From June to August 1985, the U.S. Army Field Artillery Board at Fort Sill tested the XM119 to determine its suitability. Although the trials revealed the existence of some technical problems, they concurrently demonstrated the XM119's ability to achieve the maximum range requirement, its reliability, and its solid performance. The Field Artillery Board as a result concluded that the XM119 satisfied the established standard with minor correctable qualifications. Based upon this, the Army classified the XM119 as the towed M119 105-mm. howitzer and decided to buy over five hundred of them to replace the M102 as direct support artillery in light infantry, airborne, and air assault divisions. However, technical problems with the carriage and fire control system delayed fielding the howitzer until 1989.[41]

Although the Army planned to complement the M119 with the M198 for counterfire, some Army circles envisioned the requirement for even more effective counterfire capabilities in the light division. As early as 1982, the 9th Infantry Division (Motorized) had documented the requirement for a light multiple rocket system. Although the LTV Aerospace and Defense Company proposed to build a candidate system in response, the Field Artillery School did not visualize the need for such a rocket launcher in 1983. After all, the light division would be primarily employed in contingency operations where the demand for counterfire would be low. Without any support from the field artillery, work on a light multiple rocket launcher languished for several years.[42]

In concert with the growing interest in contingency operations as the Cold War waned, the U.S. Army Missile Command outlined a requirement for a Low-Intensity Conflict Rocket System in a draft white paper in 1989 that was based upon the 9th Infantry Division's Quick Reaction Plan of 1985. Equipped with three direct support battalions of towed 105-mm. howitzers and one general support battalion of towed 155-mm. howitzers, the 9th Infantry Division (Motorized) lacked the capability of providing interdiction and counterfire and had to rely upon corps artillery for a majority of its general support fire, which reinforced the argument of advocates, who wanted counterfire in the corps. Although the Multiple-Launch Rocket System was fully capable of furnishing interdiction, counterfire, suppression of enemy air defenses, and other vital missions as a corps artillery weapon, it did not have the strategic and tactical mobility required by the light forces because it could not be carried in an Air Force C-130 or transported by Army helicopters. As the U.S. Army Missile Command viewed the situation in 1989, the light forces had an "urgent requirement for a combat multiplier weapon system that possesses deployability, great tactical mobility, range, lethality, and surge capability to accomplish their missions."[43]

While the U.S. Army Missile Command outlined its system, the Field Artillery School began articulating its solution to the requirement for interdiction and counterfire capabilities to support contingency forces. Early in 1990, the school also reaffirmed the contingency forces' dependency on corps artillery to engage deep targets. Even though the corps could furnish such support from the Multiple-Launch Rocket System and 155-mm. howitzers, the availability of aircraft for transportation could limit or even preclude employing these weapons during the early stages of a conflict. This would force early deploying light divisions to depend upon close air support, naval gunfire, attack helicopters, and their own general support artillery for targets beyond the range of their direct support artillery. Weather, enemy air defenses, and other problems, however, made the availability of this type of support problematic and made a light multiple rocket system a necessity.[44]

With this reasoning in mind, the Field Artillery School began the search for the right light multiple rocket system to eliminate the counterfire deficiency in light divisions. One option involved adopting foreign technology being used by American allies after making modifications to improve commonality within American forces. Another one was to ask private industry to produce a light version of the Multiple-Launch Rocket System by using a medium weight vehicle as the carriage and a launcher that only fired six rockets rather than twelve as the Multiple-Launch Rocket System did. This would permit keeping the Multiple-Launch Rocket System family of munitions that the Commanding General of TRADOC, General John W. Foss, and General Hallada deemed to be crucial to reduce costs and promote standardization.[45]

In April 1990 the Field Artillery School continued its push to obtain a light multiple rocket system. After reiterating the Multiple-Launch Rocket System's lack of deployability, General Hallada reaffirmed the need for the High Mobility Artillery Rocket System (HIMARS), as the school called its light multiple rocket system. At the same time, he launched efforts to obtain one as quickly as possible.[46]

The drive for automated command, control, and communications for the light forces' field artillery received equal attention to counterfire and a light multiple rocket launcher. Although the light division had the Battery Computer System for technical data solutions and some digital command, control, and communications, its automation clearly lacked the capabilities offered by TACFIRE that was in the heavy forces. Aware of this deficiency and the Advanced Field Artillery Tactical Data System's (AFATDS) fielding that was set for the late 1980s and early 1990s, some congressional committees expressed their concern.[47]

In 1985 House and Senate Appropriations Committees directed the Army to prepare a plan for providing interim automation to its light divisions. Dated 6 September 1985, the Army's plan identified two options. The first involved providing two light divisions with increased quantities of the Fire Support Team Digital Message Device (FIST DMD). Although the device was originally produced for the fire support team in the heavy division, the Army proposed using it in the division, brigade, and battalion fire direction centers in the light division. The device would be tied to the Battery Computer System in the battery and Digital Communications Terminal, a hand-held device used by forward observers, fire support teams, battalion and brigade fire support officers, and battalion and division artillery commanders.

This alternative was a lost-cost, quick-fix solution because the equipment was already being produced and could be fielded in the near future.[48]

The second option consisted of furnishing the light division with a Tactical Computer Processor. The Army subsequently dropped it because it was too heavy and costly and was not compatible with the Army Command and Control System scheduled for introduction in the near future.[49]

Even though the Army only listed two options in its September 1985 plan, a third one existed. Late in October 1983, Litton Data Systems and the 9th Infantry Division (Motorized) started work on Light TACFIRE in response to the Quick Reaction Program, dated 18 November 1982. The program established the need for an artillery tactical data system that had enhanced decentralized operations, was mobile and deployable, and reduced sustainment training to replace battalion TACFIRE. The Light TACFIRE consisted of a Lightweight Briefcase Terminal and peripheral equipment and was scheduled for fielding to the 9th Infantry Division (Motorized) in 1988. Although commanders of the 82nd Airborne Division and 7th Infantry Division expressed the need for Light TACFIRE in 1984 and 1985 and argued that the Fire Support Team Digital Message Device failed to satisfy their needs, the Army decided in June 1985 against obtaining Light TACFIRE for other light divisions. A careful evaluation by the Army determined that Light TACFIRE was too expensive for an interim system, could not be realistically deployed until a year before the Advanced Field Artillery Tactical Data System was introduced, and lacked the potential for growth to meet the requirements of the 1990s without a major and costly redesign.[50]

As a result of this decision and the one to abandon the Tactical Computer Processor, the Army's plan for interim automated fire support in the light division at the close of 1985 ruled out two of the three options. The Fire Support Team Digital Message Device, the Battery Computer System, and the Digital Communications Terminal would provide low-cost upgrades to the existing manual system by 1986 and would be a workable solution to the perplexing problem of command, control, and communication. Full light division automation would come when the Advanced Field Artillery Tactical Data System was fielded in 1989.[51]

Criticism over the decision arose quickly when Senator Dan Quayle requested the General Accounting Office to evaluate the Army's plan for furnishing interim automated fire support to light and heavy divisions. In September 1986 the General Accounting Office explained, "...the Army's plans call for using the FIST/DMD in a much wider role than for which it was designed. The FIST DMD was designed for the FIST company level position, and subsequently procured for the command and battalion fire support elements."[52] By fielding the equipment at battalion level and above fire direction centers and fire support elements, which had much greater requirements than the fire support team, the Army would employ it in a role for which it was not designed. As a result, the Fire Support Team Digital Message Device might not have the capabilities to meet the light division's automation needs. The General Accounting Office raised a valid concern and at the same time questioned the wisdom of the Army's decision.[53]

In view of its perception of the inadequacy of the Fire Support Team Digital Message Device for the light division, the General Accounting Office supported procuring Light TACFIRE,

even though it was more expensive, because it could perform more fire support missions. From the General Accounting Office's vantage point, the Army had to chose between a low-cost solution that provided limited increased capabilities in automated command, control, and communications and a higher cost one with a significant improvement in capabilities as its interim system.[54]

