



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: SAFETY IN AND AROUND
HELICOPTERS**

Date: 6/2/97

AC No: 91-32B

Initiated By: AFS-820

Change:

1. PURPOSE. This Advisory Circular (AC) provides safety guidelines for persons associated with helicopter operations and suggests ways to avoid hazards and reduce the risk of accidents. The information in this AC pertains primarily to helicopter operations conducted under the provisions of Title 14 of the Code of Federal Regulations (14 CFR) part 91; however, the safety considerations discussed may be applicable to all helicopter operations.

2. CANCELLATION. AC 91-32A, Safety In and Around Helicopters, dated 6/21/79, is canceled.

3. RELATED CFR PARTS. Parts of the regulations related to the information in this AC are 14 CFR parts 91, 133, 135, 137, and 175.

4. RELATED READING MATERIAL. The information contained in this AC complements the documents listed below. Current editions of the following AC's may be obtained at no cost by sending a written request to U. S. Department of Transportation, Subsequent Distribution Center, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785:

- a. AC 90-87, Helicopter Dynamic Rollover.
- b. AC 90-95, Unanticipated Right Yaw in Helicopters.
- c. AC 91-42, Hazards of Rotating Propeller and Helicopter Rotor Blades.
- d. AC 133-1, Rotorcraft External-Load Operations in Accordance with FAR Part 133
- e. AC 137-1, Agricultural Aircraft Operations

5. BACKGROUND. Aviation personnel and passengers have been injured, some fatally, in helicopter accidents which would not have occurred had passengers been properly briefed and basic safety practices observed. Some accidents involve passengers who, unaware of the danger, walk toward the aircraft's tailrotor after deplaning. Some accidents result from passengers seated in the front of the aircraft inadvertently hitting the aircraft controls. In other cases, pilots leave the aircraft controls while the engines and rotors are turning in order to assist passengers or coordinate the aircraft loading. To be conducted safely, any ground operation accomplished with engines and rotors turning requires meticulous observation of recognized safety guidelines and strict enforcement of passenger control measures by trained crewmembers.

6. FLIGHTCREW AND GROUND CREW PERSONNEL. Conscientious, well-trained personnel are the key to a safe operation and a major factor in the reduction of accidents. Standardized initial and recurrent training is essential. Aviation personnel should apply the basic safety guidelines provided in this AC, observe procedures detailed in the appropriate manual, and participate in all available training programs. In addition to a formal training program, adherence to a company operations manual and the use of standardized hand signals as well as radios in a high-noise environment are important elements of a safe operation.

a. Manual. A part 135 certificate holder is required to prepare and keep current a manual stating the operator's policies and procedures. The manual must be used by the certificate holder's flight, ground, and maintenance personnel. Although it is not required by part 91, it is good operating practice for all operators to develop an operations manual defining company procedures and responsibilities.

b. Training. Initial and recurrent training on a company's operating procedures should be provided to all employees.

(1) Initial training teaches a new employee the company's operating policies and procedures and helps the employee understand his/her responsibilities and the guidelines for safe operating practices.

(2) Recurrent training refreshes an employee's memory on company operating policies and ensures that each person is adequately trained and currently proficient in company equipment and procedures. In addition, recurrent training should encourage all employees to continue using safe operating practices in the workplace. Companies may derive additional benefits, such as reduced insurance rates, by providing formal recurrent training for all employees.

c. Hand Signals. Because of the high noise factor associated with helicopters, it may be impossible to hear verbal communications and is, therefore, extremely important to use standardized hand signals. Commonly-used hand signals are shown in appendix 2.

7. PILOTS. Under the provisions of § 91.3(a), the pilot-in-command (PIC) of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft; however, teamwork can help ensure a safe operation.

a. Rotorcraft Flight Manual. In accordance with § 91.9, a pilot operating a civil aircraft (rotorcraft) must comply with the operating limitations specified in the approved Rotorcraft Flight Manual.

b. Cockpit Check Procedure/Checklist. A pilot should use a cockpit check procedure or checklist appropriate to the aircraft and operation. Use of a check procedure/checklist establishes how a specific job function is to be accomplished and helps crewmembers develop safety awareness.

c. Quick Turnaround. Helicopter pilots may use a quick turnaround operation to avoid delays at airport terminals and minimize stop/start cycles of the engine. During the quick turnaround procedure, pilots sometimes leave the cockpit while the engine and rotors are turning. If possible, the pilot should remain at the flight controls whenever the engine is running and rotors are turning; however, if it is necessary for the pilot to leave the controls of a running machine, the pilot should observe the following safety precautions:

(1) Ensure that wind conditions will allow such an operation to be conducted safely.

(2) Ensure that all controls are secured in accordance with the aircraft flight manual and the company operations manual.

(3) Reduce rotor and/or engine rpm to ground idle or minimum recommended settings.

(4) Ensure that all passengers are closely supervised by appropriately trained crewmembers.

(5) Ensure that no unauthorized person(s) approach the aircraft unless properly escorted.

8. CREWMEMBERS OTHER THAN PILOTS. The type and number of crewmembers other than pilots varies, depending on the type of helicopter operation.

a. Ground Crew Personnel. Ground crew personnel should observe the following safety practices:

(1) Before a helicopter takeoff or landing, personnel should ensure that the helipad or area of operations is clear of all people, cargo, baggage, or anything that might be blown around by the force of the downdraft. (See figure 1.)

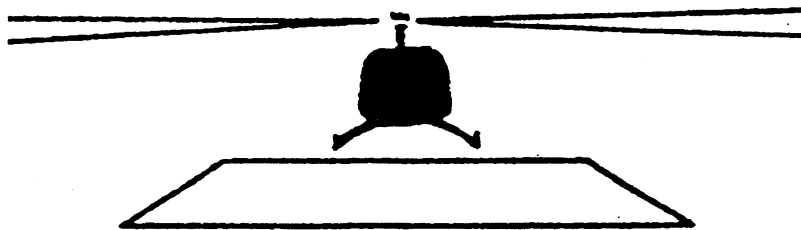


FIGURE 1. CLEAR HELIPAD/AREA OF OPERATIONS

(2) To avoid contact with the main rotor blade, long pieces of equipment or tools should be carried horizontally at or below waist level. Equipment or tools of this type should never be carried upright and/or over the shoulder. (See figure 2.)

