A-219
Helicopter Transport of External Loads

Participant Workbook

Prepared by Office of Aviation Services Training Division
and Interagency Aviation Training Partners
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Revision History

Version	Description	Date
0.00	Original Materials	9/7/2008
1.00	Major revision to include the electronic presentation, student workbook and instructor guide	6/30/2013
1.10	Revision to reflect comments and consolidate materials	7/30/2013
1.50	Update to current templates, grammatical edits	2/5/14

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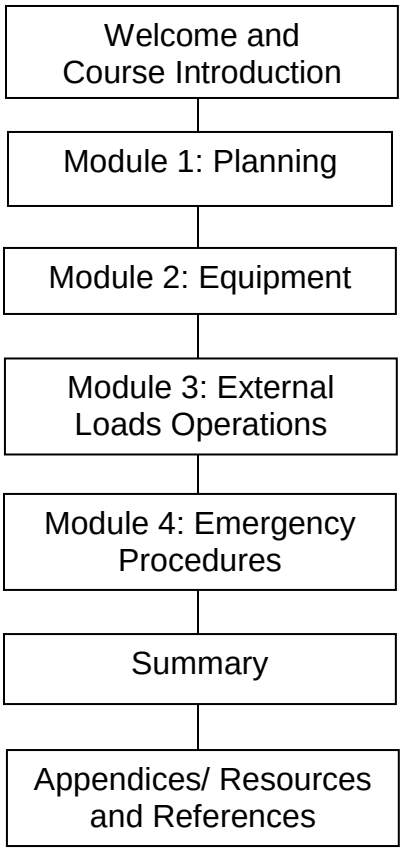
Course Map



Welcome and Introduction

Get to Know Your Classmates

Be prepared to share:

- Your name?
- Your position?
- How long have you been involved in aviation operations?
- Is this your first A-219 course or a refresher?

Course Purpose

This purpose of this course is to provide participants with the technical training and procedures needed to perform helicopter external load operations. Students will receive classroom and field training, and will be required to demonstrate the proper procedures to safely conduct helicopter external load operations.

Prerequisites

Prior to requesting enrollment in A-219, prospective students must complete the following pre-requisites:

1. A – 100 Basic Aviation Safety Training – required currency is every 3 years
2. A – 110 Aviation Transportation of Hazardous Materials – required currency is every 3 years
3. A – 200 Accident (Mishap) Review – required currency is every 3 years
4. A – 116 General Awareness Security Training – once

Objectives

At the conclusion of this course, you should be able to:

1. Determine the best tool to use for cargo to be delivered to appointed destinations safely and efficiently.

2. Determine equipment considerations needed for external load delivery.

3. Identify proper procedures to conduct a pre-mission safety briefing.

4. Properly weigh, package, manifest and rig items to be delivered via external load.

5. Demonstrate proper procedures to perform safety inspections on helicopter rigging equipment.

6. Demonstrate proper procedures to belly hook an external load.

7. Demonstrate proper procedures to conduct long line operations for an external load.

8. Demonstrate proper procedures to “daisy chain” multiple loads for long line delivery.

9. Demonstrate proper procedures to hover hook an external load.

10. Identify proper procedures of load delivery when flying cargo that can’t be weighed prior to flight.

11. Identify and troubleshoot improperly rigged loads.

12. Demonstrate proper emergency procedure considerations for external load delivery.

Introduction

Due to the operating characteristics of the helicopter—its ability to takeoff and land vertically, and to hover for extended periods of time, as well as the aircraft's handling properties under low airspeed conditions—it has been chosen to conduct tasks that were previously not possible with other aircraft, or were time- or work-intensive to accomplish on the ground. Today, helicopter uses include transportation of people and cargo, military uses, construction, firefighting, search and rescue, tourism, medical transport, and aerial observation, among others.

Helicopter flying with external loads requires special precautions to be taken if both the helicopter pilot and ground personnel are to be protected from undue risk. This course is divided into four modules: Planning, Equipment, Operations and Emergency Procedures.

Module 1: Planning

Objectives

1. Determine the best tool to use for cargo to be delivered to appointed destinations safely and efficiently.
2. Determine equipment considerations needed for external load delivery.
3. Identify proper procedures to conduct a pre-mission safety briefing.

Risk Management

Risk is the first thing to consider prior to any mission. A complete risk analysis is a must prior to deciding how a mission is to be accomplished, what equipment is to be used and if the pilot and helicopter are correct for the job.

When planning for the delivery of cargo to remote locations, you need to consider all the options available so that the risk has been reduced to as low as possible.

Review of Fundamentals of Risk Management

1. **Accept no unnecessary risk.**
   All aviation use involves risk. You must accept necessary risk required to successfully complete the mission or task. Unnecessary risk comes without a corresponding return, in terms of real benefits or available opportunities. We should be dedicated to exposing and avoiding unnecessary risks through proper mission planning.

   - (Is there road access to the location that the equipment is scheduled to be delivered to? Have you considered and evaluated all possible alternatives?)

2. **Make risk decisions at the appropriate level.** Acceptable risk should be authorized at that appropriate level of management. Managers should exercise good judgment in elevating risk decisions to the level most appropriate and in keeping with “scope of duty”.

   - (Once the risk assessment has been completed, who has the authority to authorize the risk level of the mission?)

3. **Only accept risk when the benefit outweighs the cost.**
   Not every risk will be acceptable simply because there is an associated benefit. Some risk poses the potential for extreme cost. Before engaging in a level of risk an assessment should be made to balance the potential outcome and likelihood of an incident with the benefit that action will provide.

   - (Consider the benefits/costs of performing the mission versus not performing the mission or utilizing alternative methods of delivery.)

4. **Integrate risk management throughout the mission from start to finish.** Only through time appropriate planning can proper risk assessment and management be implemented.

There are many different tools available to assess risk in an organized manner.

Some examples include:
- Risk Matrix
- GAR Model
- USFS/BLM Risk Management Handbook
- FAA risk assessment

The **Twelve Standard Aviation Questions That Shout "Watch Out!''** are a part of the risk management process that should occur.

A **Risk Assessment** Example is located in Appendix A.

The Aviation Operations Checklist is a tool available to users to help ensure that all necessary flight safety items have been addressed. (See Appendix B.)

Pre-Mission Briefing

When planning a mission there are many things that must be considered prior to conducting a mission. These should be included in the pre-mission briefing:

1. What's the Right Tool?
2. Flight Routes/Areas and Altitudes
3. Risk Assessment
4. Flight Hazard Maps
5. Objectives
6. Cost
7. Justification
8. Approval

When in doubt ASK before you fly!

Interaction/Activity: Scenario Part One

You are a trails leader at Really Cool National Park and have been assigned the task to fly 25,000 pounds of materials from park headquarters to the quarry site next to the Big Falls Trailhead along State Highway 49 for your summer project. The materials include lumber and various construction materials to rebuild the bridge that washed out last summer during the spring rains.

The project aviation safety plan was approved and signed by the park superintendent last week. A risk analysis was completed and rated out as moderate. You are current and qualified with all the required training that is required for this mission.

What question(s) should you ask your supervisor prior to accepting this mission?

Helicopter Performance

When it comes to performance, not all helicopters are created equal. To ensure external load operations are conducted safely, it's important to have a basic understanding of the factors that affect helicopter performance.

Most performance-related accidents happen in the take-off and landing phases of flight. They usually involve a failure of the pilot to adequately determine that the power required for the intended mission is available given the prevailing conditions.

Ground Effect

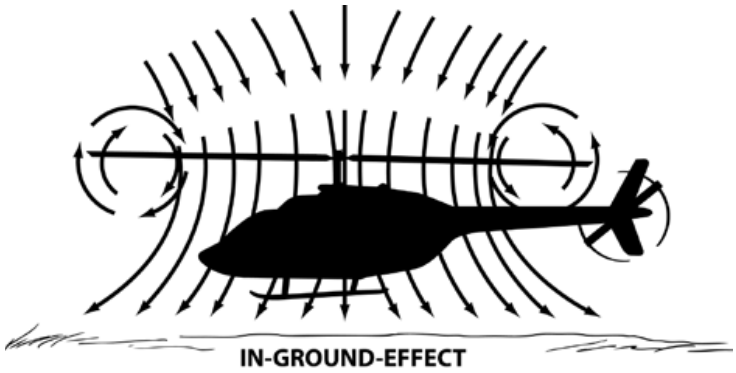
This is a condition of improved rotor system performance resulting from aerodynamic forces encountered when the helicopter is hovering **about half the rotor diameter distance from** the ground. Simplified, a cushion of air is created between the ground and the helicopter, lift is increased, and power requirements are reduced. Maximum ground effect is accomplished over smooth, level surfaces. Tall grass, steep, rough terrain, or water dissipates this cushion and may reduce or eliminate ground effect.

Hover-Out-Of-Ground-Effect (HOGE)

HOGE occurs when the terrain does not provide sufficient ground effect base or **when performing external load work**. The helicopter is power dependent. Maximum performance is required and payload may have to be reduced.

Hover-In-Ground-Effect (HIGE)

HIGE occurs when the terrain provides sufficient ground effect base. (One half rotor diameter distance from the ground.)



Interaction/Activity: Scenario Part Two

You are a trails leader at Really Cool National Park and have been assigned the task to fly 25,000 pounds of materials to rebuild the bridge that washed out last summer during the spring rains.

Your supervisor informs you that the materials for the bridge will be flown ¾ of a mile down the trail to the Broken Horse Campsite. There is no road access and the materials are too heavy for a pack train to carry in.

The staging area for the materials to be flown from is the Quarry site which is a large flat opening approximately 15 acres in size. The Broken Horse Campsite is a small opening along the ridge approximately 2 acres in size surrounded by tall Douglas-fir trees on all sides.

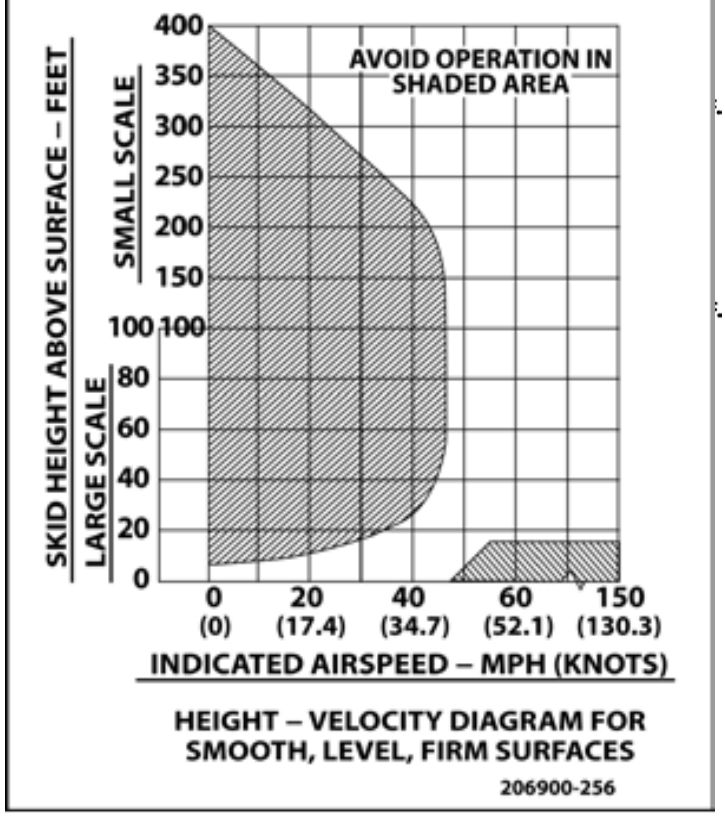
Which site do you think will require greater power from the helicopter and why?

