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FM 4–100

WAR DEPARTMENT

ANTIAIRCRAFT ARTILLERY FIELD MANUAL

ORGANIZATION AND TACTICS OF ANTIAIRCRAFT ARTILLERY

28 June 1943

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1943

WAR DEPARTMENT,

WASHINGTON 25, D. C., 28 June 1943.

FM 4–100, Antiaircraft Artillery, Field Manual, Organization and Tactics of Antiaircraft Artillery, is published for the information and guidance of all concerned.

[A. G. 300.7 (3–30–43).]

BY ORDER OF THE SECRETARY OF WAR:

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DISTRIBUTION:

D (5); R and H 1, 4 (3); Bn and H 44 (5); C 44 (3).
(For explanation of symbols see FM 21–6.)

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(This manual supersedes FM 4-105, 12 August 1940; Training Circulars Nos. 19 and 71 (sec. IV), War Department, 1941, and Training Circulars Nos. 2 and 34, War Department, 1942.)

CHAPTER 1

ORGANIZATION AND STAFF OFFICERS

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SECTION I

FUNDAMENTALS OF ORGANIZATION

■ 1. FUNDAMENTALS OF ORGANIZATION.—For fundamental principles of organization see FM 100-5 and 100-10.

■ 2. CHAIN OF COMMAND.—In all forms of military organization control is maintained by higher commanders through the smaller unit commanders. Within the antiaircraft artillery the chain of command is as follows:

a. Fighter command.—For units assigned or attached to a fighter command, the chain of command which originates with the defense command is—

Fighter command.
Antiaircraft artillery command.
Regional antiaircraft artillery command (usually a brigade).
Groups.
Battalions.

b. Army and corps.—There is no direct chain of AAA command extending from an army to its component corps; that is, instructions originating within an army for corps AAA will be directed in the name of the army commander to the corps commander who will be responsible for issuing appropriate orders to his AAA.

■ 3. FIRE UNIT.—AAA gun and automatic weapons fire, or searchlight illumination, is directed on hostile airplanes or other targets by *fire units*. In an AA balloon organization the balloon crew is comparable to the AAA fire unit. A fire unit is the smallest subdivision of an AAA organization that can actively engage the enemy. The size of the fire unit depends upon the tactical use of its weapons. The fire unit must be relieved from all details except firing.

■ 4. BATTERY.—*a.* The battery contains within itself provisions for command, combat, and maintenance, hence it is the smallest tactical unit considered in an AA organization.

b. Batteries are designated by the type of fire unit employed, such as gun battery, automatic weapons battery, or searchlight battery. The word "battery" also is used to designate certain AAA units other than those containing fire units, but when so used the name of the unit contains a descriptive title; for example, "headquarters battery."

SECTION II

BATTERIES

■ 5. GUN BATTERY.—*a. Fire unit.*—The fire unit of the gun battery consists of four AA guns (3-inch, 90-mm, or 4.7-inch), four caliber .50 local defense machine guns (In addition, Tables of Equipment prescribe one caliber .50 heavy barrel machine gun on M32 mount in the ratio of one to every four trucks, 2½-ton or larger), and the necessary detector and fire control equipment, together with the necessary operating personnel.

b. Tables of Organization.—(1) The detailed organization for a mobile AA gun battery is contained in T/O 44–17 and that for the semimobile AA gun battery in T/O 44–117.

(2) The gun battery consists of a battery headquarters and a fire unit.

(3) The battery commander is responsible for the administration, training, and tactical employment of the battery. He is assisted by the battery executive, range officer, and assistant executive.

(4) The battery headquarters consists of a headquarters section, communication section, and maintenance section.

(5) The fire unit consists of a range detector section, four gun sections, and the machine gun and executive officer's section.

■ 6. AUTOMATIC WEAPONS BATTERY.—The fire unit of the automatic weapons battery varies with the type of armament assigned by Tables of Organization.

a. Mobile and semimobile units.—In the mobile and semimobile units the fire unit consists of a trailer mounted 37-mm or 40-mm gun, a director, a power plant, and a caliber .50 machine gun. The personnel is divided into a range section and a gun section. Caliber .50 machine guns, heavy barrel, on M32 mounts are furnished on the same basis as for the gun battery.

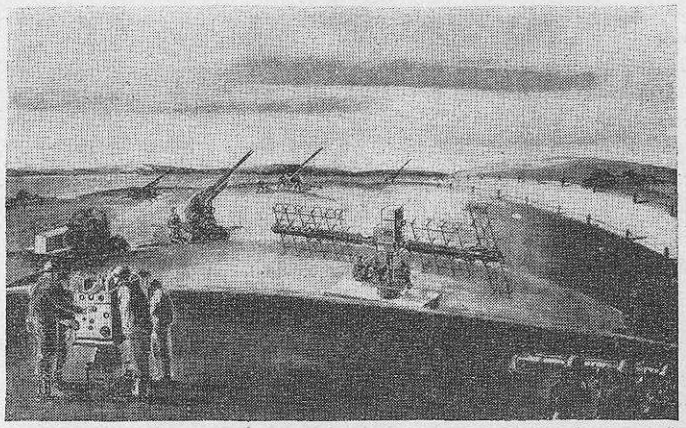
b. Self-propelled units.—In self-propelled units the fire unit consists of a self-propelled mount, with one or more weapons mounted thereon and manned by a squad. The exact number of guns depends on the type of mount.

c. Airborne units.—In airborne units, the fire unit consists of either a caliber .50 machine gun or a 40-mm AA or 37-mm antitank gun. No director or power plant is furnished with airborne units.

d. Tables of Organization.—(1) The detailed organization for a mobile AA automatic weapons battery is contained in T/O 44–27 and that for the semimobile battery in T/O 44–127. The organization of an airborne automatic weapons battery is contained in T/O 4–277, that for a self-propelled automatic weapons battery T/O 44–77 or T/O 44–28, and that for an airborne machine-gun battery in T/O 44–217 or 4–278.

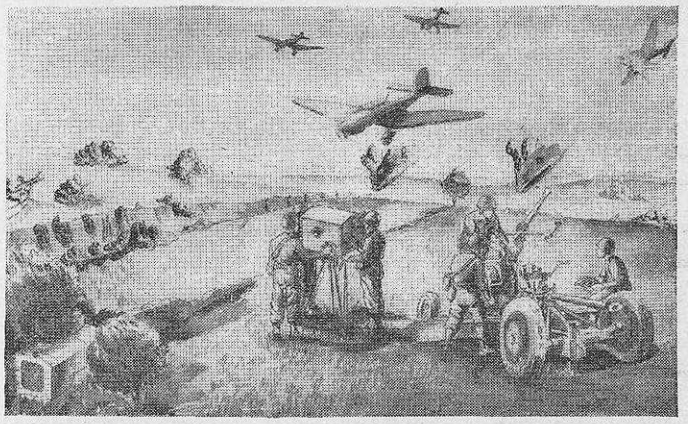
(2) The automatic weapons battery consists of a battery headquarters and two platoons (three platoons in machine-gun batteries).

(3) The battery commander is responsible for the administration, training, and tactical employment of the unit. He is assisted by a battery executive, two platoon commanders,



(This figure shows, for purposes of illustration, fire control instruments and guns which make up the fire unit, but does not show an actual combat position.)

FIGURE 1.—Gun battery fire unit.



(This figure shows, for purposes of illustration only, the complete automatic weapons fire unit so far as armament and fire control equipment is concerned, but not an actual combat position.)

FIGURE 2.—Automatic weapons fire unit, mobile.

and two assistant platoon commanders. In airborne batteries he is assisted only by the platoon commanders.

(4) The battery headquarters (except in airborne batteries) consists of a headquarters section, communication section, and maintenance section.

(5) Each automatic weapons platoon consists of a platoon headquarters section and four firing units (eight fire units in self-propelled platoons).

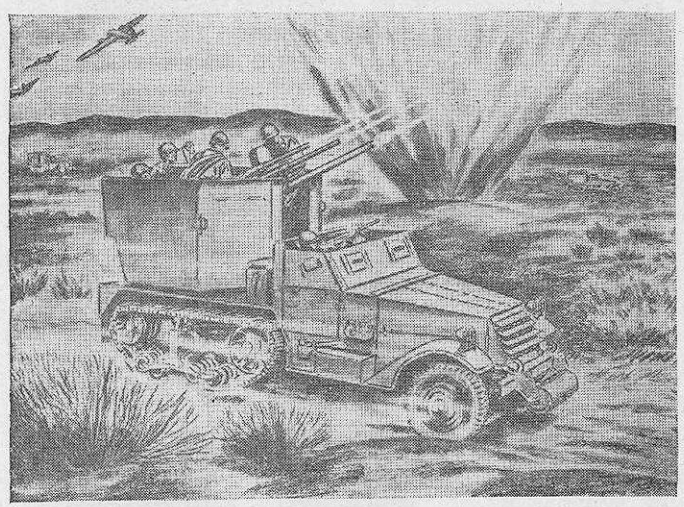


FIGURE 3.—Automatic weapons fire unit, self-propelled.

■ 7. SEARCHLIGHT BATTERY.—*a. Fire unit.*—The fire unit of the searchlight battery consists of a searchlight, with its control station and power plant, and a caliber .50 machine gun together with the necessary personnel to man the weapons and equipment. Half of the fire units also have a detector. Caliber .50 machine guns, heavy barrel, on M32 mounts are furnished on the same basis as for the gun battery.

b. Tables of Organization.—(1) The detailed organization for an AA searchlight battery is contained in T/O 44–138.

(2) The searchlight battery consists of a battery headquarters and two platoons.

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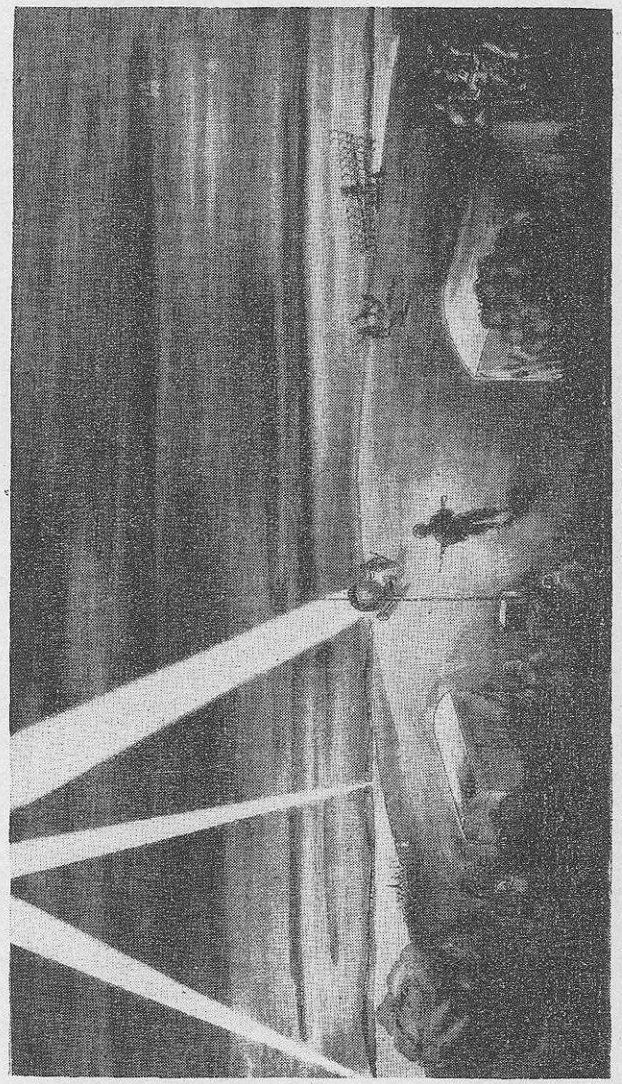


FIGURE 4.—Searchlight fire unit.

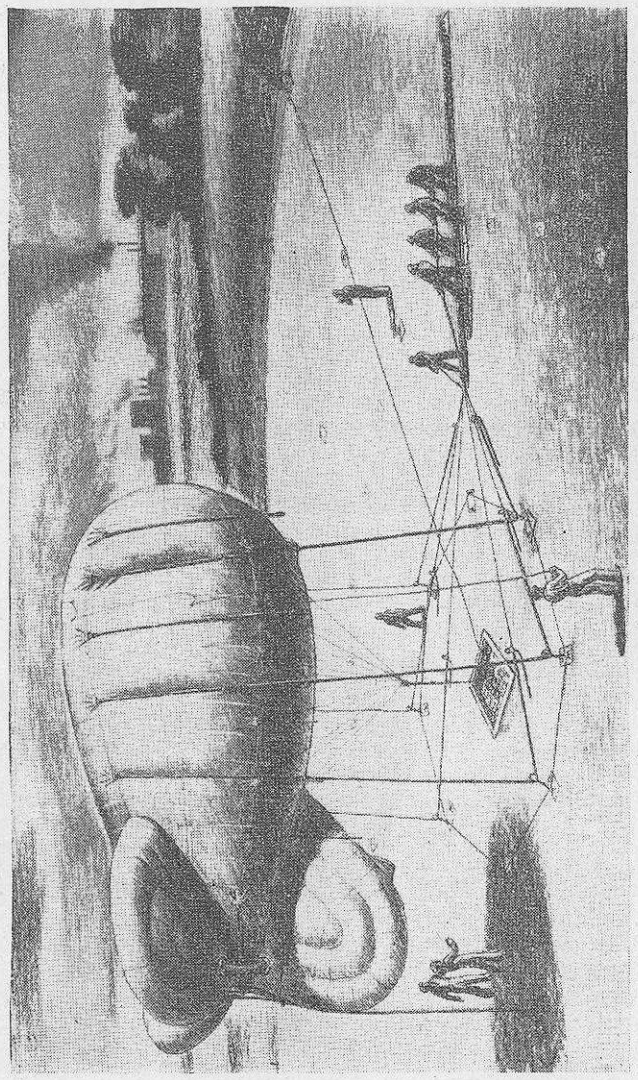


FIGURE 5.—Low altitude barrage balloon.

(3) The battery commander is responsible for the administration, training, and tactical employment of his unit. He is assisted by the battery executive, communication officer, and two platoon commanders.

(4) Battery headquarters is divided into a headquarters section, communication section, and maintenance section.

(5) The searchlight platoon consists of a headquarters section, three detector sections, and six searchlight sections.

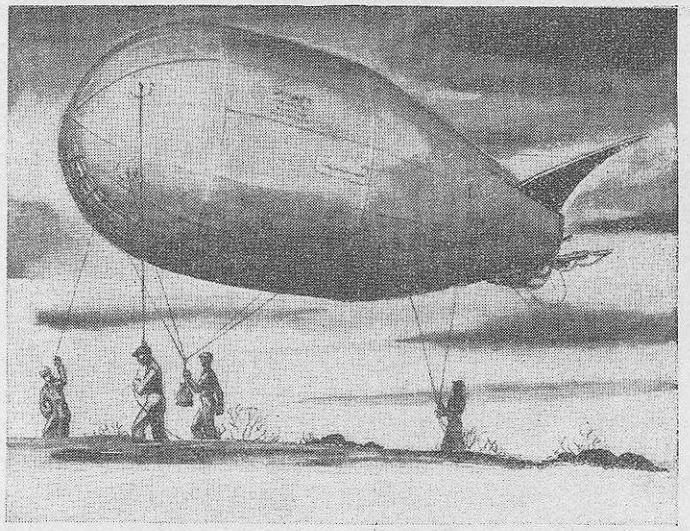


FIGURE 6.—Very low altitude barrage balloon.

■ 8. BALLOON BATTERY, LOW ALTITUDE.—*a.* The AA balloon battery consists of a battery headquarters, engineer and communication section, maintenance section, and 2 operating platoons. The armament consists of 18 barrage balloons with winches and accessories and 4 caliber .30 machine guns for local defense.

b. The detailed organization for an AA balloon battery appears in T/O 44–317.

c. The battery commander is responsible for the administration, training, and tactical employment of the battery. He is assisted by a battery executive, a maintenance officer,

two platoon commanders, and two assistant platoon commanders.

■ 9. BALLOON BATTERY, VERY LOW ALTITUDE.—*a.* The AA balloon battery, very low altitude, consists of a battery headquarters, a communication section, a supply and maintenance section, and 3 operating platoons. The armament consists of 45 very low altitude barrage balloons, winches, and accessories.

b. The detailed organization appears in T/O 44–327.

c. The battery commander is assisted by a battery executive, a supply and maintenance officer, and three platoon commanders.

d. When a very low altitude battery is activated as a *separate* battery additional personnel are assigned to man the hydrogen generator and perform the rigging and fabric repair work. Normally these duties are carried out by the battalion headquarters battery.

SECTION III

BATTALIONS

■ 10. GENERAL.—Three or more batteries of one type of fire unit and a headquarters and headquarters battery are organized into a battalion. Battalions are classified as gun, automatic weapons, searchlight, or barrage balloon. They are designated as mobile, semimobile, self-propelled, or airborne, depending upon the kind and amount of transportation assigned to them. Battalions are administrative as well as tactical units. Provisions are made for administration, including supply, so that the battalion may function as a separate organization. Tactically, the battalion is organized to perform its combat mission. All battalions have medical personnel attached; some have an attached chaplain also.

