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SECRETARY OF THE AIR FORCE

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Flying Operations

H-1 HELICOPTER OPERATIONS PROCEDURES

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction implements the guidance contained in AFPD 11-2, *Flight Rules and Procedures*. It establishes procedures for the operation of all H-1 helicopters employed by the United States Air Force to accomplish their respective missions. It does not apply to the Air National Guard or Air Force Reserve Command. It provides the most acceptable policies and procedures for most circumstances, but does not replace sound judgment. This publication applies to all USAF H-1 helicopter flying units. This instruction contains a chapter reserved for major command (MAJCOM) unique operations and a chapter reserved for unit unique operations. The use of the name or mark of any specific manufacturer, commercial product, commodity or service in this publication does not imply endorsement by the Air Force. This instruction is affected by the Paperwork Reduction Act as amended in 1996. This AFI replaces information found in AFSPCI 11-201, *Helicopter Operations*, 3 Sep 1996; Attachment 1 to AFSPCI 11-201, 3 Sep 96; MCI 11-221; *Operational Support Aircraft (OSA) Airlift Operations*, 15 April 1993; AMCI 11-202, Volume 2, 1 Nov 1995; and H-1 specific guidance in AFSOCI 11-208. Supporting Document: AFI 11-2H-1, Volume 3, Checklist (CL-1), *Helicopter Crew Briefing Guide/Checklist.*

Chapter 1

GENERAL INFORMATION

1.1. General. This directive applies to all H-1 helicopter aircrews. It consists of this instruction and AFI 11-2H-1, Volume 3, Checklist 1 (CL-1), *Helicopter Crew Briefing Guide/Checklist*. Use it in conjunction with aircraft flight manuals, Flight Information Publications (FLIP), and applicable USAF publications. It applies to training, normal, and contingency operations to reduce the need for any procedural changes at the onset of contingencies. HQ AFSPC/DOSH has overall responsibility for administration of this instruction and checklist.

1.2. Mission. The primary missions of H-1 helicopter units include support of DoD, NASA and Air Force missile and launch operations, contingency operations, operational support airlift, security, distinguished visitor (DV) airlift, medical evacuation (MEDEVAC), search and rescue (SAR), photographic support flights, formal and continuation training, and airlift of wing, base, and other personnel as required for mission accomplishment.

1.3. Applicability. This instruction is directive on all personnel assigned or attached to USAF H-1 helicopter units. Crewmembers must have a thorough working knowledge of all procedures applicable to their crew position.

1.4. Deviations and Waivers. The waiver authority for this instruction is the MAJCOM DO. Submit waiver requests in memo or message format through standardization/evaluation (stan/eval) channels. When an operational necessity exists and time does not allow pursuit of a waiver through normal channels, the group commander has one-time waiver authority to this instruction. Forward a copy of the waiver, including a summary of the circumstances, through stan/eval channels to the MAJCOM within 10 days. Report all deviations without waiver through stan/eval channels to the MAJCOM within 10 days of the occurrence. MAJCOM POCs will forward a copy of waiver or details of circumstances to HQ AFSPC/DOSH for information only. Do not deviate from the policies and guidance in this instruction except:

1.4.1. For safety. Aircraft commanders may deviate from this directive as necessary to protect their crew and aircraft if they believe strict compliance would jeopardize safe operations.

1.4.2. When circumstances require. This publication provides guidance for helicopter operations under most circumstances, but it does not substitute for sound judgment. If within communications range of command and control agencies, deviations due to unusual circumstances should be pre-coordinated.

1.5. Supplements:

1.5.1. MAJCOMs and units may publish supplements to this instruction. Supplemental guidance must not be less restrictive than this instruction. Forward MAJCOM supplements to HQ AFFSA/XOF, through HQ AFSPC/DOSH for approval before publication. MAJCOM supplements to AFI 11-2H-1 Volume 3 will be distributed within each MAJCOM. Send one copy of all supplements to HQ AFFSA/XOF and to HQ AFSPC/DOSH, 150 Vandenberg St., Ste 1105, Peterson AFB CO 80914-4200, after publication.

1.5.2. MAJCOMs and units may publish operating instructions (OIs) in accordance with the guidance contained in **chapter 17** and **chapter 18** of this instruction. Title these OIs to indicate the MAJCOM or unit concerned; for example, "AFSPC Operating Instructions" or "37 HF Local Operating Instructions," and file them after the appropriate chapter. These OIs will not duplicate, but should augment the provisions of this instruction. Prior to unit OI publication, send a copy to the applicable NAF/MAJCOM representative. Send a copy of approved OI to HQ AFSPC/DOSH for informational purposes, 150 Vandenberg St., Ste 1105, Peterson AFB CO 80914-4200.

1.6. Development of New Equipment Procedures . Individual MAJCOM, AFSPC and Robins ALC approval must be obtained prior to testing new procedures or equipment.

1.7. Requisition Procedures. Units will establish requirements for AFI 11-2H-1 Volume 3 through MAJCOM publications distribution channels in accordance with AFI 37-161, *Distribution Management*.

Chapter 2

OPERATING POLICIES

Section 2A— Command and Control

2.1. General. Air Force Space Command is the Lead Command for H-1 operations and will coordinate instruction changes and dissemination of revised information. Individual MAJCOMs may establish command and control guidelines in their supplements or post them in **chapter 17**.

2.1.1. The Wing/Group Commander and subordinate unit commanders exercise operational command.

2.1.2. The flying unit commander exercises operational control.

2.2. Mission Commander. A mission commander (MC) may be required to conduct specific deployment, employment, or redeployment activities in conjunction with contingency, exercise, training, or other operations. Designated by the appropriate command authority, the MC is delegated command authority to exercise operational control over assigned operational and mission support forces in order to attain specified mission objectives during operations and exercises. The MC is a direct representative of the designating commander. The MC is responsible for planning, coordinating, and executing the operation and, through the appropriate command and control system, directs mission support forces as required, within the limits of the designating commander's authority. It is the MC's responsibility to take care of the details and the people involved in the mission.

2.3. Posse Comitatus Act. See AFI 10-801, *Assistance to Civilian Law Enforcement Agencies*. Report all requests for assistance and coordinate all requests from civilian law enforcement authorities through appropriate command and control channels.

2.3.1. Utilization of Civilian Law Enforcement or Medical Personnel. Civilian law enforcement or medical personnel may be required to perform duties at an incident site. These duties may include death determination or human remains removal. Local/international laws may affect mission prosecution and should be reviewed prior to deployment/pickup of civilian personnel. Units will publish any local restrictions and procedures in the unit Local Operating Instructions section of **chapter 18**.

2.4. Military Support to Civil Authorities. Request for helicopter support by civil authorities will be handled IAW AFI 11-802, *Military Support to Civil Authorities*. Mission approval authorization:

2.4.1. Approval authority is the wing/group commander. Provisions of **chapter 8** explaining human remains removal policies must be are reviewed prior to mission approval.

2.4.2. Approval authority to carry civilian law enforcement or medical personnel on SAR/MEDEVAC missions may be delegated to aircraft commanders under certain circumstances. If the aircraft commander determines passengers are essential for the successful completion of the mission and they are unable to contact their controlling agency for approval, passengers may be carried on the segments of flight requiring their presence.

Section 2B— Crew Qualification

2.5. Primary Crewmembers. Primary crewmembers must be qualified and current, or in training for qualification in that crew position and mission.

2.5.1. During operational missions, training of noncurrent or unqualified crewmembers is authorized when under the supervision of an instructor in the respective crew position.

2.5.2. Crewmembers maintaining basic aircraft qualification who are noncurrent or unqualified for operational/special mission items may perform FCFs (functional check flights).

2.5.3. Flight surgeons may fly in their specialty aircraft when authorized on the flight authorization. When they are assigned/attached to helicopter units they will comply with AFI 11-401, *Flight Management*, as supplemented, AFI 11-202 Vol. 1, *Aircrew Training*, and AFI 11-2H-1 Vol. 1, H-1 *Helicopter Aircrew Training*, as supplemented for training requirements.

Section 2C— Crew Management

2.6. Minimum Crew. MAJCOM DO is the waiver authority for minimum crew complement. The minimum crew is the aircraft commander. Exceptions are noted below. Due to special circumstances, mission requirements, safety considerations, weather, and crew qualifications, mission commanders, flying unit commanders or operations officers may direct additional crewmembers (pilots, flight engineers (FE), aerial gunners (AG) and/or flight surgeons) be added to any flight. Flight engineers add significantly to the safety and efficiency of all helicopter missions and should be used to the maximum extent possible. Use of other crewmembers as scanners is also desirable. When operations involve multiple flight conditions, illumination levels, or flight profiles, the most restrictive crew complement (number of crewmembers required for the mission) will apply. On single pilot missions, flight engineers and flight surgeons may sit in the left front seat when not required in the cabin area. Crew chiefs/flight engineers may sit in the left front seat during FCFs and maintenance support flights.

2.6.1. Minimum crew for instrument procedures is the aircraft commander and a copilot. Minimum crew for simulated instrument procedures (VMC) is the aircraft commander and copilot/flight engineer.

2.6.2. Minimum crew for low-level operations at or above 100 feet above the highest obstacle (AHO) is a mission qualified aircraft commander and a mission qualified copilot or mission qualified flight engineer. Flight below 100' AHO requires a mission qualified aircraft commander, mission qualified copilot, and a qualified scanner (pilot, FE, or AG). This paragraph does not apply to FAA certified helicopter routes that require flight below 500' AGL and/or 100' AHO.

2.6.3. Minimum crew for FCF is a FCF qualified aircraft commander and either a FCF qualified copilot, FCF qualified flight engineer, or crew chief.

2.6.4. Minimum crew for a SAR is a mission qualified aircraft commander, a mission qualified copilot and a mission qualified flight engineer (if available).

2.6.5. Minimum crew for unaided night operations is an aircraft commander and a copilot or flight engineer. Minimum crew for unaided night remotes is a mission qualified aircraft commander and mission qualified copilot. For contingency missions, unaided night remotes may be conducted with a mission qualified aircraft commander and a mission qualified FE.

2.6.6. Minimum crew for NVG operations is a NVG qualified aircraft commander and a NVG qualified copilot (see paragraph **7.8.**).

2.6.7. Minimum crew for emergency procedures training is an instructor pilot and a copilot.

2.6.8. Minimum crew for formation is a mission qualified aircraft commander and a mission qualified copilot (within three rotor disks) or mission qualified flight engineer (outside three rotor disks) (see **chapter 9**).

Section 2D— Publications Required for Flight

2.7. Mission Kits. Unit commanders may supplement the minimum contents of the kit shown in **table 2.1.** Items carried by crewmembers or stored on the aircraft need not be duplicated in the mission kit. A mission kit is required for all flights except on FCFs as long as a flight manual is carried.

Table 2.1. Minimum Mission Kit.

Flight Documents	Flight Publications
- TO 1H-1(U)N-1, Flight Manual	- IFR Supplement
- AFI 23-202, *Buying Petroleum Products and Other Supplies and Services Off-Station* (Conus only*)*	- VFR Supplement - Flight Information Handbook (FIH)
- AF Form 457, **USAF Hazard Report**- AF Form 651, **Hazardous Air Traffic Report (HATR)**	- En route Low Altitude Charts (one set for area of operation)
- Emergency Briefing Card(s) - Cargo Loading and Weight & Balance TO	- Low Altitude Instrument Approach Procedures (two sets for area of operation)
- Supplemental Weight & Balance Handbook	- Maps and Charts (as required)
- AFI 11-202, Vol 3 *General Flight Rules*- AF Form 70, **Pilot's Flight Plan and Flight Log**	- Operational Site Diagrams or Photos (as required)
- AFI 11-2H-1 Volume 3, *H-1 Helicopter Operations Procedures*	

Section 2E— Alert

2.8. Alert Procedures. MAJCOMs determine alert requirements.

Section 2F— Acceptance and Functional Check Flights

2.9. General. Acceptance and functional check flights are inherently more dangerous than normal flights. In order to be safely flown, aircrews must be knowledgeable of aircraft systems, limits, and check flight procedures.

2.10. Maintenance Briefing. Prior to any functional check flight, the crew will receive a maintenance briefing. The briefing should outline FCF requirements, ensure a review of maintenance documentation, and clarify any questions. After aircraft release, or at the end of the day, maintenance will receive a thorough debrief from the FCF crew. Maintenance will ensure FCF checklists and documentation are complete.

2.11. Local Procedures. Units will define their local FCF area. Flight conditions will be in accordance with TO 1-1-300. Any unit unique FCF restrictions will be addressed in **chapter 18**.

Chapter 3

AIRCREW PROCEDURES

Section 3A— Premission

3.1. Aircrew Uniforms and Protective Devices:

3.1.1. When reporting for flying or alert duties, all crewmembers will wear appropriate flying clothing and carry a set of ID tags on their person. Commanders will determine additional requirements appropriate to terrain and climatic conditions.

3.1.2. All crew chiefs and maintenance/logistic support personnel will wear Nomex flight gear when flying on helicopters.

3.1.3. Personnel whose duties require them to be in close proximity to the operating helicopter require eye and ear protection.

3.1.4. Aircrews will ensure hearing protection is available prior to flight. A crewmember will be responsible for distributing these devices to all passengers.

3.1.5. Wearing of Reflective Material. Aircrew members will not permanently attach/affix reflective materials to flight clothing.

3.2. Aircrew Publications Requirements. All crewmembers will maintain and carry their applicable abbreviated checklists and AFI 11-2H-1, Vol 3, CL-1 to this instruction during flight. Insert current, approved flight manual checklists in the USAF flight crew checklist binder. Additional notes amplifying checklist procedures and limitations may be added. Currency of notes is the crewmember's responsibility.

Section 3B— Flight Planning and Briefings

3.3. Maps. Pilots will ensure they flight plan and fly with current maps. A current map consists of the most recent edition available with updates from the Chart Updating Manual posted on it and annotated as such. Old editions are acceptable only if every update since publication is correctly posted and annotated.

3.4. Crew Briefings and Checklists. The aircraft commander will ensure all applicable briefings and checklists are completed prior to the event. A checklist is not complete until all items have been completed in sequence.

Section 3C— Preflight

3.5. Required Documentation:

3.5.1. Aerospace Vehicle Flight Data Document. Review the AFTO Form 781, **AFORMS Aircrew/ Mission Flight Data Document**, before applying power to the aircraft or operating aircraft systems. An authorized maintenance person, if available, or the aircraft commander must sign the exceptional release before flight. Ensure the fuel identaplate is aboard the aircraft.

3.5.2. Prior to departure, the aircraft commander or designated representative will ensure a current mission kit is aboard the aircraft (see **table 2.1.**).

3.6. Aircraft Servicing and Ground Operations:

3.6.1. Aircrew members qualified in refueling may perform refueling duties. Crewmembers used as refueling supervisors/panel operators will comply with Specific Aircraft Technical Data, TO 00-25-172. At locations with refueling support, aircrews will not refuel unless extenuating circumstances dictate. When not directly involved in the refueling operation, personnel will remain at least 50 feet from the aircraft.

3.6.2. Engine-running crew changes require the following:

3.6.2.1. One pilot will have seat belt and shoulder harness fastened during pilot change.

3.6.2.2. The new aircraft commander will review aircraft weight and balance, and configuration.

3.6.2.3. Current takeoff and landing data must be computed.

3.7. Dropped Object Prevention. During preflight inspections, pay particular attention to panels and components that are potential dropped objects. All cargo/mission equipment inside the aircraft must be secured prior to any aircraft movement.

WARNING: Loose objects can become hazardous projectiles during any violent maneuver or hard landing and must be secured to prevent injury to personnel and/or damage to the aircraft.

3.7.1. When passengers are in the cargo compartment, the cargo doors will remain closed during flight unless an aircrew member is also in the cabin. Unit commanders may waive this requirement if a valid need exists and the passengers are thoroughly briefed on cabin personnel and equipment security.

Section 3D— Predeparture

3.8. Instrument Cockpit Check. If IMC is expected to be encountered during flight, complete an instrument cockpit check prior to takeoff.

3.9. Checklists. Checklists may be stowed on the aft portion of the center console provided the aircraft is not missing any switch guards and local pedestal configuration provides sufficient blank space to allow items to lie flat without covering any switches, dials, etc. All crewmembers must be briefed to take appropriate care when handling the checklists. Stow all flight materials when not in use.

3.10. Restraint Devices. At least one pilot will have seat belt and shoulder harness fastened when rotors are engaged. A seat belt, authorized restraint harness, or parachute will be worn by all occupants in the cabin compartment when doors are open during flight except as noted:

3.10.1. The aircraft commander may direct crewmembers to perform duties in the cabin unrestrained for brief periods when required to don harnesses, attend passengers, or change seats, provided doors are closed. Parachutists may change positions with doors open if parachutes are worn and the aircraft is higher than 1,000 feet above ground level (AGL).

3.10.2. For alternate loading of passengers and crewmembers, refer to **chapter 12**.

3.10.3. The aircraft commander may direct crewmembers to perform duties requiring the use of a gunner's belt in lieu of a seat and seat belt when mission requirements dictate. In this case, seats and seat belts must be readily available and immediately accessible to all crewmembers in case of an emergency. Attach the gunner's belt to any tie down ring on the floor or to any bulkhead mounted seat belt ring as long as the seat belt is not simultaneously in use. Only one gunner's belt can be attached to a tie down ring at the same time. Do not attach the gunner's belt to cargo tie down rings on the bulkhead or ceiling. Adjust the length of the gunner's belt to preclude accidental exit from the aircraft.

3.10.3.1. Exception : WR-ALC/LUHE has approved the use of a Ceiling Restraint Cable (CRC) as an alternate attachment point for gunners' belts. The CRC is a locally manufactured item. Instructions for the manufacture of this item may be obtained from WR-ALC/LUHE.

3.10.3.1.1. Description. The CRC is a cable routed through four D-rings attached to adapters connected to four ceiling mount studs. A bolt, nut, and pin arrangement connect the cable terminal ends. The CRC is only to be used by qualified crewmembers as an alternate attachment point for gunners' belts. When in use, the CRC affords crew members more flexibility and maneuverability especially during AIE's. The CRC keeps the gunner's belt off the floor and free of equipment, lessening the chance of belt entanglement.

3.10.3.1.2. Installation. The CRC is installed by flight engineers according to **figure 3.1.** The four adapters are installed on the ceiling mount studs at STA 82.0 BL 11.00 LH, STA 82.0 BL 11.00 RH, STA 100.0 BL 11.60 LH, STA 100.0 BL 11.60 RH. The cable will be fabricated according to TO 1-1A-8, Engineering Manual Series, Aircraft and Missile Repair, Structural Hardware. Manufactured cables will have the date of initial manufacture and a one-time weight testing capacity (2,500 pounds) permanently marked on the forked terminal end. Reference TO 1-1A-8 for inspection and maintenance criteria. The cable is routed through the D-rings on the adapters and then bolted together and pinned at the terminal ends. The terminal ends will be positioned in the middle of any of the four adapter assemblies. The CRC will be visually inspected each time the cable is installed and before use.

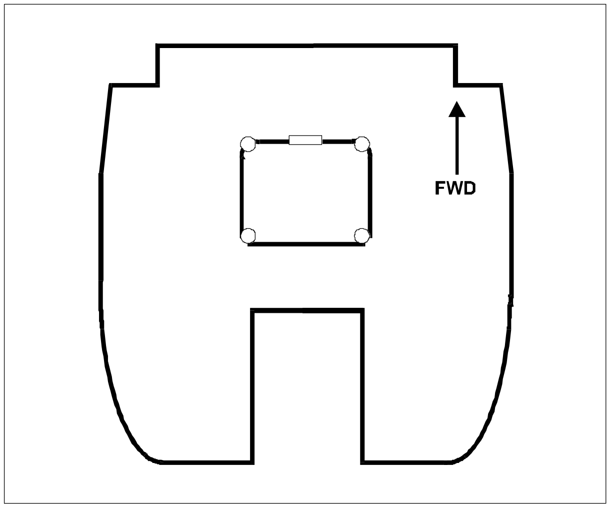
WARNING: Do not use adapters if they cannot be manipulated to the snap-to-lock position.

3.10.3.1.3. Operating Procedures. The CRC can support up to two gunner's belts at any one time. The gunner's belt may be attached at any adapter D-ring and cable or by cable alone. Only one gunner's belt may be attached to an adapter D-ring at a time and only one gunner's belt may be attached to a cable side at a time. No gunner's belt will be attached by cable alone at the terminal end attachment point.

3.10.4. If a valid mission requirement exists, commanders may permit Operational Support Fliers (OSFs) and Mission Essential Ground Personnel (MEGP) to be restrained with a gunner's belt. Commanders must ensure that these personnel are thoroughly familiar with the use of gunner's belts and are fully briefed on all pertinent safety considerations.

WARNING: An improperly adjusted gunner's belt may result in injury or loss of life.

Figure 3.1. Ceiling Restraint Cable Configuration (Typical).



3.11. Communications Policy:

3.11.1. Command Radios. The pilot will tell the crew which radio is the primary command radio. All crewmembers will monitor the primary command radio unless specifically directed otherwise by the aircraft commander.

3.11.1.1. Normally, only one command radio plus guard should be used and monitored. Monitoring two different ATC transmissions simultaneously is not recommended.

3.11.2. All crewmembers will listen to intercom and hot microphone. Clearance is required from the aircraft commander prior to going off intercom. During critical phases of flight, limit intraplane transmissions and radios monitored to those essential for crew coordination.

3.11.2.1. Avoid discussing classified information on intercom. If discussion is necessary, ensure all wafer switches are in ICS position.

3.12. Scanners. Crewmembers not performing basic crew duties will be used as scanners to avoid obstacles during ground taxiing, confined area operations, and to reduce midair collision potential during arrivals, departures, and simulated instrument flight.

Section 3E—En Route

3.13. Forced or Precautionary Landings. The helicopter has a unique ability to land nearly anywhere, providing the aircrew a tremendous safety advantage. If the crew becomes doubtful of the helicopter's airworthiness or encounters hazardous weather conditions, they should execute a precautionary landing, providing the landing conditions are not more hazardous than the inflight problem. Aircraft security and accessibility for maintenance are secondary considerations to aircrew safety. Report all precautionary landings through appropriate channels as soon as communications are established.

3.13.1. Forced or Precautionary Landings Due to Inflight Malfunction.

3.13.1.1. Aircraft malfunctions must be investigated, corrected, and inspected by qualified maintenance personnel. Coordinate maintenance support via radio, telephone, or any other means available. The unit and aircraft commander's approval is required prior to further flight when the precautionary landing occurs at a location where qualified maintenance is not available.

3.13.1.2. In the event a forced or precautionary landing occurs at a location where communications are not available, remain at the landing site and await assistance if the aircraft commander determines the aircraft is not safe for flight. If the aircraft is safe for flight, the aircraft commander may authorize further flight. If a greater hazard exists to the crew or aircraft at the landing site, then continue to the nearest safe landing area. The decision to resume flight under these circumstances must be based on a thorough evaluation of all the hazards and risks involved.

3.13.2. Precautionary Landings Due to Weather.

3.13.2.1. If deteriorating weather is encountered during VFR operations, consider a precautionary landing a viable option in addition to course reversal, course deviation, or continuing under IFR.

3.13.2.2. The aircraft commander may authorize further flight after a precautionary landing for weather. Make a reasonable effort to notify appropriate agencies of the precautionary landing and to determine additional weather information.

Section 3F— Arrival

3.14. Instrument Calls:

3.14.1. Mandatory altitude calls for the pilot not flying the aircraft during nonprecision approaches:

3.14.1.1. "One hundred feet above minimum descent altitude" (MDA).

3.14.1.2. "Minimums" at MDA.

3.14.1.3. "Runway in sight." Call when the runway environment is in sight. Do not call too soon when obstructions to vision (such as fog, haze, low stratus clouds, etc.) are present.

3.14.1.4. "Go-around." Call at missed approach point if the runway environment is not in sight.

3.14.2. Mandatory altitude calls for the pilot not flying during precision approaches:

3.14.2.1. "One hundred feet above decision height" (DH).

3.14.2.2. "Land." Call at decision height if the runway environment is in sight and the aircraft is in a position for a normal landing.

3.14.2.3. "Go-around." Call at decision height if the runway environment is not in sight or if the aircraft is not in a position for a normal landing.

3.14.3. Mandatory calls for the pilot not flying during climb out/descent:

3.14.3.1. Five hundred and one hundred feet below/above assigned altitude.

3.14.3.2. Five hundred and one hundred feet above/below initial approach fix altitude or holding altitude.

3.14.3.3. The pilot not flying the aircraft will announce heading deviations of 10 degrees, airspeed deviations of 10 knots, or altitude deviations exceeding 100 feet. Any crewmember seeing a deviation of 100 feet in altitude or a potential terrain or obstruction problem will immediately tell the pilot. Deviations from prescribed procedures for the approach being flown will also be announced.

Section 3G— Postflight

3.15. Maintenance Debriefing. As soon as possible after arrival, the aircraft commander and other required crewmembers will debrief maintenance personnel on the condition of the aircraft and equipment. Make the following entries in the AFTO Form 781A, **Maintenance Discrepancy and Work Document,** when appropriate:

3.15.1. "Aircraft subject to salt spray" when flown below 3,000 feet over salt water, except for takeoffs and landings.

3.15.2. "Aircraft flown below 30 feet above salt water."

3.15.3. "Hoist and (type rescue device) used in salt water."

3.16. Postflight Briefings. Postflight debriefings will be accomplished. The aircraft commander of each flight has the responsibility of affording each crewmember the opportunity to discuss the mission, either formally or informally Refer to AFI 11-2H-1, Vol 3, CL-1 as appropriate.

3.16.1. Training flights. The instructor will conduct the debriefing as follows:

3.16.1.1. Review and evaluate overall training performed.

3.16.1.2. Advise student or aircrew member of future training requirements.

3.16.1.3. Answer technical questions.

3.16.1.4. Complete training reports.

3.16.2. Operational Missions. Debrief the appropriate agencies immediately after the return of teams or aircrews from a sortie.

Chapter 4

HELICOPTER STANDARD CONFIGURATION

4.1. Responsibilities. Standard configurations will be IAW unit local procedures (**chapter 18**). Each flying unit will publish an OI complete with diagrams and mission equipment lists for each configuration used by the unit. Prepare a DD Form 365-4, **Weight And Balance Clearance Form F - Transport/Tactical,** for each of these configurations. Additional special mission equipment may be added at the option of the unit commander. Rescue aircraft need not be fully rescue-configured when a specific mission requires placement of additional seats/cargo in the space provided for mission equipment, when maximum gross weight is a consideration, or when otherwise required. All equipment authorized for and installed on the aircraft will be categorized and managed IAW applicable Air Force Instructions. Aircraft will not be modified to secure and/or install equipment unless authorized by aircraft technical orders or applicable Air Force Instructions.

NOTE: Cargo/Equipment. Securing life support/medical equipment/medical kits with seat belts is authorized. In addition, items weighing less than 200 pounds that require constant access, such as navigation or mission kits, may be secured with seat belts. Secure cargo/equipment items not requiring rapid removal during an aircraft or medical emergency with devices identified in TO 1C-1-71. Do not modify tie down devices in any fashion. A hoist cable quick splice device will be carried on all hoist-equipped aircraft. All hoist-equipped aircraft will have precision wire rope cutters readily available in the event the electrical cable cut guillotine fails. Affix cable cutters to the aircraft or hoist for quick access.

4.2. Deployment/Exercise Configuration. Every effort will be made to establish the standard configuration(s) prior to deployment/exercise participation. The standard configuration will be established for each planned mission. These requirements will be satisfied during the deployment/exercise planning conference and each unit will be notified of special configuration requirements. In the event a planning conference is not held, the operations officer (or designated representative) from each participating unit will establish a mutually agreed upon standard configuration for the deployment/exercise and/or mission commander's approval. The configuration(s) should not be altered just to carry additional observers, ferry simulated survivors, etc. Aircraft will be employed and perform SAR alert in the configuration(s) developed for the exercise. Survival equipment required by MAJCOM or multi-command guidance will be included in these configurations.

4.3. Rescue-Equipped TDY Aircraft. Unit commanders will determine if aircraft depart home station rescue equipped.

4.4. Deviations. Unit commanders may authorize deviations from the standard configuration. Deviations from tactical configuration requirements are authorized at deployment locations (including exercises) when the mission dictates.

4.5. FCF Configuration. Aircraft may fly functional check flights without mission equipment.

4.6. Discrepancies. Document all standard configuration discrepancies using the AFTO Form 781A.

Chapter 5

TRAINING PROCEDURES

5.1. Instructor Requirements. One instructor is required for each duty station requiring student flight training. Instructors are safety observers and are responsible for the actions of their students.

5.1.1. Instructor Responsibilities during Emergency Procedures. Training is designed to develop aircrew proficiency, reaction time, planning, and judgment in preparation for actual emergencies. Simulated emergencies must provide realistic training without unacceptably increasing risk. Accomplish all simulated emergency maneuvers according to the flight manual and this chapter.

WARNING: Instructors must be alert and take prompt action to terminate simulated emergency maneuvers and execute corrective action at the first indication of deteriorating aircraft performance or serious student proficiency problems.

5.1.1.1. Place emphasis on the procedures for positive identification of the simulated emergency condition before initiating corrective action. System failures must not be unreasonably compounded and must not be simulated in conjunction with a simulated engine failure unless normally associated with engine failure. The surprise approach of initiating emergency procedures must be tempered to allow for a possible wrong reaction/mistake that could jeopardize safety; therefore, such emergencies will only be practiced with sufficient airspeed and altitude to ensure a safe recovery.

5.1.1.2. In high-density traffic areas, emergencies that could require an in-depth analysis/discussion or detailed cockpit duties should only be simulated when traffic congestion is at a minimum.

5.2. Prohibited Maneuvers. The following maneuvers will not intentionally be accomplished in the aircraft:

5.2.1. Actual engine shutdown.

5.2.2. Blade stall and power settling.

5.2.3. Dual fuel control failures.

5.2.4. Dual hydraulic system failures.

5.3. Training Requirements:

5.3.1. Special Restrictions. Unusual attitude training and emergency procedures involving engines (to include simulated autorotations), engine fuel systems, flight controls, or hydraulic systems will be accomplished only:

5.3.1.1. During visual meteorological conditions.

5.3.1.2. After official sunrise/prior to official sunset.

5.3.1.3. During training, currency, or evaluation flights.

5.3.1.4. When passengers are not on board.

5.3.1.5. When an instructor/flight examiner pilot is designated on the flight orders under "Duty Position" as IP or EP and occupies a pilot seat with a set of controls.

5.3.2. Slide landing training areas. Local slide landing training areas are used for emergency and normal procedure maneuvers (e.g., single engine). If wind information at the slide area cannot be obtained through tower services, a wind detection device must be readily discernible to the pilots flying and close enough to provide accurate information.

5.3.2.1. IAW AFMAN(I) 32-1123, *Airfield and Heliport Planning and Design,* MAJCOMs will determine requirements/dimensions for helicopter slide landing areas.

5.3.2.2. The pilot in command will accomplish the following:

5.3.2.2.1. Brief the hazards of the slide landing area prior to commencing any maneuvers.

5.3.2.2.2. Visually inspect the slide area for hazards and surface condition.

5.3.2.2.3. If the visual inspection was inconclusive, test the surface by accomplishing a slide landing to determine its slide characteristics.

5.3.2.2.4. If the slide area is not safe, discontinue training or go to a suitable slide or hard surface area.

5.3.2.2.5. Hard surface areas such as runways, taxiways, or ramp areas may be used if free of obstacles/hazards.

5.3.3. Crash Fire Rescue (CFR). Units will establish procedures to ensure CFR support is readily available during emergency procedure training.

5.4. Maneuver Parameters. Maneuver parameters are provided to supplement the flight manual. These procedures are intended for use on all missions, but may not reflect the optimum performance required for some operational situations. Deviations from this guide may be made, if required, to accomplish mission objectives. Pilots should use all available power, if necessary, to safely accomplish operational mission objectives.

5.4.1. General Procedures:

5.4.1.1. Traffic pattern. Fly the downwind leg at 500 feet AGL and 90 KIAS. During the turn to base, descend to 300 feet AGL and slow the aircraft to 70 KIAS. Pattern altitudes may be adjusted to comply with local traffic control rules. Use caution to avoid excessive bank angles and descent rates or low airspeeds. The point of rollout on final should allow a controlled, straight approach without the need for aggravated flares, abrupt control movements, or large collective inputs. Entry altitude for all approaches will be 300 feet AGL unless specified otherwise in this instruction.

5.4.1.2. Normally, takeoffs and landings will be made using a constant heading or ground track into the wind or alignment with the runway. Crosswind correction will be accomplished by using the wing-low method on takeoff until a climb is established and during the final portion of the approach. At other times, the crab method may be used.

5.4.1.3. Maneuvers will be flown with emphasis on precise altitude, airspeed, and aircraft control.

5.4.1.4. 100 percent Nf will be used for all maneuvers.

5.4.2. Hovering Maneuvers:

5.4.2.1. A 3-5 foot skid height will be used for all hovering maneuvers unless circumstances require higher.

5.4.2.2. Sideward or backward flight will be performed using a constant heading and groundspeed.

5.4.2.3. 360-degree hovering turns will be performed using a constant rate of turn.

5.4.3. Transition Maneuvers:

5.4.3.1. Takeoffs.

5.4.3.1.1. Normal takeoff. Use hover power plus 10 percent. From the ground or a hover smoothly increase power to desired setting while accelerating forward at hover altitude. After passing effective translational lift (ETL), adjust attitude to climb. At 70 KIAS the maneuver is terminated; adjust power and attitude for a normal climb.

5.4.3.1.2. Marginal power takeoff. The simulated maximum power available is 4-foot hover power and the simulated obstacle is 50 feet. Initiate the takeoff from a 3-5 foot hover by smoothly applying forward cyclic. As the aircraft accelerates, it may tend to settle, especially with light or calm winds. If necessary, compromise the maneuver by adding power to avoid ground contact. Parallel the ground at 3-5 feet until ETL is attained. After passing through ETL, initiate a climb (without decelerating below ETL) to clear the simulated obstacle. After the desired altitude has been reached, smoothly accelerate (without descending) to 50 KIAS. At 50 KIAS, the maneuver is terminated; adjust power and attitude for a normal climb.

5.4.3.1.3. Maximum performance takeoff. The simulated maximum power available is hover power plus 10-15 percent and the simulated obstacle is 100 feet. From the ground or a hover smoothly increase power to the required setting. After climbing through normal hover altitude, adjust cyclic to establish desired climb attitude. The forward speed and rate of climb (angle) may be varied to achieve the desired performance. When sufficient altitude to clear the simulated obstacle has been reached, smoothly accelerate without descending to 70 KIAS. At 70 KIAS, the maneuver is terminated; adjust power and attitude for a normal climb.

5.4.3.2. Approaches. (According to flight manual.)

5.4.3.2.1. Turning approaches. A turning approach can be initiated from any position in relation to the intended landing area. For training, normally initiate a 90-degree turning approach from base altitude and airspeed and 180-degree or more turning approaches from downwind altitude and airspeed. Throughout the turn, adjust airspeed and rate of descent to maintain the desired approach angle. Avoid steep approach angles, high bank angles and high descent rates during the maneuver. Progressively decrease ground speed and rate of descent so as to enter a hover, touchdown, or slide over the intended landing spot.

5.4.3.2.2. Approach to a touchdown. Initiate and fly the desired approach angle. As hover altitude is approached, continue the descent and angle while slowing the groundspeed and vertical velocity to have a landing attitude and at or near zero groundspeed upon touchdown. Cushion the touchdown with collective and continue to fly the aircraft fully onto the ground.

5.4.4. Unusual Attitude Training. Entry must be at or above 1,000 feet AGL. Simulated unusual attitudes will not exceed 30 degrees of bank, a 20-degree nose high attitude, or a 10-degree nose low attitude.

5.4.5. Manual Fuel Operations. Entry must be at a minimum of 500 feet AGL and 70 KIAS, in a hover when single-engine hover capability is available, or while on the ground. Ensure collective setting is below computed single-engine torque available prior to retarding the throttle to flight idle. Complete flight manual procedures, maintaining torque on the manually governed engine approximately five to ten percent below the governed engine. Any type of approach may be used terminating to a hover or slide landing. To return to automatic fuel control, retard the manually governed engine to flight idle and return the fuel control switch to AUTO.

NOTE: Torque on the ungoverned engine may be required to be less than five percent below the governed engine under high DA conditions to preclude over temp or over torque of the governed engine.

5.4.6. Boost-Off. Entry must be at a minimum altitude of 500 feet AGL and 70 KIAS during straight and level flight or on the ground. Any type of approach may be used terminating either to a hover or a slide landing.

5.4.7. Practice Autorotations. Due to the risk associated with this maneuver, carefully consider wind, density altitude, aircraft gross weight, and individual pilot proficiency prior to performing autorotations. Fly each autorotation as if an actual touchdown may be required. If a malfunction occurs, the aircraft is then in position to execute a safe landing.

5.4.7.1. Accomplish autorotations to a runway, taxiway, or approved slide area. When such an area is not available, select a smooth, level area. The instructor/flight examiner will ensure it is free of obstructions prior to commencing training.

5.4.7.2. Minimum entry altitude is 800 feet AGL for 180-degree turning autorotations; 500 feet AGL for all others. For 180-degree autorotations, the aircraft must be wings level, have a minimum of 60 KIAS, rotor RPM within limits, normal rate of descent, and be aligned with landing/recovery heading at no lower than 150 feet AGL. If any of these conditions are not met, initiate a power recovery immediately. The wings level requirement does not prohibit minor heading corrections on final.

5.4.7.3. Practice autorotations require the aircraft landing direction heading to be aligned within 45 degrees of the wind direction when winds are 10 knots or greater. Below 10 knots, aircraft landing direction heading must be within 90 degrees of the wind. A wind indicator must be close enough to the recovery point to provide readily discernible, accurate wind information.

5.4.7.4. Practice autorotations in excess of 180 degrees must terminate by power recovering at or above 500 feet AGL.

5.4.7.5. The initial autorotation for training/currency will be a straight-ahead autorotation accomplished by the instructor or instructor candidate to evaluate aircraft performance. During evaluations the pilot being evaluated may perform this autorotation.

WARNING: Instructor pilots must immediately terminate the maneuver and initiate a power recovery at the first indication of abnormally high/low rotor RPM, excessive sink rate, low airspeed, ineffective flare, or at any time an inadvertent touchdown might occur.

5.4.7.6. Practice autorotations shall be terminated with a power recovery no lower than four feet AGL with a maximum ground speed of 15 knots.

5.5. Simulated Single-Engine Emergencies:

5.5.1. Enter in flight no lower than 150 feet AGL and 55 KIAS. If single-engine hover power is available, maneuver may be initiated in a hover or on the ground. Practice single-engine emergencies may be initiated below the above listed altitude as long as simulated torque available is limited on both engines rather than reducing torque available on the simulated failed engine. Instructors must use caution when simulating single-engine emergencies at low altitudes and airspeeds. Do not reduce throttle on the simulated failed engine unless indicated torque is below computed single-engine torque available. Single-engine approaches and landings must be practiced to a slide or hard surface landing area. During the approach, if unsafe conditions exist, both engines shall be used for the go-around or landing, as required.

5.5.2. Perform a power available check (IAW para. **6.7.**) prior to beginning the approach. For subsequent approaches using the same engine, the power available check may be simulated. Ensure atmospheric conditions are the same or better than those used for computations. If a limitation is reached, compare actual power available to computed power available. Terminate training if the engine produces less than computed power.

Chapter 6

OPERATIONAL/UNPREPARED LANDING SITE PROCEDURES

6.1. General. This chapter provides guidance for the successful accomplishment of unimproved landing site operations. Each area of possible operations requires detailed knowledge of the problems you may encounter. Prior to performing an approach to a landing or hover, the aircraft commander must consider crew qualification, aircraft power and capability, weather (including winds), terrain, environmental factors, illumination, and mission requirements. The final decision to accomplish the approach or landing rests with the aircraft commander. Safety of flight must not be jeopardized for mission accomplishment.

6.2. Aircraft Control Techniques. The smoother the pilot flies, the greater the efficiency of the helicopter. Maintaining a steady rotor disc gives you the greatest performance with the least power. All remote approaches must be flown with the utmost precision, especially during the final approach phase. A pilot must not get in a hurry with fast or erratic approaches. Remote area approaches must not be so fast as to require a flare in order to terminate, nor should they be so slow as to cause loss of ETL before the helicopter is in an immediate position to land. These procedures require practice to perfect.

6.3. Preparation. During premission preparation, use all available resources to ensure aircraft and crew limitations are not exceeded. Consider available winds, terrain, power available/required and operating altitudes to prevent an inadvertent entry into an unrecoverable flight regime. Altitude and temperature are major factors in determining helicopter power performance. However, this information may not be available for the site of intended operation and will require evaluation on scene. Keep fuel load, equipment, and personnel to the minimum required to safely accomplish the mission. Accurate wind information is more difficult to obtain and more variable than other planning data. Do not include wind information in advanced planning data even though it may serve to improve performance. The aircraft commander must obtain and use all information available for adequate premission planning.

6.3.1. Factors to consider during flight planning include: mission requirements, including aircraft configuration; special equipment and fuel requirements; route of flight using proper maps and charts; crew qualification/ability; weather; TOLD for home base and area of operations; suitability of objective area; and communications.

6.4. Crew Coordination. Crew coordination is essential to safe operations. Each crewmember has specific responsibilities. Although safe operation of the aircraft is ultimately the responsibility of the aircraft commander, it is also the responsibility of each crewmember. Any time confusion exists about current or future operations, ask questions and get clarification. If the aircraft or crewmembers are not performing correctly call "go-around" (see paragraph **6.10.**). The pilot flying must initiate a go-around immediately and the situation must be discussed and clarified prior to reattempting the approach.

6.4.1. Pilot Flying. The pilot will verbalize the site evaluation and plan of action, request input from crewmembers, and brief abort route and go/no-go (see paragraph **6.6.2.6.**) decision points and procedures. Fly the aircraft using the parameters of the transition maneuvers, i.e., if a normal approach is briefed, all normal approach transition parameters apply. The pilot will select and announce the specific spot to which he intends to fly the approach. Doing so focuses attention on flying a precise approach and provides scanners the information needed to give precise instruction. The pilot will advise the crew when he loses sight of the landing area and request directional input. Once in the site, the pilot will not maneuver the aircraft until adequate obstacle clearance is assured.

6.4.2. Pilot Not Flying (FE if single pilot). The pilot not flying/FE will take an active part in providing accurate and timely input to the pilot. Confirm TOLD (re-compute if necessary), confirm power requirements, and be aware of power available versus power required (the power margin). Inform the pilot of the amount of power being applied. Monitor approach angle, approach path, airspeed, vertical velocity, attitude, and altitude and make advisory calls for deviations. In the landing area, monitor engine instruments and help maintain adequate blade tip clearance.

6.4.3. Flight Engineer. The FE will take an active part in providing timely input to the pilot, confirm TOLD (recompute if necessary), confirm power requirements, and be aware of power available versus power required. Monitor approach angle, obstacle clearance, altitude and closure rates to the specific landing area, clear the aircraft of all obstacles and provide the pilot directions for landing. At the pilot's discretion (or earlier if required) the flight engineer will commence clear, concise, and coordinated directions and commentary on the progress of the approach and landing. The terminology normally used is similar to that used for hoist operations. The flight engineer must be able to quickly discern deviations and provide on-the-spot directions to the pilot. As the approach proceeds closer to the landing area, directions should become more detailed with emphasis placed on obstacle clearance. Once below the level of the obstacles, the flight engineer will assist the pilot in maintaining adequate obstacle clearance.

