FM 20-100

ENT OF THE ARMY FIELD MANUAL

ARMY AVIATION

DEPARTMENT OF THE ARMY • *FEBRUARY 1952*

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This manual supersedes FM 20–100, 9 September 1947.

ARMY

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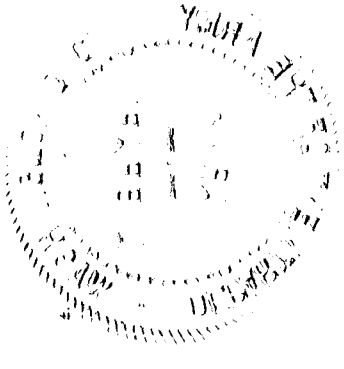

CONTENTS

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CHAPTER 1
GENERAL

Section I. PURPOSE AND SCOPE

1. PURPOSE

This manual is intended as a guide for commanders, staff officers, and other Army personnel who are concerned with the organization, training, planning, and employment of Army aircraft.

2. SCOPE

The contents of this manual are, in general, applicable to all Army aviation sections regardless of the type of aircraft with which they are equipped.

a. It covers the tactical employment of Army aviation, the technique of aerial reconnaissance and observation, transportation missions, operations, communication, supply, maintenance, and the training of Army aviation personnel.

b. For convenience of reference, a limited amount of technical information is included in this manual. Complete technical and administrative data are contained in other Department of the Army and Department of the Air Force publications. For a complete list of references, see appendix I.

Section II. MISSION AND BASIC PRINCIPLES

3. MISSION

The mission of Army aviation is to—

a. Expedite and facilitate the conduct of operations on land.

b. Improve mobility, command, control, and logistic support of Army forces.

c. Provide greater battlefield dispersion and maneuverability under conditions of atomic warfare.

4. BASIC PRINCIPLES

A thorough understanding of the following basic principles is essential to the proper employment of Army aviation.

a. Army aviation is organic to those units whose normal combat missions establish a continuous need for it.

b. The unit commander is responsible for the operations and performance of his aviation section. The unit aviation officer is directly responsible to the unit commander for the efficient and continuous operation of aircraft within the command (par. 24).

c. The value of the Army aviation section to its commander is directly proportional to the status of its equipment and training, and to its constant availability to him in the performance of his mission. A higher commander should be as reluctant to divert a subordinate unit's aircraft from their primary missions as he would be to separate a prime mover from its weapon.

d. Commanders and their principal staff officers who are concerned with the unit's observation requirements should always consider the advisability of, or need for, the use of Army aviation. In this role, the aircraft merely provide elevated, mobile platforms for the observers, and the general principles of employment and maneuver of observation apply.

e. Each higher commander should establish standing operating procedures in which the aviation requirements of his subordinate units are made known and are coordinated with the over-all requirements of the entire force. He should pay special attention to the requirements of those units which have no organic aviation sections. Based upon his estimate of relative priorities and his aviation officer's recommendations, the commander should place the required number of aircraft at the disposal of his subordinate commanders. Due consideration should be given to the principle stated in *b* above.

f. Maximum effectiveness in aerial observation is obtained when the same pilot and observer habitually work together. Maximum flexibility is gained when the largest possible number of officers are trained and available for use as aerial observers.

Section III. CHARACTERISTICS OF ARMY AIRCRAFT

5. GENERAL

Army aircraft consist of airplanes (fixed-wing) and helicopters (rotary-wing). Regardless of the type or model, the major characteristics of these Army aircraft represent a series of compromises

between various conflicting ideal features. Thus, sturdiness of construction for operation from unimproved landing areas is achieved at the cost of some additional weight. Similarly, the ability to land and take off in reduced distances compels a reduction in pay load capacity.

6. TWO-PLACE AIRPLANE

The tactical two-place Army airplane is light in weight. It can maintain a constant observing altitude at speeds as slow as 40–50 miles per hour, but it can also reach cruising speeds of 90–125 miles per hour for flights on more extended missions. Its weight and speed characteristics permit this airplane to operate in and out of small, unprepared air strips. This airplane's construction is simple enough that a minimum of complicated maintenance can keep it in flying condition. To offer a maximum field of view, the wings are placed high, the pilot and observer seats are placed in tandem, and as much transparent material as is practicable is used in the construction of the cockpit.

7. MULTIPLACE AIRPLANE

The multiplace airplane is used chiefly in an administrative role. It is normally found in the headquarters of units above the regimental level. Its missions require flights over greater distances than those required of the tactical two-place airplane. Generally, it operates between improved airfields; however, it is capable of operating on relatively smooth, unimproved sod fields. In keeping with these operating conditions, its cruising speed, range, and pay load are increased, but at some sacrifice of visibility, ability to fly at slow speeds, and ability to land or take off in short distances. For ease of maintenance, its construction is kept as simple as possible.

8. HELICOPTER

The helicopter is the most versatile of the three principal types of Army aircraft now available. Its speed ranges from zero to approximately 100 miles per hour. It can rise and descend at exceptionally steep angles, hover over a point, and fly forward, backward, or sidewise. These flight characteristics permit it to operate from landing areas barely larger than its own dimensions. Maximum use of transparent material in the cockpit, coupled with the absence of fixed-wing surfaces, provides a maximum field of view. Maintenance requirements for the helicopter are higher than those for airplanes because of complexities in construction.

9. MAINTENANCE CHARACTERISTICS

Maintenance requirements vary with the type of aircraft, but there are important characteristics, common to all types, which make for ease of maintenance and servicing. These characteristics are—

a. Maximum accessibility to engine, control system, and other vital parts of the aircraft.

b. Sectional or assembly replacement of large costly parts and maximum interchangeability of such items as control surfaces, struts, and other major components.

Section IV. CAPABILITIES AND LIMITATIONS

10. GENERAL

The operational capabilities of Army aircraft are largely dependent upon such variable factors as weather conditions, terrain, and hostile activity.

11. LANDING AREAS

Army aircraft requirements for landing areas are small enough, generally, to permit operation from the immediate vicinity of command posts. This makes the aviation section readily available to the unit commanders. The actual size of the landing area depends upon several variable factors in addition to the characteristics inherent in the particular type of aircraft involved. These factors include ground elevation, air density, temperatures, wind, type and condition of soil, slope of ground, obstacles at the ends of the area, and weight of loads to be carried. They are discussed in detail in paragraph 29.

12. SLOW FLYING SPEED

a. Observation. The capability of Army aircraft to maintain constant altitude at slow flying speeds minimizes one of the major problems of the aerial observer; namely, that of his rapidly changing position relative to the area observed. The helicopter's operation at nearly zero speed practically eliminates this problem, and the operation of Army airplanes into the wind at minimum air speed materially reduces it. For example, an airplane which can maintain straight and level flight at an air speed of 40 miles per hour, if headed into a 25-mile-per-hour wind, will cover the ground at only 15 miles per hour. In addition to reducing difficulties in orientation, these slow speeds give the observer additional time to make a more detailed study of the terrain than higher speeds would permit.

b. Evasive Maneuverability. Army aircraft are extremely vulnerable to surprise attack by hostile fighter aircraft. However, if given warning, the superior maneuverability of the slow-flying Army aircraft will permit it to take effective evasive action. It can turn more sharply than the attacking fighter, causing the latter to shoot wide. Likewise, the Army aircraft can descend close to the ground and duck in and out among trees, ravines, and other barriers in small areas where an attacking fighter normally will not attempt to follow because of its own high speed and wide turning radius.

c. Forced Landings. The same design characteristics which permit Army airplanes to maintain stable flight at slow speeds under power, also permit them to glide slowly. Except in the most rugged mountainous terrain, over extensive forests or water areas, or when visibility conditions will not permit, a well-trained pilot should be able to locate a suitable area for a safe landing even with a dead engine. Even under adverse visibility conditions, the helicopter may be landed with considerable safety because of its autorotative characteristics. Autorotation produces sufficient lift to permit forced landings in any area which will accommodate the dimensions of the helicopter.

13. VULNERABILITY

To reduce weight, increase pay load, and permit a wider range of flying speeds, Army aircraft carry no armor or armament. They are extremely vulnerable to attack by hostile aviation or ground elements. Excepting the indirect means of retaliation through access to artillery fires, their sole means of defense is evasion (pars. 12 and 19).

14. GROUND WINDS

a. The light weight of Army airplanes makes them difficult to control on or near the ground in relatively high winds. Head winds in excess of 35 miles per hour can create a lift on the wings strong enough to prevent successful landing. They can lift improperly moored airplanes off the ground. Cross winds may lift one wing high and cause the opposite wing to hit the ground, or they may cause the airplane to veer into the wind like a weather vane despite all the directional control applied by the pilot.

b. The helicopter is relatively easy to control on the ground even in high winds. This is accomplished by reducing the pitch of the rotor blades below the point where lift can develop. The helicopter's capacity for vertical flight and its ability to fly rearward and sidewise at low speeds enable the pilot to correct for cross-wind effects.

15. GROUND ELEVATION

As elevation above sea level increases, air density decreases. This decrease in air density reduces the power output of aircraft engines and the lift produced by the wings at a given forward speed. Consequently, longer runways are required for operations at higher elevations. Other problems arising from such operations are: increased maintenance requirements resulting from higher engine operating temperatures; reduced pay loads; decreased maneuverability; and slower rates of climb.

Section V. AIR SECURITY

16. GENERAL

Tactical employment of Army aircraft will be greatly influenced by the air situation (relative air superiority) and the reaction of enemy ground forces to the presence of Army aircraft. Although Army aircraft may occasionally obtain protection from friendly fighter aircraft, an effective air warning system coupled with evasive maneuvers provides the best protection.

17. WARNING SYSTEMS

The unit S2 and S3 (G2 and G3) should make all information concerning enemy air activity and planned friendly air operations available to the aviation section. This will help minimize flying hazards. Unit air warning nets are established to warn Army aircraft in flight of the presence of hostile aircraft in the area. The warning relayed to the pilots may be a result of the unit's own sightings, or it may be picked up from the antiaircraft artillery intelligence service net which the unit monitors (par. 187).

18. DETECTION BY ENEMY FIGHTERS

The ability of hostile fighter pilots to detect Army aircraft in flight depends upon two important factors—the vertical distance between the two aircraft and the light conditions. Fighter pilots usually cannot see small aircraft flying 5,000 feet or more below them. The shadow of a low-flying aircraft generally can be detected much sooner than the aircraft itself.

19. EVASIVE TACTICS

When possible, landing is the best method to evade attack by hostile aircraft. The landing should not be made at the unit airfield if it would lead to the detection of the airfield. When attacked

by hostile aircraft, the pilot's safety depends upon his own skill in evasive maneuvers. An abrupt diving turn toward the attacker is very effective, especially when the turn is executed just before the attacker closes to firing range. The pilot may also fly near friendly antiaircraft artillery positions, thus leaving the enemy fighter within range of their fire. For a discussion of evasive maneuverability, see paragraph 12.

20. SECURITY FROM ENEMY GROUND FIRE

By varying the locality in which he flies, and by changing his flight path widely during each mission, the pilot may prevent hostile ground forces from anticipating the time and position of his next appearance. He can obtain additional security from hostile ground fire by keeping the sun at his back during flights over enemy positions. Whenever practicable, the pilot should fly outside the effective range of known enemy antiaircraft fire.

21. OUTBOUND PROJECTILES

a. To accomplish their tactical missions, Army aircraft normally must fly in advance of, or over, friendly artillery; consequently, there is danger of being hit by an outbound artillery projectile. Artillery personnel should maintain the most effective surveillance possible and cease firing if friendly aircraft approach the trajectory's danger zone. Pilots should be informed of the positions occupied. It is particularly important that all pilots of Army aircraft operating in an area be warned of the location, time of commencing, and probable duration of any firing of proximity-fuzed projectiles. SOI's should include a brevity code for the transmission of such warnings.

b. When adjusting artillery fire during service practices or other training, aircraft may fly anywhere outside the safety limits of the firing weapons. They may fly within the safety limits if they remain 1,000 feet above the trajectory, and they may fly between the guns and the impact area if they remain 1,000 feet above or below the trajectory.

CHAPTER 2
TECHNIQUE OF EMPLOYMENT

Section I. GENERAL

22. CONTROL

a. General. Missions charged to Army aviation are normally initiated and assigned directly by the parent unit (or the unit to which the aviation section is attached). The missions are based on the commander's plans and decisions. Under special circumstances, as indicated below, higher headquarters may impose limitations on the employment of aircraft or prescribe certain missions to be flown on behalf of the force as a whole. In either case, the aviation section will normally get its instructions from the unit commander.

b. Limitation by Higher Headquarters. Tactical situations may arise wherein higher headquarters will restrict, in varying degrees, the activity of subordinate units' aviation. Typical situations justifying restrictions include the following:

(1) Numerous units are operating in a sector so narrow that unlimited unit aerial operations could create excessive flying hazards or result in unnecessary duplication of effort.

(2) Secrecy requirements are of paramount concern to prevent disclosure of important tactical moves. The maintenance of normal appearances during a relief in combat or during a build up of strength in an area exemplifies such secrecy requirements.

c. Missions Prescribed by Higher Headquarters. Higher headquarters may prescribe missions for a unit aviation section on behalf of the force as a whole. Such directed missions may be ordered on either a one-time-only or a recurrent basis; they may be scheduled as to time or place or both, or they may be on call. The following are illustrative examples of directed missions:

(1) Higher headquarters requires, either for its own use or for one of its units without organic aviation, specific information concerning an area known to be covered by a subordinate unit's aviation; it may direct the subordinate unit to perform the mission.

(2) In a stabilized situation or on a narrow front, when it would be wasteful of effort for all units to maintain simultaneous aerial surveillance, the responsibility for observation may be allocated equitably among all units pursuant to a coordinated time schedule.

(3) A heavily committed front-line unit has indicated to higher headquarters its need for reinforcement or relief aviation. A reserve unit may be directed to fulfill such requirements.

d. Transportation Helicopter Units. Transportation helicopter units will be employed normally by attachment to tactical units for specific operations. The tactical unit commander will command the helicopter unit during the period of the attachment.

23. COMMANDER'S PLAN

The tactical operations of Army aviation are conducted in accordance with the commander's plan. This plan is based on the commander's own estimate of the tactical situation and the recommendations of the unit aviation officer. Orders for the execution of the plan may be issued orally, or they may be included in paragraph 3 of, or an annex to, a written operation order.

24. UNIT AVIATION OFFICER

a. The senior Army aviation officer in a unit has dual functions; he is the aviation officer of the unit commander's staff and he controls the aviation section. As a staff officer, his relationship with the unit commander and with the other members of the staff is the same as that of any special staff officer. Aviation officers of higher headquarters maintain close staff liaison with subordinate unit commanders and their aviation officers.

b. The commander of a transportation helicopter unit will function as a staff officer for the commander of a unit to which his unit is attached. The discussion in this manual of the functions of the unit aviation officer as a staff officer are applicable to commanders of transportation helicopter units.

25. ESTIMATES AND RECOMMENDATIONS

The unit aviation officer makes a continuous estimate of the situation and formulates plans for the employment of the aviation section. These plans become the basis for his recommendations to the unit commander. Factors which must be considered in the aviation officer's estimate and recommendations include the following:

a. Tactical Situation. This includes friendly and enemy dispositions, with special emphasis on the location of opposing front lines, known locations of artillery and antiaircraft installations, and recent enemy air activity.

b. Mission of the Unit. This includes the assigned mission of the unit.

c. Plan of Maneuver. He considers the plan of his own unit and the plan of the force as a whole.

d. Terrain and Weather. This includes the availability of locations for airfields and cover and concealment for aircraft and personnel; the probable effect of weather on flying; and conditions of visibility.

e. Status of the Aviation Section. Strength in personnel and equipment, state of training, and the supply situation (especially fuel, lubricants, and spare parts) must be considered.

f. Observation and Reconnaissance. He must consider the probable minimum and maximum requirements, taking into account any controls imposed by higher headquarters.

g. Other Requirements. This includes courier and liaison service, use of aircraft as radio relay stations, wire laying, supply missions, evacuation missions, or other missions which may be required.

h. Enemy Capabilities. Interference with the activities of the aviation section by attack against its ground installations or against the aircraft in flight must be considered.

i. Capabilities of the Section. Based on the foregoing (plus any additional considerations which may be pertinent in each individual situation), the ability of the section to discharge the missions which can be anticipated must be determined.

j. Courses of Action. He must consider the manner in which the capabilities of the section can best be exploited, including alternate courses of action to meet possible contingencies.

26. STAFF COORDINATION

a. In small units, the activities of the aviation section are coordinated with other elements of the command by the unit commander or his executive. In larger units, the commander may designate a general staff officer to perform this coordination. In the former case, the aviation officer reports directly to the unit commander; in the latter, he reports to the designated staff officer, usually G3 or G2 (S3 or S2).

b. Detailed staff coordination on specific matters is accomplished by direct contact between the unit aviation officer and other members of the staff, as follows:

(1) Procurement of personnel, including individuals who do not hold the designation Army aviator selected for observation training: S1 and S3.
(2) Collection of information: S2.
(3) Aerial reconnaissance: S2 and S3.
(4) Maps and photographs: S2 and unit engineer.
(5) Survey: S2 and S3.
(6) Training: S3.
(7) Selection and defense of landing areas: S3, executive, or headquarters commandant.
(8) Observation and adjustment of fire: S3.
(9) Procurement of aviation supplies and maintenance of aviation equipment: S4.
(10) Signal communications, including codes and call signs, and the procurement and maintenance of signal equipment: Communication officer.
(11) Evacuation: S4 and unit surgeon.

Section II. AIRFIELDS

27. GENERAL

a. Depending on the tactical situation, the terrain, and the time available, ground installations for Army aviation range from completely organized airfields (including runways, bivouac, parking, storage, and fueling and maintenance facilities) to strips of terrain or roadway barely large enough to permit safe landing and take-off.

b. In keeping with basic principles (par. 4), it is normal for each unit to select and develop its own airfields. The necessity for economy of effort and personnel, considerations of local security, plans for the employment of aircraft, or a lack of sites for airfields may, however, justify the use of a common airfield by two or more units. This will be either by direction of higher headquarters or by mutual agreement of the unit commanders concerned.

28. RECONNAISSANCE

a. Reconnaissance for airfield locations is best accomplished by using a combination of map, air, and ground means. Some member of the aviation section (preferably the unit aviation officer) should select the site for the airfield or accompany the commander

on his reconnaissance. The commander, members of his staff, and all personnel of the aviation section should be familiar with the characteristics of a good airfield and should be able to select a location when the unit aviation officer cannot be present.

b. Usually, a study of the map is made first to determine the location of likely areas. A map reconnaissance alone is used only when no other method is possible. It may be the only method possible when displacing over long distance or into areas to which access has been previously denied. Examples of such cases are amphibious operations and some river crossings.

c. Air reconnaissance to select the most suitable areas usually follows a map reconnaissance. Air reconnaissance alone is generally hazardous, and it should be used only when a ground reconnaissance is impossible. It may be used in fast-moving situations when time will not permit ground reconnaissance, or when the condition of the ground surface is readily apparent from the air.

d. Ground reconnaissance is made to determine the nature and condition of the ground surface and to select exact locations for the various airfield installations. Ground reconnaissance alone is not as satisfactory as combined air and ground reconnaissance, but it may be necessary when aircraft are grounded.

e. In a combined air and ground reconnaissance, the aviation officer should be accompanied by a mechanic. After the new location has been selected, the mechanic may guide the aviation section overland while the aircraft are being flown in. Time may be saved if the aviation officer can direct a ground reconnaissance party to specific areas while he makes a general reconnaissance by air.

29. SELECTION

Although ideal conditions in all respects will rarely be met, the following factors are considered in selecting an airfield:

a. Location. Proximity to the unit command post will facilitate control of the unit aviation section. It may not be practicable to locate a complete airfield within the immediate unit area. In this case, it may be necessary to establish a suitable air strip in the vicinity of the command post for daytime use and send the aircraft back to the airfield proper at night. Larger airfield installations such as common airfields used by several units, or airfields for transportation helicopter units, will usually be located well to the rear.

b. Size. The size of the airfield depends upon the characteristics of the types of aircraft with which the unit is equipped (pars. 6–8). The airfield must be large enough to permit aircraft to clear any

barriers when taking off or landing. It must provide adequate space for the dispersal of both aircraft and ground installations.

c. Ground Surface and Slope. For airplane operation, the ground surface must be smooth enough to permit take-off and landing without undue damage to the aircraft. A rough surface may weaken structural parts through continued vibration. Soft ground, tall grass, or an uphill take-off increases the length requirements of the runway. These considerations are also applicable to the selection of an airfield for helicopters in areas where decreased air density makes a ground run for take-off necessary. Ground slope must be considered in selecting landing areas for helicopters. Since the main rotor shaft is always perpendicular to the ground surface upon which the helicopter is resting and control of the main rotor blade limited, landings and take-offs on slopes may be hazardous or impossible.

d. Prevailing Wind. The direction and velocity of the prevailing wind affect the length requirements of the runway. They will also affect the problem of ground handling. Cross winds are hazardous (par. 14). In restricted areas, helicopters should be facing into the wind for take-off.

e. Direction. An airfield should permit landing and taking off in more than one direction so that advantage may be taken of the wind.

f. Air Density. The distance required for take-off increases as mean air density (and consequent buoyance) decreases. The effect of decreased density on runway requirements varies with each type of aircraft. The altitude or temperature of an area may make a ground run necessary for a helicopter to take off. Commanders and staff officers, who may be required to select tentative sites for airfields, should consult the unit aviation officer concerning the effects of temperature and ground elevation on the length of runway required, before final selection is made.

g. Concealment and Cover. There should be natural concealment from air and ground observation for parked aircraft and ground installations. When possible, the airfield should be in defilade.

h. Routes. Ground routes to the unit command post and to supply installations should be adequate.

i. Drainage. The airfield should have adequate drainage.

30. OCCUPATION

a. General. The time and method of occupying the new airfield depend upon the aviation requirements of the unit's current opera-

tions, transportation available, ground conditions at the new location, and any controls imposed by higher headquarters. When extensive preparation of the site is required, it may be necessary for the commander to augment temporarily the aviation section, or obtain engineer support, for this purpose.

b. Daylight Occupation. When the tactical situation requires that a portion of the aircraft remain aloft, the aviation section occupies the new airfield by echelon. Some elements, including a radio set and refueling facilities, must remain at the old airfield until an advance echelon has prepared the new field for operation.

c. Night Occupation. When the unit occupies a new position or area at night, the ground crew goes forward with the unit while the aircraft remain at the old airfield. The ground crew prepares to receive the aircraft, arranges for security, and marks the field. Aircraft are displaced after daybreak, except under the most extraordinary conditions. When it is imperative that aircraft displace at night, the ground crew must go forward during daylight to prepare the field for night landing (par. 123).

31. ORGANIZATION

a. General. Organization of the airfield is begun as soon as it is selected. When it has been selected by combined air and ground reconnaissance (par. 28), organization is begun by the ground reconnaissance party. When the airfield is to be occupied by echelon, the advance echelon accomplishes as much of the organization as possible before the arrival of the remainder of the aviation section. The organization of a complete airfield is illustrated in figure 1.

b. Aircraft Parking Areas. Dispersed and concealed parking positions for unit and visiting aircraft are chosen, preferable where a minimum of taxiing will be required, to facilitate concealment of ground tracks.

c. Refueling Facilities. Refueling points may be established at each end of the runway to accommodate aircraft landing or taking off in either direction. Refueling may also be accomplished in parking areas by means of standard containers. This will disperse the fuel supplies over a larger area and make them immediately available to parked aircraft. However, it has the disadvantage of requiring excessive taxiing for aircraft which are landed for refueling only.

d. Operations Center. The operations center must be readily available to individuals arriving at the field either by aircraft or by ground vehicles. The operations center includes the facilities

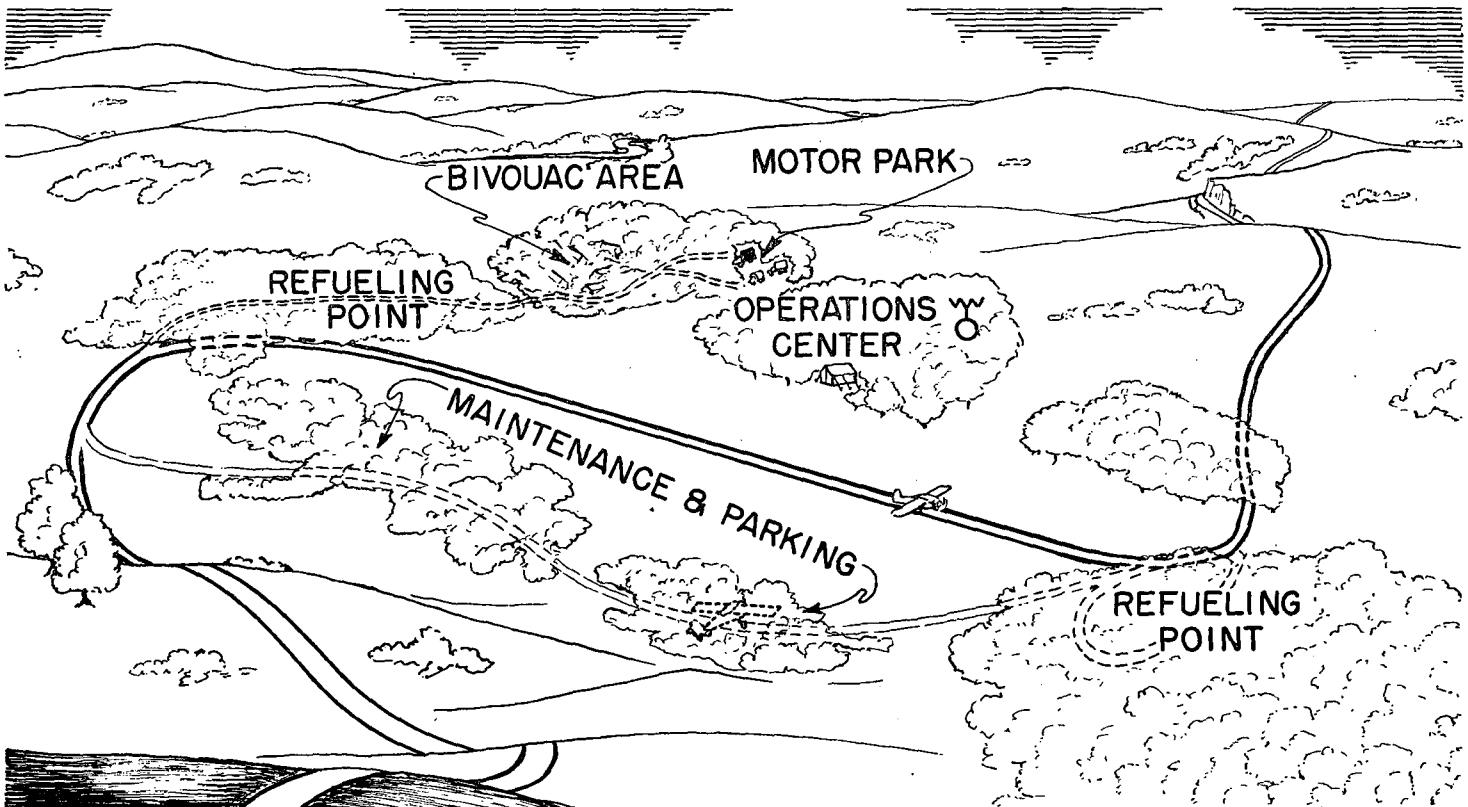


Figure 1. Organization of an Army airfield.

necessary for the proper control of all of the aviation section's activities. These facilities include files, records, publications, supply of maps, a situation map, telephone and radio communications with the command post, and radio facilities for communication with aircraft in flight. The radio receiver which monitors the AAAIS net should also be located here so that AAAIS information concerning air activity may be relayed promptly to aircraft aloft (par. 187).

e. Motor Park. Parking areas are provided near the operations center.

f. Bivouac Area. A suitable area is set aside for the bivouac and messing of aviation personnel. In some cases, unit commanders may provide the aviation section with the necessary additional personnel to operate its own mess. When this is not practicable, arrangements are made for the delivery of prepared meals to the airfield or for the aviation personnel to mess with nearby organizations.

g. Maintenance Area. When it is not practicable to perform maintenance at the aircraft parking sites, suitable maintenance areas are necessary.

h. Panel Markings. Until aviators using the field become thoroughly familiar with it, they should be assisted in determining the direction of landing and the usable limits of the airfield by means of panels. A *T* panel is placed at the downwind end of the field to indicate the direction of landing, wind direction, and the near limit of the field. A single panel is placed at the upwind end to mark the limit of the landing roll (fig. 2). If panels are not available, personnel of the section should mark the usable limits as indicated in figure 2.

32. SEQUENCE OF ORGANIZATION

While rigid rules governing the complete sequence of steps in the organization of airfields cannot be prescribed, the first three steps in the following list should be given priority in unit standing operating procedures on this subject.

a. Establish radio communication with the unit headquarters and with the aviation officer if he is not present at the new field.

b. Organize security of the airfield and make contact with any troops in the vicinity.

c. Select exact locations for the operations center, refueling points, maintenance area, and parking areas for aircraft and motor vehicles.

d. Mark routes into the area, if necessary.

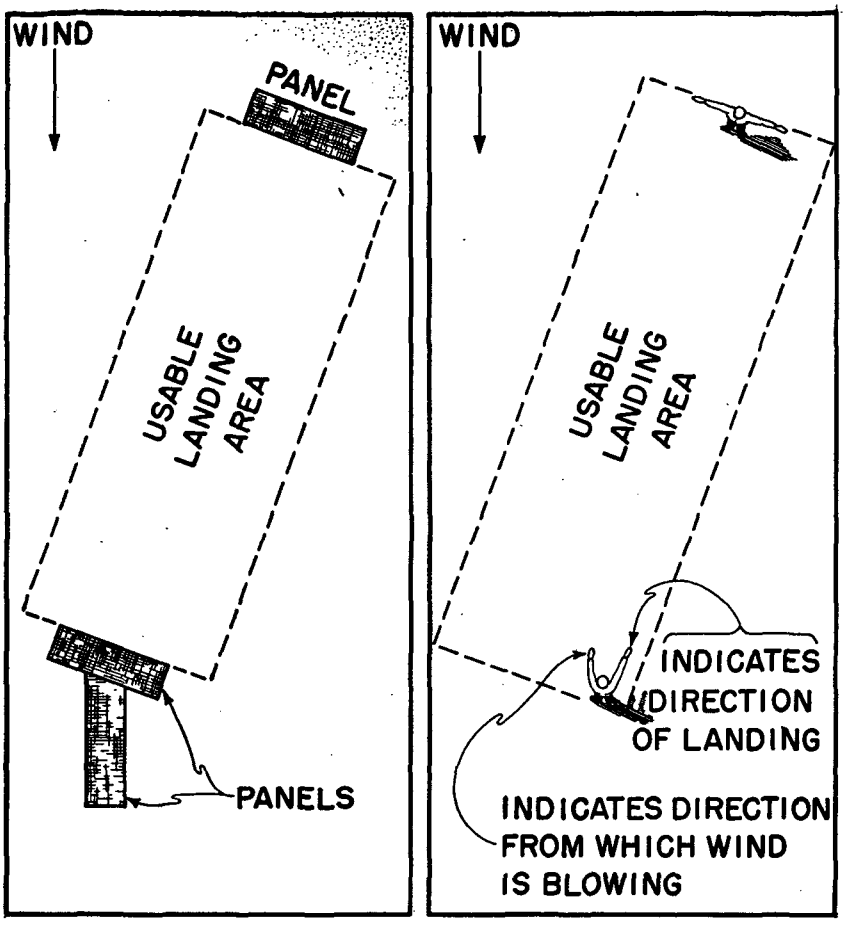


Figure 2. Marking the landing area.

e. Guide and assist the wire-laying detail from unit headquarters to establish wire communication between the headquarters and the airfield.

f. Plan and mark supply and circulation routes to avoid disclosure of the field's locations.

g. Conceal or camouflage the various elements of the aviation section as they arrive and are installed.

33. DEVELOPMENT

Development of the airfield continues as long as it is occupied. Camouflage should be inspected frequently, both from the air and from the ground. Camouflage materials should be renewed when required. Installations are dug in, and shelter is provided for

personnel. Usually no protection, other than concealment, is provided for aircraft. When it can be determined that the airfield will probably be occupied for a considerable length of time, revetments may be constructed for the aircraft (TM 5–255).

34. RESPONSIBILITY

a. The effectiveness of operations and the adequacy of security measures at Army aviation airfields are responsibilities of the controlling commander. The responsible commander generally exercises his control over the airfield through his unit aviation officer.

b. Unit airfields are the responsibility of unit commanders.

c. If common airfields are established by direction of a higher headquarters, that headquarters designates the controlling commander. If established by mutual agreement of the using units, either the senior commander or the commander having predominant interest in the airfield will be the controlling commander.

35. ACTIVE DEFENSE

a. Neither the personnel nor the equipment organic to unit aviation sections is adequate for active defense of the airfield (even when the resources of several units can be pooled, as at a common airfield). The responsible unit commander must provide for the defense of the field by augmenting the section or by including the field within the perimeter defense of other units.

b. Airfields must be included in the communications network of air warning systems (pars. 186–188).

c. Antiaircraft units or detachments are utilized at airfields when available and when the situation warrants.

d. The establishment of suitable perimeter defense usually requires augmentation of air section personnel. When practicable, the airfield is included within the unit's over-all perimeter defense or within that of some other nearby unit. A local warning system is established to alert personnel in case of attack.

e. Organic automatic weapons are employed for antiaircraft and ground defense.

36. PASSIVE DEFENSE

a. Passive defense is the primary method of protecting the airfield. The unit aviation officer is responsible to his commander for the adequate employment of the section in passive defense measures.

b. The airfield site should provide maximum concealment and cover, including defilade.

c. Camouflage plans are carefully formulated and executed. The camouflage is inspected and improved continuously (FM 5–20E and TM 5–267). Personnel are indoctrinated in the need for camouflage discipline at all times.

d. All equipment and installations are dispersed. The amount of dispersal depends on the ability to perform the assigned mission and such other considerations as camouflage, concealment, and local defense.

e. Deception is used to the maximum. Depending upon the aggressiveness and capabilities of the enemy, it may be necessary to construct one or more dummy fields. Any dummy field must be realistic enough to be recognizable as an airfield, but care must be taken to avoid blatant exposure; it should be exposed only enough to attract the first attention of an enemy searching the area for a suspected airfield.

f. When adequate defilade of the airfield cannot be obtained, contour approaches should be required. Aircraft descend to the lowest possible altitude at some distance from the actual field—possibly over a dummy field if one has been established—and approach the field by a circuitous low-level route, taking maximum advantage of all existing cover and concealment. The reverse procedure is followed for take-offs under such circumstances.

g. Alternate airfields are established for use in case the primary field becomes untenable. As time permits, such alternate fields are improved and developed for immediate occupation if the need arises.

CHAPTER 3
OBSERVATION MISSIONS

Section I. GENERAL

37. GENERAL

Army aviation finds a major tactical application in observation. It seeks to bridge the gap between more slowly maneuvering, detailed, close-in ground observation on the one hand, and the ultra-rapid, long-range capabilities of Air Force observation on the other. Observation accomplished by army aviation includes surveillance, conduct of fire, reconnaissance, column control, camouflage inspection, and aerial photography and survey operations.

38. OBSERVATION CAPABILITIES

Observation from Army aircraft is generally satisfactory for the normal requirements of the division, including the adjustment of fire of divisional artillery. Adjustment of artillery fire at greater ranges usually necessitates the use of field glasses and is limited to the more prominent targets. At extreme ranges, missions are limited to the adjustment of heavy or very heavy artillery on distinct or large area targets.

39. CONTAMINATED AREAS

Army aircraft may be used to patrol chemically and radiologically contaminated areas to aid in preventing personnel from entering the area. Aircraft may carry instruments to monitor areas contaminated by atomic explosives.

Section II. BASIC OBSERVATION TECHNIQUES

40. PREFLIGHT PLANNING

a. Unit Aviation Officer. Advance planning for any type of observation mission is performed by the unit aviation officer. His plans are based upon his knowledge of the situation and the commander's decisions and are coordinated with the S2 (G2). He fits his plan for aerial observation into the over-all observation plan of the unit. He insures that pilots and observers are briefed adequately. Briefing should cover—

(1) The situation.