■ 11. BATTALION COMMANDERS—*a. General.*—The battalion commander is responsible for the training and administration, including supply, of his battalion, for the tactical disposition of its elements, and for the assignment of proper missions to those elements. He keeps himself informed of the friendly and hostile aerial situations. He also informs

himself of the situation and activities of friendly ground and air forces through the group commander or by direct liaison with the units concerned. As the elements of his battalion may be widely scattered for extended periods of time, the maintenance of efficiency requires that he make frequent personal inspections covering all phases of their activity. *When attached to other arms the battalion commander must be prepared to advise his force commander on the subject of antiaircraft defense of the larger unit.*

b. Gun and automatic weapons battalions.—In addition, the battalion commander of a gun or automatic weapons battalion keeps his battery commanders advised of the situation so far as it affects their fire control, gives such instructions concerning fire control as the situation warrants, directs changes of position when necessary, and supervises the supply of ammunition to the batteries.

c. Searchlight battalion.—(1) In addition to the duties outlined in *a* above, the searchlight battalion commander must keep himself informed of the plan for employment of the gun battalion if furnishing illumination for a gun defense. He in turn keeps his battery commanders advised of the situation so far as it affects the employment of the searchlights, gives such instructions as are necessary for the efficient employment of the searchlights, and directs changes of position when necessary. He will submit plans for illumination when directed by the group commander, and will supervise the organization and operation of the Antiaircraft Artillery Intelligence Service (AAAIS).

(2) He must be thoroughly indoctrinated with the tactics and technique of the joint employment of fighter aviation and searchlights.

d. Balloon battalions.—In addition to the duties outlined in *a* above, the AA balloon battalion commander must concern himself primarily with the flying of barrage balloons. He must be prepared to submit plans to the group commander for employment of his barrage balloons. *If his is the only battalion operating with a force he must be prepared to act as adviser to the force commander on all matters concerning the employment of barrage balloons.*

■ 12. GUN BATTALION.—*a.* The organization of the mobile antiaircraft artillery gun battalion is contained in T/O 44–15, and that of the semimobile battalion, in T/O 44–115.

b. The gun battalion consists of a headquarters and headquarters battery and four gun batteries. The organization of the headquarters and headquarters battery for a mobile battalion is contained in T/O 44–16, and that for a semimobile battalion, in T/O 44–116.

■ 13. AUTOMATIC WEAPONS BATTALION.—*a.* The organization of the mobile automatic weapons battalion is contained in T/O 4425. The battalion consists of a headquarters and headquarters battery (T/O 44–26), three mobile firing batteries (T/O 44–27), and one self-propelled firing battery (T/O 44–28).

b. The organization of the semimobile automatic weapons battalion is contained in T/O 44–125. The battalion consists of a headquarters and headquarters battery (T/O 44–126), and 4 firing batteries (T/O 44–127).

c. The organization of the self-propelled automatic weapons battalion is contained in T/O 44–75. The battalion consists of a headquarters and headquarters battery (T/O 44–76) and four self-propelled firing batteries (T/O 44–77).

d. The organization of the airborne automatic weapons battalion is contained in T/O 4–275. The battalion consists of a headquarters and headquarters battery (T/O 4–276), three automatic weapons batteries (T/O 4–277), and three machine gun batteries (T/O 4–278).

■ 14. SEARCHLIGHT BATTALION.—*a.* The organization of the antiaircraft artillery searchlight battalion is contained in T/O 44–135.

b. The searchlight battalion consists of a headquarters and headquarters battery and three searchlight batteries. The organization of the headquarters and headquarters battery of the searchlight battalion is contained in T/O 44–136.

■ 15. BALLOON BATTALION.—*a.* The organization of the low altitude AA balloon battalion appears in T/O 44–315 and that of the very low altitude battalion in T/O 44–325.

b. Both types of AA balloon battalions consist of a headquarters and headquarters battery and three lettered batter-

ies. The organization of the headquarters and headquarters battery of the low altitude AA balloon battalion appears in T/O 44–316. The organization of the headquarters and headquarters battery of the very low altitude AA balloon battalion appears in T/O 44–326.

SECTION IV

GROUPS AND REGIMENTS

■ 16. GENERAL.—The battalion is a basic self-contained administrative and tactical unit. The group is a headquarters for the command and tactical control of two or more battalions. Group headquarters are activated in the ratio of approximately one per four battalions.

■ 17. GROUP.—*a.* The group will consist of two or more battalions. Any combination of the various type battalions may be organized as a group. For the detailed organization of the group headquarters and headquarters battery see T/O 44–12. When several AA balloon battalions are operating in the same vicinity they may be placed in a separate AA balloon group, organized under T/O 44–312.

b. Group commander.—(1) The group commander is responsible for—

(*a*) Training and tactical employment of the battalions in his group.

(*b*) Issuance of any necessary instructions for fire control.

(*c*) Advising proper authority on AA defense.

(*d*) Recommendations, if called for, or issuance of instructions on conditions of readiness.

(*e*) Making plans for relief of personnel.

(*f*) Preparing plans for standing barrages, unseen fire, predicted concentrations, and withholding fire.

(*g*) Assisting battalion commanders in supply and administrative problems.

(*h*) Recommending allocation of ammunition or issuing instructions as to its allocation.

(*i*) In addition, he keeps himself informed of friendly and hostile aerial and ground situations by frequent consultation with commanders and staffs of friendly forces.

(2) When he is the senior AAA commander with a fighter command he—

(*a*) Sets up his command post in the same room or adjacent to the command post of the fighter command.

(*b*) Cooperates with the fighter commander, advising him on all phases of the employment of AAA.

(*c*) Organizes the AA command.

(*d*) Organizes the AAAIS.

(*e*) Insures that AAAIS covers all avenues of approach of hostile attack.

(*f*) Insures dissemination of AAAIS information to all fire units.

(3) When acting as the AAA commander of a ground unit of the field forces, he may act as a staff officer of the ground force unit commander, in addition to his command duties. When operating as part of a brigade his functions will be as directed by the brigade commander but similar in scope to those listed above.

(4) As the elements of the group may be widely scattered for extended periods of time, the maintenance of efficiency requires that he make frequent personal inspections covering all phases of their activity.

■ 18. REGIMENT.—*a.* Certain AAA regiments that are already formed will continue to operate as such. The organization of these regiments is as shown in T/O 4–11 (mobile) and T/O 4–111 (semimobile).

b. Regimental commander.—The regimental commander performs administrative functions similar to those performed by the battalion commander and tactical functions similar to those performed by the group commander.

SECTION V

BRIGADES

■ 19. AA BRIGADE.—*a.* The AA brigade consists organically of a headquarters and headquarters battery. The combat elements of the brigade are made up of AA groups and battalions which are attached thereto. (See T/O 44–10–1.)

b. AA brigade commander.—Whether the AA brigade is operating with an air force, task force, corps, or army, the

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basic duties and responsibilities of the commander are the same. The AA brigade commander is responsible for the tactical employment of the troops under his command. During operations he keeps himself informed as to the situation of his own and enemy forces. He is responsible for coordination of the missions and dispositions of the groups and battalions under his command. The brigade commander must perform those duties that are listed in paragraph 17 for the group commander when operating as the senior AAA commander with a fighter command or ground force.

SECTION VI

AAA STAFF OFFICERS WITH ARMIES AND CORPS

■ 20. AA OFFICER, ARMY HEADQUARTERS.—*a.* No AA section is organic in an army headquarters. (See T/O 200–1.) However, a small AAA headquarters and headquarters battery (T/O 44–200–1) is provided to command the army AAA and act as the AAA staff of the army. The senior AAA officer present is the AA officer of the army and as such is the adviser to the army commander and his staff on matters pertaining to AA defense.

b. Duties.—The senior AAA officer present performs the following duties in connection with AA defense:

(1) Is responsible for the coordination and control of all AA units in the army.

(2) Acts as tactical and technical adviser to the army commander and his staff on use of all means of ground AA defense with the army, both assigned and attached.

(3) Prepares plans for the use and coordination of AAA and of all other ground elements of AA defense, both active and passive.

(4) In cooperation with the army air officer and other members of the special staff, prepares plans for coordination of activities of aviation with those of all elements of the ground AA defense.

(5) Supervises such AA schools as may be established.

(6) Coordinates the activities of the AAAIS within the army and with adjacent units. (This service should not be confused with the AWS, which operates under control of the fighter command.)

(7) Submits to the army G–4 the requirements for and the recommended allocation of AAA ammunition.

■ 21. AA OFFICER, CORPS HEADQUARTERS.—*a. General.*—No AA section is organic in a corps headquarters. The senior AAA officer present is the AA officer of the corps and as such is the adviser to the corps commander and his staff on matters pertaining to AA defense. (See T/O 100–1.)

b. Duties.—The AA officer of the corps performs, for the corps, duties similar to those performed by the army AA officer, and in addition, upon receipt of the corps allocation of AAA ammunition and after consultation with the corps G–3 and G–4, reallocates to the corps AAA units the AAA ammunition made available.

■ 22. SUBORDINATE STAFF OFFICERS.—The members of the staff of the officers referred to in paragraphs 20 and 21 perform, in general, the duties prescribed for staff officers in FM 101–5. In addition, they assist in coordinating the activities of the AAAIS of the corps and the army AAA; maintain liaison with friendly aviation; and, in conjunction with friendly aviation, prepare recognition codes and establish routes of approach for recognizing friendly aviation that must pass over areas defended by AAA. They prepare for publication, to the army or corps, arrangements made for joint operations with friendly aviation against hostile formations.

CHAPTER 2

ASSIGNMENT OF UNITS AND MISSIONS

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SECTION I

ASSIGNMENT OF UNITS

■ 23. GENERAL.—*a.* Modern warfare, with its greatly increased use of air power, demands a similar increase in AA protection, by AAA, barrage balloons, and the suitable organic weapons of the other arms.

b. AAA units are assigned or attached to the field forces, defense commands, bases, theaters of operations, and other forces in accordance with the special requirements of the particular plan or mission of the force concerned.

■ 24. TO DIVISION.—Divisions contain no organic AAA units nor any AAA headquarters organization, but will have AAA units attached to them from higher headquarters when required by the situation. One automatic weapons battalion is the usual allotment to each division when the division is operating as part of a larger unit. When a division is operating alone, additional AAA may be required.

■ 25. TO CORPS.—*a.* The quick shifting of modern warfare demands flexibility in organization. This flexibility is provided by attaching such groups and battalions to the corps as are required by the tactical situation. Two automatic weapons battalions are the usual allotment of AAA to the corps, as gun protection is normally not necessary. Where, due to its mission, gun protection is needed, one or more gun battalions are attached.

b. When operating independently, a corps needs more AAA protection than when functioning as part of an army. These additional attached units may be retained under direct control of the corps, or they may be attached to the divisions of the corps.

■ 26. TO ARMY.—*a.* AAA protection is provided the army by the attachment of such brigades, groups, and battalions as are required by the situation. A normal attachment of AAA to an army might be one AA brigade of two AA groups, with a total of three gun battalions, three automatic weapons battalions, and two searchlight battalions.

b. As the situation and the mission change, the army commander calls on the theater commander for any additional units needed for the army and its corps or divisions. Units no longer needed will revert to the theater reserve for use elsewhere.

■ 27. TO OTHER FORCES.—For forces assigned to oversea possessions, bases, defense commands, theaters of operation, and zones of the interior, AAA units are provided as required by the missions of the forces.

■ 28. THEATER RESERVE.—In each theater of operations the AAA units not allocated to field forces or to relatively stabilized rear area defenses are held in the theater reserve. This reserve is provided to protect strategic establishments, sensitive points, and important areas in the theater zone of communications, and as a reserve for the reinforcement of armies, independent corps, and other units operating directly under theater headquarters.

SECTION II

MISSIONS

■ 29. PRIMARY MISSION.—The primary mission of AAA is to provide local protection for field forces and important ground establishments against all forms of enemy air attacks and activities by day and night.

■ 30. SECONDARY MISSION.—The secondary mission of AAA is defense against ground and naval targets.

■ 31. SPECIFIC PRIMARY MISSIONS.—The specific primary missions of each of the several elements of AAA are as follows:

a. Guns.—To attack enemy aircraft within range, particularly high-flying airplanes, to destroy them, to cause them to abandon their missions, or to decrease the efficiency of their operations. (See FM 4–104.)

b. Automatic weapons.—To attack enemy aircraft within range, particularly low-flying airplanes, to destroy them, to cause them to abandon their missions, or to decrease the efficiency of their operations. (See FM 4–101, 4–102, and 4–103.)

c. Searchlights.—To discover and illuminate hostile targets operating during darkness in order that they may be engaged by AAA or friendly fighter aviation. In addition, searchlight units equipped with detectors are charged with obtaining and transmitting to the AAAIS operations board the location of aerial targets. (See FM 4–106.)

d. Barrage balloons.—To provide local protection for important ground establishments and field forces against minimum altitude and dive bombing attacks by day and night. (See FM 4–181.)

■ 32. SPECIFIC SECONDARY MISSIONS.—The specific secondary missions of each of the several elements of AAA are as follows:

a. Guns.—To attack and destroy enemy mechanized or other ground targets within range, particularly medium and heavy tanks and armored cars, or in coast defenses, to attack and destroy enemy motor torpedo boats or light naval craft within range. (See sec. II, ch. 8, and FM 4–104.)

b. Automatic weapons.—To attack and destroy enemy mechanized or other ground targets within range, particularly light and medium tanks and armored cars, or in coast defenses, to attack and destroy enemy motor torpedo boats or light naval craft within range. (See sec. III, ch. 8, and FM 4–102.)

c. Searchlights.—To assist friendly aircraft by illuminating landing strips and acting as marker beacons, or in coast defenses, to illuminate hostile naval craft, in order that they may be taken under fire.

d. Barrage balloons.—To attack and destroy all enemy airborne troops that may land in the vicinity of the defended point, or to institute and maintain defensive measures as directed by higher commanders.

■ 33. PRIMARY VERSUS SECONDARY MISSIONS.—*a.* AAA is normally sited so as to assist, if possible, in antimechanized

or antinaval defense. The engagement of terrestrial targets will be undertaken *only when such engagement will not interfere with the primary mission.*

b. Although AAA is not primarily designed for fire against ground targets, a force commander may in any emergency relieve AAA of its primary mission, and employ it for the accomplishment of its secondary mission. When this is done, AAA cannot be expected to provide adequate protection from air attack.

c. When AAA is engaged solely on its secondary mission, its high silhouette and relative immobility make it an extremely vulnerable target. In addition, the normal methods of employment, fire control, and fire direction cannot be used on terrestrial targets.

CHAPTER 3

CHARACTERISTICS OF WEAPONS

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SECTION I

GUNS

■ 34. RANGES.—The limit of possible fire at aerial targets is not the maximum range of the guns, but is fixed by the time element of the fuze. The maximum horizontal range at which a target can be engaged decreases with an increase in the altitude of the target. The average *maximum* slant range of AA guns is about 9,500 yards for the 3-inch guns, about 11,500 yards for the 90-mm gun, and about 14,000 yards for the 4.7-inch gun.

■ 35. FIRE CONTROL SYSTEM.—*a.* All AA gun batteries are provided with equipment for predicting a future position of the target on a basis of its present performance, and determining firing data for the guns. This fire control system is the normal source of firing data for the battery.

b. There are several types of fire control systems in service. One type employs a height finder for target altitude determination, while another employs a detector unit. The detector assists the director in getting on target, and can supply basic data to the director when fire is conducted at unseen targets.

c. Direct-fire sights.—AA guns are provided with direct-fire sighting equipment to allow the engagement of mechanized and other ground or naval targets. These sights may also be used against dive bombers. (See FM 4–110 and FM 4–121 (when published).)

d. Deterrent effect.—If the pilot is aware that he is being fired at, AAA fire may have a powerful psychological effect on him even though no direct hits are scored on the plane.

SECTION II

AUTOMATIC WEAPONS

■ 36. GENERAL.—*a. Comparison with gunfire.*—Unlike heavy AA gunfire which uses a time fuze to explode the projectile, the automatic weapons projectile must actually strike an object to be exploded. The 37-mm and 40-mm shells are equipped with a supersensitive fuze which bursts on contact with the plane, or destroys the projectile at the tracer burn-out point (about 3,500 yards). Automatic weapons fire in close proximity to a plane may have a deterrent effect on enemy pilots, as the tracer stream is frequently clearly visible. The effectiveness of automatic weapons, however, must be measured by their ability to obtain hits on aircraft.

b. Flexibility.—Automatic weapons have a flexibility permitting them to follow airplanes at a high angular rate and to shift promptly from one target to another. These factors, and the great volume of fire which automatic weapons can deliver, make them the most effective ground weapons against low-flying airplanes.

