CHAPTER 9: EQUIPMENT REQUIREMENTS AND MAINTENANCE.

I. Introduction.

The proper use and maintenance of equipment used in helicopter operations by ground, flight, and air crew personnel is essential to safety. Since much of this equipment is of high cost, proper maintenance is also cost effective.

II. Interagency Fire Helicopter Equipment Requirements.

The required items for interagency carded fire helicopters change frequently. For CWN fire helicopters, use and completion of Form HCM-2, Helicopter and Service Truck Pre-Use Checklist, with reference to the procurement document, should ensure that requirements are met. See Appendix A for instructions on completing this form. Consult the procurement document if uncertain about requirements.

III. Personal Protective Equipment (PPE).

Personal protective equipment (PPE) consists of clothing and equipment that provide protection to an individual in a hazardous environment.

If any flight crewmember, air crewmember, or passenger refuses to adhere to PPE requirements, the Helicopter Manager shall terminate the flight and report the non-compliance to the unit aviation manager using an agency incident/hazard report. Similarly, if an individual participating in helicopter ground operations refuses to wear required PPE, the operations shall be halted and a report filed.

Chart 9-1 provides a summary of personal protective equipment requirements for various aerial missions.

Chart 9-2 establishes PPE requirements for helicopter ground operations. It is at the discretion of the Helibase Manager, Deck Coordinator or Helicopter Manager to establish the appropriate level of PPE on the ground when no active helicopter operations are being conducted. Consult the specific helicopter procurement document for vendor personnel PPE requirements.
### CHART 9-1: Requirements for Personal Protective Equipment – Flight Missions General Requirements (all occupants):

| All Helicopter Flights | Fire Resistant Clothing (long sleeved shirt & pants, or flight suit)  
| | Fire Resistant and/or Leather Gloves  
| | Approved Aviator Flight Helmet  
| | All-leather Boots  
| | Hearing Protection |

**Exceptions or Additional Requirements (all occupants):**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Additional Requirements</th>
</tr>
</thead>
</table>
| Reconnaissance Over Water- Beyond Gliding Distance from Shore | -Personal Floatation Device (PFD)  
| | NOTE: Fire resistant clothing and leather boots not required. |
| Reconnaissance Over Water- Extended | -Personal Floatation Device (PFD)  
| | -Anti-Exposure Garments  
| | -Raft & Kit  
| | -Exceptions - see ALSE Handbook  
| | NOTE: Fire resistant clothing and leather boots not required. |
| Individual Not Restrained by Installed Aircraft Restraint Systems (Spotter, Cargo letdown, Cargo Freefall, ACETA, PSD, etc.) | -Approved Auxiliary Restraint Harness/Tether |
| Extreme Environmental Conditions (wet, boggy, extreme cold, etc.) | **Exception:** -Rubber/Synthetic Footwear or Clothing  
| | *Requires specific agency waiver to policy* |
| Rappel, Short-Haul, Cargo letdown, Aerial Ignition | Refer to applicable specialty guide/handbook for specific PPE Requirements. |
| firefighter | **Exception:** -May wear a hardhat with chinstrap in lieu of an aviator flight helmet only when being transported as passenger during fire operations from an established, managed helispot/helibase to another established, managed helispot/helibase.  
| | A managed helibase/helispot is established when there is a helicopter crewmember or helibase/helispot manager on the ground at the helibase or helispot before passengers are transported to these locations. |
CHART 9-2: Requirements for Personal Protective Equipment – Ground Operations

General Requirements:

| All Government Personnel – While Working Around Operating Helicopters or When “On the Deck” when Helicopters are Operating | Fire Resistant Clothing (long sleeved shirt & pants, or flight suit) Hardhat with Chinstrap (or approved aviator flight helmet) |
| Fire Resistant and/or Leather Gloves | All-leather Boots Eye Protection Hearing Protection |

It is at the discretion of the Helibase Manager, Deck Coordinator or Helicopter Manager to establish the appropriate level of PPE on the ground when no active helicopter operations are being conducted or for positions not assigned to the deck.

Exceptions or Additional Requirements:

| Longline Hook-up Personnel/ Marshallers | Additional Recommendation: |
| - Aviator helmet with handheld radio adaptor is recommended. Radio contact with pilot is required. |

| Helitorch Mixmaster, Helitorch Crewmembers | Refer to the Interagency Aerial Ignition Guide for specific PPE requirements. |

| Government Fuelers | Additional Requirement/Exception: |
| - Must wear “Non-Static” clothing. |
| - May use rubber gloves in lieu of leather gloves. |
| - Eye and hearing protection required only when in the vicinity of operating helicopters (rapid refueling). |

| Contract Fuelers | Refer to requirements for vendor personnel outlined in the procurement document. |

A. Head Protection.

When flying or when working on the ground around operating helicopters, only approved headgear shall be worn, as outlined in Charts 9-1 and 9-2. The Pilot must always wear an approved flight helmet.

1. Aviator Flight Helmets. The aviator flight helmet, consisting of a one-piece hard shell made of polycarbonate, Kevlar, carbon fiber or fiberglass must cover the top, sides (including the temple area and to below the ears) and the rear of the head. The helmet shall be equipped with a chin strap and shall be appropriately adjusted for proper fit. Helmets should be individually fitted for maximum protection.
Flight helmets for helicopter usage must conform to a national certifying agency standard such as Department of Transportation (DOT), Snell, SFI or an appropriate military standard, or appropriate equivalent standard. Examples of flight helmets currently approved for helicopter applications are the SPH-5, HGU-84P, SPH-4B and the HGU-56P manufactured by Gentex; the Alpha 200, Alpha 400 and Alpha Eagle (900) manufactured by Interactive Safety Products; and the MSA Gallet LH050 (single inner visor), LH150 (single outer visor) and the LH250 (dual visor, one inner and one outer).

