

FM 3-04.513 [1-513]

**BATTLEFIELD RECOVERY AND
EVACUATION OF AIRCRAFT**

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HEADQUARTERS, DEPARTMENT OF THE ARMY

Battlefield Recovery and Evacuation of Aircraft

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Preface

This manual provides fundamental data for effective and safe recovery of downed aircraft and maintenance evacuation of disabled aircraft. Aircraft recovery is an operation that results from an aircraft having experienced a reliability-induced or combat-damage induced forced landing on the battlefield. It also may have been disabled as the result of an accident or component/system malfunction. The operation includes an assessment, repair, and fly-out, if possible, or recovery by aerial or ground means to an appropriate maintenance facility for repair and eventual return to service. Maintenance evacuation is the physical act of moving aircraft from one maintenance location on the battlefield to another. Movement is either by aerial or ground means. The move is to effect repair, cross-level maintenance workloads, or relieve units of disabled aircraft during tactical moves.

Aircraft recovery and maintenance evacuation are closely related since, in each case, the aircraft must be rigged for lift by helicopter or rigged for lift by a crane device and secured aboard a ground vehicle. Aircraft recovery, however, requires extensive coordination. It is usually time sensitive to the tactical situation. Evacuation, on the other hand, may not have the same urgency. It is usually coordinated between maintenance activities.

This manual is only a guide and is intended for use by commanders at all levels. In actual practice, the procedures outlined might be modified or augmented to account for the size of the force; availability of aerial and ground assets; manpower, time and distance considerations; and above all, the tactical situation.

Recovery or evacuation by aerial means is likely to be accomplished in less time. Recovery or evacuation by ground vehicle, however, remains an option. The purpose of recovery or maintenance evacuation is to preclude the loss of unique assets on the battlefield and retain the persuasive combat power of aviation in all dimensions of the battlespace.

The airspeeds stated in this manual are airspeeds at which particular loads have demonstrated stability in flight. Variables affect stability. For this reason, the aircrew must monitor the stability of each load and adjust airspeed accordingly. The decision for airspeed at any time during a lift operation is reserved for the aviator.

Warnings, cautions, and notes are used throughout this manual for emphasis. A warning is an operating procedure or practice which, if not followed, could result in personal injury or loss of life under certain conditions. A caution is an operating procedure or practice. If not observed, it could result in damage or destruction of equipment under certain conditions. A note is an operating procedure, practice, or condition that warrants special attention.

Numerous terms, acronyms, and abbreviations are found within this manual. Users should refer to the glossary for their meaning or definition.

This manual implements STANAG 3117 (Aircraft Marshalling Signals) (Edition 5).

The procedures outlined in this manual are applicable at all levels of conflict in combat environments.

The proponent of this manual is Headquarters, TRADOC. Users are encouraged to recommend changes and submit comments for improvement. Key comments to the specific page, paragraph, and line of the text in which the change is recommended. Provide a reason for each comment to ensure understanding and complete evaluation. Army units should prepare comments using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to Commander, US Army Aviation Center, ATTN: ATZQ-TDS-DB, Fort Rucker, Alabama 36362-5263.

Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

This publication has been review for operations security consideration.

Chapter 1

Battlefield Management of Downed Aircraft

The loss of an aircrew and/or airframe impacts the combat capability of aviation units. The psychological impact from the loss of an aircrew may be a severe detriment to unit morale. High loss rates can rapidly deplete available operational readiness float (ORF) assets. This chapter discusses the importance of including downed aircraft recovery missions into the battalion and brigade staff tactical decision making process. It also provides the relationship of combat search and rescue (CSAR) to downed aircraft recovery teams (DARTs), and battle damage assessment and repair (BDAR) personnel augmentation to DART missions. In addition, this chapter discusses the role of DART (BDAR) when planning for an aircraft recovery mission.

NOTE: This FM and FM 3-04.113(1-113), *Utility and Cargo Helicopter Operations*, are interrelated. CSAR information in chapter 1 of this FM is generalized from FM 3-04.113(1-113) to aid commanders in distinguishing between the roles of CSAR and DART when planning a downed aircraft recovery mission. Commanders should refer to FM 3-04.113(1-113) for specific doctrinal guidance on CSAR missions.

BATTLEFIELD MANAGEMENT

1-1. Historically, the effort at recovering aircrews or aircraft off the battlefield has been minimal and poorly coordinated at best. Today, CSAR and DART/BDAR provide the methods for retrieving aircrews and aircraft as well as regenerating those resources necessary to maintain momentum on the battlefield. FM 3-04.113(1-113), chapter 7, provides commanders guidance on CSAR missions. Army and Joint CSAR procedures can be found in Joint Publication (JP) 3-50.2, *Doctrine for Joint Combat Search and Rescue*, and in JP 3-50.21, *Joint Tactics, Techniques, and Procedures for Combat Search and Rescue*. Airspace control can be found in JP 3-52, *Doctrine for Joint Airspace Control in the Combat Zone*.

EXTRACTION/RECOVERY PRIORITIES

1-2. According to FM 3-04.113(1-113), the CSAR task force (TF) commander executes the extraction of personnel followed by the recovery of equipment. This is true when both personnel and equipment are at the same location. Aircraft extracting personnel (for example, UH-60 Black Hawk) should be cleared into the extraction site immediately after the area has been secured. Equipment recovery operations may be conducted simultaneously with the personnel extraction operation or delayed until the personnel extraction has egressed the extraction site. In either case, any aircraft ingressing the extraction/recovery site will remain off-station until specifically cleared for the approach by the CSAR TF commander. Conversely, any aircraft egressing the extraction/recovery site will remain at the site until cleared for departure by the CSAR TF commander.

1-3. Simply stated, the extraction and recovery priorities are recovery of the aircrew and simultaneous evaluation of the aircraft. Determine if the aircraft is still an asset. If so, secure the aircraft or area, evacuate the aircraft, and repair the aircraft.

DEFINITIONS

1-4. Acronyms used in the battlefield management of downed aircraft are defined as follows:

- **Combat Search and Rescue (CSAR).** CSAR is the successful extraction of a downed aircrew and evacuation of the aircrew either to appropriate medical care or back to the unit. CSAR operations can be placed into separate categories—*immediate* and *delayed*. Commanders must recognize and prepare for both immediate and delayed types of CSAR operations.
- **Downed Aircraft Recovery Team (DART).** The DART team normally comprises selected command personnel. (These personnel include technical inspector, maintenance test pilot or pilot, maintenance personnel, radio operator and security force). The team successfully extracts an aircraft from a downed location to a safe location, using aerial recovery kits, trained recovery team, and recovery aircraft. Augmentation of the DART mission with BDAR trained repair personnel can recover downed aircraft using BDAR measures. These measures expedite the recovery and return of aircraft to the tactical assembly area (TAA). In addition, they prevent the aircraft from falling into enemy hands and retain control of the aircraft for future use as controlled exchange program for other aircraft and induction into a BDAR program for eventual reintegration into the battle.
- **Battle Damage Assessment and Repair (BDAR).** BDAR is the use of specialized aircraft damage assessment criteria, repair kits, and trained personnel to modify peacetime aircraft maintenance standards. The concept includes the safe return of damaged aircraft to a safe location and eventually to battle as soon as possible.
- **Rescue Coordination Center (RCC).** The Army component commander who plans, coordinates, and directs the execution of CSAR and DART operations establishes an RCC within the commander's area of operations (AO). The component commander may not directly establish an RCC. If an RCC is not established, the Army commander must designate an existing headquarters or staff section to perform the duties of the RCC. The RCC will—
 - Notify the Joint Search and Rescue Center (JSRC) as soon as possible when conducting CSAR and DART operations.
 - Extract information from the JSRC Evasion and Recovery (E&R) plan that is Army specific and disseminate that information to all Army units in theater.

- Request Joint Combat Search and Rescue (JCSAR) Support from the JSRC when Army assets cannot accomplish the CSAR
 - Forward pertinent data regarding isolated personnel to the JSRC.
 - Develop and plan mission packages in parallel with the tactical mission.
 - Manage the information flow to the two mission packages (CSAR/DART).
 - Manage the information flow of the DART mission with augmentation of BDAR personnel if require.
 - Integrate the enemy situation, from the TF tactical operations center (TOC), into the downed aircraft decision making process.
 - Execute mission packages.
- **Trigger.** According to FM 6-99.1(101-5-1), a trigger is an event or time-oriented criteria used to initiate planned actions directed toward achieving surprise and inflicting maximum destruction on the enemy. It is also a designated point or points (selected along identifiable terrain) in an engagement area (EA) used to mass fires at a predetermined range. A 'trigger,' as it applies to this manual, would be an event or time-oriented criteria used to initiate planned actions toward achieving successful extraction of downed aircrew and the recovery of downed aircraft.
 - **Assessor.** An assessor is one who can assess aircraft battle damage. One of the assessor's primary tasks is to determine the location of the damaged aircraft relative to the battlefield and the extent of the threat. Modern air defense threats may make aerial recovery in forward areas of the battlefield an impractical or unacceptably high risk. The ability to determine rapidly that a one-time evacuation mission is feasible or that a quick-fix repair is possible is important. It may prevent a situation in which the aircraft would otherwise be destroyed (in place) to prevent capture by, or compromise to, the enemy. Once the battle subsides, maintenance decisions are based on standard operational maintenance practices. An assessor can be one or a combination of the following: the aircrew of the downed aircraft; aircrew of another aircraft; the CSAR crew; the DART aircrew. The assessor's mission is to provide the commander with an initial assessment of the downed aircraft. Based on mission, enemy, terrain and weather, troops and support available – time available and civilian considerations (METT-TC), the assessor can, when appropriate, provide a more detailed assessment.

PLANNING PROCESS

INITIAL CONDITIONS/PRE-CONDITIONS

1-5. Aircraft recovery planning begins when the Army force deploys or immediately after it arrives in the area of responsibility (AOR). Commanders of aviation units emphasize both the CSAR and the aircraft recovery process

while ensuring that their units are prepared if an aircraft is lost during the fight.

1-6. Aircraft recovery operations are unique. Each operation is discrete and may involve the initiative and imagination of commanders and staff to synchronize the operation within a range of variables. Aircraft recovery on the battlefield is a recurring maintenance function. It is usually planned for, in advance, in conjunction with other maintenance support. Recovery operations are planned and coordinated in detail to minimize risk. METT-TC always influences the extent of detail and coordination. In addition, the following factors are considered:

- Commander's assessment of the threat.
- Tactical situation.
- Condition and location of disabled aircraft.
- Disabled aircraft accessibility.
- Airspace restrictions.
- Recovery assets.
- Air tasking order (ATO) missions.
 - Type of equipment required.
 - Location and availability of aircraft.
- Requirements for—
 - Fire support.
 - Air defense.
 - Engineer support.
 - Ground security.
 - Intelligence/aerial and ground surveillance.
 - Army Airspace Command and Control System (A²C²S).
 - Battlefield coordination through the S3/G3 to minimize possibility of fratricide.

1-7. C² relationships, unit responsibilities, and coordination are planned for in advance to the extent possible and included in standing operating procedures (SOPs) and operations orders (OPORDs). When an aircraft becomes disabled on the battlefield, commanders and staffs supplement preplanning with a plan of execution. The operation is controlled at the appropriate level (normally the RCC).

1-8. Physical procedures for battlefield recovery of aircraft and maintenance evacuation are nearly identical. Both may require the rigging of the aircraft for lift by helicopter or lift by a crane device for placement on a ground transport vehicle.

1-9. Recovered aircraft normally are transported from the recovery point to a preselected maintenance site without intermediate stops. Air recovery (and evacuation) capitalize on back-haul from forward areas to the extent possible. This operation reduces separate demands on aircraft, especially CH-47

Chinook aircraft that may be heavily committed to re-supply and other transport missions.

RESPONSIBILITIES FOR RECOVERY OPERATIONS

AIR MISSION COMMANDER/AVIATION UNIT COMMANDER

1-10. The first line of responsibility for a recovery operation is the air mission commander/aviation unit commander. This commander may have at his disposal (from within the assets of the operation) on-call DART organizations and lift assets capable of recovering the disabled aircraft. In such cases, the commander employs those assets to assess and effect recovery within time and tactical situation constraints.

RESCUE COORDINATION CENTER

1-11. When beyond the capability of the air mission or unit commander, the responsibility to coordinate recovery defaults to the rescue coordination center (RCC). The RCC is a contingency organization in the aviation brigade TOC. Depending on the size of the force, the RCC also may be found in division and corps TOCs. In this case, RCC is primarily a communications node for staff elements to receive voice, manual, and automated messages; coordinate resources; coordinate battlefield functions of maneuver, fire support, air defense, intelligence, and combat service support within tactical priorities and the scheme of maneuver to support recovery operations. (See Fig. 1-1.) The principal in the RCC is the staff aviation maintenance officer.

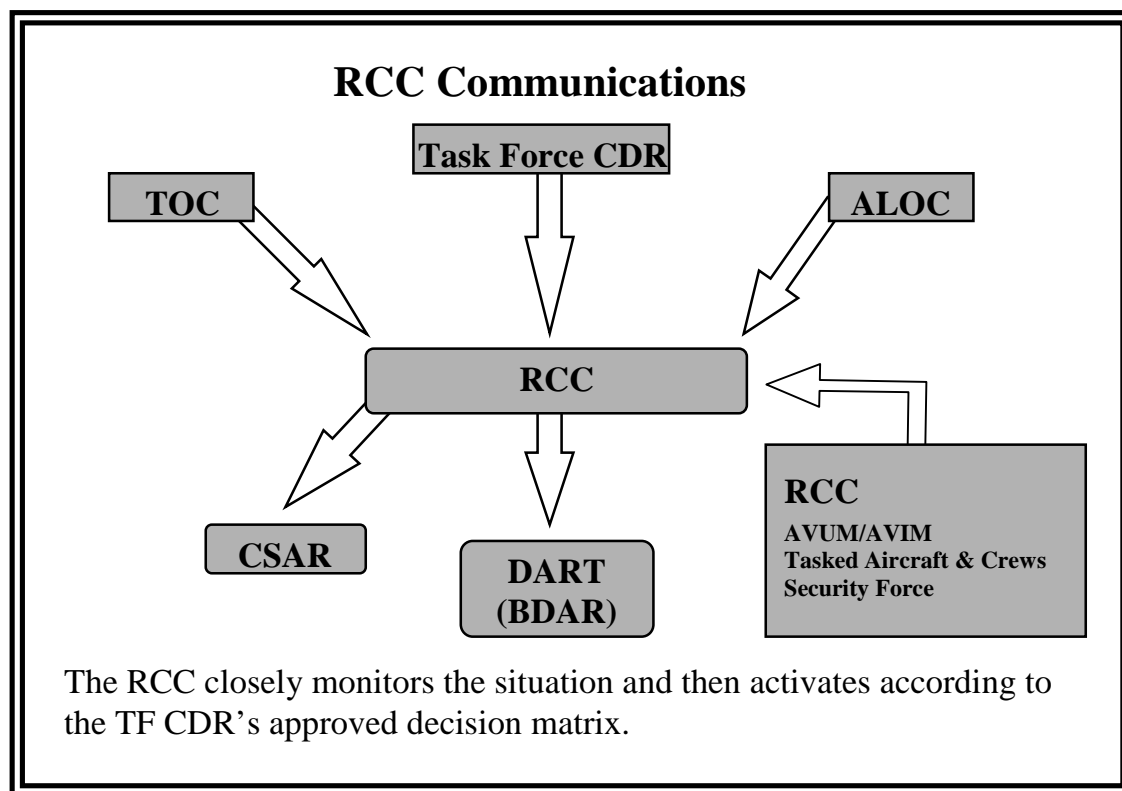


Figure 1-1. RCC Communications

AIRCRAFT COMMANDER AND AIRCREW

1-12. When an aircraft is forced down, the aircraft commander, or one of his crew, will use the aircraft radio (if operable and the tactical situation permits) to notify the parent AVUM commander of the problem and request DART assistance. This information may be relayed through other aircraft operating in the area as time and security allow. The crew takes the first step in the assessment process by providing the AVUM commander with key critical information on the problem. The information should include—

- **Critical Information:**
 - Location of aircraft.
 - Assessment of site security.
 - Adaptability of the site, including existing weather conditions, for the insertion of a DART team with the option of augmenting with BDAR personnel.
 - An evaluation of aircraft damage, to the extent possible, so that needed BDAR personnel, equipment, and parts requirements can be estimated.
 - Information on crew and passenger (s) condition to determine their capability to assist in repairing the damage. For example, the aircraft commander may be able to fly the aircraft out, eliminating the need for an aviator as part of BDAR.
 - Information provided by air traffic controllers.
- **Minimum Required Information for In-Flight Emergencies:**
 - Aircraft identification and type.
 - Nature of emergency.
 - Pilot's desires.
 - Aircraft position (grid or latitude and longitude coordinates).
- **Other Information.** Depending on the status of aircraft communications, the following items or any other pertinent information will be obtained from the pilot or aircraft operator:
 - Aircraft altitude.
 - Fuel remaining in time.
 - Pilot reported weather.
 - Pilot capability for instrument-flight requirements (IFR) flight.
 - Time and place of last known position.
 - Heading since last known position.
 - Airspeed.
 - Navigation equipment capability.
 - Navigational aid (NAVAID) signals received.
 - Visible landmarks.
 - Aircraft color.

- Number of people on board.
- Point of departure and destination.
- Emergency equipment on hand.
- Weapons available.

CONTINGENCY PLANNING FOR IMMEDIATE AND DELAYED AIRCRAFT RECOVERY OPERATIONS

GENERAL

1-13. Aircraft recovery operations can be placed into two separate categories: *Immediate* or *delayed*. Commanders must recognize and prepare for both types of recovery operations.

IMMEDIATE RECOVERY

1-14. Immediate recovery of the aircraft is possible when the aircraft at the scene of the forced landing can be assessed, fixed, and returned to service, or prepared for a one-time evacuation mission to a maintenance site in a minimal amount of time. The time required to repair the aircraft or rig it for recovery at the scene depends on the tactical situation and condition of aircraft, which may result in a delayed recovery operation.

(Example: During an air assault, an aircraft can be recovered immediately by having an aircraft in the flight follow a downed aircraft to rescue the flight crew and/or assess the aircraft damage or maintenance problem. If the problem can be fixed rapidly, the aircraft may be returned to service or prepared for a one-time evacuation mission to a maintenance site. Immediate recovery is the most effective method for recovering downed aircraft if the damage is not extensive.)

1-15. Immediate recovery is desirable because friendly aircraft usually are in the area and enemy forces probably have not had the opportunity to react. The commander must consider certain factors when planning for immediate recovery such as—

- **Continuation of Mission.** Immediate recovery may take aircraft away from the primary mission. Commanders must consider the intent of the mission and decide if it is feasible to take an aircraft away from an ongoing mission to conduct immediate recovery mission. If the mission is an air assault, the aviation commander must consult with the air assault task force commander (AATFC) before executing immediate recovery. The aviation commander may designate an aircraft, piloted by maintenance officers, to conduct immediate recovery if required.
- **Pickup Aircraft.** Commander may designate specific aircraft, crewed by maintenance personnel, with the responsibility to conduct immediate recovery, or the responsibility may fall on the nearest aircraft in support of the downed aircraft. The commander must specify and select the aircraft to be used for immediate recovery during the planning process. The selected crew must receive specific, detailed instruction on the execution of an aircraft recovery.

- **Recovery Aircraft Location.** The aircraft designated for immediate recovery may be part of the mission and formation, or it may be an additional aircraft. The recovery aircraft should be positioned where it can best support the mission.
- **Army Airspace Command and Control.** Separate airspace control measures may be developed to allow DART aircraft to recover the aircraft without interfering with the ongoing mission. If the DART aircraft is designated as part of the mission fleet, effective C² must be established to de-conflict aircraft.

DELAYED RECOVERY

1-16. Delayed recovery is any recovery that cannot be conducted immediately by aircraft in the flight. Delayed recovery will be necessary when—

- Utility or cargo aircraft are not available in the flight.
- Enemy activity in the vicinity of the downed aircraft makes an immediate recovery too risky.
- Immediate recovery cannot be executed without adversely affecting the mission; for example, an air assault formation, loaded with ground troops, en route to the landing zone (LZ), with no dedicated maintenance aircraft.
- Location of the downed aircraft is not precisely known.
- JSRC directs the unit to conduct recovery of an aircraft from another unit, service, or coalition force.
- Damage to the aircraft is extensive, rendering it unable to fly.
- Location of the aircraft does not facilitate an aerial insertion/recovery.

1-17. A delayed recovery order also may be received from the JSRC to recover a downed aircraft from another unit, service, or coalition force. This operation would be planned as a completely separate operation and may involve using JSRC assets.

1-18. Whether planning a separate CSAR mission or planning an aircraft recovery mission, planning should include procedures for immediate and delayed CSAR/DART. (In other words, planning for a separate CSAR mission should include a contingency plan if an aircraft goes down while the CSAR mission is being conducted.) Aircraft designated as maintenance aircraft should be thoroughly integrated into all plans. Planning considerations for aircrews conducting a delayed recovery mission are as follows:

- **Downed Aircraft Recovery.** Availability of recovery aircraft and DART riggers to conduct downed aircraft recovery depends on the type of aircraft in the formation. All aircraft have external sling-load weight restrictions, which dictate the types of aircraft they can recover. A UH-60 Black Hawk can recover an OH-58 Kiowa, for instance, but can not recover another UH-60 or AH-64 Apache unless the recovered aircraft is stripped down to meet weight restrictions. The CH-47D Chinook is an exception, in that the CH-47D is capable of recovering any other Army rotary- and fixed-wing aircraft, to include another CH-47D. (See lift capability data in chap 2, paras 2-23 and 24.)

- **Standby Personnel and Equipment.** The aviation commander may depend on other units to have aircraft, DART riggers, and recovery equipment standing by for downed aircraft recovery. Equipment models will list external sling-load capabilities and weights for all aircraft. (See lift capability data in chap 2, paras 1-23 and 24.)

MAINTENANCE—DART TEAM

1-19. Aircraft recovery operations are time sensitive. Aviation unit maintenance (AVUM) and aviation intermediate maintenance (AVIM) units form DARTs from within their personnel assets. These teams should be skilled in BDAR and the use of rigging kits. The typical composition of a DART includes a maintenance officer/technician, technical inspector, repairer personnel, and vehicle operators.

1-20. A DART may perform any of the following actions:

- Assess repair requirements.
- Repair the aircraft or prepare it for a one-time evacuation mission.
- Recommend recovery by aerial or ground means.
- Rig the aircraft for recovery.
- Serve as the ground crew for helicopter lift.
- Serve as the crew to secure the load aboard a vehicle.
- If the aircraft is not repairable, determine which parts, subsystems, or components can be salvaged and remove them.
- Destroy, or take part in the destruction of, a disabled aircraft that is to be abandoned (according to TM 750-244-1-5, *Procedures for Destruction of Aircraft and Associated Equipment to Prevent Enemy Use*).

1-21. A DART may respond to the recovery of a downed aircraft from within the unit, a supported unit, an adjacent unit, or any aircraft that is disabled within a sector. Normally, the team is transported with their equipment by air to the scene of the disabled aircraft and extracted by air upon completion of the mission.

1-22. Aircraft that cannot be recovered and are in danger of enemy capture are destroyed according to TM 750-244-1-5. The authority for destruction will be included in standing operating procedures (SOPs) and operation orders (OPORDs). If possible, aircraft are cannibalized before destruction. The corps, on a mission basis, accomplishes recovery and evacuation of enemy, allied, and other US services aircraft using corps assets or by tasking division assets in sector.

1-23. Both delayed and immediate recovery missions normally are planned as a part of all flight operations, but are especially critical for cross-forward line of own troops (FLOT) operations. Commanders may be required to use internal assets to conduct a delayed aircraft recovery from their own unit, with or without additional detailed planning time. General procedures typically are covered in unit SOPs. (For example, the unit SOP may specify a radio frequency to be used, a color of light or smoke to be used for recognition,

and the last aircraft in the flight may be designated as the maintenance aircraft.)

1-24. Once the downed aircraft has been located and secured, the air mission commander will direct recovery aircraft to effect recovery. Ideally the downed aircrew will have—

- Dumped secure fills and data in all avionics and navigational equipment.
- Secured the sensitive items such as documents or equipment from the aircraft. (For example, these items may include radio frequencies, call signs, maps, graphic overlays, radio secure devices, or any classified material.)
- Prepared the aircraft for destruction if recovery will not be feasible.
- Avoided capture and reported enemy situation to friendly units.

1-25. Typically, the aircrew will be recovered either before or concurrently with recovery of the aircraft. When the aircraft recovery is attempted, according to the proper TM/FM, the sequence below typically occurs. This sequence may vary depending on the number of personnel on the ground, the size of the pickup zone (PZ), or other METT-TC factors.

- Security personnel will establish security around the downed aircraft.
- Person designated and trained to rig the aircraft will be inserted. The rigger(s) may be inserted using any one of several techniques. The rigger(s) may be landed in the PZ, rappel in on a rope lowered from the aircraft, use a “fast rope” lowered by the aircraft, lowered by forest penetrator, or climb down a rope ladder. The rigger(s) will have a sling set appropriate for the aircraft to be recovered.
- The rigger(s) will prepare the aircraft for recovery (i.e., tie down rotor blades, attach slings, and attach a stabilizing drogue chute).
- A rigging team member will signal the recovery aircraft that he is prepared to attach the slings, and attach a stabilizing drogue chute.
- A rigging team member will signal the recovery aircraft that he is prepared to attach the sling set to the recovery aircraft.
- A rigging team member will attach the sling to the recovery aircraft and then move away from the downed aircraft.
- A rigging team member will signal to the pilot that the load is attached and ready to be lifted.
- The pickup aircraft will lift the downed aircraft, and depart the PZ, en route to a designated drop off point, normally the unit’s maintenance facility.
- The rigger(s), and any other ground security and support personnel, will be recovered and all aircraft will depart the area to return to base.

1-26. Air mission commanders (AMCs) are required to submit a situation report when the recovery is completed and the aircrew and/or aircraft are departing the PZ and en route to the drop off point. The report will include

the status of aircrew members and downed aircraft if aircraft recovery is being attempted.

DART – SPECIFIC PLANNING CONSIDERATIONS

DART RESPONSIBILITIES

1-27. During combat operations, situations arise making the use of DART necessary. In such cases, the unit commander will authorize the use of DART plans and procedures. DART is an AVUM-level responsibility, with backup from supporting AVIM units. The concept uses specialized assessment criteria: repair kits, recovery kits, and trained personnel. The DART team provides the means and manpower to safely return damaged aircraft to the TAA as soon as possible. The DART mission is designed to multiply force capability in a combat environment by augmenting the existing peacetime maintenance system.

REQUIREMENTS AND PROCEDURES

1-28. The discussion below defines DART requirements and procedures at the AVUM level. Similar actions apply to AVIM DART teams when used as backup support.

- **Team Composition and Materials.** The DART team is formed from AVUM platoon assets. A typical team includes a trained inspector for damage assessment, two or three repairers (MOS 67/68), and a maintenance test pilot. The actual composition of a DART team, if it is an aerial recovery or BDAR mission, depends on the type and extent of maintenance work anticipated of that airframe.
- **Revised Aircraft Recovery Criteria and Procedures.** The team uses recovery kit, airframe shipping, and BDAR manuals; and this manual, which contains revised aircraft recovery criteria and specific procedures. These manuals are formally processed and validated publications for use in combat and noncombat environments, as authorized by the unit commander. (See the bibliography for applicable manuals.) The manuals provide this information:
 - Combat damage inspection and assessment techniques.
 - Combat area maintenance serviceability and deferability criteria.
- **Recovery Kits.** The DART team should have the specially designed recovery kits for aerial and ground aircraft recoveries. With the tools and materials in these kits, team members can make quick combat extractions of downed aircraft. Recovery kits are aerial transported internally or externally (sling load) and man-portable.
- **Prepermission Drills.** Prepermission drills should be conducted for the following tasks/teams:
 - Security team.
 - Aircraft loading/unloading on vehicle.
 - Repair team (BDAR).
 - Aircraft assessment.

INITIAL INSPECTION

1-29. The AVUM unit commander authorizes dispatch (normally airlift) of a DART team with manuals, recovery kit, BDAR kits, materials, and parts, as mission necessitates, to the site. The team's initial on-site inspection determines the actual extent of damage. It also provides information needed to determine which of the following alternatives apply:

- Augmentation of the DART with BDAR personnel and equipment.
- Rig aircraft for aerial or surface recovery and make necessary recovery arrangements (repair not feasible at repair site).
- Cannibalize critical components and abandon (recover at later time) or destroy aircraft (repair or recovery not feasible). The decision to destroy an aircraft will be based on the possibility of an abandoned aircraft falling into enemy hands (according to TM 750-244-1-5).
- Clear the aircraft for immediate return to battle, deferring minor damage repairs to a later time.
- Make permanent repairs, returning the aircraft to a completely serviceable condition.
- Make temporary repairs that will allow safe return of the aircraft to meet immediate battle needs, deferring higher standard permanent repairs to a later time.
- Repair the aircraft to allow a one-time evacuation mission back to a more secure and better resourced maintenance control point (MCP) or maintenance area.

AIRCRAFT BATTLE DAMAGE ASSESSMENT

1-30. A trained assessor will assess aircraft battle damage. One of the assessor's primary tasks will determine the location of the damaged aircraft relative to the battlefield and any immediate threat. Modern air defense threats may make aerial recovery in forward areas of the battlefield an impractical or unacceptably high risk. The ability to determine rapidly that a one-time evacuation mission is feasible or that a quick-fix repair is possible is important. It may prevent a situation in which the aircraft would otherwise be destroyed (in place) to prevent capture by, or compromise to, the enemy. Once the battle subsides, maintenance decisions are based on standard operational maintenance practices. It must be emphasized that deferment of maintenance tasks is a "fly now, pay later" concept. Postponing maintenance, when feasible, will provide the combat commander with increased availability for short periods only.

DART – CRITICAL PLANNING CONSIDERATIONS

1-31. The DART must consider the following items and plan for them carefully. It must be able to exit the battle area. Once the load is secured to the transporting aircraft, the risk to the aircraft recovery team must be minimized by expediting its egress.

1-32. The DART requires an armed escort, and proper coordination from the theater RCC must be established. The DART must—

- Have coordination for passage points if cross-FLOT.
- Know the location of Level II care and communication, and be familiar with the landing site at Level II care.
- Know all airspace available and have the ability to coordinate passage through adjacent airspace. To do this, the DART must know the—
 - Enemy situation.
 - Friendly situation.
 - Air routes.
- Be able to react timely because, if the DART mission is—
 - Conducted too long in time, the enemy has the potential of using the downed aircraft as bait.
 - Conducted too soon in time, the enemy system that downed the target aircraft will not be suppressed.
- Coordinate with any or all available assets to assess and mitigate enemy systems with the use of the following operations:
 - Suppression of enemy air defense (SEAD).
 - Close air support (CAS).
 - Escort with attack helicopter aircraft.
- Predetermine an evacuation site for the aircraft. The DART must place the aircraft at a location where they can work on the aircraft. The actual site does not need to be within the perimeter of the recovering unit. It can be a pre-selected site that allows access by ground vehicle, and is securable for the anticipated amount of time to repair or cannibalize the aircraft.
- Determine the answer to these questions:
 - Has the recovered aircraft or recovering aircraft been subjected to NBC contamination?
 - Has the recovered aircraft or recovering aircraft been subject to NBC contamination?
 - Is the aircraft still armed and have measures been taken to de-arm and/or safe the aircraft?
 - Is there fuel onboard and is the aircraft leaking fuel, oils, etc?

DART - EQUIPMENT AND MANNING CONSIDERATIONS

1-33. The aircraft will be transported either by—

- Ground: Crane, lowboy trailer with tractor, personnel transport vehicles, and recovery equipment, or
- Air: UMARK, I-UMARK, HERK, or ARK system kits with recovery aircraft.

1-34. The rigging team should be composed of a five-man team and be trained in all supported aircraft. The team will—

- Be equipped to perform attachment to recovery aircraft.
- Have personal protective equipment inspected, serviceable, and carried with each member.
- Have a static discharge wand inspected, serviceable, and carried with the team.
- Be trained with a recovery aircraft crew.
- Have one of the team members combat-lifesaver qualified.
- Under all missions, have C² established at the RCC.

RCC – SPECIFIC PLANNING CONSIDERATIONS

1-35. The decision to launch DART missions into potential hostile areas when aircraft are forced down is a critical one for the commander. This decision must be made rapidly, but with caution. Commanders must not risk losing more aircraft and crewmembers by committing assets into a high threat area. A commander must consider the factors of METT-TC when he plans, coordinates, and executes an immediate recovery, delayed recovery with his own assets, or delayed recovery using joint CSAR and DART assets.

1-36. The mission dictates the size and composition of the RCC staff. The RCC staff perform the following actions when they develop, coordinate, and execute rescue plans. They—

- Ensure that mission packages are developed and planned in parallel with the tactical mission.
- Manage the information flow to the mission packages: CSAR/DART or separate CSAR and DART package(s).
- Manage the information flow of the DART mission with augmentation of BDAR personnel if required.
- Integrate the enemy situation from the TF TOC into the downed aircraft decision making process.
- Receive resources from the task force; for example—
 - Aircraft and/or crews by tasking.
 - Security teams by tasking.
 - Vehicles by tasking (if required).
 - Communications (radios, frequencies, and call signs).
- Manage the execution of CSAR/DART mission or separate CSAR and DART mission packages. (See Fig. 1-2.)
 - Determine coverage areas from the combat service support graphics.
 - Determine the location on the battlefield for the AO. The following areas need to be planned and posted on maps: CSAR - entire battlefield; DART - from the FLOT, with the possibility of extending beyond to the TAA. Augmentation of DART with BDAR personnel usually is performed in secure or securable areas.

- Determine coverage schedules.
- Determine resource requirements.
- Can be the launch authority if so delegated.
- Determine recovery sites for evacuated aircraft.
- Determine disposition of downed aircraft based on METT-TC.
- Advise the TF commander if destruction criteria for aircraft have been reached. Pass information to the TF staff for destruction missions possibly from CAS or artillery support. Confirm that destruction missions are accomplished.
- Plan equipment for only that mission, which avoids multiple mission situations. As decisions become more complex, requirements cannot be met for combination missions. Plan for possible multiple mission situations.
- Plan for security: each mission has elements of security. Protect your force.
- Ensure that each package has defined triggers.
- Integrate missions so triggers are in place and launch decisions are made in a timely and accurate manner. Set the conditions for success.
- Ensure proper A²C² coordination. May request a no-fire area over that site to protect the assets that are there. May request the air corridors forward of the FLOT to avoid already flown routes.

BDAR – SPECIFIC PLANNING CONSIDERATIONS

1-37. During combat operations, situations arise that make expediting normal maintenance procedures imperative. In such cases, the unit commander will authorize the use of BDAR procedures. BDAR is an AVUM-level responsibility, with backup from supporting AVIM units. These concepts use specialized assessment criteria, repair kits, and trained personnel. It modifies peacetime aircraft maintenance standards to safely return damaged aircraft to battle as soon as possible. Often, such return-to-battle repairs will be temporary, necessitating future permanent follow-up actions when the tactical situation permits. The BDAR system is designed to multiply force capability in a combat environment by augmenting the existing peacetime maintenance system.

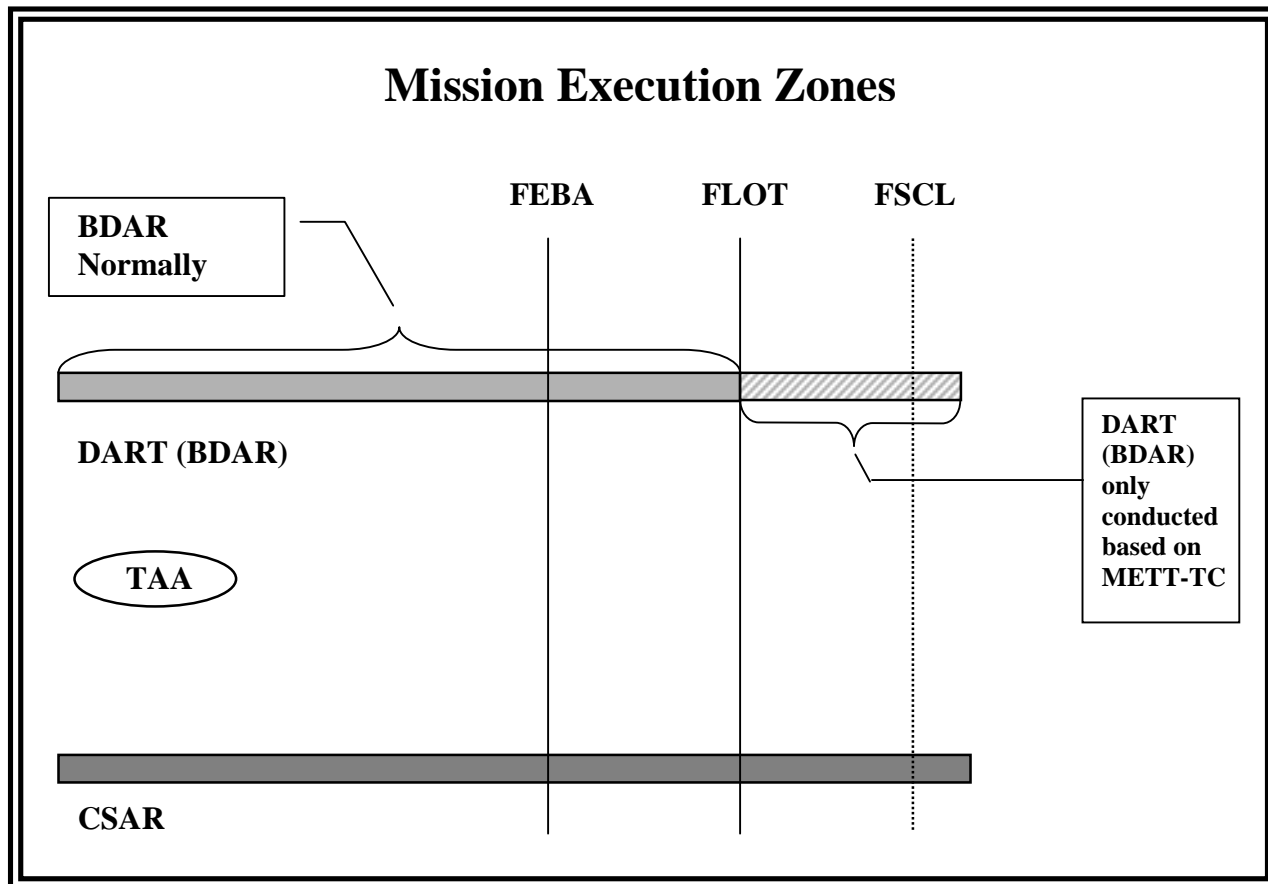


Figure 1-2. Mission Execution Zones

1-38. The following discussion defines BDAR requirements and procedures at the AVUM level. Similar actions apply to AVIM BDAR when used as backup support.

- **Composition and Materials.** BDAR personnel are formed from AVUM platoon assets, which augment the DART, dependent on mission type. Typically, the BDAR personnel are from the 68/35 MOS. The actual composition of BDAR personnel and equipment depends on the type and extent of maintenance work anticipated of that airframe.
- **BDAR Manuals.** BDAR will use manuals containing revised aircraft damage assessment criteria and repair procedures. These manuals are formally processed and validated publications for use in combat environments only, as authorized by the unit commander. Each type of aircraft has its own BDAR manuals that provide—
 - Combat damage inspection and assessment techniques.
 - Combat area maintenance serviceability and deferability criteria.
 - Cannibalization techniques that permit quick, efficient removal of critical components and structures from unrepairable and non-recoverable aircraft.

- **Combat Repair Kits.** BDAR personnel will use specially designed combat repair kits for repairing major aircraft systems. With the tools and materials in these kits, personnel can make quick, temporary combat-damage repairs. Kits are man-portable (suitcase-sized).

BDAR – EQUIPMENT AND MANNING CONSIDERATIONS

1-39. The items to be considered for BDAR equipment and manning are as follows:

- BDAR kits.
- BD manuals.
- AVUM and AVIM allied shop support.
- Aircraft assessment according to resources available.
- Minimum repairs necessary performed according to BD manuals.

PREPARATION PHASE

1-40. Preparation is divided into two phases: Pre-deployment preparation and Pre-combat checks/Pre-combat inspections (PCCs/PCIs) as follows:

- Pre-deployment preparation phase, which should be integrated into the units' pre-accident plan, includes addressing all of the items mentioned below.
- Preparation for each individual mission phase, which should include PCCs/PCIs covering the same points as the pre-deployment preparation phase, with the addition of mission-specific variables.

DART PREPARATION

1-41. The DART is prepared as indicated below. Successful DART missions require team rehearsals to iron out last-minute details and any unforeseen necessary adjustments. The DART must determine that—

- The aircraft assigned is available and suitable for the mission; for example:
 - The hours that the aircraft is available are known.
 - The possible flight hours that could be consumed that day are known. (No scheduled services should come due during that time.)
 - The performance capabilities should already be figured for that mission day; for example, the aircraft can lift the proposed loads.
 - A cargo hook is available.
 - The internal configuration is known.
 - The crew seats for the aircraft recovery crew are available.
 - The space for the selected type recovery kit is available.
 - The crew seats for security team are available.

- The communication plan has been made. (See Fig.1-3.)
- The external load configurations (sling load) are known.

Communication	Medium
Assessor to RCC	FM/UHF/VHF/HF. FM is probably primary unless RCC is equipped with UHF/VHF radios.
RCC to DART (BDAR)	REDCON – Landline or radio (A&L) En route - AMC command frequency

Figure 1-3. Communication Plan

- The team members—
 - Are composed correctly. The DART will outline specific tasks for each individual with cross-checks to minimize time on the ground.
 - Are trained. The DART will rehearse entering and exiting the aircraft and using night vision devices (NVDs).
 - Can expand and collapse a security perimeter. The DART (DBAR) will practice using covering fire.
- The after action review (ARR) has been prepared. The DART (BDAR) will determine whether the DART (DBAR) functioned as intended or if they could improve.
- The mission plan has been refined and adjusted to achieve goals.
- Handling the additional workload generated by hostile fire has been practiced.
- The unit’s ability to identify, evaluate, and categorize battle damage has been redefined.
- Load plans for additional expendable supplies required for repairing aircraft have been refined.
- The assessors are familiar with the proper BD manuals.
- Last repairs have been looked at. Determine if there is a need to re-look at how the repairs were completed. Were they timely, appropriate, and within the team’s capabilities? Look at people, parts, and tools; then refine, innovate, and anticipate changes.

PRE-COMBAT CHECKS/PRE-COMBAT INSPECTIONS

DART

- 1-42. DART PPCs/PCIs include, but are not limited, to—
- Recovery kits (UMARK, I-UMARK, HERK, or ARK) inventoried/inspected.
 - Personnel qualified/trained/rehearsed.
 - Weapons.
 - Aircraft weight estimates for downed aircraft.

- Battle graphics on maps.
- Safety procedures for armed downed aircraft.
- Drop off areas for recovered aircraft identified.

BDAR

1-43. BDAR PPCs/PCIs include but are not limited to—

- Expendable supplies. Allied shops have proper expendable supplies (rivets, sheet metal stock, hydraulic lines, swedge kit, K-747 blade repair kit, hysol products, paint , etc.).
- Personnel management. These questions pertain to BDAR personnel:
 - How many sheet metal personnel do I have?
 - How many pneudraulics personnel do I have?
 - Am I identifying the critically short MOSs and managing their time for maximum effect on my fleet. Is my only engine man assigned as a driver?
 - Do I have appropriate logistics assistant representatives (LARs) support for the hard decisions and for letters of exception (if required)?

SANITIZATION OF AIRCRAFT

1-44. Sanitization of aircraft is the process of taking the necessary measures to ensure the area around the downed aircraft is secured and remains secure. Air or ground assets, or a combination of both, are used.

- Maintenance personnel must ensure communication equipment, maps, navigation aids, critical mission equipment are secured, zeroized, or destroyed to prevent enemy compromise.
- Medical personnel will evacuate and treat casualties. The guards and gunners must understand the setup of their defensive perimeter. Sanitization of the aircraft is critical in performing recovery missions; therefore, the area around the aircraft must be secured and necessary actions performed as outlined below:
 - Organize and coordinate for armed escort aircraft.
 - Provide a ground security team, path finders, and local unit personnel.
 - If the aircraft is armed, make sure nothing is in front of the aircraft and safe weapon systems.

1-45. This paragraph outlines the assessor actions on arrival at the downed aircraft site. (The technical inspector (TI)/maintenance test pilot (MTP)/subject matter expert (SME)) upon arrival at downed aircraft site—

- Identify immediate dangers (fire, armament, fuel leakage, and electrical sparks).

- Approach from either wing position, outside of surface danger areas, according to the applicable aircraft Aircraft Operator's Manual (Technical Manual (TM) –10).
 - Safe weapons and external stores (if applicable).
 - HMMS Launcher Safe/Arm to Safe (missile locking lever release).
 - Ground M-261 rocket pods; remove possibility of firing voltage by disconnecting electrical cannon plug on rocket pod.
 - Insert wing stores ground safety pins.
 - On area weapon system, disconnect electrical cannon plug on 30mm/50 cal. machinegun.
 - Turn master arm switch in pilot station to OFF position.
 - Disconnect aircraft battery.
 - Remove KY-75 and KY-100.
 - Remove Kit-1C, KY-58 from avionics bay(s).
 - Randomize or remove M-130 control module settings.
 - Turn pilots' power levers, thrust levers, or collective throttle to the "Off" position.
 - Zero data, keys, and frequency fills for all radios.
 - Remove or zero the APX-100 transponder settings.
 - Remove or zero data, keys, and waypoint settings from the doppler, global positioning system (GPS), and data transfer cartridge.
 - Remove all maps, kneeboards, strip maps, signal operation instructions (SOIs) from cockpit.
 - Remove AN/ALQ-156 and AN/ALQ-162.
 - Remove AN-ALQ-136 from aircraft.
 - Remove or destroy AN-ALQ-144 from aircraft.
 - Remove AN/APR-39 and AN/AVR-2 threat signature card from AN/APR-39 and AN/VDR-2 digital processor or comparator.
 - Remove the data transfer cartridge from the data transfer unit.
 - Continue assessment of aircraft.
- 1-46. Guards/Gunners (PCCs/PCIs) will ensure—
- PCC/PCI weapons loads are appropriate.
 - PCC/PCI weapons are serviceable and test fired.
 - Fields of fire are interlocked.
 - Fields of fire are integrated with the aircraft mounted weapons (if applicable).
 - Fields of fire are oriented on the most likely avenue of approach.
 - The security team members have rehearsed exiting the aircraft, setting up a perimeter, and collapsing the perimeter and entering the aircraft.