6.4.4. Scanner. Scanners will monitor approach angle, obstacle clearance, altitude and closure rates to the specific landing area, clear the aircraft of all obstacles and provide the pilot directions for landing. At the pilot's discretion (or earlier if required) the scanner will commence clear, concise, and coordinated directions and commentary on the progress of the approach and landing. The terminology normally used is similar to that used for hoist operations. Scanners must be able to quickly discern deviations and provide on-the-spot directions to the pilot. As the approach proceeds closer to the landing area, directions should become more detailed with emphasis placed on obstacle clearance. Once below the level of the obstacles, the scanner will assist the pilot in maintaining adequate obstacle clearance.

6.4.5. Voice Procedures. On final approach, the pilot not flying (FE if single pilot) will make advisory altitude calls in 100 feet increments when above 300 feet AGL and 50 feet increments when below 300 feet AGL. After each advisory call, the FE/scanner(s) will provide terrain/hazard clearance inputs. During the last 50-100 feet of the approach, the pilot not flying will transfer advisory calls to the primary scanner by calling, "DOOR." The primary scanner will then direct the pilot to the hover/landing area using standard terminology (paragraph **6.4.5.1.**). The secondary scanner (if available) responds appropriately with inputs for their side of the aircraft.

6.4.5.1. Hoist Operator. The hoist operator directs the pilot over the survivor or hover point using standard terminology. Instructions should be clear and concise with commentary on the progress of the approach and hover operation. The hoist operator can aid the pilot with airspeed control during the approach by describing the reduction of distance, in a numerical sequence, from a given point from the survivor to a hover point over the survivor. The frequency of numerical calls made should indicate the speed of the helicopter toward the survivor or closure rate. A closure rate is not given in a preset distance of feet, yards, or meters. An example would be "survivor at twelve for one hundred, seventy-five, fifty, forty, etc." (the faster the call, the more rapid the closure). If the closure rate is too fast for the conditions, do not hesitate to call a "go-around." Standardized words for directions and motion may be added to better describe necessary actions, e.g. "slow forward, turn right, stop back." See the following examples:

Table 6.1. Standard Terminology for Motion and Direction.

MOTION	DIRECTION
Fast	Forward
Slow	Back
Stop	Right
Hold	Left
Turn	Up
Raise Helicopter (for initial lifting of survivor)	Down

6.5. Operational Sites. Operational sites are areas specifically prepared and maintained for helicopter operations (not including airports or helipads listed in FLIP documents). Units will designate permanent operational sites and develop site diagrams.

6.5.1. Site Diagrams. Site diagrams will be prepared for all operational sites. These diagrams should include as a minimum site elevation, location of wind indicator, significant obstacles (to include power/telephone lines, poles, antennae, and fences), GPS coordinates, TACAN/VOR fixes (when available), and any unique site hazards. Diagrams must be of good quality and easy for the crewmembers to read and identify all obstacles. If there are any sites with unique hazards, the unit commander will ensure that there is a method of highlighting these hazards to the crews. Additionally, the unit commander should coordinate with the base safety offices to determine the feasibility of making changes to the site to eliminate or reduce hazards. Units will review the sites annually and annotate the review date in the site folder. Aircrews planning on using operational sites should have access to site diagrams in flight.

6.5.2. Evaluation Requirement. The pilot will review the site diagram prior to accomplishing an Operational Site Evaluation (OSE) for all operational site landings. This review will highlight hazards and will assist the crew in determining the best approach/departure route. The pilot will review the site diagram prior to all landings and takeoffs at the site. If a site diagram is unavailable or noncurrent, complete a remote site evaluation.

6.5.3. Operational Site Evaluation. Evaluate and confirm elevation, power requirements, obstructions, wind, and approach and departure routes before initiating final approach. A power available check is not required unless the aircraft commander believes a critical requirement exists. The purpose of the site evaluation is to alert the pilot to unforeseen, dangerous situations prior to being committed for final landing.

6.6. Unprepared Landing Sites. Complete a site evaluation when landing to an unprepared or unfamiliar landing area (non-tactical). The aircraft commander may elect not to complete a full site evaluation only if doing so would severely degrade mission accomplishment. Only one site evaluation is required during successive approaches when conditions are equal to or better than previous approaches to the same area.

6.6.1. The unprepared site evaluation consists of a high and low reconnaissance. Terrain, wind, obstacles, and emergency landing areas dictate the pattern flown during the landing site evaluation. Plan the pattern to remain oriented in relation to the wind and intended landing area. Although there is not a standard pattern that covers all situations, a rectangular or modified rectangular traffic pattern should be flown. A pinnacle landing area may require flying around it at a constant altitude to provide a view of the site from all possible angles. This reconnaissance may also identify areas of updrafts and downdrafts indicating wind speed and direction. Execute as many fly-bys as necessary. Complete a power available check (IAW para. **6.7.**) prior to commencing the low reconnaissance.

6.6.2. High Reconnaissance. The high reconnaissance is flown at approximately 300 feet above the site, offset to the side, with a minimum airspeed of 50 KIAS. Evaluate:

6.6.2.1. Temperature, pressure altitude, and elevation at the site.

6.6.2.2. Area suitability--size, slope, and surface.

6.6.2.3. Winds--direction, turbulence, and null areas.

6.6.2.4. Approach, departure, and escape routes.

6.6.2.5. Power available, power required and power margin.

6.6.2.6. Go/no-go point. (The point at which maximum power available is insufficient to go-around. Beyond this point, the aircraft is committed to landing.)

6.6.3. Low Reconnaissance. The low reconnaissance allows refinement of items noted in the high reconnaissance. The pilot should fly the low reconnaissance as nearly as possible on the same approach angle and route selected for the final approach. The low reconnaissance serves as an aid in determining the safest final approach path. If the selected approach route is not satisfactory, select another route and execute another low reconnaissance. Pilots may descend to a minimum of 50 feet above the highest obstacle along the flight path. Fly an approach that is offset to the side of the site to enable the pilot to perform a thorough visual inspection at a minimum of 50 knots, and reconfirm items reviewed on the high reconnaissance. At the pilot's discretion, the low reconnaissance may be performed on final approach if OGE hover power is available.

6.6.4. Wind Determination. Wind is the most variable of all factors and must be constantly evaluated. Prior to descent for a high reconnaissance, the pilot should have a general idea of wind direction and velocity. Several methods are available to determine wind direction and velocity. Smoke generators provide the most reliable method, but constitute a fire hazard when used in areas covered with combustible vegetation. GPS is also a valuable tool in helping determine wind direction. Helicopter drift is another method; however, the accuracy of this method depends on the wind velocity. This procedure is accomplished by setting up a constant airspeed and angle of bank and exposing the aircraft to the wind as you make a turn. As the site is approached, roll into a turn so as to pass directly over the site at a constant airspeed and angle of bank. After completion of a 360-degree turn, note your position; the wind is blowing from the site to your position. Another method of determining wind direction is to deploy a streamer over a known position and visually follow it to the ground. Wind direction can also be determined from foliage, ripples on water, blowing sand, snow, or dust.

6.6.5. Operational considerations. The pilot must decide if operational requirements justify the landing risk. If marginal operating conditions exist, lighten the helicopter, locate a more suitable area, or abandon the mission. Consider the following factors when determining whether a landing is justified.

6.6.5.1. Is ground effect assured at the landing or hover site?

6.6.5.2. Is downloading at an alternate landing site necessary to decrease gross weight/increase power reserve?

6.6.5.3. Will weight to be picked up result in an unsafe power margin?

6.6.5.4. Will the power required for takeoff be greater than the power available?

6.6.6. Unprepared Landing Site Evaluations without a High and Low Reconnaissance. There are occasions when the high and low reconnaissance need not be performed, such as:

6.6.6.1. When performing tactical approaches.

6.6.6.2. During a mission where, in the judgment of the aircraft commander, the accomplishment of the high and low reconnaissance would severely degrade mission accomplishment.

6.7. Power Available Check. Perform a power available check prior to unprepared landing site operations. Perform the power available check either en route to or at the site and prior to the low reconnaissance. Perform the power check as near as possible to the same PA and OAT as the recovery site. Slowly apply collective pitch without drooping Nr below 97 percent until computed power or a limit (as defined by the flight manual, section 5) is reached. Compare maximum power available with power required for the intended hover height(s). This comparison determines the power margin for the operation. It is left to the discretion of the crew whether to pull beyond computed power available in order to determine actual engine power capabilities. As a minimum, the engines(s) must produece computed power available. If the engine(s) fail to produce the computed power available, terminate the flight. When the power margin is 10 percent or less, a second aircrew member will re-compute TOLD to confirm power requirements. Consider that power available at the site may differ from power available in flight if winds or DA differ.

6.8. Power Required. Power required charts are based on having ground effect. When making a landing to a site less than the diameter of the rotor system, such as a pinnacle or ridgeline, aircrews must ensure sufficient power is available. The degree of slope also affects power required due to loss of ground cushion. Compute power figures using the "without wind" charts in the flight manual.

6.8.1. When landing to a surface area smaller than two rotor diameters, such as a pinnacle, power for an OGE hover should be available.

6.8.2. If sufficient power is not available, lighten the helicopter, locate a more suitable landing site, or abort the mission.

6.9. Approach. Prior to the approach, brief all crewmembers on the specific approach procedures, pilot's intentions, significant terrain features, specific crew requirements, intended landing point, and abort route. If at any time during the approach the conditions do not appear favorable or safe, go around. It is not uncommon to attempt numerous approaches prior to a safe landing.

6.9.1. Approach Planning. Consider the following factors:

6.9.1.1. Plan an abort route, preferably downhill and/or into the wind without climbing. If it is necessary to turn during an abort, a right turn is preferable (terrain permitting). Never plan an approach to a confined area where there is no reasonable route of departure.

6.9.1.2. Avoid high rates of descent.

6.9.1.3. Be alert for wind shifts and downdrafts.

6.9.1.4. Monitor rotor RPM/power throughout the approach.

6.9.1.5. Analyze wind and ground effect during the approach. Any landing site with obstacles on the upwind side will subject the helicopter to a null area (an area of no wind) or, in some cases, a downdraft. It is important that this null area be avoided if marginal performance capabilities are anticipated.

6.9.1.6. The power required performance charts were developed for hover over level, nonporous surfaces. When landing in unprepared sites, be aware of increased power requirements when hovering over tall grass, slopes, and obstacles in close proximity to the aircraft.

6.9.2. Unimproved Landing Area Problems. Most helicopter landing mishaps result from conditions requiring instantaneous power for recovery or vortex ring state. Turbine engines require approximately five seconds to produce full power from flat pitch. Vortex ring state most likely will occur when descent rates exceed 800 fpm during powered vertical descents and during steep approaches where the airspeed is less than 40 knots.

WARNING: To prevent the possibility of encountering vortex ring state during unprepared area approaches, do not exceed 800 fpm descent rate when airspeed is less than 40 knots.

6.9.3. Types of Approaches. Consider the height of obstacles when determining angle and direction of the approach. As the height of obstacle increases, larger landing areas or additional power will be required. The transition period (transitioning from forward flight to hover flight) is the most difficult part of any approach. As helicopter performance decreases, select an approach angle that will make the transition more gradual. Aircrews should establish a specific final approach entry altitude (i.e.,300 feet) prior to attempting an approach to obtain a familiar sight picture.

6.9.3.1. The normal approach should be used in most cases.

6.9.3.2. The steep approach requires the pilot to stop the rate of descent at the same time the helicopter is coming out of ETL, which may require more power than is available. However, a steeper than normal approach may be required for adequately clearing obstacles and avoiding null areas.

6.9.3.3. A shallow approach allows the rate of descent to be stopped prior to the loss of ETL, resulting in a smoother transition to a hover with fewer, less exaggerated, power changes.

6.9.3.4. A turning approach may be entered from any position in relation to the landing/hover area. Maneuver and descend as necessary to a point on final where a controlled straight-in approach can be flown to the site. The point of rollout on final varies with the entry point altitude and power reserve, but should be accomplished high enough to avoid the need for rapid flares, abrupt control movements, or large collective input. Avoid low airspeeds while downwind, especially in strong winds. High bank-angle turns should be avoided. Improperly executed descending turns under such conditions can result in rapid loss of lift from which there may be insufficient altitude/power to recover.

6.9.4. Confined Area. A confined area approach need be no steeper than any other type of approach. Some confined areas with high barriers will not allow the touchdown point to be kept in sight during the approach without using an excessively steep approach angle. A common problem associated with a steep approach over a barrier is that ETL may be lost prior to the helicopter entering ground effect. This may put the helicopter in a pre-settling with power or full settling with power condition, depending on the sink rate. The confined area approach should be flown using a normal approach angle to the top of the obstacles surrounding the site. This allows the pilot to fly the approach to a simulated touchdown point. Fly the approach as though an actual landing will be made above the obstacle. Once over the obstacle, continue the approach until the actual touchdown point in the forward usable third of the landing area is in sight. At this point, the rate of descent should be very low (less than 300 fpm), and the power for landing should be steadily increasing.

6.9.5. Pinnacle/Ridgeline. The first step for pinnacle/ridgeline approaches is to plan the approach so you have an abort/go-around option. All approaches to ridgelines should be along the length of the ridgeline unless overriding conditions exist which make that impossible. The least preferred approach to a ridgeline is perpendicular to the ridgeline. Should you have to select between an approach with a left quartering headwind or a right quartering headwind, select the left quartering headwind. This will result in less power required for the anti-torque system and thus a reduced overall power demand. If power is marginal, avoid wind from the right, but at the same time, plan your abort to the right. For pinnacle and ridgeline approaches, position the skids of the helicopter, rather than your seat, over the site. Landing to your seat position could result in landing short of the intended area. During a pinnacle approach the pilot may perceive a slight overarc on short final. Use the low reconnaissance to practice the approach and pay attention to the approach angle so you will know what to expect on final approach.

NOTE: Aircrews should be aware of the need for a rapid response to "go-around" on pinnacle/ridgeline approaches. Rather than calling out the specific condition of a parameter that may be out of tolerance (i.e., "900 fpm"), crewmembers should call "go-around." Aircrews should also expect the possibility of several aborted approaches because of the existing hazards and exacting requirements for a safe, successful approach.

6.9.6. Visual Illusions. During an approach, you must be aware that uneven terrain surrounding the landing site gives poor visual cues as to the actual aircraft altitude and rate of closure. Where the terrain slopes up to the landing site, a visual illusion occurs, giving you the feeling that the aircraft is too high and the rate of closure is too slow. If the terrain slopes down to the landing site, you will experience the feeling that the aircraft is too low and the rate of closure is too fast. You must be aware of these illusions and overcome the temptation to make unnecessary control movements. Reference to the flight instruments during the approach is necessary to ensure a safe approach. Simply meeting the parameters of the type of approach flown does not guarantee the success of the approach. The crew must continue to maintain the selected angle and control the rate of descent, especially during the last 100 feet. Prior to decelerating below translational lift, the pilot should consider altitude remaining and ensure the approach can be safely completed on the selected angle. Once translational lift is lost in a marginal power situation, the possibility of a go-around is poor or nonexistent.

6.9.7. Light and Variable Winds. Light winds normally allow you to take advantage of the best approach path based on terrain and obstacles; however, marginal power approaches, coupled with light and variable winds, can result in the pilot inadvertently placing the aircraft in a settling with power condition. Light and variable wind conditions could result in a tailwind component on final approach, causing the pilot to add additional aft cyclic, thus placing the aircraft in a regime for which power is insufficient. Pinnacle and perpendicular ridgeline approaches may add to the problem by denying the pilot apparent closure rate visual cues normally experienced over flat terrain. Due to the insidious onset of settling with power under these conditions, pilots must ensure airspeed is maintained above ETL until committed to a landing/hover. Marginal power conditions and the existence of light and variable winds may dictate that an approach to a pinnacle or perpendicular to a ridgeline not be attempted.

6.9.8. Moderate to Strong Winds. Moderate to strong winds normally will require you to use a steeper than normal approach angle to be into the wind and avoid the null area and associated turbulence downwind of a ridgeline or pinnacle. Use these winds to assist you in maintaining ETL and prevent you from encountering the loss of ETL that is normally associated with steep approaches. Consider that a 10-knot wind blowing down a 5-degree slope will result in a downdraft component of approximately 88-fpm. A 40-knot wind blowing down a 30-degree slope will result in a downdraft component of approximately 2025-fpm. This can easily exceed the aircraft's rate of climb. Do not allow the aircraft to fly through strong downdraft conditions when below ETL. See **figure 6.1.**

6.10. Go-Around Decision. On short final, before the helicopter is committed to land, ensure you have the following: proper rate of closure, rate of descent under control, and power smoothly increasing but below hover power. If any variable is not meeting desired parameters, GO AROUND. If a go-around is executed in marginal conditions, the possibility of success is sharply reduced or nonexistent. Total crew involvement is paramount on all approaches to identify the need for a go-around prior to go/no-go point. The "GO-AROUND" call must be made as soon as possible on the approach and not later than the go/no-go point to successfully establish a climb.

WARNING: Aborting to the right with a left crosswind may put the helicopter in a critical tailwind condition when a critical power requirement exists.

6.10.1. To initiate a go-around apply sufficient power (maximum power available if necessary) to establish a climb and clear obstacles. Accelerate to minimum safe single engine airspeed as soon as possible. When adequate airspeed and altitude are achieved, transition to a normal climb.

6.10.2. If the decision to go-around is made too late to abort the approach and you are committed to land, proceed as follows:

6.10.2.1. Hold maximum power.

6.10.2.2. Do not droop rotor below 97 percent Nr. Excessive drooping of the rotor system may result in loss of tail rotor authority.

6.10.2.3. Descent into ground effect may arrest your descent rate.

6.10.2.4. If you cannot stop your descent, select a spot and fly the aircraft as smoothly as possible to a touchdown. Do not make any abrupt movements of the controls. Attempt to smoothly fly the aircraft to your intended spot knowing you cannot stop your descent.

6.11. Obstacle Clearance. The aircraft commander has the ultimate responsibility for obstacle clearance. If possible, use additional crewmembers as scanners to assist the pilot. Ensure scanners are thoroughly briefed and aware of their duties/responsibilities involving obstacle clearance. If possible, post scanners on both sides of the helicopter. Prior to maneuvering the helicopter in close proximity to obstacles, ascertain that the area is clear. Whenever horizontal rotor clearance is 25 feet or less, the scanner should inform the pilot of the clock position relative to the nose of the aircraft and estimated distance to the obstacle (for example: "Tree, nine o'clock, 20 feet.").

6.12. Hover. Upon arriving at a hover over an intended landing area, allow the helicopter movement to stabilize. Hovering over trees and uneven terrain requires additional power because full ground effect is not realized. Survey the landing area and determine the best landing spot. If possible, select a level area, free from obstructions. Take care when landing in low brush. Small branches and bushes flatten with rotor wash, but could spring up into the rotor blades after reducing blade pitch to minimum, reducing the engines to flight idle or after engine shutdown. Check for stumps, rocks, or depressions that could be hidden by grass or snow. Keep in mind that there is very little clearance between the bottom of the aircraft and the ground.

6.12.1. When hovering over loose snow or dust, be prepared for an immediate takeoff. Blowing dust or snow may cause loss of visual references and spatial disorientation. To avoid this, use a small tree, boulder, or other object as a reference point near your landing site. If visual references are lost, a transition to an instrument takeoff may be necessary.

WARNING: A steep approach to a touchdown in loose snow conditions can pose problems during the touchdown phase, especially if the ground is completely covered with snow. Obstructions and sloping or uneven terrain can be hidden. One technique to help reduce the potential for problems when landing is to bring the aircraft into a high hover over the site. While maintaining a hover reference, slowly lower the aircraft allowing the rotorwash to clear away the snow and reveal the ground underneath. If at any time the hover reference is lost, initiate a go-around.

6.13. Landing. Lower the helicopter gently to the ground. (Consider stowing landing and search lights in remote areas.) Maintain rotor RPM and check for complete aircraft stability before slowly decreasing collective pitch. Be ready for an immediate takeoff if the helicopter starts to tip. If excessive slope precludes a safe landing, lift off and reposition.

6.14. Takeoff. Recompute or confirm adequate power required to hover if you have added personnel or other weight to the helicopter. Complete the before takeoff checklist, recheck the wind direction and velocity, determine the best departure route, and select a takeoff abort point. If the wind is light and variable, an inadvertent downwind takeoff could adversely affect aircraft performance. If takeoff power is reduced prematurely, safe obstacle clearance may be jeopardized. In confined areas, attain a safe single-engine envelope as soon as possible. Avoid null areas if possible, since a nearly vertical downdraft may be encountered which will reduce the climb rate. Under a heavy load or limited power conditions, it is desirable to achieve ETL before encountering a null area and prior to climbing to improve overall climb performance. Under certain combinations of limited area, high upwind obstacles, and limited power available, the best takeoff route may be crosswind. Even though this is a departure from the cardinal rule of "take-off into the wind," it may be the proper solution when all factors are weighed.

6.15. Mountain Flying Considerations. There is no standard type of mountain approach. Ideally, it is made directly into the wind using a constant angle of descent; however, when certain conditions exist, a crosswind approach may be best.

6.15.1. Approach Paths and Areas to Avoid. Selection of an approach path in mountainous areas should include a consideration of the following (Examples of approach paths and areas to be avoided are shown in **figure 6.1.**).

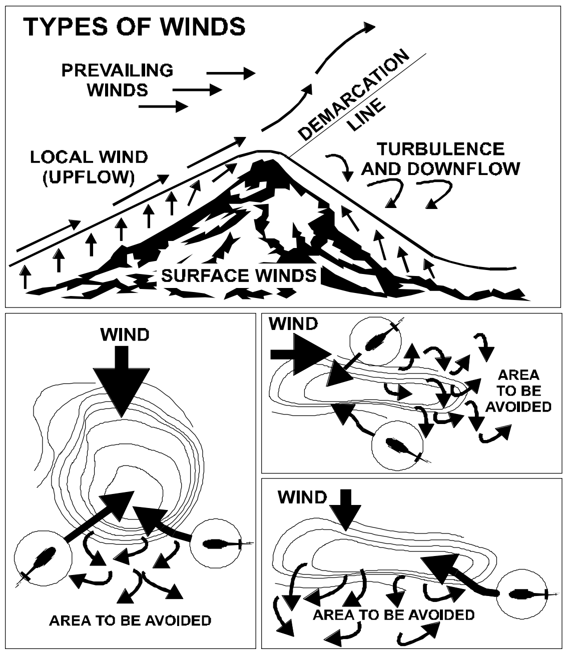
6.15.1.1. Wind Direction and Velocity. It is desirable to land into the wind; however, the terrain and/or its effect on the wind may require that a crosswind landing be made. If feasible, plan a crosswind approach so that the wind is from the left side of the aircraft. This condition will assist in overcoming the effects of torque, reduce the power required, and aid in heading control.

6.15.1.2. Vertical Air Currents. When possible avoid suspected updrafts and downdrafts.

6.15.1.3. Escape Routes. There should be at least one escape route along the approach path that can be used if a go-around is required.

6.15.1.4. Terrain Contour and Obstacles. These determine what approach angle you will use. Avoid an approach path over terrain/obstacles that force you into a steeper angle than you feel comfortable with. When possible, select a landing point on or near the highest terrain feature.

Figure 6.1. Approach Paths and Areas to Avoid.

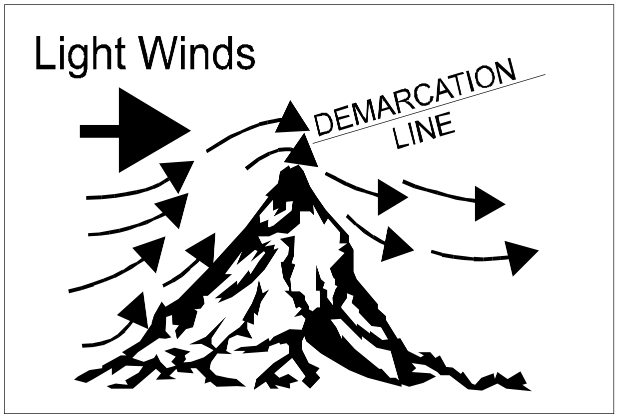


6.15.1.5. Position of the Sun/Moon - Although the wind direction and nature of the terrain are the primary factors in selecting an approach path, consideration should be given to the location of the sun/moon relative to the approach path and the presence of shadows in the landing site. If the landing point is in a shadow, the approach path should also be in a shadow. This would eliminate problems due to the eyes adjusting from one light condition to another and provide the smoothest air. An approach directly into the sun/moon should be avoided when it is low on the horizon.

6.15.2. Demarcation Line. The point that separates the upflow from the downflow of air is called the demarcation line. It forms from the highest point of the mountain and extends diagonally upward. The velocity of the wind and the steepness of the uplift slope will determine the position of the demarcation line. Generally speaking, the higher the wind speed and steeper the terrain, the steeper the demarcation line. It is recognized by the change in direction between upflowing and downflowing air. The effects of the varying wind velocities on the demarcation line are:

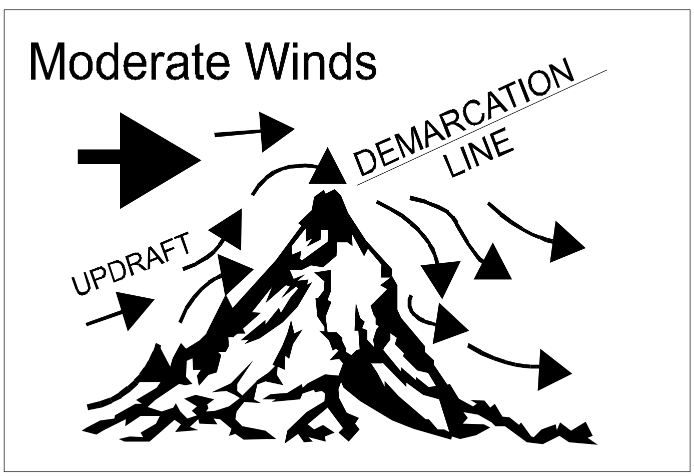
6.15.2.1. Light Winds (0 to 10 knots). A light wind blowing will accelerate slightly on the upslope, giving rise to a gentle updraft, follow the contour of the terrain feature over the crest, and at some point past the crest, turn to a gentle downdraft. In light winds when the demarcation line is shallow, a shallower than normal approach should be used. This type of approach requires less power and control movements; however, if downdrafts are encountered, insufficient altitude may be available to continue the approach. The demarcation line lies at a relatively shallow angle from a point on the upwind side of the hillcrest. (**figure 6.2.**).

Figure 6.2. Light Winds.



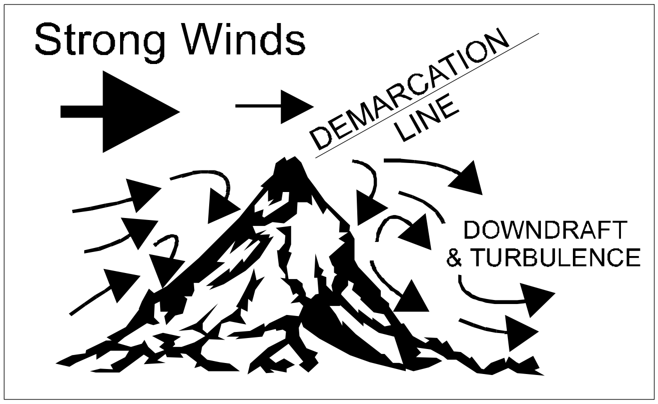
6.15.2.2. Moderate Winds (11 knots to 20 knots). Moderate winds will increase the strength of the updrafts and downdrafts and create moderate turbulence. Updrafts will be experienced on the upwind slope near the crest of the mountain. The demarcation line forms closer to the hillcrest and has a greater degree of slope. (**figure 6.3.**).

Figure 6.3. Moderate Winds.



6.15.2.3. Strong Winds (above 20 knots). As the wind increases, the demarcation line will move forward to the leading edge of the hillcrest and will become progressively steeper. The severity of updrafts, downdrafts, and turbulence will also increase. Under these conditions, the best landing spot is close to the forward edges of the terrain feature (**figure 6.4.**).

Figure 6.4. Strong Winds.



6.16. High Density Altitude Considerations. Operations conducted above 4,000 feet density altitude require detailed knowledge of the hazards associated with this area of operations. All available information must be used to safely accomplish unprepared area operations in this environment. Temperature has the greatest effect on density altitude. For every one degree Celsius increase in temperature the density altitude will increase approximately 120 feet. An increase in humidity will also increase density altitude (**figure 6.5.**). True airspeed is directly related to density altitude. With a constant indicated airspeed, an increase in density altitude will result in an increase in true airspeed.

6.16.1. Potential Effects of High Density Altitudes:

6.16.1.1. Power available decreases.

6.16.1.2. Power required to hover increases.

6.16.1.3. The power margin decreases.

6.16.1.4. Maximum allowable indicated airspeed decreases.

6.16.1.5. Control response becomes more sluggish.

6.16.1.6. The potential for blade stall increases

6.16.1.7. The potential for formation of Vortex Ring State increases.

6.16.1.8. The potential for settling with power increases.

6.16.2. Effective Translational Lift (ETL). Premature loss of ETL during an approach can result in limited options if OGE power is not available. At high density altitude (DA) the IAS/TAS relationship is significant. On final approach at high DA you will lose ETL at an earlier stage. Similarly you will achieve ETL at a later stage on go-around or takeoff. Inertia is also related to TAS not IAS. The aircraft takes longer to decelerate at higher altitude. If power is marginal, avoid winds from the right. Also, remember your best abort route is to your right, terrain permitting.

6.16.3. Bubble Effect. Temperature, terrain and weather can significantly affect surface temperatures. High density altitude, clear skies, and vegetation can cause a bubble effect on mountain tops resulting in surface temperatures 8 to 15 degrees Celsius warmer than the same elevation outside of the bubble. The best potential condition for a bubble effect is high mountain vegetated terrain under high pressure. If you suspect that the bubble effect is present, plan on your power requirements being higher based on the possible higher temperature.

6.17. Tail Rotor Factors. Anticipate conditions that can lead to loss of tail rotor authority during preflight planning. Anticipate the possibility of adverse relative winds whether natural or artificially produced. Avoid crosswinds or tailwinds when the aircraft is heavy and requires close to maximum power available.

6.17.1. Maximum demands on the tail rotor occur under one or more of the following conditions:

6.17.1.1. High DA, especially when combined with high humidity (see **figure 6.5.**).

6.17.1.2. High gross weight.

6.17.1.3. High OAT.

6.17.1.4. Hovering out of ground effect.

6.17.1.5. Low airspeed, especially during takeoff when combined with a left turn.

6.17.1.6. Steep angles of bank while trying to maintain altitude and airspeed.

6.17.1.7. Confined areas (due to loss of wind for ETL caused by descending below a tree or ridgeline).

6.17.1.8. Hovering over uneven surfaces (part of the rotor system out of ground effect).

6.17.1.9. Any maneuver requiring high power.

6.17.2. Loss of Tail Rotor Effectiveness. Avoid situations that will cause the tail rotor to exceed its ability to produce adequate thrust. Monitor power requirements and apply power carefully. Early recognition of loss of tail rotor effectiveness is essential to successfully and safely initiating corrective action. Four conditions contribute to loss of tail rotor effectiveness:

6.17.2.1. High Power. Any maneuver that requires high power and therefore high tail rotor thrust can cause loss of tail rotor authority. When the rotor system demands more power than the engine(s) can produce, the main and tail rotor RPM will begin to decay. As the tail rotor RPM decays, there is insufficient thrust available to maintain heading, causing the nose of the aircraft to yaw to the right. Left pedal corrections at this point will only continue to aggravate the situation. If a tail rotor stall occurs it will cause an abrupt yaw to the right. To recover, you must lower the collective, increase airspeed, initiate a right turn if possible and go-around. Adding right pedal, if possible, may allow for quicker recovery. In order for the recovery to be successful, the pilot must recognize the situation early enough to ensure sufficient altitude for a safe go-around.

6.17.2.2. Decelerative Attitude and Low Airspeed. A decelerative attitude may result in a combination of downwash from the main rotor and turbulence from the synchronized elevator passing through the tail rotor. Low airspeed and high power settings also increase main rotor turbulence through the tail rotor. In both cases you will require more left pedal to maintain aircraft heading. This could increase the potential for loss of tail rotor effectiveness in some situations.

6.17.2.3. Left Crosswind, Left Sideward Flight, or Right Pedal Turn. These conditions could cause the tail rotor to operate in turbulence similar to the main rotor during vortex ring state. Left sideward velocities of 5-35 knots or left crosswinds (dangerous velocities decrease with increased aircraft loading) can cause the tail rotor to work in its own rotorwash. As a result the pilot will have difficulty maintaining directional control due to large variations in tail rotor thrust. These phenomena are referred to as vortex ring state and tail rotor breakaway. To correct the problem slow or stop sideward flight, initiate a pedal turn, or gain airspeed.

6.17.2.4. Right Crosswind, Right Sideward Flight, or Left Pedal Turn. Right relative wind acting on the fuselage tends to push the tail to the left requiring more tail rotor thrust to maintain heading. As the aircraft is flown at higher gross weights, higher right relative winds, higher DAs, higher humidity, etc., full left pedal may be exceeded. To correct the situation, gain airspeed and/or initiate a right turn if possible. Running out of left pedal is the most common tail rotor problem encountered.

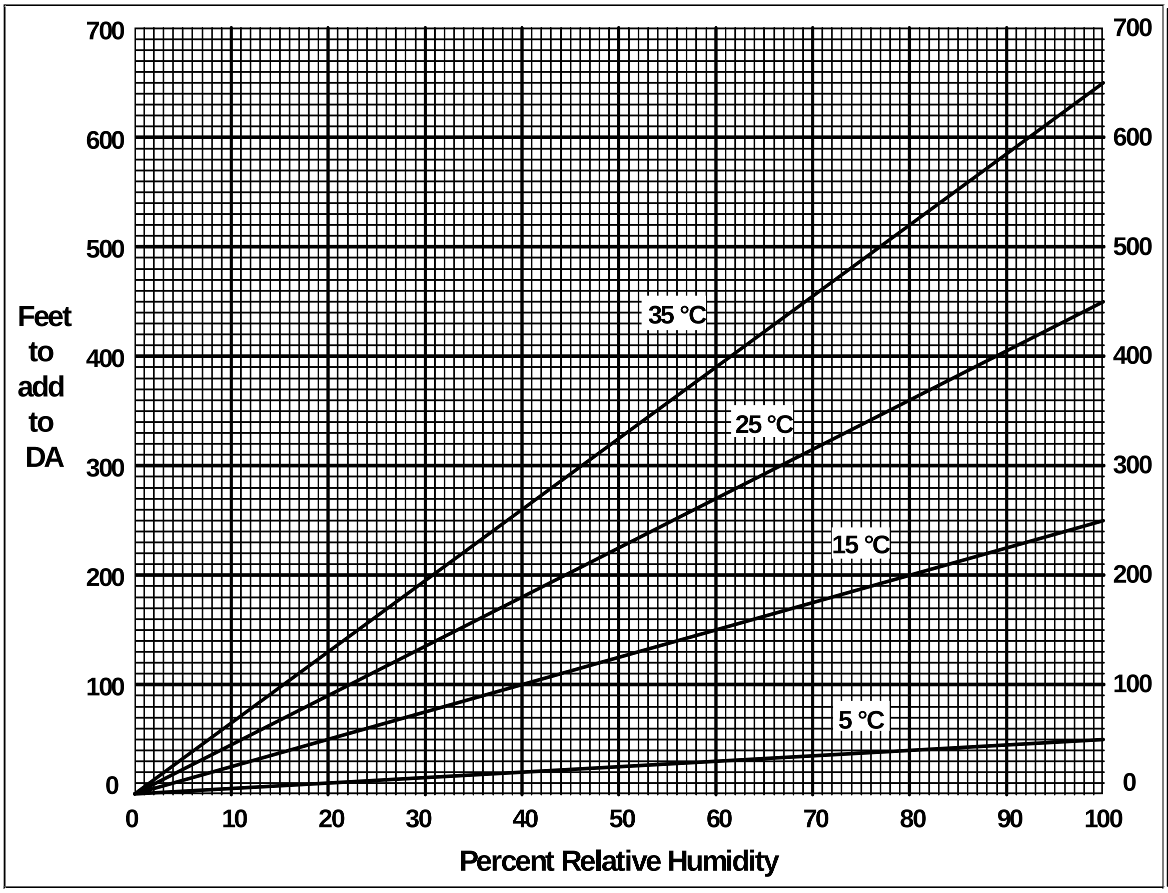
6.18. Turbulent Air Flight Techniques. Constantly evaluate and avoid areas of severe turbulence. If encountered, take immediate steps to avoid continued flight through it. To preclude exceeding the structural limits of the helicopter follow the procedures in the flight manual. Severe turbulence is often found in thunderstorms. Therefore, helicopter operations should not be conducted in their vicinity.

6.18.1. The most frequently encountered type of turbulence is orographic turbulence. This turbulence is normally associated with updrafts and downdrafts and can be dangerous if severe. It is created by moving air being lifted or depressed by natural or man-made obstructions. It is most prevalent in mountainous regions and rough terrain. The severity of orographic turbulence is directly proportional to the wind velocity. It is found on the upwind side of slopes and ridges, near the tops, and extending down the downwind slope. Its extent on the downwind slope depends upon the strength of the wind and the steepness of the slope. If the wind is fairly strong (15 to 20 knots) and the slope is steep, the wind generally will blow off the slope and not follow it down. However, there will still be some tendency to follow the slope. In this situation, there will probably be severe turbulence several hundred yards downwind of the ridge at a level just below the top of the ridge. Under certain atmospheric conditions a cloud may be observed at this point. On more gentle slopes, the turbulence will follow down the slope but will be more severe near the top. Orographic turbulence will be affected by other factors. The intensity will not be as great when climbing a smooth surface as when climbing a rough surface. It will not follow sharp contours as readily as gentle contours.

6.18.2. Rising air currents created by surface heating causes convective turbulence. This is most prevalent over bare areas. Convective turbulence is normally found at a relatively low height above the terrain, generally below 2,000 feet. Under certain conditions, it may reach as high as 8,000 feet. Turbulence can be anticipated when transitioning from bare areas to areas covered by vegetation. Increasing altitude will decrease turbulence and provide a smoother flight.

6.18.3. The best method to overfly ridgelines from any direction is to acquire sufficient altitude before crossing them to avoid leeside downdrafts. If landing on ridgelines, the approach should be made along the ridge in the updraft or at an angle into the wind that is above the leeside turbulence (**figure 6.1.**). When the wind blows across a narrow canyon or gorge, it often will veer down into the canyon. Turbulence will be found near the middle and downwind side of a canyon or gorge. When a helicopter is being operated at or near its service ceiling a downdraft of more than approximately 100 fpm will cause the helicopter to descend. Although the downdraft may not continue to the ground, a rate of descent can be established of such magnitude that the helicopter will continue descending even though it no longer is affected by the downdraft. Therefore, the procedure for transiting a mountain pass is to fly along the side of the pass or canyon that affords an upslope wind. This procedure not only provides additional lift but also provides a readily available means of exit in case of emergency. It allows for maximum turning space and makes a turn into the wind a turn to lower terrain. Flying through the middle of a pass to avoid mountains often invites disaster. This is frequently the area of greatest turbulence and, in case of emergency, the pilot has little or no opportunity to turn back due to insufficient turning space.

Figure 6.5. Density Altitude Correction for Relative Humidity.



How to use this chart:

1. Start with an observed or forecast relative humidity (RH) value. From the bottom of the chart move vertically to the observed or forecast temperature (extrapolate temperature if necessary).
2. Move horizontally to the left and read off the DA correction value.
3. Add this correction to the original DA value.

Chapter 7

NIGHT OPERATIONS

Section 7A— Unaided Operations

7.1. Altitude Restrictions. Minimum en route altitude for unaided night navigation is 500 feet above the highest obstacle within five NM of the route of flight. Published helicopter routes may dictate lower altitudes.

7.2. Illumination Requirements for Helicopter Landing Areas. Helicopters on operational support missions may be authorized by the unit commander to operate into and from unlighted areas provided all available illumination is used. On all other missions, operations into unimproved or operational sites between official sunset and official sunrise will be made only if one of the following conditions can be met:

7.2.1. The area is outlined by discernible lights.

7.2.2. The pilot can clearly see the approach path and landing surface (as would be possible immediately after official sunset or before sunrise).

7.3. Crew Coordination:

7.3.1. Mandatory calls for the pilot not flying the aircraft are:

7.3.1.1. During night VFR descents, 1,000 feet above intended altitude, 500 feet above intended altitude, 100 feet above intended altitude, and intended altitude.

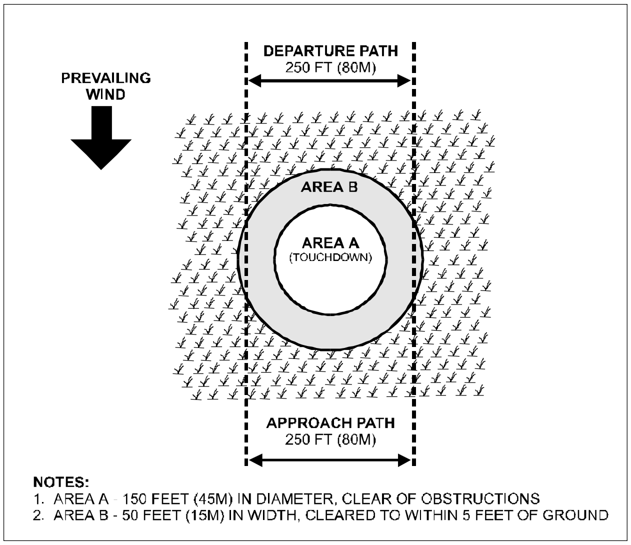
7.3.1.2. On final approach, advisory calls every 100 feet when above 300 feet AGL and every 50 feet when below 300 feet AGL. The advisory will include altitude and airspeed and, at the pilot's discretion, descent rate and power applied--in that order (i.e.,"250 feet, 40 knots, sink 500 [fpm], torque 50"). During the last 50-100 feet, the pilot not flying will transfer advisory calls to the primary scanner by calling "door" (i.e.,"100 feet, airspeed and sink unreliable, door").

7.3.1.3. On final approach, rates of descent greater than 500 fpm; "go-around" if rate of descent exceeds 800 fpm.

7.3.2. Mandatory calls for the FE/Scanner(s): On final approach, after each advisory call, the scanner(s) will provide terrain/hazard clearance inputs (i.e.,"clear down right/left"). During the last 50-100 feet, the primary scanner will talk the pilot down with standard terminology described in **chapter 6** of this instruction. The secondary scanner (if available) responds appropriately with inputs for their side of the aircraft.

7.4. Night Approaches to Unimproved and Operational Sites. Do not leave flight altitude until the location of the LZ has been positively identified. Brief and conduct a site evaluation prior to the approach much the same as under daylight conditions, provided adequate lighting is available. Under no circumstances will a low reconnaissance be conducted. Do not descend below 300 feet AGL until established on the approach. Knowledge of the area in general, known hazards, and terrain features from briefings or charts, are determining factors on how to conduct the evaluation. Prior to making the first approach, determine wind direction. Forecast winds may be used when wind direction cannot be determined otherwise. When using forecast winds, ensure an adequate power margin is available in the event winds differ from forecast.