The flight helmet should be equipped with avionics compatible with helicopter avionics specifications. Each helmet should be stored in a helmet bag when not in use, and should be kept clean and free of defects. Clean with mild soap and water only. Inspect and maintain the flight helmet in accordance with manufacturer’s specifications.

2. Hard Hats. The hard hat must be equipped and worn with a chin strap securely fastened below the chin prior to entry to the helicopter, at all times during flight, and upon departure from the aircraft.

B. Hearing Protection.

Hearing protection is required when inside or around operating helicopters. The helicopter flight helmet provides the requisite protection; however, the addition of earplugs for frequent users of helicopters is recommended. Earplugs are required for firefighters who are not required to wear flight helmets. Sound barrier earmuffs may be worn in lieu of earplugs when performing ground operations duties. See Chart 9-1.

C. Eye Protection.

Goggles, or other approved safety eyewear, shall be worn when performing ground operations duties. A helicopter flight helmet with visor down may be used in lieu of a hard hat and goggles when radio communications with the pilot is necessary via a radio connected through the helmet.

D. Fire-Resistant Clothing.

The primary purpose of fire-resistant clothing is to provide the wearer with protection from flash fire burns.

1. Material. The approved material for flight suits, gloves, and recommended for outer garments, garments worn under the flight suit, and undergarments is generically referred to as “fire resistant clothing.” The actual material may be fire resistant cotton, polyamide, aramide, polybenzimidazole, Kevlar, or blends thereof.

**NOTE:** Fire resistant clothing may be laundered and tumble dried at temperatures up to 180° F without shrinkage or damage. Dry cleaning is also approved for some material. Starch is not approved, since starch is flammable.
CAUTION: All garments must be kept clean. Fuels, grease, oils, and other combustible materials embedded in the fabric will burn at their normal flash points even though the fire resistant clothing will not char until a higher temperature is reached.

2. Flight Suits. Flight suits are fire resistant coveralls that fit loosely and provide trapped airspace that acts as insulation to provide protection in a fire. The proper size flight suit covers the maximum area of skin. This includes sleeves long enough to reach the first knuckle on the thumb before securing snugly over the flight gloves at the wrist. The pant legs shall be long enough to completely cover the boot tops while in a seated position. The slide fastener front closure provides coverage high on the neck. Flight suits are available in 4.5 ounce and 6.0 ounce material.

3. Shirt/Pants Combination. The use of the wildland firefighter fire resistant shirt and pants (two-piece) is authorized. The shirt sleeves and pant legs shall have sufficient length to allow overlap of the glove cuffs and boot tops, respectively. Shirt cuffs shall be worn down and fastened. When wearing two-piece flight suits or the shirt/pants combination, the shirt shall be tucked into the trousers.

NOTE: When the full complement of PPE is not worn, as excepted in Chart 9-1, the government supervisor is required to inform the crew and passengers of the increased personal hazard associated with wearing non-fire resistant clothing.

An example would be a search and rescue where specialized PPE or clothing necessary for protection against arctic temperatures for extended periods is deemed critical to individual survival.

IV. Survival Equipment.

This section covers requirements for survival equipment for overwater missions, survival kits for special use overland missions, and first aid kits for all missions. It is the responsibility of the Helicopter Manager or Project Flight Manager for each flight to ensure that proper and adequate survival equipment for the planned mission is aboard and available for all crewmembers and passengers.

NOTE: All survival equipment described in this section requires scheduled inspections, testing, and in some instances, timed replacement. Management at the using level shall establish and monitor the appropriate compliance procedure.

A. Overwater Flotation and Survival Equipment.

Floatation and survival gear equipment standards are specified for overwater operations by 14 CFR 91 and 14 CFR 135.

CAUTION: Users of PFDs must be trained in their proper use.
1. **Approved Personal Flotation Devices (PFD).**

   - Shall be worn by each individual on board the helicopter when conducting operations beyond gliding distance to shore, operating off of or to water, and during all hovering flights over water sources such as ponds, streams, lakes, and coastal waters. A PFD may not be required when obtaining water solely from heli-wells or porta-tanks, unless specified by procurement document.

   - Approved Personal Flotation Devices (PFD) shall be worn by each individual on board the helicopter with emergency equipment on board and easily accessible when conducting Extended Overwater Operations more than 50 nautical miles of nearest shoreline and more than 50 nautical miles from an off shore heliport structure.

   - Automatic inflation (water activated) personal flotation devices shall not be allowed.

   - Agency personnel must adhere to guidelines outlined by policy when that direction is more restrictive than the above information.

   - Vendor personnel should reference the procurement document for guidance regarding the use of Personal Flotation Devices.

   **NOTE:** Mission planning for overwater flights requires careful consideration of all elements of risk management and hazard reduction. Aviation Life Support Equipment (ALSE) appropriate for overwater missions being planned must be based on flight time over water, flight following (report frequency and accuracy), water/air temperature, search and rescue availability and response time to the mission area, and the capability of the proposed ALSE to sustain life.

B. **Overland Survival.**

   Like overwater missions, planning for overland missions requires careful consideration of all elements of risk management and hazard reduction. On overland flights, personnel will be more likely to possess appropriate garments for the mission area involved. This does not exempt mission planners from assuring that crews and passengers have adequate clothing to survive in the event of a mishap.