- The security team has established C² signals, audible or visual, for use at the downed aircraft site for communication between the team members, and aircrew of the recovery aircraft.

MISSION EXECUTION TRIGGERS

TRIGGERING CONDITIONS

1-47. Triggering conditions for an immediate recovery operation are a visual sighting of an aircraft going down or a radio report of an aircraft within the flight going down. Immediate recovery can occur only if the friendly aviation unit has utility or cargo aircraft and or maintenance personnel within the flight designated or dedicated as maintenance aircraft. (See Fig. 1-4.)

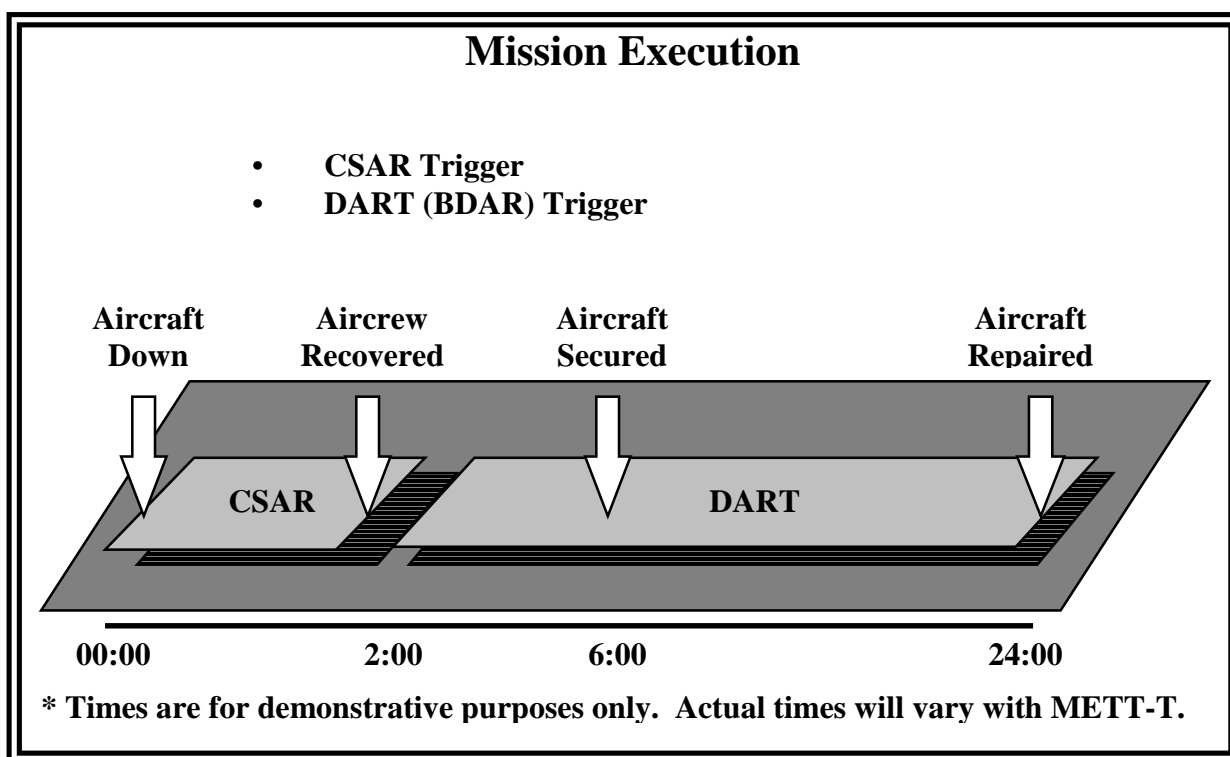


Figure 1-4. Execution of the CSAR/DART (BDAR) Mission

1-48. Either one or two different circumstances may trigger planning for downed aircraft recovery operations.

- Mission planning for any flight will trigger contingency planning for immediate and/or delayed downed aircraft recovery operations by the aviation unit. Planning will be implemented if one of the aircraft taking part in the operation goes down.
- The aviation unit may be directed by higher headquarters to conduct DART (BDAR) operations to recover aircraft belonging to some other unit, service, or coalition force. Planning for a DART (BDAR) operation also includes contingency planning for immediate or delayed recovery operation for the aircraft taking part in the DART (BDAR) operation.

CSAR TRIGGER

1-49. Triggered by aircraft being downed (See Fig. 1-5)—

- The RCC launches aircraft on command from TOC or flight operations.
- The Air Mission Commander (AMC) coordinates the use of CSAR aircraft during the mission. CSAR aircraft would be cross-FLOT and may or may not be with supported aircraft during the mission. It is feasible to place in a lager site if the tactical allows it.

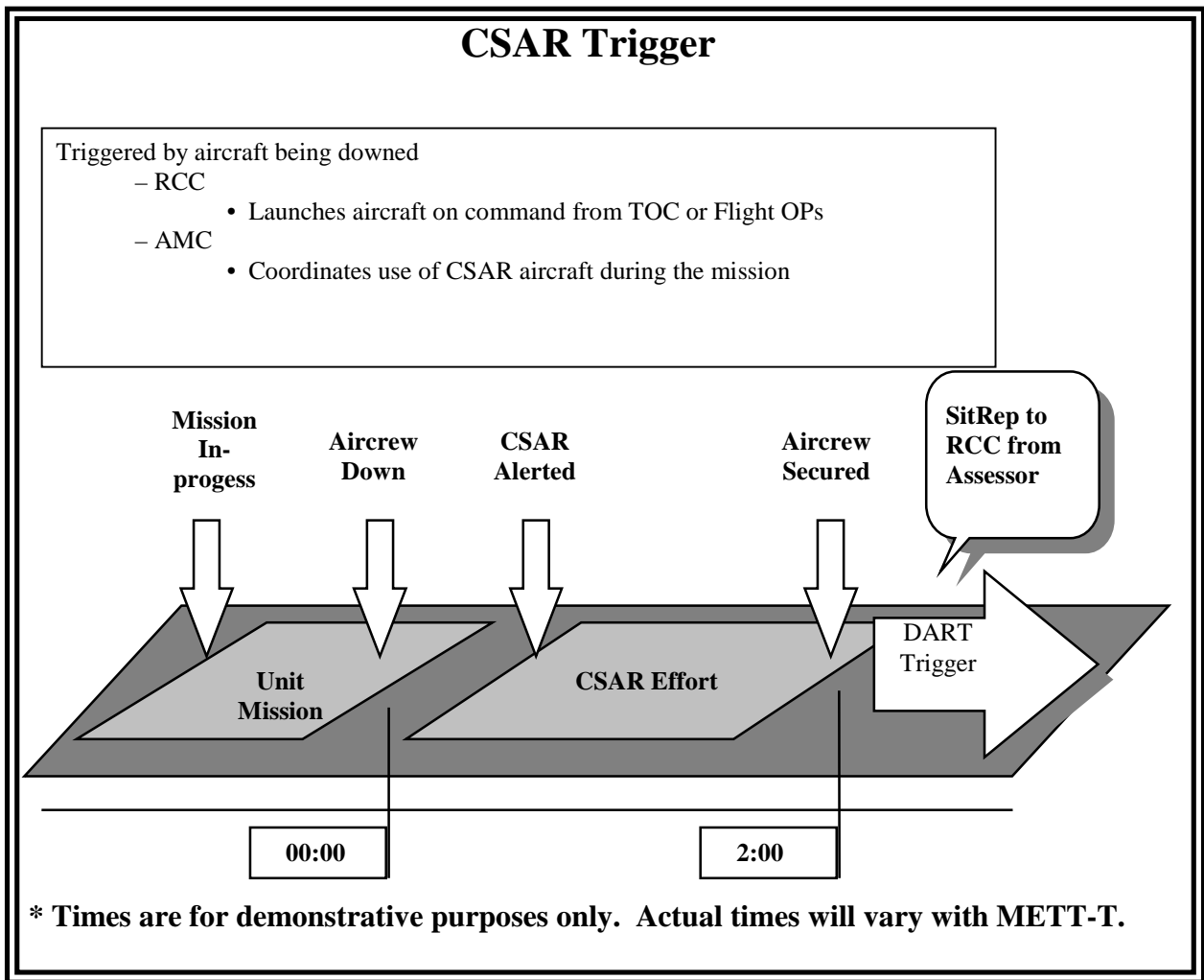


Figure 1-5. CSAR Trigger

DART/BDAR TRIGGER

1-50. Triggered by a CSAR assessor, a typical spot report is sent from assessor in the CSAR aircraft to the RCC. (See Fig 1-6.) The spot report covers the following:

- Aircraft Condition.

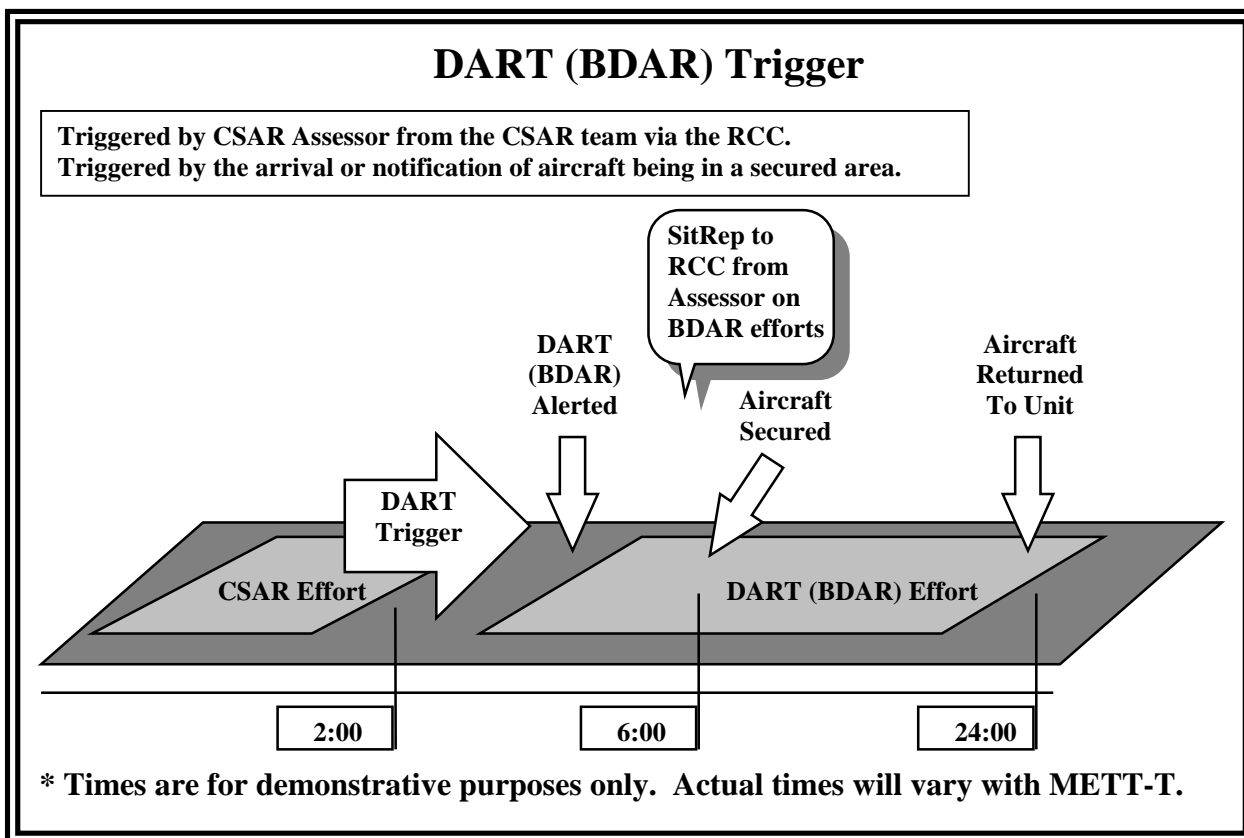


Figure 1-6. DART (BDAR)

- CAT I – Aircraft is repairable. It is possible to repair the aircraft on site by bringing resources to it. The only hindrance to this course of action may be the tactical situation on the battlefield. {In other words, there is not enough time to perform the repairs before the amount of support (tactical) exceeds what you have on hand. For instance, do not use an infantry battalion to help secure the area against the enemy who is threatening while someone changes the nose gearbox}.
- CAT II – The aircraft is recoverable. The aircraft still has intrinsic value; the engines are a good example. Assume that the aircraft lost all hydraulic fluid and managed to land after further flight was not possible. Assume that the crew managed to get the engines shut down, but the landing was a little hard; in other words, no sudden stoppages were involved. In this instance, the engines are both still good as is the possibility that the nose gear box, transmission, drive shafting, and all of the various weapon systems sub components are also. All of those items are recoverable. The fuselage was a little banged up on landing. As an aircraft, the entire airframe is an asset. Probably the most prudent decision would not be to “blow in place.” This aircraft would be a prime candidate for an aerial recovery.

- CAT III – The aircraft is destroyed. Why bother risking assets?
The aircraft is assessed as destroyed and the crews have been recovered.
- Aircraft location.
- 8 to10-digit grid.
- 10-digit grid for artillery destruction mission.
- Triggered by the arrival or notification of the aircraft being in a secured area.
- Brief elaboration of the remaining components that are worth being cannibalized.

CSAR/DART (BDAR) DECISION MATRIX

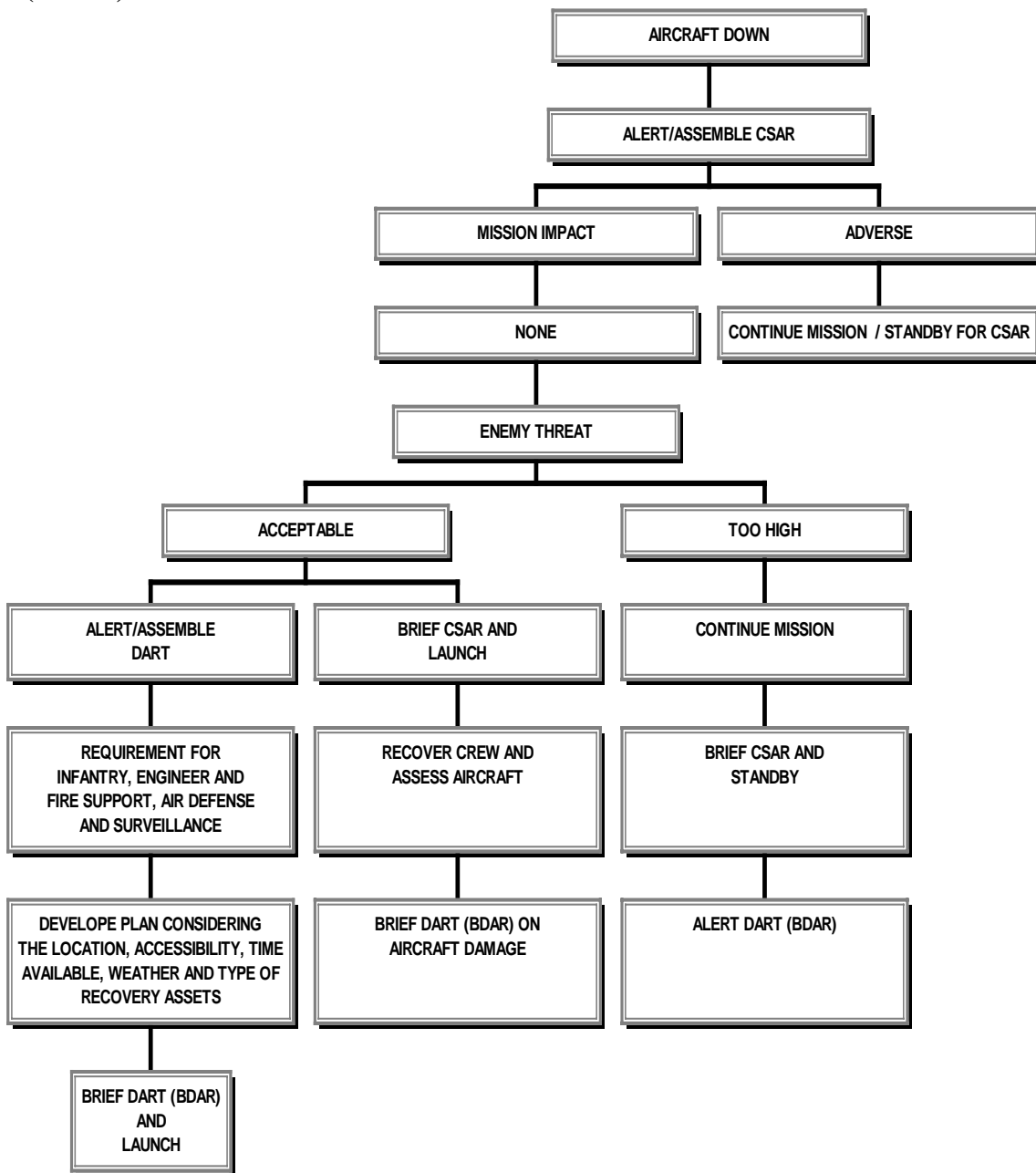


Figure 1-7. CSAR/DART (BDAR) Decision Matrix

MISSION END STATE

CSAR

- 1-52. Extraction of the crew is primary; aircraft assessment is secondary. The CSAR mission is designed to—
- Provide for the safe recovery of the downed aircrew.
 - Return the aircrews to Level II medical care if appropriate.
 - Re-integrate the aircrew into the unit.

DART

- 1-53. The DART is primarily for the extraction of aircraft, not for transport of repair teams. The DART mission may be augmented with BDAR personnel (dependent on METT-TC) for the sole purpose of BDAR procedures. Recover the airframe if—
- The aircraft is worth recovering.
 - The tactical situation allows recovery.

BDAR

- 1-54. BDAR is not actually a mission. BDAR is a method of returning the aircraft to the commander as a resource. It —
- Is preferably performed in a secured area.
 - Brings security to aircraft or bring aircraft to security.
 - Is deferment.
 - Is short term.
 - Is long term.
 - Is best performed where all the necessary tools and equipment are.
 - Is setting the conditions for success.

Chapter 2

General Recovery and Evacuation Procedures

Battlefield recovery and evacuation of aircraft places unique challenges on commanders. Planning, coordinating, and executing the safe recovery of US Army aviation assets are vital in retaining the persuasive combat power. This chapter focuses on general procedures used to develop, coordinate, and execute aircraft recovery and/or evacuation plans to prevent the loss of expensive assets on the battlefield.

MAINTENANCE EVACUATION

2-1. Maintenance evacuation is the physical act of moving an aircraft from one maintenance location on the battlefield to another. Movement is either by fly-out or aerial/ground recovery means. Evacuation is to effect repair, cross-level maintenance workloads, or relieve units of disabled aircraft during tactical moves.

2-2. Responsibility for coordinating the assets and manpower for an evacuation is shared. It is shared between the commander evacuating the aircraft and the commander receiving the aircraft. Normally, when evacuation is from AVUM to AVIM, the AVIM arranges for lift helicopter assets or ground recovery assets. The evacuation may be from one AVIM to another AVIM. If so, the receiving AVIM coordinates aerial or ground assets beyond the capability of the evacuating AVIM. Nonflyable aircraft may be evacuated from one AVUM to another AVUM. If so, the supporting AVIM coordinates aerial or ground assets beyond the capability of the evacuating and receiving AVUM. The evacuating unit normally rigs the aircraft to prepare for movement. Movement is contingent on the availability of a rigging kit. Examples of rigging kits are the Aircraft Recovery Kit (ARK), Interim-Unit Maintenance Aerial Recovery Kit (I-UMARK), Unit Maintenance Aerial Recovery Kit (UMARK), or the Helicopter Recovery Kit (HERK). The evacuating unit may have no kit available. If so, it will request a kit from the receiving or supporting unit.

2-3. Maintenance evacuation on the battlefield is a recurring maintenance function. It usually is planned for in advance, in conjunction with other maintenance support. Procedures to be followed, to include coordination chains, normally are included in aviation maintenance support plans and unit SOPs.

2-4. Normally, the first team on site to a downed aircraft is the DART focused on BDAR. Most aircraft have a BDAR technical manual. Usage of this manual during battlefield recovery is essentially important as part of the recovery. Use of the manual ensures that the downed aircraft is efficiently recovered.

2-5. Physical procedures for maintenance evacuation and battlefield recovery of aircraft are nearly identical; that is, both require the rigging of the aircraft for lift by helicopter or lift by a crane device to the bed of a vehicle. Therefore, the remainder of this manual, as it pertains to physical procedures and the use of rigging kits, applies to both maintenance evacuation and recovery.

BATTLEFIELD RECOVERY

2-6. Battlefield aircraft recovery is an operation that results from an aircraft having experienced a component-failure-induced or combat-damage-induced forced landing on the battlefield, or the aircraft is disabled because of an accident. Based on an assessment, the aircraft might be destroyed or abandoned, repaired and flown-out, or recovered to a maintenance site either by aerial or ground means.

2-7. The preferred recovery method is to repair the aircraft at the scene of the forced landing. Then the aircraft is returned to service or prepared for evacuation to a maintenance site. Ground recovery remains an option to return an expensive asset to service when the aircraft cannot be repaired at the site or air recovered. The time allotted to repair the aircraft at the scene depends on the tactical situation. The next two methods (based on METT-TC) are to recover the aircraft by—

- Aerial means, using rigging kits and helicopter assets of the owning unit, or assets of supporting or tasked units, or
- Ground means, which take more time and require the aircraft to be in such a location that large tactical vehicles can approach it.

2-8. Recovery operations always require detailed coordination. Manpower and recovery assets must be synchronized in response to time and the tactical situation. Extensive coordination among the battlefield functions of maneuver, fire support, air defense, intelligence, and combat service support also are often required. Command, control, and technical procedures are preplanned; they are included in unit SOPs, contingency plans, operation orders, and air mission briefings.

2-9. Responsibility for a recovery originates with the commander of the unit to which the disabled aircraft is assigned; however, responsibility may pass to a higher echelon when it is beyond the capability of the unit to complete the operation. A recovery operation begins when an aircraft has experienced a forced landing or is otherwise disabled on the battlefield. It ends when the aircraft has been recovered to, and is under the control of, a maintenance facility.

THREAT

2-10. Recovery operations—and to a lesser degree maintenance evacuations—are easily detected and subject to attack by enemy forces, despite combat intensity. Detection can result in hostile actions aimed toward halting or disrupting the operation, inflicting casualties, and destruction of

disabled aircraft and other equipment. Operations are threatened by any of the following:

- Ground force attack.
- Artillery, rockets, and mortar fire.
- Air attack.
- Antiaircraft weapons and small arms fire against air and ground equipment assets and crewmembers.
- Electronic devices used to disrupt communications.
- Directed energy weapons used to register fire, blind personnel, and disrupt electronic components.
- Chemical agents used to deny areas and disable personnel.
- Damaged airframe used as a decoy or to contain boobytraps. The damaged airframe could be rigged to break up in midair, harbor an explosion aboard a vehicle, or carry harmful substances or explosive devices to the repair facility.
- Mines and other barriers.

COMMAND, CONTROL, AND COORDINATION

2-11. Maintenance evacuation is a preplanned operation. It is performed by preparing the aircraft for a one-time evacuation mission to the receiving unit or movement by aerial or ground means. Maintenance evacuations between maintenance units are coordinated between the commanders of the units involved; they are assisted in some cases by the staff maintenance officer to arrange supporting equipment assets. Evacuation of groups of aircraft often are driven by unit relocations on the battlefield or reconstitution of aviation units. These evacuations would likely be controlled by the aviation brigade staff maintenance officer/S-4 in coordination with the division and corps staff. Coordination and tasking of division and corps assets may be necessary also.

2-12. Command, control, and coordination to support aircraft recovery operations are planned for in advance. Planning is within the context of the size of the force and the density of recovery assets at the disposal of commanders. The first commander in the chain of command who controls all the required assets coordinates the assets and manpower for evacuation for the recovery. When an aircraft recovery operation is required, a plan of execution supplements the preplanned procedures. The purpose of the plan is to synchronize personnel and equipment assets within the scheme of maneuver and the tactical situation. Aircraft recovery operations are time sensitive.

2-13. AVUM and AVIM maintenance units form DARTs from within their personnel assets. These teams are skilled in BDAR, the use of rigging kits, and combat expedient recovery techniques (CERTs). The typical composition of a DART includes a maintenance officer/technician, technical inspector, repairer personnel, and vehicle operators. The DART performs any of these functions:

- Assesses repair requirements.
- Repairs the aircraft or prepares it for a one-time evacuation mission.
- Recommends recovery by aerial or ground means.
- Rigs the aircraft for recovery; serves as the ground crew for helicopter lift.
- Serves as the crew to secure the load aboard a vehicle.
- If the aircraft is not repairable—
 - Determines the parts, subsystems, or components that can be salvaged and removes them.
 - Destroys, or takes part in the destruction of, a disabled aircraft that is to be abandoned.

2-14. These teams may respond to the recovery of a downed aircraft from within the unit, a supported unit, an adjacent unit, or any aircraft that is disabled within sector. Normally, these teams are transported with their equipment by air to the scene of the disabled aircraft. They are then extracted by air upon completion of the mission.

2-15. The first line of responsibility for a recovery operation is the air mission commander/aviation unit commander. This commander may have at his disposal (from within the assets of the operation) on-call DART organizations and lift assets capable of recovering the disabled aircraft. In such cases, the commander employs those assets to assess and effect recovery within time and tactical situation constraints.

2-16. If beyond the capability of the air mission or unit commander, the responsibility to coordinate recovery defaults to the RCC. The RCC is a contingency organization in the aviation brigade TOC. Depending on the size of the force, the RCC also may be found in division and corps TOCs. In this case, RCC is primarily a communications mode for staff elements to receive voice, manual, and automated messages; coordinate resources; coordinate battlefield functions of maneuver, fire support, air defense, intelligence and combat service support within tactical priorities and the scheme of maneuver in support of recovery operations. The principal in the RCC is the staff maintenance officer.

2-17. Crash site preparation for aerial extraction may require coordination with pathfinder or engineer units.

2-18. Recovery operations are unique. Each operation is discrete and may involve the initiative and imagination of commanders and staff to synchronize the operation within a range of variables.

2-19. Recovered aircraft normally are transported from the recovery point to a pre-selected maintenance site without intermediate stops. Air recovery (and evacuation) capitalize on back-haul from forward areas to the extent possible to reduce separate demands on aircraft. This is especially true of CH-47 Chinook aircraft, which may be heavily committed to re-supply and other transport missions.

2-20. Ground recovery wrecker/cranes and semi-trailers are found in AVIM units. These units deploy these assets to the scene of the disabled aircraft for

recovery operations or to the maintenance site for evacuations. When the AVIM unit is unable to support the required lift within assigned assets, a crane is obtained from another unit. An example is the 20-ton mobile crane, found in division and corps engineer battalions and corps ammunition units.

2-21. Aircraft that cannot be recovered and are in danger of enemy capture are destroyed according to TM 750-224-1-5. The authority for destruction will be included in SOPs and OPORDs. If possible, aircraft are cannibalized before destruction.

2-22. The corps, on a mission basis, accomplishes recovery and evacuation of enemy, allied, and other US services' aircraft using corps assets or by tasking division assets in sector.

2-23. The helicopter lift capability data in Table 2-1 is a guide. Figures may vary considerably, depending on mission distance (fuel load), weather conditions, and aircraft configuration.

2-24. Normally, the smallest lift helicopter is used to transport another aircraft during recovery or evacuation. Table 2-2 illustrates capabilities and can be used as a general guide.

Table 2-1. Helicopter Lift Capability Data (pounds)

<u>Helicopter</u>	<u>Lift Capability</u>
CH-47D (center hook)	26,000 (center hook rating only)
CH-47D (tandem hook)	25,000(tandem hook rating only)
CH-47D (fwd and aft hook)	17,000 (fwd and aft hook rating only)
CH-47D	20,000 (actual lifting capability)
UH-60L	9,000
UH-60A	8,000
UH-1	4,000

Table 2-2. Capabilities of Aircraft During Recovery or Evacuation

<u>Type Aircraft</u>	<u>Transported by</u>
OH-58A/C	UH-1*, UH-60, CH-47
OH-58D	UH-60, CH-47
UH-1	UH-60, CH-47
UH-60A	UH-60*, CH-47
UH-60L	CH-47
EH-60	CH-47
MH-60	CH-47
AH-1	UH-60*, CH-47
AH-64A/D	CH-47
CH-47	CH-47*
RAH-66	CH-47
RC-12	CH-47
C-23	CH-47
UC-35	CH-47

*Depending on atmospheric conditions and configurations, aircraft weight may be reduced by removing components.

2-25. Ground recovery requires wrecker/crane and semi-trailer combinations, or the palletized loading system (PLS) vehicle, which is a combination crane/extended flatbed. (See Table 2-3.)

Table 2-3. Wrecker/Crane and Semi-Trailer Combinations Used in Ground Recovery of Aircraft

<u>Aircraft</u>	<u>Wrecker/Crane</u>	<u>Semi-trailer</u>	<u>Source</u>
OH-58A/C	M543/M984		AVUM
	M246	M172/M270	AVIM
	*Palletized Loading System	*Palletized Loading System	AVIM
OH-58D	M543/M984		AVUM
	M246	M172/M270	AVIM
	*Palletized Loading System	*Palletized Loading System	AVIM
UH-1	M246	M172/M270	AVIM
	*Palletized Loading System	*Palletized Loading System	AVIM
UH-60 MH-60 EH-60	20-ton mobile		Engr Units
		M270	AVIM
	*Palletized Loading System	*Palletized Loading System	AVIM
AH-1	M543/M984		AVUM
	M246	M172/M270	AVIM
	*Palletized Loading System	*Palletized Loading System	AVIM
AH-64A/ AH-64 Long Bow	20-ton mobile		Engr Units
		M270	AVIM
		*Palletized Loading System	AVIM
RAH-66	M543/M984		AVUM
	M246	M172/M270	AVIM
CH-47 MH-47	Normally, unrecoverable because of size.		
RC-12 C-23 UC-35	TBD		
	TBD		
	TBD		
	*Currently under development for fielding.	*Currently under development for fielding.	

NOTE: Refer to TB 55-46-1, *Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize/Overweight Equipment* for Alternate Ground Recovery Equipment.

ACCIDENT INVESTIGATION BOARD

2-26. According to AR 385-40 (Accident Reporting and Records), the commander who first becomes aware of an Army aircraft accident, places a guard at the scene. This prevents anyone from moving or disturbing the aircraft or detaching parts until it is released by the president of the Accident Investigation Board and by the US Army Safety Center, if taking part.

2-27. In the combat environment, it may not be possible to comply fully with this requirement. Further, aircraft damaged as a direct result of hostile fire is considered a “combat loss,” rather than an accident.

2-28. Situation permitting, the recovery operation may not begin until one of the following occurs:

- The commander of the unit to which the aircraft is assigned orders that an accident investigation board, as prescribed by AR 385-40 is not required, or
- The president of the board releases the aircraft.

RECOVERY IN THE DIVISION

2-29. The maintenance officer of the unit owning the disabled aircraft manages aircraft recovery in the division. Organizational units prepare aircraft for recovery within their capabilities. Notification of a disabled aircraft follows normal reporting channels to the aviation battalion and aviation brigade. Additional support may be required or the recovery of the aircraft may be beyond the capabilities of the owning unit. If so, the AVIM is notified of required support. The AVIM company is equipped with air and ground recovery kits to assist with recoveries at the AVUM level.

2-30. Supporting AVIM units augment AVUM organizations as required to complete recovery operations. These units may be tasked to complete the operation if the AVUM is heavily committed or preparing to move.

2-31. Aerial recovery may be required, and the tactical situation may permit. If so, the AVUM or the AVIM recovery team rig the aircraft. The recovery teams may not be able to move the disabled aircraft. Then the maintenance officer or the production control officer of the supporting AVIM requests—through the division movement control center—a lifting helicopter from the corps support command (COSCOM) movement control center. Requests are sent through the division movement control center.

2-32. Divisional units may be tasked to support recovery operations, in sector, for other than division units and for allied and other services.

RECOVERY IN ECHELONS ABOVE DIVISION

2-33. The same principles apply to recovery in echelons above division as in the division.

RECOVERY IN A NUCLEAR, BIOLOGICAL, AND CHEMICAL ENVIRONMENT

2-34. Recovery operations in a nuclear, biological, and chemical (NBC) environment pose special risks to personnel. These risks can be minimized through the recovering crew's wearing protective clothing at the scene of the disabled aircraft. Also, the receiving crew at the maintenance site should wear protective clothing because of possible contamination of the disabled aircraft, the recovering aircraft, and rigging kits. See FM 3-11.4(3-4) (NBC Protection) for information on individual and collective protection.

NIGHT RECOVERY

2-35. Generally, night operations increase safety hazards and the need for security. Increased risks must be weighed against the urgency considering time, weather, and the tactical situation. When possible, delay such operations until the beginning of morning twilight.

RECOVERY METHODS

2-36. Three general methods used to recover and evacuate disabled aircraft are one-time evacuation mission, aerial (sling load) recovery, and surface. (See FM 3-04.500 (1-500), Army Aviation Maintenance.) The recovery officer or BDAR assessor determines the method to be used. His main concern is how to move the aircraft to the aircraft maintenance activity without further damage. Information may be needed for disassembly, packing, or shipment of the aircraft during any phase of the mission. If so, the applicable shipping or maintenance manual is used. To ensure a successful mission, personnel should follow the procedures below upon arrival at the site of a disabled aircraft:

- Remove occupants.
- Eliminate fire and safety hazards.
- Disconnect batteries.
- Remove ammunition (if possible and practical).
- Remove weapons (if possible and practical).
- Drain fuel from aircraft, as required.

WARNING

All weapons systems must be cleared before removal to avoid injury or death.

WARNING

Avoid contact with aviation fuel or with water contaminated with aviation fuel. Such contact can result in severe skin burns. In the event of skin burns/irritation, immediately seek medical aid. Contaminated clothing should be removed and cleaned/discarded according to appropriate care manuals.

EVACUATION METHOD

2-37. The evacuation method is accomplished by on-site repair of the disabled aircraft. The aircraft is prepared for a one-time evacuation mission to a regular maintenance area with a minimum flight crew (only the pilot when possible); the pilot should be proficient in all emergency procedures for the particular aircraft. Advantages and disadvantages of the one-time evacuation mission method are as follows:

- Advantages.
 - Speed.
 - Economy.
 - Minimum likelihood of further damage.
- Disadvantages.
 - Requirement for a clear takeoff path.
 - Possibility of unfound damage causing a crash.
 - Requirement for special tools and equipment.
 - Effects of weather conditions.

AERIAL (SLING LOAD)

2-38. Aerial (sling load method) recovery and evacuation involves preparing the disabled aircraft for movement; connecting it to a suitable lift helicopter, with component from an aerial recovery kit; and transporting it to a maintenance area. Advantages and disadvantages of the aerial (sling load method) recovery/evacuation are as follows:

- Advantages.
 - Less disassembly required than for surface transport.
 - Disabled aircraft accessibility.
 - Faster than by surface.
- Disadvantages.
 - Possibility of dropping disabled aircraft/inflicting further damage.
 - Effect of rotor downwash on sling load.
 - Effects of weather conditions.
 - Possibility of loss or damage to lifting helicopter.
 - A cleared approach/departure path for recovery aircraft required.

SURFACE

2-39. The surface method of recovery and evacuation involves preparing the disabled aircraft for movement, lifting it onto a suitable transportation vehicle, and transporting it to a maintenance area. Advantages and disadvantages of the surface recovery method are as follows:

- Advantages.
 - Restricts the enemy's ability to detect movement of recovery assets to an area relatively close to the movement routes.
 - Use possible when weather conditions prohibit flight.
 - Threat of total loss of the aircraft during transport because of recovery and malfunction is low.
- Disadvantages.
 - Route security assets badly needed somewhere else may be tied up. Time needed for surface recovery is much greater than for aerial recovery.
 - Recovery personnel and equipment assets are tied up for long periods.
 - Relatively high exposure time on the battlefield with slow-moving equipment increases the threat.
 - Significant amount of aircraft disassembly or modification often is required to adapt the aircraft to surface travel.
 - Ground routes must be accessible, and meticulous reconnaissance of the route is required.
 - Loading procedures and travel on rough terrain can cause further damage to the aircraft.

ON-SITE RECOVERY PROCEDURES

2-40. Procedures performed at the site of the disabled aircraft include making the recovery area accessible, using communications correctly, and making the aircraft secure, safe, and ready for stable flight.

CONDITION OF THE PICKUP SITE

2-41. The pickup site must be cleared of all trees, obstacles, and trash. The recovery helicopter pilots must know of conditions that might restrict their visibility, such as dust or snow.

2-42. Trees and obstacles should be cleared from the pickup site. The trees cut to clear an area must fall away from the area. This is done by appropriate tree notching or by a constraint applied to the tree using positioning straps and rope. Tension is applied before starting the cut by stretching the nylon straps or rope as much as possible.

2-43. The pickup area should be thoroughly policed of all trash before the recovery helicopter arrives. Items such as empty field ration cans, empty field ration cases, small pieces of the disabled aircraft, small tree limbs, tree roots,

and loose recovery equipment can all become airborne missiles, which endanger both the recovery helicopter and the ground crew.

2-44. The recovery helicopter pilots should be warned if the pickup area is dusty. This enables them to plan for a rapid climb out if visibility drops to a point that they will lose ground reference. A variety of dust control agents exists. However, natural turf is the best dust control measure; therefore, all possible efforts should be made to preserve the natural turf cover while working in the pickup area.

2-45. Snow, like dust, is primarily dangerous to a recovery mission. The reason is that snow can dangerously restrict the visibility of recovery helicopter pilots. An attempt should be made to pack the loose snow, if possible. In all cases, the recovery helicopter pilots should be warned of the condition of the snow.

RADIO COMMUNICATION

2-46. Communication must be established between the ground recovery crew and the recovery helicopter. The recovery helicopter usually will not proceed to the recovery site until the ground crew advises that they have rigged the disabled aircraft, and it is ready for hookup. In a tactical situation, this precludes endangering the recovery helicopter for a longer period than is necessary. In all situations, this minimizes flight time for the recovery helicopter. Although there maybe space for radio stowage in the recovery kit container, the radio and a fresh battery must be obtained from the unit communications section before each mission.

2-47. The ground crew also should include a radio operator co-located with the signalman. This individual should be in direct contact with the recovery aircraft to advise the aircrew on the status of the aircraft extraction.

<p>NOTE: Pilots of recovery aircraft will be taking directions from the onboard crew chief. Air-to-ground communications procedures should be coordinated in advance and included in the pre-mission brief to minimize confusion.</p>

AIRCRAFT BATTERY

2-48. The aircraft battery must be disconnected before performing any work on the disabled aircraft.

WARNING

Turn off the battery switch and all power switches before detaching battery leads. Sparks or arcs may ignite the hydrogen generated in charging and discharging. Spilled fuel or fuel vapors may be present in the vicinity of the crashed aircraft. Exercise good judgment when disconnecting batteries or electrical leads under these condition to avoid arcing of battery connection. The electrolyte used in nickel-cadmium (NICAD) batteries contains potassium hydroxide (KOH), which is a caustic chemical agent. Serious flesh burns result if the electrolyte comes in contact with any part of the body. Personnel should use rubber gloves, rubber aprons, and protective goggles when handling NICAD batteries or electrolyte. If they spill any electrolyte (potassium hydroxide) on their skin, they must immediately wash the area with cold water and seek medical aid.

COMBUSTIBLE GAS DETECTION

2-49. In explosive atmosphere is detected, ventilation must be provided. Open doors and access hatches or panels before entering the aircraft. Do not puncture the structural skin of the aircraft to provide ventilation. However, if necessary, use a nonmetallic object to break out fixed windows and jammed canopies.

AIRCRAFT EXPLOSIVE DEVICES

2-50. Ammunition, signal flares, and all other explosive devices, which are on the downed aircraft, must be removed. The ejection seat, weapons pylons and canopy, when fitted, must be disarmed. Refer to the applicable technical manual for disarming procedures.

WARNING

Aircraft explosive devices must be removed and disarmed. Extreme caution should be used when removing ammunition, signal flares, and all other explosive devices. Disarm explosive devices according to the applicable manual before moving aircraft.

REMOVAL AND SALVAGE OF BASIC AND CLASSIFIED EQUIPMENT

2-51. Loose equipment may have to be removed. Such items include troop seats, litters, radios, and other basic components. These items are necessary to reduce the weight or shift the center of gravity (CG) of the disabled

aircraft. They usually are removed when recovering the heavier aircraft. Tools in the general aircraft mechanic's tool kit usually are adequate.

2-52. Classified equipment should be retrieved if possible. The appropriate salvage or disposal instructions for classified components should be reviewed. Any required dismantled equipment or components to be salvaged with the aircraft and small enough to be stowed internally in the aircraft should be positioned in the aircraft to yield corrective ballast for aircraft CG position. These components should be padded and tied securely in place. Other corrective ballast may be used as required for recovery of the specific aircraft.

WHEELED LANDING GEAR BRAKE SETTING

2-53. The decision to set the brake on wheeled landing gear systems should be made depending on the condition of the downed aircraft. The outcome of this decision will directly affect planning considerations for the reception of the aircraft at recovery site.

USE OF GUST LOCKS

2-54. To ensure stable flight loads, all flight controls of the disabled aircraft must be securely locked in their neutral position. The controls are locked using the integral control locks usually available for most fixed-wing aircraft. If these locks are unavailable, specially designed gust locks provided with the aerial recovery kit can be used. Integral control locks in the aircraft and gust locks may be unavailable. If so, the stick or wheel control and rudder pedals must be tied down. If control linkage damage prevents locking any of the control surfaces, use either gust locks or remove the control surfaces from the aircraft before sling operations.

FLAP POSITION

2-55. If possible, the flaps must be retracted; if this is not possible, they must be removed.

WARNING

Some aircraft use hydraulic systems with accumulators. Hence, lines may be under high hydraulic pressure. Do not operate selector levers unless movable surfaces are clear of personnel. Refer to the applicable technical manual.

USE OF SPOILERS

2-56. Lift spoilers must be used on fixed-wing aircraft to prevent generation of lift by aerodynamic surfaces in flight. Attach spoiler to aerodynamic surfaces as specified in the technical manual for each type of aircraft.

NOTE: The free ends of the spoiler straps should be reassembled led with the buckles and the assembly slipped over the end of the aerodynamic surface when practical.

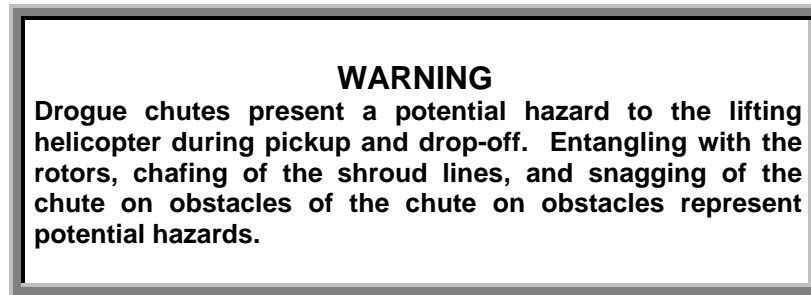
TIE-DOWN OF PROPELLERS OR ROTORS

2-57. Airplane propellers or helicopter rotors are secured to the airframe.

2-58. For two-bladed rotor system helicopters, the tail rotor blades should be aligned with the vertical fin. The main rotor blades must be aligned with the fuselage if possible. Tie-down lines become slack under air loads. Therefore, the forward and aft aligned blades must be tied down to the helicopter structure so that the restraints will not slip off the blades when they are deflected during flight by aerodynamic loading.

2-59. Rotor blades on helicopters with more than two main rotor blades may be removed to prevent damage either to the disabled helicopter or the recovery helicopter and to prevent rotor blades from flexing. Also, the blades may be removed to attach a sling, decrease the weight to be lifted, or stabilize the disabled helicopter. All US Army four-bladed rotor system helicopters have been test aerial evacuated with the main rotor blades installed and tied down.

ATTACHMENT OF DROGUE CHUTES



2-60. Without some types of yaw stabilization devices, recovery flight speeds are limited to 30 to 40 knots. A drogue chute can be used to provide yaw stabilization and increase forward speed.

2-61. The appropriate drogue chute is attached to the tail section of the recovered aircraft. A shackle at the end of the riser line swivel generally provides a convenient point of attachment.

BREAKAWAY TECHNIQUE

2-62. If it looks like the rigging equipment may become entangled, the affected items should be clustered and taped together as close to the rigged aircraft as possible and individually taped to the aircraft structure itself. (Examples of affected items are bellyband sling assembly, pendant assembly, and so forth.) The breakaway technique is to secure the legs of the rigging equipment to the aircraft and/or to each other with a low-strength item (for example, 2.0-inch pressure-sensitive tape) to hold the rigging in a desired position until lift-off. At lift-off, the tape breaks, and the rigging assumes its proper flight configuration.

