FM 4-102

WAR DEPARTMENT FIELD MANUAL

EMPLOYMENT OF ANTIAIRCRAFT AUTOMATIC WEAPONS

RESTRICTED Dissemination of restricted matter.—The information contained in restricted documents and the essential characteristics of restricted material may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized Military public relations agencies. (See also par. 18*b*, AR 380-5, 28 Sep 1942.)

WAR DEPARTMENT • AUGUST 1943

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FM 4–102 RESTRICTED

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WASHINGTON, D. C.
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WAR DEPARTMENT,
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G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

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(For explanation of symbols see FM 21-6.)

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CHAPTER 1

ORGANIZATION

Section I
Battery Organization

1. BATTERY. a. The fire unit of the automatic weapons battery varies with the type of armament assigned by Tables of Organization.

b. Mobile and semimobile fire units consist of a trailer mounted 37-mm or 40-mm gun, director, power plant, and a quadruple machine-gun power turret on a trailer mount. Their personnel is divided into a range section and a gun section. Caliber .50 machine guns, HB, on M32 mounts, are provided in the ratio of one to every four trucks, 2½-ton or larger.

c. The self-propelled 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.

d. The airborne fire unit consists of one of the following: a caliber .50 machine gun (water or air cooled), a 40-mm AA gun, or 37-mm antitank gun. No director or power plant is furnished to airborne units.

2. TABLES OF ORGANIZATION. **a.** Mobile AA automatic weapons battery (T/O 44–27).

b. Semimobile AA automatic weapons battery (T/O 44–127).

c. Self-propelled AA automatic weapons battery (T/O 44–77).

d. Airborne AA automatic weapons battery (T/O 4–277).

e. Airborne AA machine gun battery (T/O 4–278).

f. Airborne separate AA machine gun battery (T/O 44–217).

3. BATTERY COMMANDER. The battery commander is responsible for the administration, supply, and training of his battery, and for the defense of the objectives assigned to the battery. The battery commander selects the positions to be occupied by the fire units by personal reconnaissance whenever possible. Due to the dispersion of the units and the brief time of any one action, the battery commander cannot control the fire of his units. Target priorities are established by higher command and the fire units operate independently when targets are in range. The battery commander issues necessary SOP for the engagement of targets. Minimum crews that are to be on the alert at all times are dictated by the battery commander. He is responsible for local security.

Inspection of weapons, equipment, sanitary facilities, and personal cleanliness of the troops is a responsibility and function of the battery commander.

He must organize and train the battery so that it can move out and occupy new positions rapidly.

The battery commander is assisted in his duties by junior officers in accordance with appropriate T/O.

Section II
Battalion Organization

4. BATTALIONS. **a.** There are four types of automatic weapons battalions. Each type of battalion can fulfill certain types of missions. The four types of battalions are mobile, semimobile, self-propelled, and airborne.

b. The organization of the mobile automatic weapons battalion appears in T/O 44–25. The battalion consists of a headquarters and headquarters battery (T/O 44–26) and four mobile firing batteries (T/O 44–27).

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

d. The organization of the self-propelled automatic weapons battalion appears 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).

e. The organization of the airborne automatic weapons battalion appears 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).

5. BATTALION COMMANDER. **a.** The battalion commander is responsible for the administration, supply, training, and tactical employment of the elements of his command. By consultation and liaison with his group or force commander, he determines his objectives. He is informed of the priority of the objectives and given information as to the general situation and contemplated movements. In addition to his present priority of objectives to be defended, he must know in advance what

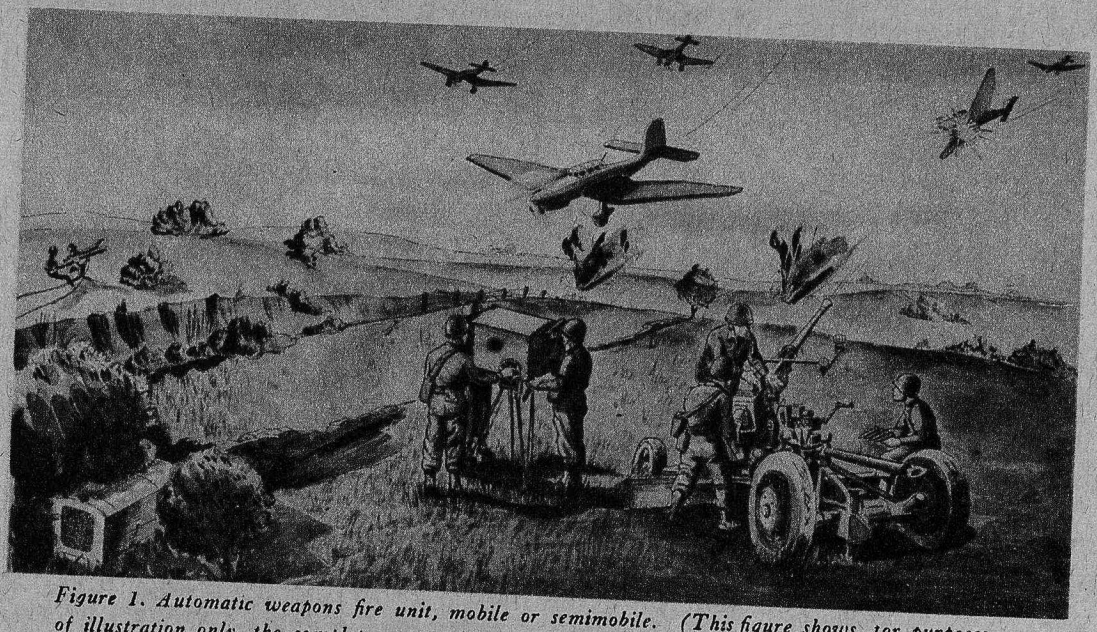


Figure 1. Automatic weapons fire unit, mobile or semimobile. (This figure shows, for purposes of illustration only, the complete automatic weapons fire unit so far as armament and fire control equipment is concerned, but not an actual combat position.) The single caliber .50 machine gun shown here has been superseded by the quadruple caliber .50 machine gun mount M51.

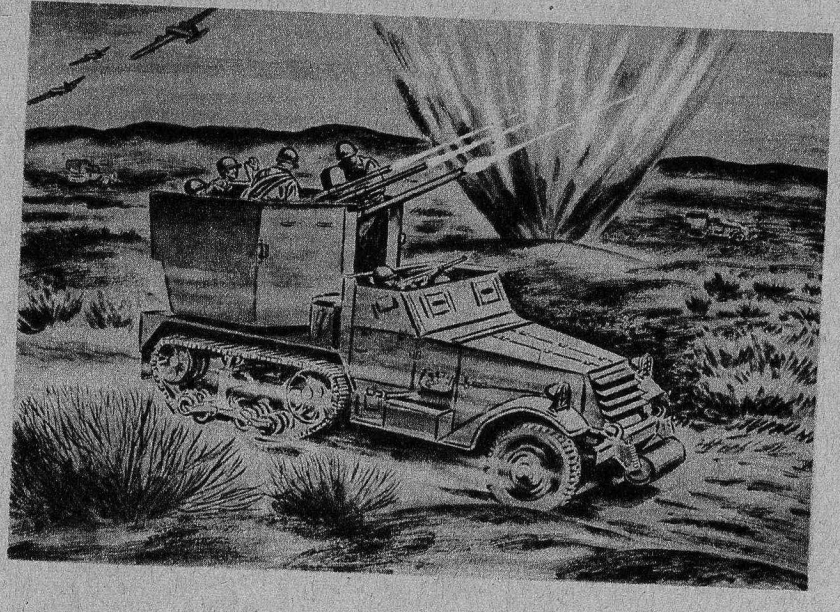


Figure 2. Self-propelled automatic weapons fire unit (squad).

his future objectives will be and their priority. Any plan that he formulates must consider his future situation and the organic antiaircraft weapons within the unit to which he is attached.

b. The elements of his battalion may be widely scattered for extended periods of time. To maintain efficiency he must make frequent inspections covering all phases of activity engaged in by the elements of his command.

c. The battalion commander must keep his battery commanders advised of the situation so far as it affects their fire action. He gives such instructions concerning fire action as the situation warrants, directs changes of position when necessary, and supervises the supply of ammunition and other supplies to the batteries.

6. BATTALION STAFF. Battalion staff action must frequently be rapid and some of the steps may not be reduced to writing. Staff members should be selected for their ability to think clearly and act rapidly. The staff members assist the battalion commander by providing basic information and advice by which he arrives at his decisions. They develop details of the commander's plan, translate the plan into orders, transmit the orders to the batteries, anticipate future needs, draft tentative plans, and secure unity of action throughout the command. To insure unity of action the staff members should assist and advise the battery commanders whenever possible. The detailed duties of the various staff members are described in FM 101–5.

Section III

Group Organization

7. GENERAL. The battalion is the basic self-contained administration and tactical unit of antiaircraft artillery.

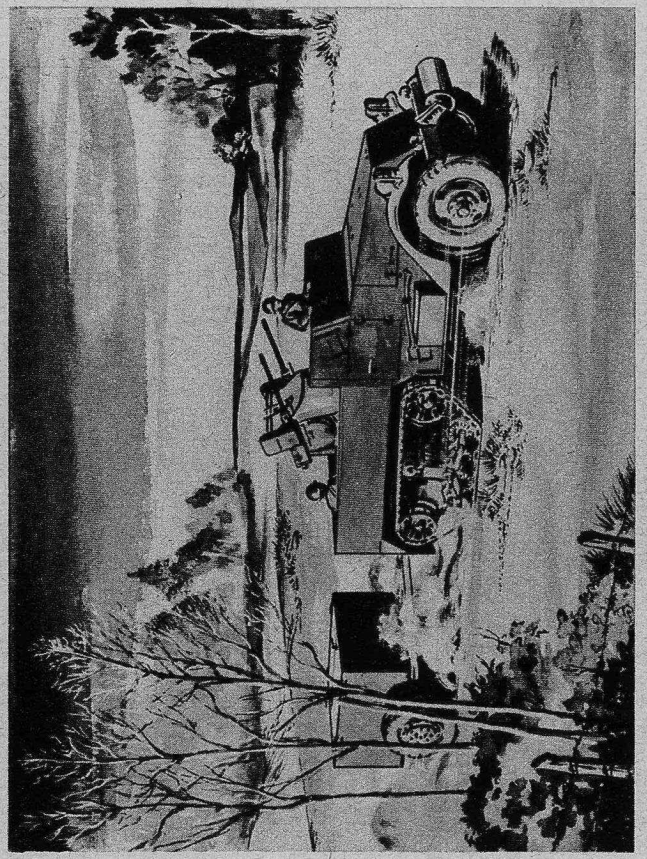


Figure 3. Self-propelled machine-gun fire unit (squad).

Where two or more battalions are operating together they become a group and a headquarters is provided to exercise command and tactical control. Groups are attached to armies, corps, or other forces, as required. Any combination of the various types of battalions may be organized as a group. For the detailed organization of the group headquarters and headquarters battery see T/O 44–12.

8. GROUP COMMANDER. **a.** The group commander is responsible for the training and tactical employment of the battalions within his group. He keeps himself informed of friendly and hostile air situations by consultation and liaison with the force commander. He advises the force commander on the proper employment of automatic weapons and how the units in his group can most effectively be employed to give the AA protection required. For estimate of the situation and preparation of field orders see FM 101–5 and 4–100.

b. The force commander will establish the priority of the objectives requiring antiaircraft protection. The group commander then prepares his estimate of the situation and assigns to the objectives the necessary automatic weapons. In cases where units available are not sufficient to protect all the objectives, the group commander will recommend protection of those objectives of high priority first and notify the force commander of the deficiency in his AA defense. Any thinning out of the defense of high priority objectives will be the responsibility of the force commander. The group commander recommends requests for additional antiaircraft units as the situation indicates.

9. GROUP STAFF. The group commander is relieved of the multiplicity of detail by his staff and certain enlisted assistants. The staff assists the commander in exercising his command functions. Certain sections of the staff con-

stantly anticipate and provide for the needs of the troops. Other sections translate decisions and plans into orders and cause such orders to be transmitted to the troops. To effectively employ the weapons in the group, the lower unit commanders must be furnished adequate information of the friendly and enemy situation. The gathering and dissemination of this information is the responsibility of the staff. A staff officer as such has no authority to command. Policies, basic decisions, and plans must be authorized by the commander. When it is necessary to issue an order in the name of the commander, responsibility for the order remains with the commander even though it was issued without his personal knowledge.

CHAPTER 2

MISSIONS

10. PRIMARY MISSION. The primary mission of automatic weapons is to attack all enemy aircraft within range, particularly low flying airplanes, to destroy them, cause them to abandon their missions, or to decrease the efficiency of their operations.

11. SECONDARY MISSION. The secondary missions of automatic weapons are to attack and destroy all enemy mechanized or other ground targets within range, particularly light and medium tanks and armored cars; or, in coast defense, to attack and destroy all enemy motor torpedo boats or light naval craft within range.

12. PRIMARY VS. SECONDARY MISSIONS. a. Automatic weapons are 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 automatic weapons are not primarily designed for fire against ground targets, a force commander may, in any emergency, relieve automatic weapons of their primary mission and employ them for the accomplishment of their secondary mission. When this is done, automatic weapons cannot be expected to provide adequate protection from air attack.

CHAPTER 3

CHARACTERISTICS OF AUTOMATIC WEAPONS

13. GENERAL. a. Comparison with gunfire. The fire of AA automatic weapons differs from that of the larger caliber guns using explosive shell with a time fuze in that, to be effective, the projectiles must actually strike the personnel or a vulnerable portion of the airplane. The 37-mm and 40-mm shells are equipped with a supersensitive fuze which bursts on contact with the airplane, or destroys the projectile at the tracer burn-out point (about 3,500 yards). Automatic weapons' fire in close proximity to an airplane may have a deterrent effect on enemy pilots, as the tracer stream is frequently clearly visible. The effectiveness of automatic weapons, however, is 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.

14. 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. Normally the gun is fired at a rate of one round per second. 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 requires 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 will be 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 are obtained when using the 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 4–151 and 4–160.

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

15. 37-mm GUN. **a.** The 37-mm M1A2 automatic gun when mounted in the M3A1 carriage has practically the same characteristics and is employed in the same manner

as the 40-mm automatic gun M1. This equipment uses a director and power plant and has a dead arc of 70° as in the 40-mm fire unit.

b. The multiple gun motor carriage M15 mounts one 37-mm M1A2 automatic gun with two caliber .50 machine guns. The weapon is elevated and traversed by handwheels. Pointing of the weapon is accomplished by a lead adjuster applying estimated leads to the sighting system (M6), the gun pointers tracking by keeping their crosshairs on the target. The weapon is fired by the vertical gun pointer using his foot pedals. The left pedal fires only the 37-mm gun. The right pedal fires the caliber .50 machine guns.

16. MACHINE GUNS. The caliber .50 machine gun is standard equipment for AAA units. Each fire unit in mobile and semimobile units is provided with four caliber .50 machine guns on a trailer mounted power turret. It has a maximum ground impact range of about 7,500 yards. When fired by an individual gunner, its range is dependent upon depth perception. Machine-gun fire is very effective against airplanes within 500 yards slant range of the gun. Short bursts can be fired at the rate of about 600 rounds per minute. Present tracer ammunition has a burn-out range of about 1,850 yards.

17. MOBILITY. **a. Trailer mounts.** The 40-mm AA gun carriage M2 is a two-axle trailer mounting the 40-mm automatic gun M1. The 37-mm AA gun carriage M3A1 is a two-axle trailer mounting the 37-mm automatic gun M1A2. These trailer type mounts permit high speed towing on good roads and at medium speed over bad roads or rough terrain. The carriages are equipped with four-wheel brakes which can be operated electrically from the towing vehicle or manually when the trailer is disconnected. The design of the carriages is such that

the unit can be brought rapidly into action by lowering them to the ground.

b. Self-propelled mounts. The self-propelled AA mounts are half-track vehicles mounting their weapons as a unit on a power-operated or hand-operated turret. The power-operated turret mounts two or four caliber .50 machine guns (same turret as in par. 16) and is capable of elevating or traversing at a rate of 55° per second. This is a highly effective weapon against fast, low-flying airplanes. The hand-operated turret mounts one 37-mm gun and two caliber .50 machine guns and is capable of being traversed and elevated at approximately 18° per second. This weapon is very effective in the defense of small objectives such as bridges and defiles along convoy routes.

CHAPTER 4

CONTROL OF FIRE

Section I
General

18. DEFINITIONS OF TERMS. **a.** Conduct of fire is the employment of technical means to place accurate fire on a target. For automatic weapons, fire is usually conducted by the fire unit or squad.

b. Fire direction is 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 is the exercise of conduct of fire and fire direction.

19. FIRE DIRECTION. **a. General.** (1) Because of the great speed and maneuverability of airplanes, the degree of fire direction that can be exercised depends to a large extent upon the efficiency of the warning service. The extent of the intelligence net is, in turn, related to the size and permanency of the defense.

(2) In rapidly moving situations, or where a unit defends an isolated objective for only a short time, it is not expected that the warning service will be elaborate. On the other hand, when units are emplaced in the defense of vital permanent establishments, a high degree of efficiency is expected.

(3) In the centralized fire direction of a large defense the size, location, and course of an attack will be plotted as the airplanes approach the vicinity of the defended area. The operations officer at the operations room alerts units and issues such restrictions beyond SOP as are necessary for the employment of the elements of the defense to the best advantage.

b. Automatic weapons. Due to their limited range and the short time that appropriate targets will be presented, fire direction of automatic weapons is exercised by the fire-unit commander even in a stabilized, coordinated defense. Such units must be furnished with information of the approach of hostile airplanes in order that the maximum opportunity for fire against appropriate targets will be obtained.

c. Restrictions of fire. See FM 4–100.

Section II
Engaging

20. TARGET PRIORITIES. a. When two or more targets enter the field of fire of a fire unit, fire is opened on that target which offers the most dangerous threat to the mission of the defense of which the fire unit is a part.

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

c. Considering doctrines in **a** and **b** above, the greatest possible number of targets should be taken under fire by a defense.

d. An airplane approaching a defended area presents a more dangerous threat to the mission of the defending force than an airplane flying away from the area.

21. OPENING FIRE. The senior member present at any automatic weapons position is responsible for recognition and opening fire and for control of the fire during the engagement. Crews are trained and equipment is so designed that commands during an action are unnecessary except for coaching by the gun commander. The fire unit commander is responsible for selecting and assigning the target most dangerous to his objective.

22. CHANGING TARGETS. During an action the fire unit commander must be alert to other possible targets which may be more dangerous to his objective than the one he is firing on. This requires clear thinking and rapid judgment. The fire unit commander is solely responsible for breaking off action against one target and opening fire on another. He controls the fire of his unit by direct supervision.

23. CONTROL. Battery or platoon control of automatic weapons fire is impossible due to the dispersion of the fire units. Instructions covering the conditions under which fire will be opened are given the fire units in SOP. The fire unit commander must then be relied upon to defend his objective without further instructions from higher headquarters.

24. CLASSES OF FIRE. Automatic weapons fire 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. AA machine-gun fire is conducted by individual tracer control. Instructions on these methods of conducting fire are published in FM 4–110 and 4–151.

25. RATE OF FIRE. The rate of fire to be delivered by AAA automatic weapons must be the maximum consistent with accuracy.

CHAPTER 5

COMMUNICATIONS

Section I
General

26. GENERAL. **a.** AAA communications comprise all the means employed to transmit orders, intelligence, and commands 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 post and with service elements for normal command and administration. In addition, the ability of an airplane to attack from any direction, and its great speed and maneuverability, require an intelligence net (AAAIS) that will give 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 AAA airguards.

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

b. Coordination. 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.

c. 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 communications. 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 operaters must be continuous and progressive. One of the most important duties of the unit communication officer is a constant check of the discipline within the communication nets.

28. NATURE AND EXTENT OF COMMUNICATION SYSTEMS. **a.** 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:

(1) Facilities available.
(2) Frequency of movement.
(3) Dispersion of units.
(4) Terrain and atmospheric conditions.
(5) Secrecy restrictions.

b. Each of these factors will be discussed in detail in succeeding paragraphs.

29. EMPLOYMENT OF SIGNAL AGENCIES. Detailed descriptions of communication material, together with instructions for their installation, maintenance, and operation, are contained in FM 24 Series, and in Signal Corps Technical Manuals. Other exterior means of communication, for air-ground liaison particularly, are signalling 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 force commander. They must be frequently changed to preserve secrecy.

Section II
Radio Communication

30. GENERAL. Various types of radio sets are now authorized for issue to AA automatic weapons units. Some are designed for use in command nets and others for use in the AAAIS nets. In cases of emergency these sets may be interchanged. No provision is made for administrative radio nets. Administrative messages are transmitted by telephone or motor messenger.

31. UNIT RADIO SYSTEMS. a. AA group. (1) *Radio equipment* (see fig. 4).

SCR–177	1
SCR–543	2
SCR–593 (receiver only)	1

(2) *Use of radio sets.* (a) *Radio Set SCR–177.* This set is used in the command net from higher headquarters.