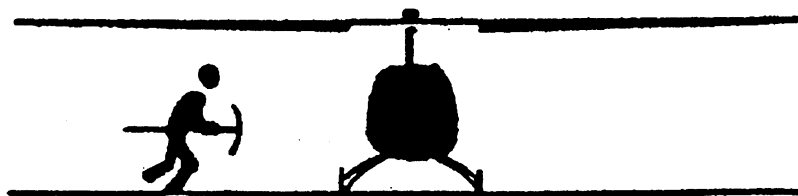


FIGURE 2. CARRYING TOOLS/EQUIPMENT

(3) Ensure that there is no loose cargo onboard the aircraft and all doors have been properly secured before departure.

b. Mechanics. Mechanics are responsible for ensuring that a helicopter is mechanically sound for the operation being conducted. Mechanics have an opportunity to observe and correct many potential safety problems that occur on the ramp area. Some specific areas where mechanics can help are:

- (1) Foreign object damage.
- (2) Tool accountability.
- (3) Spill removal.

c. Fuel Servicing Personnel. Fuel servicing personnel should be trained in the safe operation of fueling equipment. The following guidelines should be observed:

- (1) No smoking within 50 feet of an aircraft.
- (2) The helicopter and fueling vehicles should be grounded to dissipate static electricity.
- (3) If a spill occurs, refueling should be stopped and the airport fire department notified, if necessary.
- (4) Ground power units should not be connected or disconnected during refueling.
- (5) Fuel servicing personnel should not carry lighters or matches when refueling.
- (6) At the first sight of lightning in the area, refueling operations should be suspended.
- (7) Refuel outside only.
- (8) Refueling should not be conducted with passengers on board the aircraft except in accordance with the provisions of paragraph 13.
- (9) Check the color and type of fuel. 100 octane aviation gasoline (avgas) is green and 100 octane low lead avgas is blue. Jet fuel is usually clear, but sometimes it is a very light yellow color.

d. External Load Riggers and Hookup Personnel. All rotorcraft external load personnel should be thoroughly trained in company procedures. Since rigging requirements may vary several times in a single day, training in the use of the company's Rotorcraft Load Combination Flight Manual is of the utmost importance for a safe operation. Personnel involved in this type of operation should be briefed on their specific duties and responsibilities.

- (1) Personnel should know the hand signals used during an external load operation. (See appendix 2.)
- (2) The signalman should be in a position visible to the pilot and the hookup person, located to one side of the flight path and as close to the operating area as possible with his/her back to the wind. (See figure 3.)

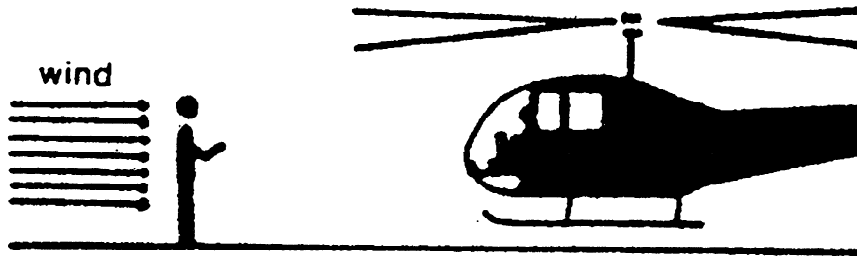


FIGURE 3. SIGNALMAN POSITION

9. PASSENGERS.

a. **Passenger Boarding.** The pilot or other crewmember should advise passengers to:

- (1) Stay away from the rear of the helicopter.
- (2) Crouch low before getting to and going under the main rotor. (See figure 4.)

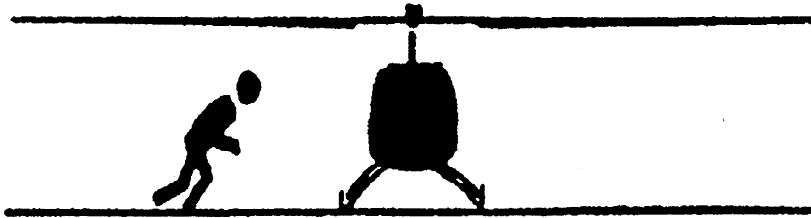


FIGURE 4. CROUCH UNDER THE MAIN ROTOR

- (3) Approach the helicopter from the side or front, but never out of the pilot's line of vision. (See figure 5.)

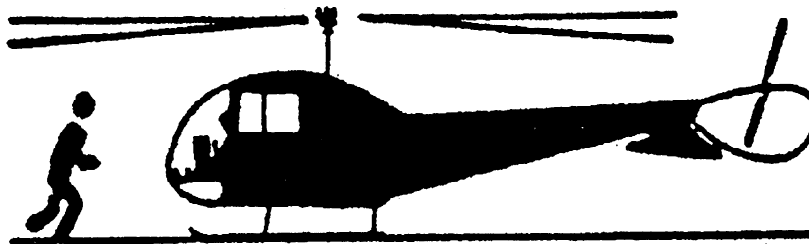


FIGURE 5. APPROACHING HELICOPTER

- (4) Hold firmly to hats and loose articles.
- (5) Never reach up or dart after a hat or other object that might be blown off or away.
- (6) Protect eyes by shielding with a hand or by squinting.

(7) If suddenly blinded by dust or a blowing object, stop and crouch lower or, better yet, sit down and wait for help.

(8) Do not try to grope or feel the way to or from the helicopter.

(9) Remain clear of an elevated heliport platform (roof top or helideck) until the pilot gives the signal to board the helicopter.

(10) If the takeoff site is on a hill, passengers should not approach or depart the helicopter on the upslope side. Avoid the area of lowest rotor clearance. Approach the helicopter from the front, never the rear.

b. Briefing. The type of operation being conducted will dictate what type of briefing is necessary. For all flights, pretakeoff briefings should include at least the following items:

(1) The use of seat belts, including shoulder harnesses, if installed.

(2) Location and means of opening exits, egress procedures and, for overwater flights, ditching procedures and the use of flotation equipment.

(3) Location and use of all emergency gear and survival equipment on board, appropriate to the type of operation conducted.

(4) Applicable smoking restrictions in the aircraft and on the ground.

c. Passenger Precautions. Appropriate to the terrain, landing site, and type of operation conducted, passengers should be instructed:

(1) Never to unbuckle seatbelts in preparation for departing the helicopter until told to do so.

(2) Never to open any door (passenger or cargo) unless directed to do so by the pilot or another crewmember.

(3) Never to remove personal gear until instructed to do so.

(4) To use caution when removing cargo from a helicopter so that the restraining devices do not become tangled in the main or tail rotors.

(5) To depart downhill if the landing site is on a hill and always walk around the front of the helicopter, never the rear, when walking around the helicopter to avoid the area of lowest rotor clearance. (See figure 6.)

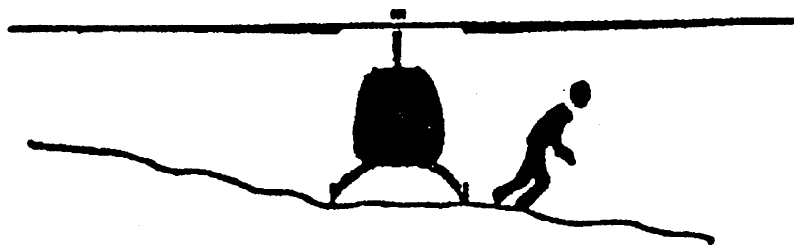


FIGURE 6. DEPARTING DOWNHILL

(6) To use caution when exiting a helicopter, especially if the helipad or helideck surface is metal and slippery or wet. (Passengers should also be told to look for nets or ropes and watch for a ground crewmember using hand signals to give directions.)

10. PASSENGER EMERGENCY PROCEDURES. A crewmember should provide the following additional information for passengers:

a. Passenger Position. The passenger's body position at the time of impact is an important factor in a survivable accident. The "brace-for-impact" position is used to reduce secondary impact and flailing around. If contact with the aircraft interior is likely, the passenger should place his/her body against what the passenger will hit before the impact occurs. If a passenger is resting against the surrounding structure, he/she can "ride the structure down" during the crash, thus avoiding a secondary impact. In addition, this position will reduce the forces acting on the body and can help reduce the severity of injuries. If a passenger is in a seat equipped with a shoulder harness and a safety belt, the harness should be snug, not slack. (See figure 7.)