Autorotation

Autorotation is a non-powered flight condition in which the rotor system maintains flight rpm (revolutions per minute) by reverse airflow. It provides the pilot a means of safely landing the helicopter. In the flight manual for each helicopter is a chart which provides necessary information to complete a safe autorotation. This is a **height velocity diagram,** indicating the comparative combination of airspeed and altitude required to accomplish a safe autorotation. By flying low level, or performing extended hovers, we are dramatically reducing our safety margin and limiting the pilot's options.

HEIGHT-VELOCITY DIAGRAM

The Height-Velocity Diagram defines the conditions from which a safe landing can be made on a smooth, level, firm surface following an engine failure. The Height-Velocity Diagram is valid only when the helicopter gross weight does not exceed the limits of the Altitude Versus Gross Weight Limit for Height-Velocity Diagram.



HEIGHT – VELOCITY DIAGRAM FOR SMOOTH, LEVEL, FIRM SURFACES

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Height-Velocity Curve

The importance of the height velocity curve to the Pilot, Ground Crew and management:

If a helicopter has a catastrophic engine failure while hovering at 100 feet AGL, it will contact the ground in approximately 2.5 seconds at a speed of 50 miles per hour, or 67 feet per second. **Keep alert while working under a helicopter doing longline work!**

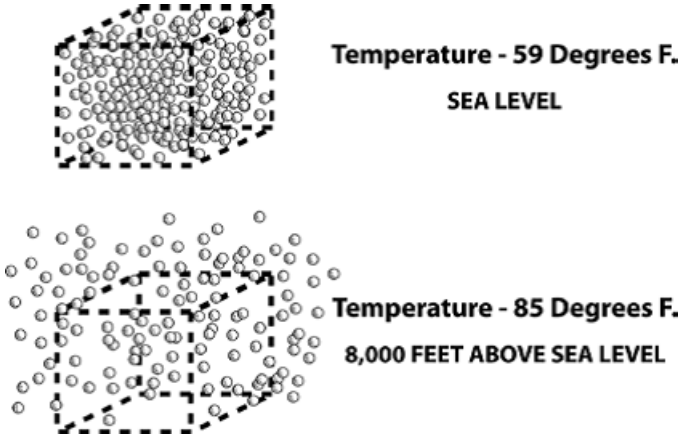
Reference: Basic Aviation Safety, **NFES 2907** (Also available at: www.iat.gov/docs/2013_Basic_Aviation_Safety.pdf)

Density Altitude

Density altitude refers to a theoretical air density which exists under standard conditions at a given altitude. It can have a profound effect on aircraft performance. There are three factors that affect density altitude in varying degrees: atmospheric pressure, temperature, and, to some degree, humidity. The most dramatic influence on density altitude is temperature.

Atmospheric pressure decreases approximately 1 inch per 1,000-foot increase in altitude. The average temperature decrease per 1,000-foot increase in altitude is 3.5 degrees Fahrenheit (2 degrees Celsius).

When planning a project, we can see the importance of starting early in the morning when temperatures are cool, to maximize the performance of the aircraft.



Weight and Balance

All helicopters are designed for certain load limits and balance conditions. The pilot is responsible for seeing that weight and balance limitations are not exceeded prior to takeoff.

Three kinds of weight must be considered by the pilot: empty weight, useful load, and gross weight.

- **Empty weight** is the total weight of the helicopter including all fixed equipment, oil, hydraulic fluid, and coolant. **This does not include fuel or the pilot.**
- **Useful load (payload)** is the weight of the pilot, passengers, cargo, and fuel.
- **Gross weight** is the empty weight plus the useful load.

Maximum Gross Weight

Maximum Gross Weight is the maximum weight that the helicopter can weigh and safely fly at sea level on a standard day. This is certificated by the Federal Aviation Administration for each helicopter type.

Although a helicopter is certified for a specified maximum gross weight, **it will not safely perform with this load in all conditions**. It may be required to "download" by removing some cargo and/or passengers, or by carrying less fuel in the helicopter.

Allowable Payload

Allowable Payload represents the amount of weight that is available for passengers and/or cargo.

The pilot can determine the gross weight by referring to the computed gross weight charts in the performance section of the flight manual. The charts are computed for

hover-in-ground-effect (HIGE) and hover-out-of-ground-effect (HOGE). If the outside air temperature (OAT) and pressure altitude are known, or at least estimated closely, the pilot plots them on the chart.

The chart gives a computed gross weight calculated for HIGE or HOGE. This is the computed gross weight that can be used for that specific temperature and altitude, for takeoffs and landings.

Center of Gravity (CG)

In conjunction with determining the gross weight of the helicopter, the pilot must consider how the load is balanced within the center of gravity limitations of the aircraft. **Center of Gravity (CG)** is the point where the helicopter is in balance and most of the weight is concentrated.

Draw an imaginary line through the center of the rotor mast, from the top of the mast to the bottom of the helicopter. This would be the center of gravity. Ideally, the helicopter should be in perfect balance. The fuselage will remain horizontal in hovering flight, with no cyclic pitch control required. Center of gravity is located directly under the rotor; the helicopter hangs horizontal.

The majority of human error accidents are related to the fact that helicopters are flown in unusual and difficult situations where the margin of error is small and the penalty can be great.

The pilot is responsible for computing the aircraft's weight and balance for all flights and for ensuring that the gross weight and center of gravity does not exceed the aircraft's limitations. A tool for determining the allowable payload is the Standard Interagency Load Calculation Method and its form (OAS-67 and FS-5700-17). (See Appendix F.)

NOTES:

Interaction/Activity: Scenario Part Three

You are a trails leader at Really Cool National Park and have been assigned the task to fly 25,000 pounds of materials from the Quarry Site to the Broken Horse Camp Site for your summer project. These sites are 15 minutes flight time in distance from each other one way.

Your local dispatch center informs you that 2 helicopters are available for the assigned project and wants to know which one you'd like to order.

Helicopter N86WT is a Bell 206 B3, also known as a Jet Ranger (light helicopter). It costs $650.00 a flight hour. The load calculation the pilot provided for the dispatcher for HOGE shows the allowable payload to be 400 pounds at 6,000 feet at 80 degrees F with 2 hours of fuel.

Helicopter N205HJ is a Bell 205 A1++, also known as a medium helicopter. It costs $1,850.00 a flight hour. The load calculation the pilot provided for the dispatcher for HOGE shows the allowable payload to be 2,150 pounds at 6,000 feet at 80 degrees F with 2 hours of fuel.

Which helicopter would you choose for the project and why?

Remember when operating at high density altitudes and weights, the 'three Hs' (High, Hot, Heavy) all combine to produce a significant reduction in helicopter performance!!

Site Selection

Inadequate areas heighten risk, increase pilot workload, and result in inefficient operations and could potentially contribute to an accident occurring.

Important Factors to Consider:

Winds

The type and direction of wind could increase or decrease helicopter performance.

- A **steady headwind** provides a benefit in terms of improved rotor efficiency and thereby performance. Ideally the helicopter should be orientated so that the wind is from its front quarter at all times. Knowing the direction is critical – especially in light wind conditions. Some helicopters have a 'critical wind azimuth' (Bell 206 B3) in which adequate control of the helicopter is not assured when the wind is from anywhere within the specified azimuth area.

- A **tailwind** requires an increase of power, a higher groundspeed and a decreased angle-of-climb, which is bad for obstacle clearance. Tailwinds should be avoided. Just a couple of knots of wind on the tail can make a huge difference to the power required to satisfactorily control the rate of descent during an approach – especially when landing at high altitudes.

- A **crosswind** may be an advantage or disadvantage depending on where it is coming from.

- **Gusty wind** conditions can result in varying power demands and an unstable approach and should be avoided when possible.

- Local terrain, trees and buildings all influence the flow of wind near them. The mechanical disturbance resulting from the disturbed airflow may become very marked on the lee side of the obstruction. This **turbulence** will require a greater power margin to deal with any unexpected loss of airspeed and sink.

Terrain

Use the same general criteria for selecting longline sites as you use for any helicopter takeoff/landing area.

- Preferred sites:

    1. Exposed peaks and ridges
    2. Windward side of ridges
    3. Meadows or open area

- Areas to avoid:

1. Leeward sides of ridges
2. Closed canopy situation
3. Draft/updraft/erratic wind situations

Obstructions/Hazards/Tree Heights

Assessing Height of Surrounding Hazards

- Trees, snags, and terrain may pose a danger to the safe accomplishment of a longline mission.
- Gauge the height of surrounding obstacles so the proper length of longline can be requested to keep the aircraft above and clear of hazards.

Below are some of the common items we carry into the field can be used to help determine the height of trees or hazards.

Using a Compass to Determine Height of Hazard

1. Back up from the tree or hazard along level ground or along a line of elevation so that the top is roughly at a 45-degree angle above you.
2. Set the compass bezel to 315 degrees (360 – 45 = 315).
3. Use the north/south axis as your horizon line.
4. Eye the top of the tree or hazard along the edge of the compass. Adjust your position to get an exact 45-degree angle. Have a partner help in adjusting the compass and your position to get the angle right.
5. Once you have a 45-degree angle and the top of the hazard lines up with the edge of the compass, pace the distance from that point back to the base of the tree or hazard.
   a. Walk a direct line with no ups and downs.
   b. Do not gauge the height from higher or lower ground. Need to be level with the base of the tree or hazard.
   c. Know the length of your pace.
   d. Add your height to the paced distance.

Using a Stick or Pencil to Determine Height of Hazard

1. Back up from the tree or hazard.
2. Bracket the tree or hazard with the stick or pencil: The top and bottom of the tree or hazard needs to match up with the top and bottom of a stick or pencil held out at arm's length.
3. Lay the stick or pencil on its side, horizontal, with one end matched up to the bottom of the tree or hazard.
4. The point where the other end falls on the horizon, along level ground, is equal to the height of the hazard. Pace from that point on the ground back to the base of the tree or hazard to get the height. Knowing the length of your pace is important in getting an accurate measure.

