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ORANGE COUNTY SHERIFF'S DEPARTMENT

AIR SUPPORT BUREAU

SEARCH AND RESCUE TRAINING MANUAL

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NOTE: OCSD EMERGENCY MEDICAL SERVICE POLICIES SHALL BE KEPT AS SEPARATE ATTACHMENTS TO THE REAR OF THE SEARCH AND RESCUE TRAINING MANUAL.

THE FOLLOWING SHALL BE ATTACHED:

OCSD EMS POLICY #100.00 – EMS DIVISION STANDARDS

OCSD EMS POLICY #110.00 – EMS PERSONNEL STANDARDS

CHAPTER 1 HOIST RESCUE TRAINING

1.1 AUTHORITY & RESPONSIBILITY

The OCSD Air Support Bureau has the authority to conduct Search and Rescue Operations per California Government Code 26614 and the resolution passed by the Orange County Board of Supervisors.

The OCSD Air Support Bureau has responsibility to ensure all training and operations are conducted within the scope of their policies and procedures. The training for each ASB member regarding hoist rescue will be documented in their individual training binder. This will ensure the safety of the crew and aircraft as well as the success of the operation.

1.2 INTRODUCTION

Helicopter hoist rescue operations have been performed safely and efficiently for decades now throughout the world. The most important factor for any agency that has determined a hoist rescue program is indicated for their mission requirements is to develop and implement the safest and most efficient means to accomplish this mission. Many of the determining factors relating to the safety and efficiency are derived from the aircraft, crew, topography and mission needs. Each of these factors will be covered in this manual.



The above photograph is the first helicopter hoist rescue performed in 1945. After 70 years, technology, equipment and experience have all added an increased level of service and ability.

Regardless of the specific manner in which a hoist rescue is performed, the focus of the training will always remain with the safety of the crew. The majority of the following document(s) reflect this paramount need to keep the crew safe. This will directly contribute to developing safe standard operating procedures and a successful helicopter hoist rescue program.

1.3 OBJECTIVES

The objectives for this manual are to define and instruct hoist rescue techniques to maintain a safe and efficient hoist rescue program that includes ground school, technical ground school and actual flight training.

1.4 POLICIES

Please refer to the Air Support Bureau Policy and Procedures Manual and the Support Bureau External Loads Manual.

1.5 UTILIZATION

Hoist rescue operations provide an extension of the capability of helicopter operations. The ability to maneuver a helicopter into a location to allow the deployment and retrieval of a rescuer via a hoist has been one of many uses of helicopters for decades now. Experience, techniques and technological

advancements have pushed capabilities even further now. Regardless of all these factors, humans still operate the aircraft, save the victim, and ultimately are responsible for the success of any mission.

Missions that could include hoist operations would be:

- + Cliff/High angle rescue
- + Remote/Difficult access rescue
- + Water rescue

Utilizing a hoist rescue operation could considerably expedite the insertion of a rescuer, treatment of the victim and the extraction of an injured/stranded victim. With the proper training, hoist rescue operations can be performed in a variety of environments and even under nighttime conditions.

CHAPTER 2 GROUND SCHOOL

2.1 INTRODUCTION

As stated in the introduction to this manual, helicopter hoist rescue operations can be an effective and safe manner in which to remove an injured or trapped person from a specific area/location.

This chapter will focus on the actual training procedures that will be instructed in order to provide safe and effective operational procedures for hoist rescue operations.

The "Ground School" portion of the instructional process is intended to be in a didactic or "classroom" setting in order to allow a controlled learning environment.

2.2 OBJECTIVES

The objectives of this chapter are to utilize the controlled environment of a

classroom setting in order to provide an initial overview of hoist rescue operations and introduce the specific manner in which the material will be instructed.

Once this chapter has been completed, the student will need to have a strong didactic grasp of the information held within this chapter. This shall include:

- + Safety Brief
- + Crew Resource Management vs. Operational Risk Management
- + Hoist Operations Theory
- + Goodrich External Hoist Overview
- + Rescue Equipment
- + Hoist Rescue Operational Procedures
- + Aircrew Positions and Responsibilities
- + Emergency Procedures

2.3 TRAINING, QUALIFICATION AND PROFICIENCY

Mandatory Quarterly Training which is required for currency, qualification and proficiency will be documented for each OCSD member.

2.4 SAFETY

Establishing a safe training program inherently promotes a safe operational program. Safety can be considered second nature, but it also instructed. By having a progressive training plan that instills a safe practice and mindset will ensure that safety is paramount to all team members.

Helicopter hoist operations can be considered inherently dangerous. Every possible effort needs to be taken to decrease risk and exposure by the agency, training staff and students.

A written safety message that is written and disseminated on the first day of training and continues through the operational phases of the agency's program should be completed by the agency management staff.

Continual safety meetings and debrief sessions after training and actual operations with the ability to speak openly and without reprimand should be facilitated and promoted by both the agency management staff and operations crews. Any information regarding safety, mishap or deviation should be disseminated to all program members.

At any time within any training scenario an unsafe action is observed or conducted, ALL training operations should immediately cease and a brief on what transpired and mitigating options should be discussed prior to resuming the training scenario.

2.5 CREW RESOURCE MANAGEMENT/OPERATIONAL RISK MANAGEMENT

Crew Resource Management (CRM)

During the 1970's, the National Transportation and Safety Board (NTSB) had observed a number of cultural issues within the commercial airline industry that affected communication and, ultimately, resulted in close call incidents and accidents during commercial flight operations. In order to improve communication among the aircrews, a program was developed to change that culture which allowed crewmembers the opportunity to provide their perspective regardless of rank or experience.

Cockpit Resource Management turned into Crew Resource Management (CRM) over the years and has become part of the culture in agencies that are involved in high risk, time sensitive operations.

CRM takes the aspects of communication, decision-making and leadership and promotes an environment for everyone involved in a training or operational situation to participate.

In the context of training, it is imperative that an atmosphere is created and established that will promote the ability for the students and training staff to speak openly yet respectfully. The intent is that by incorporating a healthy CRM program a greater level of safety will be created. Having the ability to quickly assess a situation during a high risk training operation, communicate

effectively and make a safe decision ultimately leads to a safer program.

Operational Risk Management

Recognizing and accepting that training crewmembers to perform helicopter hoist rescue operations is dangerous is the first step in Operational Risk Management (ORM). For managers, ORM involves a continual assessment, decision-making and implementing risk controls over the training process. This process may be intended as a more methodical and calculated approach than the actual crewmembers aboard a helicopter. ORM for the crewmembers must be time compressed and have more immediate impacts on the training session or on an actual rescue operation.

In essence, ORM is a step-by-step process that includes the following six components: defining the mission/task, identifying the hazards, assess the risk(s), identify the options, evaluate the risk vs. gain, execute the decision and evaluate the progress.

Appendix 2.5 (ORM Assessment Worksheet) shows a color-coated and systematic approach for both managers and crewmembers. This worksheet also provides supporting information for the above-mentioned components.

2.6 HOIST RESCUE THEORY

2.6.1 INTRODUCTION

Helicopter hoist rescue is a dynamic and demanding operation. Preparing agency personnel to handle these demands and the constantly changing operation is a challenge in itself. Providing realistic scenarios from basic to an advanced level in a progressive manner reinforces good communication, good decision-making and safe operations.

Hoist rescue theory demonstrates both the capabilities and limitations of all aircraft in the context of hoist rescue. There may be no “best” way to perform any one single rescue. It is appropriate for aircrews to have a solid foundation with performance factors and their accompanying cause and

effect within the operation.

The intent of land-based hoist rescue operations is to use the terrain of the target area to the most advantage. This can be accomplished in a variety of forms depending on a number of contributing factors. The two main factors could include the medical condition of the victim and the relative access/location of the victim. In other words, the severity of the patient and where they are located play the most in determining much of the mission.

The condition of the patient may be relayed to the aircrew via ground personnel or direct/indirect communication with the victim or bystanders. The condition of the victim will dictate the equipment deployed to the victim along with the rescuer and the need for further medical care.

The location of the victim will help in determining the target location. The victim location and the target location do not always need to be the same. If the victim is located in a relatively secure and open area, it may be more advantageous to determine the target area to be away from the victim in order to minimize the effects of rotor wash and debris. If the victim is in a precarious location, then the target area may be next to the victim in order to provide immediate support and/or security from further injury.

Communication

Communication between the Pilot and the Hoist Operator will need to be clear, concise and continual throughout the evolution. The Pilot may feel comfortable in bringing the aircraft over the target area; however, the Hoist Operator will need to communicate all of the actions to the Pilot while in the hover. The Pilot will need continual affirmation of the movement above the target and where the load is in reference to the aircraft.

Working Positions

Hoist Operator is positioned in the location in the aircraft that provides the safest and most control of the hoist cable. This may include the aircraft skid, in the aft cabin or on a "step" that is intended for the Hoist Operator to work from.

Rescuer is positioned in the aircraft in the location that provides the safest and most effective spot to be deployed to the target area. This may be in a seat within the aircraft's aft cabin or the floor of the aft cabin.

Regardless of the operating positions that the Hoist Operator and Rescuer

assume, both shall have their safety straps maintained for the precaution of an emergency event occurring.

2.6.2 HEIGHT VELOCITY CURVE

In the simplest explanation, the H-V curve is a diagram indicating the combinations of height above ground and airspeed that should be

avoided due to safety concerns relating to emergency landings. It is dangerous to operate within the shaded regions of the diagram, because it may be impossible for the pilot to complete an emergency autorotation from a starting point within these regions.

2.6.3 HELICOPTER LIMITATIONS

Allowable hoist load is calculated for lateral CG limitations. OEM provides diagrams for lateral hoist loading of specific aircraft. Refer to Appendix 2.6.3 for diagram.

2.6.4 STATIC DEPLOYMENT AND RETRIEVAL

Theory:

The rescue aircraft assumes a static position (hover) over the target location. The Rescuer is deployed and retrieved from the site while the helicopter remains in a static hover.

Due to multiple factors, it may be determined that the safest and most effective manner in which to perform a hoist rescue mission is to perform a static hoist rescue. These factors may include crew configuration, terrain and victim location. For some organizations that primarily perform dynamic hoist rescue profiles, the spot in which a victim is encountered and the surrounding terrain may be prohibitive of performing a dynamic profile.

Aircrew experience and comfort may dictate that coming into a hover above a victim's location will allow a safe hoist rescue evolution. While any "low and slow" flight of a helicopter poses its own dangers, the ability for the Pilot to establish and maintain control of a hover above the target will provide an indication that the mission is safe to attempt.

2.6.5 DYNAMIC DEPLOYMENT AND RETRIEVAL

Theory

The rescue aircraft maintains forward movement while deploying and retrieving the Rescuer. The positioning of the aircraft over the rescue site is minimal.

The Height Velocity (HV) Curve displays the support to minimize time in a hover depending on the relative gross weight and density altitude in which the operation is taking place as well as operating a single vs. twin-engine aircraft.

With the HV Curve in mind, the two actions that create a hoist evolution would be to perform the operation from an increased height (AGL) and minimize the time in a hover during both the approach and departure to the target. Maintaining some forward airspeed and reeling out hoist cable can accomplish minimizing the time in a hover during the approach (insertion of rescuer) to the target and conversely reeling in cable during the departure (extraction of rescuer).

Additionally, the "dynamic" profile assists in decreasing the problems that occur with rotation and exposure to the Rescuer, victim and other ancillary Rescuers. By maintaining forward airspeed through the majority of the insertion and extraction of the rescuer, the downward rotor wash remains focused behind the rescuer/victim. The exposure to the direct and indirect (falling rocks, branches, debris, etc.) is also lessened due to the decreased hover time above the target area.

The dynamic operational philosophy relies heavily on the ability for the Hoist Operator to provide clear and succinct commands to the Pilot while the aircraft is in forward flight. This communication technique requires the Hoist Operator accurately and quickly describes the necessary movement of the aircraft in order to position the Rescuer and/or hoist hook safely over the target area. The ability for the Hoist Operator to "paint the picture" of what is occurring with the load that is attached to the hoist cable is paramount for the Pilot to provide inputs to provide a smooth transition from forward flight to a hover above the target. The Hoist Operator will need to have the ability to anticipate the movements of the slowing aircraft and the subsequent movements translated down to the end of the hoist hook. The Hoist Operator and pilot will also need to be proficient in assessing the terrain adjacent to the target area in order to safely and effectively

complete the hoist rescue evolution.

2.6.6 HYBRID STATIC/DYNAMIC DEPLOYMENT AND RETRIEVAL-

Theory: The rescue aircraft establishes position near the rescue site. The Rescuer is deployed and retrieved as the helicopter is moved over the target site. The static position over the rescue site is decreased, but not eliminated.

2.7 GOODRICH HOIST OVERVIEW

2.7.1 PRODUCT SPECIFICATIONS

- + Goodrich Model 42325 External Hoist
- + Weight=100.6 lbs.
- + Lowering Speed=275 ft. per minute at 600 lb.
- + Lowering Speed=275 ft. per minute at 300 lb.
- + Raising Speed=150 ft. per minute at 600 lb.
- + Raising Speed=275 ft. per minute at 300 lb.
- + Cable Length 250 ft.
- + Cable Diameter 3/16 in. per MIL-W-83140
- + Maximum Lift Load 600 lb.
- + Over-tension Load Limit 1200 lb.
- + Limit load 1800 lb.