FORWARD FACING SEAT



REARWARD FACING SEAT



FIGURE 7. EQUIPPED WITH A SHOULDER HARNESS

b. Emergency Water Landing. Passengers should follow the instructions of the flightcrew in the event of a forced landing in water and inflate lifevests only when clear of the aircraft. If the liferaft lanyard is dangling loose, crewmembers and passengers should exercise extreme caution not to accidentally pull the lanyard or allow it to become entangled with the aircraft.

11. CARGO. Cargo should be loaded by helicopter company personnel. This helps ensure that the cargo is properly secured and the correct weight and location of the cargo is noted in the weight and balance computations for the flight.

12. HAZARDOUS MATERIALS (HAZMAT).

a. **The International Civil Aviation Organization** and the International Air Transport Association Technical Instructions state that no person may transport any dangerous goods in commerce unless that material is properly classed, described, packaged, marked, labeled, handled, and in condition for shipment as specified in the Technical Instructions.

b. **HAZMAT Training.** HAZMAT recognition training is required for air carrier employees. All aviation personnel should at least be able to identify HAZMAT since it is not always properly marked for air transportation. Crewmembers should be alert for any HAZMAT which might be unknowingly loaded or carried onboard the aircraft.

13. RAPID REFUELING. Rapid refueling is a refueling operation conducted while engines and/or rotor blades are turning. Normally, helicopter rotor blades should be stopped before refueling begins. Both the aircraft and the refueling unit should be properly grounded and the pilot should ensure that the proper grade of fuel and correct additives are dispensed into the helicopter fuel system. While it is generally discouraged, rapid refueling of turbine-powered aircraft can be accomplished safely in some types of operations if conducted under carefully controlled conditions by properly trained personnel. Some operators elect to use rapid refueling procedures in order to reduce thermal stress, avoid hot-starts, and keep engine cycles and starts to a minimum. Air tour flights, flights conducted under the provisions of part 133 or 137, and similar operations conducting rapid refueling operations should ensure that all personnel adhere strictly to safe operating practices. Reciprocating engine-powered aircraft fueled with avgas SHOULD NEVER be rapid refueled because gasoline is highly flammable.

a. **Training.** All personnel and flight crewmembers who will be involved in rapid refueling procedures should be trained in safe techniques and procedures before conducting such operations. Initial and recurrent ground training on rapid refueling should be included in the operator's training program and specify each person's duties and responsibilities. Training should include all of the specific engine manufacturer's recommendations and/or procedures regarding checking fluid levels, cool down times, and other pertinent items for extended-period operations. Additionally, the training should include the following topics:

- (1) Characteristics of jet fuel.
- (2) Fuel quality control procedures.
- (3) Operation of fuel vehicles and fuel tanks.
- (4) Avoidance of rotor blades.
- (5) Communications with the pilot.
- (6) Fuel spill procedures.
- (7) Proper grounding of the aircraft.
- (8) Personal injury response.

b. Passenger Safety. The marshalling and containment of passengers is a major consideration in rapid refueling operations. It is imperative that the operator develop appropriate procedures to ensure the safety of passengers during rapid refueling operations.

c. Guidelines. The following guidelines are general safe operating procedures. Flightcrew and ground crewmembers should refer to the aircraft flight manual and other guidance developed by the helicopter manufacturer for refueling procedures that are unique to a specific helicopter. Helicopter fueling while onboard engines are operating should be permitted only under the following conditions:

(1) Only turbine-powered helicopters fueled with Jet A or Jet A-1 fuels should be fueled while an onboard engine is operating.

(2) Helicopters to be refueled while an onboard engine is operating should have all sources of ignition of potential fuel spills located above the fuel inlet port(s). Ignition sources include, but are not limited to, engines, engine exhausts, auxiliary power units (APU), and combustion-type cabin heater exhausts.

(3) A Federal Aviation Administration (FAA) certificated pilot qualified in the helicopter must be at the aircraft controls during the entire fuel servicing process.

(4) Passengers should be deboarded to a safe location before rapid refueling operations begin unless the PIC deems it necessary for passenger safety that they remain aboard. If passengers remain aboard the aircraft during fuel servicing, at least one person (other than the PIC) trained in emergency evacuation procedures should be aboard. The operator should establish specific procedures covering emergency evacuation under such circumstances.

(5) Smoking must be prohibited in and around the helicopter during ALL refueling operations. Fueling personnel should not carry cigarette lighters, matches, or any type of sparking ignitor device on their person while fueling.

(6) Passengers should not board or deplane during rapid refueling operations. No passengers should be allowed within 100 feet of the helicopter during any rapid refueling operation.

(7) Only designated personnel, properly trained in rapid refueling operations, should operate the fueling equipment. Written procedures should include guidelines for safe handling of the fuel and equipment.

(8) Persons not directly involved with the refueling operation should be kept clear of the refueling area.

(9) All doors, windows, and access points that allow entry to the interior of the helicopter and are adjacent to or in the immediate vicinity of the fuel inlet ports should be closed and kept closed during refueling operations. Fumes must be adequately vented from the aircraft cabin during fueling operations.

(10) Fuel should be dispensed from approved "dead-man" type nozzles with a flow rate not to exceed 10 gallons-per-minute (38 liters-per-minute). When fuel is dispensed from fixed piping systems, the hose cabinet should not extend into the rotor space. A curb or other approved barrier shall be provided to restrict the fuel servicing vehicle from coming closer than 10 feet (3 meters) to any helicopter rotating components. If a curb or approved barrier cannot be provided, fuel servicing vehicles should be kept 20 feet (6 meters) beyond any helicopter rotating components, and a trained person should direct the fuel servicing vehicle's approach and departure.

14. ROOFTOP HELIPORTS. Antennas, turbulence, and noise should be considered when operating on rooftop heliports.

a. Antennas are extremely difficult to see during daylight and almost invisible at night. Antennas which have been erected by someone who is not familiar with helicopter operational requirements are an ongoing problem.

b. Turbulence near buildings is a significant safety consideration. With several tall buildings in close proximity and sufficient breeze, the turbulence generated from the wind blowing around the buildings can create severe turbulence and up and down drafts which may exceed the operational limitations of the helicopter. The information obtained by a pilot for flight planning should include wind velocity, gust spread, and type and location of obstacles in relation to the wind. Additionally, the pilot should obtain reports of the current weather conditions at the heliport site.

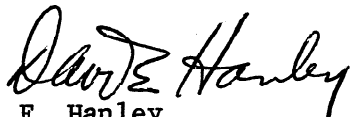
15. HELICOPTER NOISE. Helicopter operations frequently occur in quiet areas. Such operations may require the use of noise abatement procedures. Pilots should be trained in techniques to minimize noise and be aware of noise-sensitive areas.

a. **Turbine-powered helicopters** generally are quieter than reciprocating engine-powered helicopters. Blade slapping is the modulating sound of the main rotor; however, pilot techniques can minimize blade slapping. Also, selecting specific routes, altitudes, airspeeds, and climb and descent profiles can reduce the noise perceptible to persons on the ground.

b. **Meteorological conditions** also can affect helicopter noise. Since wind carries noise, a pilot should fly downwind of noise-sensitive areas, if possible.

c. **Warm air** is more turbulent than cool air and turbulent air disperses sound. An inversion layer has a tendency to "bounce" the noise to the surface, magnifying the sound. When possible, pilots should avoid flying under or in an inversion. The weather condition which most propagates noise is an overcast morning with no wind.