■ 37. 40-MM GUN.—*a. Characteristics.*—The 40-mm gun has high mobility, is fully automatic, and can deliver short bursts at the rate of 120 rounds per minute. It is air-cooled and, if fired at full rate, overheats after firing about 70 rounds. Fire must then be suspended while the barrel is changed. This requires about 20 seconds. The time required to emplace the gun from traveling position and commence firing (using direct-fire sights) is from 2 to 3 minutes. To emplace the director and prepare the unit for director-controlled fire will require from 10 to 15 minutes. The slant range of the 40-mm gun is limited by ballistic and gunnery factors to targets within approximately 3 seconds time of flight. The effective slant range is taken as 1,500 yards. Using director-controlled fire, the gun will elevate from −5° to 85° and will traverse through 360°. However, the field of fire is limited to 290°, there being a 70° dead arc at the director.

b. Fire control system.—(1) 40-mm guns are employed singly. The gun may be fired at the full automatic rate; however, the best results will be obtained when using the

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director by firing single shots at the rate of about 60 rounds per minute. Slant range is set in the director and the target is continuously tracked. Smooth tracking is essential. Firing data are computed by the director and transmitted electrically to the gun. The gun is automatically laid by a remote control system on the basis of the data from the director. (For detailed operation of director-controlled fire for the 40-mm gun, see FM 4–113 (to be superseded by FM 4–151).)

(2) 40-mm guns are also equipped with direct-fire sights for firing against aerial targets when the situation does not allow time to emplace the director, or when the director is out of commission. These sights are also used to engage terrestrial targets.

c. Tactical use.—The 40-mm gun, using director control, is a potent weapon for engaging targets within its effective range, and subject to the limitations on its field of fire. Adjacent fire units in a defense must be sited so as to be mutually supporting. Each fire unit is provided with a caliber .50 machine gun for engaging targets within the dead area of the 40-mm gun.

■ 38. 37-MM GUN.—The 37-mm antiaircraft artillery gun is employed in the automatic weapons fire unit in the same manner as the 40-mm gun. Tactically its characteristics are much the same as the 40-mm gun.

■ 39. ANTIAIRCRAFT ARTILLERY MACHINE GUNS.—The caliber .50 machine gun is standard equipment for AAA units. It has a maximum ground impact range of about 7,500 yards. When fired by an individual gunner, its range is dependent upon the gunner's depth perception. Machine-gun fire can be very effective against planes within 500 yards slant range of the gun. It will fire short bursts at the rate of about 600 rounds per minute. Present tracer ammunition has a burnout range of about 1,850 yards.

SECTION III

SEARCHLIGHTS AND ACCESSORIES

■ 40. SEARCHLIGHT.—The standard AA searchlight is a 60-inch, drum-type light with a metal mirror, and utilizes a

high-intensity arc. It may be traversed through 360° and elevated to 90°, either manually or by means of a distant electric controller. The searchlight is capable of illuminating an airplane at *slant* ranges up to about 15,000 yards, depending on atmospheric conditions and target characteristics. Provisions are incorporated for spreading the beam to about 15°, for illuminating low-flying targets, or for floodlighting effects. As the beam is spread, the slant range is materially reduced.

■ 41. POWER PLANT.—The power plant for the AA searchlight is a d-c generator, driven by a gasoline engine.

■ 42. CONTROL STATION.—The control station of the 60-inch searchlight consists of a distant electric controller for moving the searchlight in azimuth and elevation according to data received from the detector unit. A binocular, especially designed for night use, is so mounted that it may be adjusted parallel to the searchlight beam. It is used primarily for observing targets at extreme ranges and for following a target once it is illuminated.

■ 43. DETECTOR UNIT.—The detector unit provides directional data for the searchlight, which data are transmitted electrically to the searchlight and for the AAAIS operations board.

■ 44. SOUND LOCATOR.—The sound locator may continue in use in some units in lieu of the detector unit to furnish directional data for the searchlight. It is capable of following an airplane in azimuth and elevation, under very favorable conditions, up to 10,000 yards slant range.

SECTION IV

BARRAGE BALLOON AND ACCESSORIES

■ 45. OPERATING HEIGHTS.—The normal operating height of a low altitude barrage balloon is 5,000 feet. The normal operating altitude of the very low altitude barrage balloon is 2,000 feet when flown singly, and 4,500 feet when flown in tandem.

■ 46. ARMAMENT AND ACCESSORIES.—*a. Low altitude balloons.*—A low altitude barrage balloon is a light streamlined

bag containing a gas lighter than air, enabling the balloon to support a steel cable to which a lethal device is attached.

b. Very low altitude balloons.—The very low altitude barrage balloon contains approximately one-eighth the amount of gas found in a low altitude balloon. The VLA balloon flies from a single strand of steel piano wire to which the lethal device is attached. By flying VLA balloons in tandem, that is, one above the other with approximately 2,000 feet of the armed piano wire and the necessary attachment strops for each balloon, the operating height may be increased to approximately 4,500 feet.

c. Lethal devices.—The lethal devices used with barrage balloons are of two general types:

(1) The double parachute type (used with LA balloons) in which two parachutes attached to the ends of the cable exert a heavy drag on the plane after impact with the cable opens the parachutes.

(2) The bomb type (used with VLA balloons) in which a light bomb and a small parachute are attached to one end of the cable, and a larger parachute to the other end. Upon impact, both parachutes open and the larger parachute drags the cable over the wing until the bomb explodes on impact.

d. Reference.—See FM 4–181 (when published) for further details of barrage balloon employment and operation.

CHAPTER 4
AIR TARGETS

■ 47. CHARACTERISTICS OF AIRCRAFT.—From the viewpoint of AAA, the following characteristics of aircraft are important as they particularly affect the defense problem.

a. Speed—affects time available for firing.

b. Service ceiling—high ceiling increases the plane's security.

c. Maneuverability—complicates the fire control problem.

d. Vulnerability—dictates necessity for accuracy of fire.

e. Radius of action—limits the types of aircraft likely to be engaged especially in rear areas.

■ 48. CLASSIFICATION OF AIRCRAFT.—*a.* Airplanes may be classified according to their purpose or tactical mission as follows: fighters, bombardment (heavy, medium, light, or dive), reconnaissance, observation and liaison, transport or troop carrier, glider, and special purpose.

b. The tactics, operational technique, and probable missions of each of the above enumerated classes will be found in FM's 1–5, 1–10, 1–15, 1–20, 31–30, and 31–35.

■ 49. RECOGNITION VERSUS IDENTIFICATION.—*a. Recognition of aircraft.*—"Recognition" implies that the target is established as friendly or hostile by visual observation. Aircraft are recognized by one or more of the following means:

(1) Appearance, that is, silhouette, markings, etc.

(2) Behavior, that is, adherence to SOP, prescribed routes, channels of approach, formations, etc.

(3) Recognition signals, that is, lights, lamps, pyrotechnics, or smoke, displayed in SOP codes.

b. Identification of aircraft.—"Identification" implies that friendliness or hostility of the target is determined by means other than visual. The fighter command is normally responsible for identification of aircraft. Some of the methods of identification are—

(1) Special radar detector.

(2) Coordination of reports from radar equipment and from distant observers who have recognized the target.

(3) Process of elimination, based on flight plans and other knowledge of the movements of friendly aircraft.

(4) A method in which the aircraft identifies itself to a direction finding system by radiotelegraphy.

CHAPTER 5

CONTROL OF FIRE

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SECTION I

GENERAL

■ 50. DEFINITIONS OF TERMS.—*a. Conduct of fire.*—The employment of technical means to place accurate fire on a target. (See FM 4–110 and FM 4–121 and 4–151 (when published).)

b. Fire direction.—The exercise of the tactical command of one or more units in the selection of targets and in the concentration or distribution of fire thereon at the appropriate times.

c. Fire control.—The exercise of conduct of fire and fire direction.

■ 51. FIRE DIRECTION.—*a. General.*—(1) The degree of fire direction that can be exercised depends to a large extent upon the efficiency of the warning service, which is, in turn, related to the size and permanency of the defense.

(2) In rapidly moving situations it is not expected that the warning service will be elaborate. On the other hand, in a stabilized rear area defense, a high degree of efficiency is expected.

(3) In all situations where secrecy or concealment are important factors, care will be taken not to disclose vital information to the enemy by premature action of any character.

b. Direction by fire units.—Fire direction will be exercised by the fire unit commander—

(1) When time will not permit the establishment of a command net elaborate enough for fire direction.

(2) When the fire units are so widely separated as to make fire direction impractical by higher echelon.

(3) Whenever it appears to be the best method.

c. Direction by higher echelon.—(1) Fire direction will be exercised by higher echelons in a stabilized and highly organized defensive position. (This does not apply to automatic weapons fire units.)

(2) In the majority of cases, the maximum strength of the AAA defense will be exerted if the fire direction for all guns and searchlights *is centralized in one agency just prior to and during the attacks.* (See FM 4–104 and FM 4–106.)

(3) Regardless of the agency exercising fire direction there are certain details which can be promulgated by standing operating procedure to the fire units.

d. Restrictions of fire.—(1) The AAA fire unit commander in immediate command is responsible for opening and closing fire. He is the individual responsible for determining when friendly aviation is unnecessarily endangered by the fire of his unit.

(2) The normal firing status of AAA will be that of "Release to open fire under instructions contained in local SOP" until specifically restricted.

(3) The normal status of searchlights will be that of "Release to operate under instructions contained in local SOP" until specifically restricted.

(4) Barrage balloons will normally be flown at ruling operational height, until specifically restricted.

(5) Restrictions will be imposed on the minimum number of AAA units consistent with the accomplishment of the desired aim. This restriction will be imposed for a specific purpose and for a definite period of time.

SECTION II

GUNS

■ 52. FIRE CONTROL DOCTRINE.—Considering the capabilities of the AA guns and the characteristics of the airplane, certain fundamental doctrines can be deduced.

a. Targets within range must be brought under fire with the greatest possible speed.

b. Every effort should be made to secure hits with the opening rounds.

c. The maximum volume of fire should be employed.

■ 53. TARGET PRIORITIES.—The commander should be guided when designating targets by the following doctrines:

a. When two or more targets enter the field of fire of a fire unit, fire should be opened on that target which offers the *most dangerous threat* to the mission of the AA defense.

b. When two or more targets offer equally dangerous threats, that target which is not under the fire of other AA fire units should be engaged first.

c. Correlating *a* and *b* above, the greatest possible number of targets should be taken under fire by an AA defense.

d. An airplane *approaching* an area defended by AA presents a *more dangerous* threat than one moving away.

■ 54. CLASSES OF FIRE.—AA gun fire units may engage their targets with salvo fire, barrage fire, fire by individual gun, or continuous fire. The class of fire used will depend on the tactics being used by the hostile air force at the moment. The conduct of these classes of fire may be by normal director fire at seen targets, director fire using detector data at unseen targets, or barrage fire at predetermined points in the sky. Consideration must be given to the conduct of fire at close-in targets. Instructions on these methods of conducting fire are published in FM 4–110 and will be in FM 4–121 when published.

■ 55. RATE OF FIRE.—The rate of fire to be delivered by AA guns must be the maximum *accurate* rate permitted by the matériel.

SECTION III

AUTOMATIC WEAPONS

■ 56. FIRE CONTROL DOCTRINE.—The fire control doctrine as discussed in paragraph 52 for AA guns applies without change to automatic weapons.

■ 57. TARGET PRIORITIES.—The priorities appearing in paragraph 53 for guns apply equally to automatic weapons.

■ 58. CLASSES OF FIRE.—Automatic weapons units normally fire continuous fire. The conduct of fire may be by director fire at seen targets, direct fire sights at seen targets, or barrage fire at predetermined points in the sky. All machine-gun fire is conducted by individual tracer control. Instructions on these methods of conducting fire are published in FM 4–110 and FM 4–113 (to be superseded by FM 4–151).

■ 59. RATE OF FIRE.—The rate of fire to be delivered by AA automatic weapons must be the maximum consistent with accuracy.

SECTION IV

SEARCHLIGHTS

■ 60. CONTROL DOCTRINE.—*a.* Searchlights do not provide illumination for any particular fire unit or friendly fighter, but for the defense as a whole.

b. The number of searchlights in action should always be kept at the minimum consistent with the desired illumination.

c. As many targets within range as can be effectively engaged by the gun or fighter defense must be illuminated with the greatest possible speed.

d. Every effort should be made to obtain illumination immediately upon going into action.

e. The highest tactical commander who is capable of exercising effective control, and who is close enough to a given place of action to know to any material degree what action is required, is the lieutenant commanding the platoon. Tactical control during action by individual detector and light commanders, previously thoroughly trained and indoctrinated is normally the only control adequate to handle the problem.

■ 61. TARGET PRIORITIES.—For information concerning target priorities see FM 4–106.

■ 62. ILLUMINATION.—Targets may be illuminated as follows:

a. Initial illumination assisted by detector data.

b. Carrying of targets already illuminated.

c. Spread beam technique.

d. Illumination of ground objects.

e. For further information on searchlight employment and technique see FM 4–106 and FM 4–175.

SECTION V

BARRAGE BALLOONS

■ 63. DOCTRINE.—A balloon barrage, provided it is in the air, is the only AA weapon that can accomplish its mission without receiving prior warning. Hence a maximum number of the balloons in the barrage should be flying at ruling operational height at all times, weather and local situation permitting.

■ 64. BARRAGE CONTROL.—*a.* Barrage control is the process of ordering, for any reason, certain balloons in a barrage, or an entire barrage, to be grounded or the altitude to be reduced, and of again ordering the balloons of the barrage to fly at ruling operating height. For further information on employment and technique of barrage balloons see FM 4–181 (when published).

b. The unit of barrage control is the barrage. The barrage may be a single detached platoon or battery, a battalion, or two or more battalions. All of the balloons required to defend a single or multiple objective are controlled as one barrage.

CHAPTER 6

EMPLOYMENT IN REAR AREAS

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SECTION I

FIGHTER COMMAND

■ 65. GENERAL.—Theater of operations, base, department, defense, or similar commanders are responsible for the installation and operation of the complete air defense organization within their commands. This function is normally delegated to the fighter commander through the air force commander within an air defense area prescribed by the theater of operations or similar commander. Ground units of the field forces outside the air defense area are responsible for providing local antiaircraft artillery protection through the fire of assigned or attached antiaircraft units.

a. All antiaircraft units employed in air defense operations within the air defense area of a fighter command will be under the command of the fighter command.

b. Antiaircraft units assigned or attached to ground units of the field forces usually are not under fighter commands. Whenever practicable, however, these units will establish liaison with adjacent antiaircraft units under the control of the fighter command for the purpose of—

(1) Receiving intelligence and identification information on friendly and enemy aerial activity.

(2) Receiving information relative to fire on unseen targets.

Ground force commanders must see that such liaison is established.

■ 66. FIGHTER COMMAND.—The fighter command is the defensive element of an air force assigned the mission of protecting

rear areas, lines of communication, and the zone of the interior. The primary weapons employed in the general defense of an air space are fighter aviation and AAA. An AWS is necessary to provide early warning for these weapons.

■ 67. ORGANIZATION.—The fighter command consists of the fighter commander and his staff, an AWS, fighter aviation, and AAA and barrage balloons. Where its area of responsibility is large, the fighter command is divided tactically into air defense wings and territorially into regions. The regions may be further broken down into fighter control areas.

■ 68. FIGHTER COMMANDER.—*a.* So far as antiaircraft artillery is concerned, the principal duties of the fighter commander are—

(1) Command, through the AAA commander, of antiaircraft artillery units assigned or attached to the fighter command.

(2) The strategical disposition of the antiaircraft artillery. This disposition is based on the decision of the theater of operations or similar commander as to the priority of areas to be defended (air defense plan).

(3) Coordination of antiaircraft artillery and fighter action between subordinate echelons of command (normally accomplished through the medium of directives and standard operating procedure).

(4) Coordination of intelligence throughout the elements of the air defense system over which he has control.

b. The fighter commander delegates to his next subordinate commander, the wing commander, such authority as is necessary to insure coordination of action of the region AAA and barrage balloons, with the action of the air units under control of the wing.

■ 69. AIR DEFENSE WING.—A fighter command may frequently embrace a territory so large that to insure adequate control it must be subdivided. The territorial subdivision is into regions. The region is the normal territorial assignment of an air defense wing. The wing controls all fighter planes, AAA, and barrage balloons within its boundaries, and operates the collection and evaluation center for intelligence from the AWS. Identification of targets is also made in the

wing, by an identification section, which has available the flight plans of all known targets.

■ 70. WING COMMANDER.—The wing commander's principal mission is to intercept and attack hostile aircraft before they have reached vital areas. He issues such instructions as may be necessary to insure coordination between fighter aviation, AAA, and barrage balloons. These may include instructions to withhold the fire of certain AAA weapons, to control the action of searchlights, or to limit the operational height or times of flying of barrage balloons. From time to time, the wing commander may also announce periods of time when fighter night patrols will be employed over specified gun-defended areas. In practice, the wing commander exercises his tactical control through a wing controller.