(b) *Radio Set SCR–543.* One of these sets is used in the group command net which includes the headquarters of each battalion of the group. The other SCR–543 is used in the intelligence net for warning purposes.

(c) *Radio Set SCR–593.* This receiver is used at the group command post for receipt of warning messages transmitted by any element of the intelligence net.

b. Mobile and semimobile battalions. (1) *Radio equipment* (see figs. 5 and 6).

SCR–177	1
SCR–543	6
SCR–284	12
SCR–593	45

(2) *Use of radio sets.* (a) *Radio Set SCR–177.* The SCR-177 is used in the command net of higher headquarters.

(b) *Radio Set SCR–543.* The battalion headquarters battery has two of these sets. One of the SCR–543 sets is used for a command net to the component batteries of the battalion. The other SCR–543 set is used in the intelligence net for warning purposes to the elements of the battalion. Each of the four batteries has one SCR–543 set for use in the battalion command net.

(c) *Radio Set SCR–593.* This receiver is used at the battalion command post, at each of the battery command posts, at each platoon command post, and at each fire unit, for receipt of warning messages transmitted by any element of the intelligence net.

(d) *Radio Set SCR–284.* Each lettered battery has three of these sets, one for each platoon and one for the battery headquarters section. These sets are used in the battery command net and are also standby sets in the AAAIS nets.

c. Self-propelled battalion. See FM 4–101.

d. Airborne battalion. See FM 4–103.

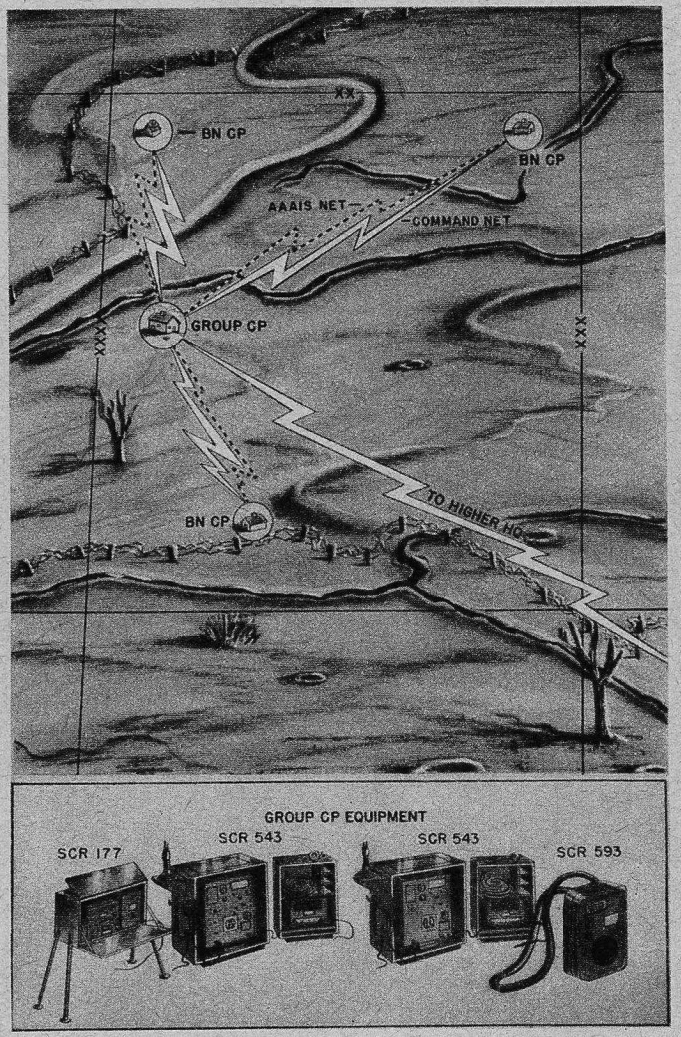


Figure 4. Group radio net.

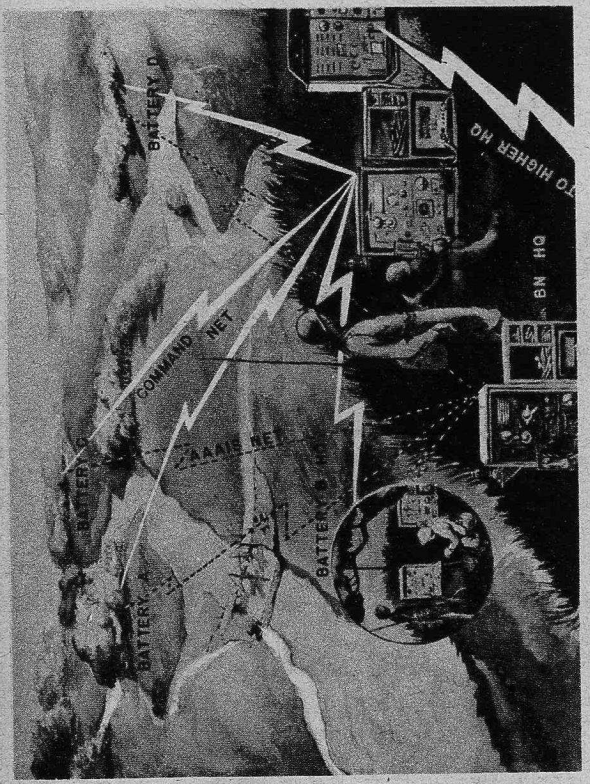


Figure 5. Radio communication, headquarters automatic weapons battalion, mobile or semimobile.

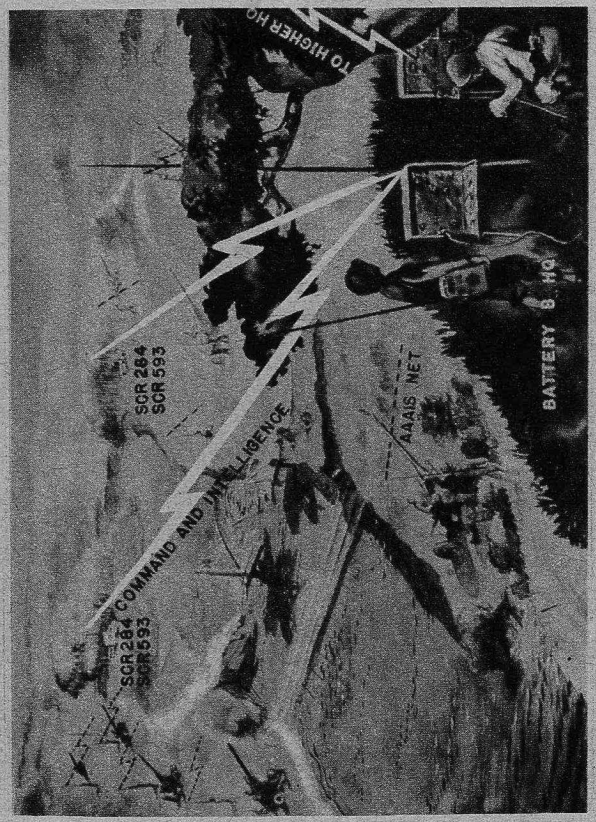


Figure 6. Radio communication, 40-mm gun battery, automatic weapons battalion, mobile or semimobile.

Section III
Wire Communication

32. GENERAL. a. Equipment. The quantity of wire communication equipment allotted to AAA units by Tables of Equipment has been reduced to a minimum. These allowances provide only enough equipment for lines between essential command posts and, within the batteries, for interior lines necessary for fire control of the various elements. Additional equipment may be drawn when needed from Signal Corps supply depots.

b. Moving situations. When AAA is protecting troops in movement involving frequent changes in position of the AAA units, radio communication is used. Wire laying will be kept at an absolute minimum.

c. Semipermanent situations. When AAA positions will be occupied for a relatively short period of time, for example from 1 to 3 days, a limited quantity of wire will be laid within the unit involved. In such situations it is doubtful if long wire lines or those which duplicate established radio communication will be laid. A guide to the maximum amount of wire that will be laid in such situations is found in the quantities allowed in Tables of Equipment.

d. Stabilized situations. When AAA positions will be occupied for a relatively long period of time the wire communication system should be as complete and extensive as time and material will permit. An elaborate communication net is required for the intelligence service as well as for administration, conduct of fire, and local security. The amount of field wire to be laid and maintained must be reduced by the maximum possible use of existing commercial facilities.

33. UNIT WIRE COMMUNICATION. Within each unit, lines are normally laid from the command post to the

command posts of subordinate elements and to the service elements of the unit. In addition the lines necessary for fire control and local security will be established within each unit. No attempt will be made here to set up standard wire communication nets that will take care of all eventualities. Each situation must be individually treated. The SOP in each unit should include the number of communication lines to be laid and their priority in various situations.

34. AWS AND AAAIS. See FM 4–106, FM 1–25, and FM 11–25 for a complete discussion of Aircraft Warning Service and Antiaircraft Artillery Intelligence Service.

CHAPTER 6

EMPLOYMENT IN REAR AREAS

Section I
General

35. GENERAL. **a.** The term "rear area defense" refers to the AAA defense of an area so located that an attack is improbable by ground forces, other than mechanized, motorized, or airborne. Use of mechanized, motorized, and airborne units with ground forces makes attacks possible in localities which were formerly considered exempt therefrom.

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

36. NATURE OF DEFENSE. A complete AAA defense of a rear area objective involves the carefully coordinated employment of guns, searchlights, automatic weapons, and barrage balloons. It must be planned so that it will provide the most effective opposition to the accomplishment of the enemy mission. Not even these combined efforts can guarantee the protection of any defended area. No matter how well an objective is defended, in the face of attacks by a determined foe it must be expected that some bombs will fall on the defended area.

37. SIZE OF OBJECTIVE. The employment of AA automatic weapons is affected by the size of the area which must be defended. In the following section the problem will be considered from two standpoints, the case of the point objective and that of the large area.

Section II
Employment

38. GENERAL. a. (1) This section pertains to the tactical employment of the *automatic weapons fire unit* which includes one director-controlled gun (37-mm or 40-mm).

(2) The director is placed not more than 15 feet nor less than 13 feet from the gun trunnions. The director should never be below the gun and preferably 1 foot, never more than 2 feet, above the gun. In order to insure against injury to the director and director personnel, a sector extending 35° on either side of the gun-director line is the "dead area" for the particular gun. Each fire unit includes one caliber .50 machine gun normally placed within the "dead area" to supplement the fire of the 40-mm or 37-mm gun and to cover the "dead area." The quadruple machine-gun trailer is normally placed approximately 100 yards from the director.

(3) Tactical dispositions are based on an effective slant range of 1,500 yards. AA automatic weapons using director-control cannot fire on high speed targets at ranges less than 450 yards, as the high angular rate of travel of the target exceeds the rate of tracking of the director.

b. The tactical employment of the automatic weapons will depend on the types and extent of air attacks to be expected. The tactics of enemy aviation will depend to a large extent upon the capabilities and limitations of his available aircraft, the local situation with respect to

control of the air, the weather, the size and nature of the objective, the nature of the surrounding terrain, and the enemy's estimate of the ground defenses in the vicinity.

c. 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.

39. BASIS FOR TACTICAL EMPLOYMENT. a. Tactics of the enemy. The types of air attack against which automatic weapons will defend are:

(1) Dive-bombing attacks, whether starting at high or low altitudes.

(2) Strafing attacks.

(3) Low-level bombing attack.

(4) Gas-spray attack.

b. Types of objectives. For the purpose of analysis, objectives can be clasified as follows:

(1) *Point objectives.* These are small, individual objectives up to about 200 yards in diameter.

(2) *Vital objectives of a considerable area.* These are individual areas which are too extensive to be regarded as "point" objectives.

(3) *A group of objectives forming a vital area.*

(4) *Long, narrow objectives.* The shape of these tends to restrict the direction of attack along the long axis of the objective.

c. Influence of terrain on the direction of attack. (1) Dive attacks are not restricted in direction, although the enemy favors attacks coming out of the sun.

(2) Certain directions of attacks may not be suitable for the level bomber if his view of the objective is restricted. On the assumption that the attacker will require a minimum aiming time of 10 seconds, his best avenues of approach are those which provide a view of the objective for this length of time. A mask not only shields

airplanes from ground observation but shields ground objectives from sighting necessary in the bomb-dropping operation. If the depression angle from airplane to objective is greater than 12° at the moment the airplane clears the mask, low-level bombing on that objective is virtually impossible from an altitude of less than 2,000 feet.

(3) Probable routes of approach will be influenced by the presence of neighboring defended areas. The enemy may be expected to exploit clear approaches, such as a sea or lake front or a dense wood which might offer a weakly defended sector.

(4) Because of the low angle of fall of the bomb released from low altitudes, adjacent structures or natural obstacles may afford some protection to an objective.

(5) In planning the automatic weapons defense, full consideration will be given to the suitability of each possible route of approach so that the most economical use can be made of the available weapons.

d. Separation of fire units. Adjacent fire units should not be separated by more than 800 yards or closer than 500 yards. The former figure of 800 yards is used in order to prevent a complete break in the defense if, for any reason, a gun is unable to fire. The latter figure of 500 yards is used as difficulty will be experienced in the identification of tracers if fire units are sited closer together. However, the latter figure does not apply to fire units disposed specifically against dive bombing or other forms of attacks where it is expected that direct-fire sights will be used predominately.

40. DEFENSE PROBLEM. a. (1) Figure 7 shows the bomb release lines and critical zones for level-flight attacks at altitudes of 500 feet and 2,000 feet for a speed of 300 miles per hour. The defense against horizontal flight attack should be planned so as to permit the maximum volume of fire while the target is flying a uniform course

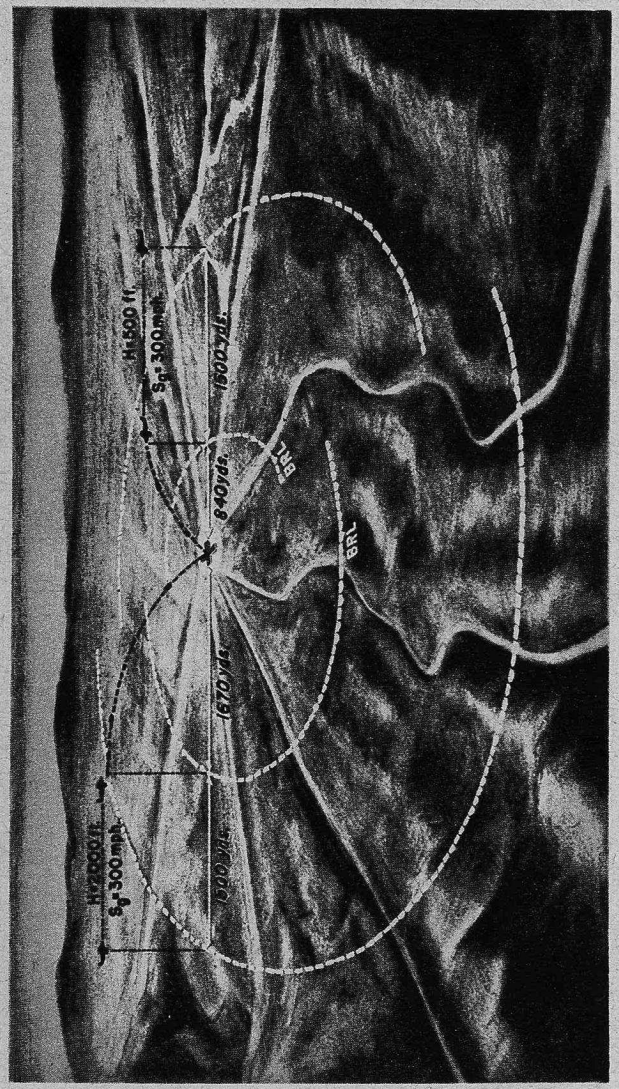


Figure 7. Bomb release lines and critical zones, point objective.

over the critical zone. It should be apparent from a study of figure 7 that the best defense against horizontal flight attack at 500 feet altitude will not be the best defense agains level flight attacks from the higher altitudes. Neither provides the best defense against dive attacks. Low level bombing attacks can best be met by disposing fire units on or near the BRL for the expected altitude of attack.

(2) In the case of dive attacks, the target can be engaged most effectively by weapons sited within 100 yards of the center of the objective. From this position, the target is approaching directly toward the gun, and the gunnery problem is simplified. However, due to the probability of neutralization in an early wave of the attack and to dust and debris obstructing the view, the best disposition of fire units for defense against dive bombardment is in a zone 300 to 500 yards from the objective center.

(3) In order to provide a defense against the types of attack noted above, the automatic weapons defense must take into account the threat to a particular objective which is presented by each possible type of attack, establish priorities for the defense, and defend against each type of attack in the order of the established priority, employing the weapons which are available.

b. 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. The recommended dispositions for automatic weapons discussed in paragraph 41 are based upon the type of objective and the locations of bomb release lines and critical zones.

41. DISPOSITIONS. a. General. (1) The automatic weapons platoon is capable of defending against only one type of attack at any one time. It can defend against either dive bombardment or low level bombardment but not against both. It cannot defend effectively an objective exceeding 200 yards in diameter.

(2) The dispositions recommended in this paragraph are offered as guides to the manner in which given quantities of materiel may be disposed in the defense of specific types of objectives. The precise and ideal locations of fire units in any situation are obtained by adapting the examples cited to meet the practical conditions at hand.

b. Explanation of figures. (1) Figures 8 through 13 illustrate suggested dispositions of platoons and batteries about various type objectives.

(2) Figure 8 illustrates one automatic weapons platoon defending a point objective (less than 200 yards diameter) against *dive* bombardment.

(3) Figure 9 illustrates one automatic weapons platoon defending a point objective (less than 200 yards in diameter) against *low level* bombing.

(4) Figure 10 illustrates one battery defending a point objective against both *dive* and *low level* bombing. Three quarters of the fire units are used in the outer ring for a defense against low level bombing. One quarter is used in the inner ring for defense against dive bombing.

(5) Figure 11 illustrates one battery defending a vital objective of considerable area (300 to 500 yards in diameter) against both *dive* and *low level* bombing. As in the case of a point objective (figure 10) approximately three quarters of the fire units are used in the outer ring and one quarter in the inner ring.