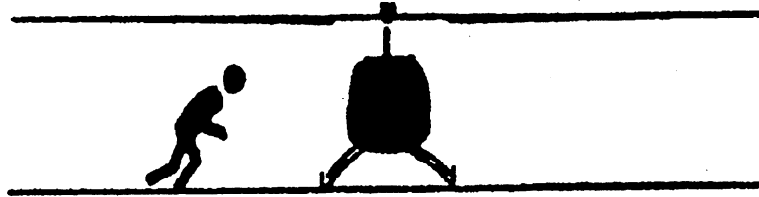
d. **It is good operating practice** to include pertinent noise abatement procedures in the company operations manual.



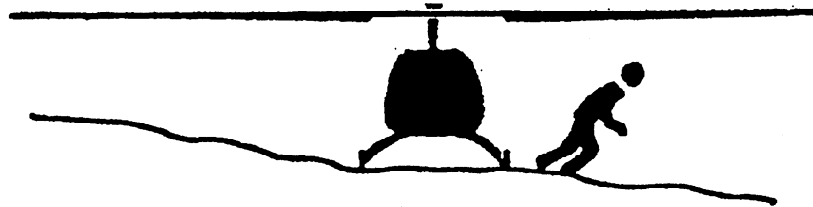
David E. Hanley
Acting Deputy Director,
Flight Standards Service

APPENDIX 1. SAFETY PROCEDURES AROUND HELICOPTERS

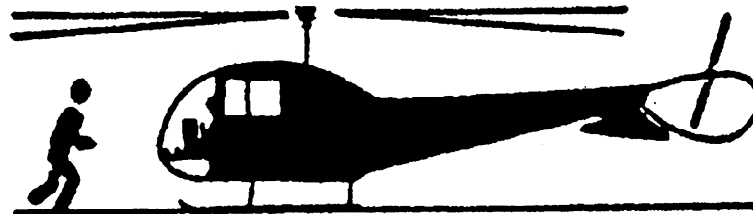
1. Approach or leave the machine in a crouching manner (for extra clearance from main rotor).



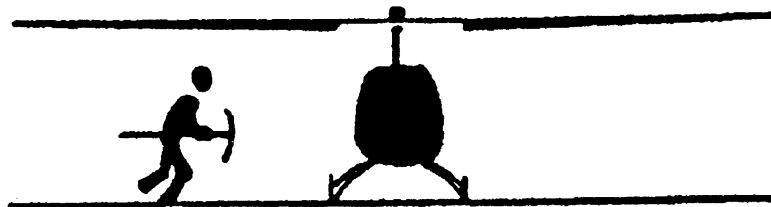
2. Approach or leave on the downslope side (to avoid main rotor).



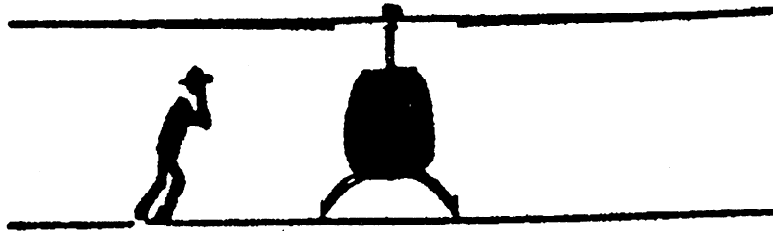
3. Approach or leave in pilot's field of vision (to avoid tail rotor).



4. Carry tools horizontally, below waist level (never upright or over shoulder).



5. Hold onto hard hat when approaching or leaving machine, unless chin straps are used.



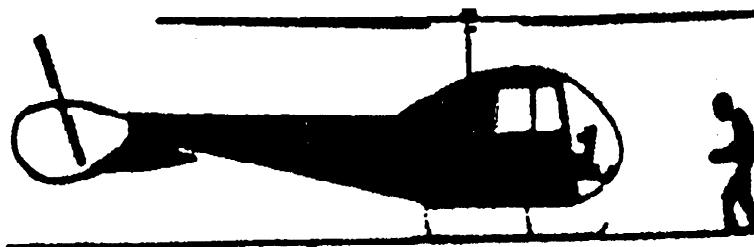
6. Fasten seat belt and shoulder harness (if installed) on entering helicopter and leave fastened until pilot signals you to release it and get out.



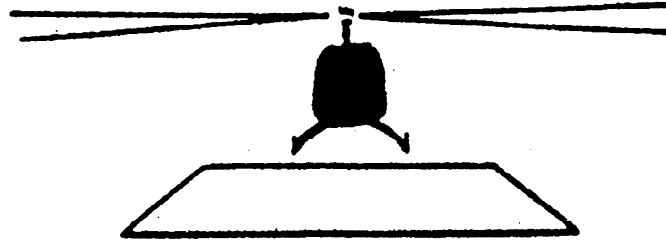
7. If leaving machine at the hover, get out and off in one smooth, unhurried motion.



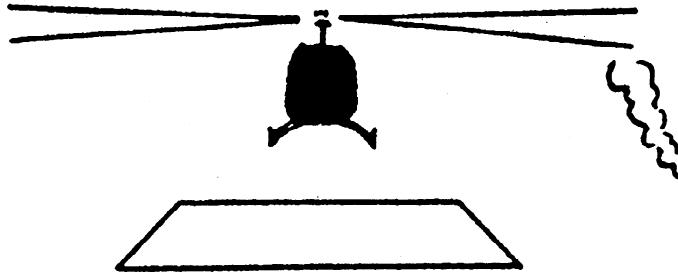
8. Do not touch bubble or any of the moving parts (tail rotor linkage, etc.).



9. Keep helispot clear of loose articles (water bags, groundsheets, empty cans, etc.).



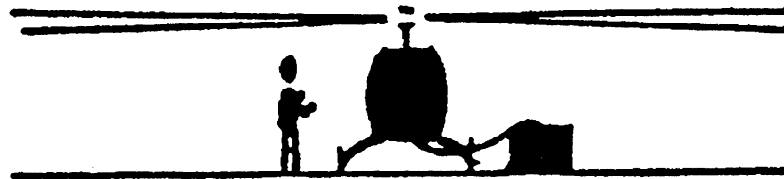
10. Keep cooking fires well clear of helispot.



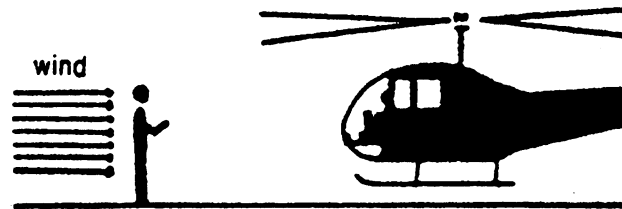
11. Loading assistants should always be supplied with plastic eye shields.