Fall a Tree

If absolutely necessary and all else fails, consider falling the tallest tree or snag around. You may need approval from a resource advisor or line manager. Once you have the tree on the ground, measure it by pacing. From that measurement, you should be able to determine the general heights of surrounding trees.

Interaction/Activity: Scenario Part Four

You are a trails leader at Really Cool National Park and have been assigned the task to fly 25,000 pounds of materials from the Quarry Site to the Broken Horse Camp Site for your summer project.

Of the sites planned for the project, which one has the potential to affect helicopter performance and why?

You've decided and justified the need for helicopter transport of external cargo and selected safe locations to conduct operations.

What information do you think would be necessary for the aircrew member to successfully carry out the mission?

Please list the information needed:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

Module 2: Equipment

Objectives

4. Properly weigh, package, manifest and rig items to be delivered via external load.
5. Demonstrate proper procedures to perform safety inspections on helicopter rigging equipment.

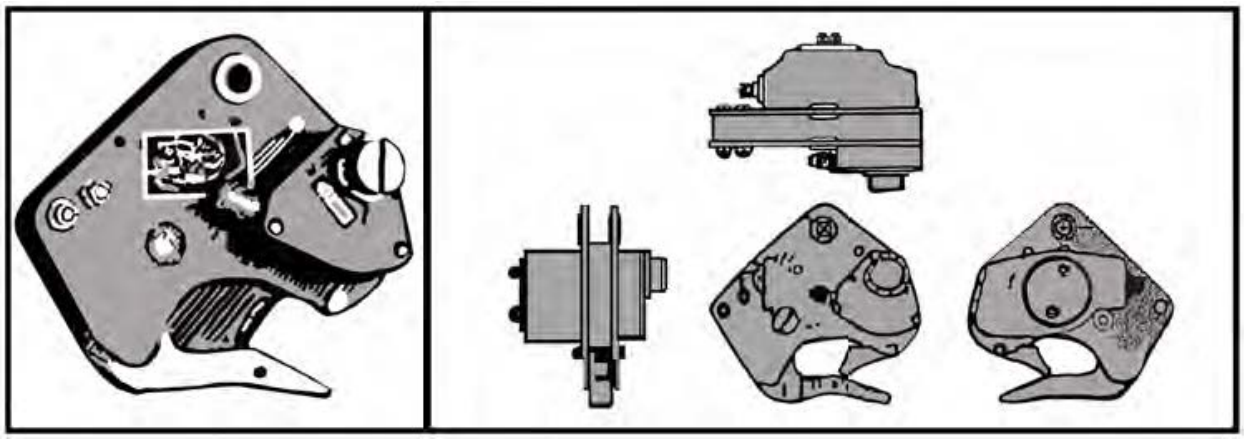
This section addresses external load helicopter accessories for transporting equipment and supplies. These components include swivels, leadlines, buckets, nets, hooks, etc., that are attached to the cargo hook of the helicopter. Equipment must be rated for vertical lifting and must have a working capacity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

Users should **ALWAYS** check the **aircraft data card** and **pilot qualifications card** to ensure that the aircraft and pilot are current and authorized to perform the external load mission.

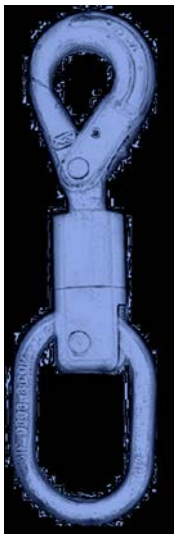
Equipment

The **Cargo Hook** is attached to the belly of the helicopter. It may be loaded and locked in a single motion with one hand. The release must be manually and electrically operated by the pilot from the cockpit.

The cargo hook also has a manual release on the hook itself that can be operated by the individual performing the hook-up.



Swivel



A cargo swivel consists of a ring or link on the upper end, a hook on the lower end, and swivel section in between. A swivel allows the load to rotate while in flight and prevents the longline from twisting, preventing cable damage or inadvertent release.

NOTE: A Swivel is required for every load.

- **Capacity of Swivels**
  Standard swivels are rated at 3,000 and 6,000 pounds and will have the capacity stamped directly on it. If not – DO NOT USE.

- **Inspection and Maintenance of Swivels**

  When inspecting and maintaining swivels, always check for:

1. The spinning action of the swivel
2. The condition of the integrated latch system
3. The bolts on the detachable types of swivels (a simple way to check for slip is to paint or mark some of the bolts on the swivel)
4. Check all serviceable parts

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.

- **Capacity and Size of Leadlines**

  Leadlines for most lengths are rated at 3,000 and 6,000 pounds. The standard length is twelve (12) feet, with twenty-five (25) and fifty (50) foot lengths available.

- **Inspection and Maintenance of Leadlines**

  Check for:

1. The condition of the keeper-gate on the hook at the end of the cable. This is the part most easily damaged. Exert lateral force on the gate and check for 'play'. If there is significant 'play' or the gate can be moved beyond the curved edge of the hook – **DO NOT USE**.
2. 'Swages' are metal sleeves where the ends of the cable form 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 – **DO NOT USE**.
3. Leadlines with aluminum swages **SHALL NOT BE USED.**

Cargo Nets

Cargo nets come in round and square configurations and are designated as "heavy" or "lightweight." The nets are 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.

Heavy Cargo Net

Each heavy cargo net consists of a net mesh and a perimeter rope(s) 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 at the end of the lines. This is the attachment point to the swivel or leadline.

- **Capacity and size of heavy cargo nets**

  Cargo nets come in the following commonly available sizes rated at 3,000 and 6,000 pounds.

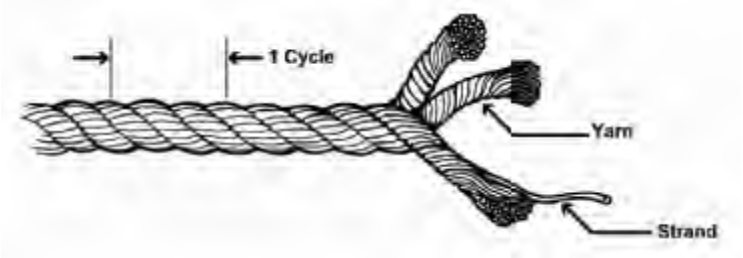
  - Square nets: 12 X 12 feet with 3,000 pound capacity or 15 X 15 feet with 6,000 pound capacity.

  - Round nets: 12 foot diameter circle with 3,000 pound capacity or 15 foot diameter circle with 6,000 pound capacity.

- **Inspection and maintenance of heavy cargo nets**

  Check for:
  1. For broken or worn braids or strands, particularly in the center of the net.

2. For brittleness, this is caused by exposure to the sun and is the most common cause of net failure. To test, bend several areas of the cargo net's rope 180 degrees back upon themselves. If the net is brittle, it will visibly break. If more than one or two strands break per bend, **DO NOT USE** the net.
3. 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.
4. 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 it to become brittle, 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.

Note: For wet or humid environments, ensure the nets are thoroughly washed and dried in the shade before storing. Storing the nets in duffel bags for humid environments is not recommended.

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.

- **Capacity of Lightweight Cargo Nets**

  Lightweight cargo nets have a capacity of **only 300 pounds**.

Cargo Lift Bags

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.

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.

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:

Barrel Hooks/Clamps

Barrel hooks are made of chain or cable. Two sets are usually used together.

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.

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.

Be especially careful not to fly over persons or structures when using chokers.
CAUTION: Chokers are not to be used as leadlines.

Seed and Fertilizer Spreaders

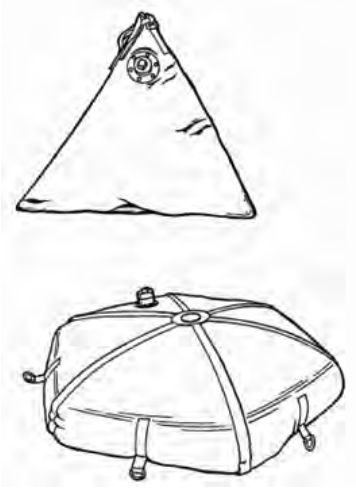
Spreaders are typically self-contained in that only power and control is required from the helicopter for the device to operate. They are supplied complete with appropriate rigging and lines for connection to the helicopter cargo hook. In some cases, spreaders are supplied with their own internal combustion engine.

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.

Two Basic Designs: Pyramid and Pillow

1. Different sizes (72-gallon and 134-gallon containers are the most common size).
2. Made of rubber-coated fabric with sewn/glued straps with metal ring attached to hook leadline or swivel.
3. If it is flown empty, the container must be rolled up and tied/taped or it may fly around and come off the hook.



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.

Every load gets a swivel!!!

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 or manually release loads attached to the remote hook.

Gaining in popularity is a longline with a swiveling remote hook, commonly referred to as the “Canam-Style Swivel.”

Longline with Canam-Style Swivel and Remote Hook

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).

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 (AKA Longline)**
   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.

   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:

   a. For kinks or abrasions in the electrical cable.
   b. For cracked or broken electrical plugs at each section.
   c. For broken or bent keepers on the hook connections.
   d. The condition of swages at the end of each cable section.
   e. The condition of keepers on hook gates at the end of each line.
   f. 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.
   g. 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).
   h. 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:
   i. The electric and manual releases are operational on the helicopter cargo hook.
   j. The remote hook is functioning.

Interaction/Activity: Scenario Part Five

You are a trails leader at Really Cool National Park and have been assigned the task to fly 25,000 pounds of materials from the Quarry Site to the Broken Horse Camp Site for your summer project.

What equipment should you plan on using for this project?

Interaction/Activity: Equipment Review

Display and **demonstrate** how each piece of equipment is to be inspected and used.

Module 3: External Load Operations

Objectives

6. Demonstrate proper procedures to belly hook an external load.
7. Demonstrate proper procedures to conduct long line operations for an external load.
8. Demonstrate proper procedures to “daisy chain” multiple loads for long line delivery.
9. Demonstrate proper procedures to hover hook an external load.
10. Identify proper procedures of load delivery when flying cargo that can’t be weighed prior to flight.
11. Identify and troubleshoot improperly rigged loads.

When cargo is transported incorrectly, there is the potential for dropped loads, hazardous materials spillage, over-grossed aircraft, cargo interference with the rotor systems, or other serious safety hazards. The incorrect method of rigging and transporting cargo can result in a catastrophic accident.

Use of the standard procedures outlined in this unit will facilitate a safe and efficient cargo operation.

Before any external load mission, ensure:

1. A risk management process has been completed at the appropriate level.
2. The pilot is qualified and the aircraft is equipped for the mission.
3. A load calculation is completed for current conditions.
4. All cargo has been weighed and manifested. Do weights include remote hook, net, swivel, and line weight?
5. Ensure total weight on manifest is less than HOGE-jettisonable allowable payload for specific aircraft.
6. Save the manifests for the project file at the completion of the mission or at the end of shift.

Cargo

During cargo transport operations, load calculations shall be performed prior to any flight activity. This information is obtained from the pilot at the beginning of the mission.