Notwithstanding the General Accounting Office's position, the Army still persisted in moving ahead in 1987 with its plan to give the Fire Support Team Digital Message Device, the Battery Computer System, and the Digital Communications Terminal to the light divisions as interim solutions. Although this action was not ideal, the pressure for getting automated command, control, and communications for the light divisions was great. Those needs were receiving increased attention in light of the growing possibility of contingency operations throughout the world. As a result, the Army could not sit back and wait, nor could it expend huge sums of money for an interim system when an objective system was being developed and would be available within a few years. The service had to move as rapidly and effectively as possible to automate light divisions.[55]

Although the Army's decision to press forward with the Fire Support Digital Message Device appeared to be viable and reasonable, Congress did not relent in its effort to provide the light divisions with Light TACFIRE. Influenced by the General Accounting Office's report of September 1986, Congress passed Fiscal Year (FY) 1987 Continuing Resolution. It directed the Army to subject Light TACFIRE to operational testing under the auspices of an independent Department of Defense testing agency and to report the findings to the Senate and House Appropriations Committee by June 1987. Based upon a test conducted from March through April 1987 using the 9th Infantry Division (Motorized) configured as a light division in an operational environment and other tests and studies, the Army concluded that Light TACFIRE was not operationally effective as the objective system. The Army also determined that Light TACFIRE was inadequate as an interim system even though it was an improvement over manual methods.[56]

As of the mid-summer of 1987, automating fire support in the light division had stalled and had become politically controversial, with Congress and the Army opposing each other's solutions. In reality, neither the Fire Support Team Digital Message Device nor Light TACFIRE seemed to provide the answer without being improved. Yet, nothing else at the time offered a viable alternative. The Army had to decide between two unsatisfactory systems unless a better option could be found.

On the basis of the situation with automating fire support in the light divisions, the Undersecretary of the Army directed an independent review committee to be convened to assess the proper course of action. During a meeting held on 3-5 August 1987, the committee concluded that the Army should employ the Advanced Field Artillery Tactical Data System and not Light TACFIRE if the tests to determine the validity of the AFATDS concept and software were successful and if AFATDS software could be fielded to light infantry divisions as soon as Light TACFIRE. This motivated the Army to speed up AFATDS's development with the creation of a block approach to software acquisition. Block one would be designed for light divisions to give them the capacity to operate in conventional and mid-intensity level conflicts with fielding in 1990, while block two would provide software for corps and heavy divisions

and furnish much of the objective AFATDS capabilities. Block three would be the objective software and would be fielded in 1991. As the action of the committee indicated, the pressure to adopt Light TACFIRE continued unabated and caused the Army to modify AFATDS in order to fend off the supporters of Light TACFIRE.[57]

Realizing that the Advanced Field Artillery Tactical Data System was only in the conceptual phase of development and unproven, the Undersecretary subsequently indicated that work on both Light TACFIRE and AFATDS would continue until the concept evaluation program for AFATDS was completed in 1987. At that time a decision would be made whether the Army would procure Light TACFIRE or AFATDS for its light divisions. This decision applied even more pressure because it kept Light TACFIRE alive for fielding to light divisions if AFATDS failed.[58]

Because some senators and congressmen thought that Light TACFIRE was not only a short-term solution but also an inexpensive, long-term solution for automated fire support, Congress persisted in pressing to introduce the system. In December 1987 Congress told the Army to develop an acquisition plan for Light TACFIRE. Four months later, the Chairman of the House Appropriations Committee and the Army Vice Chief of Staff reached an agreement. The Advanced Field Artillery Tactical Data System would be fielded to the heavy divisions, and Light TACFIRE would go to the light divisions until the former could be developed. Later in 1988, Congress reaffirmed this agreement by directing the Army to purchase Light TACFIRE as the interim system and provided the funding. With this guidance the Army awarded a contract to Litton Data Systems for Light TACFIRE Briefcase Terminals.[59]

Directed by Congress, the Army modified its light division interim automation program in 1988 and 1989. The Army decided to purchase a package of Light TACFIRE, Fire Support Team Digital Message Devices, Digital Communications Terminals, and Forward Entry Devices with an initial operational capability of early 1990. The Forward Entry Device would provide the same capabilities as the Digital Communication Terminal and would be part of the Army Tactical Command and Control System. The Light TACFIRE Briefcase Terminal would be fielded in the direct support battalion fire direction center, the division artillery fire direction center, and the division main and tactical fire support element. The Fire Support Team Digital Message Device, which had been improved by the contractors since the 1987 tests, would be placed with the battalion and brigade fire support elements, while the Digital Communications Terminal would be given to the forward observer, fire support team, battalion and brigade fire support officers, and battalion and division artillery commanders. Rather than making a complete break with its 1985 plan, the Army merely made an accommodation to satisfy Congress to make the best of a bad situation. The 1988-1989 plan blended the desires of Congress and the Army into one plan so that both were satisfied.[60]

With the exception of work slowing down with the Firefinder radar modifications, the Field Artillery School experienced some success in equipping and organizing fire support for the light forces. As the 1980s were drawing to a close, new field pieces and equipment were being introduced, while interim automated command, control, and communications systems were being adopted just as contingency operations were being elevated in importance with the collapse of the Warsaw Pact and the Soviet Union and the reduced threat of high-intensity conflict in Europe.

For the field artillery, contingency operations did not portend less serious conflicts. The Field Artillery School and TRADOC pointed out that chemical weapons were proliferating and that virtually every country would have some degree of sophisticated equipment. Although the threat of a high-intensity conflict in Europe was diminishing in 1989-1990, the lethality of the battlefield certainly was not. Even forces in low-intensity conflicts would have the capability of employing highly sophisticated technology on the battlefield. A hostile world still confronted the Army, the Field Artillery School, and the field artillery.[61]

Notwithstanding the requirements of the future as seen by the field artillery, which was in a state of transition as the 1990s opened, modernization of the arm for the heavy and light forces experienced mixed progress during the 1980s. Whereas the field artillery had doctrine and organization for fighting in Europe, materiel with the exception of a few systems, such as the Multiple-Launch Rocket System, did not exist, due to budget cuts. In some instances, budget reductions and the time required to develop a new system slowed down the acquisition process so that systems that were initially intended to be fielded early in the 1990s, such as the Advanced Field Artillery Tactical Data System, were behind schedule. In comparison, field artillery systems to support the light forces were beginning to appear, while doctrine lagged. Finally, even though many Army officers since the early part of the decade had pointed out the need for doctrine for heavy-light operations, that doctrine was even less defined than field artillery doctrine for light forces as a result of the raging controversy over combining heavy and light forces for combat operations.

CHAPTER IV

OPERATION DESERT STORM AND THE FIELD ARTILLERY

In the midst of the Army's ambitious modernization effort, a crisis in the Persian Gulf erupted when Iraq invaded Kuwait in the summer of 1990. The United States and United Nations reacted rapidly to defend Saudi Arabia from Iraqi aggression and to force Iraq to withdraw from Kuwait. In the process, the Army had the opportunity of testing the results of its modernization program in actual combat.

