

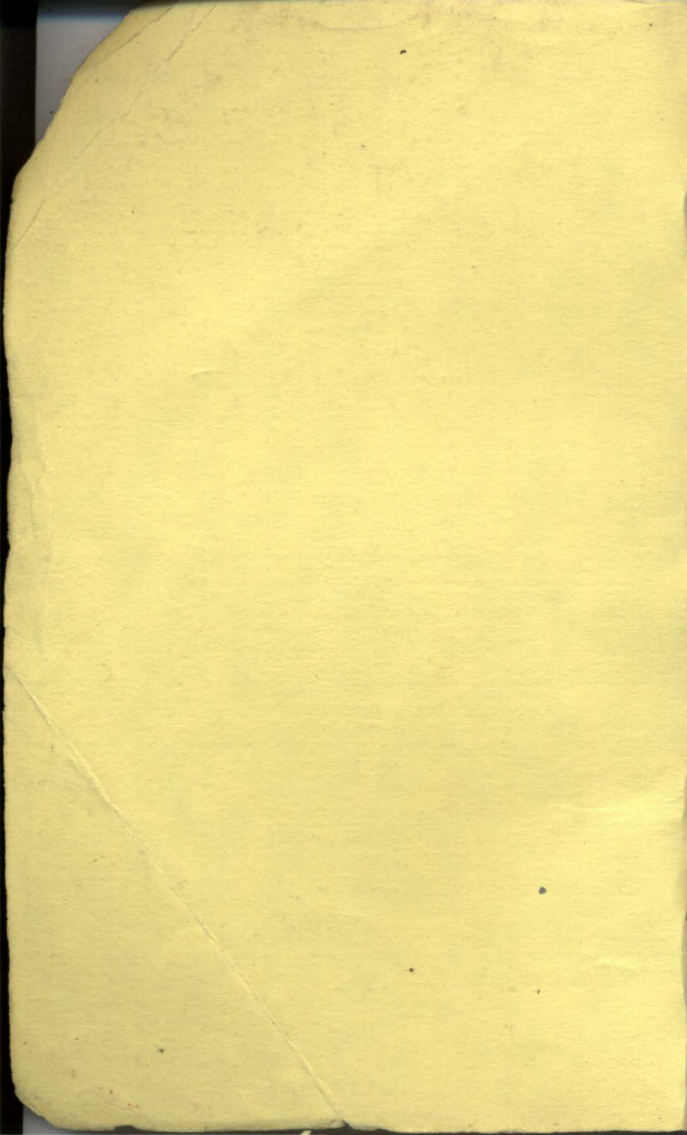
DEPARTMENT OF THE ARMY FIELD MANUAL
AVIATOR'S HANDBOOK

FM1-105

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AVIATOR'S HANDBOOK

Paragraphs Page

CHAPTER 1.	PURPOSE AND SCOPE	1-1, 1-2	1-1
2.	AVIATION TASKS AND RELATED MATERIAL		2-1
Section I.	Tactical Low-Level Operations	2-1 —2-2	2-1
II.	Tactical Landing Areas	2-3 —2-5	2-6
III.	Airlift of Materiel and Personnel	2-6 —2-11	2-8
IV.	Reconnaissance and Surveillance, and Electronic Warfare	2-12—2-17	2-13
V.	Aeromedical Evacuation	2-18—2-21	2-17
VI.	Environmental Factors		2-20
	Arctic operations	2-22	2-20
	Desert operations	2-23	2-23

*This manual supersedes FM 1-105, 20 June 1969, including all changes.

		Paragraphs	Page
	Tropical operations	2-24	2-27
	Mountain operations	2-25	2-30
Section VII.	Formation Flight	2-26—2-27	2-36
VIII.	Nuclear Warfare Environment		
	Operations	2-28—2-33	2-38
IX.	Parachuting	2-34—2-39	2-41
X.	Rappelling	2-40—2-44	2-45
XI.	FM Homing	2-45—2-47	2-49
XII.	Search and Rescue	2-48—2-59	2-52
XIII.	Transponder Equipment		
	Operation	2-60—2-64	2-60
XIV.	Wire Laying	2-65—2-70	2-65
XV.	Amphibious Operations	2-71—2-75	2-69
CHAPTER 3.	FIRE SUPPORT		3-1
Section I.	Adjustment of Fire	3-1 —3-10	3-1
	II. Naval Gunfire	3-11—3-14	3-8
III.	Helicopter and Tactical Air Support	3-15—3-19	3-11
CHAPTER 4.	SURVIVAL		4-1
Section I.	Arctic Survival	4-1 —4-9	4-1
	II. Desert Survival	4-10—4-20	4-8
III.	Tropical Survival	4-21—4-28	4-14
IV.	Mountain Survival	4-29—4-37	4-19
V.	Sea Survival	4-38—4-44	4-23
VI.	Ground-Air Emergency Codes	4-45—4-48	4-27
CHAPTER 5.	REFERENCES IN ALPHABETICAL ORDER BY TOPIC		5-1

CHAPTER 1

PURPOSE AND SCOPE

1-1. Purpose.

The purpose of this handbook is to provide the Army aviator with a pocket guide of information useful for the successful accomplishment of his mission. The material contained herein is not designed to replace the need for proficiency in, or diligent study of, aviation-related tasks. It is designed to be a supplement to the many aviation field and technical manuals. The pocket guide is designed so that the aviator may have at his disposal, both in flight and during preflight planning, a handy summary of procedures and checklists which will facilitate his mission under any environment or threat.

1-2. Scope

The handbook is organized into five chapters. The first chapter is the introduction. The second chapter deals with information pertaining to aviation tasks the aviator can be expected to perform on a relatively frequent basis. The third chapter is devoted solely to fire support and the adjustment of indirect and direct fires that an Army aviator should know. The fourth chapter is a condensation of survival information by geographic region. The fifth chapter is a reference file, by topic, for the aviator to use in assisting him to find the reference material (FM's, TM's and AR's) that pertains to his mission.

1-3. Recommended Changes.

Users of this publication are encouraged to recommend changes and submit comments for its improvement. Comments should be keyed to the specific page, paragraph, and line of the text in which the change

is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. **Comments should be prepared using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded to Commandant, US Army Aviation School, ATTN: ATST-D-TL, Fort Rucker, Alabama 36360.**

CHAPTER 2

AVIATION TASKS AND RELATED MATERIAL

Section I. TACTICAL LOW-LEVEL OPERATIONS

2-1. Definitions

a. *Low-Level Flight Operations.* Low-level flight operation is the operation of Army aircraft at optimum altitudes which afford cover and concealment from ground visual and electronic detection in order to exploit surprise to the fullest. Low-level flight operations encompass low-level flight, contour flight, and nap-of-the-earth flight.

b. *Low-Level Flight.* Flight conducted at a selected altitude at which detection or observation of an aircraft or of the points from which and to which it is flying is avoided or minimized. The route is preselected and conforms generally to a straight line and a constant airspeed and indicated altitude. This method is best adapted to flights conducted over extended distances or periods of time.

c. *Contour Flight.* Flight at low altitude conforming generally, and in close proximity, to the contours of the earth. This type flight takes advantage of available cover and concealment in order to avoid observation or detection of the aircraft and/or its points of departure and landing. It is characterized by a constant airspeed and a varying altitude as vegetation and obstacles dictate.

d. *Nap-of-the-Earth Flight.* Flight as close to the earth's surface as vegetation or obstacles will permit, while generally following the contours of the earth. Airspeed and altitude are varied as influenced by the terrain, weather, and enemy situation. The pilot preplans a broad corridor of operation based



Figure 2-1. Low-level flight, AH-1G.

on known terrain features which has a longitudinal axis pointing toward his objective. In flight, the pilot uses a weaving and devious route within his preplanned corridor while remaining oriented along his general axis of movement in order to take maximum advantage of the cover and concealment afforded by terrain, vegetation, and manmade features. By gaining maximum cover and concealment from enemy detection, observation, and firepower, nap-of-the-earth flight exploits surprise and allows for evasive actions.

e. Low-Level Navigation. Low-level navigation is the technique of directing an aircraft along a desired course at low altitudes by using pilotage, dead reckoning, and electronic navigational aids in such a manner that the position of the aircraft is known at any time.

2-2. Low-Level Operation

Low-level flight operations encompassing low-level contour or nap-of-the-earth flight techniques are extremely difficult. At these altitudes, navigation becomes more difficult because of the decreased range at which the aviator is able to observe identifiable landmarks. Airspeed must be reduced to allow the navigator to remain oriented at all times during the flight.

a. Planning factors.

(1) A study of the map or aerial photo to be used in flight should be directed toward determining the best route to be flown. Considerations which will influence selection are:

- (a) Mission.
- (b) Cover and concealment.
- (c) Identifiable terrain features.
- (d) Enemy threat.
- (e) Weather conditions.

- (f) Altitude mission will be flown.
- (g) Familiarity with terrain.
- (h) Proficiency of flight crew.
- (i) Time available to perform mission.

(2) A thorough map study will enable the pilot and navigator to visualize the area to be traversed so that during the flight only a brief reference to the map is necessary. Crewmen should rehearse proposed flight together by conducting a simulated flight using the map as a reference. Terms which the navigator will use to describe terrain features should be agreed upon by both crewmembers.

(3) Low-level operations will be primarily flown following the contour of the terrain which provides cover and concealment. When flying over terrain which affords few recognizable terrain features, dead reckoning procedures may be required. It is essential to maintain map orientation at all times. If at any time during the flight it becomes apparent that your position is unknown, immediate action should be taken to return to the last known location.

b. *Preflight Planning.* The success of low-level operations depends on proper and adequate preflight planning. The sequence of planning should include—

- (1) Mission analysis.
- (2) Map and aerial photo selection.
 - (a) Scale.
 - (b) Contour interval.
- (3) Map study.
- (4) Route selection.
- (5) Flight planning:
 - (a) Map preparation.
 - (b) Time/distance computations.
 - (c) Flight plan preparation. Compute aircraft load and operating limitations.

- (d) Selection of alternate routes.
- (e) Command and control procedures (multi-aircraft operations).
- (f) Selection of aircraft control points.
- (g) Time of crossing line of contact and re-entry over the frontline trace.
- (h) Fire support provisions .
- (i) Action to be taken if aircraft experiences emergency condition.

(6) Crew Coordination:

- (a) Crew briefing.
- (b) Equipment check.
- (c) Aircraft preflight.

c. *Map and/or Aerial Photo Preparation.*

(1) *Course lines*—Lines denoting desired ground track should be drawn on the map. Use a transparent 'magic marker,' preferably yellow to prevent obscuring map markings.

(2) *Headings*—Identify magnetic headings for legs of a flight over which recognizable terrain features are not available.

(3) *Air control points (ACP)*—Select prominent and identifiable topographical features on the ground, or radio aids over which control is to be initiated.

(4) *Time/Mileage tic marks*—Pencil marks bisecting the course line at 2-minute/5-mile intervals to aid in maintaining positive orientation throughout the flight should be drawn on the map.

(5) *Checkpoints*—Easily identifiable features on the ground, or adjacent to the flight route should be spaced at frequent intervals (4 to 6 minutes apart).

(6) *Distances, barriers, and time between ACP's*—These are other items of information that may be placed on the map face. However, this in-

formation may clutter the map and serve only to confuse the aviator.

Section II. TACTICAL LANDING AREAS

2-3. Responsibilities of the Aviator

Landing areas for Army aircraft vary from completely organized and equipped airfields and heliports to unimproved terrain or roadstrips. Although pathfinder units are responsible for selecting, organizing, and operating tactical landing areas, Army aviators may be required to perform this mission.

2-4. Operations Briefing Checklist

Briefings should include as a minimum—

- a. What unit is to be supported and its type.
- b. What type and number of aircraft will be using the landing area.
- c. What the specific mission is to be.
- d. When the landing area is to be operational at the new location and for how long.
- e. Where the unit headquarters is located.
- f. How the aviator is to operate in accomplishing the task (command relationship).
- g. How logistical support will be provided.

2-5. Planning Sequence for Selection and Occupation of Landing Areas

a. Reconnaissance.

- (1) *Map and aerial photo reconnaissance.*
 - (a) Area(s) suitable for occupation.
 - (b) Proximity of these areas to the area of operation.
 - (c) Provisions for security.
 - (d) Road nets leading into the area for the purpose of resupply, communications, etc.

(2) *Aerial reconnaissance.*

- (a) Barriers.
- (b) Size of usable area.
- (c) Runway length or rotor-blade clearance.
- (d) Obstacles.
- (e) Approach pattern and direction of land-

ing.

- (f) Parking area.
- (g) Availability of concealment.

(3) *Ground reconnaissance.*

- (a) Surface condition.
- (b) Soil texture.
- (c) Drainage.
- (d) Required construction and/or improve-

ment.

(e) Area organization, placement of the control vehicle, operations, tiedowns, etc.

Note. Even though any one of the methods ((1) through (3) above) may prove satisfactory in the selection of the landing area, a combination of the three should be used when time permits.

b. Selection.

(1) After a careful analysis of the consideration affecting aircraft operation, the landing area which best facilitates the accomplishment of the mission is selected.

(2) Once the selection is made, the location must be coordinated with the commander in whose area the landing area is located.

c. Organization. The organization of an area will vary with the type aircraft and the size of the aviation element operating from the landing area; however, areas which are common to most aviation operations include—

- (1) Aircraft parking areas.
- (2) Landing and takeoff areas.
- (3) Fuel storage areas.

- (4) Bivouac areas.
- (5) Messing areas.
- (6) Operations and administrative areas.
- (7) Aircraft maintenance area.
- (8) Ammunition storage area.
- (9) Rearming area.
- (10) Motor vehicle maintenance area.

Section III. AIRLIFT OF MATERIAL AND PERSONNEL

2-6. Pilot Planning Checklist

- a. Amount and type of material or personnel to be airlifted.
- b. Number and type of aircraft participating.
- c. Location and description of pickup zone (PZ).
- d. Time of pickup.
- e. Time of takeoff.
- f. Location and description of dropoff point.
- g. Enemy threat.
- h. Primary and alternate routes to be flown.
- i. Altitude to be flown.
- j. Air control points (if appropriate).
- k. Type of formation to be flown.
- l. Unit supported, radio frequencies, and call signs.
- m. Coordination required with fire control agencies.
- n. Aircrew responsibilities by chalk number.
- o. Crew requirements for transport of external loads.
- p. Emergency procedures.
- q. Provisions for unloading materiel (if appropriate).
- r. Provisions for recovery of aerial delivery equipment.
- s. Refuel and rearm points.

2-7. Special Equipment Checklist

a. Quantity and completeness of life vest and life rafts (over-water flights).

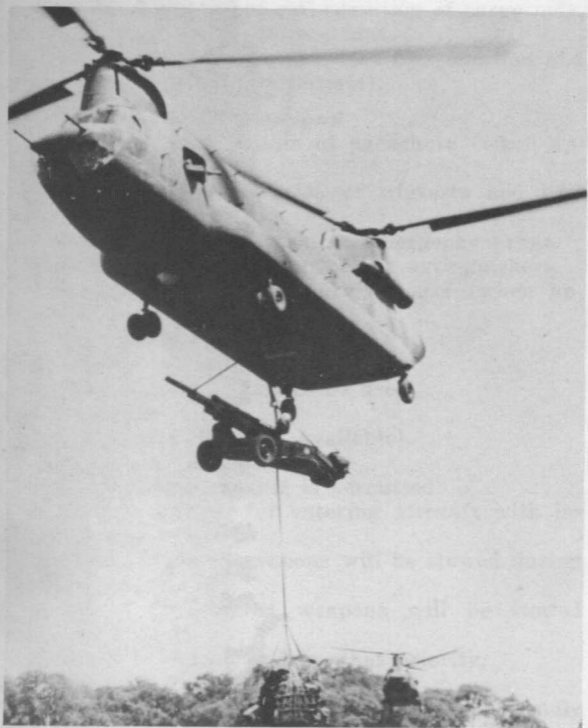


Figure 2-2. Airlift of materiel (CH-47 delivery of howitzer and ammunition).



- b. Quantity and completeness of survival kits.
- c. First aid kits and fire extinguishers.
- d. Check for presence of parabundle parachutes.
- e. Check for presence and security of static line.
- f. Check for presence and condition of cargo nets, slings, D-rings, and tiedown straps.
- g. Check cargo hook and cables for condition and proper operation (if appropriate).

2-8. Briefing Checklist (passengers)

- a. Fitting and operation of parachute (when applicable).
- b. Location and operation of lifevests and life-rafts (when applicable).
- c. Location and operation of emergency exits.
- d. Location and operation of fire extinguishers.
- e. Location and use of survival kits (when applicable).
- f. Location of first aid kits.
- g. Operation of safety belts.
- h. When safety belts will be used.
- i. Sick cups.
- j. Latrine facilities (if available).
- k. Signals (visual and oral).
- l. If and when smoking is permitted.
- m. Proper method for entering aircraft with individual weapons.
- n. How individual weapons will be stowed during flight.
- o. Where crew-served weapons will be stowed and how secured.
- p. When to unload and in what priority.
- q. Duration and route of flight.
- r. Procedures if downed in hostile or unfriendly territory (safe areas and direction of travel).
- s. Keep passengers briefed on aircraft location.
- t. Sleeves down.

2-9. Restraint of Cargo

The total force in one direction against which the cargo must be restrained depends upon the weight of the cargo and the aircraft criteria. To determine the number of tiedowns required to restrain this force, the lashing formula should be applied.

a. Lashing Formula.

$$\frac{\text{Weight} \times \text{Restraining Criteria}}{\text{Tensile strength} \times \% \text{ effectiveness}} = \text{Number of tiedowns.}$$

b. Restraint Criteria in G's.

	<i>Fwd</i>	<i>Aft</i>	<i>Vert</i>	<i>Lateral</i>
UH-1 -----	4	2	2	1.5
CH-47 -----	4	2	2	1.5

c. Percent Effectiveness (tiedown angle 30°/30°).

<i>Fwd and aft</i> -----	75%
<i>Vert</i> -----	50%
<i>Lat</i> -----	43%

For other angles, see percent restraint chart in TM 55-450-15.

d. Tiedown Devices

Nomenclature	Cable	Chain	Webbing	Tensile strength
A-2 (Cargo net)	X			
B-1	X			5,000
C-2		X		10,000
D-1		X		25,000
MB-1		X		10,000
MB-2		X		25,000
MC-1			X	5,000
CGU-1B			X	5,000

2-10. Lashing of Cargo

For details of securing cargo in aircraft, see TM 55-450-15.

2-11. Airlift of Personnel

Normally, the senior passenger aboard the aircraft is designated as the troop commander. The aviator, when acting as pilot in command or aircraft commander, is the final authority with respect to the aircraft and personnel while in flight. For detailed information on airmobile operations, see FM 57-35.

Section IV. RECONNAISSANCE AND SURVEILLANCE, AND ELECTRONIC WARFARE

2-12. Types of Aerial Reconnaissance (FM 1-80)

- a. Route Reconnaissance.*
- b. Zone Reconnaissance.*
- c. Area Reconnaissance.*

2-13. Reconnaissance Preflight Briefing

A general briefing is given daily to all air crews. In addition, a preflight briefing which includes all information relative to the conduct of the mission, is conducted in conjunction with the assignment of the mission. The briefing may be conducted using the format of a 5-paragraph operation order.

a. Situation.

- (1) Known and suspected enemy locations.
- (2) Enemy threat capability.
- (3) Friendly situation.

b. Mission.

- (1) Route, area, or specific location to be observed.
- (2) Time for observation.
- (3) Duration of observation.
- (4) Activities or characteristics of area to be observed.

c. Execution.

- (1) Method of observation (visual, sensor).
- (2) Artillery firing positions.