Figure 7.1. Helicopter Landing Zone (Night).



7.4.1. Use the type of approach best suited to the situation. Adjust pattern altitude accordingly, but in no case lower than 300 feet AGL on downwind. Throughout the entire approach, use the radar and/or barometric altimeter to maintain awareness of aircraft height above the ground.

7.4.2. Establish final approach to commence at no lower than 300 feet AGL. Cross-reference instruments throughout the approach to reach approximately 200 feet AGL with an approximate ground speed of 30 knots. Airspeed and altitude normally are decreased to reach a hover height clear of all obstacles. During the last 100 feet of the approach, limit rate of descent to approximately 300 fpm. Approaches at night generally will be flown with slightly slower rates of descent and closure rates than during daylight operations. As closure rates decrease, the time the aircraft remains in the unsafe area of the height velocity envelope increases.

7.4.3. The decision to make an approach to a hover or a touchdown is based upon power available and landing site condition. **figure 7.1.** shows a typical night landing zone (LZ) with desired departure and/or approach criteria and LZ conditions.

7.5. Site Selection for Training. Night training should include operations to both unimproved and operational sites.

7.5.1. The minimum LZ size is two rotor diameters. Sites will be selected where the vertical development of the surrounding terrain does not restrict the pilot's option to execute a go-around, with minimum maneuvering, at any point during the approach.

7.5.2. The obstacles/terrain within three NM of the site will not exceed 200 feet above the site elevation. Restricting the approach and departure route to directions that will avoid terrain or obstacles exceeding the above criteria satisfies this requirement.

7.5.3. Units will list eligible night landing sites and include applicable restricted approach and departure routes in **chapter 18** or unit supplements.

7.5.4. For sites without permanent lighting, prior to full darkness, make a visual survey of the site and position lights to outline the landing area. Check for obstacles, general site condition, and wind. This survey may be accomplished by other crews flying during the day or by ground party. After darkness, a survey may be accomplished by NVG-equipped crews.

7.6. Landing Zone Lighting. Some type of landing zone lighting should be used to assist the pilot in locating and identifying the landing zone and making a landing at night. Lighting aids, including terminal guidance systems, expeditionary lights, flare illumination, and makeshift light sources, such as vehicle lights, flashlights, strobe lights, bonfires, and smudge pots, have been used successfully. Surface vehicle headlights are an excellent lighting source provided they do not blind the pilot during the approach. When practical, employ a standard landing zone lighting pattern. Landing zone lighting should:

7.6.1. Be visible to the pilot.

7.6.2. Identify an area free of obstacles and safe for hovering and landing.

7.6.3. Employ three or more lights at least 15 feet apart to prevent autokinetic illusions.

7.6.4. Provide orientation along an obstacle-free corridor for landings and takeoffs.

7.7. Landing Zone Lighting Patterns. Since a variety of landing zone lighting patterns are in use, the pilot should anticipate diversity in lighting patterns when participating in joint and/or combined operations.

7.7.1. The inverted Y light system is an excellent way to identify landing zones. Lights for the inverted Y should normally be spaced in compliance with **figure 7.2.** When set up in this fashion, the inverted Y provides visual cues to determine the correctness of the glide angle by observing the apparent distance between the lights in the stem of the Y. If the lights in the stem appear merged into a single light, a shallow glide angle is indicated. If the lights in the stem appear to increase in distance apart, the approach is becoming steeper. Approach path lineup corrections can also be made using the stem of the Y. For example, if the stem points to the left, the helicopter is left of course and should correct to the right. The following guidance applies:

7.7.1.1. The direction of the approach is into the open end of the Y.

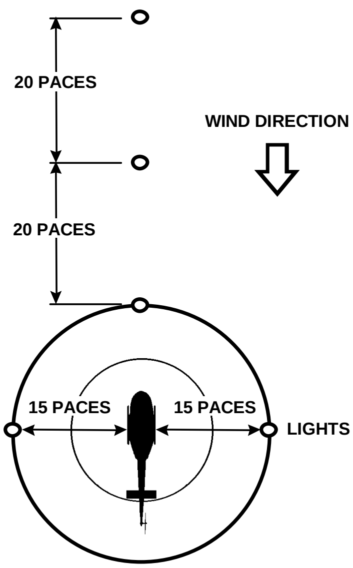
7.7.1.2. The touchdown area is outlined by the triangle formed by the three lights marking the open end of the Y.

7.7.1.3. When set up properly, wind direction will be along the stem of the Y.

Section 7B— Night Vision Goggle (NVG) Operations

7.8. Crew Complement. The entire flight crew will be either on or off goggles.

Figure 7.2. Inverted Y.



7.8.1. NVG flights with two pilots and no scanner are authorized with the following restrictions:

7.8.1.1. Training flights accomplished, as a part of an upgrade (to copilot, aircraft commander, or instructor) will have an NVG scanner. A portion of the training will stress no-scanner operations.

7.8.1.2. Two-pilot NVG flights will be conducted to/from an improved helipad/runway/ramp type landing area or designated unimproved sites as outlined in paragraph **7.8.1.3.** Airports, hospital helipads, and Missile Alert Facilities (MAFs) are examples of improved landing sites. During operational missions, unit commanders may authorize NVG landings to unprepared areas when required to accomplish the mission. Crews will use high and low recon procedures to ensure the area is free of obstructions and hazards before landing.

7.8.1.3. Units may designate unimproved sites for use during two-pilot NVG training. Sites will meet night unaided site selection criteria.

7.8.1.3.1. The specific landing area shall be easily distinguishable. Aircrews will not begin final approach into the area until all crewmembers visually acquire the specific landing area.

7.8.1.4. Each landing area shall have a hover reference. This reference will be available for use by the crew regardless of the approach path used for landing. Examples of hover references are tires, cones, Maltese crosses, and runway striping.

7.8.1.5. All intended landing areas will be reviewed during the aircrew briefing. Emphasis will be placed on obstacles and the specific landing area hover reference. If diverted to an authorized two-pilot landing area, both pilots will review the site diagram, if available, for obstacles and hover reference prior to making an approach into the area.

7.8.2. Crew complement for NVG operations into unimproved landing sites not meeting the requirements of paragraph **7.8.1.3.** is one NVG qualified pilot, one NVG qualified copilot, and one NVG qualified scanner.

7.8.2.1. The scanner will be an NVG qualified aircrew member (pilot, flight engineer or aerial gunner).

7.9. Ambient Illumination Requirements. NVGs work best with ambient illumination levels above five percent equivalent moon illumination (EMI). Clear moonless nights with average starlight provide approximately eight percent EMI. In determining actual ambient illumination levels, consideration will be given to the illumination level and position of the moon, starlight, ground lights, and any atmospheric conditions that may reduce the available ambient light. Aircrews should use their experience and judgment in estimating the amount of ambient light available when cloud cover obstructs the moon and stars.

7.9.1. Training will not be conducted with less than five percent EMI.

7.9.2. In order to fly with NVGs with less than 20 percent EMI the crew must be Low Light Certified IAW AFI 11-2H-1, Volume 1, *H-1 Helicopter Aircrew Training*, unless conducting low-light certification training with a low-light certified instructor pilot.

7.10. Altitude Restrictions:

7.10.1. MAJCOMs will direct minimum enroute altitude for NVG operations. In lieu of MAJCOM guidance the minimum enroute altitude is 300 feet AGL in surveyed low-level areas. Published helicopter routes may require lower altitudes. If the radar altimeter is inoperative consider raising the enroute altitude.

7.10.2. For NVG water operations, minimum cruise altitude is 300 feet above water level (AWL). An operable radar altimeter is required.

7.11. Aircraft Lighting:

7.11.1. Exterior lighting:

7.11.1.1. An operable white light (landing or search) is required for all NVG flights.

7.11.1.2. Position lights will be set to steady bright.

7.11.1.3. Use of one anticollision light is permitted.

NOTE: The anticollision light may be extinguished and the position lights set to dim during terminal area operations if it creates a hazard to the aircrew.

7.11.1.4. An operable searchlight equipped with an infrared filter is required for NVG training flights below 20 percent EMI and is highly recommended for all NVG flights.

7.11.2. Interior Lighting. Aircraft interiors should be painted flat black. All interior lights shall be either NVG compatible, taped, or turned off. Lights of the wrong frequency (red, white, or any other non-NVG compatible frequency) bathe the cockpit/cabin area with light that degrades the visual acuity of the NVGs. This degradation in performance may go completely unnoticed by the aircrew.

WARNING: Use extreme caution when using laser pointers. Do not use the pointer in such a way that stray light will enter the aircraft in any way. Do not use the pointer if personnel are known or suspected to be on the ground in the vicinity to be designated. Do not point the pointer at other aircraft. Failure to follow these restrictions may result in individual eye damage and potentially impact the safety of aircraft operations.

WARNING: Ensure critical information is not rendered invisible by excessive taping. The tape must allow enough light to be emitted to alert the pilot of critical information.

7.11.2.1. General. The only NVG cockpit modifications currently approved for use on H-1 helicopters are: the blue filtered secondary instrument lights, NVG compatible Master Caution segment panel, NVG compatible "peanut" lights, NVG compatible flip filters for the Master Caution and RPM warning lights, NVG compatible filters on the overhead pilot and copilot map lights, NVG compatible bulb replacements for the fire pull handle lights and an NVG compatible filter that can be temporarily mounted over the master caution segment light panel. All helicopters will at least be equipped with the blue filtered secondary instrument lights. The general H-1 NVG lighting configuration is as follows: Secondary Lights - ON (sufficiently bright to illuminate instruments), Overhead Console Panel Lights - OFF, Center Pedestal Lights - OFF, Copilot Instrument Panel Lights - OFF. Cat-eye lights will be adjusted to small slits or taped. Those segment lights on the master caution panel that are anticipated to illuminate during the flight will be taped if the entire panel is not covered with the temporary NVG compatible filter. The Master Caution lights, RPM Warning light(s) and fire pull handle lights will be taped if not equipped with NVG bulbs or filters. Tape small or medium size chemical light sticks as needed in strategic locations both in the cockpit and the cabin area, e.g. on the instrument panel near the RMI, torque indicator and turn and slip indicator.

NOTE: Use of "lip" or "finger" lights to illuminate gauges in lieu of secondary lights is not authorized.

7.11.2.2. Interior Lighting. Engine Panel Lights - ON (to lowest illumination level). This places the fuel quantity indicator light into the NVG compatible mode but prevents the remaining red lights from emitting unacceptably high levels of light. Pilot Instrument Panel Lights - As Required (insure that the Master Caution Panel light is not dimmed to a level that does not enable quick identification of illumination). Tape the radar altimeter's altitude warning and R/T status indicator lights and dim the digital altitude readout. Tape over the chip detector lights and the hoist decel lights (if hoist equipped).

7.11.3. Each crewmember will carry an NVG-compatible light source (flashlight, chemical light, etc.).

7.11.4. Prior to overwater flights, all cabin emergency exits will be marked by chemical lights which will be activated prior to flight over water. The chemical lights will be placed inside the cabin compartment as follows:

7.11.4.1. Center one circular light immediately above each cabin door.

7.11.4.2. Attach one light to each window emergency release handle (when doors are closed).

7.11.4.3. Attach one light to the handle of each cargo door (when doors are closed).

7.11.4.4. Attach one light to the life raft.

7.11.4.5. Attach one light to the life raft tiedown release handle.

7.11.4.6. Attach lights to the pilot's and copilot's emergency door jettison handles.

7.12. Rescue Device Preparation:

7.12.1. Hoist Hook. The hoist hook is prepared by attaching a chem-light to the rubber boot or hoist hook (optional when the hoist hook has a rescue device attached).

WARNING: Ensure the chem-light does not interfere with the attachment of the rescue device and does not extend past the striker plate.

NOTE: If the tagline is used, it will have a chem-light attached to the rope bag. If the snap link is deployed with the tagline after stokes litter disconnect, then the snap link will have a chem-light attached that can be visible from the ground.

7.12.2. Forest Penetrator. The forest penetrator will be configured prior to deployment with a minimum of one chem-light taped to the body of the penetrator.

7.12.3. Stokes Litter. As a minimum, the stokes litter is prepared by attaching two chem-lights to the foot end of the litter and one chem-light to the head. Ensure the chem-lights are secured so they do not touch each other. One flexible band may be looped through one of the attachment rings on the litter suspension cables.

7.12.4. Rescue Basket. The rescue basket will be configured prior to deployment with one chem-light attached on the bail cable at the hoist hook attachment point. Opposing corners (one per side) just above the flotation collars will have the chem-lights attached.

7.12.4.1. The flight engineer will decide chem-light color, size and the method of attachment. Chem-lights will be activated prior to deployment.

7.12.4.2. Medical personnel will affix a chem-light on all medical gear deployed to aid in the event visual contact is lost.

7.12.4.3. The aircrew will have a prearranged signal for all hoist extractions. This may include the use of a light signal. If a light signal is used, it is imperative that it cannot be confused with any other light source used on the ground.

7.13. Site Selection for Training. Sites shall be selected where the vertical development of the surrounding terrain does not restrict the pilot's option to execute a go-around, with minimum maneuvering, at any point during the approach.

7.13.1. Site selection criteria for two-pilot NVG operations (with no scanner) are found in paragraph **7.8.1.3.**

7.13.2. With one or more NVG qualified scanners, minimum LZ size is two rotor diameters.

7.14. Flight Planning. Flight planning is particularly important for NVG operations. Comply with all low-level flight planning requirements such as map preparation, preparation of navigation log, determining MSAs, etc.

7.14.1. Comply with the NVG preflight procedures in AFI11-2H-1, Vol 3, CL-1 or applicable NVG T.O. Do not fly with NVGs that fail to meet the visual acuity requirements.

7.14.2. The unique attributes of NVGs require special consideration when planning a flight. Flights conducted in marginal ambient light conditions (less than 20 percent EMI) must be carefully planned to account for substantial decreases in visual acuity and depth perception and increased difficulty in terrain avoidance. The following items are important to highlight:

7.14.2.1. Reduced visual acuity makes singular objects or terrain features difficult to perceive. Power lines, unlit towers, poles, dead trees, etc. are extremely difficult to see, especially against dark backgrounds. Lower enroute altitudes, within the established minimum parameters, are recommended to enhance visual acuity.

7.14.2.2. Precipitation and atmospheric moisture are not easily visible. Adverse weather may appear much farther away than it actually is or may not be seen at all. Haze, smoke, clouds, fog, rain, and low outside illumination due to overcast conditions or lack of ground lights diminish the effectiveness of NVGs.

7.14.2.3. Wind direction and velocity are difficult to discern while flying in low light level conditions.

7.14.2.4. Depth perception is degraded when using NVGs.

7.14.2.5. Lights are indistinguishable by color. Red warning lights look like all other lights.

7.14.2.6. Bright lights will reduce the gain of the NVGs and thus make objects in dark fields of view nearly invisible.

7.15. Terminal Area Operations. Do not leave enroute altitude until reaching the terminal operations area. Brief and conduct an unprepared site evaluation prior to the approach in accordance with daytime operational/unimproved site procedures (**chapter 6**). If hoist operations are anticipated, comply with either the day land hoist or NVG water operations sections contained in **chapter 11**.

7.15.1. Approaches at night are generally flown with slower rates of closure and descent than during day operations. As the closure rates decrease, the time the aircraft remains in the unsafe area of the height velocity envelope increases. The pilot will coordinate advisory calls and visual cues throughout the approach to reach approximately 200 feet AGL with an approximate ground speed of 30 knots. During the last 100 feet of the approach, limit descent rate to approximately 300 fpm. During the final approach, crews should consider using the infrared searchlight to enhance visual cues.

7.16. Crew Coordination. Cruise flight on NVGs is similar to unaided cruise flight. The pilot at the controls is primarily responsible for aircraft control while the other pilot navigates and the scanner provides terrain and obstacle clearance inputs. The pilot not flying should monitor the gauges and keep the crew informed of the aircraft's position, significant obstacles, and mission progress.

7.16.1. Crew coordination during terminal operations is critical. The entire crew will assist each other in maintaining orientation to the landing site while in the pattern. Dropping chemical lights during the high or low reconnaissance can help to establish a reference point for identifying the intended landing spot.

7.16.2. During the approach, the crew will make advisory calls IAW paragraph **7.3.**

7.16.3. Reduced peripheral vision degrades the ability to perceive motion, especially while in a hover. Closure rate, descent rate, hover drift and altitude must be consciously and deliberately perceived since peripheral and instinctive analysis are insufficient. Frequent, deliberate head turning to examine ground speed and hover drift is required. Scanners are of particular value in helping the pilot flying with early detection of excessive closure rates, descent rates, and any unintended drift. The scanner's primary duties are obstacle clearance, hover altitude reference, and drift detection.

7.17. Light Discipline During NVG SAR Operations. The following are minimum requirements to be used during operational and training missions.

7.17.1. During unaided movement in the cabin (i.e., assembling equipment, securing cargo or passengers, preparing personnel for deployment, etc.) use of the dome light with blue filter is recommended to illuminate the cabin. If any crewmember's vision is degraded then turn the brightness down until no degradation exists. The light may be turned off. White light should not be used in the cabin when crewmembers are under aided conditions.

7.17.2. In the event of an aircraft or hoist emergency during NVG SAR operations with personnel on the ground, the flight engineer will deploy a chem-light (15" red preferred) to their position on the ground. Ensure that all ground personnel are briefed that this signal indicates an aircraft or hoist emergency and they must clear away from the aircraft and establish communication.

7.17.3. In the event of a ground emergency (to include medical/SAR personnel recognizing a hoist problem), and ground to air communication is not immediately available, the medical/SAR personnel will be briefed to activate a chem-light (15" red preferred), or light distress marker (strobe light) to signal the flight engineer to cease operations until ground communication is established or the problem is recognized and corrected.

7.17.4. White and red light severely degrade NVG performance. Medical/SAR personnel should be briefed to keep white and red illumination to a minimum while the helicopter hovers overhead.

NOTE: The helicopter landing light when retracted can provide an excellent source of white light for medical/SAR personnel when needed. If any crewmember's vision is adversely affected, turn the light off.

Chapter 8

MEDEVAC, MAST, AND SAR PROCEDURES

Section 8A— Aeromedical Evacuation

8.1. Aeromedical Evacuation Missions. Aircraft will not be used for routine patient transfers. Medical evacuation flights may be operated to transport seriously ill or injured persons and/or to transport medical personnel, equipment, or supplies under emergency conditions when other means are not suitable or readily available. Prior to dispatching an aeromedical evacuation mission, obtain the best medical evaluation available to determine the need for evacuation. This evaluation is not the final determinant that the mission will be performed.

8.2. Medical Assistance. Missions involving life-threatening injuries/illnesses require immediate launch because any delays in reaching the patient/survivor further decrease the probability of survival. Avoid delays whenever and wherever possible. The flight surgeons (FS) and medical technicians (MT) will assist in emergencies and are in charge of the medical aspects of the mission. Aircraft commanders are responsible for safe mission execution and will not delegate their authority/responsibility under any circumstances. Unit commanders should continuously coordinate their local mission response criteria and requirements with flight surgeons and medical technicians to avoid potential delays. To familiarize the flight surgeons and medical technicians with procedures and the available medical equipment, encourage their participation in training and operational missions whenever possible.

Section 8B— Military Assistance to Safety and Traffic

8.3. MAST Missions. Certain helicopter units are designated as Military Assistance to Safety and Traffic (MAST) units. These units are tasked to provide assistance in serious civilian medical emergencies (i.e., situations when an individual's condition requires air evacuation to a medical care center as soon as possible to prevent death or aggravation of illness or injury). The decision to request a MAST helicopter is based solely on the judgment of the law enforcement officer, physician, or other responsible person at the scene of the emergency. Assistance may be provided if it does not interfere with the military mission. The authority for the MAST program is found in the Defense Appropriation Act, Public Law 93-155.

8.4. Medical Equipment Aboard Helicopters. All equipment must be approved IAW guidance in AFI 11-202, Vol 3 for electronic equipment and/or hazardous material.

Section 8C— Search and Rescue

8.5. Mission Generation. Within CONUS, three separate agencies play major roles in generating a SAR mission: the requesting agency, the Joint Rescue Coordination Center (JRCC), and the responding flying unit.

8.5.1. Requesting Agency. City, county, state or federal law enforcement agencies will initiate most requests for SAR support for a missing person. The Federal Aviation Administration (FAA) will initiate most requests for SAR support for overdue aircraft. If an individual requests SAR support he should be referred to the appropriate law enforcement agency or FAA. Each agency has guidelines it follows to validate the request. Considerations include how long the individual is overdue, medical history, intentions of the missing party, etc. The requesting agency then determines if they desire DoD resources to support their search. Their next step is to contact the JRCC for mission coordination. If the requesting agency contacts the flying unit directly, refer them to JRCC after they provide initial scenario information.

8.5.2. JRCC. The JRCC has three major functions. First it validates the mission by answering the following questions: Does the request warrant the use of DoD resources? Is this a potential life or death situation? Are commercial operators available which can provide the same service? (DoD resources are prohibited from competing with commercial operators.) Secondly, based on responses to these questions, the JRCC may authorize the use of DoD resources. The last major function of the JRCC is to allocate resources and contact the most appropriate unit to determine their ability to support the mission.

8.5.3. Flying Unit. All SAR requests and information should flow through a single point of contact, such as the unit operations duty officer (ODO) or supervisor of flying (SOF). Their primary role is to collect all pertinent facts necessary to initiate the mission planning. Additionally, the ODO/SOF will seek approval for the flight authorization from the commander or his representative and advise the JRCC of the unit's ability to support the search.

8.6. Mission Planning. Using the SAR Mission Planning Guide (**figure 8.1.**), the ODO/SOF should obtain as much information as possible for the aircrew's use. Often the details of the search are unclear and difficult to determine in the early stages of the search planning. For that reason, it is strongly recommended that a face to face briefing between the aircrew and search coordinator be accomplished at the established search base prior to actually executing the search. **table 8.1.**. through **table 8.3.** provide additional information when formulating the SAR plan. In addition to those items in the Mission Planning Guide, the following items should be clarified during the briefing: command and control, flight safety, communications plan, and flying civilians on USAF helicopters.

8.6.1. Command and Control for Missing Civil Aircraft Search. Depending on the search experience of the requesting agency, command and control effectiveness may vary greatly. Generally, the responsibility for a missing aircraft search is assumed by the Civil Air Patrol (CAP) through the National SAR Plan. However, a few states have delegated that responsibility to state aviation agencies such as the Montana Civil Aeronautics Board. In either case, the aircrew's role is to assist the search coordinator as requested. Normally the search coordinator will supply maps and designate search sectors for each asset available (both ground and air). Many agencies are not familiar with rotary wing capabilities and restrictions so aircrews should work with the search coordinator to ensure rotary wing assets are optimally used. Generally, helicopters can best be used for concentrated searches in rough terrain at low altitudes with fixed wing aircraft flying all preliminary searches at higher altitudes.

Figure 8.1. SAR Mission Planning Guide.

SAR MISSION PLANNING GUIDE

I. Pre-mission Considerations

A. Physical description of persons/aircraft/vehicle

B. Clothing and Equipment (i.e., Parka, tent, survival gear etc.)

C. Physical and mental condition/age/known health problems

D. Subject’s trip plans/route/last known position

E. Search area specifics

F. Weather

- Prior to search operations and at the time of loss
- Current departure/enroute/destination
- Forecast for search area
- Weather hazards

G. Communications

- Review of Command and Control frequencies (Air-to-Air, Air-to-Ground, On Scene Commander)
- Review of survivor’s communications capabilities (aircraft ELT, civilian or military hand-held radio)
- SAR Forces call signs
- Air-to-Air TACAN channels

H. Survivor evacuation transportation details

- Review ground and air options

I. Overview of search progress

- How long has the objective been missing?
- Number/Type of SAR forces
- Other aircraft in use

II. Predeparture mission specific requirements

A. Equipment needed by SAR team

- Survival equipment
- Specialized medical gear
- Ground and air maps
- Remain-over-night (RON) bag

B. Scanner Brief

- Pattern, track spacing, altitude determined on scene
- Scanning techniques
- Description of objectives
- Maximum detection range
- Methods for reporting sightings

8.6.2. Command and Control for a Missing Person Search. Again command and control effectiveness may vary greatly depending on the requesting agencies' search experience. Often the law enforcement agency that requested the search will delegate the search responsibility to a county search and rescue organization. The search coordinator may direct both the air and ground search. Since the flying unit's helicopters may be the only air asset in the search, it is important to work with the search coordinator to ensure helicopter assets are properly and effectively employed.

8.6.3. Command and Control For Missing Military Aircraft. Command and control will not be assumed by CAP or state aviation agencies. The responsible military commander for the missing aircraft will coordinate for an on-scene commander using standard contingency response procedures.

8.6.4. Flight Safety. The aircraft commander is responsible for all aspects of flight safety. He needs to ensure all local hazards are briefed, deconfliction of airspace is accomplished, and a plan for flight following is established.

8.6.5. Communication Plan. Two-way communications between the aircrew and search coordinator, and the aircrew and ground search parties is imperative for an effective search. Additionally, call signs and air-to-air frequencies need to be determined if other aviation assets are in use. It is very helpful to ensure all aircrews and ground parties are referencing the same maps during the search execution.

8.6.6. Flying Civilians on USAF Helicopters. At the discretion of the aircraft commander, helicopters may also be used to support the search in other than an actively searching mode. It may be appropriate to use helicopters to insert ground search teams and/or search dogs into inaccessible areas. Helicopter resources should not be used to fly routine administrative support during a search. Aircrews are authorized to fly civilian personnel provided the aircraft commander determines them to be mission essential, e.g. a hunting guide who knows the exact location of the objective without whom navigation would be difficult.

8.7. On-Scene Procedures:

8.7.1. Perform a power available check (IAW para. **6.7.**) prior to search operations. Perform the power available check either enroute or at the search location. Perform the power check as near as possible to the same PA and OAT as the recovery site. Compare maximum power available with power required for the intended hover height(s). This comparison determines the power margin for the operation. When power margin is ten percent or less, a second aircrew member will confirm power requirements. Do not assume power available in flight is equal to power available at the site.

8.7.2. Maintain vertical and horizontal separation of all aircraft in the search area. Helicopters are normally assigned a lower altitude in a joint search with fixed-wing aircraft.

8.7.3. Position reports are usually transmitted each hour or as required by the controlling agency.

8.7.4. Compute bingo time as soon as possible after takeoff and relay the information to the search coordinator and/or mission commander.

8.7.5. Report all deviations from planned search procedures to the search coordinator.

8.7.6. Thoroughly investigate sightings and report findings immediately. Initiate recovery action/ assistance when the objectives are located. Keep appropriate agencies informed of progress.

Table 8.1. Parachute Drift Distance.

PARACHUTE DRIFT DISTANCE (ZERO GLIDE RATIO) Distance in miles for landing position downwind from position of parachute opening							
Climb Wind in knots →	**10**	**20**	**30**	**40**	**50**	**60**	**70**
Parachute Opening Height ↓							
30,000 feet (9,000 m)	3.7	7.4	11.1	14.7	18.4	22.1	25.8
20,000 feet (6,000 m)	2.7	5.3	8.0	10.7	13.3	16.0	18.7
14,000 feet (4,300 m)	1.9	3.8	5.7	7.6	9.5	11.4	13.3
10,000 feet (3,050 m)	1.4	2.8	4.2	5.6	7.0	8.3	9.7
8,000 feet (2,400 m)	1.2	2.3	3.5	4.6	5.8	6.9	8.1
6,000 feet (1,800 m)	0.9	1.7	2.6	3.5	4.4	5.2	6.1
4,000 feet (1,200 m)	0.6	1.2	1.8	2.4	3.0	3.5	4.1
2,000 feet (600 m)	0.3	0.6	0.9	1.2	1.5	1.8	2.1

Table 8.2. Visual Detection Range in Nautical Miles.

VISUAL DETECTION RANGE IN NAUTICAL MILES					
Equipment Item	**Down Sun**	**Cross Sun**	**Up Sun**	**Overcast**	**Night**
Yellow Life Raft (1 or 7 man)	1.9	1.4	1.1	1.0	
Signaling mirror	6.3	7.0	4.8		
Dye Marker	3.8	2.5	2.2		
Smoke	8.3	7.4	7.1	6.7	
Life Jacket	0.2	0.18	0.16	0.15	
Life Jacket Light					0.5
2-cell Flashlight					2.4
Very Cartridge					17.5

Table 8.3. Distance Traveled Perpendicular to Track in a 180 Degree S/R & 1/2 S/R Turn.

DISTANCE TRAVELED PERPENDICULAR TO TRACK IN A 180× S/R & 1/2 S/R TURN					
Airspeed	**Distance S/R**	**Distance 1/2 S/R**	**Airspeed**	**Distance S/R**	**Distance 1/2 S/R**
60	0.7	1.3	100	1.1	2.1
70	0.8	1.5	110	1.2	2.3
80	0.9	1.7	120	1.3	2.6
90	1.0	1.9	130	1.4	2.8

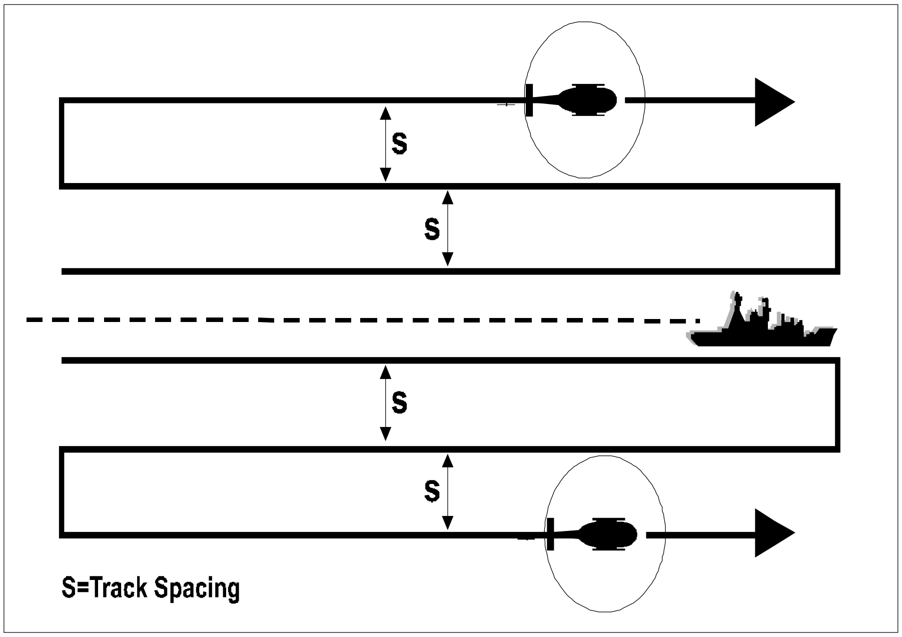
8.8. Search Patterns. Selection of the search pattern is an important aspect of mission planning; however, if the search area involves unfamiliar terrain or conditions, selection of a search pattern should be made after a preliminary inflight survey of the area. There are several types of search patterns with numerous variations. **table 8.4.** lists the advantages and disadvantages of these patterns. While conducting any search, consider adjusting the search pattern and track spacing to allow for terrain, navigation error and/or drift of the missing party.

8.8.1. Route Search. The route search consists of one search leg along a given track. Start the search leg at the closest point and search along the proposed route of the missing party between the last known position (LKP) and the intended destination. If the LKP is the last position report received from the missing party, search between the LKP and the point where the next report was due.

Table 8.4. Search Pattern Characteristics.

SEARCH PATTERN COMPARISONS		
SEARCH PATTERN	**ADVANTAGES**	**DISADVANTAGES**
Expanding Square	Starts at datum Easy navigation	Many turns Turns in middle No navigation update
Sector Search	Concentrates on datum Easy navigation after start Navigation DR only Many navigation updates	Under searches outside Difficult to set up Follow-on search difficult
Parallel Arc	Accurate track spacing Versatile Easy navigation and flying	Requires nearby NAVAID
Creeping Line Search	Easy navigation Versatile Long, straight legs Follow-on search easy	Starts at corner Only one navigation update

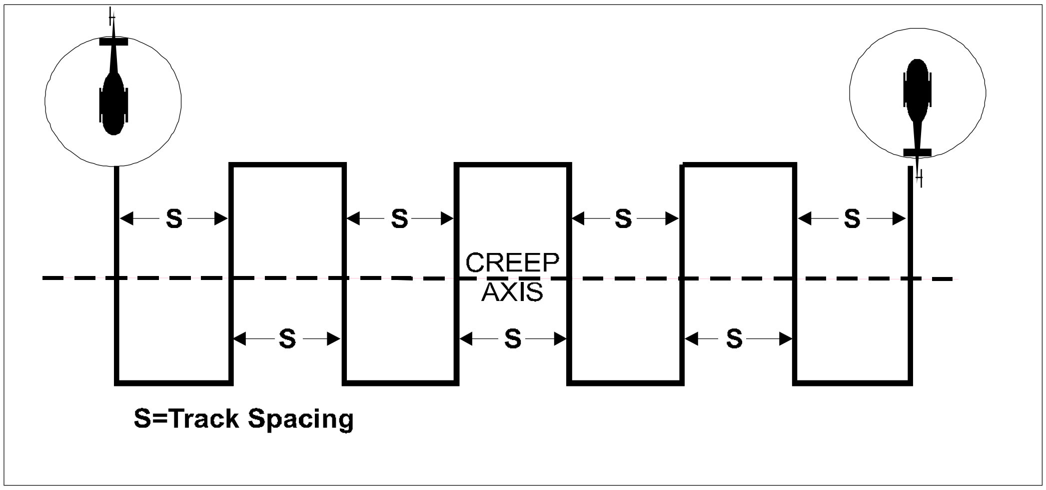
Figure 8.2. Parallel Search Pattern.



8.8.2. Parallel Search (**figure 8.2.**). The parallel search is a series of parallel legs (tracks) advancing from one side of an area to the other. The longer search legs parallel the objective's intended track or the long side of a rectangular search area. The short legs (cross leg) of a parallel search are the computed track spacing.

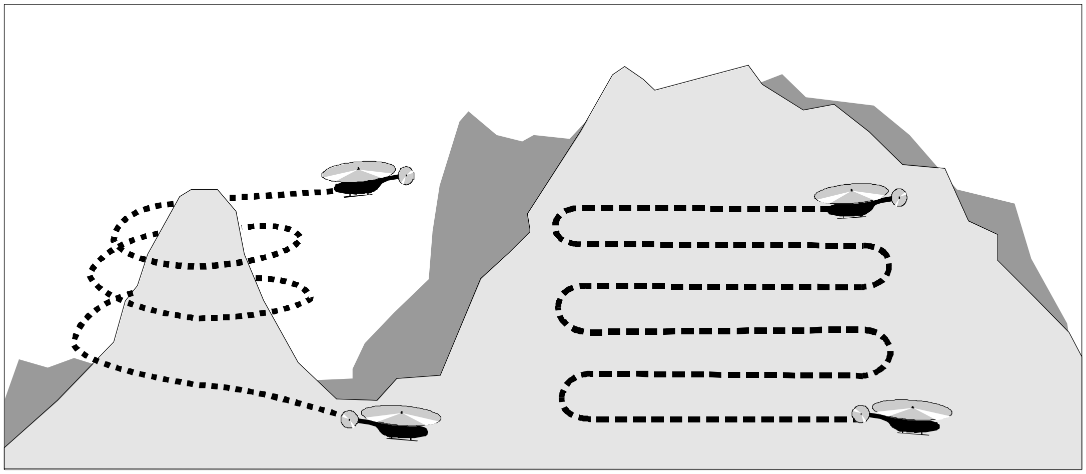
8.8.2.1. The parallel search may be used to cover the area on each side of the missing party's intended track. Begin the parallel search at one end of the route. Search and advance the pattern away from the missing party's intended track.

Figure 8.3. Creeping Line Search Pattern.



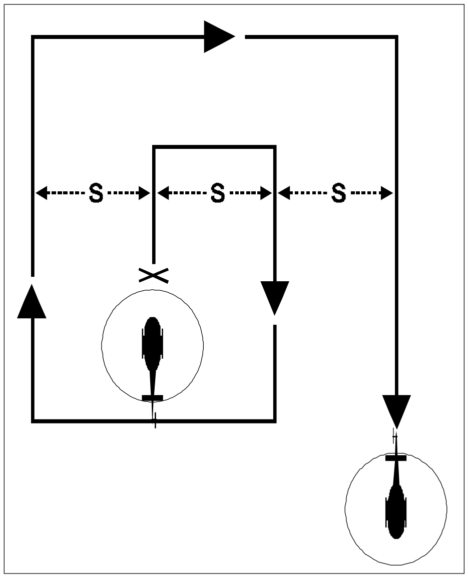
8.8.3. Creeping Line Search. The creeping line search (**figure 8.3.**) is a series of parallel tracks advancing along a given axis. The longer legs are perpendicular to the creep axis and are sufficient in length to cover the search area. The shorter legs of a creeping line search are the computed track spacing.

Figure 8.4. Contour Search Pattern.



8.8.4. A contour search (**figure 8.4.**) is the most frequent search pattern used in mountainous terrain. The easiest way to begin a contour search is to first divide the search area into smaller, more manageable sub areas. Use natural terrain features such as ridgelines and major drainage to accomplish this. Search legs should be flown from top to bottom, from a position of high power demand to decreasing power demand. Often the most effective search patterns will be a spoke pattern beginning at high terrain, flying down slope paralleling ridgelines and drainage. Altitude and airspeed should be selected to accommodate scanners but must be commensurate with safety considerations such as winds, turbulence, terrain, and visibility. Monitor and evaluate these conditions constantly throughout the search. Plan ahead and know which way to turn in the event of an emergency.

Figure 8.5. Expanding Square Search Pattern.



8.8.5. The expanding square search (**figure 8.5.**) is a series of right angle search legs which expand outward forming a square pattern. The first and second legs are equal in length to track spacing and each two succeeding legs are increased in length by the computed track spacing. Begin the search at the center point of the area of highest probability. To minimize navigational error, plan upwind, downwind and crosswind legs. Use cardinal headings if wind is negligible or time does not permit detailed preplanning.

8.8.6. The sector search (**table 8.5.** & **figure 8.6.**, **figure 8.7.**) is a series of legs which radiate from a datum point (center most probable position). Each long leg is equal to the diameter of the area where the objective is most likely to be found and the cross legs are equal to the radius. If two patterns are flown, offset the second pattern by 30 degrees. Begin the search at the datum point. Drop smoke signals or other suitable reference markers at the datum point as a reference for precise search legs. When planning the search, align the first leg with the objective's most probable direction of movement or drift. Re-mark the datum point periodically to maintain a continuous reference. Make all turns to the right for a clockwise search pattern.

Figure 8.6. Typical Sector Search.

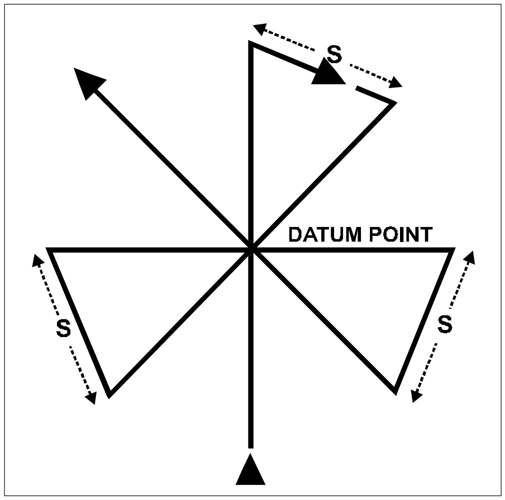
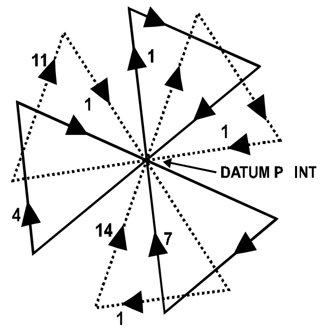


Table 8.5. Sector Search Parameters.

		TRACK SPACING									
GROUND SPEED	**SEARCH RADIUS**	**2**		**4**		**6**		**8**		**12**	
		DEGREES	TIME	DEGREES	TIME	DEGREE	TIME	DEGREE	TIME	DEGREE	TIME
75	**5**	12	1.2	24	0.6						
75	**10**	6	4.4	12	2.4	18	1.6	24	1.2	36	1.0
120	**5**	12	0.8	24	0.4						
120	**10**	6	2.8	12	1.5	18	1.0	24	0.8	36	0.7
1. Time = number of hours required to complete one 360 degree pattern 2. Degrees = number of degrees to add to 90 degrees for each turn 3. Distance measured in nautical miles											

Figure 8.7. Alternate Sector Search.

LEG	HEADING	DISTANCE	TURN
1	360	1	120
2	120	1	120
3	240	2	120
4	360	1	120
5	120	2	120
6	240	1	120
7	360	1	30
8	030	1	120
9	150	1	120
10	270	2	120
11	030	1	120
12	150	2	120
13	270	1	120
14	030	1	---



8.9. Crew Coordination:

8.9.1. The pilot flying the aircraft during a search mission will devote full attention to controlling the aircraft and maintaining terrain/obstacle clearance.

8.9.2. The pilot not flying will assist in checking the timing to conform to the planned search pattern, plot the search pattern on an aeronautical chart and record sighting information (time, location, and details of the sighting).

8.9.3. All crewmembers and operational support personnel in the cargo compartment will assist as scanners. Scanners should be alternated periodically to prevent fatigue. The pilot flying the aircraft will not scan but should focus on flying the pattern and coordinating the crew's activities.

8.9.3.1. Use a routine scanning pattern. Start the scan at a distance and work in toward the aircraft. Avoid closing your eyes, focusing short, or turning away from the scanning area. Allow your eyes to pause and focus every 1-2 seconds. This allows a scanner to detect movement more readily.

8.9.3.2. Scanning is tiring and requires periodic rest. With three or more scanners, limit scanning to 30 minutes.

8.9.4. Telltale signs to look for:

8.9.4.1. Water Searches: oil slicks, debris, wakes, lifeboats and rafts. Debris is normally found downwind of oil slicks, and rafts or boats are found downwind of debris.

8.9.4.2. Land Searches: smoke, broken or scarred trees, shiny metal, fires, freshly burned out areas, parachutes, and signals.

8.10. Sighting Procedures:

8.10.1. When a sighting is made, notify the rest of the crew using the clock system and estimated distance to indicate the position of the sighting.

8.10.2. Immediately upon making a sighting, mark the approximate location on the map. This mark will assist in returning to the search pattern if the sighting was false. If the sighting is lost prior to confirmation, a return to the mark can assist in reacquiring the objective (use caution when dropping a smoke device over a wooded area).

8.10.3. If the scanner can keep the objective in sight, turn in the direction of the objective. The scanner will continue to call out the target position and distance for orientation.

8.10.4. If the sighting is positive, report the position, number and condition of survivors, and actions in progress to effect recovery to the search coordinator. Do not hesitate to request assistance, if required. False sightings involving objects related to the search are important. Report false sightings to the search coordinator.