A load calculation is required to be completed at the beginning of the day and any change in temperature (+/- 5 degrees C) and elevation (1,000 feet gain or loss).

Obtain pilot approval of all cargo to be transported.

Personnel loading cargo must always inform the pilot of:

- Hazardous material(s) being transported
- Packaging of the hazardous material

Weigh cargo and inform the pilot of actual weights!!
Do not exceed allowable payload!!

If possible, have the cargo weighed, packaged, and marked for destination prior to the arrival of the helicopter. Portable scales can be easily set up at remote sites for weighing items.

Cargo Inspection

1. All cargo requires inspection to ensure proper procedures are followed.
2. Consider a cargo preparation area, away from other operations, if a large amount of cargo is to be flown.

Ensure that the area being used for cargo preparation will not damage or snag any sling equipment (i.e., sharp rocks, etc.).

Container Inspection

1. Some items may need to be double-bagged or boxed to prevent leakage into the helicopter. Wrap the neck of plastic bags with tape.
2. Boxes need to be taped and all loose items secured. Smaller items should be taped or tied to larger items to avoid falling through net.
3. Sharp edges need to be protected to prevent damage to the net or other cargo.
4. All liquid containers need to be boxed or secured to remain upright.
5. Fragile items should be cushioned.

Hazardous Materials

1. Hazardous materials need to be identified. The Interagency Aviation Transport of Hazardous Materials Handbook/Guide outlines required standards.
2. For external load operations, the pilot must be notified verbally of the type and quantity of hazardous materials.
3. Do not transport food items with liquid hazardous materials if at all possible.

Loading Nets

1. Place heavy/bulky items in the center of the net.
2. Build loads in pyramid shape if possible.
3. Do not over-bulk the net: The net should encompass the entire load.
4. Pull metal rings on net perimeter rope to equal lengths.
5. Do not “stitch” or “weave”: Rope should never be rubbing on rope.

6. Add ballast (rocks, tools, etc.) to light bulky loads such as sleeping bags or light cargo. Make the load at least 200 lb.

Every load gets a swivel!!!

Due to the diverse nature of our aviation programs, there may be circumstances where cargo cannot be weighed prior to lifting. Examples: wrecked vehicles in canyon bottoms, paleontological specimens encased in plaster, etc.

In these circumstances, these steps will facilitate a safe operation:

1. An estimation of weight for the cargo to be delivered shall occur.
2. Ensure the helicopter that is planned for the operation has a “load cell” on board, and is capable of lifting the highest possible weight estimation for the cargo.
3. Establish procedures for determining if power available for lift is greater than the power demand on the helicopter.
4. Establish a secondary plan in the circumstance that the load cannot be safely lifted with the planned aircraft.

Rigging Specialized Cargo

Plywood/Lumber/Logs or Poles/Pipe

1. Secure in bundle.
2. Use chokers if possible.
3. Logs and poles will fly better when attachment is on one end and flown vertically. Will also allow the pilot to pick up and set down the load easier.
4. Plywood may require a “tail.” A large net helps break aerodynamics.

Every load gets a swivel!!!

Preparation for Conducting External Load Operations

1. Proper personal protective equipment (PPE) is used (nomex pants/long sleeve shirt, hardhat with chin strap, leather boots, leather gloves, or nomex/leather combination gloves, hearing protection, eye protection).
2. Two people are recommended for most operations: One with a radio and one to ‘hook’ the load.
3. Emergency procedures for pilot and personnel are established and understood, including an engine or mechanical failure at pickup point or destination.
4. Crash and rescue procedures are identified.
5. Site preparation is completed: If the helicopter must hover below obstacles, the canopy opening shall be a minimum of a “safety circle” for the type of helicopter.
6. All hazards are identified.

- The performance of external load missions must be contingent upon proper assessment and preparation of the delivery site by first mitigating hazards.
- When obstacles present a risk of contact with aircraft or rotor blades, the pilot should decline the mission until hazards are removed, additional line can be added, or a better location can be identified. Pilots have the final say in accepting or declining any mission.

7. Appropriate longline length is utilized for opening size and to maintain clearance above highest obstacle.
8. In areas of sloping terrain or with obstacles rising to one or more sides of the cargo pickup/delivery area, the pilot shall maintain rotor clearance from all obstacles equivalent to the landing area safety circle requirements.
9. If the helicopter is within ½ rotor diameter of the highest obstacle, the pilot should consider adding another length of line.

Keep the area clear of unauthorized personnel.

The aerodynamic configuration of a load may cause it to spin and oscillate, which in turn may cause the pilot to experience control problems with the helicopter. Such difficulties may cause the pilot to return with the load for re-rigging, or, in extreme cases, to release the load, either intentionally or inadvertently.

Static electricity may present a problem to the hookup person when attaching loads to hovering helicopters. Allowing the remote hook to touch the ground, grounding the load to the helicopter skid prior to attaching to the cargo hook (never touch the skids or any other part of the helicopter without the pilot's permission), pilot keying the radio prior to the hookup person attaching the load, etc, are ways to reduce static shock. Unfortunately, there is no method that ensures that the hookup person will not receive some amount of electrical shock when the swivel touches the hook.

Proper Rigging Methods for External Cargo

The importance of inspecting equipment prior to rigging cannot be over-emphasized. Ground personnel and pilots should be thoroughly trained and briefed on rigging and hand signals.

1. Personnel should never stand under a load, or between the load and an immovable object, when working around operating helicopters.
2. When working with unstable loads, personnel should avoid placing hands in an area where they can be caught in rigging.
3. **EVERY load gets a swivel** to avoid line twisting. When building loads using multiple nets, a swivel should be in place for each net.
4. With loads comprised of multiple nets, the fragile or lighter loads may be rigged above or below the heavier loads. Consult the pilot regarding rigging preferences. **This is commonly referred to as a "daisy chain."**

How to Rig a "Daisy Chain"

REMEMBER: The pilot always has the final say regarding whether or not to conduct the mission. Do not pressure the pilot, either implicitly or explicitly, into flying a load with which he or she does not feel comfortable.

1. It is acceptable to use a longline without a remote hook **provided that qualified personnel are available at both ends of the operation and that the cargo is attached at the bottom of the longline using a swivel**.
2. Fiber taping or securely strapping rigid water tanks into the closed position will prevent them from opening in flight.
3. A single-point sling (choker strap) is not normally the best method to carry a load, except for items such as logs.
4. A two-point sling with less than a 45 degree angle to the hook or longline is the common method for most loads that will not fit into a cargo net.
5. Use a four-point sling for box-like loads.
6. A spreader bar is useful for stabilizing a load, or where the sling may catch or damage the load if attached conventionally.
7. Properly rolled and secured, empty cargo nets may be flown on the cargo hook, leadline, or a longline. The forward motion of the helicopter may cause the net to trail and drift up towards the tail, with potential to become caught in the tail rotor. Leadlines with empty cargo nets should be shorter or much longer than the distance between the cargo hook and the tail rotor.
8. Certain loads such as vehicles, crashed aircraft, and other irregular loads, require special rigging including the use of drogue chutes or spoilers. Never attempt to build such loads without prior training and/or experience.
9. There is no way to predict how each load will fly. This is especially true of non-standard loads such as large water guzzlers, cement mixers or pipe. Consult with the helicopter vendor or Pilot, who may be able to supply the necessary expertise and/or equipment.
10. If a load does not fly well, rig the next load differently and try again, provided there are no safety issues. If safety will be compromised, other means of transportation should be found, such as ground vehicle, pack train or paracargo.

Cargo Hook/Ring Interface

The connection between the cargo hook and the swivel and/or leadline ring is a critical interface. Loads can be inadvertently dropped, or can be non-releasable, due to incorrect connections.

The size or shape of the ring is a significant factor in inadvertently released loads. Personnel should be aware of the following:

- When the ring maximum inside diameter is greater than the “snout” dimension on the cargo hook, there exists a small potential for the ring to ride over the load beam and inadvertently release from the cargo hook.

- Ring shapes other than a circle (e.g., oval- or pear-shape) pose the greatest chance of inadvertent release. However, such release is rare for any rings when properly placed on cargo hooks.

- Use of a swivel reduces the chance of a hung load by limiting the torsional load that can be applied to the ring.

Basic Tasks

These basic tasks should be performed prior to performing any external load operation include the following:

1. Prepare by removing any items from the helicopter that are not essential.
2. If requested, assist the Pilot with the removal of all or any doors and store in a safe location at the Pilot’s direction.
3. Check both the rigging of the load and the external load equipment.
4. Attach the load to a swivel. Use of a swivel is required. Attach the swivel to the cargo hook or leadline. If using a longline with remote hook, attach the swivel to the remote hook.

Jettisonable Loads

What is a jettisonable load? A jettisonable load is usually associated with being an external load that can be released (jettisoned) from the cargo hook. Anything on the cargo hook on the belly of the helicopter should be capable of being released by the pilot at any time in the event it is needed to gain power for control of the aircraft.

Typically when flight planning the pilot utilizes the HOGE performance charts for external loads and then subtracts an additional safety margin weight - the fixed weight reduction (safety margin that is factored in for each aircraft) from the allowable payload. When the load can be “released” during an emergency situation (jettisoned), the fixed

weight reduction does not need to be subtracted from the allowable payload – If and only if the pilot agrees to it.

There are four methods of hooking up loads to the helicopter for transport. These are:

1. Hookup while the aircraft is on the ground
2. Hover hookup attaching the rigged load directly to the cargo hook (no leadline)
3. Hover hookup using a leadline
4. Hover hookup using a longline with a remote electric hook or carousel

Hookup with Helicopter on the Ground

This method is usually used when the helicopter is shut down, and **involves the least amount of risk to those involved**. The pilot should be present when hooking the load to the aircraft.

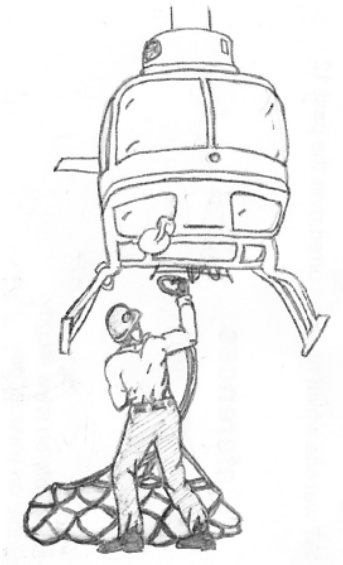
Once the load is ready, perform a two-point hook check:

1. Pilot checks manual release to the cargo hook.
2. Pilot checks the electrical release to the cargo hook.
3. Check the electrical function of the mission equipment (for example, water bucket release, remote electric hook release, helitorch pump, etc.).
4. Run the leadline from the load swivel to the cargo hook, ensuring that the line is not near or looped over any skid.