2.7.2 OVERVIEW

External hoists can be defined as a hoist assembly that is mounted to the external area of a helicopter and does not articulate/boom laterally. The advantage of utilizing an external hoist is the hoist is mounted outside of the aft cabin and therefore improves the “working space” within the aft cabin. External hoists can generally be mounted in one of four positions on the sides of an aircraft. The four positions are right forward, right aft, left forward or left aft. The mounting can be dependent on agency preference and center of gravity.

Hoist devices are designed to work simply and reliably. That is by design

and intent. Hoists are intended to have the capability to insert and extract a load. The load may be a human (live) load or cargo/equipment.

Hoist is electronically controlled and powered. Under normal operations, the hoist is controlled by a pendant by a hoist operator located in the aft cabin. A second set of controls is located on the Pilot's cyclic and will override the aft cabin's controls under emergency conditions.

In essence, a motor that wraps a cable around a drum controls the hoist electronically. To control the cable "pay-out" or "reel-in", the hoist operator has a hand-held pendant that controls the rotation of the drum by a thumb-wheel device.

2.7.3 HOIST ASSEMBLY

Electrically powered motor (28 VDC) controls a drum that is located within the hoist assembly. The drum stores the cable on it and, when activated, reels out or reels in cable. The drum is called a "translating drum" which refers to the fact that the drum moves back and forth which allows the cable to come off of the drum at only one point. This decreases the potential to foul the cable and makes the reel out and reel in process much more efficient.

The striker plate is located at the top of the hoist hook and stops the reel in process once it comes into contact with the hoist assembly. Below the striker plate is a rubber cylinder known as the energy absorption cylinder. The striker plate and the energy absorption cylinder are compressed up against the hoist assembly keeping the hoist hook in place. The striker plate also actuates the up-limit switch further prevents the reel in process.

The hoist hook is the far distal end of the hoist assembly. It is the mechanism where the rescuer, victim and equipment are attached to the hoist assembly. Hoist hooks can come in a variety of configurations. For live (human), external loads, an industry standard establishes that hooks with a locking mechanism are used to retain carabineers or other ancillary equipment to prevent unwanted opening. The locking mechanism should be an "auto-locking" system that shuts and locks the gate closed when released. Every effort should be made to keep the hoist hook off of the ground and away from debris that could foul the locking mechanism.

A back-tension of 6 lbs. is maintained on the cable during no-load reel-out and reel-in operations

Hoist Cable

The hoist cable has 250 feet of working length. The first and the last 20 feet is painted orange to indicate the ends of the cable. The tensile strength of the cable is 3330 lbs. and the working strength is 600 lbs. Each cable consists of twelve strands of wire wrapped around seven core wire strands that gives a 3/16 inch total diameter. Each strand has seven individual wires. This cable is commonly referred to as 19X7 construction describing the total number of strands and the number of wires in one strand. The cable is intended to not rotate, but it is not non-rotating. At the end of the cable, a small ball bearing assembly connects the cable to the hoist hook itself. This ball bearing allows the hoist hook to swivel 360 degrees throughout the cable axis and not twist the hoist cable.

2.7.4 SAFETY FEATURES

Fleet angles

Fleet angle can be defines as the angle in which the cable leaves the hoist assembly itself. While the hoist is designed with a single "Pay-out" location that aids in problems with excessive fleet angles, it is recommended to keep the fleet angle as close to vertical as possible. Any angle in which the cable is induced or forced, swing will be inevitable.

A roller cable guide system reduces cable abrasion that may occur when a load is not vertical (a.k.a. fleet angle)

Limit switches

Limit switches drive assembly is a manner in which reel in and/or reel out is adjusted and timed to correspond to cable extended position. Limit switches actuate at preset positions to slow or speed up reel in or reel out. The first and last ten feet of cable slow significantly to reduce sudden stops as the cable reaches its maximum length or reeled all the way in.

Load brake

A load-dependent automatic, mechanical brake controls the process of reeling out the cable and maintains the load in a stationary position if the

hoist motor is stopped. The brake also regulates speed while lowering a load. The automatic brake is oil-cooled to reduce wear and allow the hoist continuous operation.

Slip clutch

An installed limit slip clutch (load limit device) enables the hoist cable assembly to reel out automatically if the cable load exceeds 1275-1530 lbs. The slip clutch prevents damage to the aircraft in the event of cable overload or accidental entanglement of the hook during hoist operation

Cable Cutter

The Rescue Hoist Assembly incorporates an electrically initiated, guillotine cable cutting System. The cable cutter is located in the hoist assembly and is designed to operate using an explosive that will activate when electrical power is applied.

The cable cutter assembly consists of an anvil, a shear pin, cutter, packing, barrel, cap and cable cutter cartridge. In an emergency that requires the jettisoning of a hoist load, the cable cutter cartridge is activated from the pilot position. If the cable cutter assembly is activated, the anvil, shear pin, cutter, and packing must be replaced.

NOTE: The cable cutter cartridge is installed and safety wired after the receipt of a new hoist assembly or after repair and overhaul activities.

Axel Cut

The manual cable-cutting shear shall be mounted within the Hoist Operator's range. It serves as a backup cable cut device in case of a malfunctioning explosive charge. If cutting of the cable is not time critical, it is recommended to use the manual cable cutter in order to have a clean cut and save the cartridge for a time critical emergency. Using the Zephyr "Axel Cut" is highly recommended. It is operated with one hand only and ensures a quick and clean cut. With this equipment it is extremely easy to catch and cut the cable within seconds.

Cable Deflector

Cable deflectors shall be installed at the skids to prevent damage to the cable as comes into contact with the skid. This deflector shall be installed on the side of the aircraft where it is intended to install the hoist. The deflector has to be long enough to protect the cable even it is swinging.

Temperature Sensing

The Hoist incorporates a thermal warning and protection System to provide maximum output and/or torque to the point of failure without being a fire hazard.

The thermal warning and protection system consists of two automatic resetting thermal switches and a non-resetting thermal fuse.

One switch is located in the winch gearbox cover assembly while the second switch is located in the motor brush holder and thermal protector.

Each switch is designed to activate at between 280° and 300°F (138° and 149°C) and to automatically reset at between 250° and 270 °F (121 ° and 132°C).

An activated switch completes a circuit to illuminate the red OVERTEMP indicator on the control pendant assembly. This condition warns the operator of an over-temperature condition but will not stop hoist operation.

The red OVERTEMP indicator automatically extinguishes when the switch resets.

2.7.5 DAILY OPERATIONAL AND SAFETY CHECKS

Cable Inspection

The hoist cable will need to be inspected after any and every use. A qualified and trained aircraft mechanic should inspect the hoist cable. Inspection of the cable should be within accordance to the O.E.M. specifications.

Power Inspection

Verification that the hoist Bureau is receiving sufficient power should be

performed as the cable is inspected.

Hoist Hook Inspection

The hoist hook should be inspected to ensure that the hook opens and closes without complication. The locking mechanism needs to be inspected to make sure the hook locks closed if the locks are not engaged. Inspection also needs to make sure there are no visual cracks to any part of the hook.

Axel Cut Inspection

The Axel Cut device needs to be inspected to make sure that the retaining pin can be pulled easily and freely. Inspect the area around the Axel Cut to make sure there are no items that would block the Hoist Operator from accessing it in case of an emergency. Ensure the sliding sleeve along the handle slides freely. Ensure the cable cutting mechanism engages as the slide is actuated.

Safety Attachment Point Inspection

All points that both the Hoist Operator and Rescuer/Victim/Passengers are attached to the aircraft are inspected daily. The inspection process should start at the aircraft with the bolts that enter the bulkhead and continue all the way to the attachment points for the Hoist Operator and Rescuer. All webbing, delta links, restraints and carabineers should be inspected for attachment, patency and wear.

2.7.6 HOIST CABLE ISSUES



Bird Caging – Bird cages are defined as short lengths of wire rope with the outer wire strands stretched and opened to be formed in the appearance of a bird cage. A birdcage is a permanent deformation and the cable must be replaced.



Loose strands are due to improper balancing and socketing during manufacture, they cannot be tightened up and must be replaced.



Cable Milking is a common end of life phenomena and is due to the action of the hoist tension rollers on the outer strands over a long period of time. When this appears after a long life the cable may be starting to fatigue, it should be replaced.



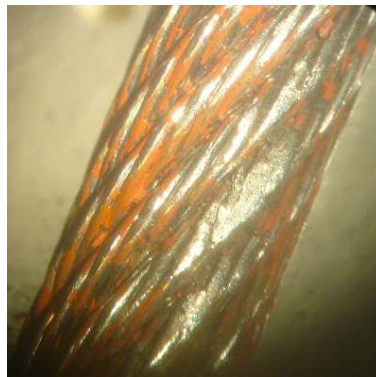
Corroded Wires is caused by salt water, moisture and non-lubrication.



Broken Wires – Broken wires occur as a result of cable damage or as a cable is nearing the end of its service life. The external mounted hoist cable must be replaced if there is any broken wire strands in any wire rope lay.



Kinks – A kink is identified as a permanent bend in a cable caused when a loop of cable is suddenly pulled tight. A kink may open a lay of cable and result in interference and early failure of the cable caused by abrasion and wire breakage. A kinked cable must be replaced.



Abrasion – Abrasion is defined as wear of individual wires resulting in flattened areas on the wire. Abrasive wear can be caused by interference with other components, dragging the cable over abrasive surfaces, or as a result of other cable damage. Cables that have abrasive damage must be replaced and, if applicable, the cause of the abrasion must be investigated and repaired.



Necking – Necking is defined as the decrease in cable diameter at a specific point. Necking is normally an indication of broken wires and is cause for cable replacement.



Flattened Areas – Flattened areas of cable result from the application of an excessive force to a small area of the cable. Trapping the cable in a door or driving a vehicle with a metallic wheel over the cable can cause this kind of damage. A cable with a flattened area must be replaced.



Dirt or sand contamination should be avoided and the cable cleaned thoroughly if encountered.



Weld - a rescue hoist cable can get so hot that it is annealed. Causes: static discharge, lightning.



Heat - Exposure to high heat softens the wire rope and can lead to catastrophic separation under load. If bluing is noted then immediate replacement is required.

2.8 Hoist Rescue Equipment

Personal equipment such as harnesses, helmets, carabineers, etc. should be the responsibility of the individual who uses the equipment and the safety officer if the agency has such a position. At a minimum, each and every piece of equipment utilized in any part of a hoist mission should be inspected regularly and that inspection should be documented. Reference to individual and specific equipment should also be referred to the manufacturer's specifications.

Hoist Rescue equipment is designed and employed to provide the Rescuers some various "tools" or "methods" in which to secure and extract a victim. Depending on the medical status, location, and topography, the most appropriate rescue equipment should be selected on these conditions.

For land-based rescue operations, the following conditions require ascertaining prior to the selection of the rescue equipment.

- + Is the victim located in a stable, safe location? If this can be confirmed, the victim then needs to be evaluated further to determine if ambulatory (able to walk) or not. If ambulatory, the victim can be extracted by a number of devices that support this condition (Screamer Suit, rescue strop, rescue triangles, etc.). If the victim is not ambulatory, a rescue device such as a Stokes stretcher or Bauman Bag will need to be deployed.
- + If the victim is **not** located in a safe/stable location and immediate rescue from the location is required, devices such as cinch collars, Cearly straps, or quick-capture straps can be used to quickly secure and extract a victim from a precarious location.

For water-based rescue operations, the conditions of the water and

location of the victim can dictate the appropriate equipment.

- + If the victim is located moving in a dynamic (swift water) water environment, the need for immediate rescue is required. Devices such as cinch collars, Cearly straps, or quick-capture straps can be used to quickly secure and extract a victim from the moving water.
- + If the victim is located in a dynamic (swift water) water environment, however is not moving (standing on a rock, clinging onto a tree, etc.) other devices in addition to the above mentioned devices can be utilized. Devices such as a rescue basket may be appropriate as well.
- + If the victim is located in a static (open body of water) water environment, a device such as a basket or strop could be used to extract the victim. Careful consideration should be given to the use of a strop in cold water.

2.8.1 HARNESSSES

Hoist Operators and Rescuers should wear a NFPA 1983 Class III harness to ensure maximum fall protection. These harnesses also provide a multitude of connection points for the Rescuer for specific mission insertion/extractions.

Inspection:

All harnesses should be regularly inspected for damage, wear or abrasions.

All stitching, metal points, and adjusters require careful and diligent inspection. Adjunct hardware (carabineers or links) should also be regularly inspected and replaced if necessary.

Safety tethers can also be part of the rescuer's harness. The inspection should encompass this personal restraint system.

2.8.2 HELMET/EYE PROTECTION

Hoist Operator/Rescuer helmets should meet industry standard (flight) helmets (Mission specific helmets may be worn by the rescuer- e.g. water rescue). Agencies should have authority over appropriate helmet selection

for specific missions.

Agencies should ensure Hoist Operators/Rescuers wear eye protection. The visors on flight helmets meet this standard.