   Survival kits are required for all special use missions. Refer to the procurement document for a description of required contents.
Chart 9-3: Recommended Survival Kit - Extreme Environmental Conditions

<table>
<thead>
<tr>
<th>#</th>
<th>WINTER</th>
<th>#</th>
<th>SUMMER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compass</td>
<td>1</td>
<td>Compass</td>
</tr>
<tr>
<td>1</td>
<td>Knife</td>
<td>1</td>
<td>Knife</td>
</tr>
<tr>
<td>1</td>
<td>Flashlight with 2 extra batteries</td>
<td>1</td>
<td>Flashlight with 2 extra batteries</td>
</tr>
<tr>
<td>1</td>
<td>Signal Mirror</td>
<td>1</td>
<td>Signal Mirror</td>
</tr>
<tr>
<td>1</td>
<td>Additional Signaling Device (Strobe, Smoke Bomb, Water Dye, etc.)</td>
<td>1</td>
<td>Additional Signaling Device (Strobe, Smoke Bomb, Water Dye, etc.)</td>
</tr>
<tr>
<td>1</td>
<td>Box Matches in Waterproof Container</td>
<td>1</td>
<td>Box Matches in Waterproof Container</td>
</tr>
<tr>
<td>1</td>
<td>Individual First Aid Kit</td>
<td>1</td>
<td>Individual First Aid Kit</td>
</tr>
<tr>
<td>1</td>
<td>40’ Length Nylon Rope</td>
<td>1</td>
<td>40’ Length Nylon Rope</td>
</tr>
<tr>
<td>1</td>
<td>Roll Toilet Paper</td>
<td>1</td>
<td>Roll Toilet Paper</td>
</tr>
<tr>
<td>2</td>
<td>Candles</td>
<td>2</td>
<td>Candles</td>
</tr>
<tr>
<td>4</td>
<td>Quarts Water/Person</td>
<td>4</td>
<td>Quarts Water/Person Water Bag (collapsible)</td>
</tr>
<tr>
<td>1</td>
<td>Water Bag</td>
<td>1</td>
<td>Whistle</td>
</tr>
<tr>
<td>1</td>
<td>Whistle</td>
<td>1</td>
<td>Handsaw or Wire Saw</td>
</tr>
<tr>
<td>1</td>
<td>Handsaw or Wire Saw</td>
<td>1</td>
<td>Collapsible Shovel</td>
</tr>
<tr>
<td>1</td>
<td>Collapsible Shovel</td>
<td>1</td>
<td>Meals-Ready-To-Eat (MREs)/Person</td>
</tr>
<tr>
<td>6</td>
<td>Meals-Ready-To-Eat (MREs)/Person</td>
<td>1</td>
<td>Survival Manual, Desert</td>
</tr>
<tr>
<td>1</td>
<td>Survival Manual, Winter</td>
<td>1</td>
<td>46 pt. IV Tubing</td>
</tr>
<tr>
<td>1</td>
<td>46 pt. IV Tubing</td>
<td>1</td>
<td>Bottle Iodine Tablets</td>
</tr>
<tr>
<td>1</td>
<td>Bottle Iodine Tablets</td>
<td>1</td>
<td>Snakebite Kit</td>
</tr>
<tr>
<td>1</td>
<td>Arctic Sleeping Bag/2 persons</td>
<td>1</td>
<td>Bottle Insect Repellent</td>
</tr>
<tr>
<td>1</td>
<td>Metal Container (for melting snow)</td>
<td>1</td>
<td>Container w/carrying handles or straps</td>
</tr>
<tr>
<td>1</td>
<td>Container w/carrying handles or straps</td>
<td>1</td>
<td>Insect Head Net (per occupant)</td>
</tr>
<tr>
<td>1</td>
<td>Personal ELT (per occupant)</td>
<td>2</td>
<td>Personal ELT (per occupant)</td>
</tr>
<tr>
<td>2</td>
<td>Signal Panels</td>
<td>1</td>
<td>Signal Panels</td>
</tr>
<tr>
<td>1</td>
<td>Snow Shoes (set)</td>
<td>1</td>
<td>Ax or Hatchet</td>
</tr>
<tr>
<td>1</td>
<td>Ax or Hatchet</td>
<td>1</td>
<td>Bottle of Sunscreen</td>
</tr>
<tr>
<td>1</td>
<td>Gill net/assorted Fishing Tackle</td>
<td></td>
<td>Gill net/assorted Fishing Tackle</td>
</tr>
</tbody>
</table>

1. Personal Survival Vests or Hand-Carried Survival Kits. In addition to the required survival kits, personal survival vests or hand-carried survival kits are strongly recommended, but not required.

**CAUTION:** Accident experience has shown conclusively that survival equipment not attached to the occupants at the time of egress will not be available to the survivors.

2. First Aid Kit – Aeronautical. Refer to procurement document.

Equipment shall be installed per agency specifications on agency owned helicopters and per the procurement document on vendor owned helicopters.
V. Aircraft Equipment.

Equipment shall be installed per agency specifications on agency-owned helicopters and per the procurement document on vendor helicopters.

A. Personnel Restraints, Seat Belts, and Harnesses.

1. General Requirements. The following are required for all helicopter flight activities, except for special activities as outlined in Section V.A.2, Restraints for Special Activities, below.
   - FAA approved double-strap shoulder harness with automatic, locking inertia reels for each front seat occupant.
   - Approved 3 or 4 point restraint system for all aft seat passengers. Shoulder harnesses shall be worn.
   - Shoulder straps and lap belts shall fasten with one single-point, metal-to-metal, quick release mechanism. Heavy-duty (military style) harnesses such as those installed in Bell medium helicopters are acceptable although they have fabric loops connecting the shoulder harnesses to the male portion of the buckle.