12. After hooking up the cargo sling, move forward and to the side to signal pilot (to avoid entanglement and getting struck with loaded sling).



13. When directing the machine for landing, stand with back to the wind and arms outstretched toward the landing pad.



14. When directing the pilot by radio, give no landing instructions that require acknowledgement because the pilot will have both hands busy.



15. When moving larger crews:

- a. Brief the crew on safety procedures.
- b. Keep them together and well back at the side of the landing zone. (This provides a clear area for the pilot in the event he/she has to land suddenly during either landing or takeoff.)
- c. Have them face away from the machine during landing and takeoff.
- d. Have each person look after his/her own personal gear.
- e. Have persons paired off and ready to get aboard as soon as the pilot gives the signal.



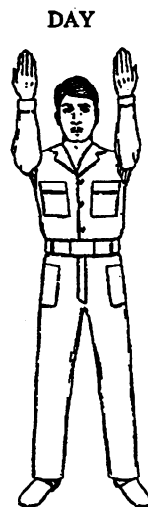
APPENDIX 2. HAND SIGNALS

The following signals are given by a signalman to an aircraft. The signalman should face the aircraft from a position where the signalman can readily be seen by the pilot.

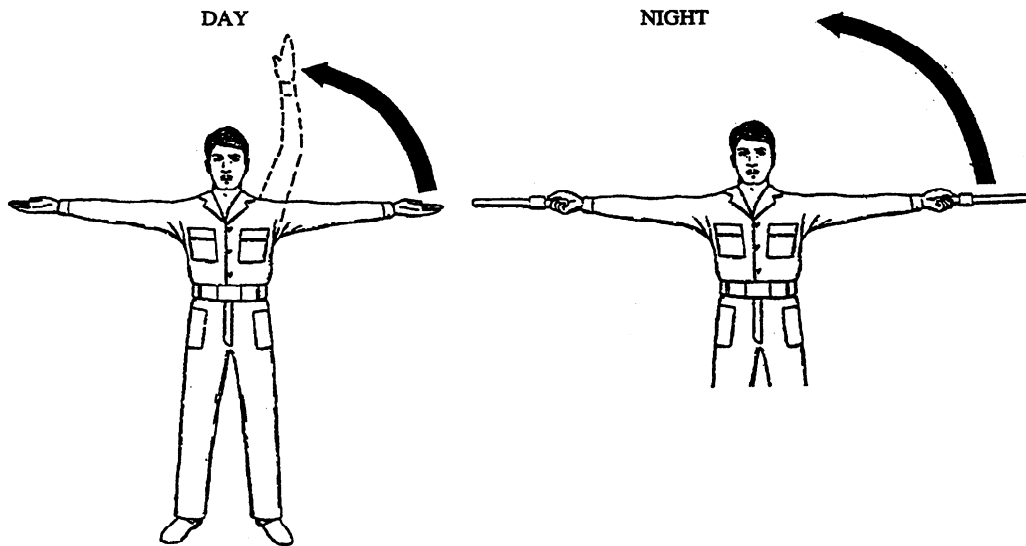
THIS AREA: Arms above head in vertical position with palms facing inward.



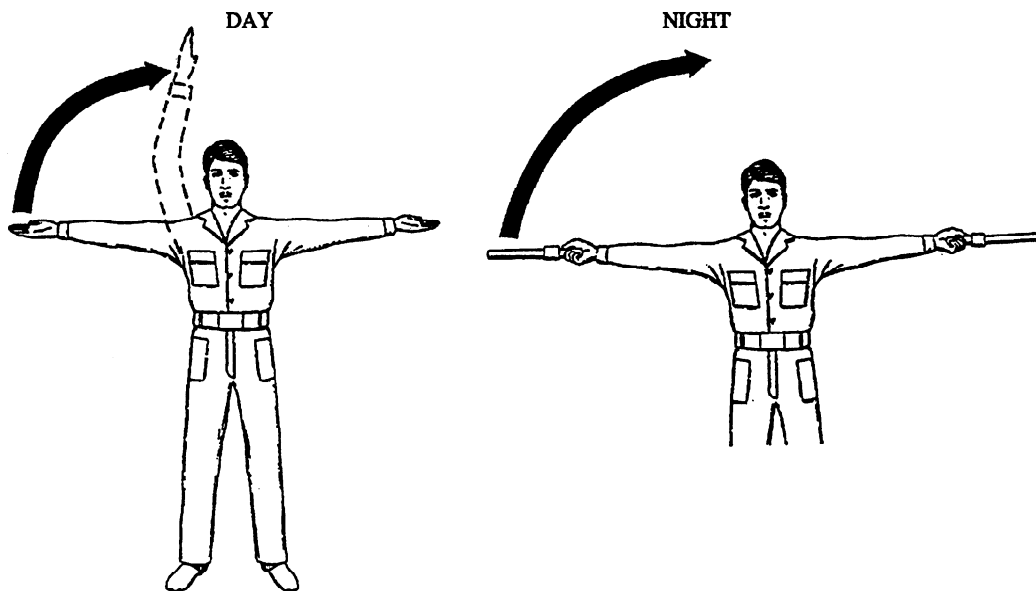
MOVE FORWARD: Arms a little aside, palms facing backward and repeatedly moved upward-backward from shoulder height.



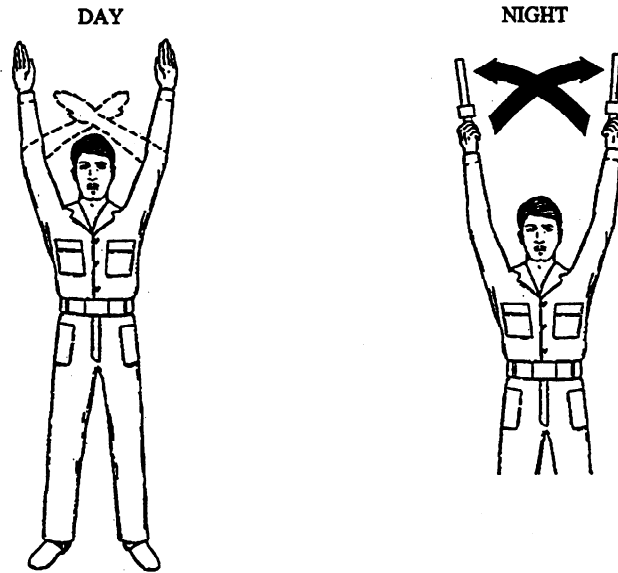
MOVE TO LEFT: Right arm extended horizontally sideways in direction of movement and other arm swung overhead in same direction in a repeating movement.