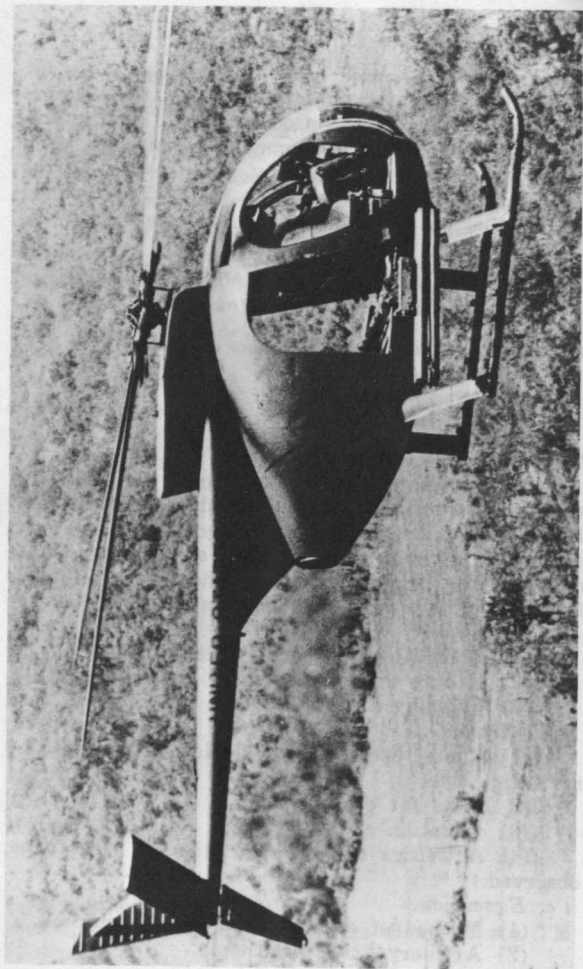


Figure 2-4. Low-level reconnaissance by OH-6.

(3) When, where, and how information is to be reported.

(4) Flight routes, altitudes, and aircraft control points.

(5) Time of departure crossing the line of contact and reentry over frontline trace.

d. Administration and Logistics.

(1) Refueling points.

(2) Availability of special equipment.

(3) Aircrew relief procedure.

e. Command and Signal.

(1) Air-ground communication (frequencies and call signs).

(2) CEOI.

(3) Units to receive in-flight reports.

2-14. Mission Planning

After receiving an aerial observation mission assignment, the aviator/observer team plans the mission. This is the preflight planning phase and consists of four steps:

a. Map and aerial photography selection.

b. Terrain evaluation.

c. Flight planning.

(1) Type mission.

(2) Time allocated.

(3) Method of reporting.

(4) Flight routes.

(5) Altitude.

(6) Direction of observation.

d. Crew coordination.

2-15. Route Reconnaissance Checklist

a. Route Identification.

(1) Route designation (e.g., Highway 84, Jones Road).

(2) Limits of route (coordinates or ground reference).

b. Route Usage.

(1) Time route will be used.

(2) Type and number of vehicles to use route.

c. Route Limitations.

(1) Type surface.

(2) Width of route.

(3) Drainage.

(4) Drive-off capability.

(5) Grades and curves.

(6) All-weather capability.

(7) Condition of the road surface.

(8) Availability of concealment.

(9) Bridge limitations.

(a) Weight carrying capability.

(b) Clearance.

(c) Bypass capability.

(10) Tunnel and underpass limitations.

(a) Clearance.

(b) Bypass capability.

**2-16. Technique and Procedures for Conducting
Reconnaissance and Surveillance Missions**

For information relating to the conduct of reconnaissance and surveillance missions see FM 1-80, FM 5-36, and FM 17-36.

2-17. Electronic Sensor Equipment

For information relating to the use of sensor equipment for fixed wing aircraft see FM 30-20, TM 11-5850-217-15, TM 11-5895-578-12, and TM 11-6720-208-12.

Section V. AEROMEDICAL EVACUATION

2-18. Missions

a. The primary mission of Army air ambulances is to provide:

(1) Aeromedical evacuation of selected patients.

(2) Provision for the movement of medical personnel and equipment.

(3) Provision for uninterrupted delivery of whole blood, biologicals, and medical supplies.

b. The secondary mission of Army air ambulances is to provide (when augmented) for air crash rescue.

2-19. Briefing Checklist

a. Patient location (grid coordinates).

b. Radio frequency and call sign (at patient location).

c. Patient category of precedence (urgent, priority, or routine).

(1) *Urgent*. Emergency cases which must be evacuated immediately to save life or limb. This precedence will be used when it is anticipated that the patient's condition is such that evacuation is required within 2 hours. Psychiatric cases are not considered in this category.

(2) *Priority*. Patients requiring prompt medical care not locally available. This precedence will be used when it is anticipated that the patient must be evacuated within 4 hours or his medical condition will deteriorate to the degree that he will become an urgent case. Psychiatric patients are not considered in this category.

(3) *Routine*. Patients requiring evacuation but whose condition is not expected to deteriorate significantly during the first several hours or longer.

Note. It is sometimes necessary to clear patients from an area of operation because of the tactical situation. When such situations develop, MEDEVAC will be requested by using the



precedence codes above, giving the total number of patients to be cleared from the area. This will be followed by a statement that the tactical urgency dictates the mission. Commanders will not use this procedure solely for the purpose of clearing priority and routine patients from their areas of operation when the tactical situation does not require their immediate evacuation.

d. Special equipment (i.e., internal rescue hoist, forest penetrator).

e. Number of litter and/or ambulatory patients.

f. Type of injury, wound, or illness.

g. Patient nationality.

h. Security of pickup site.

i. Site marking (i.e., smoke, panels, mirror, flashlight).

j. Weather at pickup site.

k. Terrain description at pickup site.

2-20. Mission Planning and Special Equipment Checklist

a. Mission planning—normal (flight routes, altitudes, airspeeds, and checkpoints).

b. Aircraft, equipment, and crew ready.

c. Any required special equipment on board.

d. Gunship escort coordination.

e. Clearances and flight following established.

f. Special instructions.

2-21. During Mission Checklist

a. Crew briefing.

b. Recheck time, distance, and fuel factors.

c. Note unusual occurrences during mission (i.e., enemy activity, type weapons, and location).

d. Assessment of injured personnel.

e. Patient loading and safety precautions.

(1) Load casualties from top to bottom.

(2) Place casualties with injured extremities toward the aisle.

(3) Place unconscious casualties on their stomachs with head to the side and lower than the rest

of the body, except when head injuries exist, so that they will not drown in their own fluids.

(4) Load most seriously injured casualties last or as required to provide easy accessibility by the in-flight medical attendant.

f. Patient destination determined and notified.

Section VI. ENVIRONMENTAL FACTORS

2-22. Arctic Operations

a. *Communications.* Radio communications generally are good but may be disrupted temporarily by electrical disturbances (aurora).

b. *Whiteout.* A major problem in northern operations is whiteout. In helicopters, an approach to the ground in lieu of an approach to a hover will reduce hazards of blowing snow which may cause a whiteout and subsequent disorientation.

c. *Landing Areas.*

(1) *Deep snow.* In deep snow, surfaces must be smoothed by grading, or packed by the use of tracked vehicles. Deep snow presents difficulties in the landing and takeoff of aircraft with skis. The deeper the skis sink in the snow, the longer the ground run required for takeoff. Landings should be as short as possible to reduce the depth which the skis will sink into the snow.

(2) *Lakes and rivers.* Frozen lakes and rivers make excellent landing areas for ski-equipped aircraft. Landings should be planned along the edges of lakes and rivers to provide a visual reference for depth perception and to reduce the possibility of encountering whiteout conditions.

d. *Maintenance.*

(1) *Starting engine.* Engines should not be started at temperatures of 20° Fahrenheit and be-

low without the use of an auxiliary power unit. A source of external heat such as a Herman Nelson heater applied to the engine accessory case, carburetor induction system, oil pump, and battery will insure easier starting.

(2) *Batteries.* When temperatures remain below $+10^{\circ}$ Fahrenheit, aircraft batteries should be re-



Figure 2-6. Arctic operations.

moved and stored in a warm place. This procedure will prevent a loss of battery power and insure a stronger battery for starting.

(3) *Engine oil.* If an external heat source is not available, drain the oil from the engine at the end of the day's operation and heat it before replacing it in the engine. For aircraft with oil dilution units, consult the established procedures in the aircraft operator's manual.

e. Navigation.

(1) *Radio navigation.* Radio is an effective means of navigation. When radio navigational aids are not available, the primary method of navigation is pilotage using aerial photographs; area and sectional charts; and tactical maps, sketches, and strip map.

(2) *Magnetic variation.* The wide degree of magnetic variation at higher latitudes renders dead reckoning unfeasible much of the time.

f. Fuel Contamination. Ice crystals are a major contaminant, but can be alleviated by the use of normal filtering methods. Fungi also present a problem, but can be controlled by periodic drainage of fuel and supply tanks.

g. Securing Aircraft. Since the ground may be very hard and difficult to penetrate, weights placed on the surface must often be used to moor aircraft. In the winter season, mooring may be accomplished by placing one end of a rope on the ground, covering it with snow, then melting the snow with external heaters and allowing it to freeze. Wheels or skis should be kept on dry surfaces or on blocks to prevent them from freezing to the surface.

h. Additional Items To Be Inspected. In addition to normal preflight or postflight inspections, the following items should be inspected.

(1) *Helicopter landing gear struts and other hydraulic units.* Clean and cover after each flight.

(2) *Airframes and airfoils.* Be especially watchful for cracks and damages from metal crystallization caused by extreme temperatures.

(3) *Control surfaces.* Remove all frost, ice, and snow before takeoff.

(4) *Anti-icing and deicing equipment.* Check for proper operation.

(5) *Electrical equipment.* Check for corrosion and/or broken connections.

(6) *Propellers.* Check for oil circulation, when applicable, and pitting from ice or gravel.

i. Daylight Limitation. Due to the short periods of daylight in the winter months, mission planning must be extensive. Flights to remote areas without runway lighting must be programed for daylight landings. Navigation without radio aid during darkness is difficult due to the lack of ground reference.

2-23. Desert Operations

(fig 2-7)

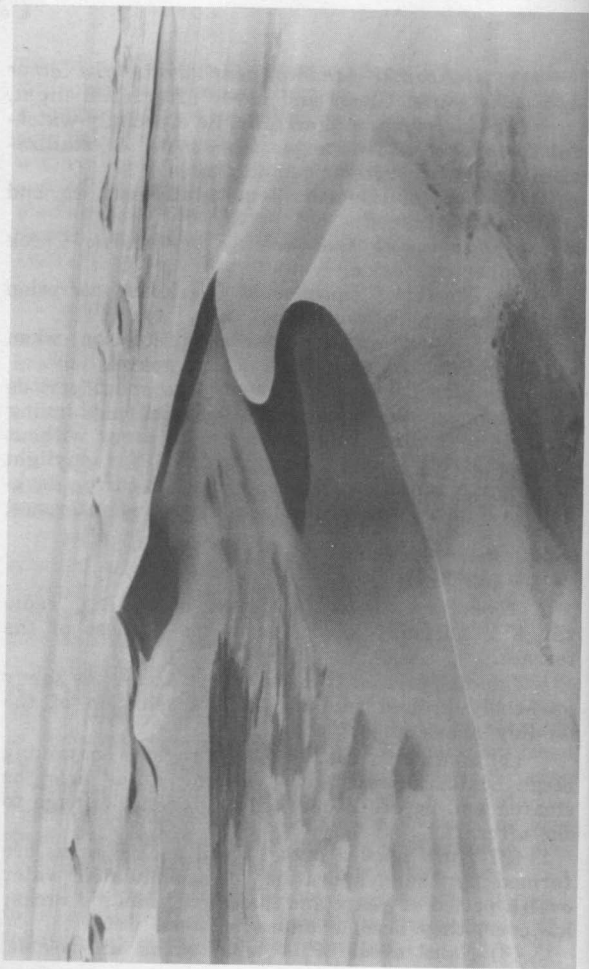
a. Communications. In desert operations, radio range is normally good due to the flatness of the terrain.

b. Landing Areas. In most desert areas, the sandy or pebbly ground surface permits selection of the landing areas almost at will.

(1) *Boulder areas.* In desert regions containing large boulderstrewn areas, landing areas must be cleared and carefully marked to prevent damage to the aircraft.

(2) *Hard packed areas.* Hard packed areas are formed by the evaporation of accumulated water over a period of years and make good landing areas; however, they become unusable when wet.

(3) *Sand areas.* Flat sand areas are usable,



even though they are the least desired for landing. If these areas are to be used, extreme caution must be exercised when running up the aircraft engines to prevent blowing sand on other personnel and equipment.

c. Maintenance.

(1) *General.* The majority of maintenance problems in deserts is caused by blowing sand and dust. Sand and dust created upon landing and takeoff are drawn into running engines and act as an abrasion on moving parts. Sand and dust also adhere to lubricated parts, causing excessive wear. To minimize damage, landings and takeoffs should be made near the mooring points to reduce taxi distance. Helicopters may be required to hover higher than normal to avoid ingestion of sand and dust into the engine.

(2) *Engine operation.* Engines should be operated as little as possible and, when in use, should be operated at low speeds. Appropriate covers for the aircraft should be installed as soon as the engine is shut down.

(3) *Maintenance sites.* Maintenance sites should be selected on the hardest ground available free of loose gravel and sand. If such areas are not available, engines should be tested over rock-filled pits or over areas covered with canvas.

(4) *Oil change.* Oil must be changed frequently to prevent wear within the engines. If there is a marked increase in oil consumption, the oil must be changed promptly to reduce engine wear and avoid a possible failure.

d. Navigation. The aviator will rely generally on dead reckoning for navigation. Radio navigational aids, when available, provide the primary means of

navigation. Sketches or notes prepared by aviation personnel who have flown over the areas assist in updating maps and photographs. These sketches should indicate various shades of sand, the general pattern of sand dunes and drifts, salt around flats, wreckage, craters, and other features which can be readily identified from the air.

e. Fuel Contamination. Blowing sand and dust are the most troublesome contaminants. Filters and screens should always be used in the transfer of fuels. Fuel tanks should be cleaned frequently to insure that accumulation of sand is removed.

f. Securing Aircraft. Aircraft must always be securely tied down. Sudden and violent winds are common in desert regions. Ground securing devices contained within standard issue mooring kits should be installed to tie down fixed wing aircraft. Spoilers will further reduce lift. Helicopter main rotor and tail rotor blades should be tied down using the standard issue tiedowns.

g. Additional Precautions. In addition to normal preflight or postflight inspections, the following items should be inspected:

(1) *Brake system.* In the summer months, the brakes should not be set during the cool part of the day or at any time that the temperature will be expected to rise. This can result in the rupturing of brake lines and damage to parts due to expansion of the fluids during radical changes in temperature.

(2) *Protection from sun.* All clear plastic, such as windscreens and helicopter bubbles, should be covered with canvas, salvage sheets, condemned parachute canopies, or any other suitable material that will keep the sun off.

2-24. Tropical Operations (fig 2-8)

a. *Communications.* In tropical (jungle) operations, radio range (ground-to-air) may be limited due to inability to place the antenna high enough to clear it of obstructions. Jungle antenna kits should be used for all ground stations and placed on the highest terrain available. By laying land-lines or acting as radio relay stations, aircraft can be of significant assistance in communicating.

b. *Landing Areas.*

(1) *General.* Surfacing of landing areas with steel mats, crushed rock, or coral is necessitated by the frequent rains. In areas where rivers and lakes are numerous and of sufficient size, they may be used by aircraft equipped with floats.

(2) *Locations.* Landing areas should be located on high ground for drainage purposes. During tropical storms, equipment might be lost through flood or water damage if the landing areas located near the edges of streams or rivers are not above the water level.

(3) *Helicopter landing areas.* If extensive clearing is necessary, felled trees may be used to construct platforms for the helicopters. This method is faster and far better than attempting to remove the tree stumps.

c. *Maintenance.*

(1) *General.* All equipment can be expected to deteriorate from fungus and corrosion in the hot, humid climate. This condition can be kept to a minimum by air ventilation and frequent drying. Rubber and fabrics are especially affected and should be checked daily.

(2) *Radio equipment.* Every piece of radio equipment should be operated daily to minimize

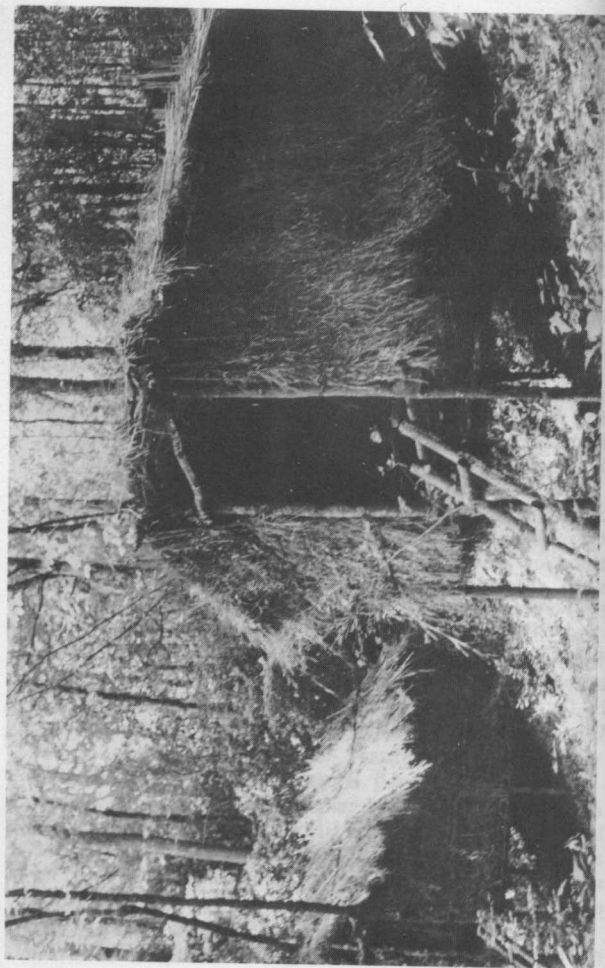


Figure 2-8. Juncus operations

moisture. When in storage, they should be kept off the ground and in well-ventilated areas.

(3) *Maintenance equipment.* All maintenance equipment should be kept on platforms, free of the ground. It should be cleaned and lubricated frequently. Reciprocating engines that have not been preserved should be run every 7 days.

(4) *Fabric items.* Clothes, canvas, etc., must be washed frequently and dried thoroughly. When not in use, these items should be hung in the open air for ventilation.

(5) *Rubber.* All items made of rubber should be cleaned frequently and lubricated lightly with brake fluid. *Never* use oil on them.

(6) *Fuels.* Fuel containers should be kept filled to reduce condensation. When servicing aircraft, water separators should be used. If the fuel is stored in drums, the bottom 5 or 10 gallons should never be used.

d. Navigation. Navigation in tropical countries is often a combination of pilotage and dead reckoning. Radio navigation is unreliable using NDB's during the rainy season due to the electrical disturbance associated with thunderstorms. The lack of radio navigation aids, controlling facilities, and scarcity of weather reporting facilities restricts IFR flight. Tactical maps usually are available; they are one of the most important aids to navigation.

e. Fuel Contamination. The two consistent contaminants are condensation and fungi. Condensation can be reduced by keeping fuel tanks full and draining off water from aircraft fuel drain sump before each flight. Fungi encountered in jet fuels are controlled by the periodic draining of supply tanks.

f. Securing Aircraft. Fixed wing aircraft should be moored and spoilers used at all times. Helicopter main rotor blades should be tied when not in opera-

tion, and those with tail rotors should be tied when gusty winds are forecast. Hangar facilities should be available to protect aircraft during the frequent and violent thunderstorms of the tropics.

g. Items To Be Inspected. In addition to normal preflight or postflight inspections, the following items should be inspected:

(1) Moving parts which are subject to corrosion.

(2) Cloth, fiber, rubber, and other materials which deteriorate quickly and are easily damaged by fungi and insects.