8.11. SAR On-Scene Procedures:

8.11.1. Once the search objective is located, the aircrew has several options. If an adequate landing area is immediately available, conduct a high and low reconnaissance as appropriate, land, and deploy medical personnel. If the aircraft is hoist equipped, medical personnel may be lowered to the objective. If there is not a suitable landing area nearby and the aircraft is not hoist equipped, consider deploying a drop kit with a radio or message streamer, vectoring in ground search teams, searching for the nearest suitable landing area, or some combination thereof. Landing the helicopter in an unprepared landing area can be demanding. The aircrew must take all necessary precautions to ensure safety of flight is not compromised.

8.11.2. Survivor's Report. Report survivors' conditions, using Echo codes in Checklist 1, without mentioning names. State condition of the objective, if applicable, to the on-scene aircraft commander.

8.11.3. Human Remains. Rescue personnel will not normally remove human remains from crash or incident sites. The decision to remove the remains from the site will be made solely by the local authorities. Do not commit resources to body removal until the mission approval and/or releasing authority (normally the Wing/Group Commander) has been informed of the request and has approved the use of DoD resources for the removal of the remains. The mission approval and/or releasing authority is responsible for the safety of resources and should not jeopardize them for body recovery. Except as provided in paragraph **8.11.3.1.**, the mission approval and/or releasing authority is responsible for compliance with all directions given by local civil authorities concerning the proper removal and handling of remains in that jurisdiction. Written authorization from the proper local authorities should be received prior to removal; however factors such as the remoteness or inaccessibility of the area, weather conditions, darkness, etc. may preclude the practicality of receiving written authorization from local authorities. In such cases, a verbal authorization may be accepted if followed by a written authorization.

8.11.3.1. Military Personnel. If the crash or incident site is on a military reservation or within military jurisdiction, the remains of military personnel shall be removed only with the approval of a medical officer. In the absence of a medical officer at the crash or incident site, approval shall be obtained from the proper military medical authority prior to removal of remains. If the crash or incident site is not within military control, jurisdiction over the remains rests with the local civil authorities. In such cases, do not remove remains unless authorized by the appropriate civil official (usually the local coroner or medical examiner). Authorizations to remove remains should be in writing. If circumstances do not permit this, the authorization may be verbal followed up by a written authorization.

8.11.3.2. Civilian Personnel. The remains of civilian personnel employed by the military are recovered as in paragraph **8.11.3.**

8.11.3.3. Exceptional Cases. In extreme situations where time is critical and communications are impossible, the aircraft commander may, after authorization from the appropriate civil official, remove remains and deliver them to the proper authorities. This procedure is authorized only if conditions already make it impossible to obtain timely approval from the mission approval and/or releasing authority. Whenever this procedure is employed, the aircraft commander shall request and comply with all directions given by local civil authorities concerning the proper removal and handling of remains in a jurisdiction.

8.11.3.4. Civil Appointments. Personnel will not, at any time, accept appointments as deputy coroner.

8.11.3.5. International Aspects. A mission requiring the removal of human remains, military or civilian, across international borders will involve national as well as local law. Prior to such operations, consult the United States diplomatic officials to the concerned countries to obtain necessary clearance(s) for the operation.

Table 8.6. Wind and Seas (Beaufort Scale).

BEAUFORT SCALE	WIND VELOCITY (KNOTS)	SEA STATE DESCRIPTION	PROBABLE WAVE HEIGHT (Meters)
0 CALM	UP TO 1	Sea looks like a mirror	0
1 LIGHT AIR	1 - 3	Ripples with appearance of scales are formed, but without foam crests	0.1
2 LIGHT BREEZE	4 - 6	Small wavelets, still short but more pronounced, crests have glassy appearance but do not break	0.3
3 GENTLE BREEZE	7 - 10	Large wavelets, crests begin to break. Foam of glossy appearance. Perhaps scattered white horses.	0.6
4 MODERATE BREEZE	11 - 16	Small waves, becoming larger. Fairly frequent white horses.	1.0
5 FRESH BREEZE	17 - 21	Moderate waves forming more pronounced long foam. Many white horses are formed. (Chance of some spray).	2.0

BEAUFORT SCALE	**WIND VELOCITY (KNOTS)**	**SEA STATE DESCRIPTION**	**PROBABLE WAVE HEIGHT (Meters)**
6 STRONG BREEZE	22 - 27	Large waves begin to form; the white foam crests are more extensive everywhere. (Probably some spray)	3.0
7 NEAR GALE	28 - 33	Sea heaps up and white foam from breaking waves begin to be blown in streaks along the direction of the wind.	4.0
8 GALE	34 - 40	Moderately high waves of greater length; the edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.	5.5
9 STRONG GALE	41 - 47	High waves. Dense streaks of foam along the direction of the wind. Crests begin to topple, tumble and roll over. Spray may affect visibility.	7.0

Chapter 9

FORMATION PROCEDURES

9.1. General. The primary purposes of helicopter formation flight are mutual support and control and increased lift capability. In addition, formation flight enhances maneuverability and flexibility. If more than three aircraft are required, consideration should be given to breaking into smaller elements. The minimum separation between the closest portions of any two helicopters in any formation is one rotor diameter, but the tactical situation will usually dictate more separation. Vertical step-up/down is optional for each succeeding helicopter. Formation will not normally be flown in marginal weather conditions.

9.2. Responsibilities. Every crewmember has specific responsibilities that directly affect the safety and mission of the entire formation.

9.2.1. Flight Lead. Flight lead is responsible for the mission conduct of the formation. He must know and consider the capabilities of all members of the flight. Flight lead is responsible for:

9.2.1.1. Briefing the flight covering, as a minimum, those items contained in the mission briefing guide (AFI 11-2H-1, Vol 3, CL-1).

9.2.1.2. Maintaining formation integrity and air discipline.

9.2.1.3. Directing radio channel changes, making radio calls, navigating, ensuring formation clearance from other aircraft and hazards, and directing all formation changes.

9.2.1.4. Conducting a post mission formation debriefing.

9.2.2. Wingman. The wingman is responsible for:

9.2.2.1. If not directly involved in flight planning, verifying the accuracy of all mission planning and be prepared to assume responsibilities as the formation leader.

9.2.2.2. Maintaining position in the formation. Advise flight lead when it is necessary to deviate from any directed position.

9.2.2.3. Acknowledging radio-channel changes by position prior to initiating the action.

9.2.2.4. Navigation and terrain/obstacle clearance independent of lead.

9.2.2.5. Backing up the flight lead where necessary and being able to assume the lead if required.

9.2.2.6. Notifying lead if visual contact with formation aircraft is lost, flying safety is jeopardized, or radio failure occurs.

9.2.2.7. Questioning flight lead via the radio any time a significant deviation occurs that may jeopardize mission accomplishment.

9.2.3. Crewmembers. Each crewmember has the responsibility to provide mutual coverage for other aircraft in the formation. This includes scanning the six o'clock position of other helicopters in the formation since rear visibility is extremely limited. Mutual coverage is especially important in any combat environment where the flight is susceptible to an attack from enemy ground and airborne weapon systems. Scanners are also responsible for notifying the pilot of all changes in the relative position of other aircraft in the formation.

9.3. Safety Considerations:

9.3.1. "Knock-It-Off" Call. This is a radio call any formation member can make to terminate maneuvering for any reason. It is particularly applicable when a dangerous situation is developing. This radio call applies to all phases of flight and all types of formation maneuvers. All formation members must acknowledge this call in turn; for example "Blade, knock-it-off". Regardless of who made the knock-it-off call, lead will acknowledge with the call "Blade 1, knock-it-off" followed by the wingman's call "Blade 2, knock-it-off", etc.

9.3.1.1. If an aircraft in the formation subsequently loses sight of the formation, the appropriate lost visual radio call should be made and lost visual procedures initiated.

9.3.1.2. If lead has the wingmen in sight and the situation requires immediate aircraft separation, lead should maneuver to ensure aircraft separation. Lead will direct a rejoin only after the wingmen are in a position where a safe rejoin can be accomplished. The wingmen should maintain a minimum of 1,000 feet separation between aircraft until directed to rejoin.

9.3.2. "Break Out" Call. The wingmen must break out of formation when directed by lead, when unable to maintain sight of lead or the preceding aircraft, when unable to safely rejoin or remain in formation without crossing under or in front of lead or the preceding aircraft, or anytime his or her presence constitutes a hazard to the formation.

9.3.2.1. When breaking out of formation, each wingman clears in the direction of the break and notifies lead of the intent to break and the direction of break. If breaking out due to a lost visual situation, each wingman breaks away from either lead's or the preceding aircraft's last known position, direction of turn, or in any direction that ensures immediate separation. Lead continues the current maneuver with the current power setting to aid in aircraft separation. If the wingmen are in sight, lead should also maneuver to obtain separation, whenever possible. After obtaining safe separation and when no further complications exist, the wingmen may request a rejoin.

9.4. Dissimilar Formation. Formation flights with dissimilar aircraft are authorized when all participating crewmembers are briefed and are thoroughly familiar with the other aircraft's performance and tactics. Rotor disk (RD) separation will be based on the largest rotor disk diameter.

9.5. Communication. Prior to formation flight, conduct a communications check of all aircraft in the formation (may not be required for contingency operations). Lead will direct an abort for any aircraft failing the check if mission requirements dictate.

9.5.1. Radio Procedures. After initial radio contact has been established between aircraft, lead is responsible for all radio calls pertaining to the flight.

9.5.1.1. Frequency changes will be initiated only by lead. Lead may pre-brief waypoints for communication changes. A sequence sheet or communications plan indicating timing and/or locations for frequency changes and communications check ins reduces confusion and enhances mission execution, particularly during communications out procedures.

9.5.1.2. Wingmen will acknowledge (by position in the flight) a frequency change prior to switching to the new frequency, or as briefed (NA for communications-out). Throughout the formation mission, an acknowledgment of a frequency change indicates all checklists are complete and you are ready for the next event. If you are not ready, reply with "standby." The frequency will not be changed until all wingmen have made the normal acknowledgment.

9.5.1.3. Lead will check in on the new frequency followed by all wingmen, in order, or as briefed (NA for communication out).

9.5.1.4. If a wingman fails to check in after a reasonable length of time, lead will attempt contact on another radio. If this fails, lead may direct a member(s) of the flight back to the previous (or a prebriefed) frequency to reestablish contact. As a last resort, lead will initiate a prebriefed CHATTERMARK (code word(s) used during covert radio transmissions) or a brief, clear radio call on guard in order to establish contact on prebriefed frequencies.

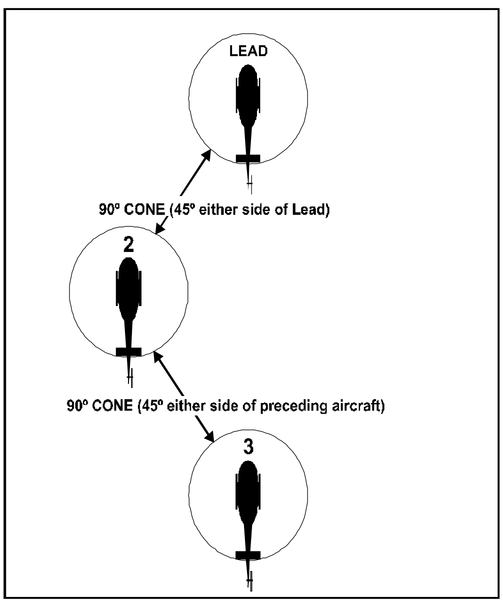
9.5.1.5. All crewmembers in each aircraft in the flight will monitor the interplane frequency.

9.5.1.6. Only essential transmissions will be made. Strict radio procedures and discipline must be enforced to avoid jeopardizing safety and mission effectiveness.

9.5.2. Signals. Use formation signals contained in AFI 11-205, A*ircraft Cockpit and Formation Flight Signals*. Additional signals may be used if prebriefed.

9.6. Types of Formation. The mission determines the type of formation most suitable for the flight. For cross country or deployment/redeployment flights, primary consideration should be given to crew fatigue. Unless otherwise specified, formations can be flown low-level or above 500 feet AGL. In tactical situations, the formation should allow lead to maintain flight integrity and still maneuver the flight with few restrictions. In all tactical formations, it is each wingman's responsibility to maintain a position that does not restrict lead's (or the preceding aircraft's) ability to maneuver. In all formations, wingmen may stack slightly high or low, as required, to maintain visual contact with the preceding aircraft. In all cases, the minimum spacing between aircraft is one rotor diameter. The following formations are authorized (MAJCOMs may authorize additional formations):

Figure 9.1. Fluid Trail Formation.

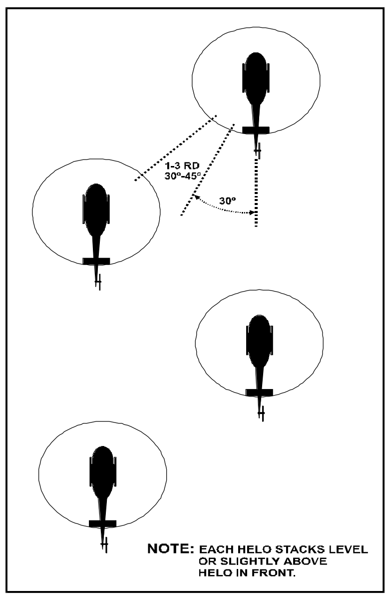


9.6.1. Trail:

9.6.1.1. Fluid Trail (**figure 9.1.**) is recommended for cross country or deployment flights and may be used in day tactical situations. Minimum lateral separation is one RD (3 RD when below 500'). Wingmen maneuver in the 90 degree quadrant aft (45 degrees left or right) of the preceding aircraft. Wingmen should be in a position to see both the preceding aircraft and the terrain being flown over without having to make head movements. This reduces the possibility of contact with obstructions and maximizes lead's maneuverability.

9.6.1.2. Fixed Trail. Lead may direct fixed trail position when terrain or maneuvering dictates. When directed to fixed trail formation, aircraft will line up directly behind and stacked slightly above preceding aircraft. Fixed trail should be avoided for extended periods of time, as closure rates are difficult to detect. Minimize maneuvers to those necessary for landing alignment in the LZ. Minimum separation is one RD (3 RD when below 500').

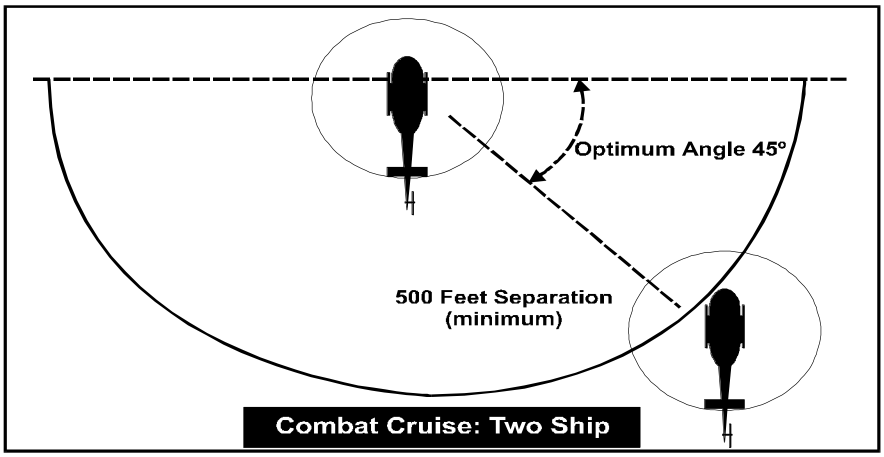
Figure 9.2. Staggered Formation.



9.6.2. Staggered (**figure 9.2.**). This formation allows lead more control of the flight. It is especially useful during terminal area operations. Lead may direct a right or left staggered formation. **figure 9.2.** depicts a left staggered formation. In right-staggered formation, aircraft chalks two and four are positioned on the right side of lead. Odd numbered aircraft remain directly behind lead. Even numbered aircraft position themselves 30-45 degrees aft of the preceding aircraft. Each aircraft stacks level or slightly above the preceding aircraft. Lateral separation is 1-3 RD. If this formation is flown below 500 feet AGL, minimum separation is three RD.

9.6.3. Combat Cruise (**figure 9.3.**). This formation is designed for low-level, tactical flight. It is similar to fluid trail and offers some of the same advantages. Lead may maneuver as desired and wingmen may position themselves to keep preceding aircraft and upcoming terrain in view simultaneously. Wingmen maneuver on an arc from the three to nine o'clock position off the preceding aircraft. Optimum position is 45 degrees either side astern of the preceding aircraft. Minimum separation is 500 feet between all aircraft. At the IP, lead may direct a tighter formation (i.e., fluid trail or staggered).

Figure 9.3. Combat Cruise Formation.



9.7. Engine Start and Taxi. Start engines by visual signal, radio call, or as prebriefed. Prior to requesting taxi clearance, flight leads will check-in the flight (NA for communications-out). The flight will normally taxi in order with a minimum of 100 feet spacing from main rotor to tail rotor.

9.8. Lineup for Takeoff:

9.8.1. Lead will normally taxi to the downwind side of the takeoff area/runway to permit lineup and hover checks. Lead must allow adequate room on the takeoff area for all formation members to maneuver.

9.8.2. Spacing should be commensurate with helicopter type and conditions (minimum of one RD). Increased spacing may be required in certain situations such as heavy gross weights or dusty conditions.

9.9. Takeoff. There are two types of formation takeoffs, "wing" and "delayed." Either type may be initiated from the ground or a hover. Prebrief the type to be used.

9.9.1. Wing Takeoff. Aircraft take off simultaneously maintaining formation separation. Lead may be required to hold a slightly lower than normal power setting to enable the wingmen to maintain position without requiring excessive power.

9.9.2. Delayed Takeoff. Lead initiates takeoff. Wingmen delay executing takeoff as briefed. Lead will climb at briefed airspeed and rate of climb.

9.10. Aborts:

9.10.1. Prior to takeoff, an aborting aircraft will notify lead, clear the formation (as appropriate), and return as directed.

9.10.2. If an abort occurs during takeoff, the aborting aircraft will call flight call sign, position, abort, and state intentions. For example, "Blade 49 Flight, two, aborting, straight ahead." Aborting aircraft will turn on a strobe at night. The aborting aircrew will, if possible, maintain the side of the formation they were on when the takeoff was started. The aborting aircraft is responsible for avoiding any aircraft in front of it.

9.10.3. Other aircraft may continue takeoffs or delay as the situation dictates.

9.10.4. If an abort occurs, all other aircraft will assume new position (maintain original formation call sign) and complete the mission as briefed. With the permission of the flight leader, a spare aircraft or the aborting aircraft may rejoin the formation in last position.

9.11. Join-Up. Two types of join-ups may be used, straight-ahead or turning. Unless prebriefed or directed by lead, wingmen will request permission to rejoin. Lead will direct which type of rejoin to be used.

9.11.1. Straight Ahead. Lead establishes a heading while wingmen accelerate until established in position.

NOTE: If an overshoot becomes unavoidable, the joining aircraft should reduce power, raise the nose to decelerate, and, if necessary, turn slightly away from the formation. Keep lead (or the preceding aircraft) in sight. If an overshoot occurs, the overshooting aircraft should fly away from the flight, maintain 1,000' separation and request permission to rejoin.

9.11.2. Turning. Lead establishes an angle of bank no greater than 20 degrees. Wingmen then turn inside of lead/preceding aircraft until established in position.

NOTE: If an overshoot becomes unavoidable, the joining aircraft should pass behind the preceding aircraft so as not to lose visual contact. Never pass directly under or over any other aircraft in the formation.

9.12. Enroute:

9.12.1. Formations are normally flown with a maximum of five aircraft per element to ensure safe lost visual contact procedures.

9.13. Changing Formation. Unless briefed otherwise, lead will direct all formation changes. Two may change position within the set formation as required to reduce pilot fatigue, provide terrain clearance, etc. If lead desires a formation change, radio, light, or visual signals may be used to change the formation. For all verbally directed formation changes, lead will state flight call sign and type of formation to assume (i.e.,"BLADE 05 FLIGHT, GO LEFT STAGGERED"). For formations without a scanner and single pilot formations, the last wingman in the flight will call in when the formation change is complete.

9.13.1. Crossover. During the crossover, wingmen will maintain appropriate clearance. Climb slightly above preceding aircraft and use a heading change of approximately five degrees to cross from one side to the other. Once number two changes, all corresponding aircraft will move to establish the new formation; i.e., if the formation is staggered left and two moves to the right, all even numbered positions will move to the right with the odd number positions maintaining their position behind the lead aircraft.

9.13.2. Lead Change (**figure 9.4.** and **figure 9.5.**). ONLY the lead aircraft can direct formation lead changes. Lead changes and formation changes will not be accomplished simultaneously. However, a staggered formation will switch sides when number two becomes lead without any repositioning of aircraft. The new lead may change formations after the lead change is completed. When lead has received acknowledgment of a lead change from all aircraft, lead will initiate the lead change. The new lead aircraft assumes lead duties, however the flight lead, as designated on the flight authorization, retains command of the flight.

9.13.2.1. For staggered formations, lead will maneuver clear of the formation and then reenter the formation as briefed. Lead will use scanners to stay clear of the flight. Variations of lead change procedures will be briefed as applicable.

9.13.2.2. When radios are used, lead will direct the lead change by stating flight call sign, aircraft number in flight, assume lead (i.e.,"BLADE 05 FLIGHT, TWO ASSUME LEAD"). The aircraft assuming lead will state "ABEAM" when approaching abeam the leader and ready to assume formation lead. Lead, when ready to relinquish formation lead, will state "TALLY HO." The new lead states "ASSUMING LEAD" and all aircraft establish proper configuration (IFF, lights, radios, etc.).

9.13.2.3. Maintain the original formation call sign regardless of the number of lead changes.

Figure 9.4. Lead Change - Fixed Trail Formation.

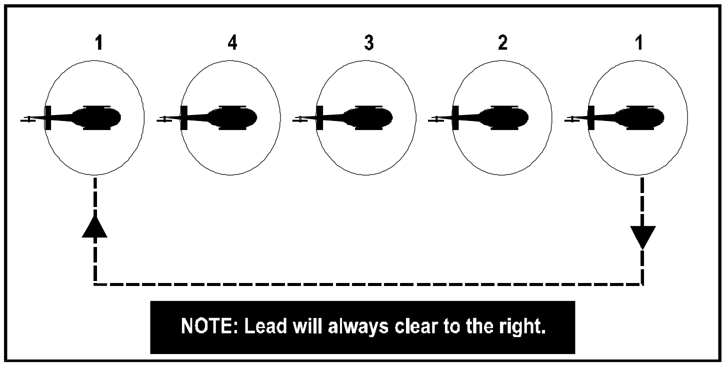
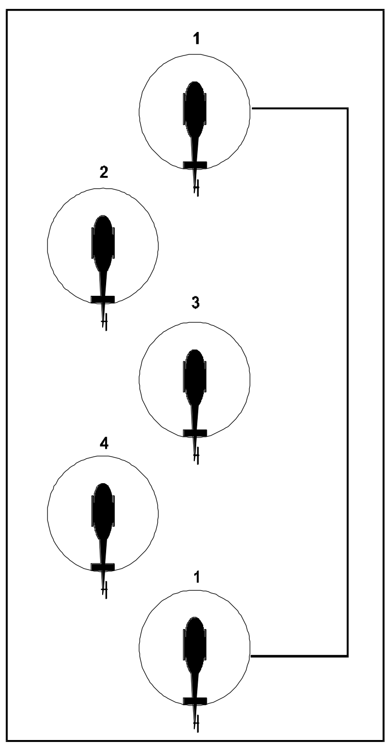


Figure 9.5. Lead Change - Staggered Left.



9.14. IMC Avoidance. Avoid IMC to the maximum extent possible. Avoiding IMC will greatly reduce the chance of entering a situation that would require the use of lost visual contact procedures and a climb to MSA. When deteriorating weather conditions are encountered en route, consider the following options: alter the course to circumnavigate the weather; reverse course to remain in VMC; send a "weather ship" ahead of the formation or make a formation landing. These options encourage formation integrity until an alternate plan of action can be determined. Every formation briefing will contain IMC avoidance considerations and lost visual contact procedures.

9.15. Lost Visual Contact. Two types of lost visual contact can occur:

9.15.1. VMC "NO JOY". In this situation a wingman loses sight of the preceding aircraft because of terrain or excessive distance, yet maintains VMC. The wingman losing sight of the preceding aircraft should call "Call sign, position, NO JOY" (e.g., "Blade 51 Flight, three is no joy"). The preceding aircraft in the formation will turn his upper strobe light on or initiate prebriefed procedures (depending on tactical situation alternate procedures may include climbing, describing location, proceeding to rejoin point, etc.) for the NO JOY aircraft to affect a rejoin. When the NO JOY aircraft is in position to resume formation flight, he will call "Position's IN" (e.g., "Call sign, three's in"). The preceding aircraft will then extinguish its strobe (if required).

9.15.2. Inadvertent IMC: "BLIND ALLEY". The other type of lost visual contact is when a wingman goes inadvertent IMC and loses sight of the preceding aircraft. All members of the formation must react quickly and precisely to prevent a midair collision. In such a case, the aircraft losing contact will call, "Call sign, position, BLIND ALLEY." Lead will immediately initiate the breakup by announcing "Execute," type of breakup (i.e.,mountainous or non-mountainous) unless prebriefed, base heading (MAG), airspeed he will maintain, and MSA for that route segment. All wingmen will take action based on the announced heading, airspeed and MSA. Wingmen will acknowledge lead's calls and turn their lights and transponders on. Once the formation executes the lost visual procedure, lead will announce or prebrief any changes to magnetic headings, airspeed, and MSA. These items may change for several reasons; e.g., formation continues on course, formation aborts mission, and/or MSA changes for next leg of route.

9.15.2.1. If another aircraft calls "BLIND ALLEY" and you still have sight of the preceding aircraft, maintain formation position on that aircraft. If you then lose sight of the preceding aircraft, execute lost visual contact procedures for your original position in the formation.

9.15.2.2. If a wingman calls "BLIND ALLEY" and lead is still VMC and able to ensure terrain/obstacle clearance, lead should stay in VMC. Lead must still make base heading (MAG), airspeed, and MSA calls for the wingmen executing the lost visual contact procedures.

9.15.2.3. If confronted with a large formation requirement where lost visual contact (i.e., inadvertent IMC) is possible, strong consideration should be given to canceling the mission or rerouting the formation. In these conditions, the maximum number of aircraft should be limited to five per element.

9.16. Lost Visual Contact Procedures for Nonmountainous Terrain (figure 9.6.):

9.16.1. Lead maintains base heading (usually straight-ahead), airspeed (this may require an acceleration for large formations), and climbs to MSA.

9.16.2. Wingmen turn away from the preceding aircraft and climb according to the following procedure: multiply your position by ten degrees for your heading offset and by 200 feet for your altitude above MSA. Timing for all wingmen is 30 seconds and starts when you reach your altitude. At the end of your timing, return to the base heading.

9.16.3. Rate of climb will be prebriefed.

NOTE: If directly behind preceding aircraft turn right to leave the formation.

9.17. Lost Visual Contact Procedures for Mountainous Terrain (figure 9.7.). These procedures are only suggested because lost visual contact in a mountainous environment, especially low-level, is a critical situation and the tactical environment, existing weather conditions, and terrain may require deviations.

9.17.1. Lead will fly at a predetermined base airspeed. If possible, the base airspeed should be high enough to allow the formation more maneuvering room and to avoid excessively slow airspeeds for wingmen. Example: Assuming 100 KIAS as the cruise airspeed, lead should maintain base heading (MAG), accelerate to 110 KIAS base airspeed, and climb to MSA if IMC is encountered.

9.17.2. Aircraft number two will adjust to maintain base airspeed minus ten knots and climb 400 feet above MSA.

9.17.3. Aircraft number three will adjust to maintain base airspeed minus 20 knots and climb 600 feet above MSA.

9.17.4. Aircraft number four will adjust to maintain base airspeed minus 30 knots and climb 800 feet above MSA.

9.17.5. As each aircraft reaches its assigned altitude, maintain heading and assigned airspeed for three minutes, then adjust to a prebriefed indicated airspeed.

9.17.6. Rate of climb will be prebriefed.

9.18. Rejoin After Breakup. Making an assessment of the weather situation, threat environment, aircraft navigation capability, etc., lead will decide whether to abort or continue the mission.

9.18.1. After completing a breakup, if lead determines it is necessary, the flight will contact ATC facilities for an IFR approach to an appropriate facility. When ATC facilities are not available and/or lead is VMC, lead will designate a specific letdown point (by waypoint number or distance short of a waypoint) and MSL altitude to descend to. Lead will ensure he is at the designated altitude.

9.18.1.1. As aircraft number two reaches the letdown point, the pilot will report altitude departing and descend at 500 fpm until reaching the designated altitude. Aircraft number two will report reaching VMC, ensure position and anticollision lights are on, and accelerate to catch lead.

9.18.1.2. When aircraft number three reaches the letdown point, if number two reports reaching VMC, number three will follow the same letdown procedure as number two.

9.18.1.3. When aircraft number four reaches the letdown point, if number three reports reaching VMC, number four will follow the same letdown procedure as number two.

9.18.1.4. As the flight rejoins, each aircraft will return to mission lighting after the succeeding aircraft rejoins. When the entire flight is rejoined, all aircraft will recheck mission lighting. If any aircraft does not achieve VMC at the designated altitude, it will immediately climb back to its assigned altitude and advise lead. As a general guide, lead will not clear the flight down until lead has appropriate weather minimums for the mission being flown (operational or training).

9.19. Formation Flight Evasive Maneuvering. See paragraph **10.15.**

9.20. Small Formation Considerations. A small formation should employ tactics that use mutual support to defeat the enemy. Lead must be free to maneuver, as necessary. The wingman then maneuvers so as to maintain visual contact with lead. Several advantages can be realized:

9.20.1. Two or three targets of opportunity may help to throw off the aggressor as he takes a split second on each pass to decide which helicopter to attack.

9.20.2. If the formation is attacked by more than one aggressor and those aggressors go after one aircraft, the free helicopter(s) may be able to warn the engaged wingman of an undetected attack from a blind quadrant.

9.20.3. The free helicopter(s) may also have more time to call for armed assistance (if available) while monitoring the attack.

9.21. Large Formation Considerations. For large formations, the response to an attack can quickly become very complicated. The response may vary greatly based on many factors, such as the nature of the airborne threat, the number and types of aircraft in the formation, terrain, etc. However, some basic principles should be observed. If the intention is to break up the formation, consider the following:

9.21.1. All members of the formation should be aware of their location within the flight and should be prepared to break away from the formation to avoid a midair. The breakup should be preplanned and prebriefed to avoid conflicts.

9.21.2. If possible, an attempt should be made to maintain element integrity, thus allowing use of the two-ship tactics mentioned above, if applicable.

9.21.3. After receipt of a break call for a bandit, all aircraft will turn away from the flight and descend to terrain flight altitude and maneuver individually against the threat. When the enemy threat has passed, the aircraft will proceed to the rendezvous point. The rendezvous point should be a prebriefed point clear of the threat (e.g., a breakup between point four and five will rendezvous at point six).

9.21.4. The type of rejoin at the rendezvous point will be prebriefed. Consideration should be made for time available for delay at the rendezvous point, the number of aircraft required for the mission, ability to land at the waypoint, responsibilities of those unable to accomplish a timely rejoin, and new threat situation.

9.22. Leaving Formation. Aircraft normally will leave the formation by maneuvering away from the formation until clear. Notify lead when departing the formation. Do not rejoin until permission is received from lead.

9.23. Terminal Operations. Procedures for formation approaches and landings must be planned and briefed in detail. This, however, does not preclude common sense deviations from preplanned procedures should an unexpected situation be encountered. Aircraft should be configured for landing prior to the approach.

NOTE: Special consideration should be made of potential brown or whiteout conditions and procedures for the flight and individual aircraft to follow.

9.23.1. Wingmen should not fixate on lead or the preceding helicopter during the approach. While maintaining formation position, pilots will identify and land to either preplanned points (such as lights) or select a landing point in relation to lead and/or the preceding helicopter. Pilots must rely on periodic crosschecks and scanners to maintain position during the approach.

NOTE: It is important for wingmen to remain in a position that allows the preceding aircraft maneuvering space since significant maneuvering may have to occur in close proximity to the LZ to accomplish the landing.

9.23.2. Shallow approaches, when feasible, are best for marginal power situations since power changes and flare attitudes are minimized and all aircraft arrive in ground effect at about the same time. Shallow approaches may minimize brownouts in dusty conditions.

9.23.3. Wingmen may stack level to slightly high in order to enter ground effect at about the same time as lead. These factors help wingmen make a simultaneous landing. Stacking low will subject the helicopter to intense rotorwash. Stacking high may result in an OGE hover. Both situations result in significantly higher power requirements.

9.23.4. Go-around procedures must be preplanned and briefed in detail. Go-arounds can be executed either as a flight or individually. If lead calls "flight go-around", the flight will maintain formation integrity and execute the go-around. Additionally, wingmen may call go-around if a hazard to the flight is observed. If flight lead needs to go-around but determines it is safe to allow the wingmen to continue the approach, he will call "lead is go-around". Individual pilots, upon determining they cannot safely execute the preplanned approach and landing, can decide to execute an individual go-around. The decision will be announced on the appropriate radio net (i.e.,"two is go-around, left side"), accompanied by a change in lighting configuration to ensure visual recognition by the remainder of the flight. If another landing attempt is to be made, the choice of landing location will be made with the following priority: original preplanned landing point, a preplanned alternate landing point or an unplanned landing point. If the pilot decides to land to an unplanned landing point, the decision will be announced on a radio. If a pilot executes an individual go-around and original position in the formation must be regained, it can be accomplished by either executing a prebriefed option of repositioning on the ground at the landing area prior to takeoff, by a takeoff in the original sequence regardless of landing point, or repositioning in the air after takeoff.

9.23.5. Lead will consider the capabilities of the wingmen (gross weight, power requirements, etc.) and the condition of the landing area (obstacles, surface, etc.) when determining the type of approach to be flown.

9.24. Landing. During staggered formation recoveries, maintain 1-3 RD separation throughout the approach and landing. Increased separation may be prebriefed. Lead may direct different landing configurations depending on mission requirements, LZ layout, and surface condition (e.g., 500 feet spacing or individual recoveries).

WARNING: Avoid excessive maneuvering on final when flying large formations. Always maintain formation separation on the preceding aircraft while considering the effects your maneuvering may have on subsequent aircraft in the formation.

Figure 9.6. Lost Visual Contact - Nonmountainous Terrain.

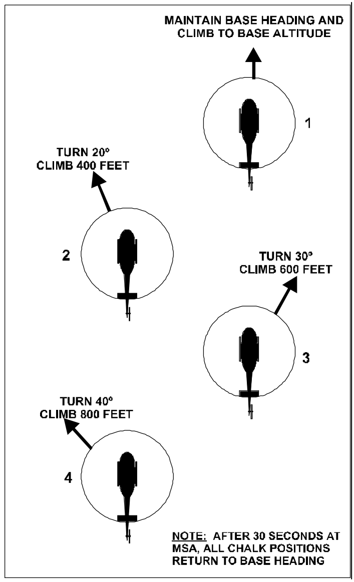
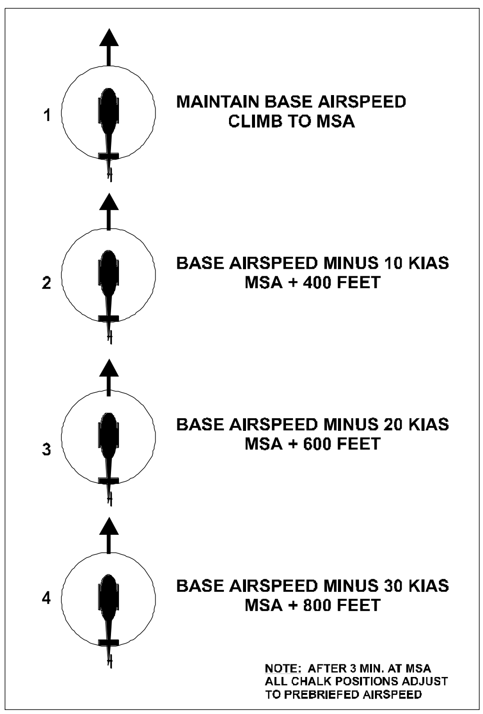


Figure 9.7. Lost Visual Contact - Mountainous Terrain.



Chapter 10

LOW-LEVEL OPERATIONS/TACTICAL PROCEDURES

Section 10A— Requirements

10.1. General. Flight below 500 feet AGL is considered low-level flying and is the subject of this chapter. Low-level flight entails greater risk than normal flight and therefore requires additional restrictions. Tactical operations may consist of low-level flight, normal flight, or a combination of both.

10.1.1. During the enroute phase, flight will be at or above 50 feet AHO or as directed by MAJCOM. Comply with crew complement requirements outlined in **chapter 2** and the requirements of this chapter.

10.2. Low-Level Flight Areas. Low-level flight must be conducted in a low-level flight area. Specific geographical areas such as missile complexes may be designated as low-level flight areas. The area/route will have defined boundaries and meet the following requirements prior to any low-level flight:

10.2.1. Established low-level surveyed routes or Low Altitude Tactical Navigation areas. MAJCOMs will publish specific operating procedures for this special category of missions in Chapter 17.

10.2.2. Complete an extensive map study of the selected areas. Annotate all man-made obstacles higher than 100 feet AGL on the flight map (or commensurate with the lowest altitude to be flow within the area). Use the Chart Updating Manual (CHUM) to ensure current obstacles are depicted on the map.

10.2.3. Helicopter low-level flight areas will be surveyed annually down to 100 feet AGL (or commensurate with the lowest altitude flown within the area). Verify all known man-made obstacles and document all new man-made obstacles on the master map and the flight maps. Annotate the survey date on the master map.

10.2.4. If low-level helicopter flight operations have not been conducted in a designated area for six months, a resurvey will be accomplished before any low-level flights are conducted in the area.

10.3. Maps:

10.3.1. A master map depicting the low-level flight areas will be maintained for flight planning purposes. Annotate all man-made obstacles over 100 feet AGL (or commensurate with the lowest altitude flown). Additionally, annotate any published low-level routes, no-fly areas, and animal farms or other hazards within the boundaries. Master maps will be updated monthly using the CHUM supplement. The date of the CHUM update will be annotated on the master map. Crewmembers should continuously scan for uncharted obstacles. When uncharted obstacles are found, temporarily suspend training and record appropriate information on to the aircrew map (location and approximate height AGL). Aircraft commanders will ensure this information is immediately passed to appropriate supervisors upon landing.

10.3.2. Maps used for flying will reflect the same information as the master map. Crewmembers will ensure the map is updated and annotated using the latest CHUM. Aircraft commanders will ensure that current operations has a copy of the planned low-level flight route.

Section 10B— Flight Planning

10.4. Map Selection. Select maps providing the detail desired to satisfy navigation requirements. Maps with a scale of 1:250,000 or greater detail are desired for low-level operations. Use a large-scale map for navigation to the objective area and if necessary/practical, transfer to a detailed map (i.e., 1:50,000 or greater) to locate the objective. Use recent aerial reconnaissance photographs of the objective area, if available. Exercise caution when transferring from one scale map to another. Make transition between maps at a prominent terrain feature, readily identifiable on both maps.

10.4.1. TPC (Tactical Pilotage Chart, scale 1:500,000) and JOG (Joint Operations Graphic, scale 1:250,000) charts depict terrain contours every 500 feet and 100 feet respectively at higher elevations. TPC and JOG charts could have an inherent error in depicting terrain elevation of up to 499 feet and 99 feet respectively. In addition, obstructions below 200 feet are not charted and are not required to be lit at night. It is possible to have an obstacle as high as 698 feet on a TPC and 298 feet on a JOG chart and not be depicted. The VFR principle of "see and avoid" applies to the ground and obstacles as well as to other aircraft.

10.5. Navigation. Thorough flight planning is the key to successful tactical/low-level operations. Pilots should arrive at their planned objective point within plus or minus two minutes of the flight plan arrival time. There are two types of low-level flying, low-level navigation and contour navigation.

10.5.1. Low-level Navigation. Low-level navigation is used when flight operations permit the use of specific headings and a constant indicated altitude and ground speed. This method of navigation lessens the possibility of enemy detection or observation in a relatively permissive environment and can be used over flat, open terrain where significant terrain features are not available for navigation reference. Use low-level navigation when flying over friendly territory or to comply with low-level corridor procedures to or from forward operating locations. Low-level navigation is less demanding than contour navigation because it permits the use of standard dead reckoning (DR) techniques.

10.5.2. Contour Navigation. During contour navigation, the pilot preplans a route based on charted terrain features leading toward the objective. Ground speed, obstacle clearance altitude, and heading may vary considerably based on the terrain, weather, visibility, and the anticipated threat. Indicated altitude will vary considerably since the pilot maintains a relatively constant obstacle clearance altitude in order to take advantage of the available contours.

10.5.3. Navigation While Terrain Masking. Low-level flying often requires a combination of both low-level and contour navigation to gain effective terrain masking. The aircraft should be flown to use terrain and vegetation objects to degrade the enemy's ability to visually, optically, or electronically detect or locate the aircraft. Depending on the available terrain and based on anticipated threats, airspeed and obstacle clearance altitude may vary. The aircraft commander preplans his route to take maximum advantage of significant terrain features in order to mask the aircraft's flight. As the flight proceeds, the pilot may make additional changes to his preplanned route, varying his flight path to take advantage of available tree cover, minor depressions, and/or small ridgelines not detectable in map study. Terrain masking tactics require significantly more preplanning and map familiarization for successful navigation.

10.6. Route Selection. Select routes avoiding enemy threats and, if possible, provide safe areas for a precautionary landing. As a minimum, base route determination on the following:

10.6.1. Avoid known hostile locations.

10.6.2. Use available terrain features for masking and navigation purposes.

10.6.3. Avoid a direct routing to the objective. Plan sufficient course changes to avoid disclosing the objective. If possible, do not use the same routing for ingress and egress. Low-level navigation training routes should be at least 30 minutes long with a minimum of three turn points. Routes will include the area within two NM either side of centerline as a minimum.

10.6.4. Normally, do not exceed 20 NM between checkpoints for dead reckoning. The type of terrain will dictate the selection and distances between checkpoints.

10.6.5. Establish an initial point (IP) over a prominent feature easily identifiable from low altitudes. The IP is a point near DZs, LZs, or extraction zones over which final course alterations are made to arrive at the specified objective. The distance from the IP to the objective will vary with the situation but should be approximately 3-12 NM from the objective.

10.6.6. Aircrews will review and deconflict low altitude charts for IFR, VFR, and slow speed low altitude (IR, VR, and SR) training routes and annotate potential conflict areas along the proposed routes during premission planning.

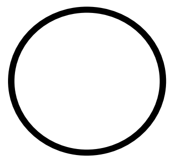
10.7. Map Preparation. Carefully review maps to identify obstacles and hazardous terrain. Annotate hostile threats and turning/checkpoints on the map (this information may classify the map). Establish specific course lines between turning points for low-level navigation. When terrain masking, these lines do not necessarily represent the ground track to be flown. Time tick marks based on an established ground speed are optional. These marks may be established for each leg or be cumulative for the entire route. Other flight planning data and information may be annotated; however, use caution to avoid obscuring pertinent information. Mission commanders are allowed to modify the symbols used based on the actual mission profile, threats, terrain, political considerations, etc.