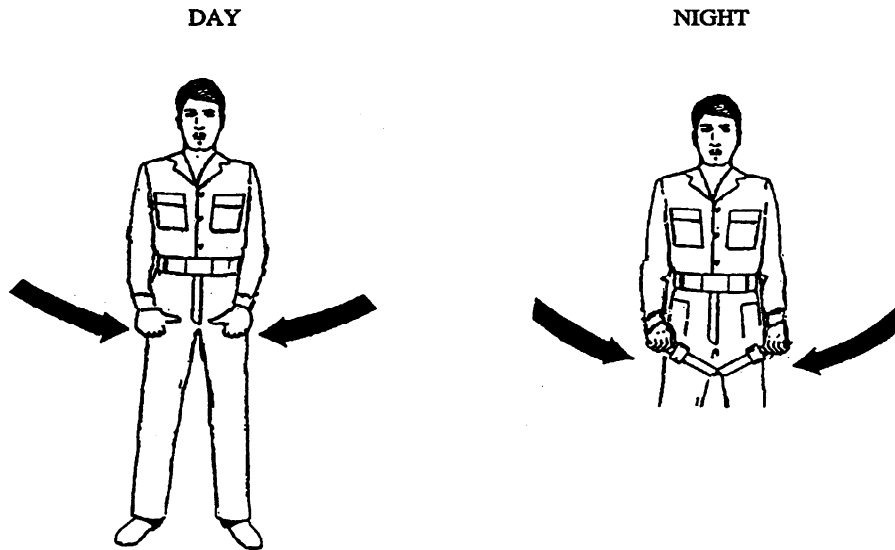
MOVE TO RIGHT: Left arm extended horizontally sideways in direction of movement and other arm swung overhead in same direction in a repeating movement.



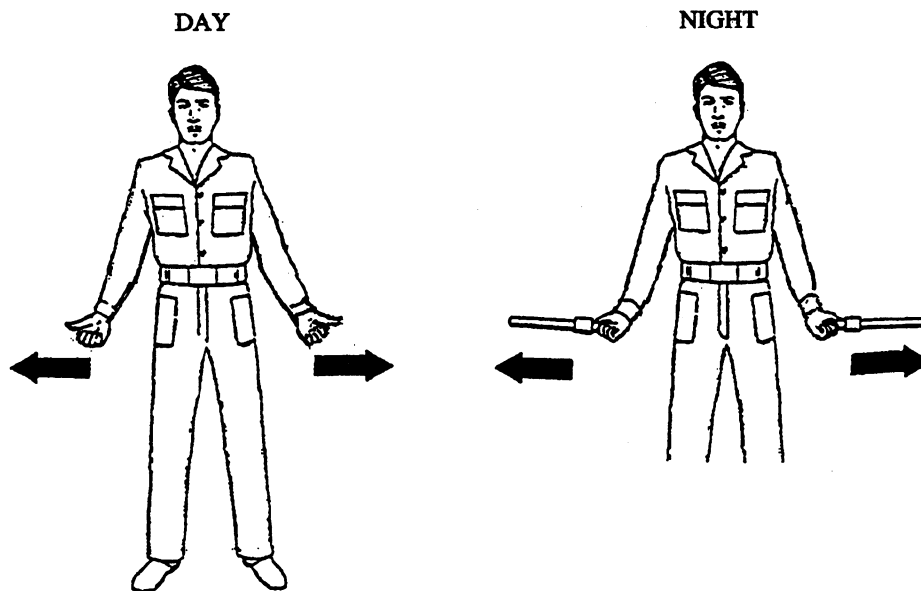
STOP: Arms held crossed overhead.



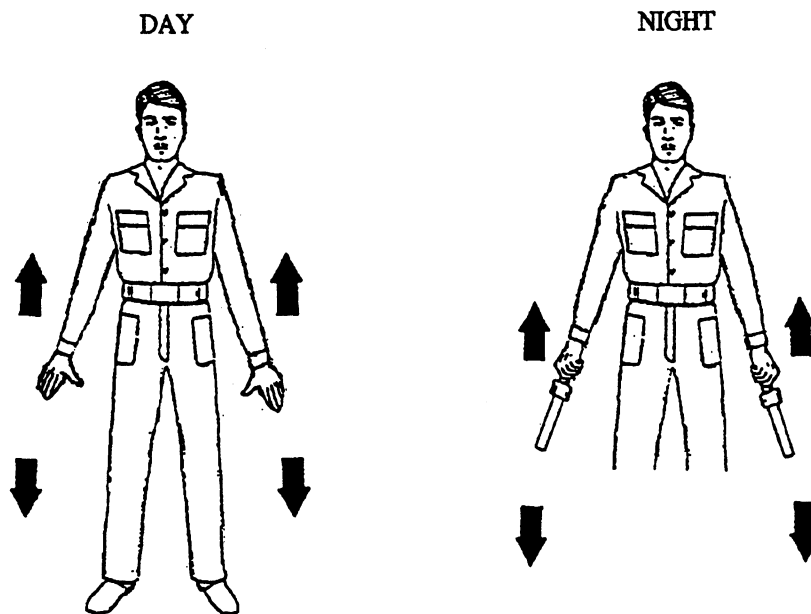
CHOCKS INSERTED: Arms down, palms facing backward, clenched fists, thumbs extended inward, move arms from extended position inward.



CHOCKS REMOVED: Arms down, palms facing forward, clenched fists, thumbs extended outward, move arms from extended position outward.

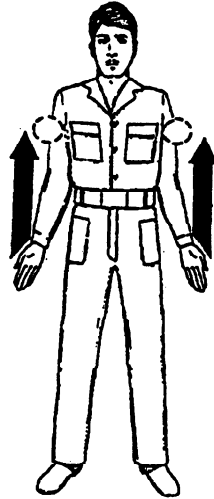


SLOW DOWN: Arms down with palms toward ground, then moved up and down several times.

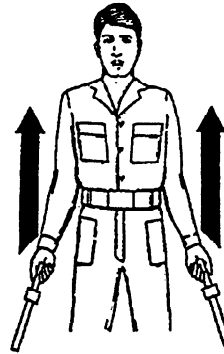


MOVE REARWARD: Arms by sides, palms facing forward, swept forward and upward repeatedly to shoulder height.

DAY

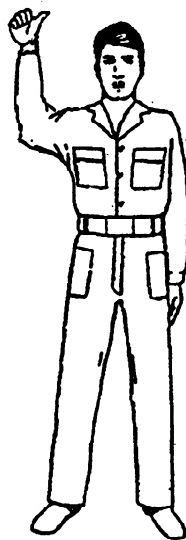


NIGHT



ALL CLEAR: Right arm raised at elbow with thumb erect.

DAY

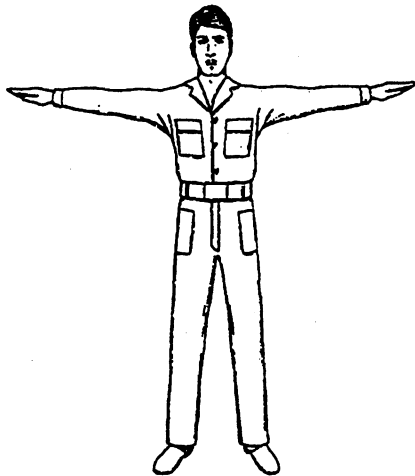


NIGHT

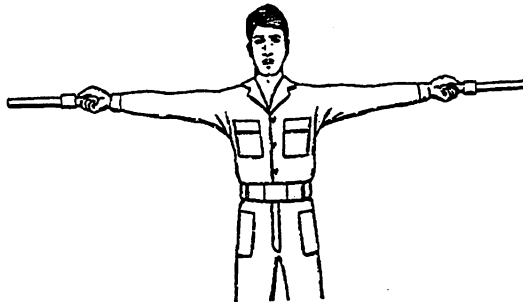


HOVER: Arms extended horizontally sideways, palms downward.