CRASH SITE HAZARDS

2-63. The CH-47 is the only aircraft model that requires fuel drainage to achieve weight reduction. Fuel can be drained by using existing drain fittings or by siphoning. If the fuel tanks and/or lines are ruptured during a crash, the remaining fuel should be drained. This prevents leaking fuel from creating a fire hazard in or near the maintenance facility receiving the recovered aircraft. In the case of CH-47 aircraft, contingency plans must be made for portable, collapsible fuel cells to reduce aircraft weight for recovery.

WARNING

Exercise extreme caution when de-fueling any aircraft. Fire-protective clothing, fire extinguishing equipment, and electrical grounding apparatus must be available.

WARNING

Some particulate matter is highly toxic. The air surrounding a fuel fire, for example, contains particulate matter that, if inhaled, can cause fluid buildup in the lungs to the extent that death can occur.

2-64. Aircraft are manufactured from various types of materials. Of these materials, some can become a hazard during an aircraft accident. Contamination from fumes, toxins, liquids, composite, and solid materials can cause serious illness or injury if protective equipment is not worn.

WARNING

Exercise extreme caution when handling any aircraft materials. Protective clothing, gloves, respirators, and equipment must be available.

HOOKUP

2-65. The ground crew must take certain precautions and perform specific functions when hooking up the rigged aircraft to the recovery helicopter.

WARNING

Recovery crew members may be required to stand on the rigged aircraft during hookup. In this case, additional caution must be exercised to prevent being pinned between the disabled aircraft and the recovery aircraft.

GROUND CREW GENERAL PROCEDURES

2-66. Ground crew teamwork and proficiency are the most important parts of an aerial recovery operation. How well ground crew personnel are trained and how familiar they are with their equipment determine the final outcome of the mission. All units should have an ongoing training program to keep their ground crews current on unit equipment and to train new ground crew personnel. The command is responsible for implementing a training program for the ground crew.

NUMBER OF GROUND CREWS

2-67. The number of personnel in a ground crew may vary depending on the situation, type of aircraft, and size of the pickup zone. The unit commander determines how many crews need to be trained. Generally, three people make up a ground crew: the signalman, the hookup man, and an assistant. The commander also must provide local security for the operation. (The ground crew is not responsible for this task.) Although each member of the crew has specific duties during the operation, each person should be trained in how to perform all duties.

GROUND CREW EQUIPMENT

2-68. The ground crew members involved in helicopter aerial recovery operations are exposed to the hazards of helicopter noise and rotor downwash. Therefore, they should wear protective equipment when performing their duties. Depending on the mission, they may need additional equipment. Figures 2-1 and 2-2 show the equipment that is normally needed. The national stock numbers (NSNs) help to prepare supply requisitions for the items needed.

STATIC ELECTRICITY DISCHARGE WAND

2-69. In flight, a helicopter generates and stores a charge of static electricity. When the helicopter lands, this charge is grounded. While the helicopter is in flight, however, this charge remains stored unless a path is provided to channel it into the earth. A ground crew member provides this path by contacting the helicopter cargo hook when it is positioned over a cargo hookup point. Although this charge may not cause an electrical burn, it can cause a muscular reaction, which may, if the individual concerned is on unsure footing, result in a fall. An individual shocked by the electricity also may suffer delayed discomfort from muscular cramps or spasms.

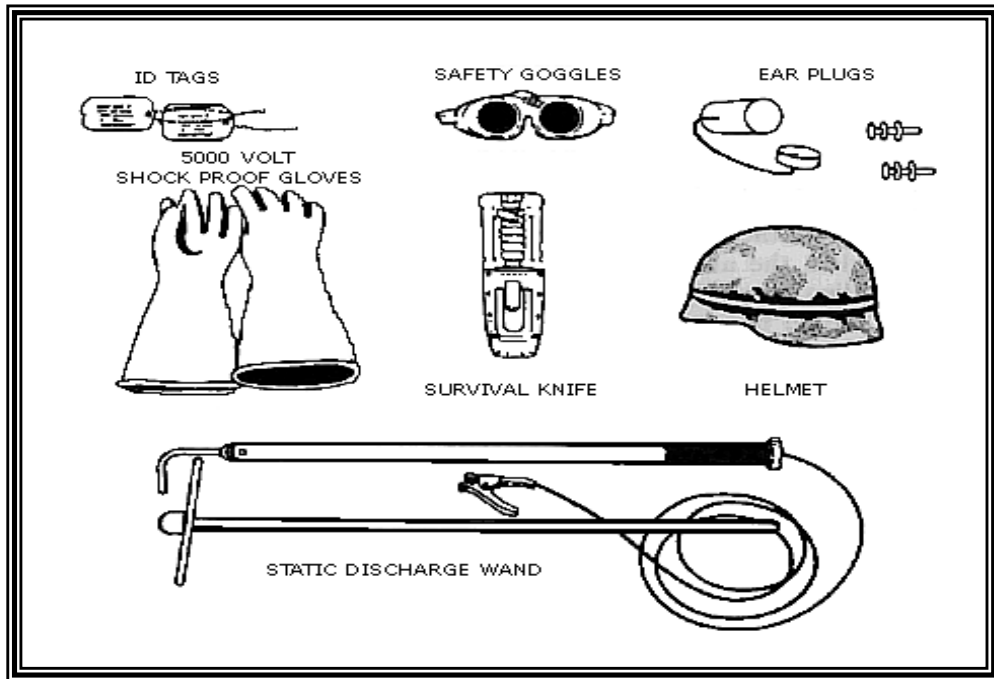


Figure 2-1. Ground Crew Protective Equipment

NOTE: If a wand is not available, one will have to be made locally.

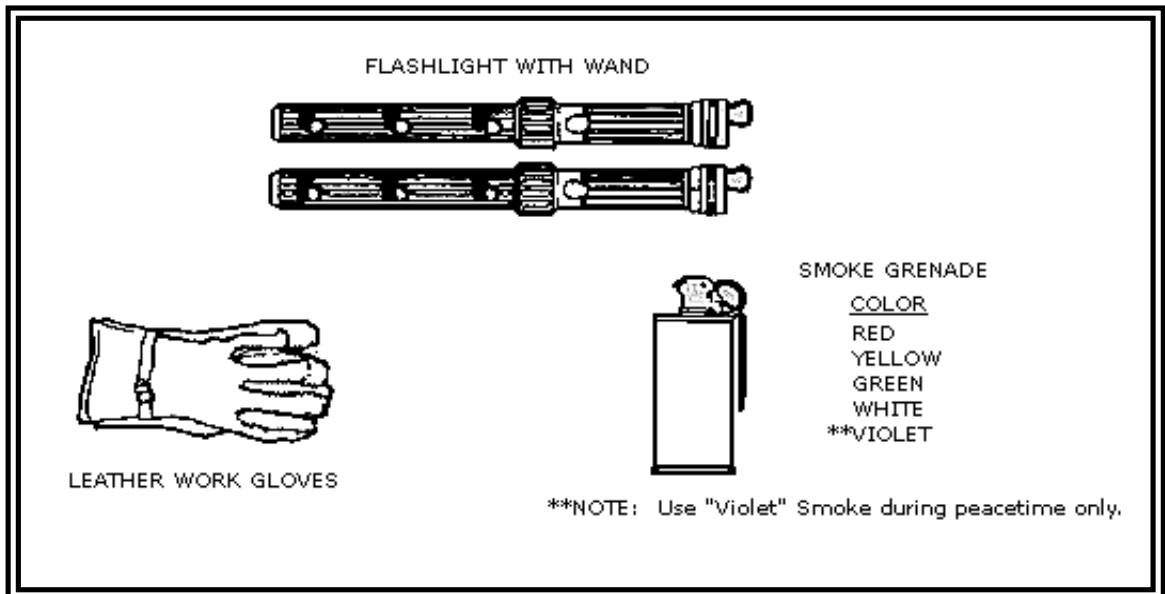


Figure 2-2. Additional Ground Crew Equipment (Depending on Mission)

2-70. To prevent static electricity shock, the ground crew member uses a discharge wand to ground the cargo hook. For added protection, the ground crew member should also wear 5000-volt shockproof gloves, if available, when using the wand.

2-71. The wand consists basically of an insulated plastic tube with a metal hook on one end with a wire attached leading to a ground rod. The entire length of wire must be insulated. The wire could cause a severe shock if it comes in contact with personnel. In use, the ground rod is driven into the earth, and a ground crew member holds the wand. As the helicopter hovers over the load, the assistant hookup man holds the wand against the cargo hook; this grounds the stored electrical charge. Meanwhile, the hookup man places the clevis on the hook.

FIELD EXPEDIENT STATIC-DISCHARGE WAND

2-72. Discharging static electricity is an important step to ensure the overall safety of the hookup team. You can assemble a field expedient static-discharge wand using the following components:

- Grounding rod, NSN 5975-00-878-3791. You will be able to make three static-discharge wands from this 5/8- by 108-inch generator grounding rod.
- Grounding cable, NSN 4010-00-286-2681. If you do not want to order this 1000-yard roll of cable, contact the nearest petroleum handling or ground power section to obtain a length of grounding cable.
- Electrical clip, NSN 5999-00-260-0447. You will receive electrical clips for five static-discharge wand.
- Rubber hose, NSN 4720-00-277-8985. Order enough of this 5/8-inch inside diameter rubber hose to cut a 12-inch section for each static-discharge wand.

2-73. The following steps should be taken to assemble the static-discharge wand:

- Step 1. Cut a section of grounding cable about 20 feet long. Strip 1 inch of insulation off both ends of the cable.
- Step 2. Cut a 20-inch and a 16-inch section from the generator-grounding rod. The 20-inch section will be the static-discharge wand, and the 16-inch section will be the grounding rod.
- Step 3. Clamp one end of the cable to the 20-inch section of rod about 12 inches from the end of the rod (Figure 2-3).
- Step 4. Slide the section of rubber hose over the cable and ground rod so that the rod is about 1 inch from the end of the rubber hose. Fill the end of the hose with silicone sealant to provide insulation protection from the bare end of the rod. If a rubber hose is not available, wrap electrical tape or pressure-sensitive tape around the clamp and the lower portion of the rod so that the tape is about ½ inch thick (Figure 2-4).

- Step 5. Bend the last 2 inches of the rod 90 degrees to form a hook to connect to the helicopter cargo hook (Figure 2-5).

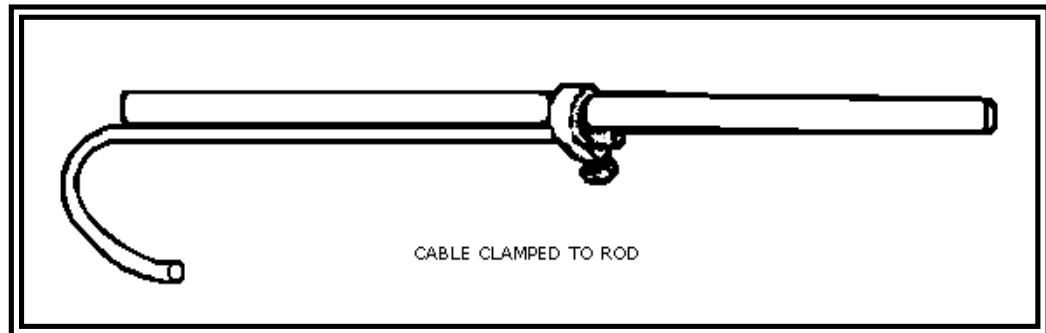


Figure 2-3. Cable Clamped to Rod

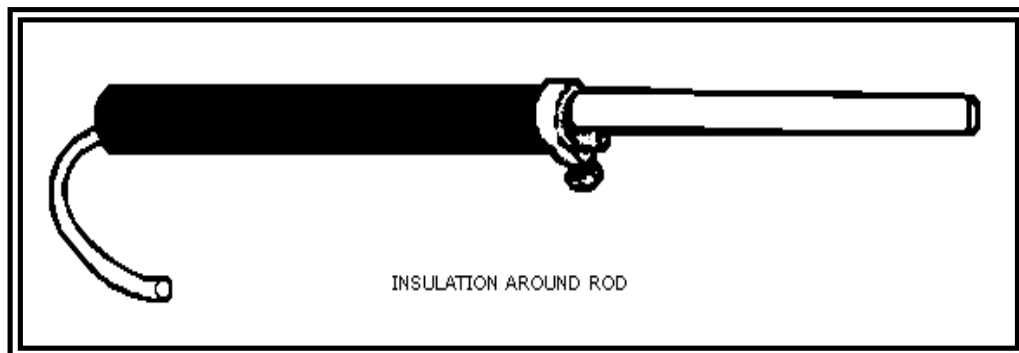


Figure 2-4. Insulation Around Rod

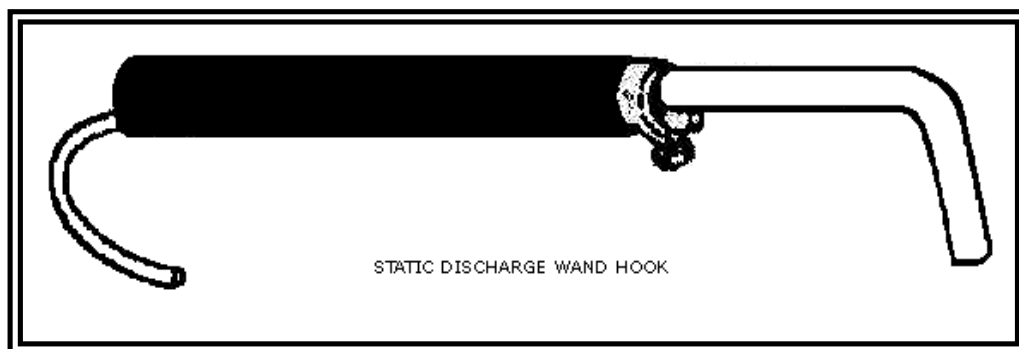


Figure 2-5. Static-Discharge Wand Hook

CAUTION

Keep hands away from the bare metal portion of the static-discharge wand when contacting the cargo hook to discharge the static electricity. Severe electrical shock can result from improper static-discharge wand operation.

- Step 6. Sharpen a point on one end of the 16-inch section of rod to make it easier to drive the grounding rod into the ground.
- Step 7. Attach an electrical clip to the other end of the 20-foot cable. Connect the clip to the grounding rod made in step 6 (Figure 2-6.).
- Step 8. Perform an electrical continuity check between the hook end of the static-discharge wand and the electrical clip on the grounding rod. Isolate and repair or replace the affected part. Lack of electrical continuity can be a safety hazard to the hookup team.

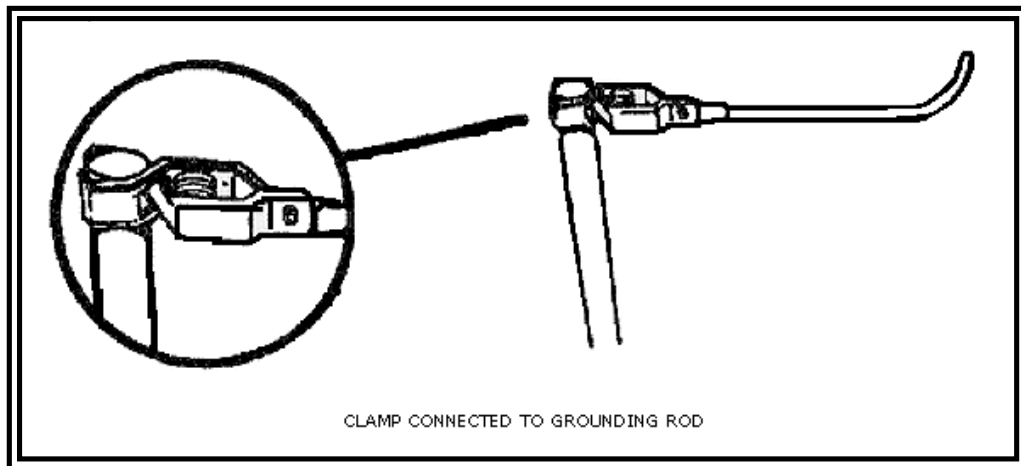


Figure 2-6. Clamp Connected to Grounding Rod

GROUNDING TO AIRCRAFT TECHNIQUE

2-74. Ground the helicopter cargo hook by touching the wand to the cargo hook (Figure 2-7.). Maintain continuous grounding contact. Wear 5000-volt shockproof gloves, if available, when using the static-discharge wand. These gloves are not repairable. They will not protect against static electricity if damaged.

2-75. Even though the helicopter has been grounded and because the grounding contact could somehow be broken, the ground crew should not touch the cargo hook. Never grasp the NO HOLD area of the wand during grounding.

2-76. Since the helicopter can recharge in less than 1 second, the wand operator must maintain continuous grounding contact. Connection of the cargo sling to the helicopter cargo hook alone does not provide good grounding.

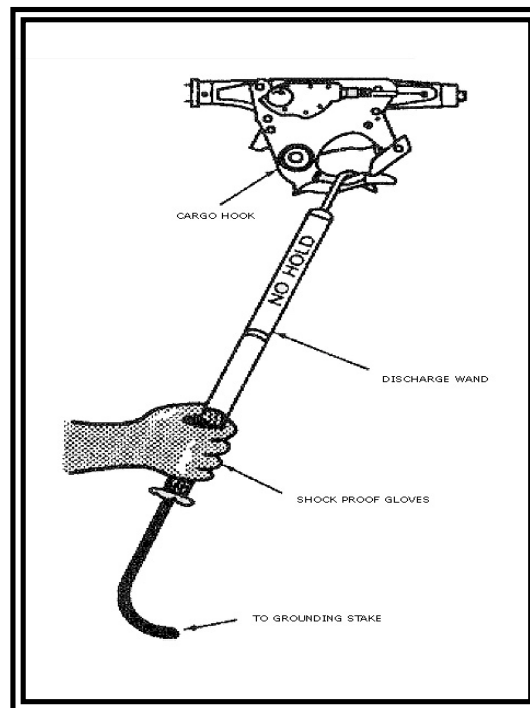


Figure 2-7. Proper Grounding Technique

WARNING

Contact between the discharge wand and the cargo hook must be maintained until the clevis is placed on the hook. If contact between the wand and the hook is not maintained, the ground crew member may receive a serious shock. This does not mean the ground crew should rig a spring clip to hook directly to the aircraft. If contact between the wand and the hook is broken, then contact must again be made before touching the hook. If static shock causes unconsciousness, determine if the victim has a pulse and/or is breathing. If not, immediately begin CPR and/or mouth-to-mouth resuscitation.

WAND MAINTENANCE

2-77. The grounding wand, cable, and clamp are not repairable. If the wand or the first 10 feet of cable (closest to the wand handle) is punctured or cracked, discard the wand. If either of the black plugs on the ends of the wand come out (they are allowed to rotate), discard the wand. Never attach metallic fittings to the wand or cable. To preserve the electrical capability of the wand and cables, remove fuel, grease, or oil from the wand with mineral

spirits; wipe dry. Remove saltwater residue or dirt with fresh water; wipe dry. Store wand in a dry place and out of direct sunlight. Store the cable and wand as shown in Figure 2-8. Turn the wand upside down and coil the cable lariat-style into several 12-inch diameter loops.

2-78. With the last remaining loop, interlace the cable around the loops several times and attach the clamp to the end plug. Hang wand upright by the wand hook.

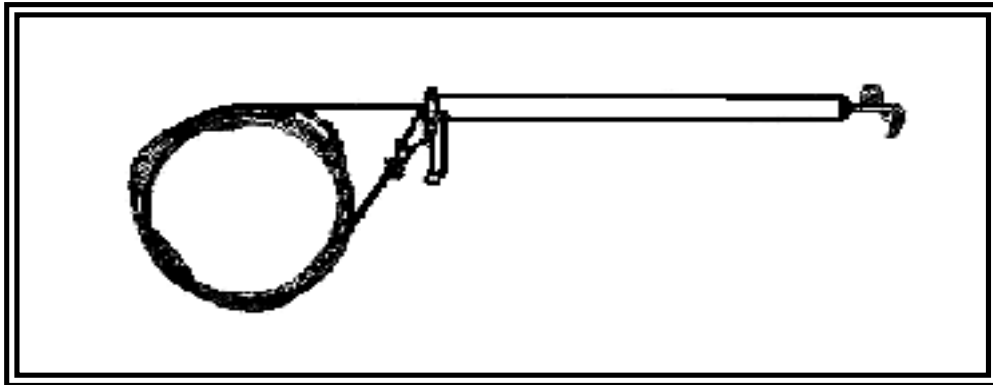


Figure 2-8. Cable and Wand Stowage Method

WARNING

Contaminants on the wand may be conductive. They may allow an electrical discharge to travel the outside surface of the wand and reach the operator.

WAND USE

2-79. The following steps tell how to use the static-discharge wand:

- Step 1. Inspect the static-discharge wand and the grounding rod to ensure they are serviceable.
- Step 2. Select the location for the grounding rod, and drive the rod into the ground. The amount of protection from static electricity depends on the depth of the grounding rod. For optimum protection, drive the rod into the ground to the 24-inch weld bead. In sandy or loose soil, drive the rod to within 1 inch of the cross handle. In hard or frozen soil, drive the rod to a practicable depth. The grounding rod should be on the side of the load away from the rendezvous point. Drive it into the ground at a 45-degree angle away from the load. At this angle the rod will cause less injury should a soldier fall on it because the rod will bend under the soldier's weight.
- Step 3. Place the static-discharge ground wire clamp around the vertical shaft (primary) of the grounding rod or the horizontal hand grips (alternate) (Figure 2-9).

- Step 4. Position soldiers on the disabled aircraft so that the static-discharge man with the static-discharge wand is farthest away from the rendezvous area; the static-discharge man is the last one to leave the load after the hookup is completed.
- Step 5. The static-discharge man places the static-discharge wand on the cargo hook. This dissipates the static electrical shock that has built up in the aircraft. He maintains contact with the load until the hookup is completed.

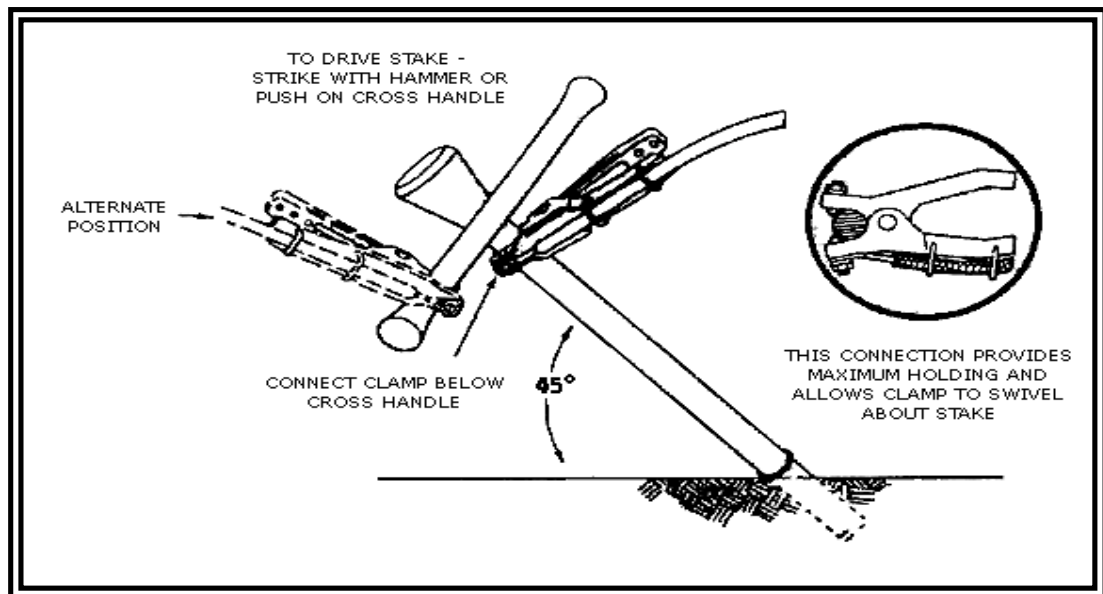


Figure 2-9. Grounding Stake and Clamp Connection

WARNING

Failure to heed the following procedures could result in personal injury or loss of life.

GROUND CREW FUNCTIONS

2-80. Before the recovery operation starts, the ground crew must make sure that the disabled aircraft is correctly prepared and rigged.

WARNING

Welded or unauthorized repairs are not acceptable on items to be airlifted. Only authorized replacement parts are acceptable.

2-81. Break away taping is used to hold lines and sling legs in place before the aircraft arrives in the pickup area. Taping holds the legs. When the aircraft puts pressure on the lifting legs, the tape is pulled off or breaks away from the place where it was taped. Thus, the legs or lines will carry only their allowed weight and will not become tangled or wrapped around any objects.

2-82. The Noncommissioned Officer in Charge identifies a rendezvous point for his ground crew to gather after each lift is completed or during an emergency. A rendezvous point is an easily recognized point on the ground (for example, trees, bunkers, buildings, vehicles, or wooded areas) where the ground crew can gather without being in danger. This point should not be in a large open area where an aircraft can make an emergency landing. It should be located as far away from the emergency landing area as practical.

2-83. In addition, the rendezvous point under emergency procedures, requires coordination with the pilot of the recovery aircraft. This will inform both teams to know which direction (clock position relative to the nose of the aircraft) the other will disperse.

2-84. The area must be policed to prevent a flying object hazard. Any object that the rotor wash can lift could become a missile and cause damage to equipment or injury to personnel.

NOTE: Although signal smoke is often used in the pickup zone to show wind direction and identify the proper landing zone, it can reduce the pilot's vision. Obstructed pilot vision could result in an aircraft crash. Smoke should only be used during the initial approach; it should be well dissipated during the lift operation.

2-85. As the helicopter approaches the pickup site, the ground crew members put on their equipment and—

- The signalman takes a position upwind from the load. This means that the wind should be at or blowing towards his back with the load between him and the helicopter. Figure 2-10 shows the proper distance for the signalman during a hookup using an UH-1 Huey. Distances will be greater for larger helicopters (about 100 feet for the UH-60 and 150 feet for the CH-47).
- The hookup man and static-discharge man go to their positions beside or on top of the load.

NOTE: Any extra personnel, such as equipment operators, are positioned so that they are clear of the hookup area and away from the landing and takeoff zones.

2-86. The signalman gives signal directions to the pilot as soon as the pilot can clearly see him. He must move with the aircraft to stay within the pilot's view. The signals must be precise to prevent any misunderstanding between the signalman and the pilot. (See para entitled "Hand and Arm Signals.")

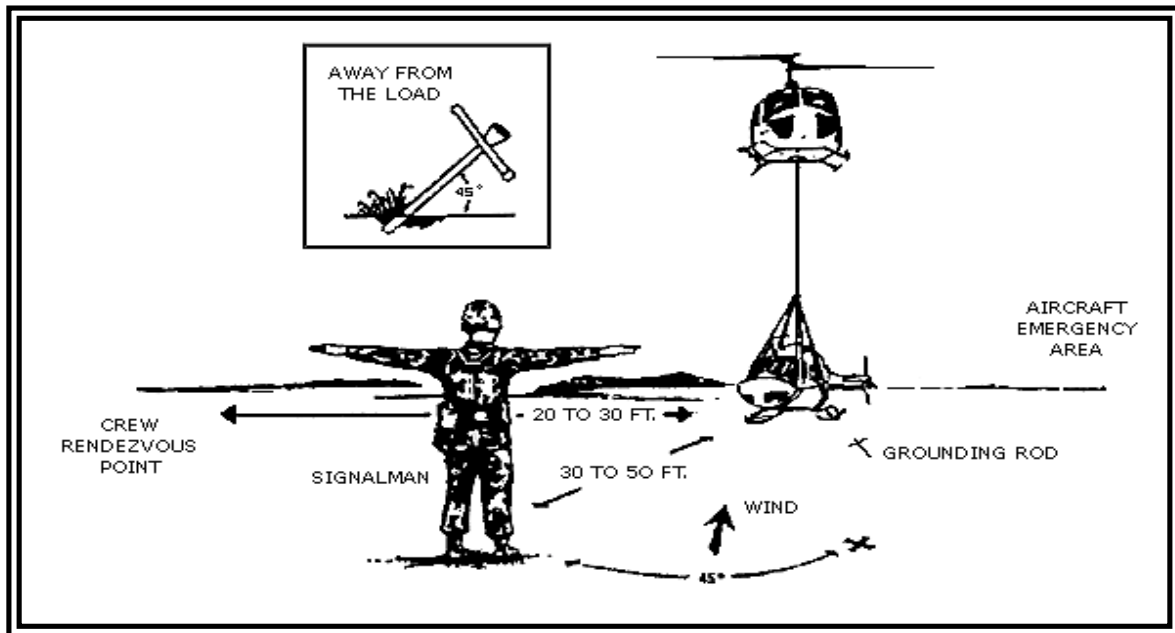


Figure 2-10. During Helicopter Hookup

2-87. While the helicopter is moving, the signalman is responsible for the safety of the hookup crew.

NOTE: During hookup of the downed aircraft, recovery personnel should maintain additional hardware (nuts, bolts, cotter keys, and pins) with them in the event that they drop the primary devices during hookup.

2-88. When the aircraft is correctly positioned, the ground crew starts the hookup. The signalman must keep his eyes on the hookup team and the cargo hook. Any mistakes at this point could cause a hazard to anyone below the aircraft. The pilot cannot see the hookup team during the hookup. The pilot must concentrate on maintaining a steady hover. The hookup team must do its jobs as fast and as safely as possible. The steps for performing a hookup are as follows:

- Step 1. The signalman signals the pilot to maintain a hover once the hook is in position.
- Step 2. The static-discharge man then places the static-discharge wand on the cargo hook. The hookup man places the apex fitting on the cargo hook keeping the sling legs straight.
- Step 3. The hookup man uses hand signals to let the signalman know if there is anything wrong with the hook or the load. After attaching the apex fitting to the cargo hook, the hookup man climbs off the aircraft. The static-discharge man then drops the static-discharge wand to the ground, clear of the aircraft in the vicinity of the grounding rod. The hookup team then departs to the rendezvous point. The signalman

gives the signal that the load is hooked up and slowly gives the pilot the “raise up” signal.

- Step 4. As the aircraft rises, the signalman visually checks the load to make sure the sling legs have not become entangled. Proper clustering and taping techniques prevent the sling legs from being entangled. The hookup team must watch the signalman to see if any problems arise with the sling legs. If the load is correct, the signalman gives the pilot the “thumb up” signal.

WARNING

Coordinate the evacuation route of the ground crew to a rendezvous point with the liaison officer or helicopter crew before the start of the operation. Proper coordination will prevent any mixup. Helicopter emergency procedures depend on terrain, wind direction, and pilot choice. Good prior coordination will prevent the helicopter and the ground crew from moving in the same direction.

- Step 5. If the load is not correct (tangled sling, hook open, damaged slings, and so forth), follow these procedures:
 - Give the pilot the “hookup” signal followed by the “negative” or “thumb down” signal.
 - Direct the aircraft downward until the hookup men can correct the rigging.
 - Once the rigging has been corrected, direct the aircraft up again to check the load before giving the “thumb up” signal.
- Step 6. The signalman then makes a circular motion with his arm extended over his head and points to the direction in which the pilot should depart the pickup zone. When pointing, the signalman steps off in the same direction that he is pointing to make his signal more pronounced to the pilot (Figure 2-11).

EXTENDED SLING SYSTEM OPERATIONS

2-89. Units may conduct aerial recovery operations with the UH-60 Black Hawk and CH-47 Chinook helicopters using the extended sling system. The ground crew consists of the signalman and the hookup man. Since the helicopter lands beside the load, a static-discharge man is not needed.

2-90. The signalman directs the aircraft to land up-slope from the load. The hookup man crawls under the helicopter, attaches the apex fitting to the cargo hook, and boards the aircraft. The signalman and other personnel wait for the aircrew member to signal them to approach and board the aircraft. All personnel must follow the directions from the aircrew. The aircraft crew member gives direction to the pilot to center the aircraft over the load and to prevent entanglement of the sling.

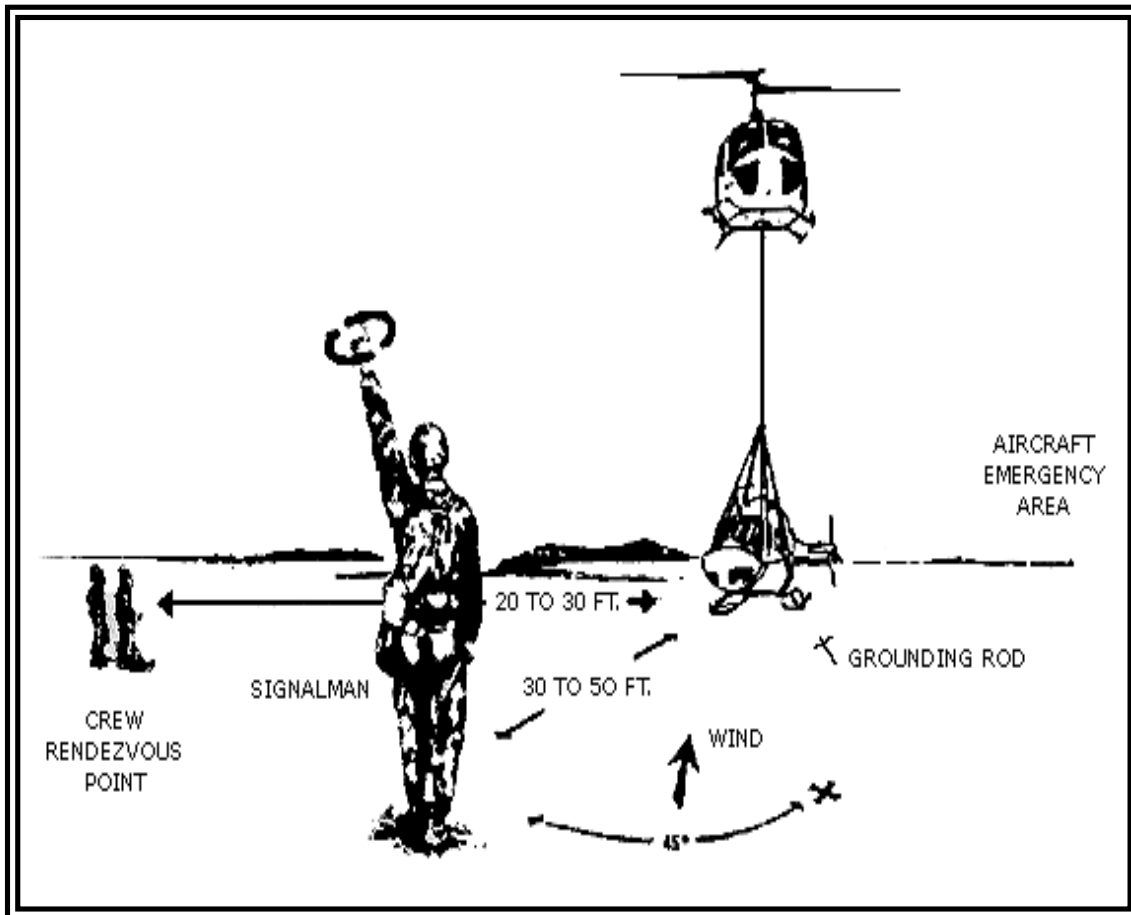


Figure 2-11. Performing Hookup

WARNING

Aircraft must land when using the extended sling system. If the disabled aircraft is on a slope, make sure the area up-slope of the load is clear to allow the helicopter to land beside the aircraft.

2-91. Extended slings may be used in areas that restrict the recovery aircraft's approach to a direct hookup or landing for the purpose of an extended sling hookup. In cases where the downed aircraft is surrounded by obstacles, it may become necessary to lower the extended sling down from the recovery aircraft to the ground crew for hookup.

RADIO SECURITY

2-92. Radio security is an important part of ground crew training. In a hostile area the safety of both the helicopter and ground crew is at stake if the enemy determines your position.

NOTE: Do not use proper names (for example, CPT Ashcom, 34th Cavalry, and so on).

2-93. Remember, the signal operating instructions (SOI) have only one purpose: to save one's life by keeping information from the enemy. Also, keeping radios in the frequency hopping, low-power mode, reduces the probability of detection.

HAZARDS

2-94. Along with other duties, the ground crew should also become safety experts. The hazards found in operating under a hovering helicopter are real. Only trained crews should be used to rig disabled aircraft and connect them to the recovery helicopter. Crew members should be aware of the electrical shock associated with connecting the web ring or the metal clevis to the cargo hook. The static-discharge wand must be used when performing load hookup.

2-95. When operating in snow, dry dust, or light rain, the hookup personnel should also know that the electrical shock might constantly be passed to them by the snowflakes, dry dust or the rain spray. Other hazards to consider and avoid are—

- Chemical hazards due to fragmented composite materials and discharged toxic chemicals may become airborne during hookup operations. Skin, nose, mouth, and eyes should be protected against potential contamination.
- Flying debris (loose items on the pickup zone or landing zone).
- Entanglement in cargo slings.
- Sharp objects protruding from the aircraft.
- Top-heavy and unbalanced loads.
- Being caught between the load and the aircraft. (Always stands or crouches beside or on top of the load so that you can move quickly out of the way of the aircraft.)
- Protruding parts of the aircraft such as struts, wheels, and cargo hooks.
- Swinging cargo hooks and cargo.
- Tripping over the static-discharge wand ground cable.

WARNING

Some particulate matter is highly toxic. The air surrounding a fuel fire, for example, contains particulate matter that, if inhaled, can cause fluid buildup in the lungs to the extent that death can occur.

CAUTIONS

2-96. Observing the following cautions will minimize the chances of the ground crew getting injured during a hookup operation. Read them and practice them. Think of these cautions whenever you are around an aircraft and remind your fellow crew members of them.

- Stay clear of rotor blades and the tail section of the aircraft.
- Use all required safety equipment.
- Use all safety procedures.
- Be conscious of what you are doing; what you are going to do next.
- Always use the static-discharge wand when hooking up loads.
 - Watch for obstacles on the ground that you could trip over.
 - Keep an eye on your fellow crewmembers; their safety is important too.
 - Check and double-check the load.
 - Know your position in relation to the helicopter at all times.
 - Stay clear of moving cargo hooks.
 - Follow the SOI if used.
 - Follow established emergency procedures.
 - Do not smoke, except in designated areas.
 - Know where your rendezvous point is in case of an emergency.
 - Know the rendezvous point of recovery aircraft in case of an emergency.

HAND AND ARM SIGNALS

2-97. The correct hand and arm signals (Appendix B) must be practiced and performed with care. There can be no misunderstanding between the signalman and the pilot.

2-98. The best way to learn these signals is to do them. Practice each signal in front of a mirror or with a friend. Two or more people working together will speed up this part of the ground crew training. In Appendix B, the man on the right is using a lighted wand. This is a standard Army flashlight with a plastic wand attached to the end. Using a flashlight in decreased visibility will help the pilot see the signals.

ACTIONS AT THE LANDING ZONE

2-99. It is just as important to plan the arrival of the downed aircraft at the recovery site as it is for its extraction. Site selection is important depending upon the extent of damage to the downed aircraft. If the main gear is damaged, it may become necessary to place the aircraft in a location that affords the loading of the aircraft on some sort of ground handling equipment for onward movement. Equally important is availability of a ground reception crew to receive the aircraft and prevent further damage to the

downed aircraft. Reception crews require training and a briefing on the operation, which should include oscillation control, aircraft hazards, and procedures in case of an emergency. A brake or chock man should be included on the team if the brakes are not set during extraction and a drogue chute is used. The drogue chute can effect the aircraft once it is on the ground and poses a potential hazard. Plans for aircraft reception should include the control and quick release of the drogue chute once the aircraft is on the ground.

GROUND RECOVERY RESPONSIBILITIES

2-100. Ground crew responsibilities remain basically the same despite the type or model aircraft being ground recovered. The aircraft is assembled or components are removed to accommodate loading the aircraft onto the transport vehicle using procedures outlined in the appropriate aircraft maintenance manual. Aircraft are rigged for lifting onto the recovery vehicle using the equipment and procedures used for aerial recovery. The ground crew will prepare the recovery vehicle load surface for transport of the aircraft. If the lighting gear has been severely damaged or removed from the aircraft, position cushioning material (mattresses, foam rubber matting, etc.) under the aircraft to minimize further damage.

2-101. The ground crew (maintenance personnel) assist in loading the disabled aircraft onto the ground recovery vehicle. They hook up the lifting device to the equipment used to lift the aircraft. They ensure that the lifting device remains properly rigged as the aircraft is raised from the ground. The ground crew minimize oscillation of the aircraft as it is moved into position over the transport vehicle and guide the aircraft into the proper position as it is lowered. They attach guide ropes to hard structures on the aircraft (towing lugs, landing gear, skids, etc.). The ropes control oscillation and positioning of the aircraft without requiring personnel to be under or in direct contact with the aircraft.

POST-RECOVERY INSPECTION AND PACKAGING

2-102. After a recovery mission is completed, the equipment is readied for the next time it will be needed.

CLEANING OF EQUIPMENT

2-103. All recovery equipment should be cleaned and dried before repackaging into the container. Refer to appropriate recovery kit manuals on how to care for and inspect the equipment.

REPACKING OF DROGUE CHUTES

2-104. Refer to appropriate recovery kit manuals on how to repack the drogue chutes.

REMOVAL OF FLASHLIGHT AND RADIO BATTERIES

2-105. Batteries should be removed from the radio and flashlights used in the recovery operation to prevent corrosion damage.

REPLACEMENT OF EQUIPMENT

2-106. Place all components of the aerial recovery kit in their appropriate compartment within the kit container. The kit container should then be locked and stored for a subsequent recovery mission. The tools, flashlight, radio, and so forth, used in the recovery mission should be cleaned and returned to the appropriate location.

ADMINISTRATIVE REQUIREMENTS

2-107. The goal of the US Army Aviation Center (USAAVNC) and the US Army Aviation and Missile Command (AMCOM) is to provide timely and accurate guidance in aircraft recovery of disabled aircraft. Therefore, upon completion of any aerial recovery mission, besides the data requested by Appendix A, respondents are urged to comment in detail on shortcomings or the failure of any components of the current kit. Send the survey to the Commander, US Army Aviation Center, ATTN: ATZQ-TDS-DB, Fort Rucker, Alabama 36362-5000. The USAAVNC will forward a copy of the report, along with comments, to AMCOM.

Chapter 3

Aerial/Ground Recovery Equipment

This chapter discusses the types of aerial/ground, recovery/evacuation kits and equipment used to conduct downed aircraft recovery. It describes the Aerial Recovery Kit (ARK), Interim-Unit Maintenance Aerial Recovery Kit (I-UMARK), Unit Maintenance Aerial Recovery Kit (UMARK), and Helicopter Recovery Kit (HERK). It defines their purpose, use, technical characteristics, and limitations. It includes before-use preparations and after-use inspections and packaging. For additional information, refer to each recovery kit manual.

AERIAL RECOVERY KIT

PURPOSE AND USE

3-1. The ARK (NSN 1670-00-264-8941, PN 1670EG109A) contains the equipment required to prepare, rig, and recover selected aircraft. The three prime-mover helicopters are the UH-1 Huey, UH-60 Black Hawk, and CH-47 Chinook.

TECHNICAL CHARACTERISTICS

3-2. The kit components are packed in a bisection, watertight aluminum container. The container is about 28.0 x 30.25 x 76.5 inches (Fig. 3-1). For external transport, six lift grips, three on each side of the container assembly, are provided for use as tie-down or suspension points. For internal transport, skid-type feet are provided to help in positioning the container either inside an aircraft or on the ground.

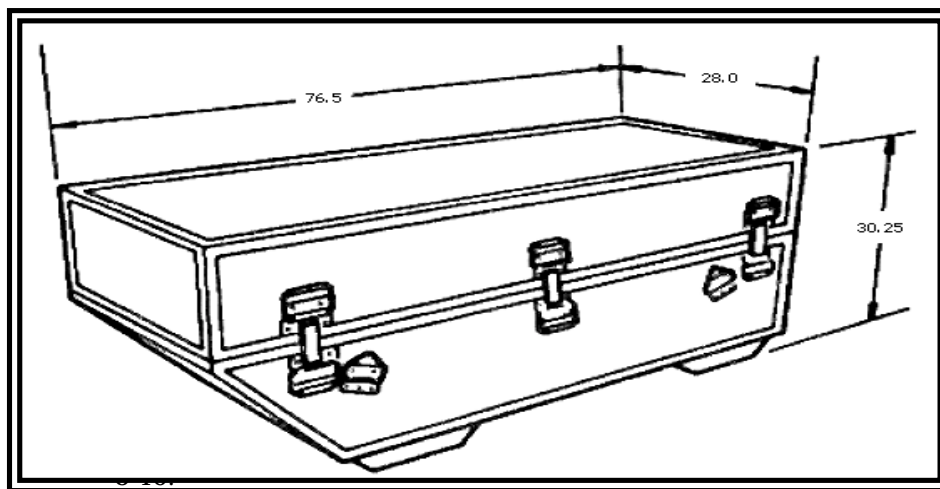


Figure 3-1. Aerial Recovery Kit Container (Part No. 1760EG120)

3-3. The container has separable top and bottom sections. Each section has compartments to house the kit components so that they are easily accessible and identifiable. Component part numbers are stenciled inside the container compartments for easy recognition and selection of components as required. Figure 3-2 shows component locations in each of these sections.