(3) All avionics equipment not treated for resistance against fungi and corrosion.

(4) Fuel cells for fungi.

(5) Oil and hydraulic systems for contamination.

2-25. Mountain Operations

(fig 2-9)

a. Communications. In mountain operations, radio communications are difficult because of intervening terrain. To maintain communications within the area of operations, aircraft may have to restrict operations to the vicinity of the unit or be assisted by additional aircraft employed as radio relay stations. Aircraft may, however, be of great assistance by laying wire over otherwise inaccessible terrain.

b. Landing Areas.

(1) *Airplanes.* Mountain operations provide a limited choice in the selection of landing areas. Consequently, airfields may often be located at a considerable distance from the areas of operations. Even then, the landing areas will probably require extensive engineer work before they are usable.

(2) *Helicopters.* When landing in a confined area, the landing area should be approximately

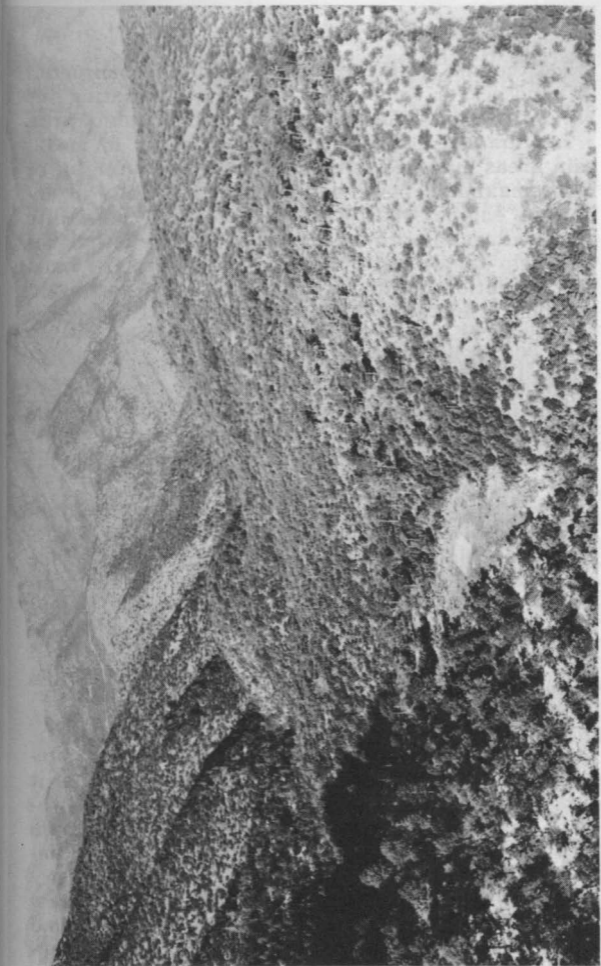


Figure 2-9. Heliport in Huachuca Mountain Range, Arizona.

twice the size of the longest axis of the helicopter. A windsock or some other means of indicating the wind direction should be used at every landing area.

c. Maintenance. High density altitudes in mountain areas may necessitate frequent operation at, or near, maximum power settings. This results in abnormal engine wear and increases the possibility of a failure. Improved mountain flying techniques will help to alleviate abrupt power changes. Land communication is difficult or impossible. As a result, equipment and supplies will be limited. Maintenance may have to be accomplished in rear areas.

d. Navigation. Pilotage is the primary means of mountain navigation. Care must be exercised to avoid entering canyons which require rapid altitude changes to clear terrain obstacles. Definition in terrain allows for use of large scale maps and contour intervals.

e. Stress. Regardless of the locality of mountain areas, turbulence is common to all. Aircraft structures and blades must be inspected frequently for overstress caused by flying through turbulent conditions. When turbulence is encountered, reduce airspeed to penetration speed as recommended in appropriate -10 TM-series. If turbulence is anticipated, loads should be decreased to reduce the stress on the aircraft.

f. Ridge Flying Techniques.

(1) Cross ridges at about 45° angle as a precautionary measure in case a pilot cannot make it over the ridge due to inadequate altitude or down-drift. Less time is required to head downslope from this position if it is determined that the ridge cannot be cleared.

(2) As a ridge is approached, take note of how much ground is visible. If you can see more and more ground on the top of the ridge as you ap-

proach, you will clear; and, conversely, if you see only the side facing you, you will not clear. In the case of the latter, a climb or a turn away from the ridge should be initiated.

g. Canyon Flying Techniques.

(1) At all times a pilot should be in a position to fly downslope in the event terrain clearance becomes questionable.

(2) When flying through a valley or canyon, the pilot should fly to one side. Usually the upslope wind side is preferred in order to take advantage of the updrafts. If turbulence is not a factor, the pilot should fly in a manner which places the open area on his side of the aircraft. This procedure gives the most room for a turnaround and the turn is toward lower ground. Turnarounds should not use up more than one-half the canyon width. The unused canyon width is a safety factor.

(3) The pilot should be aware that at high altitude the TAS and groundspeed are higher than indicated airspeed. Higher airspeed requires a greater turning distance. A reduction in speed may be required to execute the turn safely.

h. Approach Techniques. The pilot must be aware of the updrafts and downdrafts that may be encountered. When it is determined that the aircraft is below desired angle of descent, power application must be made immediately. If the angle of descent cannot be maintained, the approach should be aborted. The angle of descent will vary according to the terrain obstacles and the meteorological conditions. An alertness to changing conditions throughout the approach is required.

i. Pinnacle Landings. One of the most difficult aspects in mountain landings is assessing the level of the proposed landing area. One commonly used method is to look at the site from all angles pos-

sible and, if the site is a pinnacle, maintain a constant altitude and fly around it. This reconnaissance will also give you areas of updrafts and downdrafts indicating windspeed and wind direction. During the approach, it will be difficult to estimate the apparent groundspeed. Frequent reference to the airspeed indication will be required. During the final phase of the approach, rate of closure becomes more apparent. Deceleration and application of power must be coordinated to terminate the approach with zero forward airspeed as the helicopter arrives over the landing area. If the landing site permits, the approach should be made to the ground.

j. Ridge Landings. Basically, ridge landings are the same as pinnacle landings. If possible, select convex, not concave, sites. The terrain may require that the approach be terminated at a hover and the helicopter turned 90° to align it with the long axis of the landing site.

k. Slope Landings. Many mountain landings are made on sloping terrain. When wind is not a factor, the helicopter should be landed in the direction which will allow personnel to depart the helicopter downslope. Ground personnel must be thoroughly briefed concerning the hazards of loading and unloading helicopters on slopes.

1. *Plan the Takeoff Route.* Takeoffs are normally downhill, but under certain wind conditions they may be uphill. Since no hard and fast rules apply, takeoff conditions must be weighed with great caution to determine direction of takeoff. All takeoffs where power is marginal should be made from the ground rather than a hover. Airspeed over altitude takeoffs will be made when obstacles are not a limiting factor.

m. Confined Area Takeoff. The takeoff should be planned to take advantage of all the space available

in the confined area. Maneuvering should be held to an absolute minimum. All turns made should require the shortest turning radius. If the helicopter must be moved to provide a better takeoff path, a ground reconnaissance should be performed.

n. Snow Operations.

(1) Takeoffs and landings are the most hazardous operations associated with snow. One must be constantly alert to rapidly changing weather conditions which occur during flight. Visibility may be reduced to zero in a matter of minutes. When encountering these conditions, a reversal of course or landing is the best solution.

(2) Whiteouts may occur just before touchdown in powdery snow. If snow depth and underlying terrain are known, landings to the ground are preferable. Objects in or near the landing zone should be used as a reference to evaluate the snow depth and relative movement over the ground. During takeoff on fresh snow, you can expect to raise a snow cloud. This can be reduced by making a takeoff from the ground. Reference to instruments may be required until the aircraft is clear of the snow cloud.

(3) When texture and depth of snow are unknown, skis or floats are a must. For techniques of landing with skis, refer to FM 1-106, Float and Ski Operations for Army Aircraft.

o. Emergency Procedures.

(1) If engine failure occurs, emergency procedures should be initiated, followed by an immediate turn downslope to a suitable landing area. When the landing site is selected, set up the approach to land uphill with minimum forward speed. If altitude does not permit a turn to downslope, try to land upslope in the bottom of a ravine.

(2) If an emergency landing with power can

be made, a turn downslope should be made and an area selected which will allow the shallowest approach possible. This procedure will require minimum power and provide the safest landing.

(3) If landing in tall trees, zero the ground speed at tree-top level and descend vertically with the tail low. This will enable the tail boom to take up most of the impact forces and prevent the helicopter from going in nose first. Prior to the helicopter making contact with the trees, apply collective pitch to attain minimum rate of descent.

Section VII. FORMATION FLIGHT

2-26. Formation Considerations

Factors to be considered in selecting the formation to be flown are:

a. Mission Requirement.

- (1) Mission of the supported unit.
- (2) Mission of the supporting aviation unit.

b. Enemy Considerations.

- (1) Threat.
- (2) Condition of the landing zone (friendly or hostile).

c. Terrain and Weather.

- (1) Configuration of terrain over which flight will be flown.
- (2) Size, shape, and surface of pickup and landing zone.
- (3) Ceiling and visibility.
- (4) Winds and air turbulence.

d. Control.

- (1) Degree of control required.
- (2) Radio communications restrictions.

e. Limiting Factors.

- (1) Crew training and experience.
- (2) Aircraft limitations.

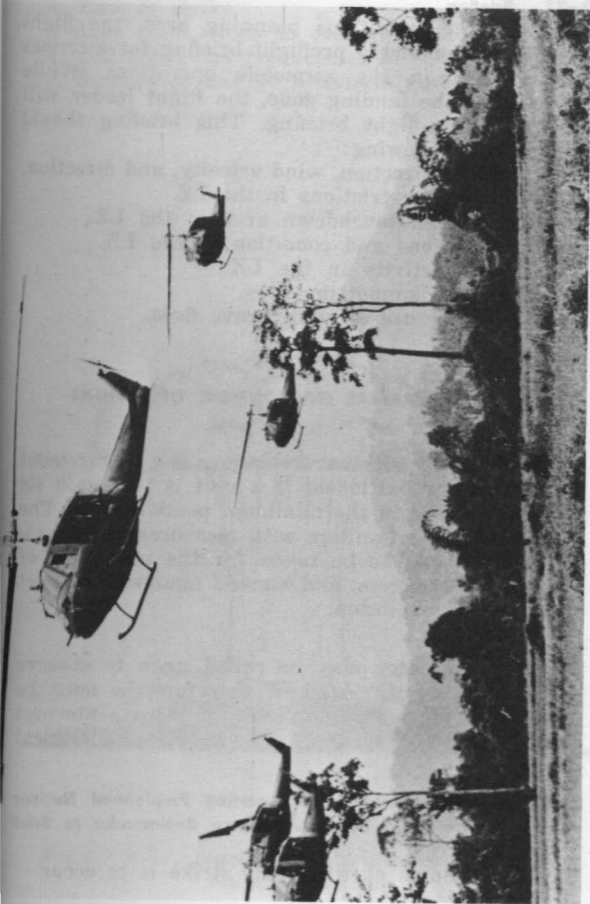


Figure 2-10. Formation flight (low level UH-1's).

2-27. Briefing

While in the operations planning area, the flight leader will conduct a preflight briefing for aircrews participating in the airmobile operations. While en route to the landing zone, the flight leader will conduct an in-flight briefing. This briefing should include the following:

- a.* Landing direction, wind velocity, and direction.
- b.* Visibility restrictions in the LZ.
- c.* Anticipated touchdown area in the LZ.
- d.* Obstructions and condition of the LZ.
- e.* Enemy activity in the LZ.
- f.* Status of supporting fires.
- g.* Rules for use of suppressive fires.

Section VIII.

NUCLEAR WARFARE ENVIRONMENT OPERATIONS

2-28. General

A knowledge of survival techniques is a requirement on the nuclear battlefield if a unit is to regain its fighting posture in the minimum possible time. The aviator must be familiar with measures (both passive and active) to be taken for the protection of his crew, passengers, and himself against the effect of a nuclear explosion.

2-29. Reports

The Army aviator may be called upon to observe pre-planned nuclear strikes; therefore, he must be qualified to render a nuclear burst report, interpret nuclear fallout warnings, and perform radiological surveys.

2-30. Briefing Checklist for Reporting Preplanned Nuclear Strikes (Used by Ground Force Commander to Brief Aviator)

- a.* Coordinates at which the strike is to occur.

- b. Time of strike.
- c. Area from which to observe strike.
- d. Call signs and frequencies to be used.
- e. Emergency and/or alternate plans.

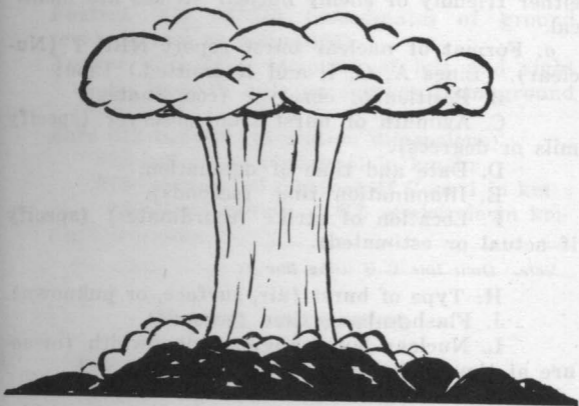


Figure 2-11. Nuclear explosion—characteristic mushroom cloud.

urement of the angles. Also include lines B and D with this second report.

(3) Transmit only those lines of the format for which data are available.

(4) Transmit line E only when observation is limited and cloud measurements cannot be obtained.

2-33. Fallout Warning

A fallout warning is given over division warning broadcast net. An example of this warning is as follows:

Red Dog, Red Dog, this is Victor, Victor, Break—
NBC 3 (Nuclear), NBC 3 (Nuclear)

Delta 240700 (date-time group of blast) (Zulu time)

Foxtrot MN 340670 (coordinates of ground zero) (actual or estimated)

Yankee 0252-0292 (azimuth of left and right radial lines in mils or degrees from ground zero)

Zulu 012-018-03 (prediction dimensions)

012—effective windspeed in km/hr

018—downward distance of Zone I in km

03—cloud radius of GZ semicircle in km

Authentication _____
is _____

Section IX. PARACHUTING

2-34. Responsibilities

a. The Army aviation supporting unit (or qualified quartermaster airborne personnel when available) is responsible for preparing the aircraft for equipment. Personnel drops are the responsibility of the jumpmaster.

b. Technical assistance and special equipment must be furnished to the aviation unit.

2-31. Safety Precautions and Hazards to Flight

- a. Keep helmet visor down.
- b. Do not look directly at fireball.
- c. Do not fly beyond assigned area.
- d. Keep nose of aircraft pointed away from ground zero until shock wave has passed.

2-32. Reporting of Nuclear Attacks

Nuclear burst report data (FM 3-12) is reported to the chemical, biological, and radiological element (CBRE) through the fire support coordination center and the fire support element (FSCC/FSE) or G2, using the command, intelligence, or artillery channels as appropriate. Formats for reporting either friendly or enemy nuclear strikes are identical.

a. Format of nuclear burst report NBC 1 (Nuclear). (Lines A, G, I, and K omitted.) Line:

B. Position of observer (coordinates).

C. Azimuth of burst from observer (specify mils or degrees).

D. Date and time of detonation.

E. Illumination time (seconds).

F. Location of strike (coordinates) (specify if actual or estimated).

Note. Omit line C if using line F.

H. Type of burst (air, surface, or unknown).

J. Flash-to-bang time (seconds).

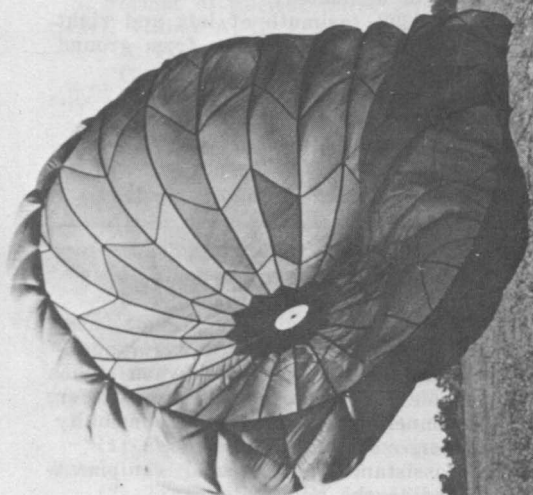
L. Nuclear burst angular cloudwidth (measure at time of bang in mils or degrees).

M. Stabilized cloud-top angle and/or bottom angle (measure at H + 10 minutes in mils or degrees).

b. *Special Instructions.*

(1) Transmit all data except line M immediately after bang time.

(2) Transmit line M immediately after meas



c. A jumpmaster must be designated for each aircraft. He must be completely familiar with the safety considerations of the aircraft for which he is responsible.

2-35. Safety Considerations

a. The pilot must be aware of the sudden change of center of gravity during the movement and exit of parachutists.

b. The total number of parachutists and air delivery containers must conform to the weight and space limitation of the specific aircraft involved.

c. Static lines and deployment bags should be retrieved as soon as the static line from the last parachutist is clear and trailing aft of the door.

d. Parachute jumps should not be made from helicopters equipped with special type flotation gear.

e. Personnel should not be dropped simultaneously with bundles rigged for external delivery.

f. Movement of parachutist inside the aircraft should be restricted. Crowded conditions may result in entanglement of static lines and premature activation of the reserve parachute.

g. Parachutists entering a helicopter with a tail-rotor will approach from the front.

h. If a crew chief or copilot is in the aircraft, he can pull in the static lines; if not, the pilot must land without hovering (a running landing) to insure that no deployment bags become entangled in the rotor blades.

2-36. Flight Leaders Briefing Checklist

a. Number of aircraft participating.

b. Total number of parachutists to be dropped and individual aircraft allowable cargo load (ACL).

c. Marshaling area.

d. Pickup time.

e. Location of drop zone.

- f. Formation.
- g. Altitude and airspeed during drop.
- h. Forecast wind condition.
- i. Checkpoints.
- j. Drop zone marking and pathfinder control.
- k. Air-to-ground and air-to-air communications to include frequency, call signs, and pyrotechnics.
- l. Emergency procedures.

2-37. Mission Planning and Special Equipment Checklist

- a. Mission planning—normal.
- b. First aid kits available.
- c. Safety belt available for individual or single safety strap.
- d. Fire extinguisher available.
- e. Sick bags available for each parachutist.
- f. Communications means available for crew chief and jumpmaster.
- g. Interior lighting operational (night).

2-38. Preparation of the UH-1D (Hoquois)

- a. Remove all slippery substances from the floor of the aircraft.
- b. Remove both cargo compartment doors, or lock in the *full* open position.
- c. Remove all troop seats, except one seat on each side behind the pilot's and copilot's seats. Install these two seats so they are facing to the rear.
- d. Install anchor cable(s).
- e. Install safety belts or strap for parachutists to tiedown rings.
- f. Pad and tape the following items with cellulose wadding and masking tape:
 - (1) The lower, aft edge of both compartment doorframes.
 - (2) Both ground-handling wheel mounting brackets.

(3) Right and left edges of the rear center bulkhead, approximately 6 inches below anchor line cable.

(4) All cable clamps used on the anchor line cables.

(5) Any other rough or protruding objects noted.

g. The jumpmaster and aircraft commander will perform a joint inspection of the above items, plus those items listed in paragraph 2-37.

h. Special considerations are—

(1) Maximum number of parachutists is eight.

(2) Indicated airspeed must be between 50 and 70 knots.

2-39. Preparation of the CH-47 (Chinook)

a. Pad and tape all clamps on the anchor line cable with cellulose pad and masking tape.

b. Seatbelts should be let out all the way to insure positive hookup when parachutists are seated.

c. During flight, the ramp should be inclined 3° below horizontal.

d. The jumpmaster and helicopter commander will perform a joint inspection of *a* above, plus those items listed in paragraph 2-37.

e. Special considerations are—

(1) Maximum number of parachutists is 28.