■ 71. FIGHTER CONTROL AREA.—The size and character of the normal region is such as to include within its limits two or more defended objectives or defensive areas. In consequence, regions are subdivided into fighter control areas, each of which comprises a geographical area containing one or more closely related defended objectives. All defended objectives within the fighter control area are located sufficiently close together as to comprise a unit within which fighter aviation may be effectively moved and controlled during a specific tactical operation. The exercise of direct operational control of AAA, and barrage balloons, located within a given fighter control area, is vested in the area commander or his representative, the area controller.

■ 72. ANTIAIRCRAFT COMMAND.—*a.* All AAA and AA balloon units assigned or attached to a fighter command are organized into an AA command, commanded by the AA commander, who is directly under the fighter commander.

b. The AA commanders of fighter commands in continental United States (not in theaters of operation) are assigned by the War Department. AA commanders of other fighter commands are designated by the theater of operations, department, or area commanders.

c. Whenever a fighter command is divided into regions, AA units within each region are organized into a region AA command. Region AA commanders are designated by the AA

commander of the fighter command. Similarly, AAA control areas coterminous with fighter control areas are organized when necessary.

■ 73. ANTIAIRCRAFT COMMANDER.—*a.* The principal duties of the AA commander are—

(1) Tactical disposition of AAA units.

(2) Training, administration, and supply of AAA units.

(3) Responsibility for combat efficiency of AAA units.

(4) To advise the fighter commander on matters affecting the strategical disposition and operation of AAA.

b. The fighter commander in moving AA units within his command and in coordinating their action with fighter aviation and other weapons will take such action *through his AA commander.*

c. The AA commander is the staff officer advising the fighter commander on all matters pertaining to AA units and commands the units assigned to him. In practice, the two commanders will, of course, work out details together. Orders, directives, standing operating procedures, and strategy will be the results of their joint effort.

d. In a fighter command having several wings, the AA commander determines policy, coordinates AAA action in the various regions, and designates the region AA commanders.

■ 74. REGION ANTIAIRCRAFT COMMANDER.—*a.* The region AA commander advises the AA commander on matters of, and is responsible for, administration training, and operation within AA units of the air defense region. In accordance with announced policies and SOP of the wing and the AA command, the region AA commander will insure coordination of action of the units under his command with fighter aviation and other weapons in the air defense wing. Information, administration, and training orders, as well as reports and information coming from the AAA units in the field, will pass through the region AA commander's headquarters.

b. When antiaircraft artillery is employed for air defense purposes within the region, and in the absence of fighter aviation, the region AAA commander normally commands

the region. When antiaircraft artillery is employed for air defense purposes within the fighter control area, and in the absence of fighter aviation, the area AAA commander normally commands the area.

c. An AAA liaison officer from the region AA headquarters is stationed at wing headquarters. The principal responsibility of the wing AAA liaison officer is to keep the wing controller informed and to advise him concerning AAA matters. He is provided as a consultant, *not as a command channel.*

■ 75. TACTICAL COORDINATION (see pars. 51*d*, 128, and 129).—*a.* It is necessary that the fighter commander coordinate the action of fighter aircraft and AAA so as to exploit to the maximum the capabilities of each in an air defense area. This includes responsibility for coordination of air defense planning and such control operations as may be necessary to effect successful joint operation. Control is exercised generally through the issuance of directives and standing operating procedures, and, in specific instances, by—

(1) Restriction of fire of AA weapons.

(2) Restriction of searchlight operation.

(3) Restriction of operation of barrage balloons.

(4) Ordering of special fires.

(5) Control of friendly air traffic, including the establishment of gun-defended areas over which flying is forbidden or restricted.

b. Standard operating procedure.—(1) It is essential for commanders concerned to issue clear, concise operating instructions for the benefit of every individual empowered to control antiaircraft artillery, to open fire, to initiate searchlight action, or to operate barrage balloons.

(2) The normal channel for control instructions is: fighter command—air defense wing—fighter control area—antiaircraft artillery operations officer—units concerned. In most instances, control instructions, other than those contained in standing operating procedure, will originate in the fighter control area.

SECTION II

AAA DEFENSE

■ 76. GENERAL.—*a.* The term "rear area defense" refers to the defense of an area so located that an attack is improbable by ground forces, other than mechanized, motorized or airborne.

b. A rear area defense may include AA protection of the lines of communication and supply, military and naval establishments, manufacturing centers, and other establishments of major importance.

■ 77. NATURE OF DEFENSE.—*a.* A complete AA defense of a rear area objective involves the carefully coordinated employment of guns, searchlights, automatic weapons, and barrage balloons.

b. AAA and balloon barrages will usually be employed in conjunction with friendly aviation in the defense of important objective. It must be recognized, however, that not even these combined efforts can guarantee the protection of any defended area. The most practical approach indicates that the defense must be employed with the view of destroying such a large percentage of the attacking planes that it would be disastrous for the enemy to continue the attacks.

■ 78. SIZE OF OBJECTIVE.—*a.* The size of the area to be defended affects the manner in which the defense is planned. Against small areas or precision objectives, an attacking bomber must fly a rectilinear (level, gliding, or diving) course during the bombing run so that the bombsight can be used to the best advantage.

b. As the size of the defended area increases, or as a greater number of precision objectives are presented within a general area, the necessity for careful bombsighting diminishes. Under these conditions, the attacking planes can take action to avoid AA fire by maneuvering and still release their bombs on the area with good assurance that some of the more important objectives will be hit.

■ 79. BASIS FOR TACTICAL EMPLOYMENT.—The tactical employment of AA guns, automatic weapons, searchlights, and barrage balloons must be based upon the current characteristics and tactics of enemy aviation, and full consideration of the powers and limitations of weapons of the defense. The following basic factors must always be considered:

a. The establishment of priorities of objectives to be defended based upon the relative importance of each.

b. The amount of AAA and barrage balloons available for the defense.

c. The establishment of an all around defense for each objective.

SECTION III

GUNS

■ 80. BASIC CONSIDERATIONS IN ESTABLISHMENT OF GUN DEFENSE.—The basic considerations affecting the tactical employment of AA guns against bombardment aviation are:

a. A defense must be capable of exerting its power against attack from any direction. This requires an equal spacing of available batteries around the objective, modified as may be necessary because of local terrain.

b. Batteries should be within mutually supporting distances. This distance will depend upon the range of the weapons at the maximum expected altitude of the hostile attack. This distance has been arbitrarily set at 6,000 yards. This spacing of batteries prevents a complete opening in the defense if, for any reason, a battery is unable to fire.

c. No single arrangement of guns will provide the maximum possible defensive strength under all conditions and forms of enemy attack. The defense must be established upon an estimate of the most likely speeds, and altitudes of attack. (See FM 4–104.)

■ 81. NUMBER OF BATTERIES IN GUN DEFENSE.—The relative strength of a defense is in direct proportion to the number of batteries allotted. Factors which must be considered in deciding upon the number to be allotted are:

a. The priority of the objective.

b. Relative strength of the opposing air forces.

c. Location of friendly fighter airdromes and the effectiveness of fighter action.

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d. Location of actual or probable hostile air bases.
e. Presence or absence of other friendly AAA defense areas.
f. Size, shape, and nature of the objective to be defended.
g. Nature of the terrain.
h. The amount of AAA immediately available.

■ 82. EFFECT OF INCREASE IN SIZE OF DEFENDED AREA.—As the size of a defended area increases, more batteries will be required on the perimeter of the defense if they are to remain mutually supporting. The gun density over the center of the objective will decrease and it may be necessary to place batteries within the area itself in order to maintain the desired density.

■ 83. DEFENSE OF LARGE METROPOLITAN AREAS.—*a.* Two general situations must be considered:

(1) The defense of only the individual objectives of importance within the general area.

(2) The defense of the entire area.

b. In the defense of individual objectives, not within mutually supporting distance of each other within the area, objectives should be provided with an all around defense in accordance with the established priority. The adjacent metropolitan district will receive incidental protection from these defenses.

SECTION IV

AUTOMATIC WEAPONS

■ 84. BASIC CONSIDERATIONS IN ESTABLISHMENT OF AUTOMATIC WEAPONS DEFENSE.—Considerations affecting the tactical employment of automatic weapons are:

a. The defense must be capable of exerting its power from any direction. This requires the equal spacing of available fire units on concentric rings around the objective, modified as may be necessary because of local terrain.

b. Fire units should be mutually supporting. The distance between adjacent fire units has been arbitrarily set as 500 to 800 yards. This spacing of fire units is used in order to prevent a complete break in the defense if, for any reason, a fire unit is unable to fire. Closer spacing than 500 yards will make it difficult to identify tracer streams.

c. 40-mm AA guns using director control cannot fire on high speed targets at less than 450 yards range because of limitations of the angular travel rate of the gun.

d. The effect of terrain on the automatic weapons defense cannot be overemphasized. In addition to affecting the enemy's choice of type of attack and direction of approach, in certain areas terrain will dictate the siting of the fire units.

e. (1) The automatic weapons defense against horizontal flight attack can best be met by disposing fire units on or near the bomb release line for the altitude of the attack. In the case of dive or glide attacks, the target can be engaged most efficiently by weapons sited within a zone 300 to 500 yards from the center of the objective.

(2) As a rule, an automatic weapons defense will first be provided to combat dive and extremely low altitude, horizontal flight bombardment attack. When a reasonable defense against these forms of attack has been provided, the remaining fire units will be disposed to extend the defense in depth and to reinforce the defense. For detailed discussion of tactical disposition of automatic weapons fire units see FM 4–102.

f. In planning the automatic weapons defense of an objective it is necessary not only to designate the positions where the fire units will be located, but also to coordinate the "dead areas" of the fire units by establishing the direction of the gun-director line for each unit.

■ 85. OTHER FACTORS AFFECTING EMPLOYMENT OF AUTOMATIC WEAPONS DEFENSE.—The discussions in paragraphs 81, 82, and 83 apply with equal force to automatic weapons.

SECTION V

SEARCHLIGHTS

■ 86. BASIC CONSIDERATION IN TACTICAL DISPOSITIONS.—*a. General.*—The basic considerations in the tactical disposition of searchlight units about a defended area are:

(1) The searchlight disposition should be as homogeneous, closely knit, and as regular in shape as possible. The defense must be capable of acting effectively against attacks from any direction. Conditions of terrain, particularly the pres-

ence of large water areas, may make such a distribution difficult or even impossible. Compensation may be made by the employment of additional searchlight units in the weak sector.

(2) Illumination, once begun, must be maintained continuously.

b. When less than one battalion is employed, searchlights normally furnish illumination for a gun defense only. In such a case the following considerations must be met:

(1) The searchlight defense must be able to illuminate the target in sufficient time to permit the gun batteries to deliver fire against the target at the maximum range of the guns.

(2) The searchlight defense will normally consist of two concentric rings of lights. The outer ring will have a radius of about 9,500 yards and the inner ring a radius of about 8,000 yards from the center of the objective.

c. When a battalion or more of searchlights is employed, the area is organized in the grid defense whether for operation with fighters or guns. The basic requirements to be met in employment of the fighter-searchlight team are:

(1) When functioning as a part of the fighter-searchlight team the illumination of the target must be adequate to allow the fighter pilot to see the illuminated hostile plane, or at least, initially, to see its location by the intersection of accurately directed searchlight beams. Five minutes of continuous illumination of the enemy target is desirable.

(2) When supporting a gun defense, the illumination of the target must be adequate to allow tracking by the gun battery.

(3) A major proportion of all hostile airplanes in multiple, wave, or formation attack must be illuminated.

(4) In a grid pattern of searchlight disposition, searchlights should be disposed at the normal interval of approximately 6,000 yards between adjacent lights of a given row and with approximately 6,000 yards between rows. The final disposition of the searchlights on the ground, while approaching these intervals, will depend on the terrain features encountered. (See FM 4–106.)

SECTION VI

BARRAGE BALLOONS

■ 87. BASIC CONSIDERATIONS IN ESTABLISHING BALLOON BARRAGES.—*a.* LA balloons have no tactical mobility and therefore are used principally in the zone of the interior and in rear areas. VLA balloons, when provided with transportation, have a limited tactical mobility and therefore may, in addition, be employed with rear echelon installations and critical points of mobile forces.

b. First priority in barrage balloon defenses must be given to those targets which are most easily reached by enemy dive bombing and minimum altitude attack aviation.

c. LA balloons (and VLA balloons in tandem) provide a defense against both dive bombing and minimum altitude or low level attack. Very low altitude balloons, when flown singly, give a defense against minimum altitude attacks and partial defense against dive bombing attacks when the "pull-out" is below 2,000 feet.

d. Balloons are not reduced in effectiveness by cloud ceiling and poor visibility and their use in areas subject to such conditions should be encouraged.

e. Barrage balloons are not suitable for defense by themselves, but must be used in conjunction with other defense weapons. This mutual defense of the same objective requires careful coordination, particularly with automatic weapons since they are defending the same air space.

f. The density of a balloon barrage must be such as to insure a high probability of impacts. Every impact between a cable and an airplane is not necessarily fatal. Proper arming of the cable will increase the ratio of destructive impacts.

g. The barrage must provide an all around defense, modified as may be necessary by terrain conditions. Weak sectors will be strengthened by the employment of additional balloons.

■ 88. AREA OF EFFECTIVENESS.—The area of effectiveness for any given form of attack is the area on the ground in which balloon sites may be located so that their cables will present a hazard to planes. This area is determined in general by—

a. Form of aerial attack.

b. Physical aspects of the defended objectives,

c. Expected ruling operating height (ROH) of the barrage.

■ 89. DISPOSITION OF BARRAGE BALLOONS.—*a. Dive bombing attack.*—(1) For an LA balloon the area of effectiveness extends outward from the objective 1,400 yards. The perimeter of the area of effectiveness is called the effective balloon line (EBL). The balloons should be distributed throughout the area of effectiveness and the defended area.

(2) Very low altitude barrage balloons when flown in tandem will be sited in the same manner as the low altitude balloons.

b. Minimum altitude attack.—(1) LA barrage balloons should be distributed throughout the defended area and outward in all directions as far as the number of units will permit.

(2) VLA barrage balloons are disposed in the same manner.

(3) Aerial torpedo launching differs from other forms of minimum altitude attack in that the plane launches the torpedo and then turns away without flying over the objective.

c. Level flight bombardment.—Barrage balloon defenses are not effective against level flight bombardment unless the attacks are made below the barrage ROH. In level flight bombardment, bombs must be released some distance out from the objective. The line around the objective, formed by projecting to the ground these points of bomb release, is called the "bomb release line" (BRL). The bombers must penetrate inside the BRL after releasing their bombs; therefore, balloons sited inside the BRL are within the area of effectiveness. Balloons should also be extended beyond the BRL, the extent of the balloons being limited by the number of balloons available. For calculation of the BRL see FM 4–104 and FM 4–181 (when published).

d. Spacing.—LA balloons (and VLA balloons in tandem) are spaced at minimum intervals of 400 yards to avoid fouling of the cables. VLA balloons are spaced at intervals of 150 to 200 yards.

e. Reference.—For a complete discussion of the tactical disposition of barrage balloons see FM 4–181 (when published).

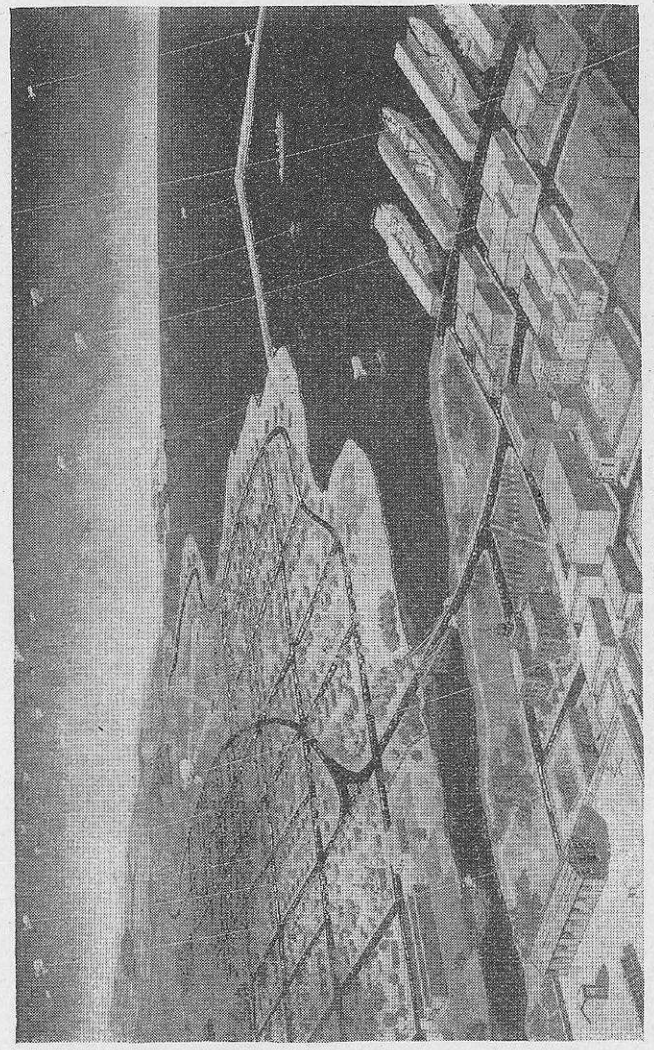


FIGURE 7.—A typical balloon barrage.