2. Restraints for Special Activities. Special activities which may require restraint systems other than the seat belt/shoulder harness configuration include, but are not limited to, helicopter rappelling, aerial ignition, ACETA missions, short-haul, cargo letdown, photography, and infrared sensing.

   Personnel performing special activities while doors are open or removed and who need to be in a location other than normal (that is, seated with normal restraint system), must wear an approved secondary restraint. The harness must be attached to an approved tether and helicopter hard point. See Exhibit 9-1.

   For additional information on restraints for special activities, refer to the appropriate guide/handbook (for example, *Interagency Helicopter Rappel Guide*) or agency directive.
Exhibit 9-1: Example of Restraint Harness Configuration
B. **Emergency Locating Transmitter (ELT).**

An Emergency Locating Transmitter (ELT) shall be installed on helicopters.

C. **Emergency Position Indicator Radio Beacon (EPIRB).**

The EPIRB is battery operated, water-resistant, and will float with the attached antenna vertical. An EPIRB should be included in the survival equipment carried in life rafts. Units required for extended overwater operations should be “Class A” with automatic water activation and a manual activation provision.

A “mini Class B” EPIRB is approved for use with life vests (survival vests, survival suits, and life rafts not required to meet the extended overwater operations criteria). These units may be manually or water-activated, and shall include a float collar or be secured to the vest.

D. **Personal Emergency Locator Transmitter (P-ELT).**

The P-ELT is available from several manufactures. Typical designations include “Portable Rescue Beacon,” “Personal Downed-Pilot Locator,” or “Human Emergency Locator.” These units are not required, but are highly recommended to be included in personal survival vests or float vests where a mini-EPIRB may be too large.

E. **Fire Extinguisher.**

A fire extinguisher meeting the requirements of the procurement document shall be installed in the helicopter.

VI. **Crash Rescue Equipment for Helicopter Landing Sites.**

The following requirements apply to helicopter landing sites on incidents or projects. Chapter 12 contains additional crash rescue information and discussion.

A. **Requirements for Fire Extinguishers, Evacuation Kits, and Crash Rescue Kits at Helicopter Landing Sites.**

Helicopter Landing Sites. Personnel must be trained and briefed in the use of crash rescue equipment. Chart 9-4 specifies required numbers and types for helibases. See Chapter 8 for helispot requirements. There is no extinguisher requirement for an unimproved landing site unless the site is used on a recurring basis.
Chart 9-4: Extinguisher, Crash rescue, and Evacuation Kit Requirements for Helibases

<table>
<thead>
<tr>
<th>No. of Helicopters</th>
<th>Number And Type Extinguishers</th>
<th>No. Of Crash Rescue Kits</th>
<th>No. Of Evacuation Kits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>1 20-pound 40-B:C Extinguisher per landing pad</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5-10</td>
<td>1 20-pound 40-B:C Extinguisher per landing pad</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>11 +</td>
<td>1 20-pound 40-B:C Extinguisher per landing pad</td>
<td>1 Kit per every 5 helicopters</td>
<td>1 Kit per every 5 helicopters</td>
</tr>
</tbody>
</table>

Permanent helibases should have the amount of equipment indicated for the largest operation that could be accommodated at the permanent helibase. In addition, it is recommended that permanent helibases substitute a wheeled, aircraft-type extinguisher for the 20-pound, 40-B:C extinguisher.

B. Crash Rescue Kit.

The crash rescue kit consists of the items specified in Chart 9-5. See Chapter 12 for further information and discussion concerning use of the crash rescue kit.

Chart 9-5: Crash rescue Kit Components

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ea</td>
<td>Axe, Crash, Serrated Edge</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Axe, Crash, Smooth Edge Blade, Hacksaw</td>
</tr>
<tr>
<td>10 Ea</td>
<td>Case, Cloth, Carrying, 2-piece Set</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Cutter, Bolt, 24”</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Frame, Hacksaw</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Knife, Rescue,</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Seat-belt Type</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Opener, Door, w/ Claw Tool</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Pliers, 12”, adjustable joint, angle nose</td>
</tr>
</tbody>
</table>
C. Evacuation Kit.

The Evacuation Kit consists of the items specified in Chart 9-6.

**Chart 9-6: Evacuation Kit Components**

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pg</td>
<td>Battery, size AA</td>
</tr>
<tr>
<td>3 Ea</td>
<td>Blanket, paper, disposable, 60” x 90”</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Carton, fiberboard, 42” x 13.5 ” x 14”</td>
</tr>
<tr>
<td>4 Ea</td>
<td>Compress, cold</td>
</tr>
<tr>
<td>1 Hk (Hank)</td>
<td>Cord, cotton braided, 1/8” x 100'</td>
</tr>
<tr>
<td>2 Ea</td>
<td>Head lamp, single cell, cordless</td>
</tr>
<tr>
<td>1 Kt</td>
<td>Kit, first aid, 24 person</td>
</tr>
<tr>
<td>2 Bx</td>
<td>Lightstick, Yellow</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Litter, S.K.E.D.</td>
</tr>
<tr>
<td>3 Ea</td>
<td>Marker, Ground</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Pamphlet, OPM-14, “How To Help The Injured”</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Pliers, slip joint, 6”</td>
</tr>
<tr>
<td>2 Hk</td>
<td>Rope, nylon. 1/4” X 100’</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Screwdriver, flat tip, 6”</td>
</tr>
<tr>
<td>1 Se</td>
<td>Splints, inflatable, all limbs, 6 piece</td>
</tr>
<tr>
<td>1 Ea</td>
<td>Stretcher, basket, 2 piece</td>
</tr>
</tbody>
</table>

VII. Standard Equipment for External Loads.

This section addresses external load helicopter accessories for transporting equipment and supplies. These components include swivels, leadlines, buckets, hooks, nets, etc., that are attached to the cargo hook of the helicopter. Equipment must be rated for vertical lifting and must have a working capacity equal to or greater than the load to be carried.