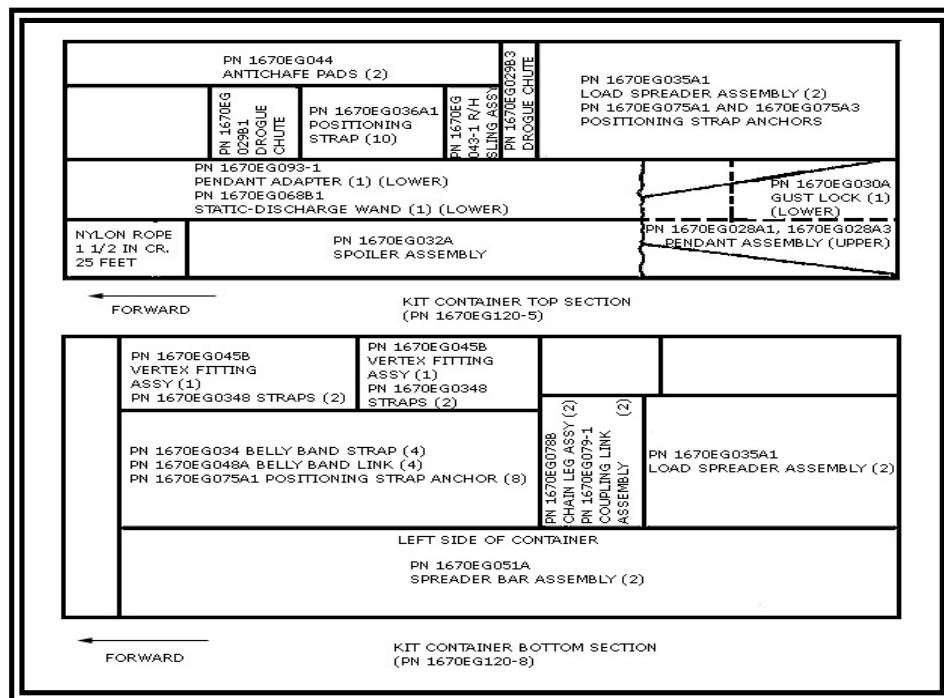


Figure 3-2. Stowage Diagram

NOTE. TM 55-1670-251-20&P has more information on the ARK.

TRANSPORTABILITY

3-4. The ARK is air transportable either as an internal or external load.

Internal Load

3-5. A UH-1H, UH-60, or CH-47 helicopter normally carries the kit. The aircraft also carries the recovery crew. Six people are required to lift the kit (as a complete unit) into the helicopter. Standard tie-down procedures are used to attach the tie-down straps to the kit handles and to lift the kit as required. Off-loading the kit at the recovery site also requires six people if the entire kit is to be used.

External Load

3-6. If desired, the ARK also may be transported in a 5,000-pound-capacity cargo net, NSN 1670-01-058-3811.

NOTE: If a cargo net is not available, several of the kit components can be used to sling the kit container (Fig. 3-3).

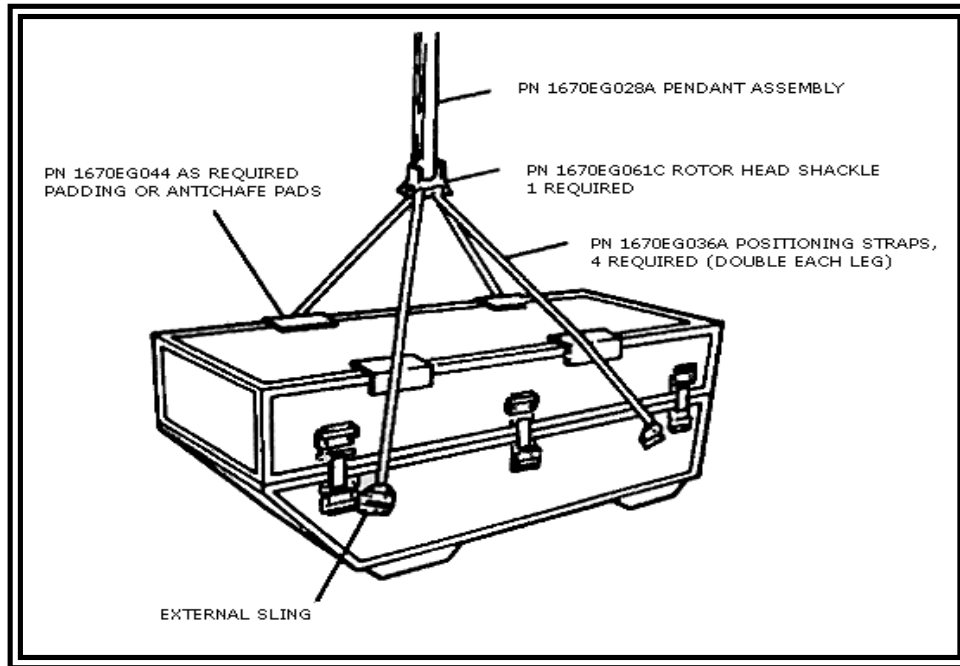


Figure 3-3. Improved External Rigging of the Kit Container

3-7. Before rigging, the connecting latches between the container halves should be checked to verify that they are attached and secure.

3-8. The kit assembly may be transported as an external sling load. If so, a small recovery crew may be assigned, as only two people are required to prepare the kit for transport. However, before reducing the number of personnel, factors such as the type of aircraft to be recovered, the type of terrain, and the extent of damage to the disabled aircraft must be considered.

LIFT LIMITATIONS OF CRITICAL COMPONENTS

3-9. When the rigging configuration is like that discussed in this manual, the critical components of the aerial recovery kit can sustain loads of 21,600 pounds. When the configuration is significantly different, capability expectations should be reduced by 10 percent (down to 19,440 pounds). This reduction allows for additional aerodynamic drag.

DESCRIPTION OF MAJOR COMPONENTS

3-10. Major components of the ARK are discussed below.

Antichafe Pad (PN 1670EG044)

3-11. The antichafe pad (Fig. 3-4) is used to maintain the spacing of, and to afford padding to, the bellyband strap assemblies in areas where they would normally contact the fuselage of the slung aircraft. These pads minimize the risk of abrasion to the bellybands and damage to the aircraft being recovered.



Figure 3-4. Antichafe Pad**Kit Container (PN 1670EG120)**

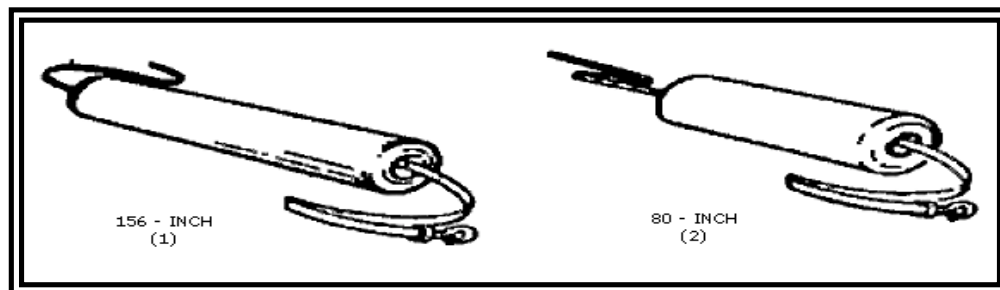
3-12. The container (Fig. 3-1) is required for storage of the kit components. It is designed to be suitable for internal and external aircraft transport and for manual handling. It also protects its contents from adverse environmental conditions.

Coupling Link Assembly (PN 1670EG079-1)

3-13. The coupling link assembly (Fig. 3-5) is used to connect the bellyband assembly to the spreader bar pendant assembly on the rotor head shackle.

**Figure 3-5. Coupling Link Assembly****Drogue Chutes (PNs 1670EG029B1 and 1670EG029B3)**

1-14.3-14. Drogue chutes (Fig. 3-6) are provided to maintain the directional stability of slung aircraft. The smaller chute (60-in diameter) (PN 1670EG029B3) is used on most aircraft; the larger chute (156-in diameter) (PN 1670EG029B1) is required on the larger and inherently unstable type of aircraft. Swivel attachments prevent the chutes from winding up because of rotor downwash.

**Figure 3-6. Drogue Chutes**

Gust Lock Assembly (PN 1670EG030A)

3-15. Gust locks (Fig. 3-7) are used to secure the control surface and to prevent motions of ailerons, rudder, elevator, and so forth.

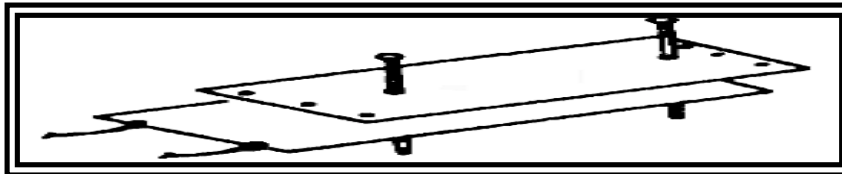


Figure 3-7. Gust Lock Assembly

Load Spreader Assembly (PN 1670EG035A1)

3-16. Load spreaders (Fig. 3-8) are required for those aircraft where structural frame members do not coincide with the required bellyband rigging stations. They reduce the risk of more structural damage to the recovered aircraft by distributing the bellyband loads over a large area.

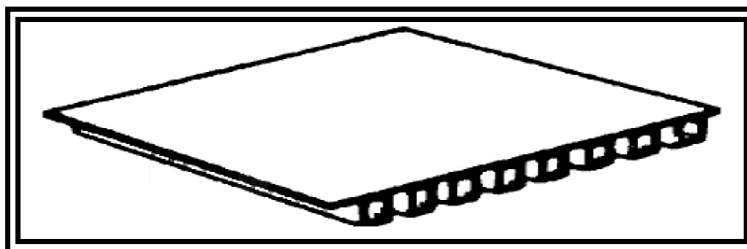


Figure 3-8. Load Spreader Assembly

Reach Pendant, 25,000-lb. Capacity (PN BOS-14-K7)

3-17. A 5-foot-long nylon rope loop is enclosed in a rigid pipe to increase the lift helicopter to load clearance for safe hookup. The pendant adapter (Fig. 3-9) is attached to the pendant assembly and the carrier cargo hook. It allows the ground crew member to engage those cargo hooks, which are rigidly attached to the carrier aircraft (for example, UH-1H and CH-47A).

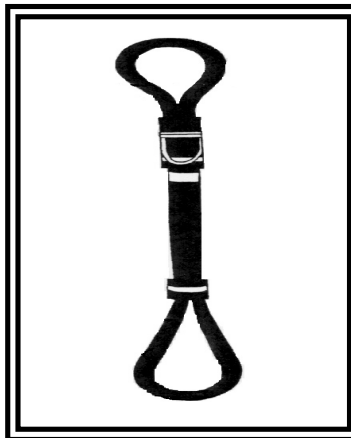


Figure 3-9. Reach Pendant, 25,000-lb. Capacity

Pendant Assemblies (PNs 1670EG028A1 and 1670EG028A3)

3-18. Pendant assemblies (Fig. 3-10) are used primarily to lengthen the distance from the cargo hook of CH-47, UH-60, and UH-1 prime movers to the slung load.

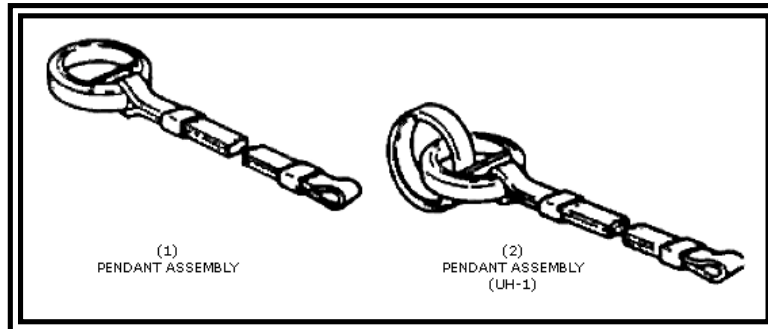


Figure 3-10. Pendant Assemblies

Positioning Strap (PN 1670EG036A1)

3-19. The positioning strap (Fig. 3-11) is used to prevent slipping of the bellybands (fore, aft, and laterally) from their required rigging locations on an aircraft fuselage.

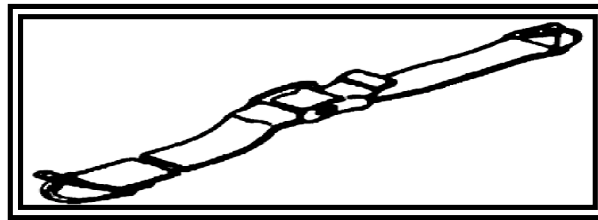


Figure 3-11. Positioning Strap

Static-Discharge Wand (PN 1670EG068B1)

3-20. The static-discharge wand (Fig. 3-12) is used to bleed and ground the static charge from the hovering recovery prime-mover helicopter. This allows safe handling of the cargo hook during hookup of the sling assembly.

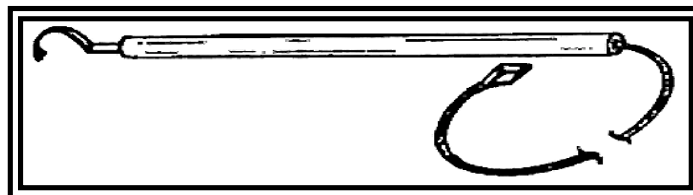


Figure 3-12. Static-Discharge Wand

Bellyband Sling Assembly (PN 1670EG057A1)

3-21. Bellyband assemblies (Fig. 3-13) are used to cradle the downed aircraft. This eliminates the need for hard point attachments for the sling system. Adjustable chain leg assemblies (PN 1670EG078B) are provided for one bellyband assembly to provide a way to change its length relative to the other band assembly so as to achieve appropriate attitude correction of the recovered aircraft.

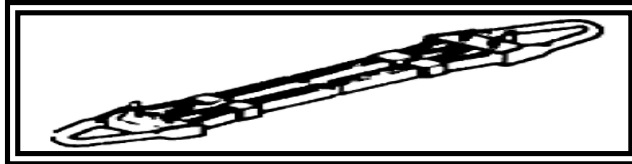


Figure 3-13. Bellyband Sling Assembly

Rotor Head Sling Assembly (PN 1670EG043-1)

3-22. The rotor head sling (Fig. 3-14) is used with the pendant assembly to facilitate rotor head slinging of light helicopters: an alternate method to bellyband rigging.

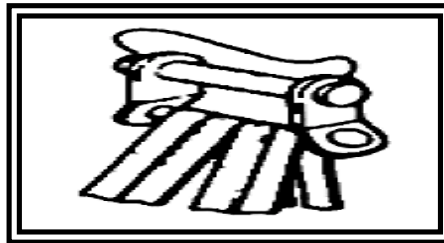


Figure 3-14. Rotor Head Sling Arrangement

Spoiler Assembly (PN 1670EG032A)

3-23. Spoilers are required to destroy undesirable lifting tendencies of the suspended fixed-wing aircraft during forward flight (Fig. 3-15). Spoilers serve an important function in preventing the slung aircraft from “flying” into the recovery helicopter.

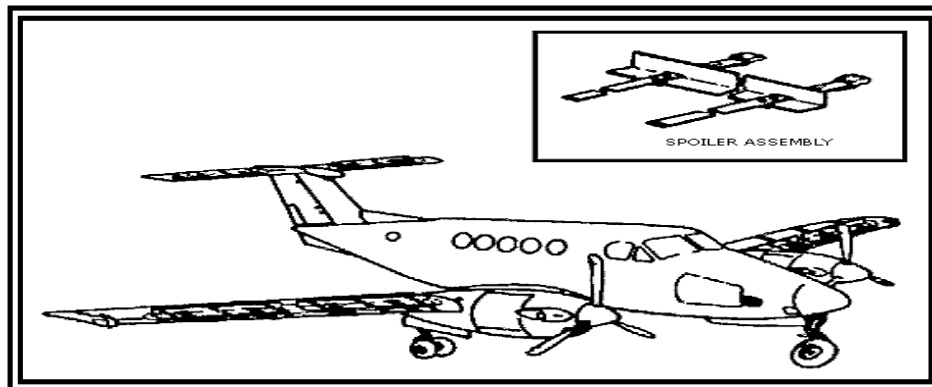


Figure 3-15. Spoilers Installed on Damaged Fixed-Wing Aircraft

Spreader Bar Arrangement (PN 1670EG060B1)

3-24. The spreader bar (Fig. 3-16) is used with the pendant and sling assemblies. It has two functions depending upon its orientation to the recoverable aircraft. On larger aircraft such as the CH-47, the spreader bar arrangement is positioned across the fuselage. This reduces the crushing effect of the bellybands on the fuselage by maintaining a fixed distance. This distance is equal to about the width of the fuselage, between the two connecting ends of the bellyband assembly. For smaller aircraft, particularly fixed-wing, the spreader bar is aligned with the centerline of the fuselage. This orientation allows for relocation of the vertex fitting on the spreader bar arrangement to correct for attitude changes of the recovered aircraft. Also, the relative angle between the fore and aft bellybands is reduced.

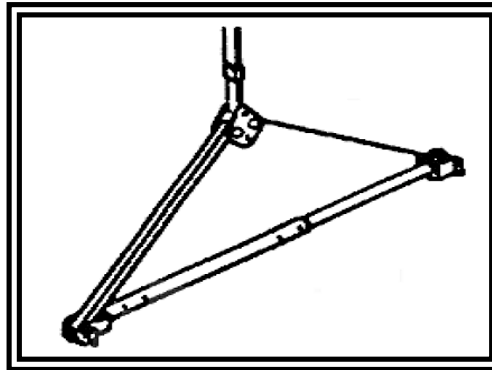


Figure 3-16. Spreader Bar Arrangement

Positioning Strap Anchors (PNs 1670EG075A1 and 1670EG075A3)

3-25. Positioning strap anchors (Fig. 3-17) provide a way to change the webbing from two strap assemblies of three bands each to three equivalent assemblies of two bands each. The antichafe pad, to prevent abrasion of the webbing and to afford a more uniform loading between the bellyband and the airframe, then covers the three strap legs.

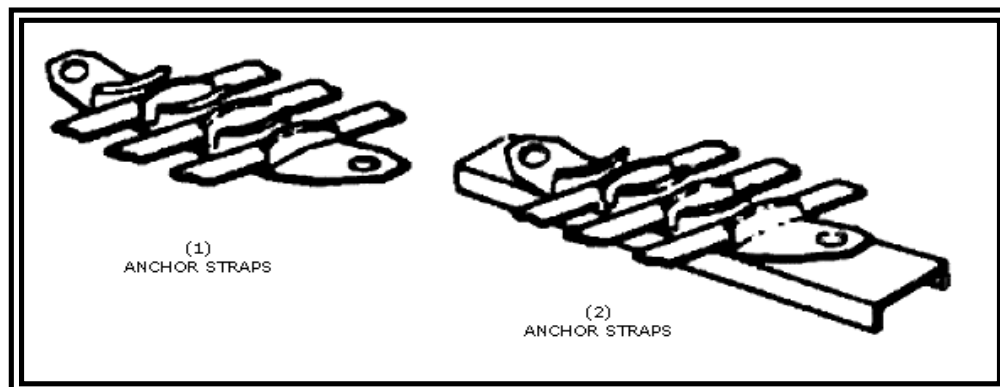


Figure 3-17. Positioning Strap Anchors

BEFORE-USE PREPARATIONS

3-26. Normally, not all of the suspension components and equipment in the ARK are required to recover a particular aircraft. The kit components and equipment not required for a given recovery mission could be removed from the kit and left at the storage site. However, these components must be replaced in the kit after completion of the mission.

AFTER-USE INSPECTIONS AND PACKING

3-27. All recovery equipment should be dried, cleaned, and inspected before repackaging it in the container. Refer to TM 55-1670-251-20&P.

INTERIM-UNIT MAINTENANCE AERIAL RECOVERY KIT

WARNING

The I-UMARK is primarily intended to recover an aircraft that has made a forced landing, is upright, and has no obvious damage to the rotor head, transmission, transmission mounts, or serious structural damage to the tail boom assembly. If damage of this nature has occurred, the aircraft will have to be recovered with ARK (PN1670EG120 and NSN 1670-00-264-8941).

WARNING

Recovery of the aircraft according to the instructions in this document may cause damage to the main rotor blades and rotor head of the recovered aircraft. Post-recovery inspection criteria have not yet been developed. Therefore, the inspection criteria for blade strike and hard landing cited in the applicable aviation unit intermediate aircraft maintenance Instructions for those aircraft should be used to ascertain further airworthiness. If any doubt exists, the rotor components should be replaced.

NOTE: Components should be used only according to the procedures contained herein. The recommended recovery airspeeds and maneuvers should not be exceeded.

PURPOSE AND USE

3-28. The I-UMARK, PN 81996-20090123, contains the equipment required to pre-rig, rig, and recover selected US Army helicopters.

TECHNICAL CHARACTERISTICS

3-29. The kit components are packed in a watertight, aluminum air mobile shipping and storage container. The container has the inside dimensions of

45 x 40 x 20 inches. For man transportability, six large-bail lifting handles around the sides of the container assembly are provided. These can also be used as tie-down points for internal helicopter transport.

NOTE: Ground crew equipment, such as shockproof gloves, goggles, earplugs, static discharge wand, radios, etc., are not provided as a part of the I-UMARK hardware. Wrenches for assembling I-UMARK components are included in the kit.

3-30. The container has separable top and bottom sections. The long lift sling is wrapped in the largest loop possible around the inside of the container. The OH-58D spreader bar assembly is disassembled and placed in the center of the container. The remaining slings and components are placed in the container to best optimize space and hold the components in place. An inventory card with component nomenclature, part number, and NSN (if applicable) is secured inside the lid of each kit. A copy of the operating procedure is included in each kit (Fig. 3-18).

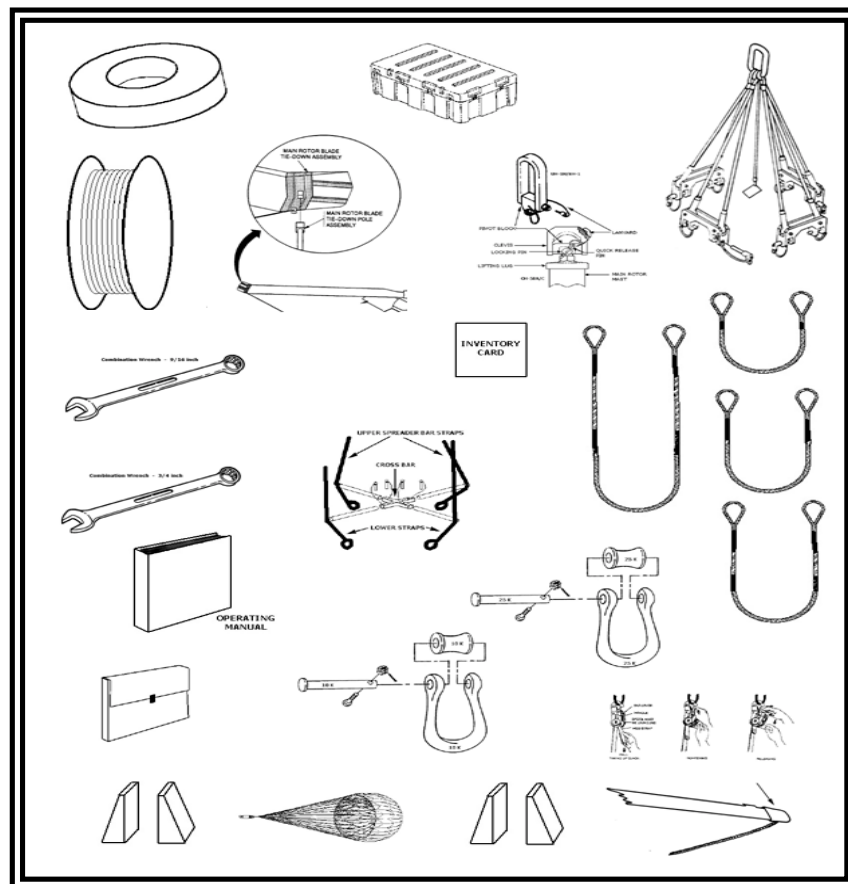


Figure 3-18. I-UMARK Recovery Kit

TRANSPORTABILITY

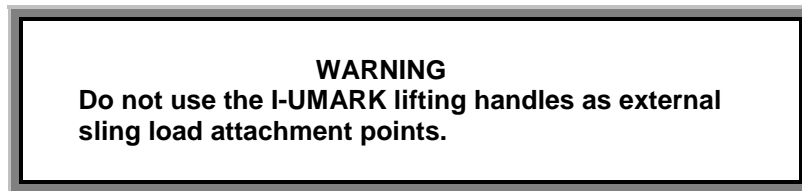
3-31. The I-UMARK is air transportable either as an internal or external load (in a net).

Internal Load

3-32. A UH-1H, UH-60, or CH-47 helicopter normally carries the kit. This helicopter also carries the recovery crew. Six people are required to lift the kit (as a complete unit) into the helicopter. Standard tie-down procedures are used to attach the tie-down straps to the kit handles and to lift the kit as required. Off-loading the kit at the recovery site also requires six people if the entire kit is to be used.

External Load

3-33. If desired, the aerial recovery kit may also be transported in a 5000-pound-capacity cargo net, NSN 1670-01-058-3811.



3-34. Before rigging, the connecting latches between the container halves should be checked to verify that they are attached and secure.

3-35. If the kit assembly is transported as an external sling load, a small recovery crew may be assigned, as only two people are required to prepare the kit for transport. However, before reducing the number of personnel, factors such as the type of aircraft to be recovered, the type of terrain, and the extent of damage to the disabled aircraft must be considered.

LIFT LIMITATIONS OF CRITICAL COMPONENTS

3-36. When the rigging configuration is similar to that discussed in this manual, the critical components of the I-UMARK can sustain loads of 22,000 pounds. When the configuration is significantly different, capability expectations should be reduced by 10 percent (down to 19,800 pounds) to allow for additional aerodynamic drag.

DESCRIPTION OF MAJOR COMPONENTS

3-37. Major components of the I-UMARK are discussed below.

Shipping Container (PN 259300 Mod B)

3-38. The shipping container (Fig. 3-19) is a watertight, aluminum air mobile shipping and storage container. The container has the inside dimensions of 45 x 40 x 20 inches. For man transportability, six large-bail lifting handles around the sides of the container assembly are provided. These can also be used for use as tie-down points for internal helicopter transport. The container has separable top and bottom sections.

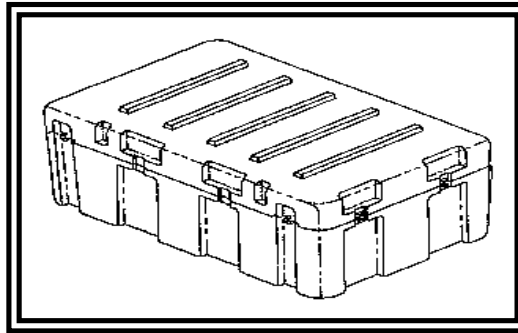


Figure 3-19. Shipping Container

Lift Sling, 100 foot (PN LR7), Lift Sling, 70 foot (PN PRS7E070), Lift Sling, 65 foot (PN PRS7E065), Lift Sling, 30 foot (PN PRS5E030), Lift Sling, 17 foot (PN PRS2E017), Lift Sling, 8 foot (PN PRS2E008)

3-39. Polyester roundslings (Fig. 3-20) are made with a continuous load-bearing core, which is fully enclosed, in a woven protective cover. The endless "round" loop is then formed into an eye and eye configuration. With the I-UMARK an oversized cover is used, which is sewn together, except for the ends, for the eyes. Polyester wear pads are sown into the end loops. A sliding wear pad is added between the eyes. Roundslings were selected for this application because they have no hard eye, like the helicopter sling. They can be snaked through restricted areas of the helicopter main rotor hubs for optimum attachment location. The unwoven load-bearing core conforms to the lifting member. It is protected from cuts or abrasion by the polyester cover and the nylon wear pad. Polyester roundslings have about one-half the stretch of nylon webbing or nylon rope. All the I-UMARK lifting slings are colored orange, as an indicator of the special cover design with a single label to indicate capacity. They may be used in a choked, vertical (pin-to-pin), or basket hitch configurations. Polyester roundslings are used to rig the helicopter for recovery and as long-line pendants to obtain separation between the lift and recovered helicopters.

Aircraft Cargo Tie-down Strap, 5K (PN GBU-1/B)

3-40. A 20-foot, 1 ¾ inch nylon strap has a hook at one end and a hook end ratchet buckle at the other end (Fig. 3-21). This assembly has a 5,000-pound-minimum breaking strength (Department of Transportation (DOT) rating of 1,670 lb.). The strap is used to provide an adjustable length lifting line for tail boom lift and attitude adjustment.

Apex Fitting Assembly, 10K (PN 38850-00004-045)

3-41. The apex assembly (Fig. 3-22) is a 10,000-pound-capacity helicopter external cargo sling. This large clevis is used to connect roundslings to each other, a reach pendant, or to the lift helicopter. The 10K apex is made of aluminum.

Apex Fitting Assembly, 25K (PN 38850-00004-046)

3-42. The apex assembly (Fig. 3-23) is a 25,000-pound-capacity helicopter external cargo sling. This large clevis is used to connect roundslings to each

other, a reach pendant, or to the lift helicopter. The 25K apex is made of alloy steel.

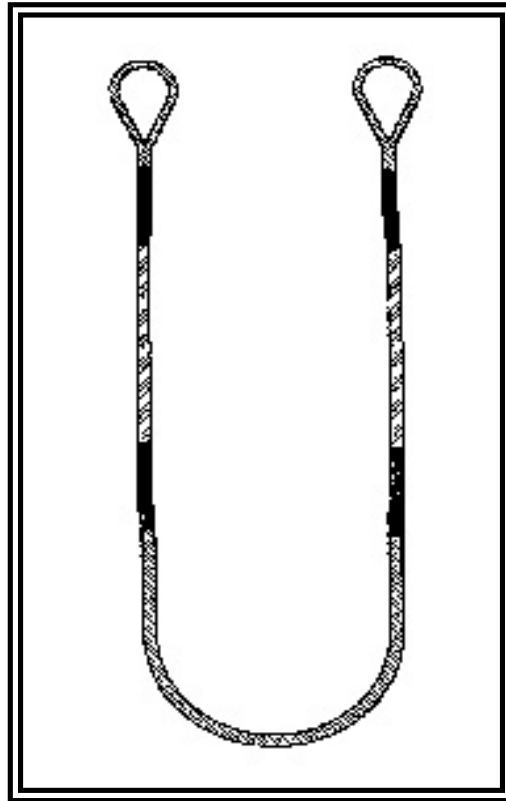


Figure 3-20. Lift Sling, 100 Foot; Lift Sling, 70 Foot; Lift Sling, 65 Foot; Lift Sling, 30 Foot; Lift Sling, 17 Foot; Lift Sling, 8 Foot

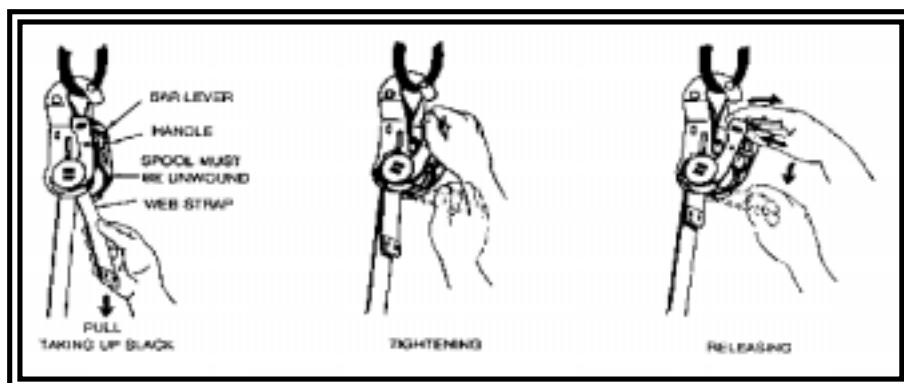


Figure 3-21. Aircraft Cargo Tie-down Strap, 5K

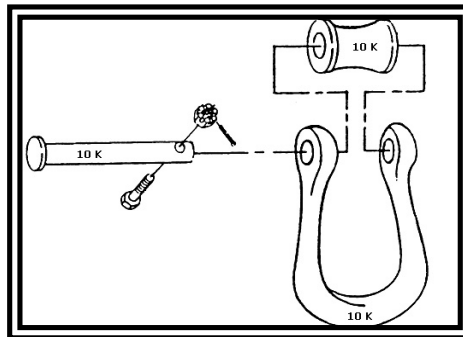


Figure 3-22. Apex Fitting Assembly, 10K

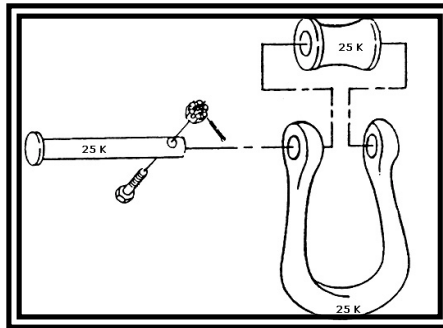


Figure 3-23. Apex Fitting Assembly, 25K

Blade Tie-down Sleeve, UH-60 Lock Assembly, Blade Main Rotor Tie-Down (PN 70700-20369-41), AH-64 (PN 7-262110002-601)

3-43. Nylon strap assemblies (Fig. 3-24) are installed at end of the main rotor blades. Securing lines are attached to these assemblies for tie-down for recovery.

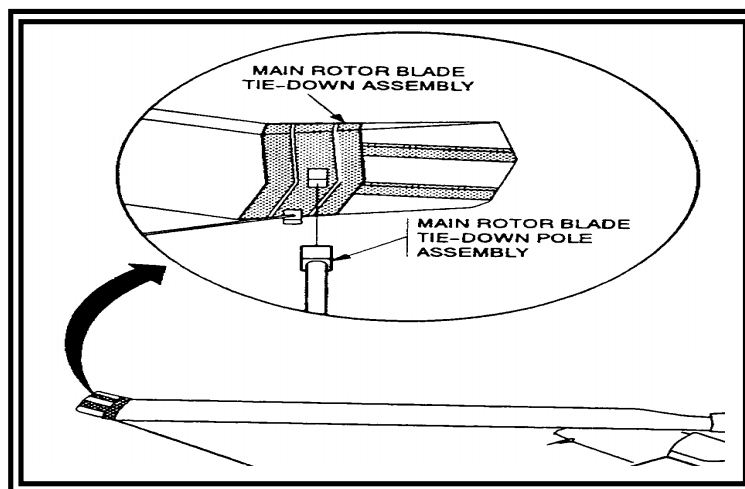


Figure 3-24. Blade Tie-down Sleeve, UH-60/AH-64

Blade Tie-down Sleeve, OH-58D (PN 406-070-300-101)

3-44. Nylon strap assemblies (Fig. 3-25) are installed at end of the main rotor blades. To these assemblies, securing lines are attached for tie-down for recovery.

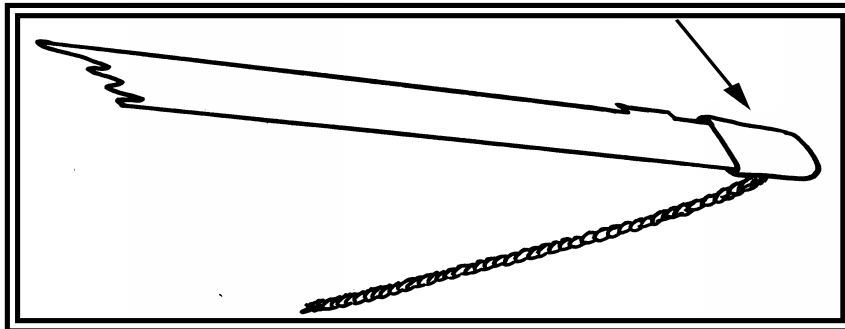


Figure 3-25. Blade Tie-down Sleeve, OH-58D

Air Vehicle Recovery Sling, AH-64 (PN 262110009-601)

3-45. A steel cables sling (Fig. 3-26) attaches to 8 lifting lugs on the AH-64. This sling has been eliminated from more recent I-UMARK when procedures were approved to lift the AH-64 using polyester roundslings choked around the legs of the main rotor hub, similar to the UH-60 rigging.

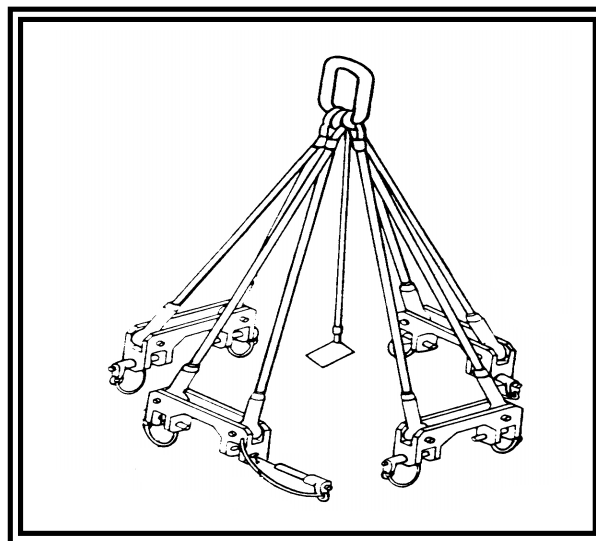


Figure 3-26. Air Vehicle Recovery Sling, AH-64

OH-58D Hoisting Sling Assembly (PN T101284-107)

3-46. This is the standard Bell nylon webbing hoisting sling (Fig. 3-27), except that the cross spreader bar is replaced with a bar especially designed to take the dynamic loads associated with aerial recovery.

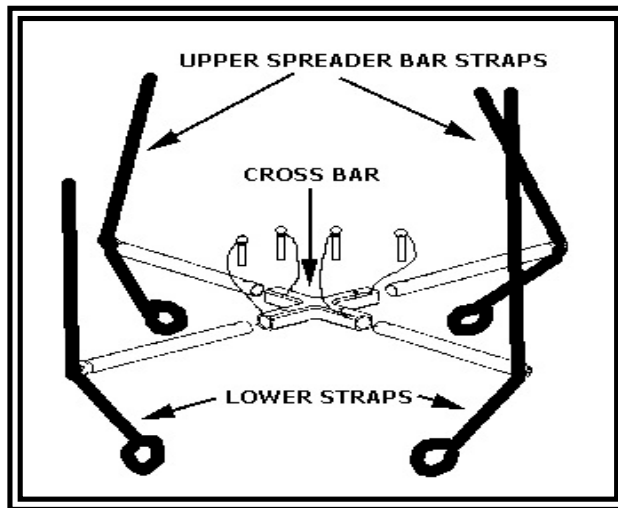


Figure 3-27. OH-58D Hoisting Sling Assembly

Securing Line (PN MIL-R-30500)

3-47. Polyester rope (Fig. 3-28) is used to tie-down main rotor blades.

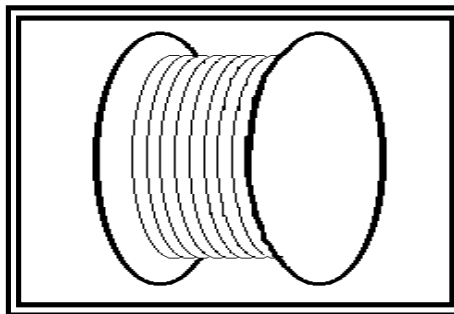


Figure 3-28. Securing Line

Pressure Sensitive Tape, Roll (PN A-A-1586)

3-48. Standard tape (Fig. 3-29) is used to secure lines to prevent snagging before lift-off.

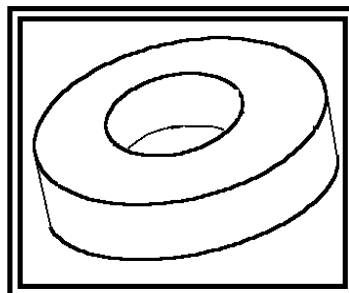


Figure 3-29. Pressure Sensitive Tape, Roll

Drogue Chute (PN 1670EG029B3)

3-49. A specially designed parachute (Fig. 3-30) attaches to the tail wheel of selected helicopters to improve the in-flight stability during recovery. Same as the small drogue chute used in the old ARK.

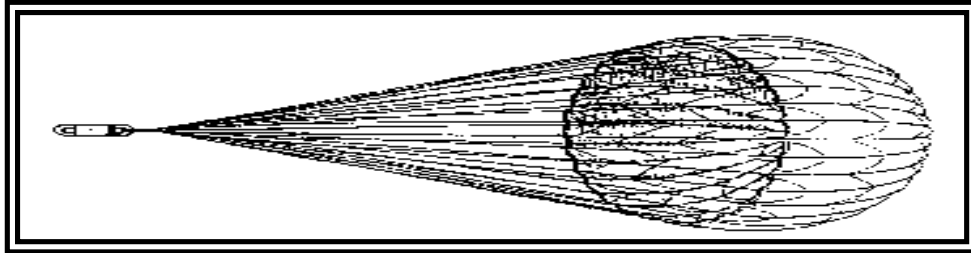


Figure 3-30. Drogue Chute

Lifting Clevis Assembly, UH-1/AH-1/OH-58A/C (PN 204-011-178)

3-50. The primary lift attachment for the AH-1/UH-1 and later OH-58A/C helicopters (Fig. 3-31) is the lifting clevis assembly.

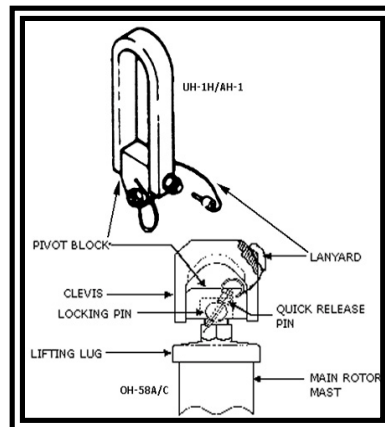


Figure 3-31. Lifting Clevis Assembly, UH-1/AH-1/OH-58A/C

Combination Wrench, 9/16 inch (PN GGG-W-636)

3-51. Standard open-end and box-end wrenches (Fig. 3-32) are used to secure the lift bolts on the UH-1/AH-1 lifting clevis assembly and the safety bolt on the apex fitting assembly.

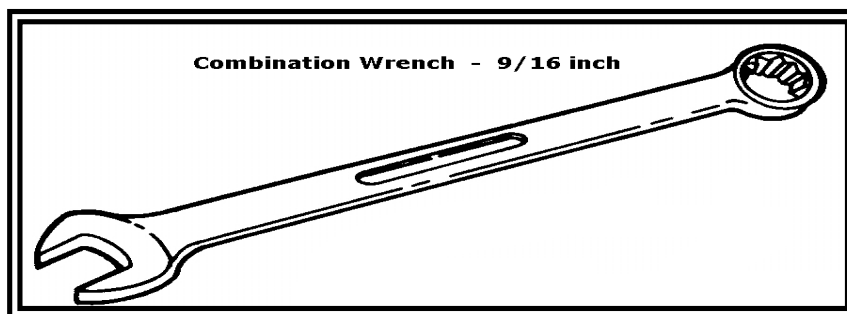


Figure 3-32. Combination Wrench, 9/16 inch

Combination Wrench, 3/4 inch (PN GGG-W-636)

3-52. Standard open-end and box-end wrenches (Fig. 3-33) are used to secure the lift bolts on the UH-1/AH-1 lifting clevis assembly and the safety bolt on the apex fitting assembly.

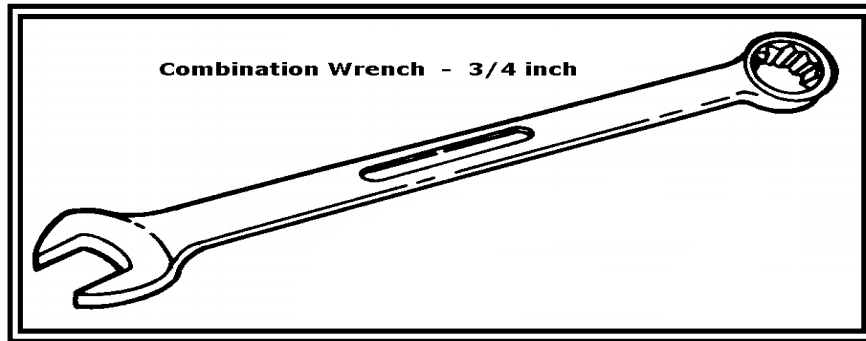


Figure 3-33. Combination Wrench, 3/4 inch

I-UMARK Tool Pouch (NSN 5140-00-329-4306)

3-53. This pouch (Fig. 3-34) holds the above tools.

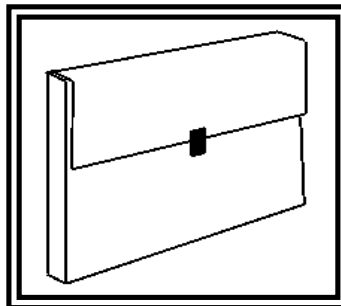


Figure 3-34. I-UMARK Tool Pouch

I-UMARK Inventory Card (PN 1670EG20090IC)

3-54. This inventory card (Fig. 3-35) provides a listing of these components with part numbers and NSNs when available. (No new NSNs were obtained for I-UMARK components. NSNs were obtained for all HERK polyester roundslings and only already stocked items when used to make up the listing of components.)



Figure 3-35. I-UMARK Inventory Card

Wooden Wedge, OH-58A/C (Fabricate - PN 1670EG20090W2)

3-55. A tapered wood block (Fig. 3-36) is inserted next to the rotor mast to prevent mast bumping on Bell rotors during recovery. Fabricate tapered wood block, 5 inches long, 4-1/4 inch thick, 7/8 inches wide at one end and 1/4 inch wide at the other end.

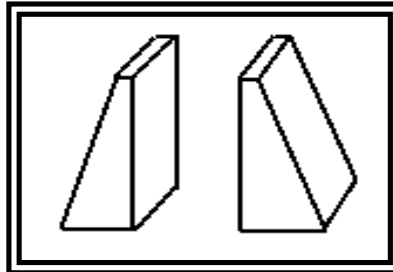


Figure 3-36. Wooden Wedge, OH-58A/C

Wooden Wedge, AH-1 (Fabricate - PN 1670EG20090W1)

3-56. A tapered wood block (Fig. 3-37) is inserted next to rotor mast to prevent mast bumping on Bell rotors during recovery. Fabricate tapered wood block, 5-3/8 inches long, 1-1/2 inches thick, 1-3/4 inches wide on one end to 1 inch wide on the other end.