10.7.1. Pilots must compute a minimum safe altitude for each leg of the low-level route. For flights conducted in a designated low-level area, one minimum safe altitude may be computed for the planned area of operation. The heading and altitude must provide a minimum of 1,000 feet (2,000 feet in mountainous areas) clearance above obstacles within five NM. This altitude will be used in the event of inadvertent IMC. Mountainous areas are defined as areas where a 500 feet elevation change occurs within one half NM of the flight path.

10.8. Standard Symbols for Map Preparation. The following standard annotations and symbols should be used in preparing maps for both tactical and nontactical operations. Use markers, tape symbols, or other devices that won't smudge or be inadvertently erased. Use a plotter for annotating standard symbols. Other symbols may be used in addition to those listed.

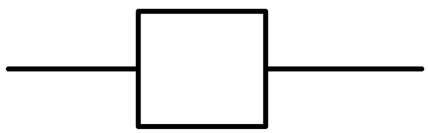
10.8.1. Way point. Use a circle to depict en route points where the aircraft course is altered or key actions occur. Label waypoints consecutively to facilitate identification. If used, place corresponding navigation information blocks (NIB) immediately adjacent to the course line.

Figure 10.1. Waypoint.



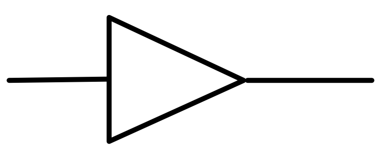
10.8.2. Initial Point (IP). The IP is identified by a square centered on the point.

Figure 10.2. Initial Point.



10.8.3. Objective Point (OP). The OP is identified by a triangle centered on the planned point with the apex pointing in the direction of flight.

Figure 10.3. Objective Point.



10.8.4. Navigation Information Block (NIB). The NIBs are designed to give the crew the required navigational data from the present waypoint to the next waypoint. If an AF Form 70, Pilot's Flight Plan and Flight Log, is used, the NIB is not required.

10.8.4.1. To waypoint: The designator of the next waypoint.

10.8.4.2. MAG Heading: The magnetic heading to the next waypoint.

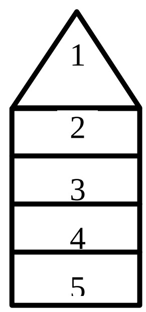
10.8.4.3. Distance: Enter the distance to the next way point or leg distance.

10.8.4.4. ETE: The time to the next waypoint.

10.8.4.5. Fuel: Fuel required to complete the planned flight and reserve.

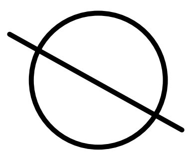
10.8.4.6. MSA: Minimum Safe Altitude for each leg.

Figure 10.4. Navigation Information Block.



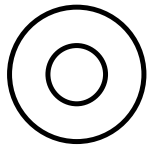
10.8.5. Emergency Landing Bases (optional). Use a single circle with a diagonal line to identify those airfields compatible with unit aircraft and which may be used in an en route emergency.

Figure 10.5. Emergency Landing Bases.



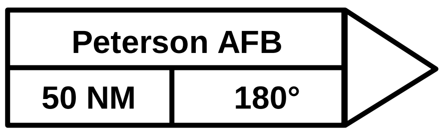
10.8.6. Alternate Recovery Bases (optional). Use two concentric circles to identify those airfields compatible with unit aircraft and which are preferred for recovery in case the primary base is unusable because of weather, damage, or other reasons.

Figure 10.6. Alternate Recovery Bases.



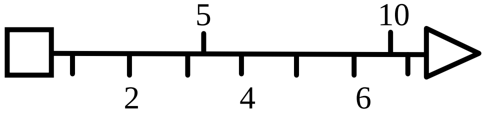
10.8.7. Recovery Arrow Box (optional). Use a horizontally divided arrow box pointing in the general direction of the alternate recovery base to provide navigational information to the alternate base. This box depicts base name, distance in NM, and magnetic course from divert point to alternate base.

Figure 10.7. Recovery Arrow Box.



10.8.8. Course Line and Time/Distance Marks. Draw course lines for the entire route inbound to the objective and continue on to portray the return route.

Figure 10.8. Course Line and Time/Distance Marks.

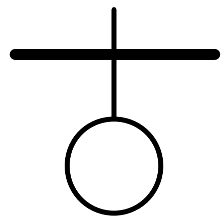


10.8.8.1. Time Marks (optional). Place them on the right side of the course line. Time marks are of particular value along the pre-initial point route segment.

10.8.8.2. Distance Mark (optional). When used, place them on the left side of the course line.

10.8.9. Hostile Area Entry Point (optional). A heavy line identifies and locates the point at which the flight route crosses into an area where hostile threats may be encountered. The line extends at least one inch on either side of the course line. The entire Hostile Threat Area should be annotated, if known.

Figure 10.9. Hostile Area Entry Point.



10.8.10. Operational Advisory Annotations. Advisory annotations concerning operational aspects of the mission are positioned to the side of the course line. The annotations consist of a line at the point en route where the function should be performed with the action noted on the side end of the line. The action description may be either enclosed in a box or left open at the discretion of the mission planner. Examples of these operational advisories are as follows: start climb, start descent, IFF/SIF Standby, Lights off, lights on, TACAN receive only, IFF/SIF-On, TACAN-T/R.

Figure 10.10. Operational Advisory Annotation.

10.8.11. Order Of Battle (OB). Depict threat information directly on the navigation chart using standard symbols and annotations.

10.9. AF Form 70, **Pilot's Flight Plan and Flight Log**. Prepare an AF Form 70, or a more detailed navigation log for each mission and include the following as a minimum: turning points, headings, distances, ETEs, MSAs and fuel computations. An AF Form 70 is not required if the above information is included on the map.

Section 10C— Enroute

10.10. Power Available Check. Perform a power available check (IAW para 6.7.) prior to low-level operations.

10.11. Crew Coordination. Crew coordination is a critical factor during low-level operations. Limit crew conversation to accomplishment of essential tasks. Each crewmember will call out hazardous obstacles and assist navigation by identifying prominent features along the route.

WARNING: 3 to 3´ seconds are needed from the time a stimulus (perceived closure rate, crewmember input, etc.) is received and recognized until the reaction (control input, crewmember action, etc.) to the stimulus is complete. All crewmembers need to be cognizant of this relationship, especially during critical phases of flight.

10.12. Pilot Responsibilities:

10.12.1. Plan enough room for cruise airspeed maneuvering.

10.12.2. Be aware of wind direction and velocity.

10.12.3. Avoid steep angles of bank. At approximately 45 degrees, the tip path plane will be below the landing gear.

10.12.4. Do not attempt to clear terrain and obstacles by cyclic inputs alone. Climbs and descents are best accomplished by coordinated cyclic and collective inputs. Be aware of abrupt aft cyclic inputs while low-level because they may result in tail rotor contact with surface obstructions.

10.12.5. Anticipate power requirements when approaching a ridgeline. If feasible, increase power early and accelerate so that when the climb is initiated, there will be sufficient airspeed to assist in clearing the terrain. Approach ridgelines at approximately 45 degrees; this provides an escape route if power is insufficient to climb over the ridge or if an unexpected threat is encountered on the other side.

10.12.6. Special consideration should be given to preplanning immediate actions in the event of engine failure while low-level. Leave an escape route whenever possible.

10.13. Pilot Not Flying Responsibilities:

10.13.1. Monitor aircraft position on the map at all times.

10.13.2. Keep the crew informed of threats, ETAs, descriptions of turning points, and intermediate checkpoints.

10.13.3. Announce the direction of turn for the next leg prior to the turning point. When reaching a turning point, give the pilot a turn and tell him when to stop.

10.13.4. Compare actual time and fuel against planning data at each checkpoint.

10.13.5. Monitor cockpit instruments.

10.13.6. Make radio changes.

10.13.7. Monitor and update navigation aids.

10.14. Enemy Threat Encounter. If appropriate, initiate immediate evasive action if exposed to ground/air threats. The evasive maneuver used will depend upon the nature of the threat, aircraft limitations, and terrain. Use jinking (rapid turns, climbs, and descents) or terrain masking away from the preplanned route. The aircrew must continue to navigate during these maneuvers so that the mission may be resumed once the threat is evaded. Plot threats on the map for intelligence debriefing after the flight.

10.15. Evasive Maneuvering:

10.15.1. Evasive Maneuver Training. For safety, do not initiate a break call or evasive maneuver below 100 feet obstacle clearance. Maintain evasive maneuvers above 100 feet obstacle clearance. Pilots will make crew advisory calls prior to turns and will clear their flight path throughout maneuvering.

10.15.2. General. No rigid set of procedures can be given to cover all tactical situations since the maneuvers used by a helicopter force vary according to the threat and tactical situation. For a formation to successfully execute evasive maneuvering, preplanning (in the form of certain radio calls and agreed upon responses to those calls) is essential. However, in all situations a decision must be made promptly whether to take evasive action. Once the decision to take evasive action has been made, the maneuver must be initiated immediately.

10.15.3. Attack Warning. A successful evasion depends on the timely receipt of an attack warning. Adequate warning is contingent upon effective lookout techniques and rapid communications; i.e., radios calls in a communications-out environment.

10.15.4. Lookout Doctrine. Each aircrew member must be assigned a sector of lookout responsibility. Within the limitations of aircraft configuration, the aggregate of such sectors shall provide 360 degrees of lookout around the aircraft.

10.15.5. Exact terminology should be used when calling threats. Some examples are:

10.15.5.1. Bogie - Any aircraft not positively identified as friendly.

10.15.5.2. Bandit - Any aircraft positively identified as hostile.

10.15.5.3. SAM - Visual sighting of missile launch.

10.15.5.4. Triple A - Visual sighting of antiaircraft weapons.

10.15.5.5. Ground Fire - Visual sighting of small arms fire.

10.15.6. The sequence and content of threat calls must be accurate and succinct. The "break" call implies two critical elements, you are engaged and the aircraft is CLEAR in the direction of the break called. If a break is required to the opposite side of the aircraft from the scanner calling the break, the opposite scanner is responsible to immediately call "CLEAR RIGHT/LEFT" or "STOP TURN" and the reason the aircraft is not clear to turn. When calling a break, use the following sequence:

10.15.6.1. Desired Evasive Maneuver.

10.15.6.2. Type of Threat.

10.15.6.3. Clock Position.

10.15.6.4. Relative altitude.

10.15.6.5. Distance.

10.15.6.6. Description of Threat (time permitting).

10.16. Unknown Position. If a checkpoint cannot be identified, continue on course (as a guide, use leg time plus ten percent) and then turn to the next course. Continue the route without establishing the exact position only if prominent terrain features can be readily identified and the area of planned over flight is relatively secure. Climbing may assist in determining position by increasing the field of vision; however, you will be more susceptible to enemy detection. If a climb is initiated, concentrate on reorientation so a descent can be made as soon as possible. If position cannot be established, abort the mission. During training, if unable to establish your position, climb to a safe altitude and reorient yourself before resuming low-level navigation.

Section 10D— Terminal Operations

10.17. Concept of Operation. The concepts, procedures, and techniques in this chapter describe a low-level mission profile that degrades enroute hostile threats. The most likely threat encountered by H-1 aircraft is a terminal area threat, i.e., hostility within and around the intended landing zone. This mission profile more closely resembles an air assault/air mobile operation than a typical combat SAR or special operations mission. Tactics that allow a safe landing in an LZ, which is very close to an incident site, must be used to ensure that the mission can be accomplished. Therefore, in addition to guidance for general low-level flying, the following information is provided.

10.18. Tactics. To get in close proximity to hostile small arms fire or even larger weapons, the helicopter must remain visually concealed as long as possible and/or be supported by suppressive friendly fields of fire. To take advantage of terrain relief, natural vegetation, and man-made obstacles, the aircraft should be flown at an altitude that affords protection. Consider using pre-arranged ground signals to help identify the landing area. The aircraft landing area and arrival and departure paths must be coordinated with the ground forces.

10.19. Safety. Flight below 100 feet has risks that can be minimized by reducing airspeed (ground speed) and limiting aircraft attitude changes (maneuvering). Proper mission planning should result in a "near straight in approach" from the enroute phase. Airspeed must be reduced to remain in a see-and-avoid envelope for the increasing proximity to the ground and hazards. Pitch changes (angle of bank and tail low attitudes) must be minimized. Staying within the aircraft's height-velocity envelope, flying into the prevailing wind, and avoiding settling with power profiles are major considerations. Flight safety must never be needlessly compromised for threat avoidance.

10.20. Low-Level Flight and Tactical Approaches:

10.20.1. Power Reserve. A major factor affecting low-altitude flight is power reserve, especially in mountainous terrain. During training in multi-engine helicopters, when safe single-engine performance is not available, consider flying at a higher altitude and maintaining single-engine airspeed or above.

10.20.1.1. Prior to any steep turns (45 degrees or more) when power available is critical, ensure airspeed is adequate to trade for necessary "g" loading to maintain level flight. To prevent ground impact during a steep turn immediately decrease the angle of bank, then increase "g" loading.

10.20.2. LZ size is restricted to two rotor diameters. Maintain all parts of the helicopter well clear of all obstacles. All crewmembers must actively scan for obstacles during the landing phase.

10.20.3. Tactical approaches will only be performed during tactical training maneuvers and missions where the risk of flying a normal rectangular pattern or turning approach would be greater than maneuvering directly for an approach or landing.

10.20.4. Tactical Approach. This approach is used during missions requiring low altitudes for ingress to the objective, maneuvering in a limited area and transitioning into a landing/hover with minimum exposure. Included in tactical approaches are high to low speed straight ahead and turning approaches. These approaches are more demanding and may involve constant change of approach angle, airspeed, and rate of descent. Keep the crew informed of position in the approach. This enables the crew to clear the flight path for the pilot.

10.20.4.1. The tactical approach may be started from any position in relation to the landing/hover area. Be aware of tail rotor clearance throughout the deceleration phase. Align the final portion of the approach into the wind, if possible. At high density altitudes with heavy gross weights, anticipate blade stall. Anticipate power increases prior to completion of the deceleration. To avoid vortex ring state, do not exceed the vertical velocity limits for the type approach being flown. Constantly monitor main rotor RPM to prevent main rotor overspeeds.

10.20.4.2. Exercise care when decelerating in a low-level environment. During a low-level deceleration above 50 feet, it is permissible to rotate the helicopter around the transmission. However, when below 50 feet, pilots will rotate the helicopter around the tail rotor. This is accomplished by increasing collective to maintain tail rotor altitude and then applying aft cyclic to decrease airspeed. **figure 10.11.** depicts tail rotor clearances when the helicopter is rotated around the tail. In either case, extreme caution must be used when descending below 50 feet and on the approach to prevent tail rotor to ground contact.

10.20.5. Quick Stop. This is a high-speed, low-level deceleration maneuver used in a tactical environment to reduce exposure to enemy threats. **figure 10.12.** shows a typical tactical approach using the quick stop maneuver. It is designed to position the helicopter, as rapidly as possible, into a hover or landing attitude by delaying the flare until the last possible moment. This allows the crew to take advantage of low-altitude terrain masking while maintaining a faster approach speed after crossing the IP. In most quick-stop approaches, a gradual flare to trade airspeed for distance can be used (20 degrees or less). However, in some tactical situations, because of the element of surprise required to carry out an operation, a faster approach and greater flare will be required to slow the helicopter. If this type flare is required, aircrews must be aware of tail rotor ground contact limits contained in the flight manual. The maneuver is used at altitudes from 50-300 feet and incorporates the same guidance as outlined in the discussion of tactical approaches.

Figure 10.11. H-1 Tail Rotor Clearance.

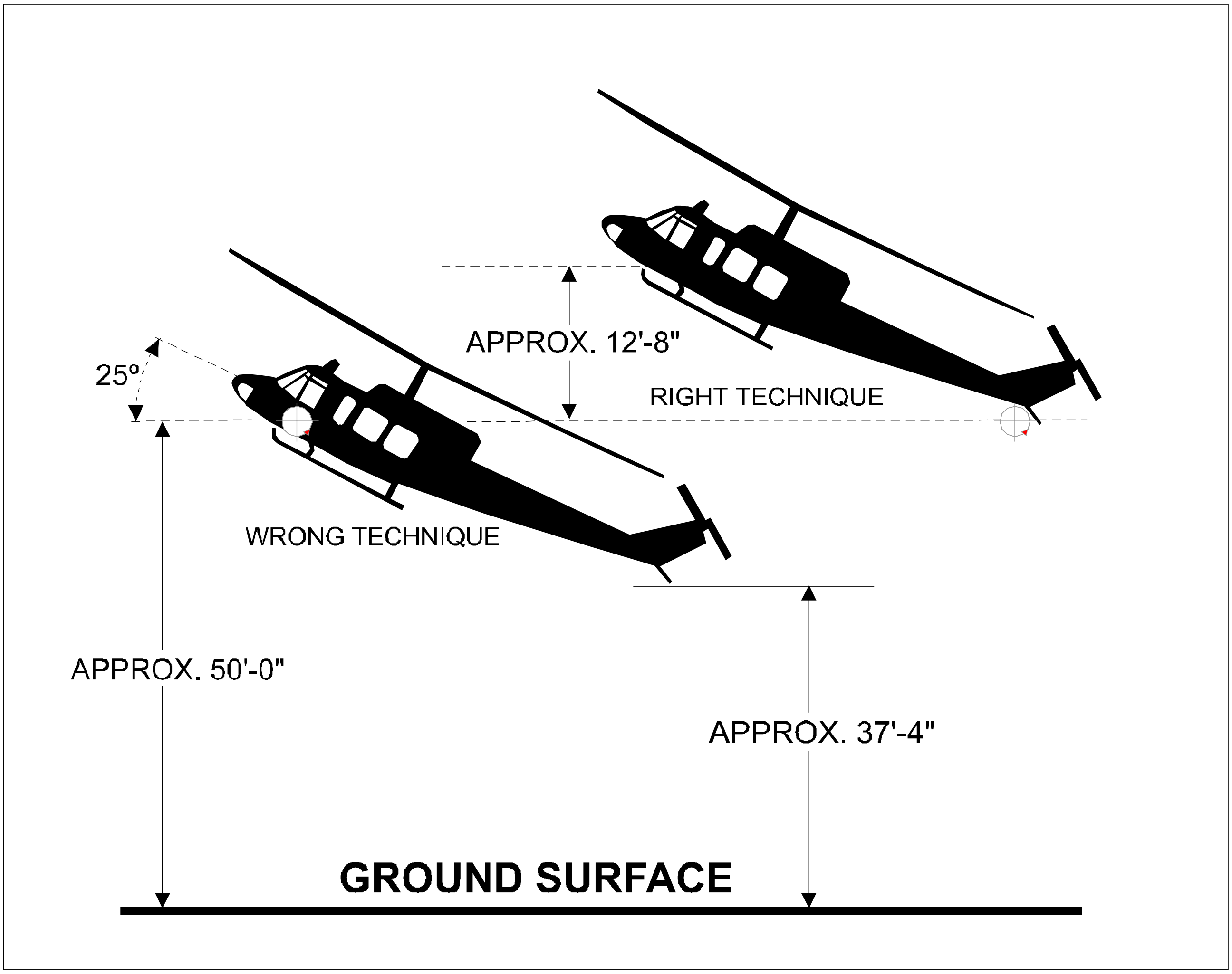
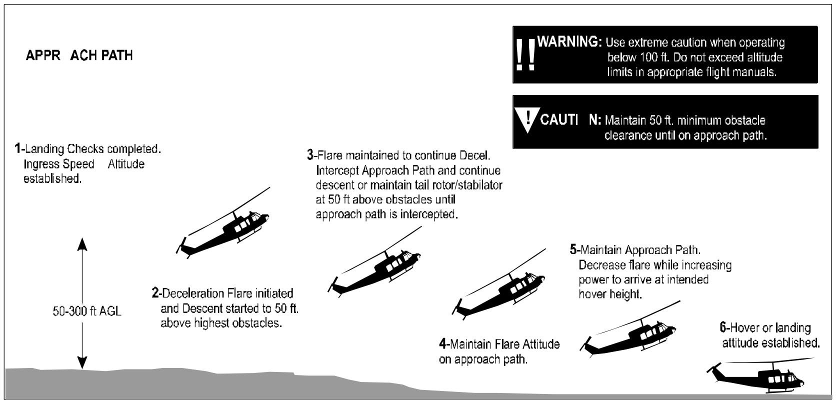


Figure 10.12. Tactical Quick Stop Maneuver.



Section 10E— Contingency Mission Planning

10.21. Employment Concept. Prior to detailed combat/contingency mission planning, the mission planner must develop the employment concept. Consider including the following information.

Table 10.1. Employment Concept Considerations.

Tasking order	**Mission: Primary and Alternate**	
(if applicable)	Time On Target (TOT)	
	Mission Aircraft	
	Ordnance	
	Objective Coordinates	
	IFF Squawk	
Intelligence	Security Classification	
	General Situation	
	Hostile capabilities: Enroute and Objective	
Weather	Local	
	Enroute	
	Objective	
	Egress	
Communications	Sequence	
	Frequencies	
Execution	Pre-Launch	Crew rest and show time
		Planning time and briefing time
		Special instructions (cover story, alternates, etc.)
		Rules of Engagement (ROE)
		DO or CC back brief time

		Special equipment
		Fuel
	Launch	Engine start and takeoff time
		Sequence
		Join-up, formation, and rendezvous
		Go/no-go procedures
	Ingress and Egress	Route: Primary and Alternate
		Enroute NAVAIDs and Waypoints
		Airspeed and altitude
		Rendezvous
		Known hostile locations
		Abort plan
	Terminal Area	LZ: Primary and Alternate
		Suppressive fire plan
		Holding area
		Command, control, and communications
		Identification and authentication
		Insertion procedures
	Backup Force (BF) Plan (if required)	
	Emergency Procedures	Aborts
		Lost communication procedures
		Inflight emergency or downed aircraft
		IMC Procedures/Divert bases
	Support Procedures	Refueling
		Fire support (TOT, ground, type)
		Intelligence
	Command and Control	Mission Commander
		Airborne Mission Commander (AMC)
		On-Scene Commander (OSC)
		Formation lead
		Recall procedures
		Signals and Code words

10.22. Mission Commander Pre-Launch Guide. The depicted sequence of events is intended to serve as a guide to assure all required pre-launch actions are accomplished.

Table 10.2. Mission Commander Pre-Launch Guide.

Breakout tasking order (if applicable).	Tasked forces
	Alert window (if applicable).
	TOTs
Establish objective	Formulate initial game plan
	Check weather forecast
Consult with aircraft commanders (including	Provide initial game plan
off station participants) and BF team	Discuss deconfliction concepts
leader(if applicable).	Discuss support force employment
Establish TOTs	Planned and Alternate TOTs for late takeoffs
Brief all participants on unique considerations, such as live ordnance and range restrictions	
Ensure fuel coordination is accomplished	
Cross-check all route time and space relationships for conflicts	
Establish firm takeoff times and proper crew rest for crews	
Develop a detailed taxi, arming, and loading plan	
Sit back and “what if” your plan	Aborts
	Weather impacts

	Takeoff delays
	Range restrictions
	Means of passing mission essential advisories
Conduct a mass briefing to ensure everyone knows exactly what everyone else is doing (mission commander's briefing).	
Schedule a debrief to thoroughly assess problems and successes	

10.23. Mission Commander Briefing Guide. Plan a brief interval between aircrew show time and briefing start time for crews to review contents of mission handouts and complete other administrative details.

Table 10.3. Mission Commander Briefing Guide.

Briefer and visitors	Intelligence	Terminal area
Time hack	Hostile situation	Primary LZ
Roll call	Hostile capability	Alternate LZ
Mission	COMSEC and OPSEC procedures	Suppressive fire
Classification	Debriefing time and place	Holding area
Primary and alternate	Weather	Landing heading/formation
Objective	Takeoff, en route, terminal	ROE
General routing	PA, temp, and wind	Load, PAX, and cargo
Onload requirements	Alternate and recovery bases	Hazards and NOTAMs
Maps	Sunrise and sunset	Egress
Tasked organization(s).	Munitions	Primary route/way points
Aircraft assignments	BF weapons (if required).	Alternate route/way points
Tail numbers	Personal weapons	Emergency LZ
Call signs	Execution	Destination
Fuel loads	Pre launch	Fuel
Load description	Start time	BF briefing (if required)
Other aircraft	Communications check time	Emergency procedures/aborts
Command	(frequency and sequence)	Systems
AMC and OSC	Taxi time	Weather
Formation lead	Special equipment required	Lost communications
Ground commander (if	Fuel required	Escape and evasion
applicable).	Launch	Inflight emergency or
Recall procedures	Takeoff heading	downed aircraft
Communications	Formation	IMC
Control agencies	Go/no-go procedures	SAR
Frequencies/sequence	Enroute	Refueling procedures
Authentication	Primary route and way points	Debriefing
NAVAIDs	Alternate route and way points	Maintenance
Code words	Formation	Operations
Comm-out signals	Airspeed and altitude	Intelligence
IFF squawks	Frequency change procedures	Mass debrief
	Flight lead change procedures	Special items
	Known hostile locations	Transportation
	Hazards and NOTAMs	Messing
		Life support
		Flight safety

Chapter 11

HOIST OPERATIONS

11.1. General. Alternate insertion/extraction (AIE) is the insertion or extraction of any personnel by means other than landing the aircraft, to include hoist operations. The following procedures apply to both day and night operations. Night hoist operations can be safely accomplished using aircraft lighting and/or night vision goggles. Use these procedures unless there is a conflict with the flight manual.

11.2. Standard Configuration:

11.2.1. All hoist-equipped aircraft will have precision wire rope cutters readily available in the event the electrical cable cut guillotine fails. Affix cable cutters to the aircraft or hoist for quick access.

11.2.2. A hoist cable quick splice device will be carried on all hoist-equipped aircraft.

11.2.3. During all live hoist operations, the aircrew, based on the mission, will determine if carrying additional AIE equipment is necessary.

11.3. Aircrew Procedures:

11.3.1. Perform a power available check (IAW para **6.7.**) prior to hoist operations.

11.3.2. Throughout the entire recovery phase, the pilot not flying/flight engineer monitors the flight instruments and advises the pilot when reaching the altitudes, airspeeds, and rates of descent prescribed. When in a hover, the pilot not flying cross-references the attitude indicator and the reference marker. If the pilot becomes disoriented, initiate an instrument takeoff or direct the other pilot to assume control of the aircraft.

11.3.3. If a loss of engine power is experienced while hoisting, continue to hoist the person into the helicopter or attempt to lower the person to the surface, whichever is most feasible. It may be necessary to cut the cable. Should an inadvertent landing occur, primary consideration must be given to moving away from personnel on the ground.

11.3.4. During live hoist training, personnel will wear eye protection, heavy or flight gloves, and a helmet when riding the hoist. The aircrew or PROTEC®-type helmet may be used. Exception: During water hoist operations, deployed personnel may delete this requirement if it interferes with the wear of survival/SCUBA equipment. During training missions, terminate live hoisting immediately at the first indication of hoist equipment malfunction. If possible, return the individual to the surface by lowering the aircraft.

11.4. Hoist Training Precautions:

11.4.1. Land Hoist:

11.4.1.1. Pilots should consider escape routes and emergency landing areas when conducting hoist training. Hoist training over trees may be conducted at sites adjacent to suitable emergency landing areas.

11.4.1.1.1. Power requirements for live hoist training are: clear escape route, power for intended hover height +5 percent; restricted escape route, OGE hover power +5 percent.

11.4.1.2. Restrict live hoist training to the minimum necessary to accomplish initial qualification, requalification and proficiency training. Unit commanders determine eligibility of personnel to ride the hoist during training. Recommended hoist altitude is 10 feet, but will be no higher than 25 feet.

11.4.2. Water Hoist:

11.4.2.1. Conduct water training at approved water operating areas using the following criteria:

11.4.2.1.1. Conduct all water hoist training a minimum of 100 yards offshore. For live hoist training, hover at the minimum altitude necessary to avoid salt spray.

11.4.2.1.2. Radar altimeters must be operable for all water operations.

11.4.2.1.3. Life preservers will be worn by helicopter aircrews and passengers, HEEDs (helicopter emergency egress device) will be worn by crewmembers, and a life raft will be carried on overwater flights when the route of flight is beyond autorotational gliding distance of shore. Life rafts are not required if a radio-equipped boat or a hoist-equipped helicopter provides cover. Life rafts, life preservers, or HEEDs are not required when overwater flight occurs only for short distances immediately after takeoff or before landing.

11.5. Exercise Procedures:

11.5.1. Alternate Extraction:

11.5.1.1. Personnel on the ground acting as survivors and instructors are necessary to provide realism and supervision during exercises. The above personnel may ride the hoist, rope ladder, etc., during exercises according to the following:

11.5.1.1.1. Survivors. Personnel not familiar with AIE operations will require a qualified observer. This requirement may be met by lowering a qualified crewmember to assist the survivor.

11.5.1.1.2. Select a clear area for the recovery to enhance speed and safety and to allow the helicopter to land or use the extraction device from as low a hover altitude as possible and/or practical. If a recovery is to be accomplished from a forested area, the foliage must be sparse enough to ensure the survivor will not be dragged through the branches. When practical, select areas with trees of a minimum height to decrease recovery time and provide additional safety for the survivor in the event of hoist or other equipment malfunction.

11.5.1.2. Other exercise personnel. Every practical effort will be made to recover other exercise personnel by landing. They may be recovered by hoist if the remaining range time prevents movement of these personnel to a suitable landing area, or when an extended period of time is required to reach a suitable landing area. These personnel will be briefed to select an area within a reasonable distance that will allow the helicopter to hover as low as practical.

11.6. Hoist Operator Procedures. The primary hoist operator will be the flight engineer or aerial gunner. The hoist operator's duties are to relay directional instructions on intercom and to operate the hoist from the cabin position leaving the pilot free to concentrate on hovering.

11.6.1. Protective Equipment. The hoist operator will wear a heavy work glove in addition to a flight glove on the hand used to guide the hoist cable and have the helmet visor down (visor down is not required when wearing NVGs).

11.6.2. Voice Procedures. The hoist operator directs the pilot over the survivor or hover point using standard terminology. Instructions should be clear and concise with commentary on the progress of the approach and hover operation. The hoist operator can aid the pilot with airspeed control during the approach by describing the reduction of distance, in a numerical sequence, from a given point from the survivor to a hover point over the survivor. The frequency of numerical calls made should indicate the speed of the helicopter toward the survivor or closure rate. A closure rate is not given in a preset distance of feet, yards, or meters. An example would be "survivor at twelve for one hundred, seventy-five, fifty, forty_" The faster the call, the more rapid the closure. "Five, four, three, two, one, stop." If the groundspeed is too fast and you cannot safely slow the helicopter down in time, do not hesitate to call "go-around." Standardized words for directions and motion may be added to better describe actions necessary for safe operation; i.e., "Slow forward, turn right, stop back." See the following examples:

Table 11.1. Standard Terminology for Motion and Direction.

MOTION	DIRECTION
Fast	Forward
Slow	Back
Stop	Right
Hold	Left
Turn	Up
Raise Helicopter (for initial lifting of survivor)	Down

11.6.3. Intercom Failure. Do not initiate hoist training with the hoist operator's intercom inoperative. If an intercom failure occurs during hoist operations between the pilot and hoist operator and cannot be remedied by changing intercom cords, have the copilot or another crewmember relay the hoist operator signals to the pilot. The hoist operator gives directions by moving an open hand with the palm turned in the desired direction of movement. To hold position, clench the fist. The hoist operator can direct use of the hoist control or indicate hoist operation by extending the thumb of a clenched fist either up, down, in or out, as applicable. To indicate “survivor in and secure, and ready for takeoff,” make circular motion with hand and then point in the direction of intended takeoff.

11.6.4. Monitoring Equipment. Monitor the hoist mechanism to ensure proper cable feedout and retrieval. Crew briefings prior to hoisting will include positive actions to be taken in the event of equipment malfunctions or impending failures.

11.6.5. Monitoring Cable. Exercise caution during hovering operations to preclude anchoring the helicopter hoist hook or cable around an immovable object. The hook and cable should be kept in view at all times to prevent the cable from becoming entangled with ground objects. If the hook or cable should become fouled, attempt to free it by letting out slack and manipulating the hoist cable by hand. Use caution when applying tension to the cable. If the cable should break, cable whiplash action can cause rotor damage. Notify the aircraft commander any time the hoist cable cannot be adequately monitored. In such cases, alternate methods of making the pickup should be considered or an additional crewmember should be used to help monitor the hoist cable. Ensure cable slack is held to the minimum necessary to perform the recovery. Excessive slack can be especially dangerous during a water recovery since the survivor cannot see the cable.

11.6.6. Grounding. Ground the hoist hook to discharge static electricity to prevent personnel on the ground or water from sustaining a shock. To preclude ignition of fuel, do not ground the hoist near spilled fuel from damaged aircraft or vehicles.

11.6.7. Retrieving Survivors. When pulling the survivor into the helicopter, the easiest method is to turn the survivor's back to the helicopter and pull in. This procedure reduces the possibility of semi-conscious or injured survivors fighting the hoist operator. The flight engineer may request the pilot to operate the hoist boom and let out cable to assist in the retrieval of the survivor. Normally, the hoist operator will raise the survivor, however he may request the pilot to "raise the helicopter". The hoist operator will keep the pilot advised of the survivor's position.

11.6.8. Retaining Pin Procedures. To prevent dropping the rescue device, use the hoist hook safety/ retaining pin. When raising or lowering an empty stokes litter for water recoveries, the use of the safety/retaining pin is not required. This makes it easier to remove the litter from the hoist hook. Install the safety/retaining pin prior to hoisting the litter with a survivor.

11.6.9. Pendulum Action and Rotations. Pendulum action is defined as a two-dimensional movement of the cable (swinging). Rotation refers to the normal rotation of the hoist hook on the hoist cable. It is imperative that pendulum action or rotation of the rescue device be recognized and corrected immediately. Delay in doing so may produce pendulum action or rotations of unmanageable proportions. The pendulum action and/or rotations may reach a magnitude sufficient to cause hoist cable-to-aircraft contact.

11.6.9.1. The pendulum action may be dampened by moving the cable in the opposite direction of the movement of the rescue device. Rotation of the rescue device can be stopped, if detected early, by rotating the hoist cable in a one or two foot circle in the opposite direction of the rotation of the rescue device. The techniques used for the control of stokes litter pendulum action are the same as for any other rescue device.

WARNING: Raising a swinging load will only increase the pendulum action. A swinging load should be stopped where it is until the pendulum action is stopped. If the pendulum action is severe, return the rescue device and/or survivor(s) to the ground. The pilot can transition to forward flight up to 30 knots to stop pendulum action and/or rotation.

11.7. Inert Survivor Recovery. Hoisting procedures for the recovery of an unconscious or inert survivor from water or land areas are as follows:

11.7.1. The hoist operator determines if the victim is unconscious or unable to enter the rescue device. The pilot directs one of the crewmembers to be lowered by the hoist and another to act as hoist operator. Use qualified medical personnel, when available, as primary crewmembers for deployment to aid an injured or inert survivor.

11.7.2. The hoist operator ensures the crewmember being lowered is properly equipped and the equipment is properly adjusted. Advise the pilot when the crewmember is ready to be lowered.

11.7.3. Secure the survivor for hoisting and give a "thumbs up" signal to indicate the survivor is ready for pickup.

11.8. Civilian Law Enforcement or Medical Personnel. The primary method of deploying or recovering civilian law enforcement or medical personnel is by landing. Civilian law enforcement or medical personnel may be deployed and recovered by rescue hoist provided all other transport resources have been examined and determined to be inadequate and the civilian is briefed on the potential hazards and volunteers for such operations.

11.8.1. Prior to rescue hoist deployment, civilian law enforcement or medical personnel will be briefed on:

11.8.1.1. Rescue devices to be used.

11.8.1.2. The pilots' intentions during an aircraft emergency to include engine failure, hoist malfunction, loss of communication, and alternate pickup areas.

11.8.1.3. Use of the survival radio.

11.8.1.4. Survival vest content/usage.

11.8.2. The following constraints apply:

11.8.2.1. An aircrew member should accompany the civilian personnel on the hoist provided weight limitations of the hoist are not exceeded.

11.8.2.2. Maintain the lowest hover possible.

11.8.2.3. A survival vest will be worn when available.

11.8.2.4. An aircrew or PROTEC®-type helmet will be worn. Exceptions will be at the discretion of the aircraft commander.

11.9. Rescue Devices. The aircrew determines which device to use. A survivor unfamiliar with the rescue device should be assisted by a crewmember, briefed over a loud hailer, or provided printed instructions attached to the device to ensure proper entry and security for a safe pickup. The rescue hoist will not be used to relay messages except when all other possible means of communications have been exhausted. In this event, the rescue hoist may be used only when necessary in a life or death situation or to determine if one exists.

NOTE: Rescue devices used for hoist training will be identical to and configured the same as operational equipment. If live hoist training is to be conducted, only operational equipment will be used.

11.9.1. Forest Penetrator. The description and maintenance instructions for the forest penetrator are contained in TO 14S6-3-1, *Operations and Maintenance Instructions with Parts List, Forest Penetrator Rescue Seat Assembly* and TO 00-25-245, *Operating Instructions Testing and Inspection Procedures for Personnel Safety and Rescue Equipment*, section IV. The forest penetrator can be used for single or multiple recoveries from land or water. It is recommended for recovering personnel whose parachutes have become entangled in trees. It allows assisting personnel use of both hands to aid the survivor. The forest penetrator can be used to recover inert or injured personnel safely with the exception of those with back injuries. Use the following procedures:

11.9.1.1. Fold the seat paddles and stow velcro safety straps before lowering the forest penetrator through trees or dense foliage.

11.9.1.2. If the hoist operator loses sight of the rescue device, the cable tension must be relied upon to detect when the penetrator has reached the ground. If it appears the penetrator has reached the ground, it should be raised several feet and re-lowered to ensure it is not hung up.

11.9.1.3. When there is no communication with the survivor, the hoist operator will hold the hoist cable to detect the survivor's signal. A jerk on the cable is the signal to start retrieval. Hoist retrievals from trees must be slow enough to allow survivors to fend off branches and prevent cable entanglement.

11.9.1.4. It may be possible for a crewmember on the penetrator to recover the survivor without unstrapping from the penetrator.

11.9.1.5. While it may be physically possible to recover three people at one time with the penetrator, this should only be done when time is critical since it may load the hoist to the limit and/or exceed aircraft lateral CG limits.

11.9.1.6. If the crewmember leaves the penetrator to assist the survivor during a tree recovery, fold the seat paddles and stow the safety straps so they will not snag on obstructions if the helicopter moves or the hoist cable has to be retracted.

11.9.1.7. For water recoveries, install the flotation collar prior to lowering the penetrator. Place at least one seat paddle in the down position and remove one safety strap from the stowed position. Do not unhook the safety strap fastener from the penetrator.

11.9.2. Stokes Litter. The MEDEVAC IIF is the only stokes litter authorized for live extraction. This device is constructed of wire/plastic mesh, lightweight steel tubing, or a plastic body that holds a survivor immobile in a supine position. The sides of the litter protect the survivor from bumping against obstructions or the side of the helicopter during retrieval. The stokes litter will be configured with the sling, flotation devices (for water operations only), and three restraining belts when stowed on the aircraft. Construction, modification, inspection and maintenance instructions for the stokes litter are contained in TO 00-75-5, *Use, Inspection and Maintenance Stokes Rescue Litters.* Use the following procedures:

11.9.2.1. The stokes litter should be used to immobilize the survivor. Once the survivor is strapped securely in this device, he/she need not be moved until arrival at the medical facility. The stokes litter will be secured to the helicopter prior to takeoff.

11.9.2.2. To lower the litter, place it outside the aircraft foot end first, then move it parallel to the side of the helicopter. The hoist operator may be required to lean out of the door to maneuver the litter. At the flight engineer's discretion, the litter may be lowered disassembled.

NOTE: For water recoveries, the stokes litter may be deployed using the low and slow deployment procedures (see **chapter 12**). This is the quickest means of deployment and subjects a critically injured survivor in the water to less exposure to rotor wash.

11.9.2.3. Lower the stokes litter to the survivor after the helicopter is established in a hover. The hoist operator provides enough slack to allow the crewmember to disconnect the hoist cable. It is not necessary to stay over the survivor once the litter is removed. After the survivor is secured in the litter and ready for hoisting, reconnect the hoist cable ensuring the rescue hook safety pin and carabiner locking sleeves are properly positioned. When using the stokes litter, ensure the survivor is securely strapped in the litter prior to hoisting. For small patients, the belt can be routed directly across the patient. For large patients, the belt can be routed outside and over the top bar before securing the patient to the litter.

NOTES:

Use extreme care when hoisting the stokes litter because of litter pendulum action and /or rotation. The pendulum action or rotation of the litter may increase to unmanageable proportions if not quickly stopped by the hoist operator. The pendulum action is dampened by first stopping the hoist cable up/down movement, then by moving the cable in the opposite direction of the swing. Litter rotation can be arrested by first stopping the hoist cable up/down movement, then by rotating the hoist cable in a small circle in the opposite direction of the rotation of the litter. Lowering the rescue device to the surface will always stop pendulum action and rotation. However, caution should be exercised when using this technique due to the effect on the survivors. In extreme emergencies, if litter rotation cannot be stopped by the hoist operator, the pilot can transition to forward flight at an airspeed of up to 30 knots to stop a swinging or rotating litter. The use of a tag line has proven to be 100 percent effective in preventing litter rotation and pendulum action of the hoist cable. The above techniques should also be used to dampen and control any pendulum action or rotation when the forest penetrator is attached.

Installation of the snow shield on a stokes litter may result in uncontrollable rotation. Consider using a tag line when the snow shield is installed.

WARNING: Take immediate action to prevent hoist cable/aircraft contact when the rescue device is exhibiting a pendulum action and/or rotation.

WARNING: Do not place any part of your body between the hoist cable and aircraft while applying any pendulum action or rotation dampening techniques.

WARNING: Failure to use a tag line during stokes litter operation could result in uncontrollable litter rotation.

11.9.2.4. Stop the litter just below the helicopter. Then maneuver the litter to align it parallel to the aircraft with the head of the litter towards the tail of the aircraft. At the same time, push the litter outward so that the basket does not contact the side of the helicopter. Litter maneuvers may require both hands. This maneuvering may be accomplished by using the litter cables.

11.9.2.5. When the stokes litter is parallel, raise the hoist to the full-up position so the litter is above the cabin floor level. Turn the litter perpendicular to the aircraft and pull it into the cabin head first. The pilot or another crewmember may need to provide cable slack at this point.

11.9.3. Rescue Basket. The rescue basket is fabricated from 304 stainless steel tubing and cable and is used to hoist survivors from land or water during helicopter rescue operations. The basket weighs approximately 39 pounds. Two nylon covered etha-foam floats, silk screened with the words "Remain Seated" provide the rescue basket with a floatation capability. The bail has a folding assembly of tubing and cable that hinge at all four corners to provide for the inward folding of the bail. Drain holes are located in the bottom tubing to allow for water drainage. The basket's design eliminates sharp corners by incorporating large radii; thus minimizing the potential for puncturing the skin of the aircraft while it is in use. Because entry is easier and quicker for a survivor compared to the forest penetrator, it is the best device for recovering survivors from frigid water. Use the following procedures:

11.9.3.1. The rescue basket may be lowered on final approach at airspeeds below 30 knots. Lower the basket to the water just short of the survivor at an approximate ground speed of five knots.