A. Approval of Helicopters and Pilots for External Loads.

Users should always check each Aircraft Data Card and Pilot Qualifications Card to ensure that the aircraft and pilot are current and authorized to perform the external load mission.

B. Cargo Baskets and Racks.

Loads contained in cargo baskets or racks are considered external, non-jettisonable loads. All cargo carried in baskets or racks shall be restrained by means of “bungee cords” or other fastening device. Chapter 11 outlines correct methods of loading and carrying cargo in external racks.
C. Cargo Hook.

The cargo hook is attached to the belly of the helicopter. It must be FAA approved, self-cocking and automatic locking. It may be loaded and locked in a single motion with one hand. The release must be both manually and electrically operated by the Pilot from the cockpit. See Exhibit 9-2.

The cargo hook also has a manual release on the hook itself that can be operated by the individual performing the hook-up. This release allows the Pilot or hook-up person to check that the hook is functioning properly.

CAUTION: Prior to using the hook, it is extremely important to first test the manual release, then the electrical release to ensure that both function properly. This sequence is necessary because the manual release is usually a cable release susceptible to snagging.

Move the cargo hook to its extreme travel limits to ensure that the manual release will not operate inadvertently. There should be at least $\frac{1}{2}$ " slack in the operating cable with the hook in all possible positions.

D. Swivel.

A cargo swivel consists of a ring or link on the upper end, a hook on the lower end, and a swivel section in between. The ring or link and hook may be integral with, or detachable from, the swivel body. If detachable, components should be replaceable and attached by bolts secured with self-locking nuts, or some other system that provides equivalent safety. See Exhibit 9-3.

A swivel allows the load to rotate while in flight and prevents the leadline from twisting, preventing cable damage or inadvertent release.
1. Capacity of Swivels. Standard swivels are rated at 3000 and 6000 pounds. Swivels must be rated for vertical lifting and must have a working capacity equal to or greater than the load to be carried. Approved swivels may be obtained through the National Fire Cache System.

   **CAUTION: Swivels without a capacity stamp must not be used.**

2. Inspection and Maintenance of Swivels. When inspecting swivels, check:
   - The spinning action of the swivel.
   - The condition of the integrated latch system.
   - The bolts on the detachable type of swivel.
   - Check all serviceable parts.

**E. Leadline.**

A leadline is an accessory that connects the load to the helicopter. A leadline is constructed of flexible steel cable with a ring or link on one end, and a hook on the other. All end loops for leadlines are formed around heavy metal thimbles and spliced or swaged. See Exhibit 9-4

**Exhibit 9-4: Typical Leadline**

Chapter 11 contains a discussion of when and how to use a leadline, when to use longer leadline lengths, etc.
CAUTION: The use of synthetic leadlines made of nylon/polypropylene rope or nylon or natural fiber straps is not normally approved due to the potential of these materials to become frayed and fail, or for snapback or stream back into the tail rotor system. However, there are missions such as the transport of live animals where the use of non-twisting synthetic or natural fiber ropes or straps is preferred, and is in fact critical to the well-being of the animals. If used, the equipment must be closely inspected.

1. Capacity and Size of Leadlines. Leadlines for most lengths are rated at 3000 and 6000 pounds. Standard length is twelve (12) feet, with twenty-five (25) and fifty (50) foot lengths available. The leadline must have a working capacity equal to or greater than the load to be carried.

2. Inspection and Maintenance of Leadlines. When inspecting leadlines, check:
   - The condition of the keeper-gate on the hook at the end of the cable. The keeper-gate is the part that generally becomes broken or damaged. Exert force laterally on the keeper gate. If there is significant “play” in the gate, do not use. Also, if the gate can be moved beyond the curved edge of the hook (that is, outside the hook itself), do not use. Be sure to tag the leadline with an explanation on what is wrong with it.
   - Swages are metal sleeves where the end of the cable forms a loop. Ensure they are secured on the cable. Swages are painted for slippage check and should not be covered. Copper swages should have a compression groove from being pressed together. If in doubt, or the cable is kinked, tag the line as out-of-service and do not use.

   CAUTION: Leadlines with aluminum swages shall not be used.

F. Longline with Remote Electric Hook

The longline/remote hook system consists of suspension cable sections, a remote cargo hook, a remote hook guard and handgrip, appropriate matching attaching hardware, and electrical pigtail. The Pilot is able to electrically release loads attached to the remote hook. See Exhibit 9-5.

1. Remote Hook.

   At the end of the cable is a remote electric hook, similar to the cargo hook on the helicopter. An electrical line runs the length of the cable and is plugged into the electrical system of the helicopter. The other end is plugged to the remote hook. The hook is self-cocking (that is, it should return to “latched” position after the electrical “release” signal is removed).

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1Remote hook systems are described in detail in “Remote Hook Systems for Helicopters,” No. 8457 1203, USDA Forest Service, San Dimas Technology And Development Center, San Dimas, CA 91773.
Exhibit 9-5: Typical Longline/Remote Electric Hook Equipment Configuration
2. Remote Hook Guard.

The general requirements of the remote hook guard are to provide:

- A medium to attach the remote hook to the remote hook system suspension cable.
- Protection of the remote hook when the hook is placed on the ground.
- A handle for the crewmember using the remote hook from the ground.
- Adequate weight to ensure good flying qualities of the remote hook and longline.