(2) The general plan of observation and the aerial observation plan.

(3) The specific mission to be performed, including the areas and activities to be covered, and relative priorities.

(4) The method and time of reporting.

(5) Signal communication instructions, including radio frequencies, call signs, codes, and restrictions if any.

(6) Special security regulations, including limitations on flight paths, altitudes, crossing of front lines, and the use of maps or documents.

(7) Flying safety precautions, including known enemy air activity, ground antiaircraft installations, anticipated friendly fire of proximity-fuzed projectiles, and, if appropriate, special survival procedures in case of forced landing.

b. Pilot and Observer. Following their briefing, the pilot and the observer jointly plan the details of the accomplishment of their mission, including—

(1) Evaluation of the terrain to be covered. This may be based on a study of maps and photographs or on prior familiarity with the area. It may be very brief or highly detailed, depending upon time available and the nature of the mission.

(2) Preparation of map or chart for convenient use during flight.

(3) Detailed flight plan, covering time, flight path, altitudes, etc.

(4) Check list covering indications of all items included in their mission (par. 41).

(5) Check of equipment and supplies required to accomplish the mission (maps, field glasses, radio, camera, film, etc.).

41. INDICATIONS

Indications of enemy activity which may be detected either in a general search or in a detailed study of an area are—

a. Dust. Dust may indicate movement of vehicles or troops, or the firing of artillery, tanks, or rockets.

b. Fire. Fires may indicate possible assembly area, bivouac area, or supply or ammunition dump.

c. Flashes. Flashes may indicate possible artillery, mortar, tank, or rocket positions.

d. Incongruous objects (not in keeping with terrain or background). Such objects may indicate an installation or activity.

e. Lights. Lights may indicate possible positions, bivouac, or night movement.

f. Movement. Movement may indicate any type of activity, depending upon direction and size of moving elements.

g. Reflection. Reflection may be from vehicle windshields, unpainted surfaces of weapons, or messing equipment in bivouac areas.

h. Shadows. In daylight, shadows aid in identification of objects; on roadways at night, they may reveal movement of troops and supplies.

i. Smoke. Smoke may indicate bivouac areas, messing areas, or weapons firing.

j. Tracks. Tracks aid in locating vehicles, assembly areas, gun positions, and bivouacs.

k. Unusual Shapes, Sizes, Shades, Shadows, Tones or Colors. These may indicate faulty camouflage.

42. USE OF FIELD GLASSES

Constant use of field glasses causes eyestrain, tends to canalize the observer's attention, and may cause him to neglect large sections of the area under observation. Field glasses should be used only for detailed study of specific objects or of definite indications of an activity.

43. FLIGHT PATHS

The flight path in the immediate vicinity of the airfield is controlled by instructions from the unit aviation officer. It is based on considerations of terrain, weather, and protection of the airfield from exposure to enemy observation (pars. 36*f* and 40*a*(6)). If no flight path has been prescribed, the observing team selects any flight path which will facilitate accomplishment of the observing mission with the least risk. Normally, this flight path is a compromise between the comparative safety of flying well behind friendly front lines, the best observing position (directly over the observed area), and the possibility of disclosing the mission by flying too close to the area.

44. ALTITUDES

The proper altitude for observation depends upon the mission, the terrain, the weather, and the enemy's ability to interfere with the mission. Detailed examination of an area or an activity may require the aircraft to fly at very low altitudes; whereas, more general observation may be accomplished effectively from considerably higher altitudes.

45. DIRECTION OF OBSERVATION

Identification of a specific object or activity is simplified when it is observed from several different aspects. In general, the observer should try to keep the sun at his back. Observing away from the sun makes objects easier to identify and is less tiring than observing toward the sun. In addition, detection of an aircraft by ground visual observers is more difficult when they must look into the sun.

46. RECORDING INFORMATION

Prior to taking off, the observer should fold his map to a size convenient for use and arrange it in his map case (or other transparent substitute) so as to permit rapid recording of information obtained during the mission. When a clue to activity on the ground is detected, its location is marked. After a more detailed examination discloses the nature of the activity, a ray is drawn from the location to a note describing it. Such notes should be brief, but they should always indicate the time of the observation, what was seen, and the nature of the activity (fig. 3).

47. REPORTING INFORMATION

a. Time and Method. Depending upon the nature of the mission and the unit aviation officer's instructions (par. 40), information may be reported immediately, at stated intervals, or upon the conclusion of the mission. It may be transmitted by radio; by dropping marked maps, overlays, or written messages (par. 184); by oral report; or by any combination of these. Regardless of the reporting technique employed during the mission, the observer reports to the unit S2 (or unit aviation officer) for complete oral interrogation upon completion of the mission.

b. Positive Information. In reporting his observations, the observer states as fact only what he has *actually seen.* When it is necessary to estimate such factors as distance or the size of troop units, he should be careful to state clearly that it is an estimate.

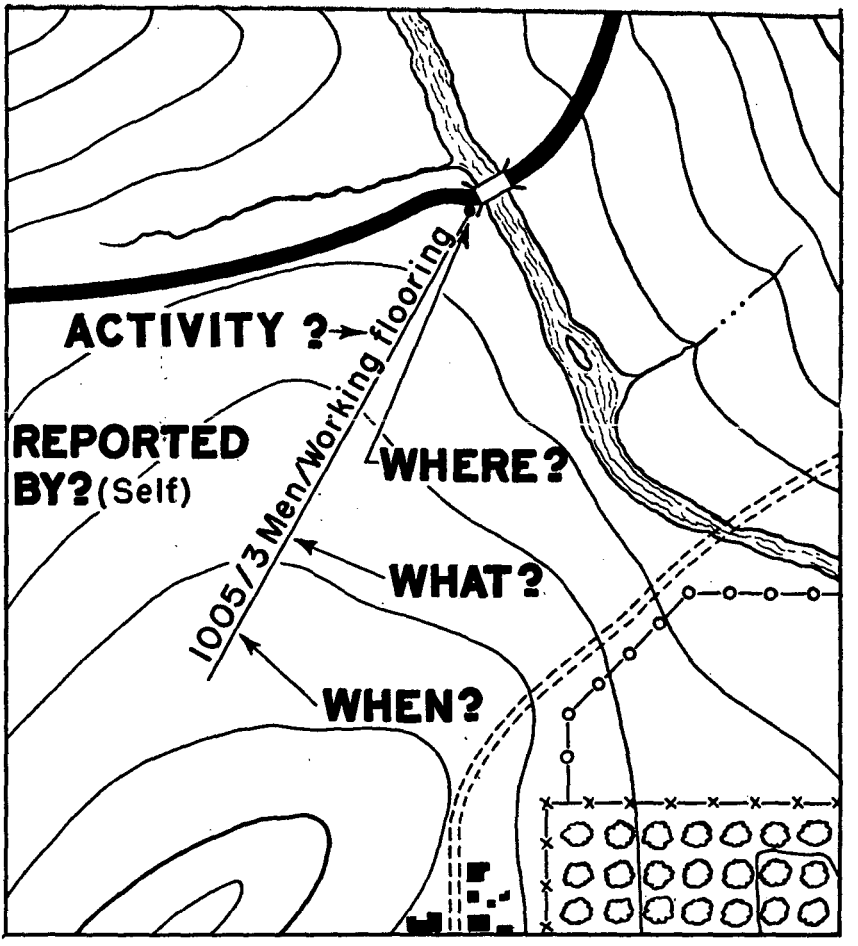


Figure 3. Example of observer's notes.

For example, he may identify tanks but may not be able to state their number accurately, although he estimates their strength. In such cases, he might report, "Enemy tanks at (coordinates); estimated strength, one company."

c. Negative information. Negative observation must not be ignored; it is frequently highly valuable to intelligence agencies, especially when it confirms other information available. The observer should report negative information when it is called for or when he considers it pertinent. Again, as in the case of positive observations, he must be careful to limit his negative report to the mere fact that *he has seen nothing;* his failure to observe any activity must not lead him to assume or to report that no activity exists.

Section III. SURVEILLANCE

48. GENERAL

Surveillance is the continued observation of an area or activity. It may be divided into the following two general categories:

a. Battlefield Surveillance. Battlefield surveillance is general observation maintained over the battlefield. Its purpose is to observe hostile activity and the progress of engagements, to locate targets, to confirm suspected enemy installations, and to give warning of enemy counterattacks, withdrawals, reinforcements, and changes in dispositions. A special type of battlefield surveillance is *counterbattery surveillance.* Its specific purpose is the location of hostile artillery positions.

b. Surveillance of Fire. Surveillance of fire is the general observation of friendly artillery or naval gunfire for the purpose of reporting its accuracy and effectiveness.

49. TECHNIQUES OF SURVEILLANCE

a. Advance Training. The ability to locate and identify the wide variety of objects and activities encountered in surveillance missions is developed by continuous practice only. The observer must be able to translate his aerial observations into accurate map information. One method of developing this ability is to use maps and aerial photographs covering the same training area. The observer is flown over the area. While in the air, he notes on the map all prominent objects and terrain features. Upon landing, he compares his map notes with the objects as they appear on the photograph and notes any errors in his identification of objects.

b. Planning Surveillance Missions. Terrain analysis (par. 40) is particularly important in planning surveillance missions. The observing team considers the nature of the terrain as it affects the enemy's observation, fields of fire, cover and concealment, obstacles, and routes of communication. The whole area is then subdivided into zones or subareas to be searched.

c. Flight Techniques. Each of the subareas is searched in turn, beginning with those most critical to the friendly force's mission. The flight path over each area is varied so as to insure observation from several directions. For initial search, the aircraft is flown at a relatively high altitude to obtain a wide field of view. When any indications of activity are noted (par. 41), flying altitude is reduced sufficiently to permit detailed examination and identification of the activity. When the observer has completed his examination of the target or activity, he returns to the higher

altitude and repeats his general search of each subarea until indication of some other activity is noted.

d. Reports. Initial identifications are reported as they are made. Reports of changes (or negative reports) are usually made on a time schedule prescribed by the unit aviation officer during the briefing session. A complete summary report, written or oral, is made at the end of the mission.

50. COUNTERBATTERY SURVEILLANCE TECHNIQUE

General or specific areas to search for enemy artillery activity may be found in intelligence reports such as hostile battery lists. When indications of such activity are detected in searching the enemy area, detailed examination from various observing angles is made to confirm the location and to fix its coordinates. In addition to indications discovered within the hostile area, clues to hostile artillery locations may be obtained by observing enemy fires falling in friendly areas and determining the direction to their origins. The following methods may be employed:

a. Backsight Through Observed Bursts. An imaginary line drawn through two or more successive bursts or volleys *fired at a single deflection setting* will indicate the general direction in which the observer should search for the hostile battery (fig. 4). Depending upon the enemy's methods of conducting his artillery fire, rounds fired for adjustment may be fired at differing deflection settings, and a backsight might lead in the direction of an enemy ground observer rather than the gun position. The observer, therefore, accepts with reserve the direction indicated by successive single rounds. This is true especially if the time interval between rounds is fairly long. When he can determine that the hostile battery has begun fire for effect (a series of rounds or volleys fired into the same area at comparatively short intervals), he has better reason to assume that the deflection has been constant and that a backsight will lead him toward the hostile artillery position.

b. Bisecting Side Spray. The side spray of a percussion burst is usually more apparent to an aerial observer than it is to an observer on the ground. The side spray gives the burst the appearance of an arrowhead, pointing back toward the gun. Backsighting along a line bisecting the angle formed by side spray will indicate the direction in which the observer should search (fig. 5). From an observing position directly over the burst, single rounds fired during adjustment may indicate the direction to the hostile position.

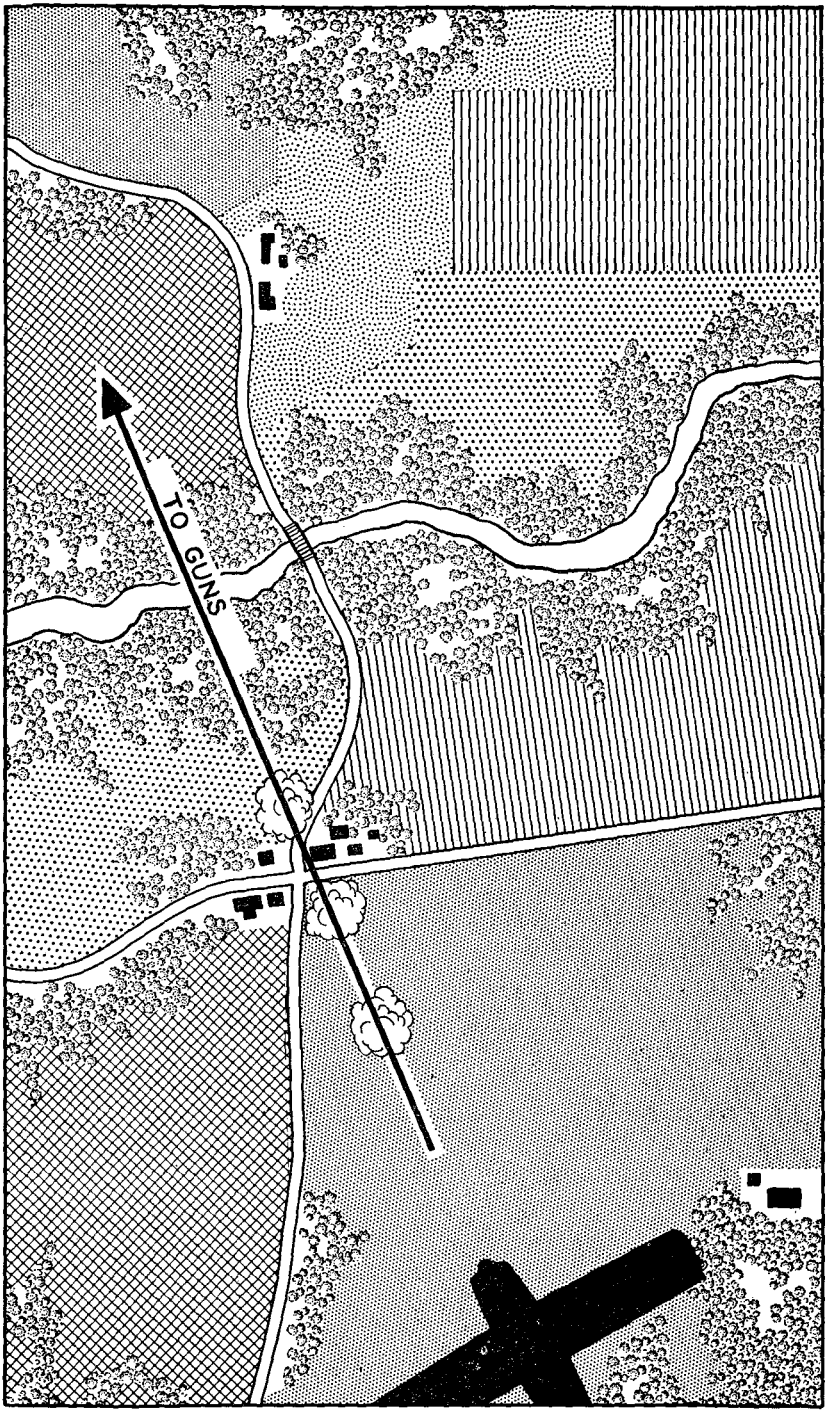


Figure 4. Locating the line of fire through backsight.

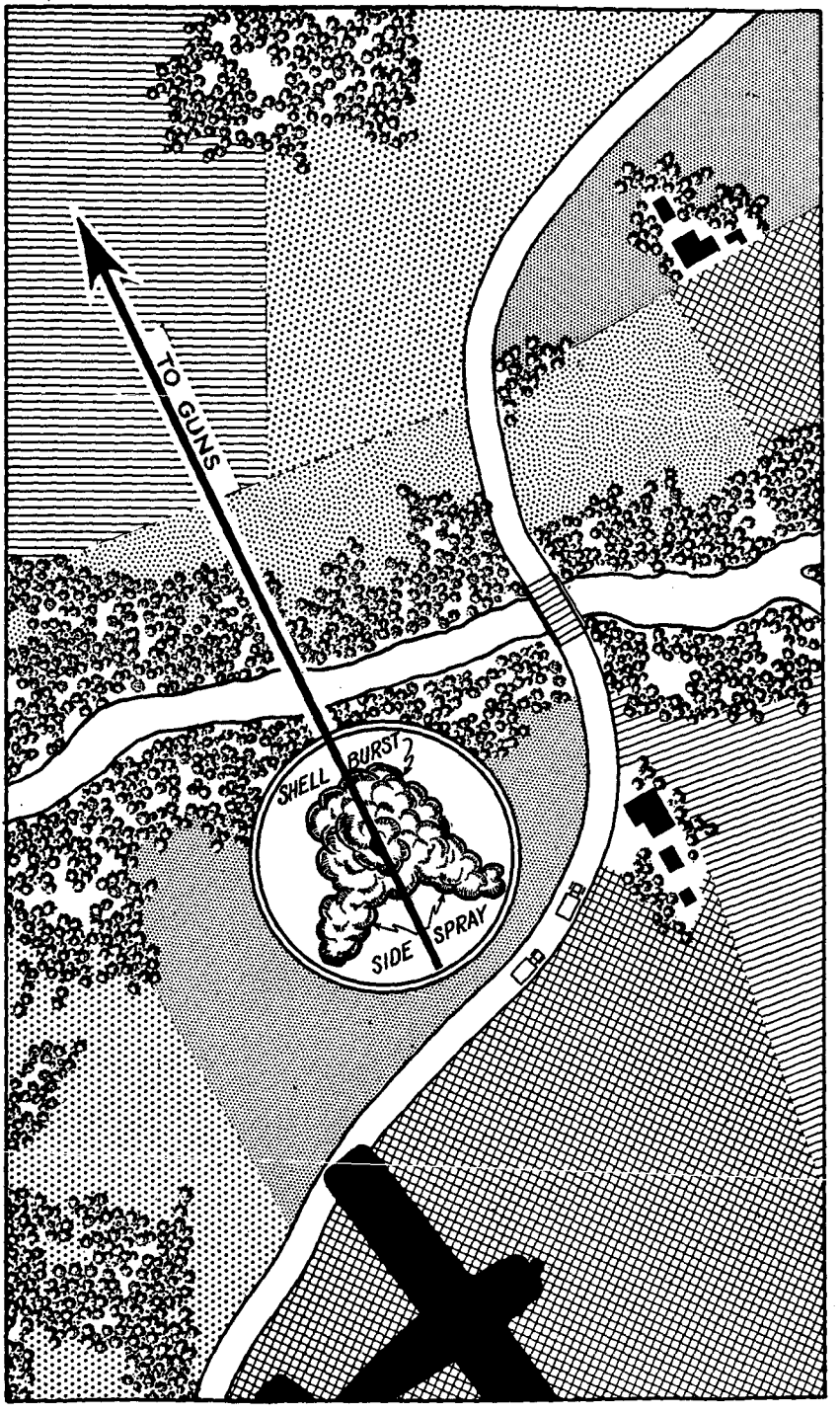


Figure 5. Bisecting side spray to locate the line of fire.

c. Direction From Air Bursts. As in the case of percussion bursts, the pattern of an air burst is a good indication of direction to a hostile battery. The pattern on the ground is generally crescent in shape, convex toward the gun, with the easily discernible longer axis of the pattern perpendicular to the direction of fire. Ricochet bursts form a similar pattern, but because of the erratic path of the projectile after impact with the ground, the pattern is not as dependable as that of an air burst in determining a direction to the gun.

d. Craters. With proper condition of soil and vegetation, the damage patterns described in *b* and *c* above may be easily recognized on the ground from the air.

e. Reports. Locations of hostile artillery positions are reported by the most rapid means available. The reports include coordinates, number and caliber of weapons, and the time and volume of any firing observed. Frequently, the observer is directed to conduct counterbattery fire upon the hostile positions which he has located and reported (pars. 51–53).

Section IV. CONDUCT OF FIRE

51. GENERAL

Maximum flexibility in obtaining prompt and accurate fire support is obtained by training all Army aviators and observers in the conduct of observed fires, regardless of their basic branch. For detailed discussions of the procedures employed in the adjustment of artillery fire, mortar fire, and naval gunfire, see FM 6–40 and FM 6–135.

52. SENSING

a. General. A ground observer normally adjusts fire along the straight line from his fixed position to the target (observer-target line). Because the aerial observer's position changes constantly during flight, he must employ the gun-target line as the basis for his adjustment of fire. At comparatively short ranges, and with good visibility, he may simplify his problem of adjustment by flying over the weapons being adjusted, or in their near vicinity. When this is not possible, he must visualize the gun-target line.

b. Locating the Gun-Target Line. When the aerial observer does not know the position of the weapons being adjusted, he may obtain an approximation of the gun-target line by requesting that two rounds be fired at different ranges but at the same deflection setting. Observing the two bursts, the observer applies an imag-

inary line in a manner similar to that described in paragraph 50. This line is the gun-target line. Observation of the bursts shown in figure 6 indicates the direction of the gun-target line. Since the observer also knows the amount of the range change between the bursts, he has a "yardstick" for use in estimating subsequent range and deflection changes. The range change between bursts should be at least 400 yards. This will allow an accurate visualization of the gun-target line, and it will minimize the effect of normal dispersion on the "yardstick."

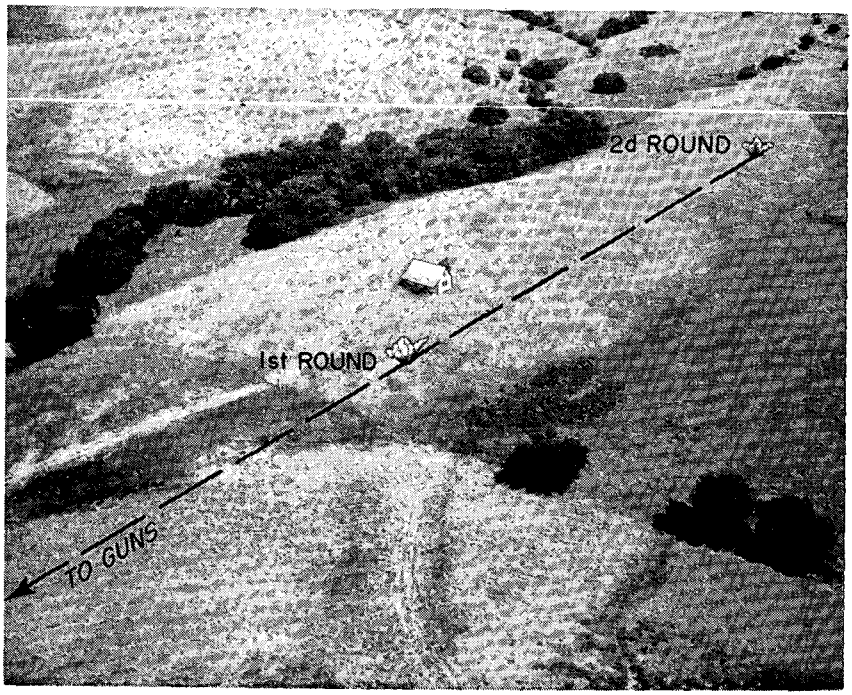
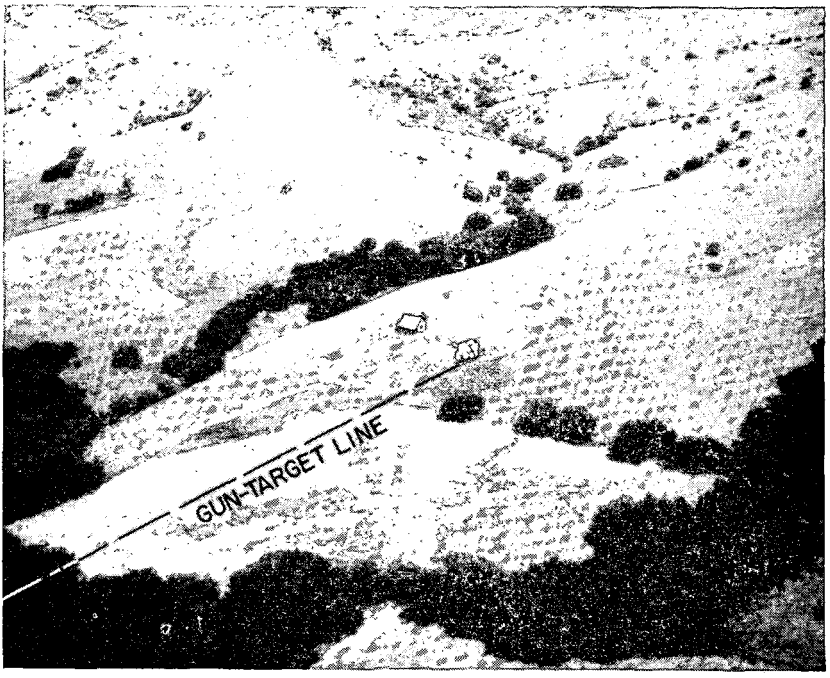


Figure 6. Locating the gun-target line.

c. Target Offset. Because his observing position constantly changes, the observer must be aware of the effect of the target offset. He should select points on the ground which will help him remember the correct gun-target line. Figure 7 shows a single burst viewed from three different aerial positions and illustrates the variation in aspect which results from a changing target offset. In this situation, a well-trained aerial observer would keep in mind the gun-target line previously established (fig. 6) and, regardless of his position at the moment of the burst, would visualize the line running along the ridge. His changing position will assist him in making a more accurate sensing.



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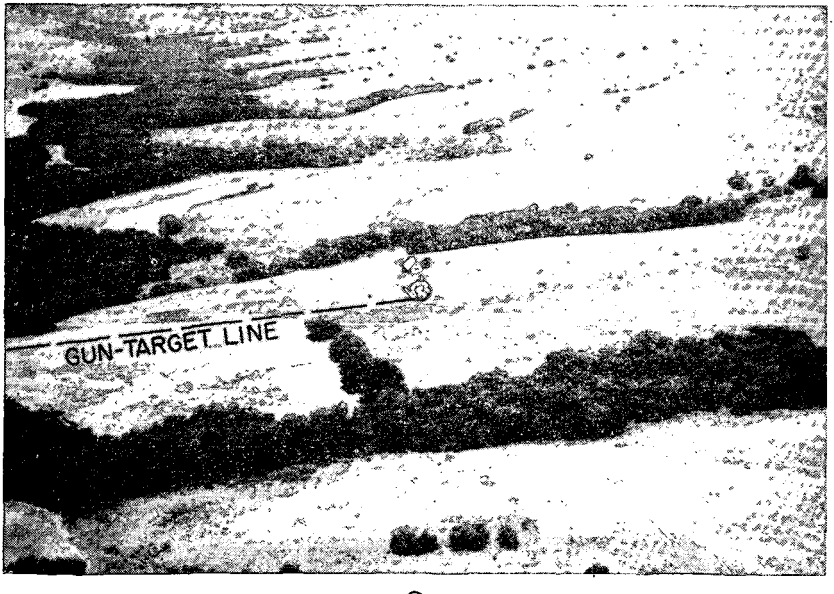

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Figure 7. Variation in aspect caused by target offset.

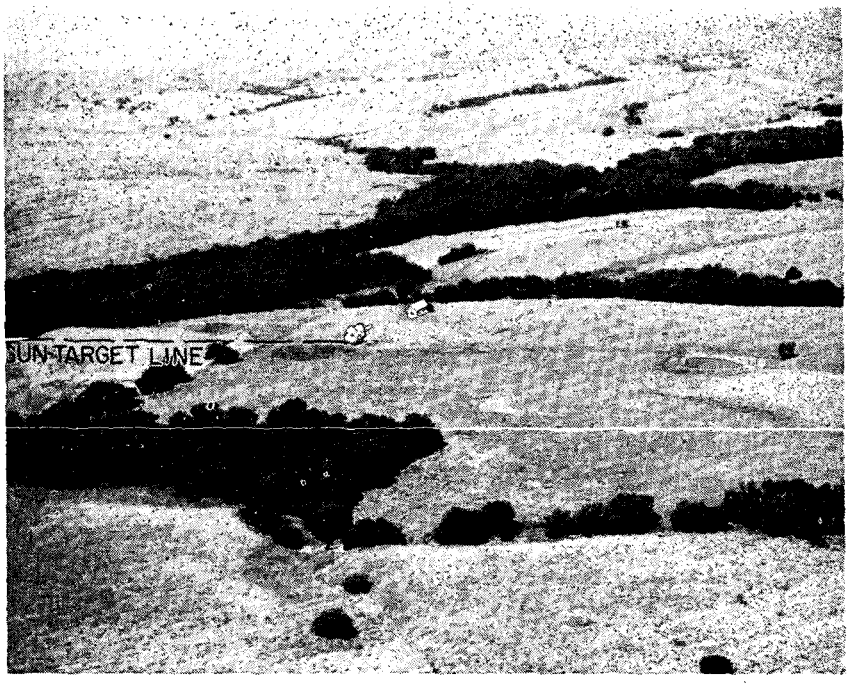

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Figure 7.—Continued

53. LOCATING THE BURST

Rough terrain, trees, poor visibility, or the color of the background may make location of bursts difficult. This is particularly true of the first burst on a new target or in a new area. A burst from smoke shell is readily visible under all daylight conditions, and may be used for the initial round. As an aid to the observer, the artillery fire direction center may transmit the warning word SPLASH 5 seconds before the end of the time of flight of the projectile. This warning is especially necessary when high-angle fire or long-range artillery is being adjusted to give the pilot time to maneuver for a favorable observing position.

54. FLIGHT TECHNIQUES

The combined requirements of speed and accuracy in the adjustment of fire require the application of techniques with which all observing teams should be familiar.

a. Orientation. In addition to visualizing the gun-target line, the observer should select a prominent terrain feature or object near the target to facilitate identity of the target if he becomes disoriented during a turn in flight.

b. Flight Path. Flight paths in fixed patterns should be avoided. They enable the enemy on the ground to determine the course, speed, and altitude of the aircraft and to bring fire to bear on it. A small circular pattern over the target also invites hostile ground fire. Generally, the flight path should parallel the friendly front line and, whenever possible, should keep the aircraft between the sun and the target. When friendly antiaircraft weapons are present, the flight path should be planned so as to be near them (par. 19).

c. Altitude. The aircraft is flown at whatever altitude will afford the best observation without undue risks. When determining what altitude to fly, the mission, terrain, visibility, enemy ground fire, the disposition of friendly indirect fire weapons, and the flight pattern employed must be considered.

d. Turns. The aircraft should be flying straight and level when a burst is observed. If it is necessary to turn, the turn should be completed by the time the round bursts. If the aircraft is flying parallel to the gun-target line on its windward side, all turns should be made into the wind to avoid drifting across the line of fire and exposing the aircraft to danger from the outbound projectile.

Section V. AIR RECONNAISSANCE

55. GENERAL

Air reconnaissance is usually directed toward gathering specific information of a particular area, object, or activity, in contrast to the more general surveillance described in paragraph 48. Air reconnaissance is used alone only when ground reconnaissance is impossible or impracticable; normally, it is employed prior to, or in conjunction with, ground reconnaissance. It is most effective when it is employed to assist and supplement ground reconnaissance, in the following ways:

a. Affording security by reconnoitering ahead, to the flanks, over crests, and around curves, and warning ground reconnaissance parties of any enemy road blocks, ambushes, or installations which might interfere with the ground reconnaissance mission.

b. Informing the ground party of the condition of roads and bridges on its route, and locating and reporting alternate routes or detours.

c. Performing general reconnaissance and directing the ground party to specific areas for detailed examination.

d. Acting as a radio relay station between the ground party and the unit headquarters.

56. ROUTE RECONNAISSANCE

The purpose of route reconnaissance is to determine whether or not a certain unit or units can use specific routes. Examination of roads and bridges to the extent required by engineer reconnaissance (par. 58) is not necessary. An observer reconnoitering a route should—

a. Determine the general condition and types of roads and bridges.

b. Estimate the carrying capacity of the road in terms of traffic density.

c. Locate any road blocks on the route, and estimate the amount of material or equipment required to reduce them. Road blocks may be organized infantry ambushes.

d. Seek defiladed routes.

e. Locate detours and alternate routes where necessary.

f. Estimate the number of route markers required.

57. POSITION RECONNAISSANCE

a. In reconnoitering for positions, the observer must know the mission of the unit which will occupy the positions. Regardless of the offensive or defensive nature of the unit's mission, the observer considers all the military aspects of the terrain—observation, fields of fire, cover and concealment, obstacles, and routes of communication.

b. In areas where terrain characteristics make difficult the location of suitable sites for ground radio relay stations, aircraft are of great value in making a rapid reconnaissance for these positions. The helicopter's ability to hover makes it especially suited for this mission. A map reconnaissance of the area between the radio stations is made to select radio relay sites. These sites are then verified by the aircraft. The pilot flies from the base radio station toward the first site selected from the map study. As he approaches the first position, he flies at its altitude and visually locates the next mask. After he passes the first site, he turns 180° and looks for masks to the base radio station. If unsuitable intervening masks are present, he reconnoiters other sites selected from the map or by observation. If there are no masks, he proceeds to the second site and checks for the next mask beyond. This procedure continues until positions have been selected for the required relay stations.

58. ENGINEER RECONNAISSANCE

Engineer reconnaissance is classified as specific reconnaissance or area search.

a. Specific Reconnaissance. Specific reconnaissance is used to obtain information required for engineer planning in connection with the construction, improvement, or demolition of specific roads, bridges, railroads, pole lines, airfields, stream crossings, mine fields, or other obstacles, any of which may be in friendly or enemy territory. The effectiveness of defensive works, barriers, and demolitions is also determined by specific reconnaissance. The data sought through specific engineer reconnaissance are too varied and detailed for the scope of this manual. The observer for such missions should be a qualified engineer officer. If the observer is not an engineer officer, the unit engineer should furnish detailed briefing instructions for the observer. Engineer reconnaissance of roads and bridges can be adequately accomplished only by specially qualified personnel. Rotary-wing aircraft are more suited to such missions than fixed-wing aircraft.

b. Area Search. Area search is used when the location of engineer reconnaissance objectives is unknown. Its purpose is to locate sources of engineer supplies, equipment, or building materials; sites for airfields; water crossings; water points; storage areas; road nets, detours, and routes of communication. It is used also to locate newly laid enemy mine fields and any other types of recently prepared enemy obstacles which the engineers may have to reduce.

59. REPORTS

Information obtained by reconnaissance must be transmitted accurately, clearly, and rapidly. Any or all of the methods of reporting (par. 47) may be employed. When the reconnaissance covers a long route or large area, marked maps or overlays with conventional signs and symbols are particularly useful for recording and reporting information. In addition to the conventional signs and symbols prescribed in FM 21–30, other symbols may be devised and used for brevity, provided they are clearly understood both by the observer in the air and the using personnel on the ground. Standard symbols for reporting engineer road and bridge reconnaissance data are listed in FM 5–34.

Section VI. COLUMN CONTROL

60. GENERAL

Army aviation can be used effectively for column control. On extended marches, suitable terrain must be available for aircraft to land during a march for refueling, for maintenance, or to return

observing personnel to the march column. Army aviation is particularly useful when route reconnaissance is lacking as in the case of advanced guard actions. Refueling of column-control aircraft is accomplished during periodic halts; the ground crew marches near the tail of the column to facilitate refueling without delaying the march. For the technique of marching and displacement of Army aviation, see paragraphs 100 to 102, inclusive.

61. FLIGHT PATH AND ALTITUDE

When the march is in the presence of the enemy, the flight path of column-control aircraft should be varied to conceal the fact that it is being used over a column. Progressive circling over the route should be avoided. The aircraft should fly at an altitude low enough to evade enemy observation. If this is not possible, it should fly high enough to permit observation of the column with a minimum of circling.

62. COMMUNICATIONS

Aircraft engaged in column control should be assigned the same radio frequency as that used for column control on the ground. Alternate methods of communication should be planned for use in case radio communication is impossible (pars. 181–183).