THE AMERICAN RESPONSE

Early on 2 August 1990, the first Iraqi military columns attacked the small, oil-rich state of Kuwait after Iraq and Kuwait had failed to resolve their long-standing differences over oil production and prices and other controversial issues. Equipped with Soviet- and Western-made military technology, three Republican Guard divisions (two armored, the Medina and Hammurabi, and one mechanized, the Tawakalna) invaded Kuwait. One division raced down the coastal road to Kuwait City. One division moved to seize the inland oil fields, while the third division rushed to secure Kuwait's border with Saudia Arabia. Although the emir of Kuwait and other government officials escaped and eventually formed a government in exile, Iraqi military forces rolled over scattered and ineffective Kuwaiti military opposition. By the time that the Iraqis had completed their blitzkrieg, they were in a position to invade Saudia Arabia and seize control of most of the Persian Gulf oil resources upon which the world depended so heavily. For the Saudis an attack was a distinct possibility because intelligence data at the time indicated that the Iraqi leader, Saddam Hussein, planned to dismember their country as well as Bahrain and Qatar.[1]

The United States and the United Nations quickly acted to resolve the crisis. The very day of the invasion, President George Bush froze Iraqi and Kuwaiti assets and signed an executive order that banned trade with them, while the United Nations demanded an immediate and unconditional withdrawal. The following day, President Bush warned Iraq not to invade Saudi Arabia and offered American assistance to the Saudi ruler, King Fahd, who accepted it on 6 August 1990.[2]

To defend Saudi Arabia and compel Iraq to withdraw from Kuwait, the United Nations initiated Operation Desert Shield, a huge buildup of a multinational military force. On 6 August 1990 the United States began deploying the 1st Tactical Fighter Wing and the 82nd Airborne Division to Saudi Arabia and shortly thereafter dispatched the 7th Marine Expeditionary Brigade and several strategically located supply ships based at the United States facility at Diego Garcia in the Indian Ocean. By November 1990 American ground forces in Saudia Arabia complemented by air and naval forces included U.S. Marine units, the 82nd Airborne Division, the 101st Air Assault Division, the 24th Infantry Division (Mechanized), the 1st Cavalry Division, and the 3rd Armored Division. All of these forces were complemented by European, Arab, and African troops.[3]

Initially, the United States and United Nations planned to stay on the defensive. When it became apparent that economic sanctions would not drive Saddam Hussein out of Kuwait, they turned to Operation Desert Storm, a major military offensive.[4]

In November 1990 President Bush outlined his objective to augment Allied forces already in the Gulf region with an additional two hundred thousand American troops by transferring mechanized and armored units from Germany and the United States and by bringing in more air and naval units. This led to shipping the VII Corps from Germany, the 1st Infantry Division (Mechanized) from the United States, and other units and extended the call-up of Reserve and National Guard units of all the services. By bolstering combat strength the President gave the Allied forces the capability of waging an offensive war to free Kuwait.[5]

THE WAR AND FIELD ARTILLERY

After Saddam Hussein failed to withdraw his forces from Kuwait by the 15 January 1991 deadline established by President Bush and supported by Congress and the United Nations, Operation Desert Storm commenced with an aggressive air offensive early in the morning of 16 January 1991. Lasting through 23 February 1991, the Allied air campaign systematically crippled Iraqi war making capabilities and shaped the battlefield for the ground war that followed.[6]

On 24 February 1991, American and Allied ground forces struck. As the Allies threatened amphibious landings, assaulted with U.S. Marines supported by Saudi forces across the eastern part of Kuwait's southern border toward Kuwait City, and conducted probes farther to the west, the U.S. XVIII Airborne Corps on the Allied extreme left flank penetrated deep into Iraq to the Euphrates River Valley on the first day to isolate the enemy and prevent reinforcement. Meanwhile, to the west of the Marines, Arab coalition forces pushed beyond the Kuwaiti-Saudi border barriers to deceive the enemy into believing that a frontal assault was underway. As this was occurring, the U.S. VII Corps executed a massive wheeling maneuver north and east to encircle Iraqi forces as the U.S. Marine and Arab coalition drove up from the south to Kuwait City. Within one hundred hours, Allied ground forces had liberated Kuwait.[7]

During Operation Desert Shield from August 1990 through January 1991, the Total Army deployed field artillery units from active and reserve components to Saudi Arabia to support American and Allied maneuver forces. By the time that the deployments had been completed, the Army's field artillery force consisted of forty-three battalions (108 105-mm

howitzers, 642 towed and self-propelled 155-mm. howitzers, 96 8-inch self-propelled howitzers, and 189 Multiple-Launch Rocket Systems with 18 of them being configured for the Army Tactical Missile System). They were organized into seven division artilleries and seven artillery brigades with two corps artillery headquarters providing command and control of corps assets.[8]

The dramatic success of Operation Desert Storm highlighted fire support strengths as well as weaknesses. Within months after the liberation of Kuwait, the Field Artillery School issued "emerging observations" from the war in July 1991 on doctrine, organization, materiel, training, and leadership in a report to the Director of the Center for Army Lessons Learned, Fort Leavenworth, Kansas. Based on interviews with participants and after action reports, the observations offered critically needed perspectives on the field artillery's ability to provide fire support and identified ways to make it more effective.[9]

As numerous commanders, participants, and observers noted, Operation Desert Storm validated AirLand Battle fire support doctrine as it had evolved through early 1991. In an article published in *Field Artillery* in April 1991, Colonel David A. Rolston, who had given up command of the 24th Infantry Division (Mechanized) Artillery in December 1990 after two years in command and had become the Deputy Assistant Commandant of the Field Artillery School in January 1991, reaffirmed the value of massed fires. He wrote, "Training prior to the deployment and the operation itself reinforced another tenet: don't dilute fire support by 'nickel and diming' the effort with fires on small and relatively insignificant targets. Hit the high-payoff targets with massive fires."[10] To be sure, this pronouncement reinforced the necessity of massing artillery fires that had been learned over the years and offered no new prescriptions for artillery fire. Equally important, it was consistent with the thinking of brigade, division, and corps commanders, who stated in the aftermath of Operation Desert Storm that the massive use of artillery fires paved the way for the rapid victory. Fire support, especially field artillery, "was used in Desert Storm to the maximum in order to minimize the number of effective enemy units that our soldiers in tanks and infantry fighting vehicles had to take on at close range."[11]

Despite a significant Iraqi advantage in both numbers of tubes and range capability, the field artillery's "system of systems" helped overwhelm the enemy. The integration of target acquisition systems; command, control, and communication systems; and cannon, rocket, and missile systems took away the enemy's ability to locate targets beyond the forward line of troops and silenced all of the opponent's artillery that dared to fire. Massed artillery fires provided timely support to the maneuver commander, furnished overpowering fire superiority, and allowed the commander to exploit the effects of fires. Rapidly moving artillery formations were able to supply fires when and where the ground forces needed them the most. After reading many after action reports from field artillery units that had participated in Operation Desert Storm, the Director, Fire Support and Combined Arms Operations Department, U.S. Army Field Artillery School, Colonel David A. Rolston, wrote the Director of the Center for Army Lessons Learned in July 1991. He explained, "Our fire was so effective and demoralizing that the Iraqi soldiers gave it the name "STEEL RAIN."[12]

An article in *Field Artillery* in October 1991 reiterated Colonel Rolston's observation. Coordinated fires of upwards to eleven battalions on enemy positions repeatedly proved to be

absolutely devastating. As a captured Iraqi artillery commander related, he lost only ten percent of his field artillery before the ground war. During the initial phases of the ground assault, he lost all of his remaining guns to massed indirect fire.[13] In fact, in that short war, Army field artillery units fired over 57,000 rounds with the M109 self-propelled 155-mm. howitzer shooting over 43,000.[14]

In the fall of 1991, Major Kenneth P. Graves of the S-3 (Operations) section, XVIII Airborne Corps Artillery, also emphasized the impact of massed fires. Acting as the force artillery headquarters in the western sector of the XVIII Airborne Corps for five American artillery battalions, the 18th Field Artillery Brigade (Airborne) habitually massed the entire brigade on targets, while the 24th Infantry Division (Mechanized) Artillery and 212th Field Artillery Brigade usually massed at least three battalions on a target. Major Graves added, "On the final day, the 18th and 212th FA [Field Artillery] Brigades and 24th Infantry Division Artillery massed nine battalions in a devastating early morning preparation to destroy the Hammurabi RGFC [Republic Guard Forces Command] Armored Division."[15]

Major Mark S. Jensen, a battalion operations officer in the 1/27th Field Artillery, a Multiple-Launch Rocket System (MLRS) unit, shared a similar experience with massed fires in an article in *Field Artillery* in August 1991. During an artillery raid in February 1991, his battalion engaged twenty-four targets at ranges between twenty-one and thirty kilometers. The first ripple attacked 15 targets with 181 rockets, and the second fired 106 rockets at 9 targets. In less than five minutes, the battalion delivered the equivalent of seventy-one volleys from a battalion of twenty-four cannons.[16]