3. Suspension Cable Section.

The system is designed in cable lengths of fifty (50) feet and greater. The line should be constructed of anti-twist, counter-wound cable. The cable attaches to the helicopter cargo hook on one end by means of a steel ring. On the other end, it attaches to the remote hook by means of a clevis or hook.

NOTE: Synthetic longlines may be used by the vendor as suspension cable sections when specified in the procurement document and approved by the agency aircraft inspector.

4. Inspection and Maintenance of Longline with Remote Electric Hook. When inspecting longlines with remote hooks and preparing them for use, lay the cables out and check:

- For kinks or abrasions in the electrical cable.
- For cracked or broken electrical plugs at each section.
- For broken or bent keepers on the hook connections.
- The condition of swages at the end of each cable section.
- The condition of keepers on hook gates at the end of each line.
- That the electrical line is attached to the cable with plastic tie-wraps or duct/electrical tape placed at 12-inch intervals the length of the longline.
- That the electric plug to the helicopter is a standard and not a twist-type plug (it must be able to release if the longline is jettisoned during an emergency).
- That there is no swivel between the helicopter and the remote hook.

After everything has been checked, attached, and plugged in, test to ensure that:

- The electric and manual releases are operational on the helicopter cargo hook.
- The remote hook is functioning.
G. **Multiple Remote Cargo Hook System (Carousel Hook).**

This system is identical to the remote hook system, except that an integrated multiple cargo hook device, a carousel, is substituted for the remote hook and remote hook guard. The multiple remote carousels enhance efficiency by allowing the delivery of various loads to different locations. See Exhibit 9-6.

A carousel consists of four or more individual hooks mounted together on a single hookguard. The pilot controls the release system from the cockpit.

Check all components associated with the longline system, plus ensure that all electrical connections in the carousel are protected from dust and impact.

**Exhibit 9-6: Typical Four-Hook Carousel System**

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2 For additional information, see Equip Tips "Four Hook Carousel and Light Cargo Net System," USDA Forest Service, San Dimas Technology and Development Center, San Dimas, CA 91773
H. Cargo Net.

1. Heavy Cargo Net. Cargo nets come in both round and square configurations. The net is used to transport cargo suspended beneath the helicopter from the cargo hook, permitting delivery without landing. Nets are usually constructed from braided polypropylene or nylon rope.

Each net consists of a net mesh and a perimeter rope or ropes with tethering rings connecting the segments of the perimeter rope. The lines are attached to the net by loops with thimbles that reinforce the rope loops.

When tension is applied to the lines, during both load preparation and during lifting, the net is forced closed, similar to a drawstring. This is referred to as a “purse net.”

One or two steel rings are attached to the end of the lines. This is the attachment point to a swivel or leadline.

a. Capacity and Size of Cargo Nets. Nets come in the following commonly available sizes at 3000 and 6000 pound capacities:

- Square nets: 12’ x 12’ (3000) or 15’ x 15’ (6000)
- Round nets: 12’ (3000) or 15’ (6000) Diameter


Exhibit 9-7: Rope Inspection

When inspecting cargo nets, check:

- For broken or worn braids or strands, particularly in the center of the net.
- For rope embrittlement, which is caused by exposure to the sun’s ultraviolet rays and is the most common cause of net failure. To test for brittleness, bend several areas of the cargo net’s rope 180 degrees back upon themselves. If there are brittle strands, they will audibly and visibly break. If more than one or two strands break per bend, do not use the net. Discard it, or return it to the manufacturer for repair.
• All rope loop thimbles for cracks, fractures and missing sections. Thimbles can sometimes be replaced by the manufacturer. On some of the heavier cargo nets, the mesh intersections are fixed with molded plastic crosses. These should be visually inspected for cracks and missing parts whenever the loop thimbles are inspected.

• Polypropylene nets for chalking. Run a hand over several of the ropes in the net, grasping the ropes lightly. If small, white, chalk-like fragments of the rope come off in your hand, then chalking has occurred. If chalking is present, it is likely that the net has received enough ultraviolet rays to cause embrittlement, and the net must be further inspected for broken strands before it is returned to service.

Ultraviolet exposure is the most important factor in the degradation of the strength of the cargo nets constructed from polypropylene rope, not use or age. There is no visual or other field inspection technique that will guarantee that a cargo net is free from degradation due to ultraviolet exposure. However, if the net is free of brittleness, has no more than 10 percent broken strands in any two adjacent cycles, and there is no chalking or other visible damage, then the net is probably safe for further use. If in doubt, remove from service.

NOTE: To prolong the life of cargo nets, use duffel bags to avoid unnecessary exposure to sunlight.

2. Lightweight Cargo Net.

An inexpensive, lightweight cargo net constructed of synthetic cord is desirable for certain operations. Lightweight nets come in round or square configurations and have a minimum 10 foot and a maximum 12 foot diameter or side dimension. These nets usually weigh approximately 1.5 pounds.

The net may have a four-corner pickup instead of a drawstring enclosure. Rope intersections are knotted to prevent slippage. Each corner has a 4.5 inch opening and is knotted and bonded with fiberglass to the mess line. There are also three knotted and fiberglass attachments on each side to ensure rapid and complete deployment.

It is recommended that a metal, locking carabineer or pear ring be placed between the corner loops and the swivel.

CAUTION: Lightweight cargo nets have a capacity of only 300 pounds.
I. Cargo Lift Bag.

Cargo lift bags, also known as “flexible intermediate bulk containers,” are an inexpensive alternative to cargo nets. They are available in both standard and custom-made sizes, are cubic in shape, and are made from an ultraviolet-resistant polypropylene fabric that “breathes.” Most styles have a safety band around the perimeter of the bag. Options include different liners, lifting straps, and filling and emptying capability through a bottom chute. A common size is 35” x 35” x 40”, with a weight of 5 pounds. See Exhibit 9-8.