CHAPTER 7

EMPLOYMENT IN COMBAT ZONE

	Paragraphs
SECTION I. Ground forces	90–101
II. Forward area airdrome defense	102
III. Barrage balloons	103–104

SECTION I

GROUND FORCES

■ 90. ATTACHMENT OF AA UNITS.—For purposes of illustrative examples in this chapter, the following attachment of AAA to the ground forces will be assumed:

a. To army.—One AA brigade of two AA groups with a total of three gun battalions, three automatic weapons battalions, two searchlight battalions, and one VLA balloon battalion.

b. To corps.—One AA group of one gun battalion, and two automatic weapons battalions.

c. To division.—One automatic weapons battalion.

■ 91. MISSION.—*a.* The primary mission of AAA with ground forces is to provide AAA protection to important corps and army installations, critical localities along the lines of communications and supply, and routes of march against observation, bombardment, low level and dive bombing attacks in accordance with an established priority.

b. The secondary mission of AAA with ground forces is to supplement other artillery fire on ground and naval targets.

■ 92. BASIC DOCTRINE.—*a.* The doctrine for the employment of AA in rear area defense, as discussed in paragraphs 76 to 79, inclusive, applies equally well to AAA operating with the ground forces when installations or areas to be defended are likely to become objectives for bombardment attack.

b. In the forward area of the combat zone, suitable objectives for heavy and medium bombardment attacks normally are rare or completely lacking. The defense is chiefly concerned with combating hostile observation, low level, and dive bombing combat aircraft.

c. Both tactical and administrative plans of the commander must be known in considerable detail before the AA defense plan can be prepared. The AA defense plan must change to conform with movements of the ground forces. The defense plan will provide for the attachment of AAA to the various corps, the remainder being held under army control. It will specify missions of the army AA and the rear limits of the areas or elements assigned to the AAA of the several corps. In addition, measures for coordinating all AAA will be provided. Missions of the army AAA should be assigned with a view to reducing to a minimum any readjustment of the coordinated defense necessitated by the movement of one or more corps. Corps AAA should not be assigned missions which might restrict or interfere with possible future movements of the corps.

d. All available means of AA protection, both active and passive, must be coordinated. Combat units of the arms will provide their own active defense against low-flying aviation so far as possible by the use of their organic weapons and appropriate small arms, including the caliber .50 machine gun on truck ring mounts. Each unit is responsible for providing its own lookouts and air guards. Great reliance must be placed on passive measures for protection from high altitude observation. Also, in order to deny the enemy information from which he might deduce changes to or tactical movements of the ground forces, extreme care must be exercised in the disposition, employment, and shifting of AAA.

e. AAA should be sited so as to take advantage of defilade from hostile artillery and ground observation.

f. Searchlights will be employed in conjunction with gun batteries or fighter aviation in defending heavy or medium bombardment objectives. Detector units are used for intelligence purposes 24 hours a day and constitute an integral part of the AAAIS.

g. Fire units must be in positions, ready to fire, when a target appears. Allowance must be made for the time required for the unit to go into position and to prepare for accurate fire.

h. If the front of the force to which the AAA is attached is greatly extended, control becomes so difficult that decentralization to the various commanders is necessary.

i. The mobility of the AAA is normally equal to or greater than that of the protected unit of the ground force. When time and space factors, road net, and road priorities permit, fire units advance by bounds, to their positions along the route of march preceding the main body. The force or column commander should, whenever possible, give the AAA priority on the roads. The movement of AAA by bounds for the protection of motorized columns is not possible.

■ 93. CONCENTRATIONS.—*a.* The basic doctrines discussed in paragraph 92 are applied in the employment of AAA in defense of a concentration.

b. AAA units should be among the first troops to arrive in the concentration area.

c. Figure 8 shows the areas in which a corps is to concentrate, the railroad net leading thereto, and the direction from which the troops and supplies are to arrive. The AAA gun units have been disposed in this situation to protect the arriving troops and their concentration areas, the vital railway bridge, and the corps supply establishments. In this particular situation, a total of eight gun batteries and six automatic weapons batteries have been used. Of these, four gun batteries and two automatic weapons batteries from higher headquarters have been assigned as a permanent defense of the railroad bridge. The corps concentration areas are given gun protection primarily against observation, and automatic weapons protection against low flying and dive bombing attacks.

■ 94. BIVOUAC.—*a.* Normally, automatic weapons are the only AAA protection provided for a bivouac area.

b. Automatic weapons are employed in the same manner as in the defense of a concentration area.

c. One or more of the batteries may be left at the bivouac to protect the column as it forms.

■ 95. ADVANCES.—*a.* The problem of defending a column or columns in an advance is essentially one of defending critical localities. The principles enunciated in paragraph 92 apply.

b. AAA should be located in the column between the advance guard and the main party.

c. Since advances are generally made on a wide front, decentralization of control is indicated.

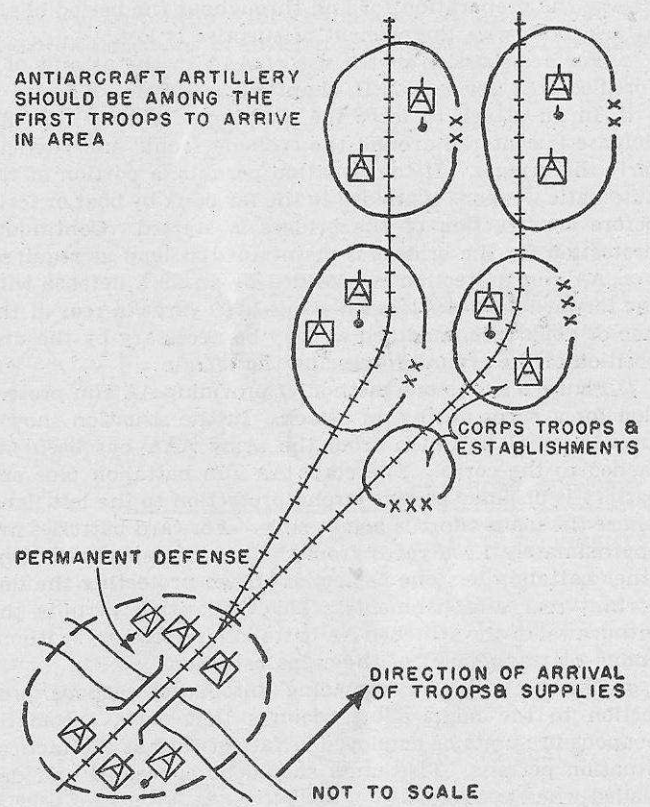


FIGURE 8.—Antiaircraft artillery protecting a corps concentration area.

d. When a corps or division is detached or widely separated from the main body, coordination of the AAA is no longer possible. More AAA should be attached to the separated unit.

■ 96. OFFENSIVE.—*a.* The problem of furnishing AAA protection in support of an offensive is essentially one of warding off air attacks designed to stall the offensive.

b. The denial of hostile observation is of vital importance during the preparation for and throughout the period of the attack, otherwise the element of surprise is lost.

c. For a discussion of the use of AAA in the assault of a fortified area, see section II, chapter 8, and FM 4–104.

d. In an attack to force the crossing of a river line, AA defense is centered around the crossing fronts and particularly the bridges. If the situation permits, a portion of the automatic weapons is crossed to the far bank by boat or ferry before construction of the bridges is started. Continuous protection for the bridges is maintained as long as required.

e. AA gun protection is provided by an area defense with the forward batteries located about 1,000 yards in rear of the line of departure, modified as may be necessary by the disposition of the ground forces and the terrain.

f. Figure 9 shows one method of providing AA gun protection for a corps during an attack. In the situation shown, an additional battalion from the army AAA has been attached to the corps. The corps AA gun battalion plus one battery is disposed to give strong protection to the left flank where the main effort is being made. Forward batteries are approximately 1,000 yards from the line of departure. The other battalion less one battery is shown protecting the important rear establishments. This disposition permits the withdrawal of the attached AA battalion if necessary, without undue rearrangement of the corps battalion.

g. The necessity for providing automatic weapons protection to the main effort requires that some automatic weapons fire units be employed as far forward as the tactical situation permits. Fire units should be concealed and defiladed when possible.

h. Figure 10 shows the disposition of automatic weapons for protection of a corps in an attack. The division automatic weapons battalions are protecting the combat elements. The division making the main effort has been reinforced by the attachment of one battery of automatic weapons from the corps battalion. The corps battalions less detachments are

protecting the corps reserves, rear elements in the vicinity of the division rear boundaries, and important corps establishments in the rear.

i. The initial coordination of division, corps, and army AAA units will be provided for in the army attack orders. Forward displacement of division and corps AAA units should

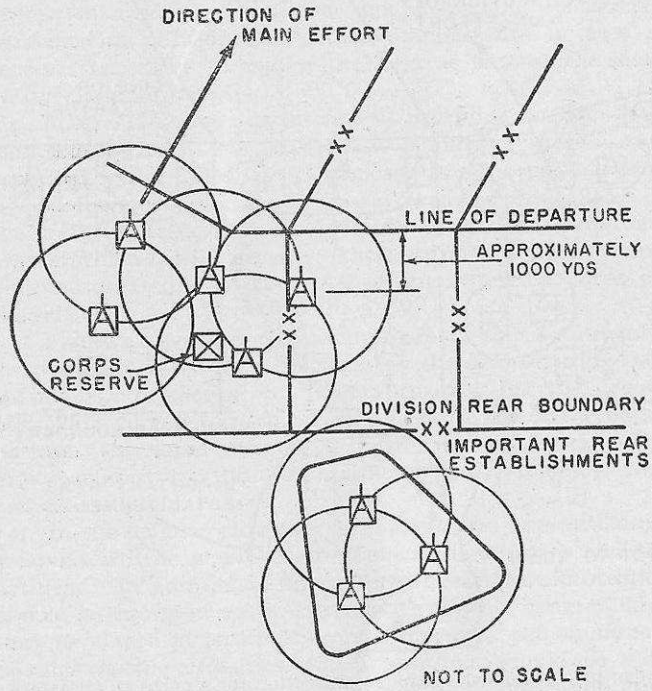


FIGURE 9.—Two AA gun battalions protecting a corps in an attack.

be made by bounds. The army AAA is displaced forward when the changing situation indicates the necessity for revision of established priorities.

■ 97. DEFENSIVE.—*a.* When a force is on the defensive, AA defense becomes of increasing importance as there is usually

a local inferiority in strength not only of the ground forces but also of the air forces. A hostile attack will usually be supported by powerful concentrations of combat aviation which will achieve local air superiority. Under these conditions, the AAA units must furnish the major portion of the defense against hostile air activity. The problem of furnishing AAA protection on the defensive is one of providing protection to those units which are bearing the brunt of the enemy's attack.

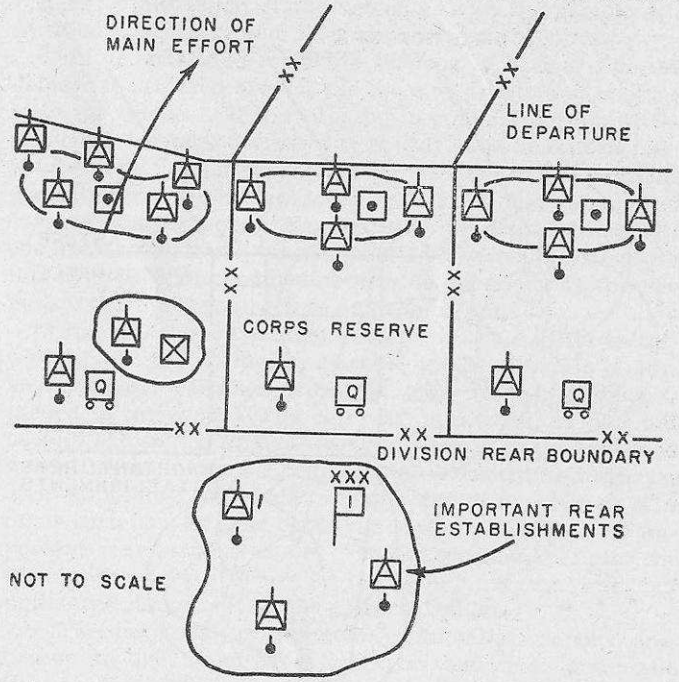


FIGURE 10.—Automatic weapons protection for a corps in an attack.

b. In general, corps AAA units are not attached to divisions when part of a corps during the defense. The defense established is an area defense coordinated by the AAA com-

mander. Forward gun batteries are approximately 3,500 yards in rear of the MLR. Automatic weapons battalions previously attached to the divisions will remain under division control with the exception of the control necessary to coordinate the defense. Automatic weapons fire units should be disposed not less than 800 yards from the MLR.

c. In a defensive situation, mechanized attack may be a serious menace. Preparations should include the reconnaissance of positions for antimechanized fire in case it becomes necessary to employ the AAA as part of the local antimechanized defense.

d. Figure 11 shows one method of providing AA gun protection for a corps during defense, employing the AA gun battalion. Gun batteries are disposed so as to provide protection for troops occupying forward defensive localities of the main battle position and for the corps reserve and the area in which it will be used. They are mutually supporting and coordinated with the AAA of the adjoining corps on the left.

e. Figure 12 shows one method of providing AA automatic weapons protection for a corps during the defense using four battalions. Protection has been provided for the troops occupying forward defensive localities of the main battle position, the corps reserves and their routes forward, the area occupied by the field artillery, and important rear establishments.

f. In the defense of a river line AAA guns and automatic weapons will be employed to protect the reserves and the artillery. In addition, some automatic weapons protection should be provided on or near the river line. Searchlights may be placed in positions from which they can illuminate possible hostile crossings. Such positions should be most carefully selected to provide the maximum protection from fire delivered from the opposite bank of the river.

g. In protecting extensive counterattacks, employment of AAA units is similar to their employment in the attack, provision being made in the plan for prompt reestablishment of the defense when the objective of the counterattack has been secured, or for continuing the attack in case the counterattack develops into an offensive.

■ 98. PURSUIT.—The problem of AAA protection in a pursuit is essentially an offensive operation in the case of direct pressure, and a rapid advance in the case of an encircling movement. In the case of direct pressure, the AAA units must be prepared to move forward rapidly by bounds. AAA guns normally will not be used in an encircling movement. Armored forces normally are assigned the mission of the encircling maneuver in the pursuit. For the discussion of the tactical employment of AAA with the armored forces engaged on this mission, see FM 4–101.

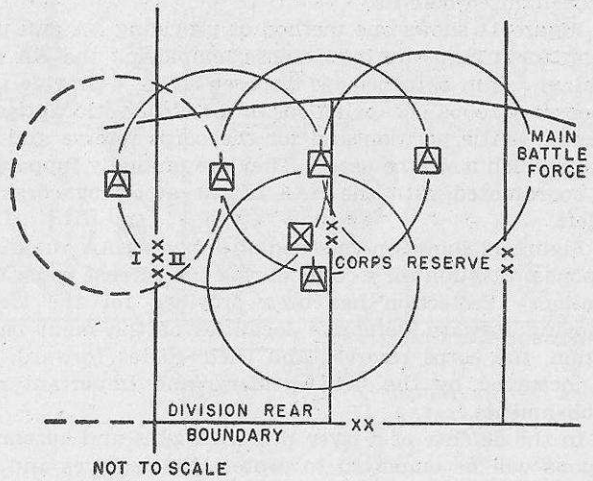


FIGURE 11.—AA gun battalion protecting a corps in defense.