(6) Figure 12 illustrates one platoon defending a long, narrow objective against low level bombing *only*. Horizontal flight attacks from altitudes below 2,500 feet against long, narrow objectives are generally made within 30°

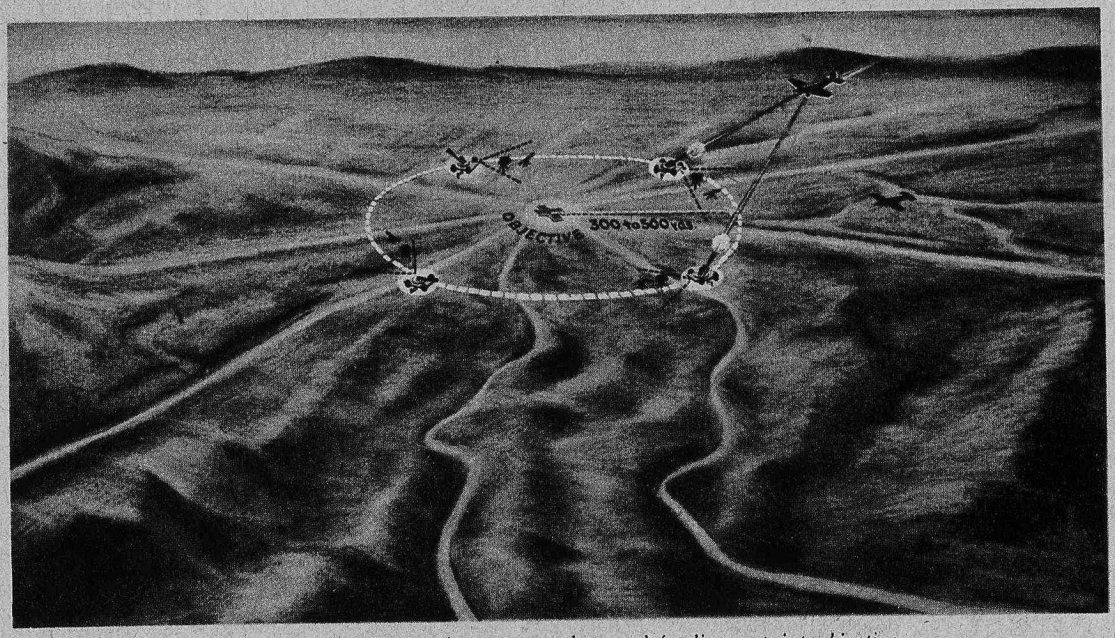


Figure 8. One automatic weapons platoon defending a point objective (less than 200 yards in diameter) against dive *bombardment.*

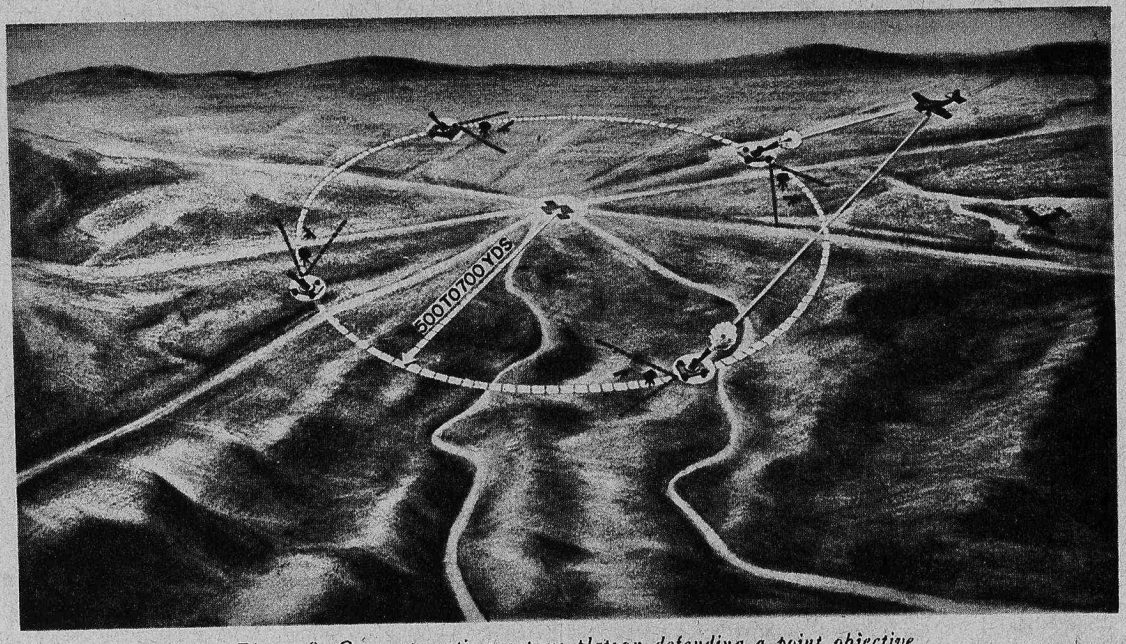


Figure 9. One automatic weapons platoon defending a point objective (less than 200 yards in diameter) against low level *bombing.*

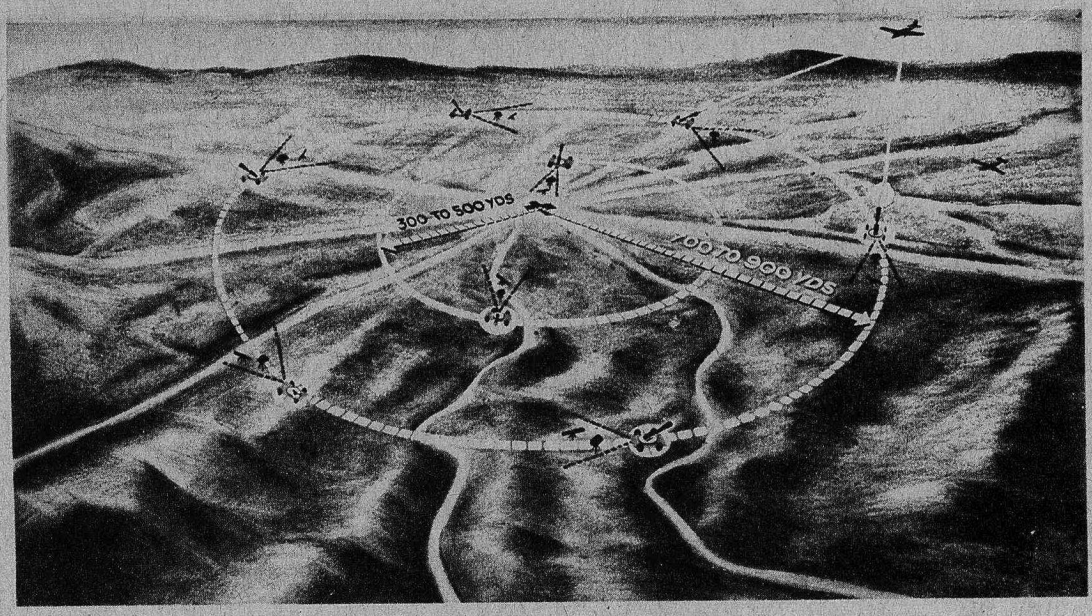


Figure 10. One battery defending a point objective against both dive *and* low-level *bombing.*

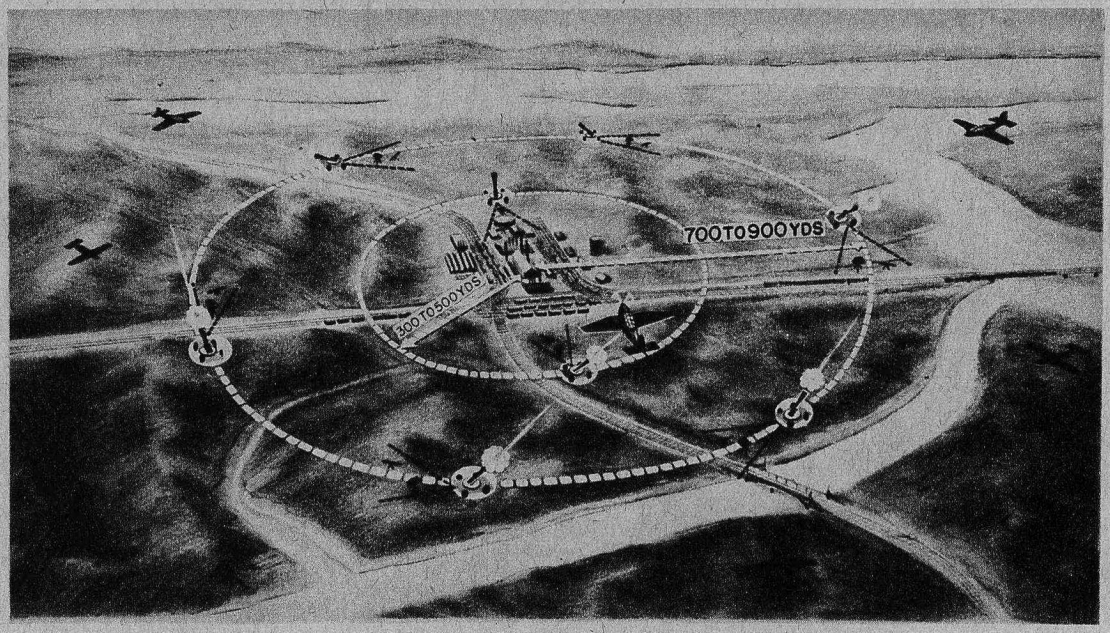


Figure 11. One battery defending a vital objective of considerable area (200 to 500 yards in diameter) against both dive *and* low-level *bombing.*

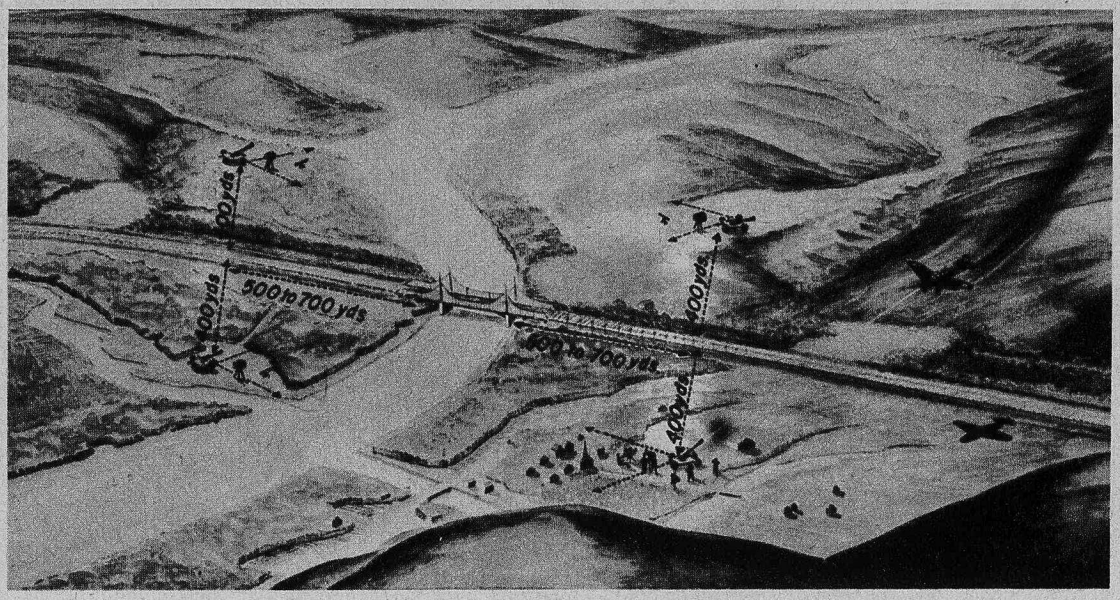


Figure 12. One platoon defending a long, narrow objective against low-level *bombing only.*

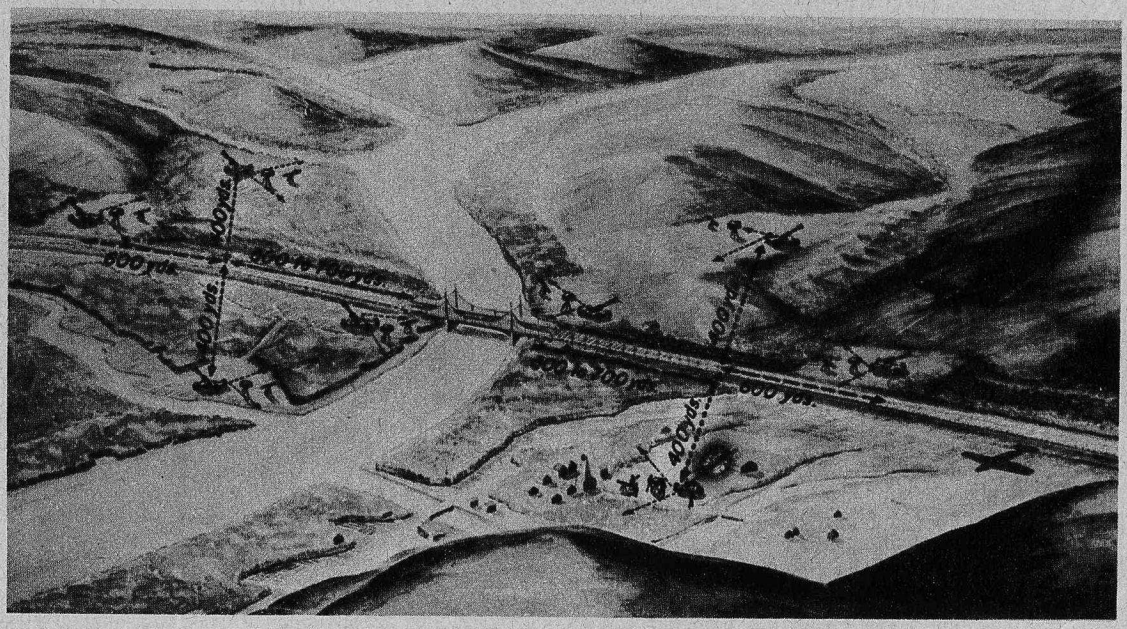


Figure 13. One battery defending a long, narrow objective against dive *and* low-level *bombing.*

of either side of the long axis of the objective. The fire unit should be disposed near the bomb release line and within 30° on either side of the long axis.

(7) Figure 13 illustrates one battery defending a long, narrow objective against dive and low-level bombing. Since the effective range of automatic weapons is limited, the disposition shown in figures 12 and 13 will apply to objectives up to about 800 to 1000 yards in length. As the objective increases in length a point will be reached where fire units disposed at the end of the objective cannot cover the center of the objective. In this case, the only solution is to provide emplacements for additional fire units at or near the center of the objective. In the case of long bridges, platforms built on the bridge should be considered.

c. A group of objectives forming a vital area. The steps necessary for planning the defense of such an area are as follows:

(1) Prepare a sketch showing all objective to be defended. Draw a line bounding the outer edges of the outer objectives to include all parts of all objectives being considered. This is the area boundary line.

(2) To defend the area against dive attack, fire units must be located about 300 to 500 yards from the objectives, if possible.

(3) Against horizontal flight attack, fire units must be located near the general area bomb release line. (This is the bomb release line, figured from the general area boundary line.) (See fig. 14.)

(4) For a complete defense, additional units should be extended in depth to provide protection against horizontal flight attacks for slightly higher altitudes. In any event, the locations of all fire units must be carefully coordinated to insure protection of all objectives, at least from dive bombing attack and low-flying horizontal flight attack.

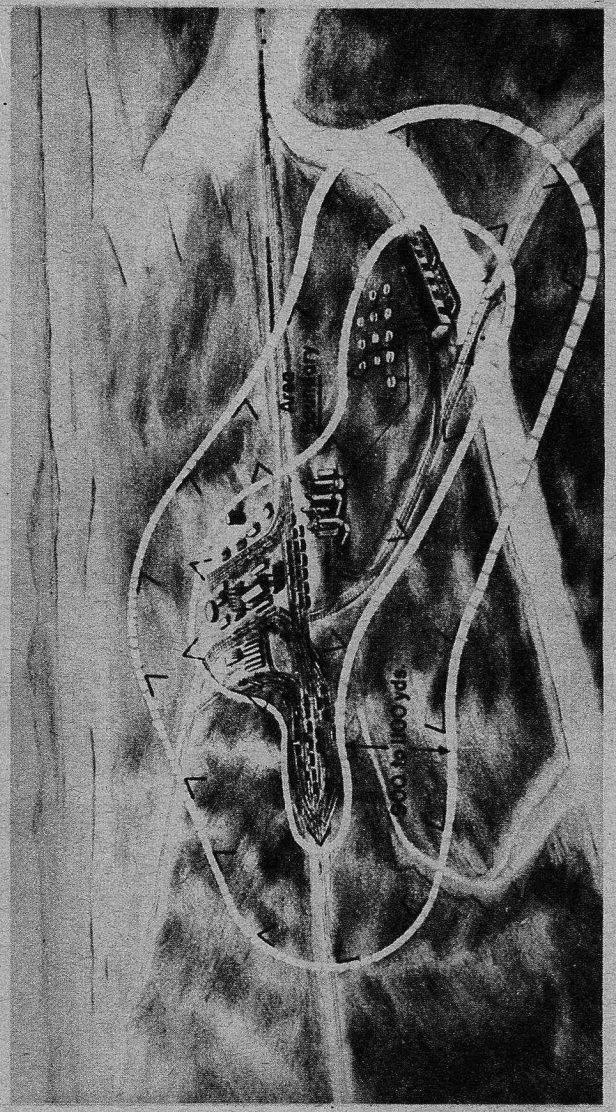


Figure 14. One battalion protecting a large area objective. (Fire units are disposed on the outer ring for defense against low-flying attacks. Fire units are also disposed on the inner ring for defense against dive bombers. The dead areas are coordinated as shown.)

42. COORDINATION. In planning the automatic weapon defense of an objective, it will be necessary not only to designate the positions where the fire units will be located, but also to coordinate the "dead areas" of the guns so that there will be no avenues of approach in which no gun can fire. This can be accomplished by establishing the direction for the gun-director line for each unit at the time the position is designated. Normal and contingent zones of fire will be specified for each fire unit to insure efficient engagement of all targets. Except for general directions from higher authority relative to withholding fire, priorities of targets, and specific orders to coordinate with friendly air force operations, fire direction is exercised by the fire-unit commander.

43. WARNING SYSTEM. Each automatic weapons fire unit receives warning from the AAAIS. The AAAIS is normally the responsibility of the searchlight defense. Where there is no searchlight defense, the AAA units present must establish and operate an AAAIS. Even when the normal AAAIS is present, each fire unit posts AAA airguards to alert the fire unit in time to engage enemy airplanes approaching the position.

CHAPTER 7

AIRDROME DEFENSE

44. STEPS IN PREPARING THE ANTIAIRCRAFT DEFENSE OF AN AIRDROME. The following steps, if possible, should be completed and the defenses installed before the airdrome is occupied by operational combat aircraft.

a. The airdrome commander indicates the order of priority of targets for which he desires AAA defense.

b. Bearing in mind the amount of armament available, and the priority of targets indicated, a map study and ground reconnaissance of the airdrome and vicinity are made.

c. The airdrome commander is requested to furnish a plane in which an AAA officer may make an aerial reconnaissance of the field and the positions selected.

d. A study of outstanding terrain features surrounding the airdrome and the routes selected by pilots unfamiliar with the terrain in simulating attacks indicates the most probable routes of enemy approach.

e. After the most probable routes of approach are determined, the defense is built up to make certain that each route has adequate coverage, and the entire area has an all around defense. Adjacent AAA defenses are also considered in determining the most probable route of approach.

f. Positions which take advantage of natural concealment are preferred to those which require artificial camouflage.

g. Selected positions must be coordinated with the airdrome commander to prevent the possibility of interference with airdrome operation or future construction.

45. RECOMMENDED DISPOSITIONS. Each defense must be constructed to meet the prevailing or anticipated types of hostile action. The dispositions described here are offered as guides to the manner in which given quantities of material may be disposed in the defense of specific types of objectives. Actual field dispositions of fire units can be obtained only by adjustment of the examples cited to meet the practical conditions at hand.

46. REAR AREA AIRDROMES. a. Assignment of defense units. (1) For large, important airdromes in rear areas, one or more battalions of automatic weapons would probably be needed. In this case, the problem of preparing an automatic weapons defense, all around and in depth, presents no difficulties. The principles outlined in chapter 6 apply. In case guns and/or searchlights or barrage ballons are also present, the locations of all elements must be coordinated.

(2) When a large rear area, provided with a coordinated gun defense, contains two or more airdromes, each airdrome must be given a separate automatic weapons defense unless the airdromes are so close together that the fire units of the separate defenses are mutually supporting.

b. Steps in planning automatic weapons defense. (1) Outline the vital area of the airdrome to be defended against low-level bombardment. In this example it is assumed that two mobile automatic weapons battalions are available and that the airdrome commander indicates that the defense of the whole airdrome is desired.

(2) Draw in the BRL and critical zone for both the 500-foot and 2,000-foot altitudes of attack. The width of the critical zone is equal, in this case, to 10 seconds' time of flight of the attacking aircraft (fig. 15).

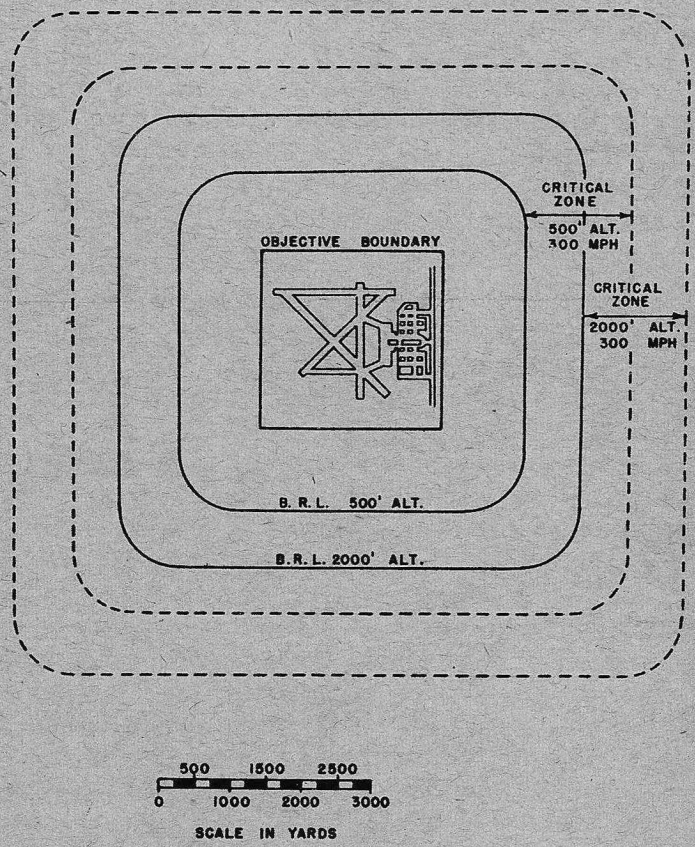


Figure 15. Bomb release lines and critical zones for automatic weapons.