(2) Indicated airspeed must be between 80 and 110 knots.

Section X. RAPPELLING

2-40. Safety Precautions

a. The pilot will compute operating limitations for hovering out of ground effect.

b. During rappelling operations the helicopter should be headed into the wind.

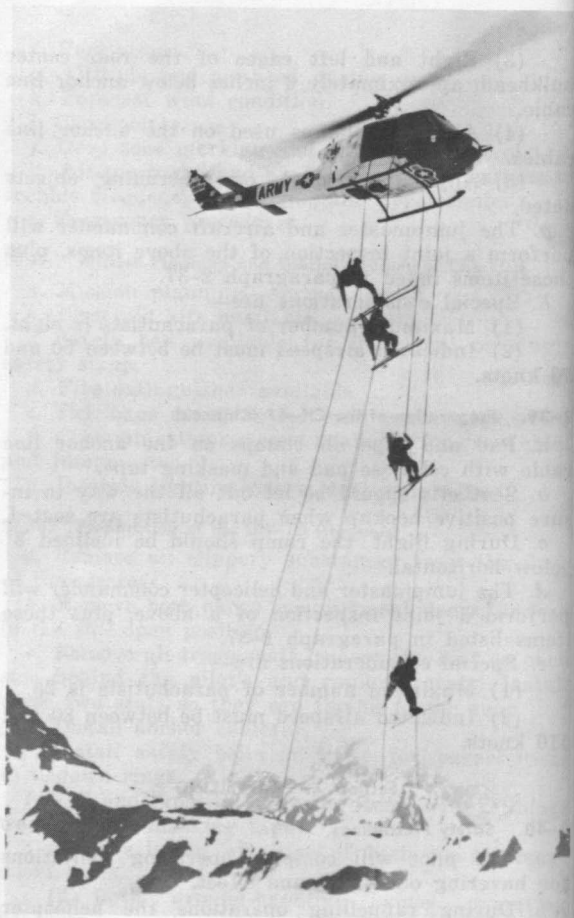


Figure 2-13. Rappelling.

c. The aviator must be prepared to correct against rapid shifts in the center of gravity during the exit of rappellers.

d. Rappelling lines should be retrieved or dropped as soon as the last rappeller has cleared the lines.

e. The helicopter commander will designate a safety NCO or his crew chief to supervise rappelling operation from the cabin section. He will receive his command from the pilot. During emergencies he will take action to provide immediate assistance.

f. Emergency procedures for a loss of power will be explained during the crew/passenger briefing.

g. Other than for training purposes, personnel should be rappelled from helicopters only when a suitable landing site cannot be found.

2-41. Pilot Checklist

a. Total number of rappellers to be rappelled.

b. Pickup point.

c. Time rappellers are to be loaded.

d. Rappelling area.

e. Air-to-ground FM radio frequency and call signs.

f. Coordination with safety personnel and medical support.

g. Briefing of troops on emergency procedures.

2-42. Mission Planning and Special Equipment Checklist

a. Mission planning—normal.

b. First aid kits available.

c. Sharp knife.

d. Safety belt or strap available for each passenger.

e. Fire extinguisher available.

f. Sick bags available for each passenger.

g. Means of communication available between aviator, crew chief, and safety NCO or rappeller team leader.

- h. Donut ring attached to the floor.
- i. Helicopter prepared in accordance with paragraph 2-44.

2-43. During Mission Checklist

- a. Conduct power check, hovering out of ground effect at 25 feet, prior to departing pickup zone.
- b. Position helicopter at a stationary hover pointing into the wind over rappelling area.
- c. Rappelling lines properly deployed and touching ground.
- d. After rappelling, lines properly retrieved and stored or dropped.

2-44. Preparation of the Helicopter

a. *Inspection of the Helicopter.*

(1) *External inspection.* Insure that—

- (a) Protruding objects or sharp edges in the vicinity of the exit door and struts are padded and taped.

- (b) Skid tube is clean and not slippery.

(2) *Interior inspection.* Insure that—

- (a) Seats are removed.

- (b) Doors are removed or locked in the open position.

- (c) Edges of doors and projections are padded and securely taped.

- (d) Donut ring is secured to the center of floor.

- (e) All equipment is securely stowed and lashed.

- (f) The floor is not slippery.

b. *Preparation of the Helicopter, Parachuting and Rappelling Techniques.* Publications covering the preparation of helicopter, parachuting and rappelling techniques are FM 31-71, FM 31-72, and TM 57-220.

Section XI. FM HOMING

2-45. AN/ARC-44 Aural Homing

a. General. The AN/ARC-44 Fm radio provides an aural homing system capable of homing to any radio transmitter that transmits in a frequency range of 24.0 to 51.9 MegaHertz (MHz). The operation of this system is based on the phase of the incoming signal as it reaches the antennas. If the signal reaches the left antenna first, the aviator will hear the letter D (- . .) in Morse code. If the signal reaches the right antenna first, the aviator will hear the letter U (. . -) in Morse code. When the signal reaches both antennas simultaneously, a solid tone will be heard and the station will be directly in front of or behind the aircraft (fig 2-14).

b. Operation.

(1) Set AN/ARC-44 for normal operation.

(2) Select the desired frequency and identify the station. Use authentication for positive identification.

(3) Instruct station operator to key his transmitter for periods of 30 seconds with 10-second pauses between transmissions.

(4) Set the Com-Home Switch to HOME position.

(5) Listen to the signal received.

(a) If a D (- . .) is heard, turn left.

(b) If a U (. . -) is heard, turn right.

(c) If a steady solid tone is heard, turn slightly off course and then respond to the D or U signal. The signal received will indicate the direction to the station. Turn in the direction which is indicated by the signal until a continuous tone is received. At this time the aircraft will be going toward the station.

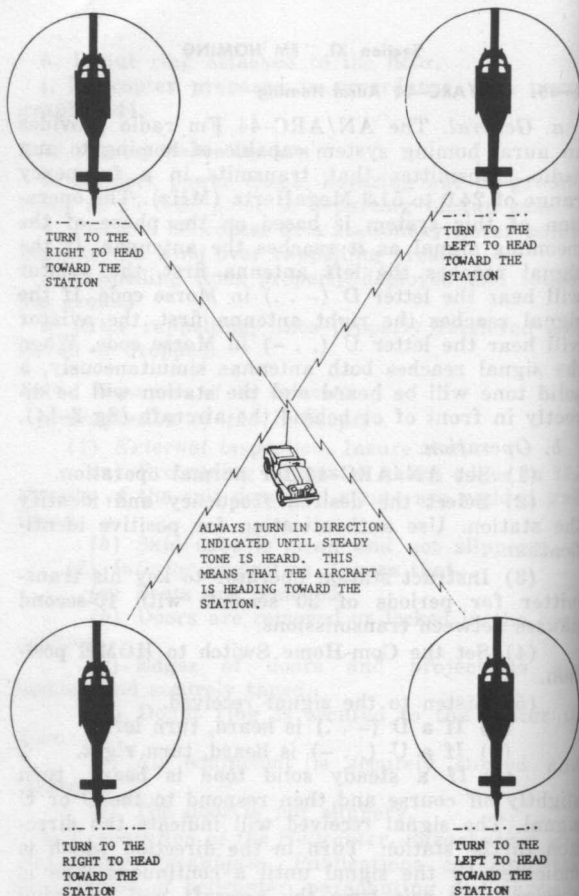


Figure 2-14. Homing procedure (AN/ARA-31).

c. *Station Passage.* To determine station passage, turn off course at 1- or 2-minute intervals; turn each time in the same direction, listen to the signal, and turn back on course. A reversal of the signals will indicate station passage. Also, the station operator should be requested to inform the aviator when the aircraft passes over the station.

2-46. AN/ARC-54 Visual Homing

a. *General.* The AN/ARC-54 homing system requires a homing indicator (ID-48 or ID-453 Omni indicator) and homing antenna system (towel rack) which allows the pilot to home on any signal transmitted within the set's frequency range of 30.00 to 69.95 MHz. Data provided by the homing facility is displayed visually on the course indicator, which is mounted on the instrument panel. Voice capability is provided in all three operating positions.

b. *Operation.*

(1) Establish contact with the station and specify a definite key period and pause period.

(2) Set the mode control to HOME.

(3) Set the SQUELCH control to CARR.

(4) Observe the homing indicator. If sufficient signal strength is being received, the off flags on the course indicator will disappear. The position of the right-left vertical pointer indicates the direction either to or from the station. A turn in the direction of the needle will cause it to center.

(5) If upon tuning the station the needle is centered, a turn should be made to insure that the system is functioning properly. Normal procedure should be followed as explained in (4) above if the needle deflects left or right during the turn.

(6) To determine station passage, turn off course at 1- to 2-minute intervals, *each time in the same direction.* Follow the vertical needle to return

to an on-course indication (centered needle.) Station passage will be indicated by a reversal of the vertical needle indication.

Note. Horizontal needle displays relative signal strength of station and should be used as a guide only for determining station passage.

2-47. AN/ARC-131 Visual Homing

a. Equipment.

b. General. The AN/ARC-131 homing system requires the same equipment as the AN/ARC-54 (Omni indicator, and Towel Rack antenna) and employs the same operational procedures.

Section XII. SEARCH AND RESCUE

2-48. Missions

Search and rescue missions may include situations of national disaster, missing persons, missing aircraft, or aircraft downed in enemy territory.

2-49. Briefing Checklist

- a.* Primary search area.
- b.* Secondary search area.
- c.* Object of search.
- d.* Number of aircraft participating.
- e.* Radio frequencies.
- f.* Call signs and code words.
- g.* Takeoff time.
- h.* Duration of search.
- i.* Weather forecast.
- j.* Map and/or aerial photo briefing.
- k.* Location of medical facility.
- l.* Aircraft emergency procedures.
- m.* Refueling location.
- n.* Aircrew relief procedure.

2-50. Mission Planning and Special Equipment Checklist

- a. Mission planning—normal.
- b. Type of search pattern and altitude to be flown.
- c. Survival rations and gear to be carried.
- d. Presence of smoke grenades.

2-51. Inflight Mission Checklist

- a. Record and report all pertinent observations.
- b. Record exact area of coverage.

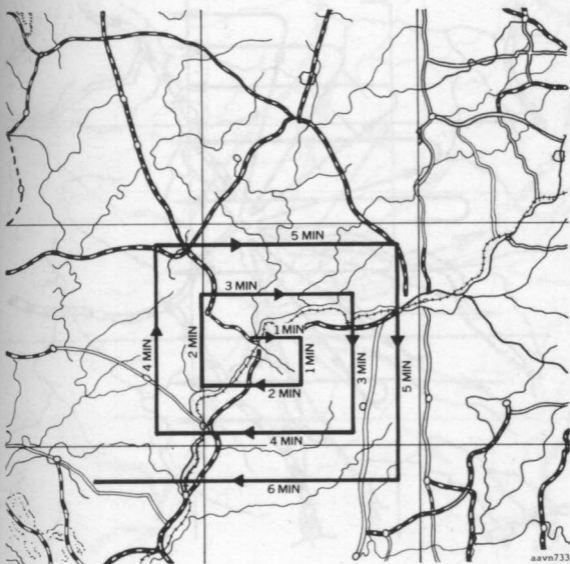


Figure 2-15. Square search pattern.

2-52. Square Search Pattern
(fig 2-15)

This pattern is the most adaptable to tactical situations. Start from any given point in the search area and fly approximately 1 minute in a given direction (preferably north, south, east, or west).

- a. Turn right 90° and fly 1 minute.
- b. Turn right 90° and fly 2 minutes.
- c. Turn right 90° and fly 2 minutes.

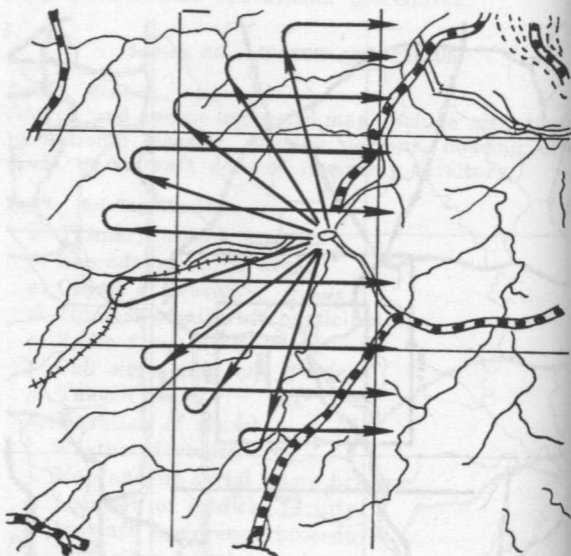


Figure 2-16. Radial search pattern.

- d. Turn right 90° and fly 3 minutes.
- e. Turn right 90° and fly 3 minutes.
- f. Turn right 90° and fly 4 minutes, etc.

2-53. Radial Search Pattern
(fig 2-16)

- a. This method is used by employing one aircraft for each radial to be flown.
- b. A magnetic heading is assigned to each aviator participating.
- c. Each aircraft starts from the same point.

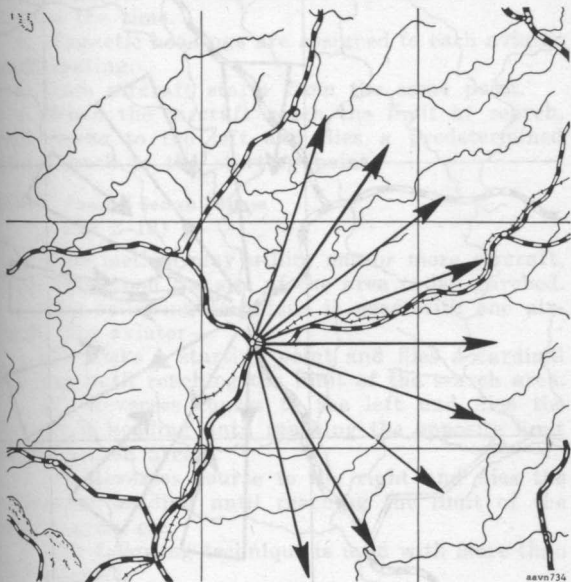


Figure 2-17. Radial search followed by parallel track.

2-54. Radial Search Followed by Parallel Track
(fig 2-17)

a. This method is used when a more thorough search is desired. One aircraft is used for each radial to be flown.

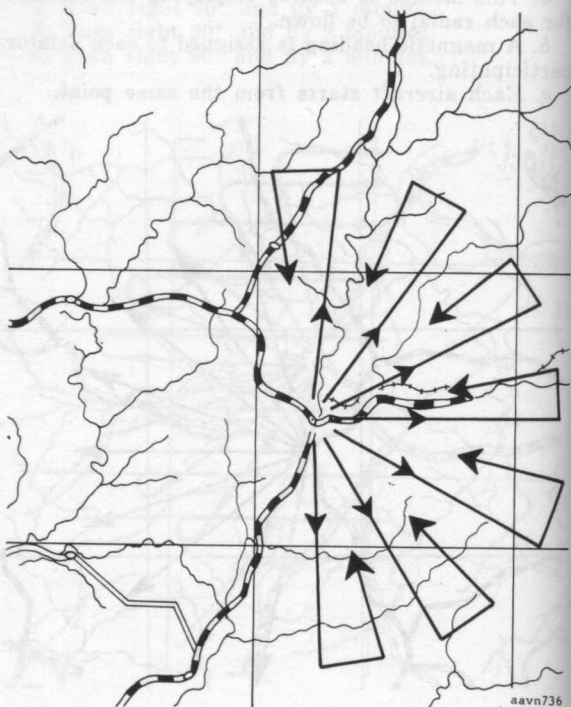


Figure 2-18. Radial search with return search.

b. A magnetic heading is assigned to each aviator participating.

c. Each aircraft starts from the same point.

d. When the aircraft reach the limit of search, each turns to the right and flies a predetermined parallel course back to a predetermined point.

2-55. Radial Search With Return Search

(fig 2-18)

a. This method utilizes fewer aircraft than the radial search. The main disadvantage is that it doubles the time.

b. Magnetic headings are assigned to each aviator participating.

c. Each aircraft starts from the same point.

d. When the aircraft reach the limit of search, each turns to the left and flies a predetermined course back to the starting point.

2-56. Parallel Search Pattern

(fig 2-19)

a. This method may utilize one or more aircraft, depending upon the size of the area to be searched.

b. The following technique is used with one aircraft. The aviator—

(1) Picks a starting point and flies a cardinal heading until reaching the limit of the search area.

(2) Reverses course to the left and flies the reciprocal heading until reaching the opposite limit of the search area.

(3) Reverses course to the right and flies the reciprocal heading until reaching the limit of the search area, etc.

c. The following technique is used with more than one aircraft:

(1) Magnetic headings are assigned to each aviator participating.

(3) When reaching the limit of the search area, aircraft reverse course to the left and fly the reciprocal heading back to the starting line.

(fig. 2-20)

This method is used when aircraft availability is limited and the object of the search is known to be



Figure 2-19. Parallel search pattern.

on a general line from a known point. An S-turn pattern is flown down the line of search.

2-58. Rescue

Rescue may entail performing one or more of the following types of missions:

- a. Airlift of material.
- b. Airlift of personnel.

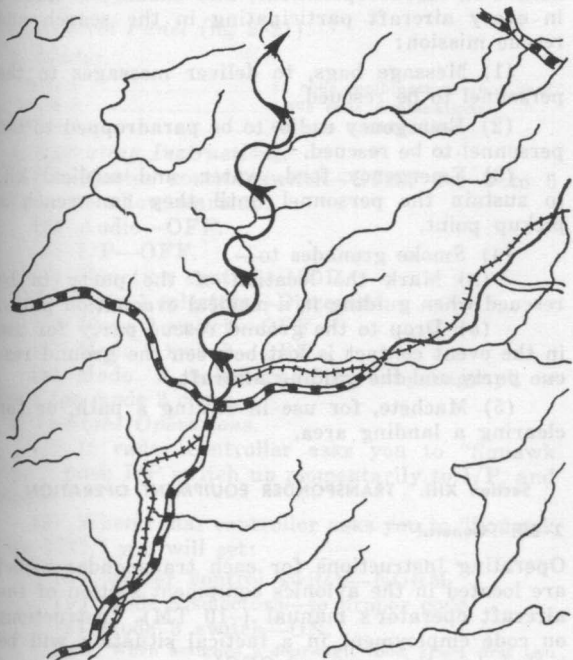


Figure 2-20. S-turn search pattern.

- c. Aeromedical evacuation.
- d. Message drop and pickup.

2-59. Types and Uses of Special Equipment

a. In effecting the rescue of personnel, it may be necessary, first, to guide them to an area where they may be picked up.

b. The following items of equipment may be needed in rescue operations, and should be carried in every aircraft participating in the search and rescue mission:

(1) Message bags, to deliver messages to the personnel to be rescued.

(2) Emergency radio, to be paraded to the personnel to be rescued.

(3) Emergency food, water, and medical kit, to sustain the personnel until they can reach a pickup point.

(4) Smoke grenades to—

(a) Mark the location of the party to be rescued when guiding in a medical evacuation party.

(b) Drop to the ground rescue party for use in the event contact is lost between the ground rescue party and the guiding aircraft.

(5) Machete, for use in cutting a path, or for clearing a landing area.

Section XIII. TRANSPONDER EQUIPMENT OPERATION

2-60. General

Operating instructions for each transponder model are located in the avionics equipment section of the aircraft operator's manual (-10 TM). Instructions on code employment in a tactical situation will be included in the command CEOI.

2-61. AN/APX-44 Transponder Set

The AN/APX-44 transponder receives, decodes, and responds to interrogations of identification friend or foe (IFF), selective identification feature (SIF), and to interrogation of civil ground radar systems. It is used to transmit a specially coded reply to a ground-based radar interrogator system. The form of the coded reply permits positive identification of the aircraft.

a. Control Panel (fig 2-21).

b. Modes.