Section VII. CAMOUFLAGE INSPECTION

63. FREQUENCY

a. The unit commander or his representative should inspect the camouflage of the unit from the air as soon as the unit has occupied position. Commanders of units having no organic aviation section may make arrangements with adjacent units for such inspection flights; if this is not feasible, a request for camouflage inspection may be made to the next higher headquarters.

b. Inspection flights should be made frequently and at regular intervals. The interval between camouflage inspections should not exceed 1 week. Installations that are the focal point of heavy traffic should be inspected at least twice weekly to detect new vehicle tracks which may have been created. When vegetation is cut for camouflage purposes, inspection should be conducted daily to detect any deterioration of the camouflage materials through weathering. Positions in snow-covered areas should be inspected daily. For a discussion of camouflage methods and materials, see TM 5–267.

c. In addition to periodic inspections, pilots and observers should habitually note the condition of camouflage of friendly units whenever the nature of the air mission permits. Any camouflage deficiencies or breaches of camouflage discipline should be reported at once.

64. FLIGHT TECHNIQUE

a. Speed. Aircraft employed for camouflage inspections should be flown as slow as possible to permit detailed study of the ground installations.

b. Flight Path. When there is reason to believe that the enemy can observe the aircraft, prolonged circling over the area should be avoided. The flight path should be such as to create the impression that the aircraft's mission is to observe in enemy territory.

c. Altitude. Inspections should be made from both high and low altitudes. High altitude permits a general study of the entire area. Low altitude permits a detailed study of specific installations or portions of the area.

d. Angles of View. The enemy is capable of observing the position from all directions, including the rear. Therefore, inspection flights must be conducted so as to give the observer a view of the area from all sides as well as from overhead. Flights should be timed to take maximum advantage of the sun which, in addition to illuminating the area, casts shadows that may reveal camouflage faults.

65. USE OF AERIAL PHOTOGRAPHS

Prior to the occupation of a new position, the area should be photographed from the air. After the occupation is completed, the area should be rephotographed periodically and its appearance compared with the original photograph so that any changes can be detected and corrected. Photographs are particularly useful to check the texture of artificial camouflage materials used.

Section VIII. AERIAL PHOTOGRAPHY

66. GENERAL

a. Although Army aircraft are not specifically designed for aerial photography, they can be employed successfully for photographic missions of a tactical nature. Photography for mapping is the responsibility of the Air Force. For a technical discussion of aerial photography, see FM 30–21, TM 5–240, TM 11–2324, and TM 11–2325.

b. The proximity of unit aviation sections to the forward areas makes it possible for them to take prompt advantage of good weather and perform photographic missions, within their capabilities, with a minimum of advance planning. In most instances, the unit aviation personnel should be able to undertake a photographic mission with a minimum loss of time for briefing inasmuch as they will normally be familiar with the local situation in their area.

67. PREFLIGHT PLANNING

a. Improvisation may be necessary to mount a camera in an Army aircraft for vertical photography. It is necessary to provide an opening in the bottom of the aircraft and to install a camera mount with means for its cross-leveling. Authority for modifications must be obtained from the Chief of Ordnance.

b. The type of photograph desired (vertical, high oblique, low oblique) depends on the purpose for which the photographs are needed (par. 68).

c. The scale of the photograph may be defined as the ratio of the focal length of the camera to the altitude at which the photograph was taken. The scale desired determines the altitude at which the aircraft must fly.

d. If strip mosaics are desired, the speed of the aircraft and the exposure interval must be determined so that the desired overlap may be obtained.

e. Take-off time should be so planned as to insure arrival over the area to be photographed during periods of good illumination.

f. Notes should be made to supply marginal data for the photographs and for proper indexing. These notes should accompany the negatives to the agency which will develop and print the photographs. These data will be inked on the film after it is developed. The notes include—

(1) Direction of flight of the aircraft for orientation purposes.
(2) Identification of the area covered.
(3) Focal length of the camera and altitude of the aircraft (to permit computation of scale).
(4) Type of photograph.
(5) Date and time of the photograph.
(6) Identification of the unit performing the mission.

68. USES

a. Oblique photographs taken from low altitudes are of considerable value to the infantry unit commander in studying the ter-

rain before him, particularly when used in conjunction with maps of the same area.

b. Oblique photographs taken above observation posts and covering the observers' areas of responsibility may be of particular value to commanders and their intelligence officers in determining the adequacy of observer coverage of the area and any additional coverage necessary.

c. Oblique photographs can be mil gridded and used by artillery observers in designating targets. They may be used by fire direction centers, in conjunction with their firing charts, for determining target locations and vertical intervals (FM 6–40).

d. Commanders of engineer units can make fairly reasonable estimates of the characteristics of roads and bridges by studying oblique photographs.

e. Photographs of stream crossings and approaches assist engineering planning.

f. Faulty camouflage can be detected by a study of photographs.

g. Vertical photographs of difficult or inaccessible terrain may be of assistance to survey parties.

h. Vertical photographs may assist in the identification of artillery targets.

Section IX. SURVEY OPERATIONS

69. GENERAL

a. The helicopter is the most valuable type of Army aircraft for survey operations. It can transport ground survey personnel and instruments to distant stations which may be inaccessible both to ground transport and to airplanes. Although any Army aircraft may be used in the survey methods described below, the helicopter's ability to hover over a point makes it more suitable than an airplane. It is possible to obtain an accuracy greater than 1/2000, depending on the training and experience of the pilot and survey personnel.

b. Army aircraft may be employed on reconnaissance missions in connection with survey planning.

70. LOW-ALTITUDE INTERSECTION

a. Instruments are set up and oriented at two or more known points. When possible, radio communication is established between the aircraft and instrument operators. The instrument operators track the aircraft, and, when it is over the desired point, a prearranged signal (radio or visual) is given; all instrument opera-

tors stop tracking and record their instrument direction readings. The point of intersection is then computed, and the location of the point is established.

b. The relative accuracy of this method of target location depends upon the following factors:

(1) Altitude of the aircraft over the desired point; the greater the altitude, the more difficult it is for the pilot or air observer to determine when he is directly over the point.

(2) Ability of the instrument operators to track accurately and smoothly on the same point of the aircraft throughout its flight. Tracking the rotor mast of the helicopter presents little difficulty.

(3) Time lag between the pilot's recognition of his position over the desired point and his transmission of the prearranged signal.

(4) Time lag between each operator's receipt of the prearranged signal and his cessation of tracking.

(5) Size of the angle of intersection; the smaller the angle, the greater the cumulated effect of the preceding possibilities for error.

71. LOW-ALTITUDE, ANGLE-OF-SITE METHOD

a. When only one known point can be occupied by an instrument operator, he tracks the aircraft both horizontally and vertically until the prearranged signal is given. He then stops tracking and reads both horizontal and vertical angles. In this method, the altimeter (aircraft or surveying) must be set at the altitude of the airfield or other point of known altitude before the mission is flown. The pilot reports his altimeter reading over the desired point. The difference in altitude between the instrument and the aircraft represents the side opposite the measured vertical angle. This permits a trigonometric solution for the adjacent side which is the horizontal distance to the desired point. A ray is then drawn on the chart at the measured azimuth and the target is plotted at the computed distance.

b. This method involves all the possibilities for error listed in paragraph 70, plus several additional ones (which make it even less accurate) as follows:

(1) The instrument operator must attempt to track smoothly and accurately in two directions simultaneously.

(2) Computation for distance is based on an altimeter reading, which is not precise. Altimeter readings are actu-

ally measurements of atmospheric pressure which, with altitude remaining constant, varies with locality and is continuously affected by atmospheric conditions.

(3) Computation for distance is based on the extremely acute vertical angle at the instrument; a small error in reading will cause a large error in distance computed.

72. LOW-ALTITUDE RESECTION

In this method of point location, a helicopter must be used since the aircraft must be positioned over a point with considerable accuracy when instrument readings are made. Instruments are set up at points whose locations are to be determined. They are zeroed on any distant point for reference. Instrument operators track the rotor mast as the pilot positions the aircraft over one known point. When in position over the point, the pilot gives a prearranged signal (radio or visual). Instrument operators record their instrument readings and again zero their instruments on their reference points. In this manner, the horizontal angle between the reference point and each of the known points is determined at each instrument position. Horizontal angles between the known points can then be determined and the location of each of the instruments found by a three-point resection computation (FM 6–120 and TM 5–235).

73. HIGH-ALTITUDE PHOTOGRAPHIC METHOD

a. When the situation prohibits flight over the desired target at low altitude, the following method may be used. An aerial camera is mounted in an aircraft which has been suitably modified to permit vertical photography. Instruments at two or more known points track the aircraft. Upon a prearranged signal, both instrument operators record direction, and the photographer simultaneously takes a vertical picture. The location of the aircraft is determined by intersection; the center of the photograph is the point on the ground directly under the computed intersection.

b. The accuracy of this method depends upon the same factors as those described in paragraph 70. An additional error is introduced if the camera axis is not exactly vertical at the instant the picture is taken.

74. RADAR METHOD

a. A variant of the method described in paragraph 71 employs a radar instead of optical instruments. The radar location should be surveyed accurately and radio communication provided from

the aircraft direct to the radar operators. The aircraft is flown as nearly as possible on a line from the radar location toward the target. If the target is in a radar clutter area, the aircraft is flown from beyond the target toward the radar. The radar operator locks the radar on the aircraft and places the radar in automatic tracking. Automatic tracking of a helicopter is inaccurate due to the large rotating surfaces of the main rotor blades. This inaccuracy is eliminated if the tracking is performed manually. Each radar indicator is monitored and, at the pilot's radio signal, all readings are taken simultaneously. A ray is projected from the chart position of the radar at the measured azimuth. Horizontal distance to the target (or photo center) is computed (radar's slant-range reading multiplied by the cosine of the elevation angle), and the point is plotted.

b. This method involves inaccuracies because of the pilot's error in location, time lag for pilot's signal, and time lag for the radar operators' responses to the signal. The last effect may be reduced materially if the radar is equipped with an automatic plotter.

CHAPTER 4
TRANSPORTATION MISSIONS

Section I. GENERAL

75. GENERAL

Transportation missions which Army aviation may perform include messenger service, liaison, evacuation of casualties, rescue, supply, troop transport, wire laying, and radio relay. With special equipment, they may be used to spray areas for the control of disease bearing insects.

76. ORGANIC UNIT AVIATION

Aircraft organic to units of the ground arms are the tactical, two-place airplane, the utility helicopter, or the multiplace airplane. The design characteristics of these aircraft limit their employment on transportation type missions to messenger and liaison service; emergency evacuation, rescue, and supply; wire laying; and limited use as radio relay stations.

77. TRANSPORTATION HELICOPTER UNITS

The mission of transportation helicopter units is to provide short-haul transport to expedite tactical operations and logistical support in the forward areas of the combat zone. Helicopter units are employed to augment other transportation facilities in the movement of personnel and cargo and to perform tasks that cannot be accomplished by ground transportation means.

Section II. MESSENGER SERVICE AND LIAISON

78. GENERAL

Army aircraft are frequently employed for messenger and courier service as a means of reducing travel time between widely separated installations. Similarly, the unit commander and members of his staff may utilize Army aviation for command visits to subordinate units and for liaison visits to other units.

79. SECURITY

a. Documents. In using Army aircraft for messenger and courier service, care must be exercised that information transmitted by such means is not allowed to fall into the hands of the enemy if the aircraft is forced down. Generally, material of intelligence value should not be carried by Army aircraft if they are to fly over enemy territory at any time en route.

b. Landing Pattern. In visiting units whose airfields may be under observation by the enemy, pilots of aircraft on messenger or liaison missions must take every precaution to avoid revealing the location of the field. They should be thoroughly familiar with the landing and take-off procedure of any airfield which they propose to visit. If necessary, they will request landing instructions from the aviation officer of the unit concerned, prior to making the visit.

Section III. EVACUATION OF CASUALTIES

80. CRITERIA FOR USE

Generally, the use of Army aircraft for evacuation of casualties is justified under one or more of the following conditions:

a. When the casualty requires medical attention sooner than he could reach it using ground transportation.

b. When the casualty's condition is such that ground transportation would be dangerous to him.

c. When the nature of the terrain is such that ground transportation is not feasible.

d. When the tactical situation prohibits any other means.

e. When ground transportation is insufficient or not available.

81. FLIGHT TECHNIQUE

When carrying patients, particularly litter patients, the pilot should observe the following precautions:

a. Prior to take-off, the pilot should brief the patient on flight sensations to be encountered.

b. Take-offs should be smooth and the angle of climb of airplanes shallow.

c. Abrupt maneuvers in flight should be avoided; turns should not exceed gentle banks.

d. Landings should be smooth; for airplanes, power approaches are recommended to lessen the jar.

82. INSTALLATION OF LITTERS

The following principles must be observed when litters are mounted in (or on) Army aircraft:

a. Installation of the litter must not displace the aircraft's center of gravity beyond safe limits.

b. If the litter cannot be installed in such a manner as to maintain lateral balance, counterweights should be employed within the maximum weight capacity of the aircraft.

c. The litter must not interfere with operation of the aircraft.

d. The patient must be kept comfortable; the litter should be horizontal during flight.

e. The litter must be lashed so that it will not shift while in flight, and safety straps must be adequate to keep the patient on the litter without unnecessary discomfort.

Section IV. RESCUE

83. GENERAL

Army aircraft may be employed on missions to recover individuals and units isolated behind enemy lines. The aircraft may be employed as vehicles to actually transport the personnel or they may be used to locate the personnel and to guide ground rescue units to them.

84. EMPLOYMENT OF AIRCRAFT

The small tactical aircraft are limited to the rescue of individuals such as aircraft pilots, however, small isolated patrols may be recovered by shuttling. The light cargo helicopters of the transportation helicopter units may be used to recover larger units. Use of airplanes on this type of mission is limited due to the requirement for large, relatively smooth landing areas. The ability of the helicopter to land in small areas, and to hover, eliminates this problem. The operating radius of Army aircraft must be considered in planning rescue missions.

85. ENEMY ACTION

The feasibility of rescue operations is dependent upon the activity of enemy units in the area and relative air superiority. The effectiveness of enemy ground units may be neutralized by the action of the isolated unit. The supporting tactical Air Force may be required to achieve and maintain local air superiority in order to assure success of the rescue mission.

Section V. SUPPLY

86. GENERAL

a. In addition to facilities afforded by transportation helicopter units, Army aircraft can be used to supply small isolated units and patrols, observation posts, radio relay stations, and similar installations which cannot be supplied conveniently by ground means. Transportation helicopter units are organized and equipped for this type mission. It should be borne in mind that unless organic unit aircraft are designed for supply missions, the added strain on the engines and weight-bearing structural members will necessitate considerable additional maintenance if the aircraft are employed on such missions for an appreciable length of time.

b. Plans for use of Army aircraft on supply missions should consider the operating radius of the aircraft and navigational problems involved. Radar may be used to guide the aircraft to the areas where supplies are to be delivered. Panels may be used to indicate areas for dropping supplies or for landing; at night a shielded light may be used in the area. Helicopters are particularly well suited for night supply missions.

87. TYPE OF SUPPLIES

Any item whose weight and size will permit its transportation by Army aircraft can be delivered. The more common items which might be delivered are food, water, ammunition, medical supplies, and communication equipment. Items such as clothing, fuel, and special instruments may be delivered if their need constitutes a genuine emergency.

88. EQUIPMENT

a. If standardized delivery equipment is not available, packaging for delivery by Army aircraft can be improvised.

b. If they are available, the standard A-series of containers utilized by the Air Force are satisfactory for Army use. They are made of canvas and are light, strong, and flexible.

c. The standard M-series parachute used by the Air Force is satisfactory for making parachute drops from Army aircraft. It is a 24-foot rayon parachute supplied in several colors. Personnel of the unit aviation section can be trained in about 3 hours to repack this parachute.

89. MODIFICATIONS REQUIRED

a. For interior loads, the installation of D-rings for lashings is required. The installation of D-rings must be made in compli-

ance with pertinent technical instructions issued by Chief of Ordnance. If there is any possibility of damaging the fabric or structural members of the aircraft, the cargo must be padded or wrapped.

b. For exterior loads, devices to hold the load must be attached at points where they will least affect the flight performance of the aircraft. To permit dropping loads while in flight, such devices should be capable of operation from within the cockpit. Bomb shackles capable of being tripped mechanically or electrically are suitable for this purpose. They are light in weight, easy to operate, require very little maintenance, and can be installed on the aircraft permanently. Their size is such that additional metal must be used to provide a frame to which they can be welded. On airplanes, they should be mounted on the wing struts at points (e.g., the wing tip, root, or the jury strut) where the struts are supported. On helicopters, bomb shackles may be mounted on each side of the fuselage close to the center of gravity. Modifications to Army aircraft types to incorporate bomb shackles or other devices for purposes of carrying external droppable loads will be prescribed in applicable Department of the Army publications. Since such external loads affect the flight performance and structural integrity of aircraft, no field modifications of Army aircraft are authorized without prior approval of Department of the Army.

c. If bomb shackles are not available, or if the quantity of cargo is greater than wing loading can accommodate, belly racks or side racks fabricated from scrap materials can be utilized. Such racks must be so mounted on the aircraft that the weight of the cargo is transferred to structural members strong enough to bear the load. It is also feasible to carry loads suspended in cargo slings beneath helicopters for relatively short distances.

90. DIMENSIONS, WEIGHTS, AND POSITIONS OF LOADS

a. The frontal dimensions of an exterior load must be small enough to avoid the creation of excessive drag, which results in serious loss of flying efficiency. Safe cross-sectional limits differ for each type of aircraft. The length of a load is governed only by a consideration of balance. If the load does not move the center of gravity of the aircraft beyond its prescribed safe limits, the length is immaterial.

b. Weights which may be carried vary with the power and structural strength of the aircraft being used. Over-all weight must remain within the maximum load-carrying capacity listed as safe for the particular aircraft; the individual load at each suspension point must be kept within the support capacity of the structural members bearing the weight.

c. The cargo must not displace the center of gravity beyond safe limits. External loads must be distributed equally on both sides of the aircraft. If an external load is carried on the wings of an airplane, it should be divided into parts of equal weight and carried on both wings. Likewise, the load should be distributed equally on both sides of a helicopter.

91. LASHING

a. All internal loads should be securely lashed to keep them fast during flight and to prevent interference with the controls.

b. The swaying of an external load will place a strain upon both the pilot and the aircraft. On short flights, these strains can be borne fairly readily, but they become so severe on longer flights that it is necessary to lash the loads. Since it is not practicable to cut the lashing in flight, a long haul must end in a ground delivery at the destination, or an intermediate landing must be made near the delivery point to remove the lashing and prepare the load for release during flight on the final short leg of the trip.

92. DROPPING LOADS

a. Depending upon their degree of fragility, loads may be dropped in one of three ways—

(1) *Free drop.* A free drop is made from the lowest safe altitude. It is suitable for unbreakable objects, such as clothing.

(2) *Blanket chute.* A blanket chute is a parachute improvised from a blanket. It not only breaks the fall of the supplies, but also provides the receiving personnel with bedding if required.

(3) *Supply parachute.* This is the standard M-series parachute (par. 88). This is the best method of drop for any materials which might be damaged.

b. The best altitude for dropping by either blanket chute or supply parachute is from 200 to 300 feet. This is low enough to provide reasonable accuracy in dropping into the desired area, yet high enough to insure opening of the parachute in time to break the fall.

93. FLIGHT CHARACTERISTICS OF LOADED AIRCRAFT

a. Airplanes. A loaded airplane reacts more sluggishly to its controls than an unloaded airplane. The take-off distance is materially increased. The additional weight, plus the drag created by external loads. raise the stalling speed of the airplane. Flying

speed on the drop run should be kept well above the stalling speed in order to insure lateral control in the event one bundle should fail to drop. Aviators must be extremely careful to maintain flying speed and to avoid all but the most gentle maneuvers. Medium and steep turns should be avoided.

b. Helicopters. Although not susceptible to stalling, helicopters sacrifice some degree of maneuverability when heavily loaded, especially if the load is unevenly distributed. The aviator must exercise caution to avoid loss of control in flight. When sufficient power for vertical take-off or landing is not available because of the increased gross weight, a ground run will be necessary to compensate for the power deficiency.

Section VI. TROOP TRANSPORT

94. GENERAL

Transportation helicopter units are provided to increase the speed and flexibility available to commanders for tactical operations. These units permit the rapid movement of troops over or around fixed defenses and natural obstacles and into areas inaccessible to ground transport means. Assault troops may be landed accurately and with planned dispersion.

95. PLANNING CONSIDERATIONS

Plans for the use of helicopter units must consider the number and type of helicopters available, maintenance requirements, and the operating radius of the aircraft. These units are extremely vulnerable to hostile fighter aircraft. Local air superiority must be maintained for the duration of the troop movement and for any period of time during which the units must be supplied by air.

Section VII. WIRE LAYING AND RADIO RELAY

96. AERIAL RADIO RELAY

Aircraft may be used effectively as radio relay stations. They should be employed on these missions for limited periods of time only, and then only when ground relay stations are impractical because of the distance or time element. When an aircraft relay is to be used in this manner for long periods of time, the radio net in which it operates should operate on a time schedule, if possible.

97. WIRE LAYING

a. Army aircraft can lay wire over short distances without landing and thus overcome difficult terrain obstacles such as streams, gullies, and steep slopes. The length of wire that can be laid is limited by the weight which the aircraft can carry. It varies with the type of wire and dispenser used. In general, two wire circuits of assault type wire, 3½ to 4 miles in length, can be laid simultaneously.

b. The use of Army aircraft for wire laying is justified only when the terrain or the tactical situation makes the use of conventional means unsatisfactory. Time alone as a consideration should not be governing, in view of the time required to load wire dispensers into containers and to mount the containers on the aircraft.

c. The superior maneuverability of the helicopter, particularly its ability to hover, makes it much more suitable than an airplane for aerial wire laying missions. Wire can be cut from the helicopter when the required length has been laid. Unlike the airplane, it can use any type of spool or reel.

98. WIRE-LAYING EQUIPMENT FOR AIRPLANES

a. Wire can be laid from airplanes by means of pretwisted coils only; revolving drums or spools are unsuitable because of backlash. Because there is no feasible way of cutting the wire while an airplane is in flight, coils must be kept to an economical size to avoid wastage. They must be packaged in such a manner as to preclude snarling or tangling in flight. They must be spliced end-for-end so that a series of coils may be used to lay a continuous line.

b. For maximum flexibility in length of lines to be laid, coil dispensers are loaded in a container which is long enough to accommodate the maximum number of dispensers that may be used. Dispensers are loaded in the container with their pay-out ends toward the rear. When short lines are to be laid, any unused headspace in the forepart of the container is loaded with an appropriate number of empty dispensers.

c. To mount the containers, it is necessary to attach an external device which can be operated from within the cockpit. Mechanical bomb shackles are suitable (par. 89).

99. WIRE-LAYING TECHNIQUE

a. General. Prior to actually laying wire from Army aircraft, a thorough wire route reconnaissance should be made and the

flight path marked by terrain features. Note should be made of road and railroad crossings so that ground personnel may place the wire over or under these crossings. It may be possible to avoid the necessity of servicing wire at these obstacles by laying wire in the tops of trees in the area. Wire must never be laid across power lines. Long, unsupported spans of wire caused by ground forms, trees, etc., will usually fall to the ground. However, the possibility that they will not must be considered. Breakage will occur when the weight of unsupported spans exceeds the tensile strength of the wire.

b. Airplanes. Maximum stability in flight is maintained when two wire circuits are laid simultaneously from containers mounted under each wing. If a single circuit is to be laid, the necessary wire is laid from dispensers under one wing; half this amount of wire is placed in containers under the other wing to act as a counterbalance. When deciding which end of the route will be the starting point, the direction of the wind should be considered. Airplanes flying at low altitude should be flown into the wind for safety reasons; ground speed is diminished. The airplane is flown low over the near terminus as slowly as possible. The pilot triggers the weighted pay-out end of the wire which then falls to the ground where it is retrieved and made fast. The pilot follows the previously selected route to the far terminus at as low an altitude as will permit him to maneuver the airplane with safety. Since there is no way to cut wire in an airplane, flight must be continued beyond the far terminus until all the wire has been paid out. If expendable wire dispensers are available, they may be dropped at the terminus, thereby providing additional wire to the ground personnel.

c. Helicopters. At the near terminus, the helicopter descends to ground level and the pay-out end of the wire is made fast. The helicopter flies slowly at minimum safe altitude by the most direct route, paying out wire as it goes. At the far terminus, the helicopter reduces speed to zero and descends again to ground level. The necessary slack is unreeled, and the wire is cut.

CHAPTER 5
OPERATIONS

Section I. TROOP MOVEMENTS

100. GENERAL

a. The role of Army aviation in troop movement operations varies with the character of the move—administrative or tactical. It also varies with the method used for the movement of the main body of the unit—rail, motor, marching, or any combination of these. For movements in connection with special operations (amphibious or airborne), see paragraphs 120 to 176, inclusive.

b. At one extreme, Army aviation moves passively as a part of its parent unit; an administrative movement wholly by rail is a typical example. At the other extreme, Army aviation becomes an extremely active participant in the execution of the move, with responsibilities for route reconnaissance, column control, and security—as in an uncovered tactical movement with enemy contact imminent. Transportation helicopter units may provide the transportation for the movement of troops. Between these two extremes, many variations are dictated by circumstances.

101. ADMINISTRATIVE MOVEMENT

a. Since administrative movements are made when contact with the enemy is remote, considerations of economy and efficiency are paramount.

b. Aircraft may be flown to their destination. This method of movement may be used merely to move the aircraft, or it may be used to permit use of the aircraft in conjunction with the movement of other elements of the unit. A lengthy administrative move may afford an exceptional opportunity for cross-country navigational training of the aviators.

c. When large numbers of aircraft are to be moved, it may prove advantageous to use an aerial convoy. General march principles apply. The aircraft are formed into march units of similar flight characteristics (speed and operating radius), and commanders are appointed for each unit. Detailed plans are prepared covering composition of march units, routes, intermediate fields, communications, messing, refueling, and reports required.

d. Aircraft may be moved by rail, crated or uncrated, or they may be partially disassembled and moved by truck (app. II).

102. TACTICAL MOVEMENTS

a. General. As movement toward the front continues and contact with the enemy becomes progressively more likely, tactical considerations become paramount in the organization and conduct of a march. Columns are broken down into their tactical components, and march formations become progressively broader in frontage. By the time contact is imminent, the leading elements are fully developed for the occupation of assembly areas or attack positions. Broad formations reduce flexibility; hence, tactical reconnaissance is pressed vigorously to the front and flanks. Distant reconnaissance by the Air Force assists the march commander in gauging the imminence of contact and avoiding premature deployment. Closer and more detailed reconnaissance by all his organic means, including Army aircraft, assists him in meeting the enemy on ground of his own choice with troop formations which fit his own plan of action and scheme of maneuver.

b. Route Column. When, because of distance from the enemy or protection by a covering force, contact is judged remote, movements are executed in route column. The employment of Army aviation is controlled by the highest headquarters directly involved in the movement. General principles governing administrative movements apply (par. 101).

c. Tactical Column. Between the relatively distinct phases of remote contact and imminent contact, movements to contact pass through a widely varying phase of improbable contact. During this phase, units are regrouped into columns of tactical formations which will best lend themselves to continuous development as they progress toward the front. If organic unit aircraft have been employed under centralized control in route column, they revert to their units in tactical column. Except when limited by secrecy requirements, unit commanders employ them as needed for route and bivouac reconnaissance, column control, and security of the marching column. Along each principal route of advance, column commanders coordinate the employment of unit aviation sections to insure continuous contact with covering forces to the front and flanks and to provide continuous security reconnaissance on any uncovered flank. This is best accomplished by publishing march orders which allocate specific zones of responsibility to the subordinate units within the column. While marching in tactical column, aircraft are refueled during periodic halts. This may be done either at the previous night's bivouac airfield or at inter-

mediate air strips along the route. To minimize interference with the column's movement during refueling, ground crews and fuel trailers march well toward the rear of their unit. In some instances, it may be advisable to use common intermediate air strips along the route and to march all ground crews with the trains. Many of the details as to tactical column formations, bivouacs, and refueling may be covered by standing operating procedures.

d. Approach March. When contact with the enemy is imminent, elements normally develop approach march formations to place them in their assembly areas or attack positions properly distributed for employment against the enemy. Subject only to possible secrecy limitations, all units employ their aviation sections freely during this phase. They use them to establish their unit airfields, to reconnoiter position areas and routes thereto, to control the movement of their troops, and to protect the unit against surprise enemy attack. In addition to these general classes of missions common to all units, aviation sections are employed continuously to supplement other reconnaissance agencies in obtaining the information required to develop their own units' plans for combat. The following are examples of some of the types of specific missions which might be charged to unit aviation sections during the approach march.

(1) *Infantry.* Aviation sections may perform intensive battlefield reconnaissance (as far toward the unit objective as it is safe for aircraft to fly) to locate critical terrain features including intermediate objectives for assault battalions, covered approaches, natural obstacles and the possibilities for bypassing them, commanding terrain, landmarks to facilitate recognition of unit boundaries and to maintain proper direction, and likely sites for enemy supporting weapons. Transportation helicopter units may be employed for the rapid movement of troops to seize critical terrain features.

(2) *Armor.* Army aviation may be used with armor the same as with infantry with particular emphasis of reconnaissance on obstacles; negotiability of terrain, roads, and bridges; road blocks; and likely sites for antitank weapons.

(3) *Artillery.* Aviation sections may be used by artillery for vigorous counterbattery surveillance and for the adjustment of counterbattery fires; for the location of enemy columns, assembly areas, bivouacs, and routes therefrom toward the battle area and the conduct of observed fires to force early deployment and maximum disruption of move-

ment; for the adjustment of fires in support of covering forces; and for the identification of suitable check points throughout the area.

(4) *Engineers.* Aviation sections may be used by engineers for specific reconnaissance of routes to determine in part the traffic capabilities of roads and bridges and probable requirements for improvements or for engineer assistance in breaching obstacles. They may also be used to reconnoiter for construction materials and water points.

Section II. OFFENSIVE COMBAT

103. PRELIMINARY OPERATIONS

To facilitate advance planning for an attack, all the unit reconnaissance agencies, including aviation, seek to develop detailed information of the hostile positions. Types of missions assigned to various unit aviation sections are similar to those required during the contact-imminent phase of tactical troop movements. Location of the enemy's flanks is particularly important. In all types of offensive operations, aircraft activity may be used in conjunction with other efforts to deceive the enemy.

104. PENETRATION

a. During an attack to penetrate the hostile main line, units are normally free to employ their aircraft as they desire. Infantry and armored aviation sections maintain continuous surveillance over the attack to report its progress to their commanders. They keep special watch for any movement of hostile reserves which might threaten either to block the penetration or to pinch it off. When they can observe such threats, they may adjust the fire of the supporting artillery. Artillery aerial observation teams identify and report on the effectiveness of as many of the preplanned supporting fires as possible. They seek additional targets as the attack progresses and adjust fire upon them. In addition, they reconnoiter routes and positions for the displacement of their units as the line of battle advances. Engineer aviation sections follow closely the progress of the penetration. They devote particular attention to any indications of obstacles, presence of demolitions, or the laying of mine fields which the engineers may have to clear.

b. The helicopter may be used as a supplement to or as a substitute for, slower surface transportation. Commanders employing helicopters may maneuver reserves rapidly to envelop critical

terrain features, circumvent stubborn centers of resistance, and counter hostile threats to attack. Maneuver is possible over and around hill masses, across water barriers, and into areas lacking in suitable road nets.

105. ENVELOPMENTS AND TURNING MOVEMENTS

Missions executed by Army aviation in enveloping attacks and turning movements are essentially the same as those in a penetration. In the preliminary phases of these operations, the need for secrecy may impose limitations on the use of aviation over the routes of the planned main (enveloping or turning) attacks, while the secondary attack units may be left entirely free or even encouraged to intensify frontal aerial reconnaissance. Once the attacks are launched, limitations are generally lifted, and all units are free to use their aviation on whatever missions the commanders consider desirable. Where the main and secondary attacks are separated widely enough to be out of mutual supporting distance, Army aviation of both attacking forces maintain especially close surveillance over the gap to protect the flanks and to keep each force informed of the other's progress.

106. EXPLOITATION

When the assigned objective is taken and organized, aviation of the assaulting units seeks out the locations of any by-passed hostile pockets within the zone of advance, and it may be used to assist in efforts to reduce them. All unit aviation searches for the location of hostile reserves or probable assembly positions, and is prepared to adjust artillery fires upon them. The area forward of the seized objective is reconnoitered, at least to the maximum range of supporting artillery, for indications of enemy efforts to reconstitute his defense. Observers of long-range artillery units search the enemy's rear areas for signs of either reinforcements or withdrawals.

107. PURSUIT

Army aviation is particularly valuable in the pursuit. The aviation of direct pressure forces reconnoiters the enemy's retreat route for indication of the preparation of any demolitions, obstacles, or mine fields by his rear guards. Mobile pursuit forces engaged in an envelopment movement use their aviation to reconnoiter routes of advance paralleling the retreat and to maintain constant observation of the fleeing main body. The extremely rapid and decentralized nature of pursuit actions requires exten-

sive use of aircraft for liaison and communication between the pursuing elements. Transportation helicopter units may be used to transport troops to isolate and destroy enemy delaying forces.

108. DISPLACEMENTS

Terrain permitting, units in the attack normally establish their unit airfields close to the command posts. As the attack progresses, observers aloft on any mission look constantly for new command post positions within the unit's zone of advance, especially for positions with suitable airfield sites close by. In a successful attack, command posts will generally displace forward more frequently and over shorter distances than would justify attempts to establish complete new airfields. If the complete unit airfield is not displaced with the command post, it is usually advisable to establish an advanced air strip near the new command post for control, briefing, and interrogation of pilots and observers.

109. RELIEF OF COMMITTED UNITS

The aviation officers of both the old and new units should be present at all conferences planning the details of a relief. The aviation officer of the unit to be relieved conducts his relief on a personal reconnaissance of the airfield and its installations. He acquaints him with any special operating problems, such as terrain, weather, winds, and obstacles peculiar to the locality. Maintenance of secrecy as to the projected relief usually will prevent relieving aircraft from being brought forward until the relief of the ground elements has been completed. Time permitting, however, relieving pilots and observers come forward by motor vehicle and accompany relieved pilots on familiarization flights over the battle area. Relieving ground crews come forward during the night preceding completion of the relief. Relieving aircraft should reach the new airfields by the time the command passes.

Section III. DEFENSIVE COMBAT

110. PRELIMINARY OPERATIONS

The time available and the relative strength of opposing forces materially affect the employment of Army aviation during the preliminary phases of organization for defensive combat. The speed with which Army aviation can accomplish much of the detailed reconnaissance of the battle position must be weighed against the risk that unlimited aerial activity may focus the enemy's attention on the position. Higher headquarters, there-

fore, may limit preliminary use of unit aviation over the battle position. They may prescribe common airfield positions and may specify particular circuitous flight patterns for approaching and departing aircraft. All reconnaissance is used to locate the mass of the enemy's force and to seek indications of his course of action. All likely avenues of approach are examined for the planning of defensive fires, mine fields, and obstacles. Continuous reconnaissance is maintained toward the flanks for security. As preparations for the defense progress, all aviation personnel are kept informed of the location of security forces, unit defensive sectors, planned withdrawal routes of security forces, and the detailed organization of the battle position. Camouflage inspection is especially important; it is continuous on the part of all aviators flying over the main battle position for any reason.

111. SECURITY FORCES

a. Plans for the organization of a defensive position should consider the security forces' requirements for Army aviation, the method of control (par. 22) to be used in the employment of the aircraft, and a schedule covering changes in missions and methods of control of the aircraft as the security forces are withdrawn to the main battle position.

b. Security forces frequently contain units large enough to have their own organic aviation. However, the front may be too wide for continuous effective observation by organic aircraft alone. In such a case, the principal force commander may allocate additional aircraft from those at his immediate disposal, or he may prescribe a schedule of surveillance missions to be flown by his subordinate units on behalf of the security force.

c. Transportation helicopter units may be employed with security forces to expedite their maneuver, transport reinforcements and supplies, evacuate casualties, and assist units which may become isolated.

d. Regardless of the distribution of aircraft or their missions, all information of the enemy obtained by any aerial observer is furnished promptly to the covering force and outpost commanders.

112. DEFENSE OF MAIN BATTLE POSITION

Once the enemy has driven in the security forces and has been engaged by fire from the main battle position, previous secrecy restrictions on the use of unit aviation are usually lifted. Units employ their aviation on any missions which will help them to accomplish their mission. Surveillance is maintained over all ave-

nues of approach to detect enemy movements and bring them under fire promptly. Mine fields and other obstacles are kept under observation so that enemy efforts to clear them may be taken under fire. Artillery observers study particularly the movements of hostile artillery and adjust counterbattery fires upon it—before it occupies positions, if possible. Some aircraft are specifically charged with flank security missions to detect enemy maneuvers in that direction. Cargo helicopters may be employed in expediting the maneuver of reserves.