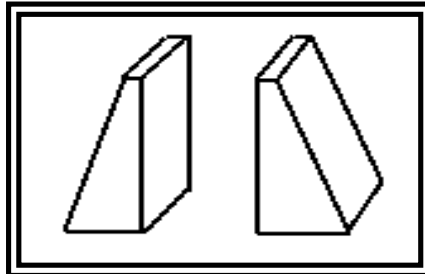


Figure 3-37. Wooden Wedge, AH-1

Manual, Operating

3-57. This technical publication (Fig. 3-38) contains description, technical data, procedures, inspections criteria, and procurement data on the I-UMARK kit and components.

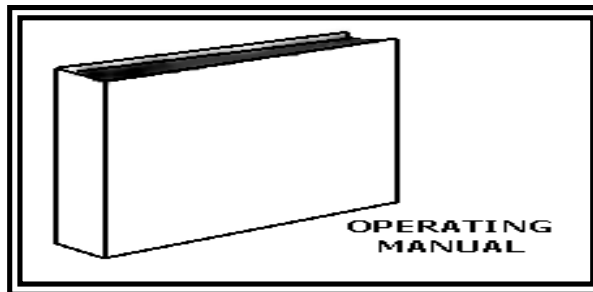


Figure 3-38. Manual, Operating

BEFORE-USE PREPARATIONS

3-58. Normally, not all of the suspension components and equipment in the recovery kit are required to recover a particular aircraft. The kit components and equipment not required for a given recovery mission could be removed from the kit and left at the storage site. However, these components must be replaced in the kit after completion of the mission.

AFTER-USE INSPECTIONS AND PACKING

3-59. After a recovery mission has been completed, the I-UMARK equipment must be returned to a ready for issue (RFI) condition.

3-60. All recovery equipment should be dried, cleaned, and inspected before repackaging it in the container. TM 55-1670-251-20&P, Organizational Maintenance Manual (Including Repair Parts and Special Tools List) for Aerial Recovery Kit, PN 167EG109A (NSN 1670-00-264-8941), describes how to care for and inspect the ARK components contained in the I-UMARK.

3-61. After completion of the cleaning and inspection for damage, all components of the I-UMARK should be replaced in the I-UMARK container in a neat and orderly fashion. Any component damaged must be replaced. The container should then be secured and stored for a subsequent recovery mission.

UNIT MAINTENANCE AERIAL RECOVERY KIT

PURPOSE AND USE

3-62. The unit maintenance aerial recovery kit (UMARK) is a system of slings, tie-downs, stabilizing equipment, and interconnecting hardware that can be assembled in multiple configurations to effect the safe aerial recovery of disabled or damaged helicopters. Helicopter damage may include, but is not limited to:

- The destruction of the main rotor head.
- The main rotor shaft or mast bent, broken, or loose in the transmission.
- The main transmission case cracked, broken, loose, or separated from the airframe.
- Damage to the tail boom to such an extent that it is not suitable as a lifting point.
- Bending or buckling of the airframe so as to create aerodynamic instabilities that could result in additional damage during the recovery flight.
- Engine(s) severely damaged or separated from the airframe.

3-63. UMARK is designed to allow three ground personnel to rig a disabled helicopter for aerial recovery in less than 15 minutes. An exception to this time frame would be the aerial recovery of a CH-47 helicopter, which requires the installation of components from two UMARK kits. The disabled or

damaged helicopters are not required to be stripped of components, defueled, disarmed, or have any additional maintenance actions performed on them before aerial recovery.

3-64. Personnel wearing combat, mission-oriented protective posture-4 (MOPP-4), or cold weather protective gear can install UMARK under all environmental conditions, day or night (using artificial illumination or night vision equipment). It can be transported internally by the UH-1 helicopter or on larger utility/cargo aircraft. It can be transported on the ground by the commercial utility cargo vehicle (CUCV) and larger vehicles.

3-65. Table 3-1 lists the recovery aircraft models, disabled aircraft models, and maximum allowable recovery weights. In general, the UH-60 series helicopters can be used to recover helicopters weighing less than 8,000 pounds (3,636 kilograms). The CH-47 series helicopters can be used to recover helicopters weighing less than 25,000 pounds (11,363 kilograms). These weights will vary with mission distance, weather conditions, and aircraft configuration.

Table 3-1. Recovery/Disabled Aircraft Models and Maximum Allowable Recovery Weights

Disabled Aircraft	Maximum Recovered Wt. Lb (Kg)	Recovery Aircraft		
		CH-47C/D	UH-60	UH-1
AH-64	20,000 (9,090)	X		
AH-64 Longbow	20,000 (9,090)	X		
CH-47	26,000 (11,818)	X		
UH-60	14,000 (6,364)	X		
AH-1 (All Army Models)	8,000 (2,727)	X		
UH-1 (All Army Models)	6,000 (2,727)	X	X	X
OH-58D	5,500 (2,500)	X	X	X
OH-58A/C	3,000 (1,364)	X	X	X

TECHNICAL CHARACTERISTICS

3-66. The UMARK components (Fig. 3-39) are packaged in three watertight, NBC contamination survivable containers. Each container is equipped with recessed latches, hinges, handgrips, and a pressure relief valve. Ribs molded into the top and bottom of each container interlock for stacking. When packed with UMARK equipment, two personnel using the recessed handgrips can carry each container. The handgrips can also be used as tie-down points during transportation.

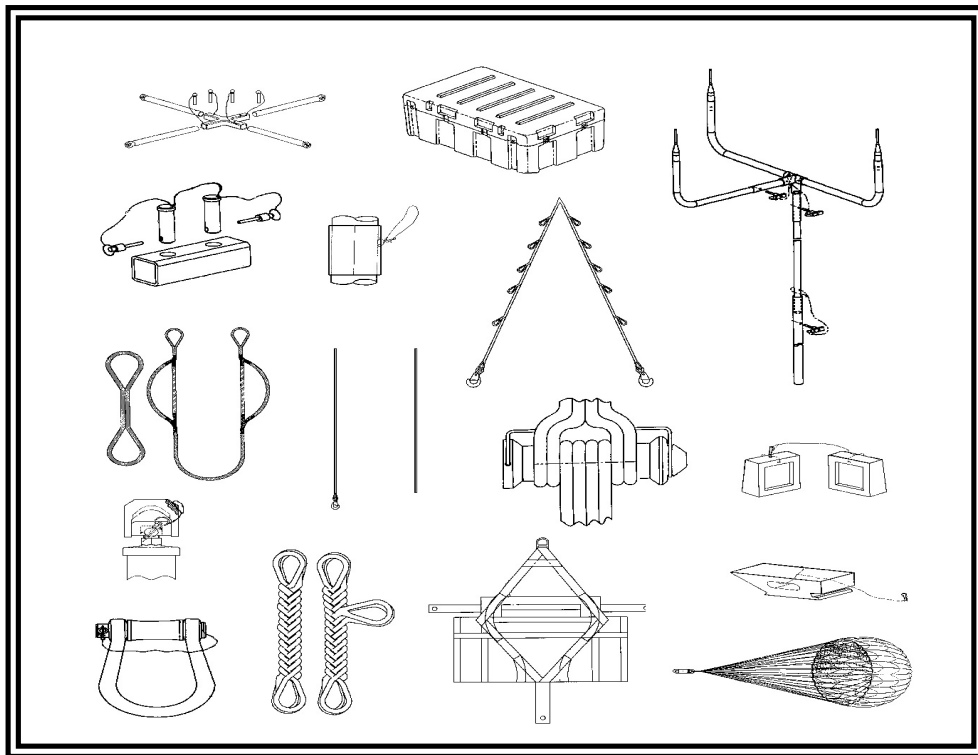


Figure 3-39. UMARK Recovery Kit

3-67. The following components are included in each UMARK:

- Thirteen lightweight slings.
- Three heavyweight slings.
- Three box link assemblies.
- Three sling link assemblies.
- One cross bar assembly.
- One lifting clevis assembly.
- One shackle assembly.
- Four blade sleeve assemblies.
- Four adjustable length tie-down assemblies.
- Five fixed length tie-down assemblies.
- One sight wedge assembly for use on the OH-58D helicopter.
- Two mast wedges (One mast wedge is used on the OH-58D helicopter; the second mast wedge is used on the AH-1 helicopter).
- One square wedges for use on the UH-1 helicopter.
- One blade pole assembly.
- Two CH-47 hook thimbles.
- Three shipping containers.
- One drogue parachute.

TRANSPORTABILITY

3-68. The UMARK is air transportable as either an internal or external load (in a net).

Internal Load

3-69. A UH-1H, UH-60, or CH-47 helicopter normally carries the kit. The helicopter also carries the recovery crew. Two people are required to lift the kit (as a complete unit) into the helicopter. Standard tie-down procedures are used to attach the tie-down straps to the kit handles and to lift the kit as required. Off-loading the kit at the recovery site also requires two people if the entire kit is to be used.

External Load

3-70. If desired, the aerial recovery kit may also be transported in a 5000-pound-capacity cargo net, NSN 1670-01-058-3811.

3-71. Before rigging, the connecting latches between the container halves should be checked to verify that they are attached and secure.

3-72. If the kit assembly is transported as an external sling load, a small recovery crew may be assigned, as only two people are required to prepare the kit for transport. However, before reducing the number of personnel, factors such as the type of aircraft to be recovered, the type of terrain, and the extent of damage to the disabled aircraft must be considered.

LIFT LIMITATIONS OF CRITICAL COMPONENTS

3-73. When the rigging configuration is like that discussed in this manual, the critical components of the UMARK can sustain loads of 22,000 pounds. When the configuration is significantly different, capability expectations should be reduced by 10 percent (down to 19,800 pounds) to allow for additional aerodynamic drag.

DESCRIPTION OF MAJOR COMPONENTS

Lightweight Sling Assembly (PN 94D519-001, -003, -005)

3-74. The lightweight slings (Fig. 3-40) are constructed of synthetic braided materials. Two lightweight sling configurations, in five color-coded lengths, are included in UMARK (Table 3-2). All lightweight slings are small in diameter and equipped with a sling hook eye at each end. The bodies of the green/black slings also are equipped with a 25-inch-long elastic cord. The cord is used to maintain tension on the slings during OH-58D and AH-64 Longbow recovery operations with the cross bar assembly.

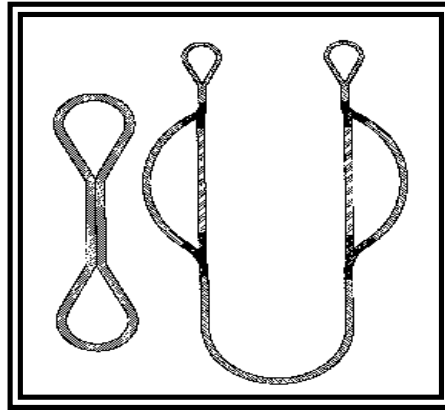


Figure 3-40. Lightweight Sling Assembly

Table 3-2. Identification Chart for Each Lightweight Sling Assembly

Color Code	Length	Quantity
Black/White	10 feet (120 in.)	1
Green/White	12.5 feet (150 in.)	4
Yellow/White	12.75 feet (153 in.)	4
Red/White	17.33 feet (208 in.)	2
Blue/White	30 feet (360 in.)	2

Heavyweight Sling Assembly (PN 94H520-001)

3-75. The heavyweight slings (Fig. 3-41) are constructed of synthetic braided materials. All three heavyweight slings included in UMARK are of large diameter and color-coded with black and white stripes. Each sling is 30 feet (360 in.) in length. The heavyweight slings are all equipped with two large-diameter hook eyes on the top end and one large-diameter hook eye on the bottom end. Besides having the same large-diameter hook eyes, one sling also is equipped with two bridle eyes about 7 feet (84 in.) from the top end.

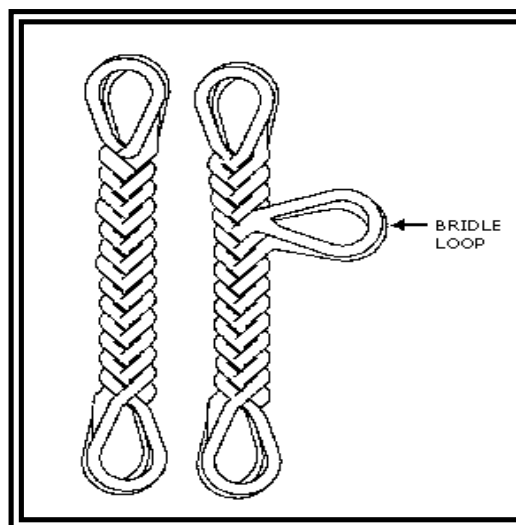


Figure 3-41. Heavyweight Sling Assembly

Box Link Assembly (PN 94C524-001)

3-76. A box link assembly (Fig. 3-42) is used to connect two slings in series configuration. Components of a box link assembly include the box link housing, two box link pins, and two quick release pins. Two holes, corresponding to the diameter of the box link pins, are drilled on the top and bottom of the box link housing. The two box link pins and the two quick release pins are interconnected by wire rope.

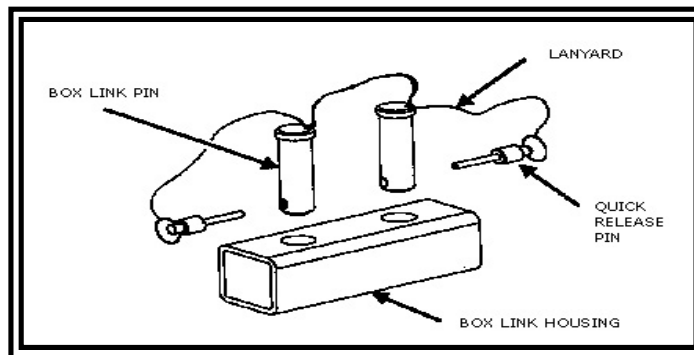


Figure 3-42. Box Link Assembly

Sling Link Assembly (PN 94D523-001)

3-77. A sling link assembly (Fig. 3-43) is used to connect four slings in a series-parallel configuration. Components of the sling link assembly include a sling link pin with attached spring lock.

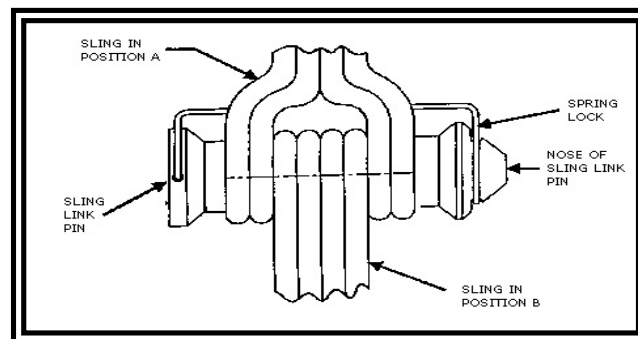


Figure 3-43. Sling Link Assembly

Cross Bar Assembly (PN 94H501-001)

3-78. The cross bar assembly (Fig. 3-44) is used to provide a load path around the AH-64 Longbow radar antenna or the OH-58D mast-mounted sight. The cross bar assembly consists of a cross bar housing, four tube assemblies, and four quick release lock pins.

3-79. The metal cross bar housing is X-shaped with four arms positions 90-degrees apart. Each arm of the cross bar housing has a hole bored through the top and bottom surfaces. The bottom of the cross bar housing is fitted with a foam fitting, which centers the cross bar housing on the radar antenna or sight and protects the antenna or sight during transportation of the

aircraft. The foam also allows for assembly of the cross bar on the antenna or sight.

3-80. Each tube assembly is fitted with a lug fitting on the outboard end. The lug fitting is equipped with a spring lock. A hole is bored through the inboard end of each tube assembly. Quick release pins are used to connect the tube assemblies to the cross bar housing.

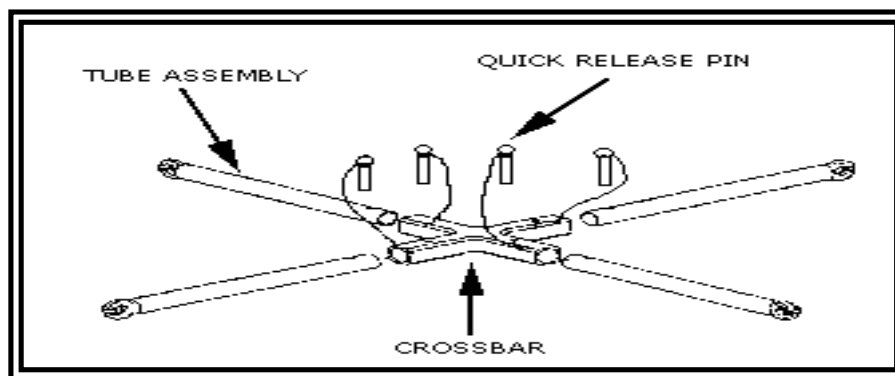


Figure 3-44. Cross Bar Assembly

Lifting Clevis Assembly (PN 94D509-001)

3-81. During AH-1, UH-1, and OH-58A/C helicopter recovery operations, the lifting clevis assembly (Fig. 3-45) replaces slings as the primary attachment devices to the main rotor assembly of the disabled helicopter. Components of the lifting clevis assembly include a clevis subassembly, a locking pin, and a quick release pin.

3-82. The clevis subassembly consists of a clevis, two clevis pins, and a pivot block. The clevis pins are used to attach the clevis to the pivot block. The pivot block acts as a universal joint allowing movement in both fore-and-aft and side-to-side directions. The locking pin is used to attach lifting clevis assembly to the helicopter hub nut lug. The quick release lock pin is used to secure the locking pin into position. Wire ropes are used to attach the locking pin and quick release pin to the clevis subassembly.

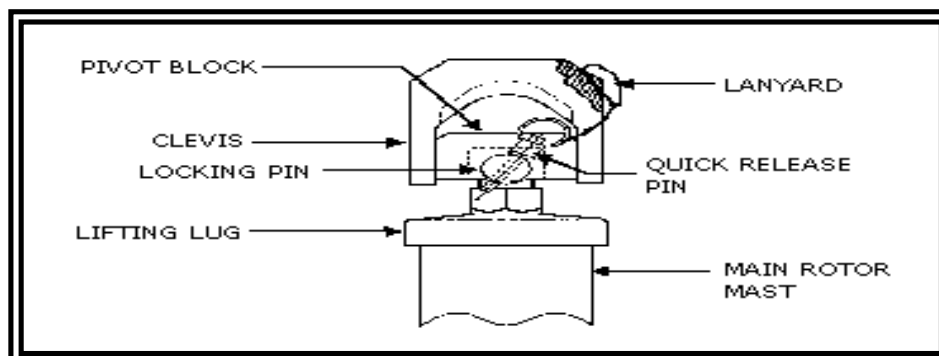


Figure 3-45. Lifting Clevis Assembly

Shackle Assembly (PN 94D514-001)

3-83. The shackle assembly (Fig. 3-46) is used to connect two or three slings in a series-parallel configuration. Components of the shackle assembly include a clevis, a clevis pin, a sling spacer, and a quick release pin. The clevis pin and quick release pin are interconnected by wire rope. The clevis pin and quick release pin are interconnected by wire rope.

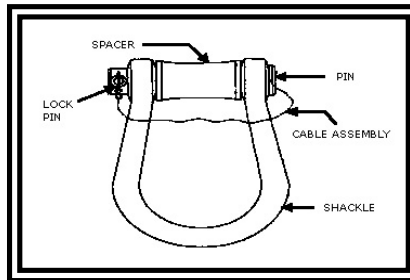


Figure 3-46. Shackle Assembly

Blade Sleeve Assemblies (PN 94J516-001)

3-84. The main rotor blades (Fig. 3-47) of a disabled helicopter may be intact. If so, the blades must be secured to prevent them from flexing during transportation. Excessive upward and downward deflection of the blades due to aerodynamic loading could result in damage to the blades and/or rotor assembly. In addition, downward deflection of the disabled helicopter main rotor blades will limit airspeed of the recovery helicopter. Installation of blade sleeves with tie-down will prevent the upward and downward deflection of the main rotor blades during transportation. The blade sleeve assembly included in the UMARK is designed for multiple aircraft configurations. It is constructed of fabric with attached straps and metal rings.

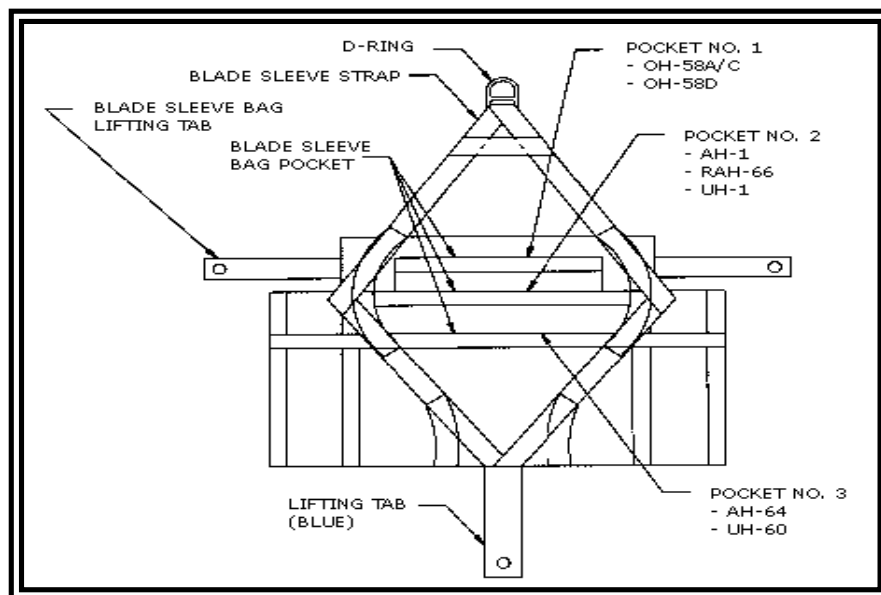


Figure 3-47. Blade Sleeve Assemblies

Blade Pole Assembly (PN 94J531-001)

3-85. The blade pole assembly (Fig. 3-48) included in the UMARK is constructed of 1-inch in diameter aluminum tubing. Matching and aligning the poles with its color-coded stripes and inserting the three attached quick release pins can assemble the blade pole assembly.

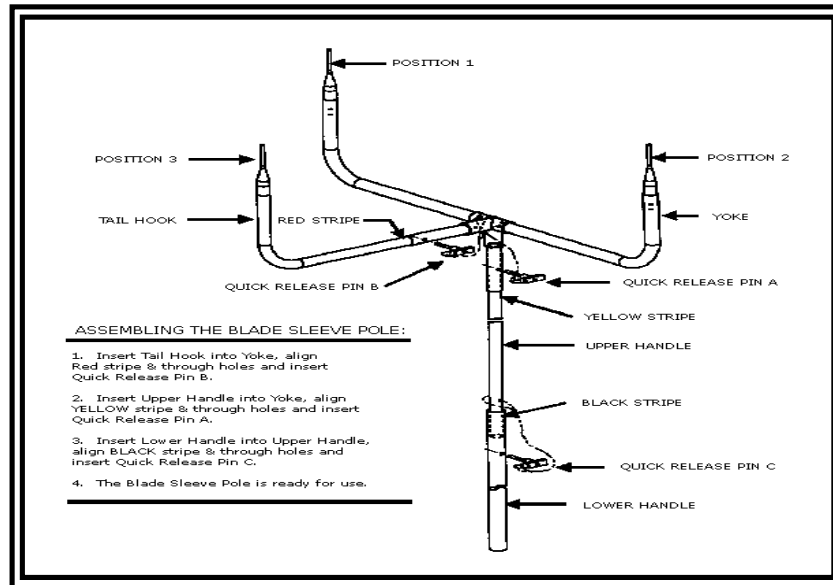


Figure 3-48. Blade Sleeve Pole Assembly

Fixed-Length Tie-down Assemblies (PN 94C522-001, -011)

3-86. The fixed-length, tie-down assemblies (Fig. 3-49) included in UMARK are constructed of synthetic braided material, they are 40 feet (480 in.) in length. Two configurations are provided. Four of the tie-downs have a fused top end and a sling hook eye with attached snap hook at the bottom. A single tie-down has fused ends at both the top and bottom ends.

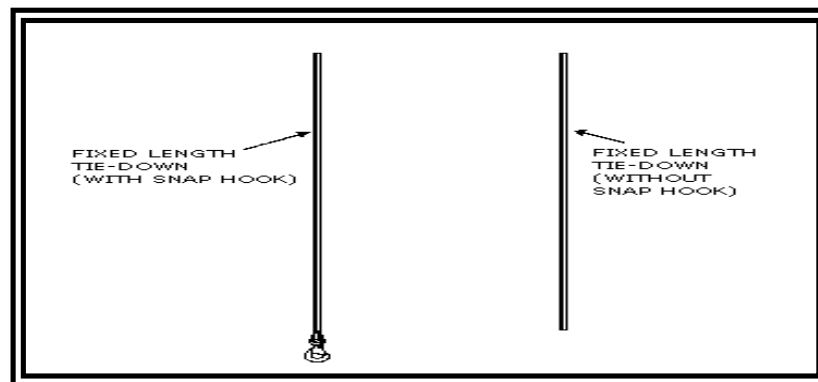


Figure 3-49. Fixed-Length, Tie-down Assemblies

Adjustable Length Tie-down Rope Assemblies (PN 94H521-001)

3-87. The adjustable tie-down assemblies (Fig. 3-50), included in UMARK, are constructed of synthetic braided material; they are 51.66 feet (620 in.) in length. Each tie-down is equipped with a sling hook eye on the top end and a sling hook eye with attached snap hook at the bottom end. Adjustability is obtained by using one of the sling hook eyes positioned slings the body of the tie-down assembly. A 10-foot (120 in.) sling extension is also provided.

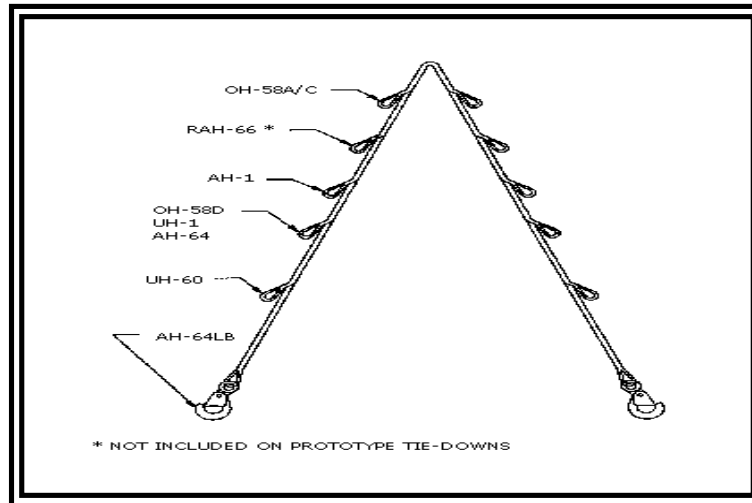


Figure 3-50. Adjustable Length Tie-down Rope Assemblies

OH-58D Sight Wedge Assembly (PN 94D527-001)

3-88. The OH-58D sight wedge (Fig. 3-51) is used to stabilize the mast-mounted sight during transportation of the disabled helicopter and to stabilize the sight during assembly of the cross bar. The sight wedge is constructed of neoprene rubber. It is equipped with a wire rope with an attached spring steel wire snap. The snap is used to secure the sight wedge into position.

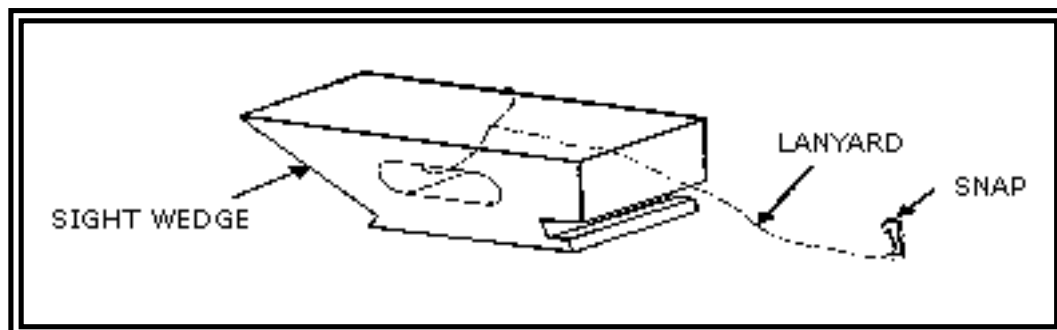


Figure 3-51. OH-58D Sight Wedge

AH-1/OH-58A/C Mast Wedges (PN 94D529-1, 94D530-1)

3-89. The AH-1 and OH-58A/C mast wedges (Fig. 3-52) are circular silicone rubber tubes. They are used to position and secure the disabled helicopter mast during transportation. Two sizes are included in UMARK. The large-diameter mast wedge is used to secure the AH-1 mast; the small-diameter mast wedge is used to secure the OH-58A/C masts. Each mast wedge is equipped with a wire rope on one side and a spring steel snap ring attached with wire rope on the opposite side. This secures the mast wedge to the mast and main rotor and prevents tilting of the main rotor during transportation.

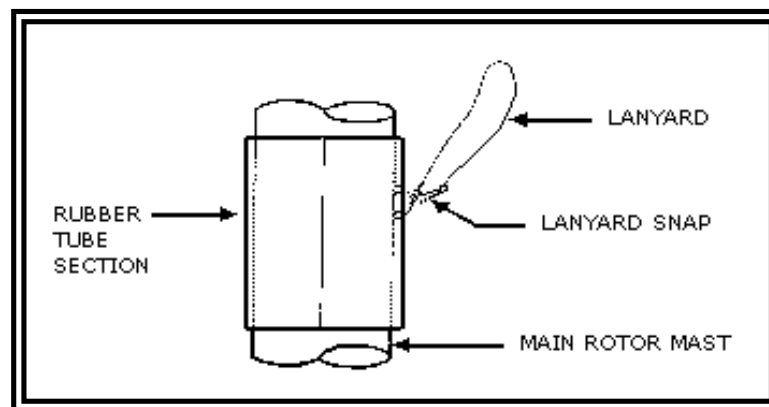


Figure 3-52. AH-1/OH-58A/C Mast Wedges

UH-1 Square Wedge Assembly (PN 94D528-001)

3-90. The UH-1 square wedges (Fig. 3-53) are installed on the main rotor stops to prevent tilting of the main rotor during transportation of the disabled helicopter. The wedges are constructed of synthetic rubber. One wedge is equipped with a wire rope with a spring steel snap ring attached. The second wedge is equipped with a wire rope only. The snap ring and wire rope are used to position and secure the square wedges.

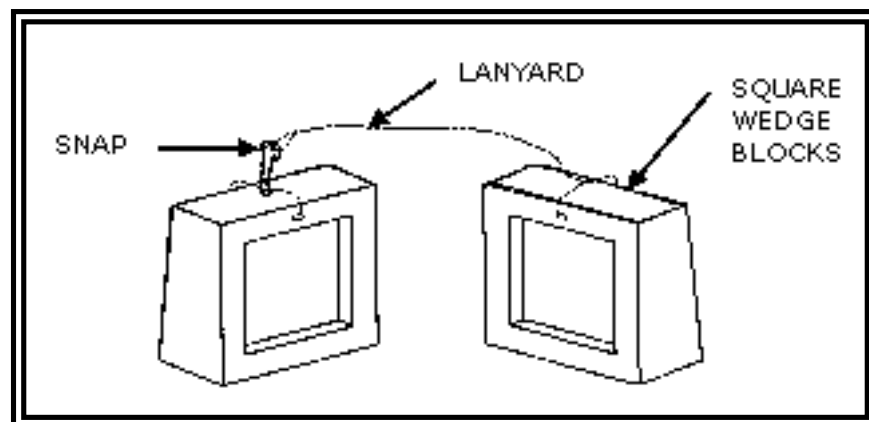


Figure 3-53. UH-1 Square Wedges

Shipping Containers (PN 21-4021-0804)

3-91. The UMARK components (Fig. 3-54) are packaged in three watertight, NBC contamination survivable containers. Each container is equipped with recessed latches, hinges, handgrips, and a pressure relief valve. Ribs molded into the top and bottom of each container interlock for stacking. When packed with UMARK equipment, two personnel using the recessed handgrips can carry each container. The handgrips can also be used as tie-down points during transportation.

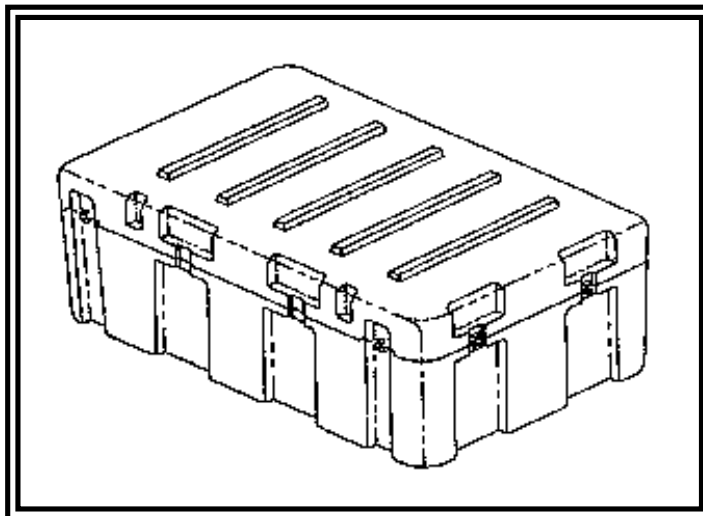


Figure 3-54. Shipping Containers

Drogue Parachute (PN 1670EG029B3)

3-92. A drogue parachute (Fig. 3-55) is included in UMARK. The drogue parachute must be deployed during recovery operations to maintain aerodynamic stability. The drogue parachute also must be deployed when recovering and heavily damaged helicopter when either the vertical or horizontal stabilizer is broken off.

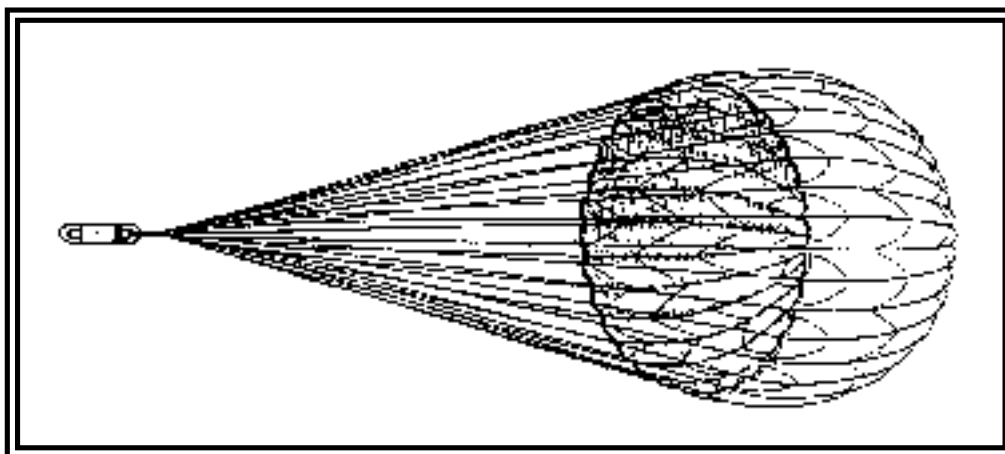


Figure 3-55. Drogue Parachute

CH-47 Hook Thimble (PN 94C533-001)

3-93. The hook thimble (Fig. 3-56) will be installed on the CH-47 cargo hook. The ultimate load is 100,000 pounds before failure. The proof load is 40,000 pounds with no permanent deflection or visible damage. The hook thimble is used with 5- to 10-foot sling (PN 94H520-001).

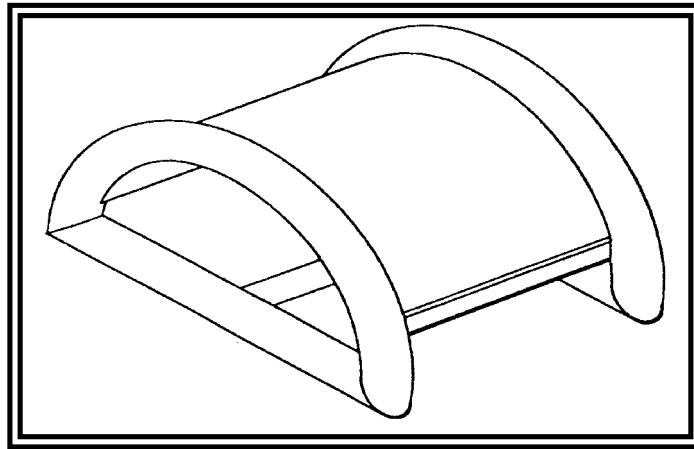


Figure 3-56. CH-47 Hook Thimble

BEFORE-USE PREPARATIONS

3-94. Normally, not all of the suspension components and equipment in the recovery kit are required to recover a particular aircraft. The kit components and equipment not required for a given recovery mission could be removed from the kit and left at the storage site. However, these components must be replaced in the kit after completion of the mission.

AFTER-USE INSPECTIONS AND PACKING

3-95. After a recovery mission has been completed, the UMARK equipment must be returned to a ready for issue (RFI) condition.

3-96. All recovery equipment should be dried, cleaned, and inspected before repackaging it in the container.

3-97. After completion of the cleaning and inspection for damage, all components of the UMARK should be replaced in the UMARK container in a neat and orderly fashion. Any component damaged must be replaced. The container should then be secured and stored for a subsequent recovery mission.

HELICOPTER RECOVERY KIT**PURPOSE AND USE**

3-98. The HERK (Fig. 3-57) contains the equipment required to pre-rig, rig, and recover selected US Army helicopters.

Internal Load

3-101. A UH-1H, UH-60, or CH-47 helicopter, which also carries the recovery crew, carries the kit. Two people are required to lift the kit (as a complete unit) into the helicopter. Standard tie-down procedures are used to attach the tie-down straps to the kit handles and to lift the kit as required. Off-loading the kit at the recovery site also requires two people if the entire kit is to be used.

External Load

3-102. If desired, the aerial recovery kit may also be transported in a 5000-pound-capacity cargo net, NSN 1670-01-058-3811.

3-103. Before rigging, the connecting latches between the container halves should be checked to verify that they are attached and secure.

3-104. The kit assembly may be transported as an external sling load. If this occurs, a small recovery crew may be assigned, as only two people are required to prepare the kit for transport. However, before reducing the number of personnel, factors such as the type of aircraft to be recovered, the type of terrain, and the extent of damage to the disabled aircraft must be considered.

LIFT LIMITATIONS OF CRITICAL COMPONENTS

3-105. When the rigging configuration is like that discussed in this manual, the critical components of the HERK can sustain loads of 22,000 pounds. When the configuration is significantly different, capability expectations should be reduced by 10 percent (down to 19,800 lb.) to allow for additional aerodynamic drag.

DESCRIPTION OF MAJOR COMPONENTS

3-106. Major components of the HERK are discussed below.

Case, Polyethylene (PN 5140-EG-090-001)

3-107. This case (Fig. 3-58) is the same as the basic case used to house the aviation foot locker (AFL), fielded with the new aircraft tool system (NATS). It has six carrying handles for 2- or 4-person carry. One or more of these cases can be used to provide waterproof storage and transport of those components needed for a specific recovery operation.

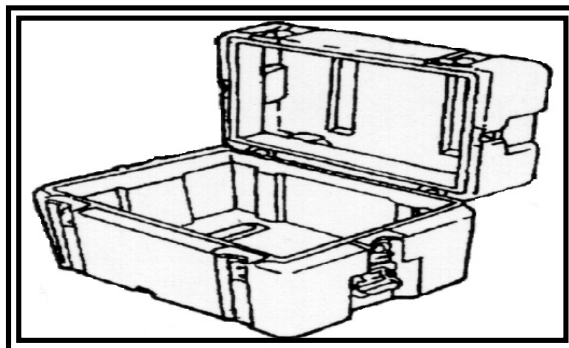


Figure 3-58. Case, Polyethylene

Polyester Roundsling (PN PRS2E008, PN PRS3E008, PN PRS2E017, PN PRS3E017, PN PRS5E030, PN PRS7E065, and PN PRS7E070)

3-108. A polyester roundsling (Fig. 3-59) is made with a continuous, load-bearing core, which is fully enclosed in a woven protective cover. With the I-UMARK and HERK, the endless "round" loop is formed into an eye and eye configuration by sewing a sleeve over center of the roundsling body. High-bulk nylon (Cordura) wear pads are sown into the end loops and a sliding wear pad is added between the eyes. Roundslings were selected for this application because they have no hard eye, like the helicopter sling, and can be snaked through restricted areas of the helicopter main rotor hubs for optimum attachment location. The unwoven, load-bearing core conforms to the lifting member and is protected from cuts or abrasion by the polyester cover and the nylon wear pad. Polyester roundslings have about one-half the stretch of nylon webbing or nylon rope. Polyester roundslings are color coded and labeled in two locations to indicate the capacity. They may be used in choked, vertical (pin-to-pin) or basket hitch configurations. Polyester roundslings are used to rig the helicopter for recovery and as long-line pendants to obtain separation between the lift and recovered helicopters.

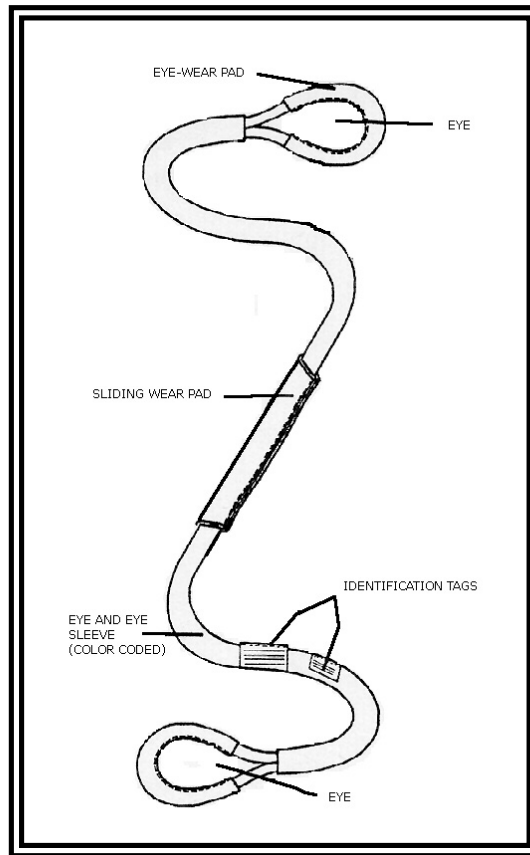


Figure 3-59. Polyester Roundsling (PN PRS2E008, PN PRS3E008, PN PRS2E017, PN PRS3E017, PN PRS5E030, PN PRS7E065, and PN PRS7E070)

Apex Assembly, 10K (PN 38850-00004-045)

3-109. The apex assembly (Fig. 3-60) is a 10,000-pound-capacity helicopter external cargo sling. This large clevis is used to connect roundslings to each other, a reach pendant, or to the lift helicopter. The 10K apex is made of aluminum.

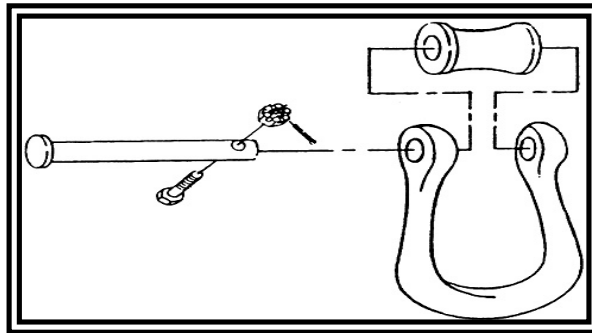


Figure 3-60. Apex Assembly

PIP Pin (PN MS17984C612) (Optional) (1.6-inch Grip)

3-110. PIP (push-in-pullout) pins (Fig. 3-61) are quick-disconnect pins used in place of nuts and bolts in applications requiring rapid attachment/installation. For helicopter hoisting and recovery operations, they may be used in place of the safety bolt to secure the apex load pin.

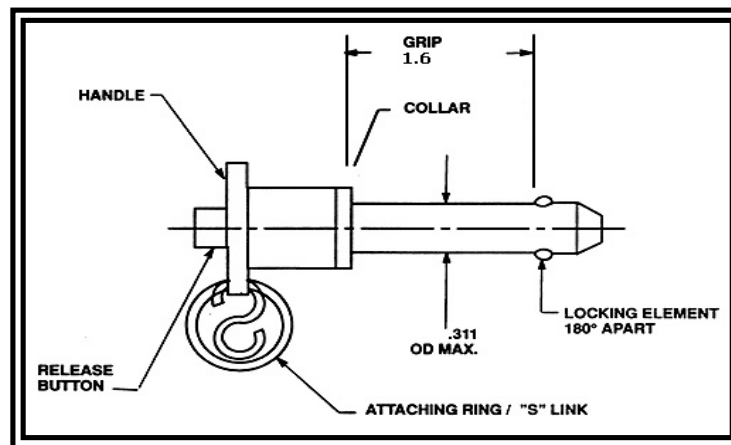


Figure 3-61. PIP Pin

Apex Assembly, 25K (PN 38850-0000-046)

3-111. The apex assembly (Fig. 3-62) is a 25,000-pound-capacity helicopter external cargo sling. This large clevis is used to connect roundslings to each other, a reach pendant, or to the lift helicopter. The 25K apex is made of alloy steel.