Mode 1	-----	32 code combinations—not used.
Mode 2	-----	4,096 code combinations.
Mode 3	-----	64 code combinations.

c. Operating Instructions.

(1) Master control switch—STBY for 3 to 5 minutes to allow warmup.

(2) Audio—OFF.

(3) I/P—OFF.

(4) Function control—MOD.

(5) Mode 1 selectors—Disregard.

(6) Mode 2 switch—OFF.

(7) Mode 3 switch—OFF.

(8) Mode 3 selectors—See subparagraph c above for mode 3 codes.

d. In-flight Operations.

(1) If radar controller asks you to "Squawk Ident," push I/P switch up momentarily to I/P, and release.

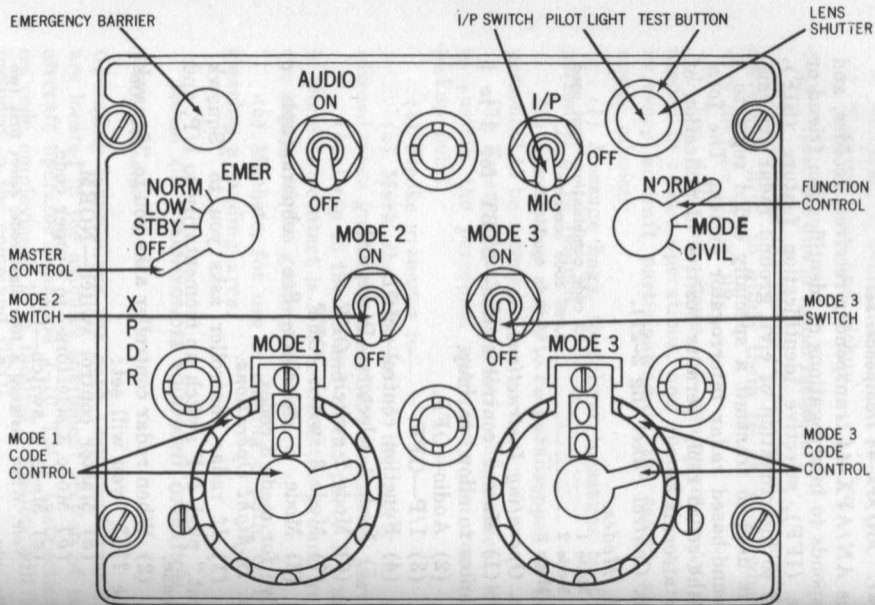
(2) When radar controller asks you to "Squawk Code ????", you will set:

(a) Master control switch—NORM.

(b) Mode 3 selectors—to proper code.

(c) Mode 3 switch—ON.

Note. When assigned a four-digit code, select first two digits only.



e. Emergency Operations.

- (1) Master control switch—Depress barrier button and set switch to EMER.
- (2) Mode 3 selectors—7700.
- (3) MAYDAY message—Transmit MAYDAY message over radio.

2-62. AN/APX-72 Transponder Set

The AN/APX-72 transponder is used to present positive identification, position, altitude, and emergency conditions (if they exist) of an aircraft to a suitably equipped radar interrogation station. It receives, decodes, and responds to the characteristic interrogations of operational modes 1, 2, 3/A, M-C, and 4.

a. Control Panel (fig 2-22).

b. Modes.

Mode 1	32 code combinations.
Mode 2	4,096 code combinations.
Mode 3/A	4,096 code combinations.
Mode M-C	Altitude reply to radar station.
Mode 4	Operationally classified.

c. Operating Instructions.

- (1) MASTER control ----- STBY for 1 or 2 minutes to allow warmup.
- (2) M-1, M-2, M/3A, OUT—OUT (until code is selected on specified modes (s)).
- (3) RAD TEST-MON ----- OUT.
- (4) IDENT-MIC ----- OUT.
- (5) MODE 4 ----- OUT—Operationally classified.

d. In-Flight Operations.

(1) When radar controller asks you to "Squawk mode 3, code ????" you would set:

- (a) Master control—NORM.
- (b) Mode 3/A code selectors—to specified code.
- (c) Mode 3/A switch—ON.

(2) If the radar controller asks you to "squawk Ident," push IDENT switch up momentarily and release.

e. Emergency Operations.

- (1) Master control—Pull out and set to EMER.
- (2) Mode 3/A selectors—7700.
- (3) Transmit MAYDAY message over radio.

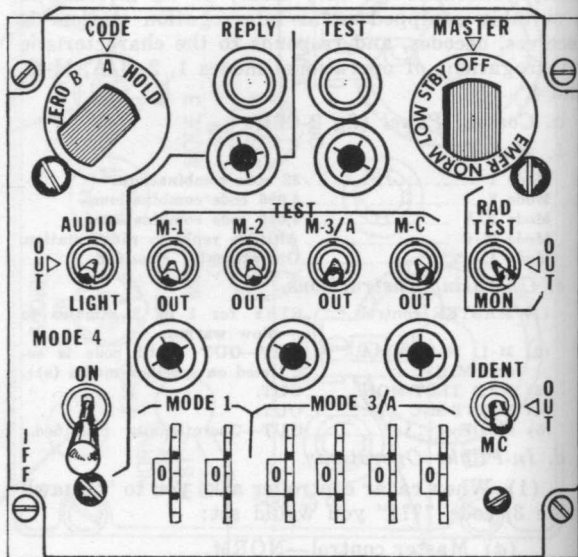


Figure 2-22. Control panel (AN/APX-72 transponder set).

2-63. Standard Operating Codes

Mode 3 transponder codes used by Army aircraft.

VFR flight from surface to 10,000 feet	1200
VFR flight above 10,000 feet	1400
Radio failure	7600
Hijacking	3100
NORAD aircraft	0000
IFR	As directed by ATC
Emergency	7700

Note. Do not use unassigned codes; they are reserved for other purposes.

2-64. Standard Phraseology

PARROT	A transponder.
SQUAWK &	Refers to operating transponder with master control in NORM position.
SQUAWK LOW	Operating transponder with master control in LOW position.
SQUAWK EMERGENCY	Operating transponder with master control in EMER position.
SQUAWK STANDBY or GO STANDBY	Operating transponder with master control set to STBY position.
IDENT	A request to identify a given aircraft by operating the I/P switch.
CODE	The numbers to set on the mode 3 code selector. If given in four number blocks (i.e., code 1200), set only the first two numbers on the AN/APX-44.

Section XIV. WIRE LAYING

2-65. Flight Techniques

a. Navigation is one of the more important considerations in wire laying. The following items should be considered:

(1) Whenever possible, make a reconnaissance flight over the proposed route. This will reveal any obstacles, hazards to flight, best routes, and other information which may affect the mission.

(2) Because of the low altitudes at which wire is deployed, each flight should be treated as a low-level type mission and low-level techniques of navigation should be used.

b. Certain specific precautions and flying techniques must be observed if the wire laying mission is to be accomplished in a safe manner by helicopter.

(1) Airspeed of 50 to 60 knots is desirable when air laying field wire, and the optimum altitude is 50 to 100 feet above ground during daylight.

(2) At an airspeed of 50 to 60 knots, wire will trail below the helicopter at an angle of approximately 25° . This is caused by the downwash of the rotor working in conjunction with the effects of gravity. If turbulence is encountered or if the aviator has to flare the helicopter, the wire may be picked up by the tail rotor. This unsafe condition can be reduced by flying the helicopter in a crab with the tail rotor away from the wire. The crab angle should be only that required to avoid contact of the tail rotor and the wire. Extended flight in a crab angle should be avoided to prevent excessive stress on the tail boom.

(3) Avoid binding of the lines when the helicopter is in a turn. This is particularly noticeable if the helicopter banks sharply in the opposite direction to which the wire is being dispensed. This angle may cause the wire to break, especially if an empty canvas container is being dispensed during this maneuver. The helicopter should be flown in as flat a turn as possible, reducing speed if necessary.

(4) Avoid sudden changes in altitude when air-laying wire. Sudden declines may cause the wire to blow upward and snag on the undercarriage of the helicopter.

2-66. Night Operations

At times it may be necessary (or very desirable) to establish wire communication to a newly located command post under the cover of darkness. Airlaying such wires at night can be accomplished using the same procedure as in daylight, if the following additional procedures are followed:

- a. Make a prior reconnaissance if possible.
- b. Using a large-scale terrain map, study the ground elevation along the proposed route.
- c. Mark the proposed route on the map, including the route for the return trip. Indicate all known obstacles on the map.
- d. Obtain a complete briefing before flying the mission and mark the compass bearings on the map for the two-way flight.
- e. Normally, conduct the flight at a corrected altitude that clears the highest obstacle by several hundred feet.

Note. This type of flying in mountainous country can be very hazardous. Do not exceed a 600-foot altitude above the terrain since the span of field wire between the aircraft and the ground becomes too long and increases the possibility of breakage. Also, wind currents may cause the wire to drift significantly away from the proposed route.

2-67. Briefing Checklist

- a. Number and length of lines to be laid.
- b. Starting and ending point of each line.
- c. Known obstacles along flightpath.
- d. Areas of contamination.
- e. Artillery firing zones.
- f. Minefields.

g. Route to be used by heavy equipment and tracked vehicles.

2-68. Mission Planning and Special Equipment Checklist

a. Missions must be planned to bypass—

- (1) Danger zones.
- (2) Heavily trafficked routes.
- (3) Powerlines.

b. After flight route is planned, use enough wire to reach between starting and ending point plus 10 percent (minimum) excess.

c. Check field wire continuity by attaching a field phone to each end of the wire and talking through it.

d. Insure that a locally obtained weight (minimum of 6 pounds) is on board before takeoff. This weight is to be attached to the payout end of the wire.

2-69. Mission Checklist

During mission checklist—

a. Record starting point, ending point, and unit for each line laid.

b. Record each point at which wire crosses roads. (Ground parties may have to bury wire at these points.)

2-70. Safety Precautions and Hazards to Flight

a. When possible, fly generally into the wind and lay wire from high ground to low ground. If it is not possible to do both, the wind should be the prime consideration.

b. If possible, maintain optimum airspeed and altitude.

c. Maintain a constant lookout for wires and other obstructions along the flight route.

d. If possible, plan all turns so that the tailrotor turns away from the wire.

e. A crewmember should be positioned near the wire dispenser to insure proper operation and to keep the pilot advised of any malfunctions. He should have in his possession a pair of wire cutters and should be prepared to cut the wire anytime a malfunction occurs.

Section XV. AMPHIBIOUS OPERATIONS

2-71. Planning for Operations Aboard an Amphibious Assault Ship

Prior to embarkation aboard an amphibious assault ship, an embarkation advance party of Army aviation and ground personnel will board the ship to make all final arrangements, including coordination of all detailed plans for flight operations. In addition to the embarkation officers, the advance party will consist of communication, mess and billeting, and logistics personnel, and a minimum of one helicopter crew.

2-72. Briefing Checklist

The aviation advance party must become familiar with the ship's standing operating procedures (SOP), which will contain most of the information necessary for the unit to operate from amphibious assault ships. However, detailed plans must be made for—

- a. Flight deck procedures.
- b. Hangar deck procedures.
- c. Carrier qualification criteria for aviators.
- d. Combat information center and helicopter direction center.
- e. Launch procedure.
- f. Carrier landing pattern.
- g. Recovery of aircraft.
- h. Facilities and space available for aircraft and troops.

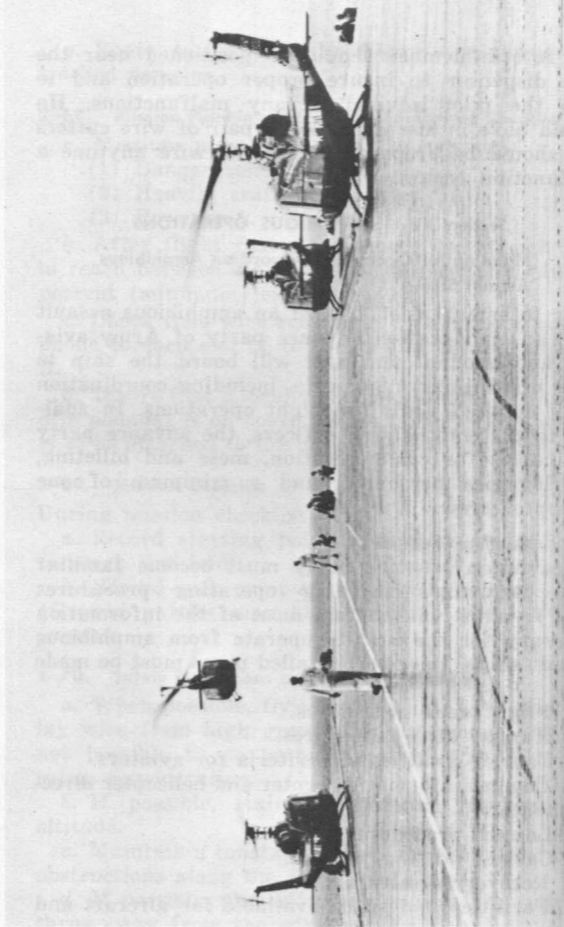


Figure 2-23. Amphibious operations.

2-73. Hand and Arm Signals

For signals used in amphibious operations, see FM 21-60 and TC 1-65.

2-74. Traffic Pattern for Landing Aboard Amphibious Ships

The charlie pattern, rather than the standard Army rectangular pattern, is required during carrier operations (fig. 2-24). Prior to embarkation, aviators will practice this pattern on landing using the field carrier landing practice (FCLP). While the

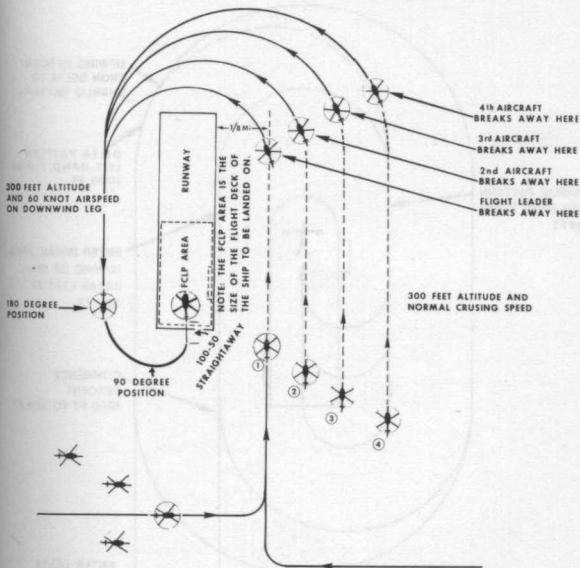


Figure 2-24.

Charlie pattern and traffic pattern for FCLP.

ship is in motion, the helicopters in the traffic pattern undergo constant movement to keep in position relative to the ship. When required by the controlling agency to hold, the aviator will use the delta pattern (fig. 2-25). During IFR conditions, the aviator will hold on the ship's NDB as specified by the controlling agency.

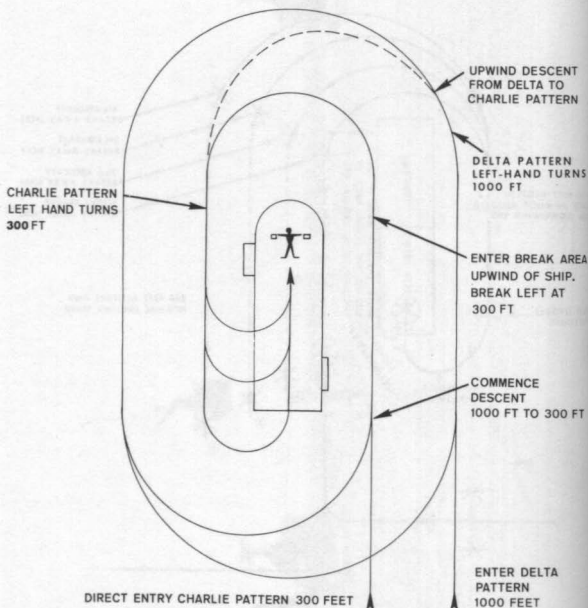


Figure 2-25. Delta pattern and descent from delta pattern to charlie pattern.

2-75. Plans and Operations

For detailed descriptions of planning requirements and operational techniques for Army operations aboard amphibious assault ships, see FM 31-11, FM 31-12, and TC 1-65, Helicopter Operations from Amphibious Assault Ships.

When adjusting artillery fire, the aviator must observe his aircraft in an area or position from which he can observe the target and remain oriented to the location of the gun-target interval. This is dependent upon terrain, weather, enemy action, and the trajectory of the firing artillery. The location of the maneuver area and the altitude to be flown will vary. The aviator should use the existing terrain to his best advantage and plan the flightpath so that the aircraft will be exposed to enemy action as little as possible. The flightpath should be varied as needed to avoid setting up a definite pattern.

Flight Patterns and Techniques

Helicopter and helicopter flight patterns will be basically the same, except that when operations require that one or more helicopters be "popped" from a secure area, helicopters may use the "pop" pattern. This technique involves the landing or approach of the helicopter in a secure area, lifting to a high hover from which the aviator observes the target just before the rounds are due to fall, exiting the rounds, and dropping back to a hover or landing. Some important considerations regarding this technique are to--

1. Obtain the time of flight of the projectile from the target to insure that the rounds are due to fall when the aviator should exit the rounds.

CHAPTER 3

FIRE SUPPORT

Section I. ADJUSTMENT OF FIRE

3-1. Maneuver Area

While adjusting artillery fire, the aviator must maneuver his aircraft in an area or position from which he can observe the target and remain oriented on the location of the gun-target (reference) line. Dependent upon terrain, weather, enemy action, and the trajectory of the firing artillery, the location of this maneuver area and the altitude to be flown will vary. The aviator should use the existing terrain to the best advantage and plan the flightpath so that the aircraft will be exposed to enemy action as little as possible. The flightpath should be varied to avoid setting up a definite pattern.

3-2. Flight Patterns and Techniques

Airplane and helicopter flight patterns will be generally the same, except that, when operating over a secure area, helicopters may use the "popup" technique. This technique involves the landing or hovering of the helicopter in a secure area, lifting up to a high hover from which the aviator/observer can see the target just before the rounds are due to burst, spotting the rounds, and dropping back to a low hover or landing. Some important considerations in using this technique are to—

a. Obtain the time of flight of the projectiles from the FDC to insure that the helicopter is in position to observe when the rounds arrive on the target.

b. Avoid popping up continually from the same point.

c. Note the prominent terrain near target to insure rapid orientation when the helicopter pops up.

3-3. Briefing Checklist

- a. Location of artillery units.
- b. Sector of responsibility for each artillery unit.
- c. Call signs and frequencies of each artillery unit available to fire.
- d. Type mission (area, destruction, etc).
- e. Time and location of friendly airstrikes and preplanned fires.
- f. Location and number of concentrations and surveyed points.
- g. Known and suspected enemy locations.
- h. Flack and fire suppression plans.
- i. Flight restrictions imposed en route and on site.
- j. Frequency to monitor for warnings.

3-4. Mission Planning and Special Equipment Checklist

- a. Make a map and/or photo study (large scale preferred).
- b. Plot all known enemy locations.
- c. Plot all registration points and previously fired target locations.
- d. Obtain binoculars.
- e. Check aircraft radios on all frequencies which may be used.

3-5. Types of Missions

a. *Precision.* A precision mission is directed against an *immobile*, point type target, e.g., registration point, bunker, etc.

(1) Registration is a mission for determining, by adjustment, the firing data that will cause the mean point of impact of a group of rounds to occur at a point of known location, called a registration point.

(2) Destruction is a mission to destroy a target by one or more direct hits.

b. *Area*. A mission to neutralize large and/or mobile targets.