Counterfire simultaneously received critical acclaim for its performance. In October 1991 the Commandant, U.S. Army Field Artillery School, Major General Fred F. Marty, published an article in *Field Artillery* that reflected the conclusions of many field artillery personnel and that was based upon his readings of after action reports. Firefinder radars rapidly identified targets for counterfire and sent the data digitally or verbally to the guns. Cannon and MLRS assets then silenced Iraqi artillery by delivering "convincing" fires.[17] That same month, an article in *Field Artillery* exclaimed, "This 'proactive' counterfire destroyed the enemy's will to fight, allowed maneuver forces to maintain the rapid pace of their attack and saved friendly lives."[18]

Although emerging observations confirmed that doctrine as a whole was effective, they concurrently pointed out the existence of some critical weaknesses that required correction. For example, doctrine through corps level was sound, while doctrine for planning and executing fire support at the field army and joint level did not exist. Until the latter stages of the operation, no fully capable fire support element existed at Army Central Command (ARCENT) because tactics, techniques, procedures, and organizational guidelines did not exist to form one.[19]

Simultaneously, controversy over fire support at echelons above corps often adversely influenced joint (Army and Air Force) operations. Responsibilities and structure for planning and executing fire support at the joint force level was not in doctrinal publications, which allowed each service to view fire support from its own perspective and not incorporate the other's. Also, Air Force and Army fire support doctrine often varied, especially over definitions of fire support coordination measures. The Army employed the fire support coordination

line as a permissive fire support coordinating measure that allowed Army units to fire beyond it without coordination, whereas the Air Force treated it as a restrictive measure that required the Army to coordinate all surface-to-surface fires beyond the line. This situation hampered the ability of corps and Army commanders to plan and conduct deep operations and even delayed the processing of long-range missile fires at times because the line had two different and conflicting meanings.[20]

The problems associated with joint fire support doctrine in Operation Desert Storm and the difficulty of forming a fire support cell at Army Central Command led to several conclusions at the Field Artillery School. Army component and joint force headquarters had to establish a staff element with responsibilities similar to a fire support cell at the corps, while doctrine had to be written to guide fire support cells at echelons above corps. Equally important, the Army and Air Force had to develop joint doctrine to resolve interservice fire support doctrinal conflicts, such as that with the fire support coordination line.[21]

Combat service support doctrine for nondivisional artillery units also caused problems in the Persian Gulf. The area support concept for corps units, particularly field artillery brigades, did not provide the required level of support. During Operation Desert Storm, many different combat service support units supported an artillery unit for only a short period of time because of the rapid reallocation of artillery between divisions and corps on the extremely mobile battlefield. This generated confusion and frequently hindered adequate support. For example, a light force oriented combat service support unit often had to support a self-propelled M110 8-inch howitzer battalion. In other instances, because the combat service support unit was not pushed forward fast enough, lines of communications between it and the supported field artillery unit were extremely long, which in turn forced the artillery to depend upon its limited organic haul capacity. As a result of this situation, many field artillery units had run out of or had almost run out of supplies when the cease fire was declared. To resolve this problem the Field Artillery School advocated supplying nondivisional artillery units with dedicated combat service support.[22]

Other problems arose with doctrine as well as organization. Given the importance of the MLRS, a battery of nine launchers could be overworked, if not simply overwhelmed, by the demands of supporting the entire division. Also, the changing relationship of corps field artillery brigades with the division meant that the division could not count on having the field artillery brigade's MLRS battalion when it was needed. To eliminate these two problems the division required a battalion of twenty-seven MLRS launchers rather than a battery of nine launchers. This would improve firepower, permit rotating fire missions among a greater number of MLRS launchers, and allow conducting maintenance and resting the crew.[23] Besides increasing the number of MLRS launchers in the division, the commander of the 1st Infantry Division's artillery, Colonel (later Brigadier General) Michael L. Dotson, went as far as to advocate making two additional cannon battalions organic to the division. This would provide the division commander with sufficient fire support to conduct "most operations without further augmentation."[24]

Although many field artillery officers at division level wanted more firepower than what they had to perform their missions, some at corps level also pushed for additional firepower. For example, the commander of the 42nd Field Artillery Brigade, Colonel (later Brigadier

General) Morris J. Boyd, pointed out in a memorandum a critical motivating factor. In April 1991 he wrote that "we can make up for a shortage of artillery by focusing what you do have at the right place and right time, but it isn't easy."[25] This implied that an extraordinary effort on the part of field artillerymen was required to offset the lack of sufficient quantities of artillery. Having more artillery to make the field artillery's job much easier was Boyd's implicit message.[26]

In comparison, Operation Desert Storm provided a number of notable materiel successes. In its first use in combat, the Multiple-Launch Rocket System decisively demonstrated its ability to shoot, move, and survive and to inflict tremendous damage to the enemy's morale and materiel. In fact, it was the "weapon of choice" to silence the enemy artillery in counterfire missions up to a range of thirty kilometers. In response to the weapon's performance, the Commander, 212th Field Artillery Brigade, Fort Sill, Colonel Floyd T. Banks, said, "It is a great weapon system."[27] The Commander, 1st Armored Division Artillery, Colonel Vollney B. Corn, Jr., supported this view when he explained that the system's accuracy and lethality quickly established it as a "critical part of our force artillery firepower. In particular, we relied on the MLRS as our primary counterfire weapon, and in this role, we silenced all enemy artillery that fired at us."[28] Although the system was an incomparable area support weapon and worked harmoniously with tube artillery, it lacked pinpoint accuracy to serve as a close support weapon and certainly was not a replacement for tube artillery.[29]

Although it was in limited production, the Army Tactical Missile System complemented the Multiple-Launch Rocket System and tube artillery. Fired from a MLRS launcher, it furnished the corps commander with the ability to attack critical deep targets at ranges beyond one hundred kilometers. Of the 102 Army Tactical Missile Systems sent to the Gulf — all that the Army had available at the time — approximately thirty were kept under the control of Army Central Command to ensure that they were used only against high-value targets. Limited by the number of systems available and a supporting policy, the field artillery shot the Army Tactical Missile System at Scud missile and air defense missile sites, logistical bases, tactical bridges, and gun and rocket artillery positions.[30] Even though precision submunitions for the system were still under development during the war, the existing warhead loaded with dozens of dual-purpose antimateriel and antipersonnel bomblets destroyed every engaged target according to preliminary reports.[31] Reflecting upon his brigade's employment of the Army Tactical Missile System, the Commander, 75th Field Artillery Brigade, Colonel (later Brigadier General) Jerry L. Laws, stated that the system performed better than anticipated and played a critical role in defeating the Iraqi army.[32]

Also previously untested in combat, target acquisition systems executed their missions well in the Gulf War. Despite some mobility problems, highly sensitive Firefinder radar systems (Q-36 and Q-37) detected any type of object moving in a ballistic trajectory through the air. If the targeting process verified the existence of an actual target, such as an enemy artillery unit, the artillery then fired at it. Such a capacity gave American field artillery a distinct advantage over Iraqi artillery, which had lost its target acquisition capabilities early during the air war and could not determine the location of Allied artillery positions.[33]

Although Firefinder radars performed well in the counterfire battle, the field artillery still required the ability to acquire enemy artillery before it fired. In the view of many, a

remotely piloted vehicle (RPV), also called an unmanned aerial vehicle (UAV), would have satisfied this deficiency. Writing in the *Field Artillery* in October 1991, Colonel Corn explained, "One of the most effective target acquisition means used in the theater was the British RPV."[34] For the British, the system furnished outstanding real-time intelligence for artillery target processing as well as maneuvering — capabilities that the American army, especially the field artillery, lacked as a result of the death of the Aquila RPV program late in the 1980s. "If I still had Aquila . . . , it would have been in Southwest Asia, and the Army would be buying it right now," exclaimed the Director, Target Acquisition Department, U.S. Army Field Artillery School, Colonel Stanley E. Griffith, in July 1991.[35]