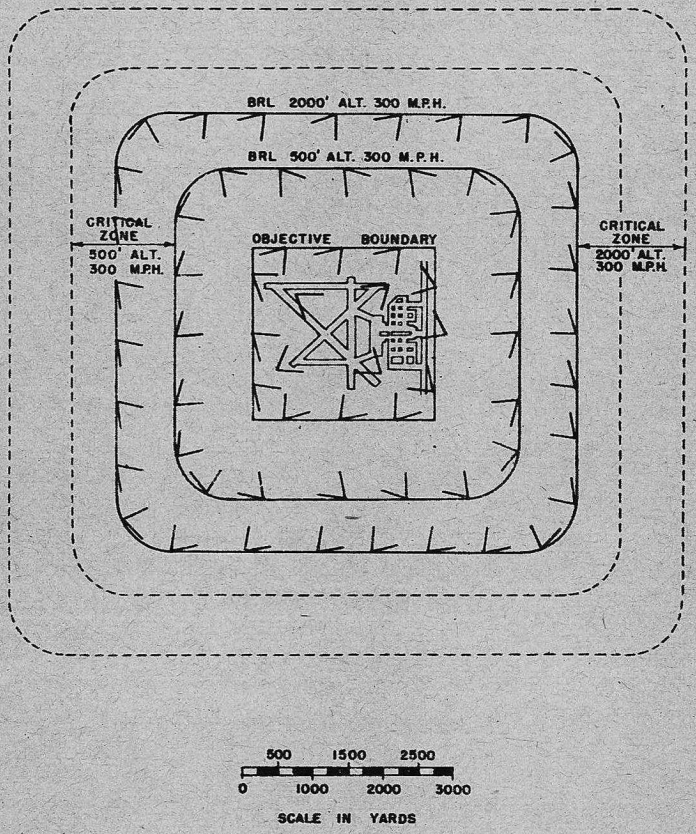


Figure 16. A solution for the disposition of automatic weapons.

(3) Locate approximately 45 percent of the automatic weapons fire units on or close to the BRL for the 2,000-foot altitude attack. One edge of the dead area (70°) of each fire unit is placed parallel to or on the BRL with the dead areas of all fire units, either facing clockwise or counterclockwise and with fire units 500 to 800 yards apart.

(4) Locate approximately 30 percent of the automatic weapons fire units on the BRL for the 500-foot altitude attack. These units should be spaced from 500 to 800 yards apart. The dead areas are coordinated as in (3) above.

(5) Approximately 25 percent of the automatic weapons fire units are located adjacent to or within the defended area to provide dive-bombing protection. The individual landing strips and installations susceptible to dive-bombing attacks should be protected. See figures 16 and 17 for the indicated positions of all automatic weapons and various gun density areas.

(6) The quadruple machine-gun trailer, with each automatic weapons fire unit, is placed approximately 100 yards from the automatic weapon, to cover the dead area and supplement the fire of the automatic weapon.

47. FORWARD AREA AIRDROMES. Such strips are long, narrow objectives against which the enemy usually makes horizontal bombing attacks (from altitudes below 2,500 feet) along the long axis, or at an angle not greater than 30° from the long axis. To defend against horizontal attacks, some fire units are emplaced near the bomb-release line and within approximately 30° on either side of the long axis. Some fire units are also disposed at or near the ends of the objective to protect against dive bombers.

a. Defense of a short landing strip. When only a small number of automatic weapons fire units are available for each airdrome, they are disposed as follows:

(1) Four fire units. Place all units on the prolongation of the long axis of the objective, one near each end of

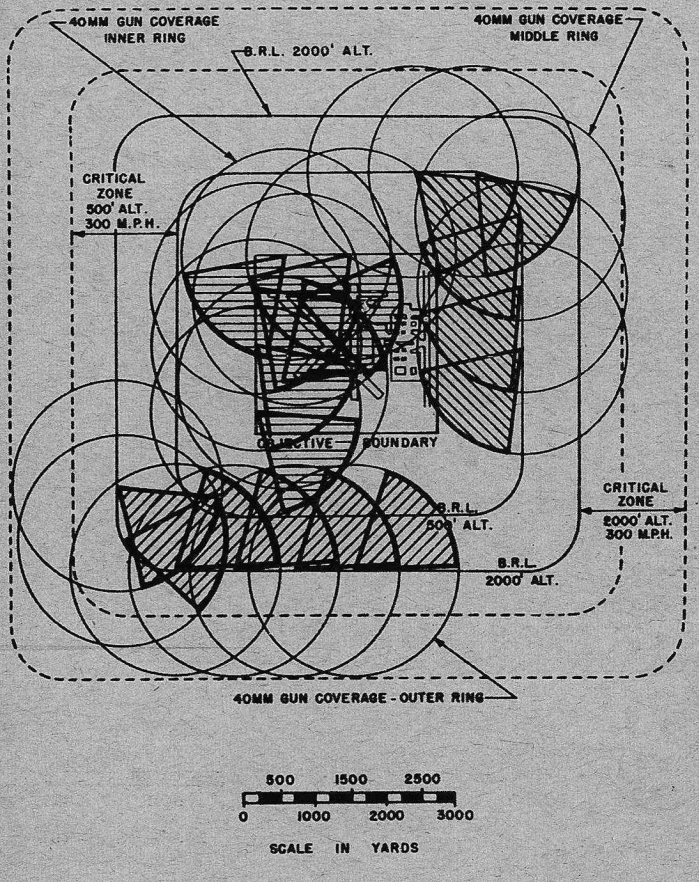


Figure 17. Coverage of automatic weapons.

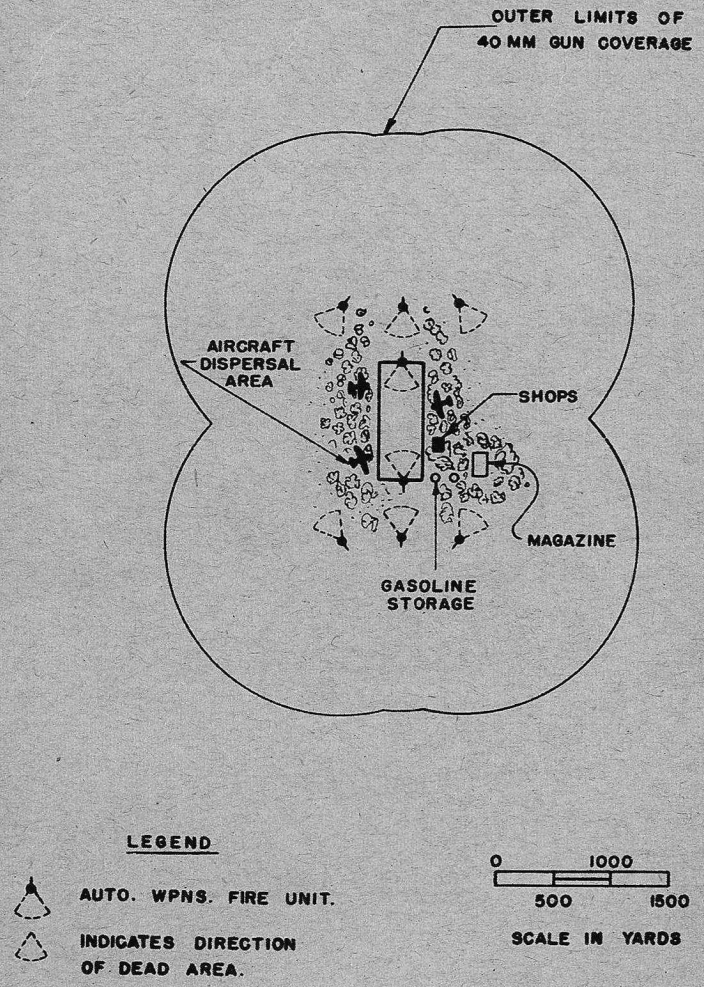


Figure 18. Automatic weapons defense of a short landing strip in a forward area.

the objective, and one 500 to 800 yards beyond each end.

(2) Eight fire units. Four units are disposed as outlined in (1) above, with the additional units placed about 500 yards to either flank of the two units beyond each end of the objective (fig. 18).

(3) As the objective increases in length a point will be reached where fire units disposed at the ends of the objective cannot cover the center of the objective. In this case, some fire units must be withdrawn from the ends and emplaced along the sides of the objective or more fire units assigned to the defense.

b. Defense of a long landing strip. (1) Figure 19 shows a typical defense of a longer landing strip located in a forward area. In this example it has been assumed that there is available one battery plus one platoon of automatic weapons (twelve fire units).

(2) As shown in figure 19, the twelve automatic weapons fire units are placed in a perimeter defense, each unit being from 500 to 800 yards from the edges of the landing strip. The dead areas are in the direction shown.

(3) It is again emphasized that in planning the defense of a landing strip in forward areas, as in planning all other antiaircraft defenses, the terrain is an all important consideration. The plan for the defense includes a detailed reconnaissance to determine the most favorable locations for the automatic weapons.

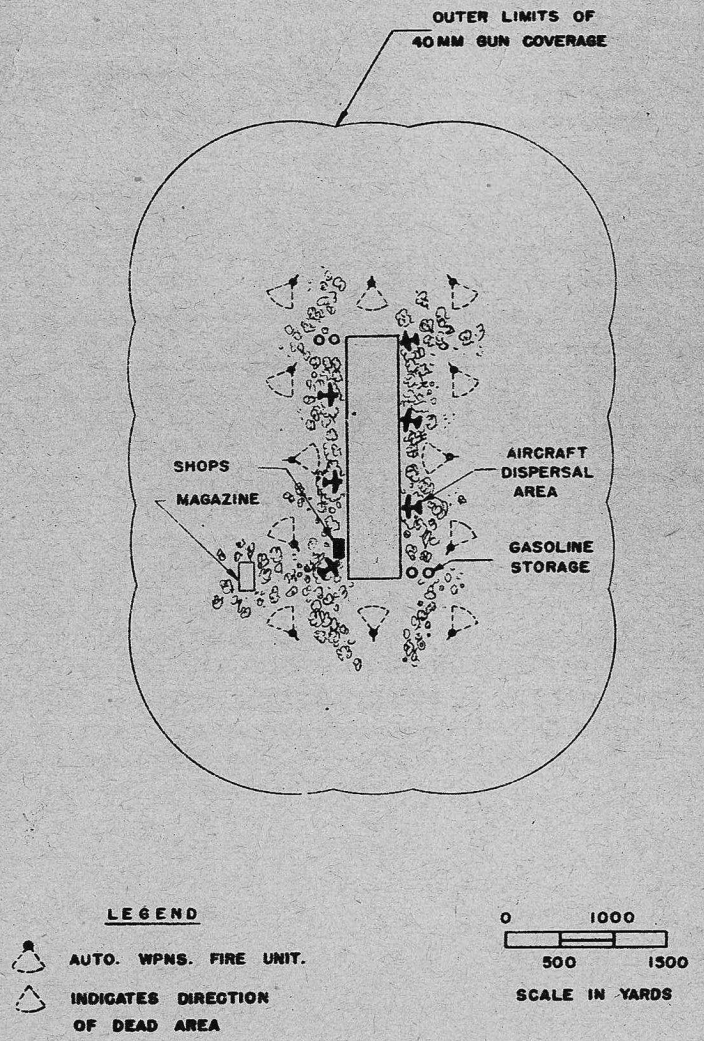


Figure 19. Automatic weapons defense of a long landing strip in a forward area.

CHAPTER 8

EMPLOYMENT IN THE COMBAT ZONE

Section I
General

48. PROBLEM. Automatic weapon units operating with ground forces are confronted with the problem of providing protection for troops in moving situations and of defending installations or areas which by their nature are likely to become objectives for air attack. The tactical dispositions of the units will necessarily change in conformity with the movement of the ground forces and establishments. Units operating with ground forces must also coordinate their operations with friendly air forces operating in the area.

49. BASIC DOCTRINE. **a.** The doctrines for the disposition of automatic weapons in rear area defense apply equally well to automatic weapons operating in the combat zone.

b. All available means of AAA protection, both active and passive, must be coordinated. The degree of coordination possible depends upon the degree of dispersion of the troops, areas involved, and the relative stability of the situation. Combat units of the arms provide their own

active defense against low-flying aviation so far as possible by the use of their organic AA 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 airguards.

c. AA automatic weapons battalions will rarely be disposed as units. It will ordinarily be necessary to distribute batteries throughout the zone of action, to afford protection to vital areas and units. The criterion is to give adequate protection to the most vital points or units, then consider protection for the points or units which have lower priority. ANY ATTEMPT TO DISTRIBUTE THE INDIVIDUAL FIRE UNITS OF THE BATTALION THROUGHOUT THE ENTIRE ZONE OF ACTION IS FATAL; it results in unwarranted dispersal and consequently no element receives adequate protection.

d. The mobility of the AA automatic weapons 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 AA automatic weapons priority on the roads. Movement of AA automatic weapons by bounds for the protection of motorized columns is not possible. DO NOT DISPERSE FIRE UNITS INDIVIDUALLY ALONG THE ROUTE OR THROUGHOUT THE COLUMN. FIRE UNITS MUST BE MUTUALLY SUPPORTING. (See fig. 20.)

e. When units of an AA automatic weapons battalion are widely dispersed throughout the zone of action, such dispersal makes control by the battalion commander difficult. The decision whether to attach batteries to units or installations of divisions or corps, or to have the batteries support such units under the AA battalion commander's

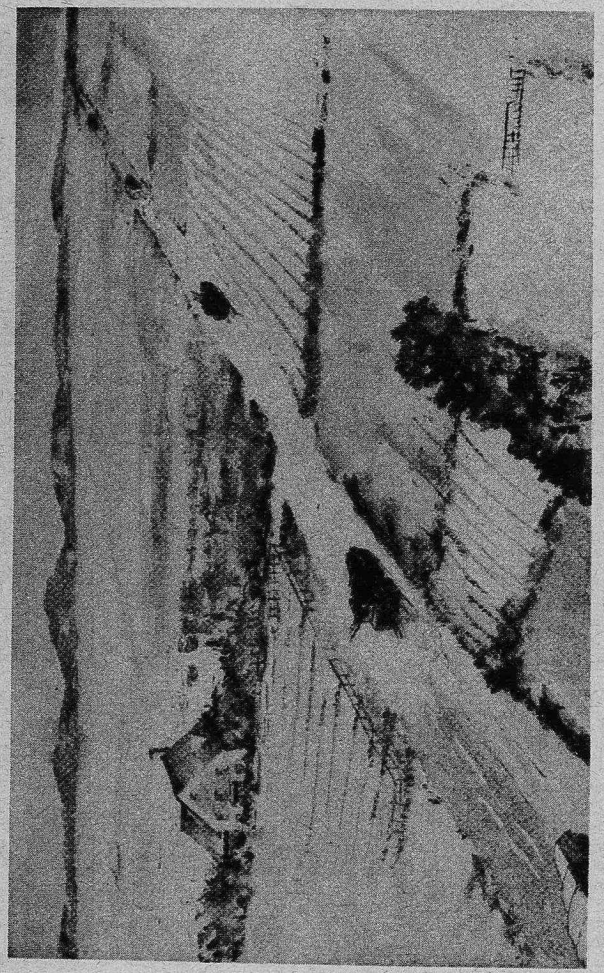


Figure 20. Guns are distributed in pairs. The front crew should protect to the front, right, and left. The rear crew should protect to the rear, right, and left. 50 to 175 yards between vehicles.

control, is a command decision which must be based on the situation. RETAIN BATTERIES UNDER THE AA BATTALION COMMANDER'S CONTROL WHENEVER POSSIBLE. It is particularly necessary that batteries be retained under control of the battalion commander in protection of defiles, or if the AA unit is to remain in position after the supported unit leaves.

f. 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 the AA automatic weapons.

g. Fire units normally move at night and are in position, ready to fire, prior to daybreak. During movements, 40-mm automatic weapons units can go into action almost instantly firing from the wheels or dropped position using direct fire sights. Director controlled fire is more accurate and should be used whenever possible, but additional time is required to emplace the fire unit and to prepare it for action.

h. The self-propelled automatic weapons battalions are employed in general as the other units and, in addition, are especially suited for the following:

(1) For the protection of forward units in an advance.

(2) For the protection of rear guards in delaying actions.

(3) For the protection of the most forward elements in either an offensive or defensive situation.

(4) For the protection of trains and other motor convoys.

(5) For the protection of flank antitank and tank destroyer units.

(6) For the protection of a unit engaged in reconnaissance in force.

i. The employment of the self-propelled automatic weapons battalion with armored forces is covered in FM 4–101.

Section II
Concentrations—Bivouacs

50. GENERAL. Similar doctrines govern the AAA protection of troops in concentrations and bivouacs. Some of the AAA units should arrive early in the area, preferably just after the advance guards of the columns, and the remainder of the units should be in position protecting the area before arrival of the mass of combat troops.

51. EMPLOYMENT. Corps AA automatic weapons are employed to provide protection for corps troops, corps headquarters, corps trains, and suppy establishments against low-level and dive bombardment. Where protection of railheads is required, it is necessary to protect them only while they are in operation. Those automatic weapons units which have the least important missions to perform at the time may be detached for this defense. In determining the disposition of the automatic weapon units, consideration will be given to the amount of local protection afforded by organic AA weapons of the corps units and the extent to which each unit is able to utilize passive measures of defense. Protection for the vital elements of each division may be furnished by such AA automatic weapons units as may be attached. The principles outlined in chapter 6 apply to the automatic weapons defense of concentrations and bivouacs. (See figs. 21 to 24 incl.)

Section III
Advances

52. TACTICAL EMPLOYMENT DURING THE ADVANCE. a. In an advance, troops are vulnerable to attack by hostile low-flying and dive-bombing airplanes, especially when

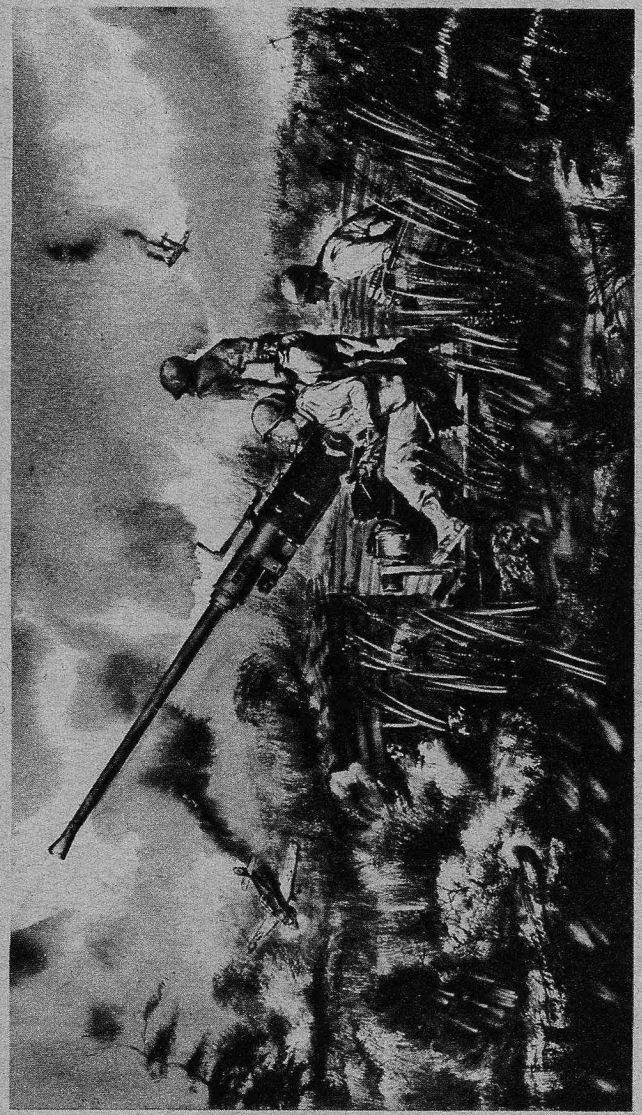


Figure 21. When a bivouac is well concealed, do not fire at airplanes unless the bivouac is attacked.

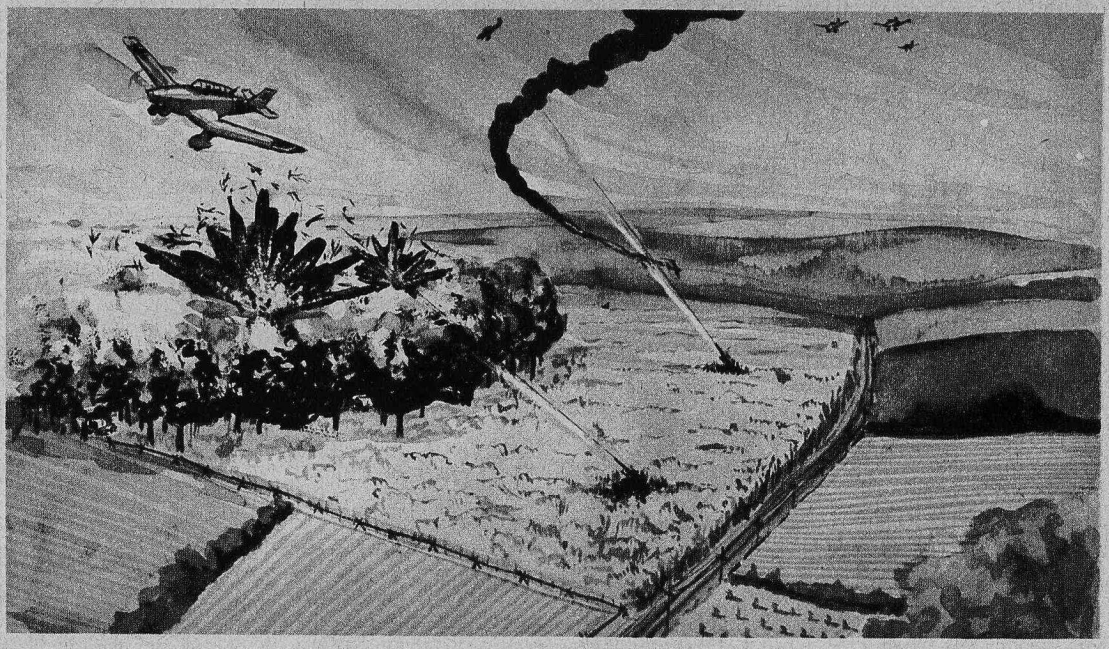


Figure 22. To do so will disclose the position and heavy attack may result.