3-6. Adjustment Procedures

If the initial round (volley) does not hit the target, an adjustment must be made to bring fire onto the target. The basic procedures—

a. Bring rounds to line in deviation (gun-target line) and establish a range bracket.

b. Keep rounds on line and reduce range bracket by splitting it until one of the rules for entering fire for effect is met.

c. Rules for entering fire for effect—

(1) When a range correct spotting is obtained.

(2) When the appropriate range bracket is split (100 meters normally).

d. For additional information, see FM 6-40.

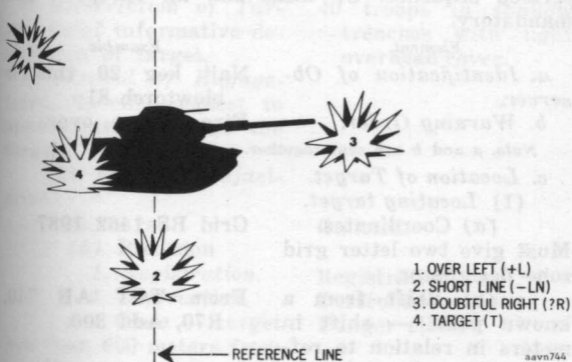


Figure 3-1. Spottings.

3-7. Fire for Effect Procedures

a. Precision Fire (fig 3-1).

(1) *Registration.* Fire direction center (FDC) terminates mission when data is obtained.

(a) *Impact registration.* Observer sends range and deviation spottings to FDC.

(b) *Time registration.* Observer sends fuze action spottings (air or graze) to FDC.

(2) *Destruction.* Observer sends range and deviation spottings to FDC until desired results are obtained. Observer terminates mission when desired results are obtained.

b. *Area Fire.* Observer sends corrections to FDC to bring subsequent volley(s) onto the target to complete the mission. If the fire is effective and sufficient, the observer announces END OF MISSION and reports observed effects.

3-8. Call for Fire

The call for fire contains six elements in a prescribed sequence. Of these six, all except *e* are mandatory.

Element	Example
a. Identification of Observer.	Nail keg 20 this is blowtorch 81
b. Warning Order.	Fire mission, over.
Note. a and b are sent together.	
c. Location of Target.	
(1) Locating target.	
(a) Coordinates.	Grid BS 1462 1987.
Must give two letter grid zone designator.	
(b) Shift from a known point — shift in meters in relation to reference line from known point to target.	From TGT AB 710, R70, Add 300.

Element

(c) Known point—target known to FDC and observer.

(2) Reference line. An imaginary line on the ground of specified direction which enables the observer to make corrections to bring fire on the target.

(a) Gun — target line.

(b) Line of known direction. Coordinated with FDC prior to flight.

(c) Convenient reference line. Selected by observer during flight.

d. *Description of Target.* Brief informative description of target.

e. *Method of Engagement.* Specific request to appropriately engage the target.

(1) *Type of adjustment.*

(a) Area.

(b) Precision

1. *Registration.*

2. *Destruction.*

(c) Close — target less than 600 meters from friendly troops (mandatory with naval gunfire).

Example

Target Charlie.

(Observer says nothing if he wants to use this line.)

Reference line A.

Reference line 360°.

40 troops in shallow trenches with light overhead cover.

Omitted.

Registration.

Destruction.

Danger close.

<i>Element</i>	<i>Example</i>
(a) Low angle.	Omitted
(b) High angle.	High angle.
(3) <i>Ammunition.</i>	
(a) <i>Projectile.</i>	
1. Shell HE stan-	Omitted.
dard.	
2. Other when ob-	Shell WP
server desires specific	
type.	
(b) <i>Fuze.</i>	
1. Fuze quick —	Omitted.
standard.	
2. Other — when	Fuze VT
observer desires specific	
fuze.	
(3) <i>Distribution of</i>	
<i>fire.</i> Pattern of rounds in	
target area.	
(a) Normal sheaf.	Omitted.
(b) Other.	Open sheaf.
<i>f. Method of Fire and</i>	
<i>Control.</i>	
(1) <i>Method of fire.</i>	
(a) Normally the	Omitted.
battery fires all guns	
simultaneously.	
(b) If observer de-	Battery-right.
sires, weapons will be	(left).
fired at timed intervals	
from right or left.	
(2) <i>Method of control.</i>	
(a) Adjust fire —	Adjust fire.
observer can see target	
and will adjust rounds.	

*Element**Example*

(b) Fire for effect
—accurate target location
or rounds have been ad-
justed onto target.

Fire for effect.

(c) At my command
—(in conjunction with (a)
or (b) above). Observer
has reason to tell FDC
when to fire each round.

At my command.

(d) Cannot observe
—observer unable to see
or adjust rounds.

Cannot observe.

Note. When observer accu-
rately describes the target, the FDC
will determine the priority, and se-
lect the volume of fire used in at-
tacking the target.

3-9. Message to Observer

When FDC decides to fire the mission, it sends the
following information to the aerial observer:

*Element**Example*

a. Unit to fire for
effect.

Battalion.

b. Battery to fire in ad-
justment.

Bravo.

c. Any element of the
call for fire, in proper
sequence, which is changed
by the fire order.

Fuze quick.

Note. When observer accurately
describes the target, the FDC will
determine the priority, and select
the volume of fire used in attacking
the target.

<i>Element</i>	<i>Example</i>
d. Number of rounds (per weapon) to be fired in fire for effect.	3 rounds.
e. Target number.	Target AB 701

3-10. Subsequent Correction

After the initial volley appears, the observer uses the following sequence to send his corrections to FDC. Only those elements which change or need correction are sent.

<i>Element</i>	<i>Example</i>
a. Reference line.	Reference line ALPHA.
b. Trajectory.	High angle.
c. Method of fire.	Battery right.
d. Distribution.	Converge.
e. Shell.	Shell HE and WP.
f. Fuze.	VT.
g. Deviation.	Right 80.
h. Range.	Add 50.
i. Height of burst.	Up 20.
j. Control.	At my command, fire for effect.

Section II. NAVAL GUNFIRE

3-11. Naval Gunfire Adjustment

The techniques of calling for and adjusting naval gunfire are identical to those used in adjusting artillery, except as indicated in paragraphs 3-12, 3-13, and 3-14.

3-12. Gun Target Line Method of Adjustment

The gun target line method of adjustment may be used in adjusting naval gunfire; however, there is a minor deviation from the gun target line method used in adjusting artillery. When adjusting artillery, the aviator has to establish the gun target line;

when adjusting naval gunfire, the ship's fire control center will establish the gun target line from the coordinates given in the call for fire. The gun target line will be transmitted to the aviator as a bearing in degrees from the ship to the target; furthermore, since the ship is moving, the fire control center will also inform the aviator whenever the gun target line changes more than 10°.

3-13. Call for Fire

When sending the call for fire, the observer will inform the ship whether yards or meters will be used in adjustment.

a. Identification—same as artillery fires.

b. Warning order—same as artillery fires.

c. Location—same as artillery fires except that the observer may shift from the target being fired upon to a new target, provided the new target is within 1,000 meters of the target from which the shift is made and END OF MISSION has not been given. To shift to a new target, the observer precedes his call for fire with FRESH TARGET. The command FRESH TARGET insures that the information gained from previous adjustments is not lost and normally bracketing may not be necessary.

d. Description of target—same as artillery fires.

e. Method of engagement—same as artillery fires with the following exceptions:

(1) Trajectory—high and low angle fire does not apply to naval gunfire. The aviator may request the charge to be used, e.g., full charge or reduced charge.

(2) Ammunition—ammunition for naval gunfire is similar to standard ammunition for artillery; however, the terminology is different. If the type of projectile and/or fuze action is not specified, shell,

high capacity, or fuze quick will be used as appropriate.

(3) Distribution of fire—not used for naval gunfire.

f. Method of fire and control—same as that for artillery fires with the following exceptions:

(1) Method of fire.

(a) Salvo fire is used for all missions. Because the ship is moving, it cannot fire battery right/left.

(b) Normally, the observer requests the number of guns for use during adjustment and the armament to be used. Neutralization fire is normally opened with two or more guns.

(2) Control—when the aviator wants the ship to adjust fire, he will identify the target, specify the effect desired, and send the final element in the call for fire—SHIP ADJUST FIRE.

3-14. Adjustment

The procedures used in the adjustment of naval gunfire are essentially the same as those used in field artillery fire. All terms used in field artillery adjustment are also used in the adjustment of naval gunfire; however, there are additional terms used in the adjustment of naval gunfire that are uncommon to field artillery.

a. Delay—the term used to indicate that the ship is not ready to fire. It is followed by an estimated time to be ready.

b. Straddle—the term sent when multigun fires straddle the target.

c. Large spread—the term used to indicate that the distance between bursts is excessive.

d. Trend—the term sent if fires are observed to be creeping off the target and followed by an indication of direction: for example, TREND SOUTH-WEST.

e. Fresh target—the term used when a new target appears within 1,000 meters from the target being fired on and the end of mission is not desired. This reduces confusion caused by a large shift.

f. Neglect—the term used to inform the observer that the last rounds were fired with incorrect settings.

g. Will not fire—the term used to indicate for safety or other reasons, that the ship is unable to fire; for example, the ship is under attack.

h. Salvo fire—the term used to describe the method of fire in which a number of weapons are fired at the same target simultaneously.

Section III. HELICOPTER AND TACTICAL AIR SUPPORT

3-15. Aerial Field Artillery

Aerial field artillery is organic to the airmobile division. Aerial field artillery units are an aerial extension of artillery's fire support capability. It is part of and requested through standard artillery channels. The attack helicopters of aerial field artillery units carry armament similar to the attack helicopters of the air cavalry troop.

3-16. Call for Fire

The call for fire requesting aerial field artillery may be sent to the supporting artillery unit; however, the call for fire will be modified to distinguish between a request for aerial field artillery and field cannon artillery.

Report elements

a. Identification

Example of transmission

SHORT TIMER 69,
THIS IS BISHOP
19.

b. Warning order

FIRE MISSION,
AERIAL FIELD
ARTILLERY

<i>Element</i>	<i>Example</i>
c. *Location of target	SS122525
d. Description of target	50 INFANTRY, IN THE OPEN
e. **Method of engagement	HE AND FLECHETTE

f. Method of fire. To receive the desired fire support the aviator should request aerial field artillery by a specific size unit. In the aerial field artillery battalion of the airmobile division these are 3 batteries with 12 aircraft in each. In each battery there are 3 platoons with 4 aircraft in each. Each platoon consists of 2 sections and a platoon headquarters. The aerial field artillery unit of the corps may contain any number of attack helicopters based on availability of aircraft.

3-17. Adjustment

Adjusting aerial field artillery is a combination of adjusting artillery fires and standard adjustment of attack helicopters. The aviator may use any combination of attack helicopters to adjust the fire on target. Standard artillery corrections and commands will be used throughout the adjustment phase; however, bracketing is not necessary. The aviator may request FIRE FOR EFFECT, when fire on the target is observed.

3-18. Tactical Air Support

Normally, the forward air controller is responsible for directing tactical airstrikes; however, if a forward air controller is not available, the aviator can direct tactical airstrikes.

* The aviator should include a 1,000-meter grid designator with the coordinates.

** The aviator may request specific ordnance to engage the target; however, the ordnance provided will depend on availability and convenience.

3-19. Tactical Airstrike Control Procedures

a. Coordinate rendezvous with strike aircraft.

Note. The rendezvous portion of the airstrike is when the FAC (or aviator) and fighter establish radio contact on a predetermined frequency and coordinate verbal directions to the target area.

b. Analyze the target by noting its geographical limits and the locations of any friendly ground units that may be affected by the airstrike.

c. Plan the airstrike (inbound and breakaway restrictions).

d. Make contact with the strike aircraft.

Note. Normally, the flight leader of the strike aircraft will initiate radio contact. The flight leader will provide the following information:

- (1) *Flight call sign.*
- (2) *Mission number.*
- (3) *Number and type aircraft.*
- (4) *Ordnance and fuzing.*
- (5) *Flight location.*
- (6) *Flight altitude.*
- (7) *Time to arrive at target location.*

e. Brief the strike aircraft. Regardless of who is directing the airstrike, the aviator should report any known information that might assist the strike aircraft. When the strike aircraft arrive at the target area, they should be briefed on the following:

(1) Ground situation, location of enemy forces, anticipated enemy ground fire (type—if known), best bailout areas, distance to the nearest airfield, and entry and exit routes.

(2) Target: size, location, mobility, and elevation.

(3) Current weather: ceiling, winds, and altimeter setting.

(4) Recommended sequence of ordnance delivery and attack headings.

(5) Restrictive fire plans and their effect on the strike.

(6) Advice on target and friendly marking type, location, and when it will be employed. Normally, the aviator can most effectively mark a target. Forward air controllers normally utilize 2.75mm WP rockets to mark targets for tactical airstrikes. A slight error of a few meters may cause the ordnance to miss the target. The aviator has the capability of pinpointing a target and marking its center of mass.

(7) FAC position and latitude during the strike.

f. Direct and adjust the airstrike.

(1) While directing the airstrike, the FAC (or aviator) will clear each of the strike aircraft to go "hot" prior to each run of the strike; the FAC (or aviator) must have visual contact with the strike aircraft before he clears them to arm their weapons systems. To assist in gaining visual contact, the strike aircraft will provide the FAC (or aviator) with his call sign, where he is coming from, and what ordnance will be employed.

(2) The aviator may be able to increase the accuracy of an airstrike by remarking the target midway through the airstrike. This will depend on terrain, enemy threat, and fuel supply of the strike aircraft.

CHAPTER 4

SURVIVAL

Section I. ARCTIC SURVIVAL

4-1. Major Requirements for Survival

a. The time to prepare for arctic survival is before a mission. The presence and condition of an arctic survival kit should be verified as part of the pre-planning SOP. This kit should include—

(1) Tent, canvas, or parachute with lines and rope.

(2) Combat rations for 3 days.

(3) Large supply of waterproof matches.

(4) Small heating unit—gas operated preferred for food preparation and melting snow to obtain water.

(5) Sleeping bag.

(6) Axe/shovel kit.

(7) Canteen and cup.

(8) Compass.

(9) Fishing tackle.

(10) First aid kit.

(11) Pocket knife.

(12) Emergency radio.

(13) Water purification tablets.

(14) Snowglasses.

(15) Candles.

b. Temperatures range from cool to frigid. Shelter, warm clothing, and food are essential to survival. The colder the weather, the more rapidly heat is dissipated. The source of body heat is the *food* a person eats to compensate for the accelerated heat loss in cold climates.

4-2. Immediate Actions

a. In winter, protection from cold is your immediate and constant problem. Keep dry, avoid snow blindness, and check for frostbite. To stay dry—

(1) Keep snow out of boots, gloves, and clothing.

(2) Avoid open water.

(3) Always remove outer clothing when working or moving.

(4) Have shelter at night.

b. If down in a glacier area, be on your guard against falling into crevasses when moving. Rope party together, preferably three men to a rope. As you walk, probe the snow in front of you with a pole or ice ax to detect crevasses covered by thin snow.

c. In summer, protect yourself against insects; keep dry.

d. Avoid snow blindness by wearing goggles or sunglasses.

4-3. First Aid

a. Treatment for injuries should consist of the following:

(1) Keep injured man warm and dry.

(2) Put patient in sleeping bag, provide shelter, and build fire.

(3) Treat injury as necessary, using first aid equipment available.

(4) Give warm foods and liquids.

b. *Frostbite* and *snow blindness* are two definite hazards to arctic survival.

(1) Being able to recognize frostbite and take necessary action is the best first aid available. As a rule, the first sensation of frostbite is numbness rather than pain. You can see the effect of frostbite (a grayish or yellow-white spot on the skin) before you can feel it.

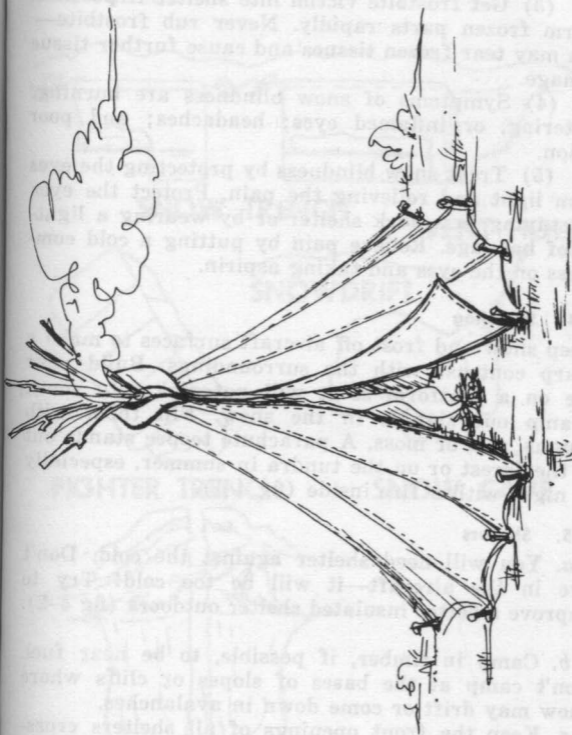


Figure 4-1. Paratepee.

(2) Use the buddy system. Watch your buddy's face to see if any frozen spots appear and have him watch yours.

(3) Get frostbite victim into shelter if possible. Warm frozen parts rapidly. Never rub frostbite—you may tear frozen tissues and cause further tissue damage.

(4) Symptoms of snow blindness are burning, watering, or inflamed eyes; headaches; and poor vision.

(5) Treat snow blindness by protecting the eyes from light and relieving the pain. Protect the eyes by staying in a dark shelter or by wearing a light-proof bandage. Relieve pain by putting a cold compress on the eyes and taking aspirin.

4-4. Signaling

Keep snow and frost off aircraft surfaces to make a sharp contrast with the surroundings. Build your fire on a platform so it will not sink into snow. Tramp out signals in the snow. Fill them with boughs, sod, or moss. A parachute teepee stands out in the forest or on the tundra in summer, especially at night with a fire inside (fig 4-1).

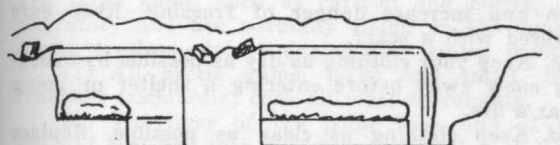
4-5. Shelters

a. You will need shelter against the cold. Don't live in the aircraft—it will be too cold! Try to improve a better insulated shelter outdoors (fig 4-2).

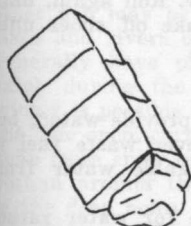
b. Camp in timber, if possible, to be near fuel. Don't camp at the bases of slopes or cliffs where snow may drift or come down in avalanches.

c. Keep the front openings of all shelters crosswind. A windbreak of snow or ice blocks set close to the shelter is helpful. In making shelters, remember that snow is a good insulator.

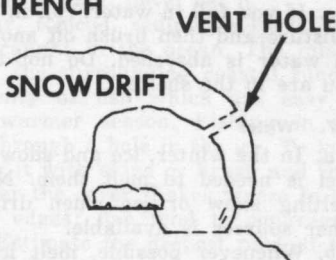
d. Don't sleep directly on the snow—provide insulation under your sleeping bag or body. Keep your sleeping bag clean, dry, and fluffed up to give maximum warmth.



SNOW TRENCH



FIGHTER TRENCH



SNOW CAVE



Figure 4-2. Arctic shelters.

4-6. Clothing

a. It is important to wear clothing properly to keep warm and dry. Insulation combined with body heat is the secret to warmth.

b. Wear clothing loosely. Tight fits cut off circulation and increase danger of freezing. Keep ears covered with a scarf.

c. Keep your clothing as dry as possible by brushing snow away before entering a shelter or going near a fire.

d. Keep clothing as clean as possible. Replace buttons and repair holes promptly.

e. If you fall in water, roll in dry snow to blot up moisture and then brush off snow. Roll again, until all water is absorbed. Do not take off shoes until you are in the shelter.