From these colonels' and others' vantage points, Operation Desert Storm substantiated the requirement for a remotely piloted vehicle. "If we [the Army] had been able to send it [the Aquila] over there [Southwest Asia], that would have been the hero of the war not GPS [Global Positioning System]," Colonel Griffith asserted as he assessed the potential impact of the Aquila in the war.[36] Based upon the success of the British RPV and the requirement for real-time intelligence and targeting, these officers and the Fire Support and Combined Arms Operations Department in the Field Artillery School argued for acquiring an unmanned aerial vehicle for fire support missions as soon as possible.[37]

Another system, the OH-58D helicopter that the field artillery had also lost during the latter years of the 1980s because budget reductions had decreased the number of helicopters to be purchased also performed well in Desert Storm. Two senior field artillery commanders from Fort Sill, who served in the Gulf, unanimously agreed about the system's importance for target acquisition for field artillery. Looking back upon his unit's experience with the OH-58D, Colonel Laws said, "It was superb, exceptional."[38]

Unfortunately, the helicopter was almost always used as a division aviation asset. For the most part, OH-58Ds operated with AH-64 Apache helicopters to designate targets for Hellfire precision-guided missiles.[39] This practice limited the field artillery's opportunity for employing them in a target acquisition role. Even so, the restricted but successful employment of the OH-58D in fire support roles corroborated the requirement for having the helicopter organic to division artillery where the division artillery commander could determine its deployment and have it at his disposal to acquire targets and lase targets for Copperhead munitions.[40]

As Operation Desert Storm indicated, the very target acquisition systems — the OH-58D and a remotely piloted vehicle that the Field Artillery School had worked so hard to obtain during the 1980s but had lost — proved to be critical. Unfortunately, someone else controlled both systems and determined their employment.

Notwithstanding the problems just noted, the Commanding General, 24th Infantry Division (Mechanized), Major General (later Lieutenant General) Barry R. McCaffrey, summed up the contribution of fire support to the quick victory over the Iraqis in the *Field Artillery*. In moving prose, General McCaffrey said, "All of us appreciate the tremendous contribution of the artillery. Our enormous success was due, in large part, to the artillery."[41] Armor and airpower might have appeared to be more dramatic and "glamorous," but the field artillery played a critical role by permitting the other combat arms to maneuver and simultaneously limited casualties. The field artillery was a vital member of the combined arms team.[42]

Although the General's comments directly addressed the field artillery's contribution to the victory in the Persian Gulf, they also provided insight into the modernization program of the past two decades. Launched early in the 1970s in response to the Soviet and Warsaw Pact military buildup and to an appreciation of the greatly increased lethality of modern weapons, the effort produced the doctrine, force structure, and many of the field artillery systems employed in the Gulf War. Addressing the modernization program, the Commanding General, III Corps Artillery, Fort Sill, Brigadier General Howard J. von Kaenel, said, "The investment ... in hardware, the investment in training and maintenance . . . were totally justified and led to the success . . . with a minimal loss of life not just of American lives but enemy lives as well."[43]

General von Kaenel's remark pointed out the critical factor of training. Along with introducing new systems, tactics, doctrine, and organizations, the Army had dramatically improved its training since 1973. The traditional Army Training Program had prescribed the number of hours to be devoted to each subject and task but had never really focused on the quality of the training, and it was abandoned. In its place the U.S. Army Training and Doctrine Command (TRADOC) developed a performance-oriented training program that required soldiers and units to perform to a prescribed standard. The program included the Army Training and Evaluation Program (ARTEP) for unit collective training, Skill Qualification Tests (SQT) for determining individual proficiency, a new literature program, and training extension courses. Subsequently, the drive for force-on-force and live-fire exercises to make training more realistic led to the creation of the National Training Center in 1982 at Fort Irwin, California; the Joint Readiness Training Center in 1987 at Fort Chaffee, Arkansas; the Combat Maneuver Training Center in 1987 at Hohenfels, Germany; and the Battle Command Training Program in 1987, a five-day war fighting seminar at Fort Leavenworth, Kansas. Together, the various elements of the program produced highly-trained soldiers and units.[44]

The vast field artillery modernization program designed with fighting in Europe in mind paid valuable dividends in Southwest Asia early in 1991. The training, equipment, doctrine, and organization that appeared after 1973 performed effectively and met expectations.

CONCLUSION

Once again focusing attention upon Europe after a long preoccupation with Vietnam during most of the 1960s and early 1970s, the U.S. Army, a major component of the North Atlantic Treaty Organization's (NATO) armed forces, confronted a numerically superior and well-equipped military colossus, the Soviet-led Warsaw Pact. In view of the overwhelming threat that it faced in Europe and the greatly enhanced lethality of modern weapons revealed by the Arab-Israeli War of 1973, the Army had to modernize to survive on the modern battlefield. It had to rewrite doctrine, reform training, reorganize its force structure, and reequip with state-of-the-art technology.

Written by the U.S. Army Training and Doctrine Command (TRADOC) during the mid-1970s, active defense doctrine presented a means to fight outnumbered and win. It emphasized employing liberal doses of firepower on the defense before turning to the offense. In harmony with that doctrine and other work being done by TRADOC to design a heavy division for combat in Europe, the U.S. Army Field Artillery School rewrote field artillery doctrine and reorganized the field artillery so that it could apply its firepower more effectively.

Although new doctrine and force structures were imperative reforms, field artillery systems (weapons; target acquisition; support; and command, control, and communications) of the times severely restricted their impact. The field artillery was composed of 1950s technology, even though an incipient modernization effort was unfolding. The old technology was pitted against the threat's technology that was superior in many cases. For that reason, the field artillery had to initiate an extensive acquisition program to achieve technological parity, if not superiority. However, unlike doctrinal and organizational reforms that could be accomplished in a relatively short period of time, obtaining new technology would take years.

Although the modernization effort initiated early in the 1970s to remedy the Army's unenviable position in Europe would enhance the field artillery's ability to fight, it had a serious limitation. The active defense did not sufficiently consider the Soviet Union's and Warsaw Pact's tactic of echeloning their armed forces to give them the capability of overwhelming NATO's defenses even if NATO had stopped the first echelon. Aware of the glaring weakness of the active defense, the Army had to revise its doctrine. During the latter 1970s and early 1980s, TRADOC replaced the active defense with Airland Battle doctrine that was specifically designed for fighting echeloned forces and concurrently developed the Army of Excellence corps and heavy division.

For the field artillery, supporting Airland Battle doctrine posed serious problems. It required engaging the enemy's first and second echelons simultaneously, a capability that the

field artillery did not have. In addition, doctrine described a highly mobile battlefield for which existing field artillery was not suited. These critical deficiencies led to a new round of system acquisition beginning in the late 1970s and early 1980s to obtain field artillery systems that could engage the second echelon and fight on a highly mobile battlefield.

Even though the Field Artillery School rewrote doctrine, revamped force structure, and worked hard to introduce new systems, the effort to modernize the field artillery for a high-intensity conflict in Europe failed to produce the intended results. The Commanding General, U.S. Army, Europe, General Glenn K. Otis, identified fire support (naval gunfire, tactical air, mortars, and field artillery) as his command's number one deficiency in 1987. Much to his chagrin, acquiring new field artillery systems had not kept up with the Army's overall pace of modernization. Since the early 1970s the Army had consistently ranked the acquisition of new field artillery systems low on its list of priorities and had not funded or paid sufficient attention to this critical combat arm. Along with the complexity of system acquisition, that neglect had limited the number of new field artillery systems that were available to support Airland Battle. Only the towed M198 155-mm. howitzer, the Multiple-Launch Rocket System, the AN/TPQ-36 and AN/TPQ-37 counterfire radars, and Tactical Fire Direction System were added during the two decades of modernization. Of these major systems, only the Multiple-Launch Rocket System had the required characteristics to fight on the deep, highly lethal, and mobile battlefield envisioned by Airland Battle.

Even before steps could be taken to eliminate the deficiency by increasing production of the Multiple-Launch Rocket System or by stepping up the pace of modernization, international events changed the political scene in Europe. The end of the Cold War, which had fueled the massive arms buildup in Europe, now raised the critical question about the necessity of maintaining a large American military presence on the continent and simultaneously threatened to stall modernization. As far as the Army, TRADOC, and the Field Artillery School were concerned, the new political climate in Europe did not mean that modernization should come to a halt. Threats to American national security still existed that justified the requirement to continue modernizing.