2.8.3 GLOVES

Hoist Operators must wear gloves that are specific to heavy-duty wear in rope rescue or rigging. The hoist cable will slide through the palm of the Hoist Operator's hand that necessitates extreme protection. Hoist Operators may also use $\frac{3}{4}$ gloves that allow the ends of their fingers to be exposed which increases dexterity. Rescuers should don standard leather or NOMEX flight gloves.

2.8.4 CARABINEERS/DELTA LINKS/COLLECTION RING

Carabineers with **locking mechanisms** should be employed in aircraft operations. Remember that the design of a carabineer requires that the loads be placed longitudinally. Gate failure may occur if the load is placed on the sides of the carabineer.

Locking links can come a number of various sizes and shapes. These links all have screw-locking mechanisms that keep the load locked in. The various shapes allow the load to be dispersed through the configuration of the link. Delta links are useful in high-load possibilities. However, care must be exercised not to tighten the screw lock past finger tight. The introduction to a load will tighten the screw lock and could become tightened to the point that a wrench may be required to open the screw lock open.

Collection rings are constructed of steel and are intended to accommodate a number of high loads while retaining strength. Collection rings are used for the Bauman Bag in order to place a number of carabineers and be inserted into the hoist hook for extraction.

2.8.5 WEBBING/ANCHOR STRAPS/RESTRAINTS (ATR)

The maintenance staff in accordance with the aircraft specific manual and the aircraft Supplemental Type Certificate (STC) should determine anchor

locations. The anchors need to be rated to secure the hoist operator, rescuer and loads working inside and outside the aircraft cabin.

From the actual anchor location, the anchor straps extend to provide a safety strap to restrain the passengers and equipment. Generally speaking, hoist operations involve the aft cabin door(s) being opened prior to becoming airborne or while in flight. The intent is to secure everyone and everything to the aircraft at all times. The tethers are the protective conduits from the aircraft to the passengers/equipment. The tethers should allow the helicopter crewmembers movements so that they are able to perform their duties yet provide the necessary restraint. Tethers and the ancillary equipment can come in variety of configurations. The overall objective is to provide the necessary restraint and prevention of personnel and equipment in accidentally leaving the aircraft.

Anchors and tethers should be inspected regularly to ensure patency and security. If any signs of wear to the straps are displayed, the tethers should be replaced immediately.

2.8.6 SCREAMER SUIT

Designed for rapid extraction by hoist or short haul, the Screamer Suit dons quickly without the delay of putting on a full body harness designed for a Rescuer. The Screamer Suit is easy to put on and holds the subject securely during lifting. The system adjusts from small patients to large patients up to 500 lbs. (227 kg). The Screamer Suit is NOT intended for a patient with a spinal injury or other injury requiring a litter evacuation.

2.8.7 BAUMAN BAG

The Bauman Bag provides a single-point suspension for lifting a patient during a hoist or short-haul evacuation. The Hoist model has adjustable length straps allowing the bag to be configured to a specific aircraft. The fixed length straps on the Short Haul model position the bag at the best aerodynamic angle for flight stability. Both bags can be used with backboards or litters. Less than 13 lbs. (6 kg), the Bauman Bag stores in an 11 x 21 inch (28 x 53 cm) stuff bag, reducing weight and storage space on the aircraft. The Bauman Bag includes reflective tape and a pocket for a chemical light sticks for low light and night operations.

In order to use the Bauman Bag for hoisting operations, the victim must be placed onto or into a rigid board (backboard, scoop stretcher or stokes basket). The bag is not stiff enough on its own to be used for extraction via hoist or short haul.

Make certain the Bauman Bag is oriented in the correct direction. An obvious U-shaped opening is the head end. The Bauman Bag has three internal Fast-Tec straps that hold the rigid extraction device. Make sure at least one of the Fast-Tec buckles goes through the extraction device. The bag is then closed via Velcro closures. Note: The bag is not ventilated very well. Be cognizant of the time that the victim will be placed in the bag during warm weather conditions. Five Fast-Tec buckles secure the outside portion of the bag that secures the victim into the Bauman Bag. The final step is to bring all of the carabineers into the collection ring for extraction.

2.8.8 QUICK CAPTURE STRAP

The quick capture strap is constructed of two sections of two-inch nylon flat webbing that are attached to each other via a metal fastener. This fastener allows the webbing to slide thus, expanding the length of the strap.

The strap also has two, non-locking (“Kong” carabineers) that are attached to three ends of the webbing through a sewn loop. The Hoist Operator attaches a locking carabineer to the hoist cable hook. The non-locking “Kong” carabineers are attached to the ends of the webbing that are used to capture the victim.

Safety Note: The quick capture strap is primarily designed for rapidly securing a victim from a precarious spot and subsequent quick placement to the closest and safest environment. Optimally, this will be performed in a short-haul evolution with the Rescuer and victim remaining relatively close to the ground (5-15 feet AGL). However, the “closest and safest environment “ may be the helicopter itself. In this case, the Rescuer and victim could be hoisted into the helicopter.

2.8.9 AXEL CUT OPERATIONS-SEE EMERGENCY OPERATIONS

2.9 HOIST RESCUE OPERATIONS

2.9.1 TRAINING OVERVIEW AND OBJECTIVES REVIEW

2.9.2 CREW POSITIONS

Pilot

Pilot is responsible for:

- + Pilot approved for AS350B3e or UH-1H or both.
- + Pilot must be approved by the ASB Chief Pilot or an ASB Sergeant.
- + Final approval for hoist rescue operations should be based upon:
- + Completion of ground school
- + Completion of long line training and proficiency
- + Demonstrated ability to safely and efficiently maneuver the helicopter during a series of simulated hoist rescue operations
- + Demonstrates ability to work with hoist operator
- + Demonstrates ability to safely and efficiently position helicopter where the Hoist Operator can control the descent and insertion/extraction of the rescuer
- + Demonstrates knowledge of hoist operations emergency procedures during simulated and practical drills
- + Demonstrates ability to perform Weight and Balance computations (Center of Gravity) for hoist rescue operations.
- + Upon meeting the fore mentioned requirements, an OCSD Special Operations Pilot may be considered approved for hoist rescue operations.

Pilot Training:

- + Pilot shall demonstrate the and display the knowledge and experience relating to the proper utilization of hoist rescue operations related equipment and specified PPE
- + Successfully pass a ground school training program focused on all aspects of agency specific hoist rescue operations and

emergency procedures.

- + Successfully pass the OCSD in-house training program. This includes the demonstration of repetitive safe and efficient insertion and extraction of Rescuer, victim and equipment in varying terrain.
- + Possess the ability to demonstrate the emergency procedures protocol for in-flight emergencies.
- + Possess the ability to demonstrate clear, concise and agency-specific communications with the Hoist Operator and Rescuer.
- + Possess the knowledge to complete accurate and timely hoist documentation.
- + Ensures the compliance with all and/or interagency policies and procedures.

Pilot Proficiency:

The ASB Chief Pilot shall evaluate the entire rescue operation as well as the supporting facets of hoist rescue operation (safety, communication, manipulative ability, etc.) and evaluate accordingly. Evaluations shall be documented to allow the pilot in training to understand areas for improvement.

Pilot Recurrent Training

OCSD Pilots shall maintain quarterly currency as prescribed in the OCSD Search and Rescue Operations Manual and have hoist operations either discussed or demonstrated during each annual flight evaluation.

Hoist Operator

Hoist Operator is responsible for:

- + Operating the hoist
- + Safely insert and extract the Rescuer, victim(s) and equipment.
- + Effective and clear communication with the Pilot
- + Completes Hoist Rescue Checklist prior to all hoist rescue missions.
- + Reports relative position within the hoist rescue pattern.
- + Reports movement within the aft cabin.

- + Advises the Pilot when Rescuer is detached from safety.
- + Requests repositioning movements of the Pilot.
- + Advises Pilot that Rescuer/victim are clear of obstacles.
- + Advises Pilot of reactions of the load on the rescue hoist.
- + Advises Pilot when load safely detaches/attaches to hoist hook.
- + Continually updates Pilot on safe flight characteristics of the load on the rescue hoist cable.
- + Declares need for emergent actions if required.

Hoist Operator Training:

- + Hoist Operator shall demonstrate and display the knowledge and experience relating to the proper utilization of hoist rescue operations related equipment and specified PPE
- + Successfully pass a ground school training program focused on all aspects of agency specific hoist rescue operations and emergency procedures.
- + Possess the ability to demonstrate the emergency procedures protocol for in-flight emergencies.
- + Possess the ability to demonstrate clear, concise and agency specific communications with the Pilot and Rescuer.
- + Possess the knowledge to complete accurate and timely hoist documentation.
- + Ensures the compliance with all and/or interagency policies and procedures

Hoist Operator Proficiency

ASB Hoist Operator Instructors will determine the proficiency of the Hoist Operator Trainees and document training on daily evaluations.

Hoist Operator Recurrent Training:

Hoist Operators shall maintain OCSD Quarterly Currency as prescribed in the ASB Search and Rescue Operations Manual.

Hoist Operator Specific Training:

- + Hoist Operators should be familiar with the type (make/model) of the actual hoist that is used for hoist rescue operations. Hoists are

manufactured differently so it is imperative that the Hoist Operator has a thorough and tested knowledge of the specific hoist's capabilities and limitation.

- + Hoist Operators should have knowledge of the mounted placement of the hoist relative to the airframe of the helicopter. Difference will occur relative to placement specific to center of gravity. The hoist operator must have a working knowledge of load dynamics relative to fore/aft mounting.
- + Hoist Operators must have a working knowledge to helicopter specific capabilities and limitations. Additionally, Hoist Operators must have knowledge of helicopter specific emergency procedures.
- + Hoist Operators should possess the ability to demonstrate proficiency in all the above-mentioned areas prior to authorization to perform a hoist rescue operation in OCSD Helicopters.

Rescuer

The Rescuer is responsible for:

- + The safe and efficient insertion and extraction of a victim(s) and equipment.
- + They are also responsible for communicating with the Hoist Operator.

Rescuer Training:

Rescuer shall demonstrate the and display the knowledge and experience relating to the proper utilization of hoist rescue operations related equipment and specified PPE.

- + Successfully pass a ground school training program focused on all aspects of agency specific hoist rescue operations and emergency procedures.
- + Possess the ability to demonstrate the emergency procedures protocol for in-flight emergencies.
- + Possess the ability to demonstrate clear, concise and agency specific communications with the Pilot and Hoist Operator.
- + Possess the knowledge to complete accurate and timely hoist

documentation.

- + Ensures the compliance with all OCSD policies and procedures.

Rescuer Proficiency:

ASB Rescuer Instructors will determine the proficiency of the Rescuer Trainees and document training on daily evaluations.

Rescuer Recurrent Training:

Rescuers shall maintain OCSD Quarterly Currency as prescribed in the ASB Search and Rescue Operations Manual.

Rescuer Specific Training:

- + Rescuers should be familiar with the type (make/model) of the actual hoist that is used for hoist rescue operations. Hoists are manufactured differently so it is imperative that the Rescuer has a thorough and tested knowledge of the specific hoist's capabilities and limitation.
- + Rescuers should have knowledge of the mounted placement of the hoist relative to the airframe of the helicopter. Difference will occur relative to placement specific to center of gravity. The rescuer must have a working knowledge of load dynamics relative to fore/aft mounting.
- + Rescuers must have a working knowledge to helicopter specific capabilities and limitations. Additionally, Rescuers must have knowledge of helicopter specific emergency procedures.
- + Rescuers should possess the ability to demonstrate proficiency in all the above-mentioned areas prior to authorization to perform a hoist rescue operation in a specific helicopter.

2.9.3 LIMITATIONS

Weather

- + What is the weather like here?
- + What is the weather like at the rescue location?
- + What is the weather along the way to the rescue location?

Terrain

- + Is the terrain at the location known?

Fuel

- + What is the fuel status now on the aircraft?
- + Is additional fuel needed to complete the mission?
- + Will we need to conserve fuel once at the rescue location?

Aircraft Performance

- + Will the aircraft be able to perform at the location of the rescue location given the DA and fuel needed?

Density Altitude

Density altitude is the altitude relative to the standard atmosphere conditions.

In , the density altitude is used to assess the aircraft's aerodynamic-performance under certain weather conditions. The lift generated by the aircraft's airfoils and the relation between indicated and true airspeed is also subject to air density changes. Furthermore, the power delivered by the aircraft's engine is affected by the air density and air composition.

2.9.4 PRE-FLIGHT OPERATIONS

A systematic pre-flight inspection of the aircraft and the crew's personal equipment should be performed. A quick "sweep" of the aircraft's cabin will contribute to the safety and security of the mission. The crew should be looking for any loose items that may have been left in the cabin(s) or any untighten cowlings on the aircraft itself. Additionally, each crewmember should perform a "buddy-check" on each other in order to ensure all PPE/safety equipment and secure.

2.9.5 PRE-OPERATION BRIEFING/CHECKLIST (SEE APPENDIX 2.9.5)

The pre-hoist briefing can be divided into different categories. The categories could be referred to as “ground-based” briefings and “in-flight” briefings.