113. AIRFIELDS

In a deliberately prepared defensive situation, time will generally permit the complete organization of airfields, whether established separately by each unit or commonly by several units. A complete system of wire communication, characteristic of the defense, facilitates control of the unit air section. Alternate airfields are established and included in wire communication systems. They are maintained in a state of readiness for immediate use during critical stages of the battle. Whenever possible, units employing airfields distant from their command posts will prepare air strips close to the command post.

114. RELIEF OF DEFENDING UNITS

In a defensive situation, preparations for the relief usually are more detailed than in an offensive situation (par. 109). Generally, time will be available to bring forward all the personnel of the aviation sections and to familiarize them with the details of airfield installations, communications, alternate fields, and the tactical situation. All incoming pilots and observers are briefed by their outgoing counterparts; in addition, they participate in extensive familiarization flights. Detailed arrangements are made to transfer installed equipment to the incoming unit in place; for maximum secrecy, such transfers may even include the aircraft themselves.

Section IV. RETROGRADE MOVEMENTS

115. GENERAL

Delaying actions, withdrawals, and retirements are special types of defensive operations classified as retrograde movements. For a discussion of the principles involved in such operations, see FM 100–5. In these operations, the command moves away from the enemy, back over essentially familiar terrain. Consequently, in

the preliminary stages, route and position reconnaissance seldom requires use of Army aircraft to the extent required in preparation for either offensive or full-scale defensive combat. In the execution of retrograde movements, full exploitation of Army aviation capabilities contributes materially to the success of the operation.

116. DELAYING ACTION

The purpose of forces committed to a delaying action is not to fight a decisive engagement, but to gain time at the expense of space. They seek to block the enemy's path, compel him to reconnoiter and to deploy his forces, or engage in time-consuming maneuvers. The extremely broad fronts on which delaying forces operate and the wide gaps which exist between adjacent units multiply reconnaissance, observation, and transportation requirements. To meet these requirements, the force commander reinforces organic army aviation in each delaying zone, or allocates aviation to units that are without it. Primary missions for aircraft include continuous observation of the enemy's forces and his principal routes of advance, liaison with adjacent units, visual patrol over any gaps through which the enemy might attempt to push by the flanks of the delaying units, and timely information of the enemy's deployment in order to avert close engagement with him. Transportation helicopter units increase the flexibility of the ground units by providing a rapid means of transportation for supply, evacuation, and the maneuver of forces.

117. WITHDRAWALS

When units are withdrawn from action, the maintenance of secrecy can be facilitated by continuing the previous patterns of aerial operations over the abandoned positions. In such cases, the aviation of the withdrawing units passes to the operational control of the force covering the withdrawal. First priority is given to countering hostile reconnaissance elements to prevent discovery of the withdrawal. Second priority is given to the detection of any hostile movements (especially of armor or other mobile elements) toward gaps and weak points resulting from the withdrawal. When the covering forces commence their own withdrawal, control of aircraft usually reverts to the parent units.

118. RETIREMENT

In a retirement, centralized control of aircraft is necessary to insure their most efficient employment. First priority in allocating Army aircraft is given to the reconnaissance requirements of

the rear guard and to the flank security of each retiring column. Aircraft not required for these priority missions may be employed for column control along each retirement route to prevent congestion and delay at critical points, especially in approaches to towns, bridges, and other defiles. As the force closes into its objective area and is reorganized for combat, aviation sections revert to unit control.

119. AIRFIELDS

The coordinated employment of Army aviation required in retrograde movements justifies a more general use of common airfields than is the case in either offensive or defensive combat. In delaying actions, the use of common airfields simplifies the problem of providing them with local security. In withdrawals, aircraft which remain behind for deceptive operations over the abandoned positions utilize the airfield of the covering force. This permits the withdrawn units to close down all of their airfield installations and have them completely reestablished at rearward positions awaiting the return of their aircraft from operations with the covering force. When a withdrawal is to terminate in a retirement instead of the occupation of a rearward position, ground elements of the aviation sections may be consolidated into a group to march with the trains ahead of the main body. At appropriate points along each route of march, common air strips are selected and necessary quantities of fuel, lubricants, rations, and other supplies are left with only the minimum personnel necessary to meet the servicing needs of all the retiring aircraft along that route. Upon the opening of similar strips farther to the rear, unused supplies and equipment are moved to the rear. Unserviceable aircraft and supplies which cannot be transported by the using aviation unit or evacuated by the ordnance supply activity are completely destroyed. If available time and equipment permit, obstacles are established to prevent enemy use of the strip that is being evacuated. These may consist of mines, demolitions, or chemical contaminations of material objects.

CHAPTER 6
SPECIAL OPERATIONS

Section I. GENERAL

120. GENERAL

Special operations are those in which the terrain, weather, nature of the operation, or a combination of these factors requires the application of special measures, equipment, and techniques.

121. ADAPTABILITY OF ARMY AVIATION

In special operations, Army aviation performs the same types of missions as in any other operation. The emphasis will vary and some modification of aircraft or operating techniques may be necessary to fit the special characteristics of each type of operation involved.

Section II. NIGHT OPERATIONS

122. GENERAL

a. With adequate training of aviation section personnel and with favorable atmospheric conditions, night operations can be carried out with considerable success. Terrain features and road nets are clearly visible under moonlight. On dark nights, artificial illumination such as illuminating shell or flares (par. 127) can be used. Because the aircraft are almost invisible to observation except by radar, they can operate over enemy positions with a minimum of risk.

b. Aircraft used for night flying must be equipped with luminous instruments and a dim red light for map reading.

c. Night missions must be carefully planned and must be coordinated with other units. Air Forces and ground forces, especially antiaircraft artillery, must be informed of the area, time, altitude, type of aircraft, and the mission to be flown. Failure to coordinate may result in the attack of the aircraft by friendly forces.

d. Pilots and observers should be briefed concerning all friendly activity within the zone of their proposed operation. Unless the pilot and observer know the plan of artillery fires, they may mistake friendly shell bursts for enemy gun flashes.

e. When aircraft from several units are operating at night in the same sector, the flights are coordinated through the appropriate higher headquarters to avoid collisions. The aviation officer of the coordinating headquarters may designate altitudes at which aircraft of the various units will operate.

f. Aircraft operating at night must be in perfect mechanical condition to avoid forced landings which are especially hazardous in darkness.

123. AIRFIELDS

a. It will seldom be possible for airplanes to operate at night from fields in the immediate forward areas, because the lighting necessary for safe take-off and landing may reveal the position of the airfield to the enemy. On bright moonlight nights the two place aircraft can be operated off unlighted airfields provided the field is twice the length normally used for daylight operation and is relatively unobstructed at the ends. Helicopters, however, may not be so restricted because they require much less lighting than airplanes; either a single light that can be shielded or a landing light device which projects a beam of light at a preset angle is adequate.

b. The tactical situation and the terrain may dictate the use of minimum lighting on the airfield. For airfields to be used by airplanes, this can be accomplished by using portable field lighting sets, flare pots, or flashlights with covers to shield the light except from the direction of approach. Figure 8 shows two suggested methods of employing minimum lighting for night landings of airplanes. In both methods, the direction of landing is indicated by lighting the side of the airfield which will be on the pilot's left; the side lighting begins at the near end of the usable limits of the field and extends to the far end to indicate usable length; an additional single light in the near corner on the opposite side of the field indicates the usable width.

c. Runways for night operations must be at least twice as long as required for daylight landings and take-offs. Whenever possible, fields free of obstacles at either end should be selected. When this is impracticable, any obstacles which constitute a hazard must be illuminated or otherwise made easily identifiable to the pilot.

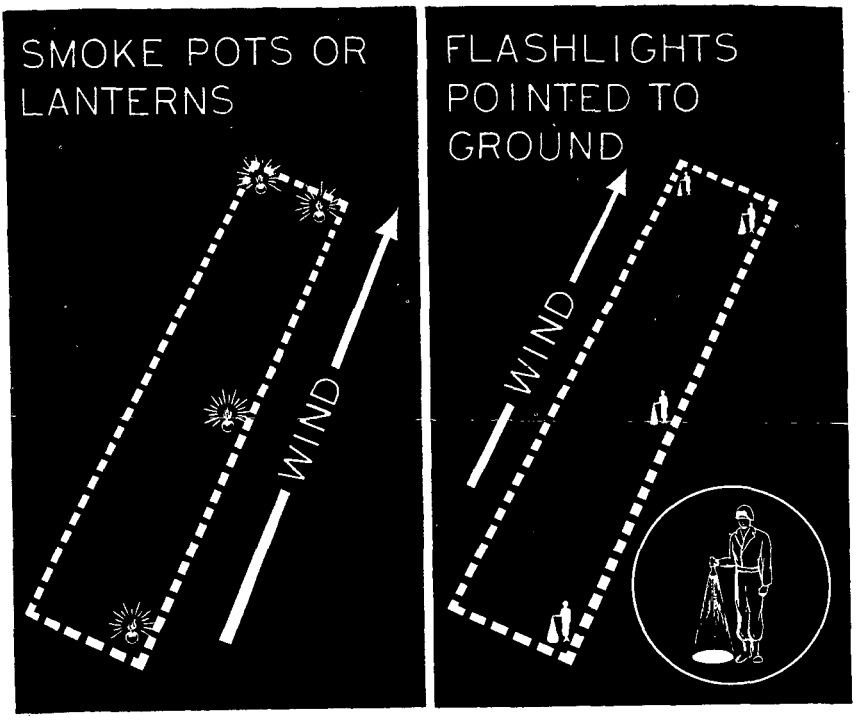


Figure 8. Lighting the airfield for night operation of airplanes.

124. NAVIGATION

a. Except on moonlight nights, or with the assistance of radio aids, navigation in the forward areas is extremely difficult at night. The pilot and observer must be thoroughly familiar with the terrain over which they fly, particularly as it appears during darkness. So far as possible, this familiarity should be acquired by night familiarization flights. In the initial phases of the familiarization program, flights are confined to the immediate vicinity of the airfield; they are extended gradually to the desired distances.

b. Maximum map reconnaissance and planning should be made prior to each flight to minimize the need for map reading after take-off. The use of even a dim red light will impair night vision to some extent.

c. Aircraft engaged in transportation operations may be guided by radar and informed by radio when they are over the proper area. A single, shielded light may be used on the ground for verification of the position.

d. Ground activity can be observed best from positions directly over the objective at altitudes between 1,500 and 7,500 feet.

125. MISSIONS

a. The majority of tactical missions at night are observation missions, particularly surveillance and adjustment of fire. Air observers, from positions over the enemy area, can observe objects and activities which are not visible to ground observers. Lights, even when shielded, are more readily seen from the air than from the ground. The flash of a weapon in defilade appears as a diffused glow to the ground observer; to the air observer, it appears as a distinct and easily located flash. Certain objects or activities, which are in contrast with their backgrounds, are easily detected. This is especially true of vehicles or troops on a road, particularly if the road surface is light in color.

b. Army aircraft may also be used at night liaison and courier missions. The helicopter is especially suited for night operation in the forward areas.

c. Transportation helicopter units can perform their normal missions at night. Operations of these units must be carefully coordinated (par. 122*c*) and navigational aids (par. 124) and lighting (par. 123) must be provided.

126. COMMUNICATIONS

a. At night, communication between the aircraft and the ground is limited almost entirely to radio.

b. Although visual messages may be transmitted from the ground either by the use of lights or by pyrotechnics, their use by an aircraft will reveal its position to the enemy.

c. Message pickup and drop are impracticable in most situations because of the danger involved in flying low at night.

127. ARTIFICIAL ILLUMINATION

a. Illuminating Shell. For a discussion of illuminating shell, see FM 6–40.

b. Illuminating Flares. There are several types of illuminating flares suitable for use by Army aviation. All are of the parachute type. These flares may be fired from a pistol, or they may be released from bomb shackles carried under the wings.

c. Technique of Using Illuminating Flares. The pilot flies as close to the objective area as possible by dead reckoning or pilotage. One or more preliminary flares are used to verify the position and to orient the pilot and observer before beginning the actual mission. To estimate when and where to release the orienting flares, the pilot considers wind velocity and direction, the altitude of the aircraft, and any knowledge of the terrain gained through

prior daylight reconnaissance. Based on observation of the fall of the orienting flares, the pilot corrects his position and then drops the required number of flares in a series at time intervals which will maintain the desired intensity of illumination until the mission is completed. Additional corrections are made during the mission if necessary.

d. Effectiveness of Illuminating Flares. The effectiveness of flares depends upon the type of flare used, the altitude of the aircraft, and the height of the ceiling.

(1) The type of flare to be used is determined by the size of the area to be illuminated and the purpose of the mission.

(2) The altitude at which the aircraft flies depends upon the size of the area to be illuminated and the intensity of illumination desired. A small area or point target can be illuminated and observed best by flying at a low altitude (about 1,000 feet). To obtain illumination over a larger area, aircraft must fly at a higher altitude. On such missions, the rated characteristics of the flare (TM 9–1981) should be considered. The plane should be flown at the least altitude which will assure coverage of the desired area, since the intensity of illumination decreases rapidly as the distance from the area to be illuminated increases.

(3) Atmospheric conditions, including visibility, precipitation, and the height of the ceiling affect the illumination of an area. Best results are obtained when visibility is unlimited, precipitation is zero, and the ceiling is relatively low (2,000 to 4,000 feet).

e. Safety Precautions. The following safety precautions must be observed in using flares:

(1) Fire fighting equipment suitable for use against chemical fires must be readily available.

(2) Flares must be protected against extreme heat or cold and against exposure to the weather.

(3) Flares should not be armed until just prior to take-off.

(4) When flares are fired from a pistol, the pistol should be held in both hands. It is held as far outside the aircraft as possible to reduce the likelihood of sparks from the propellant blowing back into the cockpit. The cartridge case should be extracted immediately after firing and allowed to fall to the ground. In case of a misfire, the pistol must be unloaded outside the aircraft and the entire flare discarded. THE FLARE MUST NOT BE BROUGHT BACK INTO THE AIRCRAFT. A flare dis-

charged inside the cockpit probably would destroy the aircraft.

Section III. AIRBORNE OPERATIONS

128. GENERAL

An airborne operation is one which depends upon air transport as the means of entry into the ground combat area. For a complete discussion of airborne operations and techniques, see FM 71–30, and FM 100–5.

129. TRANSPORTATON OF ARMY AIRCRAFT

a. General. Army aircraft may be flown to the airhead under their own power; they may be towed; or they may be disassembled for transport in cargo aircraft. Aircraft may also be disassembled and brought in later by ground transportation or ships. The method of transportation depends upon the means available, the tactical situation, the distance to be covered, the type of aircraft, and the planned mission of the aviation section.

b. Flight to the Airhead. When the unit airfield is within flight range, or when intermediate air strips are available, Army aircraft may be flown directly to the airhead. This method makes the aircraft available for use in the airhead at the earliest possible time, but it usually requires the aircraft to fly over enemy-held terrain. To obtain maximum protection by friendly tactical aviation while crossing hostile positions, and to avoid flight over enemy antiaircraft positions, a detailed flight plan is prepared and coordinated with the headquarters controlling the entire airborne operation. Such a flight plan specifies the exact route to be followed from the departure airfield to the airhead; it includes altitudes and speeds to be flown over each leg of the trip and the times of departure and arrival for each flight element. The plan may be drawn to list specific times (if they can be determined in advance) or it may be prepared in terms of an H-hour to be announced.

c. Towed Aircraft. Certain types of Army aircraft may be towed to the airhead when the distance is too great to permit flight. This method has the same advantage as that given in *b* above; in addition, the aircraft arrive in the airhead with their fuel tanks full.

d. Transportation by Cargo Aircraft. When the distance involved is such that Army aircraft can neither be flown nor towed, they may be transported by cargo aircraft. This method requires disassembly of the aircraft (app. II). It has the following disadvantages:

(1) Time is lost because the aircraft must be reassembled and flight tested at the airhead before they can be used.

(2) The airborne force is deprived of the use of one cargo aircraft for each Army aircraft transported.

e. Overland or Overwater Transportation. Army aircraft may be disassembled and moved by motor vehicle with the land tail when no other means are available, or when it can be determined that the aircraft will not be needed in the initial phases. In combined airborne-amphibious operations, the aircraft may be transported by ship with the sea tail (par. 137 and app. II). Transportation with the land or sea tail deprives the unit commander of the use of the aircraft until the tail has joined.

130. AIRFIELDS

a. Airfields in the airhead are selected from aerial photographs of the area. Usually, the terrain selected for drop and landing zones is relatively flat and free of obstacles and is suitable for the landing of Army aircraft. If the selected airfields are to be used as landing zones for gliders, arrangements should be made to have the fields cleared as soon as possible after the gliders have landed. The arrival of Army aircraft should be timed so as to insure that the airfield has been cleared of the enemy.

b. At least one aviation mechanic from each unit which is to use the airfield should enter the airhead with the assault echelons to assure proper clearing and marking of the airfield prior to the arrival of the aircraft.

c. In the initial phases of an airborne operation, local security will be a prime consideration in selecting airfield locations.

131. NAVIGATION

It may be necessary to equip Army aircraft with special radio equipment, in order to use the navigational aids established by pathfinder units, or to provide the pathfinder units with radio equipment transmitting signals which can be received by radio equipment normally installed in Army aircraft. Usually, specific terrain objectives can be identified visually by the activity within the airhead. The selected airfield is identified by the panels or other devices displayed by the advance elements of the aviation sections. More reliance may have to be placed on dead reckoning if easily identifiable points on the ground are lacking or widely separated as in barren desert or arctic areas, or in areas covered with heavy jungle growth.

132. MISSIONS

a. While the airborne force is still in the marshalling areas, army aviation is used primarily for liaison and courier missions.

b. During the initial assault, the most important missions of Army aircraft are reconnaissance, surveillance, and the adjustment of artillery fire. Helicopter units increase the flexibility of units in the airhead in the movement of troops and supplies.

c. In accomplishing the ground link-up between the airborne force and the advancing land force, Army aircraft are employed to extend communications, identify units, and generally assist in the coordination and establishment of contact.

133. COMMUNICATIONS

Air-ground radio communications in an airborne operation are no more difficult than in normal operations and should present no special problems. Abnormal damage and loss of equipment should be anticipated and additional equipment brought in to insure keeping the radio nets in action.

134. MAINTENANCE

Aircraft utilized in an airborne operation must be put in the best possible condition prior to the operation since time and facilities for maintenance in the airhead are extremely limited. Within the over-all limitations of the supply load to accompany the assault forces, spare parts and supplies must be provided in quantities which will assure continued operation of the aircraft until the situation permits establishment of adequate supply methods for the force as a whole. Conservation of all parts and supplies, including fuel, is essential.

135. CONTROL

During the initial phases of an airborne attack, unit commanders have the widest possible latitude in the use of their aviation facilities. Higher headquarters rarely attempt to schedule operations within the force as a whole until the situation becomes relatively stable.

Section IV. AMPHIBIOUS OPERATIONS

136. GENERAL

Amphibious operations are those in which personnel and equipment are moved by water transportation to the objective where they debark and land on the hostile shore fully prepared for combat. In the initial stages of an amphibious operation, use of the

aviation section depends upon the situation on the hostile shore, the type of unit and its mission, and the method of transporting the aircraft (par. 137). Detailed discussions of amphibious operations are contained in FM 31–5, FM 100–5, and the FM 60 series.

137. TRANSPORTATION AND LAUNCHING OF AIRCRAFT

a. If the operation plan does not require the use of Army aircraft until suitable airfields have been established ashore, the aircraft may be disassembled and stowed aboard a vessel. To facilitate unloading at the objective area, aircraft may be loaded in trucks (app. II) and reassembled after such trucks have reached the shore. This method has the advantage of keeping personnel and equipment of the section intact until needed. Whether loaded in trucks or stowed in holds, space requirements must be calculated closely, and if at all possible, practice loading exercises conducted to verify space requirements.

b. If the aircraft are required for missions during the initial phases of the operation, the distances involved and the types of vessels and equipment available determine whether the aircraft should be launched directly from a land base or transported part of the way by a vessel which can serve as a floating base.

(1) *Land base.* Army aircraft are dispatched from a land base when there is a friendly airfield near enough to permit them to fly directly to the objective area, execute their missions, and then either return to their original field or be assured of a protected landing in the objective area before their fuel has been exhausted. In this case, aircraft are moved as in any displacement. It is undesirable to attempt to use this method when the overwater distance is more than half the cruising range of the aircraft.

(2) *Floating base.* Army aircraft are dispatched from a floating base when the distance to the objective area exceeds half the cruising radius of the aircraft. In this method, Army aircraft are transported near the hostile shore by surface vessels and launched from them while at sea. Shallow-draft vessels of the LST type may be built up as improvised carriers, (app. II). Use of aircraft carriers to transport and launch Army aircraft is generally impracticable.

138. AIRFIELDS

a. Frequently, the landing beach will provide the best available airfield initially. To avoid congestion at the beach, airfields are

located there temporarily only, and inland airfields are selected as soon as possible.

b. Upon landing, the ground crew moves at once to the airfield previously selected from the map or photograph and begins the organization of the area. When time permits, the suitability of the airfield should be verified by inspection on the ground and the landing area marked (fig. 2) before it is used by the aircraft.

c. As friendly forces move inland, new airfields are selected as described in paragraphs 28 and 29.

139. NAVIGATION

When aircraft are to be flown from nearby land bases to the objective, navigation is difficult because normally it must be by dead reckoning. Pilotage is not feasible unless the course to the objective is marked by readily identifiable islands or a line of ships. Because radio silence is normally imposed during amphibious operations until the assault is begun, radio aids to navigation are not available.

140. MISSIONS

a. In addition to the more common missions of reconnaissance and surveillance, Army aircraft may be employed to direct landing parties, to conduct naval gunfire, and to observe the progress of the landing.

b. Helicopters may also be utilized for supply, evacuation, and for ship-to-shore or ship-to-ship courier missions since very little preparation is required to provide adequate operating areas for them aboard vessels larger than landing craft. Transportation helicopter units may be used to place units of the landing force ashore.

c. Until suitable ground observation posts can be established ashore, Army aviation may furnish a principal means of observation.

141. COMMUNICATIONS

The principal communication difficulties in amphibious operations are those inherent in the heavy radio traffic of a large number of units concentrated in a relatively small area. Except that such congestion is greater in amphibious operations than in normal operations, the problems are no greater. Pilots and observers must be completely briefed on frequencies and call signs, particularly those of naval elements with which they may be working.

142. MAINTENANCE

a. The problems of maintenance and supply begin before the amphibious force embarks. To determine what maintenance will be required during the operation and what supplies can be taken, the following must be considered:

(1) Immediate mission of the aviation section.

(2) Number and type of aircraft required to accomplish the mission.

(3) Location of initial airstrips ashore, and expected time such strips will be available.

(4) Method of transporting aircraft—whether assembled and ready for flight, or disassembled.

(5) Loading plan as it affects the space available for the transportation of aviation section equipment, supplies, and personnel.

b. During the embarkation phase and through the initial assault phases, maintenance problems consist principally of the following:

(1) Disassembly and assembly.

(2) Protection against the corrosive action of salt water and air.

(3) Landing necessary maintenance equipment with aircraft that are landed over the beach.

(4) Insuring that adequate personnel and equipment go ashore to establish the necessary facilities for aircraft that are flown ashore.

c. As the operation progresses, maintenance is affected by the amount of supplies, parts, and equipment which can be brought in. At all times conservation measures must be enforced rigidly.

143. LIFE PRESERVERS

During amphibious operations and at any time when flight over large bodies of water is required, the pilot and observer are required to wear life preserver vests and are required to have one-man life rafts attached to their parachutes. As an additional precaution, boats should be launched to stand by during shipboard take-off and landing operations.

Section V. JUNGLE OPERATIONS

144. GENERAL

Jungle operations are conducted in terrain characterized by dense (almost impassable) vegetation and swamp land. The

climate in jungle areas is usually extremely humid and hot. For a complete discussion of jungle operations, see FM 72–20 and FM 100–5.

145. AIRFIELDS

a. Even though jungle areas are not completely covered with heavy growth, large swamp areas and areas covered by heavy foliage limit the number of sites available for airfields. Because of the scarcity of suitable sites, Army aviation frequently may be forced to establish common airfields or operate from bases constructed in rear areas for high performance aircraft. The construction and development of a complete airfield for Army airplanes in jungle areas often requires considerable time and heavy equipment. Such airfields are difficult to conceal from aerial observation. The helicopter's ability to operate from small areas makes it extremely valuable in jungle operations.

b. To permit operations during the frequent rains, it is generally necessary to surface landing areas for airplanes. Depending on the nature of the soil, surfacing may be accomplished with landing mats, crushed rock, or crushed coral.

c. In areas where rivers and lakes are numerous and of sufficient size, floats may be attached to the aircraft, and waterways used in lieu of airfields.

d. Displacements in the jungle usually are over short distances. Passage is so difficult that the problem confronting the commander is not how far the unit displaces but how long it will take. Unit aviation sections do not displace as frequently as they would in less difficult terrain. This infrequent displacement alleviates, to some extent, the problem posed by the absence of suitable airfield sites.

e. Because characteristics of jungle areas are favorable to the use of infiltration tactics, local security of airfields is of prime importance in considerations of their location and organization.

146. NAVIGATION

Because of the heavy foliage, suitable check points are rare, and navigation by pilotage is exceptionally difficult. The Army aviator and observer must learn to recognize the terrain over which they operate by acquainting themselves with terrain characteristics not ordinarily used for orientation, such as local variations in the color and density of vegetation or differences between the types of vegetation found in various sectors. It is particularly important that they be trained to identify their airfield from all

possible angles of approach, because growth may be so dense that the field will be visible only from directly overhead.

147. MISSIONS

a. The dense growth and often very flat terrain makes ground observation highly inadequate in jungle operations. For this reason, aerial observation may be the primary means of observation for ground units. The survey expedients described in paragraphs 69 through 74 may have to be resorted to frequently.

b. Ground travel may be difficult because of the dense growth and general lack of roads. Therefore, Army aircraft may be employed for troop movements, resupply, evacuation, wire laying, and other transportation missions more often than would be necessary under normal terrain conditions.

c. The thick vegetation often obscures shell bursts, making the conduct of fire difficult. In such cases, the use of white phosphorous smoke shell for adjustment is recommended. The density of the vegetation may also conceal the target from view except from positions directly overhead.

148. COMMUNICATIONS

Radio is the primary means of air-ground communications. The use of panels is difficult because of the lack of cleared areas for displaying them. Aircraft are frequently required to assist in ground communications by laying wire (pars. 97–99) and acting as radio relay stations (par. 96).

149. MAINTENANCE

a. The highly humid climate fosters the rapid formation of fungus growths on all parts of an aircraft. If not checked promptly, these growths can weaken and rot spars and other wooden structural members. Although some of these members are not readily visible, they all must be inspected regularly and closely; any material on which fungus growth is found must be tested for strength to prevent structural failure in flight.

b. The humidity also causes metal parts to rust quickly. A coating of grease will give protection against corrosion, but the grease must be examined regularly and replaced whenever necessary to prevent an excessive adherence of dust particles and consequent wear of the surface.

c. Where airfields have been surfaced with rough materials like crushed rock and coral, tires will wear out quickly.

Section VI. DESERT OPERATIONS

150. GENERAL

a. Deserts are characterized by lack of water, sparse vegetation, large areas of sand, high daytime temperatures, relatively cool nights, and low humidity. The chief problem confronting Army aviation in desert operations is maintenance. For a discussion of desert operations, see FM 31–25 and FM 100–5.

b. Desert areas may be mountainous, and operations in these areas are similar to those in other mountainous areas (pars. 156–161).

151. AIRFIELDS

a. In most desert areas, the sandy or pebbly ground surface permits the selection of airfields almost at will. They may be located in the immediate vicinity of the unit command post when such a location does not jeopardize the security of the command post. In certain desert regions where large boulder-strewn areas are found, a thorough reconnaissance should be made, and the airfield should be marked carefully. Certain hard-packed areas formed by the evaporation of accumulated water will become unusable in the event of rain.

b. Desert terrain provides scant concealment or camouflage for aircraft and equipment. Aircraft can be seen easily by enemy fighters, and evasive action is more difficult because of the lack of protecting terrain features. Improvements to landing fields, which will facilitate location by enemy air observation, should be avoided. Aircraft, vehicles, and equipment must be dispersed widely and their outlines broken by the use of camouflage nets or any other materials which blend with the terrain.

c. Local security of airfields may be a prime consideration in their selection because of the wide deployment of units, open flanks, and active enemy raiding parties.

152. NAVIGATION

Navigation in the desert is complicated by the relatively long distances between installations dispersed for security and by the general scarcity of terrain features or other reference points on the ground. Aviation personnel supplement maps and photographs by their own sketches showing terrain features which they can identify readily. Various shades of sand, the general pattern of sand dunes and drifts, salt or mud flats, and any wreckage or craters should be noted on the sketches. The aircraft compass is used to a great extent.

153. MISSIONS

The missions most frequently assigned to Army aviation in desert operations are the conduct of artillery fire, security surveillance, courier service and to provide contact with and carry supplies for widely dispersed command, reconnaissance, and security groups, thereby decreasing the vulnerability of supply lines.

154. COMMUNICATIONS

The range of radio communication in flat desert areas is appreciably greater than in other types of terrain.

155. MAINTENANCE

a. The chief maintenance problems are caused by sand and dust. Aircraft create large clouds of sand and dust when landing and taking off. Sand and dust are drawn into running engines and act as abrasives on internal parts. Transparent materials are pitted by blowing sand, with a resultant loss of visibility. Sand adheres to lubricated parts and causes excessive wear.

b. To minimize the damage caused by dust and sand, landings and take-offs should be made as near as possible to mooring points to reduce taxiing distances. All openings should be covered as soon as the engine is stopped. Maintenance sites should be selected on the hardest ground available. Engines should not be operated at high speed over loose sand because of the resulting damage to propellers and windshields. For engine tests, run-up stands should be constructed in areas free of sand. If such areas are not available, engines should be tested over pits filled with rocks or over areas covered with tarpaulins. When a marked increase in oil consumption is noted, indicating internal wear of parts, the engine must be changed promptly; otherwise, it will be worn beyond the point of economical repair.

c. Because sudden and violent winds are common in desert regions, aircraft should be moored in chock holes to reduce the angle of attack of the wings. To reduce lift further, spoilers should be placed on the wings (app. IV).

Section VII. MOUNTAIN OPERATIONS

156. GENERAL

a. Mountainous terrain is usually characterized by exaggerated relief, rocky crags, compartmentation, limited communication routes (generally of poor quality), extreme weather conditions,

and high altitudes. For a discussion of mountain operations, see FM 70–10 and FM 100–5.

b. In the mountains, weather is inclement, both in summer and winter, and is subject to large temperature differences between day and night, sudden and localized violent rain and snow storms, and fog. Atmospheric turbulence and strong air currents make flying difficult.

157. AIRFIELDS

a. Mountainous areas provide only limited choice in the selection of airfield sites because of the general lack of clear and level terrain. Fields often must be located at a considerable distance from the unit; this makes both control by the commander and briefing or interrogation of observing teams difficult. In most instances, the scarcity of suitable sites compels the establishment of common airfields.

b. In addition to the difficulties imposed by the broken nature of the terrain, altitude further complicates the problem of airfield site selection. Airfields at high altitudes must be considerably longer than those required for operations at or near sea level (par. 29*f*). The thinner atmosphere also decreases the rate at which the aircraft can climb.

c. Because sites which are suitable for airfields are also suitable for artillery positions, the aviator may face abnormal danger from outbound projectiles in entering and leaving his airfield (par. 21).

158. NAVIGATION

With adequate maps or photographs, navigation by pilotage in the mountains is not difficult except when fog restricts visibility. Occasionally, identification of check points may become a problem when it is necessary to fly circuitous routes to avoid impassable peaks and ranges; the aviator keeps a constant check on his position to avoid wrong identifications. In seeking routes around obstacles, care must be exercised that the aircraft is not flown into a blind compartment from which there is no other exit.

159. MISSIONS

a. Because of the difficulties involved in ground reconnaissance, Army aircraft are used frequently to reconnoiter routes and position areas.

b. Wire-laying missions, within the wire-laying range of the aireraft, are common.

c. Courier and liaison missions may be frequent.

d. Message drop and pickup greatly assist ground communications.

e. Terrain interference with ground-to-ground radio communication may often require the use of Army aircraft as radio relay stations (par. 96).

f. Special missions, especially by helicopter units, may often be necessary to and from points inaccessible to ground transportation.

g. Cargo helicopters greatly increase the mobility of troops in mountainous areas.

160. COMMUNICATIONS

a. Radio communication may be difficult because of intervening ground forms. To maintain communication with the unit, aircraft may have to remain in the vicinity of the unit, or additional aircraft may have to be employed as radio relay stations.

b. Because the unit airfield may be a considerable distance from the unit, it is particularly important that wire communication be established with the command post to facilitate briefing and interrogation of aviation personnel.

161. MAINTENANCE

a. The altitudes involved in mountain flying generally compel aircraft to climb and cruise at full throttle and in low temperatures. The result of this strain on the engine is the gumming and sticking of exhaust valves and a general loss of engine efficiency.

b. Frequently, routes of communication are such that supply is extremely limited. Major maintenance may have to be accomplished at bases in the rear areas where the necessary parts and equipment are available.

Section VIII. OPERATIONS IN SNOW AND EXTREME COLD

162. GENERAL

For a discussion of operations in snow and extreme cold, see FM 31–70, FM 70–15, and FM 100–5.

163. AIRFIELDS

a. The preparation of airfields depends upon the conditions encountered. In deep snow, the surface must be smoothed and packed by the use of a drag or by driving heavy vehicles over it. With a small amount of pioneer work, hard wind-packed areas can be

made usable for aircraft equipped with skis. Frozen lakes and rivers make excellent airfields for helicopters and for airplanes equipped with skis.

d. Deep, soft snow presents difficulties in the landing and take-off of airplanes, even when they are equipped with skis. The deeper a ski sinks into the snow, the longer will be the ground run required to take off.

c. Airplanes equipped with conventional three-point landing gear generally operate more satisfactorily on skis than those equipped with tricycle gear. In the latter case, the nose of the ski tends to dig into the snow.

164. NAVIGATION

a. Although adequate maps of certain parts of Canada and Alaska (particularly along airways) are available, most parts of the arctic regions are not mapped. If they can be identified properly, the lakes which abound in many arctic regions may make pilotage feasible. In some regions, accurate identification of lakes may become extremely difficult, especially in the spring when thaws temporarily multiply the number of lakes in the area.

b. The magnetic compass is often unreliable because of magnetic disturbances in the arctic regions. This fact, together with the lack of maps in most areas, requires special navigational aids. For relatively close-in operations, a ground radar set with standard radio equipment may be used to provide a homing device for aircraft. A standard portable radio beam or broadcasting station, in conjunction with directional antennas on the aircraft, can also provide a reliable homing device. When the situation precludes the use of radio, it is necessary for the pilot to provide himself with photographs or sketches of the area in which he is operating, showing prominent terrain features, and to navigate primarily by pilotage.

165. MISSIONS

a. On observation missions, detection of movement is possible at long ranges because of the long shadows cast in daylight. Tracks created by enemy movement can be detected except when obscured by drifting snow. Vapor clouds which form over vehicles, troops, and firing weapons are plainly visible. When the enemy is dug in or in bivouac, he may be concealed quickly by snow.

b. The conduct of artillery fire may be difficult because shells, even with superquick fuzes, tend to bury themselves in deep snow which smothers the burst. The use of colored smoke shell during adjustment often offers a solution in such circumstances.

c. Since the white snow offers a good background for the observation of activity and installations not adequately camouflaged, most observation missions can be performed effectively at night with a minimum of light such as twilight.

d. Army aircraft can assist in many tasks rendered difficult for ground troops because of the difficulty of overland passage, such as wire laying, transportation of personnel, supply, and evacuation. Helicopter units can maintain contact with units which could not be supported by surface transportation.

e. Army aircraft also offer a satisfactory means of flank reconnaissance and early detection of threats.