DAY

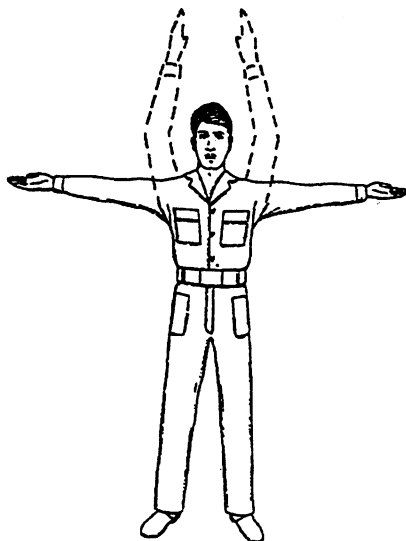


NIGHT

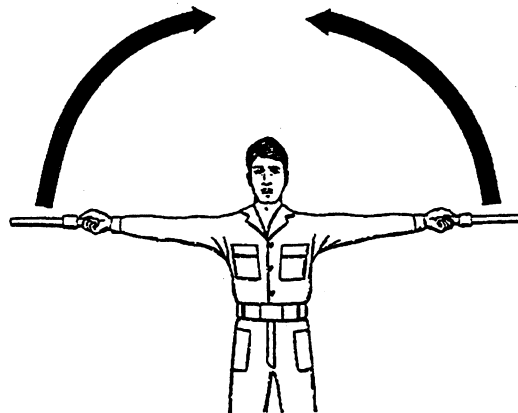


MOVE UPWARD: Arms extended horizontally sideways, beckoning upward with palms turned up.

DAY

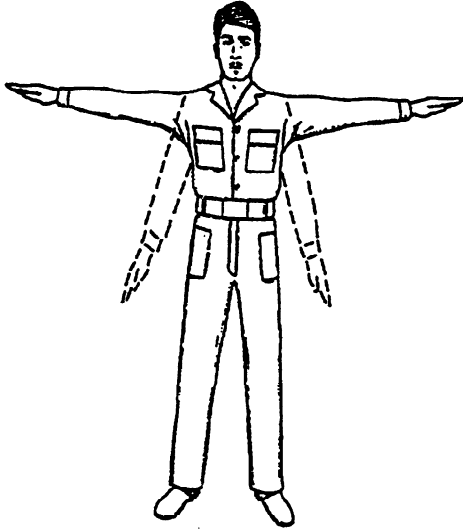


NIGHT

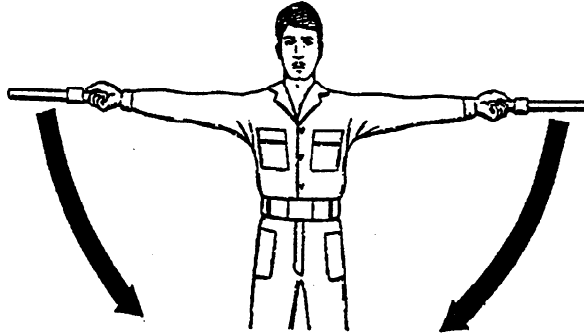


MOVE DOWNWARD: Arms extended horizontally sideways, beckoning downwards with palms turned down.

DAY

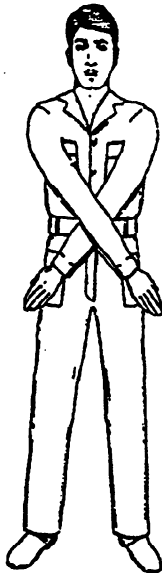


NIGHT

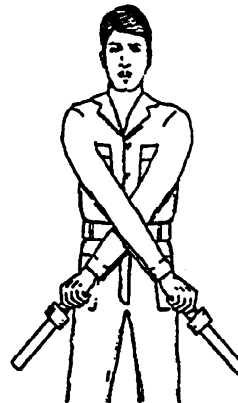


LAND: Arms crossed and extended downward in front of the body.