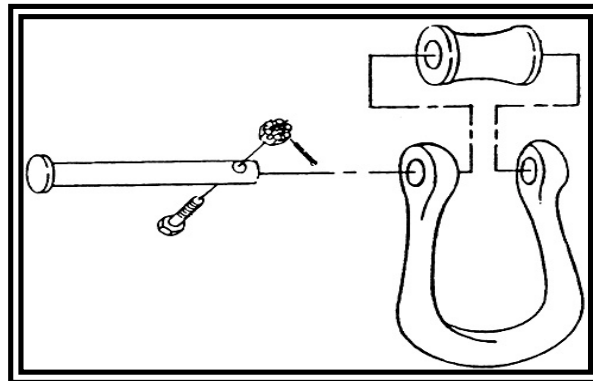


Figure 3-62. Apex Assembly

PIP Pin (PN MS17984C616) (Optional) (2.0-inch Grip)

3-112. PIP (push-in-pullout) pins (Fig. 3-63) are quick-disconnect pins used in place of nuts and bolts in applications requiring rapid attachment/installation. For helicopter hoisting and recovery operations, they may be used in place of the safety bolt to secure the apex load pin.

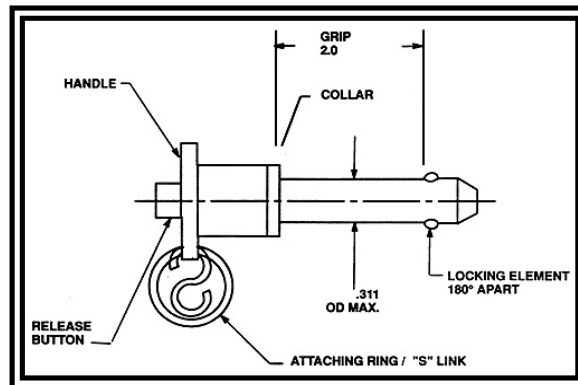


Figure 3-63. PIP Pin

Eye Hook (PN S-320A-11)

3-113. The eye hook (Fig. 3-64) is used for quick attachment of a roundsling to one or more additional roundslings. The pin of an apex assembly is attached to the eye of the hook. The HERK includes two eye hooks to expedite hoisting of UH-60s for vessel shipment.

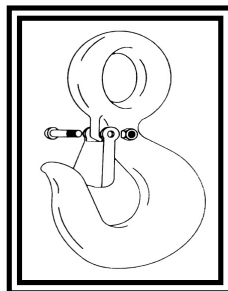


Figure 3-64. Eye Hook

Grabhook, 25K Sling (PN 38850-00011-046)

3-114. The grabhook assemblies (Fig. 3-65) also are from the 25,000-pound-capacity helicopter external cargo slings. A grabhook with an 8-foot length of chain is attached to one end of a roundsling to provide a quickly adjustable length leg. The two grabhook and chains are included in the HERK for use in vessel transport of UH-60 helicopters.

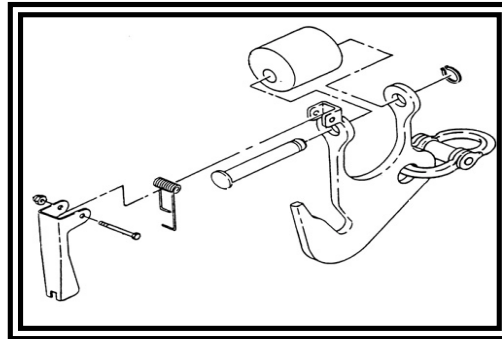


Figure 3-65. Grabhook, 25K Sling

Chain, 25K Sling (PN 38850-00053-102)

3-115. One end of this 8-foot length of steel alloy chain (Fig. 3-66) is attached to the grabhook with a coupling (Hammerlock) fitting. The other end is routed through a lift provision and secured back in the grabhook. The link count determines the length of the sling leg.

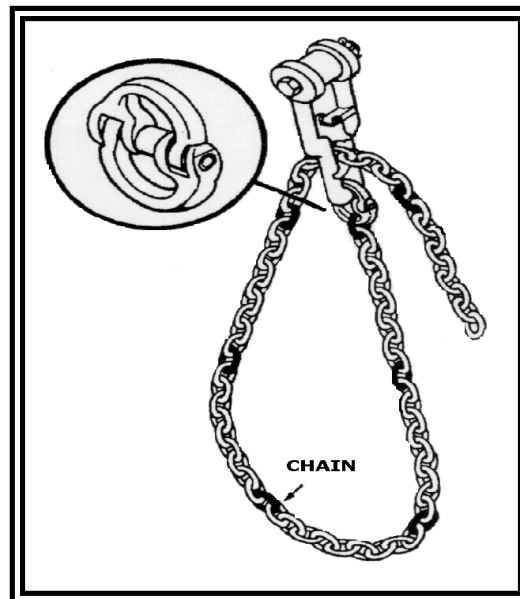


Figure 3-66. Chain, 25K Sling

Shackle, Anchor (PN 1019515 (75535))

3-116. An anchor shackle (Fig. 3-67) is a small clevis used to attach to a lift eye. The four anchor shackles are included in the HERK to allow attachment of polyester roundslings to the fuselage hard point on the CH-47.

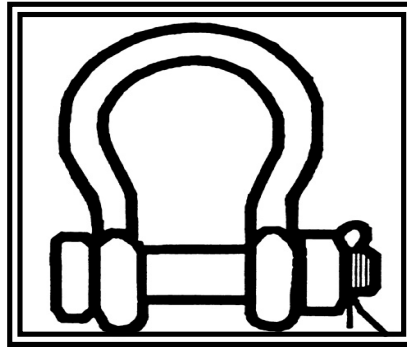


Figure 3-67. Shackle, Anchor

SUPPLEMENTAL ITEMS

SPREADER BAR (TM 1-1520-237-S, FIG. 7-6)

3-117. A 3-section, aluminum tube, two inner tubes and one outer tube, with 10K apex assemblies at each end (Fig. 3-68) is used to keep the lifting line from contacting the lifted helicopter. Principle use is vessel transport of the UH-60.

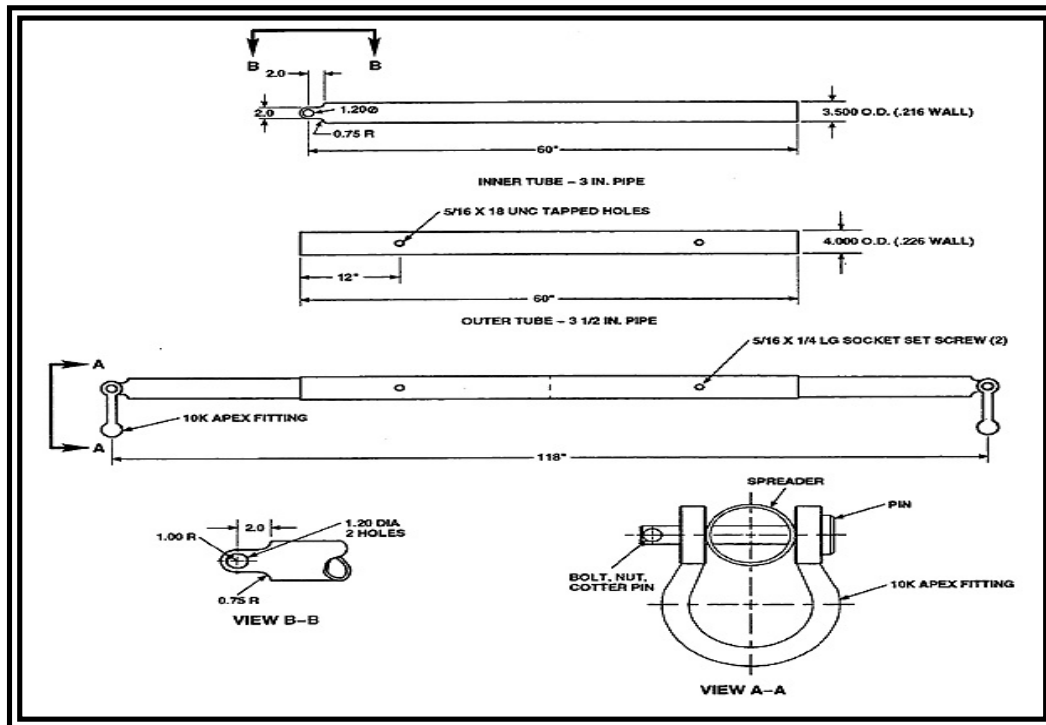


Figure 3-68. Spreader Bar

Lifting Clevis, AH-1/UH-1 (PN 204-011-178-1)

3-118. The primary lift attachment for the AH-1/UH-1 and later OH-58A/C helicopters is shown in Figure 3-69.

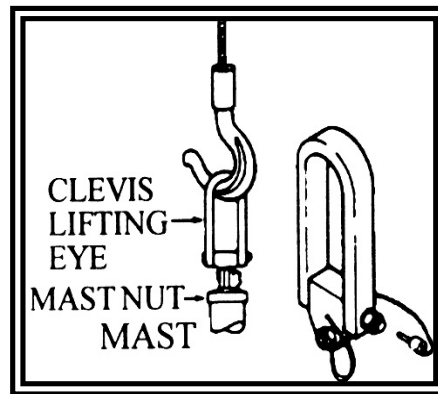


Figure 3-69. Lifting Clevis, AH-1/UH-1

Lifting Ring (PN 114E5909-8)

3-119. Rings (Fig. 3-70) are screwed into the rotor masts on the CH-47 for attachment of hoisting slings when transmission mounts are intact.

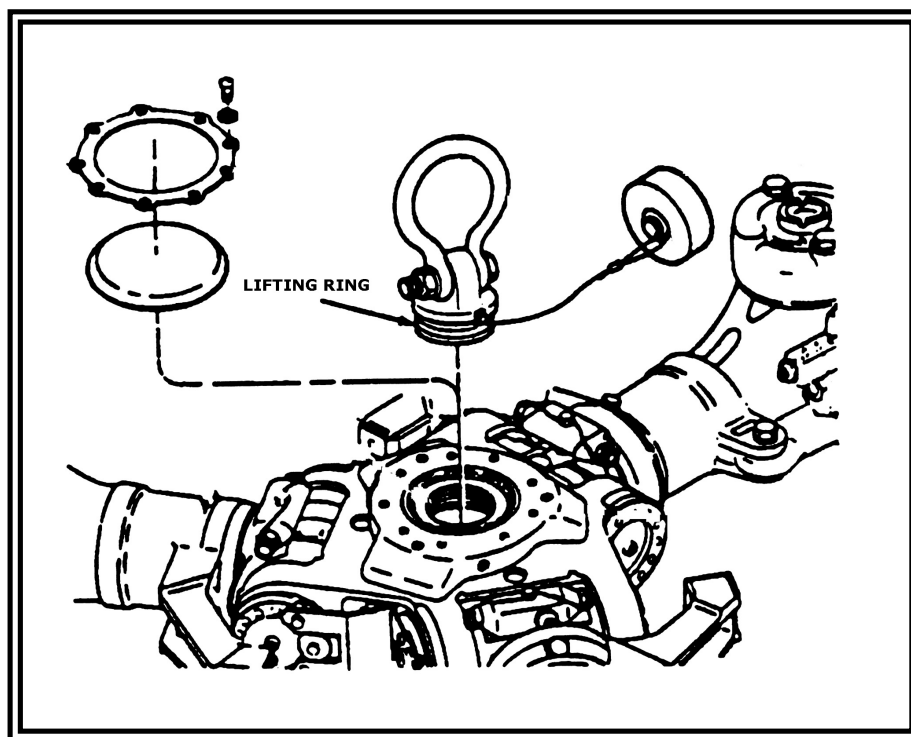


Figure 3-70. Lifting Ring

Reach Pendant, 25,000-lb. Capacity (PN BOS-14-K7)

3-120. A 5-foot-long, nylon rope loop (Fig. 3-71) is enclosed in a rigid pipe to increase the lift helicopter to load clearance for safe hookup.

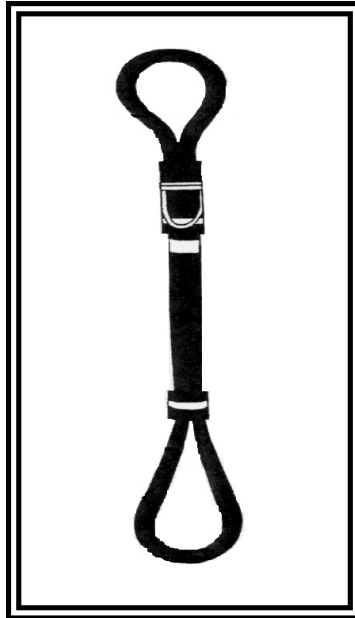


Figure 3-71. Reach Pendant, 25,000-lb. Capacity

Drogue Chute (PN 1670EG029B3)

3-121. A specially designed parachute (Fig. 3-72) attaches to the tail wheel of selected helicopters to improve the in-flight stability during recovery.

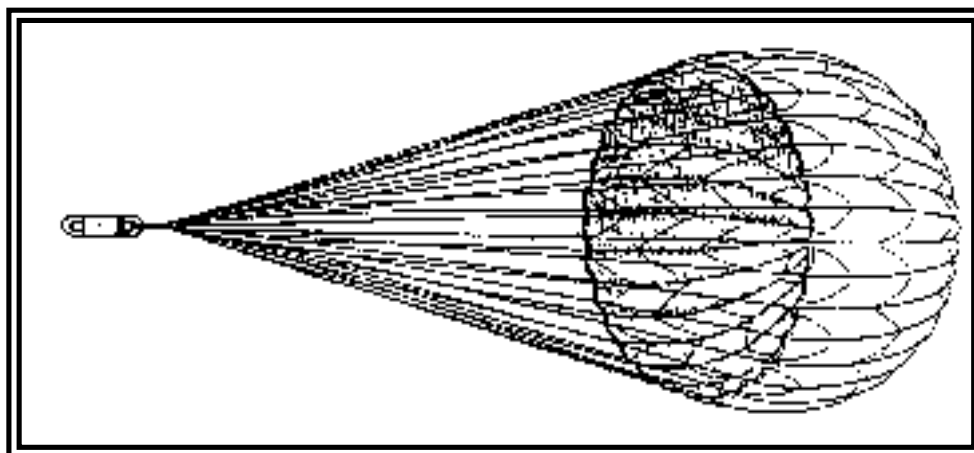


Figure 3-72. Drogue Chute

NOTES

NOTE: Vessel shipment of UH/EH/MH-60 using main rotor head rigging. Rigging instructions contained in TM 1-1520-237-S, Chapter 3, require spreader bar, eye hooks, and at least four additional roundslings be used to expedite lift-on/lift-off operations by pre-rigging the rotor head attachment.

NOTE: Vessel shipment of UH/EH/MH-60 using fuselage hard point rigging. Rigging instructions contained in TM 1-1520-237-S, Chapter 3, require two hoisting adapters; allow rapid attachment without personnel having to climb on the shrink-wrapped helicopter.

NOTE: Aerial recovery of H-60 and AH-64 using main rotor head rigging. Rigging instructions for the UH/EH-60 are contained in TM 1-1520-237-S, Chapter 9. Attach to the AH-64 using rigging procedures contained in the I-UMARK Operating Procedures, Revision A, 30 Nov 90. The mast-mounted assembly must be removed from the AH-64D.

NOTE: Aerial recovery of H-60 using main gear drag beam rigging. Rigging instructions are contained in TM 1-1520-237-S, Chapter 9; used if the main rotor head, transmission, or transmission mounts are damaged.

NOTE: Aerial recovery of H-60 using bellyband rigging. Rigging instructions are contained in TM 1-1520-237-S, Chapter 9; used if main rotor head, transmission, transmission mounts, and main landing gear are damaged.

NOTE: Aerial recovery of OH-58D. Rigging instructions are contained in TM 1-1520-248-S, Chapter 9. The mast-mounted sight must be removed.

NOTE: Aerial recovery of AH-1, UH-1, and OH-58C. Rigging instructions are contained in I-UMARK Operating Procedures, Revision A, 30 Nov 99; require lifting clevis described in the applicable aircraft shipping manual.

NOTE: Aerial recovery of CH-47 using rotor mast attachment. Rigging instructions contained in TM 1-1520-241-S, Chapter 8, require two hoisting adapters at forward and aft transmission vertical shafts. Reach pendant is used if lift CH-47 cannot land for hookup.

NOTE: Aerial recovery of CH-47 using fuselage hard points. Used in place of CH-47C Aircraft Maintenance Sling, P/N 114G1013-1, NSN 1730-00-071-1690, which is no longer produced. The reach pendant is used if lift CH-47 cannot land for hookup. Using roundslings as long-line pendants is optional. Use 10, 25K apexes to connect pendants to end, and to attach to lift helicopter.

BEFORE-USE PREPARATIONS

3-122. Normally, not all of the suspension components and equipment in the recovery kit are required to recover a particular aircraft. The kit components and equipment not required for a given recovery mission could be removed from the kit and left at the storage site. However, these components must be replaced in the kit after completion of the mission.

AFTER-USE INSPECTIONS AND PACKING

3-123. After a recovery mission has been completed, the HERK equipment must be returned to a ready for issue (RFI) condition.

3-124. All recovery equipment should be dried, cleaned, and inspected before repackaging it in the container.

3-125. After completion of the cleaning and inspection for damage, all components of the HERK should be replaced in the HERK container in a neat and orderly fashion. Any component damaged must be replaced. The container should then be secured and stored for a subsequent recovery mission.

Chapter 4

Typical Aircraft Rigging Procedures

This chapter covers the typical rigging procedures used when recovering disabled rotary-wing and fixed-wing aircraft. Unfortunately, not all these downed aircraft are in a condition that will enable aerial evacuation using the I-UMARK, UMARK, or HERK. Critical attachment points and/or the airframe itself may not be structurally sound. Therefore, ARK may be used with other recovery kits to perform the recovery. This operation will enable the return of aircraft for logistical considerations or to complete extensive repairs.

PROCEDURES

4-1. The ARK, described in chapter 3, is designed for the safe aerial recovery of disabled aircraft using the suspension system. It also is used to rig aircraft for ground recovery. The recovery officer or BDAR assessor determines which aerial recovery method to use. Care should be exercised to prevent further structural damage. Stations given for rigging are approximate. Some minor alignment may be necessary to prevent further damage. More positioning of straps may be required. Load spreaders should be supported from above until load is lifted.

4-2. The structure of downed aircraft may require strengthening before extraction. The recovery officer/BDAR assessor should evaluate the overall structural soundness of the aircraft before extraction. The purpose of the examination is to determine the effects of components upon compromised structural integrity. Components should be removed to relieve structural stress. Compromised stringers and longerons should be reinforced or repaired to prevent the breakup of the airframe upon extraction.

WARNING

All safety precautions will be strictly followed during all recovery procedures. If safety precautions are not strictly followed, loss of life could possibly occur.

CAUTION

Exercise caution when bellybanding an aircraft that has sustained crash damage because of a weakened airframe structure. BDAR assessors must pay particular attention to structural damage when performing BDAR.

CAUTION
The maximum weight to be lifted with the aerial recovery kit should not exceed 21,600 pounds.

CAUTION
Using the bellyband method may cause additional sheet metal damage.

NOTE: Whenever possible, multiple lifting systems should be used in with the bellyband method to relieve the stress and provide redundancy for the primary system.

4-3. Typical bellyband rigging procedures are as follows:

- Extend the bellyband assemblies (two each) to their full length (about 33 feet each) and remove the twist from the straps.
- Attach the chain leg, the positioning strap anchor, and the coupling links to the bellyband links as specified for the particular aircraft to be recovered. (Fig. 4-1 shows the general assembly configuration.)
- Attach the load spreaders (four each) to the fuselage of the disabled aircraft as specified for the particular aircraft to be recovered using two positioning straps and two positioning strap anchors (1670EG075A3) for each arrangement. (Fig. 4-2 shows the general configuration.)
- Position the bellybands at their appropriate stations. Align the index mark on the bellyband with the fuselage centerline (Fig. 4-3). Tie the bellybands to the fuselage using a positioning strap and the positioning strap anchor (1670EG075A1).
- Thread the bellyband straps through the positioning strap anchors (Fig. 4-1, Fig. 4-2, and Fig. 4-4).
- Attach positioning straps as required. Tighten all positioning straps evenly. Ensure that the bellybands remain at their straps evenly and at their proper fuselage station.
- Secure the bellybands to the spreader bar or rotor head shackle as specified for the aircraft to be recovered.
- Attach antichafe pads to the bellybands as specified under the rigging procedures for the particular aircraft to be recovered.
- Roll all loose ends of the straps; pad and tape them as required.

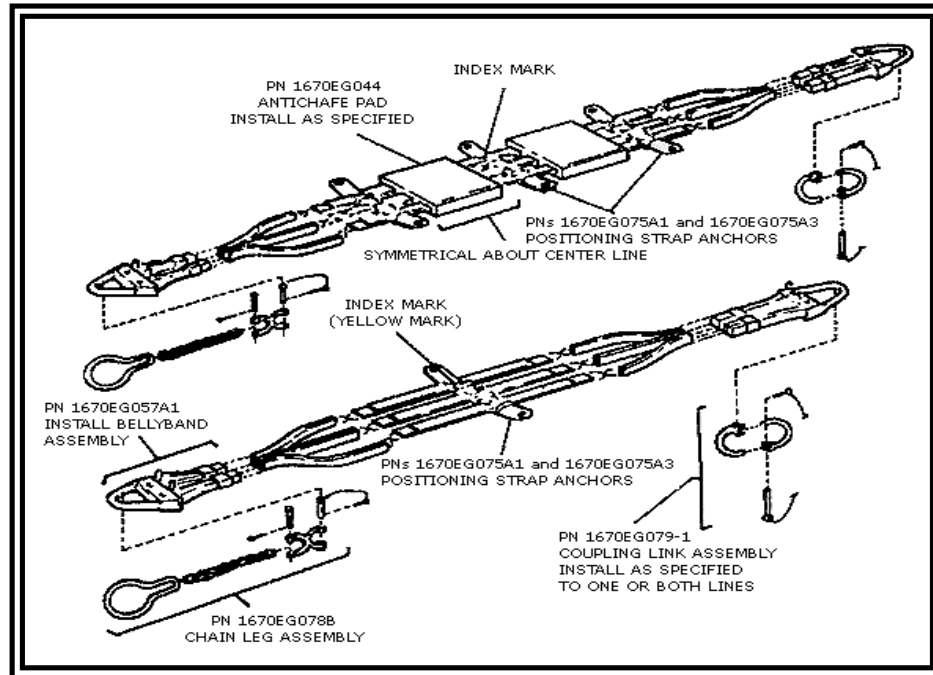


Figure 4-1. General Arrangement of Bellyband Installations

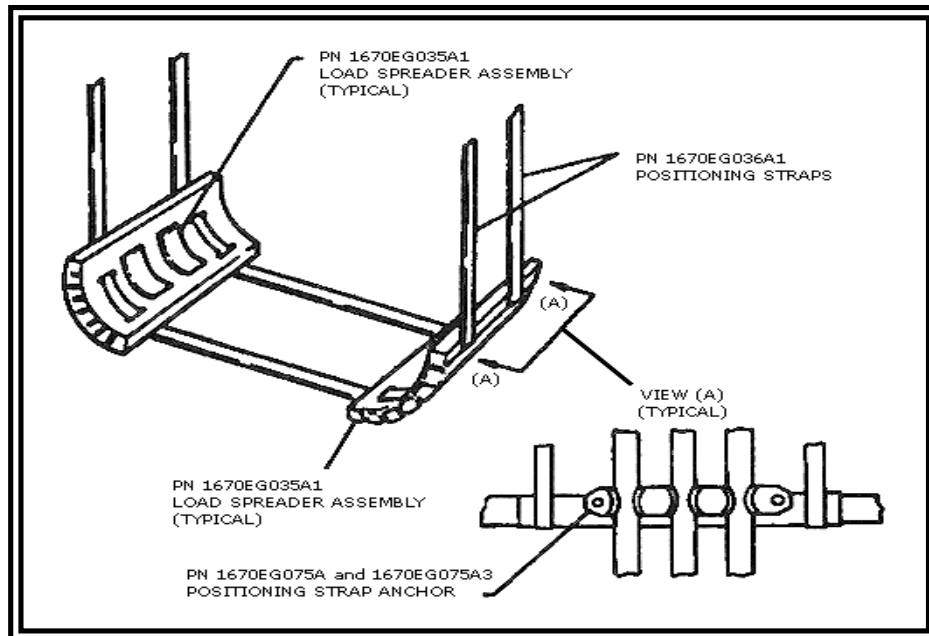


Figure 4-2. General Arrangement of Load Spreader Installation

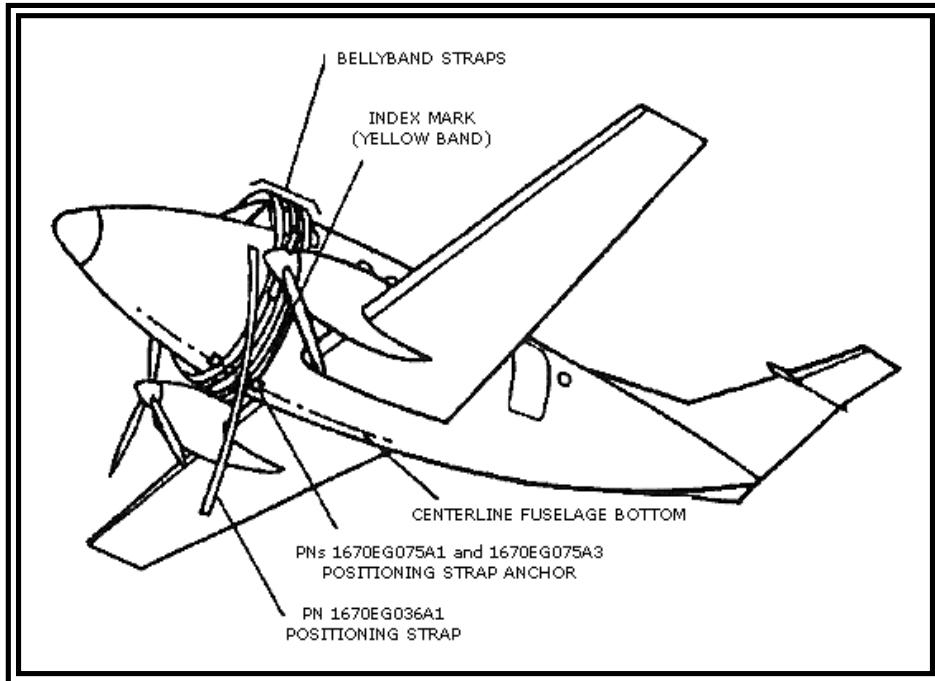


Figure 4-3. Typical Indexing of Bellyband to Fuselage

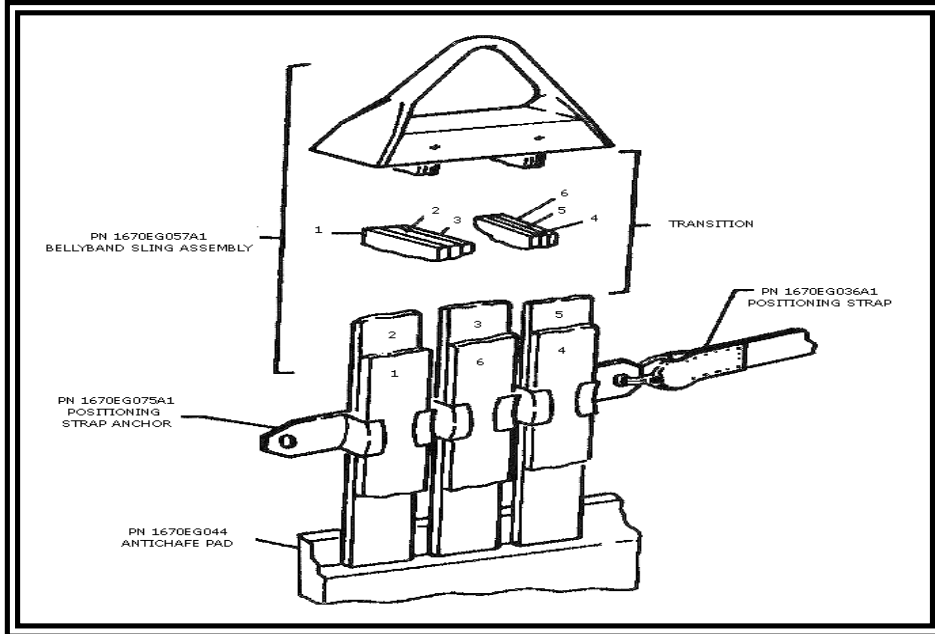


Figure 4-4. Typical Applications of Positioning Anchor

ASSEMBLY OF SUSPENSION COMPONENTS

4-4. The assembly of the suspension components includes these actions:

- Attach the bellybands to the spreader bar shackle.
- Adjust the length of the spreader bar.
- Attach the pendant assemblies to the pendant adapter (primary and alternate methods).
- Install the rotor head sling.
- Attach the bellyband assemblies to the lift pendant.

ATTACHING BELLYBANDS TO THE SPREADER BAR SHACKLE

4-5. Figures 4-5 and 4-6 show the typical connections between the bellybands and the spreader bar shackle. Figure 4-5 shows direct connection between these two suspension components. Figure 4-6 demonstrates the use of coupling links, grab links, and/or the chain leg assembly in connecting the bellybands to the spreader bar. Figure 4-6 shows the coupling link assembly connected to the spreader bar.

Bellyband Link or Grab Link Attachment

4-6. Attach the bellyband link or the grab link to the spreader bar shackle as follows:

- Remove the quick-disconnect pin from the shackle clevis pin and slide the clevis pin out from the forked end. Note that this also releases the spreader bar straps from the spreader bar assembly (Fig. 4-5, View A).
- Slip the spreader bar shackle through the bellyband link (Figure 4-5, View A) or through the grab link (Fig. 4-6). Note that while Figure 4-5 shows two bellyband links being attached to the spreader bar shackle, there are cases in which only one bellyband link will be attached.
- Reassemble the parts to the spreader bar assembly.
- Ensure that there is no twist in the spreader bar straps.

Coupling Link Attachment

4-7. Attach the coupling links to the spreader bar shackle (Fig. 4-6) as follows:

- Disengage the quick-disconnect pin of the coupling link assembly.
- Remove the clevis pin from the coupling link and separate the two links.
- Pass one coupling link over the spreader bar shackle.
- Mate the other link with that in the step above.
- Insert the clevis pin through the coupling links and engage the quick-disconnect pin.

ADJUSTING LENGTH OF THE SPREADER BAR

4-8. Adjust the spreader bar length as follows:

- Disengage the quick-disconnect pins from the pin assembly (1670EG052A) (Fig. 4-5).

- Remove the pin assembly from the tube.
- Select the correct length for the spreader bar assembly and reinstall the pin assembly.

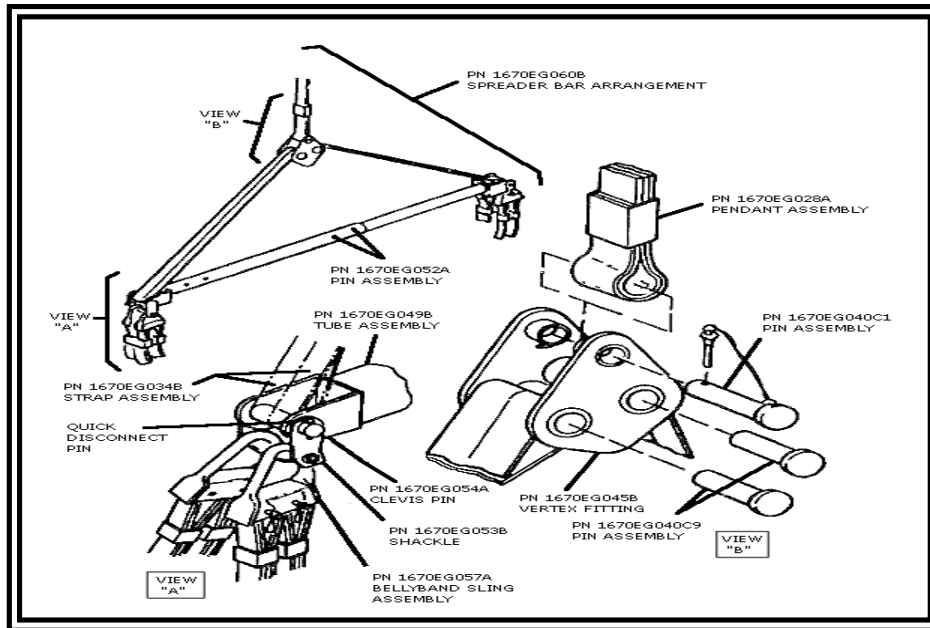


Figure 4-5. Typical Spreader Bar Arrangement

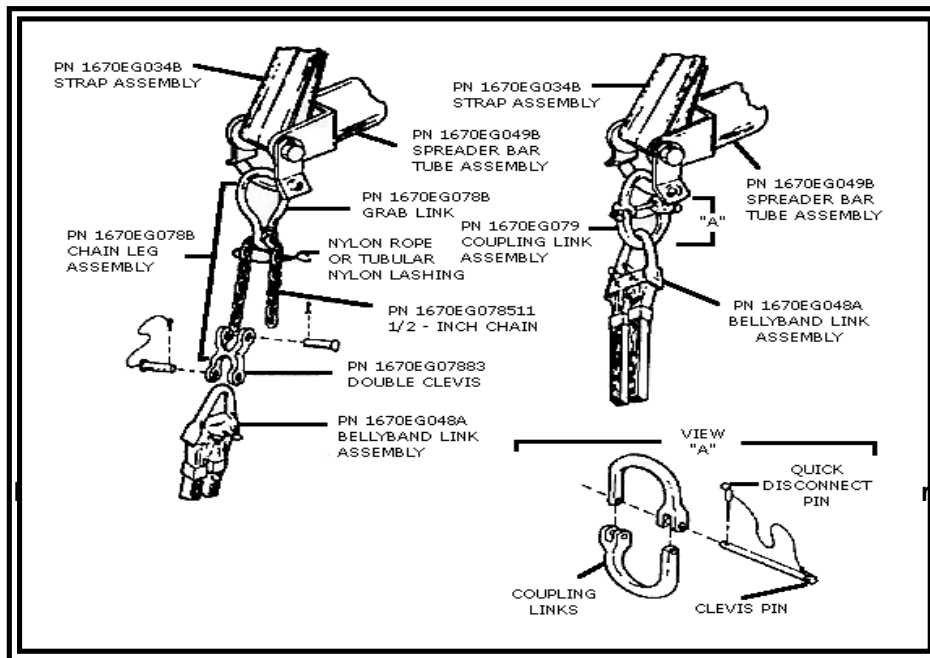


Figure 4-6. Typical Arrangements of Bellyband Arrangements to Spreader Bar

ATTACHING PENDANT ASSEMBLIES TO PENDANT ADAPTER

4-9. The two methods of attaching the pendant assemblies to the pendant adapter are described in the paragraphs below.

Primary Method

4-10. Figure 4-7 shows the typical connections between the pendant adapter and the pendant assemblies. The two pendant assemblies (1670EG028A1, 1670EG028A3) are identical except that one pendant assembly has only one ring assembly (1670EG069). The additional ring on the 1670EG028A3 pendant assembly attaches to the cargo hook. This ring cannot be disassembled. The intermediate rings (1670EG070B) can be disassembled.

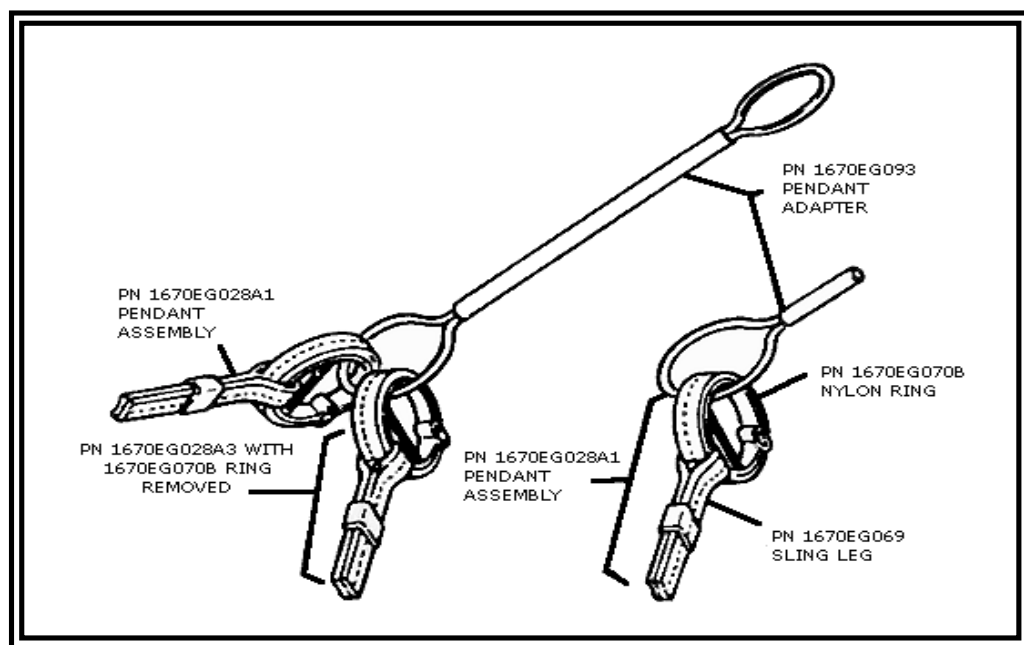


Figure 4-7. Pendant Arrangements

NOTE: Care should be exercised when attaching the pendant adapter and the pendant assemblies in the double-leg configuration. Both nylon doughnuts of the pendant assembly should be connected to the loop of the pendant adapter (Fig. 4-7).

4-11. Attach the pendant assembly to the pendant adapter as follows (Fig. 4-8):

- Remove the nuts (6) from the link assembly.
- Separate the links (4), bolts (3), and bushings (5) from the webbing (1).
- Unwind the ring (1).

- Reassemble the nylon ring, but encircle both the pendant adapter loop and the sling leg loop. To assemble the ring, refer to Figure 4-8 and perform the following steps:
 - Lay the webbing (1) out flat with the nylon sleeve (2) over the shorter stitched end.
 - Slip the sling leg (7) over (1).
 - Form the webbing (1) into an approximate 8-inch-diameter circle beginning from the shorter stitched end.
 - Wind the webbing, forming three turns. Adjust the webbing so that the sewn loops are positioned as shown.
 - Thread the webbing, during winding, through the additional suspension; that is, pendant (7) or components as required.
 - Insert the bushings (5) through the loops of the inner and outer wraps.
 - Install the bolts (3), links (4), bushings (5), and nuts (6).

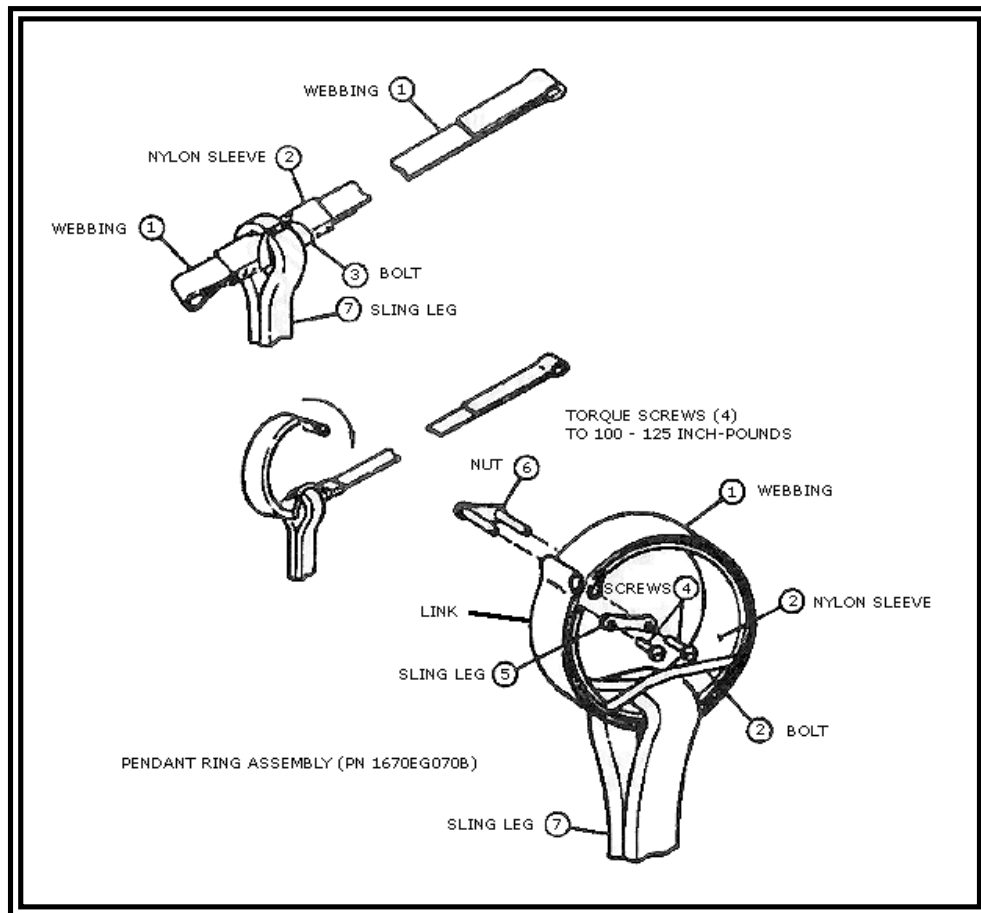


Figure 4-8. Attachment of Pendant Assemblies to Pendant Adapter

Alternate Method

4-12. The pendant assemblies can be attached to the pendant adapter using the rotor head shackle (Fig. 4-9). Use the following procedure:

- Remove the quick-disconnect pin from the shackle pin (Fig. 4-10).
- Unscrew the shackle pin and remove it from the shackle.
- Place, as required, one-ring assembly or two-ring assemblies of the pendant assemblies on the shackle.
- Position the loop of the pendant adapter in the rotor head shackle.
- Install the shackle pin, making sure that it passes through the loop of the pendant adapter.
- Insert the quick-disconnect pin.

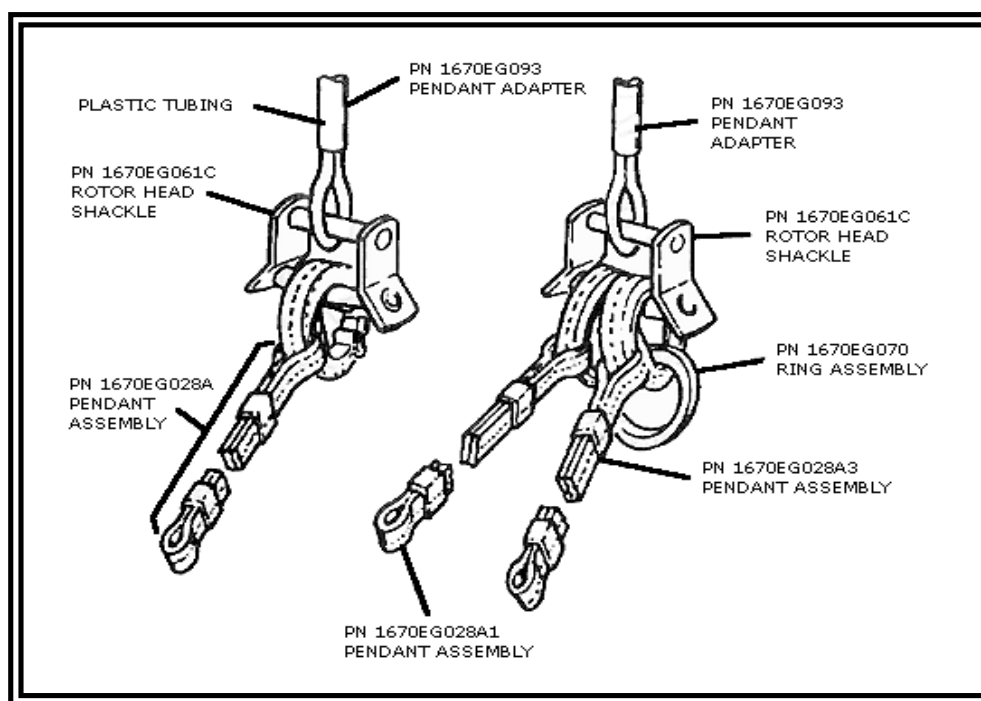


Figure 4-9. Typical Lift Pendant Arrangement using Rotor Head Shackle

ATTACHING BELLYBAND ASSEMBLIES TO LIFT PENDANT

4-13. Figure 4-10 shows the bellyband assemblies attached to the single-leg lift pendant arrangement using the rotor head shackle. It also shows the assembly of the grab links and the coupling links to the rotor head shackle.

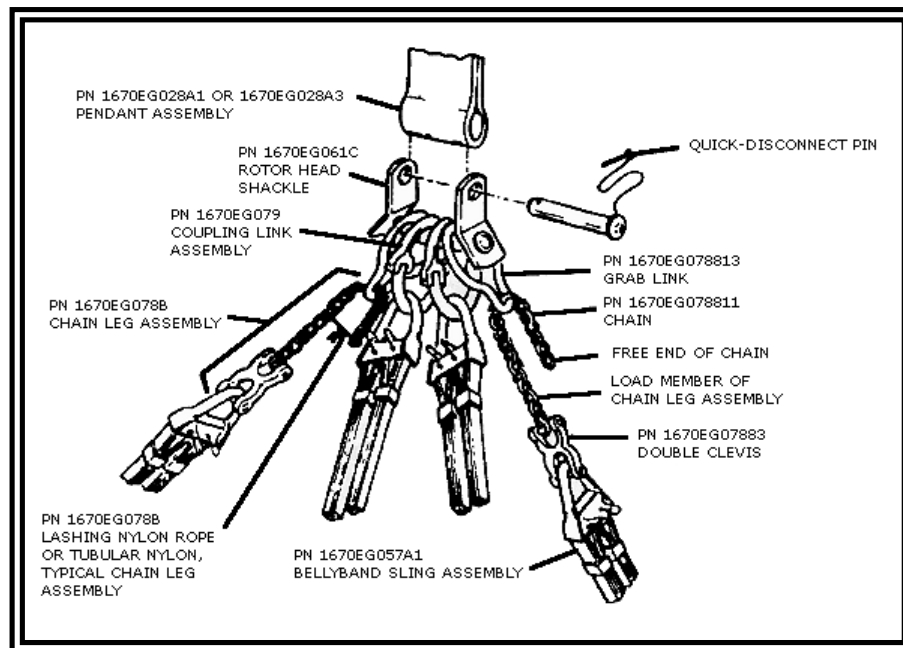


Figure 4-10. Typical Attachments of Bellyband to Rotor Head Shackle

INSTALLING THE ROTOR HEAD SLING

4-14. The rotor head sling arrangement may be used to lift lightweight helicopters by their rotor heads. Figure 4-11 shows a typical rotor head sling installation, including the use of antichafe pads.