The ground-based briefings should be performed while the crew is on the ground and can discuss what is being what is requested of them. Once the crew has the mission, a generalized briefing can be formally developed and implemented. Certain topics should be part of any briefing. Topics such as risk assessment, weather assessment, terrain awareness, etc. should be included in the initial, ground-based brief. This brief can be considered as the “what and where” part of the mission. A few simple questions can be discussed amongst the crew:

- + What is being asked of us?
- + Where is the mission located?
- + What could be the risks associated with this mission and how can they be mitigated?
- + What is the weather at the base, along the way to the target location and at the target?
- + What is the intended rescue technique going to be?
- + What equipment could be needed to affect the rescue?
- + What is the condition of the victim?

The in-flight briefing can be described as the discussions that the crew has during once airborne and throughout the remainder of the mission. It is important to note that even with the best initial intelligence of the mission, the situation once at scene can be completely different from what was initially briefed. It is important to remember this and not become mission driven. Constant risk assessment needs to be performed until the mission has been completed.

2.9.6 PRE-HOIST CHECKLIST

Prior to commencing in any hoist operation, a checklist shall be read (verbatim) by the Hoist Operator. The checklist will consist of assurances that all aircrew members (and passengers if applicable) are attached and secured to the aircraft in a manner in which will prohibit them from falling inadvertently. The checklist will also assure that there are no loose items within the aircraft. The checklist will also cover the communication plan with the aircrew during the mission.

Once the Hoist Operator recites and confirms that all items within the checklist are completed, the Pilot in Command (PIC) will go through their portion of the checklist to confirm that all necessary systems within the aircraft are operational and the mission is a go.

Pre-Hoist Checklist-Hoist Operator

- + Mission brief complete
- + Hoist Operator attached and secure
- + All other passengers are attached and secure
- + All items in aft cabin are secure
- + There are no loose items in aft cabin
- + PFD are/not required for the mission
- + Ensure necessary power for the mission
- + Escape routes identified
- + Radio communications established
- + Both doors are opened and pinned
- + Power to the hoist
- + Green light illuminated on pendant
- + Right side clear, tail clear, clear to lift

Pre-Hoist Checklist-Pilot

- + Power to the hoist is on
- + The cable cut is in

- + Siren is on and loud
- + All T's and P's are in the green
- + Throttle(s) is open and locked
- + Forced trim is off
- + Fuel is at...XXXX
- + Radios are on XXXX
- + Ready to lift

2.9.7 RECONNAISSANCE

The initial assessment of any location should focus on the initial safe operating area for the aircraft and crew. As a crew, any visual, known and/or presumed hazards should be discussed and mitigated. This should be done in the manner of both a "high" and "low" reconnaissance of the target area.

During the high reconnaissance, the crew should be looking at the "big picture" relative to the target area. This would include wind direction, hazards, terrain features, towers, wires, etc.

Once the high reconnaissance is completed and no hazards have been identified (or mitigated), a low reconnaissance should be performed that focuses more so on the specific target area. The crew should evaluate the target location to insert and extract the Rescuer. These two spots may not be the same. A location that would be the safest and closest spot to insert the Rescuer should be identified and agreed upon by all crewmembers. Consideration to slope, trees, dust, and falling debris should be part of the target assessment.

The initial evaluation of the target location is paramount to the safety and success of any hoist operation. While the assessment to position specific information will be made, collective information will be to be discussed, planned for and mitigated during the assessment of the target location.

Note: Upon insertion of the Rescuer, if at any time the Rescuer or the Hoist Operator does not feel comfortable allowing the Rescuer to come off the hoist cable, abort the insertion and bring the Rescuer back into the cabin to mitigate the issue.

2.9.8 VERBAL COMMANDS

Verbal commands are intended provide communication between the Hoist Operator and Pilot. As time is compressed during the hoist operation, so is the need for quick, exact and clear communication.

All of the verbal commands during the hoist operation should be the same regardless of the combination of Pilot and Hoist Operator. There should be no deviation from the approved agency commands. The Pilot who is maneuvering the aircraft into position may not have sight on the target. This requires the Hoist Operator to provide clear commands.

2.9.9 TERRAIN INTERPRETATION

During the hoist operation, continual assessment of the terrain is imperative by both the Pilot and Hoist Operator. Communication relating to hazards or obstructions is paramount.

Question and acknowledge the recognition of hazards and obstructions between the Pilot and Hoist Operator (e.g. *"Confirming you see the rock just above the target?" "Affirmative, I see the rock just above the target and will keep the load below it."*)

2.9.10 HAND SIGNALS

Hand signals are the primary means of communication between the Rescuer and the Hoist Operator during the hoist operation.

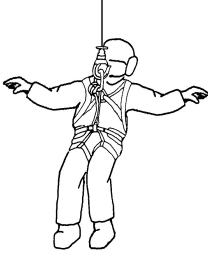
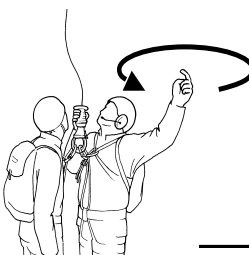
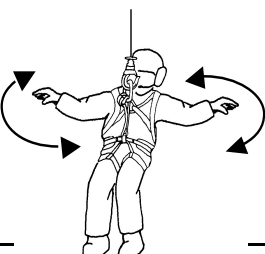
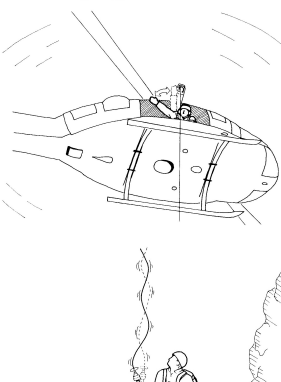
Radio communication could pose a hazard if the verbal communication between the Pilot and Hoist Operator is interrupted or made unclear. Adding another form of input that the Hoist Operator must listen to may overload the Hoist Operator and cause a disruption.

The hand signals used by the Rescuer should be performed clearly so that the Hoist Operator will not mistake the signal.

The hand signals that the Rescuer should use are:

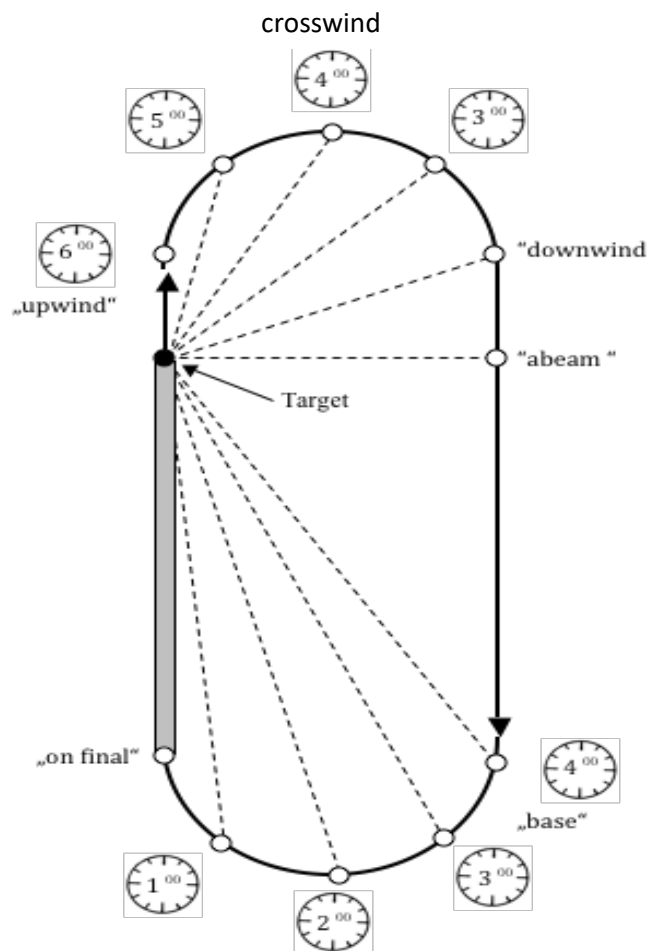
- + Load or hook is ten feet from the ground (or any hazard)-are stretched out to the side

- + Load or hook is ready to come up/continue to lift up-circular motion with one hand over the head
- + Load or hook needs to be lowered/continue to lower-circular motion with one hand below waist
- + Hook is at chest level-one arm at chest level waving back and forth
- + Wave off/discontinue hoist operation-both arms at chest level continually waving back and forth

	<p>As the Rescuer approaches at a distance of approx. 10 ft. above the ground or operating height (tree, rock, and/or any other structure) this hand signal will be given. The Hoist operator then will reduce speed and settle the Rescuer down gently.</p> <p>Also if approaching steep or vertical terrain, it is almost impossible for the Hoist Operator to estimate the true height. In this case he fully depends on the Rescuer signal.</p>
	<p>Prior to pick up the shown hand signal is used. One hand circles above the Rescuer's head.</p> <p>This hand signal also is used as a positive confirmation of the safety check. The Rescuer performs this hand signal after pick up as the crew is performing its power check.</p>
	<p>If the safety check is negative and / or the Rescuer has any other problem and would like to set back down on the ground, the abort signal is used.</p> <p>Waiving arms horizontally back and forth indicates that something is going wrong and requires the immediate reaction of the rest of the crew.</p>
	<p>If the helicopter crew has any problems and would like the Rescuer to detach from the hoist hook, a short blast from the onboard siren will sound. This is an indication that something perhaps may be abnormal and requires immediate detachment from the hoist hook. The Rescuer will maintain visual contact with helicopter.</p> <p>It is also possible for the Hoist Operator to give the Rescuer a "slashing" motion across the arm. This hand signal is used during operation with stretcher and anti-rotation line as the Hoist Operator requests detaching the anti-rotation line.</p>

2.9.11 STANDARD APPROACH AND DEPARTURE PATTERNS

The target area will be accessed and departed from via a pre-planned direction(s). This is done in order to allow the aircrew an idea of terrain features and/or potential obstacles/hazards along the approach and departure path. This also allows a more accurate assessment of wind direction and identifying an escape flight path away from the target area in case of an emergency. The standard approach pattern is a clockwise, oval pattern that keeps the target area on the right side of the aircraft for the best possible visual reference by the crew (especially the Hoist Operator).



When approaching the operation site, a standard approach pattern is chosen. During this pattern, the helicopter is flying at a safe speed and at a safe

altitude; all necessary briefings, preparation of the cabin and of the Rescuer take place during the pattern.

For the UH-1H with the hoist installed on the right hand side a *Standard Pattern Right* is the approach pattern as the Pilot and Hoist Operator can see the target throughout the pattern.

Pattern Entry

The pattern is entered after the reconnaissance and a short hover check. The pattern begins with the over flight of the target "*Upwind*" with the helicopter heading into the wind.

After over flight, a 180° turn is initiated towards the right "*Crosswind*". The maximum bank angle should not exceed 30°. After completion of the turn, "*Downwind*" and subsequently "*Abeam Target*" is reported.

Depending upon the specific mission and the needed time for preparation, it can be decided whether a short or long final approach should be used. For instance, if the helicopter is approaching the target with an empty hook and short cable length, only a short pattern will be necessary. If the Hoist Operator has to prepare the Rescuer (boom into position), Bauman Bag and scoop stretcher, and if a long cable is used, the downwind and the pattern must be larger in order to have everything ready as the helicopter enters final approach.

Downwind:

The Pilot will announce when the aircraft is in the "downwind" portion of the pattern. This portion of the pattern will allow the Rescuer to move from their "seated" position in the aft cabin, gather any necessary rescue equipment and position themselves in aircraft in order to be moved outside of the aircraft. At this time, the Rescuer should have the hoist cable hook attached to their rescue harness and remain attached to their safety strap.

Pilot: "*We are now downwind of the target.*"

Hoist Operator: "*Copy downwind of the target. The Rescuer is coming off of communications and moving into pre-deployment position.*"

Downwind Abeam:

Pilot will announce when the aircraft is abeam of the target in the downwind leg of the pattern. This indicates to the hoist operator to visually acquire the target location and prepare for the base leg of the pattern.

Pilot: *"We are downwind abeam of the target."*

Hoist Operator: *"Copy downwind abeam of the target. Target area in sight. Rescuer is ready to be deployed upon the base leg."*

Note: The Hoist Operator may request additional time for the Rescuer to gather and secure the necessary equipment for the rescue mission.

Hoist Operator: *"Requesting more time for the rescuer to secure rescue equipment."*

Pilot: *"Copy. I will extend the downwind leg."*

Base:

Pilot will announce the aircraft is turning 90 degrees into the "base" leg. The Hoist Operator will take tension on the hoist cable that will allow the Rescuer to move outside of the cabin and be in position to be deployed to the target area.

Note: In order to retain visual reference to the target, it is suggested that both the Pilot and Hoist Operator are located on the same side of the aircraft.

Note: Hoist Operator should retain control of actuating the safety carabineer prior to deployment.

During the turn, position of the operation area is continuously reported either by the Pilot or the Hoist Operator (*Standard Pattern Right with right-mounted hoist*). Again, the maximum bank angle should not exceed 30°.

After the Pilot informs the Hoist Operator that base leg is being initiated, the Hoist Operator will advise the Pilot that the Rescuer is being boomed out of the cabin and into position.

Pilot: *"We are turning to the base leg."*

Hoist Operator: *"Copy turning base. Rescuer is being moved outside of the*

cabin. Rescuer is ready to be deployed to the target area. Rescuer remains on safety."