11.9.3.2. The survivor is secured upon entry into the basket and is ready to be raised into the helicopter.

CAUTION: When retrieving the rescue basket with the hoist in the forward position, do not let the rescue basket come in contact with the hinged panel door. If the mission allows for it, remove the hinged panel door prior to flight. The pilot will be required to swing the hoist boom in since the hoist operator needs to use both hands in retrieving the basket. When disconnecting the hoist hook from the bail attachment point, hold the bail tubes firmly to prevent the bail attachment points from contacting the survivor.

NOTE: Until inspection and maintenance guidance can be published in TO 00-25-245, use the US Coast Guard aviation computerized maintenance system (MSR 240.0).

11.9.4. Survivor's Sling (Horse Collar). The survivor's sling (NSN 1680-00-511-2712) is a buoyant device consisting of a fiber filling encased in a brightly colored waterproof cover to facilitate high visibility during rescue operations. Webbing, woven through the cover with both ends terminating in two v-rings, is used to attach the sling to the hoist hook. Two retainer straps, one long with a quick ejector snap and one short with a v-ring, are provided for personnel security. Additional information on the survivor's sling is found in NAVAIR 13-1-1-6.5. Personnel performing rescue operations when it is impossible for the helicopter to land use the survivor's sling. The sling can be used to lower a rescuer, as well as raise a survivor over land or water. Use the same procedures as for the forest penetrator.

11.10. Tag Line Procedures. The tag line aids the pilot by reducing the time required to hover and prevents pendulum or spinning motion of the rescue device. It may be used to guide the rescue device into or out of confined areas or to keep it out of the effects of rotor wash. Use the following procedures:

11.10.1. A weight should be attached to the end of the tag line without the weak link. The other end of the tag line may be fastened to either the hoist hook small eye or the rescue device. Snap the tag line to the hoist hook or the hoisting device by the weak link, just before the device goes out the door.

11.10.2. Deliver the tag line from a hover while using extreme care to avoid fouling the line in the rotor system. To deliver the tag line to a small vessel, establish a hover short of the vessel and lower the tag line to the water, and then raise it approximately five feet above the water. The hoist operator will then direct the pilot to the vessel. To deliver the tag line to a large vessel with a restricted pickup area, the tag line should be lowered after the helicopter is in a hover over the vessel. The pilot normally loses sight of the vessel during deployment of a tag line and has to rely entirely on the hoist operator for position information.

11.10.3. Once the tag line is on the surface and the ground crew is tending it, the hoist operator directs the pilot clear of the pickup area while letting out slack in the tag line. When the pilot can again see the pickup area, the hoist operator begins to lower the hoist.

11.10.4. Ground personnel use the tag line to guide the rescue device into the desired location.

11.10.5. When the rescue device is on the surface and the survivor is ready for hoisting, the hoist operator gives directions to position the helicopter back over the pickup area. Retrieving the rescue device vertically may not always be possible. Be aware of this and be prepared to recover the rescue device at an angle. However, when conditions permit, always recover the rescue device vertically. As soon as the survivor is clear of the surface and all obstructions, the hoist operator clears the helicopter away from the pickup area, usually left but sometimes back. Maintain this position until the survivor is in the cabin and the tag line is either retrieved or discarded, and the crewmember has reported ready for forward flight.

11.10.6. The tag line may be used in lieu of the hoist cable to lower small items to a boat. The item to be lowered will be attached to the snap link with a weight. Use the same procedure previously described for delivery of the tag line to small and large vessels. The weak link end of the tag line will be attached to a cabin tie down ring.

11.11. Hoist Procedures - Land:

11.11.1. Determination of wind direction and velocity is important to successful hoist operations. If a smoke device is used, plan to drop the smoke device during the high or low reconnaissance to confirm winds. Deploy smoke close enough to the survivor to give accurate wind information and, if possible, in an area that can be seen from anywhere in the hoist pattern. Select a nonflammable target area for the smoke device.

11.11.2. Complete the alternate insertion/extraction briefing and the hoist operator's checklist prior to starting final approach for the hoist recovery.

11.11.3. If possible, establish a right-hand, rectangular pattern with the final approach oriented into the wind. This aids in keeping the survivor in sight while preparing for the pickup.

11.11.4. The pilot will keep the hoist operator informed of position in the pattern, i.e., downwind, crosswind, etc. The hoist operator will acknowledge each position report and will inform the pilot when ready to deploy smoke markers or accomplish the pickup. It is the aircraft commander's responsibility to ensure a crewmember keeps the survivor's position in sight and provides updates to the crew.

11.11.5. If the survivor appears to be attached to a parachute, hover at an adequate distance to prevent the rotor wash from billowing the parachute and dragging the survivor.

11.11.6. When the pilot has determined the recovery can safely be accomplished, direct the hoist operator to "Go Hot Mike" prior to losing sight of the survivor. The pilot must devote full attention to maintaining a steady hover using all available references and the hoist operator's instructions. The pilot not flying will monitor the engine instruments, help maintain adequate blade tip clearance, and remain oriented with the horizon throughout the hoisting operation to assist the pilot should the need arise. The hoist operator will assist the pilot in maintaining adequate rotor tip clearance to the rear and right side of the helicopter.

11.11.7. When the survivor is in the rescue device and ready for hoisting, the hoist operator will give instructions to position the helicopter over the survivor and take up any slack in the cable. Normally, the hoist operator will raise the survivor, however he may request the pilot to "raise helicopter." The hoist operator will keep the pilot advised of the survivor's position. When the survivor is in the cabin, notify the pilot "survivor in and secure, ready for takeoff" and complete the Hoist Operator's After Pickup checklist upon completion of final hoist operation. When over trees, advise the pilot when the survivor is clear of the trees.

11.12. Hoist Procedures - Water. Smooth water adversely affects depth perception. Lack of depth perception and possible disorientation at night and in marginal weather requires more precise smoke drop patterns and procedures. The hover position for water hoists is directly over the survivor. However, once the rescue device is lowered to the water, the pilot may elect to move to a holding hover. Once the survivor is ready, the pilot should establish the hover over the rescue device prior to hoisting the survivor out of the water.

11.12.1. Day Pattern:

11.12.1.1. Complete alternate insertion/extraction briefing and hoist operator's checklist prior to final approach.

11.12.1.2. Prior to deployment of any pyrotechnics, the Smoke/Flare Drop checklist must be completed.

11.12.1.3. After the initial sighting of the survivor, maneuver to a position approximately 100 feet downwind of the survivor from which an observation pass can be accomplished (**figure 11.1.** and **figure 11.2.**). Pattern direction (either left or right patterns) is at the discretion of the pilot. If the survivor's condition is unknown or swimmer deployment is anticipated, the observation pass will be made at a maximum of ten-feet AWL and ten knots with a heading from zero to 90 degrees of the wind line to allow for swimmer deployment. If swimmer deployment is not required, make the observation pass above ETL at a minimum of 25 feet AWL.

11.12.1.4. After the observation pass, initiate a climbing turn at 50 feet AWL to a 100 feet AWL minimum downwind altitude. Deploy sea dye or smoke markers as directed by the pilot. If OGE power is not available, a minimum of 50 KIAS and 50 feet AWL is required prior to initiating the climbing turn to downwind. With OGE power, start the turn at a minimum of translation lift airspeed and 50 feet AWL. Use sea dye instead of smoke markers to avoid detection during combat or when an oil or fuel spill is near the survivor. In high sea states or high winds, use of more than one sea dye is recommended. If use of sea dye or smoke markers is prohibited or not required, proceed without them.

11.12.1.5. Do not descend below 50 feet AWL until established on final. If the survivor is not ready for immediate pickup, situation permitting, establish a holding hover approximately 75 feet downwind of the survivor.

11.12.1.6. On final, descend to hover altitude and slow to approximately five knots forward hover speed 75 feet downwind from the survivor. If the helicopter instrument panel interferes with forward visibility, the final approach may be displaced to the side.

11.12.2. Water Hoist Precautionary Measures:

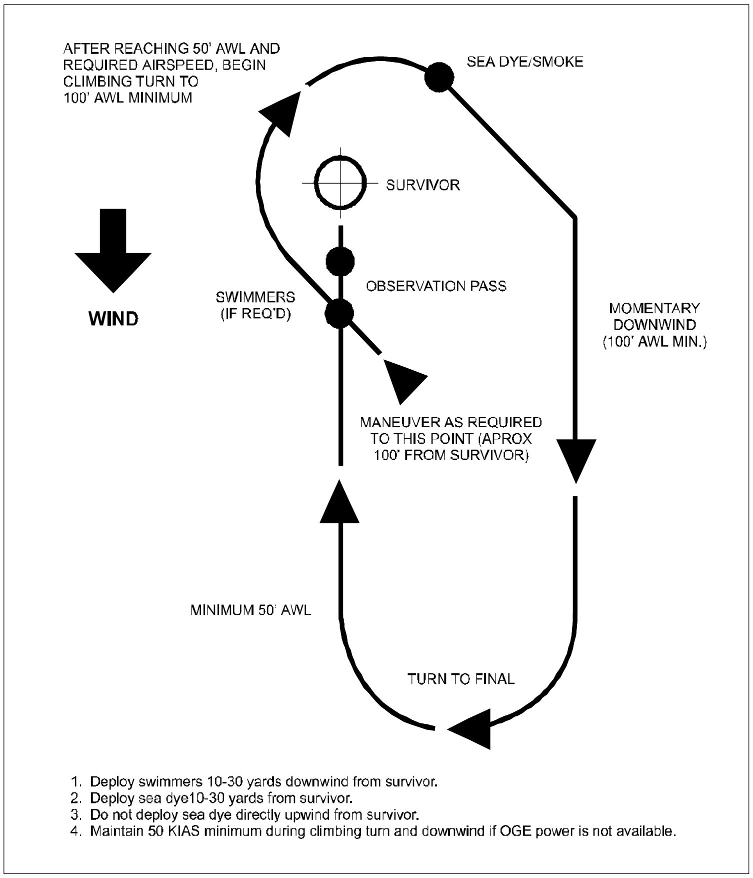
11.12.2.1. Cross-reference the radar altimeter with the barometric altimeter throughout the pattern and hover. Monitor rate of descent and call out excessive descent rates. If airspeed and/or rate of descent are excessive on final, go around. The pilot not flying should make altitude calls during the hover to aid the pilot flying and/or the hoist operator.

11.12.2.2. Attempt to determine where the smoke generated by the markers is drifting. Under light or variable wind conditions, the smoke may pose a visibility and orientation hazard. Be prepared to execute a go-around, if necessary.

11.12.2.3. If the survivor is attached to a parachute, hover at an adequate distance to prevent the rotor wash from billowing the parachute and dragging the injured survivor.

11.12.2.4. The pilot must not attempt to watch the pickup as spatial disorientation may result. Pilot vertigo can become a problem during a water hoist recovery. Use the attitude indicator as an additional reference in conjunction with the dye and smoke markers.

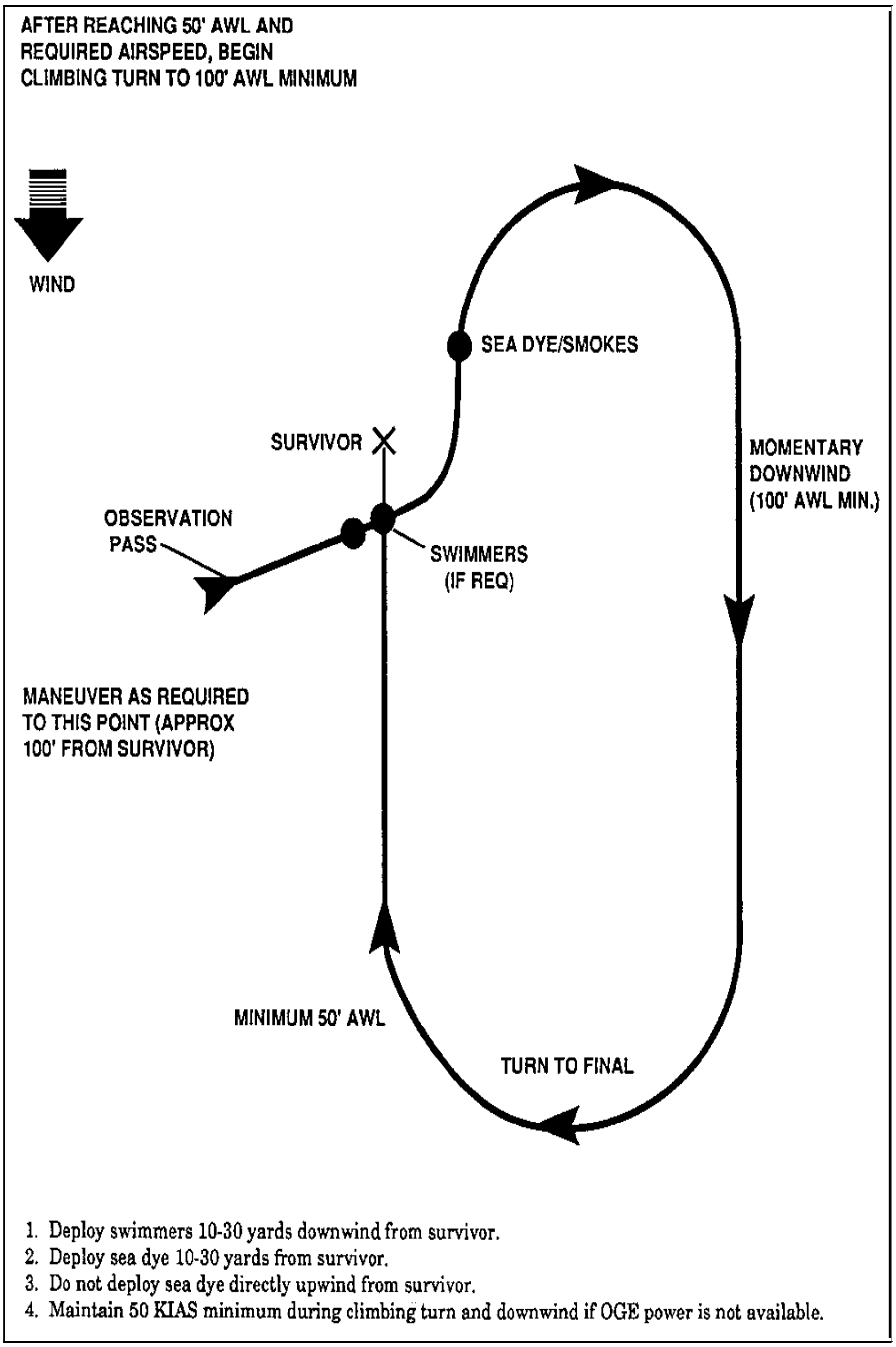
Figure 11.1. Typical Day Water Hoist Pattern.



11.12.2.5. Beware of the tendency to drift backwards while hovering over water. This may result in a loss of relative wind and loss of lift causing the helicopter to descend. If allowed to continue, sufficient power may not be available or over torque of the transmission may be required to recover.

11.12.2.6. One method to guard against inadvertent water contact is to set the pilot not flying radar altimeter lower than the pilot's as a warning to take immediate corrective action.

Figure 11.2. Optional Day Water Hoist Pattern.



Chapter 12

ALTERNATE LOADING/INSERTION/EXTRACTION PROCEDURES

Section 12A— Alternate Loading Procedures

12.1. General. All personnel flying in rotary wing aircraft must be restrained by the safest means possible for the type mission flown. Standard troop seats should be used to the maximum extent possible, however, they are sometimes too narrow to accommodate combat-equipped personnel (backpacks, parachutes, etc.). The use of standard seating normally requires this equipment to be removed and secured. This method is satisfactory for administrative transportation, but is impractical in a tactical environment where rapid on/offloading is required. Additionally, helicopter standard troop seating does not always provide sufficient seating for the number of personnel required by tactical scenarios.

12.2. Concept of Operation. For alternate loading methods, all seats and equipment not required for the mission may be removed. The cabin floor itself will be defined as the seat. Either tie down straps, seat belts or personal snap-link devices will restrain the occupants. All restraints may be removed upon landing in the LZ or while taxiing to the offload point. For hover operations (including water operations), restraining devices will be removed as required. These procedures may only be used during tactical/training/contingency operations when standard seating is inappropriate or for parachute deployments.

WARNING: Personnel must be aware of the possibility of reduced main rotor and/or tail rotor blade ground clearance and avoid the upslope side and tail rotor side of the helicopter when loading or off loading.

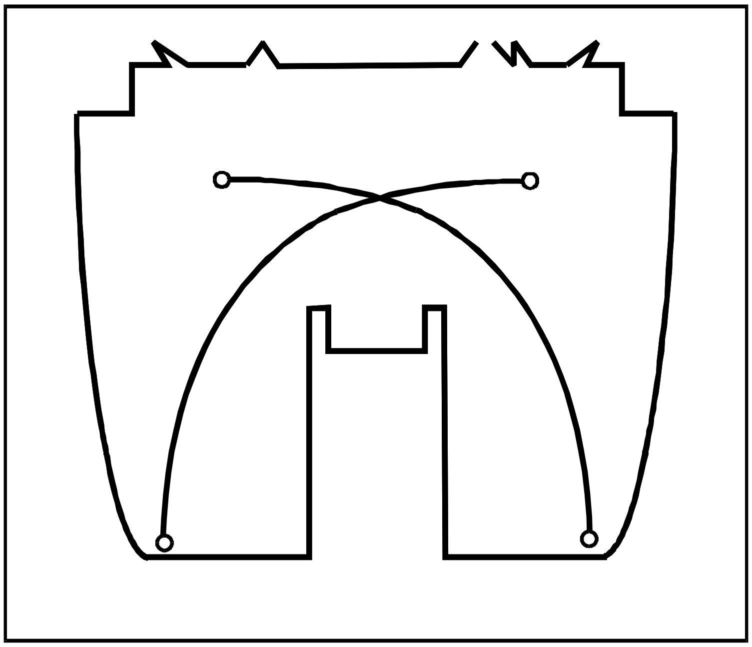
12.3. Alternate Loading of Combat-Equipped Personnel. Mission requirements and helicopter gross weight will dictate the total number of combat-equipped troops to be loaded. Recovery equipment may be installed as required in accordance with appropriate directives. The following procedures will be used:

12.3.1. Aircraft Configuration. The cabin area will be stripped of all equipment not required for the mission. Seat belts attached to tie down rings on the cabin floor or two tie down devices will be used for securing troops for flight. Tie down straps will be loosely attached according to **figure 12.1.** Crewmembers must have seat belts installed. Seat belts for up to two crewmembers should be installed at positions 31, 27, 28, and 32.

12.3.2. Personnel Loading. Personnel will have weapons pointed down and safetied and radio antennas collapsed prior to entering the area beneath the rotor disk. They should enter this area only when cleared by a crewmember and should always approach from the sides and/or front of the helicopter. Personnel will seat themselves on the cabin floor with their backs against the transmission area. Once seated, crewmembers will ensure that all passengers are secured using tie down straps, snap-link devices, or seat belts to preclude inadvertent exit from the helicopter.

12.3.3. Personnel Offloading. Once the aircraft has completed the approach to hover or landing, the restraint devices may be released and personnel allowed to exit. They will depart the rotor disc area from the sides and/or front of the helicopter.

Figure 12.1. Alternate Loading Configuration.



Section 12B— Alternate Insertion/Extraction Procedures

12.4. General. The following rope insertion/extraction methods provide an effective alternate means of delivering/extracting personnel during a tactical operation when landing is not feasible. Current Air Force methods of helicopter insertion and extraction include helo-rappelling, fast roping and rope ladder. These methods are referred to collectively as helicopter rope suspension operations. These methods and procedures apply to both day and NVG operations.

12.5. Classification Standards. UH-1N helicopters may conduct airborne insertion and extraction operations using rappelling and fast rope only under the supervision of qualified and certified masters to ensure thorough training and active safety. Individuals who qualify to conduct and supervise the collective Helicopter Rope Suspension (HRS) training methods may be designated HRS masters. Flight engineers may be qualified as HRS masters; however, performing both flight engineer and master duties simultaneously may be task saturating. Air Force Pararescue and sister service rope qualifications are valid for UH-1N operations.

12.6. Qualification. Advanced level qualification is attained through instruction at either an AFI 36-2223, *USAF Formal Schoo*l or equivalent MAJCOM approved course.

12.7. Operational Authority. To ensure the highest degree of operational safety, a definite channel of authority must exist during all HRS evolutions. The individuals within this channel of authority are the aircraft commander (AC), the flight engineer (FE) and the rope master. Further discussion will delineate the scope and range of their individual authority.

12.7.1. In all situations, the AC has full responsibility for the safety of the crew, passengers and the orderly conduct of the flight. Likewise, the AC carries overall responsibility for the safe conduct of HRS operations. The AC exercises final authority to cease or terminate operations.

12.7.2. The safetyman will be a flight engineer trained and qualified in the AIE event being performed. He is responsible for the safe conduct of all passengers and proper configuration of the aircraft for HRS operations. The safetyman will be in position to monitor all exit activities, relay communications, monitor the deployed ropes to ensure ground contact is maintained, and recover or release the ropes upon completion of the insertion/extraction.

12.7.3. A rope master of senior grade, the FE or the AC may relieve a rope master showing a lack of proficiency. Any current rope master present for the evolution may assume the duties and responsibilities of the relieved rope master or may immediately terminate the evolution. If no rope master is present following the relief, the FE will immediately terminate the evolution.

12.7.3.1. During helicopter operations, the master is subordinate in authority to the FE and the AC.

12.7.4. The rope master is responsible for the safety, conduct and performance of HRS personnel. The rope master is responsible for inspecting and rigging the aircraft and hooking up and launching ropers. Only one rope master may control an evolution, but any other rope master or the FE may assist the master in their duties.

12.8. Terminology. This section provides general terminology peculiar to HRS operations. The following terms are peculiar to helicopter-rope suspension training and operations.

12.8.1. Belay/Brake. A method to control or stop the uncontrolled descent of a roper by friction.

12.8.1.1. Bight. A bend or U-shaped curve in a rope in which the line does not cross itself.

12.8.1.2. Fast Rope. (a) an HRS technique used to quickly insert personnel and (b) a special braided rope used in fast rope operations.

12.8.1.3. Figure 8 Assault Descender. A metal alloy device roughly resembling the numeral 8 in structure, used for rappelling with heavy loads.

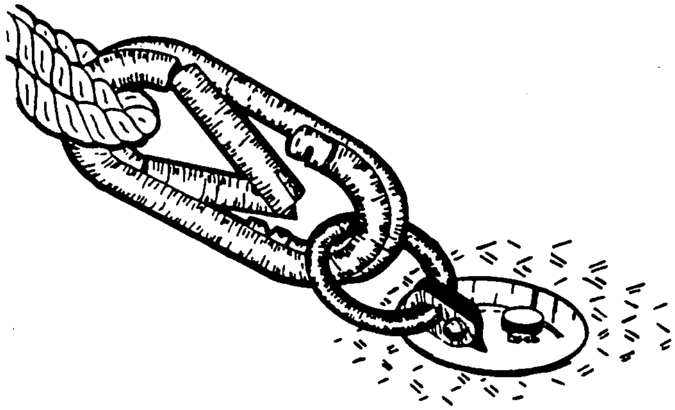
12.8.1.4. Line. In rappelling, a 7/16-inch-diameter rope (11 mm).

12.8.1.5. Loop. A bend in a rope in which the line crosses itself.

12.8.1.6. Monkey Ball. A method of rolling a rappelling line onto itself so it readily deploys without entanglement when dropped from a helicopter or tower.

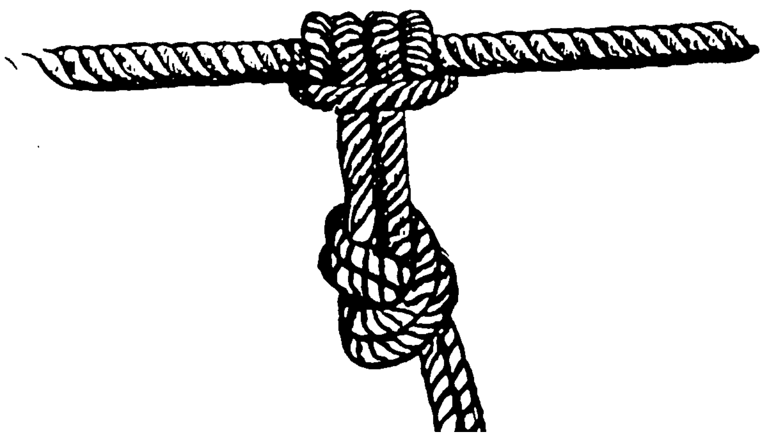
12.8.1.7. Opposing Snaplinks (**figure 12.2.**). The placement of two non-locking snaplinks on an attachment point (rope, cargo tiedown ring, etc.) so the gates open in different directions to prevent inadvertent release from the attachment point.

Figure 12.2. Opposing, Non-locking Snaplink.



12.8.1.8. Prusik Knot (**figure 12.3.**). This knot is used to put a moveable rope on a fixed rope of different diameter. This knot maintains 70 percent to 75 percent of the rope's tensile strength and is used primarily as a safety for a rappeller who is not afforded a belay. If the rappeller were to lose their brake or "fall," the prusik knot will act as a brake until the roper regains control.

Figure 12.3. Prusik Knot.



12.8.1.9. Rope Ladder. (a) an HRS technique well-suited for extracting personnel from land, water, small boats, barges, etc. and (b) two nylon lines connected by aluminum rungs used in rope ladder operations.

12.8.1.10. Rope Station. (a) the point on a static tower or helicopter where a person executes a descent and (b) the area(s) on a static tower or helicopter where ropes are rigged for HRS training and operations.

12.8.1.11. Round Turn. Wrapping the rope around a specific object such as a post, rail or pipe so the running end leaves the circle in the same direction as the standing end.

12.8.1.12. Running End. The free or working end of a rope.

12.8.1.13. Sling Rope. A 12- to 15-foot length of 7/16-inch rappel line, whipped and burned on both ends, used to construct rappel seats and safety lines.

12.8.1.14. Snaplink. A D-shaped steel ring with a spring tension gate that may or may not be configured with a threaded, screw-top locking gate. It is also called a Carabiner or Stubai.

12.8.1.15. Standing End. (a) the end of a rope secured to an anchor point and (b) the static end of a rope.

12.8.1.16. Stick. A number of individuals exiting an aircraft in rapid succession.

12.8.1.17. Whipping. Wrapping or binding light cord around the end of a line to prevent it from unraveling.

12.8.2. Training Insertion/Extraction. For the purpose of this instruction, a training insertion/ extraction is a training evolution conducted for the purpose of mastering the insertion/extraction technique.

12.8.3. Operational/Extraction. Operational insertions/extractions should not be performed until individuals have mastered the insertion/extraction technique.

12.9. Training:

12.9.1. Minimum requirements to conduct HRS operations. The following requirements are mandatory in all instances where personnel are inserted/extracted by helicopter.

12.9.1.1. Internal Communication System (ICS). Positive communication over ICS interphone must be maintained throughout any insertion/extraction evolution between all aircrew members including the rope master. While alternate signals must be established, their use should be limited to emergency situations.

12.9.1.2. Mission Briefs. Prior to deployment, the aircraft commander will ensure the alternate insertion/extraction briefing in AFI 11-2H-1, Vol 3, CL-1 is completed for the applicable device to be used. The master must conduct an operation brief for all insertion/extraction personnel and a face-to-face mission brief for all aircrew personnel participating in the HRS operations. The brief must include a discussion of emergency procedures.

12.10. General Safety. Lack of knowledge, poor training, equipment failure and improper rigging can create a dangerous situation. Safety must be the primary concern during training operations. Training should ensure that individuals develop confidence in themselves and their equipment. Safety can only be effective if it is actively applied. Safety must not be sacrificed for training realism.

12.10.1. The procedures contained throughout this publication are, by design, the absolute minimum requirements to ensure safety. In cases not covered by these procedures, sound judgment and common sense must prevail to ensure the safety of all concerned. Aside from reliable equipment and procedures training, many outside factors influence the safe conduct of operations.

12.10.2. Environmental factors may affect the pilot's ability to safely position the helicopter and maintain that position over the target area. Also, the affects of altitude, temperature, wind and humidity affect aircraft performance.

12.10.3. Care must be taken to select a drop/pickup zone that is relatively free of dust, snow or other objects that could obscure the pilots vision.

12.10.4. Night or limited visibility operations further affect the rope master's ability to maintain control of personnel during the evolution.

12.10.4.1. Night operations may be conducted with or without NVGs as long as the pilot can maintain a steady position over the target area and all other qualifications and conditions are met.

12.10.4.2. During night training (unaided or aided), the rope master should use chem-lights to determine rope and personnel positions. Using a finger light or a chem-light provides a reference for the rope master to hook up each roper. A chem-light on each individual's left arm and one on their right leg provides the rope master and/or belayer a reference of the person's position during the evolution. Chem-lights can also assist with hand-and-arm signals during night operations. It is imperative that the FE is able to see the rope in contact with the ground at all times after it is deployed.

12.10.5. Inner Aircraft Safety. The following recommendation enhances the safety inside the aircraft.

12.10.5.1. Hand Holds. When possible, improvise handholds to assist in moving from a seated position to rope stations. Cargo straps, ropes or webbing can be secured overhead to provide a secure hand hold during movement.

12.10.5.2. Loose Gear. Loose gear or equipment inside the helicopter will be secured at all times.

12.11. Mishap Procedures:

12.11.1. If a mishap occurs, all training will cease. Follow local procedures. Do not disturb the rope rigging if it was a factor in the mishap, unless it interferes with the evacuation of the injured personnel.

12.12. Flight Dynamics:

12.12.1. Rotor Downwash. Rotor downwash causes sand and small objects to be blown in the drop/pickup zone.

12.12.2. Hover Height. Numerous factors determine suitable hover heights and, therefore, preclude establishment of a prescribed altitude for helicopter operations.

12.12.2.1. A rope hanging beneath the helicopter can become agitated by rotor downwash and could cause a potentially dangerous situation. Hover height should be adjusted to reduce the affects of this phenomenon. A slightly higher hover reduces the affect of rotor downwash on the ground and rope.

12.12.2.2. While operating in wooded or mountainous areas, hover height is restricted to the lowest possible height commensurate with rope length, obstacle clearance, visual cues, soil stability, rotor downwash and helicopter performance.

12.12.3. Static Discharge. Static electricity is generated by a helicopter's rotors disturbing the air. It is discharged from the aircraft by contact with the ground.

12.12.3.1. Dry Conditions. Ropes are non-conductive and do not allow static electricity to be discharged through them. The deployed personnel may experience a slight shock upon touching the ground. The shock could be masked by other sensations associated with the evolution.

12.12.3.2. Wet Conditions. Ropes may become conductive if wet. Conductivity lessens as the length of the rope increases.

12.13. Equipment:

12.13.1. All aircraft surfaces must be clean and free of oil and solvents.

12.13.2. All personnel accomplishing HRS operations are required to wear the following protective clothing/equipment:

12.13.2.1. Any uniform that fully covers the roper's arms and legs is recommended to avoid cuts, abrasions and skin irritations.

12.13.2.2. Either a kevlar helmet, PROTEC®-type helmet or flight helmet will be worn during HRS operations.

12.13.2.3. Approved hearing protection i.e., ear plugs, ear muffs or a flight helmet.

12.13.2.4. Each participant must wear approved protective eye wear. If the participant normally wears prescription eyeglasses, they may wear prescription safety glasses during HRS operations. Generally, standard issue eye goggles or an aircrew flight helmet visor will fulfill the requirement.

12.13.2.5. Each participant must wear an approved personal floatation device when conducting HRS operations over water or when the aircraft's route to the drop/pickup zone passes over water and is not within autorotational distance of land.

12.13.2.6. While airborne with the cargo door(s) open; all personnel accomplishing HRS operations will be wearing a restraint device (i.e., gunner's belt, seat belt, safety strap, or snap-link device).

12.14. Sequence of Events. HRS procedures follow a standard sequence of events for all UH-1 aircraft. The sequence of events follows standard challenge and response dialogue. The dialogue transpires in three distinct phases; prior to takeoff, in-flight and while in a stable hover. (Dialogue is highlighted in bold capital letters.)

12.14.1. Prior to Takeoff. Following the operations and aircrew briefings and after loading personnel aboard the aircraft, the rope master initiates the standard HRS dialogue:

12.14.1.1. STRAP IN. Ensure all HRS personnel are secured with a restraint device. The FE will check all restraint devices for security.

12.14.1.2. CHECK EQUIPMENT. Each roper checks their equipment for loose or obstructive components.

12.14.1.3. SOUND OFF FOR EQUIPMENT CHECK. Each roper gives their status to the rope master as OK (or a thumbs up or down if rotors are turning) or states what is fouled with the equipment.

12.14.1.4. CLEARED FOR TAKEOFF. The rope master advises the FE when the ropers are ready for takeoff.

12.14.2. IN-FLIGHT. All HRS participants remain strapped in and follow the directions of the FE. The AC will provide deploying personnel with 20-, 10-, 5-, and 1-minute out calls, as a minimum. The rope master may require more than the minimum time calls. The FE will relay time calls to deploying personnel.

12.14.2.1. TEN-MINUTES OUT Call. The AC passes this advisory information to the rope master when the aircraft is approximately ten minutes from the drop zone. Ropers should be ready for deployment and the team leader should inspect all team members prior to the "5-minutes out" call.

12.14.2.2. FIVE-MINUTES OUT Call. The AC passes this advisory information to the rope master when the aircraft is approximately five minutes from the drop zone. Once cleared by the AC to open cargo doors, the FE, with assistance from the rope master, opens the cargo doors (if closed) and prepares the rope stations. Chem-lights attached to insertion/extraction equipment will be activated at the "5-minutes out" call.

NOTE: For tactical HRS operations the rope master will ensure that he/she is OFF intercom and headset is removed and secured prior to the one-minute call. For non-tactical HRS operations the rope master may elect to use the intercom and headset/helmet throughout the operation.

12.14.2.3. ONE-MINUTE OUT Call. The AC passes this advisory information to the rope master when the aircraft is approximately one minute from the drop zone. The rope master moves to his/her rope station with gunner's belt attached. The rope master will confirm the deployment location.

12.14.2.4. GET READY. The rope master gives the ropers a signal to check themselves one final time and ready equipment.

12.14.3. STABLE HOVER. Since the dialogue for each AIE method is somewhat unique to that specific method. The dialogue used during the stable hover sequence of events phase is described in each specific HRS section of this chapter.

12.15. EMERGENCY COMMANDS AND HAND-AND-ARM SIGNALS. The following commands are not part of the normal HRS sequence of events. They are used to either suspend or terminate HRS operations whenever unsafe or questionable situations arise. These commands and signals are general in nature and can and will be applied to all UH-1N HRS operations. (Commands are highlighted in bold letters.)

12.15.1. Abort. Initiated by any crewmember to include the rope master. Used to cease further HRS operations until an unsafe situation is corrected. The signal is a hand moving back and forth in front of the neck in a slashing motion.

12.15.2. Aircraft Emergency. Initiated by the pilot on the controls or the FE. Indicates an aircraft emergency presently exists. The signal is a hand with fingers extended and palm down is raised and lowered above the head.

12.15.3. Crash Landing. Initiated by the pilot on the controls to indicate a crash landing. The signal is both hands, each with fingers extended and palms down, raised and lowered above the head in unison.

12.15.4. Cut Rope. Initiated by the pilot on the controls or the FE. Used as a last ditch effort to free a fouled rope or device. The signal is a hand with fingers extended and joined moving in a chopping motion against the opposite wrist.

12.15.5. Entanglement. Initiated by the FE or rope master. Indicates the rope, device, or ropers are fouled on obstacles. The signal is forearms raised laterally to the front at shoulder height, clasping hands with palms facing inward and fingers interlocking.

12.15.6. Hold. Initiated by any crewmember to include the rope master. Ropers stand fast and await further instructions. The signal is a forearm raised vertically (as in taking an oath) with a clenched fist in front of the face.

12.15.7. Lost Communications. Initiated by any crewmember to include the rope master. Indicates ICS or air-to-ground communication has been lost. The signal is hands placed at the ears with palms open and forward.

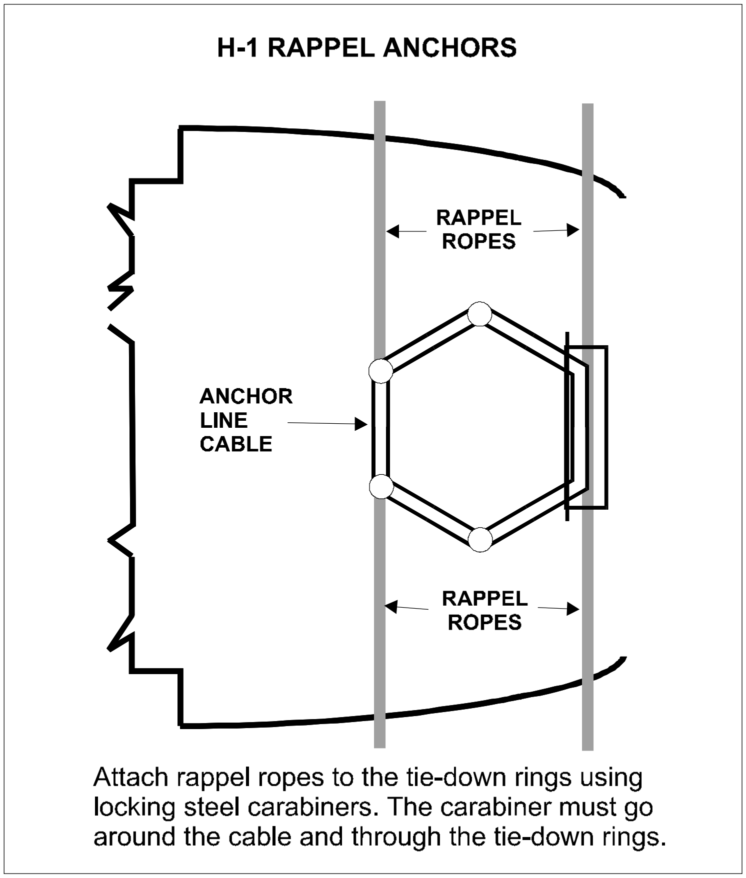
12.15.8. Strap In. Initiated by any crewmember to include the rope master. Directs ropers remaining in the aircraft to return to their seats and don their restraint device. The signal is double clenched fists at the belt buckle.

12.15.9. Rope Deployment. Initiated by the FE. Directs the ropers or rope master to deploy the rope(s). The signal is a sweeping horizontal motion of the hand with the index finger extended towards the exit.

Section 12C—Rappel Procedures

12.16. General. Helicopter rappelling is a means of descending from a hovering helicopter by sliding down a rope passed through or across a friction device that slows the descent. Rappelling of qualified personnel is faster than hoist operations and reduces aircraft exposure. In mountainous terrain, helicopter rappelling techniques are employed to move equipment and personnel to terrain unsuitable for aircraft landing. This technique is also useful in urban environments. This section establishes the basic guidelines for employing helicopter rappelling techniques. Deploying personnel may be secured using alternate loading procedures.

Figure 12.4. Rappel/Personnel Delivery Anchor Cable.



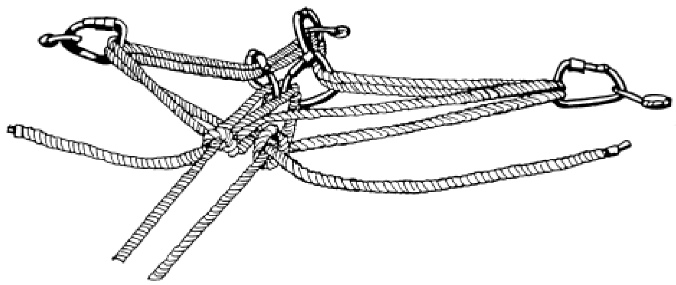
12.16.1. All UH-1N helicopters will be rigged for rappel using one of two basic methods; the Rappel Anchor Cable method (**figure 12.4.**) or the UH-1N Rappel method (**figure 12.5.**). No aircraft modifications are necessary for either rappel rigging method.

12.16.2. Aircraft seats will be removed as necessary from the cargo compartment.

12.17. Specific Equipment for Rappelling. During training, pad the entire bottom edge of the cargo door opening where the rappel rope(s) come in contact with the edge. Use appropriate material (i.e., two thickness of 1/2-inch hair felt pads, carpet or other suitable material) to ensure that all sharp edges are padded and not merely taped over.

12.17.1. Where possible, have the padding extend from the edge of the cargo door opening at least four inches back toward the rappel rope anchor point(s). Ensure that the padding also extends (a minimum of four inches) over the bottom edge of the cargo door opening as well.

Figure 12.5. UH-1N Rappel System (Dual Rope Installation).



12.17.1.1. Secure the padding so that it cannot be inadvertently displaced or dropped during flight; it may be taped to the cabin floor or tied to the cabin floor utilizing cargo tie-down rings and or the external hard points.

12.17.1.2. As a minimum, each roper must have a sling rope (or an approved rappel seat), one locking snaplink, a pair of rappelling gloves, and a sheath knife.

12.17.1.3. Ensure that a safety line/rope is available during rappel operations.

12.17.1.4. One V-blade knife is mandatory.

12.17.2. Combat Equipped Troops. For rappelling operations the following special considerations apply:

12.17.2.1. Cartridge belts are unfastened for ease of braking.

12.17.2.2. All excess straps on the rucksack are stowed.

12.17.2.3. Rifles are slung over the shoulder and across the back. The butt of the weapon is up, with the muzzle down, and opposite the brake hand.

12.17.2.4. M-60 machine guns are worn in the same manner as rifles. The feed tray and cover, cocking handle, barrel locking lever and carrying handle should be padded and taped.

12.18. Individual Equipment. Personnel accomplishing rappelling operations will wear and adhere to all equipment/clothing requirements specified in paragraph **12.13.2.**

12.19. Restrictions. Only one rappeller will be connected to a rappel line at a time. A sufficient length of rappel line in contact with the ground can act as a weight to assist in counteracting the affects of rotor downwash. A minimum of 20 feet of rappel line must remain in contact with the ground during rappel operations.

WARNING: Under no circumstances will a deployment device be attached to the end of the rappel line. The line must be free of obstructions to allow rappellers to leave the rappel line once they are on the ground.

12.20. Aircraft Rigging:

12.20.1. UH-1N Rappel Anchor Cable Method. A cable will be installed according to Figure 12.4. The cable is nine feet two inches long, one-fourth-inch diameter, 6,400 pounds test, with swaged cable eye and forked terminals, fastened with steel bolt and lock nut with safety pin. Cables will be fabricated according to TO 1-1A-8. Manufactured cables will have the date of initial manufacture and weight-testing capacity (2,500 pounds) permanently marked on the forked terminal. Cables will be visually inspected each time the cable is installed.

12.20.1.1. Reference TO 1-1A-8 for anchor line cable inspection and maintenance requirements and criteria.

12.20.2. UH-1N Rappel Method. Using this method the UH-1N helicopter can be rigged with one to six rope stations, up to three on each side. The UH-1N rappel method incorporates a total of three-anchor points for each rope station.

12.20.2.1. All aircraft rappel rigging employs three anchor points.

12.20.2.1.1. Rappel rigging configurations must ensure even distribution of load among all three-anchor points.

12.20.2.1.2. Rappel training may be conducted using one or two rappel lines on the same rig.

12.20.2.1.3. When rigging an aircraft, a master may replace any locking snaplink with two opposing, non-locking, snaplinks (**figure 12.2.**).