Figure 23. Do not move into a bivouac and do nothing.

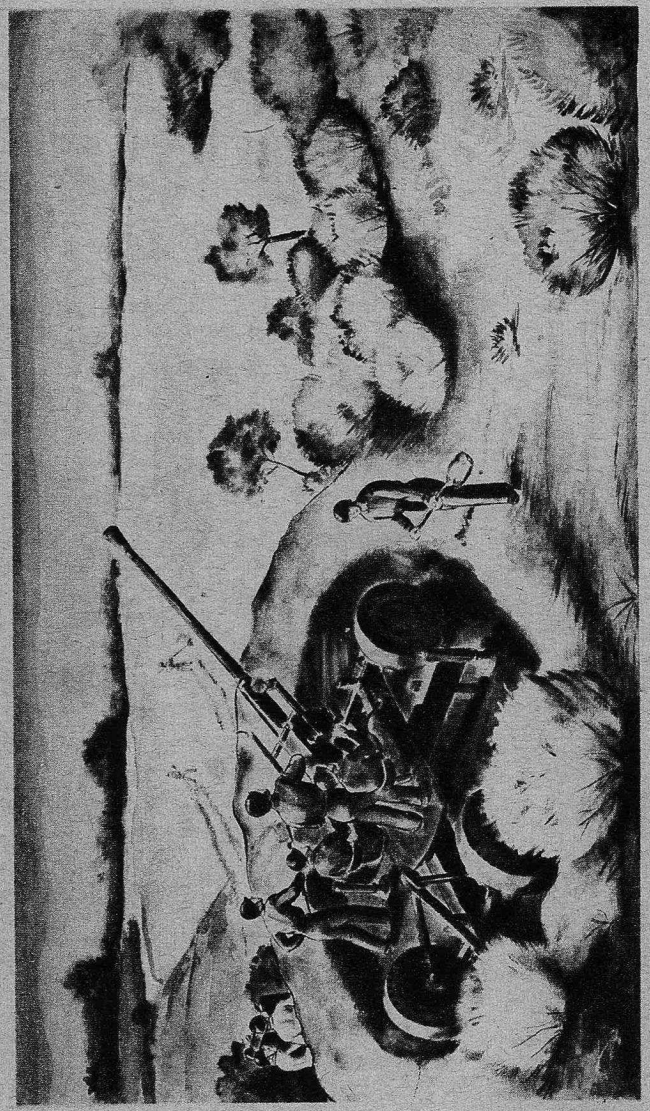


Figure 24. Emplace the gun in a position to protect the bivouac. Begin fortifications and brush out tracks.

passing through defiles. AA automatic weapons are sited at critical localities along the line of advance. DO NOT DISPERSE FIRE UNITS INDIVIDUALLY THROUGHOUT THE ENTIRE ZONE OF ACTION. FIRE UNITS MUST BE MUTUALLY SUPPORTING. Against attacks by strafing, low-flying, and dive-bombing airplanes, every armed man in the column is a potential defender. All small arms must be brought to bear on the aerial attack.

b. Detachments of AA automatic weapons are often attached to troop units moving by rail for the purpose of providing AA protection en route. These weapons are mounted, ready to fire, on flat cars or gondolas, spotted in the train so as to provide all around and mutually supporting fields of fire. (See fig. 25.)

Section IV
Offensive

53. TACTICAL EMPLOYMENT ON THE OFFENSIVE. a. During preparation for and throughout the period of attack, the combat forces are particularly subject to hostile aerial observation and attack, not only because of the density of their concentration but also because the enemy will use all the means at his disposal against those elements of our forces which constitute the greatest menace to his security. Therefore, the available AA automatic weapons are disposed so as to provide the maximum protection to those elements which are most vulnerable and whose disorganization might jeopardize the successful accomplishment of the assigned missions. DO NOT DISTRIBUTE FIRE UNITS INDIVIDUALLY THROUGHOUT THE ENTIRE ZONE OF ACTION. FIRE UNITS MUST ME MUTUALLY SUPPORTING.



Figure 25. Antiaircraft protection of a train.

b. In an attack to force the crossing of a river line, AA automatic weapons defense is centered around the crossing fronts and particularly the sites of 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.

c. Forward automatic weapons fire units are disposed as far forward as the situation permits. This is especially true of the self-propelled automatic weapons units. They are concealed, and defiladed where practicable. Combat troops are largely responsible for their own protection-but, when in actual combat, need additional automatic weapons protection. Automatic weapons battalions attached to the division will normally have the mission of protecting the artillery area and division reserves. This will leave the automatic weapons battalions of the corps free for the protection of corps reserves, routes of approach, and the rear elements of the corps.

d. Figure 26 shows an arrangement for protection of a corps in attack. The attached AA automatic weapon battalions (mobile) of the divisions are protecting the combat elements. The division making the main effort has been reinforced by the attachment of one of the batteries from the corps battalions. 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.

Section V
Defensive

54. TACTICAL EMPLOYMENT IN THE DEFENSIVE. a. When a force is on the defensive, effective AA defense becomes of increasing importance as there is usually a

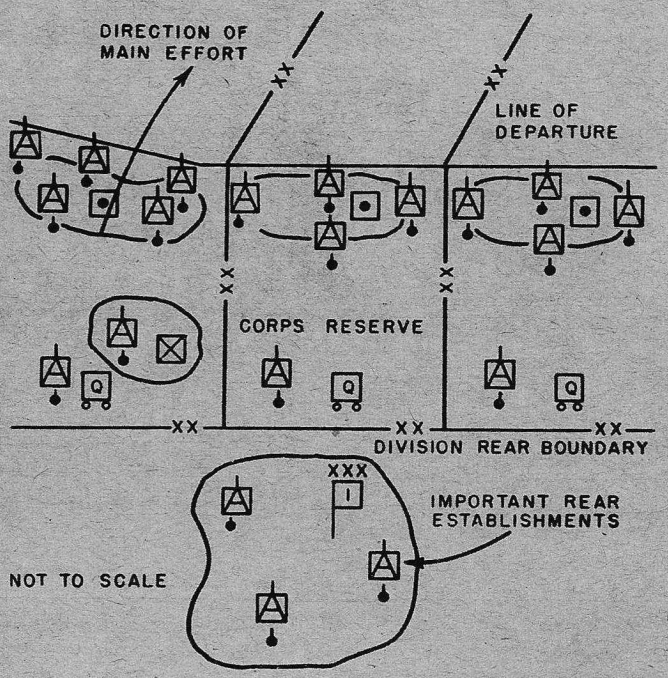


Figure 26. Automatic weapons protection for a corps in an attack.

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 may have to furnish the entire defense against hostile aerial activity, except that afforded by other units with their organic AA weapons. 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. DO NOT DISTRIBUTE FIRE UNITS INDIVIDUALLY THROUGHOUT THE ENTIRE ZONE OF ACTION. FIRE UNITS MUST BE MUTUALLY SUPPORTING.

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

c. Position defense. (1) Position defense is characterized by organization of a single position on which the resistance is based. The AA automatic weapons units are disposed to furnish a defense of those forces and elements essential to maintenance of the position. The defense must be continuous throughout all stages of a hostile attack and must be so arranged as to facilitate protecting our forces in case of a withdrawal from the position.

(2) Forward AA automatic weapons units should be disposed to provide protection for troops occupying forward defensive localities of the main battle position. Fire units should not be disposed closer than 800 yards to the MLR. Self-propelled batteries *may* be employed forward of the MLR.

d. Figure 27 shows one method of providing AA automatic weapon protection for a corps during the defense. 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 oc-

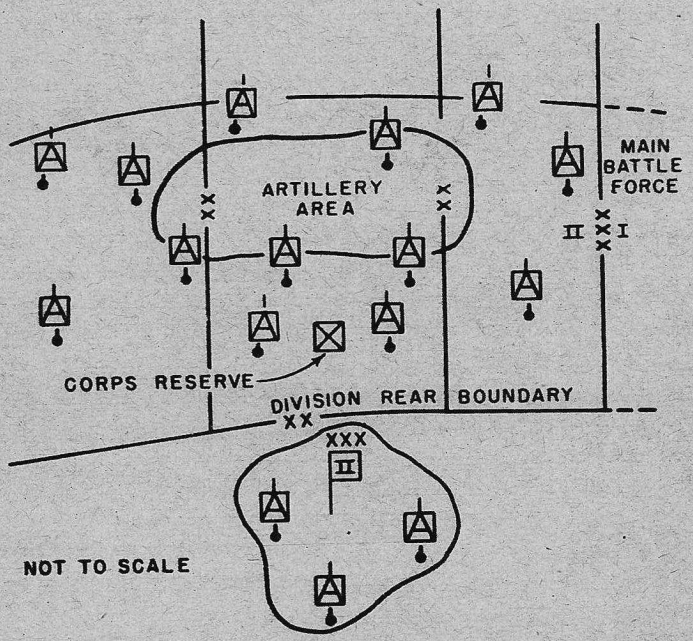


Figure 27. AA automatic weapons protecting a corps in defense.

cupied by the field artillery, and important rear establishments.

e. Defense in counterattacks. In protecting extensive counterattacks, the employment of AA automatic weapons units is similar to their employment in the offensive, 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.

Section VI
Pursuit

55. PURSUIT. The AAA commander must be prepared to provide AA automatic weapons protection in the pursuit, both in direct pressure and in encircling movements. As coordination is difficult during the pursuit, it is usually found necessary to attach AA automatic weapons units to the various elements continuing the attack. The force making the encircling maneuver also needs AA automatic weapons protection. Because of the rapidity of movement and circuitous routes of encircling forces, automatic weapons are attached to combat teams as the commander deems necessary. Self-propelled batteries are especially well suited for these missions. Units so attached revert to the control of the force commander as early as practicable.

Section VII
Retrograde Movements

56. EMPLOYMENT PROTECTING A WITHDRAWAL. a. When not pressed by the enemy, a withdrawal is protected

by AAA as in an advance. In addition, the rear guard must be protected by AA automatic weapons as in a defensive situation. Self-propelled batteries are well suited for this mission. When withdrawing under pressure of hostile ground forces, AA automatic weapons are employed to insure the protection of the columns against aerial observation and attacks by combat aviation. The enemy aviation will attack not only columns and formations but also critical localities on routes to the rear.

b. The progress of leading elements must not be obstructed as this would jeopardize the movements of the main forces following. Protection of defiles is of the utmost importance.

c. Withdrawals are usually made under cover of darkness. The tactical situation may demand a daylight operation, when AAA protection becomes even more important.

d. In a withdrawal, enemy mechanized forces are a serious threat and the AAA defense must be planned accordingly. Care must be taken that guns are not left without protection in positions exposed to mechanized attack. Alternate positions for antimechanized fire should be reconnoitered so that the AA automatic weapons may engage ground targets if the mechanized threat requires it.

57. EMPLOYMENT PROTECTING A DELAYING ACTION. In delaying actions, AA automatic weapons are employed primarily to protect the artillery, reserves, and critical defiles in rear from hostile air attack and observation. Since decisive engagements are avoided in delaying actions, withdrawals are made from one defended position to another. During the withdrawal, AA automatic weapons are employed in the manner described in paragraph 56.

CHAPTER 9

EMPLOYMENT WITH AMPHIBIOUS FORCES

Section I
Characteristics of Amphibious Operations

58. GENERAL. The term "amphibious operation" refers to any operation of a task force that requires movement by water to the enemy held territory. Such operations may involve movement across a relatively narrow expanse of water or movement across hundreds of miles of water. (See FM 31–5.)

59. HOW AMPHIBIOUS OPERATIONS DIFFER. a. In a shore-to-shore movement, there will be attached to the infantry combat team the elements needed to put the combat troops ashore by means of small landing craft and the service troops needed to handle the supplies coming ashore. In a ship-to-shore operation, the landing craft are normally operated by naval personnel.

b. The task force commander must have at his disposal sufficient strength to meet any emergency. He cannot withdraw to reorganize for a new offensive.

c. Once the attack on land has developed, the operation will become one that is normal for ground forces.

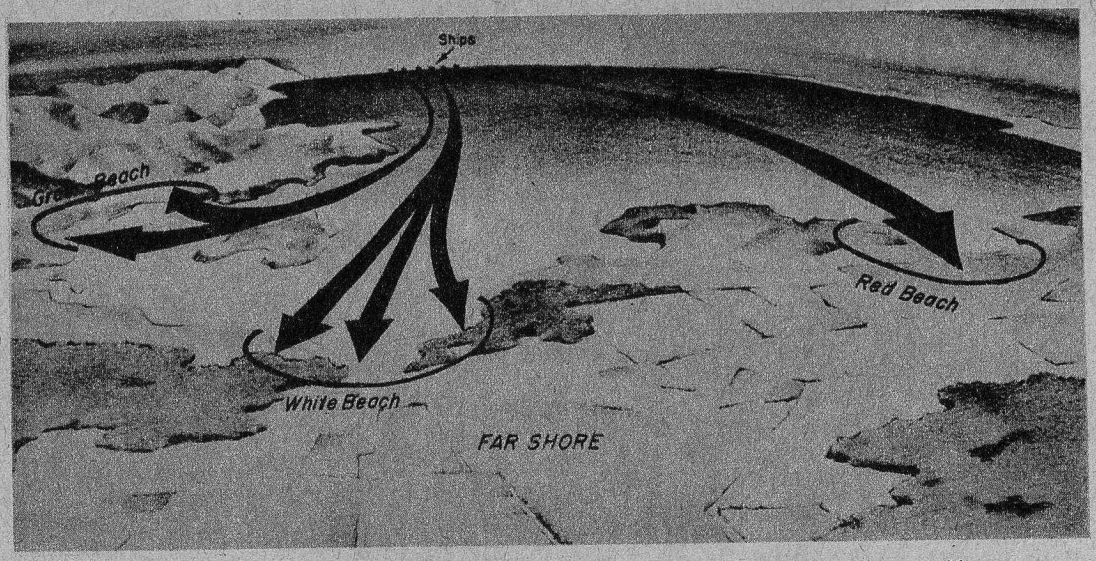


Figure 28. An amphibious operation may involve a movement by transport or other ship to a point off the enemy shore, thence by landing craft to the enemy held beaches (ship to shore). The distance from ship to shore may be only a few or many miles. The forces involved may be relatively large or small. It may involve landing on one or many closely or widely separated beaches.

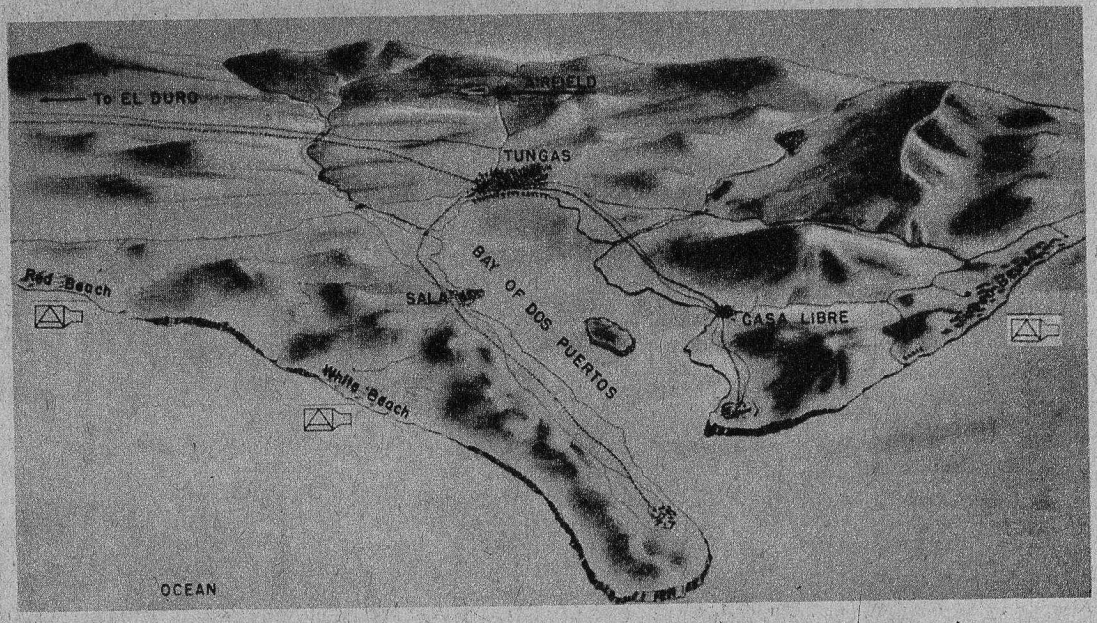


Figure 29. Regardless of the tactical formation the landing assumes, there must be antiaircraft artillery protection on every beach that the force commander plans to use for landing reinforcements and supplies.

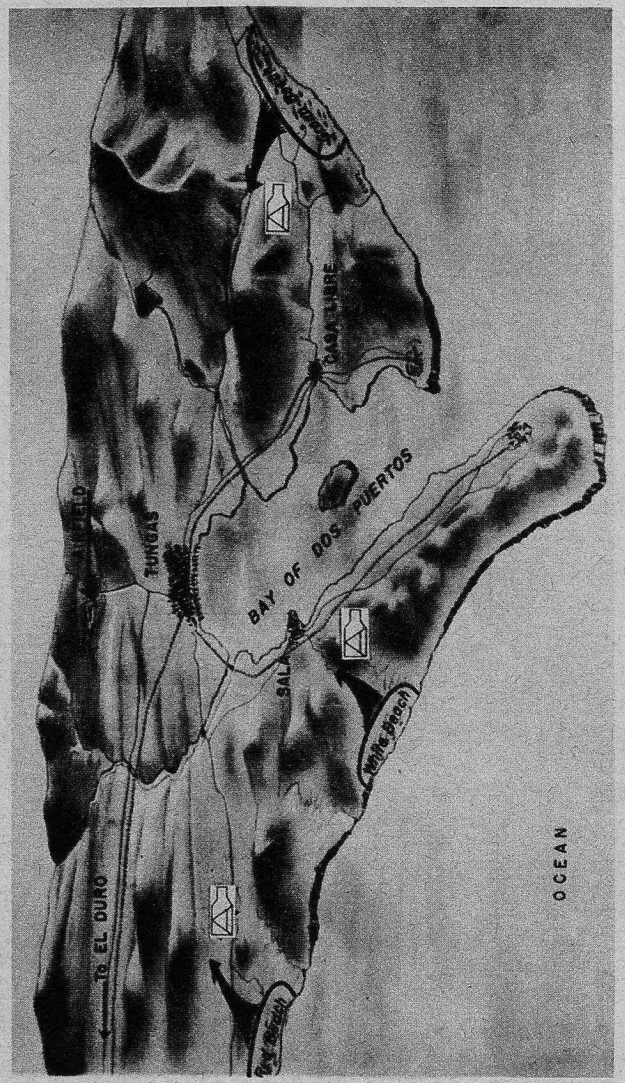


Figure 30. Antiaircraft artillery protection is required at critical points along the route of advance of the attacking troops.

Section II

Automatic Weapons Battalion with Amphibious Operations

60. GENERAL. The AA automatic weapons battalion (self-propelled) will normally be used in amphibious operations. Some situations may occur where the AA automatic weapons battalion (mobile) will be given a mission with an amphibious force. In such a case the tactical principles set forth in this chapter for the self-propelled battalion apply to the mobile battalion.

61. LOADING BEACHES AND DOCKS (See fig. 31). **a.** The embarkation area at the outset of a contemplated amphibious operation may become the scene of great enemy activity. If the enemy can break up such an operation at its outset, he will certainly gain much. Depending upon the number of transports and/or landing craft being concentrated and the vulnerability of the beaches or harbor to air attack, various calibers and numbers of AA weapons will be required for this phase.

b. The tactical principles contained in FM 4–100 will govern the assignment and use of weapons in the protection of a harbor. The only difference will occur when the self-propelled units which have been supplementing the harbor defenses are pulled out to move with the attacking troops. In such a case there must be sufficient AAA assigned to this area to assure adequate protection after these units leave.

c. If a self-propelled battalion is protecting loading beaches for a shore-to-shore movement, careful planning is required concerning the movement of the AAA from the near to the far shore. (See fig. 32.) Usually the elements of the landing force embark from fewer beaches than they intend to land upon. This means that the AAA



Figure 31. The port of embarkation for an amphibious operation where large concentrations of supplies, boats, landing craft, and troops are located, will need to be well protected by antiaircraft artillery. The number and caliber of weapons assigned such a mission depends upon the area to be defended and the danger of enemy aerial attack.