During the pattern the Hoist Operator makes announcements regarding relative position to the Pilot.

The entire pattern is flown at a speed of approximately 20-40 knots.

Depending on the length of the final approach, speed and altitude are decreased during final approach or even during the turn into final.

The speed on short final should not exceed 20 knots.

The maximum bank angle should not exceed 30°.

All preparations should be completed before the helicopter enters final approach (Rescuer will be boomed out of the cabin and ready to deploy to target).

The *final approach* does not differ regardless of the approach pattern used. This part of the approach requires complete and uninterrupted focus due to the fact that the Pilot cannot see the operation site and depends fully on the input of the Hoist Operator.

With the operation site in a 12 o'clock position, the pilot reports "*on final*". The Hoist Operator will confirm: "*Target in sight.*"

During the final approach, height and speed must be adapted to each other in order to come to a solid hover position above the target that does not need correction.

2.9.12 RESCUER DEPLOYMENT

The Rescuer can be deployed to the rescue location after all of the checklists and approach patterns have been established.

The Rescuer is to remain seated with seatbelt (and safety strap) in place until the verbal command to remove the seatbelt and move to the floor of the cabin is delivered by the Hoist Operator.

Once the command that the "*target is in sight*", and the target location is obstacle free, the Hoist Operator will inform the Pilot that the Rescuer is

"coming off safety". The Hoist Operator will remove the safety carabineer and begin to deploy the Rescuer once stopped target.

Note: The only person responsible for opening the gate of the safety strap carabineer and removing the safety strap will be the Hoist Operator.

This procedure prevents an unnecessary long hover period above the operation-site.

Beware of sufficient obstacle clearance.

The final height of the helicopter should be reached (90 to 120 feet) before the operation site (depending on terrain and type of operation). Downwash must be taken into consideration at this time. The effects of downwash may impair the Rescuer's and ground personnel's efforts to treat and package the victim. When this operation is performed ideally, the Rescuer will be at the target before the downwash can "catch-up" to the target.

High descent rates after this point with exposed cable increases the danger of prematurely setting down or crashing down the load or cable entanglement with forward speed before the operation site is reached.

Hover position above the operation site must be established according to Hoist Operator reports and requests.

Pilot will announce when aircraft is turning onto the final leg of the pattern. This is indicated as the "final" approach

Pilot: "We are on final approach"

Hoist Operator: "Copy final approach. The Rescuer is on safety. I have the target area in sight" (if applicable).

The Hoist Operator counts down a cadence to the target. The cadence is intended to provide a "pace" that the aircraft is coming toward the target.

Once the aircraft is on final approach, the Hoist Operator will begin the final approach commands:

Hoist Operator: "Forward 300, forward 200, forward 100, forward 50, forward 40, 30, 20, 10, forward 5, 4, 3, 2, 1, stop your forward"

The Pilot reduces speed and altitude accordingly.

The Hoist Operator must take into consideration that the Pilot will need some time to bring the helicopter to a hover after the Hoist Operator announces the “*forward, stop*” (depending on visual references, speed, wind, etc.). The Hoist Operator must estimate the right moment for announcing the “*forward, stop*”. This should happen, in any case, before the helicopter reaches the vertical position.

Depending on the cable length used and obstacles present, the Hoist Operator reels out the cable once stopped above the target. He must choose the right moment to start lowering and will announce this to the pilot by stating, “*cable is reeling out*”.

As the helicopter comes to a stop above the target or prior to picking up a load, the aircraft may not be in or remain in a perfectly over (vertical) the target. The Hoist Operator must correct the aircraft’s positioning over the target by giving the direction and counting down the distance to the target. After each correction, a stop command must follow in order to make clear that this correction has been completed (e.g. “*Stop forward and come right 2. Stop right*”).

The Hoist Operator shall not make too many corrections at one time. Allow the Pilot and the helicopter time to make the inputs and for the load to react to the inputs. The Hoist Operator needs to monitor the movement of the helicopter closely, even if it is moving without announcements. The aircraft might move into the right direction in many cases.

Hoist Operator: “*Right/left/aft 3, right/left/aft 2, right/left/aft 1, stop your right/left/aft*”

Hoist Operator: “*Hold your position*”

Hoist Operator: “*The Rescuer is off safety and on the way down*”

During the approach or after the helicopter is stabilized above the target, setting down the load or persons is initiated. The Hoist Operator performs setting down the load. The helicopter should maintain a stable hover.

WARNING

When the load is approaching the ground, make sure that the helicopter ground speed is zero to avoid injury to persons or ground entanglement of the cable

Primary communication between the Hoist Operator and the Rescuer should be performed with clear hand signals. As the Rescuer reaches a distance of ten (10) ft. above the ground, the appropriate hand signal is given informing the Hoist Operator that they are approaching ground.

Hoist Operator: *"Coming down at 10, 5, 4, 3, 2, 1, the Rescuer is on the ground"*

It is very important to tell the pilot the exact moment when the load is reaching the ground, as the power demand and the lateral CG of the helicopter will change. In order to correct for this change immediately, the Pilot relies on this information.

Hoist Operator: *"The Rescuer is off the hook"*

Hoist Operator: *"The hook is clear of obstacles"*

Hoist Operator: *"Clear to take-off"*

When the Rescuer and the equipment are released from the hook, the Hoist Operator will reel in the cable and the helicopter shall fly to a convenient holding position. This is done to avoid injuries caused by movements of the hook. Furthermore, personnel and equipment at the operation site are not hindered by the helicopter downwash

Hoist Operator: *"The hook is at the skid"*

Hoist Operator: *"The hook is homed"*

2.9.13 RESCUER RETRIEVAL

Generally, the rescuer will contact the aircraft when they are ready for extraction.

The same pattern that is used to deploy a Rescuer is used to retrieve the Rescuer. The pattern can be shortened, but the communication and commands remain the same. The cadence will be communicated to the Pilot in order to safely position the aircraft over the extraction site.

The Pilot will communicate to the Hoist Operator when the "pattern" is commencing in order to begin the extraction sequence.

Downwind:

The Pilot will announce when the aircraft is in the "downwind" portion of the pattern. This portion of the pattern will allow the Hoist Operator to prepare the aft cabin for the Rescuer and victim's arrival. At this time, the Hoist Operator should have the hoist cable hook in their hand and ready to be deployed.

Pilot: *"We are now downwind of the target."*

Hoist Operator: *"Copy downwind of the target. I have the target in sight and ready to deploy the hoist hook."*

Downwind Abeam:

Pilot will announce when the aircraft is abeam of the target in the downwind leg of the pattern. This indicates to the hoist operator to visually acquire the target location and prepare for the base leg of the pattern.

Pilot: *"We are downwind abeam of the target."*

Hoist Operator: *" Copy downwind abeam of the target. Target area in sight."*

Base:

Pilot will announce the aircraft is turning 90 degrees into the base leg.

Pilot: *"Turning base"*

Hoist Operator: *"Copy base leg"*.

Final:

Pilot will announce when aircraft is turning onto the final leg of the pattern. This is indicated as the "final" approach.

Pilot: *"We are on final approach"*

Hoist Operator: *"Copy final approach. I have the target area in sight" (if applicable).*

Hoist Operator: *"Forward 300, forward 200, forward 100, forward 50, forward 40, 30, 20, 10, forward 5, 4, 3, 2, 1, stop your forward"*

Hoist Operator: *"Right/left/aft 3, right/left/aft 2, right/left/aft 1, stop your right/left/aft"*

"Hooks on the way down at 10, 5, 4, 3, 2, 1, the hook is in the Rescuer's hand"

After the helicopter is stabilized above the target, picking up the load is initiated.

Communication between the Hoist Operator and the Rescuer should be performed with clear hand signals.

The attachment points shall be hooked into the hoist hook. The Rescuer must ensure that this is done properly and safely.

After the load is hooked onto the hoist hook, the Hoist Operator will wait for Rescuer to provide the hand signal to pick up the load. The correct hand signal for picking up a load is circling one hand above the head.

The Hoist Operator will ensure that the helicopter is in a vertical position over the load. The Rescuer will stay in the initial position unless otherwise instructed by the helicopter crew.

Hoist Operator: *"The load is centered"*

Hoist Operator: *"The rescuer is giving the 'up' signal"*

The Hoist Operator must tighten the cable. Occasionally vertical movements of the helicopter must be compensated with the hoist.

Hoist Operator: *"I am taking tension to the wire"*

The Hoist Operator must carefully lift the load off the ground. The load should be lifted off for not more than 10 feet.

As the load leaves the ground the Hoist Operator requests:

Hoist Operator: *"You have the load"*

Hoist Operator: *"How your power?"*

This request means more than only check the power. As the Pilot hears the

request, this indicates that:

- + The load has left the ground
- + Stop climbing
- + Check the power

Pilot: "*Power is good*"

As the cable is under tension and the load leaves the ground, a safety check is performed by the Rescuer. The safety check verifies that ALL carabineers and attachment points in the specific rescue equipment are attached and loaded correctly. If this safety check is positive, the Hoist Operator will receive a second hand signal. The correct hand signal for the secondary safety check is circling one hand above the head.

Hoist Operator: "*Getting the secondary*"

Hoist Operator: "The load is coming up and flying well" or in the case that a spin is initiated "*The load is clear of obstacles-take off*"

In a case where the safety check is negative (hand signal indicating "wave off"), set the load back on the ground immediately. It is important that the Pilot **maintain position** after the Hoist Operator requests a "You have the load, how's your power".

Once the load has been picked up, the power check and the safety check are conducted and positive, the Hoist Operator reels in the cable. Simultaneously, the Hoist Operator checks for obstacles in the departure path.

As the load is obstacle free:

Hoist Operator: "*The load is clear of obstacles-clear to takeoff*"

The Pilot begins to initiate forward movement and gain airspeed as the Hoist Operator continuously reels in the cable by counting down the distance to the skids. This information is important to the Pilot as the forward airspeed can be adjusted in relation to the exposed cable length.

With a greater amount of cable out, the airspeed shall be approx. 10-20 knots. As the load is coming closer to the helicopter the speed can be increased depending on the situation.

If enough power reserve is available the helicopter shall not pick up speed horizontally. The Pilot shall increase the power, allow the helicopter to climb vertically for a short moment, and simultaneously increase forward speed. This shall be done for two reasons:

- + The load stays more stable compared to a horizontally takeoff
- + Obstacles in the departure path can be cleared easier

As the load / persons reach the skids, the Hoist Operator must reduce hoist speed as the load passes the skids.

WARNING

Avoid entangling the cable with the rescuer's head or any other body part. This can be very dangerous and cause major injuries.

Hoist Operator: *"The load is coming with no swing/spin"*

Hoist Operator: *"The load is 50 feet from the skids"*

Hoist Operator: *"The load is at the skids"*

As the load reaches the cabin level, the primary focus is to secure them to the helicopter. The Hoist Operator will attach a safety strap to the Rescuer first and the victim second. The Hoist Operator will then release the tag line (if applicable) before booming into the cabin in the case of the Bauman Bag operations.

Hoist Operator: *"The load is on safety"*

Hoist Operator: (Bauman Bag Operations) *"Tag line is released and clear"*(If applicable)

Hoist Operator: *"The load is coming into the cabin"*

Hoist Operator: *"The load is in the cabin and secured"*

Hoist Operator: *"The hoist hook is homed"*

Hoist Operator: *"Secure power to the hoist"*

2.9.14 SCREAMER SUIT OPERATION

Indications for use

- + Victim shall be in a stable/static environment
- + No immediate rescue of victim is required
- + Victim shall be evaluated by Rescuer prior to applying Screamer Suit
- + Victim must be either ambulatory (non -injured) or have minor injury allowing Screamer Suit as victim extraction device

Screamer Suit application

- + Place victims arms through arm holes
- + Connect chest Fast-Tec buckle and adjust tension
- + Gather the three connecting rings located on each side (waist) and diaper panel (between legs) of the Screamer Suit and attach auto-locking carabineer
- + To size the suit to the particular victim, utilize either of the two connecting rings located at the diaper panel of the suit

Prepare victim for extraction

- + Explain rescue procedure to victim.
- + Victim will be instructed to remain still, do not reach for anything once at the helicopter, do not stand on the skids and remain calm
- + Provide reassurance to victim

Extraction

- + Attach Rescuer harness auto-locking carabineer to hoist cable hook first
- + Orient victim to Rescuer so that head and torso will enter the helicopter first (Rescuer is on the victim's left side)
- + Attach Screamer Suit auto-locking carabineer to hoist hook second
- + Rescuer will put upward tension to the hoist hook assembly to ensure proper vertical loading of the auto-locking carabineers
- + Rescuer will allow hoist cable to tension and "pull" Rescuer and victim off the ground

- + Rescuer will manage and reassure victim during hoist evolution
- + Rescuer will manage victim upon reaching the helicopter
- + Prevent victim from reaching out and grabbing at the skids, Hoist Operator or doors of helicopter
- + Hoist Operator will attach safety straps via auto-locking carabineer to Rescuer's safety and to the auto-locking carabineer on the Screamer Suit
- + Hoist Operator raises the victim and Rescuer to the "home" position of hoist
- + Rescuer will secure multi-loop straps (one in each hand) and nod to Hoist Operator when ready to "push" victim into cabin.
- + Hoist Operator will lower the victim and the Rescuer from the "home" position
- + Hoist Operator will release tension on the hoist cable and will disconnect the auto-locking carabineers attaching the victim and Rescue Medic
- + Rescuer will remain positioned at the right side doorway until the victim is seated and securely fastened
- + Rescuer will assume seated and buckled position until aircraft lands

2.9.15 BAUMAN BAG OPERATION

The Bauman Bag and scoop stretcher may be let down with or without the Rescuer. The Rescuer *can* be attached to the Bauman Bag when hoisting up the Bauman Bag so as to be able to attend to the patient, to release the anti-rotation line at the proper moment, and to assist the operator during the loading phase.