166. COMMUNICATIONS

a. Radio communications are sometimes made difficult because of electrical disturbances (aurora) in the artic regions which completely block out radio traffic. However, such disturbances are temporary, and radio communication is generally good. Homing devices (par. 164) will rarely be rendered ineffective. The extremely low temperatures adversely affect batteries. Generating equipment must be kept in excellent condition. Prewarming of batteries increases their output.

b. All other means of communication can be employed without difficulty. Army aircraft are particularly useful in the pickup and delivery of messages.

167. MAINTENANCE

a. The problems of maintenance stem directly from the low temperatures. Special precautions and equipment are necessary to insure efficient operation of the aircraft. Shelter must be provided for personnel performing maintenance.

b. Engines should not be started at temperatures of 20°F. and below without use of an electrical power unit for assistance in starting. A source of external heat for application against engine accessory case, carburetor induction system, oil sump and battery will insure easier starting. Standard portable combustion type heater incorporating a blower and flexible hoses for application of heat to localized areas may be used for preheat of aircraft areas for starting. In addition to preheating engines for starting, these units may also be employed to heat specific portions of the aircraft so that maintenance personnel can work without gloves. When temperatures are habitually below +10°F., aircraft batteries when not in use, should be removed and stored in a warm place to maintain their charge.

c. Thickening of oils at low temperatures presents problems in operation and starting. An aid in extreme cold is the installation of standard winterization equipment which includes baffles on oil coolers to maintain proper temperatures. Oil dilution units may also be installed, although it is normally satisfactory to drain the oil from engines at the end of the day's operations and to heat it prior to replacing it in the engine. When stopping the engine of an aircraft equipped with a controllable pitch propeller actuated by engine oil pressure, the propeller pitch control should be set in the high pitch control (low rpm) position to drain engine oil from pitch change actuating mechanism and prevent its congealing.

d. Carburetor heat is used generally during operation and flight operation to raise air inlet temperature of carburetor thereby increasing rate of fuel evaporization and minimizing the possibility of carburetor ice which may result in engine roughness, loss of power, and under severe icing conditions, of complete power failure. Carburetor heat should be used judiciously, within the operating limitations of the applicable operating instructions handbook of the particular aircraft type.

e. Frost and ice covering on wing surfaces destroys aerodynamic efficiency of aircraft; takeoff should not be attempted under any condition until frost and ice covering are removed.

f. Wheels should be kept on dry surfaces or on blocks to prevent them from freezing to the ground.

g. Mooring of aircraft is made relatively simple in regions of extreme cold by the expedient of placing one end of the rope on the ground, covering it with snow, wetting the snow and allowing it to freeze fast.

Section IX. OPERATIONS AGAINST GUERILLA FORCES

168. GENERAL

For a detailed discussion of operations against guerilla forces, see FM 31–20 and FM 100–5.

169. MISSIONS

In operations against guerilla forces, Army aviation performs the same missions as in other offensive operations. However, because of the infiltration of enemy units and their operations within areas held by our forces, the importance of certain types of missions may increase.

a. Security reconnaissance missions may be as necessary in rear areas as they are to the front and flanks.

b. Route reconnaissance for columns moving in rear areas may be required.

c. Commanders and liaison officers may be more dependent on air transportation between units than in normal offensive operations.

d. Transportation missions such as supply and evacuation may be more frequent than normal. Helicopter units may be used to transport units countering the operations of enemy units behind friendly lines.

170. AIRFIELDS

The operations of guerilla forces seriously increase the problems of local security of airfields. Aviation sections will require augmentation if the airfield is distant from the perimeter defense of their units. Airfields should be included within the local defense of their own or other units whenever possible. The use of common airfields may be required for defense purposes. Aircraft may operate from air strips in the vicinity of the unit command post during daylight and move to the rear to a common airfield at night.

171. COMMUNICATIONS

Since guerilla forces will usually cut any wire which they encounter, good radio communication between airfields and command posts is essential.

172. PRECAUTIONS

All aviation section and other personnel should constantly be on the alert for devices constructed by guerilla forces to wreck low-flying or landing aircraft, for example, wire stretched between trees.

Section X. OPERATIONS IN SUPPORT OF GUERILLA FORCES

173. GENERAL

For a discussion of operations in support of guerilla forces, see FM 31–21 and FM 100–5.

174. MISSIONS

a. For operations in support of guerilla forces, the flight characteristics and inconspicuous size of Army aircraft make them suitable for use on a wide variety of missions, including the following:

(1) Carrying messages and other written material back and forth between friendly troops and individuals working for friendly forces inside the enemy's lines.

(2) Transporting individuals across the lines.

(3) Transporting limited amounts of supplies and equipment to forces working inside the enemy's lines. Such supplies can be dropped (par. 92), or the aircraft can be landed and unloaded.

(4) Evacuation of casualties from within enemy lines.

b. When circumstances permit utilization of aircraft by the guerilla forces themselves, the short landing field requirements of Army aircraft favors their use for the transportation of personnel to disrupt enemy lines of communication, to execute demolitions, and generally to harass the enemy.

175. PRECAUTIONS

The following principles must be observed in utilizing Army aircraft in any guerilla activities.

a. The pilot of the aircraft must be thoroughly briefed as to the location of the airfield or other area in which he will land. He must be completely informed of the location of all known enemy installations and positions near which he may have to pass.

b. A system of prearranged messages for communication with the guerillas on each specific mission must be established whenever practicable to provide maximum security in communication.

c. Arrangements must be made to identify the airfield to the pilot to eliminate landing in the wrong area. In addition, the airfield should be marked to indicate its usable limits and the wind direction (fig. 2) so that the pilot may land without circling the field or otherwise revealing its location to possible enemy observers.

d. Any airfield selected must be as distant from enemy forces as the situation will permit.

e. Because of the likelihood that the enemy will discover the location of the airfield despite all efforts to conceal it, the field must be changed frequently. If there is any possibility that the enemy has learned even the approximate location of the field, it should not be used again.

f. Identification signals must be used both by the pilot and personnel on the ground for their mutual protection.

g. Friendly units along the flight path must be informed of the proposed aircraft passage so that they will not fire upon it.

h. Whenever possible, flights across the lines should be made under cover of darkness. If the aircraft is suitably camouflaged with dark paint, it will be almost impossible for the enemy to observe it except by electronic means. Missions which cannot be completed in one night should not be undertaken unless the situation indicates that the aircraft can remain safely on the ground in enemy territory during the following day and return to the friendly lines the next night.

176. FLIGHT PATHS AND ALTITUDES

a. For night operations, the aircraft should be flown at the highest practicable altitude to lessen the possibility of its being detected by sound. Noise can be eliminated further by cruising at minimum throttle. When over the proposed landing site, and still at high altitude, the throttle should be cut for a glide toward the earth without power. If the dimensions of the field permit, the landing should be completed from the power-off glide.

b. If the mission must be flown during daylight, it can be flown most safely at minimum altitude—only high enough to clear obstacles on the flight path. The aircraft should be flown below tree-top level, along stream lines, in ravines, or wherever concealment from ground observation can be obtained. Operation at minimum altitude also offers maximum protection against observation by hostile fighter aircraft.

c. Whether flying during daylight or darkness, the flight path should be circuitous. A flight path direct to the field of intended landing, or to the area where supplies are to be dropped, is dangerous. Not only can the enemy locate the airfield in such a case, but he can also alert his units along the flight path to take the aircraft under fire on the return trip.

CHAPTER 7
COMMUNICATIONS

Section I. RADIO

177. RADIO NETS

a. All Army aircraft organic to units of the ground arms should have access to some agency which can provide artillery fire against targets of opportunity. Artillery aircraft should be able to communicate not only with their parent unit for fire but also with the next higher artillery headquarters.

b. Radio communication must be available between the unit command post and the unit airfield.

c. Because adequate warning of the approach of hostile aircraft is vital for the protection of aircraft in flight and for the security of the airfield, the airfield must have a radio receiver to receive warnings transmitted over the AAAIS net (pars. 186–188).

d. Radio equipment issued to utility helicopter units provides for the radio control of the aircraft within limited range. Units to which utility helicopter units are attached must furnish the necessary equipment for ground communications.

178. FLEXIBILITY

a. General. Flexibility of radio communication is essential, particularly for the conduct of fire. Army air observers may be called upon to observe fires involving units other than their parent units. Without some common fire direction channel, the conduct of the mission would be retarded while the traffic was relayed through other channels and would interfere with the normal traffic of these channels.

b. Division Artillery.

(1) Aircraft of divisional artillery battalions normally operate on two channels.

(*a*) On one channel, they operate in the battalion command net (FM) (infantry and airborne division artillery) or the battalion fire direction net (armored division artillery). Thus, they can conduct the fire of any battery in the battalion or of the battalion as a whole using direct communication.

(*b*) On the second channel, they operate in the division artillery fire direction net. This furnishes them with direct communications to fire any battalion in the division artillery.

(2) Aircraft of division artillery headquarters normally operate in the division artillery fire direction net on one channel and in the corps artillery command net (FM) on the other. They are thus capable of firing any battalion in corps artillery with a minimum of relay.

c. Other Divisional Aircraft. Aircraft in the division other than those of the artillery should operate in the division artillery fire direction net on one channel to have access to fire when needed. If these aircraft are equipped with radio sets which cannot be netted with those of artillery units, suitable sets should be provided at one or more of the artillery units. Other channels available on the aircraft radio are utilized as dictated by the situation and the aircraft's mission.

Section II. WIRE

179. GENERAL

a. Normally, wire is the primary means of communication between the unit command post and the airfield. The unit communication officer installs this line. Wire is laid to a point specified by the unit aviation officer. However, because the unit aviation officer may not always have time to fix the position of his operations center in advance, all personnel in the aviation section should be capable of extending or moving wire communication about the airfield.

180. COMMON AIRFIELD

In the operation of common airfields, it may be advantageous to install circuits between the operations center of the airfield and the various aviation sections using the field. The unit commander responsible for the operation of the field normally provides the additional personnel and equipment necessary to install these circuits. Personnel of the various sections should be made available to assist in the installation and maintenance of the wire.

Section III. VISUAL

181. GENERAL

Communication between aircraft in flight and agencies on the

ground normally will be by radio. When radio cannot be used, communication may be accomplished by visual means, utilizing pyrotechnics, panels, arm and body signals, and aircraft maneuvers.

182. METHODS

a. Visual signals are usually prearranged to suit the immediate needs of the situation and to utilize materials or equipment available for their transmission.

b. Transmissions which cannot be prearranged can be made by the use of panels as prescribed in ACP 129 series. When standard panel sets are not available, they can be improvised from any available material which offers good contrast with the background.

c. For emergency signaling between personnel on the ground and aircraft aloft, standard prearranged visual signals have been adopted (app. III). These signals are so numerous that it may not be possible for all personnel to memorize them. To insure mutual understanding in an emergency situation, a copy of these signals should be stenciled on a prominent part of the fuselage of each aircraft and affixed to each parachute. If aviators observe friendly personnel obviously in distress, they may drop a message containing instructions on the use of the signals to facilitate rescue operations.

183. SECURITY

The pilot of aircraft engaged in visual communication with the ground must exercise care to avoid revealing the location of the ground station to enemy observation by his flight pattern and answering maneuvers. He should vary his flight path to receive signals from the ground without circling over the station. His reply maneuvers should be made from different positions visible to the ground station.

Section IV. MESSAGE DROP AND PICKUP

184. GENERAL

When other means of communications cannot be used, or when the tactical situation or terrain conditions prevent landing, written messages can be exchanged between aircraft and the ground by a system of message drop and pickup. This system is described in FM 24–17.

185. SECURITY

a. It is essential that the personnel in the aircraft be certain of the identity of the ground personnel to whom a message is to be dropped, particularly in areas where infiltration by the enemy is likely. The ground station should be required to display panels or similar prearranged identification to indicate that the message may be dropped with safety.

b. Helicopters normally can land in the vicinity of command posts and message centers to accomplish the transfer of messages. A limitation is imposed when such activity would reveal the location of these installations to hostile observation.

Section V. AIR WARNING

186. GENERAL

Prompt warning of hostile air activity is essential to the security of Army aircraft. The principal agency furnishing air warning is the antiaircraft artillery intelligence service. In addition, each unit employing Army aviation normally establishes its own supplementary system of air warning to cover local sightings.

187. ANTIAIRCRAFT ARTILLERY INTELLIGENCE SERVICE (AAAIS)

a. The observation facilities of all antiaircraft artillery units operating within a corps area are coordinated. Their activities are supervised by the antiaircraft operations center (AAOC). It receives information or intelligence from three primary sources—

(1) Ground observation posts, including the eight three-man observation post teams provided in the organic antiaircraft battalion of each division.

(2) Radar observation available through the facilities of antiaircraft units operating in the area.

(3) Higher echelons, such as elements of the aircraft warning service (AWS)—a long-range, Air Force warning system.

b. All ground observation posts operating under a single AAOC utilize a common radio frequency (AAAIS net) to report their observations. Interested elements in the corps are equipped with radio receivers which can monitor all transmissions over this net. They can thus obtain prompt warning of the approach of hostile aircraft by hearing the initial report transmitted from the ground observation post to the AAOC. When the AAOC receives warnings

from agencies other than its own ground observation posts, it transmits such warnings over the AAAIS net to alert all stations.

c. All Army airfields must be equipped with radio receiver sets on the AAAIS frequency. These receivers must be monitored at all times. When a warning is received, personnel at the airfield immediately relay the warning to the aircraft in flight. It is relayed over the radio net in which the aircraft are operating. This warning has priority over any other traffic.

188. UNIT AIR WARNING

To supplement the AAAIS air warning system, units employing Army aircraft utilize their own observation posts and communications for local air warning purposes. The precise method will vary with the type of unit and its communications. It is usually prescribed by standing operating procedures to insure thorough training and familiarity with the most expeditious routing of the warnings from the observer to the aviation section.

CHAPTER 8
SUPPLY AND MAINTENANCE

Section I. SUPPLY

189. GENERAL

a. The procurement of Army aviation equipment and supplies is a responsibility of the unit commander. Equipment and supplies are procured through normal supply channels.

b. The unit aviation officer makes his needs known to the unit commander through the S4 (G4) or other supply agency.

190. SUPPLY ECONOMY

The exercise of supply economy is a command responsibility. The maximum life must be obtained from each item, and the maximum use must be made of salvage. As applied to the unit aviation section, supply economy includes conservation, maintenance, safeguarding, recovery, repair, and salvage of Army aviation equipment and supplies. Accumulation of excess supplies must be avoided to prevent waste and to retain the mobility of the aviation section.

Section II. MAINTENANCE

191. GENERAL

The unit aviation officer is responsible to his commander for the maintenance and operation of the aircraft, vehicles, and other equipment of the aviation section. He must insure that prescribed standards of maintenance are maintained. His supervision includes the direction, inspection, and correction if necessary, of the personnel charged with the operation and maintenance of aircraft. AR 750–5 designates certain responsibilities and prescribes general policies and limitations pertaining to the maintenance of equipment.

192. MAINTENANCE SYSTEM

a. Categories of Maintenance. Maintenance operations are divided into three broad categories as follows:

"(1) *Organizational maintenance* is that maintenance authorized for, performed by, and the responsibility of, a using organization on its own equipment. This maintenance consists normally of inspecting, cleaning, servicing, preserving, lubricating and adjusting as required and also may consist of minor parts replacement not requiring highly technical skills.

"(2) *Field maintenance* is that maintenance authorized and performed by designated maintenance activities in direct support of (a) using organization(s). This category normally will be limited to maintenance consisting of replacement of unserviceable parts, subassemblies, or assemblies.

"(3) *Depot maintenance* is that maintenance required for the repair of matériel which requires a major overhaul or complete rebuild of parts, subassemblies, assemblies and/or end item as required. Such maintenance is intended to augment stocks of serviceable equipment or to support lower levels of maintenance by use of more extensive shop equipment and personnel of higher technical skill than are available in organizational or field maintenance activities. The Department of the Air Force is responsible for depot maintenance on Army aircraft and allied equipment."

b. Echelons of Maintenance. For the purpose of providing flexibility, the categories of maintenance are further subdivided to provide five echelons of maintenance. Repairs are performed in the lowest echelon of maintenance consistent with the nature of the repair, authorized spare parts, tools, time available, capabilities of personnel, and the tactical situation. No echelon of maintenance performs the work of a higher echelon at the expense of its assigned functions (AR 750–5). The normal relationship between the categories and echelons of maintenance is as follows:

(1) Organizational maintenance: first and second echelons.

(2) Field maintenance: third and fourth echelons.

(3) Depot maintenance: fifth echelon.

193. AIRCRAFT TECHNICAL INSPECTIONS

The unit commander is responsible that aircraft technical inspections are performed. Technical and periodic inspections, and the maintenance of related forms and records, are guided by Department of the Air Force technical orders or by appropriate

Department of the Army directives applicable to current types of Army aircraft.

194. TECHNICAL PUBLICATIONS

Basic technical publications on aircraft operations and maintenance, supply catalogs and other technical publications of a general nature are published by both the Department of the Army and the Department of the Air Force. Air Force technical orders applicable to the operation and maintenance of Army aircraft are listed in Department of the Army publications.

CHAPTER 9
TRAINING

Section I. TRAINING OF AVIATORS

195. GENERAL

a. A high degree of skill is required of the Army aviator to operate in and out of areas of reduced size, off roads and unimproved fields, and in cross winds. This skill can be maintained only through constant practice. Through his training at aviation schools, the newly rated aviator will be able to operate Army aircraft in accordance with the techniques required for proper military operation. He can retain this ability only if he participates in a regular training program after he joins his unit.

b. The preparation and execution of training programs for aviators must be supervised actively by the commander. It may be desirable to centralize the individual training of aviators in headquarters above the unit level to conserve on training areas and to achieve standardization. Integration of the individual aviator with the remainder of the section and his unit can be accomplished only by tactical training at the unit level.

c. Training of the aviators should be coordinated with the various phases of the unit's over-all training program. As the unit undergoes the individual training phase, the aviator should undergo his. When the unit enters the tactical phase, the aviation section should be integrated with the remainder of the unit.

196. INDIVIDUAL TRAINING

The individual training of an aviator includes—

a. Basic Flight Maneuvers. To retain the "feel" of the aircraft and the necessary habits of nervomuscular coordination in the control of the aircraft, the aviator requires continuous practice in take-offs and landings, level turns, climbing and diving turns, slips, spins, stalls, and similar exercises.

b. Special Flight Maneuvers. These maneuvers include precision take-offs and landings between panels, over barriers, in short fields, on roads, and in cross winds. This will maintain the aviator's sense of speed, wind effect, and judgment. Such training

prepares him to operate instinctively under the terrain conditions which he might encounter when operating with his unit in a combat area.

c. Extended Cross-Country Flights. This training is particularly important for those aviators assigned to units which require flights of relatively long distances. They are essential to the maintenance of the aviator's ability to navigate his aircraft over unfamiliar terrain.

d. Night Flying. For a discussion of night flying, see paragraphs 122 to 127, inclusive.

e. Meteorology. The Army aviator must have a working knowledge of weather as it affects the operation of his aircraft.

f. Maintenance. The aviator must be able to supervise the maintenance performed by the enlisted members of the section. In case he has to make a forced landing, he must be competent to make emergency repairs on his aircraft.

g. Adminstration. The aviator must be qualified in the administration of the air section to include maintenance of forms and records and a knowledge of supply procedures.

197. TACTICAL TRAINING

The purpose of tactical training is to qualify the aviator to employ the aviation section as an integral part of the unit. The following items should be included in tactical training programs for aviators. Training should include participation in the unit maneuvers and field exercises.

a. Missions—various types of missions the aviation section may be required to perform (pars. 37–99).

b. Operations—employment of the section under various conditions of terrain and weather and in various tactical situations (pars. 100–176).

c. Displacements—displacement of the aviation section (pars. 27–36).

198. OTHER TRAINING

In addition to the training necessary for the efficient performance of his aviation duties, the aviator should undergo training to maintain proficiency in his basic branch of service (par. 4*d*).

Section II. TRAINING OF ENLISTED PERSONNEL

199. GENERAL

a. The commander of the headquarters company or battery is

responsible for the training of enlisted members of the aviation section in the school of the soldier and similar basic subjects.

b. The unit aviation officer is responsible for training the enlisted men of the aviation section in specialized subjects relating to their duties within the section. He prepares detailed training schedules, in consultation with the operations and training officer, to insure that the section's training keeps step with the training phases and objectives of the unit as a whole. He may conduct the instruction himself, or he may arrange that some portions of the instruction be given by other qualified specialists. When the individual training phase has been completed, he insures that the section is included in the unit's tactical training programs and personally supervises the welding of his section into a team which will meet the unit's aviation needs.

200. INDIVIDUAL TRAINING

The training necessary to qualify the individual enlisted men to perform their duties as members of the aviation section is conducted concurrently with the individual training of the aviators. It includes—

a. Ground handling of aircraft, including taxiing and mooring (app. IV).

b. Communications, covering the facilities available to the section. Usually, this training can be given most effectively in a unit school conducted under the supervision of the communication officer.

c. Maintenance and servicing of the aircraft and other section equipment (AR 750–5 and other applicable Army and Air Force publications).

d. Airfield selection, development, and organization (pars. 27–36).

e. Security measures (pars. 34–36).

f. Loading of aircraft for air, rail, truck, and water transportation (app. II).

g. Forms and records, including maintenance of aircraft forms and records and use of pertinent reference publications, such as Air Force technical orders.

Section III. TRAINING OF OBSERVERS

201. PERSONNEL TO BE TRAINED

a. On any mission involving scrutiny of the ground and, at the same time, alertness to enemy action either in the form of hostile

aircraft or ground fire, it is essential to provide an observer to assist the aviator. The aviator can then devote his attention to flying and protecting the aircraft, while the observer devotes his entire attention to carrying out the mission.

b. Personnel selected for observer duties must be thoroughly proficient in the techniques and tactical employment principles of their basic branch. They must know the capabilities and limitations of the unit on the ground to appreciate its problems and meet its requirements adequately.

c. It is as advantageous to qualify an officer as an aerial observer as it is to qualify him as a ground observer. The semipermanent assignment of observers is preferable to frequent rotation of various officers to this duty (par. 4*g*). To provide a pool of trained observers, it is advisable to train as many officers of the unit as possible. To maintain their proficiency, they should be given frequent opportunities to observe from the air.

d. It is particularly important that the unit commander and any of his staff officers who may conduct reconnaissance or assist in the control of the unit while it is on the march be trained in aerial observation.

202. NECESSITY FOR TRAINING

The contrast between conditions surrounding the air observer and those affecting the ground observer indicates the need for thorough specialized training.

a. From his fixed position, the ground observer experiences little difficulty in orienting himself and in maintaining his orientation. The aerial observer, on the other hand, must learn to adapt himself to a constantly changing position. He must learn how to orient himself without delay, and how to remain oriented regardless of the changes in his position.

b. Because his position is fixed, the ground observer can study objects at length by means of optical instruments. When an aerial observer uses field glasses, he must cope with the vibration of the aircraft and the problem of remaining oriented while his vision is narrowed down to the objective field of the glasses. To reduce these problems to a minimum, he must learn to search an area without the aid of instruments and to detect objects or activities deserving closer observation.

c. An inexperienced observer can estimate distances more easily from the ground than from the air. He is used to the ground view and he can make his estimates from a fixed position. The aerial observer must accustom himself to an unfamiliar vertical view and

must consider the movement of his position when he makes his estimates.

d. In addition to the changes in estimating distances described in *c* above, the dissimilarity between the aerial view and the ground view requires the development of a new conception of ground forms for effective terrain analysis from vertical and near-vertical positions.

203. SCOPE OF TRAINING

The training of aerial observers is divided into two aspects—ground training and air training. Ground school subjects will be completed prior to beginning flight subjects.

a. Ground training includes—

(1) Nomenclature, characteristics, functioning, and ground handling of the aircraft in which the observer will work.

(2) Cockpit procedure and safety precautions in entering and leaving the aircraft.

(3) Training in the use of maps, photographs, and navigational charts.

(4) Conduct of fire of all indirect fire weapons.

(5) Study of friendly and enemy weapons, vehicles, and tactics to permit instant recognition and to facilitate analysis of what is seen from the air.

(6) Radio operation and procedure.

b. Air training includes—

(1) Orientation flights to accustom the observer to the movements of the aircraft in flight, and to enable him to keep his sense of direction throughout all maneuvers.

(2) Comparison of terrain features with maps and photographs of the area.

(3) Practice in estimating distances from various altitudes.

(4) Practice in designating locations by means of coordinates.

(5) Practice in route and position reconnaissance.

(6) Adjustment of fire of all indirect fire weapons.

(7) Frequent exercises as an "enemy" observer during unit maneuver to gain experience in observing movements, positions, matériel, and gun flashes.

(8) Extended navigational flights to develop further the ability to remain oriented over unfamiliar terrain and to accustom the observer to new values of time and space factors.

(9) Training of the pilot and the observer as a team. The noise during flight makes conversation between the two difficult. Both must be able to anticipate the needs of the other and to function as a team with a minimum of conversation.

APPENDIX I
REFERENCES

Section I. DEPARTMENT OF THE ARMY AND JOINT PUBLICATIONS

See SR 310–20 series, *Military Publications,* SR 110–1–1, *Index of Army Motion Pictures and Film Strips,* and FM 21–8, *Military Training Aids,* for full list of references.

AR 95 series	Flying.
AR 750–5	Maintenance Responsibilities and Shop Operations.
AR 700–50	Army Aircraft and Allied Equipment.
AR 750–11	Responsibilities of the Department of the Air Force and the Department of the Army.
SR 95 series	Flying.
SR 320–5–1	Dictionary of United States Army Terms.
SR 320–50–1	Authorized Abbreviations.
SR 710–45–50	Monthly Army Aircraft Inventory, Status and Flying Time Report (Reports Control Symbol AF–SC–A74).
SR 700–50–5	Assignment of Certain Responsibilities to the Heads of Technical Services for Items of Air Force Supply.
SR 750–95–20	Repair Allowances and Disposition of Army Aircraft.
SR 700–45–5	Unsatisfactory Equipment Report.
FM 5–10	Routes of Communication.
FM 5–15	Field Fortifications.
FM 5–20	Camouflage, Basic Principles.
FM 5–20E	Camouflage of Aircraft on the Ground, and Airdromes.
FM 6–20	Field Artillery Tactics and Techniques.
FM 6–40	Field Artillery Gunnery.
FM 6–101	Tactics and Technique Battalion and Battery Motorized.

FM–6–130	Field Artillery Intelligence.
FM 6–135	Adjustment of Artillery Fire by the Combat Soldier.
FM 7–40	Rifle Regiment, Airborne.
FM 11–22	Signal Operations in the Corps and Army.
FM 11–25	Aircraft Warning Service.
FM 17–100	Armored Division and Combat Command.
FM 21–25	Elementary Map and Aerial Photograph Reading.
FM 21–26	Advanced Map and Aerial Photograph Reading.
FM 21–30	Conventional Signs, Military Symbols and Abbreviations.
FM 24–17	Communication Center Operation.
FM 24–18	Field Radio Techniques.
FM 24–20	Field Wire Technique.
FM 30–10	Military Intelligence—Observation.
FM 30–21	Aerial Photography Military Applications.
FM 31–5	Landing Operations on Hostile Shores.
FM 31–20	Operations Against Guerilla Forces.
FM 31–21	Conduct of Guerilla Warfare.
FM 31–25	Desert Operations.
FM 31–35	Air-Ground Operations.
FM 31–40	Supply by Air in Combat Operations.
FM 31–70	Basic Arctic Manual.
FM 60 series	Amphibious Operations.
FM 70–10	Mountain Operations.
FM 70–15	Operations in Snow and Extreme Cold.
FM 57–20	Airborne Techniques for Divisional Units.
FM 57–30	Airborne Operations.
FM 72–20	Jungle Warfare.
FM 100–5	Field Service Regulations—Operations.
FM 101–5	Staff Organization and Procedure.
TM 5–240	Aerial Phototopography.
TM 5–255	Aviation Engineers.
TM 5–267	Camouflage.
TM 5–316	Airplane Crash Fire Fighting.

TM 9–1981	Military Pyrotechnics.
TM 11–619	Radio Set, SCR–619.
TM 11–2240	Wire Dispenser, MX–306/G.
TM 11–2324	Fundamentals of Photography.
TM 11–2325	Specialized Photography.
TM 71–210	Air Transport of Troops and Equipment.
PAM 11–7	Ground/Air Emergency Code.
JAAFAR 5–10–1	Employment of Aircraft for Performance of Certain Missions.
JANAP 121(A)	Joint Communication Instructions Part I—General.
JANAP 122(A)	Joint Communication Instructions Part II—Security.
JANAP 123(A)	Joint Communication Instructions Part III—General Procedures.
JANAP 131(A)	Joint Communication Instructions Appendix I—Joint Operating Signals.
ACP 124	Communication Instructions—Radio Telegraph Procedure.
ACP 125	Communication Instructions—Radiotelephone (R/T) Procedure.
ACP 129	Communication Instructions—Visual Signaling (V/S) Procedure.
ACP 166	Voice Procedure for Ground Controlled Approach.

Section II. DEPARTMENT OF THE AIR FORCE PUBLICATIONS

See Circular 34, 1951, for supply information.

TO 00–1–1	Numerical Index of Technical Publications.
TO 00–5–1	Explanation of Technical Order and Stock List System.
TO 00–20A–1	Aircraft Inspection System.
TO 00–60 series	Arctic, Desert, and Tropic Publications.
TO 01–1–1	Cleaning of Aeronautical Equipment.
TO 01–1–2	Corrosion Treatment for Aircraft.
TO 01–1–7	Storage for Aircraft.
TO 01–1–50	Ground Handling of Aircraft.

TO 01 series for Specific Aircraft:

TO 01–*	–01 List of Applicable Publications.
TO 01–*	–1 Flight Operation Instructions.
TO 01–*	–2 Erection and Maintenance Instructions.
TO 01–*	–3 Structural Repair Instructions.
TO 01–*	–4 Parts Catalog.
TO 01–*	–** All other technical orders pertinent to aircraft with which the unit is equipped.

* Group title number.

**Subject title number.

TO 16 series. Communication Publications (Applicable to Radio).

APPENDIX II

METHODS OF LOADING AND TRANSPORTING ARMY AIRCRAFT

1. GENERAL

The method employed in loading Army aircraft for transportation by motor vehicle, railroad, air, or surface ship is determined by the type of movement (administrative or tactical), distance involved, transportation space allotted, weight, and the anticipated mission of the aviation section upon arrival at the destination. For example, it is normally preferable to disassemble and crate aircraft for shipment by water over long distances. In the case of amphibious operations, however, (or in any case where the aircraft is to be used immediately upon arrival at the destination), loading with a minimum amount of disassembly is desired. For full information on packing, crating, disassembly, and assembly, see Air Force technical orders pertaining to the particular aircraft.

2. LOADING ON MOTOR VEHICLES

a. Airplanes. An airplane may be transported by motor vehicle (2½ truck or larger); it is disassembled and loaded headfirst, as illustrated in figure 9. The wings, struts, propeller, landing gear, and horizontal tail surfaces are removed. Wings are placed in jigs and attached to the sides of the vehicle; all other removed parts are placed in the cockpit or secured to the bed of the vehicle. Parts in the cockpit are padded and lashed to prevent damage. The fuselage is placed in the center of the vehicle bed and supported by a number of jigs sufficient to prevent damage.

b. Helicopters. Because they are relatively narrow, some helicopters can be loaded into vehicles without disassembly. The aircraft should be loaded into the vehicle headfirst. It should be loaded either by means of a hoist applied at the mast, or over a ramp. The main rotor blades should be secured fore and aft. The wheels should be chocked, and the entire fuselage secured against movement. For larger helicopters, or for movement over long distances, the rotor blades should be removed. They should be placed in a padded blade rack lashed to the side of the vehicle or in a box (par. 3*b*) which can be fastened to the floor of the truck bed.

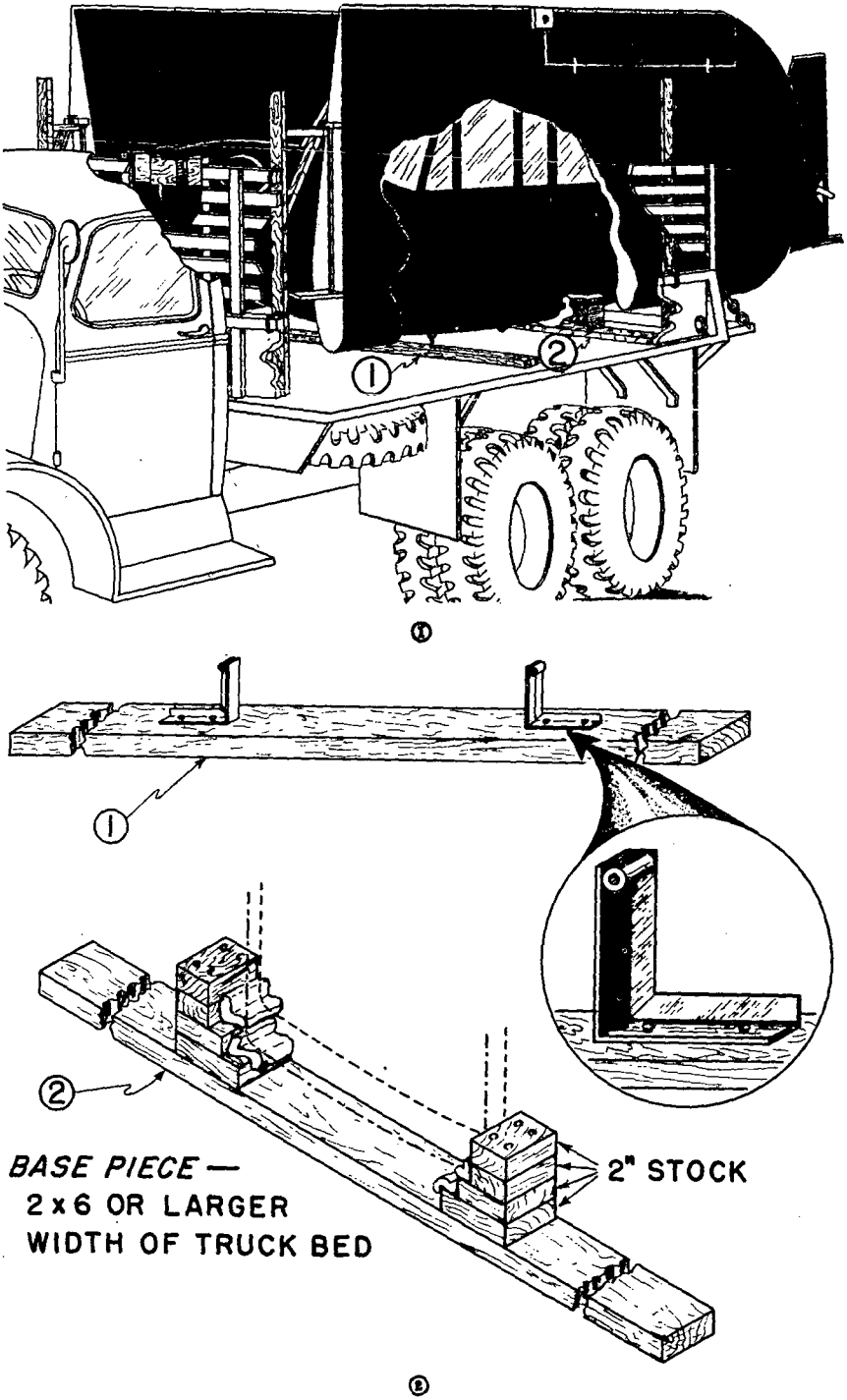


Figure 9. Airplane loaded on truck.