**CAUTION:** These bags should not be flown empty due to the potential for tail rotor entanglement. If no cargo is available, 50 pounds of ballast should be placed in the bag. It should be flown at a reduced airspeed. Use according to agency direction.

Exhibit 9-8: Typical Cargo Lift Bag
J. Rings, Links and Hooks.

Exhibit 9-9 depicts connector components including rings, links, and hooks. These form the connections between swivels, leadlines, cargo hooks, longlines, and/or remote hooks. The size, both inside and outside dimension, of rings, links, and hooks is critical, particularly at the cargo hook connection point, due to the potential for inadvertent release or “hung loads.” Sizes must conform to the cargo hook manufacturer’s recommendations. See Chapter 11 for a discussion of the importance of the cargo hook/ring interface.

Exhibit 9-9: Rings, Links and Hooks

K. Buckets.

Buckets are typically used on fires to dispense liquids such as water, fire retardant, and foam. Buckets used for hauling water may have a foam injection system for adding foam concentrate to the water while in flight. See Exhibits 9-10, 9-11 and 9-12.

The Pilot remotely activates the bucket mechanism. Each bucket consists of an open top shell, a bottom discharge door, control mechanism, support cable, and fittings. There are two basic shell designs, collapsible and rigid. A version of the collapsible type is also foldable. A Pilot-operated electrical switch mounted on the collective control must be the only switch to activate the discharge door.

Many buckets used for hauling water also have a foam-injection system for adding foam concentrate to the water while in flight.

Several methods are used to limit bucket capacity so that the weight of the water that fills the bucket is within the allowable payload limit. These include zippers, port caps or plugs. These items used as part of the capacity limiting system should be fastened to the bucket to prevent loss or damage.

The weight of the bucket and capacity at each position or adjustment level must be marked on the bucket.
For other than tandem rotor helicopters, while conducting water bucket operations, airspeed shall be limited to 80 KIAS or the airspeed limitation established by the Rotorcraft Flight Manual, whichever is less. Each operator, Pilot and helicopter manager shall review the manufacturer’s bucket operator’s manual and limitations for the applicable bucket prior to use.

NOTE: Refer to chapter 7, III. 14, for more information on managing bucket payloads.

Longlines may be used during bucket operations. This allows access to different dip sites as well as reduces the amount of rotor wash experienced at the delivery site.

- If a longline is used for water bucket operations, then the longline shall be a minimum of 50 feet in length to reduce the risk of entanglement with the tail rotor or tail boom.
- Pilots using longlines with water buckets must be approved for vertical reference longline operations.
- Lines of less than 50 feet are not authorized and pilots who are not approved for longline vertical reference operations must attach the bucket directly to the cargo (belly) hook during water bucket operations.

Exhibit 9-10: Typical Bucket - Rigid Shell
L. **Helicopter Fixed Tank.**

A helicopter fixed tank is used to transport water, foam, or retardant to the fireline. The tank is attached to the belly of the helicopter. Some tanks require removal of the cargo hook.

Tanks are often filled with water from hoses connected to engines, fixed ground tanks, or other sources. When retardant is used, a portable retardant mixing site is located adjacent to the fill site. Tanks may also have on board foam-injection systems.

Some helicopter fixed tanks have the capability to draw water via an extended nozzle or snorkel while hovering above the water source.

**CAUTION:** Do not use Lignin Sulphate product in fixed tanks.
VIII. Specialized External Load Equipment.

External load equipment is designed to transport items whose dimensions or other characteristics preclude use of conventional cargo nets and/or leadlines. These include, but are not limited to:

A. Barrel Hooks/Clamps.

Barrel hooks are made of chain or cable. Two sets are usually used together. A bungee cord with a clip on one end allows the pilot to independently hook up loads. Not attaching the bungee allows the hooks to drop off the barrel on touchdown at an unattended site. See Exhibit 9-13.

CAUTION: Be especially careful not to fly over persons or structures when using barrel hooks/clamps. A cargo net is the recommended method for transporting barrels.

Exhibit 9-13: Barrel Hooks/Clamps
B. **Chokers.**

Chokers are used primarily to transport logs, lengths of pipe, or other materials that are too long or bulky to be transported in a cargo net. They are made of wire rope, fabric strapping, chain, and other materials. Logging operations use a cable choker with a ball on the end that clips into a sliding catch further up the cable. The result is that the cable “chokes” down on the load when it is under tension. See Chapter 11 for more information on the correct rigging of chokers. See Exhibit 9-14.

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**CAUTION:** Be especially careful not to fly over persons or structures when using chokers.

**CAUTION:** Chokers are not to be used as leadlines.

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**Exhibit 9-14: Typical Chokers**
C. Seed and Fertilizer Spreaders.

Spreader are typically self-contained in that only power and control is required from the helicopter for the device to operate. They are supplied complete with appropriate rigging and lines for connection to the helicopter cargo hook. In some cases, spreader are supplied with their own internal combustion engine. See manufacturer's literature for specific operating instructions and weights for load calculations. See Exhibit 9-15.

**Exhibit 9-15: Typical Seeder Configuration**
D. Helitorch.

The helitorch is a self-contained unit used for aerial ignition. The torch dispenses gelled gasoline or diesel fuel and provides a hotter, faster, and longer ignition than other methods. The unit is jettisonable in an emergency. It is attached to the helicopter at a line length to give the pilot maximum visibility and control. The unit can be attached to any helicopter with a cargo hook and a 28-volt power supply. A complete helitorch system includes control cables, aluminum mixing paddle, extra barrel, spreader bar and augmented ignition system. See Exhibit 9-16.