The Bauman Bag has a tendency to rotate during a vertical hoist up. Extreme centrifugal forces may thereby affect the rescuer and the patient. This can cause health hazards; it is called "*Rotation Trauma*". Two procedures are available to avoid rotation of the rescue bag:

- + Initiating forward flight after picking up the load
- + Using the anti-rotation line

GOING INTO FORWARD FLIGHT AFTER PICKING UP THE LOAD (No Anti-Rotation Line)

If the takeoff is obstacle free for the helicopter **and** the load, a slow forward rising flight of 20-30 KIAS may be assumed immediately after picking up the load. The air stream from the front and the deflection of the rotor downwash during forward flight prevents excessive rotation of the rescue bag.

When reaching the skid slight turning of the rescue bag must carefully be stopped before it is hauled above the skid.

USE OF THE ANTI-ROTATION LINE (AKA Tag Line)

The Tag Line can be used in instances where a static hoist evolution is being conducted. It is used to counteract the forces caused by rotor downwash that induce a spin to the load once pulled from the ground or target area. The Tag Line may be utilized in a deep canyon, tall canopy trees, or even on a vessel with a tall mast.

During this operation, the Tag Line tender must stay on the ground and guide the line. This Tag Line tender must always wear suitable gloves.

Indications for use

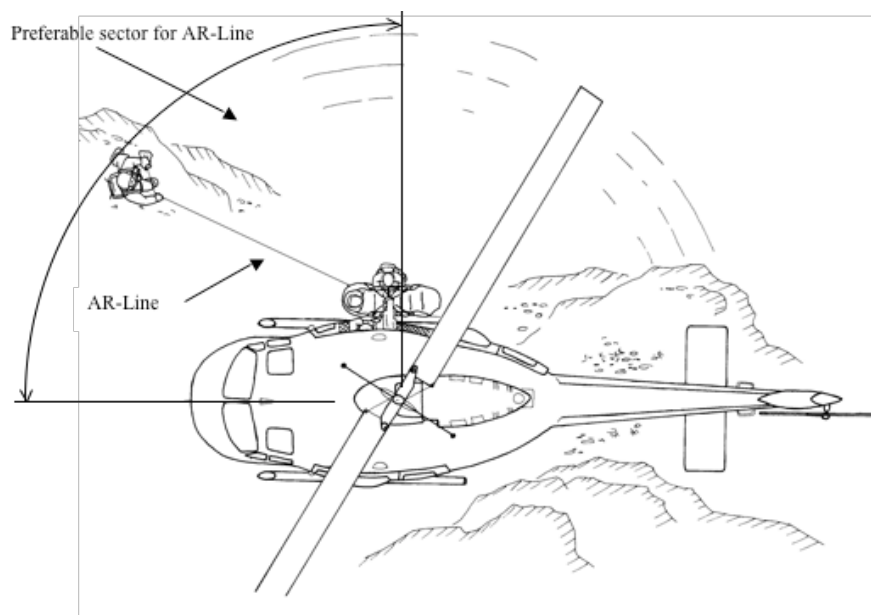
Victim NOT in c-spine precaution upon arrival of Rescuer

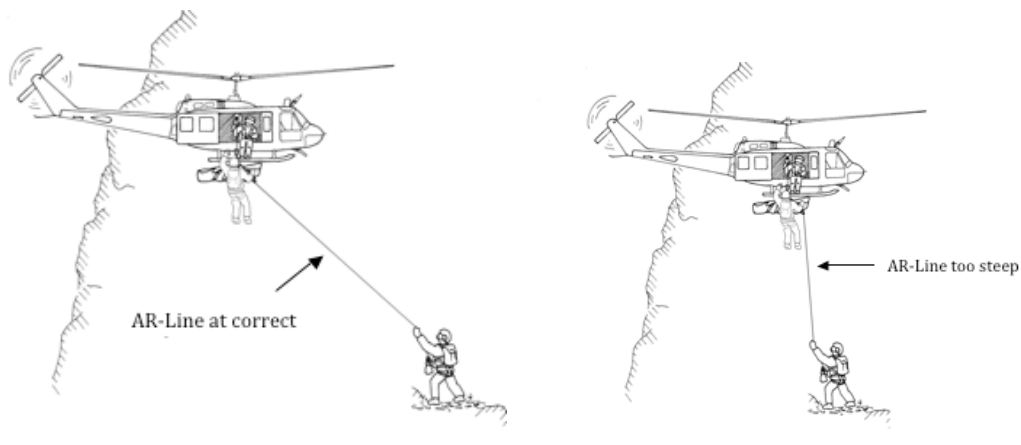
- + Place victim in full c-spine precaution utilizing c-collar, head bead and scoop stretcher.
- + Place helmet and goggles onto victim
- + Remove Bauman Bag from scoop and orient bag to victim
- + Place Bauman Bag next to victim properly oriented to victim
- + Head section of Bauman Bag has semi-circle cut out section and sewn-on manufacturer's label
- + Remove one of the steel auto-locking carabineers from the steel collection "O" ring keeping the bridles attached to the carabineer
- + Unfasten outer Fast-Tec buckles, remove Velcro, and inner Fast-Tec buckles to fully open bag
- + Place scoop stretcher into bag

- + Assure scoop stretcher is aligned straight and evenly in Bauman Bag in order to have horizontal (flat) lift
- + Secure scoop stretcher into Bauman Bag utilizing inner Fast-Tec buckles
- + Attach Velcro and fasten outer Fast-Tec buckles
- + Attach steel auto-locking carabineer to steel collection "O" ring
- + Assure both steel auto-locking carabineers are locked

Prepare for extraction

- + Rescuer will orient Bauman Bag properly
- + Rescuer will be on victim's left side





Extraction-Dynamic

- + Rescuer attaches auto-locking carabineer from personal harness to hoist cable hook FIRST
- + Rescuer attaches the steel collection "O" ring into hoist cable hook SECOND
- + Once tension is taken in hoist cable, Rescuer verifies proper vertical loading of all carabineers in the system
- + Rescue Medic will manage Bauman Bag at the helicopter skid
- + Rescue Medic assures Bauman Bag will clear skid safely
- + Rescuer assure Bauman Bag is aligned so that the head will enter the helicopter first
- + Hoist Operator will place safety strap carabineers onto Rescuer harness and onto Bauman Bag steel collection "O" ring
- + As the Hoist Operator booms Bauman Bag into helicopter, Rescuer will help guide Bauman Bag into secure position on floor of helicopter cabin
- + Hoist Operator will release tension on hoist hook cable
- + Both Bauman Bag and Rescuer will remain on safety strap as the steel collection "O" ring and Rescuer personal harness carabineer is removed from hoist cable hook
- + Rescuer and Hoist Operator will secure Bauman Bag to the helicopter floor via the two forward carabineer tie-downs and the aft seatbelt straps
- + Rescuer provides necessary medical treatment to victim
- + Victim transported per protocol

Victim in c-spine precautions upon arrival of Rescuer

- + Hoist Operator will make contact with ground Bureau and establish the location and condition of victim
- + Treatment of victim (specifically c-spine precautions)
- + Hoist Operator and Rescuer will make the determination of necessary equipment needed for rescue
- + Once Rescuer arrives on scene, turnover from ground Bureau will be provided to Rescue Medic
- + Place helmet and goggles onto victim
- + Ground Bureau personnel will assist Rescuer in placing victim into Bauman Bag
- + Extraction will be conducted as above stated

Extraction-Static

- + Rescuer attaches tag line to the HEAD end of the Bauman Bag
- + Rescuer attaches the steel collection "O" ring into hoist cable hook
- + Once tension is taken in hoist cable, Rescuer verifies proper vertical loading of all carabineers in the system
- + Rescue Medic will manage Bauman Bag from the ground via tag line
- + Rescue Medic assures Bauman Bag does not spin during the hoisting process by holding tension in the tag line and maintaining the proper angle on the ground
- + Hoist Operator will place safety strap carabineers onto Bauman Bag steel collection "O" ring
- + As the Hoist Operator booms Bauman Bag into helicopter, Second Rescuer will help guide Bauman Bag into secure position on floor of helicopter cabin
- + Hoist Operator will release tension on hoist hook cable
- + Both Bauman Bag will remain on safety strap as the steel collection "O" ring is removed from hoist cable hook
- + Second Rescuer and Hoist Operator will secure Bauman Bag to the helicopter floor via the two forward carabineer tie-downs and the aft seatbelt straps
- + Rescuer provides necessary medical treatment to victim
- + Victim transported per protocol

Victim in c-spine precautions upon arrival of Rescuer

- + Hoist Operator will make contact with ground Bureau and establish the location and condition of victim

- + Treatment of victim (specifically c-spine precautions)
- + Hoist Operator and Rescuer will make the determination of necessary equipment needed for rescue
- + Once Rescuer arrives on scene, turnover from ground Bureau will be provided to Rescue Medic
- + Place helmet and goggles onto victim
- + Ground Bureau personnel will assist Rescuer in placing victim into Bauman Bag
- + Extraction will be conducted as above stated

2.9.16 QUICK CAPTURE OPERATION

Safety Note: The quick capture strap is primarily designed for rapidly securing a victim from a precarious spot and subsequent quick placement to the closest and safest environment. Optimally, this will be performed in a short-haul evolution with the Rescuer and victim remaining relatively close to the ground (5-15 feet AGL). However, the “closest and safest environment “ may be the helicopter itself. In this case, the Rescuer and victim could be hoisted into the helicopter.

Indications for use

Precariously placed victims in unstable environments

- + Dry land rescue (cliff)
- + Water rescue
- + Dynamic water (swift water/ surf)
- + Static water (lake/ open water)

Pre-deployment preparation

- + Rescuer will have received annual recurrent training utilizing the quick capture strap in both dry (cliff rescue) and wet (water rescue) environments
- + In addition to annual training, it is strongly encouraged to periodically refresh these skills even if in a “dry-land” scenario.

Pre-deployment brief

- + Sequence of rescue evolution discussed

- + Specifically: Short-haul vs. hoist recovery of victim
- + Hoist Operator will discuss and confirm rescue evolution (Short-haul drop point or hoist into helicopter cabin)

Deployment of Rescuer (Dry land rescue)

- + Rescuer comes to the floor
- + Hoist Operator will attach the carabineer from the Rescuer's rear-attachment to the hoist hook. The rear attachment configuration will place the Rescuer in a forward facing position to quickly secure a victim without having the hoist hook cable interfering with during the capture
- + Hoist Operator will attach the quick capture strap locking carabineer to the hoist cable hook and place the two non-locking "Kong" carabineers over the Rescuer's shoulder
- + Rescuer will always manage the quick capture strap (avoid releasing the strap allowing it to possibly strike a crewmember or the helicopter)
- + Hoist Operator will take tension on hoist cable placing the Rescuer outside of the cabin ready to deploy to the target
- + Hoist Operator will remove safety strap and lower Rescuer upon final approach to target
- + Rescuer will acquire one non-locking "Kong" carabineer in each hand and prepare strap for rescue
- + Rescuer will indicate to hoist operator an altitude of ten (10) feet above ground level (AGL) by spreading arms apart horizontally with non-locking "Kong" carabineers
- + Rescuer will approach victim ready to make an aggressive, expedient and effective capture

Capturing and securing victim

- + Rescuer will reassure victim during capture and rescue
- + Rescuer will wrap victim's upper torso and connect the two non-locking "Kong" carabineers. Rescuer will then take tension on the adjustable side of the strap

Safety note: Caution must be used in applying the non-locking "Kong" carabineers. Tension on these types of carabineers must be limited to a direct "pull" along the spine. A twisting motion applied to these carabineers could

inadvertently open the carabineer's gate and release the load.