3. RAIL LOADING

For administrative movements by rail, it is preferable to disassemble and crate the aircraft. The number of crated aircraft which can be loaded on one car depends upon the size and type of car furnished and the volume of the crates. If it is desired to ship the aircraft uncrated, disassembly may be kept to a minimum, but care must be taken to secure the aircraft within the car to prevent damage. Methods of loading differ with the types of aircraft involved, as indicated below.

a. Airplanes. With a minimum of disassembly, two airplanes can be loaded in one boxcar (fig. 10). The wings and empennage (tail assembly) are removed from the airplanes. Wings are placed in jigs and lashed to the inside wall of the boxcar. Empennage parts are placed in the cockpit of the aircraft, and all nuts and bolts are attached to the parts from which they were taken. The fuselage must be lashed down securely, taking advantage of such points as the propeller shaft, engine mount, fuselage spar butt fittings, fuselage landing-gear V fitting, tail lift handles, and tail-leaf spring for tie-down. If car space is at a premium, or time is not an important element, it is possible to load three airplanes in the boxcar by disassembling the land gear in addition to the steps already mentioned (fig. 10). In such a case, landing gear is stowed in the cockpit with the parts, and the fuselage secured on jigs fastened to the floor in the same manner as for haul by motor vehicle (fig. 9). Parts placed in the cockpit are padded to prevent damage and secured against shifting.

b. Helicopters. When helicopters are shipped uncrated, especial precautions must be taken to avoid damage to the delicate rotor-blade surfaces. The rotor blades, rotor-hub assembly, mast assembly, and tailrotor assembly should be removed and packed in individual wooden boxes (fig. 11). Boxes should be secured inside the boxcar so that they cannot shift. To aid in securing the fuselage against movement, it should be mounted on a skid which is then nailed or bolted to the floor. Corrosion preventatives should be applied as prescribed in appropriate technical orders. All crated parts should be padded where necessary to prevent rubbing and undue wear.

4. LOADING FOR WATER TRANSPORTATION

The method of loading for this type of movement is greatly influenced by the mission and the space allotted. For administrative movements, it is preferable to crate the aircraft. When the situation (amphibious operation) requires that the aircraft be

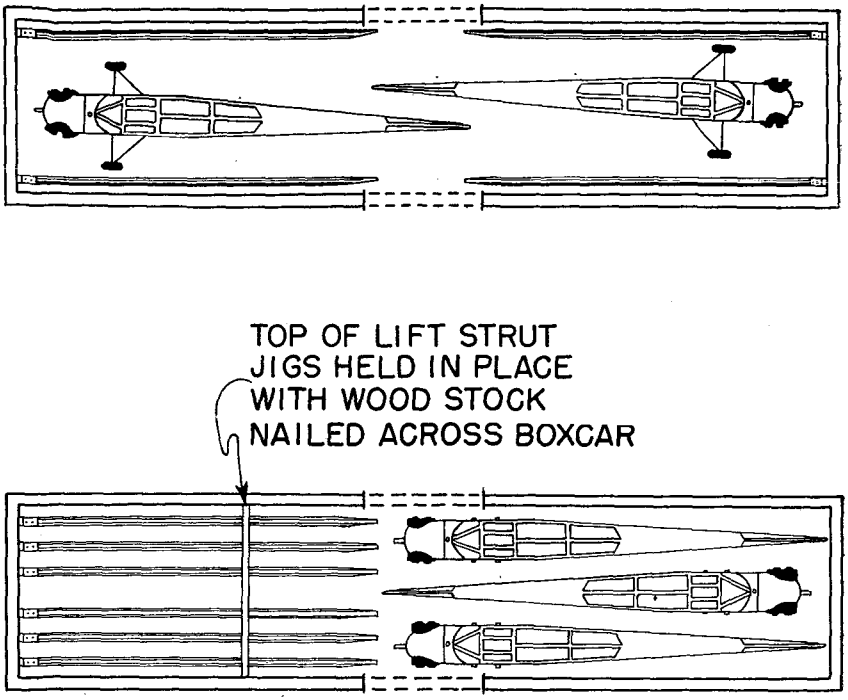


Figure 10. Airplanes loaded for rail movement.

flown from the ship, or when it will be needed in a minimum time after landing, disassembly should be held to a minimum, but should include removal of wings or rotor blades and parts of the empennage to avoid damage. The aircraft should be treated to prevent corrosion. For use in minimum time after landing, airplanes may be loaded on trucks. Several alternate methods may be employed when the aircraft must be flown ashore, as follows:

a. Shallow-Draft Improvised Carrier. Vessels of the LST type can be equipped with short flight decks and can be taken close to shore. Although airplanes can take off from such vessels, the restricted length of the flight deck, its narrow width, and the position of the superstructure of the ship (which constitutes an obstacle) make landing almost impossible. This method provides a means of getting airplanes to shore, but it does not afford a means of recovering them once they are launched. Suitable facilities for receiving the aircraft must be established ashore. Helicopters, because of their ability to take off and land vertically, may operate from the weather deck of LST type vessels without difficulty, thus, utilizing the ship as a base until facilities ashore are available.

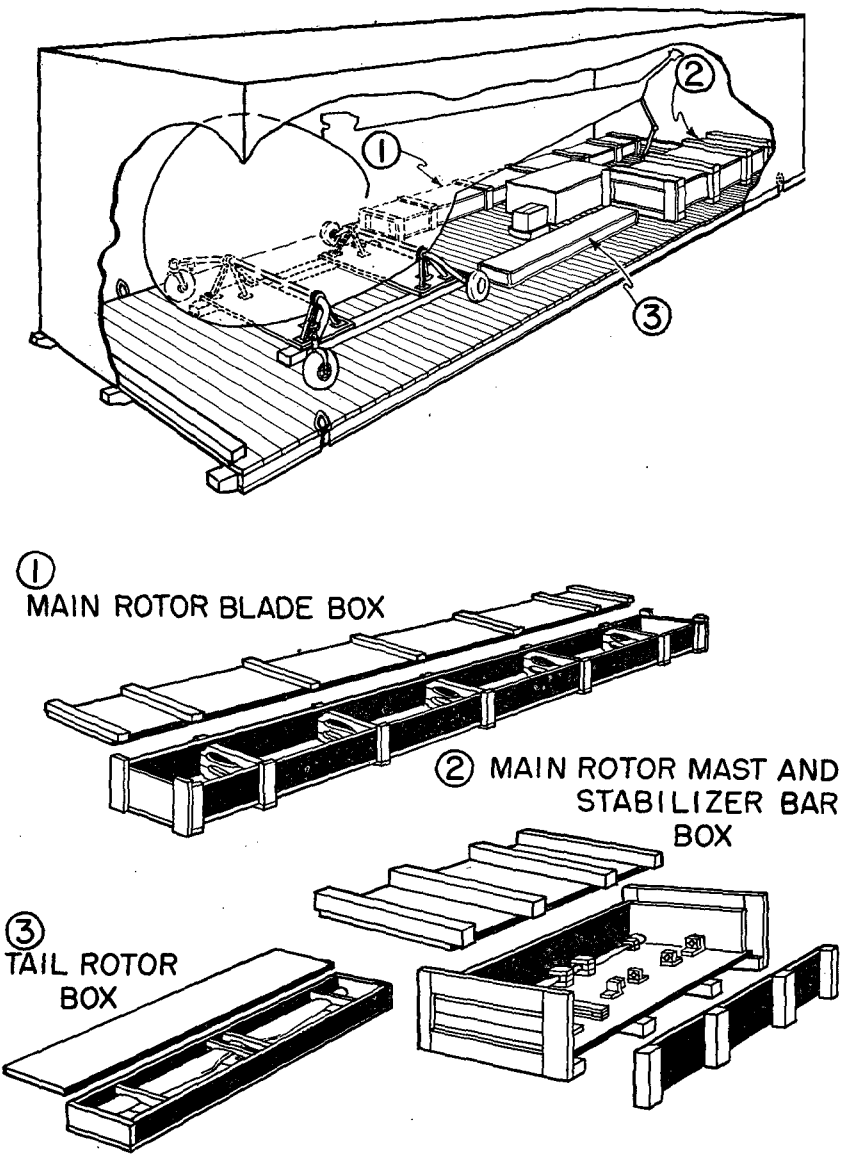


Figure 11. Helicopter loaded for rail movement.

b. Floats. In calm seas, airplanes can be equipped with floats and lowered to the surface of the water, after which they can operate from alongside the ship. Float-equipped helicopters are amphibious and can operate from water, ground, or deck surfaces.

5. AIR TRANSPORTATION

a. By Cargo Aircraft. The primary consideration in air cargo

transportation is weight. Because of both the weight and space involved, it is undesirable to crate aircraft for shipment by cargo aircraft. The same methods of loading for movements by rail are applicable for cargo aircraft. Some helicopters may be loaded in cargo aircraft without any disassembly.

b. By Towing. In airborne operations, certain types of Army aircraft may be towed to the airhead. Structural characteristics of the aircraft involved *must* be studied carefully, because all are not designed to withstand flight at towing speeds. Such flights require special training on the part of Army aviators. Modification of the towed aircraft is required to permit installation of mechanical devices to which the tow line can be attached and from which it can be released in the air when the destination has been reached.

APPENDIX III

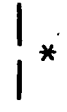
GROUND TO AIR EMERGENCY CODE DISTRESS SIGNALS

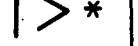
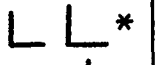
1. PANELS

The symbols shown in figure 12 are standard signals by which personnel in distress on the ground may communicate their needs to friendly aircraft flying overhead. The symbols may be made with panels or any locally available materials (parachutes, lumber, stones, tracks in sand or snow, etc.) which will provide sharp contrast with the ground surface.

2. ARM AND BODY SIGNALS

If material to form emergency panel symbols is not available, the arm and body signals shown in figure 13 may be substituted.

MEANING	SYMBOL
REQUIRE DOCTOR. SERIOUS INJURIES.	
REQUIRE MEDICAL SUPPLIES.	
UNABLE TO PROCEED.	
REQUIRE FOOD AND WATER.	
REQUIRE FIREARMS AND AMMUNITION.	
REQUIRE MAP AND COMPASS.	
REQUIRE SIGNAL LAMP WITH BATTERY, AND RADIO.	
INDICATE DIRECTION TO PROCEED.	

MEANING	SYMBOL
AM PROCEEDING IN THIS DIRECTION.	
WILL ATTEMPT TAKE-OFF.	
AIRCRAFT SERIOUSLY DAMAGED.	
PROBABLY SAFE TO LAND HERE.	
REQUIRE FUEL AND OIL.	
ALL WELL.	
NO.	
YES.	
NOT UNDERSTOOD.	
REQUIRE ENGINEER.	

*SPACE ELEMENTS OF SYMBOL 10 FEET APART WHEREVER POSSIBLE.

Figure 12. Ground to air emergency code distress signals (panel).

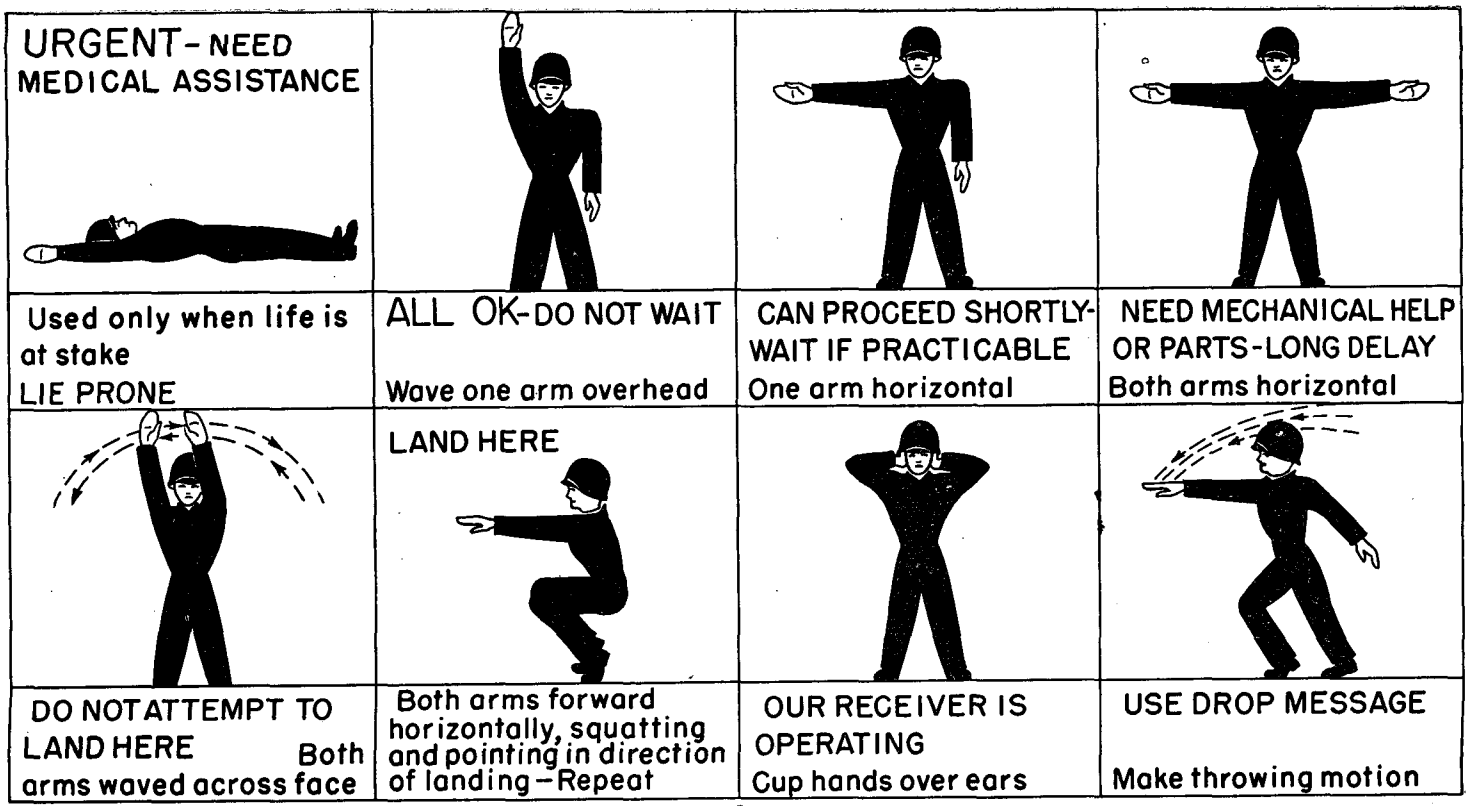
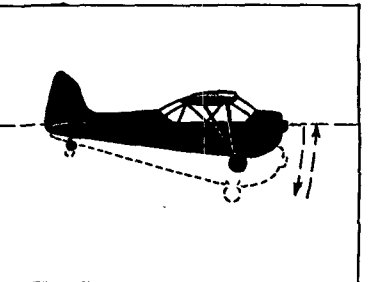


Figure 13. Ground to air emergency code distress signals (arm and body).

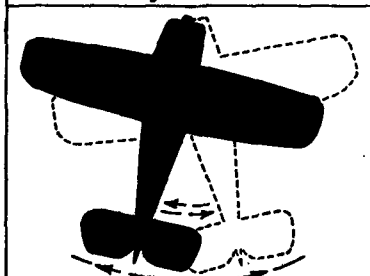
AFFIRMATIVE (YES)
White cloth waved vertically

NEGATIVE (NO)
White cloth waved horizontally

PICK US UP –
PLANE ABANDONED
Both arms vertical



AFFIRMATIVE (YES)
Dip nose of plane several times



NEGATIVE (NO)

Fishtail plane

USE OF EMERGENCY SIGNALS:

If you are forced down and can attract the attention of the rescue pilot, as he circles over your position, the body signals illustrated on these pages can be used to transmit messages to him. Stand in the open with a clear background when giving signals. Go through the motions slowly. Repeat the signal until you are positive that the message is understood.

Figure 13.—Continued

APPENDIX IV
GROUND HANDLING AND MOORING

1. GENERAL

a. Scope. This appendix covers the principles and procedures which must be followed to assure safe ground handling and mooring of aircraft. They are applicable at either temporary or permanent air fields.

b. Specific Aircraft. For details of ground handling and mooring of specific aircraft, see appropriate technical orders.

2. FIXED-WING AIRCRAFT

a. Mooring (figs. 14–15). In mooring fixed-wing aircraft, the wheels must be braked by use of wheelholes, wheelboxes (fig. 14), or chocks (fig. 15). Mooring ropes will be affixed only to points specified in appropriate technical orders. A tail support device should be used for airplanes having tricycle landing gear (fig. 16).

b. Control Surface Locks. Ailerons, elevators, and flaps must be locked securely. Some airplanes have locking devices installed in the cockpit (fig. 15). For airplanes not equipped with installed locking devices, control surfaces are locked by padded locking devices to which eye-catching safety streamers are attached (fig. 17).

c. Pitot Tubes. Pitot tubes must be covered and an eye-catching safety streamer attached to the cover.

d. Manhandling. Pressure to move an aircraft by hand may be applied only at the points designed to receive pushing and pulling forces (figs. 18–19). These points are specified in appropriate technical orders. No pressure may be applied to those delicately rigged or thinly covered surfaces plainly marked "NO PUSH," "NO STEP," etc. on all aircraft.

e. Towing. Normally, towing is not necessary since army airplanes can be manhandled easily. When towing airplanes with conventional landing gear, a "dollie" designed to fit the tail wheel may be used. Some are provided with towing hooks affixed to the landing gear. Airplanes with the tricycle type landing gear may be towed using a tow-bar attached to the nose wheel.

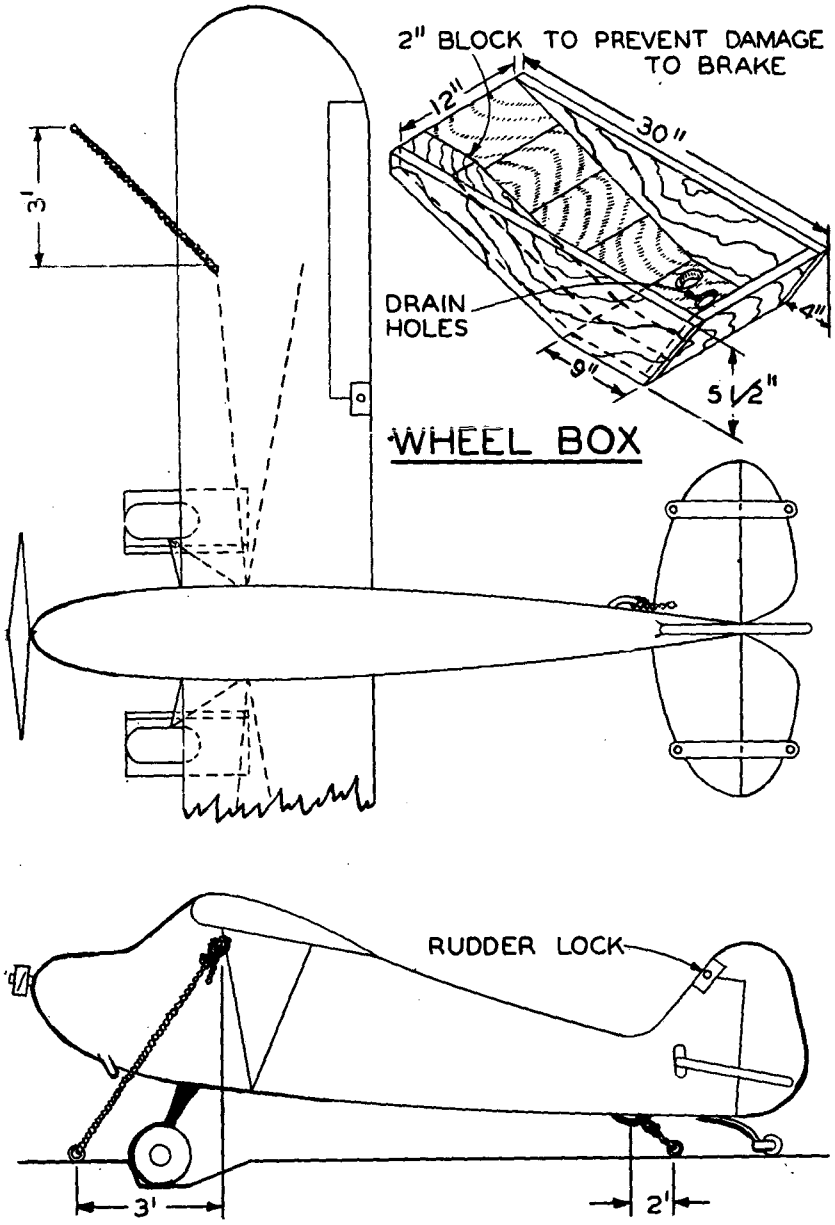


Figure 14. Mooring a type airplane with conventional landing gear.

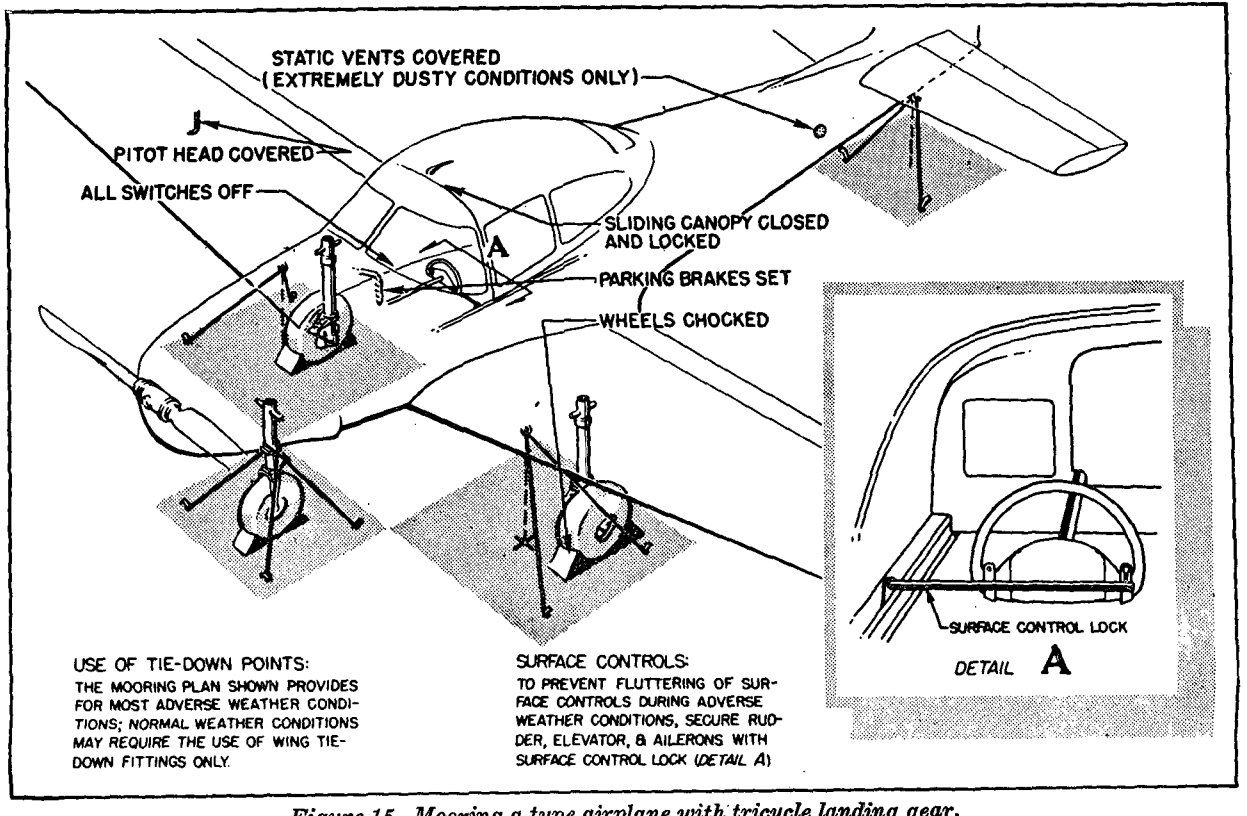


Figure 15. Mooring a type airplane with tricycle landing gear.

Figure 16. Tail support device for an airplane with tricycle landing gear.

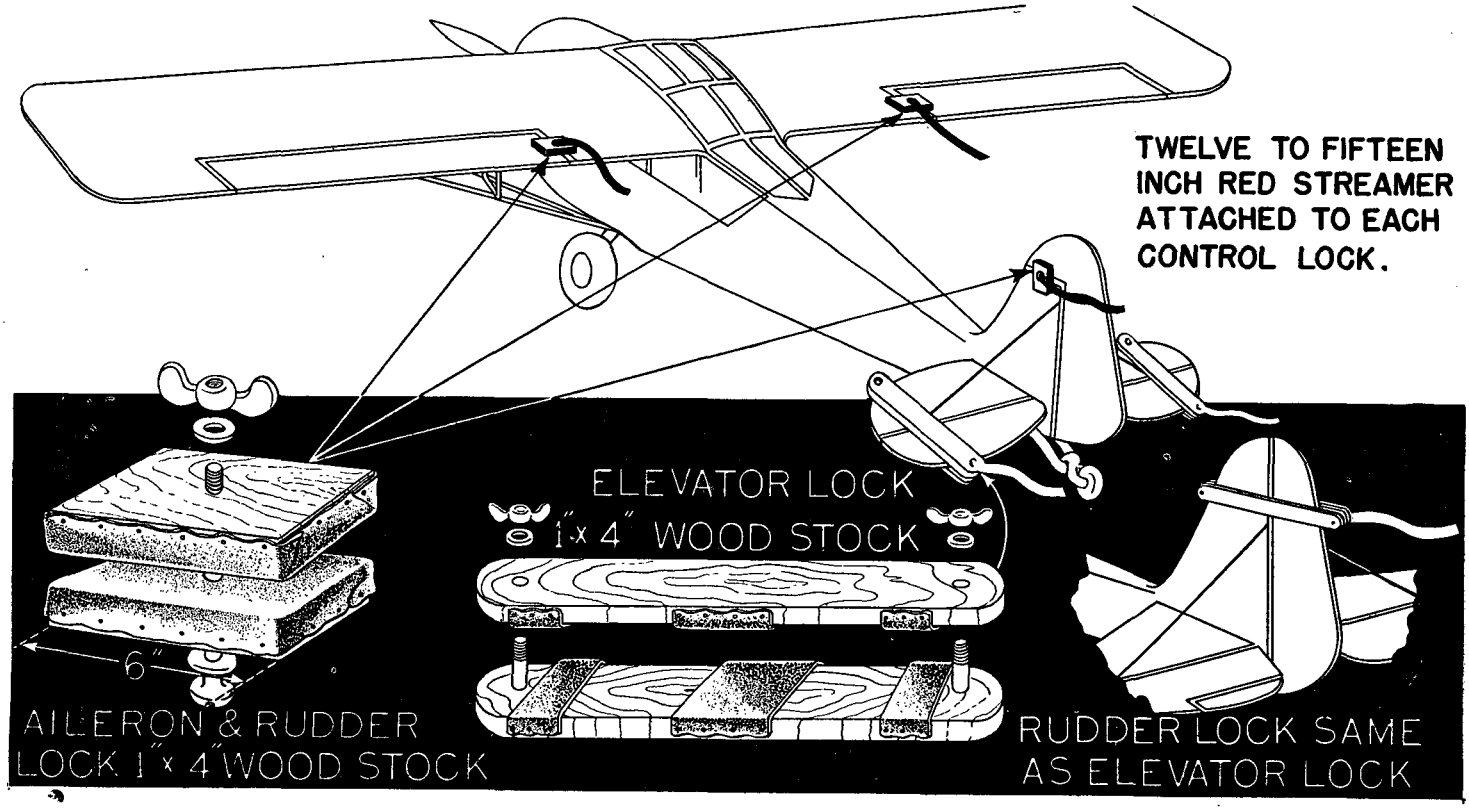
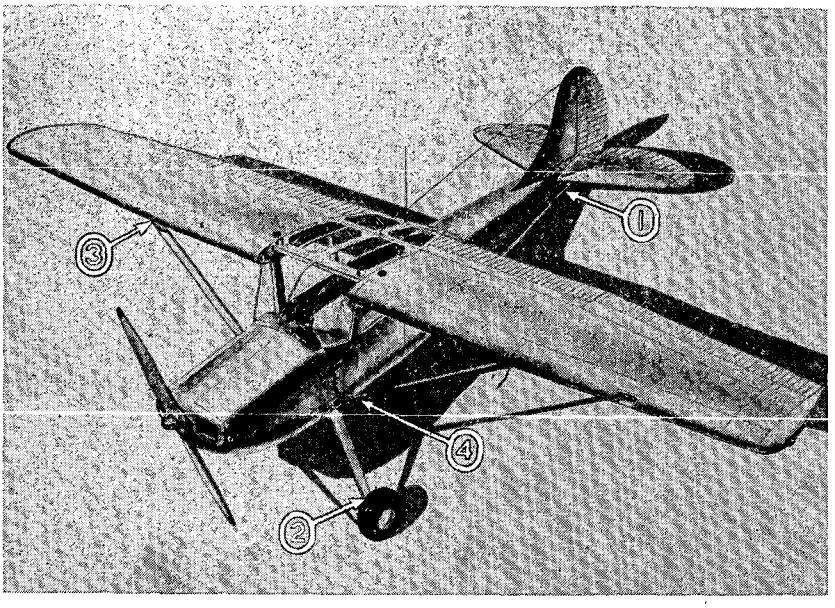
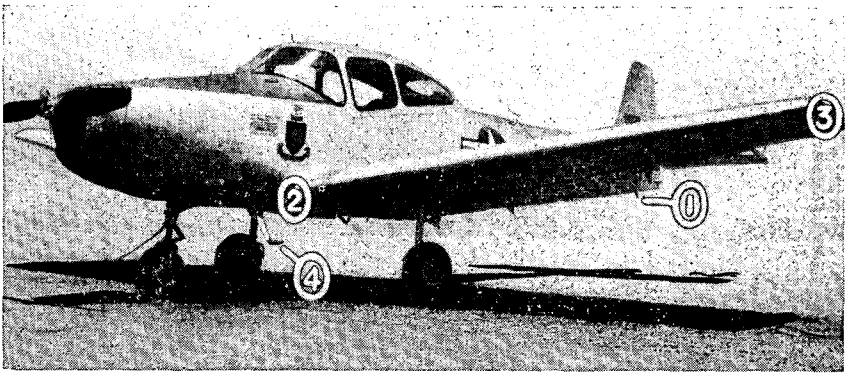


Figure 17. Control surface locks.



① Flush retracting handles.
② Towing lugs.
③ Tie-down rings.
④ Strut push-pull point.

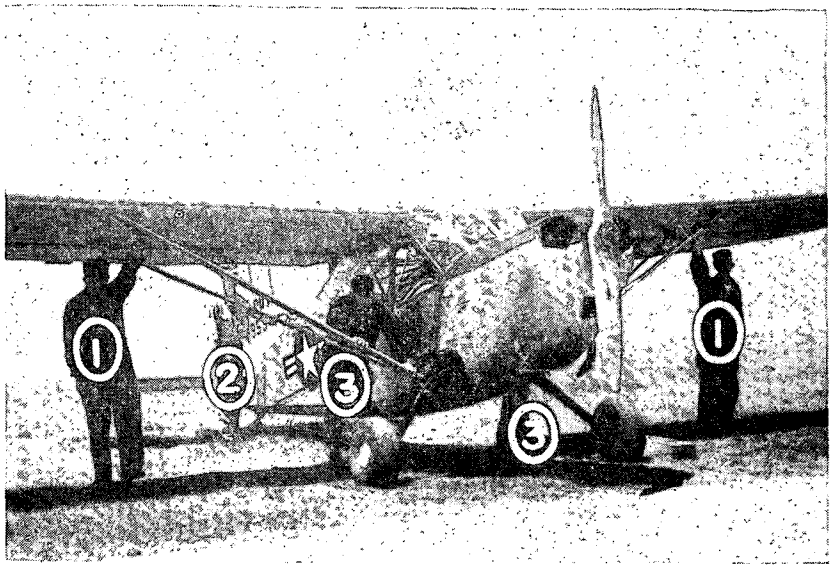
Figure 18. Ground handling and mooring points for a type airplane.



① Tail skid.
② Wing root to a point 2 feet out from the fuselage.
③ Wing tip.
④ Step.

Figure 19. Ground handling points for a type airplane.

f. Ground Handling in High Winds. In gusty or high winds, taxiing airplanes must be escorted by ground personnel (fig. 20). In addition to the parking and mooring procedures already described, "spoilers" will be placed on the wings (fig. 21).



① Wingmen.
② Tailman.
③ Movers.

Figure 20. Ground handling in high wind.

3. ROTARY-WING AIRCRAFT

a. Mooring (fig. 22). Rotary-wing aircraft are provided with hydraulic parking brakes, which should be set when the aircraft is parked. Mooring ropes are affixed only at points on the landing gear specified in technical orders. Possible movement of the aircraft in any direction is prevented by proper placement of the mooring stakes.

b. Control Surface Locks. A canvas web strap and a blade-securing block are used to prevent flapping or rotation of the main rotor blade by wind (fig. 22).

c. Pitot Tubes. Pitot tubes must be covered and an eye-catching safety streamer attached to the cover.

d. Manhandling (fig. 23). Pressure to move the aircraft by hand may be applied only at points designed to withstand pushing and pulling forces. These points are specified in appropriate technical orders. To an even greater degree than in the case of fixed-wing aircraft, care must be taken to assure that no damage is done to the delicate rigging or the fabric covered surfaces.

e. Towing. The rotary-wing aircraft may be towed using tow-bars designed for the particular aircraft. The tow-bar is attached to the forward landing gear (fig. 24).

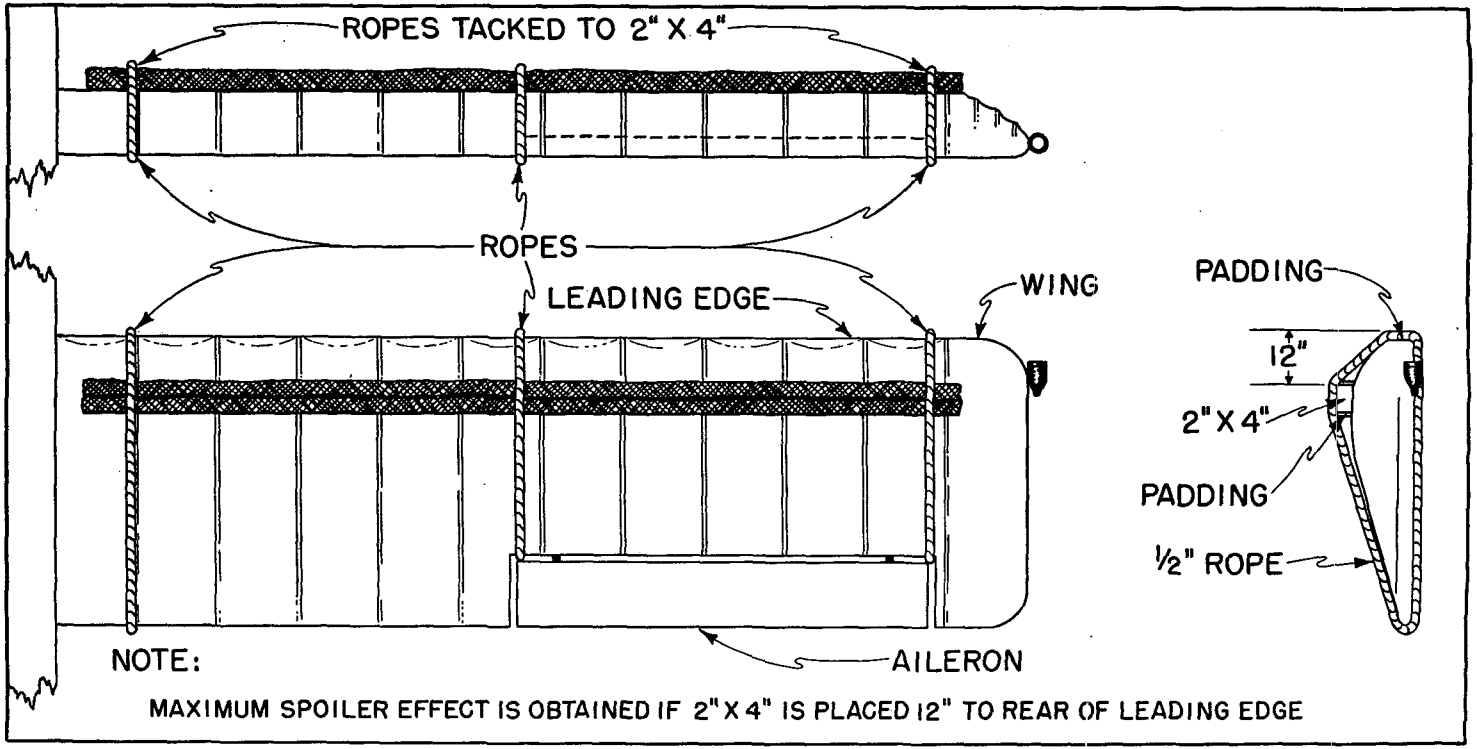


Figure 21. Installation of "spoilers."