For further information, refer to the *Interagency Aerial Ignition Guide*. See manufacturer’s literature for specific operating instructions and weights for load calculations.

**Exhibit 9-16: Typical Helitorch**
E. Plastic Sphere Dispenser (PSD).

The PSD is an effective aerial ignition tool when used to ignite fine, flashy fuels. The device functions by injecting glycol into a plastic sphere (“ping-pong ball”) which contains potassium permanganate. An exothermic reaction starts, and the dispenser expels the primed sphere from the aircraft. It is designed to accomplish this process with minimum manipulation and a high degree of safety and reliability. See Exhibit 9-17.

The main frame of the dispenser is constructed of welded aluminum. Power is supplied to the dispenser from the aircraft power supply through a quick-disconnect fitting and internal fusing. A central control panel contains all the electrical components and switches to operate the different stations such as the main drive, glycol pump, slow-fast speed and the emergency water supply. All electrical controls for this operation are conveniently located on the hopper.

For further information, refer to the Interagency Aerial Ignition Guide. See manufacturer’s literature for specific operating instructions and weights for load calculations.

Exhibit 9-17: Typical Plastic Sphere Dispenser
F. **Slingable Bags.**

Slingable bags are flexible and somewhat self-supporting. They are used to transport and store various liquids such as potable water, water for firefighting, fuel, etc. These bags are designed to be attached to a swivel and leadline, which is then attached to the cargo hook on the helicopter or the remote hook/longline, depending on operational needs. See Exhibit 9-18.

**CAUTION:** Avoid placement on slopes unless there are personnel on the ground to secure the bag. Otherwise, it may roll downhill. When transporting empty water bags, they must be taped into a compact package and attached to the leadline or longline with a swivel.

**Exhibit 9-18: Typical Slingable Water Bags.**
- Top: Less than 160 Gallons
- Bottom: 300 Gallons
IX. Ground-Based Tank Systems for Helicopter Dipping and Filling.

A. Portable Auxiliary (Rigid) Water Tanks.

Portable auxiliary (rigid) water tanks are designed for water storage during fire suppression or other operations requiring a reserve water supply. Water may be mixed with retardant in the tank using a portable retardant blender. Tanks are available in 600 to 3000 gallon sizes. See Exhibit 9-19.

CAUTION: Tanks must be tethered to the ground with ropes or cord, with rocks or other material placed in the bottom of the tank to prevent the tank from being blown into the helicopter rotor system.

The following applies to rigid water tanks.

- Helicopters may dip out of the tanks, which are filled from either a natural water source such as a stream or pond or from a mobile source such as a water tender.

- Inspect all portable retardant tanks prior to use for protrusions and snagging hazards. Ensure that there are NO rings or protrusions around the perimeter of the tank that a snorkel or bucket can catch on. Remove the hazard or shield it from the snorkel/bucket assembly. If the parts can't be removed and the hazard can't be otherwise mitigated by shielding/wrapping, remove the tank from service.

- Helicopters may transport water to the tank via bucket or fixed-tanks, with water supply operations to the line conducted by pumping or gravity feed out of the tank. Use of this method can significantly increase water efficiency, especially during mop up, particularly if tanks are strategically placed.
Exhibit 9-19: Typical Portable Auxiliary (Rigid) Water Tanks
B. Self-Supporting Open-Top ("Pumpkin") Water Tanks.

Pumpkin water tanks come in many sizes and hold water or retardant. They may be filled by ground from a water or retardant source for helicopters to dip out of, or they may be supplied by helicopter to support hose lay operations from the tank. See Exhibit 9-20.

Tanks are designed to be transportable in a compact, collapsed state. A buoyant collar surrounds the top opening. Hydrostatic pressure supplies the only support.

CAUTION: The top opening of even the largest pumpkin tanks may be too small for Type 1 helicopter buckets to be safely filled.

Exhibit 9-20: Typical Self-Supporting Open-Top ("Pumpkin") Tank

X. Helicopter Manager’s Kit.

The kit items listed in Appendix B, Exhibit B-18, are recommended for a Helicopter Manager’s Kit for both incident and project use. Helicopter managers are responsible for assembling the kit and maintaining it. Additional copies of forms should be reproduced locally at the incident.
XI. Helibase Manager’s Kit.

The items listed in Appendix B, Exhibit B-19, are recommended for a Helibase Manager’s Kit for both incident and project use. Helibase Managers are responsible for putting the kit together and maintaining it. Additional copies of forms should be reproduced locally at the incident.

XII. Recommended Standard Contract Helicopter Crew Support (Chase) Truck.

The following specifications are a recommended standard for a fire, exclusive-use contract helicopter, crew support truck.

- Vehicle with GVWR capable of carrying helicopter support and associated equipment listed on Chart 9-9.
- 6 Passenger Crew Cab
- High-Profile, Utility Body

XIII. Recommended Standard Equipment for Contract Helicopter Crew Support (Chase) Truck.

The stocking levels listed in Appendix B, Exhibit B-20, enable an exclusive-use contract fire helicopter crew to meet not only local initial attack needs, but also the minimum equipment and operational needs for establishing a helibase during the initial phases of a large incident. This capability is essential since there may be multi-day delays in obtaining required helibase safety and operational equipment through warehouse caches.

These items should be carried on board the chase truck to all incidents or projects. Helicopter Managers are responsible for obtaining and maintaining the stocking levels.

Managers are also responsible for updating the NFES numbers on the list.

Local units with moderate to high fire activity, or with recurrent project helibase operations, are encouraged to stock an adequate supply of helibase management equipment (cargo nets, leadlines, swivels, etc.) in the local fire cache.