It is important to test the manual release first before the electrical release. This sequence is necessary because the manual release is usually a cable susceptible to snagging or incorrect rigging. Some operators want to test the manual release only once per day as more checks may put undue wear on the release. If this is the case, those manual releases may be checked one time per day.

After all checks have been performed, visually inspect the cargo hook to ensure the release arm or knob is fully reset.

Only one person is necessary for this type of operation, since the person hooking the load can accomplish the hookup, then exit and perform the marshalling duties.



Hover Hookup with Leadline

Hover hookups with leadline are effective when:

- Multiple loads need to be transported in a short time frame.

- The load destination involves terrain on which the helicopter is unable to land.

Only trained and qualified personnel shall perform hover hookup operations. It is recommended that two individuals perform the operation, a person to marshall (parking tender) and a hookup person.

Ensure that the ground crew and pilot are thoroughly familiar with standard hand signals.

For hover hookups, these should include:

- The helicopter's height above the hookup person (accomplished by using the Move Downward signal)
- Indication that the helicopter should hold while the hookup person leaves the area (Hold Hover signal)
- Indication of load clearance (accomplished by using the Move Upward signal)
- Clear to take off (Clear to Take Off signal)

Hover Hookup with Longline and Remote Electric Hook

Hover hookups with longline and remote electric hook are effective:

- When multiple loads need to be transported within short time frames.
- When the load is on terrain on which the helicopter is unable to land or take off.
- When the surrounding vegetation and/or terrain is such that the helicopter is unable to perform a hover hookup with a standard length of leadline.
- When ground personnel are not at the receiving site.
- Use of a longline with remote electric hook carousel allows the pilot to place loads at different locations during the same mission.

Two people are recommended, a person to marshall (parking tender) and a hookup person. If circumstances dictate, one person may perform the operation, provided there is positive air-to-ground radio communication between the pilot and the individual performing the hookup.

Advantages:

1. Can provide more flexibility for cargo missions.
2. Gives the pilot more altitude in an emergency.
3. Allows loads to be placed in more confined areas and without personnel at the site.
4. Reduces rotor wash.
5. Has the same procedure as a hover hookup but adds a vertical aspect to signaling. Personnel will need to back up farther and to the pilot's side of the aircraft to remain in the pilot's line of sight.

Note: It is preferable to use a radio instead of hand signals.

Standard Procedures for Hover Hookup

These are standard procedures for any hover hookup, regardless of whether or not a leadline is used:

1. The load should be placed in front of the helicopter skids, with no potential for lines to become snagged over the skids.
2. The cargo net's perimeter lines should be drawn over the top of the load and laid so that the lines and leadline are prevented from becoming entangled in the net during liftoff.
3. The Parking Tender should direct the Pilot by radio or standard hand signals.
4. The Parking Tender should be far enough back of the load to remain visible to the Pilot at all times.
5. The Parking Tender should be slightly to the side of the load so that they can maintain visual contact with the Pilot. For helicopters that are flown from the right seat, the Parking Tender should be approximately at the Pilot's "2 o'clock" position.
6. The Parking Tender should wear a non-flammable, high-visibility vest if available to distinguish him or her from other personnel.
7. Measures to prevent static electrical shock may be taken by the hookup person and the Pilot, once agreed upon.
8. After the hookup is completed, the hookup person should exit from underneath the helicopter to the front and in full view of the Pilot and proceed to a position that is not in the departure path of the helicopter. Always keep the load between you and the helicopter.
9. When the hookup person is clear, the Parking Tender may signal the Pilot to begin moving the load. The Parking Tender must pay close attention as the helicopter lifts and tension is applied to the line. An improperly rigged or placed load can become snagged at any time. If the load becomes snagged or is improperly rigged or hooked, the Parking Tender must communicate this to the Pilot using the radio or hand signals.
10. The hookup person should remain ready to take direction from the Parking Tender should the load or line become snagged.

CAUTION: The **hookup person should never re-enter the load area** beneath the hovering helicopter **unless** the Parking Tender directs the hookup person to do so, and the pilot is aware of the person's movement.

The **hookup person should never attempt to re-rig a load when tension is still applied** to the load by the helicopter. Hands, arms, or other parts of the body could become snagged in the load, causing serious injury.

Longlines should be attached to the helicopter while it is **on the ground** and **NOT** while the helicopter is hovering overhead.

Hover hookups to connect electrical power accessories should not be performed. If an electrical connection is loose or not functioning, the pilot should land and rectify the problem.

Longline with Remote Electric Hook Procedures

Considerations and requirements for longline with remote electric hook operations include:

1. The sling load should be placed on the ground in the center of the loading area.
2. On approach, the signal person should advise the Pilot on load clearance from trees, load height above the ground, and any problems that might arise in the pickup or drop zones.
3. For safety purposes, the hook should be placed next to the load. The hookup person should not be next to the load at the time the Pilot is placing the hook.
4. Once the hook is placed on the ground, the Pilot should then move the helicopter to the side so the hookup person is not directly beneath the hovering helicopter.
5. When attaching a load to the remote electric hook, the hookup person should allow the hook to contact the ground before touching it. This grounds the hook and eliminates the possibility of shock from static electricity.
6. When attaching a load to a remote hook, take the remote hook to the swivel rather than taking the swivel to the remote hook. This ensures positive control of the hook.
7. The hookup person hooks the load to the remote electric hook and leaves the area. On approach or departure to the remote hook, the **hook-up person shall not step over the longline** when attaching the load.
8. Helicopter is then positioned above the load and the load is lifted from the ground and flown out.
9. When receiving a load, stay clear of the landing area. Let the Pilot set the load on the ground and release it before entering the area. On approach or departure the **hookup person shall not step over the longline** when detaching the load.

Communications

1. Positive radio communication must be established or NO GO!
2. Short and to-the-point transmission. Be specific. (Emphasize the importance of using appropriate radio etiquette.)
3. Shield the microphone with your hand (rotor wash might "garble" your transmissions).
4. Use the radio remote connection to the flight helmet or mic and headset if available.

5. Ask the pilot how much instruction or talking he or she wants. Some pilots will not want any once they know where you want the load (unless there is a problem). Radio traffic can be more of a distraction to the pilot than a help.
6. Advise the pilot of the actual weight of load when he is ½ mile out.
7. Inform the pilot and other personnel of any known hazards in the area.
    a. Other aircraft in area
    b. Winds
    c. Wires or snags
    d. Hazard heights and location
8. May use a signal mirror to assist the pilot in finding your specific spot.
9. Use clock directions from the pilot's perspective. (Visualize the rotor disk as the clock with the nose at 12 o'clock and the tail at 6 o'clock.)
10. Give distances and clearances of load to ground, not helicopter to ground.
11. Use "up, down, back, forward, hold, upslope, downslope," etc., to direct the pilot/helicopter movements.
12. Indicate the wind by using flagging or throwing dirt in the air.
13. Give the pilot a "target." Mark the spot where you want the load delivered.
    a. "X" with flagging, logs, rocks, etc.
    b. Stand on the spot. Back off once the pilot tells you he has the site in view.

REMEMBER: The pilot always has the final say regarding whether or not to conduct the mission. Do not pressure the pilot, either implicitly or explicitly, into flying a load with which he or she does not feel comfortable.

Interaction/Activity: Equipment Review

Display and **demonstrate** how each piece of equipment is to be inspected and used.

NOTES:

Module 4: Emergency Procedures

Objectives

12. Demonstrate proper emergency procedure considerations for external load delivery.

Despite the best efforts of all involved in helicopter operations, it is recognized that accidents can and do occur. Even with the limits inherent in operating at remote sites, an accident demands an immediate and correct response to prevent serious injury or property damage.

Types of aviation emergencies might include, but are not limited to, the following:

In-Flight Emergency

Planning to cover these emergencies should include answers to the following:

1. Are passengers being regularly briefed on in-flight emergencies?
2. Have emergency landing areas near the project area been identified and made known in the morning briefing?
3. Are these areas accessible by ground or by the identified medevac aircraft?
4. Are there limitations to ground access (bridges, gates) that will require that the entire response be by air?
5. Has an emergency response team and aircraft been identified?
6. Have ground crews been briefed in the event the helicopter makes an emergency landing at their location?

External Load Operations Emergency

Planning to cover these emergencies should include answers to the following:

1. Are fire extinguishers available at all helispot locations?
2. Is the site accessible (adjacent to the landing area)?
3. Does the site have interface issues (buildings, schools, houses, etc.)?
4. Is flight following adequate so that aircraft location is always known?
5. Have Pilots been briefed on area-wide hazards as identified on the incident or project map?
6. Have Pilots been briefed on hazards in the vicinity of each helispot location?

Fire Extinguisher

The required extinguisher for helicopter landing areas is a 20-pound, dry chemical, 40 B:C rated extinguisher.

This size extinguisher is lightweight, portable, self-contained, and highly effective on Class B (flammable liquid) fires. However, its effectiveness will always depend on the training and knowledge of the person using it.

Personal Protective Equipment

Except in rare instances when the Pilot has recognized and/or declared an in-flight emergency, ground support personnel will have no advanced notice of a helicopter emergency. Therefore, personal protective equipment shall be worn at all times by all personnel functioning as the ground crew so as not to delay an immediate response to an accident.

CAUTION: Clothing, either regular or fire resistant, affords little thermal protection from the radiated heat of aviation fuel fires. Extreme caution must be used by personnel approaching a burning aircraft.

Additionally, smoke from aircraft fires may contain toxic gases and/or minute particulates of combustion. Exposure without a self-contained breathing apparatus must be avoided.

Emergency Procedures During the Hook-Up

Prior to external load operations, emergency procedures must be established between the pilot and ground crew. The emergency briefing is usually presented by the pilot and addresses procedures in the event of a mechanical failure.

- The pilot should indicate that the intent will be to move the helicopter away from the hookup person underneath the aircraft. Generally, this will be to the pilot's side of the helicopter, but confirm this with each pilot.

- The hookup person should move in the opposite direction from that of the helicopter, or fall flat next to the load and attempt to gain as much protection as possible.

Strategy and Tactics

Strategy

The primary objective of helicopter ground support personnel participating in crash rescue activities is to **prevent loss of life** or property. If needed, firefighting action should provide maximum fuselage integrity and an escape path for occupants. To the extent possible, crash rescue personnel should assist in evacuation of the helicopter using normal or emergency means of egress.

The most important factors involved in effective rescue and firefighting efforts in a survivable helicopter accident are:

• Training received.
• The response time of crash rescue personnel and equipment.
• The effectiveness of crash rescue and extrication equipment.

All actions taken must be aimed at providing care to survivors as quickly as possible.

Tactics

One of the most important skills in crash rescue is the ability to improvise. Every emergency response is unique, and accident sequences often occur in an unforeseen manner. Being able to adjust the response to fit the situation is an absolute necessity.