12.20.2.1.4. Components and Configuration. Each UH-1N rope station incorporates one or two rappelling ropes and five locking snaplinks (steel are preferred) or five pair of opposing non-locking snaplinks (**figure 12.2.**) in a three point, Omni-directional, floating self-equalizing assembly. This assembly allows for quick installation and removal while maintaining safety (**figure 12.5.**).

NOTE: Depending on the speed and proficiency of the ropers, the rope master may elect to use a double rappel line for slowing rappellers' descents and for added safety.

12.20.2.1.5. Installation. Each rope station uses three cargo tie-down fittings. Since the rigging incorporates an adjustable bowline on a bight knot, the rigging can use any serviceable cargo tiedowns located on the cabin floor.

12.21. Rappel Line Deployment. Rappel lines that are knotted or fouled can increase the time it takes to insert a rappeller. The use of the monkey ball, daisy chain and deployment bag ensures that the lines do not become tangled on deployment.

12.21.1. UH-1N rappelling procedures require that the #1 rappeller on each rope station hook up on the rappel lines prior to strapping in. If each rappeller has their own rappel station, they should be connected to the rappel line at this time. Feet must be inside the cabin (not on the skid) for initial take-off and landing.

WARNING: Exercise care when deploying rappel lines to avoid striking personnel on the ground.

12.21.2. For night deployments, attach one chem-light to the top of the weighted rappel rope deployment bag.

WARNING: Do not attach chem-lights to rappel lines during night operations.

12.22. Sequence of Events. See para. **12.14.** for general dialogue and sequence of events. Refer to rappel stable hover sequence of events for specific dialogue for rappel operations.

12.23. Helicopter Rappel Operations:

12.23.1. Stable Hover. Since the stable hover dialogue for rappelling is somewhat unique to this HRS operation, the dialogue used for rappel operations is described below. Once in a stable hover the pilot on the controls will initiate rappel operations by announcing "ROPES, ROPES, ROPES".

12.23.1.1. "ROPES, ROPES, ROPES." By announcing "ROPES, ROPES, ROPES," the pilot on the controls clears the FE, rope master or roper to deploy the rappel line(s).

12.23.1.2. "ROPES." The FE gives the command "ROPES" while simultaneously pointing out the open cargo door(s). At this time the rappellers are authorized to deploy the ropes. Only upon the command "ROPES, ROPES, ROPES" from the pilot on the controls will the FE give the command "ROPES."

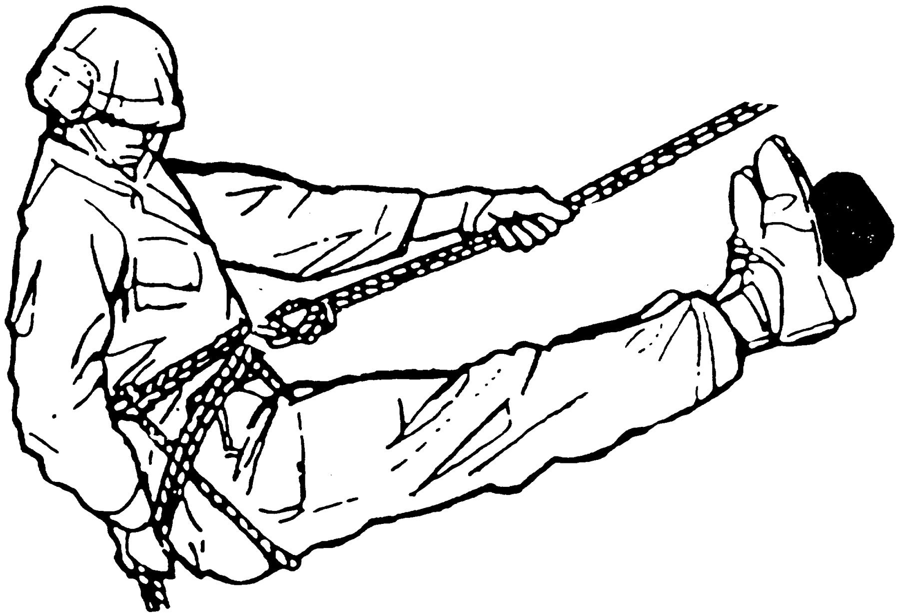
12.23.1.3. "ROPE(S) DEPLOYED." Once the FE has determined that the rappel lines have deployed safely with a minimum of 20 feet of rope on the ground, he passes the advisory call "ROPES DEPLOYED" to the pilot on the controls.

12.23.1.3.1. After the FE verifies that the correct amount of rappel line is on the ground, he will direct the rope master to deploy the rappellers. During the evolution, the FE will give hover calls, as necessary, to maintain the aircraft over the target area.

12.23.1.4. "UNBUCKLE." On the clearance from the FE, the rope master directs rappellers to remove seat belts leaving their safety straps attached (unless already connected to a rappel line) until they are hooked into a rappel line. Once connected to a rappel line, the rappeller is authorized to remove the safety strap.

12.23.1.5. "STAND-BY." The rope master individually directs each rappeller to the rope station and assists each rappeller to the "L" position (**figure 12.6.**) on the skid. If the rappeller is not afforded a belay, they should use a "prusik" for safety.

Figure 12.6. "L" Position.



12.23.1.6. "GO." The rope master directs each rappeller to begin their descent.

12.23.1.7. "RAPPELLER # ___ AWAY." The FE passes an advisory count of rappellers down the rappel line to the aircrew.

12.23.1.8. "ROPE(S) CLEAR." The FE advises the pilot on the controls that no more rappellers are on the rappel line(s) and that the last rappeller is free and clear of the rope.

12.23.1.9. "ROPE(S) RELEASED/RETRIEVED." The FE passes this advisory call to the pilot on the controls once the rappel line(s) have either been released or retrieved into the aircraft and secured. (In an actual tactical situation, cut the rappel lines if time is critical.)

NOTE: For multiple training evolutions, the rappel line may remain attached to the aircraft while ground personnel walk the rappel line(s) clear of the aircraft as it descends to the ground.

12.23.1.10. "CLEAR FOR FORWARD FLIGHT" or "CLEARED FOR LANDING." The FE confirms to the pilot on the controls that the rappel line(s) are clear of the aircraft or obstacles and that there is no possibility that the rappel line(s) will become fouled. Once assured that all is clear, the aircraft commander transitions the aircraft from a stable hover to forward flight or, during multiple training evolutions, lands.

WARNING: It is essential that the rope(s) are completely recovered or released prior to forward flight.

12.24. Emergency Procedures. Many varied and unique situations can arise when rappelling from a hovering aircraft. Aside from inherent dangers of rappelling, the rappel master and the rappellers must be prepared to address aircraft emergencies that could reasonably occur during rappel operations. The following procedures address some emergencies that could reasonably occur during helicopter rappel operations. Multiple emergencies, adverse weather or other unusual conditions may require modifications to these procedures. The nature and severity of the emergency dictate the degree of compliance. Therefore, sound judgment is the critical element in corrective action. Declarative or directive statements indicate actions taken by the FE and rope master. The decision to cut the rappel rope(s) will be made by the aircraft commander and executed at his command or as briefed.

12.24.1. Aircraft Emergency. If the helicopter experiences engine failure or other aircraft emergencies during rappel operations, rappellers on the line need to descend as rapidly as possible and move from beneath the helicopter to the 6-o'clock position. In the event of an aircraft emergency, initiate the following procedures:

12.24.1.1. Upon notification by the pilot on the controls of an emergency situation, signal the ropers still inside the aircraft to ABORT, STRAP IN and AIRCRAFT EMERGENCY if time permits.

12.24.1.2. On command from the pilot on the controls to ABORT, the rope master ensures rappellers already descending the rappel line are clear of the rappel line and the possible helicopter impact area. Signal ground personnel there is an AIRCRAFT EMERGENCY, if possible.

NOTE: Once seated and secured, all personnel in the cabin follow the FE's directions.

12.24.2. Lost Communication/ICS Failure. ICS communications between the pilot on the controls, FE and the rope master is mandatory. In the event of ICS failure, initiate the following procedures:

12.24.2.1. Signal the remaining rappellers: HOLD and or ABORT, LOST COMMUNICATION, and STRAP IN.

NOTE: Hand-and-arm signals are only used to complete the descent of the ropers on the rappel lines at the time of the ICS failure. At no time are descents initiated during an ICS failure.

12.24.2.2. If ICS is re-established, the FE will direct the pilot on the controls back into position and operations may continue.

12.24.3. Hung Rappeller. This is a rappeller who has exited the aircraft and is unable to complete the descent to the ground. A rappeller can become hung for a variety of reasons--fouled rappel line, loose clothing, straps, equipment or a misplaced hand. In the event of a hung rappeller, initiate the following procedures:

12.24.3.1. The rope master or the FE immediately notifies the aircraft commander.

12.24.3.2. If possible, the aircraft will descend to lower the rappeller to the ground.

12.24.3.3. If the pilot is unable to land the helicopter and must search for a landing site, the rope master lowers a safety line down the rappel line to the hung rappeller with a snaplink attached. The hung rappeller connects the safety line snaplink to their rappel seat snaplink. The safety line is secured to the inside of the aircraft at an anchor point other than the fouled rappel line's anchor points and is set up in a belay.

12.24.3.4. If the aircraft is unable to land and the hung rappeller is unable to attach the safety line, the rope master lowers the hung rappeller to the ground from inside the aircraft. Accomplish the following:

12.24.3.4.1. The rope master will notify the aircraft commander and obtain FE assistance.

12.24.3.4.2. The pilot will descend as low as possible.

12.24.3.4.3. Remove tension from the hung rappel line, disconnect the hung rappel line from all anchor points.

12.24.3.4.4. By releasing tension on the safety rope (belay), the rope master lowers the hung rappeller to the ground.

12.24.4. Fouled Rappel Line. A rappel line may become fouled or entangled on ground obstacles during rappel operations. If this happens, initiate the following procedures:

12.24.4.1. Immediately notify the pilot on the controls of the fouling and ensure all rappellers are clear.

12.24.4.2. If possible, the pilot descends or repositions the aircraft in order to decrease tension on the rappel line. If the rope tension is removed, the FE or rope master will attempt to clear or untangle the rappel rope(s).

12.24.4.3. If unable to land, clear or untangle the rope(s) remove the rappel rope(s) from the anchor points and release it, if you cannot release the rope(s) due to tension, cut the rappel line(s).

WARNING: Do not use the helicopter to pull the rappel rope(s) free.

12.24.5. Helicopter Gains Altitude. If the helicopter gains altitude so that less than 20 feet of rappel rope is on the ground, or if the helicopter drifts off target, initiate the following procedures:

12.24.5.1. Have the rappeller immediately brake and lock-in.

12.24.5.2. Signal team member to HOLD preventing any further descents.

12.24.5.3. Redirect the helicopter back over the target or descend to the correct altitude. Once back on target and/or altitude and on approval from the pilot on the controls, continue rappel operations.

NOTE: The FE must have a V-blade knife readily available throughout rappel operations.

Section 12D— Fast Rope Procedures

12.25. General. Fast rope is a unique form of helicopter insertion. It consists of descending from a helicopter by sliding down a heavily braided rope gripped between the hands, thighs and feet. As in rappelling, the individual (referred to hereafter as a roper) descending upon the rope applies friction on the rope to control their descent. Unlike rappelling, the roper does not use a mechanical friction device to control the descent. Rather, the roper applies necessary friction using hands, thighs and feet; these are brakes. The tighter the grip, the slower the descent, and vice versa.

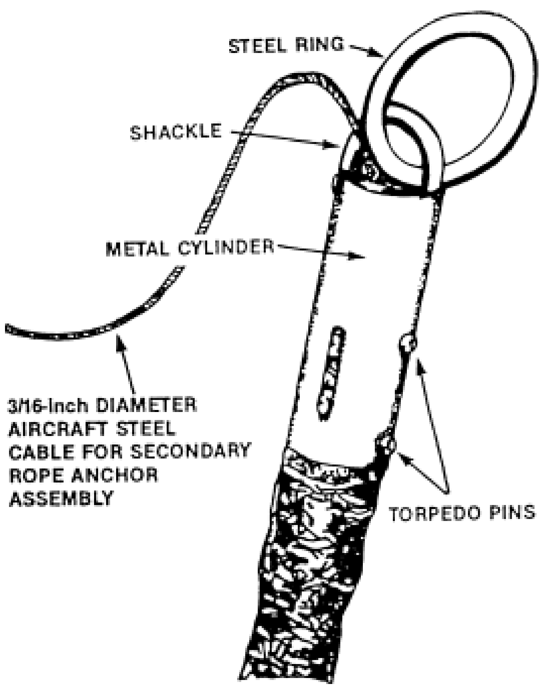
12.25.1. The fast rope is suitable for most terrain including mountainous and heavily wooded areas. This technique is especially used in urban environments to rapidly descend onto buildings. Because fast roping does not involve a mechanical hookup between the roper and rope, the roper can exit the aircraft and assume a tactical role at a greater tempo than is possible through a rappel insert. This increased tempo facilitates inserting more ropers over a shorter period of time, thus minimizing the exposure of ropers and aircraft to the threat.

12.25.2. Since fast roping does not incorporate mechanical fasteners or friction devices, it is unsuitable for delivering equipment. Fast roping is solely a means of moving an individual from a hovering helicopter to terrain unsuitable for aircraft landing. The skills necessary to perform fast roping are far less tasking than those required for rappelling. The inherent simplicity and speed of fast rope operations constitute its greatest attributes.

12.26. Specific Equipment for Fast Roping. The fast rope consists of eight strands of multifilament polypropylene. Each strand is covered with multifilament polyester. The eight strands are braided into a 1 3/4-inch diameter rope, having a tensile strength of 35,000 pounds. It is available in 60-, 90-, and 120-foot lengths. Each fast rope is equipped with a steel safety cable that is interwoven within the strands of the fast rope. The free end of the safety cable forms a loop that extends just beyond the end cap. The purpose of the safety cable is to provide a redundant hookup point for the fast rope (in case the end cap ring fails).

12.26.1. The rope contains an end cap assembly on one end to facilitate fastening the rope to the hook-up point (**figure 12.7.**). The end cap consists of a metal cylinder which is drilled to accept torpedo pins, an end diaphragm that holds a shackle by means of a clevis bolt and a 3-inch steel ring held by the shackle. A hose clamp secures the end fibers of the fast rope. This clamp prevents the strands from separating and releasing the torpedo pins when placed under a load. The clamped rope end fits into the cylinder. Two torpedo pins pass through the cylinder and between the strands securing the rope to the end cap.

Figure 12.7. Fast Rope End Cap.



12.26.2. The rope master or FE will inspect each fast rope before accepting it for use. Refer to AFI 11-2H-1, Vol 3, CL-1 for fast rope inspection criteria.

12.26.3. Individual Equipment. All personnel accomplishing fast rope operations will wear a pair of heavy work-type leather gloves and adhere to all other equipment/clothing requirements specified in paragraph **12.13.**

12.26.3.1. Heavy work-type leather gloves will be worn during the descent. They must fully enclose the roper's fingers to ensure full protection.

12.27. Restrictions. Only three ropers are authorized on the fast rope at any one time. At no time will the total load on any fast rope exceed 600 pounds. At least 10 feet of fast rope must be on the ground prior to the roper's deployment.

12.28. Aircraft Rigging. The FE and rope master are responsible for inspection of the aircraft and the fast rope system. The fast rope and safety cable is connected to the rescue hoist hook on the UH-1N. A full length cable preflight of the hoist is not necessary for fast rope operations; however, the FE will conduct all other remaining portions of the Hoist Operator's Checklist (Breeze Eastern/Lucas Western) prior to takeoff.

12.28.1. All aircraft fast rope rigging employs only one anchor point.

12.28.2. The fast rope may be attached to the hoist hook before takeoff or anytime during the flight. In-flight prior to using the hoist for fast rope operations, the FE will accomplish the Hoist Operator's Before Pickup Checklist (Breeze Eastern/Lucas Western).

12.29. Fast Rope Deployment. A fast rope that is knotted or fouled can increase the time it takes to insert personnel. Coil the fast rope toe-to-head. Once coiled it may be strapped down to the cabin floor using a seat belt/cargo tiedown strap or given to the first roper in the stick for security. To deploy the rope, merely drop the rope outside the aircraft. The fast rope simply uncoils and falls to the ground. Do not deploy the fast rope inside of its container. Remove the fast rope from the container prior to takeoff.

WARNING: Exercise care when deploying fast ropes to avoid striking people on the ground.

12.29.1. During night operations, the FE should place chem-lights at the running end, 10 feet from the running end and at the fast rope attachment point. Each roper should have a chem-light attached to their person for easy identification.

12.29.2. Each roper sits laterally in a single file line front-to-back, facing the hoist with the first roper holding the fast rope in their lap. Each roper must wear a restraint device. The FE will check all restraint devices ensuring they are properly fastened and secured to the aircraft. All legs must be in the cabin during takeoff and landing.

12.29.3. Ensure all fast ropers remain strapped in and follow the directions of the rope master/FE.

12.30. Sequence of Events. See paragraph **12.14.** for general dialogue and sequence of events. Refer to fast rope stable hover sequence of events for specific dialogue for fast rope operations.

12.31. Helicopter Fast Rope Operations:

12.31.1. "FIVE-MINUTE" Call. The FE will disconnect the security straps securing the fast rope and reposition it next to the exit or hand it over to the first roper in the stick in preparation for roper deployment.

12.31.2. "ONE-MINUTE" Call. All team members will move into position and prepare for deployment. When the aircraft is below 30 KIAS, the pilot or FE may swing the hoist boom out.

12.31.3. Stable Hover. Since the stable hover dialogue for fast rope is somewhat unique to this HRS operation, the dialogue used during fast rope operations is described below. Once in a stable hover the pilot on the controls will initiate fast rope operations by announcing "ROPES, ROPES, ROPES."

12.31.3.1. "ROPES, ROPES, ROPES." By announcing "ROPES, ROPES, ROPES", the pilot on the controls clears the FE, rope master, or roper to deploy the fast rope.

12.31.3.2. "ROPES." The FE points out the open cargo door and yells "ROPES". At this time the ropers, rope master or FE are authorized to deploy the rope. Only upon the command "ROPES, ROPES, ROPES" from the pilot on the controls will the FE give the command "ROPES".

12.31.3.3. "ROPE DEPLOYED." Once the FE has determined that the fast rope has deployed safely with a minimum of 10 feet of rope on the ground, he passes the advisory call "ROPE DEPLOYED" to the pilot on the controls.

12.31.3.3.1. After the FE verifies that the correct amount of fast rope is on the ground he directs the rope master to deploy ropers. During the evolution, the FE will give hover calls, as necessary, to maintain the aircraft over the target area.

12.31.3.4. "UNBUCKLE." On clearance from the FE, the rope master directs the ropers to remove their restraint devices. The first roper will have physical control of the fast rope prior to removing their restraint device.

12.31.3.5. "STAND-BY." The roper grasps the fast rope at eye level and prepares to exit. The remaining ropers line up behind their stick leader staying off the rope until the rope master commands them to "GO."

12.31.3.6. "GO." The rope master directs each roper to begin the descent. The #1 roper, with hands already on the rope, moves forward and makes immediate rope contact with thighs and feet. A downward descent is instantaneous. The rope master commands a subsequent roper to "GO" when the preceding roper descends approximately half the length of the rope. The rope master may also deploy, but only after all other ropers have deployed.

12.31.3.7. "ROPER # ___ AWAY." The FE passes advisory calls to the pilot on the controls and counts the number of ropers descending.

12.31.3.8. "ROPE CLEAR." The FE informs the pilot on the controls that no more ropers are on the rope and that the last roper is free and clear of the aircraft.

12.31.3.9. "ROPE RELEASED / RETRIEVED." The FE passes advisory to the pilot on the controls once the fast rope has either been released or retrieved into the aircraft and secured. (In an actual tactical situation, cut the fast rope if time is critical.)

NOTE: For multiple training evolutions, the fast rope may remain attached to the aircraft while ground personnel walk the rope clear of the aircraft as it descends to the ground.

WARNING: Ensure all personnel are clear from below the aircraft before releasing the fast rope.

12.31.3.10. "CLEAR FOR FORWARD FLIGHT" or "CLEARED FOR LANDING." The FE confirms to the pilot on the controls that the fast rope is clear of the aircraft or obstacles and there is no possibility the fast rope will become fouled. Once assured that all is clear, the pilot on the controls transitions the aircraft from a stable hover to forward flight or, during multiple training evolutions, lands.

12.32. Emergency Procedures. Many varied and unique situations can arise from fast roping personnel from a hovering aircraft. Aside from the inherent dangers of fast roping, the rope master and ropers must be prepared to address aircraft emergencies. The following procedures address a few emergencies that could reasonably occur during helicopter fast rope operations. Multiple emergencies, adverse weather or other unusual conditions may require modifications to these procedures. The nature and severity of the emergency dictate the degree of compliance. Therefore, sound judgment is the critical element in corrective action. Declarative or directive statements indicate actions taken by the FE and rope master. The decision to cut the fast rope will be made by the aircraft commander and executed at his command or as briefed.

12.32.1. Aircraft Emergency. If the helicopter experiences engine failure or other aircraft emergencies during fast rope operations, ropers on the fast rope must descend as rapidly as possible and move from beneath the helicopter to the 3-o'clock or 9-o'clock position (depending on which side the hoist is on). The pilot on the controls attempts to land the helicopter by moving forward. In the event of an aircraft emergency, initiate the following procedures:

12.32.1.1. Upon notification by the pilot on the controls of an emergency situation, signal the ropers still inside the aircraft to ABORT, STRAP IN and AIRCRAFT EMERGENCY if time permits.

12.32.1.2. On command from the aircraft commander to ABORT, the rope master ensures ropers already descending the fast rope are clear of the rope and possible helicopter impact area. Signal ground personnel there is an AIRCRAFT EMERGENCY, if possible.

NOTE: Once seated and secured, all personnel in the cabin follow the FE's directions.

12.32.2. Lost Communications/ICS Failure. ICS communications between the pilot on the controls, the FE and the rope master is mandatory. In the event of an ICS failure, initiate the following procedures:

12.32.2.1. Signal the remaining ropers HOLD, and or ABORT, LOST COMMUNICATION, and STRAP IN if time permits.

NOTE: Hand-and-arm signals are only used to complete the descent of the ropers on the fast rope at the time of the ICS failure. At no time are descents initiated during an ICS failure.

12.32.2.2. If ICS is re-established, the FE will direct the pilot on the controls back into position and operations may continue.

12.32.3. Fouled Fast Rope. A fast rope may become fouled or entangled on ground obstacles during the course of fast rope operations. If a fast rope becomes fouled, initiate the following procedures:

12.32.3.1. Immediately notify the pilot on the controls of the fouling and ensure all ropers are clear.

12.32.3.2. If possible, the pilot on the controls descends or repositions the aircraft in order to decrease tension on the fast rope, if rope tension is removed, have the FE or rope master attempt to clear or untangle the fast rope.

12.32.3.3. If unable to land, clear or untangle the fast rope, release the fast rope from the hoist hook and let it fall to the ground. If you cannot release the fast rope due to tension on the rope, cut the hoist cable using the hoist cable cut switch.

WARNING: Do Not Use the Helicopter To Pull the Fast Rope Free.

12.32.4. Helicopter Gains Altitude. If the helicopter gains altitude so that less than 10 feet of fast rope is on the ground, or if the helicopter drifts off the target, initiate the following procedures:

12.32.4.1. Direct ropers to HOLD preventing any additional descents.

12.32.4.2. Redirect the helicopter back over the target or descend to correct altitude. Once back on target and/or altitude and on approval from the pilot on the controls, continue fast rope operations.

Section 12E— Rope Ladder Procedures

12.33. General. The rope ladder can be used for both air to ground deployment and extraction of personnel from water or land recovery zones. Rope ladder HRS operations offer an alternate to hoist recovery and are suitable for most terrain. The major drawback to using the rope ladder for HRS operations is its limited capability due to the ladder length, size and weight.

12.34. Specific Equipment for Rope Ladder. The rope ladder is made of nylon webbing with aluminum rungs and varies in length from 20 to 60 feet. The rope ladder features six weighted rungs (first six rungs from the bottom), two heavy-duty steel standoff wheels and a simple quick release mechanism that allows the ladder to be immediately jettisoned from the aircraft in case of an emergency or during tactical situations. A poly-foam floatation device used during water operations can be attached to the last rung of the ladder. The complete assembly weighs 43 lbs. and is load rated at 2,500 lbs. The only authorized rope ladder for use on the H-1 is PN# ELD800PD-1.

12.34.1. The quick release mechanism includes a base plate that contains a rotating release handle and control shaft assembly, safety pip-pin and two attaching straps with snap hooks. The snap hooks are designed with spring-loaded locking gates that prevent the snap hooks from accidentally working off of the cargo tie-down fittings.

12.34.1.1. The release mechanism design creates a three-step release procedure preventing accidental rotation of the control shaft. To jettison the rope ladder, first depress the safety button on the pip-pin, then remove the pip-pin from the bracket and finally rotate the release handle. Rotating the release handle raises two fastener pins allowing the ladder (under it's own weight) to be pulled away from the base plate.

12.34.1.2. The flight engineer is responsible for providing, inspecting, and rigging rope ladders. When use of the rope ladder is anticipated, refer to AFI 11-2H-1, Vol 3, CL-1 for rope ladder inspection criteria.

12.35. Individual Equipment. All personnel accomplishing rope ladder operations will wear and adhere to all of the equipment/clothing requirements specified in para. **12.13.**

12.36. Restrictions. The maximum number of personnel on the ladder at any one time is three; this does not include the anchorman who is only performing anchorman duties. If more than three personnel are allowed to climb the rope ladder at the same time, the excess weight could cause loss of aircraft control and or CG problems. Ensure that a minimum of five rungs are maintained on the ground at all times during rope ladder operations.

12.37. Aircraft Rigging. The rope ladder will be secured to the aircraft by attaching the ladder snap hooks through both the anchor cable and the cargo tie-down fittings (**figure 12.8.** and **figure 12.9.**). When the snap hooks are attached to the anchor cable and cargo tie-down fittings, ensure the gates are facing up and that the ladder attaching straps are not twisted and lie relatively flat on the cargo floor. The rope ladder will be fan folded or rolled up and secured before flight.

Figure 12.8. UH-1N Rope Ladder Attaching Points (Left Side).

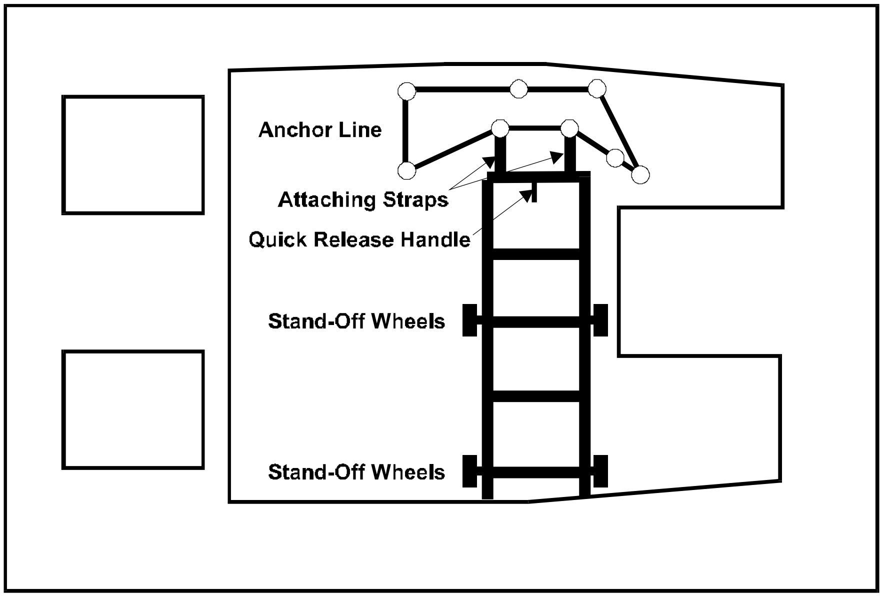
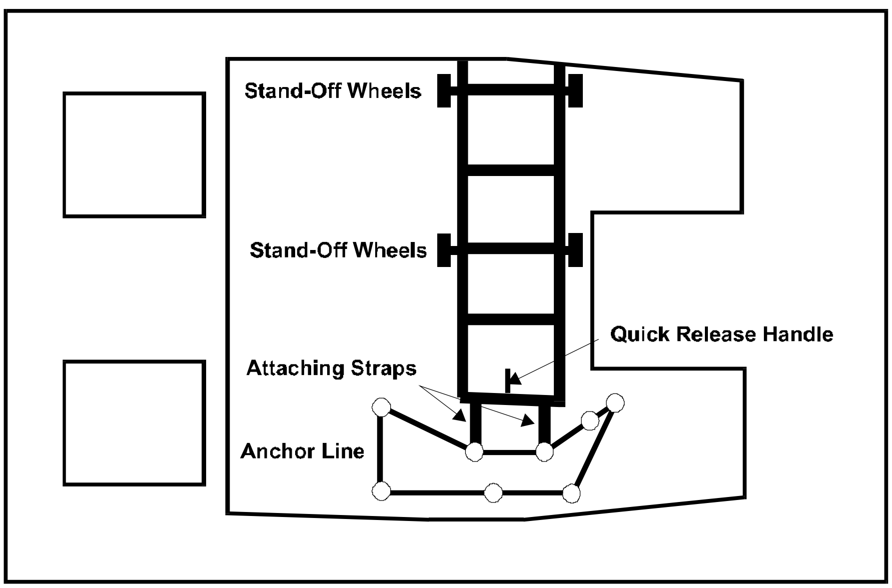


Figure 12.9. UH-1N Rope Ladder Attaching Points (Right Side).



12.37.1. The cargo tie-down fittings to be used for the left side rope ladder installation are 38, 42, 44, 54, 56, 58, 60, and 64. These are the only tie-down fittings that can be used.

12.37.2. The cargo tie-down fittings to be used for the right side rope ladder installation are 37, 41, 43, 53, 55, 57, 59, and 63. These are the only tie-down fittings that can be used.

12.38. Rope Ladder Deployment. A rope ladder that is knotted or fouled can increase the time it takes to insert or extract personnel. Depending on mission requirements you can fan fold the rope ladder, position and secure it in the doorway ready for immediate deployment, or position and secure it out of the way for later use. Once fan folded and positioned in the aircraft, it may be secured to the cabin floor using a seat belt/cargo tie-down strap.

12.38.1. To prepare the rope ladder for deployment, merely unstrap the ladder, attach it to the anchor cable and reposition the ladder in the doorway ensuring it is properly folded for deployment (this should minimize ladder fouling). Once in the doorway, ladder security may be accomplished by using your body weight, cargo tie-down straps or seat belts.

12.38.1.1. Upon command from the pilot on the controls deploy the rope ladder by tossing the last weighted rung outside the aircraft. The rope ladder simply unfolds and falls to the ground. Do not deploy the rope ladder in its carrier. Remove the rope ladder from its carrier prior to takeoff.

WARNING**:** Exercise care when deploying the rope ladder to avoid striking people on the ground.

WARNING**:** During ladder deployment ensure that an adequate amount of body clearance is maintained between your body and the rope ladder during pay-out. If not, you may be struck by the rope ladder possibly causing injury.

12.38.2. During night operations, a chem-light will be attached to each side of the ladder at the first and fifth rungs. Another chem-light will also be placed around the immediate vicinity of the rope ladder quick release handle. Team member(s) should have a chem-light attached to their person for easy identification.

12.38.3. Water Deployment. During water deployments or extractions, use an established water hoist pattern. Ladder deployment and retrieval is the same as over land; however, it may be necessary for the team members to position themselves along the wind line at approximately 25-foot intervals to allow the pilot to hover taxi the aircraft for pickup. Hover taxiing at approximately two to five knots will reduce water spray and aid in a more rapid extraction of personnel.

12.38.4. The hover height of the aircraft depends upon rope ladder length. The FE will monitor the ladder to ensure that a minimum of two steps are in the water prior to reaching the first member and advise the pilot of required altitude changes to maintain this condition. As the ladder is trolled through the water, personnel will grab the ladder and ascend immediately.

12.39. Sequence of Events. See para. **12.14.** for general dialogue and sequence of events. Refer to rope ladder stable hover sequence of events for specific dialogue for rope ladder operations.

12.40. Helicopter Rope Ladder Operations:

12.40.1. "ONE-MINUTE OUT" Call. The FE will disconnect the cargo tie-down straps or seat belts securing the rope ladder and reposition it in the doorway. Then when the aircraft is below 30 KIAS, the pilot or FE may swing the hoist boom out.

12.40.2. Stable Hover. Since the stable hover dialogue for rope ladder is somewhat unique to this HRS operation, the dialogue used during rope ladder operations is described in paragraphs **12.40.2.1.** through **12.40.2.6.** Once in a stable hover the pilot on the controls will initiate rope ladder operations by announcing "ROPES, ROPES, ROPES."

12.40.2.1. "ROPES, ROPES, ROPES." By announcing "ROPES, ROPES, ROPES," the pilot on the controls clears the FE to deploy the rope ladder.

12.40.2.2. "LADDER DEPLOYED." Once the FE has determined that the rope ladder has deployed safely, without fouling, and with a minimum of five rungs on the ground, he passes the advisory call "LADDER DEPLOYED" to the pilot on the controls.

12.40.2.3. Upon verifying that the correct amount of rope ladder is on the ground the FE will then wave the team in and provide the crew with a running commentary of the team's ascent into the aircraft. During the evolution, the FE will give hover calls, as necessary, to maintain the aircraft over the target area.

12.40.2.4. "LADDER CLEAR." The FE informs the pilot on the controls that no more team members are on the rope ladder and that the last member is in the aircraft.

12.40.2.5. "LADDER RELEASED/SECURED." The FE passes this advisory call to the pilot on the controls once the rope ladder has either been released or retrieved into the aircraft and secured. (In an actual tactical situation, jettison the rope ladder if time is critical.)

NOTES:

For multiple training evolutions, the rope ladder may remain attached to the aircraft while ground personnel walk the rope ladder clear of the aircraft as it descends to the ground.

WARNING: Ensure all personnel are clear from below the aircraft before jettisoning the rope ladder.

12.40.2.6. "CLEAR FOR FORWARD FLIGHT" or "CLEARED FOR LANDING." The FE confirms to the pilot on the controls that the rope ladder is clear of the aircraft or obstacles and there is no possibility the rope ladder will become fouled. Once assured that all is clear, the pilot on the controls transitions the aircraft from a stable hover to forward flight or, during multiple training evolutions, lands.

12.41. Emergency Procedures. Many varied and unique situations can arise from rope ladder operations. Aside from the inherent dangers with using a rope ladder the FE and team members must be prepared to address aircraft emergencies. The following procedures address some emergencies that could reasonably occur during helicopter rope ladder operations. Multiple emergencies, adverse weather or other unusual conditions may require modifications to these procedures. The nature and severity of the emergency dictate the degree of compliance. Therefore, sound judgment is the critical element in corrective action. Declarative or directive statements indicate actions taken by the FE and rope master. The decision to jettison the rope ladder will be made by the aircraft commander and executed at his command or as briefed.

12.41.1. Aircraft Emergency. If the helicopter experiences engine failure or other aircraft emergencies during rope ladder operations, members on the ladder must remain on it until ground or water contact is made. Upon contact have personnel clear the rope ladder and the area beneath the helicopter to either the 3 or 9-o'clock position (depending on which side the rope ladder is on). The pilot on the controls attempts to land the helicopter by moving forward. In the event of an aircraft emergency, initiate the following procedures:

12.41.1.1. Upon notification by the pilot on the controls of an emergency situation, signal the team members still ascending the ladder to ABORT, and AIRCRAFT EMERGENCY if time permits. If possible signal ground personnel there is an AIRCRAFT EMERGENCY.

12.41.1.2. In an emergency or if the aircraft comes under fire and forward flight is possible, personnel will secure themselves to the ladder and the aircraft may depart the area. Care should be taken during forward flight due to the ladder twisting and turning. This twisting and turning causes the ladder to become unstable which could dislodge personnel. Slow forward flight to a safe area should be accomplished if flight characteristics and power requirements allow. Airspeed with personnel on the ladder should not exceed 60 KIAS.

NOTE: Once seated and secured, all personnel in the cabin will follow the FE's directions.

12.41.2. Lost Communication/ICS Failure. ICS communications between the pilot on the controls and the FE is mandatory. In the event of an ICS failure, initiate the following procedures:

12.41.2.1. Signal the remaining ground personnel to HOLD or ABORT, and LOST COMMUNICATION if time permits.

NOTE: Hand-and-arm signals are only used to complete the ascent of the members on the rope ladder at the time of the ICS failure. At no time are ascents initiated during an ICS failure.

12.41.2.2. If ICS is re-established, the FE will direct the pilot on the controls back into position and continue with rope ladder operations.

12.41.3. Hung Climber. This is a member who has started climbing the rope ladder and is unable to complete the ascent. A member can become hung for a variety of reasons--injury, loose clothing, straps, equipment, or physical exhaustion. In the event of a hung climber, initiate the following procedures:

12.41.3.1. The FE immediately notifies the crew.

12.41.3.2. Signal the climber(s) to HOLD-ON or LOCK-IN.

12.41.3.3. If possible, have the aircraft descend to lower the climber(s) to the ground/water.

12.41.3.4. Once the climber(s) reaches the ground/water have them clear off the rope ladder. If able, land and on load the member(s). If unable to land the aircraft for on-loading the member(s), maintain a low hover and have the member(s) attempt a second climb.

12.41.3.5. If the aircraft is unable to land or descend to off-load the climber(s) and if power requirements and flight characteristics allow, accomplish the following:

12.41.3.5.1. Signal the climber(s) to LOCK or TIE-IN and hold on.

12.41.3.5.2. Notify the aircraft commander that all climber(s) are on the rope ladder and secured and it is clear for forward flight.

WARNING: In forward flight the rope ladder has a tendency to twist and turn which causes the ladder to become very unstable and could dislodge climber(s) from the ladder. Maintain slow forward flight not to exceed 60 KIAS.

12.41.3.5.3. The FE will provide advisory calls to the pilot of the climber(s) condition while they are Locked or Tied-In and the stability of the rope ladder. Accomplish slow flight to an area suitable for helicopter landing. Descend until climber(s) contact the ground/water. Allow the climber(s) to clear off the rope ladder and then land for pickup.

12.41.4. Fouled Rope Ladder. A rope ladder may become fouled or entangled on ground obstacles during the course of ladder operations. If the rope ladder becomes fouled, or entangled initiate the following procedures:

12.41.4.1. Immediately notify the pilot on the controls of the fouling and ensure all members are clear.

12.41.4.2. If possible, have the FE retrieve or attempt to clear the ladder. Once cleared the FE can deploy the ladder and continue with rope ladder operations.

12.41.4.3. In the event the rope ladder becomes entangled initiate the following procedures:

12.41.4.3.1. If possible have the pilot descend, reposition or land in order to decrease tension or untangle the rope ladder. When tension has been removed from the ladder, have the FE attempt to untangle the ladder.

WARNING: Do Not Use the Helicopter To Pull the Rope Ladder Free.

12.41.4.3.2. If unable to land or untangle the rope ladder, jettison the ladder by pulling the quick disconnect pin, actuating the jettison handle and letting it fall to the ground.

12.41.4.3.3. In the event the ladder becomes entangled on the ground and aircraft control is questionable, it may be desirable to jettison the ladder. Aircraft and personnel safety will determine the course of action to be taken.

12.41.5. Helicopter Gains Altitude. If the helicopter gains altitude so that there are less than five rungs of rope ladder on the ground, or if the helicopter drifts off the target, initiate the following procedures:

12.41.5.1. Direct team members to HOLD preventing any additional ascents.

12.41.5.2. Redirect the helicopter back over the target or descend to the correct altitude, once back on target and/or altitude and on approval from the pilot on the controls, continue rope ladder operations.

Section 12F— Free Fall Swimmer Deployment Procedures

12.42. General. This maneuver provides an effective method of delivering a swimmer(s) near a target or objective area in the water. All forces may utilize free-fall swimmer deployment.

12.42.1. Determine the wind direction prior to personnel delivery. Some objectives can drift up to ten percent of the wind velocity. Usually, personnel deliveries should be made down drift of the objective. When mission circumstances warrant, deliver swimmers up or off wind.

12.42.2. Make an approach into the wind at approximately 10 feet AWL and 10 knots.

12.42.3. Deployment Procedures:

12.42.3.1. Safetyman positioning/exit points: Forward and slightly aft of the last deploying team member/sitting position from either or both cabin doors.

12.42.3.2. Safety considerations during final approach:

12.42.3.2.1. The team members should be in a position to view the objective area at approximately 50 feet AWL.

12.42.3.2.2. All deploying exits will be open at 50 feet AWL and below. Deploying personnel will be secured until established on final approach.

12.42.3.2.3. The "thumbs up" from the safetyman to the deploying team on final indicates 10 feet AWL and 10 knots is confirmed and the team is cleared to deploy at the team leader's discretion.

WARNING: The safetyman will ensure the departing team members have removed their restraining device(s) prior to deployment.

12.42.3.2.4. It is recommended all rescue hoist checklists be completed in the event an injury occurs to the departing team. An immediate extraction may be required.

12.42.3.2.5. The team leader will brief equipment delivery procedures.

12.42.3.2.6. The safetyman will ensure adequate gear/airframe clearance exists during deployments.

12.42.3.2.7. Deploying team members should show a "thumbs up" signal after water entry. This indicates they are "OK" and have not sustained injuries.

12.42.4. If a pattern is planned, aircrews will use the typical water hoist patterns discussed in Chapter 11. Regardless of the type pattern flown, when OGE power is not available, turns will not be accomplished below 50 feet AWL. A minimum of 50 KIAS will be maintained during the water recovery pattern.

12.42.5. Restrictions:

12.42.5.1. Day. Free-fall swimmer deployments require a standby hoist equipped or raft equipped helicopter and crew to be available for SAR operations unless a safety boat is stationed in the vicinity of the deployment location.

12.42.5.2. Night. Accomplished only during NVG water operations. When delivering other than USAF personnel, a safety boat or second hoist equipped or raft equipped helicopter should be present.

12.43. Swimmer Recovery Procedures. Hoist recovery procedures in **chapter 11** apply for all water hoist recoveries. An alternative method of recovery is by rope ladder as described in this chapter. Ensure the rope ladder is grounded in the water prior to reaching the first swimmer.

Chapter 13

PARACHUTE DELIVERY PROCEDURES

Section 13A— Personnel Delivery Procedures

13.1. General. These procedures apply to all aircrews participating in the delivery of personnel by parachute. Coordination between the aircraft commander and jumpmaster is the key to success. Details for delivery patterns are provided in Field Manual 57-230, Advanced Parachuting Techniques, and AFM 100-27, U*S Army/Air Force Doctrine for Joint Airborne and Tactical Airlift Operations.* Personnel parachute delivery pattern/procedures are depicted in **figure 13.1.** All training will be conducted at surveyed and approved drop zones.

13.1.1. Deployment of Parachutists. Unit/mission commanders may authorize parachutists to deploy from aircraft under their control. Personnel authorized must have a valid operational currency, administrative or training requirement. In addition, the personnel must be graduates of an accredited armed forces parachutist course and possess aeronautical parachutist orders. The aircraft commander or a designated representative will inform the jumpmaster of required qualifications. It is the jumpmaster's responsibility to ensure all participants are in compliance with these requirements. For water jumps utilizing SCUBA equipment, personnel must be certified military SCUBA divers.