While the field artillery struggled to modernize for a high-intensity conflict, the organizing and equipping of light forces for contingency operations attracted increasing attention, especially after 1979. Because of the ambiguous role of field artillery in low- to mid-intensity conflicts and because of the debate over heavy-light operations, however, the field artillery was still striving at the end of the 1980s to develop suitable light-force doctrine. Yet, the fielding of weapon systems and interim automated command, control, and communications systems for the light forces was underway.

The modernization of the King of Battle had achieved mixed results as the 1980s drew to a close. On the one hand, many critical systems for combat in Europe still had not yet appeared despite years of work, although doctrine and organizations were in place. That meant that exploiting Airland Battle doctrine and the heavy division would be difficult. On the other hand, vital systems to support low- and mid-intensity conflict were being introduced, although the corresponding doctrine was still being debated. Notwithstanding this ambiguous situation, the Persian Gulf crisis of 1990-1991 suggested that the modernization effort of the 1970s and 1980s was not unproductive. The modernized field artillery systems that had been introduced

as well as the new doctrine performed as anticipated. Some systems, such as the Multiple-Launch Rocket System, even surpassed performance standards.

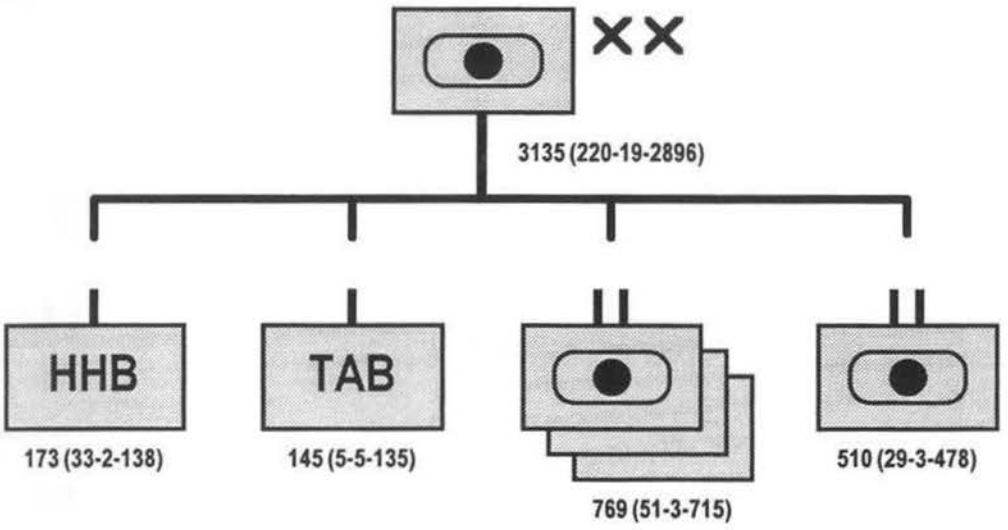
Although a number of needed systems were in development in 1991 and doctrine in some instances remained unclear, particularly for low- to mid-intensity conflicts, the overall modernization of the field artillery since the Vietnam War had achieved notable success. The effort set the stage for revolutionizing American field artillery by high technology at the approach of the 21st century.

LIST OF ACRONYMS

AFAS	Advanced Field Artillery System
AFATDS	Advanced Field Artillery Tactical Data System
AHIP	Army Helicopter Improvement Program
ARCENT	Army Central Command
Army TACMS	Army Tactical Missile System
ARTEP	Army Training and Evaluation Program
ATACMS	Army Tactical Missile System
CALL	Center for Army Lessons Learned
CSSG	Close Support Study Group
DSWS	Division Support Weapon System
ESPAWS	Enhanced Self-Propelled Artillery Weapon System
FADAC	Field Artillery Digital Automated Computer
FAMAS	Field Artillery Meteorological Acquisition System
FDC	Fire Direction Center
FIST	Fire Support Team
FIST DMD	Fire Support Team Digital Message Device
FM	Field Manual
FORSCOM	U.S. Army Forces Command
FOV	Forward Observation Vehicle
FSCOORD	Fire Support Coordinator
FY	Fiscal Year
GPS	Global Positioning System
GSRS	General Support Rocket System
HELP	Howitzer Extended Life Program
HHB	Headquarters and Headquarters Battery
HIP	Howitzer Improvement Program
HMMWV	High Mobility Multipurpose Wheeled Vehicle
INF	Intermediate-range Nuclear Forces
MLRS	Multiple-Launch Rocket System
NATO	North Atlantic Treaty Organization
RGFC	Republican Guard Forces Command
ROAD	Reorganization Objective Army Division
RPV	Remotely Piloted Vehicle
SADARM	Sense-and-Destroy Armor Munition
SQT	Skill Qualification Test
TAB	Target Acquisition Battery
TACFIRE	Tactical Fire Direction System
TRADOC	U.S. Army Training and Doctrine Command
UAV	Unmanned Aerial Vehicle

Appendix A

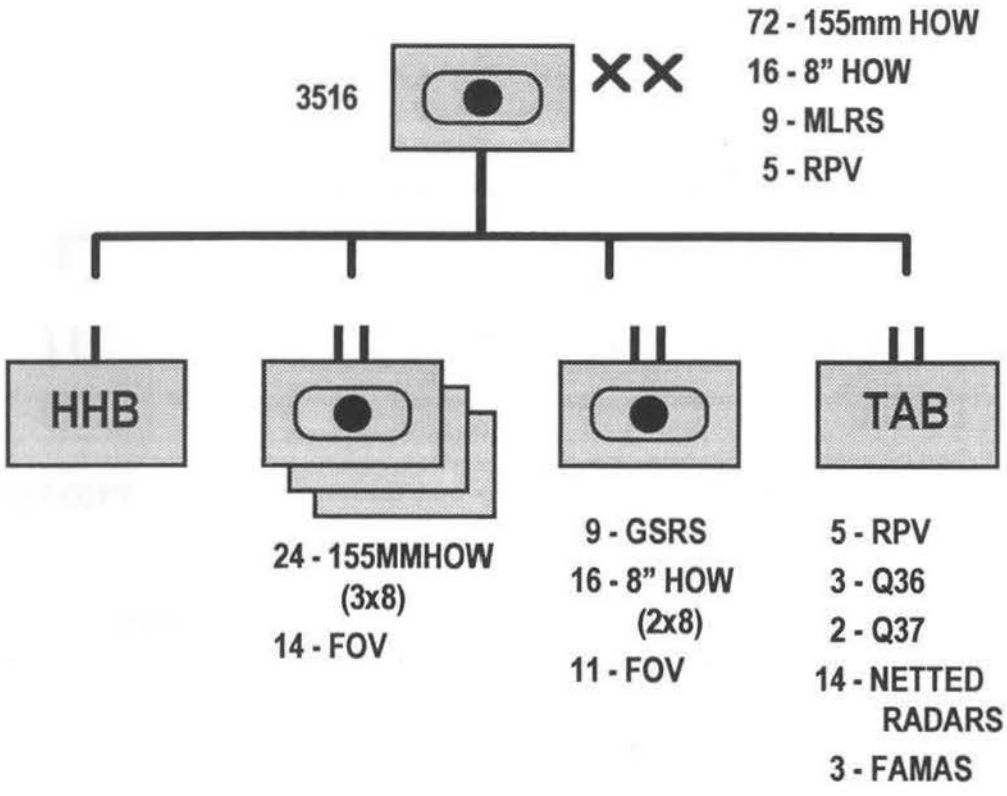
DIVISION RESTRUCTURING STUDY
HEAVY DIVISION ARTILLERY



Source: TRADOC Division Restructuring Study, Phase I, The Heavy Division, 1 March 1977, E-1-11 - E-1-12