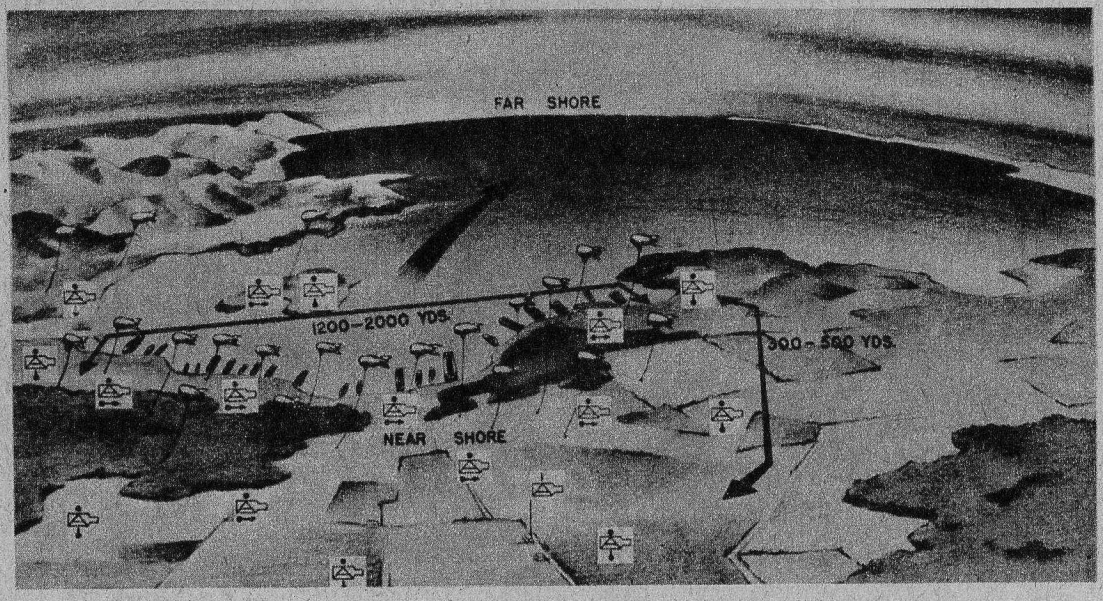


Figure 32. The protection of a regimental loading beach (shore to shore) with a battery of automatic weapons is shown. Barrage balloons may or may not be present. In either case an area defense for the automatic weapons is required.

platoons that function with the force reserve must be able to stay on the near shore to aid in protecting loading beaches, while the platoons that are to land with the assault units move away in early waves.

62. WATER CROSSING. **a.** If the operation involves a ship convoy and then a ship-to-shore movement, the weapons of the self-propelled AA battalion must be emplaced on decks of the transports and other ships to provide additional protection to the convoy.

b. When moving by small landing craft, either from shore to shore or from ship to shore, the self-propelled AAA weapons are used to help protect these craft. This is accomplished by placing fire units in different waves and then placing these boats on or near the flanks.

c. The first weapons to land should be the self-propelled machine guns. These should come in on early waves. Automatic weapons and ammunition carriers should come in on later waves. Figure 33 shows a landing beach for a battalion landing team. Two machine gun squads are coming ashore in wave III and two in wave IV. Four automatic weapons squads are coming ashore in wave VI. Ammunition carriers are in wave VII. This has given protection to the boat column and has brought AAA protection ashore early when it is sorely needed.

63. LANDING BEACH PROTECTION. **a.** This is the most critical period for the self-propelled AAA battalion. Enemy aerial activity is likely to be great and, if unopposed, will seriously threaten the whole operation, both from the standpoint of troops who are landing, and from the standpoint of supply activities.

b. The minimum number of self-propelled AA weapons required to protect a beach to be occupied by a battalion landing team is four machine gun squads and four automatic weapons squads. For two battalion teams landing abreast, a battery of automatic weapons is normally sufficient.



Figure 33. In crossing from shore to shore, or from ship to shore, the antiaircraft weapons are dispersed in the waves of landing craft so they can furnish protection against enemy surface craft or aircraft. The caliber .50 machine-gun mounts are landing from LCM's in waves III and IV, the automatic weapons mounts in wave VI, and the ammunition carriers in wave VII.

c. Figure 34 illustrates one possible disposition of a composite platoon which is protecting a battalion landing team beach.

64. DUTIES OF THE BATTALION COMMANDER (See FM 4–100 and FM 101–5). In addition to the duties set forth in these Field Manuals, the battalion commander will—

a. Together with the S–3's of the landing force and of the units providing the water transportation, determine the amount of space required in landing craft.

b. Together with the AA balloon commander, if balloons are to be used, coordinate the beach AA defense of the two units.

65. COMMUNICATION. Communication within the battalion will be by wire, radio, messenger, hand semaphore, or voice. Particular attention must be given to the AAAIS and communication with air forces supporting the landing.

66. SUPPLY. a. During the early stages of the landing operations, supply points for the landing unit are established near the beach area. As the operation becomes stabilized, and until ports are secured or developed, one or more beaches are developed into the force supply points. The battalion draws its supplies from these various dumps as prescribed in orders by higher authority.

b. Of vital concern to the AAA commander is the adequate supply of ammunition of the proper type on the landing shore. All available space on gun carriers, ammunition carriers, and other vehicles is utilized on the initial trip. Ammunition not capable of being loaded on vehicles may be loaded on the craft and manhandled at the beach by the personnel of the beach organizations.

c. For an amphibious operation, certain special items of equipment and supplies must be procured and made

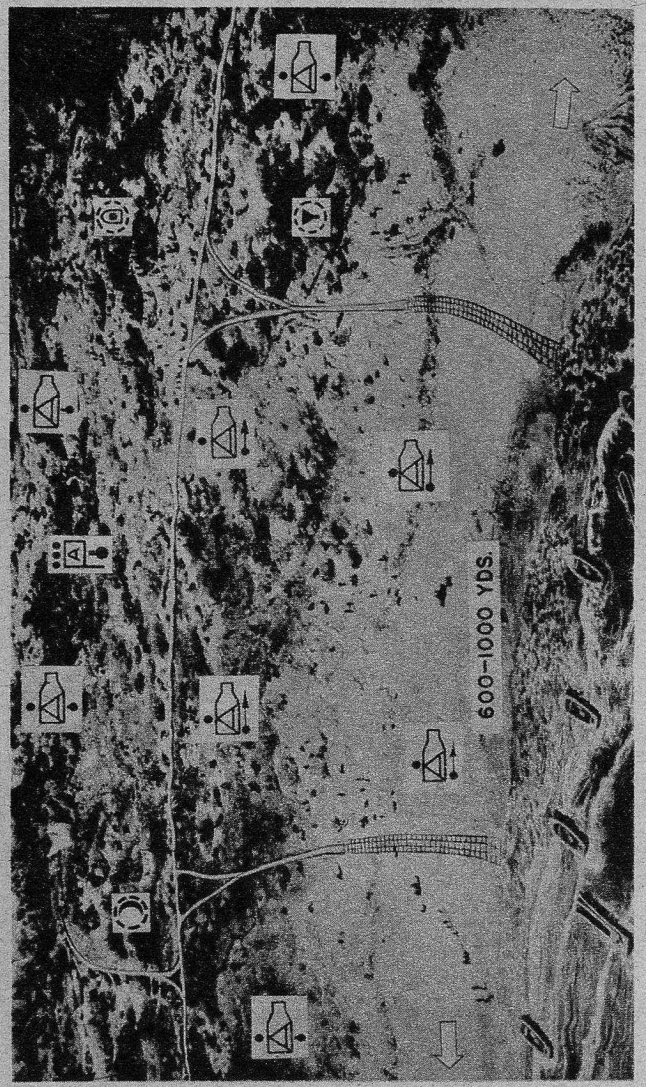


Figure 34. The weapons of a composite self-propelled automatic weapons platoon are shown emplaced to protect a battalion landing team beach.

available to assault units. Such items are waterproofing materials for weapons, vehicles, and radios, and rope and lashings for use in landing craft and camouflage materials.

d. The AAA unit operating for the protection of any beach will be attached to the landing force unit operating that beach for the purpose of supply.

67. EVACUATION. The medical units of the landing force are responsible for evacuation of personnel back to the far shore. Medical units of the task force accomplish the movement of casualties from the landing shore.

68. SPECIAL TRAINING. FM 31–5 outlines the special training considered essential for landing operations on a hostile shore, based upon a ship-to-shore movement. From the standpoint of the AAA units participating in an amphibious operation, in addition to the special training mentioned in this chapter, the following training topics are considered worthy of emphasis, and careful consideration in such training is most essential:

a. Types, nomenclature, and characteristics of ships and landing craft.

b. Navy customs, terms, and rules aboard ship.

c. Embarking and debarking from landing craft by day and by night.

d. Use of rope ladders and cargo nets.

e. Lowering equipment and supplies from various heights to small craft.

f. Removal of beach obstacles; placing and removal of demolitions and booby traps.

g. Firing from moving landing craft.

h. Camouflage and concealment on the loading beaches and on the landing shore.

i. Special means of wearing equipment while on board the craft.

j. Water conditioning of vehicles and equipment.

k. Operation of vehicles and equipment on beaches.

Section III
Loading

69. GENERAL. **a.** For any amphibious operation, landing craft are not made available in sufficient quantity to float all elements of the landing force at any one time. Space within the available landing craft is at a premium and, since "combat" loading is essential, certain equipment must be left behind. The commander of automatic weapons units engaged in this type of an operation must therefore know what equipment is not essential to him in the early stages of the landing.

b. Craft of all types are allocated to the landing force by higher authority and the landing force, in turn, allocates these same craft to its subunits. Staffs of the subunits, for example the battalion landing team, consider the boat space requirements of all of its elements and allocate all of the space available, based upon priority established by the tactical and logistical demands of the situation. The automatic weapons commander must be familiar with the boat space requirements for his equipment and vehicles and he must establish priorities for them. The following priority is suggested:

First—Automatic weapons and machine-gun carriers.

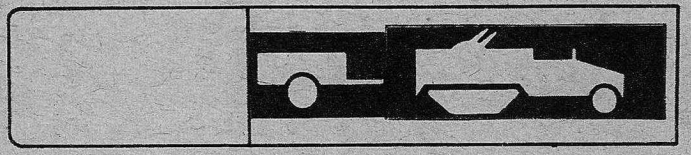
Second—Ammunition supply vehicles, the number depending upon location of supply points.

Third—Communication vehicles.

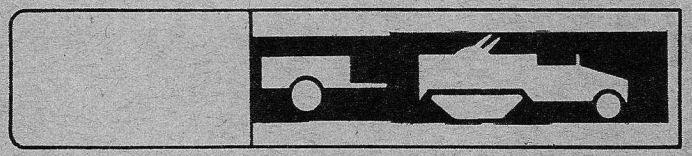
Fourth—Supply and maintenance vehicles.

Fifth—Rear echelon vehicles.

70. LOADING SUGGESTIONS. To aid the automatic weapons battalion commander in determining craft types and space requirements the following information and sketches show typical boat loading combinations:



(LCM)



(LCM)

Figure 35. Two caliber .50 machine-gun mounts.

a. For the early waves, a machine-gun carrier may be transported in an LCM with a limited space left in front of the carrier for personnel only. (See fig. 35.)

b. In the later waves of the battalion landing team, not more than half of the fire units to be used should be placed in any one craft (LCT). The remaining space will be occupied by other elements of the force. (See fig. 36.)

c. In the wave following the fire unit should come the ammunition vehicles carrying sufficient ammunition to initially provide *two units* of fire in addition to that carried by the fire units. (See fig. 37.)

d. The automatic weapons battalion commander and a small staff land with the *force command group*.

e. Maintenance, supply vehicles, and ambulance land on call with other rear elements of the landing force.

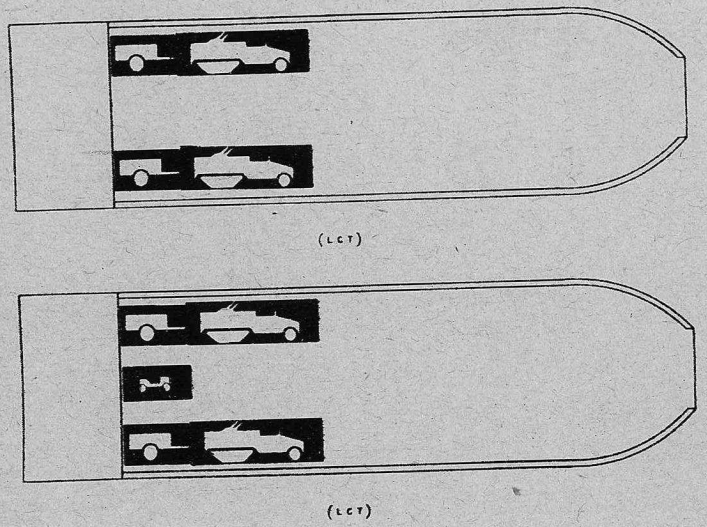


Figure 36. Four automatic weapons mounts and the platoon commander's command car. Remainder of space on craft utilized by vehicles of other assault units.

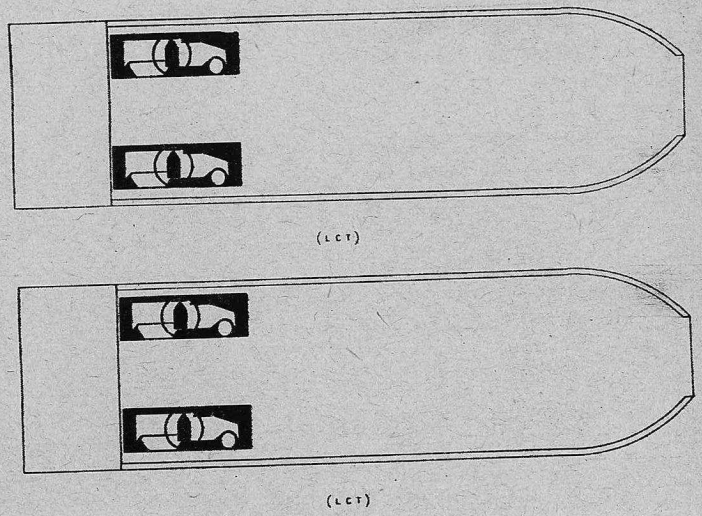


Figure 37. Four ammunition carriers. Remainder of space on craft utilized by vehicles of other assault units.

CHAPTER 10

EMPLOYMENT WITH AIRBORNE FORCES

71. MISSION OF AIRBORNE ANTIAIRCRAFT UNITS. The primary mission of airborne AAA units is to provide AAA protection for captured airdromes and landing strips. Other AAA missions such as protection of captured railheads and supply installations may be assigned by the force commander. FM 31–30 outlines the tactics and technique of airborne troops. FM 4–103 describes in detail the employment of airborne AAA units.

72. TRAINING. Airborne AAA battalions and separate batteries must be specially trained in the following:

a. Enplaning and deplaning of troops, equipment, and supplies.

b. Planning and execution of operations requiring precise coordination with air forces, parachute troops, and other supporting arms.

c. Communication with supporting aviation and task force headquarters.

d. Administration, supply, and evacuation without normal motor transportation facilities.

e. Independent operation of squads, sections, and platoons.

73. EMPLOYMENT. **a.** Airborne AAA is transported in small complete units in transport type airplanes or gliders. Immediately upon landing the small units set up a defense of the landing strip to protect other elements arriving. Following platoons occupy positions previously selected and strengthen the defense of the landing strip or area. As time permits, emplacements are continually improved to provide antimechanized as well as antiaircraft defense. Communication with command posts is established as soon as possible after landing.

b. The AAA commander arrives with the first element of his first unit. He advises the force commander of the situation regarding the AA defense of the landing strip or area. He coordinates the occupation of positions by the AAA units as they arrive.

c. Battery and platoon commanders arrive with the first element of their units and coordinate the occupation of positions by their units.

74. PLANNING. **a.** Detailed plans, flexible enough to meet unforeseen contingencies, must be made prior to an operation. Air photos and maps of the landing area and vicinity must be secured and distributed down to include the platoon. Tentative gun and command post positions are selected. An advance party should accompany the first elements flown in, to reconnoiter the positions selected and act as guides for units as they arrive. Alternate positions must be selected and reconnoitered. All equipment must be carefully inspected prior to an operation.

b. During the planning stage, constant contact must be maintained with the force G–2. All pertinent information gained concerning the enemy should be disseminated throughout the AAA unit.

c. Plans for the recognition and identification of aircraft are particularly important, since the normal AAAIS

and AWS will probably be lacking during the early stages of airborne operations.

75. LOADINGS. **a.** Loading lists and time tables must be carefully prepared. Every person responsible for the loading of a glider or airplane should have a list showing what personnel and equipment will be loaded in the glider or airplane, and see that the necessary equipment for loading and lashing is on hand.

b. Weapons are transported with the crews that serve the weapons. In addition, the glider or airplane carries ammunition and rations. This type of load, which is called a "combat" load, is used in order that the loss of a glider or airplane will not seriously hamper the operation.

76. LANDING. **a.** Upon landing, the situation may require immediate AAA protection for the landing area. In that case, the first platoon that arrives goes into position in the immediate vicinity of the point of landing. The remainder of the organization move to their selected positions. Where a unit is required to move some distance after landing to set up its AAA defense, movements are made by individual guns or platoons. Waiting to assemble an entire battery wastes time.

b. In landing on an airfield which has been secured by our forces and setting up an AAA defense for that field, the pilots can assist materially by landing their aircraft as close as possible to the selected gun positions. This saves time and also disperses the aircraft. Cooperation can be accomplished prior to take-off by having the unit commander confer with the pilots and point out the gun positions on a map or aerial photo.

77. LOCAL SECURITY. Local security is established in each position. It is important to remember that there is no "front" in airborne operations. Outposts and patrols

are established to give an early warning of an impending attack by mechanized vehicles. Close contact and coordination with surrounding units greatly strengthens the security of positions.

78. MOTOR TRANSPORTATION. Motor transportation is limited and careful supervision must be maintained in order to obtain the maximum benefit from its use. Depending upon the availability of air transportation, as much motor transportation as possible is flown in with the units.

79. AIR TRANSPORTATION. **a.** The principal reason for the employment of gliders is that they can be landed on areas where it is impossible to land powered aircraft. A secondary reason is that gliders can be released at some distance from the landing area and make their approach silently.

b. Since either gliders or airplanes may be used to transport troops, airborne AAA units must be trained in the loading and lashing of both.

CHAPTER 11

EMPLOYMENT AGAINST LAND AND NAVAL TARGETS

Section I
Mechanized Targets

80. CHARACTERISTICS OF TARGETS. All types of mechanized vehicles except the heavy tank are suitable targets for antiaircraft automatic weapons employed on their secondary mission of antimechanized fire.

a. Vulnerability of tanks. Tanks are most heavily armored on turrets and the front of the vehicle. The most vulnerable points are the vision slits, ports, belly, tracks, and track suspension mechanisms. Flanking fire is preferable to frontal, because most 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.

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

81. FIRE CONTROL DOCTRINE. a. Decentralized. Control of fire is decentralized to the fire unit commander.

b. Targets. 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. Tanks abreast gun position. 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. Tanks approaching or stopped. 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.

e. Accuracy of fire. To stop a tank, it must be hit 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, AA automatic weapons must withhold fire until mechanized targets are within 600 yards for 37-mm or 40-mm and 400 yards for caliber .50 machine guns.

f. Speed of opening fire. Aerial or 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. Once the target is within the range specified above, every second of delay in opening fire increases the probability of discovery with possible disastrous results to the fire unit.

82. TACTICAL EMPLOYMENT. a. Dispositions. The employment of AAA in antimechanized defense is a responsibility of the force commander. The locations of AA automatic weapons units in the defense must be coordinated with those of the antitank units and the mission stated with sufficient clarity for AAA commanders to employ their units intelligently. In general, weapons are disposed to cover probable routes of mechanized approach and in such a manner that they are mutually supporting. Not only should the fields of fire of adjacent weapons overlap, but each should be able to assist adjacent positions in the event of a direct attack upon that position. Self-propelled AAA may be placed as far forward as the antitank guns. The less easily maneuvered, towed automatic weapons, whenever possible, should be arranged for a defense in depth.

b. Selection of position. (1) In general, good antitank positions are found behind and well below the crests of hills where weapons are concealed from supporting tanks or enemy artillery and can suddenly engage tanks coming over the crest of the hill as well as those which may come around the hill.

(2) In level terrain, guns should be emplaced in depressions in the ground or be dug in to reduce the silhouette of the piece. On such terrain a field of fire several hundred yards greater than the maximum ranges at which

fire will be opened is desirable so that targets can be tracked for a few seconds before fire is begun.