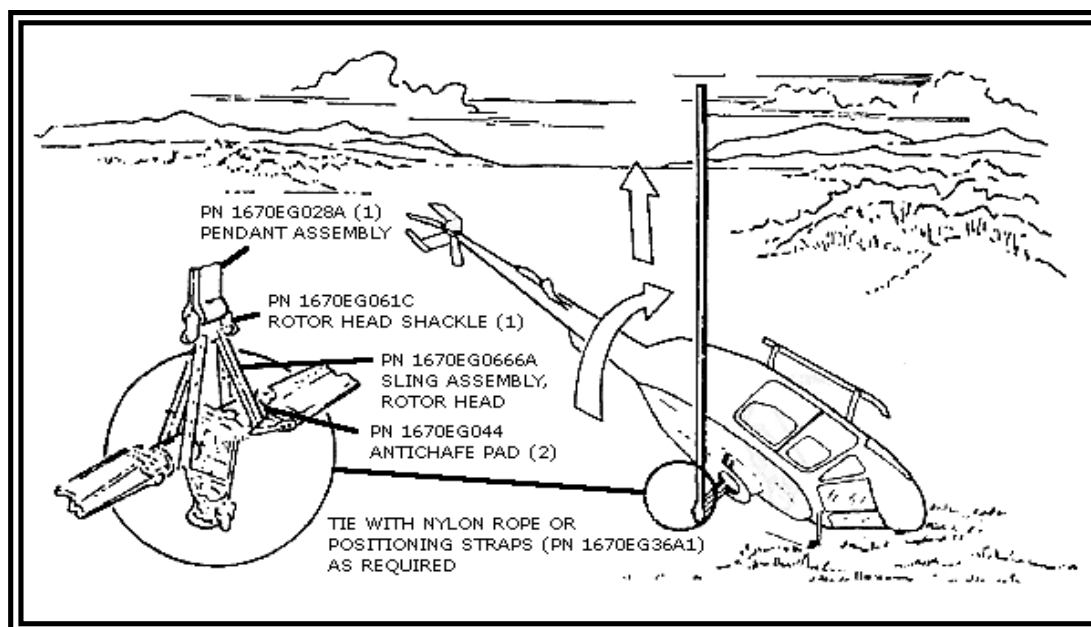


Figure 4-11. Typical Rotor Head Sling Installation

RIGGING AIRCRAFT FOR GROUND RECOVERY

4-15. Rigging aircraft for ground recovery is essentially the same as for aerial recovery. The aircraft is prepared for lifting onto the transport vehicle; components (bellybands, slings, etc.) of the aerial recovery kit are used. The only major difference is that the device used to actually perform the lift is a crane, or similar piece of equipment, instead of a helicopter. Any disassembly of the aircraft required because of road obstacles—or size of the transport vehicle—is performed using procedures outlined in the appropriate aircraft technical manual. Procedures outlined in the appropriate aircraft shipping manual are used to prepare any devices (cradles, shipping skids, etc.) required for loading the aircraft onto the transport vehicle. Observe the same basic safety procedures (disarming, disconnecting batteries, etc.) adhered to during aerial recovery during ground recovery.

4-16. An aircraft may have severe crash damage; that is, major portions of the aircraft such as the engine, transmission, and rotor system were torn from the aircraft. If so, rigging procedures may require modification to suit the situation. The ground personnel determine the method used to lift the aircraft. The primary concerns in this situation are to minimize further damage to the aircraft and ensure the safety of the ground crew.

4-17. Nonflyable aircraft may be transported between maintenance facilities or moved because of relocation of the maintenance facility. When this occurs, the aircraft will be prepared and loaded for ground transport as specified in the applicable shipping manual. The procedures outlined in shipping manuals are used when shipping flyable aircraft over extended distances. The same procedures are effective for moving aircraft intact but not flyable because of maintenance. Use of these procedures will minimize the possibility of damage to the aircraft occurring as a result of movement. Sling loading is an option in this situation; however, the chance of damage occurring to the transported aircraft is much greater than with ground transport. The availability urgency of the situation and the transportation assets determine the method of movement to be used.

Chapter 5

Aircraft Recovery Methods and Applications

This chapter covers rigging methods, configurations, and the required recovery kit(s) for specified US Army rotary-wing and fixed-wing aircraft. The methods and applications in this chapter were verified as effective. However, the extent of damage to the disabled aircraft may require modified procedures. In all cases, the recovery helicopter should hold the disabled aircraft at a hover before transition into flight. This ensures that a proper balance is maintained and the disabled aircraft assumes a 0- to 10-degree, nose-low attitude.

When ground recovering an aircraft, the rotor head suspension method (if authorized) is the simplest means of loading the aircraft onto the recovery vehicle. Aircraft damage, configuration, or limitations may preclude use of either of these methods: the rotor head suspension; hard point attachment sling; attitude-controlled rotor head suspension; or the attitude-controlled, tandem hook, rotor head suspension. If so, load the aircraft using the bellyband method. Install lifting devices (straps, bellybands, etc.) as directed for the particular aircraft. This minimizes further damage to the aircraft. Modification of some procedures may be required to accommodate boom extension of the lifting equipment. This means positioning lifting eye closer to the aircraft.

AERIAL RECOVERY

RECOVERY METHODS

(See table 5-1 for specific instructions for each aircraft.)

OH-58A/C

5-1. The recovery methods for OH-58A/C aircraft are—

- Bellyband suspension – Approved.
- Rotor head suspension – Approved.
- Hard point attachment sling – Not applicable to this airframe.

OH-58D

5-2. The recovery methods for OH-58D aircraft are—

- Bellyband suspension – Approved.
- Rotor head suspension – Approved.
- Hard point attachment sling – Not applicable to this airframe.

UH-1H/V/N AND EH-1H

5-3. The recovery methods for UH-1H/V/N and EH-1H aircraft are—

- Bellyband suspension – Approved.
- Rotor head suspension – Approved.
- Hard point attachment sling – Not applicable to this airframe.

UH-60A/L, EH-60L AND MH-60G/K

5-4. The recovery methods for UH-60A/L, EH-60-L, and MH-60G/K aircraft are—

- Bellyband suspension – Approved.
- Rotor head suspension – Approved.
- Hard point attachment sling – Approved.

AH-1E/F/P/S

5-5. The recovery methods for AH-1E/F/P/S aircraft are—

- Bellyband suspension – Approved.
- Rotor head suspension – Approved.
- Hard point attachment sling – Not applicable to this airframe.

AH-64A AND AH-64 LONGBOW

5-6. The recovery methods for AH-64A and AH-64 LONGBOW aircraft are—

- Bellyband suspension – Approved.
- Hard point attachment – Not applicable to this airframe.
- Attitude-controlled, rotor head suspension – Approved.
- Attitude-controlled, tandem hook, rotor head suspension – Approved.

RAH-66

5-7. Procedures for rigging a disabled RAH-66 helicopter for recovery will be published at a later date.

CH-47D AND MH-47E

5-8. The recovery methods for CH-47D and MH-47E aircraft are—

- Rotor head suspension – Approved.
- Bellyband suspension – Approved.

C-12 AND RC-12

5-9. The recovery method for C-12 and RC-112 aircraft is—

- Bellyband suspension – Approved

C-23 SHERPA

5-10. The recovery methods for C-23 Sherpa aircraft are—

- Bellyband suspension – Approved.
- Hard point attachment sling – Approved.

UC-35 CESSNA CITATION

5-11. The recovery methods for UC-35 Cessna Citation aircraft are—

- Bellyband suspension – Approved.
- Hard point attachment sling – Approved.

Table 5-1. Methods and Application Table

AIRFRAME	RECOVERY EQUIPMENT					RECOVERY METHODS				
	ARK See Notes: 32, 34	I-UMARK See Notes: 32, 34	UMARK See Notes: 32, 34	HERK See Notes: 32, 34	OTHER	Rotor Head Suspension	Bellyband Suspension	Hard Point Attachmet Sling	Attitude- Controlled Rotor Head	Attitude- Controlled, Tandem Hook, Rotor Head Suspension
TYPE										
AH-1E/F/P/S	Yes See Notes: 2, 8	Yes See Notes: 2, 9, 16, 29, 35, 36	Yes See Notes: 2, 11, 16	No	No See Notes: 18, 21, 22, 23, 28, 31	Yes See Notes: 2, 15	Yes See Notes: 2, 17	No	No	No
AH-64A/ AH-64 LONGBOW	Yes See Notes: 3, 8	Yes See Notes: 3, 9, 16, 27, 30	Yes See Notes: 3, 11, 16, 27, 30	No	No See Notes: 18, 23, 28, 31, 33	Yes See Notes: 3, 15	Yes See Notes: 3, 17	No	Yes See Notes: 3	Yes See Notes: 3
C-12 RC-12	Yes See Notes: 8	No	No	No	Yes See Notes: 18, 23	No	Yes See Notes: 17	Yes See Notes: 17	No	No
C-23	Yes, See Notes: 8	No	No	No	Yes See Notes: 14, 18, 23, 28	No	Yes See Notes: 17	Yes See Notes: 17	No	No
CH-47D MH-47E	Yes See Notes: 5, 8	No	Yes See Notes: 5, 16	No	No See Notes: 18, 23, 28, 31, 33	Yes See Notes: 5, 15	Yes See Notes: 5, 17	No	No	No
EH-1H/ UH-1H/V/N	Yes See Notes: 6, 8	Yes See Notes: 6, 9, 16, 35, 36	Yes See Notes: 6, 16	No	No See Notes: 18, 21, 23, 28, 31	Yes See Notes: 6, 15	Yes See Notes: 6, 17	No	No	No
EH-60L/ MH-60G/K/ UH-60A/L	Yes See Notes: 4, 8, 19	Yes See Notes: 4, 9, 16, 26, 27	Yes See Notes: 4, 16, 27	Yes See Notes: 4, 10, 12, 16	No See Notes: 18, 20, 23, 28, 31, 33	Yes See Notes: 15	Yes See Notes: 4, 17	No	No	No
OH-58A/C	Yes See Notes: 1, 8	Yes See Notes: 1, 9, 16, 35, 36	Yes See Notes: 11, 16	No	No See Notes: 18, 21, 23, 28, 31	Yes See Notes: 1, 15	Yes See Notes: 1, 17	No	No	No
OH-58D	Yes See Notes: 7, 8	Yes See Notes: 7, 9, 16, 25	Yes See Notes: 7, 11	No	No See Notes: 18, 21, 23, 28, 31	Yes See Notes: 7, 15	Yes See Notes: 7, 17	No	No	No
RAH-66	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24	TBD See Notes: 24
UC-35	Yes See Notes: 8	No	No	No	Yes See Notes: 13, 18, 23, 33	No	Yes See Notes: 17	No	No	No

NOTES

¹Refer to TM 55-1520-228-23 series and recovery kit operating manuals for specific aerial/ground recovery rigging procedures.

²Refer to TM 55-1520-234-23 series and recovery kit operating manuals for specific aerial/ground recovery rigging procedures.

³Refer to TM 55-1520-238-S for specific aerial/ground recovery rigging procedures.

⁴Refer to TM 1-1520-237-S for specific aerial/ground recovery rigging procedures.

⁵Refer to TM 55-1520-241-S for specific aerial/ground recovery rigging procedures.

⁶Refer to TM 55-1520-242-S for specific aerial/ground recovery rigging procedures.

⁷Refer to TM 55-1520-248-S for specific aerial/ground recovery rigging procedures.

⁸Refer to TM 55-1670-251-20&P, *Organizational Maintenance Manual (Including Repair Parts and Special Tools List) for Aerial Recovery Kit (ARK)*, 6 June 1975, with C4, dated 12 July 1989.

⁹Refer to TM, I-UMARK, *Interim Unit Maintenance Aerial Recovery Kit Operating Procedures*, Revision B, 30 January 1991.

¹⁰Refer to I-UMARK TM, for HERK, *Helicopter Recovery Kit Operating Procedures*.

¹¹Refer to TM, *Unit Maintenance Aerial Recovery (UMARK)*, Kaman Aerospace Corporation, 22 June 1995, revised 30 April 1996, for specific aerial/ground recovery rigging procedures.

¹²Refer to TB 1-1520-237-20-157, *Hoisting and Aerial Recovery of UH-60/EH-60 ESSS Fixed Provisioned Helicopters*, for specific aerial/ground recovery rigging procedures.

¹³Refer to Chapter 7, *Lifting and Shoring*, Cessna Aircraft Company, Model 560, Maintenance Manual, for specific aerial/ground recovery rigging procedures.

¹⁴Refer to C-23 Sherpa, Maintenance Manual, for specific aerial/ground recovery rigging procedures.

¹⁵When ground recovering an aircraft, the rotor head suspension method is the simplest means of loading the aircraft onto the recovery vehicle or to aerial recover to a designated area. If aircraft damage, configuration or limitations preclude use of the rotor head suspension method, then the aircraft is loaded using the belly band method.

¹⁶The I-UMARK, UMARK, and HERK are intended primarily to recover aircraft that have made a forced landing; are upright; and have no obvious damage to the rotor head, transmission, transmission mounts, or serious structural damage to tailboom assembly. If damage of this nature has occurred, aircraft will be recovered with the Aerial Recovery Kit (ARK).

¹⁷Fuselage damage may occur if the belly band method is used.

¹⁸After completion of the recovery, ensure that aircraft is firmly on the ground.

¹⁹On aircraft having the External Stores Support System (ESSS) installed, removal of the ESSS will be required to facilitate installation of the slings.

²⁰If hard points are damaged beyond their ability to support the weight of the helicopter, then the bellyband suspension can be used instead of the hard point method.

²¹Failure to place the collective in the full down position will result in damage to the blades.

²²When the main rotor system is being tied down, the web strap on the forward and aft blades must be crossed then tied down. All tie-down points are the same as those on the B540 main rotor system. If the blades are tied down so tight that there is a coning of them, damage will occur to them. The K747 rotor blades must remain straight and level.

²³Make certain that the cowlings, panels, and doors are secure before hookup.

²⁴Method and configuration for rigging a disabled RAH-66 Comanche helicopter for recovery will be published at a later date.

²⁵US Army flight tests have shown that the OH-58D aircraft may be recovered with the I-UMARK. In this configuration, the aircraft is lifted by the rotor hub with slings and spreader bar, which provides a load path around the mast turret assembly (MTA). The helicopter is flown with the main rotor blades attached and tied down during the aerial recovery. Except in emergency conditions, the mast mounted sight on the OH-58D requires removal.

²⁶US Army flight tests have shown that the UH-60 aircraft may be recovered with the I-UMARK. In this configuration, the aircraft is lifted by the rotor hub, with slings around each of the rotor head hub arms. The helicopter is flown, only in emergency situations, with the main rotor blades attached and tied down during the aerial recovery.

²⁷The position of the collective flight control and stabilizer may be left "as is" and need not be set in any special position for the I-UMARK or UMARK aerial recovery.

²⁸Post-recovery inspection criteria have not yet been developed. Therefore, the inspection criteria for blade strike and hard landing cited in the aviation unit and intermediate aircraft maintenance instructions; TM 55-1520-240-23, TM 55-1520-236-23, TM 55-1520-220-23, TM 55-1520-210-23, TM 1-1520-250-23, TM 1-1520-252-23, TM 55-1520-228-23, TM 55-1520-234-23, TM 1-1520-237-23, TM 1-1520-238-23, TM 55-1520-248-23 series for the OH-58A/C, AH-1, UH-60/EH-60, AH-64A/AH-64 Longbow, CH-47/MH-47, UH-1/EH-1 aircraft should be used to ascertain further airworthiness. A specific aircraft inspection may be required after using the rotor head suspension method. Check applicable maintenance manual, special inspection section. If any doubt exists, the rotor component should be replaced.

²⁹US Army flight tests have shown that the AH-64 aircraft may be recovered with the I-MARK. In this configuration (alternate), the aircraft is lifted by the rotor head mast nut with redundant slings. The helicopter is flown with the main rotor blades attached and tied down during the aerial recovery.

³⁰It is impossible to attach the AH-64 air vehicle recovery sling to the rotor hub with the air data sensor (ADS) in place. Removal of the ADS, if time permits, requires about 20 minutes. If time does not permit removal of the ADS, attachment of the air vehicle recovery sling will require physical bending of the ADS to install the air vehicle recovery sling to recover the AH-64 helicopter. In addition, the removal of the fire control radar (FCR) is required on the AH-64 Longbow. If the Extended Range Fuel System (ERFS) is installed, removal is required (if possible) because of the possibility of unusual flight characteristics.

³¹Exceeding the flight limits may severely damage the main rotor head and/or main rotor blades of the recovered aircraft and requires replacement of these components. Report the amount and duration of flight limits that were exceeded to the unit that owns the recovered aircraft.

³²Height of the load above the ground may be difficult to determine during low level ARK, I-UMARK, and UMARK operations because of the length of the recovery sling system. Pilots should exercise caution during recovery operations to ensure that the load remains clear of obstacles.

³³Except in emergency situations, the main rotor blades are to be removed from all UH- 60/EH-60, AH-64A and Longbow, and OH-58 helicopters before recovery.

³⁴Welded or unauthorized repair parts on the ARK, I-UMARK, UMARK, and HERK components are not acceptable. Only authorized replacement parts are acceptable.

³⁵US Army flight-tests have shown that the AH-1, UH-1, and OH-58A/C aircraft may be recovered with the I-UMARK. In this configuration, the rotor hub mast nut lifts the aircraft, with slings around each barrel of the rotor head. The helicopter is flown with the main rotor blades attached and tied down during the aerial recovery.

³⁶The spacer is not used on the AH-1, UH-1, and OH-58A/C aircraft recovery and should be placed in the I-UMARK shipping container until the aerial recovery is completed and the components are inventoried and secured for future use.

GROUND RECOVERY

5-12. Rigging aircraft for ground recovery is essentially the same as for aerial recovery. The aircraft is prepared for lifting onto the transport vehicle using components (bellybands, slings, etc.) either from the ARK, I-UMARK, UMARK, or HERK recovery kit. The only major difference is that the device used to actually perform the lift is a crane or similar piece of equipment instead of a helicopter. Any disassembly of the aircraft required because of road obstacles or size of the transport vehicle is performed using procedures outlined in the appropriate aircraft technical manual. Any devices (cradles, shipping skids, etc.) required for loading the aircraft onto the transport vehicle are prepared using procedures outlined in the appropriate aircraft shipping manual. The same basic safety procedures—disarming, disconnecting batteries, etc.—adhered to during aerial recovery are observed during ground recovery.

5-13. An aircraft may have severe crash damage. Major portions of the aircraft such as engine, transmission, and rotor system may be torn from the aircraft. If so, rigging procedures may require modification to suit the situation. The ground personnel determine the method used to lift the aircraft. The primary concerns in this situation are to minimize further damage to the aircraft and ensure the safety of the ground crew.

5-14. Nonflyable aircraft may be transported between maintenance facilities or moved because of relocation of the maintenance facility. When they are, the aircraft will be prepared and loaded for ground transport as specified in the applicable shipping manual. The procedures outlined in shipping manuals are designed for use when shipping flyable aircraft over extended distances. The same procedures are effective for moving aircraft that are intact but not flyable because of maintenance. Use of these procedures will minimize the possibility of damage to the aircraft occurring as a result of the movement. Sling loading is an option in this situation; however, the chances of damage occurring to the transported aircraft are much greater than with ground transport. The urgency of the situation and the availability of transportation assets determine the method of movement to be used.

Appendix A

Aircraft Recovery After Action Survey

A-1, The aerial recovery after action survey should contain the following information:

- Recovery unit, phone number, and e-mail address.
- Date.
- Type of aircraft recovered.
- Type of recovery equipment used.
- Condition of recovered aircraft.
- Conditions at recovery site (if combat conditions, so state).
- Recovery team composition (by number and military occupational specialty (MOS)).
- Method of recovery (bellyband or rotor head).
- Narrative of recovery (time required, failures, and shortcomings noted in equipment, remarks, recommendations).

A-2. Send the survey to—

**COMMANDER
US Army Aviation Center
ATTN: ATZQ-TDS-DD
Fort Rucker, AL 36362-5000**

E-Mail: ATZQ-TDS@Rucker.Army.Mil

Appendix B

Hand and Arm Signals

THIS APPENDIX IMPLEMENTS STANAG 3117 (Edition 5).

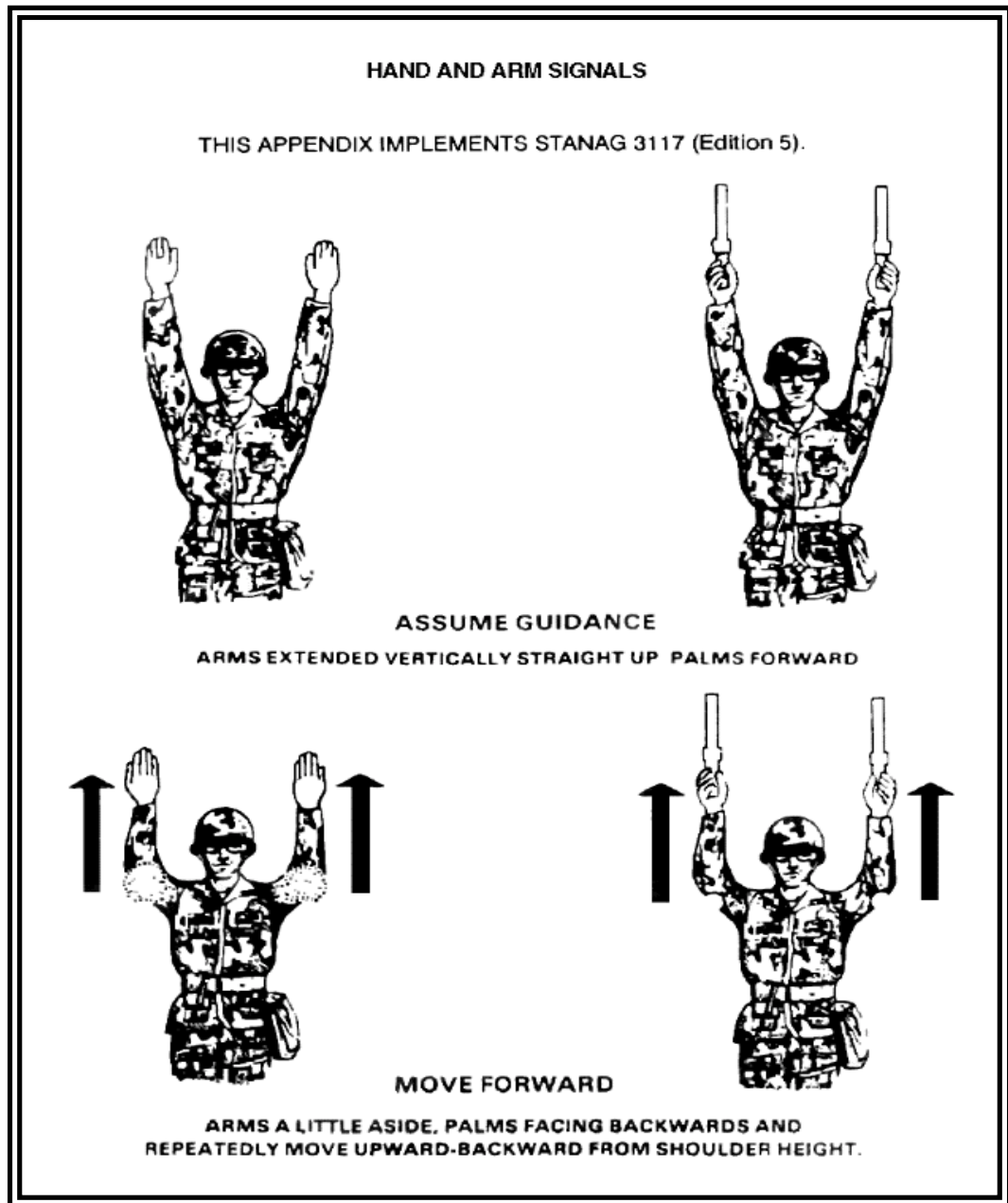


Figure B-1. Hand and Army Signals: Assume Guidance; Move Forward

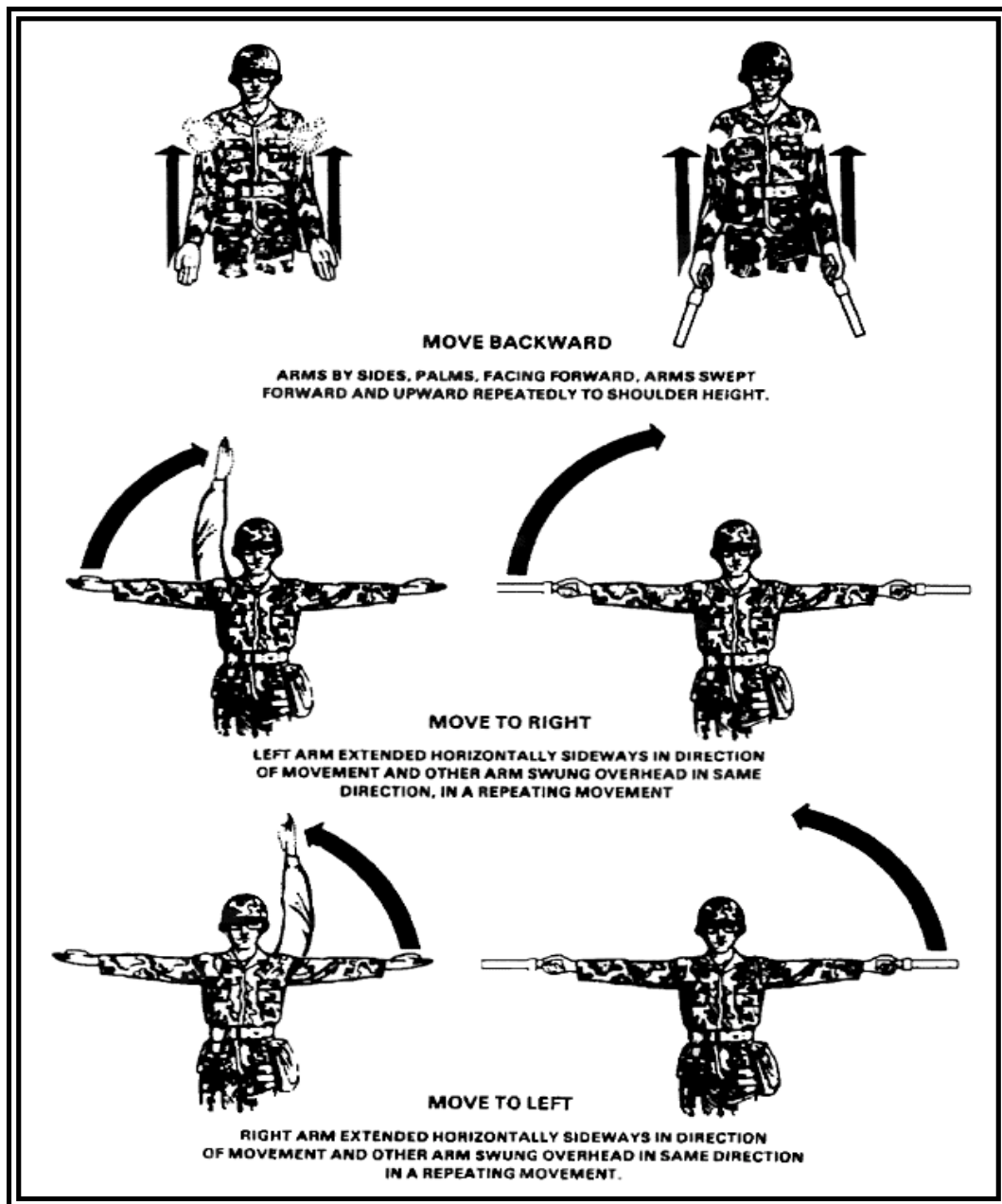


Figure B-2. Hand and Arm Signals: Move Backward; Move to Right; Move to Left

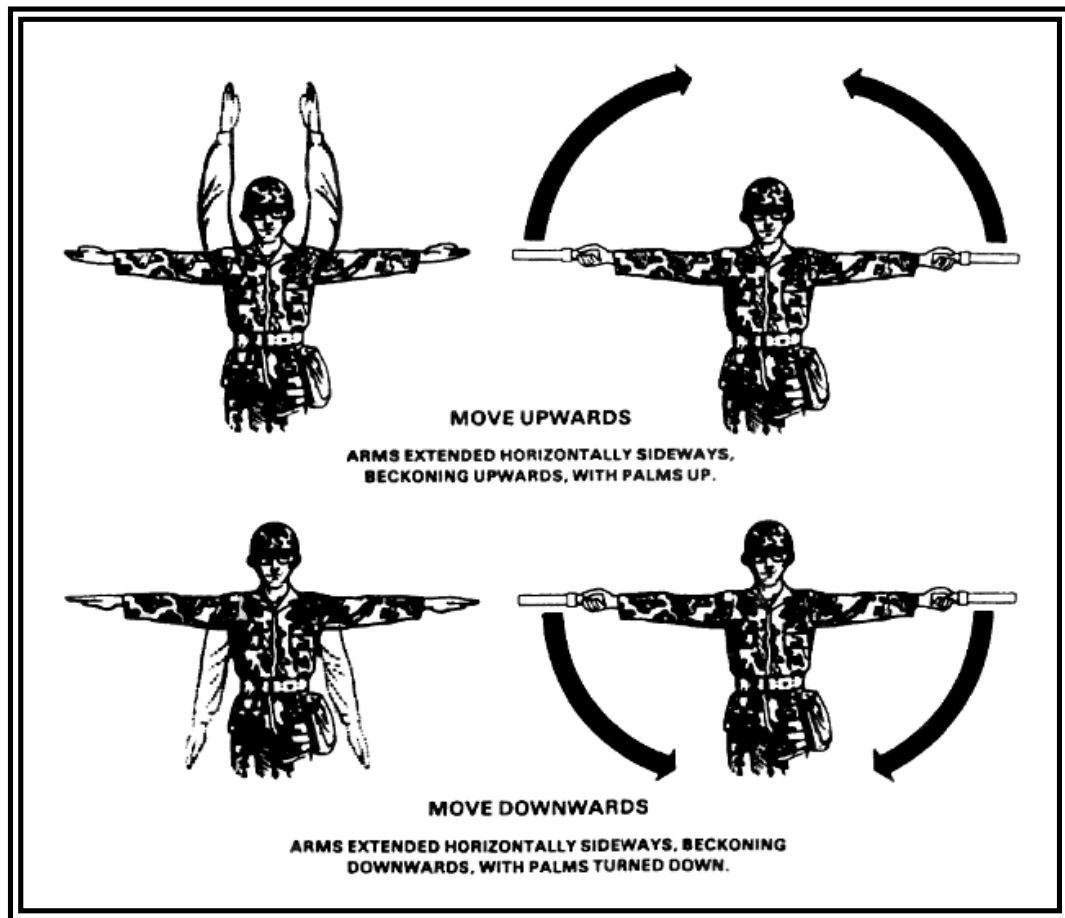


Figure B-3. Hand and Arm Signals: Move Upwards; Move Downwards

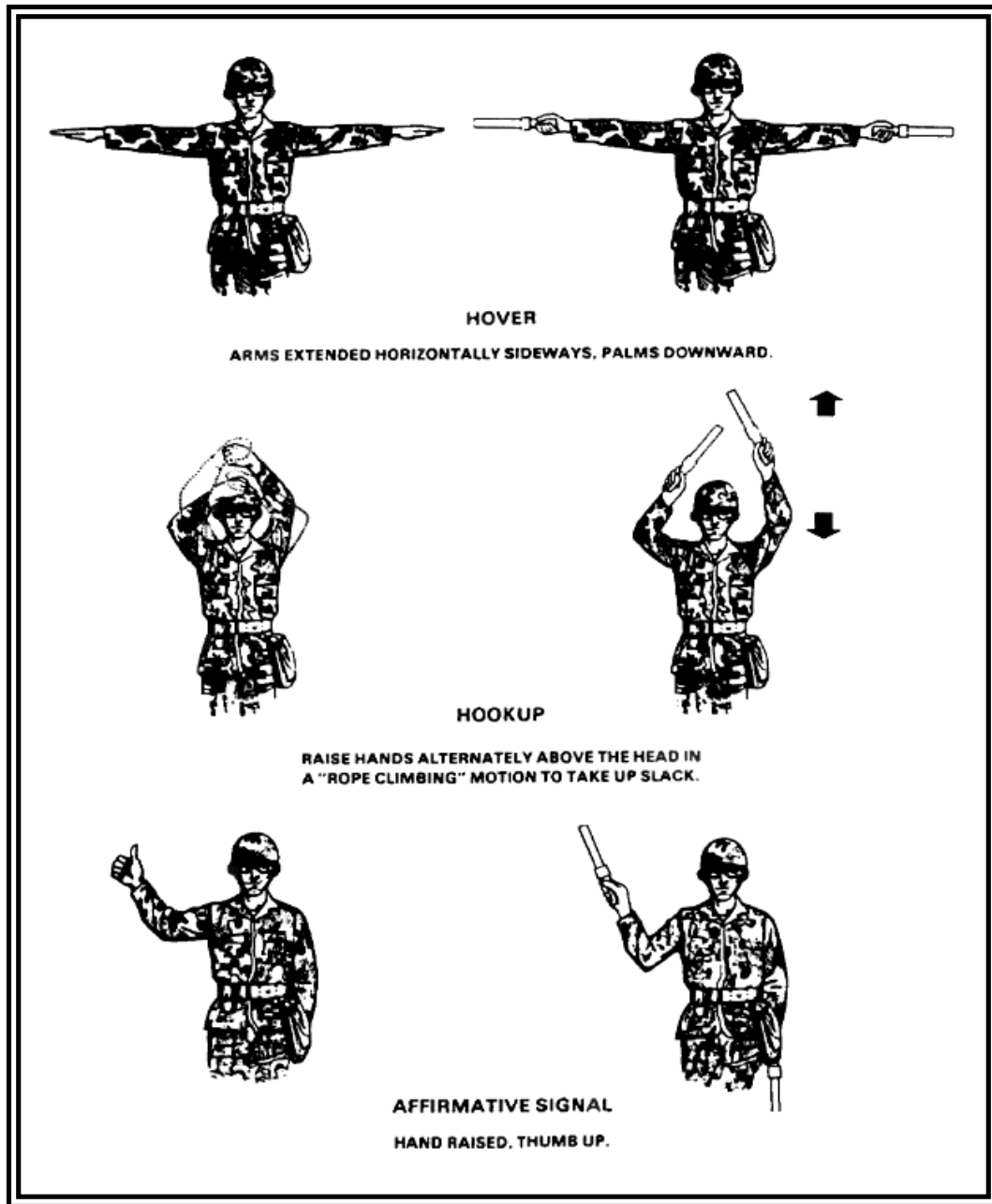


Figure B-4. Hand and Arm Signals: Hover; Hookup; Affirmative Signal

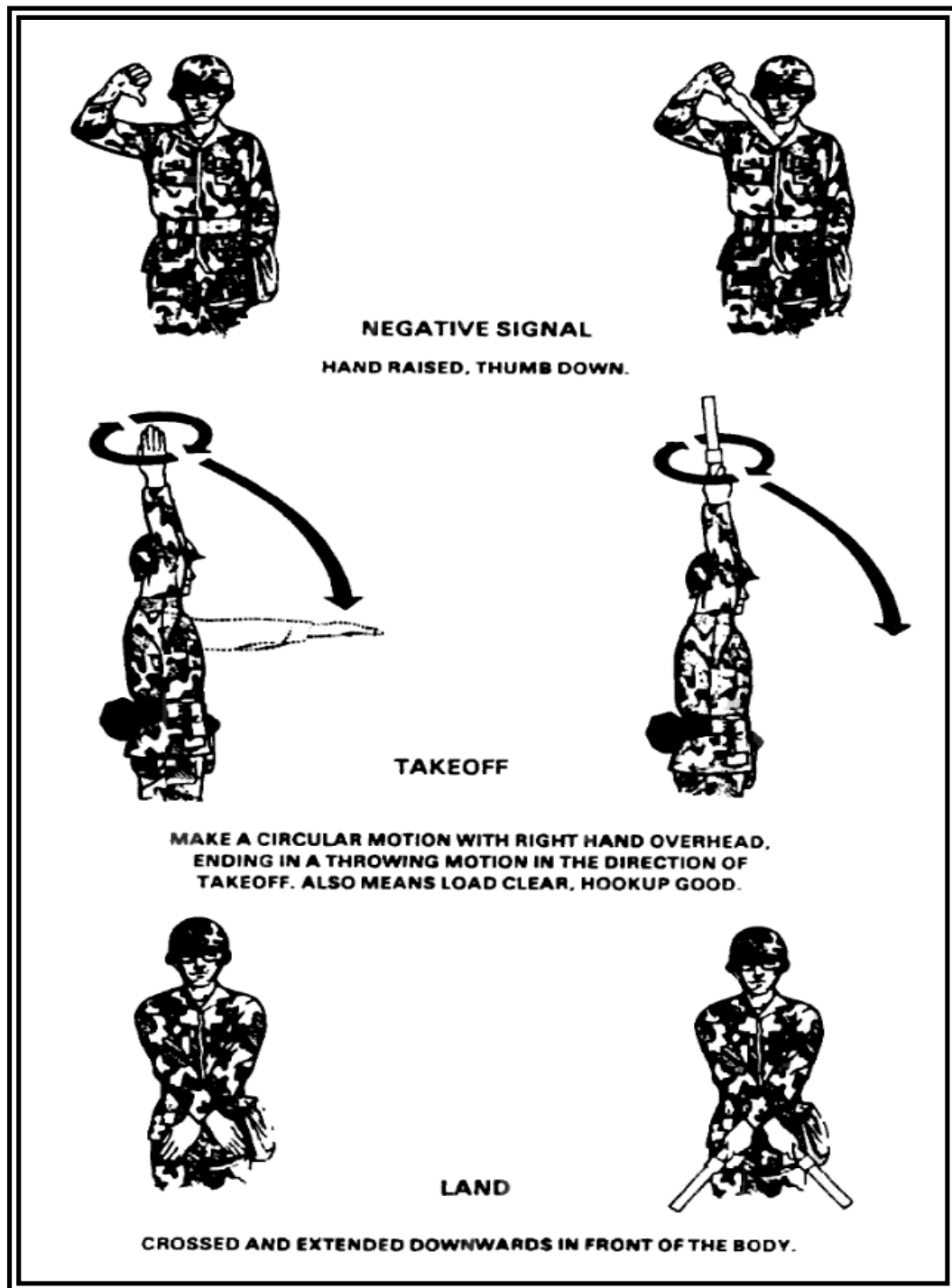


Figure B-5. Hand and Arm Signals: Negative Signal; Takeoff; Land

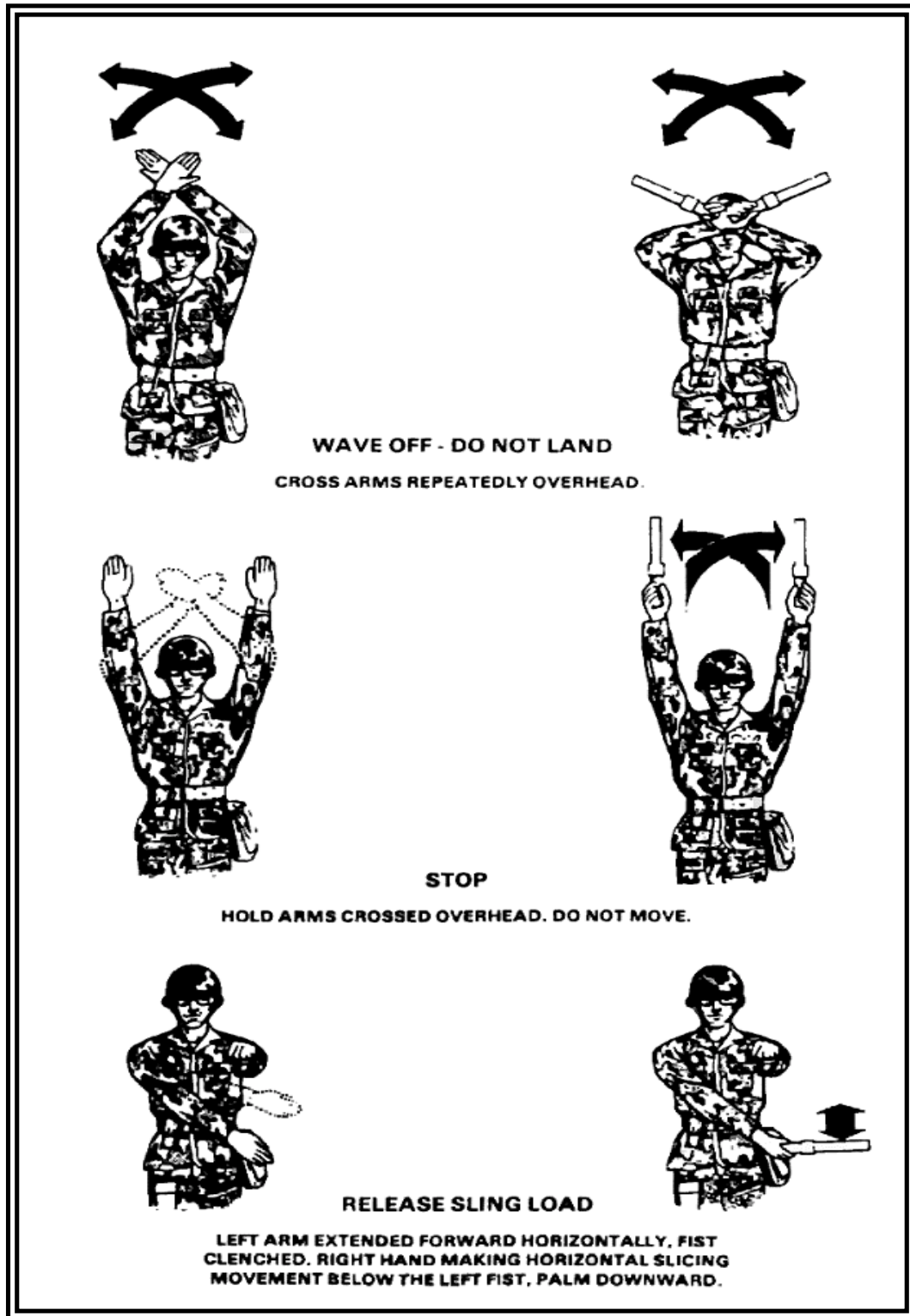


Figure B-6. Hand and Army Signals: Wave Off – Do Not Land; Stop; Release Sling Load

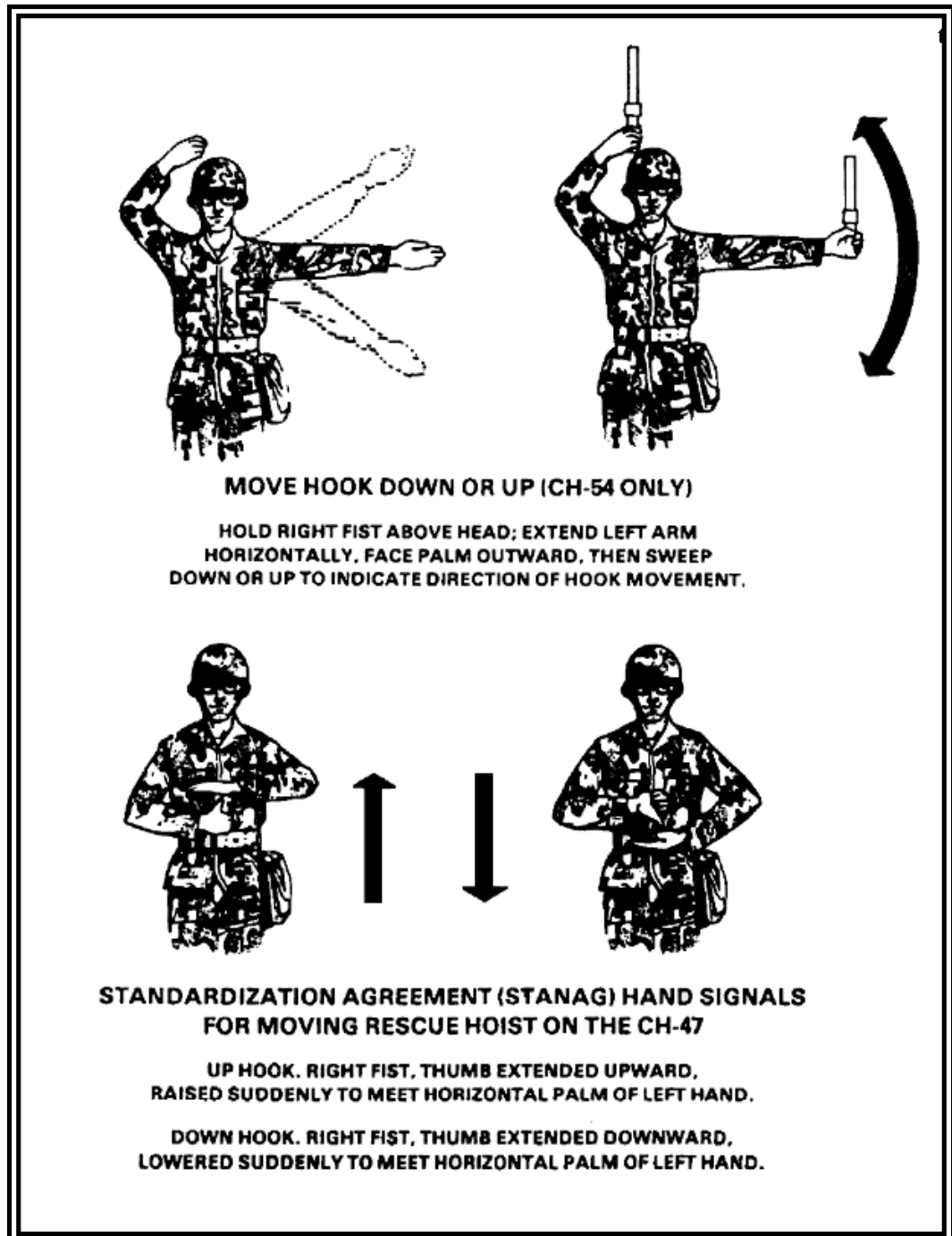







Figure B-7. Hand and Arm Signals: Move Hook Down or Up (CH-54 Only); Standardization Agreement (STANAG) Hand Signals for Moving Rescue Hoist on the CH-47

If a problem occurs on a load when the aircraft raises up and the slings tighten, follow these directions:



HOOKUP
(followed quickly by a negative signal)

MOVE DOWNWARD



HOVER
(while the ground crew corrects the load)

RELEASE SLING LOAD
(if necessary)

ONCE THE LOAD IS CORRECTED GO BACK TO NORMAL HOOKUP PROCEDURES

If the problem cannot be corrected by this method, give the pilot the release the load signal.