Appendix B

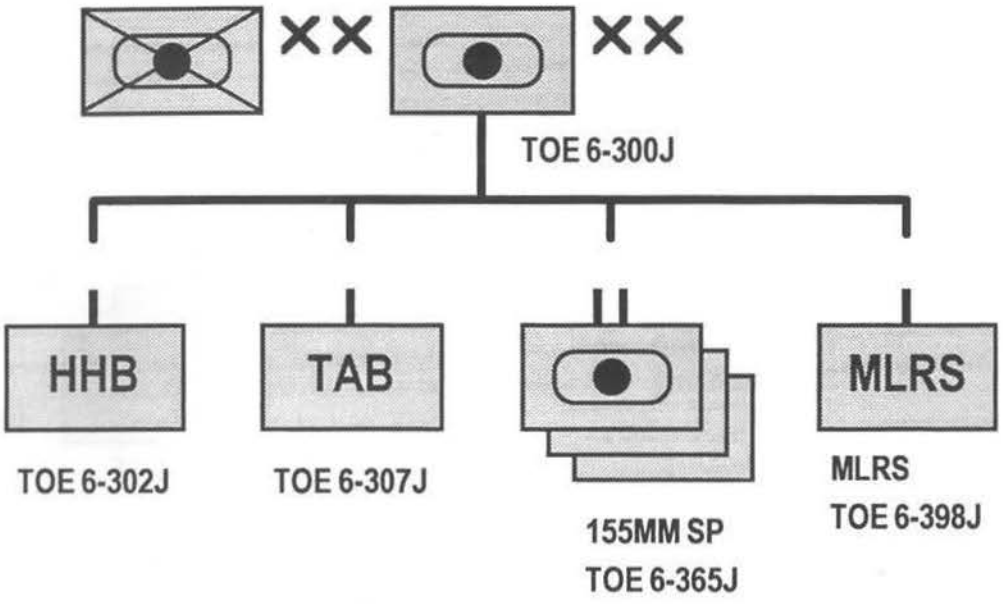
HEAVY DIVISION 86
DIVISION ARTILLERY



Source: John L. Romjue, A History of Army 86, Division 86: The Development of the Heavy Division, Vol I (Fort Monroe, VA: Historical Office, U.S. Army Training and Doctrine Command, 1982), p. 116.

Appendix C

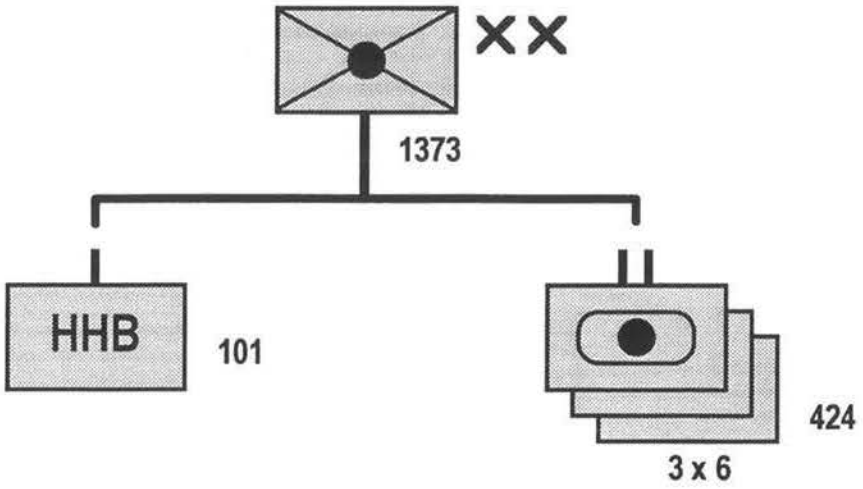
ARMY OF EXCELLENCE (AOE)
ARMORED AND MECHANIZED INFANTRY DIVISION ARTILLERY



Source: U.S. Army Command and General Staff College, Organizational and Tactical Reference Data for the Army in the Field, June 1986, p. 9-4.

Appendix D

ARMY OF EXCELLENCE (AOE)
LIGHT INFANTRY DIVISION ARTILLERY



RECAP

4 - FDC (TACFIRE)
54 - M102 HOWITZERS
3 - Q36 RADARS
246 - HMMWV
25 - TRK 5T

Source: John L. Romjue, The Army of Excellence: The Development of the 1980s Army (Fort Monroe, VA: Office of the Command Historian, U.S. Army Training and Doctrine Command, 1993), p. 158.

Appendix E

MAJOR FIELD ARTILLERY WEAPONS IN 1991

System	Range	Prime Mover
M102 105-mm. howitzer	11.5 kilometers with conventional projectiles	truck
	15.1 kilometers with rocket-assisted projectiles	
M119 105-mm. howitzer	14.3 kilometers with conventional projectiles	truck
	19.5 kilometers with rocket-assisted projectiles	
M198 155-mm. howitzer	30 kilometers with rocket-assisted projectiles	truck
M109A2/A3 155-mm. howitzer	18.5 kilometers	self-propelled
	23.7 kilometers with rocket-assisted projectiles	
M109 155-mm. HIP howitzer (Paladin)	NA	self-propelled
M110A2 8-inch howitzer	30 kilometers with rocket-assisted projectiles	self-propelled
Multiple-Launch Rocket System	30 kilometers	self-propelled
Lance Missile	91 kilometers	NA
Army Tactical Missile System	124 kilometers	self-propelled

Source: 1993 U.S. Army Field Artillery Center and Fort Sill Annual Command History, pp. 125, 126, and 160; "Field Artillery Equipment and Munitions Update," *Field Artillery*, Dec 1990, pp. 49-55.

END NOTES

CHAPTER ONE

1. Paul H. Herbert, *Deciding What Has to Be Done: General William E. DePuy and the 1976 Edition of FM 100-5, Operations* (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1988), pp. 5-6; John L. Romjue, *From Active Defense to AirLand Battle: The Development of Army Doctrine, 1973-1982* (Fort Monroe, VA: U.S. Army Training and Doctrine Command [TRADOC] Historical Office, 1984), p. 3; Draft Training Circular 6-4-1, May 75, p. 1, U.S. Army Field Artillery School (USAFAS), The Threat Background Material File, Morris Swett Technical Library (MSTL) Archives, Fire Support Research Center (FSRC), USAFAS.

2. Russell F. Weigley, *History of the United States Army* (Bloomington, IN: Indiana University Press, 1984), pp. 522, 526, 536, 573-78; Maj Robert A. Doughty, *The Evolution of U.S. Army Tactical Doctrine, 1946-76* (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1979), p. 43.

3. Maj Gen David E. Ott, "Counterfire," Draft Article, ca. mid-1976, Chronology of Counterfire Doctrine Development/Evaluation File, MSTL Archives; Herbert, *Deciding What Has to Be Done,* pp. 29-36; Romjue, *From Active Defense to AirLand Battle*, pp. 3, 6-7; Doughty, *The Evolution of U.S. Army Tactical Doctrine, 1946-76*, pp. 41-42; Interview, Dr. Boyd L. Dastrup with Maj Gen (Ret) Eugene S. Korpal, former Cmdt, USAFAS, 24 Feb 92, Historical Records and Document Collection (HRDC), Command Historian's Office, U.S. Army Field Artillery Center and Fort Sill (USAFACFS); Maj Joseph A. Adelman, "Preparedness for Counterfire," unpublished Masters of Military Art and Science thesis, U.S. Army Command and General Staff College, 1984, p. 43.

4. Romjue, *From Active Defense to AirLand Battle*, p. 7; John L. Romjue, Susan Canedy, and Anne W. Chapman, *Prepare the Army for War: A Historical Overview of the Army Training and Doctrine Command, 1973-1993* (Fort Monroe, VA: Office of the Command Historian, U.S. Army Training and Doctrine Command, 1993), p. 43; Weigley, *History of the United States Army*, pp. 584-86; Memorandum for Record, 1 Dec 75, FM 6-20 File, USAFAS, Office of the Assistant Commandant (AC), MSTL Archives; Ltr, Lt Gen (Ret) David E. Ott to Dastrup, 12 Feb 93, HRDC; Oral History Interview, Col Stanley Cass with Lt Gen David E. Ott, Dec 79, U.S. Army Military History Institute, Carlisle Barracks, PA, p. 46; Robert H. Scales, Jr., *et al, Certain Victory: The U.S. Army in the Gulf War* (Washington DC: Office of the Chief of Staff, U.S. Army, 1993), pp. 9-10.