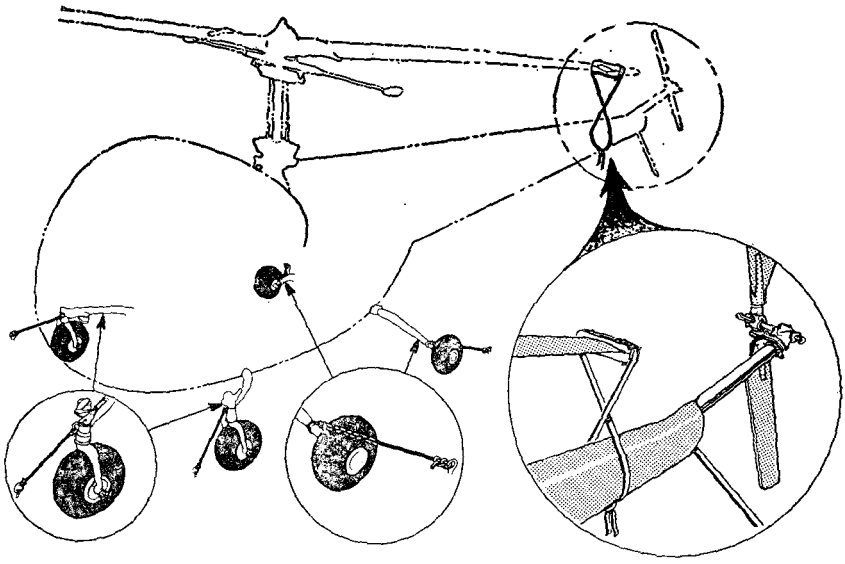
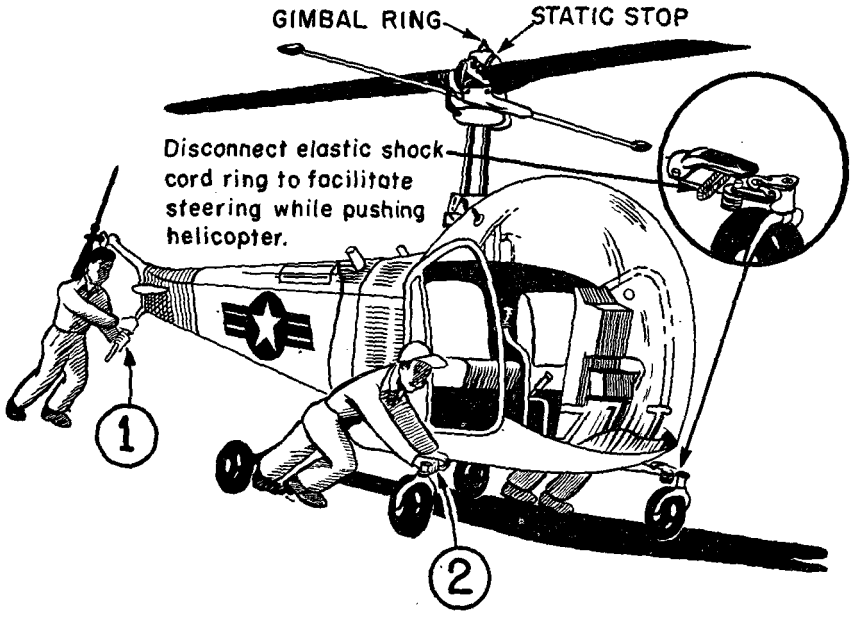


Figure 22. Mooring points for a type helicopter.



① Tail skid. ② Forward landing gear legs.

Figure 23. Ground handling points for a type helicopter.

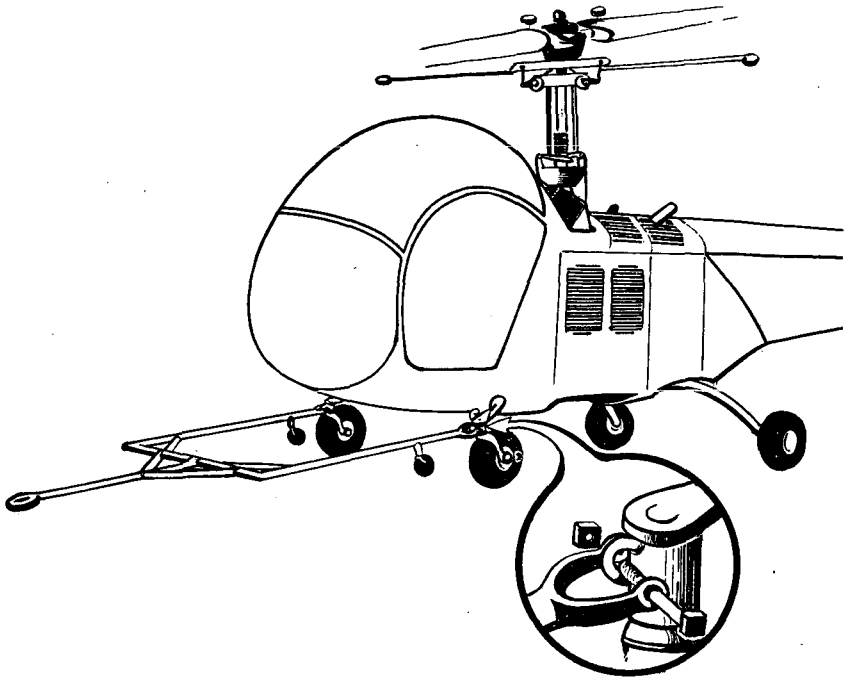


Figure 24. Tow-bar used for a type helicopter.

f. Ground Handling in High Winds. The rotary-wing aircraft may be maneuvered on the ground in high winds without ground crew assistance. The pilot must exercise great care to prevent the aircraft from "weather-vaning" into the wind.

4. ENGINE OVER-PRIMING

When airplane engines will not start because of over-priming, it is necessary to clear the cylinders of excess gasoline. This procedure is called "unloading."

a. Aircraft engines equipped with electric starters are "unloaded" by either of the two methods described below. The first of these methods is as follows:

(1) Set the ignition switch in the "off" position.
(2) Open the throttle completely.
(3) Set the mixture control at "idle cut-off."
(4) Using the starter, crank the engine until gasoline ceases to drain from the exhaust stack (approximately three complete revolutions of the propeller).
(5) Close the throttle.
(6) Repeat starting procedure.

b. Aircraft engines not equipped with electric starters *must* be cranked by manual rotation of the propeller; aircraft with electric starters *may* be cranked in this method. When the propeller is rotated manually, the procedure for "unloading" is as follows:

(1) Set the ignition switch in the "off" position.
(2) Open the throttle completely.
(3) Manually rotate the propeller until gasoline ceases to drain from the exhaust stack (approximately three complete revolutions of the propeller).
(4) Close the throttle.
(5) Repeat starting procedure.

5. UNASSISTED STARTING OF AIRPLANE ENGINES

a. With airplanes equipped with electric starters, no difficulties are encountered in unassisted starting, provided normal safety precautions are observed and proper starting procedures are followed.

b. For unassisted starting of airplanes not equipped with electric starters, the additional safety precautions listed below must be followed closely.

(1) When the wind is gusty or when the wind velocity exceeds 15 miles per hour, unassisted starting should not be attempted except in emergencies.
(2) One wheel must be chocked securely and the parking brake set.
(3) The airplane should be headed into the wind.
(4) The stick is tied in the "rear" position.
(5) The ignition is turned "on" and the throttle closed or opened slightly depending on the characteristics of the particular airplane. It is particularly important that the throttle be closed after the "unloading" procedure (par. 4) to assure the proper positioning of the throttle for starting.
(6) When cranking the engine, the propeller should be grasped only with the ends of the fingers to avoid possible injury in case of "kicking" or unexpected starting. Both feet should be on the ground during the entire cranking procedure and the body clear of the propeller path. Particular caution must be exercised if the footing is uncertain.
(7) The engines of most Army airplanes may be hand-cranked from a position either in front or in rear of the propeller. For unassisted starting, hand-cranking from

behind the propeller facilitates access to the controls of the airplane. When cranking from behind the propeller, the individual should grasp a convenient part of the airplane with the left hand and turn the propeller with the right hand. This procedure should be used wherever possible.

(8) If the engine is cranked from a position in front of the propeller, both hands should be used to turn the propeller. The motion of the body is always away from the propeller path.

6. GROUND OPERATION OF AIRCRAFT

a. Personnel Who May Operate Aircraft on the Ground. Aircraft engines will be started, run, warmed up, or tested, and aircraft on the ground will be taxied or otherwise operated only by—

(1) Qualified aviators, or student aviators when specifically authorized.

(2) Qualified mechanics. (SR 95–85–5 outlines requirements.)

b. Running Engines. Except in an emergency, engines of aircraft on the ground will be started or run only when—

(1) Chocks are placed securely in front of the wheels of any airplane, regardless of the fact that it may have parking brakes.

(2) A person qualified to operate the aircraft on the ground is seated at the controls, except—

(*a*) During instruction of students in unassisted starting procedures for aircraft engines not equipped with starters.

(*b*) During unassisted starting of aircraft engines not equipped with starters.

c. Taxiing. In any movement of an aircraft on the ground, whether by taxiing under power or by movement by hand, extreme care must be exercised to avoid damaging the aircraft by striking surrounding objects or encountering holes or other obstructions with the wheels. Certain basic precautions should be observed at all times.

(1) An aircraft will be taxied at least 100 feet from runways upon which other aircraft are in the process of landing or taking off, except when necessitated by terrain or specifically directed otherwise.

(2) The individual taxiing the aircraft must be able to stop it instantaneously.

(3) When an airplane is taxied in proximity to other aircraft, buildings, or other obstructions, or in gusty or high wind conditions, a member of the ground crew will be stationed at each wing tip to insure adequate clearance.

(4) When taxiing airplanes in winds of sufficient velocity to endanger the aircraft, crewmen should secure a hold at prescribed ground handling points and escort the airplane. When the wind is coming from ahead, the elevators should be kept in the "full up" position, and when the wind is coming from either front quarter, the upwind aileron must also be in the "full up" position. For wind from the rear or either rear quarter, elevators should be in the "full down" position and the upwind aileron held "full down." Taxiing in direct cross winds should be avoided.

(5) When an aircraft with poor forward visibility is being taxied, the aircraft must not be taxied on a straight line unless it is accompanied by "wing walkers" or otherwise directed by personnel on the ground who can insure that it will clear all obstacles. When such assistance is not available, the aircraft must be S-turned constantly in order to provide a view of the area ahead.

(6) When swinging the aircraft through a turn, the operator must check the proposed path of the tail to insure that no part of the tail surfaces will strike any obstacles during the turn.

7. SERVICING AIRCRAFT

a. General. Standard procedure for servicing aircraft to insure rapid completion of such activity with the maximum efficiency and safety should be prescribed by each unit aviation officer. The ground crew must be properly trained as to the proper engine oils and fuels to use, capacity of oil and fuel tanks, and safety precautions to be observed. Caution must be taken in filling gas tanks to avoid breaking gas tank necks.

b. Safety Precautions. During refueling operations, safety precautions must include:

(1) No smoking within 50 feet of any aircraft, gas truck, or gas dump. *This rule applies at all times whether refueling or not.*

(2) Grounding (bonding) of refueling apparatus to lessen the danger of fire resulting from static electricity (fig. 25).

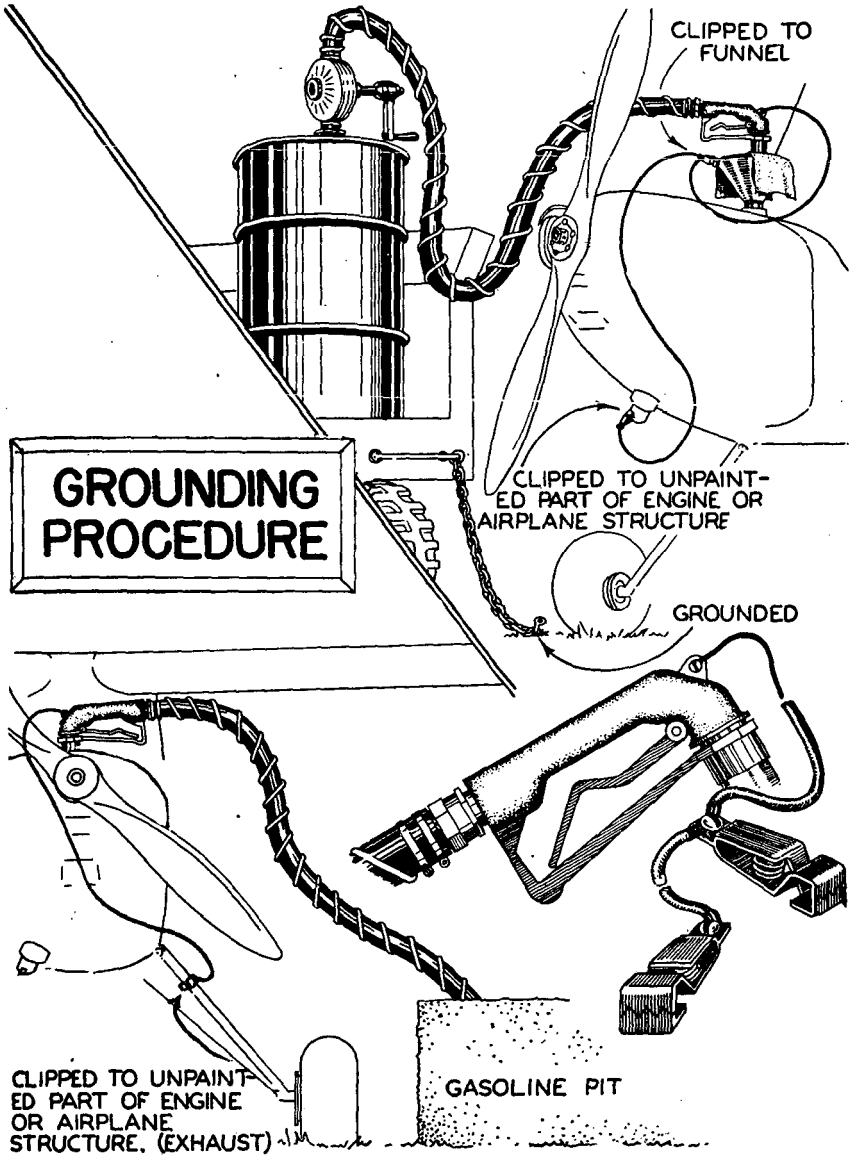
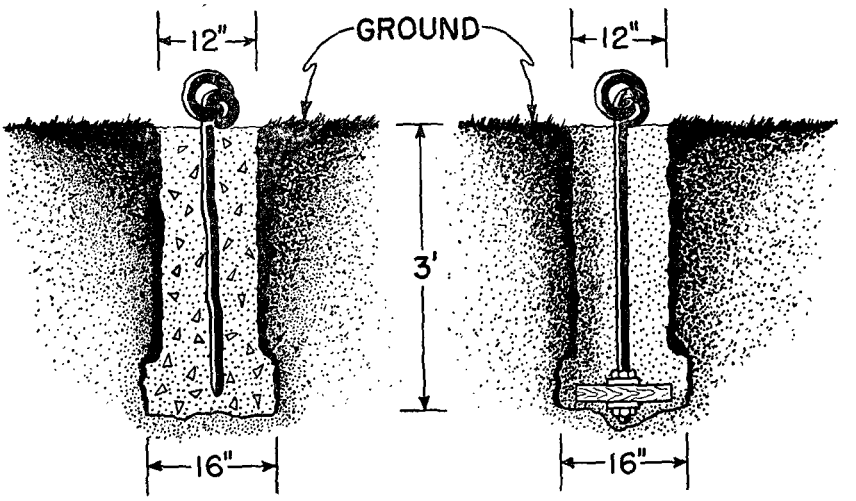


Figure 25. Grounding of refueling apparatus.

8. ANCHORS AND ROPES

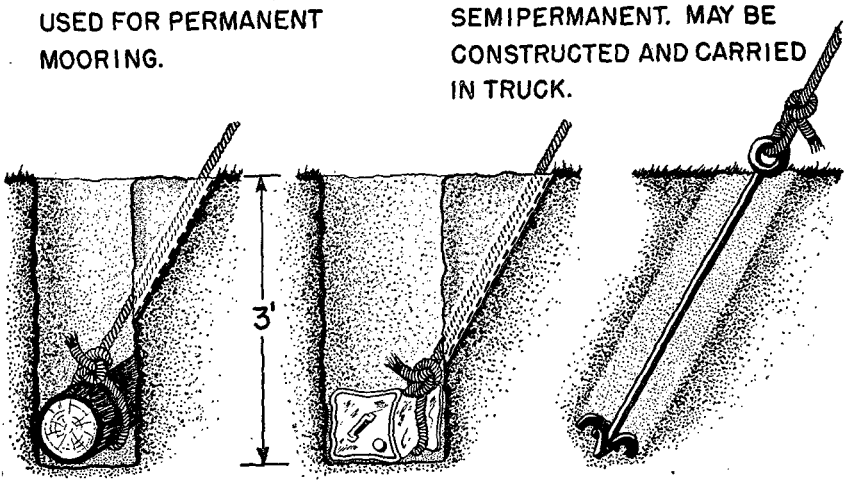
a. Anchors. Several types of anchors which are satisfactory for mooring Army aircraft are illustrated in figure 26. A mooring kit should be carried in each aircraft at all times.

b. Ropes. Mooring ropes must be at least one-half inch in diameter and made of hemp or nylon. They should be inspected frequently to detect signs of wear and should be replaced whenever



IRON ROD WITH RING SET IN CONCRETE, USED FOR PERMANENT MOORING.

LONG EYE BOLT THROUGH 2" X 4" OR LARGER, BOARD. SEMIPERMANENT. MAY BE CONSTRUCTED AND CARRIED IN TRUCK.



DEADMAN:

LOG 6" DIAMETER OR LARGER. ROPE, CABLE, OR CHAIN ATTACHED. (ROPE MAY ROT IN MOIST SOIL)

DEADMAN:

5-GALLON CAN CRUSHED SLIGHTLY IN CENTER TO PREVENT ROPE FROM SLIDING OFF: GOOD IN LOOSE OR SANDY SOIL. FILL CAN WITH DIRT OR SAND.

PORTABLE MOORING KIT FURNISHED WITH AIRPLANE. FAIRLY DEPENDABLE EXCEPT IN LOOSE OR SANDY SOIL. (SAME SLANT AS ROPE)

Figure 26. Types of anchors.

their strength is questionable. In securing aircraft, ropes should not be tied so tightly that shrinkage, if they become wet, will damage the aircraft. They should be just tight enough to prevent bouncing of the aircraft in the event of a high wind. For detailed instructions covering knots and splices, see TM 5–225.

9. OPERATION AT OTHER THAN ARMY INSTALLATIONS

Army personnel operating aircraft from an installation under other than Army control will comply with appropriate additional safety regulations prescribed by that installation commander.

10. HAND SIGNALS

A standardized system of hand signals for the operation and movement of aircraft on the ground has been agreed upon by the United States Army, United States Navy, United States Air Force, United States Marine Corps, Royal Air Force, and Royal Navy. This system includes the following elements and signals.

a. Flagman and Taxi Signalman. The flagman is stationed on the airfield at a position far enough from the parking area to be clearly visible to the pilot of an approaching aircraft. By the use of a distinguishing flag of black and white checks, the flagman directs the pilot's attention to the taxi signalman. The taxi signalman indicates that he is ready to assume guidance of the aircraft by extending both arms vertically above his head, palms inward (fig. 27).

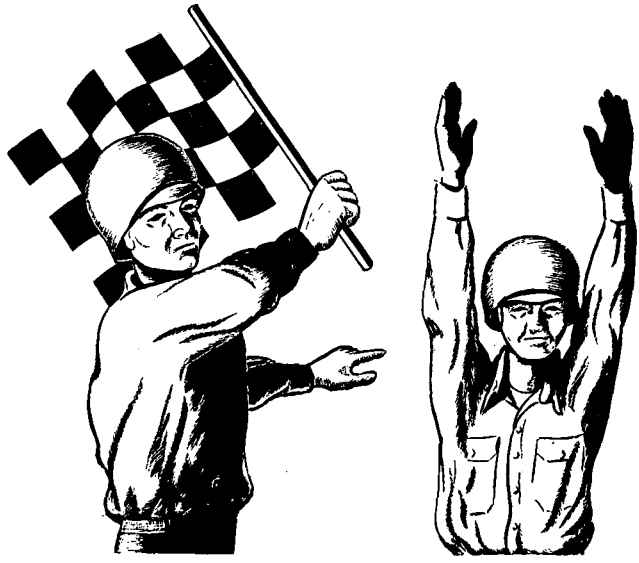


Figure 27. Flagman and taxi signalman.

b. Position of Taxi Signalman. The taxi signalman assumes a position on a line extending directly forward from the left wing tip, except when this position is rendered impracticable by special conditions of the parking area (fig. 28). He should always be able to see the pilot's eyes.

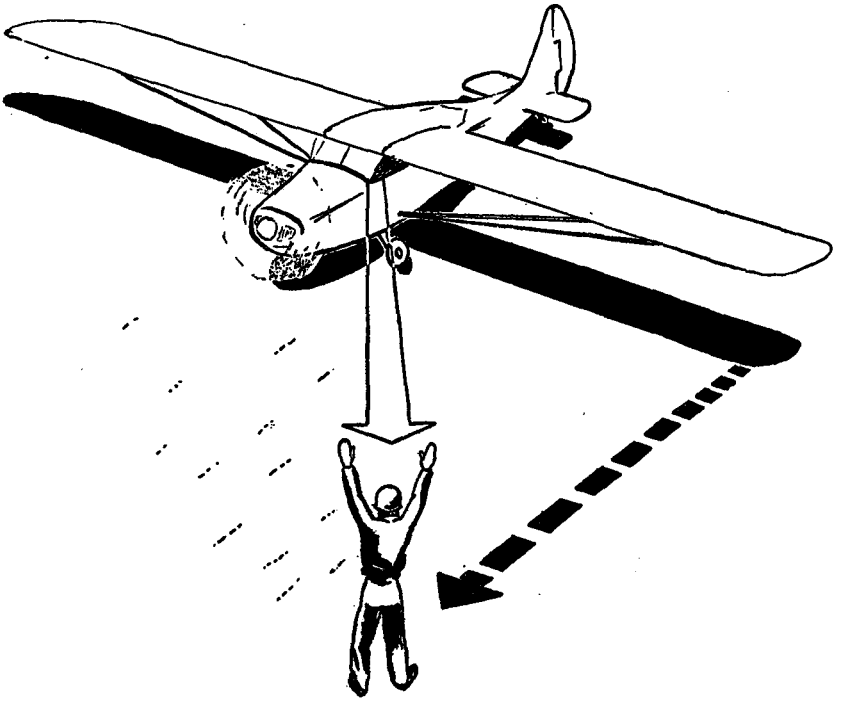


Figure 28. Position of taxi signalman.

c. Come Ahead. The taxi signalman raises both hands before his eyes, elbows flexed, and palms turned toward his face. He executes beckoning motions with both hands. The rapidity of the hand motions indicates the speed desired of the aircraft (fig. 29).

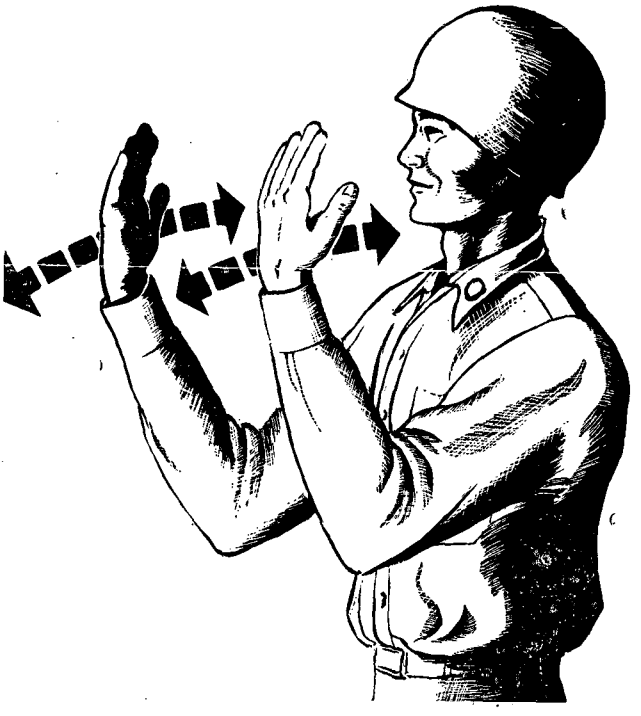


Figure 29. Come ahead.

d. Right Turn. The taxi signalman executes the "come ahead" signal with his right hand, pointing with his left hand to the wheel which is to be braked (right wheel of aircraft) (fig. 30).

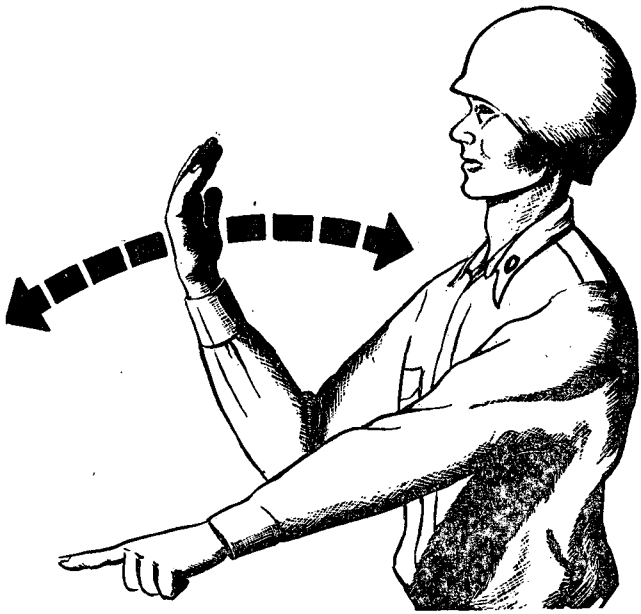


Figure 30. Right turn.

e. Left Turn. The taxi signalman executes the "come ahead" signal with his left hand, pointing with his right hand to the wheel which is to be braked (left wheel of aircraft) (fig. 31).

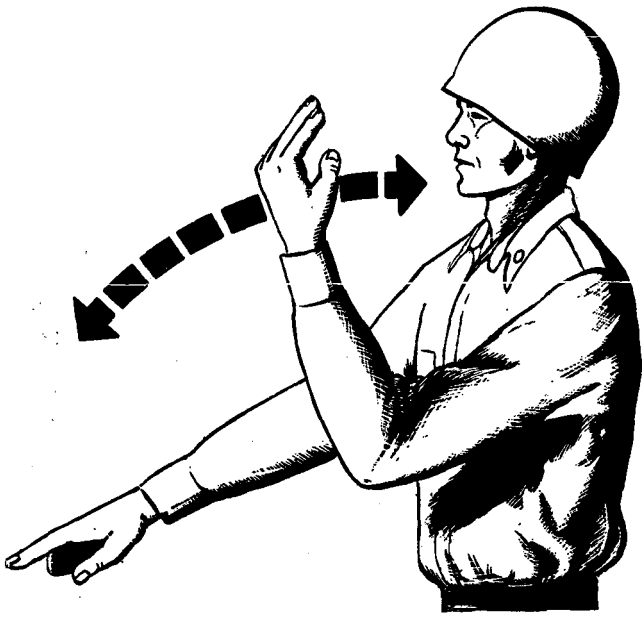


Figure 31. Left turn.

f. Stop. The taxi signalman raises both hands to eye level, elbows flexed, and palms turned outward toward the aircraft (fig. 32).

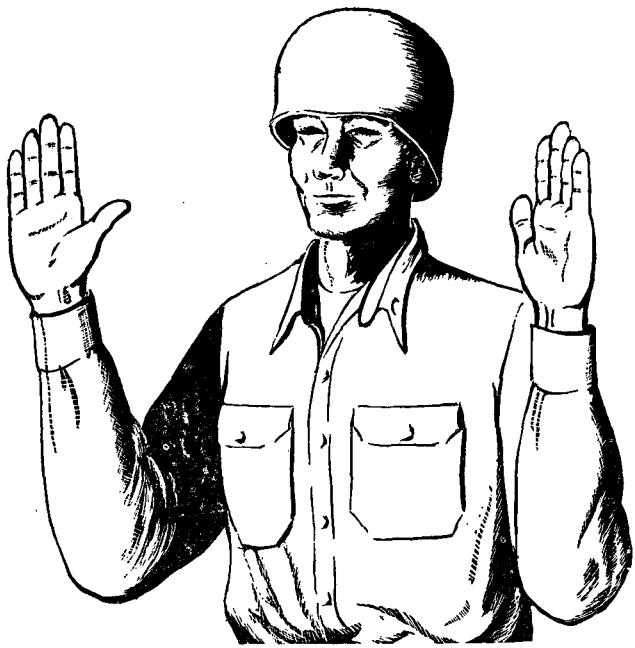


Figure 32. Stop.

g. Emergency Stop. The taxi signalman raises both arms over the head, palms turned toward the aircraft, and moves the arms from side to side, crossing above the head (fig. 33).

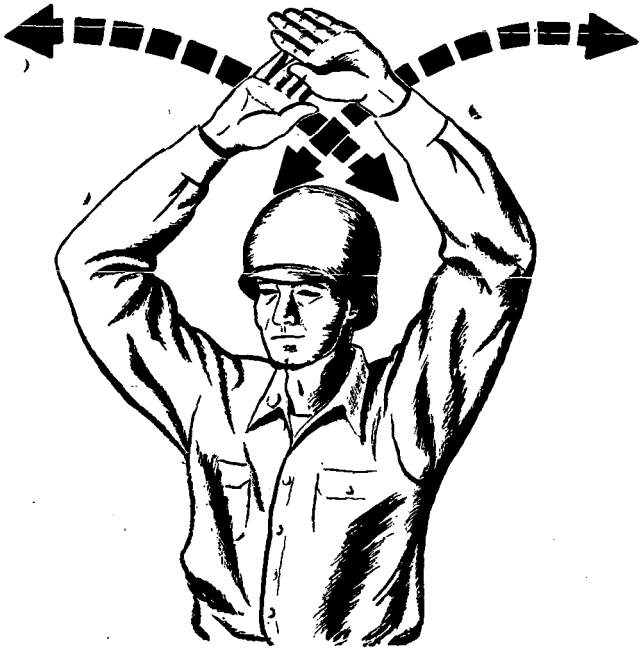


Figure 33. Emergency stop.

h. Cut Engine. The taxi signalman draws the extended forefinger of one hand across his neck in a "throat cutting" motion (fig. 34). If it is desired that a specific engine of a multiengine aircraft be cut, the taxi signalman executes the above signal, pointing with the other hand to the appropriate engine.

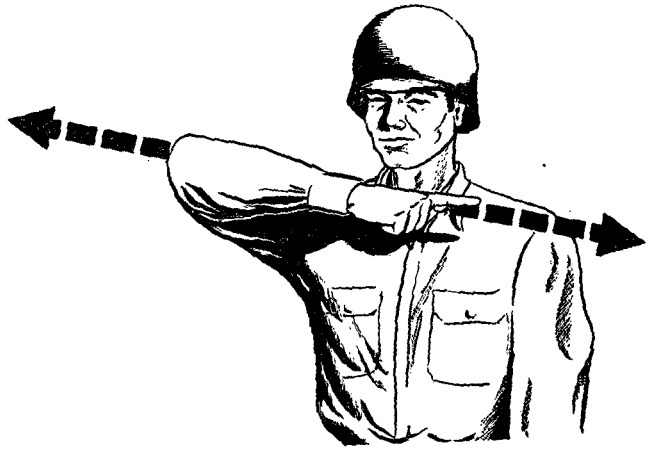


Figure 34. Cut engine.

i. Insert Chocks. The taxi signalman sweeps his fists together at hip level with the thumbs extended and pointing inward (fig. 35).

Figure 35. Insert chocks.

j. Start Engine. The pilot insures that the brakes are set. He then indicates verbally that he is ready to start the engine. The taxi signalman responds by rotating his hand before him in a clockwise circling motion (fig. 36). In the case of a multiengine aircraft, the pilot extends a number of fingers to indicate which engine will be started (1, 2, etc.). The taxi signalman responds by pointing the same number of fingers at the proper engine and rotating the other hand before him in a clockwise circling motion. A fire extinguisher is kept readily available to the signalman, or other ground personnel, during the starting procedure.

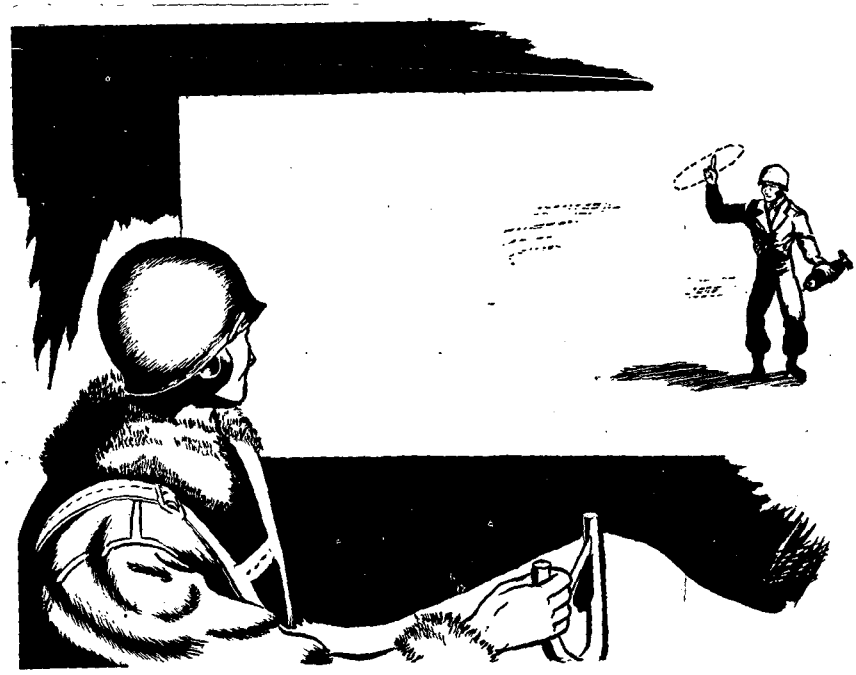


Figure 36. Start engine.

k. Pull Chocks. The pilot insures that the brakes are set. He then signals for chock removal by an outward sweeping motion of the fist, with the thumb extended and pointing outward. The taxi signalman acknowledges the signal with a sweep of the fists away from each other at hip level with the thumbs extended and pointing outward (fig. 37).

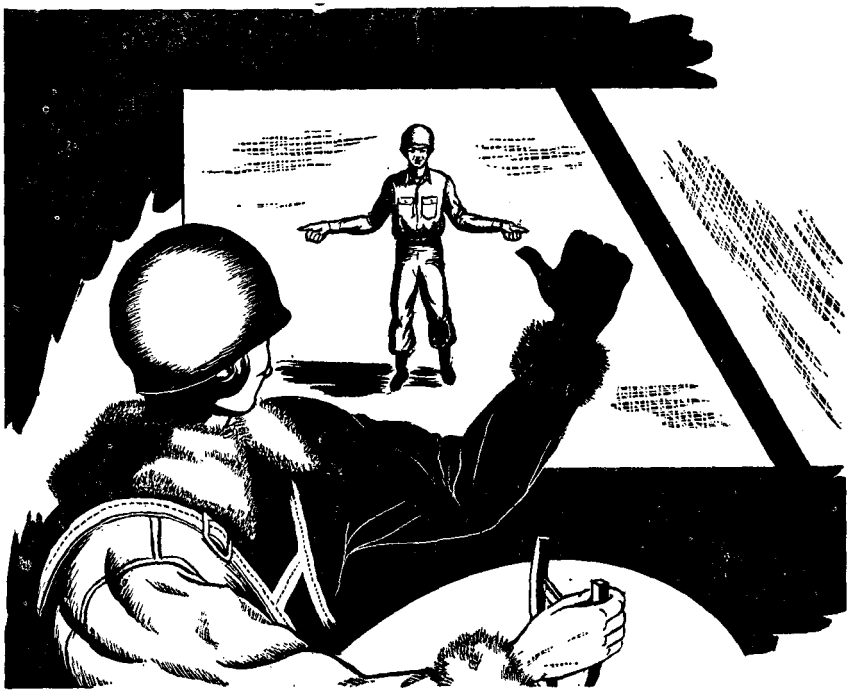


Figure 37. Pull chocks.

l. Clear to Taxi. The "clear to taxi" signal is initiated by the pilot to indicate his desire to begin taxiing. He signals by touching the tip of the index finger to the tip of the thumb with the remaining fingers extended. If all is clear to taxi, the taxi signalman responds with a similar gesture (fig. 38).