4-7. Water

a. In the winter, ice and snow provide water; but fuel is needed to melt them. Never waste fuel in melting snow or ice when drinkable water from other sources is available.

b. Whenever possible, melt ice for water rather than snow. You get more water for the volume in less time. If you melt snow by heating, compress it before putting it in a container. If water is available, put a little in the bottom of the pot and add snow gradually.

c. Use old sea ice for drinking water. It is bluish, has rounded corners when broken, and is free from salt. New sea ice is gray, milky, hard, and salty. Don't drink it!

4-8. Food

a. In the Arctic, native animals and plants are not a reliable source of food. Your best chances of survival are along the coast lines of Asia, Alaska,

and Greenland, because seafood is common there, providing a dependable supply of food.

b. Tundra animals include rabbits, lemming mice, ground squirrels, and foxes. Winter or summer, they may be trapped or shot anywhere on the tundra. The large game, such as caribou and moose, are migratory and are normally found on the tundra (open, treeless plains) during the winter months.

(1) All arctic game, large and small, may transmit trichinosis; cook all meat thoroughly.

(2) The liver of the polar bear and of the bearded seal has such a high concentration of Vitamin A that it is toxic to man; never eat it.

(3) Arctic char, tomcod, sculpin, eelpout, and other fish may be caught in the ocean. The inland lakes and rivers of the surrounding coastal tundra generally have plenty of fish which are easy to catch during the warmer season. Fishing in the winter is possible through a hole in the ice. To keep the hole open, cover it with skins or brush and then heap loose snow over the cover. Lakes freeze to the bottom around the edges; fish tend to congregate in the deep holes. Estimate the deepest part of the lake before making a hole.

4-9. Travel

Travel in the Arctic is extremely difficult and hazardous. The decision to travel should be reached only after careful consideration of the following requirements *for successful travel:

a. Exact knowledge of your present location and of the objective of the journey.

b. Knowledge of orientation methods.

c. Unusual amount of physical stamina.

d. Suitable clothing.

e. Adequate food, fuel, and shelter, or the equipment for obtaining them.

Section II. DESERT SURVIVAL

4-10. Procedure for Desert Survival

a. Preparation for Desert Operation. Prevention is always easier than the cure. Before flying in a desert environment, verify the presence and condition of a desert survival kit suitable to your aircraft. If you do not carry parachutes, make certain you are carrying a canvas or other suitable shelter material.

b. Immediate Actions. Water will be your biggest problem if you are down in the desert. Get into the shade as soon as possible; keep your head and the back of your neck covered. If you have crashed or bailed out, reserve any decisions or activity until possible effects of shock have passed.

4-11. First Aid

Exposure to desert sun can be dangerous. It can cause three types of heat collapse: *heat cramps*, *heat exhaustion*, and *heat stroke*.

a. Heat Cramps. The first warning of heat cramps usually is cramps in the leg or belly muscles. Keep the patient resting; give him salt dissolved in water, but only if there is plenty of water to drink.

b. Heat Exhaustion. The patient is first flushed, then pale; he sweats heavily. His skin is moist and cool, he may become delirious or unconscious. Treat him by placing him in the shade, flat on his back. Give him salt dissolved in water, two tablets to a canteen. Since he is cold, keep him wrapped up and give him warm drinks, if available.

c. Heat Stroke. A heat stroke may come on suddenly. The face is red and the skin hot and dry. All sweating stops. The head aches severely; pulse is fast and strong. Unconsciousness may result. Treat the patient by cooling him off. Loosen his

clothing, lay him flat, but off the ground, in the shade. Cool him by wetting clothes with water and by fanning. Do not give stimulants.

4-12. Water

In the desert, your life depends upon your water supply; therefore, you must have an initial water supply. In hot deserts, you need a minimum of 1 gallon of water a day. Since the water supply is going to be somewhat scanty, the best way to conserve water is to ration your sweat. Drink water as you need it, but keep heat out of your body by keeping clothes on. Clothing helps ration sweat by not letting it evaporate so fast that you get only part of its cooling effect. Although it is not wise to depend upon finding natural water in an unfamiliar area, there are a number of sources from which water may be obtained.

a. In all deserts, *wells* are the sources of most water. Handdug wells have furnished water to irrigate desert oases for many centuries. They are located in low places of the desert. Desert wells are generally located along trails. In rocky deserts and on some gravel plains, however, it is not always easy to find the wells.

b. On some flat plains, wells which are not often used are covered against sandstorms. Even though there is no sand in the immediate area, sandstorms would in time fill up such wells. Desert people have learned to cover these wells a little below the top. Sand drifts in, but the well is protected. If you travel, be constantly looking for these hidden wells.

4-13. Tips on Locating Sources of Water

a. Desert natives often know of lingering surface pools in dry streambeds or other low places. They cover them in various ways to protect them from

excessive evaporation. If you look under likely brush heaps or in sheltered rocks, you may locate such pools in semiarid brush country.

b. Birds all need water. Some of them fly considerable distances at sunrise and sunset to reach waterholes. If you hear their chirping in the early morning or late evening, you may locate their private drinking fountains. In true desert areas, flocks of birds will circle over waterholes.

c. Places which are visibly damp, where animals have scratched or where flies hover, are more reliable places to dig for water, because they indicate surface water was there recently.

4-14. Food

a. In most deserts, animals are scarce. Their presence depends upon water and vegetation and true deserts offer little of either. However, few animals have been able to adjust their body processes to desert conditions, the best known of these being the camel and the gazelle. Apparently, the desert antelope (gazelle) can get enough moisture from its food, as records indicate these creatures drink little, if any, water.

b. Some small rodents (rabbits, prairie dogs, rats), snakes, and lizards have learned to live in deserts. Look for animals at waterholes; in grassy canyons, low-lying areas, or dry riverbeds where there is a greater chance of moisture; or under rocks and in bushes. Animals are most commonly seen at dusk or early morning. The smaller animals are your best and most reliable sources of food.

c. When hunting an animal on the desert, remember that distances are deceiving. Make certain the animal is actually within range before you fire. You will probably get just one shot.

d. Plant growth in the desert is widely scattered.

On contacting plants to assure edibility, make the edibility test.

4-15. Signaling

a. You can make a good improvised flare from a tin can filled with sand soaked with fuel. Light it with care. Add oil and pieces of rubber to make dense smoke for daytime signal. Burn fuel or use other bright flame at night.

b. Dig trenches to form signals, or line up rocks to throw shadows.

c. If you can find brush in the area, gather it into piles and have it ready to light when a search aircraft is heard or sighted.

d. Smoke fires and smoke grenades are best for use in daytime. Flares and bright flames are hard to see.

e. The mirror is a very good desert signal. Practice using it. Use brightly polished metal as a substitute.

4-16. Shelter

a. You will need some type of immediate shelter from the direct rays of the sun and the extreme heat of the day. Natural shelter is limited to the shade of cliffs or the lee side of hills. In some desert mountains, you can find good, cave-like protection under the tumbled rocks broken from cliff sides.

b. If you stay with the aircraft, don't use the inside of it for shelter in the daytime; it will be too hot. Get under the shade of the wing or rotor blade, or stretch the parachute or canvas over the aircraft to make a shelter.

c. If the aircraft is not available, make a shelter of your parachute or canvas (fig 4-3). The layers of cloth separated by an airspace of several inches makes a cooler shelter than a single thickness. The parachute or canvas can also be placed across a



DESERT COLD WEATHER SHELTER



SHADE SHELTER



SHADE TRENCH

Figure 4-3. Desert shelters.

trench dug in the sand. The temperature 1 foot above and 1 foot below ground is normally 30° to 45° cooler than the surface temperature.

4-17. Firemaking

In some deserts, fuel is extremely rare. Whenever you find plant growth, use all twigs, leaves, stems, and underground roots for burning. Stems of palm

leaves and similar wood serve as fuel in or near oases. Out on the open desert, dry roots or bits of dead vegetation are carefully collected to boil tea or cook a meal. Dried camel dung is the standard fuel where woody fibers are lacking.

4-18. Clothing

In hot deserts, you need your clothing for protection against sunburn, heat, sand, and insects, so don't discard any of it. Keep your head and body covered during the day; you will last longer on less water. Wet a cloth neckpiece to cover the back of your neck from the sun. Your T-shirt makes an excellent neck drape, with the extra material used as padding under your cap. If your clothing wears out, use the parachute for protection.

4-19. Travel

a. The great deserts of the world have been crossed and recrossed for hundreds and thousands of years. The crossings follow definite routes along marked trails from oases to wells and from wells to waterholes or other oases. Desert trails resemble interlacing cowpaths, all leading in the same general direction. Usually these networks of paths are only a few yards wide and as clear and distinct as the cowpaths in a pasture.

b. Generally, the best advice is to stay with the aircraft. You'll last much longer without water if you stay near the aircraft, in the shade, rather than exhausting yourself by trying to walk out. Travel only if you are sure that assistance is nearby, that you have enough water, or that there is reasonable doubt that rescue is possible.

4-20. Survival Equipment

a. Recommended Minimum.

(1) Water—canned or in canteens. This is *most* important since the human body can survive much longer without food than it can without water.

(2) Food—combat rations for 3 days.

(3) Shelter—parachute or canvas. This is very important in the event of violent sandstorms, which can cause a person to suffocate if he is not in some type of shelter.

b. Other Desirable Items.

(1) Compass.

(2) First aid kit.

(3) Pocket knife.

(4) Waterproofed matches.

(5) Snakebit kit.

(6) Sunburn ointment.

(7) Water purification tablets.

(8) Day and night signal flares.

(9) Emergency radio.

(10) Salt tablets.

Section III. TROPICAL SURVIVAL

4-21. General

Some people think of the tropics as an enormous and forbidding jungle through which every step taken must be hacked out and where every inch of the way is crawling with danger. Actually, much of the tropics is not jungle. What jungle there is must be traveled with some labor and difficulty, but with little danger from anything bigger or more terrifying than malaria-carrying mosquitoes. Tropical areas may be jungle, mangrove or other swamps; open, grassy plains; or semiarid brushland. They may contain deserts, cold, or mountainous districts.

4-22. Immediate Actions

Take shelter from tropical rain, sun, and insects. Malaria-carrying mosquitoes and other insect pests are the immediate dangers, so protect yourself against bites. In the tropics, even the smallest scratch can quickly become dangerously infected. Promptly disinfect any wound. Don't leave the crash area without carefully blazing or marking your route. Use your compass. *Know what direction you are taking.*

4-23. Water

a. In tropical survival, an adequate supply of water normally is available. Water from tropical streams, pools, springs, and swamps is safe to drink only after it has been purified. Water that is turbid may be partially cleared by filtering through an improvised filter such as parachute cloth.

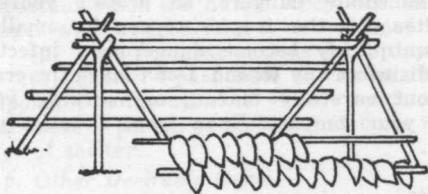
b. Vines are often good sources of water. The water should be fresh and clear. Never drink from a vine that has milky sap. Bamboo stems sometimes have water in the hollow joints. Shake the stems of old, yellowish bamboo. If you hear a gurgling, cut a notch at the top and bottom of each joint and catch the water in a container.

c. Animal trails often lead to water. Follow them, but take care not to get lost.

4-24. Food

a. Food is usually abundant in tropical areas. Paths and roads are the normal passageways along which animals travel through tropical forest. Look on the ground for hedgehogs, porcupines, anteaters, mice, wild pigs, deer, and wild cattle. The dangerous beasts such as tigers, rhinoceros, and the elephant are rarely seen and best left alone.

b. Fruits and berries are usually plentiful throughout this area; it is just a matter of performing the edibility test.



THATCH SHELTER

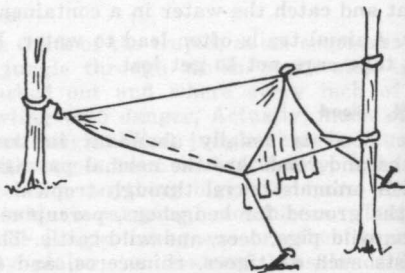
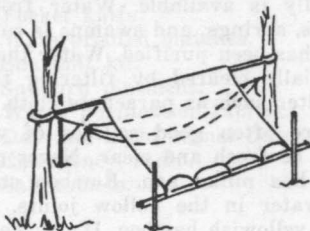


Figure 4-4. A-frame type shelters.

4-25. Shelter

a. Try to pick a campsite on a knoll or high spot, in an open place well back from swamps. You'll be bothered less by mosquitoes, the ground will be drier, and there will be more chance of a breeze. In the wet jungle forest, you will need shelter from dampness. If you stay with the aircraft, use it as a shelter if possible; but try to make it mosquito-proof by covering openings with netting or parachute cloth. The easiest improvised shelter is made by draping a parachute or tarpaulin over a rope or vine stretched between two trees (fig 4-4).

b. A good rain shelter can be made by covering an A-type framework with a good thickness of palm or other broad leaves, pieces of bark, or mats of grass. Lay the thatch shingle-fashion, with the tips of the leaves pointed downward, starting from the bottom and working up to shed the rain (fig 4-4). Don't camp too near a stream or pond, especially during the rainy season. Don't camp on game trails or near waterholes.

c. Don't sleep on the ground. Contact with the ground is chilling. Make a hammock from your parachute. It will keep you off the ground and will discourage ants, spiders, leeches, scorpions, and other pests.

4-26. Firemaking

Wood is usually plentiful in the tropics. During the rainy season, the fire problem may be more complicated by the difficulty of finding dry fuel; but many of the larger trees, whether dead or alive, have hollow trunks. Cut strips of the dry inner lining for kindling. You may also find dry wood hanging in the network of vines or lying on bushes. Don't use bamboo for fuel. It burns too quickly, emits dangerous fumes, and may explode. Keep

spare wood dry by stowing it under your shelter or beneath broad green leaves. Dry out wet kindling and fuel near your fire for future use.

4-27. Clothing

a. Keep your body covered to prevent malaria-carrying mosquitoes and other pests from biting you. Protect your skin against infections caused by scratches from thorns or sharp grasses, and prevent sunburn in the open country.

b. Wear long pants and shirts with the sleeves rolled down. Tuck your pants in the tops of your socks and tie them securely.

c. Loose-worn clothes will keep you cooler.

d. Wear a mosquito headnet or tie an undershirt or T-shirt around your head. Wear it especially at dawn and dusk.

e. Dry your clothing before nightfall to avoid discomfort from cold. Wash clothing, especially socks, daily. Dirty clothes not only rot, but may lead to skin diseases.

4-28. Travel

a. If you come down in dense jungle where your aircraft and signals can't possibly be seen from the air, you will probably do wisely to travel out.

b. The most useful aids to travel in the tropics are a machete to help cut your way, a compass for maintaining direction, a first aid kit to keep down infection and fever, stout footgear, to save your feet and enable you to walk, and a hammock.

c. Travel only in daylight. Avoid obstacles such as thickets and swamps. Find a trail and follow it. Go downhill until you find a stream, then follow the stream. In some dense jungles, however, you will find that you must travel on ridges where less vegetation makes cross-country travel possible. Your

best chance of finding villages and people is along trails and streams and on coasts.

Section IV. MOUNTAIN SURVIVAL

4-29. Immediate Action

Travel in mountain country can be dangerous and confusing unless you know a few tricks. Direction can be determined using the "stick-and-shadow method" or the "watch-and-sun-method" (fig 4-5). What looks like a ridgeline from a distance might be a series of ridges and valleys in extremely high mountains. A snowfield or glacier that appears to be continuous and easy to traverse might cover a sheer drop of hundreds of feet.

4-30. First Aid

In your quest for survival in mountain country, first aid can be of utmost importance in determining the outcome. For further references, see FM 21-76 and FM 21-11.

4-31. Water

Water is one of your first and most important needs. Start looking for it immediately. In rocky ground, look for springs and seepages. Water is more abundant and easier to find in loose sediments than in rocks. Look for springs along valley floors or down along their sloping sides. Dig in dry stream beds because water is often present under the gravel. When in snowfields, put snow in a container and place it in the sun out of the wind.

4-32. Food

There are 120,000 varieties of edible plant food that will sustain you, although it may not provide a balanced diet. Many plant foods like nuts and seeds

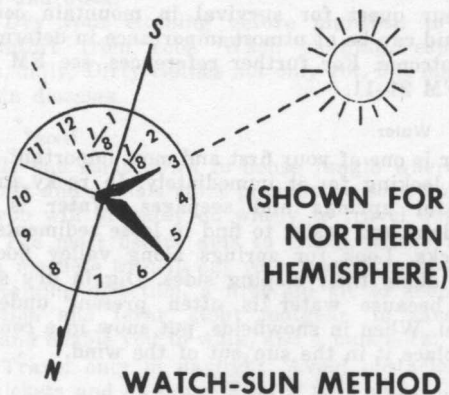
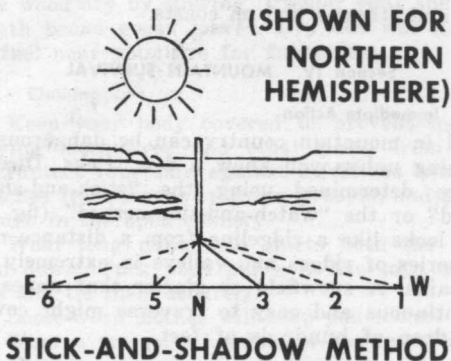


Figure 4-5. Determining direction.

will give enough protein for normal efficiency. Small animals may be trapped by using twitchups or dead-falls (fig 4-6 and 4-7). For further references see FM 21-76.

4-33. Signaling

Dig trenches to form signals, or line up rocks to throw shadows. If you have a parachute or other suitable cloth, drape a parachute or blanket over the rocks or shrubs. Your survival radio would be ideal in this situation. The mirror is a very good mountain signal. Use brightly polished metal as a substitute.

4-34. Firemaking

The importance of fire in survival cannot be over-emphasized. You need fire for warmth, for keeping dry, for signaling, and for cooking. Don't build your

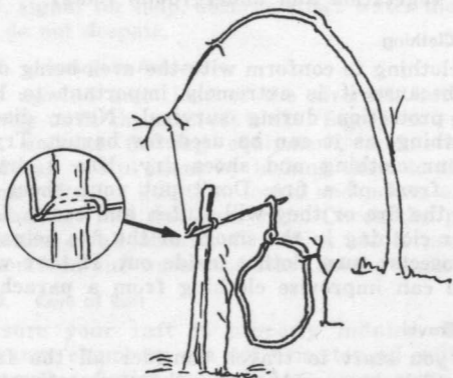
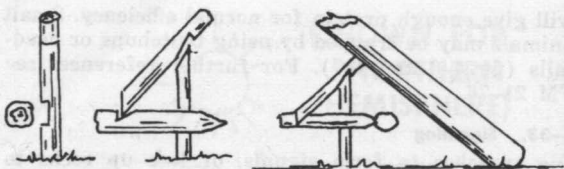


Figure 4-6. Small animal "twitchup".



**FIGURE FOUR
TRIGGER**

DEADFALL

Figure 4-7. Deadfall.

fire too large. Small fires require less fuel and are easier to control. The three categories of combustible materials and the order in which they are used are (1) tinder, (2) kindling, (3) fuel (dry roots or bits of dead vegetation and underground roots).

4-35. Clothing

Select clothing to conform with the area being overflown, because it is extremely important to have proper protection during survival. Never discard any clothing, as it can be used for barter. Try to keep your clothing and shoes dry. Use a drying rack in front of a fire. Don't put your shoes too close to the fire or they will stiffen and crack. Drying your clothing in the smoke of the fire helps get rid of insects; turn clothes inside out. If they wear out, you can improvise clothing from a parachute.

4-36. Travel

Before you start to travel, consider all the facts. Lay careful plans, and make a thorough estimate of the situation. Wear shoes you can walk in comfortably or improvised footgear adequate for walking.