Briefings

Briefing material should include, but is not limited to:

- Door operation
- Location and operation of emergency exits
- Location and operation of the Emergency Locator Transmitter (ELT)
- Location of the first aid kit and fire extinguisher(s)
- Operation of crew/passenger restraint devices
- Emergency shut-down procedures for the battery, fuel, and other aircraft systems.

All of the above items are part of the Aircraft Safety Briefing required to be given to all passengers. Prior to the commencement of operations, it is particularly important that all ground crew personnel be given a more in-depth briefing on these items.

If a fire is present, the best approach is usually from upwind so that the responder is not hindered by smoke or heat. Extinguishing agents are also more effective when applied from upwind. However, all responder(s) need to evaluate conditions before approaching.

CAUTION: Extreme care should be used when cutting into an aircraft. Occupants might be injured by tools penetrating too far into the aircraft. Also be aware that cutting actions may create sparks which might ignite fuel vapors. Evaluate the situation carefully.

CAUTION: Extreme care must be taken when moving injured personnel to prevent aggravation of existing injuries or causing additional ones. Due to the high vertical deceleration forces experienced in a helicopter hard landing or accident, assume lower back injuries are present. Assistance from trained medical personnel should be obtained before moving injured personnel ***unless immediate threat to life is present***.

BE AWARE AND BE PREPARED. SOMEONE'S LIFE MAY DEPEND ON YOUR ACTIONS.

Interaction/Activity: Scenario Part Six

You are a trails leader at Really Cool National Park and have been assigned the task to fly 25,000 pounds of materials from the Quarry Site to the Broken Horse Camp Site for your summer project.

Break into two groups, designate a group leader and develop an emergency procedures briefing for the project. One group provides a briefing for the Quarry Site and the other for Horse Camp Site.

Summary

You should now be able to accomplish the objectives for this course. If you have any remaining questions regarding them, ask the instructor for clarification at this time.

Objectives

1. Determine the best tool to use for cargo to be delivered to appointed destinations safely and efficiently.
2. Determine equipment considerations needed for external load delivery.
3. Identify proper procedures to conduct a pre-mission safety briefing.
4. Properly weigh, package, manifest and rig items to be delivered via external load.
5. Demonstrate proper procedures to perform safety inspections on helicopter rigging equipment.
6. Demonstrate proper procedures to belly hook an external load.
7. Demonstrate proper procedures to conduct long line operations for an external load.
8. Demonstrate proper procedures to “daisy chain” multiple loads for long line delivery.
9. Demonstrate proper procedures to hover hook an external load.
10. Identify proper procedures of load delivery when flying cargo that can’t be weighed prior to flight.
11. Identify and troubleshoot improperly rigged loads.
12. Demonstrate proper emergency procedure considerations for external load delivery.

Evaluation

Please be sure to complete and submit the Course Evaluation Form OAS-111 provided by the instructor.

APPENDIX A

Risk Calculation Worksheet - Calculating Risk Using GAR Model (GREEN-AMBER-RED)

To compute the total level of risk for each hazard identified below, assign a risk code of 0 (For No Risk) through 10 (For Maximum Risk) to each of the six elements. This is your personal estimate of the risk. Add the risk scores to come up with a Total Risk Score for each hazard.

SUPERVISION
Supervisory Control considers how qualified the supervisor is and whether effective supervision is taking place. Even if a person is qualified to perform a task, supervision acts as a control to minimize risk. This may simply be someone checking what is being done to ensure it is being done correctly. The higher the risk, the more the supervisor needs to be focused on observing and checking. A supervisor who is actively involved in a task (doing something) is easily distracted and should not be considered an effective safety observer in moderate to high-risk conditions.

PLANNING
Planning and preparation should consider how much information you have, how clear it is, and how much time you have to plan the evolution or evaluate the situation.

TEAM SELECTION
Team selection should consider the qualifications and experience level of the individuals used for the specific event/evolution. Individuals may need to be replaced during the vent/evolution and the experience level of the new team members should be assessed.

TEAM FITNESS
Team fitness should consider the physical and mental state of the crew. This is a function of the amount and quality of rest a crewmember has had. Quality of rest should consider how the ship rides, its habitability, potential sleep length, and any interruptions. Fatigue normally becomes a factor after 18 hours without rest; however, lack of quality sleep builds a deficit that worsens the effects of fatigue.

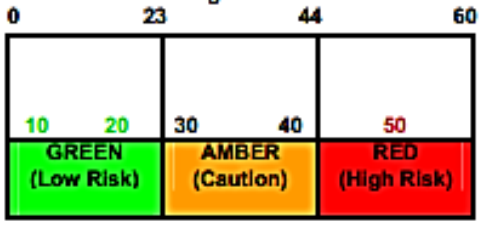
ENVIRONMENT
Environment should consider factors affecting personnel performance as well as the performance of the asset or resource. This includes, but is not limited to, time of day, temperature, humidity, precipitation, wind and sea conditions, proximity of aerial/navigational hazards and other exposures (e.g., oxygen deficiency, toxic chemicals, and/or injury from falls and sharp objects).

EVENT or EVOLUTION COMPLEXITY
Event/Evolution complexity should consider both the required time and the situation. Generally, the longer one is exposed to a hazard, the greater are the risks. However, each circumstance is unique. For example, more iterations of an evolution can increase the opportunity for a loss to occur, but may have the positive effect of improving the proficiency of the team, thus possibly decreasing the chance of error. This would depend upon the experience level of the team. The situation includes considering how long the environmental conditions will remain stable and the complexity of the work. Assign a risk code of 0 (For No Risk) through 10 (For Maximum Risk) to each of the six elements below.

Supervision _____
Planning _____
Team Selection _____
Team Fitness _____
Environment _____
Event/Evolution Complexity _____
Total Risk Score _____

The mission risk can be visualized using the colors of a traffic light. If the total risk value falls in the GREEN ZONE (1-23), risk is rated as low. If the total risk value falls in the AMBER ZONE (24-44), risk is moderate and you should consider adopting procedures to minimize the risk. If the total value falls in the RED ZONE (45-60), you should implement measures to reduce the risk prior to starting the event or evolution.

GAR Evaluation Scale
Color Coding the Level 0f Risk



The ability to assign numerical values or "color codes" to hazards using the GAR Model is not the most important part of risk assessment. What is critical to this step is team discussions leading to an understanding of the risks and how they will be managed.

APPENDIX B

Aviation Operations Checklist

United States Department of the Interior
Aviation Management Directorate

IF YOU ANSWER NO TO ANY OF THE FOLLOWING, STOP REEVALUATE

Pre-Operation Planning

Project Aviation Manager and Flight or Helicopter Manager

❑ Yes	Approved/Signed/Current Aviation Management Plan?
❑ Yes	Approved/Signed/Current Project Aviation Safety Plan (PASP)?
❑ Yes	Operational Risk Assessment completed?
❑ Yes	Flight hazard map reviewed and flight hazards identified?
❑ Yes	Approved/Signed/Current Mishap Response Plan?
Management Approval:	
❑Yes	Acceptable risk?
❑Yes	Pilot/crewmembers in compliance with training requirements?
❑Yes	Aviation Life Support Equipment (ALSE)?

IF YOU SEE SOMETHING SAY SOMETHING

Operation Briefing and Preflight Plan

Flight or Helicopter Manager and Pilot/Flight Crew

❑ Confirm all personnel have introduced themselves by name, qualification and role.		
❑ Confirm mission objectives, strategies and tactics clear.		
Is the Weather Forecast Within Limits:		
❑ Yes	Winds?	
❑ Yes	Visibility within minimums?	
❑ No	Icing conditions possible?	❑ Mitigations and equipment planned.
Essential Considerations to Manager:		
❑ Yes	Aircraft/Pilot approved for each special use mission and current?	
❑ Yes	Pilot and crew flight time/duty day requirements within limits?	
❑ Yes	Pilot briefed on mission and inherent hazards?	
❑ **Yes**	Performance Planning Complete?	

Operation Briefing and Preflight Plan (continued)

Essential Considerations To Pilot:		
❑ Yes	Preflight responsibilities fulfilled?	
❑ Yes	Flight Following procedures established?	
❑ Yes	Load calculation/weight and balance calculation completed?	
❑ Yes	Frequencies obtained?	
❑ Yes	Flight plan filed?	
❑ Yes	Pilot expectations communicated?	
All Personnel Review Including Pilot:		
❑Yes	Project Aviation Safety Plan (PASP)?	
❑Yes	Flight Hazard Map?	
❑Yes	Operational Risk Assessment?	
❑Yes	Mishap Response Plan?	
Passengers and Cargo:		
❑Yes	Hazardous materials properly planned for?	❑N/A
❑Yes	Safety briefing conducted for all passengers?	
❑Yes	Passenger and cargo manifest completed?	
❑ Confirm all users aware that anyone involved may terminate a flight if an unsafe condition is perceived to exist.		

IF YOU SEE SOMETHING SAY SOMETHING

During Operation

All Personnel

Essential In-Flight Discipline For All Personnel:		
❑ Yes	All personnel have been allowed to express any mission apprehensions and these concerns have been addressed?	
❑ Yes	Flight Following procedures being conducted?	
❑ Yes	PPE and ALSE being utilized and available?	
❑ Yes	Flight hazard map being utilized?	
❑ Yes	High reconnaissance flight to identify wires/obstacles that are on the flight hazard map.	❑ N/A

IF YOU ANSWER NO TO ANY OF THE ABOVE, STOP REEVALUATE

APPENDIX C.1 TASK SHEETS

Name_____ **Date**_____

Student: Complete the checklist. Ask the instructor to initial each item completed. To receive credit for A-219, you must have all tasks initialed by the instructor.

CARGO PREPARATION AND RIGGING

Instructor Initials	Date	Task	Task Details
		Cargo inspected	1. Loose/small items are boxed or placed in plastic bags. 2. Fragile items are cushioned and labeled. 3. Boxes/bags are taped. 4. Tools or sharp objects are protected. 5. Hazmat is identified, labeled, and planned for transport according to *Interagency Aviation Transport of Hazardous Materials Handbook/Guide.*
		All cargo weighed	1. Actual weights are used, no estimations.
		Manifest completed	1. Sling equipment is included. 2. Hazmat is identified.
		Sling equipment inspected	1. Swivels 2. Leadlines 3. Nets 4. Other equipment
		Cargo net loaded	1. Heavy and/or large items are placed in center first. 2. Cargo is stacked around and on top of large items making pyramid shape. 3. Light and/or fragile items are on top. 4. Items are taped together to keep from slipping through net. 5. Net is secured correctly.
		Sling equipment correctly attached to net	1. Leadline is attached if purse strings are too short. 2. Swivel is attached to load or leadline. 3. Load weight and destination are on net and/or manifest.

APPENDIX C.2a TASK SHEETS

Name_____ **Date**_____

Student: Complete the checklist. Ask the instructor to initial each item completed. To receive credit for A-219, you must have all tasks initialed by the instructor.

Instructor: Have a radio to monitor transmissions and be in position to assist if needed.