- + Rescuer will wrap his/her arms around at least one of the victim's arms and entire torso
- + Rescuer will secure victim close their body and ensure victim is securely fastened into quick capture strap

Extraction

- + Rescuer will reassure victim and signal the Hoist Operator to take the load (Signal is side-to-side movements of the Rescuer's head)
- + Rescuer will allow the helicopter to take the load and tension the hoist cable. The Rescuer will ensure that the quick capture strap is connected properly and securely around victim and give another signal to the Hoist Operator verifying security of victim
- + Rescuer will wrap his/her legs around the victim during rescue evolution
- + Regardless if the rescue evolution is a short-haul or hoist into the helicopter cabin, the Rescuer will maintain control of the victim at all times

Short-haul extraction

- + Short-haul drop point will be discussed during the pre-deployment brief
- + The Rescuer will disconnect victim from quick capture strap once safely at short-haul drop point and in a secure spot preferably with land-based rescuers
- + Rescuer will then be hoisted into helicopter (follow normal single hoist procedure)
- + Rescuer will maintain control (in at least one hand) of quick capture strap at all times

Hoist extraction

- + Rescuer will capture and secure victim
- + Rescuer will reassure victim while being hoisted into helicopter
- + Rescuer will maintain control of the victim when approaching and at the helicopter skid
- + Hoist Operator will secure Rescuer and victim utilizing safety strap

- + Rescuer will assist Hoist Operator with managing victim while booming victim into cabin
- + Rescuer will assist Hoist Operator secure victim onto seat of helicopter
- + Rescuer will assume secure position in helicopter cabin until helicopter has landed
- + Rescuer will maintain a position between the victim and the door to the aircraft

Deployment of Rescuer (Water rescue)

- + Rescuer will have proper PPE necessary for water rescue
- + The Rescuer will be lowered into a “rescue ready” position with lower legs “dragging in the water” which will allow the Rescuer greater control of side-to-side movement
- + Once the Rescuer is placed at the victim (static water) or the victim comes to the Rescuer (dynamic water), the Hoist Operator will spool out enough hoist cable to allow Rescuer to capture and secure victim without restriction

Capturing and securing victim

Safety note: The rescue of a moving victim in a dynamic water environment is arguably the greatest challenge and poses the most difficulty to the Rescuer. The coordination and timing amongst all crewmembers must be precise in order to rescue a potentially exhausted and hypothermic victim.

- + Technically, the capture and securing of the victim a water environment is the same as a dry land rescue
- + Rescuer capture of victim in a dynamic water environment
- + Rescuer will approach victim with quick capture strap fully expanded and ready to capture and secure victim
- + Rescuer will wrap quick capture strap around victim, connect two, non-locking “Kong” carabineers and take tension on the adjustable side of the strap, which will ensure a positive connection of the two carabineers
- + Rescuer will ensure that the quick capture strap is secure around victim and that the non-locking carabineers are connected properly. This will prove difficult due to the moving water around

the Rescuer and victim caused by the dynamic water flow and/or the downwash from the helicopter

Safety note: Caution must be used in applying non-locking “Kong” carabineers. Tension on these types of carabineers must be limited to a direct pull along the spine. A twisting motion applied to these carabineers could inadvertently open the carabineer’s gate and release the load.

- + Rescuer will wrap his/her arms around at least one of the victim’s arms and entire torso
- + Rescuer will secure victim close to their body and reassure victim

Extraction

- + The extraction of a victim from the water environment will be the same as the dry land extraction

Safety note: Extreme caution needs to be exercised in a water environment due to the possibility of the hoist cable wrapping around the Rescuer’s (or victim’s) neck or arm. The Hoist Operator should take tension slowly to see that the cable is clear and provide the Rescuer time to move the cable away from his/her body.

2.9.17 SHORT HAUL OPERATION

During both normal and possibly emergencies hoist operations, the need to transfer to a short haul operation may be encountered. This operation should be part of the initial training curriculum and periodically reinforced throughout the proficiency and recurrent training processes.

2.10 EMERGENCY PROCEDURES

Regardless of how well a crew is trained while utilizing the state-of-the art equipment, an operation can have unexpected encounters. How the crew deals with these situations will be dictated by their training and ability to cope with emergencies.

A well-trained crew should be able to anticipate and plan for most of the hoist operation. This is referred to as “reading” the terrain and environment. For example, a crew should be able to anticipate and plan for a load to

swing or spin depending on the terrain and perhaps even the wind conditions/approach path. A plan should be developed to decrease a swing or spin prior to it actually occurring.

2.10.1 CABLE ENTANGLEMENT

Event:

Cable entanglement is considered a potentially catastrophic event that could result in serious injury or fatalities. Employing clear, calm and concise commands between the Pilot and the Hoist Operator can mitigate Cable entanglement.

Cable entanglement can be defined as the cable and/or hoist hook is inadvertently lodged in a place that prevents normal operation and free movement of the cable and hoist hook. The cable could become entangled in a number of possible locations such as a tree, rock or other man-made objects. This situation poses a threat to the ability of the helicopter to move and cause forces that could cause a catastrophic incident.

Actions:

The initial priority for the Hoist Operator is to communicate the situation to the Pilot. The second action should be to prepare to cut the hoist cable. **IF the Pilot is unable to maintain position of the helicopter, the hoist cable must be cut.** IF the Pilot can maintain the position of the helicopter, the Hoist Operator should reel out cable to create enough slack in the cable so that the Rescuer can untangle the cable or hoist hook.

Always maintain the ability to cut the cable during this event.

Safety Note: Prior to placing a load onto the cable/hoist hook, the cable and hoist hook needs to be inspected for damage. If in doubt, place the hoist out of service.

2.10.2 LOAD SWING (OSCILLATION)

Event:

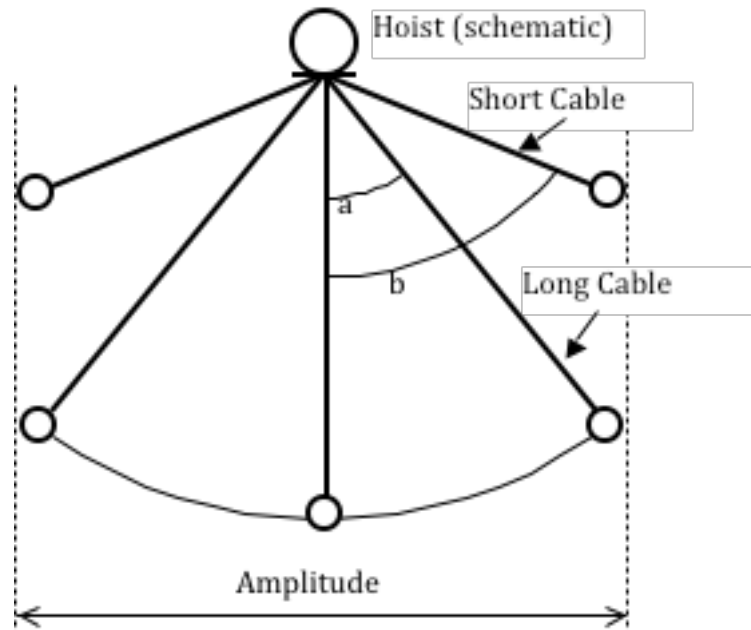
Load swing (or commonly referred to as oscillation) can occur from a number of different actions. Failure to position the helicopter directly over the load prior to lifting the load, sudden movements by the Pilot and wind gusts are the most common causes that induce swing on a load.

Oscillating loads can be hazardous as they can produce CG imbalances, cable damage from rubbing against the skid and damage to the hoist arm if the swing is excessive (past 10 degrees). Extreme oscillation has occurred to the point that the load swings so far fore or aft that the cable becomes caught in the fore or aft skid tube preventing further reel in action. Additionally, there have been occurrences when loads have swung dangerously close to the tail rotor.

Actions:

The Hoist Operator will communicate to the Pilot that there is a swing and which direction (fore/aft or right/left) the load is swinging. In the case of any oscillating load, stop the reel in process. Physics has taught that decreasing the length of a pendulum does not decrease the swing. If the oscillation is right/ left, the Pilot can assist by "moving" the aircraft over the load as it swings right or left.

The Hoist Operator can decrease the swing by pushing the cable in the opposite direction of the swing until the load swing decreases. The Hoist Operator should grab the cable as low as possible to push against the cable. If these actions do not decrease the swing, the aircraft will need to gain airspeed and the cable should be reeled out until the swing.



2.10.3 LOAD SPIN

Event:

A spinning load (with the assumption that the load consists of a human) can be extremely dangerous and cause extreme injury to a Rescuer or victim. Extreme centrifugal forces could be applied to the Rescuer and/or the victim causing neurological damage.

Spin usually occurs when the load is lifted from the ground and the rotating downwash comes into contact with the load. Without some counteracting force applied against the load, spin could increase rapidly.

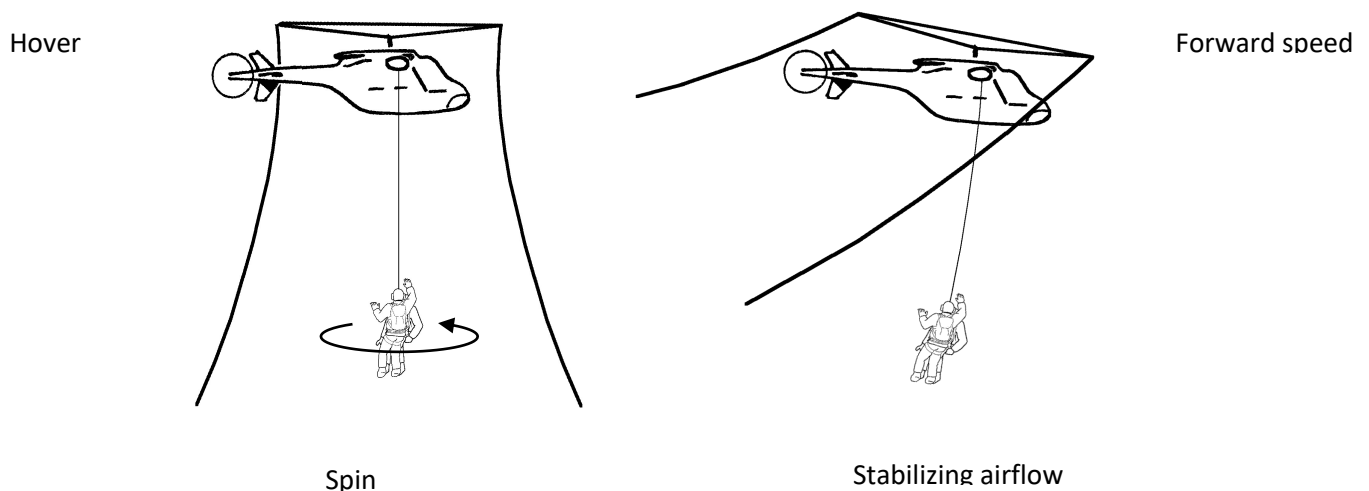
Action:

Two recommended actions to take to control and/or decrease the

possibility of a spinning load are to attach an anti-rotation line or initiate forward airspeed as quickly as possible.

The use of an anti-rotation line is described in the Bauman Bag section. Proper downside positioning of the anti-rotation is critical to the success of this use.

By initiating forward airspeed once the load is off of the ground puts air across the Bauman Bag and causes a wind foil action which will decrease spin. This action can be applied to Screamer Suit and single Rescuer loads as well.



2.10.4 HOIST MOTOR FAILURE

Event:

Hoist motor stops working. Load has stopped from reeling out or reeling out.

Action:

Hoist Operator advises Pilot that the hoist has stopped working. Pilot cuts power to the hoist. Pilot pushes in cable cut breaker that keeps active the cable cut option if required. Hoist Operator and Pilot begin "short haul" evolution to lower load to a safe location. As the load is slowly lowered to

ground, the Hoist Operator gathers the excess cable and places it in a figure-eight configuration in the aft cabin. If unable to land, the cable must be pulled up and into the cabin from a hover.

2.10.5 RUNAWAY CABLE

Event:

Hoist cable uncontrollably reels in or out at full speed. The hoist pendant does not respond to inputs.

The load could strike the ground at a high rate of speed causing injury or death if at low altitude. If at higher altitude, the cable come become separated from the cable drum and load could fall to the ground.

Actions:

Hoist Operator immediately communicates that there is a runaway cable. The Pilot immediately cuts power to the hoist.

Set the load on the ground by slowly decreasing altitude and the load reaches the ground.

Use the Axel Cut device and cut the cable.

2.10.6 GENERATOR FAILURE

Event:

Pilot indicates generator failure.

Action:

One generator may deliver a maximum of 150 Ampere

At full load the hoist consumes a maximum of 125 Ampere

Before starting further hoist operation, try to reset the failed generator. If that is without any success, reduce electrical load of remaining generator to 50 Ampere or below (watch ammeter) by switching off unnecessary equipment as soon as possible.

If the electrical load cannot be reduced to or below the above values without hoisting, hoist operation has to be interrupted after completion of the actual cycle.

NOTE

For single generator operation, moving NON ESS BUS switch from NORMAL to MANUAL may restore nonessential busses. Monitor to ensure loads are within limits.

WARNING

In order not to overload the remaining Generator hoist load is limited to 250 lbs. (114 kg).

2.10.7 ENGINE FAILURE

Event:

The aircraft loses engine power and begins a rapid descent. The ability to reel in the load depends to the distance between the load and the aircraft as well as the forward path being free of obstacles. If either of these situations prevents the complete reeling in of the cable and load, the cable will need to be cut.

Action:

Pilot notifies the crew-

“Engine failure”

Pilot has to lower the collective in order to maintain rotor RPM. At the same time he is accelerating the helicopter to help gain RPM and glide ratio. Upon hearing “engine failure”, the Hoist Operator immediately reels in the cable at maximum speed and continuously reports the load height above ground and obstacle clearance to the Pilot. This information is very important for the Pilot. Based on this he has to decide to cut the cable or not. If the flight path is free of obstacles and the load is high enough above ground the cutting of the cable may not be required. As the load starts

climbing in relation to the ground the Hoist Operator informs the Pilot by "load is clear of obstacles" and then counting down the distance to the skids. At any point the Hoist Operator states: "CUT, CUT, CUT", the Pilot must depress the cable cut immediately without question.