Remember that you must depend on your feet to bring you out. Always try to make camp early.

4-37. Group Travel

Leadership is of great importance in survival, and the party must work as a team to insure that all tasks are accomplished in an equitable manner. In enemy territory, group travel must be discouraged. A large group attracts more attention than a small group of two or three, and solitary travel may prove to be best of all.

Section V. SEA SURVIVAL

4-38. General

Four-fifths of the earth's surface is covered by open water. The basic rules for ground survival also apply in this area. In general, shelter yourself from the elements, keep as dry as possible, keep trying for food, signal for help, observe strict water discipline, and do not despair.

4-39. Immediate Actions

Stay upwind and clear of the aircraft, but in the vicinity until the aircraft sinks. Search for missing men, salvage floating equipment, and stow and secure all useful items by lashing them to the raft. Check rafts for inflation, leaks, and points of possible chafing. Bail out your raft. Check the physical condition of all aboard. Give first aid if necessary. Ration food and water and start fishing immediately.

4-40. Care of Raft

Be sure your raft is properly inflated. If main buoyancy chambers are not firm, top off with pump or mouth inflation tube. Inflate cross seats, where provided, unless there are injured men who must lie down. Don't overinflate. Hot air expands; so on hot

days, release some air. Add air when the weather cools. In a large raft, keep the canopy erected at all times. Keep your raft as dry as possible. Leaks can be easily repaired by the repair plugs provided.

4-41. Signaling

If a radio is available, transmit distress signals at frequent intervals or otherwise follow briefing instructions. Practice signaling with the mirror in the raft kit. As a substitute, use an ordinary pocket mirror or any bright piece of metal. Punch a hole in the center of the metal for sighting. Use smoke signals in the daytime and fire signals at night. Keep all flares dry and use them once the search aircraft is in the immediate vicinity. Use the sea marker during the daytime. Except in rough sea, these spots of dye remain conspicuous for about 3 hours. At night, use flashlight or any light available. Lights can be seen on the water for many miles.

4-42. Water

Water is your most important need. Your water supply will come from catching rainwater, or by using either the desalting kit or the solar stills. These two pieces of equipment should be put into operation as water is needed.

4-43. Food

a. Your food supply will be from two sources, either seafood or water fowl. You should start fishing immediately, and much patience is required to be successful. Shining a light on the water at night will attract fish. Clean and cut all fish immediately and eat them before they spoil. Preserve leftover fish by cutting it in thin strips and drying it in the sun.

b. All birds are potential food. They can be caught on baited hooks, triangular pieces of shiny metal

with a noose, or a baited toggle of metal or wood (fig 4-8). Many birds will be attracted to the raft as a possible perching place. Sit still in the raft, and they may settle on the raft or even on your head or shoulder. Grab them as soon as they have folded their wings; but don't grab until you are sure you can reach the bird.

4-44. Travel

a. Whether you like it or not, your raft will move. The course it will take is the result of both wind and ocean currents, modified by the use of oars or paddles, tiller, sea anchor, and sails. When ocean currents are moving toward your destination, but the winds are unfavorable, put out a sea anchor. Huddle low in the raft to offer as little wind resis-

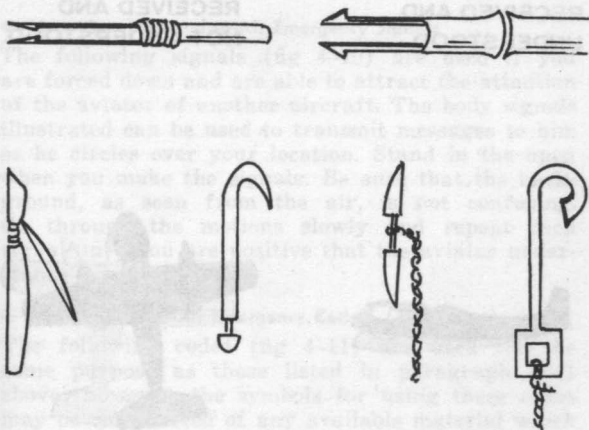
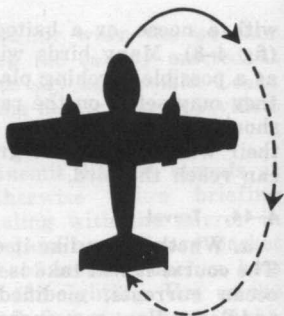


Figure 4-8. Hooks and spears.



**ROCKING WINGS--
RECEIVED AND
UNDERSTOOD.**



**RIGHT TURN--
RECEIVED AND
NOT UNDERSTOOD.**

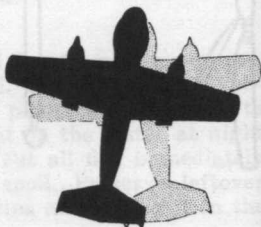


Figure 4-9. Aircraft acknowledgment signals.

tance as possible. In the open ocean, currents seldom move more than 6 to 8 miles a day.

b. Rafts are not equipped with keels, so they can't be sailed into the wind. However, anyone can sail a raft downwind. When the wind is blowing directly toward your destination, inflate the raft fully, sit high, take in the sea anchor, rig a sail, and use an oar as a rudder.

Section VI. GROUND-AIR EMERGENCY CODES

4-45. Aircraft Acknowledgment Signals

The following signals (fig 4-9) may be executed by either airplanes or helicopters and are used in answering messages sent by ground-to-air emergency signals and codes contained in paragraphs 4-46, 4-47, and 4-48 below.

4-46. Visual Ground-to-Air Emergency Signals

The following signals (fig 4-10) are used if you are forced down and are able to attract the attention of the aviator of another aircraft. The body signals illustrated can be used to transmit messages to him as he circles over your location. Stand in the open when you make the signals. Be sure that the background, as seen from the air, is not confusing. Go through the motions slowly and repeat each signal until you are positive that the aviator understands you.

4-47. Ground-to-Air Emergency Codes

The following codes (fig 4-11) are used for the same purpose as those listed in paragraph 4-41 above; however, the symbols for using these codes may be constructed of any available material which contrasts with the background; i.e., strips of parachute canopy, undershirts torn into wide strips,



NEEDED MEDICAL ASSISTANCE - URGENT.

Used only when life is at stake.

Lie prone.



ALL OK; DO NOT WAIT.

Wave one arm overhead.



CAN PROCEED
SHORTLY - WAIT
IF PRACTICABLE.

One arm horizontal.



NEED MECHANICAL
HELP OR PARTS -
LONG DELAY.

Both arms horizontal.



DO NOT ATTEMPT
TO LAND HERE.

Both arms waved
across face.



LAND HERE.

Both arms forward
horizontally, squat-
ting and pointing in
direction of landing
Repeat.



USE DROP MESSAGE.

Make throwing motion.



OUR RECEIVER
IS OPERATING.

Cup hands over ears.



NEGATIVE (NO).

White cloth waved
horizontally.



AFFIRMATIVE (YES).

White cloth waved
vertically.



PICKS US UP -
PLANE ABANDONED.

Both arms vertical.

Figure 4-10. Visual ground-to-air emergency signals.

All well	LL
No	N
Yes	Y
Not understood	JL
Require engineer (mechanic)	W
Require doctor. Serious injuries	I
Require medical supplies	II
Unable to proceed	X
Require food and water	F
Require firearms and ammunition	W
Require map and compass	□
Require signal lamp with battery, and radio	I
Indicate direction to proceed	K
Am proceeding in this direction	↑
Will attempt takeoff	▷
Aircraft seriously damaged	L ₇
Probably safe to land here	△
Require fuel and oil	L
Operation completed	LLL
We have found all personnel	<u>LL</u>
We have found only some personnel	++
We are not able to continue. Returning to base	XX
Have divided into two groups, proceeding in direction indicated	↙↘
Information received that aircraft is in this direction	→→
Nothing found. Will continue to search	NN
Require an answer to my message via message drop	III

Figure 4-11. Ground-to-air emergency codes.

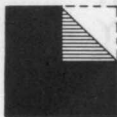


YELLOW *
OR RED

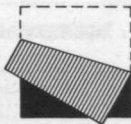


BLUE *

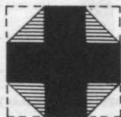
*Any contrasting colors may be used.



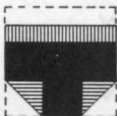
NEED GAS AND OIL
PLANE IS FLYABLE.



NEED TOOLS
PLANE IS FLYABLE.



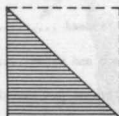
NEED MEDICAL
ATTENTION.



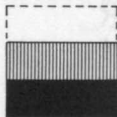
NEED QUININE OR
ATABRINE.
ON SEA: NEED
SUN COVER.



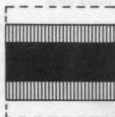
NEED EQUIPMENT
AS INDICATED,
SIGNALS FOLLOW.



NEED FOOD
AND WATER.



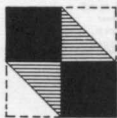
SHOULD WE WAIT
FOR RESCUE PLANE?
ON SEA: NOTIFY SAR
OF MY POSITION.



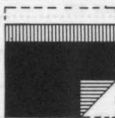
INDICATE DIRECTION
OF NEAREST CIVILIZATION.
ON SEA: INDICATE DIRECTION
OF RESCUE CRAFT.



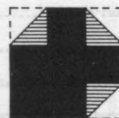
OK TO LAND IN
DIRECTION SHOWN.



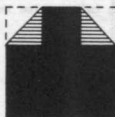
DO NOT ATTEMPT
LANDING.



WALKING IN THIS DIRECTION.
ON SEA: DRIFTING
THIS DIRECTION.



NEED FIRST-AID
SUPPLIES.



NEED WARM CLOTHING
OR CLOTHING INDICATED.

Figure 4-12.

Ground-to-air emergency code. paulin signals.

rocks, sticks, foliage stripped from tree branches, etc. Once laid out, these signals (codes) are of a semipermanent nature and the downed aviator may continue with other duties.

4-48. Ground-to-Air Emergency Code Paulin Signals

The following signals (fig 4-12) cannot normally be executed by downed aviators because of the requirement for a two-color reversible panel; however, other personnel may have the required panel and may use these signals.

One Green LA-13A and
 Two Green LA-13A and LA-13A.

Air-to-Air Communication

AR 95-1

Army Aviation -- General
 Provisions and Flight Reg-
 ulations.

AR 40-23

Evacuation of Patients.

AR 40-136

Worldwide Aeromedical
 Evacuation.

FM 9-15

Medical Services in Division,
 Separate Brigades and the
 Armored Cavalry Regi-
 ments.

FM 9-25

Transportation of Sick and
 Wounded.

Aviation of Mounted

FM 91-35

Airborne Operations.

TM 35-100-10

Air Movement of Troops and
 Equipment.

Automobile Operations

FM 57-35

Automobile Operations.

...the following signals (the 4-12) cannot normally be executed by downed aviators because of the physical limitations of the aviator. These signals may have to be executed by other personnel.

4-12 Ground-to-Air Emergency Code Panels

The following signals (the 4-12) cannot normally be executed by downed aviators because of the physical limitations of the aviator. These signals may have to be executed by other personnel.

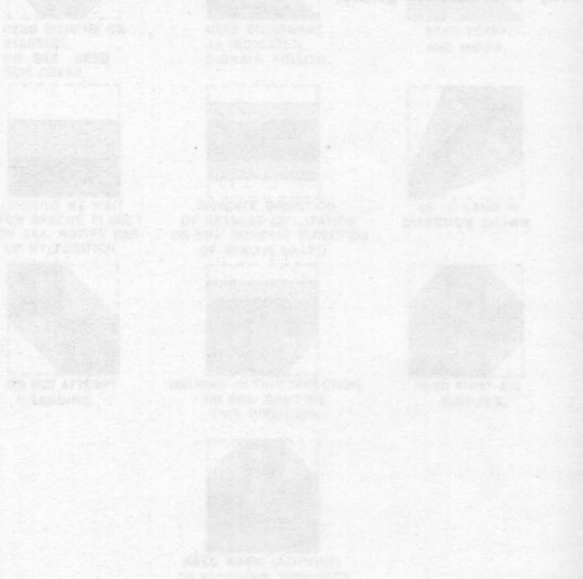


Figure 4-12. Ground-to-air emergency code panels.

CHAPTER 5

REFERENCES IN ALPHABETICAL ORDER BY TOPICS

Aerial Photography (KS-61 System)

TM 11-6720-
208-12

Operator's and Organizational Maintenance Manual: Cameras, Still Picture KA-30A and KA-30A2; Lens Cone Group LA-136A; and Lens Cones, Aerial Camera LA-132A and LA-133A.

Aeromedical Evacuation

AR 95-1

Army Aviation — General Provisions and Flight Regulations.

AR 40-20

Evacuation of Patients.

AR 40-535

Worldwide Aeromedical Evacuation.

FM 8-15

Medical Services in Divisions, Separate Brigades, and the Armored Cavalry Regiment.

FM 8-35

Transportation of Sick and Wounded.

Airlift of Material

FM 57-35

Airmobile Operations.

TM 55-450-15

Air Movement of Troops and Equipment (nontactical).

Airmobile Operations

FM 57-35

Airmobile Operations.

Adjustment of Fire

FM 6-2	Field Artillery Survey.
FM 6-20	Field Artillery Tactics and Operations.
FM 6-40	Field Artillery Cannon Gunnery.

Arctic Survival

FM 21-76	Survival, Evasion, and Escape.
AFM 64-3	Survival—Training Edition.

Attack Helicopter Gunnery

FM 1-40	Helicopter Gunnery.
---------	---------------------

Amphibious Operations

FM 31-11/ NWP 22 (B)/ AFM 2-53/ LFM 01	Doctrine for Amphibious Operations.
FM 31-12	Army Forces in Amphibious Operations (The Army Landing Force).

Camouflage

FM 5-20	Camouflage.
---------	-------------

Chemical

FM 3-8	Chemical Reference Handbook.
FM 3-10/NWIP 36-2/AFM 355-4/FMFM 11-3	Employment of Chemical Agents.
FM 21-40	Chemical, Biological, Radiological, and Nuclear Defense.

FM 21-41	Soldiers Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare.
FM 21-48	Chemical, Biological, and Radiological (CBR), and Nuclear Defense Training.
TC 3-11	Use of M10 Airplane Smoke Tank on Army Aircraft.
TC 3-16	Employment of Riot Control Agents, Flame, Smoke, Antiplant Agents, and Personnel Detectors in Counter guerrilla Operations.
TM 3-215/AFM 355-7	Military Chemistry and Chemical Agents.
TM 3-400/TO 11C 2-1-1	Chemical Bombs and Clusters.
TM 3-1040-207-15P	Operator, Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists for Smoke Tank, Airplane, M10 (FSN 1040-368-6078).
TM 3-1040-220-12	Operator's and Organizational Maintenance Manual: Dispenser, Riot Control Agent, Helicopter or Vehicle-Mounted, M5.
SB 3-1040-10	Smoke Tank, Airplane, M10; Serviceability Standard Long-Term Storage.
AR 220-58	Organization and Training for Chemical, Biological, and Radiological (CBR) Defense.

Courier Flight

- | | |
|--------------------------------|---|
| AR 340-16 | Safeguarding "For Official Use Only" Information. |
| AR 380-5 | Department of the Army Information Security Program. |
| US Code, Title 18, Section 793 | Gathering, Transmitting, or Losing Defense Information. |

Disaster Relief

- | | |
|-----------|---------------------|
| AR 500-60 | Disaster Relief. |
| FM 19-15 | Civil Disturbances. |

Desert Operations

- | | |
|----------|--------------------|
| FM 31-25 | Desert Operations. |
|----------|--------------------|

Desert Survival

- | | |
|----------|--------------------------------|
| FM 21-76 | Survival, Evasion, and Escape. |
| AFM 64-3 | Survival—Training Edition. |

Electronic Warfare

- | | |
|--------------|-------------------------|
| (C) FM 32-20 | Electronic Warfare (U). |
|--------------|-------------------------|

Internal Defense and Internal Development

- | | |
|----------|--|
| FM 31-16 | Counterguerrilla Operations. |
| FM 31-23 | Stability Operations — US Army Doctrine. |
| FM 57-35 | Airmobile Operations. |

Illumination

- | | |
|----------|---|
| FM 20-60 | Battlefield Illumination. |
| TC 1-16 | Employment of Aircraft Flares From Army Aircraft. |

Jungle Operations

- | | |
|----------|--------------------|
| FM 31-35 | Jungle Operations. |
|----------|--------------------|

Mountain Operations

DA Pam 95-8
FM 31-72

Mountain Flying Sense.
Mountain Operations.

Mountain Survival

FM 32-76

Survival, Evasion, and Escape.

FM 31-72
AFM 64-3

Mountain Operations.
Survival—Training Edition.

Night Operations

FM 31-36
(TEST)

Night Operations.

Northern Operations

FM 21-76

Survival, Evasion, and Escape.

FM 31-71

Northern Operations.

Nuclear Warfare Environment

FM 3-12/
FMFM 11-5

Operational Aspects of Radiological Defense.

Parachuting

TM 57-220

Technical Training of Parachutists.

Psychological Operations

FM 33-1

Psychological Operations —
US Army Doctrine.

FM 33-5

Psychological Operations —
Techniques and Procedures.

Radio Retransmission

See Aircraft
-10 TM's
FM 24-18

Field Radio Techniques.

Radiological Survey

FM 3-12/
FMFM 11-5

Operational Aspects of Radiological Defense.

FM 21-40	Chemical, Biological, Radiological, and Nuclear Defense.
FM 21-41	Soldiers Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare.
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 11-6665-213-12	Operator and Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Radiacmeter 1M-174/PD.
Rappelling	
FM 31-71	Northern Operations.
FM 31-72	Mountain Operations.
Reconnaissance and Surveillance	
TM 11-5841-236-12	Organizational Maintenance Manual: Transmitting Set, Radar Data AN/AKT-16 and Test Facilities Kit MK-990/AKT-16.
TM 11-5895-284-12	Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Radar Surveillance Sets AN/APS-94B and AN/APS-94C; Test Facilities Kit MK-652/APS-94.
FM 1-80	Aerial Observer Techniques and Procedures.
FM 5-36	Route Reconnaissance and Classification.

FM 17-36

Armored Cavalry Platoon,
Troop, and Divisional Armored Cavalry Units.

FM 30-20

Aerial Surveillance-Reconnaissance, Field Army.

Riot Control

FM 3-series

(Chemical.)

FM 19-15

Civil Disturbance.

FM 21-48

Planning and Conducting
Chemical, Biological, and
Radiological (CBR), and
Nuclear Defense Training.

FM 33-1

Psychological Operations —
US Army Doctrine.

TM 3-1040-
215-12

Operator and Organizational
Maintenance Manual: Dis-
penser, Riot Control Agent,
Helicopter or Vehicle-
Mounted, M4.

TM 3-1040-
220-12

Operator and Organizational
Maintenance Manual: Dis-
penser, Riot Control Agent,
Helicopter or Vehicle-
Mounted, M5.

Search and Rescue

FM 20-150/
NWP 37(B)/
AFM 64-2/
CG-308

National Search and Rescue
Manual.

Survival

FM 21-76

Survival, Evasion, and Es-
cape.

Tactical Low Level Navigation

TM 1-225

Navigation for Army Avia-
tion.

Topographic Survey

FM 5-146

Engineer Topographic Units.

Unconventional Warfare

FM 31-16

Counter guerrilla Operations.
Special Forces Operational
Techniques.

FM 31-20

FM 31-21

Special Forces Operations—
US Army Doctrine.
Stability Operations — US
Army Doctrine.

FM 31-23

US Army Counterinsurgency
Forces.

FM 31-73

Advisor Handbook for Sta-
bility Operations.

Weight and Balance

TM 55-405-9

Army Aviation Maintenance
Engineering Manual:
Weight and Balance.

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