(3) Since towed AA automatic weapons are unable to shoot and run to new positions, concealment is of high priority in the selection of positions. Concealed routes to the position materially reduce the chances of enemy observation of the occupation of position. Nearby concealment and cover must be sought for prime movers and other necessary vehicles.

(4) Self-propelled AA units are able to change position rapidly and even fire on the move. However, due to its high silhouette, the concealment and defilade of a self-propelled mount is extremely important.

c. Occupation of position. Positions must be occupied speedily and concealed quickly. To prevent hostile observation, movement into position is made under cover of darkness whenever possible. Prime movers must be returned to nearby concealed positions immediately after towing in the guns.

d. Organization of position. Where natural concealment permits, small parties begin organizing the position prior to the time of occupation so that the position must be field fortified as rapidly as time and materials permit. Concealment is improved by the use of camouflage where necessary. *Fox holes are constructed for the protection of personnel.* Disposition of the elements providing local security is made. As time permits, the position is improved by the erection of barriers and emplacement of antitank mines.

e. Local security. Full advantage must be taken of the protection afforded by obstacles, both natural and artificial, and by the location of friendly troops. Local defense of the positions is provided by the caliber .50 machine guns and small arms. It is important that positions be prepared to detect and defend themselves against attack by small dismounted parties.

f. Position sketch. A rough sketch of the position and the field of fire covering probable avenues of attack is made. Ranges to prominent or critical points are obtained by the most accurate means available and recorded on the sketch. Critical ranges must be memorized by the gun commander and gun pointers.

g. Warning system. In addition to guards for local security of the position, each unit arranges to obtain an early warning of the approach of hostile mechanized vehicles. In a stabilized situation, a tie-in with the general warning system may be sufficient. Under other circumstances, the battery or platoon must post lookouts in commanding positions to observe the probable routes of enemy approach.

h. Alternate positions. Although it is not expected that AA automatic weapons (except self-propelled mounts) will move during the actual fire-fight, alternate positions must be selected and prepared for movement thereto when the situation demands. When there is reason to believe that the location of a position has been revealed to the enemy, movement to an alternate position must be made.

i. Mobility. (1) The towed automatic weapons possess a limited tactical mobility. The time required to move from traveling to firing position (using direct-fire sights) is about 3 minutes.

(2) Because of the length of time required to remove the towed automatic weapons, they must not be used in the first line of the antitank defense, but rather disposed in depth to cover possible break-throughs in the front line. No attempt should normally be made to move them just prior to or during an engagement.

(3) Self-propelled automatic weapons possess a high tactical mobility. They should be located well forward in the antitank defense, and should take advantage of their ability to shoot and run.

Section II
Assault of Fortifications

83. GENERAL. The fire of all automatic weapons in the assault of fortifications follows the doctrine discussed in FM 4–100 and 4–104. Automatic weapons fire can be effectively employed against the ports and embrasures of the fortification.

84. DISPOSITIONS. Since fire is by direct laying, 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. On the other hand, in order to hit those targets, guns must often 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 indicated. In general the same rules can be applied here as were discussed for antimechanized defense, except that the organization for local security may not be carried out to as great an extent.

Section III
Naval Targets

85. MISSION. The secondary mission of AA automatic weapons disposed on or near water areas in which enemy units may operate is fire for the destruction of light hostile naval craft, especially motor torpedo boats.

86. TARGETS. Motor torpedo boats attack at high speed in order to achieve surprise, and depend upon their speed and maneuverability for protection.

87. EMPLOYMENT. a. Fire units. When 37-mm or 40-mm guns are fired with director control, the fire unit is one gun.

b. Selection of position. AA automatic weapons employed against motor torpedo boats must be emplaced at as low heights of site as practicable to take full advantage of the flat trajectory. Directors must never be emplaced below the gun and should preferably be emplaced about 1 to 2 feet above the trunnions of the gun. Observation stations should have a good height of site to aid in observation.

c. Coordination. AA automatic weapons used as antimotor torpedo boat guns will usually be located in a harbor defense where fixed seacoast guns are also used for the same mission. Their employment should, therefore, be coordinated under a single commander.

CHAPTER 12

RECONNAISSANCE AND OCCUPATION OF POSITIONS

Section I
General

88. General. The principles given in the paragraphs below govern the selection and occupation of any automatic weapons position. Factors that influence this selection due to the type of equipment will be discussed in separate paragraphs.

89. RECONNAISSANCE. a. The purpose of reconnaissance is to obtain information about the terrain in which the fire units are to operate. A reconnaissance may be either map or ground. *A ground reconnaissance is always made.*

b. If ample time is available, tentative positions are selected by a map reconnaissance followed by an actual ground reconnaissance by the battery commander, and very likely also the battalion commander.

c. If time is extremely limited, the platoon and fire unit commanders must be relied upon for the ground reconnaissance. Action by the battery and battalion commanders is limited to the selection of tentative positions by map reconnaissance. Consequently every member of a

fire unit should know what features of terrain constitute a good position, and should be trained in the actual selection of positions.

d. Ground reconnaissance requires intelligence and initiative. The selection must be based on what exists in the area. Every position is a compromise between the terrain features and the requirements of a good position.

90. SELECTION AND OCCUPATION OF FIRING POSITION. **a.** Selection of a firing position entails consideration of two conflicting requirements—field of fire and concealment.

b. A good position should—

(1) Permit a wide sector of fire. All around fire is desirable.

(2) Allow guns to fire down to lowest elevation.

(3) Afford good ground cover.

(4) Afford maximum concealment possible consistent with AAA mission.

(5) Be suitable as an antitank position.

(6) Be situated to take advantage of ground protection afforded by other troops.

(7) Be fairly level to provide ease of emplacement.

(8) Be situated so that the equipment can be moved out quickly.

(9) Provide alternate positions for both antiaircraft and antitank defense.

(10) Be mutually supporting with neighboring fire units.

c. The manner in which a position is occupied is the problem of the fire unit commander. If time permits, study the position and determine how it can be occupied with minimum damage to the existing terrain features. Prepare the position as much as possible before occupying it. In going into position used covered routes. Every scar made on the terrain must be removed by camouflage.

Brush out tracks. They will disclose your position. Hide or disperse the vehicles as quickly as possible. Strictly enforce camouflage discipline.

91. FIELD FORTIFICATIONS. **a.** Field fortifications must be designed for the protection of material and personnel from HE demolition bombs, antipersonnel bombs (the so-called "daisy-cutter"), strafing attack, and artillery fire.

b. Fortifications may be dug-in, built-up, or a combination of both, but in any case, fortification of the automatic weapons must be up to the gun trunnion height. The decision must be made based on various factors.

(1) The dug-in position is more rapid than the built-up, requires less materials such as sandbags or equivalent, and when completed has a low silhouette. On the other hand, little protection is afforded against "daisy-cutters." Water level near the surface, or rock formations, may prohibit a dug-in position.

(2) The built-up position affords excellent protection from "daisy-cutters," and conditions of the subsoil do not prevent its construction. On the other hand, sandbags or equivalent are required, it takes longer to construct, and when finished the silhouette is more difficult to camouflage.

(3) The combination dug-in and built-up position is the most rapid, reduces silhouette, has some protection from "daisy-cutters" and does not require as much material as the built-up position. Subsoil conditions may prohibit its construction.

c. Field fortifications for an antiaircraft automatic weapon are constructed with the minimum emplacement diameter consistent with the unhampered operation of the gun and crew. The director emplacement is part of the general emplacement separated from the gun by an antiblast wall. The walls around the director must be

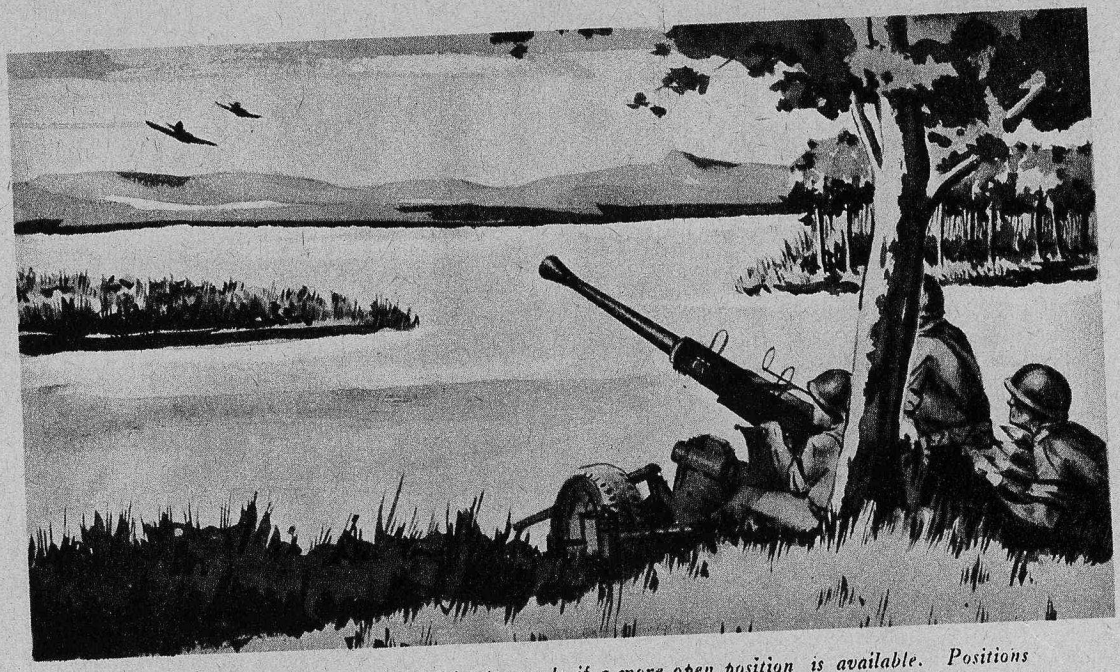


Figure 38. Do not occupy a position in woods if a more open position is available. Positions in corner of woods, preferably on high ground, may be used.



Figure 39. Place mount in open where a 360° field of view is available.

built up to just below the telescopes. Gun stops must be provided to prevent the gun from firing into the director at low elevations. Ammunition recesses are built into the inside walls and protected from the weather.

d. For the built-up type of emplacement the inside wall for a 37-mm gun to obtain horizontal fire must be no higher than 3 feet, 9 inches; for a 40-mm gun, 3 feet, 6 inches. Walls must be a minimum 8 feet thick at the base and 3 feet thick at the top. As time permits, the protection is improved by extending the base of the wall outward. This also facilitates camouflage.

e. The machine-gun emplacement is built on the same general principles as that of the automatic weapon. An all around, horizontal field of fire is necessary.

f. Ammunition supply points, whether dug in or on the ground, must have drainage and free circulation of air around each box of ammunition and protection from the weather.

g. Personnel protection at the gun or bivouac site are of a minimum size, built individually, and as prescribed by higher headquarters SOP.

Section II
Mobile Units

92. BATTERY COMMANDER'S RECONNAISSANCE. a. Purposes. The automatic weapons battery contains eight fire units which, in many situations, may be widely separated. It is probable that in most cases the battery commander will be unable to visit all gun positions before their occupation, and will have to rely on his platoon commanders and section chiefs to select them on the ground. The battery commander selects locations for his fire units from a map, or assigns the defense of certain objectives to his

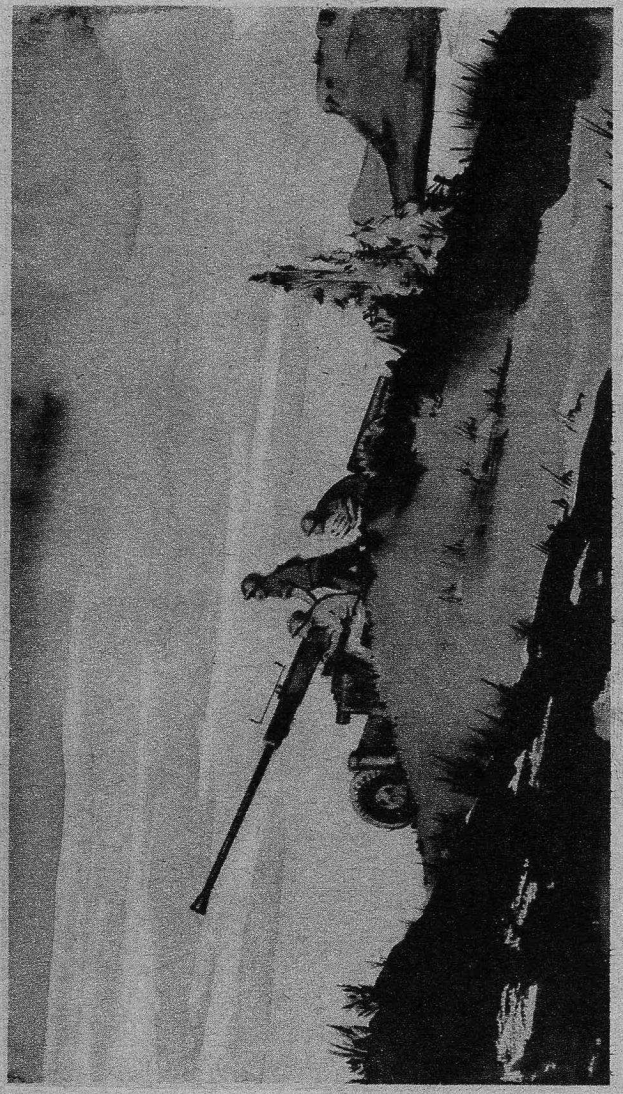


Figure 40. Do not occupy a firing position on the crest of a hill. Concealment is very difficult and the position is exposed to destruction by tank fire.



Figure 41. Select a level position behind the crest if practicable. Such a position is also good for antitank firing.

platoons, in accordance with the requirements of his mission and orders from higher authority. When the two platoons are within supporting distance of each other, or are both a part of a single defense, the battery commander coordinates the positions of the fire units in the two platoons and the direction of their fields of fire, so that the "dead area" of each fire unit is covered by at least one other fire unit. The battery commander also selects the position for his command post, motor park, maintenance section, and bivouac area.

b. Procedure. When the battery is marching as a unit, the battery commander, before proceeding on his reconnaissance, informs his executive of the situation and instructs him as to the route of march, and the time and place where further orders will be issued. If the column is to break up before his return, he specifies the break-up point. The battery commander's party normally includes the platoon commanders, communication sergeant, and one or more privates as guides and messengers.

93. PLATOON COMMANDER'S RECONNAISSANCE. a. Purpose. The platoon commander on his reconnaissance selects—

(1) Position for each firing unit and its field of fire.
(2) Routes to positions.
(3) Location of platoon command post and OP.

b. Unit positions. The platoon commander also determines positions for the following elements of each firing unit, assisted by his fire unit commanders:

(1) Positions for the gun, director, and power plant.
(2) Position for the local defense machine guns.
(3) AA lookouts.
(4) Truck park and bivouac.
(5) Alternate position.
(6) Ammunition storage.

c. Procedure. When sufficient time is available, the platoon commander accompanies the battery commander on reconnaissance. All positions are visited and fields of fire coordinated. When time is limited, the platoon commanders, accompanied by their fire unit commanders, make the reconnaissance and select and lay out the positions in accordance with the orders received from the battery commander. In extreme cases, the platoon commander may designate the positions and general lay-out for the fire unit, while the actual selection of positions on the ground is made by the fire unit commanders. Fire unit commanders guide their units into position and supervise the occupation of position.

94. BATTERY COMMAND POST. The battery command post is located at a point which facilitates the establishment of communication with the platoons and with battalion headquarters.

95. PLATOON COMMAND POST. The platoon command post is located at a point which affords observation of the fields of fire of the guns of the platoon.

96. CONSIDERATIONS AFFECTING SELECTION OF POSITIONS FOR AUTOMATIC WEAPONS. a. Field of fire and observation. (1) 37-mm or 40-mm guns are located on high or level ground where they have a clear all around field of fire against both air and ground targets. Where all around visibility to these limits cannot be secured, AA lookouts are placed on the far side of obstructions and communications established.

(2) Each automatic weapons fire unit is given a normal and contingent zone both for surveillance and for fire action, so that, regardless of the direction of approach of enemy airplanes, they can be observed and fired on. All units maintain constant observation over their normal

sectors regardless of the sector in which their weapons are engaged.

(3) The machine guns in the automatic weapons fire unit are provided for the local defense of the position, particularly to cover the dead arc in the rear of the director, and supplement the fire of the automatic weapon. The mount is sited approximately 100 yards from the gun position.

(4) The director is emplaced 13 to 15 feet from the gun in order to minimize parallax. The director must never be emplaced below the gun, and preferably should be emplaced 1 foot, and not more than 2 feet higher than the gun.

(5) The power plant has a connecting cable which permits an offset from the gun of about 225 feet.

b. Firm and level ground for emplacing gun and director. The gun and director should be located on ground that permits considerable firing without changing the orientation or level of the gun. Rocky or hilly ground is avoided and firm, level ground chosen. Level ground permits rapid and accurate initial leveling without grading. Firm ground prevents the gun from changing level while firing.

c. Concealment from ground and air observation. Whenever possible, camouflage is installed before the position is worked on or occupied.

d. Protection from artillery fire. Positions in the immediate vicinity of road intersections or other points subject to interdiction and harassing fire by hostile artillery are avoided where possible. When it is suspected that the enemy is aware of the present location, movement to an alternate position is made.

e. Cover. Immediately after a position has been selected, steps are taken to provide cover for the men and material against blast and fragmentation from aerial bombs and artillery shells.

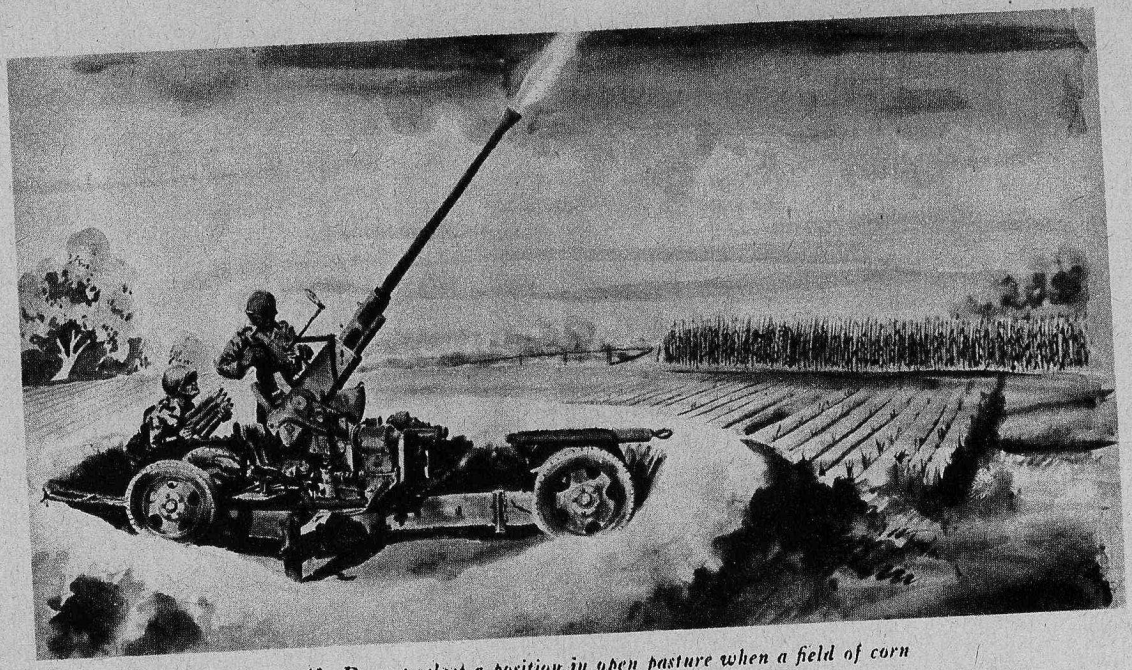


Figure 42. Do not select a position in open pasture when a field of corn will offer concealment.



Figure 43. Place the gun in cornfield.

f. Defense against mechanized attack. Where it can be done without interfering with the performance of the primary mission, guns will be sited so that they can be employed against mechanized attack.

g. Interference with traffic. Automatic weapons are sited a sufficient distance from roads so that fire at low elevations will not interfere with traffic.

h. Elevated sites. In defending objectives in and about urban centers, it will often be impossible to find positions on the ground which provide the required fields of fire for the guns. In such cases, suitable sites may be found on the tops of buildings of heavy construction. When units are placed on buildings or other structures, shock absorbing platforms for the director must be provided to prevent interference by gun vibrations. In residential districts, towers can be constructed and the equipment placed on the platform by a ramp or crane. When using towers, the machine guns are placed on the tower with the gun and director. The power plant is concealed on the ground. The bottom of the tower may be closed in, to provide clip loading facilities and housing for the troops. The entire structure is then camouflaged to conform to surrounding structures. The tower is high enough to give the desired field of fire.

97. OCCUPATION OF POSITION. Occupation of position is directed and supervised by the fire unit commander. The platoon commander issues instructions to each fire unit commander, giving the position for the gun and its dead area, time and rate of march, and other instructions necessary to insure timely arrival and employment of the fire unit.