NOTE: Remember to always go back to HOVER between signals.

CORRECTING A LOAD

Figure B-8. Hand and Arm Signals: Correcting a Load

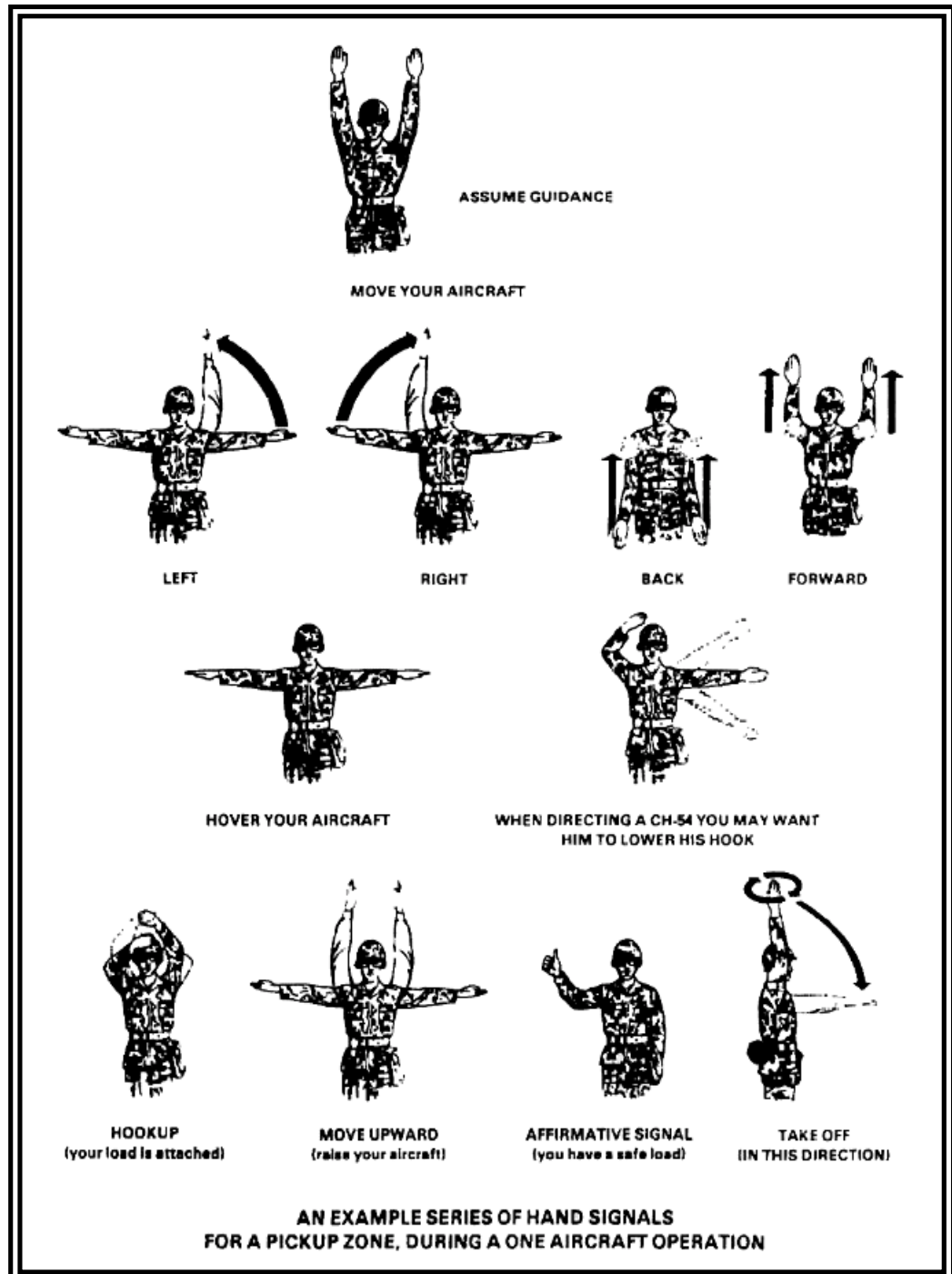


Figure B-9. Hand and Arm Signals: An Example Series of Hand Signals for a Pickup Zone, During a One-Aircraft Operation

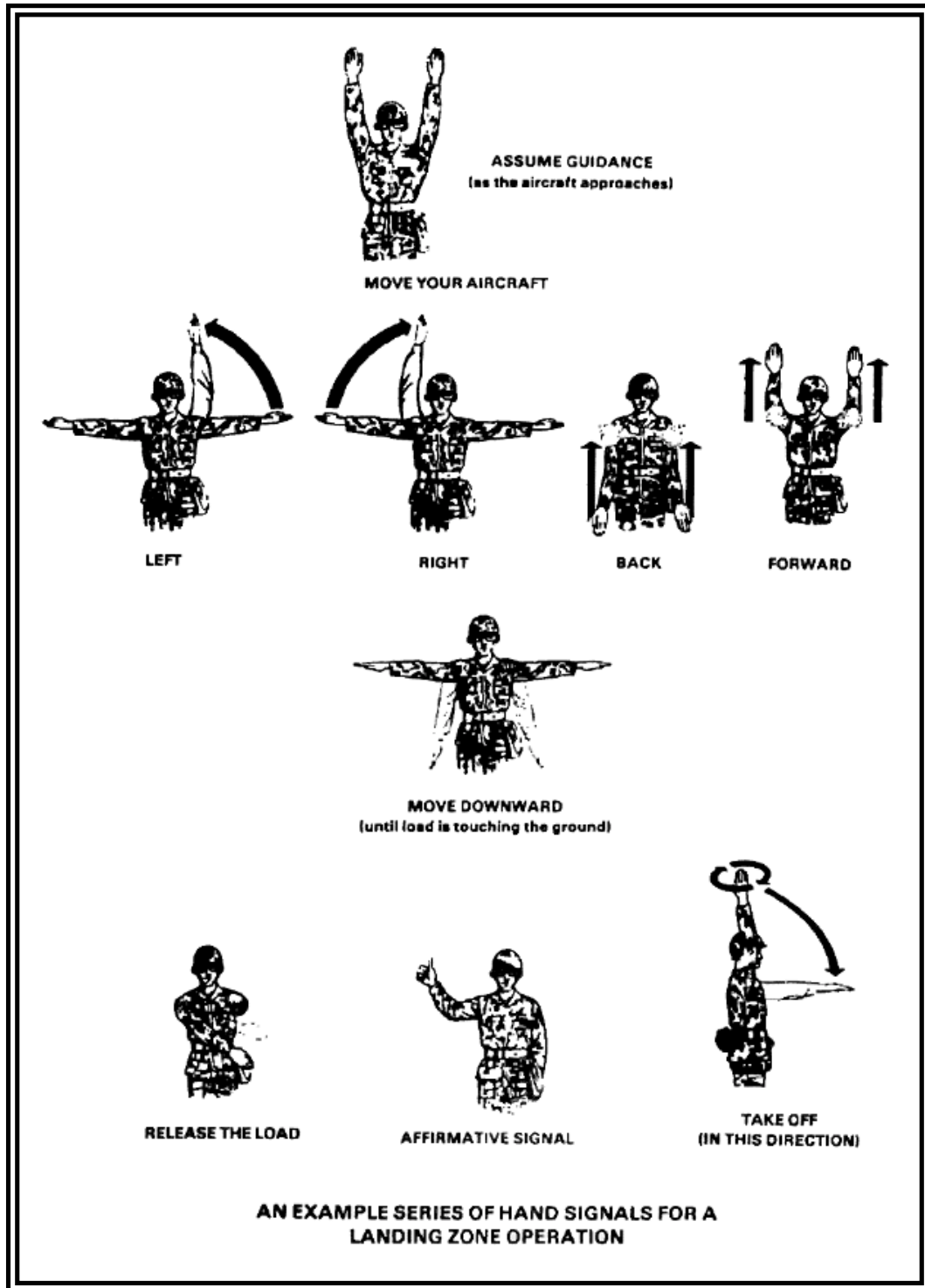


Figure B-10. Hand and Arm Signals: An Example Series of Hand Signals for a Landing Zone Operation

Appendix C

Sample SOP for Battlefield Aircraft Recovery and Evacuation

This appendix can assist in developing an AVUM or AVIM SOP. It provides a generic format and information on battlefield aircraft recovery and evacuation. Aircraft recovery is an operation that results from an aircraft being involved in a forced landing because of mechanical or battle damage. The aircraft also may have been disabled as the result of an accident or component/system malfunction. The operation includes an assessment, repair, and flyout if possible. It may include recovery by aerial or ground means to an appropriate maintenance facility for repair. The aircraft may eventually return to service, which is normally conducted by the AVUM. Maintenance evacuation is the physical act of moving a nonflyable aircraft from one maintenance location on the battlefield to another. Movement may be either by aerial or ground means. Evacuation is to effect repair, cross-level maintenance workloads, or relieve units of disabled aircraft during tactical moves. The AVIM normally conducts a maintenance evacuation.

Aircraft recovery and maintenance evacuation are closely related. In each case, the aircraft must be rigged for lift by helicopter or rigged for lift by a crane device and secured aboard a ground vehicle. Aircraft recovery, however, requires extensive coordination. It is usually time sensitive to the tactical situation. Evacuation, on the other hand, may not have the same urgency. It is usually coordinated between maintenance activities.

This appendix is only a guide. It can be modified for both an AVUM and AVIM organization. In actual practice, the procedures outlined might be modified or augmented based on unit composition. The modification would account for the size of the force; availability of aerial and ground assets; manpower; time and distance considerations; and, above all, the tactical situation.

BATTLEFIELD AIRCRAFT RECOVERY AND EVACUATION

1. References:

- a. FM 3-04.500 (1-500).
- b. FM 3-04.513 (1-513).
- c. TM 1-1520 series.
- d. TM 55-1520 series.
- e. Recovery kit manuals.

2. Purpose: To ensure required information is obtained to organize and execute—
 - a. An aircraft recovery at the AVUM level.
 - b. An aircraft recovery at the AVIM level.
 - c. An aircraft evacuation between the AVUM and AVIM level.
 - d. An aircraft evacuation between an AVIM and another AVIM organization
 - e. An aircraft evacuation between an AVIM and a depot organization.
3. General:
 - a. The owning unit has primary responsibility for aircraft recovery.
 - b. If the owning unit is unable to recover its own aircraft, aircraft recovery support will be requested from the AVIM company.
 - c. The owning unit of the downed aircraft has total responsibility for security of the site.
4. Responsibilities:
 - a. Aviation unit maintenance (AVUM).
 - (1) SOP.
 - (2) Team.
 - (3) Security.
 - (4) Fly away.
 - (5) Request
 - b. Aviation intermediate maintenance (AVIM).
 - (1) SOP
 - (2) Backup support.
 - (3) Team.
 - (4) Security.
 - (5) Fly away.
 - (6) Request.

c. Aviation maintenance officer (AMO).

- (1) Company/Troop level.
- (2) Battalion/Squadron level.
- (3) Brigade/Regiment level.
- (4) Division level.
- (5) Corps level.
- (6) Theater level.

5. Procedures:

a. AVUM:

(1) AVUM unit performing the aircraft recovery will obtain the following information:

(a) Site recovery officer.

- (1) Type and serial number of aircraft.
- (2) Location of aircraft (six-digit grid). Eight-digit grid preferable.
- (3) Air-to-air/ground frequency/call sign in effect.
- (4) Type of security in the area.
- (5) General condition of aircraft (crashed, precautionary landing, partially destroyed or intact).

(b) Complete a DA Form 2407 (Maintenance Request) for the aircraft recovery with the information listed below:

- (1) Type and serial number of aircraft.
- (2) Location of aircraft (six-digit grid). Eight-digit grid preferable.
- (3) Air-to-air/ground frequency/call sign in effect.
- (4) Type security in the area.
- (5) General condition of aircraft (crashed, precautionary landing, partially destroyed, or intact).
- (6) Location where the aircraft is to be delivered.

- (7) Release from brigade safety office or accident investigation board.
 - (c) Complete an aircraft recovery mission data sheet (see page C-19 for example).
 - (d) Turn in data sheet to the AVUM unit production control office.
- (2) AVUM units requesting aircraft recovery and evacuation support submit the following information to the AVIM production control officer:
- (a) Site recovery officer.
 - (1) Type and serial number of aircraft.
 - (2) Location of aircraft (six-digit grid). Eight-digit grid preferable.
 - (3) Air-to-air/ground frequency/call sign in effect.
 - (4) Type of security in the area.
 - (5) General condition of aircraft (crashed, precautionary landing, partially destroyed, or intact).
 - (b) Complete a DA Form 2407 (Maintenance Request) requesting aircraft recovery and/or evacuation.
 - (1) Type and serial number of aircraft.
 - (2) Location of aircraft (six-digit grid). Eight-digit grid preferable.
 - (3) Air-to-air/ground frequency/call sign in effect.
 - (4) Type security in the area.
 - (5) General condition of aircraft (crashed, precautionary landing, partially destroyed, or intact).
 - (6) Location where the aircraft is to be delivered.
 - (7) Release from brigade safety office or accident investigation board.
 - (c) Complete an aircraft recovery mission data sheet. (See page C-19 for example.)
 - (d) Turn in data sheet to the AVIM support unit production control office.

b. AVIM:

(1) AVIM production control officer will obtain the following information from the AVUM unit requesting support for either an aircraft recovery or evacuation.

(a) Site recovery officer.

(1) Type and serial number of aircraft.

(2) Location of aircraft (six-digit grid). Eight-digit grid preferable.

(3) Air-to-air/ground frequency/call sign in effect.

(4) Type of security in the area.

(5) General condition of aircraft (crashed, precautionary landing, partially destroyed, or intact).

(b) Complete DA Form 2407 requesting aircraft recovery.

(1) Type and serial number of aircraft.

(2) Location of aircraft (six-digit grid). Eight-digit grid preferable.

(3) Air-to-air/ground frequency/call sign in effect.

(4) Type security in the area.

(5) General condition of aircraft (crashed, precautionary landing, partially destroyed, or intact).

(6) Location where the aircraft is to be delivered.

(7) Release from brigade safety office or accident investigation board.

(c) Complete an aircraft recovery mission data sheet. (See page C-19 for example.)

(d) Develop a recovery team data sheet. (See page C-20 for example.)

6. Courses of action.

a. Abandon the aircraft. Personnel, aircraft, and equipment are highly vulnerable throughout the recovery phase because of threat or inaccessibility.

b. Destroy the aircraft. Aircraft cannot be recovered and is in danger of enemy capture.

c. Recover and evacuate the aircraft. Move the aircraft to an occupied and the secure area or the nearest maintenance facility, incurring as little damage as possible.

7. Reasons for abandonment of aircraft.
 - a. Crash area is inaccessible to aircraft or surface vehicles.
 - b. Damaged aircraft is not worth recovering because of crash or fire damage.
 - c. Combat situation will endanger the safety of the recovery crew.
 - d. Weather conditions.
8. Procedures for abandonment.
 - a. Remove all classified equipment and records.
 - b. Remove all weapons.
 - c. Remove all ammunition.
 - d. Remove communication equipment.
 - e. Remove all loose equipment (first aid kits, fire extinguisher, and toolbox).
 - f. Remove all unit property.
 - g. Mark aircraft for abandonment.
 - h. Remove manufacturer's data plate.
9. Destruction – Authority (SOP/OPORD) – selectively cannibalize; then destroy the aircraft.
 - a. Priorities of destruction.
 - (1) Priority must be given to destruction of classified equipment and associated documents.
 - (a) Identification, friend or foe (IFF) equipment.
 - (b) Classified electronics equipment – KY-58, KIT-1A/C, KY-75, KY-100, AN/ALQ-136, AN/ALQ-144, AN/APR-39, AN/AVR-2, and aircraft survivability equipment (ASE).
 - (c) Publications /Documents.
 - (2) When lack of time prevents complete destruction of equipment, priority should be given to the destruction of essential parts.
 - (a) Installed armament.
 - (b) Engine assembly.

- (c) Instruments, radios, and electronic equipment.
 - (d) Airframe/Flight controls.
 - (e) Electrical, fuel and hydraulic systems.
- b. Methods of destruction.
 - (1) Explosives.
 - (2) Fire.
 - (3) Mechanical means.
 - (4) Other means.
- 10. Safety:
 - a. The owning unit is responsible for obtaining a release from the brigade safety office or accident investigation board before recovery operations. If AVUM requests AVIM support, provide copy of the release to the AVIM production control officer.
 - b. Night recoveries will be made only in exceptional circumstances and then only with the approval of the commanding officer of the AVUM company, AVIM company, or higher headquarters.
- 11. Priority means of recovery – Recovery officer or battle damage and assessment repair (BDAR) assessor determines the method to be used:
 - a. Flyout method: Complete on-site repair or component change, thus, returning the downed aircraft to an operational status for a one-time flight.
 - b. Aerial/Ground recovery (based on METT-TC).
- 12. Recovery team – Downed aircraft recovery team (DART)/Augmentation of DART with BDAR personnel:
 - a. Qualified aircraft maintenance officer or maintenance test pilot.
 - b. Aircraft technical inspector – Performs the duties as the aircraft rigging inspector/certifier.
 - c. Trained aircraft mechanic/rigging crew.
 - d. Medical personnel (if available or needed, combat life saver).
 - e. Security force.
- 13. Organization – the size and composition of the recovery team will depend on:

- a. Type and condition of disabled aircraft.
 - b. Method of recovery.
 - c. Accessibility.
14. Three-phase training period.
- a. Individual.
 - b. Group.
 - c. Team.
15. Receive training on team equipment:
- a. Type equipment.
 - b. General equipment.
 - c. Environment.
16. Considerations.
- a. Location of downed aircraft.
 - b. Assessment of damage to aircraft.
 - c. Tactical situation and proximity of the threat.
 - d. Time available (planning time for AVUM, preparation and rigging: 30 to 60 minutes, which may vary based on METT-TC).
 - e. Aerial versus surface recovery.
 - f. Weather.
 - g. Assets available.
 - h. Fighter management.
17. Courses of action:
- a. To make combat repairs, defer further maintenance, or return aircraft to service.
 - b. Make repairs for one-time evacuation and fly the aircraft to an appropriate maintenance area or safe/secure area.
 - c. Recover the aircraft by surface means.

- d. Recover the aircraft by aerial means.
 - e. Selectively cannibalize, destroy, or abandon the aircraft according to pertinent SOP, Army regulations, field manuals, technical manuals, and other governing regulations.
18. Upon arrival at the site of a disabled aircraft:
- a. Eliminate fire hazards.
 - b. Remove occupants (based upon guidance by qualified medical personnel).
 - c. Remove classified items and equipment records.
 - d. Disconnect batteries.
 - e. Remove weapons.
 - f. Remove ammunition.
 - g. Drain fuel, as required.
19. One-time evacuation method – The pilot should be proficient in all emergency procedures for that particular aircraft.
- a. Advantages.
 - (1) Quick.
 - (2) Economical.
 - (3) Further damage to aircraft is minimized.
 - b. Disadvantages:
 - (1) Requirement for a clear takeoff path.
 - (2) Possibility of unseen damage caused during the crash.
 - (3) Requirement for special tools and equipment.
 - (4) Effects of weather conditions.
20. Aerial recovery/sling load:
- a. Advantages of aerial recovery.
 - (1) Less disassembly is required than for surface transportation.

(2) Accessibility of the disabled aircraft.

(3) Faster than surface.

b. Disadvantages of aerial recovery.

(1) Possibility of dropping the disabled aircraft and inflicting further damage.

(2) Effects of the rotor downwash on the sling load.

(3) Possibility of damage to the recovery helicopter because of improper rigging or equipment malfunction.

(4) Availability of recovery kits and lift assets.

21. Surface recovery – Precautions and special considerations: Air defense, minefields, likely enemy avenues of approach, perimeter defense, and convoy escort:

a. Advantages.

(1) A takeoff path is not required.

(2) The chance of total loss because of further damage to aircraft is reduced.

b. Disadvantages:

(1) Often causes damage to aircraft.

(2) Is slower than aerial recovery or flyout.

(3) Requires more disassembly.

(4) Requires accessible ground routes.

(5) Requires a more thorough reconnaissance of the route.

(6) May require increased security of the route.

(7) Requires mobile assets.

(8) Requires crane or lifting device.

22. Recovery preparations – To be performed at the site of the disabled aircraft, including making the recovery area accessible, using communications correctly, and making the aircraft secure, safe, and ready for recovery or flyout.

a. Accident investigation (do not recover until aircraft is released).

b. Pickup site (police area).

- c. Communications (ground, air team, aviation operations (AO) commander (Cdr)).
 - d. Signaller (needs to be standardized).
 - e. Aircraft battery.
 - f. Removal and salvage of equipment – loose equipment /troops seats, litters, radios, and other basic components to reduce weight or shift center of gravity (CG). Classified equipment should be retrieved if possible.
 - g. Fuel drainage/ventilation.
 - h. BDAR kits.
 - i. Technical manuals.
 - j. Expendable materials (rags, safety wire, tape, fuel and oil sample bottles, and tubes).
 - k. Spill response kit.
 - l. General mechanics tools box.
 - m. Special tools.
 - n. Technical inspector's (TI's) kit.
 - o. Parts – identify specific repair parts needed.
 - p. Ground guides.
23. Equipment.
- a. Individual weapon with basic load.
 - b. Crew served weapon with basic load.
 - c. Nuclear, biological, and chemical (NBC) survey/decon equipment.
 - d. Communication equipment – ground, air, and AO Cdr.
 - e. Signal operating instructions (SOI).
 - f. Tactical maps with appropriate overlays and compass.
 - g. PGPS, SLUGGR/SAGGR.
 - h. Rations/water.

- i. Pyrotechnics/signals.
 - j. Vehicles.
24. Aerial Recovery.
- a. Load description (type aircraft).
 - (1) Weights.
 - (a) Empty.
 - (b) Combat.
 - (c) Unarmed/armed.
 - b. Dimensions.
 - (1) Length.
 - (2) Height.
 - (3) Blades – on/folded/removed.
 - c. Type lift aircraft.
 - (1) Weights.
 - (a) Empty.
 - (b) Combat.
 - (c) Unarmed/armed.
 - d. Required material from recovery kit.
 - (1) Aerial Recovery Kit (ARK) – Technical manual.
 - (2) Interim-Unit Maintenance Aerial Recovery Kit (I-UMARK) – Operator's manual.
 - (3) Helicopter Recovery Kit (HERK) – Shipping manuals.
 - (4) Unit Maintenance Aerial Recovery Kit (UMARK) – Operator's manual.
 - e. Other required materials.
 - (1) Tape.
 - (2) Tools.

- (3) Radio.
 - (4) Axes.
 - (5) Sandbags – ballast.
 - (6) Flashlights.
 - (7) Applicable technical manuals for aircraft or component disassembly.
- f. Aircraft preparation – to be performed at the site of the disable aircraft.
- (1) Disconnect battery.
 - (2) Disarm and unload weapons.
 - (3) Main rotor blades – remove or fold in stowed position.
 - (4) Secure tail rotor blades.
 - (5) Remove any critical components that may be damaged during recovery.
 - (6) Drain fuel.
- g. Rigging – Breakaway technique.
- (1) Bellyband suspension method.
 - (2) Rotor head suspension method.
 - (3) Hard point attachment sling.
 - (4) Attitude-controlled, rotor head suspension.
 - (5) Attitude-controlled, tandem hook, rotor head suspension.
- h. Hookup
- (1) Ground crew protective equipment.
 - (a) Identification (ID) tags.
 - (b) Goggles.
 - (c) Earplugs.
 - (d) Shockproof gloves.
 - (e) Survival knife.

- (f) Helmet.
- (g) Static discharge wand.
- (h) Flashlight with wand.
- (i) Gloves (leather, working).
- (j) Smoke grenade.

(2) Ground crew function.

- (a) Prepare aircraft.
- (b) Approach guidance.
- (c) Signal.
- (d) Static discharge.
- (e) Hookup.
- (f) Rendezvous point.
- (g) Extended sling system operations.

i. Liftoff.

- (1) Flight parameters (As specified in TM and recovery aircraft - 10).
 - (a) Max speed – optimum speed.
 - (b) Max angle of bank.
 - (c) Rate of climb and descent.

j. After use inspection and packing.

- (1) Cleaning of equipment.
- (2) Repacking of drogue chute.
- (3) Removal of flashlight and radio batteries.
- (4) Replacement of equipment.

k. Prepare aerial recovery after action report (AAR):

- (1) Recovery unit and phone number.

- (2) Date.
- (3) Type of aircraft recovered.
- (4) Condition of recovered aircraft.
- (5) Conditions at recovery site (if combat conditions, so state).
- (6) Recovery team composition (by number and MOS)
- (7) Method of recovery (bellyband; rotor head; hard point attachment; attitude-controlled, rotor head suspension; or attitude-controlled, tandem hook, rotor head suspension).
- (8) Narrative of recovery (time required, failures, and shortcomings noted in equipment, remarks, recommendations).
- (9) Send to—

**COMMANDER
US Army Aviation Center
ATTN: ATZQ-TDS-DD
Fort Rucker, Alabama 36362-5000**

25. Surface recovery.

a. Load description.

- (1) Weights.
 - (a) Empty.
 - (b) Combat.
 - (c) Unarmed/armed.

b. Dimensions.

- (1) Length.
- (2) Height.
- (3) Blades – on/folded/removed

c. Required material from recovery kit.

- (1) Aerial Recovery Kit (ARK) – Technical manual.

- (2) Interim-Unit Maintenance Aerial Recovery Kit (I-UMARK) – Operator’s manual.
- (3) Helicopter Recovery Kit (HERK) – Shipping manuals.
- (4) Unit Maintenance Aerial Recovery Kit (UMARK) – Operator’s manual.
- d. Support equipment.
 - (1) Crane.
 - (2) Flatbed trailer.
 - (3) Tractor.
- e. Other required materials.
 - (1) Tape.
 - (2) Tools.
 - (3) Radio.
 - (4) Axes.
 - (5) Sandbags – ballast.
 - (6) Flashlights.
 - (7) Applicable technical manuals for aircraft or component disassembly.
- f. Aircraft preparation – to be performed at the site of the disable aircraft.
 - (1) Disconnect battery.
 - (2) Disarm and unload weapons.
 - (3) Main rotor blades – remove or position longitudinal.
 - (4) Secure tail rotor blades.
 - (5) Remove any critical components that may be damaged during recovery.
 - (6) Drain fuel.
- g. Rigging – Breakaway technique.
 - (1) Bellyband suspension method.
 - (2) Rotor head suspension method.

(3) Hard point attachment sling.

h. Hookup

(1) Ground crew protective equipment.

(a) ID tags.

(b) Goggles.

(c) Earplugs.

(d) Gloves.

(e) Survival knife.

(f) Helmet.

(h) Flashlight with wand.

i. After use inspection and packing.

(1) Cleaning of equipment.

(2) Removal of flashlight and radio batteries.

(3) Replacement of equipment.

j. Prepare surface recovery after action report (AAR):

(1) Recovery unit and phone number.

(2) Date.

(3) Type of aircraft recovered.

(4) Condition of recovered aircraft.

(5) Conditions at recovery site (if combat conditions, so state).

(6) Recovery team composition (by number and MOS)

(7) Method of recovery – Surface or aerial (bellyband; rotor head; hard point attachment; attitude-controlled, rotor head suspension; or attitude-controlled, tandem hook, rotor head suspension).

(8) Narrative of recovery (time required, failures, and shortcomings noted in equipment, remarks, recommendations).

(9) Send to—

**COMMANDER
US Army Aviation Center
ATTN: ATZQ-TDS-DD
Fort Rucker, Alabama 36362-5000**

AIRCRAFT RECOVERY MISSION DATA SHEET

1. PERSON CALLING _____
2. TYPE ACFT _____
3. ACFT TAIL NUMBER _____
4. LOCATION _____
5. TIME _____
6. EXTENT OF DAMAGE _____

7. PARTS REQUIRED, NSN, QTY _____

8. TYPE RECOVERY KIT REQUIRED _____
9. MAINTENANCE TEST PILOT REQUIRED _____
10. ENEMY ACTIVITY _____
11. AREA SECURED BY _____
12. CREW MEMBERS REMOVED _____
13. AMMUNITION ABOARD _____
14. NBC STATUS _____
15. CLASSIFIED DOC/SECURE EQUIPMENT _____
16. DISPOSITION OF ACFT RECORDS _____
17. SPECIAL INSTRUCTIONS _____

18. POC AT SITE AND CALLSIGN/FREQ _____
19. UNIT POC AND CALL SIGN/FREQ _____

Figure C-1.

RECOVERY TEAM DATA

RECOVERY TEAM LEADER _____
METHOD OF RECOVERY _____
TRANSPORTATION TO ACFT SITE _____
DEPARTURE TIME _____
EXTERNAL EQUIPMENT SUPPORT REQUIRED _____

POC AT SITE AND CALL SIGN/FREQ _____

POC IN REAR AREA AND CALL SIGN/FREQ _____

FINAL BRIEF TIME _____
SPECIAL INSTRUCTIONS _____

DELIVER ACFT TO _____

METHOD OF RECOVERY (IN ORDER OF PRECEDENCE)

1. ON-TIME FLIGHT
2. REPAIR FOR ONE-TIME FLIGHT
3. SLING LOAD
4. GROUND RECOVERY
5. RECOVER AT LATER TIME

Figure C-2.

Appendix D

Risk Management/Risk Assessment

Tough, realistic training conducted to standard is the cornerstone of Army warfighting skills. An intense training environment stresses both soldiers and equipment, creating a high potential for accidents. The potential for an accident increases as training realism increases, just as it does in combat. The end result is the same; the soldier or asset is lost. Commanders must find ways to protect individuals, crews, teams, and equipment from accidents during training and combat. How well they do this could be the decisive factor in winning or losing. Risk management is a commonsense tool that leaders can use to make smart risk decisions in tactical and everyday operations. It is a method of getting the job done by identifying the areas that present the highest risk and taking action to eliminate, reduce, or control the risk. It is not complex, technical, or difficult. It is a comparatively simple decision making process, a way of thinking through a mission to balance mission demands against risks.

COMMAND RESPONSIBILITIES

D-1. Commanders are responsible for effectively managing risk. They must—

- Willingly determine the proper balance that will achieve optimum performance from their command.
- Select the best risk-reduction options from those that the staff provides.
- Accept or reject residual risk, based on perceived benefits.
- Recommend appropriate control measures.
- Train and motivate leaders at all levels to effectively use risk management concepts.
- Ensure that risk controls are integrated into plans and orders.
- Ensure that unnecessary safety restrictions are eliminated to maximize training and combat effectiveness.
- Maintain a total commitment to mission accomplishment and the welfare of subordinates.
- Use the risk management process to identify, assess, and control hazards for their mission.
- Report risks beyond their control or authority to their superiors for resolution.

INDIVIDUAL RESPONSIBILITIES

D-2. Each individual soldier must—

- Understand, accept, and implement risk reduction guidance and the concept of risk management and assessment.
- Maintain a constant awareness of the changing risks associated with the operation.
- Make leaders immediately aware of any unrealistic risk reduction procedure.
- Report risks beyond their control or authority to their superiors for resolution.

FIVE-STEP RISK MANAGEMENT PROCESS

D-3. Step 1. Identify Hazards.

- Identify the major events that are expected to occur during the operation and the hazards associated with all specified and implied tasks. The staff reviews and expands, as appropriate, the list of hazards and major events during the training or combat scenario. This procedure helps to ensure that all significant hazards have been identified, and the staff can determine the appropriate force protection measures.

D-4. Step 2. Assess Hazards.

- Assess hazards based on their probability of occurrence and severity of effect. Based on this assessment, the staff can—
 - Determine the level of risk associated with a given hazard.
 - Decide where or when control measures are appropriate to protect the force.
- Use the risk assessment matrix alone or with other techniques. Risk assessment matrices provide a simple analysis method of subdividing an operation into its major operational events. In this way areas may be discovered where the staff might eliminate or reduce risk. Each unit should develop its own risk assessment matrix with applicable major operational events similar to the one shown in TC 1-210. The matrix is nearly always more effective than intuitive methods in identifying the extent of risk. When using a risk assessment matrix, the risk assessor must—
 - Review each situation to ensure he has evaluated all significant areas of concern, even if the matrix does not include them.
 - Use the matrix to analyze risk and target areas of concern for risk reducing techniques.
 - Review individual areas of concern before recommending options.
- Use the mission, enemy, troops, terrain – time available, civilian considerations (METT-TC) format as another technique in the risk assessment procedure. Leaders can subjectively decide the likelihood

and extent of accidental loss based on this type of analysis. When using the METT-TC format, the risk assessor must—

- Determine the mission's complexity and difficulty.
- Assess the enemy situation and identify specific hazards.
- Consider all aspects of the terrain as well as weather and ability.
- Determine the supervision required and evaluate the experience, training, morale, and endurance of units and their equipment.
- Determine the time available for planning and executing the mission.

D-5. Step 3. Develop Controls.

- Develop control measures that reduce the risk to the mission. The staff must—
 - Identify hazards and assess risk.
 - Focus on critical events first.
 - Eliminate unnecessary risks.
 - Reduce the level of mission essential and prudent risks by applying controls.
 - Develop control options that synchronize the operation to eliminate or reduce risks.
 - Recommend options for the commander's decision. Check for residual effects before suggesting options. Visualize what will happen once the option has been implemented. Sometimes reducing one risk will only introduce other risks.
- Leaders can detect and analyze safety restrictions that impede the realism or effectiveness of training. With proper controls in place, these restrictions can be reduced or eliminated. Sensible consideration and consultation with the unit's most experienced personnel are the key.

D-6. Step 4. Implement Controls.

- Adopt, implement, and integrate specific controls into plans, operations orders (OPORDs), standing operating procedures (SOPs), and rehearsals. Knowledge of controls, from the commander down to the individual soldier, is essential to successfully implement and execute controls.

D-7. Step 5. Supervise.

- The commander must enforce controls. Leaders must verify, monitor, follow-up, and appropriately correct or modify those controls that the commander imposes on his subordinates.
- When monitoring operational activities, leaders must—
 - Avoid administrative intrusions on their subordinates' time.

-
- Go where the risks are and spend time at the heart of the action.
 - Analyze and think through issues, not just observe.
 - Work with key personnel to improve operational procedures after the action. Leaders must not hesitate to assess imminent danger issues on the spot.
 - Fix systemic problems that are hindering combat effectiveness.
 - Retain and disseminate lessons learned from mishaps, near misses, etc., to affect present and future operations.
- Leaders must also balance the cost of risks with the value of the desired outcome. They must consider and manage risks in making such decisions using three general rules—
 - Never accept an unnecessary risk. The leader who has the authority to accept or reject a risk is responsible for protecting his soldiers from unnecessary risks. If he can eliminate or reduce a risk and still accomplish the mission, the risk is unnecessary.
 - Make risk decisions at the appropriate level. The leader who must answer for an accident is the person who should make the decision to accept or reject the risk. In most cases, he will be a senior officer, but small-unit commanders and first-line leaders might also have to make risk decisions during combat. Therefore, they should learn to make risk decisions during training.
 - Ensure that the benefits of a prudent risk outweigh the possible cost of the risk. Leaders must understand the possible risk and have a clear picture of the benefits to be gained from taking that risk.

Appendix E

Environmental Issues

This appendix discusses the Army's environmental programs. It provides references for environmental issues, and regulations and publications governing environmental protection. Compliance with environmental regulations is a command responsibility. Education and planning are key to the successful completion of environmental missions.

AWARENESS AND COMPLIANCE

ENVIRONMENTAL PROGRAM REFERENCES

E-1. FM 3-100.4, AR 200-1, AR 200-2, AR 200-3, and AR 385-63 explain the Army's environmental programs. These regulations reference additional documents that should be reviewed. TC-5-400 provides a comprehensive listing of all items of interest in the preparation for operating near and avoiding environmentally sensitive areas. Other good references (graphic training aids) for environmental issues are:

- GTA 5-8-2, *Environmental Risk Assessment*.
- GTA 5-8-3, *Hazardous-Material-Spill Procedures*.
- GTA 5-8-4, *The Soldier and the Environment*.

ARMY ENVIRONMENTAL COMPLIANCE ASSESSMENT SYSTEM

E-2. Compliance with environmental regulations is a command responsibility. All maintenance units must be aware of the regulations and publications governing environmental protection. All aviation maintenance units handle hazardous waste (HW) and hazardous materials (HM). Each maintenance unit, company and above, must designate, in writing, a hazardous waste coordinator.

E-3. The units must comply with the Environmental Compliance Achievement Program (ECAP) protocol and will be periodically inspected. The units can attain the ECAP protocols from Department of Public Works, Education Division (DPW, ED) or by calling the Army Environmental Hotline at 1-800-USA-3845.

E-4. Environmental awareness training should ensure all personnel know to report any notice of tax, penalty, fee, fine, sanction, or other compliance order arising from local, state, or federal environmental requirements or

enforcement activities or alleged violation of any local, state, or federal environmental law or regulation, either to—

- Commander.
- DPW, ED.
- Environmental Law Attorney, Office of the Staff Judge Advocate (OSJA).

ENVIRONMENTAL COMPLIANCE OFFICER/NCO

E-5. The hazardous waste coordinator also may serve as the Environmental Compliance Officer/NCO within the unit or organization. This person is the unit point contact (POC) and is responsible for environmental education, SOP updates, preparation of environmental risk assessments, incident reporting, etc. Commanders, along with the hazardous waste coordinator and the Environmental Compliance Officer/NCO, must—

- Ensure all unit personnel have had, or are scheduled to receive, environmental awareness training.
- Designate, in writing, an environmental compliance officer/HW coordinator and ensure they are properly trained and qualified.
- Ensure the unit environmental compliance officer interfaces with appropriate environmental personnel and unit is in compliance with environmental laws and regulations.
- Meet with battalion S3, S4, and installation personnel who deal with environmental issues.
- Identify requirements concerning ECAP inspections that may affect the unit and how to avoid or protect environmentally sensitive areas.
- Ensure the unit SOP addresses environmental issues/procedures and coordinate environmental requirements with appropriate installation/chain of command personnel.

PLANNING

E-6. Advanced preparation is key to successful completion of missions and for environmental awareness and protection. Environmental awareness can be incorporated into the unit training program with minimal additional planning.

E-7. Hazardous waste topics can be reviewed by contacting DPW, ED, and Natural Resources Branch (NRB); Staff Judge Advocate (SJA); and/or Directorate of Plans, Training, Mobilization, and Security (DPTMSEC), Range Control. In most cases, ED and NRB are located under DPW.

E-8. Hazardous materials topics fall under the purview of the Directorate of Logistics (DOL), Hazardous Material (HAZMAT) Control Center. Noise pollution and range control topics can be reviewed by contacting DPTMSEC, Range Division.

E-9. A general POC matrix to assist personnel with environmental concerns follows:

<u>TOPIC</u>	<u>POC</u>
Air pollution	Directorate of Public Works (DPW), Environmental Division (ED)
Archeological and historic sites	ED and Natural Resources Branch (NRB)
Clean and safe water	ED
Legal considerations	Environmental Law Attorney, OSJA
Hazardous materials	Directorate of Logistics (DOL), Hazardous Material (HAZMAT) Control Center; Defense Reutilization and Marketing Office (DRMO)
Hazardous waste	ED
Noise pollution	ED, Range Control (Directorate of Plans, Training, Mobilization, and Security (DPTMSEC)
Range clearances and restrictions	Range Control (DPTMSEC)
Standing operating procedures	ED
Spill reporting	ED
Threatened/endangered species	NRB
Water pollution	ED
Wetland protection	NRB, Range Control
Wildlife management	NRB, Range Control

E-10. When overseas, refer to the US agencies providing liaison with the equivalent of the above listed POCs. If there is no host nation equivalent, all

training and maintenance will be conducted under US policies and requirements. Units should coordinate with these organizations to provide a briefing before deployments.

UNIT LEVEL ENVIRONMENTAL PROGRAMS

E-11. There may be several types of environmental programs at the unit level. Refer to TC 5-400 for more information.

- HM Programs.
- HW Programs.
- Hazardous Communications (HAZCOM) Programs.
- Pollution Prevention and Hazardous Waste Minimization (HAZMIN) Recycling Programs.
- Spill Prevention and Response Plan Programs.

Glossary

A²C²	Army airspace command and control
A²C²S	Army Airspace Command and Control System
AA	assembly area
AAR	after action review
AATFC	air assault task force commander
AB	air base; aviation brigade
ADS	air data sensor
AIC	air information center
ALOC	aviation logistics operation center
AMC	air mission commander
AMCOM	US Army Aviation and Missile Command
AO	area of operations
AOR	area of responsibility
AR	Army regulation
ARK	Aerial Recovery Kit
ATO	air tasking order
ATS	air traffic services
AVIM	aviation intermediate maintenance
AVUM	aviation unit maintenance
BD	battle damage
bde	brigade
BDAR	battle damage assessment and repair
bn	battalion
C²	command and control

CAS	close air support
cdr	commander
CERT	combat expedient recovery technique
CG	center of gravity
COMSEC	communications security
COSCOM	corps support command
CPR	cardiopulmonary resuscitation
CSAR	combat search and rescue
CSS	combat service support
CUCV	commercial utility cargo vehicle
DART	downed aircraft recovery team
DOL	Directorate of Logistics
DOT	Department of Transportation
DPTMSEC	Directorate of Plans, Training, Mobilization, and Security
DPT	Directorate of Public Works
EA	engagement area
EAD	echelons above division
ECAP	Environmental Compliance Achievement Program
ECAS	Army Environmental Compliance Assessment System
ED	Environmental Division
Engr	Engineer
ERFS	Extended Range Fuel System
E&R	evasion & recovery
ESSS	External Stores Support System
FARP	forward arming and refueling point

FCS	fire control radar
FEBA	forward edge of the battle area
FLOT	forward line of own troops
FM	field manual; frequency modulated
FS	fuselage station
FSCL	fire support coordination line
ft	feet
GTA	graphic training aid
GW	gross weight
HAZCOM	hazardous communications
HAZMAT	hazardous material
HAZMIN	hazardous waste minimization
HERK	Helicopter Recovery Kit
HF	high frequency
HM	hazardous material
HMMS	Hellfire modern missile system
HW	hazardous waste
ID	identification
IFR	instrument-flight requirements
in	inch
ISOREP	isolation preparation
I-UMARK	Interim-Unit Maintenance Aerial Recovery Kit
JP	Joint publication
JSRC	Joint Search and Rescue Center
JSCAR	Joint Combat Search and Rescue

KOH	potassium hydroxide
LAR	logistic assistant representative
lb	pound
LZ	landing zone
MCP	maintenance collection point
METT-TC	mission, enemy, terrain, troops – time available, civilian considerations
MMS	mast-mounted sight
MOPP	mission-oriented protective posture
MOS	military occupational specialty
MSN	mission
MTA	mast turret assembly
MTP	maintenance test pilot
NAVAID	navigational aid
NBC	nuclear, biological, and chemical
NCO	noncommissioned officer
NCOIC	noncommissioned officer in charge
NICAD	nickel-cadmium
NRB	Natural Resources Branch
NSN	national stock number
NVG	night vision goggles
OIC	officer in charge
OPCON	operational control
OPORD	operations order
ORF	operational readiness float

OSJA	Office of the Staff Judge Advocate
PCC	pre-combat check
PCI	pre-combat inspection
PIP	push-in-pullout
PLS	palletized loading system
PN	part number
POC	point of contact
PP	passage point
PPC	performance planning card
PZ	pick-up zone
RCC	rescue coordination center
REDCON	readiness
RFI	ready for issue
ROZ	restricted operation zone
SAW	squad automatic
SDC	signal data converter
SEAD	suppression of enemy air defense
SJA	staff judge advocate
SME	subject matter expert
SOI	signal operating instructions
SOP	standard operating procedure
STANAG	standardization agreement
TAA	tactical assembly area
TF	task force
TI	technical inspector

TM	training manual
TOC	tactical operations center
TRADOC	US Army Training and Doctrine Command
UHF	ultra-high frequency
USAAVNC	US Army Aviation Center
UMARK	Unit Maintenance Aerial Recovery Kit
USASC	US Army Safety Center
VHF	very high frequency

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