■ 99. RETROGRADE MOVEMENTS.—*a.* When withdrawing under pressure from hostile ground forces, AAA protection is provided for the moving columns as in an advance. In addition, the rear guard must be provided with AAA protection as in a defensive situation. It is highly probable that the enemy will have at least limited air superiority. The progress of leading elements must not be obstructed as this would jeopardize the movements of the main forces following. Protection of defiles is, therefore, of the utmost importance. The

success of the withdrawal will depend largely on the secrecy with which it is accomplished.

b. Withdrawal is usually made under cover of darkness. However, the tactical situation may in exceptional cases demand a daylight operation and AAA protection becomes even more important under this condition.

c. In a withdrawal, enemy mechanized forces are a serious menace, and the AA defense should be planned with this in

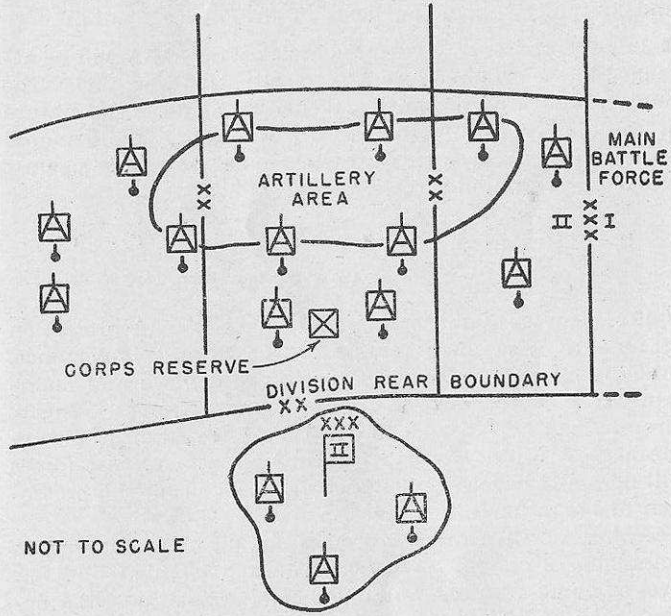


FIGURE 12.—AA automatic weapons protecting a corps in defense.

mind. Care must be taken that AAA guns are not left without protection in positions exposed to mechanized attack. Alternate positions for antimechanized fire should be reconnoitered, so that the AAA may engage ground targets if the mechanized threat requires it.

d. When not pressed by the enemy, a withdrawal is protected by the AAA as in an advance.

e. Coordinated control in the case of AAA gun units is usually practical in a withdrawal and should be maintained. If AAA is to be used with a covering force, it should be attached thereto.

■ 100. PROTECTION OF TRAINS.—AA automatic weapons fire units will often be attached to troop units moving by rail. These weapons will be mounted, ready to fire, on flatcars or gondolas, spotted in the train so as to provide all around and mutually supporting fields of fire. (See fig. 13.)

■ 101. EMPLOYMENT WITH ARMORED FORCES.—AAA will be attached to the armored forces as the situation warrants. The number and kind of units attached depend on the nature of the operations and the terrain over which the armored forces operate. Weapons attached must be usable against either air or ground targets. (See FM 4–101.)

SECTION II

FORWARD AREA AIRDROME DEFENSE

■ 102. FORWARD AREA AIRDROME DEFENSE.—*a.* AA protection of forward area airdromes is of the utmost importance. Friendly aircraft cannot be expected to achieve and maintain air superiority over unprotected airdromes. Enemy aircraft may be expected to place unprotected airdromes in the highest priority for all forms of air attack. Air forces will normally have AAA assigned or attached for the protection of operational airdromes.

b. Most forward area airdromes should be considered as point objectives which may be attacked by high and low level bombing, strafing, and dive bombing aviation. AA defense may include both guns and automatic weapons. The doctrine outlined in paragraphs 76 to 85, inclusive, for rear area defenses applies equally to guns and automatic weapons employed for defense of forward area airdromes.

c. Searchlights are used to illuminate the area against sabotage, ground attack, airborne attack, for the dazzle and glare effect on low level raiders, homing beacons, and for illumination of landing strips. Normal illumination for guns, automatic weapons, and friendly fighter interception will



FIGURE 13.—Antiaircraft protection of a train.

be the exception, rather than the rule, around forward area airdromes.

d. The AAA commander coordinates his fields of fire, gun emplacements, camouflage discipline, and communications with other airdrome defense troops and with the airdrome commander. (See FM 4–102 and 4–104.)

SECTION III

BARRAGE BALLOONS

■ 103. TYPE.—VLA barrage balloons possess some mobility and may be adapted to tactical employment with the field forces, particularly in a rear area installation of an army or corps.

■ 104. MISSION.—*a.* VLA balloons flown singly may be employed in the following ways:

(1) As a mobile defense in convoy duty to protect ships against minimum altitude attack. In open regions such as deserts the balloons may also be used to protect land convoys, both rail and motor.

(2) As a semimobile defense, VLA balloons may be used to protect supply establishments, railheads, bridges, defiles, and troops in bivouac areas.

(3) Balloons may be employed in amphibious operations for convoy protection and as a semimobile defense to protect beachheads and supply dumps after the landing is accomplished.

b. VLA balloons flown in tandem may be employed under the same conditions as when flown singly, thus giving protection against dive bombardment or low level attack to higher altitudes. For a complete discussion of VLA balloons see FM 4–181.

CHAPTER 8

EMPLOYMENT AGAINST LAND AND NAVAL TARGETS

	Paragraphs
SECTION I. Engagement of mechanized targets	105–112
II. Assault of fortifications	113–115
III. Engagement of naval targets	116–119

SECTION I

ENGAGEMENT OF MECHANIZED TARGETS

■ 105. TARGETS.—*a.* Mechanized targets which the AAA may be required to engage are—

(1) *Heavy tanks (50 to 75 tons).*—These are suitable targets for AA guns, but normally are not vulnerable to fire from AA automatic weapons except at very short ranges.

(2) *Medium tanks (18 to 35 tons).*—These are suitable targets for 37-mm or 40-mm AA automatic weapons at ranges up to 500 yards and for AA guns.

(3) *Light tanks and armored cars.*—These are lightly armored and are suitable targets for AAA of caliber .50 and above.

(4) *Unarmored vehicles.*—These are suitable targets for all weapons including small arms.

b. The personnel of AA batteries must be trained to distinguish between hostile and friendly armored vehicles. FM 30–40, FM 30–41, and FM 30–42 will serve as guides for this training. FM 21–7 lists Film Strips on tank recognition.

■ 106. VULNERABILITY OF TANKS.—The most vulnerable points are the vision slits, ports, sides, belly, tracks, and track suspension mechanisms. Flanking fire is preferable to frontal because more of these vulnerable points are brought under fire. At close range, even small-arms fire should be brought to bear on the vulnerable points discussed above.

■ 107. FIRE CONTROL DOCTRINE.—*a.* Control of fire is decentralized to the fire unit commander.

b. In general, as many targets as possible, within range, will be engaged by the fire unit. The fire of more than one

gun on one target will be ordered only when no other suitable target presents itself for the other guns.

c. The crews of moving tanks are relatively deaf and blind except in a narrow sector to their front. These handicaps should be exploited by the use of ambush wherever possible. For example, three tanks which appear to be traveling a course that will take them to the flank of a gun position, should be permitted to come almost abreast of the position and the *last* tank in column engaged first; then the second in column; and, last, the leading tank. The essential feature of this action is that the tanks are not threatening the fire unit position.

d. On the other hand, when tanks are threatening to overrun a gun position, the tank which is most menacing (usually the closest to the gun) should be fired upon until hit; then the next nearest (or most menacing) should be fired upon. A halted tank is capable of more effective fire than a moving tank. Consequently, a halted tank that is firing upon the gun position may be more menacing than a closer, moving tank.

■ 108. ACCURACY OF FIRE.—To stop a tank, hit it with a force sufficient to penetrate the armor, demolish a vital part of the mechanism, or incapacitate the crew. It is essential that initial fire be accurate. If opening fire is inaccurate, the tank can seek another avenue of approach or withdraw to a defiladed spot and neutralize the disclosed position. Also when antitank positions are disclosed, they may be attacked by dismounted parties. To obtain greater initial accuracy, AAA weapons must withhold fire until mechanized targets are within the following ranges:

a. 400 yards for the caliber .50 machine guns.
b. 600 yards for automatic weapons.
c. 1000 yards for the AA guns.

■ 109. SPEED OF OPENING FIRE.—Mechanized attacks may come quickly and with little warning, and must be engaged speedily. In a rapidly shifting situation the battery commander will be forced to use his own judgment and initiative and will have to make the final decision as to the targets to be engaged. (See figs. 14 and 15.) Once the target is

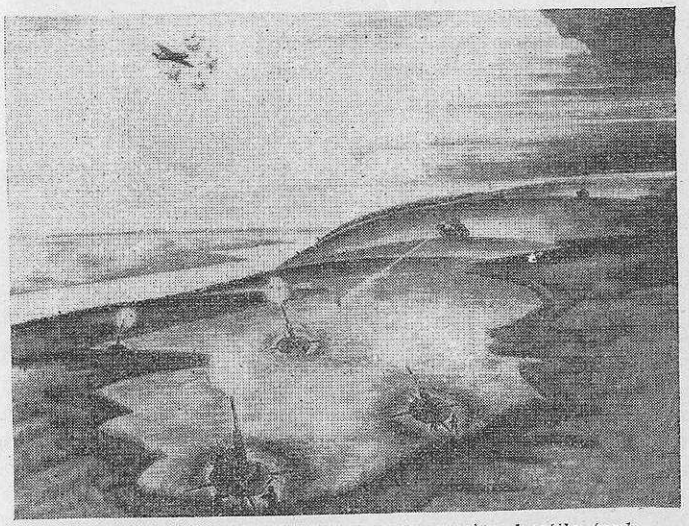


FIGURE 14.—Wrong—battery is not engaging hostile tank.

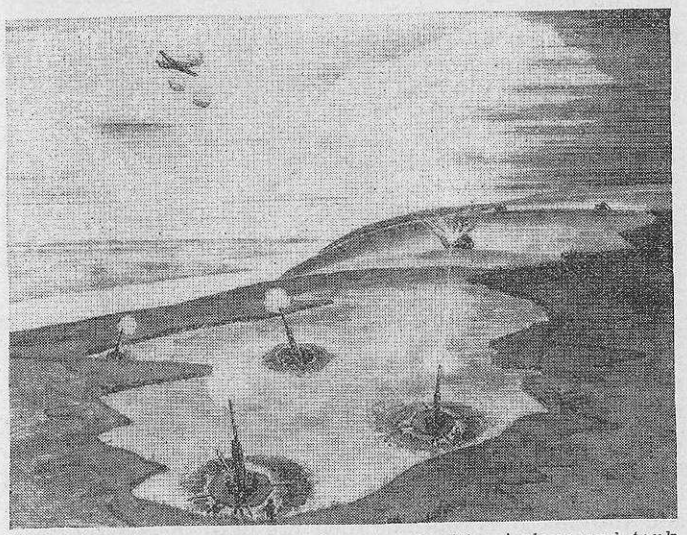


FIGURE 15.—Right—battery is engaging hostile airplane and tank.

within the ranges specified above, every second of delay in opening fire increases the probability of discovery with possible disastrous results to the fire unit.

■ 110. AMMUNITION.—*a.* Armor-piercing projectiles, if available, should be used against armored targets.

b. High explosive is preferable against lightly armored or unarmored vehicles.

■ 111. MOBILITY.—*a.* AAA weapons possess a limited tactical mobility. The time required to go from traveling to firing position varies from about 3 minutes for the 40-mm gun (for use of direct-fire sights), to about 15 minutes for the 90-mm gun.

b. Because of the extreme length of time required to move AA guns they should not be used in the first lines of the antitank defense, but rather should be disposed in depth to cover possible break-throughs in the front lines. No attempt should normally be made to move AAA fire units just prior to or during an engagement. Self-propelled AAA has greater mobility and may be used as far forward as antitank guns.

■ 112. REFERENCE.—For information on selection, occupation, and organization of positions for AAA fire units on antimechanized missions, see FM 4–101, FM 4–102, and FM 4–104.

SECTION II

ASSAULT OF FORTIFICATIONS

■ 113. GENERAL.—*a.* Present day technique for the assault of permanent fortified positions requires the employment of a selected, mixed force which may include AAA as assault artillery. The actual assault is preceded by a bombardment during which the fortifications are shelled by long range artillery and bombed by airplanes. During this phase, the flat trajectory, high muzzle velocity antitank and AAA weapons are moved into positions from which fire can be placed directly on the ports and embrasures of the fortifications. After the long range artillery ceases its fire, the AA and antitank guns continue their fire until the assault parties can actually cover the structure with flame throwers and smoke. Having closed with the emplacement, special parties destroy it with demolition charges and grenades.

b. In addition, AAA may be called upon to reduce small pill boxes or to penetrate armored turrets by direct fire.

■ 114. MISSION.—In the assault of permanent fortifications, the mission of the AAA is to force the defenders to keep ports closed and deny their use for returning fire. Against smaller structures, the destruction of the fortification may be required. For technique to be employed see FM 4–102, FM 4–104, and FM 4–121.

■ 115. DISPOSITIONS.—The prime tactical consideration is a clear view of the target at a range sufficiently short to permit observation and adjustment of fire on small openings in the fortification. In order to hit these targets, guns must be emplaced within the field of fire of the defending weapons. Concealment, movement into position under cover of darkness, and adequate provisions for protection of the gun crews are necessary.

SECTION III

ENGAGEMENT OF NAVAL TARGETS

■ 116. MISSION.—The secondary mission of AAA, disposed on or near water areas in which enemy units may operate, is fire for the destruction of hostile naval craft. Highest priority is given to fire against motor torpedo boats.

■ 117. CHARACTERISTICS AND TACTICS OF MOTOR TORPEDO BOATS.—*a.* Motor torpedo boats have the following characteristics:

(1) Speed, from 30 to 60 miles per hour.
(2) Hull construction, almost entirely of wood.
(3) Low silhouette, about 10 feet above water line.
(4) Radius of action, up to 1,000 miles at reduced speed.

b. Motor torpedo boats will attempt an attack at high speed in order to achieve surprise, and will depend upon their speed and maneuverability for protection against fire from shore batteries.

■ 118. EMPLOYMENT.—*a.* Both AA guns and automatic weapons are capable of defending against motor torpedo boats. However, automatic weapons are relatively ineffective at ranges greater than 2,500 yards chiefly because of fire control difficulties.

b. Two AA guns should be used as a fire unit. The automatic weapons fire unit is one gun.

c. Since motor torpedo boat attacks can be made during the hours of darkness, searchlight illumination of the fields of fire should be provided. Searchlights may also be used to dazzle or blind the hostile naval craft.

d. Antiaircraft artillery used as antimotor torpedo boat weapons will usually be located in a harbor defense where fixed seacoast guns may also be used for the same mission. Their employment should, therefore, be coordinated under a single commander.

■ 119. REFERENCE.—For information on selection, occupation, and organization of positions see FM 4–102, FM 4–104, and FM 4–106.

CHAPTER 9

ANTIAIRCRAFT DEFENSE PLAN

■ 120. GENERAL.—An effective defense against the operations of enemy aircraft requires the coordinated effort of all elements of the command and the utilization of every available active and passive means of defense. This chapter deals with a plan for their coordinated use.

■ 121. COORDINATION OF DEFENSE MEASURES.—*a.* The desired coordination of all AA defense measures in any large area is usually effected by the organization of a command for air defense. Operation of AAA in defense of ground troops and installations must be coordinated with those of aircraft. This applies particularly to the employment of that fighter aviation designed primarily for defensive missions in the AA security of important areas and ground installations and the protection of ground troops and their observation aviation beyond the range of AAA. Suitable air-ground communication and recognition signals must be established.

b. AAA forms the framework upon which all active ground measures for air defense are built.

■ 122. TERRAIN.—In preparing the AA defense plan, a careful study, by means of maps, aerial photographs, reconnaissance, and reports should be made of the terrain over which the defense is to function.

■ 123. ENEMY AVIATION.—A study of enemy aviation should include—

a. Composition and strength of hostile air forces.

b. Location and type of enemy airdromes and air establishments.

c. Air tactics employed by the enemy.

d. Probable objectives of enemy aerial observation or attack and direction or directions of approach to them.

■ 124. FRIENDLY TROOPS.—*a. Aviation.*—A thorough knowledge of our own forces, both ground and air, and of the overall plan of operations is necessary. The method of employ-

ment of the various types of aviation used, the locations of our airdromes, the routes and schedules used by our aerial formations, the areas over which they habitually pass, and the areas over which they do not normally operate, are essential factors.

b. AAA.—There must be coordination of the plans for the employment of the AAA with the force and its components and that of adjacent forces. For example, the army commander should fix the responsibility for the coordination of the AAA defense between the several corps and along the corps rear boundary.

■ 125. COORDINATION OF FIRE AT AIR TARGETS.—Some of the coordinating measures which may be taken are as follows:

a. AAA.—The dispositions of AAA and the fields of fire of the guns and automatic weapons should be clearly indicated on an overlay which is attached to the plan. Elements receiving special protection should be indicated.

b. Organic AA weapons.—Other elements of the force are equipped with machine guns designed primarily for AA fire. The disposition of these weapons should be coordinated with the AA's own machine guns by indicating on an overlay the areas to be covered.

c. Auxiliary weapons.—In addition to the fire of AAA and of organic AA weapons referred to in *a* and *b* above, all small arms of the several arms and services should be employed against low-flying hostile aviation. The machine guns of units in reserve should be sited habitually to provide AA protection.

■ 126. WARNING OF APPROACH OF ENEMY AIRCRAFT.—AA defense depends upon an efficient warning system which functions with sufficient speed to permit the operation of the AA defense plan. This warning may be provided by the following:

a. Aircraft warning service.—This service is described in FM 11–25. Information as to its establishment and operation should be incorporated in the AA defense plan. Instructions for its coordination with the AAAIS should be clearly defined.

b. AAAIS.—This service is described in FM 4–106. The AAAIS is normally operated by the searchlight defense.