13.2. Mission Briefing. The aircraft commander will give a thorough briefing. All aircrew members and the jumpmaster will attend. Ensure a passenger briefing is given. In addition, the following items will be covered:

13.2.1. Use of restraining devices.

13.2.2. Exits.

13.2.3. Movement in cargo compartment.

13.3. Drop Zone Markings:

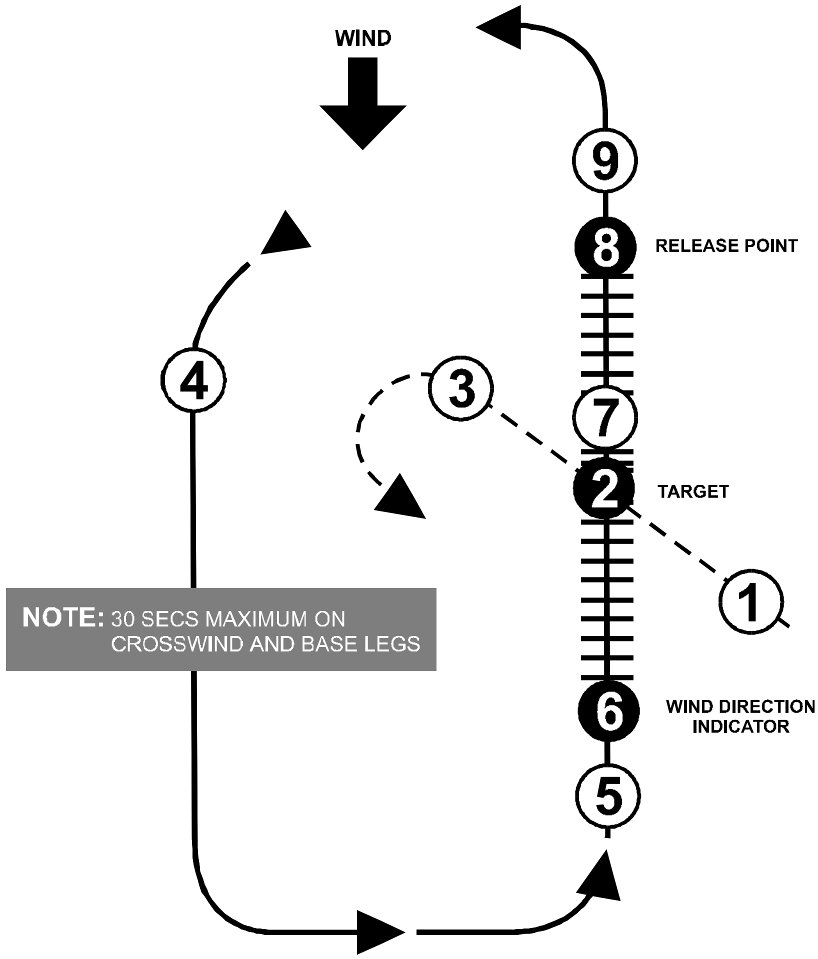
13.3.1. Placement and markings for both night and day drops will be as outlined in Field Manual 31-20, Doctrine for Special Forces Operations and this instruction. Emphasis must be focused to ensure the DZ controllers and aircrews are fully coordinated on markings used, configuration on the DZ, method of identification and/or authentication, and release point.

13.3.2. For training or exercise missions, a "Regular L" is normally used. The helicopter flies up the base of the "L" and the jumpers exit when abeam the flanker panels. When using this marking system, the helicopter does not normally fly the 50-meter offset.

13.4. DZ Identification/Authentication:

13.4.1. Surface-to-Air:

Figure 13.1. Nontactical Spotting and Personnel Parachute Delivery.



Legend

1. Head directly toward the target, regardless of wind direction
2. Release the wind direction indicator (WDI) directly over the target (if required)
3. Immediately upon release, execute right/left turn to observe descent and position of WDI
4. Establish rectangular drop pattern oriented so that the final approach will be aligned with the WDI
5. Turn on approach. Make minor heading changes to pass over the WDI and the target on a direct line. Aircraft drift correction should be applied prior to passing over the WDI
6. Initiate a uniform count over the WDI
7. Reverse count over the target
8. Deploy a second WDI (if required) or parachutist when the last digit in the reverse count is reached
9. After the jumper clears the aircraft and the flight engineer states, "Jumper away, clear to turn," turn to observe the accuracy of the drop.

13.4.1.1. The primary method of confirming DZ identification is by radio contact or the display of a specified target marker during the scheduled time block. However, the specified target marker displayed from two minutes prior to two minutes after a scheduled TOT, oriented to the approach azimuth and/or track and at the specified geographical location, may serve as DZ identification and authentication.

13.4.1.2. An additional code light or smoke signal may be used for identification/authentication.

13.4.1.3. All authentication requirements indicated on the mission request must be met or the drop will be aborted.

13.4.2. Air-to-Surface. The aircraft is identified or authenticated by arriving in the objective area within the specified time frame on the designated approach azimuth and/or track.

13.5. Abort Procedures. When conditions are not safe for the drop or if the drop is aborted for any reason, the term "no drop" will be used to alert the crew of an aborted deployment. A crewmember will display a closed fist to personnel not on intercom. Do not attempt to stop a jumper who has already initiated exit.

13.6. Wind Limitations. Wind limits will be prebriefed to the aircraft commander by the jumpmaster.

13.7. Altitude/Airspeed Limitations (Training):

13.7.1. Minimum pattern altitude_1,500 feet AGL/AWL.

13.7.2. Delivery airspeed is normally 60-90 KIAS. Do not exceed 70 KIAS for APS-17/18 (The jumpmaster will brief the specific airspeed requirements prior to takeoff).

NOTE: Static lines will not be hooked up until the aircraft is 1,000 feet AGL.

13.8. Seating Positions. Jumpers sit on the floor at the edge of cargo doors. From either/both sides (if only one side is used, it should be the side opposite the tail rotor).

13.9. Aircraft Restrictions:

13.9.1. The cabin door on the tail rotor side should remain closed unless delivering parachutists from both sides.

NOTE: To keep the static line from becoming entangled, all excess static line will be restowed in the jumper's parachute static line retaining bands.

13.10. Aircraft Preparations:

13.10.1. The anchor line will be connected through the tie down rings as depicted in **figure 13.2.**

13.10.2. During preflight, the crew will ensure the following actions are accomplished:

13.10.2.1. All protruding objects and sharp edges in the vicinity of the exit doors are removed or taped.

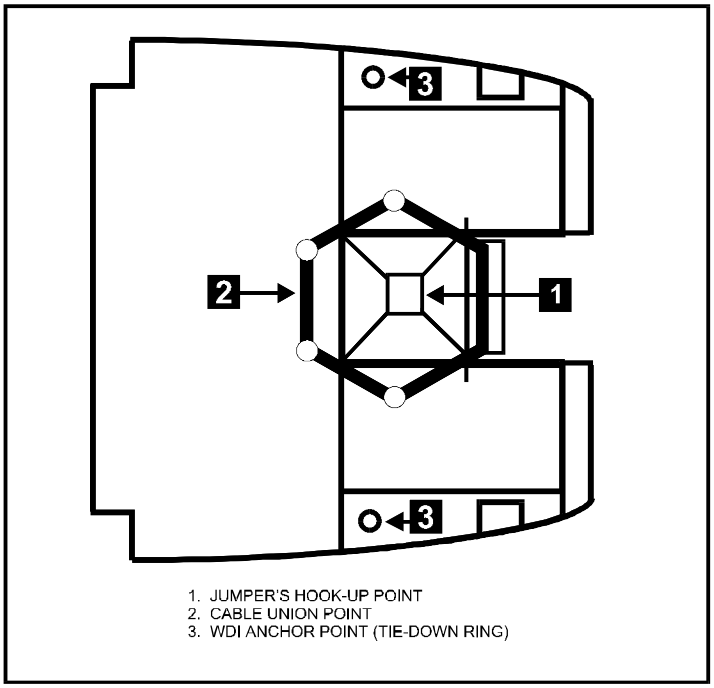
13.10.2.2. The anchor line cable is secure.

13.10.2.3. A seat belt is provided for each parachutist.

13.10.2.4. A safety harness is provided for the aircrew safetyman and jumpmaster.

13.10.2.5. Troop seats will be configured to avoid damage or entanglement.

Figure 13.2. Anchor Line Cable.



13.11. Delivery Procedures:

NOTE: The flight engineer does not perform safetyman duties, however, he will assist the jumpmaster as required.

13.11.1. Head directly toward the target, regardless of the wind direction.

13.11.2. Release the WDI (wind direction indicator, i.e., spotter chutes or streamers) directly over the target (if required).

13.11.3. Immediately upon release, turn to observe descent and position of WDI.

13.11.4. Establish rectangular drop pattern oriented so the final approach will be aligned with the WDI and the target, respectively.

13.11.5. Turn on approach. Make minor changes in heading to pass over the WDI and the target on a direct line. Aircraft drift correction should be established prior to passing over the WDI.

13.11.6. Initiate uniform count over the WDI.

13.11.7. Reverse count over the target.

13.11.8. Deploy the second WDI (if required) or parachutist when the last digit in reverse count is reached.

13.11.9. After the jumper clears the aircraft the flight engineer states, "JUMPER AWAY." When the flight engineer retrieves the static line and deployment bag he states "CLEAR TO TURN." The purpose of the turn is to maintain visual contact with the jumpers.

WARNING: Do not turn until the static lines and deployment bag have been retrieved.

13.12. Communications:

13.12.1. Air-to-Surface. Radio contact with the DZ is normally required. This requirement is waived if:

13.12.1.1. Lost radio procedures are prebriefed (not authorized for night jumps).

13.12.1.2. Red smoke grenades or flares are available to the DZ control party.

13.12.1.3. Marker panels and DZ markers are visible to the pilot or jumpmaster when inbound to the DZ.

13.12.2. Aircrew Communication Procedures:

13.12.2.1. Voice terminology. The accuracy of a personnel delivery mission depends on the coordination between crewmembers. The pilot will normally give ten-minute, five-minute, and one-minute warnings prior to reaching the drop zone. The pilot will call one minute prior to drop and will acknowledge "CLEAR TO DROP" after he receives the response "SAFETYMAN CHECK COMPLETED." The decision whether or not to jump rests with the aircraft commander. The jumpmaster will acknowledge all calls from the pilot. The jumpmaster provides heading corrections on final approach using the following standard terminology:

13.12.2.1.1. "STEADY." Present course is satisfactory.

13.12.2.1.2. "RIGHT." Change direction to the right five degrees.

13.12.2.1.3. "LEFT." Change direction to the left five degrees.

13.12.2.1.4. "RIGHT/LEFT ___ DEGREES." Change direction as indicated. This direction is utilized to direct changes in excess of five degrees.

13.12.2.1.5. "NO DROP." No drop will be made due to unsafe or unknown conditions or unsatisfactory positioning over target.

13.12.2.1.6. "JUMPER AWAY, CLEAR TO TURN." The pilot is clear to turn and begin the next pass or observe the results of the drop just accomplished. The safetyman retrieves all deployment bags prior to issuing a clearance to turn.

13.12.2.1.7. Special considerations. To inform the pilot of the location of the WDI, or jumper, use clock positions relative to the last final flown; i.e.; "The WDI landed at the 12 o'clock position, 100 yards away".

13.12.2.2. Hand signals. When off intercom, the jumpmaster will use the following hand signals to relay course corrections through the safetyman. Hand signals will be briefed prior to flight.

13.12.2.2.1. Thumb left/right indicates five-degree corrections.

13.12.2.2.2. Straight ahead is indicated by a vertical "slicing" motion parallel to the longitudinal axis of the aircraft, hand held perpendicular to the floor.

13.12.2.2.3. Abort jump or lost target is indicated by clinching the fist and placing it in front of the first jumper for an aborted jump, or passing the hand in front of the face to indicate the DZ is lost.

13.13. Emergency Procedures. The jumpmaster and/or safetyman will notify the pilot if a parachutist is being towed. The jumpmaster/safetyman recovers and stores all other deployed static lines and deployment bags. The pilot slowly descends to the DZ or other appropriate site and brings the aircraft to a hover. The jumpmaster/safetyman unhooks the towed parachutist's static line, deplanes, and detaches the towed parachutist. Avoid flying over land if jumper is SCUBA equipped.

WARNING: Do not lower an unconscious jumper into the water.

Section 13B— Equipment Delivery Operations

13.14. General. The procedures in this section are provided for those instances where equipment airdrops are required. Airdrop operations refer to air movement of supplies or equipment in which unloading of equipment is accomplished in flight. Free-fall bundle drops are recommended.

13.15. Wind Limitations:

13.15.1. Surface wind: 17 knots.

13.15.2. Drop altitude winds: 40 knots.

13.16. Procedures. Briefings, drop zone markings, authentication, and abort procedures are identical to those procedures listed in **section 13a** - PERSONNEL DELIVERY. The approach should be planned so delivery of equipment can be accomplished at the lowest airspeed and altitude allowing safe flight. Caution must be exercised to preclude injury to personnel on the ground during the delivery. Drops will always be made to targets set up by ground personnel. Aerial delivery of equipment will be accomplished in the following manner:

13.16.1. Ground forces personnel are responsible for selecting the DZ and marking the desired point of impact with panels, smoke, or lights. The pilot is responsible for selecting the release point and initiating the airdrop so the cargo impacts as close as possible to the designated target.

13.16.2. Free-fall drops should be made as low as safety permits, but never above 200 feet AGL.

13.17. Life Raft Delivery (Non-Emergency):

13.17.1. Preparing the raft for drop:

13.17.1.1. Remove the raft inflation D-ring from its pocket and leave the pocket unsnapped. Install a chem-light on the D-ring during night operations.

13.17.1.2. Secure a 14 inch piece of MIL-T-5661-C (45 lb. breaking strength) web tape through the D-ring to form an approximate 5-inch diameter loop.

13.17.1.3. Secure the raft in a convenient location in the cabin.

13.17.1.4. Locally manufacture a ten foot lanyard by sewing one snap hook, P.N. MS70120, to each end of a 10 foot long piece of 1,000 lb. tensile strength or greater nylon webbing with a box-X stitch. Attach one snap hook to a tie down ring located near the cabin door. Attach the other snap hook to the 5-inch diameter loop of web tape.

13.17.1.5. On night flights, attach chem-lights to the raft's lifeline prior to deployment.

13.17.2. Delivery Procedures:

13.17.2.1. Use a smoke device on all life raft drops to assist in determining the exact wind direction and a drop reference (if required).

13.17.2.2. Use normal traffic pattern airspeeds/altitudes.

13.17.2.3. Make a shallow approach in order to establish level flight at 40 knots and 75 feet AWL on final. Two crewmembers work together, one to monitor the survivor and signal the other crewmember to deploy the raft when directly over the survivor. Delay the drop one second for every five knots of wind over 10 knots. After dropping the raft, call "RAFT AWAY" and immediately recover the lanyard.

13.17.3. Safety Procedures:

13.17.3.1. When scanning or conducting life raft deployments, all personnel will wear safety harnesses to preclude accidental exit from the helicopter.

13.17.3.2. A V-blade knife should be available to cut the raft if it should become entangled.

13.17.3.3. Do not hold the 10-foot lanyard after the raft is dropped.

Chapter 14

PREPARATION AND LAUNCH OF PYROTECHNICS

14.1. General. This chapter covers the preparation and launch of pyrotechnics. TO 11A8-2-1, Operators' Manual -- Hand and Rifle Grenandes, 66MM Rocket Launcher, 81MM Mortars, 90MM Recoilless Rifle, 40MM Cartridges, Flares and Signals, Smoke Pots, Land Mines, and Cartridge, 84MM M136 (AT-4) -- (ATOS), TO 11A8-5-7, Storage and Maintenance Procedures -- Grenades, Hand and Rifle, TO 11A10-24-7, Storage and Maintenance Procedures -- Aircraft Parachute Flares, M8A1 PN 9217950 or MILF20363, LUU-2/B PN 7U41975-01, LUU-2A/B PN 728921 LUU-2B/B PN 8240946-10 LUU-4/B PN 747548 F5B, F5E., TO 11A10-25-7, Storage and Maintenance Procedures -- Pyrotechnic Markers, MK1 MOD 3 PN B11690, MK2 PN 344505, MK25 MOD 3 PN LD 615141 OR 1332145, M59 PN 78-0-68 ANS LUU-10/B PN 726217 F5B, F5E, and TO 11A10-26-7, Storage and Maintenance Procedures -- Pyrotechnic Signals F5B, F5E, contain the technical data on pyrotechnics, and AFMAN 91-201, Explosives Safety Standards, contains mandatory explosive safety standards. Eye protection and/or visor will be worn when deploying all pyrotechnics. All pyrotechnics must be used in a manner so as not to create a fire hazard. Personnel will not depart the area until all pyrotechnics have been extinguished.

WARNING: Prior to arming pyrotechnics in flight, a door will be open to permit emergency jettisoning.

14.2. AN-MK 6, MOD 3; Aircraft Smoke and Illumination Signal:

14.2.1. Use. This signal provides long-burning surface smoke and illumination for day or night use. It is used to mark sightings at sea, make sea evaluations, mark sea-lanes for night water landings, or wind drift determination prior to deploying personnel. It may be used to provide smoke on land surfaces if a fire hazard does not exist. Burn time is 40 minutes (approximately).

14.2.2. Operation. Prior to launching the signal, remove the adhesive tape covering the pull ring.

NOTE: Do not remove the four square patches of adhesive tape covering the metal caps in the holes from which flame and smoke issue after ignition of the candle. When the signal is launched, actuate the pull-type igniter, either by hand or by a lanyard. This signal may be deployed from altitudes up to 5,000 feet AGL.

***WARNING*:** The illumination and smoke signal must be launched immediately after the igniter has been actuated.

14.2.3. Special Precautions. Do not use a static line or lanyard to actuate the smoke signal when used for wind determination prior to personnel deployment.

14.3. MK 25, MOD 4:

14.3.1. Use. The MK 25, MOD 4 is designed to be launched from aircraft to provide day or night reference points. The marker is suitable for any type of sea-surface reference-point marking that calls for both smoke and flame for a period of approximately 15 minutes.

14.3.2. Operation. When the marker is launched, seawater enters the battery cavity and serves as an electrolyte causing the MK 72 battery to produce current that activates the MK 13 squib. The squib ignites the starter composition, which in turn ignites the red phosphorus pyrotechnic candle. Gas buildup forces the valve assembly from the chimney in the nose and yellow flame and white smoke are emitted. Burning time ranges from 13.5 to 18.5 minutes.

14.3.3. Operation. Remove the marker from the shipping container and inspect for damage of any kind. Dented, corroded, or otherwise damaged markers shall not be used. Remove the protective cover by rotating (unthreading) counterclockwise. Fully depress (0.3 inch, using 18 pounds of force) arming cap and remove. Throw the marker into the water. The marker contains a pyrotechnic scuttle element and three .013 diameter flood holes to assure that the marker will scuttle and sink within three to twelve hours after water impact or one to three hours after ignition.

WARNING**:** To avoid possible injury, personnel should stay clear of the end of the marker containing the nose valve. Nose valve ejection can spontaneously occur due to internal pressure from hydrogen generation.

WARNING**:** This marker contains more than 26 ounces of red phosphorus which burns to produce high temperature flame and abundant smoke which is a caustic irritant to the skin and mucous linings of the nose and throat.

14.4. AN-MK 59; Marine Location Marker:

14.4.1. Use. This marker is designed to produce a reference point on the ocean's surface in the form of a fluorescent green dye slick. It is used to mark sightings or as a signal in search and rescue operations. Dye persists for approximately two hours.

14.4.2. Operation. Open the cardboard container and remove the barrier line and completely open the end of the barrier bag overpack. When ready for deployment, invert the bag and allow the dye bag to free-fall from the protective bag. Upon striking the surface, the plastic bag ruptures, releasing the dye.

NOTE: Due to the fragile nature of the plastic bag containing the dye, it should be left in the barrier bag until deployment.

14.5. MK 18; Smoke Grenade (Red, Green, Yellow, or Violet):

14.5.1. Use. This grenade is used for daytime ground and ground-to-air signaling of search aircraft to indicate wind direction or for prearranged visual communications. Smoke time is approximately one minute.

14.5.2. Operation. To launch, grasp the signal firmly in one hand holding the safety lever firmly against the grenade body while the cotter pin is removed and until the grenade is launched.

14.5.3. Special Precautions. Do not remove the safety cotter pin from the firing mechanism unless the smoke is held properly and is ready for launching. The grenade type firing mechanism must be held so as to assure the safety lever is secure against the body of the smoke until it is launched. Only a small movement of the release lever is required to free the striker igniting a one to two second delay element of the fuse.

WARNING**:** Do not remove the safety pin until just prior to deployment. Once prepared for use, the smoke must be expended.

Chapter 15

CARGO SLING OPERATIONS

15.1. General. It is not practical or necessary to publish separate aircrew procedures for every possible sling load helicopters may be tasked to carry. Problems regarding sling loads primarily involve improper preparation of the load. If the load is configured correctly, the procedures are the same, whatever the load may be. The aircraft commander is responsible for selection of the hookup and release points. Coordination with the unit requesting the airlift and the unit furnishing support is necessary. The hookup and release areas should be selected to avoid flight over people, vehicles, buildings, or congested areas and to provide optimum safety. The surface should be relatively level and free of vertical obstructions. Areas of dust, mud, snow, or ice should be avoided. Mark the hookup and release point for easy identification. Determine wind direction and estimated velocity prior to conducting cargo sling operations; however, to allow for a margin of safety, wind is not considered in computations for power required to hover. Preposition loads to expedite hookup. Thoroughly brief all personnel concerned with the mission on their duties and responsibilities during the operation. Give particular attention to the increased rotor downwash and its effect on loose equipment, personnel, and debris.

15.2. Preparation and Lift Off. Prior to cargo sling/hook operations, thoroughly preflight all cargo sling/hook components. Accomplish a power available check (IAW para. **6.7.**) prior to sling operations. Compare computed power required to lift the load with power available to ensure an adequate power margin is available.

15.2.1. Cargo Pickup. Hookup to the cargo load is accomplished using intercom instructions between the scanner and the pilot and, when required, hand signals between scanner and hookup person. Brief the hookup person on hookup procedures to include hook grounding, ingress/egress routes, hand signals, and emergency procedures.

15.2.2. Hookups may be accomplished by landing near the load or hovering over the load, depending on the availability of personnel to perform hookup duties.

15.2.3. When landing next to the load, hover the helicopter into a position near the load and place the collective at flat pitch. Maintain adequate rotor and/or aircraft clearance with the load. Route the lift strap and/or cable around the landing gear/skid allowing sufficient slack so it will not be taut when the helicopter is raised to a hover. The scanner will monitor the lift strap/cable during the takeoff to a hover and direct the helicopter to a position over the load.

15.2.4. When securing the load from a hover, hover the helicopter into the wind and position it over the load. The pilot can best control the approach until the pickup point can no longer be observed. When the pilot can no longer observe the load, the scanner directs the pilot to a position to accomplish the hookup. As soon as the load is securely attached to the cargo hook, the hookup person will clear the area directly beneath the helicopter and the scanner will notify the pilot the load is ready to lift. Ensure sufficient power is available to take off by slowly increasing collective pitch to take up any slack in the sling and center the helicopter over the load. When operating in sandy or dusty conditions, avoid abrupt power changes in order to minimize the possibility of reduced visibility. Objects that take on water should be allowed to drain while the helicopter is in hover prior to takeoff. During takeoff and climbout, the scanner informs the pilot of the towing characteristics being encountered. If the load begins to develop undesirable or abnormal aerodynamic characteristics, reduce forward speed to a point where the load is stable and continue the mission. If the airspeed to stabilize a load is too slow, it may be necessary to return to the pickup point and secure spoilers or reconfigure the load. Spoilers may be drag chutes, sandbags, or other material which distort the airflow.

15.2.5. The radar altimeter, when installed, can be useful during sling operations. A good technique when operating over level terrain with a 40-foot sling is to set the radar altimeter pointer on 50 feet and use that altitude as a level off point until the scanner has sight of the load. During pickups where the ground personnel attach the sling to the helicopter, a radar altimeter setting of 20 feet is a good minimum until the hover is established and the pilot starts receiving directions.

15.3. Inflight. Each sling load is different. Limit forward flight to an airspeed commensurate with the aerodynamic stability of the load.

15.3.1. Normally, turn the sling arming switch off at altitudes above 500 feet AGL and turn it on at or below 500 feet AGL. During sling training in a closed traffic pattern, the sling arming switch may remain armed throughout the pattern.

15.3.2. Attempt to avoid flying over personnel, buildings, or equipment.

15.3.3. Flight with a sling load in turbulent air can result in severe oscillations and possible loss of aircraft control. Avoid areas of known or suspected turbulence.

15.3.4. Under normal circumstances, flight controls should not be transferred while the cargo sling is armed. If a requirement exists to transfer controls with the sling armed, the pilot assuming control should take extreme caution.

15.3.5. Use extreme caution when using cyclic stick switches if the cargo sling is armed to preclude inadvertent load release.

15.4. Delivery. Closely monitor power requirements and anticipate power changes. The key to successful sling approaches is smooth and positive aircraft control. Take care to prevent dragging the load on the ground. Normally, hover with the load approximately 5-10 feet above the ground. Descend vertically to place the load on the surface for release. Certain sling loads can cause the radar altimeter to give an erroneous reading throughout the flight. When load interference is not a factor, the radar altimeter set pointer should be set at a value equal to the sling length + load height + desired load height above ground. This provides adequate ground clearance upon load delivery.

15.5. Intercom Procedures. Use the terms "LOAD HOOKED" for completion of hookup and "LOAD RELEASED" when cargo is unhooked to inform the pilot of the cargo condition. The scanner provides additional information, including cargo ground clearance, during approach or hover and the condition of cargo in flight.

15.6. Safety Procedures. The following procedures will apply to all cargo sling missions:

15.6.1. At the aircraft commander's discretion, the hookup person may be positioned at the 2 o'clock position until cleared in for the hookup. Position the hookup person at the load to effect an immediate hookup. After the hookup, the hookup person egresses at the 2 to 3 o'clock position. Egress can be made at the 10 to 11 o'clock position if necessary.

15.6.2. The hookup person must wear gloves, head/hearing protection and eye protection (i.e., goggles and helmet or helmet with visor down).

15.6.3. Check all lift straps/cables for proper condition prior to picking up a sling load.

15.6.4. Move all cargo sling loads slightly before pickup to ensure they are not frozen or otherwise held fast to the surface.

15.6.5. Lights should be turned off and retracted if they could distract the hookup person or interfere with the hookup.

15.7. Emergency Procedures. It is not practical to publish all emergency situations that could occur during cargo sling operations. Good training habits and sound judgment by all concerned should eliminate problems when emergencies do occur. When using ground hookup personnel:

15.7.1. If, prior to hookup, complete loss of power occurs, execute a hovering autorotation to the left of the load. Hold sufficient pitch and left cyclic after autorotation is entered to clear the load. Once clear of the load, execute a normal hovering autorotation.

15.7.2. After hookup, should engine failure or loss of power occur over the load, make every attempt to release the load and execute a hovering autorotation (if required) to the left of the load.

15.7.3. If engine failure or loss of power occurs, the ground crew should consider the following:

15.7.3.1. Marshaller. Turn away from the aircraft and lie face down on the ground, covering head with both arms to protect from flying objects, should the aircraft crash.

15.7.3.2. Hookup Person. Take action prebriefed with the crew (i.e., hug the load, dive clear to the right, etc.).

15.7.4. If an inflight emergency is encountered, external loads should be jettisoned if necessary.

Chapter 16

FLIGHT ENGINEER PROCEDURES

16.1. General. This chapter contains normal procedures for flight engineers not contained in the flight manual and/or applicable Technical Order. If flight engineers are not assigned to the flying unit or are not being used for the mission, the pilot not flying will complete the requirements of this chapter.

16.2. Flight Engineer Station. The flight engineer will be at his primary crew position during engine starts, takeoffs, critical phases of flight, landings and engine shutdown unless mission requirements dictate otherwise.

16.2.1. Flight engineer's will be seated with their seat belts fastened whenever they are not performing duties requiring them to be out of their seat.

16.3. Refueling/Defueling. Flight engineers are not normally required to refuel or defuel aircraft. However, the flight engineer may be required to refuel/defuel when maintenance personnel are not available. Without exception, use the applicable refueling/defueling checklist. If ground support personnel are not available, the aircraft commander designates other crewmembers to assist the flight engineer as required.

16.4. Aircraft Systems Management. The flight engineer will monitor aircraft systems during ground and flight operations unless the mission dictates otherwise. Notify the pilot of all abnormal indications and take action as directed. When noting a malfunction during takeoff that may be cause for an abort, call "ABORT" and state the problem, i.e., "ROTOR RPM LOW."

16.5. Flight Monitoring. The flight engineer will assist with flight monitoring as directed by the pilot.

16.5.1. Notify the pilot when seeing deviations more than 100 feet/10 KIAS from assigned altitude/airspeed or 10 degrees from assigned heading. Also, advise the pilot when approaching any flight manual limitation and comply with other duties as briefed by the pilot.

16.5.2. Notify the pilot if an aircraft configuration is not correct for the intended maneuver.

16.5.3. Maintain proper scanning procedures during flight.

16.5.4. Monitor the primary radio, inter-plane radio, intercom, and HOT MIC.

16.5.5. Assist with navigation as required.

16.6. TOLD (Take Off and Landing Data):

16.6.1. In accordance with TO 1H-1(U)N-1, *Flight Manual*, TOLD cards will be completed and briefed prior to takeoff. Whenever possible, TOLD cards should be completed prior to the aircrew briefing. Use the TO 1H-1(U)N-1, TOLD card as a worksheet. Compute data applicable to the mission profile.

16.6.2. During multiple takeoffs/landings, only affected parameters need to be recomputed if favorable conditions afford an additional margin of safety in all other areas (i.e., gross weight decreases due to fuel burn-off, while pressure altitude and temperature remain constant).

16.6.3. The AF Form 4103, **H-1 Mini-TOLD Card**, is a tool to bring critical performance data to the attention of the entire crew. The AF Form 4103 will be used for approaches when power required is within ten percent of power available, when OGE power is not available, or at the discretion of the aircraft commander. If involved in NVG or low-level operations, the card should be filled out during pre-mission planning using worst case data. The AF Form 4103 need not be displayed during NVG flights where reduced cockpit lighting prohibits readability. However, TOLD data will be thoroughly briefed and will be immediately available to the entire crew.

16.7. Fuel Management:

16.7.1. Preflight. The flight engineer will visually ensure the pre-planned fuel load is on board the aircraft.

16.7.2. In flight. The flight engineer will monitor fuel transfer and fuel consumption and keep the pilot advised of fuel status.

16.8. Weight and Balance:

16.8.1. The flight engineer will compute crew/passenger/equipment off-loading or on-loading to ensure CG and weight limits are not exceeded. These computations will address the maximum number of personnel or maximum amount of equipment allowed in the cargo compartment without exceeding CG or structural limitations. This procedure applies to all operations in which CG or weight limits may be exceeded as a result of personnel/equipment on or off-loading.

16.8.2. Automated weight and balance system. Use of the approved automated automated weight and balance system (AWBS) is authorized and highly recommended. Use the "Transport" side of the form.

16.8.3. Use a DD Form 365-4 for each flight. The DD Form 365-4, records the weight, moment, and center of gravity calculations for a specific loading arrangement on a specific aircraft to ensure the aircraft remains within its safe weight and balance limitations. Both handwritten, expendable pad versions, and automated or computerized versions generated by the AWBS are authorized for use.

16.8.3.1. Standard Configurations. In accordance with paragraph **4.1.**, a DD Form 365-4 may be prepared for standard configurations used by the unit. These "canned" forms are authorized when an aircraft's weight, moment and CG remain within specific limits. Such "canned" DD Forms 365-4 (either computerized or expendable pad version) must be filed and maintained in both the primary and supplemental weight and balance handbooks. These forms can only be used for the configuration for which they were designed and computed. They must be checked for accuracy at least every 180 days.

16.8.3.2. Initial Takeoff Gross Weight. When initial takeoff gross weight (item 16) does not change by more than 500 lbs, then a new or corrected DD Form 365-4 need not be generated. Although no written adjustments are required, the aircraft commander or flight engineer will ensure that the new gross weight and CG are within limits. Brief the aircraft commander on the new gross weight and CG during the crew/mission brief or during flight, as required. If the initial takeoff gross weight (item 16) changes by more than 500 lbs, a new DD Form 365-4 must be used or generated.

16.8.3.3. "Zero fuel" weight computations are required on the DD Form 365-4.

16.8.3.4. Passengers. Item 13 will indicate the number of passengers in a given position, their weight, and the associated arm. Example: 2 Pax/360 lbs/117.0

16.8.3.5. Cargo. Use the last cargo and compartment/arm/station on the right side of the form.

16.9. Tool Kits. Unit commanders determine if tool kits are required for their unit. If required, the unit commander will also determine the tools to be carried in the kits. For units requiring tool kits, the flight engineer will ensure it is carried on all flights. As a minimum, kits will include tools to remove and install chip detector plugs and perform inspections. Tool kits will have an inventory list for accountability and will be sealed. If the seal is broken, the flight engineer will inventory the kit and sign the accountability list prior to flight.

Chapter 17

MAJCOM PROCEDURES

17.1. General. MAJCOMs may publish supplements or may supplement by using **chapter 17**, starting with paragraph 17.2.

17.1.1. Forward MAJCOM supplements to HQ AFSPC/DOSH for approval before publication. Send one copy of all supplements to HQ AFFSA/XOF and to HQ AFSPC/DOSH, 150 Vandenberg St., Ste 1105, Peterson AFB CO 80914-4200, after publication.

17.1.2. The purpose of this chapter is to allow MAJCOMs an opportunity to insert specific information and directives and to provide aircrews with information pertaining to their command. MAJCOMs may publish a supplement to this instruction (according to their MAJCOM publishing policies) or may use **chapter 17** as a vehicle from their supplemental material. If using the **chapter 17** format, number paragraphs as follows: 17.10 to include information pertaining to **chapter 1**, paragraph 17.20 for information in **chapter 2**, etc.

Chapter 18

LOCAL PROCEDURES

18.1. General. Units may publish a standard supplement to this instruction or publish supplemental material in Chapter 18 (as directed by MAJCOM). If a Chapter 18 is published, the title of this publication will indicate the unit and MAJCOM concerned, e.g., "36 RQF (AETC) Local Operating Instructions; AFI 11-2H-1 Volume 3, Chapter 18".

18.1.1. Prior to unit OI publication, send a copy to the applicable NAF/MAJCOM representative. Send a copy of approved OI to HQ AFSPC/DOSH for informational purposes, 150 Vandenberg St., Suite 1105, Peterson AFB CO 80914-4200.

18.1.2. The purpose of the supplement/Chapter 18 is to allow an opportunity to insert unit-specific information and directives, and to provide aircrews with information pertaining to their local flying area. These OIs will not duplicate, but should augment the provisions of this instruction. Units directed by their MAJCOM to supplement this instruction by publishing a Chapter 18 will do so by using paragraph 18.1. to include information pertaining to Chapter 1, paragraph 18.2. for information in Chapter 2, etc. Supplemental material will begin with paragraph 18.2. on page XXA with subsequent pages being numbered XXB, XXC, etc.

18.1.3. As a minimum, the following subjects will be included, as applicable:

18.1.3.1. Filing flight plans. (Paragraph 18.3.)

18.1.3.2. Taxi/parking procedures. (Paragraph 18.4.)

18.1.3.3. Scramble procedures. (Pararaph 18.5.)

18.1.3.4. Traffic pattern and landing areas. (Paragraph 18.6.)

18.1.3.5. Training/operational landing sites. Paragraph 18.7.)

18.1.3.6. Air operations security procedures. (Paragraph 18.8.)

18.2. Forms Prescribed. AF Form 4103, **H-1 Mini-TOLD Card.**

MARVIN R. ESMOND, Lt General, USAF
DCS/Air and Space Operations

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 10-801, Assistance to Civilian Law Enforcement Agencies

AFI 10-802, Military Support to Civil Authorities

AFI 11-202 Volume 1, Aircrew Training

AFI 11-202 Volume 3, General Flight Rules

AFI 11-205, Aircraft Cockpit and Formation Flight Signals

AFI 11-2H-1 Volume 1, H-1 Helicopter Aircrew Training

AFI 11-2H-1 Volume 3, Checklist 1 (CL-1), Helicopter Crew Briefing Guide/Checklist

AFI 11-401, Flight Management

AFI 23-202, Buying Petroleum Products and Other Supplies and Services Off-Station

AFI 36-2223, USAF Formal Schools

AFMAN(I) 32-1123, Airfield and Heliport Planning and Design

AFMAN 91-201, Explosives Safety Standards

AFPD 11-2, Flight Rules and Procedures

FM 31-20, Doctrine for Special Forces Operations

FM 57-230, Advanced Parachuting Techniques

FM 100-27, US Army/Air Force Doctrine for Joint Airborne and Tactical Airlift Operations

Public Law 93-155, Defense Appropriation Act

TO 00-25-172, Specific Aircraft Technical Data

TO 00-25-245, Operating Instructions Testing and Inspection Procedures for Personnel Safety and Rescue Equipment

TO 00-75-5, Use, Inspection and Maintenance Stokes Rescue Litters

TO 1-1A-8, Engineering Manual Series, Aircraft and Missile Repair, Structural Hardware

TO 11A10-24-7, Storage and Maintenance Procedures -- Aircraft Parachute Flares, M8A1 PN 9217950 or MILF20363, LUU-2/B PN 7U41975-01, LUU-2A/B PN 728921 LUU-2B/B PN 8240946-10 LUU-4/B PN 747548 F5B, F5E

TO 11A10-25-7, Storage and Maintenance Procedures -- Pyrotechnic Markers, MK1 MOD 3 PN B11690, MK2 PN 344505, MK25 MOD 3 PN LD 615141 OR 1332145, M59 PN 78-0-68 ANS LUU-10/B PN 726217 F5B, F5E

TO 11A10-26-7, Storage and Maintenance Procedures -- Pyrotechnic Signals F5B, F5E

TO 11A8-2-1, Operators' Manual -- Hand and Rifle Grenandes, 66MM Rocket Launcher, 81MM Mortars, 90MM Recoilless Rifle, 40MM Cartridges, Flares and Signals, Smoke Pots, Land Mines, and Cartridge, 84MM M136 (AT-4) -- (ATOS)

TO 11A8-5-7, Storage and Maintenance Procedures -- Grenades, Hand and Rifle

TO 14S6-3-1, Operations and Maintenance Instructions with Parts List, Forest Penetrator Rescue Seat Assembly

TO 1C-1-71, Listing of Cargo Tiedown Equipment Authorized for All Series Aircraft

TO 1H-1(U)N-1, Flight Manual

Abbreviations and Acronyms

AC—Aircraft Commander

AFSPC—Air Force Space Command

AG—Aerial Gunners

AGL—Above Ground Level

AHO—Above The Highest Obstacle

AIE—Alternate Insertion/Extraction

ALC—Air Logistics Center

AWBS—Automated Weight And Balance System

AWL—Above Water Level

CAP—Civil Air Patrol

CFR—Crash Fire Rescue

CG—Center Of Gravity

CONUS—Continental United States

CRC—Ceiling Restraint Cable

DA—Density Altitude

DH—Decision Height

DME—Distance Measuring Equipment

DoD—Department Of Defense

DV—Distinguished Visitor

DZ—Drop Zone

ELT—Emergency Locator Transmitter

EMI—Equivalent Moon Illumination

EP—Examiner Pilot

ETL—Effective Translational Lift

FAA—Federal Aviation Administration

FCF—Functional Check Flight

FE—Flight Engineer

FIH—Flight Information Handbook

FLIP—Flight Information Publications

fpm—Feet Per Minute

FS—Flight Surgeon

GPS—Global Positioning System

HATR—Hazardous Air Traffic Report

HEED—Helicopter Emergency Egress Device

HF—Helicopter Flight

HQ—Headquarters

HRS—Helicopter Rope Suspension

IAS—Indicated Air Speed

IAW—In Accordance With

ICS—Internal Communication System

IFR—Instrument Flight Rules

IMC—Instrument Meteorlogical Conditions

IP—Instructor Pilot

ITT—Inter Turbine Temperature

JRCC—Joint Rescue Coordination Center

KIAS—Knots Indicated Airspeed

LKP—Last Known Position

LZ—Landing Zone

MAF—Missile Alert Facility

MAJCOM—Major Command

MAST—Military Assistance To Safety And Traffic

MC—Mission Commander

MDA—Minimum Descent Altitude

MEDEVAC—Medical Evacuation

MEGP—Mission Essential Ground Personnel

MT—Medical Technician

NAF—Numbered Air Force

NASA—National Aernautics And Space Administration

Nf—RPM (Engine)

Ng—RPM (Gas Producer Turbine)

NM—Nautical Mile

Nr—RPM (Rotor)

NVG—Night Vision Goggle

OAT—Outside Air Temprature

ODO—Operations Duty Officer

OGE—Out Of Ground Effect

OI(s)—Operating Instruction(S)

OSE—Operational Site Evaluation

OSF—Operational Support Flier

PA—Pressure Altitude

POC(s)—Point(s) Of Contact

RPM—Revolutions Per Minute

RQF—Rescue Flight

SAR—Search And Rescue

SCUBA—Self-Contained Underwater Breathing Appartus

SOF—Supervisor Of Flying

TACAN—Tactical Air Navigation

TAS—True Air Speed

TDY—Temporary Duty

TOLD—Takeoff And Landing Data

TOT—Time On Target

VFR—Visual Flight Rules

VMC—Visual Meterological Conditions

VOR—VHF Omni-Directional Range

VORTAC—VOR TACAN

WDI—Wind Direction Indicator

Terms

AIE—Alternate insertion/extraction is the insertion or extraction of any personnel by means other than landing the aircraft, to include hoist operations.

Alternate Loading—A method of restraining passengers without using standard troop seats. Allows more combat-equipped troops to be carried. Used in tactical situations.

Bandit—Any aircraft positively identified as hostile.

BLIND ALLEY—Standard terminology for inadvertent IMC.

Bogie—Any aircraft not positively identified as friendly..

CAUTION—Operating procedure, technique or information that may result in damage to equipment if not carefully followed.

CHATTERMARK—Code word(s) used during covert radio transmissions.

MAST—Military Assistance to Safety and Traffic

may—Indicates an acceptable or suggested method.

Mission Commander—The Mission Commander is delegated command authority to exercise operational control over assigned operational and mission support forces in order to attain specified mission objectives during operations and exercises.

NO JOY—Standard terminology for lost visibility due while VMC

Note—Operating procedure, technique or information that is essential to emphasize or explain.

RD (Rotor Disk)—Measure of separation within a helicopter formation. Based on the largest rotor size of any aircraft within the formation.

SAM—Visual sighting of missile launch.

should—Indicates non-mandatory, desired, preferred, or recommended method.

Triple A—Visual sighting of antiaircraft weapons.

WARNING—Operating procedure, technique or information that may result in death or injury if not carefully followed.

will, shall, or must—Indicates the requirement or procedure is mandatory.