HOVER HOOKUP TASK SHEET

Parking Tender			
Instructor Initials	Date	Task	Task Details
		Is positioned in appropriate location.	1. Back is to the wind 2. In view of pilot 3. Out of helicopter safety circle
		Establishes contact with pilot using hand signals when helicopter comes into view.	
		Directs pilot to site using hand signals.	See list below.

1. Gives wind indication.
2. Directs pilot toward load.
3. Guides pilot directly over load.
4. Directs pilot to move helicopter directly over hookup person.
5. Signals pilot to hold hover while hookup person attaches load to helicopter cargo hook.
6. Directs pilot to hold hover while hookup person exits from underneath helicopter toward parking tender.
7. Signals pilot to center over load and lift off ground, when hookup person exits from underneath main rotors and is in view of pilot.
8. Looks one last time over shoulders and around for aerial hazards (other aircraft, etc.).
9. Signals pilot it is clear to move forward and to transition to fly into the wind when the load lifts 3 to 4 feet from ground or above possible obstructions.
10. Moves out of departure path and away from helicopter flying overhead.

(See the next page for Hookup Person tasks.)

APPENDIX C.2b TASK SHEETS

Name_____ **Date**_____

Student: Complete the checklist. Ask the instructor to initial each item completed. To receive credit for A-219, you must have all tasks initialed by the instructor.

Instructor: Have a radio to monitor transmissions and be in position to assist if needed.

HOVER HOOKUP TASK SHEET

Hookup Person			
Instructor Initials	Date	Task	Task Details
		Stands directly in front of loaded cargo net (between net and Parking Tender).	
		Raises swivel above head providing target for pilot to see as helicopter comes into view.	
		Maintains visual contact with the helicopter.	
		When the helicopter is directly overhead and in arms' reach, attaches swivel into cargo hook.	**1. Gives light tug to swivel.** 2. **Checks for line snagging and entanglement on load, aircraft, and around feet before exiting**.
		Exits from under helicopter toward Parking Tender without crossing under landing gear and avoids antennas or other objects.	
		Moves past Parking Tender in view of the pilot and away from departure path.	

APPENDIX C.3a TASK SHEETS

Name_____ **Date**_____

Student: Complete the checklist. Ask the instructor to initial each item completed. To receive credit for A-219, you must have all tasks initialed by the instructor.

Instructor: Have a radio to monitor transmissions and be in position to assist if needed.

HELICOPTER LONGLINE TASK SHEET

Radio Signal Person			
Instructor Initials	Date	Task	Task Details
		Is positioned in appropriate location: In view of load/helicopter/hookup person.	
		Establishes radio contact with helicopter pilot.	
		Directs pilot to site.	1. Short and to-the-point transmissions. 2. Uses cardinal compass directions or clock directions from pilot's perspective.
		Transmits wind information to pilot.	
		Gives actual weight of load to be carried.	
		Notifies pilot of any hazards.	
		Directs pilot into site.	1. Provides hook/load clearance. 2. Informs pilot to hold position when load/hook is on the ground and stable.
		Notifies pilot: "Sending hookup person to load."	1. Slight pause to allow pilot to respond. 2. Signals hookup person to move in and hook/unhook load.
		Informs pilot when hookup person is clear: "Pilot can lift load."	1. Directs pilot to appropriate action (pilot leaves area, maintains hover, etc.). 2. Directs pilot out of area, providing clearances from ground and obstacles while visually inspecting rigging and line as it lifts.

(See the next page for Hookup Person tasks.)

APPENDIX C.3b TASK SHEETS

Name_____ **Date**_____

Student: Complete the checklist. Ask the instructor to initial each item completed. To receive credit for A-219, you must have all tasks initialed by the instructor.

Instructor: Have a radio to monitor transmissions and be in position to assist if needed.

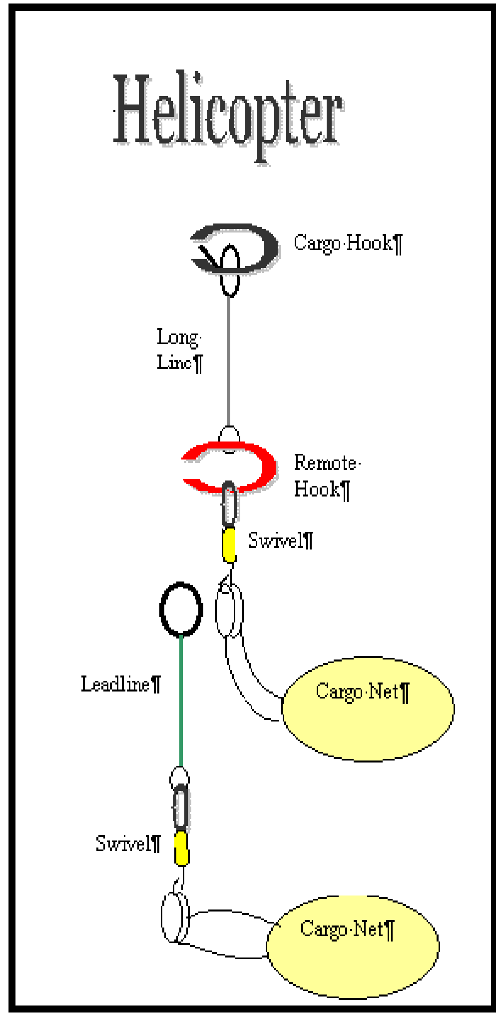
HELICOPTER LONGLINE TASK SHEET

Hookup Person			
Instructor Initials	Date	Task	Task Details
		Is positioned in appropriate location.	
		Maintains visual contact with helicopter.	
		Moves in, to hook load, upon signal from Radio Signal Person.	1. Waits for hook to touch ground before attaching load. 2. Gives light tug to swivel. 3. Checks for line snagging or entanglement on load or around feet before exiting.
		Gives "thumbs up" signal to Radio Signal Person while exiting (toward Radio Signal person) from underneath helicopter, in view of the pilot and away from departure path.	

APPENDIX D
LONGLINE RIGGING POCKET CARD

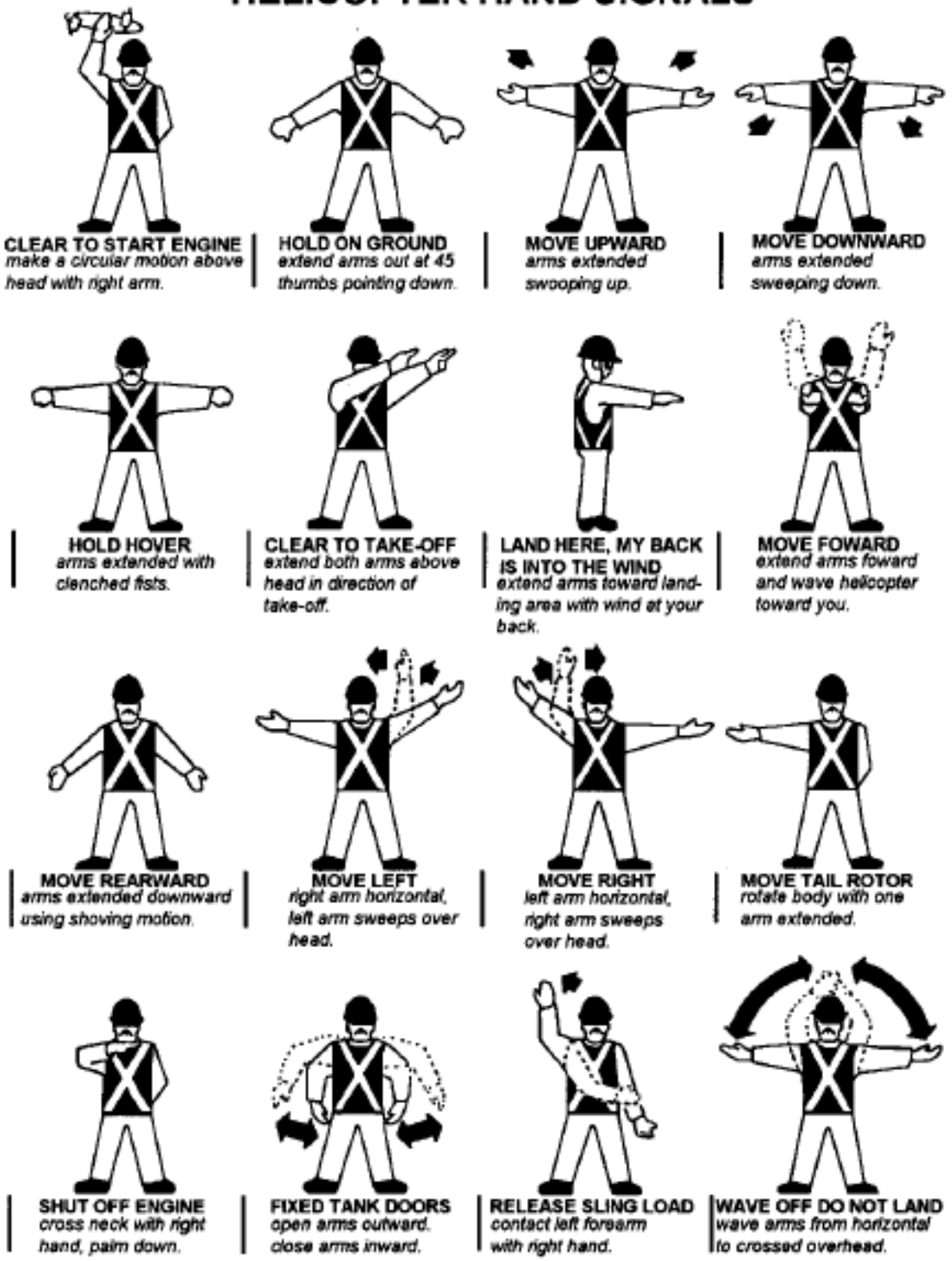
Principles of Longline Remote Rigging

1. Provide a Safety Briefing
2. Is there a safer way to accomplish the mission?
3. Are personnel qualified?
4. Have you inspected the equipment?
5. Always choose the best location, not the most convenient. Use exposed peaks and ridges, windward slopes, or open areas.
6. Be sure that your site has an adequate safety circle for the helicopter type if the helicopter must descend below obstacles.
7. Emergency procedures have been established and briefed.
8. Obtain allowable payload for helicopter.
9. Give actual weights of the cargo and hazmat notification to the helibase or the pilot.
10. Communicate information pertaining to how much longline will be needed at the site, known hazards (height), and current wind speed and direction.
11. With multiple loads, use a leadline to stagger one load to fly lower than the other. The heavier load should always be placed on the bottom.
12. Every load gets a swivel.
13. Establish radio communication with the pilot.
14. Brief pilot on hazards and mission objectives
15. Limit exposure for pilot, helicopter, and yourself.