2.10.8 HOIST OVERTEMP

Event:

After repeated use, the hoist may develop high temperature due to friction and motor heat. The hoist incorporates a thermal warning and protection system to provide maximum output and/or torque to the point of failure without being a fire hazard. The thermal warning and protection system consists of two automatic resetting thermal switches and a non-resetting thermal fuse.

One switch is located in the winch gearbox cover assembly while the second switch is located in the motor brush holder and thermal protector. Each switch is designed to activate at between 280° and 300°F (138° and 149°C) and to automatically reset at between 250° and 270 °F (121 ° and 132°C).

An activated switch completes a circuit to illuminate the red OVERTEMP indicator on the control pendant assembly. This condition warns the operator of an over-temperature condition but will not stop hoist operation.

Action:

The immediate action is for the Hoist Operator to announce an "OVERTEMP" to the Pilot and stop using the hoist. If a load is on the hoist, a safe location on the ground should be found as quickly as possible.

If safe to do so, the Hoist Operator should conduct a short haul transition and "talk" the load down to the ground through verbal command to the Pilot.

Allow the hoist to cool off and reset which is the most common occurrence. The red OVERTEMP indicator automatically extinguishes when the switch resets

CHAPTER 3 TECHNICAL GROUND SCHOOL

3.1 INTRODUCTION

The technical ground school portion of the training builds on what was instructed in the ground school and allows for an initial “hands-on” for the students. This portion of this training is also intended to provide an environment that will allow the OCSD trainees to develop the experience of hoist rescue operations through actual manipulation of equipment and repetition in a static (non-flying) location.

3.2 OBJECTIVES

The objectives of the technical ground school are to provide opportunities for all crewmembers to practice and become more comfortable with the hoist operation scenarios.

3.3 TRAINING SIMULATION

If possible, the use of a platform that could simulate a helicopter/hoist would be cost effective and beneficial in aiding to the training of hoist operations.

An acceptable training platform would include:

- + Platform should be able to replicate a helicopter as much as possible. Cabin configuration, seating positions, skid height, anchor locations and hoist placement should be as close to the actual aircraft as possible.
- + The platform, access areas, anchors, etc. should all conform to both agency and any occupational requirements.
- + The anchors should be assured to conform to any specific occupational standards.
- + Platform should be inspected regularly.

3.4 PERSONAL PROTECTIVE EQUIPMENT

This portion of the training allows the students the opportunity to manipulate the personal protective equipment in a static and controlled environment. The emphasis is to build awareness, comfort and confidence with donning and doffing the rescue harness. Entire crew participation is required to implement the same level of knowledge regarding this piece of equipment.

Flight helmets:

- + Donning/Doffing Harness
- + Donning/Doffing

3.5 RESCUE EQUIPMENT FAMILIARIZATION

This portion of the training allows the students the opportunity to manipulate the rescue equipment in a static and controlled environment. The emphasis is to build awareness, comfort and confidence with using the various rescue tools. Entire crew participation is required to implement the same level of knowledge regarding each piece of equipment.

Carabineers

Delta Links

Multi Loop Straps

Restraints

3.5.1 AMBULATORY VICTIM

Student will be provided a demonstration to utilize an “ambulatory victim” extraction device and practice placement of the device in a static environment.

Screamer Suit

- + Donning and securing victim
- + Victim orientation
- + Victim at skids
- + Victim at aft cabin

- + Secure victim in aft cabin

3.5.2 NON-AMBULATORY VICTIM

Student will be provided a demonstration to utilize a “non-ambulatory victim” extraction device and practice placement of the device in a static environment.

Bauman Bag/Scoop Stretcher

- + Setting up scoop and Bauman Bag
- + Donning and securing victim
- + Tag Line Operations
- + Victim orientation
- + Victim at skids
- + Victim at aft cabin
- + Secure victim in aft cabin

3.5.3 IMMEDIATE NEED RESCUE

Student will be provided a demonstration to utilize an “immediate need” extraction device and practice placement of the device in a static environment.

Quick Capture Strap

- + Pre-Deployment set up
- + Securing victim in strap
- + Signal to Hoist Operator
- + Releasing victim
- + Securing victim in aircraft (if applicable)

3.6 OPERATIONAL TRAINING

This portion of the training allows the students the opportunity to manipulate the rescue equipment as well as rehearse the hoist rescue operations in a static and controlled environment. The emphasis is to build awareness, comfort and confidence with using controlled conditions. Entire crew

participation is required to implement the same level of knowledge regarding each hoist rescue evolution.

Implementation of specific operational philosophy (profile) will occur during this phase of the training.

3.6.1 HOIST RESCUE OPERATIONS

OCSD trainees will be briefed on which specific hoist rescue evolution will be the focus for each specific training event. For example, the student aircrew may be tasked with inserting the Rescuer with rescue equipment for an ambulatory victim and a double (two-person) extraction.

3.6.2 PRE-HOIST RESCUE BRIEFING

The OCSD trainees will be provided a demonstration of a hoist rescue briefing as well as have multiple opportunities to rehearse a briefing with their aircrew. The training emphasis will rely on effective aircrew communication, problem solving and safety.

Practical Exercise 1:

Pilot, Hoist Operator and Rescuer sit in aircraft and go through the pre-hoist briefing with no flight helmet on. Objective is to become familiar with pre-hoist briefing with clear communication between the crew.

Practical Exercise 2:

Pilot, Hoist Operator and Rescuer sit in aircraft with flight helmets on and APU/GPU providing power to the ICS. Objective is to go through pre-hoist briefing clearly through the aircraft ICS.

3.6.3 HOIST RESCUE CHECKLIST

The OCSD trainees will be provided a demonstration of a hoist rescue checklist as well as have multiple opportunities to rehearse a checklist with their aircrew. The training emphasis will rely on strict adherence to the uninterrupted completion of the checklist and ensuring all items contained

within the checklist are completed.

Practical Exercise 1:

Pilot, Hoist Operator and Rescuer sit in aircraft and go through the hoist rescue checklist without flight helmets donned. Objective is to go through the hoist checklist with clear communication.

Practical Exercise 2:

Pilot, Hoist Operator and Rescuer sit in aircraft with flight helmets on and APU/GPU providing power to the ICS. Objective is to go through hoist rescue checklist clearly through the aircraft ICS

3.6.4 DEPLOYMENT OF RESCUER

The students will be provided opportunities to rehearse deploying a Rescuer out of the helicopter's cabin in multiple operational scenarios.

Practical Exercise 1:

Pilot, Hoist Operator and Rescuer sit in aircraft and go through the deployment of a Rescuer without flight helmets donned. Objective is to go through the deployment sequence with clear communication.

Practical Exercise 2:

Pilot, Hoist Operator and Rescuer sit in aircraft with flight helmets on and APU/GPU providing power to the ICS. Objective is to go through the Rescuer deployment scenarios clearly through the aircraft ICS. This includes the hoist rescue sequence starting after the hoist checklist is completed through bringing the Rescuer to the deployment position on the hoist.

These exercises should include:

- + Rescuer with no equipment
- + Rescuer with Screamer Suit
- + Rescuer with Bauman Bag

In both Practical Exercise 1 and 2, all crewmembers should assume their respective positions within the aircraft and move accordingly. One of the

objectives of these exercises is to provide the opportunity for the Hoist Operator to practice their verbal command(s) as the Rescuer is moving into the deployment position. Another objective is to allow the Rescuer practice moving from the seat to the aircraft floor, securing the necessary equipment and move into the deployment position.

Ample practice should be provided with the aircraft APU/GPU powering the ICS and hoist Bureaus.

Objectives for the Rescuer should include:

- + Smooth and methodical movements while in the aft cabin
- + Maintain awareness of the safety restraint strap
- + Safely and efficiently secure rescue equipment

Objectives for the Hoist Operator should include:

- + Approved verbiage for the scenario
- + Bring the aircraft to the rescue target location
- + Provide continual updates to Pilot relating to the movements within the aft cabin
- + Practice manipulating hoist wheel while placing Rescuer in deployment position

3.6.5 RETRIEVAL OF RESCUER/LOAD

The OCSD trainees will be provided opportunities to rehearse retrieving a Rescuer from the target location in multiple operational scenarios.

Practical Exercise 1:

Pilot, Hoist Operator and Rescuer sit in aircraft and go through the retrieval of a Rescuer without flight helmets donned. Objective is to go through the retrieval sequence with clear communication.

Practical Exercise 2:

Pilot, Hoist Operator and Rescuer sit in aircraft with flight helmets on and APU/GPU providing power to the ICS. Objective is to go through the Rescuer retrieval scenarios clearly through the aircraft ICS. This includes the

hoist rescue sequence starting when the Rescuer is ready to be retrieved through securing the Rescuer (and victim if indicated) to aft cabin of the aircraft.

In both Practical Exercise 1 and 2, all crewmembers should assume their respective positions within the aircraft and move accordingly. One of the objectives of these exercises is to provide the opportunity for the Hoist Operator to practice their verbal command(s) in bringing the Rescuer/Load from the ground and into the aft cabin of the aircraft. Another objective is to allow the Rescuer practice entering the aircraft with a victim, securing the victim within the aft cabin and securing the rescue equipment.

These exercises should include:

- + Rescuer with no equipment
- + Rescuer with Screamer Suit
- + Victim with Bauman Bag (Tag line)

Ample practice should be provided with the aircraft APU/GPU powering the ICS and hoist Bureaus.

Objectives for the Rescuer should include:

- + Smooth and methodical movements while securing victim on the aft cabin of the aircraft
- + Maintain awareness of the safety restraint strap
- + Safely and efficiently secure rescue equipment

Objectives for the Hoist Operator should include:

- + Approved verbiage for the scenario
- + Provide continual updates to Pilot relating to Rescuer/Load while reeling in the cable
- + Practice manipulating hoist wheel while Rescuer is on the cable and securing victim in aft cabin of the aircraft
- + Release tag line when appropriate

3.6.6 EMERGENCY PROCEDURES

The students will be provided opportunities to rehearse various emergency procedures in a static environment.

Practical Exercises will include all of the emergency procedures.

3.7 FLIGHT TRAINING PREPARATION

Briefing held for the flight operations training evolutions.

CHAPTER 4 FLIGHT TRAINING

4.1 FLIGHT TRAINING

A progressive approach to the training evolutions should be followed:

- + Empty Hook (Flat Terrain)
- + Weighted Hook (Flat Terrain)
- + Weighted Hook (Varying Terrain)
- + Single Rescuer No Equipment (Flat Terrain)
- + Single Rescuer No Equipment (Varying Terrain)
- + Screamer Suit (Flat Terrain)
- + Screamer Suit (Varying Terrain)
- + Bauman Bag (Flat Terrain)
- + Bauman Bag (Varying Terrain)
- + Quick Capture Strap
- + Tag Line or Anti-Rotation Line Operations

4.2 FLIGHT TRAINING OBJECTIVES

The objectives for the flight-training portion are to safely and effectively complete all aspects hoist rescue operations. This shall include:

- + Hazard/Risk assessment
- + Pre-hoist brief
- + Target identification
- + Pre-hoist rescue checklist

- + Rescuer deployment
- + Rescuer retrieval
- + Debrief

4.3 PRE-HOIST RESCUE BRIEFING

Refer to "Pre-Hoist Rescue Briefing" as noted in Section 2.5.9 and Appendix 2.9.5.

4.4 PRE-HOIST RESCUE CHECKLIST

Checklist should be placed in the aft cabin of the aircraft in clear view for the Hoist Operator to read verbatim. See Section 2.9.6 for checklist.

4.5 TARGET ASSESSMENT

Aircrew members shall demonstrate the ability to work with the Pilot during a high recon and low recon to identify hazards, obstacles and safe insertion and extraction areas for the rescuer.

4.6 POWER ASSURANCE CHECK

Pilots will perform power assurance check at the target area to ensure necessary power for the hoist rescue mission.

4.7 DEPLOYMENT OF RESCUER

Instructors demonstrate deployment of a Rescuer for each hoist rescue evolution prior to each specific evolution.

Objectives:

- + Hoist Operator demonstrates the ability to successfully direct and place the Rescuer to the proper target using the correct verbiage, depth perception, and directions to the Pilot.
- + Hoist Operator properly identifies any unsafe conditions and chooses the correct point to abort the evolution when necessary.

4.8 RETRIEVAL OF RESCUER

Instructors demonstrate retrieval of a Rescuer for each of the specific hoist rescue evolutions.

Hoist Operator demonstrates the ability to successfully place the hoist hook to the proper target and retrieve the Rescuer using the correct verbiage, depth perception, and directions to the Pilot.

Hoist Operator properly identifies any unsafe conditions and chooses the correct point to abort the evolution when necessary.

4.9 EMERGENCY PROCEDURES

Instructors conduct a verbal demonstration of the emergency procedures. Crewmembers will conduct verbal drills based on the emergency procedures instruction.

4.10 DEBRIEF

In order to honestly and accurately assess the actions of the training, an organized debrief of the evolutions should commence as soon as possible after the training has been completed.