Where there is no searchlight defense, the other AAA units must establish and operate an AAAIS.

c. Air guards.—All units are responsible for security and should maintain air guards at all hours. The approach of enemy aircraft should be indicated by the prescribed alerting signal restricted for this use only.

■ 127. SUPPLY ACTIVITIES.—Supply installations and trains should be located in areas protected by AA fire and should be concealed. Immobility during aerial activity may prevent detection. Effort should be made to route convoys and trains through protected areas.

■ 128. RESTRICTIONS TO AVOID CASUALTIES.—To avoid casualties to our own forces, both on the ground and in the air, certain restrictions upon AA fire from the ground must be imposed (see pars. 51 and 75). These *may* include—

a. Designation of minimum elevation for firing of guns, automatic weapons, and small arms when the direction of fire is over or toward our own forces.

b. Prohibition of fire against airplanes actually engaged in aerial combat, a question of policy.

c. Prohibition of fire at airplanes by individuals except as a part of the supervised fire of a squad or higher echelon.

d. Prohibition of fire against airplanes unless they are recognized as hostile or commit a hostile act.

e. Prohibition of fire during the announced period of a "fighter night" except when the fire unit is subject to an overt hostile act.

■ 129. OTHER RESTRICTIONS.—Other restrictions *may* include—

a. Restrictions on fire and the use of searchlights against aircraft in order to insure secrecy.

b. Restrictions on the use of barrage balloons to avoid disclosing strongly defended points, interference with the conduct of AAA fire, and operations of friendly aircraft.

■ 130. NORMAL RESTRICTIONS.—The following general rules on restriction of AAA fire and operation will constitute the normal basis of local SOP:

a. "Seen" targets.—(1) Restriction of fire against "seen" targets will be the exception rather than the rule. AAA will

normally open fire on the following targets whenever it can do so without unnecessarily endangering friendly aviation, unless specifically restricted:

(*a*) Aircraft identified as hostile by the fighter command.

(*b*) Aircraft recognized as hostile, either by appearance or by actions.

(*c*) Parachute mines, as follows: automatic weapons will engage parachute mines down to an altitude of 300 feet when the angle of elevation is greater than 10°.

(2) Protection of certain vulnerable points or areas may be so important that modification of the above rules may be necessary to allow—

(*a*) AAA to open fire on any aircraft which is not positively recognized as friendly.

(*b*) Fire to be opened on hostile targets regardless of the position of friendly aviation.

(3) AAA to open fire on any dive bomber or low-flying aircraft actually attacking defended installations, even though fire has been restricted.

(4) AAA to open fire at any time when directly attacked.

b. "Unseen" targets.—(1) Normally "unseen" targets identified as hostile may be engaged at any time by AA guns which are included in the air defense communications system of a fighter command, unless specifically restricted.

(2) AA guns, not included in the air defense communications system of a fighter command and in an area where friendly aviation might be endangered, will *not* fire on unseen targets unless a hostile act is committed.

(3) Automatic weapons will not engage unseen targets unless directly attacked.

(4) It is the responsibility of the local AAA commander to make every effort to determine whether or not there is friendly aviation in the vicinity *prior to opening fire* on an unseen target.

(5) Defense in certain areas may be such that modifications, similar to those in *a* (2) above, may be necessary.

c. Searchlights.—The normal status of searchlights will be as given in paragraph 51*d*. Illumination may be withheld for reasons similar to the following:

(1) To protect friendly fighters.

(2) To prevent illumination of friendly formations.

(3) When such illumination would be an aid to the enemy without resultant advantage to friendly forces (blackout).

d. Barrage balloons.—(1) Barrage balloons will normally fly at ruling operating height (ROH).

(2) The controller, or similar authority, may, for a specific purpose, order certain balloons close-hauled, or change the altitude at which the barrage will be flown, or order fighter aviation to engage drifting barrage balloons. AAA weapons will not engage drifting barrage balloons.

■ 131. FORM FOR AN AA DEFENSE PLAN.—An AA defense plan may be issued in the form of an annex to the orders of the force commander. The following is an example of the substance of such an annex, issued by a corps commander:

a. Enemy aviation.—Information on recent employment of enemy aviation, including a description of the tactics employed by each type and an estimate of its organization, strength, and employment in the coming operation.

b. Friendly troops.—(1) *Aviation.*—As much of the plan of employment of friendly aviation for the coming operation as will enable the ground forces to recognize and avoid placing their AA fire on friendly airplanes. Times, localities, and altitudes of activities, special markings, formation, recognition signals, locations of local airdromes, and landing fields should be covered.

(2) *AAA.*—As much of the plan of employment of the AAA of the army and adjacent corps for the coming operation as will insure coordination between these units and the corps AAA.

c. A statement of the general measures of all forces with the corps to maintain an effective defense against enemy air attack and observation. Statement of means to be employed—active defense, passive defense, and an effective warning system.

d. Corps and division aviation.—Orders for the employment of the corps aviation and appropriate coordinating instructions for divisional aviation, during the coming operation, with special reference to AA defense.

e. AAA fire.—(1) *Antiaircraft weapons.*—Subparagraphs for the corps AAA units, division AAA units, and the or-

ganic AA weapons of corps troops. The attached overlay shows the plan of employment of all these weapons for the coming operation, their locations, zones of responsibility, and contingent zones. Explanatory instructions are placed on the overlay, or in this paragraph, to insure thorough understanding by all concerned of the coordinated corps plan of employment.

(2) *Auxiliary weapons.*—Instructions directing and controlling the fire at aircraft of those weapons of the ground forces which are not assigned in (1) above to AA defense as a primary mission.

(3) *Conduct of AA fire.*—Restrictions on fire and searchlight employment to insure secrecy. Target priorities. Employment of organic AA weapons against mechanized forces. Restrictions as to minimum angles of elevation, directions of fire, withholding of fire, and AA fire by elements in actual contact with enemy ground forces. Instructions to insure the protection of friendly aviation from our own AA fire.

f. Passive defense.—Instructions for conduct of troops in movement and in bivouac to avoid detection and to reduce casualties from attacks by enemy aviation. Control of lights. Use of cover and concealment. Camouflage. Use of smoke. Instructions for conduct of civilian population within the service command as to the use of lights and cover.

g. Factors pertaining to AA defense to be given consideration in the selection of supply installations and train bivouacs, and in the selection of convoy and train routes. Restrictions on the size, composition, and movement of convoys. Use of lights in convoys.

h. Instructions for the collection of important enemy aircraft intelligence from, and for its dissemination to, divisions, line of communication troops, supporting ground and air units, and the rear echelon. Directions for the maintenance of AA lookouts by units. Standardization of alarm signals.

i. Instructions for coordination of the AWS with the AAAIS.

CHAPTER 10

COMMUNICATIONS

■ 132. GENERAL.—*a.* AAA communications comprise all the means employed to transmit commands, intelligence, and administrative messages between AAA units; and for liaison with units of the other arms and services, except those transmitted by special couriers in the Army and civil postal service.

b. Within the AAA units, communications are needed between the various command posts and with service elements for normal command and administration. In addition, an intelligence net is required to transmit timely warning of the approach of hostile aircraft. In the lower echelons, communication must be established also for conduct of fire and for the use of air guards.

■ 133. RESPONSIBILITY OF COMMANDERS.—*a.* The commander of each tactical AA unit is responsible for the communications within his own unit. In all AA units down to and including the battalion, a unit communication officer, appointed by the unit commander, exercises immediate supervision over the installations, operation, and maintenance of the communication agencies of the unit.

b. To insure coordination, the commander of each tactical unit exercises supervision over the communication agencies of subordinate units. This control is both tactical and technical. Tactical control insures establishment of necessary communication agencies between tactical units in accordance with the tactical plan. Technical control standardizes the installation, operation, and maintenance of the various communication agencies. In the exercise of technical control, the communication officer deals directly with the communication officers of subordinate units.

■ 134. NATURE AND EXTENT OF COMMUNICATION SYSTEMS.—A selection of the agencies to be employed and the extent to which the communication system will be installed in any situation depend upon the following factors:

a. Facilities available.—(1) Present Tables of Equipment provide for the issue of radios down to and including all fire units. Radio will form the framework of the communication system. A minimum amount of wire communication equipment is carried by the various units. If time permits and the situation requires the use of more wire communication equipment than is carried, it may be drawn from Signal Corps supply depots. Finally, the commercial facilities available influence the amount of wire that must be laid. Fullest possible use should be made of established lines.

(2) In barrage balloon organizations wire communication is usually employed for both LA and VLA units. Radio communication may be used to supplement the wire nets or as an emergency means of communication.

b. Frequency of movement.—The opportunity to expand the communication system beyond the radio net will depend upon the time available for laying wire. The amount of wire that can be laid will vary from none, in a situation where the AAA changes position frequently, to an elaborate system set up by semimobile units in a stabilized situation.

c. Dispersion of units.—The physical separation of the AA elements may be the deciding factor as to what agencies can be employed. Where elements are disposed in a defense of an establishment, distances between the various units will not have any great influence on what types of communication can be used. Where AAA is employed with the ground forces in the combat zone, however, the greater separation of units may prevent the use of one or more agencies.

d. Secrecy.—In certain situations, secrecy may dictate the selection of the agency employed.

e. Terrain and atmospheric conditions.—Atmospheric conditions affect the range of radio communication as does terrain, particularly where the sets must be emplaced at a lower elevation than the surrounding terrain.

f. Communication discipline.—A unit with a complete complement of communication equipment properly installed will frequently experience great difficulty in receiving messages and maintaining a rapid and accurate flow of information. Communication discipline is lacking. All personnel must be impressed with the necessity for an orderly, systematic handling of communication. Officers and men alike must be indoctrinated with the necessity for brevity. Never use two words when one will convey the meaning. The training of radio, switchboard, and telephone operators must be continuous and progressive. One of the most important duties of the unit communications officer is a constant check of the discipline within the communication nets.

■ 135. EMPLOYMENT OF SIGNAL AGENCIES.—Detailed description of communication matériel, together with instructions for its installation, maintenance, and operation, are contained in 24-series Field Manuals and 11-series Technical Manuals. Other exterior means of communication, for air-ground liaison particularly, are signaling by means of panels, pyrotechnics, flashlights, headlights and winglights, reflectors, exhaust smoke, flares, prearranged maneuvers of planes and formations of trucks, and other improvised systems. Such means, together with simple codes, must be prescribed in coordinated signal operating instructions issued by the army or task force commander. They must be changed frequently to preserve secrecy.

■ 136. UNIT COMMUNICATION NETS.—For detailed discussion of communications within the antiaircraft units see the appropriate sections of FM 4–101, 4–102, 4–103, 4–104, and 4–106, and FM 4–181 (when published).

CHAPTER 11

PROTECTION AND LOCAL SECURITY

■ 137. CAMOUFLAGE.—*a.* Camouflage is the work done to deceive the enemy as to the existence, nature, or location of troops, establishments, and matériel.

b. Effective camouflage depends on the following factors in the priority indicated:

(1) Proper choice of position.

(2) Camouflage discipline.

(3) Proper erection of camouflage materials.

(4) Suitability of camouflage materials.

c. The following factors make camouflage of AAA difficult:

(1) Units must be placed in the open to have an all around field of fire.

(2) The distinctive pattern of an AAA fire unit position.

(3) Camouflage must be so designed that it can be removed instantaneously.

(4) The size and shape of the detector in an AAA gun or searchlight fire unit and the fact that they must be in operation 24 hours a day.

d. Dummy positions aid in the concealment of active positions by diverting the attention of the enemy. The construction of these dummy positions is of primary importance. Their construction should be controlled by a general plan (applicable only to rear area defenses). Evidences of activity about dummy positions, including simulated fire by means of flash and smoke devices and moving personnel dummies, will increase their apparent reality.

e. The best check of camouflage and the degree of camouflage discipline is the study of aerial photographs and observation from the air.

f. For a detailed discussion of camouflage principles, materials, construction, and discipline, see FM 5–20.

■ 138. COVER.—*a.* Cover is the means employed for the prevention of injuries to personnel and matériel. Dependence for protection must be placed on dispersion and concealment,

slit trenches, fox holes, and parapets. Protection of vehicles, equipment, and personnel on the march is best accomplished by dispersion. A density of 10 to 12 vehicles per mile is an unprofitable target for enemy attack.

b. For details of design and construction of field fortification see FM 5–15.

■ 139. LOCAL SECURITY.—Local security is the all around protection of a command to prevent surprise, interference, sabotage, and minimize the effect of enemy attacks. Every commander is responsible at all times for the security of his command. For further details see FM 4–102, 4–104, 4–106, 7–5, 7–10, and 7–40.

APPENDIX I

ESTIMATES, PLANS, AND ORDERS

	Paragraphs
SECTION I. Estimate of situation	1–7
II. Commander's plan	8
III. Field orders	9–12

SECTION I

ESTIMATE OF SITUATION

■ 1. GENERAL.—As a preliminary to the preparation of his plan, the AAA commander should make an estimate of the situation. Ordinarily, the estimate of the situation is a continuing mental process leading to a decision when needed. In this estimate, he considers his mission, the situation, the means available to him and to the enemy, and the results possible in future action.

■ 2. FORM FOR AAA COMMANDER'S ESTIMATE OF SITUATION.—The form given below is the standard five-paragraph commander's estimate of the situation. Each paragraph with its contents is covered separately. In most cases it will be unnecessary for the AAA commander to go into such great detail, as instructions from higher authority will in large part take the place of this estimate.

■ 3. MISSION (par. 1).—State the mission assigned by higher authority or as deduced from instructions from that source or from knowledge of the situation.

■ 4. SITUATION AND POSSIBLE LINES OF ACTION (par. 2).—*a. Considerations affecting possible lines of action.*—Consider and analyze, in connection with your mission, those factors in the situation which will influence your choice of a line of action as well as those which will affect the physical capabilities of the enemy. Indicate your conclusions or deductions as to the effect of each factor on any of the enemy's capabilities or your own possible lines of action. *The following list of factors is suggestive and not complete; nor will all of these necessarily have any important bearing on every situation:*

(1) *Relative combat power of opposing forces, include—*
(a) *Composition and numerical strength, include—*
Own AAA force.
Own air force.
Balloon barrages.
Enemy air force.
(b) *Arms and armament, include—*
Number and types of AAA weapons.
Number and types of own balloon barrages.
Number and types of own aircraft.
Number and types of enemy aircraft.
(c) *Combat efficiency, include—*
Physical condition.
Morale.
Training.
Battle experience.
Leadership.
(d) *Dispositions, include—*
Present dispositions of own AAA.
Present dispositions of own balloon barrages.
Present dispositions of own air force.
Present dispositions of enemy air force and local enemy AAA.
(e) *Assistance to be expected from—*
Our own air force.
Adjacent AAA units.
Balloon barrages.
(2) *Aircraft warning service, include—*
Nature.
Extent.
Reliability.
Rapidity of transmission of information.
(3) *Restrictions on operations, include—*
Presence of air force.
Presence of balloon barrages.
(4) *Reinforcements.*
(5) *Time and space, include—*
Our own troop and air force movements and time required.
Hostile air force movements and time required.

(6) *Terrain and water areas, include—*

Effect on AAA dispositions, observation, fields of fire, concealment, cover, obstacles, and movement.

Effect on enemy air force approaches and methods of attack.

(7) *Nature of objective or objectives being defended, include—*

Size, shape, construction, and relative importance.

Whether forward or rear area.

Fixed or moving.

Vulnerability to the several types of hostile aircraft.

Vulnerability to attack by hostile ground or air-borne forces.

Type and quantity of AAA armament.

(8) *Dispositions (as predisposing toward or against a certain line of action), consider—*

Plans for disposing the AAA available to meet the different possible lines of enemy action which can interfere with accomplishment of your mission.

(9) *Signal communication.*

(10) *Weather, consider—*

Influence of climatic conditions, visibility, prevailing winds, and position of sun with reference to the objective to be defended.

(11) *Status of supply and evacuation, include—*

Sufficiency in the immediate situation and maintenance in future.

(12) *Enemy's knowledge of our AAA and air force strength and dispositions.*

(13) *Tactical doctrines of hostile air force.*

NOTE.—Only those factors which have an actual effect on your choice of a line of action or on the physical capabilities of the enemy should receive consideration.

b. Enemy capabilities.—As a result of the preceding deductions, list, in general terms only, all possible lines of action within the physical capabilities of the enemy which can interfere with the accomplishment of your mission. List counteractions you can take to forestall them.

c. Own lines of action.—List, in general terms only, all reasonable and practicable lines of action open to you which,

if successful, will accomplish or facilitate the accomplishment of your mission. *In simple situations and in cases involving small commands, it usually will be possible to eliminate all but one of your own lines of action* by deductions made in paragraph 4*a*. In such a case, the analyses and comparisons made in paragraphs 5 and 6 are omitted and the estimate is completed by a statement of the decision.