5. See Boyd L. Dastrup's *King of Battle: A Branch History of the U.S. Army's Field Artillery* (Fort Monroe, VA: TRADOC Historical Office, 1992) for a short perspective on modernizing the field artillery during the 1970s. Herbert, *Deciding What Has to Be Done*, pp. 1, 5, 6, 101-02.

6. FM 100-5, *Operations*, 1 Jul 76, pp. 2-1 - 2-32; Herbert, *Deciding What Has to Be Done*, pp. 36, 39, 79-85. TRADOC was created as a result of Operation Steadfast that was a major reorganization of the U.S. Army in 1973. Operation Steadfast disestablished the U.S. Army Combat Developments Command and the U.S. Continental Army Command, and established TRADOC and the U.S. Army Forces Command (FORSCOM). TRADOC acquired responsibilities for individual training, researching new techniques of land warfare, and developing doctrine, while FORSCOM gained control over U.S.-based operational units.

7. Doughty, *The Evolution of U.S. Army Tactical Doctrine, 1946-76*, pp. 44-45; Weigley, *History of the United States Army*, p. 578; Romjue, Canedy, and Chapman, *Prepare the Army for War*, p. 52.

8. DePuy, "Field Manual 100-5," Position Paper, Sep 76, Field Manuals File, USAFAS, Office of the AC, MSTL Archives.

9. FM 100-5, pp. 1-1 - 1-5; Herbert, *Deciding What Has to Be Done*, p. 7.

10. FM 6-20, *Fire Support in Combined Arms Operations*, May 77, preface; Memorandum, 1 Dec 75, FM 6-20 File, MSTL Archives; Ltr, Maj Gen Donald R. Keith to Maj Gen John R. Thurman III, Cdr, U.S. Army Combined Arms Center, Ft. Leavenworth, KS, 27 May 77, Field Manual File, USAFAS, Office of the AC, MSTL Archives. Rather than listing each separate letter, please see FM 6-20 File and Field Manual File in MSTL Archives. Both contain correspondence with division artillery commanders and others concerning the draft of FM 6-20. One message went as far as to dispute that FM 6-20 was a true capstone fire support document because of its inadequate discussion of close air support.

11. Ltr with Encl, Keith to Brig Gen Eugene Kelly, Jr., Cmdt, U.S. Army Intelligence School, Ft. Huachuca, AZ, May 77, Field Manual File.

12. Ltr, Keith to Meyer, undated, Field Manual File.

13. Herbert, *Deciding What Has to Be Done*, pp. 21-22, 27-28; John L. Romjue, *The Army of Excellence: The Development of the 1980s Army* (Fort Monroe, VA: Office of the Command Historian, TRADOC, 1993), pp. 7-8.

14 TRADOC, Division Restructuring Study Phase I Report, Executive Summary, 1 Mar 77, pp. v, 1, 5-9, 13-14, A6-A12, MSTL Archives; Division Restructuring Evaluation, U.S. Army Combined Arms Combat Development Activity, Executive Summary, Sep 78, p. iv, MSTL Archives; Msg, Cdr, TRADOC, to Cdr, Combined Arms Center (CAC), *et al*, subj: Reorganization Proposals, 081618Z May 76, HRDC; Lt Col Homer J. Gibbs, "A Report on DRS," *Field Artillery Journal*, May-Jun 78, p. 36; John L. Romjue, *A History of Army 86: Division 86, The Development of the Heavy Division* (Fort Monroe, VA: TRADOC Historical Office, 1982), pp. 4-6, hereafter cited as *Division 86*; Ltr, TRADOC to See Distribution, subj: Division Restructuring Study Concept Paper, 21 Sep 76, HRDC; Draft Concept Paper, ca. 1976, Heavy Division Restructure File, MSTL Archives; Memorandum for Record, subj: Outline

Concept Paper for Division Restructuring Study, ca. Sep 76, pp. 4-7, Heavy Division Restructure File, MSTL Archives; Ltr, Ott to Dastrup, 12 Feb 93, HRDC.

15. Romjue, *Division 86*, pp. 7-10.

16. Ltr, Ott to Dastrup, 12 Feb 93.

17. Fire Support Mission Area Analysis (FSMAA) (C), 15 Jan 81, p. 12, material used is unclassified, HRDC; Draft Ltr, Ott to Editor-in-Chief, *Army Magazine*, undated, Chronology of Counterfire Doctrine Development/Evaluation File, MSTL Archives; "Towards Improved Counterfire Capabilities," student paper, U.S. Army Command and General Staff College, 1975, pp. 1-5, 7-13, Counterfire File, MSTL Archives; Ott, "Counterfire," pp. 4-5; Ltr, Ott to Dastrup, 12 Feb 93; Oral History Interview, Cass with Ott, Dec 79, pp. 63-64.

18. FSMAA (C), 15 Jan 81, p. 12, material used is unclassified; "Towards Improved Counterfire Capabilities," pp. 15, 39, 51; Draft Ltr, Ott to Maj Gen John H. Cushman, Cmdt, U.S. Army Command and General Staff College, undated, AC, USAFAS File, MSTL Archives. In June 1977, the Field Artillery School published a concept paper, entitled "The Field Artillery Brigade" that described the corps artillery group's role as being vague and staffed it throughout the field artillery community for review and comments. The concept paper was generally received well except for the statement ". . .the role of the field artillery group has always been vague." As might be expected, this statement stimulated a vigorous debate between the Field Artillery School and corps artillery commanders in Germany. As far as the commanders were concerned, the group's role was not vague because its major mission involved augmenting the fires of the division. See Msg, Cdr, V Corps Artillery to Cmdt, USAFAS, 020811Z Aug 77; Ltr, Cdr, V Corps Artillery, to Keith, ca. Aug 77; Cdr, VII Corps Artillery, to Cdr, USAFAS, 031650Z Aug 77; Ltr, Cdr, VII Corps Artillery, to Keith, 15 Aug 77. The above letters and messages are located in USAFAS, Cmdt, FA Section/FA Brigade File, MSTL Archives.

19. Ltr, Ott to Dastrup, 12 Feb 93.

20. *Ibid.*

21. Ott, "Counterfire," pp. 3-4.

22. *Ibid.*, p. 4.

23. Briefing, subj: Counterfire, Jul 75, Counterfire Briefing File, MSTL Archives.

24. Ltr, Ott to Dastrup, 12 Feb 93; Ltr, Cmdt, USAFAS, to Cdr, TRADOC, subj: Recommended Changes to TOE 6-401H, Artillery Group, 3 May 77, HRDC; Col Edward R. Coleman, "Field Artillery Brigade," *Field Artillery Journal*, May-Jun 77, pp. 40, 51; FM 6-22, Division Artillery, Field Artillery Brigade, and Field Artillery Assigned to Corps (Draft), Extract, May 77, pp. 4-1, 4-2, HRDC; Oral History Interview, Cass with Ott, Dec 79, pp. 62-65.

25 Ott, "Counterfire," p. 5; "Towards Improved Counterfire Capabilities," pp. 53-59; Memorandum for Chief of Staff, Army, subj: Counterfire Decision — Decision Memorandum, Apr 76, USAFAS Counterfire Decision Memorandum File, MSTL Archives; TRADOC, Division Restructure Study Phase I Report, Executive Summary, p. 13; Ltr (draft), Ott to Cushman, undated; Ltr, Ott to Dastrup, 12 Feb 93.

26. Msg, DA to Cdr, TRADOC, 072049Z May 76, Counterfire Doctrine File, MSTL Archives; Ltr, Cmdt, USAFAS, to Cdr, TRADOC, subj: Recommended Changes to TOE 6-401H, Artillery Group, 3 May 77.

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CHAPTER TWO

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