98. SEMIMOBILE UNITS. The same principles and methods that are desirable for mobile units apply to semimobile units. Transportation to accomplish the move will be furnished by higher headquarters.

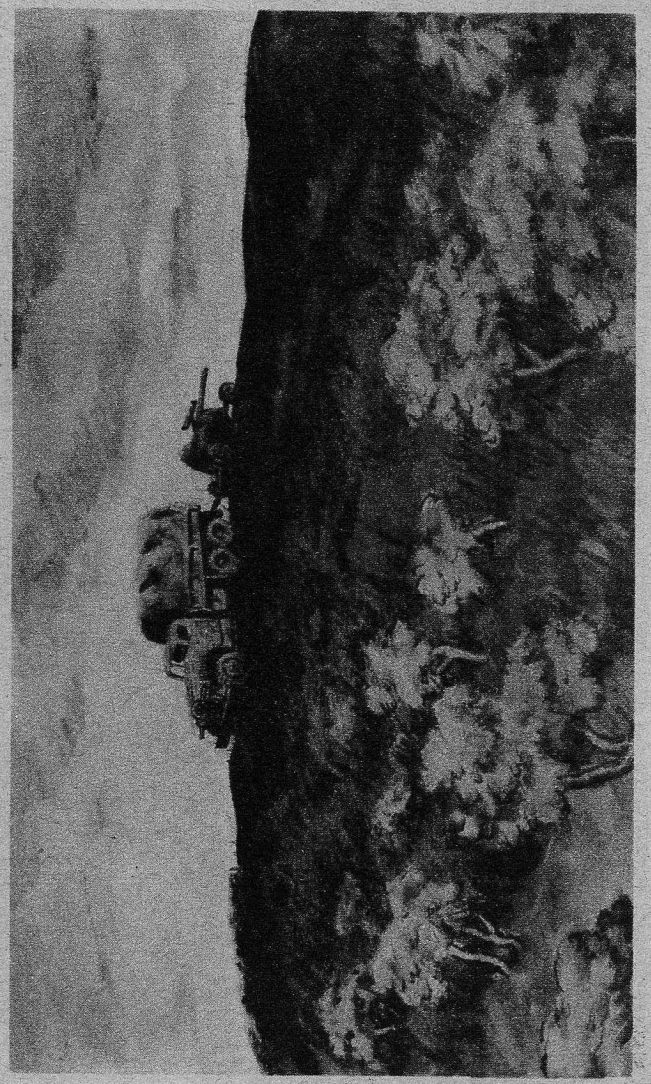


Figure 44. Do not move into a position by a skyline route.

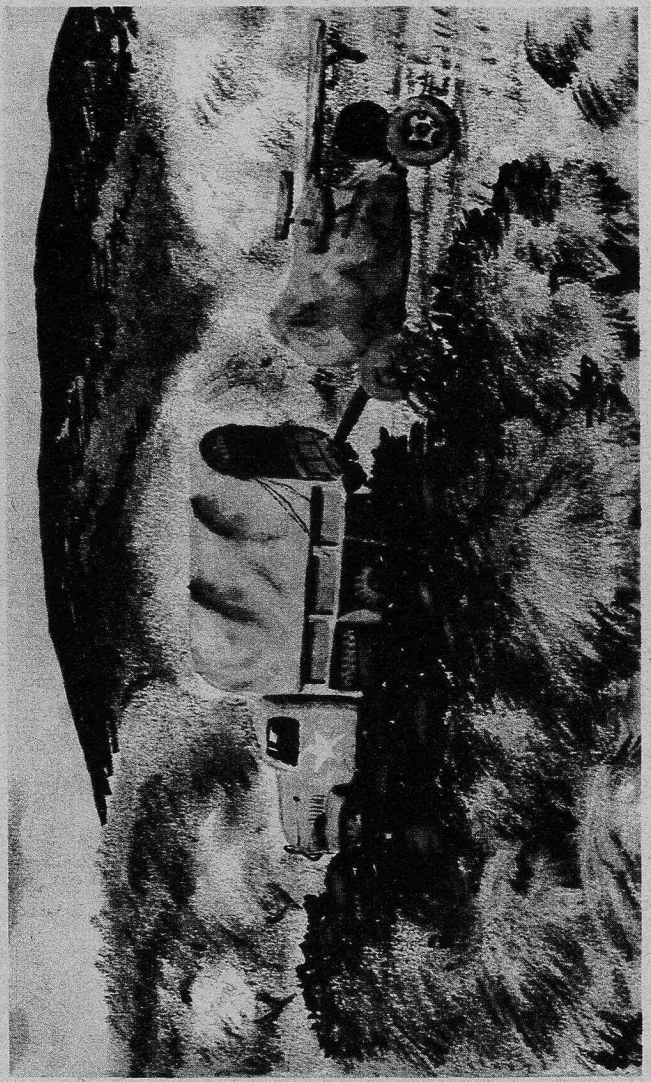


Figure 45. Use a covered route.

Section III

Self-Propelled Units

99. BATTERY COMMANDER'S RECONNAISSANCE. The self-propelled batteries contain 16 fire units which in practically all situations will be widely scattered. The battery commander is not able to make the desired personal reconnaissance of all gun positions. He must rely on his platoon commanders and section leaders to select the positions on the ground. The battery commander selects objectives from a map and assigns them to the platoons. He coordinates the operations of the units to protect the assigned objectives by map study of routes and areas. Future objectives are obtained from the force commander and assigned to the platoons as a result of map reconnaissance.

100. PLATOON COMMANDER'S RECONNAISSANCE. The platoon commander on his reconnaissance selects—

a. Position for each fire unit.
b. Routes to positions.
c. Alternate positions.
d. Location of security outposts.
e. Location of platoon CP.
f. Location of platoon ammunition supply point.

101. SECTION LEADER'S RECONNAISSANCE. The section leader, whenever possible, reconnoiters his positions before moving in the vehicles. He determines—

a. Exact location of each position.
b. Route to the position.
c. Routes away from the position.
d. Location of antitank position.
e. Location of alternate position.
f. Concealment for ammunition carrier.
g. Location of security guards.
h. Means of camouflage.

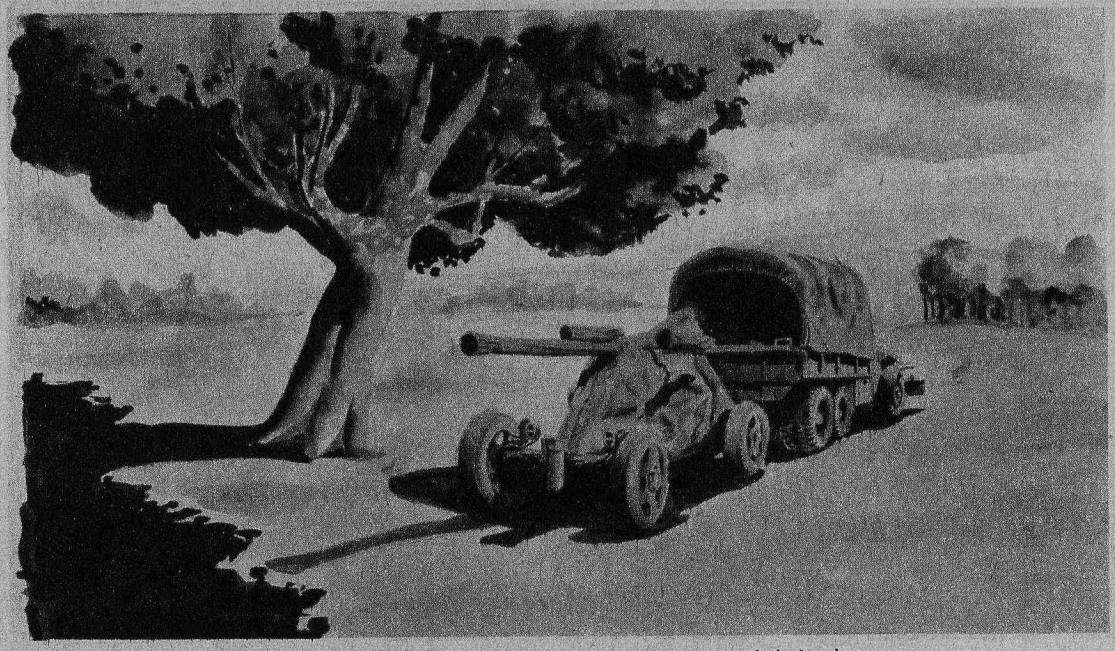


Figure 46. When making short halts near trees, do not halt in the sun.



Figure 47. Halt in the shade and move the gun as shade moves.

Section IV
Airborne Units

102. RECONNAISSANCE. Reconnaissance for airborne units is accomplished by detailed study of all available material on the terrain in which the unit will operate. This includes a study of maps, aerial photographs. sand table reproductions of the area, and all available intelligence. Each squad is given detailed instructions regarding the position it will occupy on arrival. This requires that the plan be very detailed and complete in every phase.

103. OCCUPATION OF POSITIONS. Upon arrival at the objective, speed is the primary requisite. The carriers must be unloaded quickly. The squads determine their positions and move into them as rapidly as possible. The weapons are emplaced first. As time permits, the positions are improved for protection and camouflaged.

104. ANTIMECHANIZED POSITIONS. Airborne weapons may include 40-mm AA, 37-mm antitank and .50 caliber machine guns. Whether antimechanized or AA defense, or both, are being provided all fire unit positions must be coordinated. An antimechanized defense must be organized in depth along the flanks. Concealment, so as to provide surprise, is of primary importance in antitank.

105. ALTERNATE POSITIONS. Airborne units must have alternate positions. They must always be prepared to move to an alternate position which will permit aerial and ground fire.

CHAPTER 13
SUPPLY AND EVACUATION

Section I
Supply

106. GENERAL. This chapter covers the supply of mobile AA automatic weapons units. In general, the procedure for supply of semimobile AA automatic weapons units will be similar. Officers having supply functions should refer to FM 100–10 for definitions and basic supply procedure.

107. SUPPLY AGENCIES. **a.** Mobile and semimobile battalions have the personnel and transportation required to draw and deliver all classes of supplies. The group does not carry any supplies for the battalions. The supply section of the group headquarters battery draws and delivers supplies for the group headquarters battery only.

b. All supplies which are procured by requisition are first requisitioned by the batteries. The battalion supply officer consolidates these requisitions and forwards a consolidated requisition to the group or other higher echelon supply officer. This supply officer in turn forwards his consolidated requisition to the next higher supply echelon.

c. When requisitioned supplies become available, each supply unit is notified in turn down to the battalions. The drawing of and distribution of the supplies are covered by the supply plan of the higher echelon.

108. CLASS I SUPPLIES (RATIONS). The forward flow of rations is normally automatic, based on daily battalion, or group consolidated reports of actual strength. A daily train carrying the needed supplies from depots in the communications zone is sent forward for each division and for corps and army troops. Upon arrival at the railhead, the rations are picked up by the battalion supply sections.

109. CLASS II SUPPLIES (SUPPLIES AND EQUIPMENT PRESCRIBED BY T/E). These supplies are requisitioned, drawn, and distributed as described in paragraph 107.

110. CLASS III SUPPLIES (GASOLINE AND OIL). The army quartermaster establishes gasoline and oil supply points at all railheads and depots or at convenient locations, such as civilian gasoline filling stations on the main supply routes. Each vehicle sent to an army supply point replenishes its supply at a convenient gasoline supply point at or on route to the army supply point. Vehicles remaining in the forward areas are resupplied by exchanging empty containers for full ones brought forward from gasoline and oil supply points by unit transportation.

111. CLASS IV SUPPLIES (ARTICLES OF MISCELLANEOUS NATURE). Supplies such as construction material are normally requested through special requisitions. The receipt and delivery of such supplies are the same as for class II supplies.

112. CLASS V SUPPLIES (AMMUNITION). **a.** For replenishment of ammunition, battery commanders submit periodic expenditure reports to the battalion munitions officer. A consolidated report is transmitted to the group or other higher echelon munitions officer who forwards it to the proper requisitioning or procuring authority. The unit reports are made by telephone, if possible, and later confirmed by written reports. Extra ammunition

normally is ordered forward by higher authority whenever an increased supply appears necessary.

b. The battalion ammunition section is employed to draw and distribute ammunition from the supply point to battery positions. However, when ammunition expenditure is rapid or the distance to the supply point great, the battalion ammunition section vehicles may be used to bring ammunition to an intermediate supply point, from which the battery vehicles supply the batteries.

113. VARIATIONS IN SUPPLY CAUSED BY TACTICAL EMPLOYMENT. When the AAA unit is not operating as part of a division, corps, or army, the foregoing methods of supply may not be applicable.

Section II

Evacuation

114. MEDICAL PERSONNEL ATTACHED TO AAA. There is no medical detachment with the headquarters and headquarters battery of the AAA brigade or group, but each battalion has attached medical personnel. For command purposes, and for administration and supply, the battalion medical detachment is an integral part of the battalion.

115. ORGANIZATION DURING COMBAT. **a.** The battalion aid station detail supervises the medical service of the battalion. It is organized to provide an administrative, supply, and evacuation service for the battery aid details; for establishment and maintenance of battalion aid stations and dispensaries; for care and treatment of troops located in the vicinity of battalion headquarters; and for direction and supervision of the dental service of the battalion.

b. A battery aid man is assigned to each battery to provide dressings and first aid.

116. FUNCTIONING DURING COMBAT. **a.** In general, the tactics employed by combatant units determine the tactics to be employed by attached medical units, and the tactics employed by medical detachments in the field have as their objective the rendering of support and assistance to combat troops.

b. In the field, the battalion aid station is established at or near the rear echelon of the AAA battalion headquarters. From this position, the surgeon maintains contact with battalion headquarters and with each battery aid detail, supervising, reinforcing and, to a limited degree, supplying these latter units with medical supplies and materials.

c. Aid stations must not be established near ammunition supply points nor in proximity to the designated parking places for artillery vehicles. They may be established near roadways, but never at important points such as road intersections and crossroads. A road in the immediate vicinity of an aid station facilitates evacuation by ambulance.

d. During periods of activity the battery aid men live with the batteries to which attached, and return to their sections only at such times as the battalion is brought together for rest or training. When a battery remains in one position for a considerable period of time, battery aid men obtain a small surplus of medical supplies with which to establish local aid posts near the battery positions. Battery aid men care for the casualties occurring in the battery and take post in the vicinity of the guns when the battery is firing or receiving hostile fire. Casualties are promptly removed to a place of safety, given first aid, tagged, and carried or directed to an aid station. Evacuation from the battalion is as directed by higher headquarters. In stabilized or partially stabilized situations, the battery aid men are required to report at least once daily to the battalion aid station for the purpose of giving information and receiving instructions.

APPENDIX

ESTIMATES, PLANS, AND FIELD ORDERS

Section I
Estimates and Plans

1. FORM. For a form for an AAA commander's estimate of the situation and plan see appendix I, FM 4–100.

Section II
Field Orders

2. GENERAL. For general information on orders and annexes, as well as for the technique of preparation of a field order, see FM 101–5. Ordinarily AAA commanders issue either oral or dictated orders which may later be confirmed by written orders. In the paragraphs below are given check lists which may be used as reminders 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. However, those items which are included should be expressed in the proper sequence. A trained commander or staff officer prepares an order to fit the situation, not a form.

3. STANDING OPERATING PROCEDURE. In every unit standing operating procedure is 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. I, FM 4–100.)

4. INSTRUCTIONS FOR AAA IN AN 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 missions of the army (or corps) AAA and attached AAA, directing particular attention, if necessary, to those bodies of troops, installations, or critical points considered of vital importance. Instructions are also 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 corps areas; 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 follow in substance those given in this paragraph.

5. BRIGADE CHECK LIST.

"**1. a.** Situation of the opposing forces, brief as to ground forces, but more complete as to the operations of the enemy air force.

b. Plan of our forces (brief) stating clearly the plan of our own army. Disposition and employment of adjacent AAA and balloon barrages.

Extent and efficiency of aircraft warning service.

"**2.** Decision of the brigade commander for the operation.

"**3.** Mission of each group of the brigade.

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

"**4.** Refer to the army administrative order or additional administrative instructions when necessary.

"**5.** Brigade and group axes of signal communication and special instructions relating to the AAAIS.

Command posts of the brigade and of each group or separate unit of the brigade."

6. GROUP CHECK LIST.

"**1. a.** Enemy situation—information of hostile air activity to include types of airplanes, character and method of attack, locations of airdromes, landing fields, and probable routes of approach.

b. Tactical plan of the supported unit and locations of elements to be protected—locations of adjacent aviation units, if known; locations of balloon barrages; activity of friendly aviation affecting the employment of the AAA; location of adjacent AAA, and, if the group is part of a brigade, the plan of the brigade and mission of other groups of the brigade.

"**2.** Decision of the group commander—to provide automatic weapons protection for certain areas, units, or establishments.

"**3. a.** Mission for automatic weapons battalions—to provide protection for certain units, areas, or establishments:

Detachment of units or reversion to battalion control of detached units.

When applicable, the general location of one or all of the batteries.

Movements or routes—regulation by divisions of movements through their areas or assignment of routes to positions.

Special instructions as to fire control.

x. Instructions applicable to all battalions—time when ready to go into action; displacement; camouflage; instructions to accomplish coordination between or among the battalions and with aviation units, balloon barrages, and adjacent AAA units; secrecy; restriction of movements; priority on roads.

"4. Locations of service elements if they can be prescribed at the time and instructions relative to rations.

Ammunition supply points; special instructions as to ammunition supply.

Aid station or instructions covering evacuation.

"5. Special instructions relating to signal communication.

Antiaircraft artillery intelligence service (AAAIS).

Axes of signal communication for group and battalions when applicable.

Command posts for group and battalions."

7. AUTOMATIC WEAPONS BATTALION CHECK LIST.

"1. Enemy situation (see Group Check List).

Plan of action of supported unit, including zones of action, sectors, or bivouac areas, and missions of subordinate units; locations of troops and establishments requiring protection; plans of friendly aviation as they affect the employment of the organic fire units; location of adjacent AAA, balloon barrages and aviation units, if known; group plan of action and mission of adjacent AA battalions.

"2. Decision of the battalion commander—to provide protection for certain units, areas, or establishments.

"3. Position, route, mission, normal and contingent sectors, detachment of units or reversion to battalion control of detached units.

x. Instructions applicable to more than one battery—time when ready to go into action; withholding action; instructions as to control; camouflage, instructions to accomplish coordination with aviation, with balloon barrages and with adjacent AAA units; secrecy; restriction of movement; priority of targets, priority on roads.

"4. Location of service elements if it can be prescribed at the time and instructions relative to rations; location of and instructions for ammunition train when applicable; location of aid station, or instructions covering evacuation.

"5. Plan of signal communication.

Special instructions relating to the AAAIS.

Axes of signal communication for the battalion, when applicable.

Command posts of the battalion and each battery, when applicable."

8. BATTERY CHECK LIST.

"1. Enemy situation — special information regarding enemy air tactics. Battalion commander's plan, plan of action of supported unit, including zones of actions, sectors, or bivouac areas, and missions of supported units; location of troops and establishments requiring protection; plans of friendly aviation as they affect employment of the battery; location of balloon barrages; location of adjacent and/or other AAA units.

"2. Decision of the battery commander based on his mission.

"**3.** Position for the battery, and instructions for its internal protection.

Instructions on special employment of particular matériel.

Routes to positions.

x. Special instructions as to fire control—sectors of fire; method of occupying position; secrecy; camouflage; cover; restriction of movement; local defense; when to be ready to go into action; priority of targets; withholding action; priority on roads; alternate position.

"**4.** Ammunition and other supplies; aid station, or instructions covering evacuation.

Location of trucks not required at positions.

Location of maintenance section.

"**5.** Plan of signal communication, including at least one alternate.

Location of spotting stations.

Special instructions relating to the AAAIS.

Command post or posts (platoon)."

9. MARCH ORDERS.—All march orders should follow the prescribed form of the five-paragraph field order. If the convoy is large or if the march is to require several days, the march order may be accompanied by a march table. (See FM 101–5.) In a small unit such as a battalion, especially when part of a larger command, the battalion commander's order may be quite brief and may be issued orally. Check list for march orders, follows:

"**1.** Enemy and own situation.

"**2.** Order of march.

Time of departure.

Initial point.

Exact route to be followed (use map or overlays).

Statement as to maximum allowable speed.

Destination of unit or daily run.

"**3.** Instructions for various organizations of the convoy. Instructions applicable to all organizations are included in the last subparagraph lettered "**x**".

"**4.** Administrative details, such as supply and messing.

"**5.** Information and instructions as to means and maintenance of communication between units of the convoy.

Time of closing old command post and of opening the new one, and positions enroute."

10. WARNING ORDERS.—A warning order should precede the march order. It should be issued as soon as information of a move is received. The proper use of warning orders will allow subordinates time to prepare for a contemplated move and will avoid keeping them alerted over an extended period.

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