APPENDIX E

HELICOPTER HAND SIGNALS



APPENDIX F

INTERAGENCY HELICOPTER LOAD CALCULATION

AMD-67/FS 5700-17 (10/06)

NFES #1064

INTERAGENCY HELICOPTER LOAD CALCULATION AMD-67/FS 5700-17 (10/06)		MODEL
		N#
PILOT(S)		DATE
MISSION		TIME

1 DEPARTURE	PA	OAT
2 DESTINATION	PA	OAT
3 HELICOPTER EQUIPPED WEIGHT		
4 FLIGHT CREW WEIGHT		
5 FUEL WT (_____gallons X_____lbs per gal)		
6 OPERATING WEIGHT (3 + 4 + 5)		

	Non-Jettisonable		Jettisonable
	HIGE	HOGE	HOGE- J
7a PERFORMANCE REF (List page/chart from FM)			
7b COMP GROSS WT (FM Performance Section)			
8 WT REDUCTION (Req for all Non-Jettisonable)			
9 ADJUSTED WEIGHT (7b minus 8)			
10 GROSS WT LIMIT (FM Limitations Section)			
11 SELECTED WEIGHT (Lowest of 9 or 10)			
12 OPERATING WEIGHT (From Line 6)			
13 ALLOWABLE PAYLOAD (11 minus 12)			

14 PASSENGERS/CARGO MANIFEST	
15 ACTUAL PAYLOAD (Total of all weights listed in Item 14) Line 15 must not exceed Line 13 for the intended mission.	

PILOT SIGNATURE	HazMat
MGR SIGNATURE	Yes____No ___

INSTRUCTIONS
A load calculation must be completed for all flights. A new calculation is required when operating conditions change (± 1000' in elevation or ± 5°C in temperature) or when the Helicopter Operating Weight changes (such as changes to the Equipped Weight, changes in flight crew weight or a change in fuel load).

All blocks must be completed. Pilot must complete all header information and Items 1-13. Helicopter Manager completes Items 14 & 15.

1. DEPARTURE – Name of departure location and current Pressure Altitude (PA, read altimeter when set to 29.92) and Outside Air Temperature (OAT, in Celsius) at departure location.

2. DESTINATION – Name of destination location and PA & OAT at destination. If destination conditions are unknown, use MSL elevation from a map and Standard Lapse Rate of 2° C/1000' to estimate OAT.

Check the box in Line 1 (Departure) or Line 2 (Destination) to indicate the most restrictive values used to obtain Computed Gross Weight in Line 7b.

3. HELICOPTER EQUIPPED WEIGHT – Equipped Weight equals the Empty Weight (as listed in the Weight and Balance Data) plus the weight of lubricants and onboard equipment required by contract (i.e. survival kit, rappel bracket).

4. FLIGHT CREW WEIGHT – Weight of the Pilot and any other assigned flight crewmembers on board (i.e. Co-pilot, flight engineer, navigator) plus the weight of their personal gear.

5. FUEL WEIGHT – Number of gallons onboard **X** the weight per gallon (**Jet Fuel = 7.0 lbs/gal**; AvGas = 6.0 lbs/gal).

6. OPERATING WEIGHT – Add items 3, 4 and 5.

7a. PERFORMANCE REFERENCES – List the specific Flight Manual supplement and **hover performance** charts used to derive Computed Gross Weight for Line 7b. Separate charts may be required to derive HIGE, HOGE and HOGE-J. **HIGE:** use Hover-In-Ground-Effect, External/Cargo Hook Chart (if available). **HOGE & HOGE-J:** use Hover-Out-Ground-Effect charts for all HOGE operations.

7b. COMPUTED GROSS WEIGHT - Compute gross weights for HIGE, HOGE and HOGE-J from appropriate Flight Manual **hover performance** charts using the Pressure Altitude (PA) and temperature (OAT) from the most restrictive location, either Departure or Destination. Check the box in Line 1 (Departure) or Line 2 (Destination) to indicate which values were used to obtain Computed Gross Weight.

8. WEIGHT REDUCTION – **The Government Weight Reduction is required for all "non-jettisonable" loads**. The Weight Reduction is optional (mutual agreement between Pilot and Helicopter Manager) when carrying jettisonable loads (HOGE-J) where the pilot has total jettison control. The appropriate Weight Reduction value, for make & model, can be found in the current helicopter procurement document (contract).

9. ADJUSTED WEIGHT – Line 7b minus Line 8.

10. GROSS WEIGHT LIMITATION – Enter applicable gross weight limit from **Limitations Section** of the basic Flight Manual or the appropriate Flight Manual Supplement. This may be Maximum Gross Weight Limit for Take-Off and Landing, a Weight/Altitude/Temperature (WAT) limitation or a Maximum Gross Weight Limit for External Load (jettisonable). Limitations may vary for HIGE, HOGE and HOGE-J.

11. SELECTED WEIGHT – **The lowest weight, either line 9 or 10, will be entered for all loads.** Applicable limitations in the Flight Manual must not be exceeded.

12. OPERATING WEIGHT – Use the value entered in Line 6.

13. ALLOWABLE PAYLOAD – Line 11 minus Line 12. The maximum allowable weight (passengers and/or cargo) that can be carried for the mission. Allowable Payload may differ for HIGE, HOGE and HOGE-J.

14. PASSENGERS AND/OR CARGO – Enter passenger names and weights and/or type and weights of cargo to be transported. Include mission accessories, tools, gear, baggage, etc. A separate manifest may be used.

15. ACTUAL PAYLOAD – Total of all weights listed in Item 14. Actual payload must not exceed Allowable Payload for the intended mission profile, i.e. HIGE, HOGE or HOGE-J.

Both Pilot and Helicopter Manager must review and sign the form. Check if HazMat is being transported. Manager must inform the pilot of type, quantity and location of HazMat onboard.

Bambi Bucket Actual Payloads			
USE THIS CHART WHEN CARRYING WATER, ONLY. (1 U.S. Gal = 8.3 lbs) Use this chart to determine actual bucket payloads based on Model # and bucket percentage adjustment. ***Actual Payloads must not exceed Allowable Payloads***.			
Formula: (Gallons X 8.3) + Bucket Empty Weight = Actual Bucket Payload **Note:** Bucket Empty Weights have already been added to arrive at figures below. **Note:** Weight of any extra hardware used (longline/remote) must be added.			
%	**Model**	**Model**	**Model**
	# 6072	**# 8096**	**# 9011**
	(66 lbs empty wt)	*(70 lbs empty wt)*	*(70 lbs empty wt)*
100	72 gal → **666 lbs**	96 gal → **867 lbs**	108 gal → **966 lbs**
90	65 gal → **606 lbs**	86 gal → **784 lbs**	97 gal → **875 lbs**
80	58 gal → **547 lbs**	77 gal → **709 lbs**	86 gal → **784 lbs**
70	50 gal → **481 lbs**	67 gal → **626 lbs**	76 gal → **701 lbs**
	# 1012	**# 1214**	**# 1518**
	(72 lbs empty wt)	*(73 lbs empty wt)*	*(75 lbs empty wt)*
100	120 gal → **1068 lbs**	144 gal → **1268 lbs**	180 gal → **1569 lbs**
90	108 gal → **968 lbs**	130 gal → **1152 lbs**	162 gal → **1420 lbs**
80	96 gal → **869 lbs**	115 gal → **1028 lbs**	144 gal → **1270 lbs**
70	84 gal → **769 lbs**	101 gal → **912 lbs**	126 gal → **1121 lbs**
	# 1821	**# 2024**	**# 2732**
	(76 lbs empty wt)	*(135 lbs empty wt)*	*(154 lbs empty wt)*
100	210 gal → **1819 lbs**	240 gal → **2127 lbs**	324 gal → **2843 lbs**
90	189 gal → **1645 lbs**	216 gal → **1928 lbs**	292 gal → **2578 lbs**
80	168 gal → **1470 lbs**	192 gal → **1729 lbs**	259 gal → **2304 lbs**
70	147 gal → **1296 lbs**	168 gal → **1529 lbs**	227 gal → **2038 lbs**
	# 3542	**# 4453**	**# 5566HD**
	(167 lbs empty wt)	*(170 lbs empty wt)*	*(304 lbs empty wt)*
100	420 gal → **3653 lbs**	530 gal → **4569 lbs**	660 gal → **5782 lbs**
90	378 gal → **3304 lbs**	477 gal → **4129 lbs**	594 gal → **5234 lbs**
80	336 gal → **2956 lbs**	424 gal → **3689 lbs**	528 gal → **4686 lbs**
70	294 gal → **2607 lbs**	371 gal → **3249 lbs**	462 gal → **4139 lbs**
	# 5870HD	**# 6578HD**	**# 7590**
	(330 lbs empty wt)	*(356 lbs empty wt)*	*(375 lbs empty wt)*
100	700 gal → **6140 lbs**	780 gal → **6830 lbs**	900 gal → **7845 lbs**
90	630 gal → **5559 lbs**	702 gal → **6183 lbs**	810 gal → **7098 lbs**
80	560 gal → **4978 lbs**	624 gal → **5535 lbs**	720 gal → **6351 lbs**
70	490 gal → **4397 lbs**	546 gal → **4888 lbs**	630 gal → **5604 lbs**

APPENDIX G

There are lots of resources available to you.

We've listed these in your participant workbook on page 40. Take a moment now and turn to that page.

People

Your local, regional, or national Aviation Managers are here to assist you with planning and implementing safe aviation projects. The Technical Assistance Directory lists most of the Bureaus contact information.

The Office of Aviation Services has people willing and available to assist you with planning for projects and you can contact them at 208-433-5000, Monday – Friday normal business hours.

Print

The Interagency Helicopter Operations Guide is a useful tool with standard operating procedures to plan and implement helicopter external load projects. Some bureaus have adopted this guide as policy for helicopter operations. Be sure to check your local policy for guidance.

The Basic Aviation Safety Book, NFES 2907 has valuable information related to aircraft safety and performance. Also located on the web at:
www.iat.gov/docs/2013_Basic_Aviation_Safety.pdf

The "Orange – 5 Steps to a Safe Flight" and "Blue – 12 Aviation Situations that Shout Watch Out" Cards – are useful tools.

Web

Technical Assistance Directory: http://www.nwcg.gov/pms/pubs/pms504.pdf
Interagency Helicopter Operations Guide:
http://www.nwcg.gov/pms/pubs/pms510/index.htm
DOI Policy Link: http://oas.doi.gov/library/index.htm
USFS Policy Link: http://www.fs.fed.us/fire/aviation/av_library/index.html
Safety Management Systems:
http://www.fs.fed.us/fire/av_safety/risk_management/index.html#ra
Interagency Aviation Mishap Response GUIDE & CHECKLIST:
http://oas.doi.gov/safety/iamrp.html
ALSE Handbook: http://oas.doi.gov/library/handbooks/library/AlseHB.pdf
SAFECOM: www.safecom.gov
Interagency Aviation Training: www.iat.gov