■ 5. ANALYSIS OF POSSIBLE LINES OF ACTION (par. 3).—Review mentally what would happen under all of the possible combinations if each of your lines of action were opposed by each of the hostile capabilities. This is to determine the degree of success, toward the accomplishment of your mission, that can be expected from each of your lines of action, and to discover the weakness of each when tested against each of the capabilities of the enemy. From these mental analyses, state briefly such of your conclusions as have an important bearing on your choice of a line of action.

■ 6. COMPARISON OF OWN LINES OF ACTION (par. 4).—With reference to each of your own lines of action, determine and state the decisive factor or factors that lead you to discard or adopt it. State, in conclusion, which line of action is most advantageous for carrying out your mission, whatever action the enemy may take. This determination will result from balancing mentally the comparative advantages and disadvantages of your own lines of action, and from judging and weighing their relative merits. It will require a mental review of the deductions and conclusions made in paragraphs 5 and 6.

■ 7. DECISION (par. 5).—The scope of the decision will vary between wide limits. The estimate made at any definite time should conclude with a decision as complete as the situation at that specific time warrants. The decision should be concise and should state what the force as a whole is to do and so much of the elements of when, where, how, and why, as may be appropriate.

SECTION II

COMMANDER'S PLAN

■ 8. GENERAL.—Following the decision, certain supplementary decisions must generally be made as to the details of its execution. The more important of these may be announced by the commander as a directive to his staff. With the commander's directive as a basis, the staff prepares the plan in detail. Since the commander is responsible for all instructions issued to the command, the entire plan must have his approval or authorization.

SECTION III

FIELD ORDERS

■ 9. GENERAL.—For general information on orders and annexes as well as for the form of a field order, see FM 101–5. Ordinarily AA commanders will issue either oral or dictated orders which may later be confirmed by written orders. The commander's check list given below may be used for a reminder in the preparation of AAA field orders, for units assigned or attached to the field forces. It is not to be inferred that all items listed must be included nor that other items are unnecessary. A trained commander or staff officer prepares an order to fit the situation, not a form.

■ 10. STANDING OPERATING PROCEDURE.—In every unit, standing operating procedure should be prescribed by the commander whenever possible. This procedure covers those features of operations which lend themselves to a definite or standardized procedure without loss of effectiveness. The adoption of such procedures saves time in the preparation and issuance of orders, minimizes the chances of confusion and errors when under the stress of combat, and greatly simplifies and expedites the execution of operations in the field. (See app. II.)

■ 11. INSTRUCTIONS FOR AAA IN ARMY (OR CORPS) FIELD ORDER.—Instructions for the AAA in an army (or corps) field order are normally given in paragraph 3, under the heading "Antiaircraft Units." These instructions include the mis-

sions of the army (or corps) AAA and attached AAA, directing particular attention, if necessary, to those bodies of troops, installations, or critical points considered to be of vital importance. Instructions should also be included governing all attachments of AAA to the several corps (or divisions in case of a corps order); directing the protection of such army troops or establishments as may be located in the several service commands; and insuring coordination between the army and corps AAA, among the AAA of the several corps and with AAA of adjoining forces.

NOTE.—The instructions for AAA operating with a division will follow in substance those given in this paragraph.

■ 12. COMMANDER'S CHECK LIST.—*a.* (1) Situation of the opposing forces, brief as to ground forces, but more complete as to the operations of the enemy air force.

(2) Plan of our forces (brief) stating clearly the plan of our own organization. Disposition and employment of adjacent AAA and balloon barrages, extent and efficiency of aircraft warning service.

b. Decision of the unit commander for the operation.

c. Mission of each element of the unit. (A separate subparagraph for each element.)

Instructions applicable to more than one element—time when ready to fire, withholding fire, displacement, camouflage, instructions to accomplish coordination within the unit and with adjacent AA units, coordination with friendly aviation and balloon barrages, secrecy and restriction of movements.

d. Refer to field force administrative order or additional administrative instructions when necessary.

e. Axes of signal communication and special instructions relating to the AAAIS. Command posts of the AAA unit and of the subordinate units.

APPENDIX II

STANDING OPERATING PROCEDURE FOR ANTIAIRCRAFT ARTILLERY UNITS

	Paragraphs
SECTION I. General	1–5
II. Check List	6–15

SECTION I

GENERAL

■ 1. The purpose of standing operating procedures is given in FM 101–5 and FM 100–5.

■ 2. Technical instructions which concern only a limited number of specialists or other individuals, should be issued in the form of separate instructions, appropriate reference being made thereto in the standing operating procedure. Staff standing operating procedures, covering such matters as duties of various individual members of the staff, or procedure in establishing, moving, or closing the command post, may be issued as separate documents, appropriate reference being made thereto in the unit standing operating procedure. All tactical doctrine, training instructions, and extracts from training literature should be omitted from a standing operating procedure, but when desirable, appropriate reference may be made to such doctrine, instructions, or extracts.

■ 3. In general, standing operating procedures are for use in tactical operations. Since the object of all training is successful employment of the unit in combat, standing operating procedures are developed during the training period, but do not cover training methods or training instructions. These items are covered in appropriate training schedules, programs, and memoranda.

■ 4. By reference to standing operating procedure in appropriate paragraphs of combat orders, the issuing of these orders is facilitated.

■ 5. To insure uniformity in preparation of standing operating procedures, and to assist personnel in the use of these documents, the following arrangement of subject matter is prescribed:

a. General.
b. Organization.
c. Reconnaissance, selection, and occupation of positions.
d. Operations.
e. Movements.
f. Intelligence and counterintelligence.
g. Communications.
h. Administration.
i. Command.

SECTION II

CHECK LIST

■ 6. The check list contained in this section covers some of the matters which may be included in standing operating procedures developed for antiaircraft artillery units. They should be used only as guides or reminding lists. Depending on the type of unit being considered, some of the items listed may be omitted, while others may be added. References to pertinent manuals should be included where applicable.

■ 7. GENERAL.—Purpose; references to standing operating procedure of next higher unit; next lower units to base standing operating procedure thereon; when effective; to whom applicable.

■ 8. ORGANIZATION.—Tactical organization of unit; assignment of subordinate units; manning tables; composition of forward and rear echelons; subdivisions of units (headquarters sections, gun sections, range sections, maintenance sections).

■ 9. RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITIONS.—*a. Reconnaissance.*—Action by organization commanders; composition of parties (battalion and battery commander's and superior); when made and when completed; reconnaissance for future movements.

b. Selection of positions.—Field of fire first consideration;

suitability for occupation and withdrawal; cover; concealment; possibilities for camouflage; defilade; routes of approach; possibility for use in antimechanized defense; circulation plan; presence of other units in vicinity which have automatic weapons for their own antiaircraft protection.

c. Occupation of positions.—Use of agents, markers, and guides; local security and warning service; designation of emplacements; communication tie-in; emplacement; alarm systems; cover and concealment; orientation and synchronization; command post; field fortifications; camouflage and camouflage discipline; kitchen; latrines; local defense measures; dispersion of supplies, vehicles, etc.; antigas defense; antimechanized defense; antitank mines; alternate positions; dummy positions; rear echelons.

■ 10. OPERATIONS.—*a. Own security measures.*—(1) March.

(2) Bivouac.

(3) Ground and antimechanized defense in position.

b. Firing operations.—(1) Fire control (hold and resume fire).

(2) AA seen fire (normal and emergency).

(3) AA unseen fire (normal and emergency).

(4) Fixed barrage plans.

(5) Predicted barrage plans.

(6) Field (and seacoast) artillery support.

(7) Fighter command cooperation.

c. Alert status.

d. S–2 and S–3 reports.

■ 11. MOVEMENTS.—*a. Motor.*—(1) *Shuttling* (if applicable).

(2) *Loading.*—Loading lists and diagrams; uniformity in loading; means and methods of securing loads; marking vehicles carrying explosives or ammunition.

(3) *Safety precautions.*—Guards and traffic signals; personnel seated when vehicle in motion; safety straps; no passing of vehicles in column; precautions while gassing; static chains; compliance with instructions from traffic guards.

(4) *Speeds.*—Maximum for different types of terrain; for command and control cars; at night; with and without lights.

(5) *Intervals.*—Driving intervals (day and night); at night; between serials and march units; in congested areas; when halted.

(6) *Halts.*—When, where, how often, and how long? Selection of halting places, method of losing distance on halting and gaining distance when starting.

(7) *Control.*—Control vehicles; methods of posting and relieving traffic guards; use of route markers, signals, phase lines, messengers and signal communications; action at stop lights.

(8) *Motor maintenance.*—Inspections during halts and while in bivouac; motor maintenance sections and their places in columns; towing bars; towing trucks; action in case of disabled vehicles; wreckers; spare parts.

(9) *Refueling.*—Procedure during halts and in bivouac; reserve gasoline and oil; use of 5- and 10-gallon containers; safety precautions.

(10) *Accidents.*—Designation of investigating officers; location in column; immediate action in case of accident; reports and use of forms.

(11) *Defense.*—Procedure to be followed by the following when subjected to air attack:

(*a*) Convoy containing antiaircraft protection.

(*b*) Convoy without antiaircraft protection.

(*c*) Single vehicles.

b. Rail.—Cubic feet of car space for items of unit equipment; weight of items of unit equipment; lists of numbers and types of cars needed; packing lists for boxes and crates; securing vehicles to cars; guards en route; loading passenger cars; car guards; water; kitchen cars; inspection of cars before loading, and with railroad representative on arrival at destination; release from railroad.

■ 12. INTELLIGENCE AND COUNTERINTELLIGENCE.—*a. Reports.*

b. AAAIS.

c. Prisoners of war, documents, captured matériel.—Segregation, treatment prior to interrogation; interrogation; disposition; reports.

d. Counterintelligence.—Vehicle markings; maps, personal effects, letters, and diaries; code symbols for signs and route

markers; message authentication; action in event of capture (*name, rank, and serial number only*).

■ 13. COMMUNICATIONS.—Wire nets; radio nets; priorities of installation; responsibility for installation; message centers; variations in communication systems from those prescribed in Field Manuals; use of signal agencies when in position and on march; establishment of communication with adjacent units, with air force units, and with the aircraft warning service; codes, including code names and numbers; authentications; preserving security of communication system; recognition signals; additional communications for AAAIS, if needed; radio silence.

■ 14. ADMINISTRATION.—*a. Supply.*—Class I—distribution; ration cycle; extra rations; class II, class III, class IV, class V, disposition of unit loads quantity of ammunition at emplacements, ammunition resupply, water.

b. Evacuation.—Aid stations; prophylactic stations; sick call; evacuation of casualties.

c. Motor maintenance.—First and second echelon.

d. Maintenance of armament.—First and second echelon.

e. Reports.—Battery and/or battalion unit reports; strength reports; ammunition expenditure; gas and oil consumption.

f. Demolition of matériel.—When undertaken; authority for; responsibilities of personnel; methods of; location and handling of; materials for.

■ 15. COMMAND.—*a. Command posts.*—Location during march organization; forward and rear echelons; location to be made known to all elements.

b. Liaison.

c. Orders.—Oral, fragmentary; operation maps or overlays; distribution.

APPENDIX III

PERIODIC REPORTS

■ 1. GENERAL.—*a.* These reports consist of unit reports submitted by battery and battalion, and of intelligence reports submitted by regiment or group.

b. Some logical system of reports that will give prompt, accurate information is necessary. The following system of reports is offered as a guide. They may be varied by the requirements in a particular theater of operation.

■ 2. ACTION REPORT.—This report should immediately be made by the battery to the battalion when any firing unit of the battery goes into action against the enemy. This report is to be submitted by radio, wire, or visual means, and should include merely the unit designation and the fact that the unit is in action.

■ 3. ABBREVIATED REPORT.—This report should be forwarded from battery to battalion by radio, wire, or messenger immediately upon completion of action or during a lull. This report, in a form that will not disclose information to the enemy should he intercept the message, will contain—

a. Number of planes destroyed or damaged.

b. Number of rounds fired.

c. Personnel casualties and matériel damage.

■ 4. DAILY BATTERY COMPLETED ACTION REPORT.—This report serves as a confirmation of the abbreviated reports and furnishes further details. It should be submitted daily, preferably in the form shown in the first form below, but in any case containing similar information. Further information of value should be transmitted informally by the battery commander to the battalion commander as the situation permits.

■ 5. BATTALION REPORT.—AAA battalions will submit to the next higher headquarters such reports as may be directed.

■ 6. GROUP INTELLIGENCE REPORTS.—These reports will be submitted according to orders from higher authority and will

be similar to the G–2 periodic reports shown in Form 16, paragraph 75, FM 101–5.

■ 7. BARRAGE BALLOON DAILY IMPACT REPORT.—*a.* This report, for barrage balloon units, will take the place of the "Daily Battery Completed Action Report" used for AAA units.

b. The Daily Impact Report should contain the following information:

(1) Total number of planes entering barrage area.
(2) Types of planes.
(3) Friendly or enemy planes.
(4) Estimated altitude of planes.
(5) Date and hour.
(6) Number of planes impacting cable.
(7) Effect of impact on plane.
(8) Type of cable armament used.
(9) Did cable armament function?

■ 8. INSTRUCTIONS FOR DAILY BATTERY ACTION REPORT.—*a. General.*—The Daily Battery Completed Action Report is to be filled out each day that combat firing occurs and forwarded to the next higher headquarters. The time covered by the report will be from midnight to midnight.

b. Explanation of items.—Method of fire control—Circle the method which was used, and, in the case of guns, circle either the height finder or Radar if either were used. Amplify in remarks if necessary.

Guns—Circle type of guns reported on.

1. Approximate time—Enter approximate time that attack occurred, using 24-hour system.

2. *a.* Formation—wether a "V", "V" of "V's"; Javelin, etc. Where necessary, amplify under remarks.

b. Number of planes—Approximate number of planes in the formation fired on.

c. Average altitude—Enter altitude in feet if possible and tell whether this is taken from the director (D), height finder (HF), or estimated (E).

3. Type of attack—Dive, glide, level, strafing, etc. If necessary, amplify under remarks.

4. Seen (S), unseen (U)—Enter S or U.

5. Number of guns in action—Enter both primary armament and the number of caliber .50 machine guns involved.

6. Number rounds fired—Enter both primary and caliber .50.

7. Planes. *a.* Destroyed, and *b.* Damaged—Make a separate entry for both primary armament and caliber .50.

8. Fuze range of hits (guns only)—Enter the approximate fuze range of hits and tell how determined (i. e., D or E as in 2c).

9. List all matériel and ammunition damages and failures.

10. Enter any pertinent remarks to amplify items above.

NOTE.—See sample report following:

DAILY BATTERY COMPLETED ACTION REPORT

Unit _____
Place _____
Date _____

METHOD OF FIRE CONTROL: Telescopic Sight; Lead Setting Sight; Forward Area Sight; Computing Sight; Director; Height Finder; Radar

Guns: .50 cal. MG: 20mm; 37mm; 40mm; 3" Fixed, Mobile; 90mm; 4.7"; 105mm; 5"/38.5"/25 NAVY

	Course Fired On 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Approx. Time										
2. a. Formation										
b. No. of Planes										
c. Average Altitude										
3. Type of Attack										
4. Seen (S) Unseen (U)										
5. No. Guns In Action cal.50										
6. No. Rds. Fired cal.50										
7. Planes: a. Destroyed (cal.50										
Planes: b. Damaged (cal.50										
8. Fuze Range of Hits (Guns Only)										
9. Matériel and Ammunition Damages & Failures:										

10. Remarks:

Battery Commander

DAILY BATTERY COMPLETED ACTION REPORT

Unit 5-76A Gun AA Bn.

Place [redacted]

Date 5/12/43

METHOD OF FIRE CONTROL: (Telescopic Sight; Lead Setting Sight; Forward Area Sight; Computing Sight; Director) (Height Finder; Radar)

Guns: (50 cal.) MG; 20mm; 37mm; 40mm; 3" Fixed, Mobile; (90mm); 4.7"; 105mm; 5"/38, 5"/25 NAVY

		Course Fired On 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	Approx. Time	1200	1405								
2.	a. Formation	myn	- -								
	b. No. of Planes	3	1								
	c. Average Altitude	10000(D)	200(E)								
3.	Type of Attack	Level	Straf.								
4.	Seen (S) Unseen (U)	S	S								
5.	No. Guns In Action cal.50	4	4								
6.	No. Rds. Fired cal.50	40	400								
7.	Planes a. Destroyed (cal.50)	1									
	Planes b. Damaged (cal.50)		1								
8.	Fuze Range of Hits (Guns Only)	17.1 (D)									

9. Matériel and Ammunition Damage & Failures: None with 90-mm; .50 cal. MG #053, feed lever broken.

10. Remarks: In the action at 1200, the lead plane was taken under fire, hit, and seen to fall in flames. Other planes were under fire of other batteries. Both were seen to leave, out of range of this btry, smoking badly.

In the action at 1405, one fighter plane, Me 109 F strafed position twice. Was hit by .50 cal. on second run and immediately started smoking. Was then lost from view. Small arms fire was also conducted with little noticeable effect. No personnel casualties.

John J. Doe
Battery Commander Capt. C.A.C.

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