Figure 38. Clear to taxi.

m. Towing. To direct the towing of an aircraft, the taxi signalman assumes the same position as that indicated in *b* above, with the addition that he must be visible to the driver of the towing vehicle at all times (fig. 39).

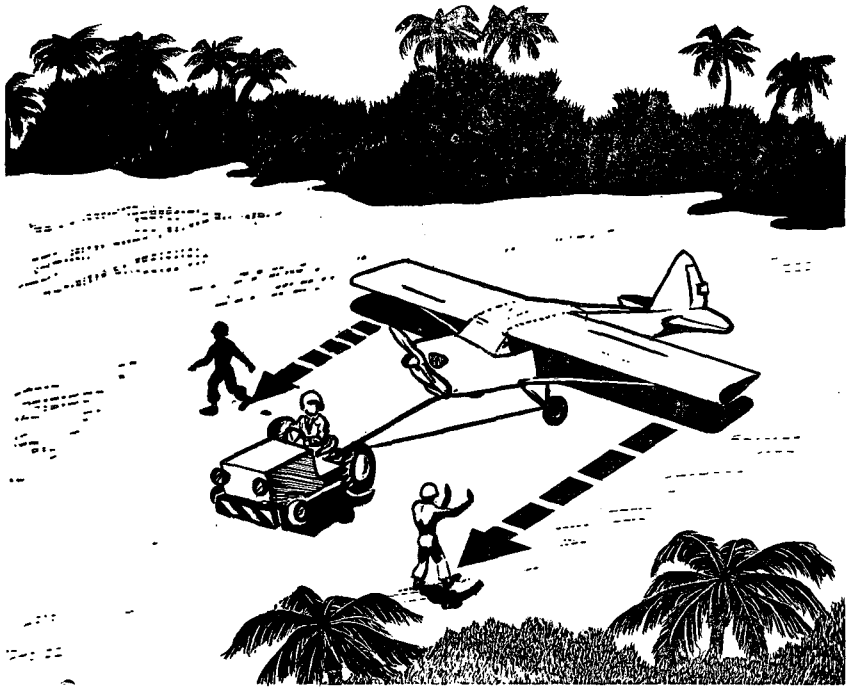


Figure 39. Towing.

n. Night Operations. In the absence of a suitably lighted airfield, signals are executed by employing illuminated wands or flashlights. Signals used with wands or flashlights are identical with those listed in *c* through *l* above, except that the signal for "emergency stop" is made by crossing the wands or flashlights before the face of the signalman (fig. 40). Care must be exercised to avoid flashing lights in the eyes of the pilot.

Figure 40. Emergency stop (night operations).

11. TRAINING

The unit aviation section initially should receive thorough training in the foregoing procedures. This training should be repeated at least every 3 months. Instruction should include practical application of ground handling procedures applicable to the types of aircraft with which the unit is equipped. It should also include familiarization with proper procedures to be followed in the ground handling of other Army aircraft. Such training should be in the form of conferences and practical application of the procedures prescribed herein.

APPENDIX V

CHECK LIST FOR COMMAND INSPECTION OF AVIATION SECTION

Section I. TRAINING

1. Are training directives, programs, and orders adequate?

2. Is training continuous, and directed at the improvement of flying technique, maintenance, and the technique of air observation?

3. Is adequate communication training conducted?

4. *a.* Does flight training include practice in take-offs and landings—

(1) On roads?

(2) Between panels?

(3) Over simulated barriers?

(4) In actual airstrips and short fields?

b. Does flight training include practice in basic flight maneuvers and evasive maneuvers?

5. Do aviators maintain their proficiency in navigation through regular extended cross-country flights?

6. Is observer training for aviators and other selected officers of the unit being conducted?

7. Are all members of the aviation section as well as other personnel who may be concerned, such as certain staff officers and designated observers, being trained in—

a. The selection and preparation of roads and fields suitable for use as airstrips?

b. The concealment and camouflage of the aircraft and matériel?

c. Ground handling of aircraft (section personnel and observers only)?

8. Are members of the aviation section, including designated observers, proficient in reading maps and photographs to locate—

a. Suitable areas for airfields?

b. Routes of access and supply to airfields?

c. Best possible flight paths for flying missions?

d. Specified points designated by coordinates or other standard methods?

9. Are satisfactory ground schools organized and conducted for aviators in the following subjects:

a. Navigation?

b. Meteorology?

c. Air traffic rules?

d. Radio procedures?

e. Cross-country flight procedures?

f. Maintenance techniques?

g. Pertinent forms and records?

10. Do aviation section personnel, including designated observers, participate frequently in tactical exercises for practical experience in—

a. Reconnaissance, selection, occupation, organization, development, and operation of airstrips?

b. Short-field flying technique?

c. Coordination with the unit on field maneuvers?

11. Are all aviation section personnel, including designated observers, being trained in the use of such arms and communication equipment as are authorized the section?

12. Is the training for tactical employment conducted in accordance with this manual?

13. Are aircraft which are on the ground during tactical operations habitually camouflaged or concealed?

14. Are air warning systems established and operated during field exercises?

15. Are all extended cross-country flights authorized by the appropriate commander and conducted in accordance with directives of higher headquarters?

16. Is training in night flying being conducted safely and properly?

Section II. ADMINISTRATION

17. Are the following publications on hand and available for reference?

a. Applicable Department of the Army field manuals and training circulars.

b. Applicable directives issued by unit and higher headquarters.

c. Appropriate Army Regulations.

d. Appropriate technical publications.

18. Has the local flying area been designated, and have safety regulations been prescribed and are they being enforced?

19. Are all aviators familiar with local restricted and danger areas?

20. Are aeronautical charts and applicable maps available in sufficient quantity?

21. Are new aviators required to familiarize themselves with local conditions of terrain and weather before attempting tactical or extended flights?

22. Is a record of aircraft accidents and damages adequately maintained?

23. Is a satisfactory record of missions maintained?

24. Are proper precautions observed concerning mooring, starting, refueling, and ground handling of aircraft?

25. Are all aviators physically qualified for flying as attested by successful completion of prescribed physical examinations?

26. Are all supplies and equipment properly handled and stored?

27. Are pertinent forms and records properly maintained, such as—

a. Operations forms?

b. Aviation equipment forms?

c. Individual forms, including flight record?

28. Are all prescribed inspections of aircraft conducted properly and at the specified times?

29. Are proper grades of aircraft engine oil, hydraulic fluids, and gasoline being used?

30. Are aircraft clean and free of accumulated oil and dirt? Are windshields and windows clear?

31. Is gasoline strained through a standard strainer or chamois? Is the refueling apparatus properly grounded when aircraft are being refueled?

32. Are compasses adjusted periodically as required by pertinent directives?

33. Are parachutes inspected once every 10 days, as prescribed? Are they repacked by an authorized parachute rigger at least once every 60 days?

34. Are parachutes clean, handled properly, and stored in a clean dry place?

35. Are all fire extinguishers filled to capacity and in good condition?

36. Are all adequate measures being taken to safeguard equipment?

37. Are test flights performed by designated flight test officers?

APPENDIX VI

MINIMUM TRAINING SCHEDULES

Section I. GENERAL

1. PURPOSE

This appendix is a general guide for minimum training of personnel *in the subjects contained in this manual.*

2. SCOPE

It is designed to provide the *minimum* instruction necessary to familiarize commanders and staff personnel with the characteristics, capabilities, limitations, and employment of Army aviation. It outlines the *minimum* instruction necessary for aviation sections to perform essential duties and work as a team to meet the minimum training standards. *Additional training beyond the scope of this appendix is necessary to develop efficient and well-trained individuals and sections.*

3. SCHEDULES

Four schedules are provided as follows:

a. Familiarization. This schedule is intended to provide the instruction necessary to familiarize unit officers with the characteristics, capabilities, limitations, and tactical employment of army aviation.

b. Army Aviators. This schedule is intended to provide the instruction necessary for Army aviators to carry out their command functions with respect to the aviation sections and their functions as staff officers on the unit commanders' staffs.

c. Observer Personnel. This schedule is intended to provide the instruction necessary to familiarize air observers with the characteristics, capabilities, and limitations of Army aviation and to familiarize air observers with techniques of observation from the air.

d. Aviation Section Personnel. This schedule is intended to provide the instruction necessary for the performance of essential duties by the enlisted personnel of the aviation sections.

4. APPLICATION

a. Training will be conducted in accordance with the doctrine and procedures described in FM 21–5 and TM 21–250.

b. Training of individuals in technical specialties should be conducted in addition to the time allotted in this schedule. For example, flight training of aviators should be given in appropriate Army aviation schools.

c. Throughout the training period, the application of prior instruction to current training is stressed.

d. Because of the limited number of personnel in the unit aviation section, it may be advantageous to conduct certain phases of instruction under the supervision of a higher headquarters.

e. The necessity for developing leadership and initiative must be borne in mind throughout the training.

5. EQUIPMENT

T/O&E and T/A as applicable, mooring devices and units equipped with indirect fire weapons, as available.

6. TRAINING AIDS

Sandtables, blackboards, chart, and forms.

Section II. SUBJECT SCHEDULES

7. FAMILIARIZATION (7½ HOURS)

Period	Hours	Subject	Text references	Area	Training aids and equipment
1	1	Basic principles, capabilities, and limitations of Army aviation (conference and demonstration).	Pars. 3–21	Classroom; airfield	Blackboard, charts, and unit aircraft.
2	1	Technique of employment (conference and demonstration).	Pars. 22–36	do	Blackboard, charts, and T/O&E equipment.
3	1	Missions (conference).	Pars. 37–39; 43–45; 47–49; 55–69; 75–80; 83–87; 92–97.	Classroom	Blackboard and charts.
4	2	Operations (conference).	Pars. 100–119	do	Do.
5	1	Special operations (conference).	Pars. 120–176	do	Do.
6	1	Communications, supply and maintenance, and training (conference).	Pars. 177–203; app. II, par. 1; app. III; apps. V–VI.	do	Do.
7	One-half hour per student.	Familiarization flight (practical).	Pars. 5–21; 37–50; app. IV, pars. 4–6.	Airfield	T/O&E aircraft.

a. First Period.

(1) *Objective.* To acquaint unit officers with the capabilities of Army aircraft.

(2) *Outline.* This is a conference and demonstration covering the mission of Army aviation, basic principles of employment, characteristics of Army aircraft with particular emphasis on the types with which the unit is equipped, capabilities and limitations of Army aircraft, and the problems of security in the air. Students should be given an opportunity to examine as many types of aircraft as possible during the last half hour.

b. Second Period.

(1) *Objective.* To acquaint unit officers with command and staff functions in relation to Army aviation.

(2) *Outline.* This is a conference and demonstration covering methods of control used in employing Army aviation; the functions of the unit aviation officer; staff coordination with the unit aviation officer; reconnaissance, selection, occupation, organization, and development of airfields; command responsibility for airfields; and defense of airfields. During the last 15 minutes, the students should be given the opportunity to examine a typical airfield as it would be established in the field.

c. Third Period.

(1) *Objective.* To acquaint unit officers with the types of missions which Army aviation may perform.

(2) *Outline.* This is a conference on the technique of employment of Army aviation to include observation, reconnaissance, column control, camouflage inspection, photography, and survey. Particular stress should be placed on the capabilities and limitations of the types of aircraft with which the unit is equipped and the value of particular types of missions to the particular unit.

d. Fourth Period.

(1) *Objective.* To acquaint unit officers with the employment of Army aviation in conjunction with normal types of operations.

(2) *Outline.* This is a conference covering the employment of Army aviation in conjunction with administrative and tactical troop movements, offensive combat, defensive combat, and retrograde movements. It should cover the

employment of Army aviation as a whole, but particular emphasis should be placed on its employment in the operations of a particular unit.

e. Fifth Period.

(1) *Objective.* To acquaint unit officers with the employment of Army aviation in special operations.

(2) *Outline.* This is a conference covering the employment of Army aviation in conjunction with night, airborne, amphibious, jungle, desert, and mountain operations; operations in snow and extreme cold; and operations in support of and against guerilla forces. It should cover the employment of Army aviation as a whole, but particular emphasis should be placed on its employment in the operations of the particular unit.

f. Sixth Period.

(1) *Objective.* To acquaint unit officers with the communications, supply and maintenance, and training of the air section; and with the information available in appendixes II, III, V, and VI of this manual.

(2) *Outline.* This is a conference covering methods of communicating with the air section including air warning nets; responsibilities for supply and maintenance including echelons of maintenance, technical inspection and technical publications; and training of aviators, observers and enlisted personnel of the aviation section with particular emphasis on the necessity for such training. Appendixes II, III, V, and VI should be briefly discussed to acquaint officers with the material available in them.

g. Seventh Period.

(1) *Objective.* To acquaint officers with the problems of observation and orientation.

(2) *Outline.* This period should include landing in a small, undeveloped air strip. Officers should be required to locate on a map a point marked on the ground and on return from the flight describe the route followed and activity observed.

8. ARMY AVIATORS (19 HOURS)

Period	Hours	Subject	Text references	Area	Training aids and equipment
1	1	Technique of employment (conference).	Pars. 3, 4; 20–26	Classroom	Blackboard and charts.
2	1	Observation and surveillance (conference).	Pars. 20, 21; 37–54	do	Do.
3	1	Air reconnaissance, column control, and camouflage inspection (conference).	Pars. 55–65	do	Do.
4	1	Aerial photography and survey operations (conference).	Pars. 66–74	do	Do.
5	1	Transportation missions (conference).	Pars. 75–99	do	Do.
6	1	Communications (conference).	Pars. 177–188	do	Do.
7	1	Reconnaissance, selection, occupation, organization, and development of unit airfields; communications (conference).	Pars. 27–36; 108; 177–178; 186–188.	do	Sandtable, blackboard, and charts.
8	4	Organization of the unit airfield; communications (practical).	Pars. 31–33; 177–179; 186–188.	Field	T/O&E equipment.
9	8	Reconnaissance, selection, occupation, organization, and development of unit airfields; communications (practical).	Pars. 27–36; 108; 177–179; 186–188.	do	Do.
10					
11	4	Night operations (practical).	Pars. 122–124; 126	do	Do.
	1	Operations, troop movements (conference).	Pars. 100–102	Classroom	Blackboard and charts.

8. ARMY AVIATORS (19 HOURS)—Continued

Period	Hours	Subject	Text references	Area	Training aids and equipment
12	8	Methods of loading and transporting aircraft (conference and practical).	App. II	Airfield	T/O&E equipment, vehicles and/or mock-ups.
13	2	Operations, offensive combat (conference and practical).	Pars. 103–109	Classroom	Blackboard, charts, and maps.
14	2	Operations, defensive combat (conference and practical).	Pars. 110–119	do	Do.
15	2	Special operations (conference).	Pars. 120–176	do	Blackboard and charts.
16	1	Supply, maintenance, and training (conference).	Pars. 189–203	do	Do.

a. First Period.

(1) *Objective.* To acquaint unit aviators with the responsibilities as unit aviation officers on a unit commander's staff.

(2) *Outline.* This is a conference covering the functions of the aviator as a staff officer and the factors to be taken into consideration in the training and employment of aviation sections. It includes the mission of Army aviation and the basic principles of employment. It also covers methods of control utilized by higher headquarters; estimates, recommendations, and plans; and staff coordination. Security from enemy ground fire and outbound projectiles should also be covered briefly.

b. Second Period.

(1) *Objective.* To acquaint unit aviators with the technique of employment of Army aviation in the performance of observation and surveillance missions.

(2) *Outline.* This is a conference covering the employment of Army aviation on observation and surveillance missions. It should cover basic observation techniques; preflight planning; indications of activity; use of field glasses; flight path and altitudes; direction of observation; recording and reporting information; surveillance, including counterbattery surveillance; and conduct of fire.

c. Third Period.

(1) *Objective.* To acquaint unit aviators with the technique of employment of Army aviation on reconnaissance missions and for column control.

(2) *Outline.* This is a conference covering the employment of Army aviation for reconnaissance, camouflage inspection, and column control. It includes route, position, and engineer reconnaissance, including reporting of information; column control, including flight path, altitude, and communication; camouflage inspection, including frequency of inspection; flight technique; and the use of photographs.

d. Fourth Period.

(1) *Objective.* To acquaint unit aviators with the employ-

ment of Army aviation for aerial photography and survey operations.

(2) *Outline.* This is a conference covering the employment of Army aviation on photography and survey missions. It includes preflight planning for photographic missions and the value of photographs to units. That portion of the conference concerning survey operations should include a brief demonstration of the computations used to solve the intersection, angle of site, and resection problems as well as the technique of using aircraft on the missions.

e. Fifth Period.

(1) *Objective.* To acquaint unit aviators with the types of transportation missions for which Army aviation is suitable.

(2) *Outline.* This is a conference covering the employment of Army aviation on transportation missions. It includes messenger service, liaison, evacuation, rescue, supply, troop movement, wire laying, and radio relay. Emphasis should be placed on the fact that aircraft should not be diverted from observation missions except in cases of emergency.

f. Sixth Period.

(1) *Objective.* To familiarize unit aviators with the means of communication available to aviation sections.

(2) *Outline.* This is a conference covering radio, wire, and visual communications and message drop and pickup. It includes a discussion of air warning nets. The communications of the particular type of unit to which the aviators are assigned should be used to illustrate the facilities available.

g. Seventh Period.

(1) *Objective.* To teach unit aviators the techniques used in establishing unit airfields.

(2) *Outline.* This is a conference covering the reconnaissance, selection, occupation, organization, and development of unit airfields, including the communications established at the airfield. This period is in preparation for periods 8 and 9.

h. Eighth Period.

(1) *Objective.* To show unit aviators a correctly selected airfield and to give them practice in organizing an airfield after the site has been selected.

(2) *Outline.* This is a practical exercise on the organization of a complete unit airfield. Unit aviators, with their aviation sections, should be required to complete all installations at a previously selected site. This period should stress the necessity for dispersion, camouflage, and security. A brief flight over the site, after the installation is completed, should be used to emphasize the need for dispersion and camouflage. This period should be conducted at the same time as period 4, paragraph 10.

i. Ninth Period.

(1) *Objective.* To give unit aviators practical experience in the reconnaissance, selection, occupation, and organization of a unit airfield.

(2) *Outline.* This is a practical exercise in reconnaissance, selection, occupation, organization, and development of the unit airfield. Throughout the exercise personnel should perform their normal duties. Reconnaissance should be performed using a combination of map, air, and ground means based on a tactical situation. This exercise may be executed in conjunction with a unit field exercise. Reconnaissance may be performed by the unit commander or a staff officer with the unit aviation officer. Organization and development should progress as far as time will permit. The completed installation should be inspected thoroughly from the air and on the ground. If time permits, one displacement should be executed with the air section furnishing continuous support to the unit during the displacement. This period should be conducted at the same time as period 7, paragraph 10.

j. Tenth Period.

(1) *Objective.* To give unit aviators practical experience in working with their sections in night operations.

(2) *Outline.* This is a practical exercise in the occupation of a unit airfield during darkness. The airfield should be selected during daylight and the displacement, occupa-

tion, and organization conducted after dark. This exercise may be used as a continuation of the ninth period. It should be conducted at the same time as period 8, paragraph 10.

k. Eleventh Period.

(1) *Objective.* To familiarize unit aviators with the operation of Army aviation in conjunction with troop movements.

(2) *Outline.* This is a conference covering the employment of Army aviation with the administrative and tactical movements of troops. Tactical movements should be presented as a progressively developing tactical situation on a map with the students solving short requirements to illustrate the principles of employment.

l. Twelfth Period.

(1) *Objective.* To give unit aviators practical experience in working with their sections in loading aircraft for movement.

(2) *Outline.* This period consists of a conference on loading aircraft for movement and a practical exercise in loading aircraft on trucks. The first part of the period, not to exceed 1 hour, should be devoted to a conference on the loading of aircraft for rail, water, and air movement. The remainder of the period should be used for loading the aircraft on a truck for a long haul, and then unloading and preparing the aircraft for operation. This period should be conducted at the same time as period 9, paragraph 10.

m. Thirteenth Period.

(1) *Objective.* To teach unit aviators the principles of employment of Army aviation in support of offensive operations.

(2) *Outline.* This is a conference and map exercise covering the principles of employment of Army aviation with units on offensive operations. It includes penetrations, envelopments and turning movements, exploitation, pursuit, displacements, and relief of committed units. Students should be presented with tactical situations on a map

and be required to solve short problems to illustrate the principles of employment.

n. Fourteenth Period.

(1) *Objective.* To teach unit aviators the principles of employment in support of defensive operations.

(2) *Outline.* This is a conference and map exercise covering the principles of employment of Army aviation with units on defensive operations. It includes preliminary operations, security forces, defense of the main battle position, relief of defending garrisons, delaying actions, withdrawals, retirements, and airfields. Students should be presented with tactical situations on a map and be required to solve short problems to illustrate the principles of employment.

o. Fifteenth Period.

(1) *Objective.* To familiarize unit aviators with the peculiarities of the various types of special operations.

(2) *Outline.* This is a conference covering night, airborne, amphibious, jungle, desert, and mountain operations; operations in snow and extreme cold; and operations against and in support of guerilla operations. This period should stress the fact that Army aviation will perform the same mission in special operations as in other operations. The special considerations required by the nature of the operation, terrain, or weather should be the subject of the conference.

p. Sixteenth Period.

(1) *Objective.* To familiarize unit aviators with their responsibilities for supply, maintenance, and training.

(2) *Outline.* This is a conference covering the responsibilities for supply, maintenance; the categories and echelons of maintenance; responsibility for aircraft technical inspections; and technical publications. It includes also the scope of the training programs for aviators, observers, and enlisted personnel of the aviation section; the responsibilities of the unit aviation officer for this training; and the necessity for all personnel to maintain a high degree of skill in their specialties. This conference should be conducted from the point of view of the aviation officer as a staff officer on the unit commander's staff.

9. OBSERVER PERSONNEL (31 HOURS)

GROUND SCHOOL SUBJECTS

Period	Hours	Subject	Text references	Area	Training aids and equipment
1	1	Familiarization (conference and demonstration).	Pars. 5–9	Airfield	T/O&E aircraft.
2	1	Ground handling, servicing and mooring of aircraft (conference and demonstration).	App. IV	do	Do.
3	1	Elementary navigation (conference and demonstration).	Pars. 124; 131; 139; 146; 152; 158; 164.	Classroom	Blackboard, charts.
4	1	Technique of observing from the air (conference).	Pars. 37–50.	do	Blackboard, charts, aerial photos.
5	6	Conduct of fire conference and terrain board (exercise).	Pars. 51–54	do	Blackboard, charts, firing tables, terrain boards.
6	1	Principles of aerial reconnaissance (conference).	Pars. 55–59	do	Blackboard, charts, projector, aerial photos.
		Flight Subjects			
7	5	Elementary observation (practical).	Pars. 5–15; 22–26; 37–74; App. IV.	Airfield	T/O&E equipment.
8	3	Conduct of fire (practical).	Pars. 51–54	Airfield and local area.	T/O&E aircraft and firing units.
9	12	Advanced observation (practical).	All previous assignments.	Airfield	Charts, T/O&E aircraft.

a. First Period.

(1) *Objective.* To familiarize air observers with the particular type of aircraft in which they will fly.

(2) *Outline.* This is a conference and demonstration covering the characteristics of the type aircraft with which the unit is equipped. Students should be given an opportunity to examine the aircraft thoroughly. The landing and take-off characteristics and maneuverability should be demonstrated.

b. Second Period.

(1) *Objective.* To familiarize observer personnel with the ground handling, servicing, and mooring of aircraft.

(2) *Outline.* This is a conference and demonstration period in ground handling, servicing, and mooring aircraft. The period should include instruction in cockpit procedures, tie-down methods, service checks, and safety procedures. The student should be given sufficient instruction so that he will be able to assist the pilot in starting the aircraft and in mooring the aircraft.

c. Third Period.

(1) *Objective.* To familiarize the student with navigational aids and basic navigation techniques used by the Army aviator.

(2) *Outline.* This is a conference and demonstration covering the use of aeronautical charts, time and distance calculations, course lines, speed lines, check points, elevation, and navigation aids.

d. Fourth Period.

(1) *Objective.* To familiarize the student with the technique of observing from an air OP.

(2) *Outline.* This is a conference covering techniques peculiar to observation from an air OP, time and space factors, terrain analysis, pre-mission planning, area scanning, detailed study of features, and clues to activity.

e. Fifth Period.

(1) *Objective.* To review the principles and procedures of

observed fire and to teach the observer the application of these in the conduct of fire from the air observation post.

(2) *Outline.* This is a conference and terrain board exercise period. The early conference hours should be devoted to review of the general principles of the conduct of fire; location of targets; fire requests and subsequent corrections; elementary ballistics and dispersion; and the selection of proper projectile, charge, and fuze. Later conferences should cover air OP procedures for the conduct of precision and area fire missions using percussion fuze, and the conduct of time registration and time area fire using fuze time and VT fuze. The last two hours should be devoted to terrain board exercises.

f. Sixth Period.

(1) *Objective.* To familiarize the student with the principles of aerial reconnaissance.

(2) *Outline.* This is a conference covering the capabilities and limitations of air reconnaissance and the conditions under which it is used.

g. Seventh Period.

(1) *Objective.* To teach the student the application of the basic techniques of planning and executing observation missions.

(2) *Outline.* This is a practical exercise period. The first hour should be devoted to a practice flight in which the observer will be subjected to various flight maneuvers peculiar to proper handling of an aircraft in the conduct of air OP missions. An orientation exercise by the student should be included in this hour. The next 2 hours are devoted to a practical flight in which the pilot will demonstrate the proper observation technique to be used from an air OP. This will include locating terrain features and objects by map coordinates, converting ground locations to map coordinates, estimating range on the ground, and identifying objects. The last 2 hours are devoted to practical observation exercises in which the student will be required to perform the air observation missions demonstrated during the previous two hours.

h. Eighth Period.

(1) *Objective.* To give the student practical experience in conduct of observed fire from an air OP.

(2) *Outline.* This is a practical gunnery service practice to be conducted from an air OP using the principles, technique, and procedures learned in all previous gunnery periods.

i. Ninth Period.

(1) *Objective.* To give the student practical experience in observing for his unit from an air OP.

(2) *Outline.* This is a practical observation flight period in which the student will be required to apply all material presented in previous observation instruction periods. During this period the observer should perform reconnaissance and observation missions suited to the tactical role of his unit. This period should be conducted, if possible, at a time when the student can be employed as an air observer for his unit on a tactical field exercise. Two hours of this period will be devoted to a night observation exercise in which the student will observe ground activity from an air OP aided by any means of artificial illumination available.

10. AVIATION SECTION (32 HOURS)

Period	Hours	Subject	Text references	Area	Training aids and equipment
1	1	Capabilities and limitations of army aircraft (conference).	Pars. 5–21	Airfield	Blackboard, charts, and unit aircraft.
2	1	Types of missions performed by army aviation (conference).	Pars. 3; 55–66; 69; 75–99.	Classroom	Blackboard and charts.
3	1	Organization of the unit airfield; communications (conference).	Pars. 27–33; 35–36; 108; 177–179; 186–188.	do	Sandtable, blackboard, and charts.
4	4	Organization of the unit airfield; communications (practical).	Pars. 31–33; 177–179; 186–188.	Field	T/O&E equipment.
5	4	Ground handling and mooring (conference and practical).	App. IV	Airfield	T/O&E equipment and mooring devices.
6	1	Reconnaissance, selection, occupation, organization, and development of unit airfield; communications (conference).	Pars. 27–33; 35–36; 108; 177–179; 186–188.	Classroom	Sandtable, blackboard, and charts.
7	8	Reconnaissance, selection, occupation, organization, and development of unit airfields; communications (practical).	do	Field	T/O&E equipment.
8	4	Night operations (practical).	Pars. 122–124; 126	do	Do.
9	8	Methods of loading and transporting aircraft (conference and practical).	App. II	Airfield	T/O&E equipment, vehicles, and/or mock-ups.

a. First Period.

(1) *Objective.* To familiarize personnel of the unit aviation section with the capabilities and limitations of Army aircraft.

(2) *Outline.* This is a conference covering the characteristics, capabilities and limitations of Army aircraft, and the problems of security from hostile action against the aircraft. It should include a discussion of all Army aircraft, but particular emphasis should be placed on the discussion of the type aircraft with which the unit is equipped. Students should be given the opportunity to examine as many types of aircraft as possible during the last half hour.

b. Second Period.

(1) *Objective.* To familiarize personnel of the unit aviation section with the missions of Army aviation.

(2) *Outline.* This is a conference covering briefly the types of missions which Army aviation may be required to perform. The discussion should cover all types of Army aircraft, but it should emphasize those missions applicable to the type of unit and the aircraft with which the unit is equipped.

c. Third Period.

(1) *Objective.* To teach personnel of the unit aviation section the organization of a unit airfield.

(2) *Outline.* This is a conference covering the organization of a complete unit airfield. Principles discussed are illustrated using the blackboard and the sandtable.

d. Fourth Period.

(1) *Objective.* To give personnel of the unit aviation section practical experience in organizing completely a unit airfield.

(2) *Outline.* This is a practical period on the organization of a complete unit airfield. Personnel should be required to complete all installations at a previously selected site. This period should stress the necessity for dispersion, camouflage, and security. A brief flight over the site, after the installation is completed, should be used to emphasize the need for dispersion and camouflage. This

period should be conducted at the same time as period 8, paragraph 8.

e. *Fifth Period.*

(1) *Objective.* To teach the proper procedures and give practical experience in ground handling and mooring of unit aircraft.

(2) *Outline.* This is a conference and practical period in ground handling and mooring of aircraft. Instruction should be restricted to the type aircraft with which the unit is equipped. Starting of engines and ground operations of aircraft should be demonstrated. Safety precautions to be observed in the vicinity of aircraft should be stressed.

f. *Sixth Period.*

(1) *Objective.* To teach personnel of the unit aviation section the procedures and considerations in establishing a unit airfield.

(2) *Outline.* This is a conference to familiarize personnel of the unit aviation section with the procedures of reconnaissance, selection, occupation, organization, and development of unit airfields and the factors which must be taken into consideration in the selection of the site.

g. *Seventh Period.*

(1) *Objective.* Practical application of the instruction presented in the third period.

(2) *Outline.* This is a practical exercise in reconnaissance, selection, occupation, organization, and development of the unit airfield. Throughout the exercise personnel should perform their normal duties. Reconnaissance should be performed using a combination of map, air, and ground means based on a tactical situation. This exercise may be executed in conjunction with a unit field exercise. Reconnaissance may be performed by the unit commander or a staff officer with the unit aviation officer. Organization and development should progress as far as time will permit. The completed installation should be inspected thoroughly from the air and on the ground. If time permits, one displacement should be executed with the air section furnishing continuous support to the unit during the displacement. This period should be conducted at the same time as period 9, paragraph 8.

h. Eighth Period.

(1) *Objective.* To give personnel of the unit aviation section practical experience in the occupation of an airfield during darkness.

(2) *Outline.* This is a practical exercise in the occupation of a unit airfield during darkness. The airfield should be selected during daylight and the displacement, occupation, and organization conducted after dark. This exercise may be used as a continuation of the practical exercise in the sixth period. It should be conducted at the same time as period 10, paragraph 8.

i. Ninth Period.

(1) *Objective.* To teach personnel of the unit aviation section the methods of loading and transporting aircraft.

(2) *Outline.* This period consists of a conference on loading aircraft for movement and a practical exercise in loading aircraft on trucks. The first part of the period, not to exceed 1 hour, should be devoted to a conference on the loading of aircraft for rail, water, and air movement. The remainder of the period should be used for loading the aircraft on a truck for a long haul and then unloading and preparing the aircraft for operation. This period should be conducted at the same time as period 12, paragraph 8.

INDEX

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FM 20-100
C 1

FIELD MANUAL

ARMY AVIATION

CHANGES No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *14 May 1953*

FM 20-100, 25 February 1952, is changed as follows:

6. TWO-PLACE AIRPLANE

The tactical two-place Army airplane is light in weight. It can maintain a constant observing altitude at speeds as slow as 50–60 miles per hour, but it can also reach cruising speeds of 90–125 miles per hour for flights on more extended missions. Its weight and * * * of the cockpit.

21. OUTBOUND PROJECTILES

a. (Superseded) To accomplish their tactical missions, Army aircraft normally must fly in advance of, or over, friendly artillery; consequently, there is a possibility of being hit by an outbound artillery projectile. Army aviation sections should maintain accurate, up-to-date locations of friendly artillery position areas plotted on their operation maps. Pilots should consider these locations when planning flights in order to accomplish their missions with the least hazards from friendly artillery fire. Artillery personnel should maintain effective surveillance and cease firing if friendly aircraft approach the trajectorys' danger zone.

* * * * * * *

24. UNIT AVIATION OFFICER

a. The **ranking** Army aviation officer in a unit has dual functions; he is the aviation officer of the unit commander's staff and he controls the aviation section. As a staff * * * their aviation officers.

* * * * * * *

40. PREFLIGHT PLANNING

a. Unit Aviation Officer. Advance planning for * * *. Briefing should cover—

* * * * * * *

(7) (Superseded) Flying safety precautions, including known enemy air activity, ground antiaircraft installations, and, if appropriate, special survival procedures in case of forced landing.

* * * * * * *

51. GENERAL

Maximum flexibility in * * * their basic branch. For detailed discussions of the procedures employed in the adjustment of artillery fire, mortar fire, and naval gunfire, see FM 6-40, FM 6-135, **FM 23-90, and** FM 23-92.

85.1. PLANS

(Added)

To expedite and facilitate the accomplishmnt of a rescue mission, well prepared plans should be made. The plans should include items such as designation of aircraft, communication procedures, personnel, supporting arms, and as much detail as possible in order to enable the rescue plan to be implemented immediately.

86. GENERAL

* * * * * * *

b. Plans for use * * * in the area. **Cargo** helicopters are **suitable** for night supply missions.

89. MODIFICATIONS REQUIRED

a. For interior loads, the installation of **D**-rings for lashings is required. The installation of **D**-rings must be made in compliance with pertinent technical instructions issued by Chief of **Transportation.** If there is * * * padded or wrapped.

* * * * * * *

125. MISSIONS

* * * * * * *

b. Army aircraft may also be used at night liaison and courier missions. The **cargo** helicopter is suitable for night **supply missions.**

* * * * * * *

155. MAINTENANCE

a. The chief maintenance * * * causes excessive wear. **To help retard this wear, frequent servicing of air intake filters is mandatory.**

* * * * * * *

APPENDIX I

REFERENCES

Section I. DEPARTMENT OF THE ARMY AND JOINT PUBLICATIONS

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(Added)

AR 35–6520	Property Accountability and Responsibility.
AR 35–6700	Disposition of Property Records.
AR 726–10	General Policies.
AR 735–150	Accounting for Lost, Damaged, and Destroyed Property.

* * * * * * *

(Added)

SR 32–150–20	Flying Clothing and Equipment for Army Personnel.
SR 735–230–1	Allowable Losses in Handling Bulk Petroleum Products.
SR 755–5–1	Reporting of Station and Technical Service Excess Personal Property.

* * * * * * *

FM 6–101	**The Field Artillery Battalion.**
FM 7–40	**Infantry Regiment.**
FM 21–30	**Military Symbols.**

(Added)

FM 23–90	81-mm Mortar, M1 and M29.
FM 23–92	4.2-Inch Mortar, M2.

[AG 373 (13 Apr 53)]

[redacted]ion

BY ORDER OF THE SECRETARY OF THE ARMY:

J. LAWTON COLLINS
Chief of Staff, United States Army

OFFICIAL:
WM. E. BERGIN
Major General, USA
The Adjutant General

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NG: same as Active Army.
Army Reserve: Same as Active Army.
For explanation of distribution formula, see SR 310–90–1.

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