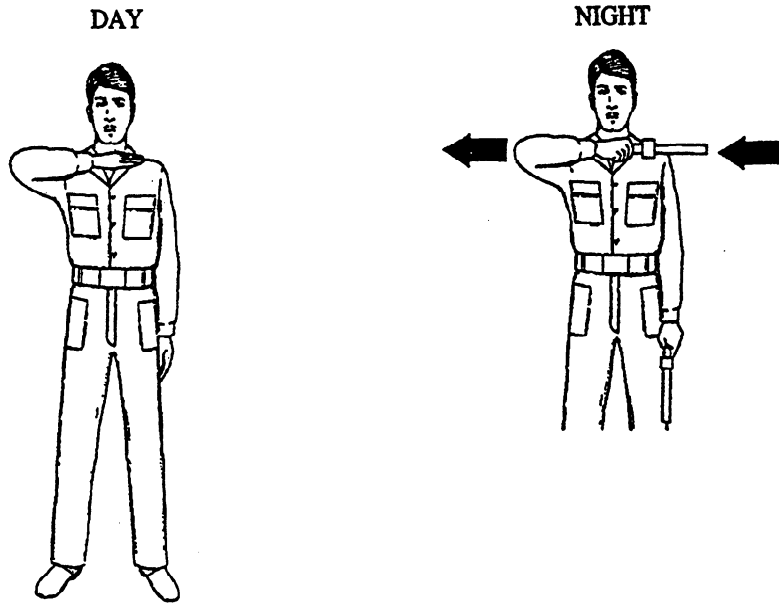
DAY



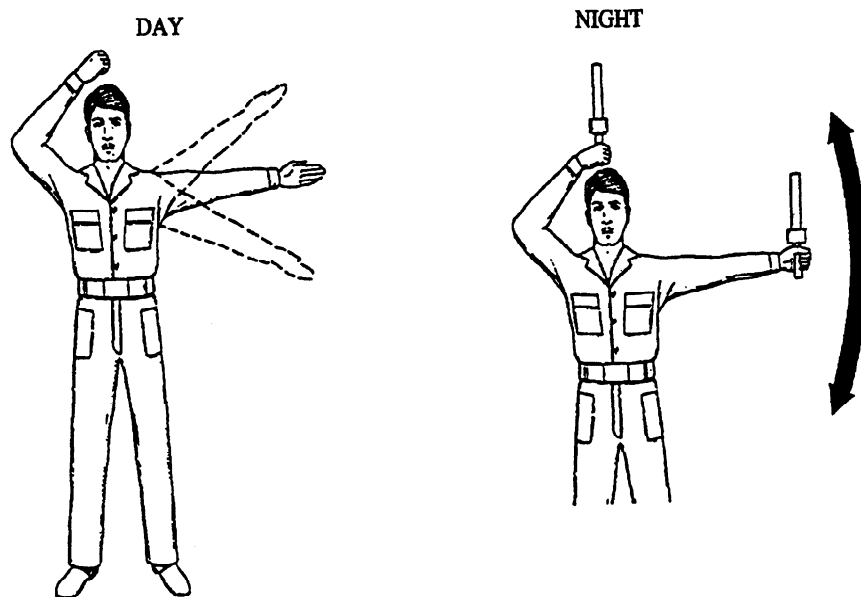
NIGHT



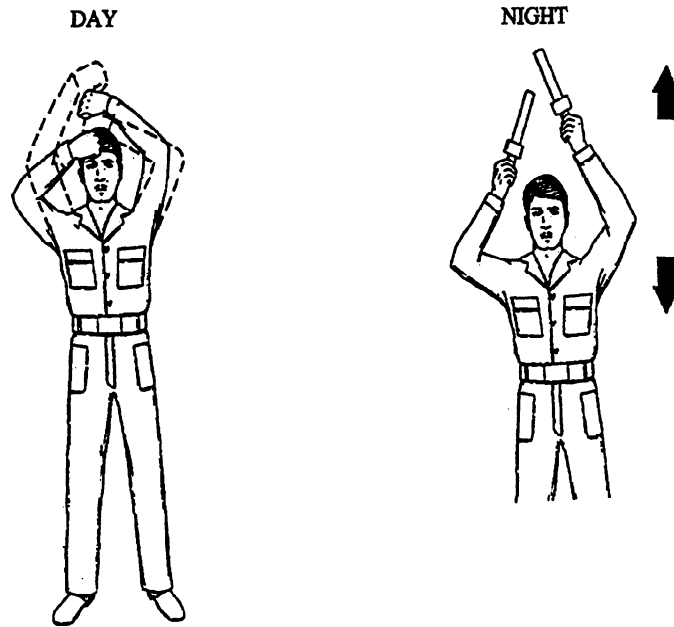
CUT ENGINE(S): Either arm and hand level with shoulder, hand moving across throat.



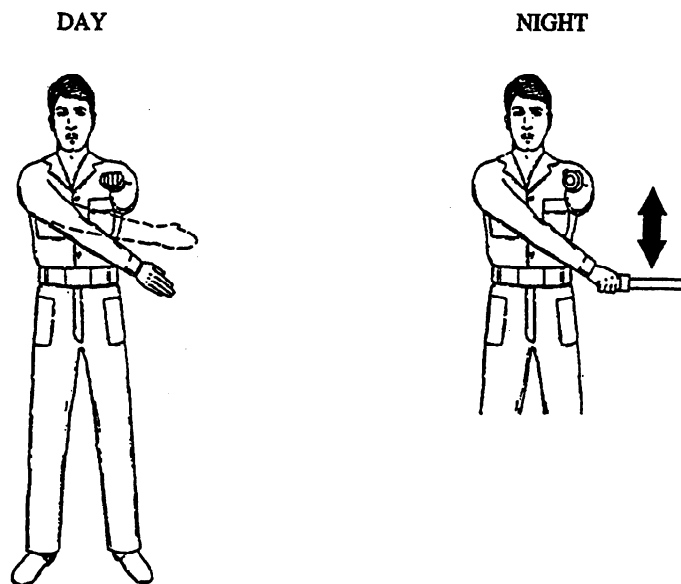
MOVE HOOK UP OR DOWN: Right fist held above head; left arm extended horizontally, palm facing outward, then swept down or up to indicate direction of hook movement.



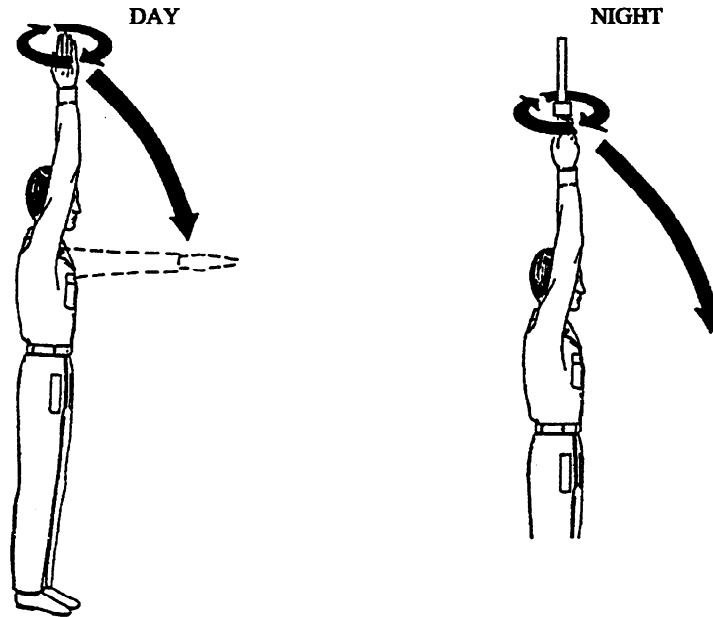
HOOKUP: Hands raised alternately above the head in a rope-climbing motion to take up slack.



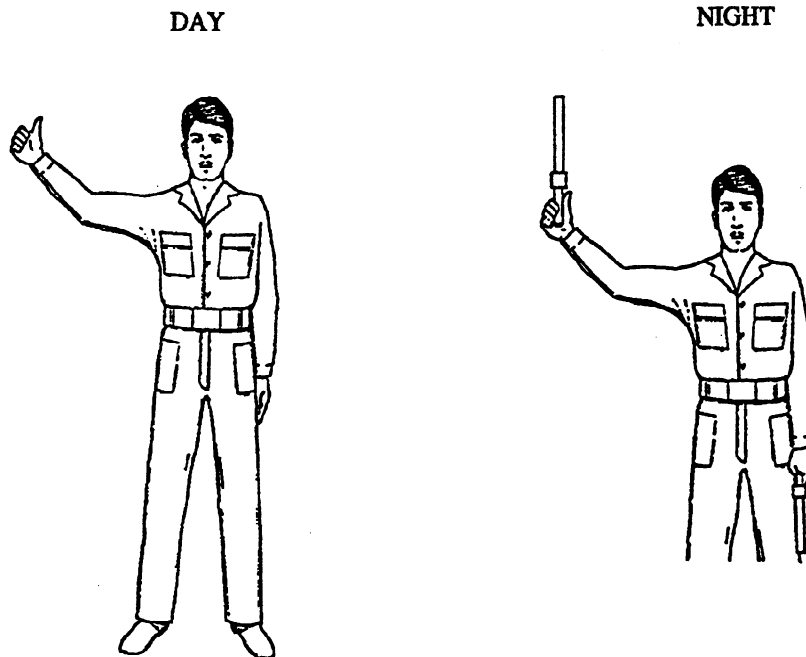
RELEASE SLING LOAD: Left arm extended forward horizontally, fist clenched, right hand making horizontal slicing movement below the left fist, palm downward.



TAKEOFF: The right hand is moved in a circular motion overhead, ending in a throwing motion in the direction of takeoff. Also means load clear, hookup good.

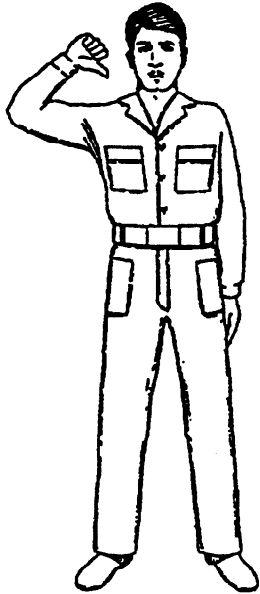


AFFIRMATIVE SIGNAL: Hand raised, thumb up.



NEGATIVE SIGNAL: Hand raised, thumb down.

DAY



NIGHT



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