King County Sheriff's Office
Hoist Operations Attachment

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General Concept

The helicopter provides a safe, stable aerial platform from which to conduct hoisting operations when landing is not feasible. The externally mounted rescue hoist is capable of carrying loads up to 600lbs.

Personnel

The personnel required for day helicopter non-training hoist operations are the Pilot-in- Command (PIC), a Tactical Flight Officer (TFO) or Co-Pilot, System Operator (SO), ~~and~~ (~~1~~2) Rescue Specialist (RS) and a Medic. ~~A second RS is recommended.~~

The personnel required for night helicopter hoist operations are the PIC, Co-Pilot, SO, ~~and~~ (2) RSs and a Medic.

The PIC can authorize deviation from minimum crew standards.

Pilot-in-Command

- Responsible for the mission, crew, and aircraft

Co-Pilot or TFO

- Assists PIC as required.

System Operator

- Ensures internal communication between the Pilot and SO, and external communication between the aircraft and the ground.

- Inspects all equipment and uses only authorized serviceable equipment.

- Inspects and tests all mechanical interfaces, anchor points, and performs the pre-operational hoist checklist before the mission starts.

- Ensures that all RSs receive a mission briefing and the pilots and aircrew have conducted the pre-flight safety, open door, and on scene checklists.

- Maintains communications with the pilot at all times.

- Responsible for the safety of all crew and ensures that all safety precautions are followed

Rescue Specialist
RSs are crew members designated to be lowered from the helicopter. Commissioned Deputies will serve as the ~~primary~~ RS~~, or RS1~~. ~~Non-KCSO personnel may be trained and serve as a RS per the ASU Crew Training Manual.~~

- Know the hoisting equipment used in helicopter operations and any special equipment required for helicopter hoisting.

- Ensur~~es~~~~ing~~ the safe recovery of personnel and equipment.

- Physically check~~s~~ all equipment prior to use.

ASU Paramedic

The primary function of the ASU paramedic (medic) is to provide safe emergency care and safe transport to the injured subject. Trained King County Medic One personnel will serve as medics. Medics are designated to be lowered from the helicopter as needed to help with patient packaging and to address medical concerns. Medics are trained to the standards outlined in the Paramedic Training Manual.

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Training

See relevant ASU training manual.

Safety

- All SO/RSs shall carry a fixed blade knife.

- Loose clothing and equipment are secured.

- Helmets are worn with chin straps fastened.

- RS will wear high visibility clothing, helmets, eye protection, gloves and a certified rescue harness.

- All seats and hoisting equipment must be inspected by the SO before hoisting, and all Personal Protective Equipment will be inspected before the aircrew board the aircraft.

- Personnel approach and depart the helicopter from the front and forward of the rear of the cargo doors.

- All personnel on board the aircraft shall be anchored at all times.

Communications

- Voice communications between the Pilot and the SO are required before commencing hoisting.

- The ~~SO~~ RS will use standardized hand signals to communicate with the SO~~R~~RS. Additionally, the RS will have radio communication with the aircraft.

- The RS should carry a back up radio on missions.

Weather

Hoist operations will not be conducted under the following conditions:

- Winds in excess of 30 knots.

- Gust spread of 15 knots or more.

- Lightning strikes within 20 nautical miles of hoisting operations.

- Wind chill factors caused by the helicopter's rotor wash or extraction cruise air speeds, which could cause cold weather injuries.

- Icing conditions or (visible moisture with temps at 35F or below), ice on the hoist cable hook inhibiting the ability of the RS to connect and disconnect safely.

- Significant blowing particles produced by rotor wash causes the aircrew or the SO to lose visual contact with the ground.

Equipment

- Only equipment previously identified and approved shall be used by the aircrew.

Hoist Operations

Objective

A person is recovered by means of hoisting from a hovering helicopter when:

1. No other practical way of recovery is possible.

2. The victim's injuries and/or situation are such that conventional methods could endanger the person or the rescuers.

Rigging of the helicopter for rescue hoisting

The SO performs the following to rig the helicopter.

- Secure all gear to helicopter for open door flight.
- Secure all seating.
- Locks the doors in the open position (as required)
- Attaches fall arrestor and tri-links to ceiling and wall mounted anchors and ensures backup webbing is in place.
- Secures the SO's fall protection rigging

Setting up the rescue:

1. Formulate an action plan (the action plan should also include any actions necessary according to observation and information furnished by any ground crew on scene).
2. Perform Safety Checklist Part 1 before departing the air operations base.

~~1. Perform Rescue Checklist Part 2 en route~~

~~2~~.3. Complete ~~On Scene Briefing~~Pre-Rescue Checklist Part ~~2~~3 and begin the hoist evolution.

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Hoisting Procedures/Commands
Helicopter hoisting is conducted in a noise-filled environment. All personnel must know the commands, procedures, and appropriate hand and arm signals.

- SO: ready for cargo door
  - ✓ Pilot: less than 55 knots, clear for cargo door (or negative SO standby)
- SO: ready to move to skid
  - ✓ Pilot: less than 30 knots, clear to move to skid (or negative SO standby)
- SO: on the skid ready to hoist
  - ✓ Pilot: clear to hoist (or negative SO standby)
- SO: Advise when you lose sight of target.
- SO: (Continually verbalize actions.) RS at the cabin door, RS at skid, Orca strap disconnected. RS on the way out (down) (Use consistent standard language. Say it the same way every time.)
- PIC: Losing sight of target.
- SO: Counts down to target. 40,30,20,10,5,4,3,2,1. Hold hover. (The spacing of the numbers shall be even and consistent so the pilot can gauge the distance to the target that he can't see.)
- SO: RS on the ground in 3, 2, 1.
- SO: RS on the ground
- SO: RS ~~1~~ disconnecting
- SO: RS~~1~~ is disconnected hooks coming in.
- SO: hook is half-way in.

- SO: hook is 15ft below the skid you are clear for easy forward.
- SO: hook is stowed, cargo door is closed, cabin secure.
- SO: ~~free to go~~clear for forward flight

  ✓ Pilot: On the go

RS EXTRACTION

- SO: ready to move to skid
  ✓ Pilot: less than 30 knots, clear to move to skid (or negative SO standby)
- SO: on the skid ready to hoist
  ✓ Pilot: clear to hoist (or negative SO standby)
- SO: Advise when you lose sight of target.
- PIC: Losing sight of target.
- SO: Counts down to target. 40,30,20,10,5,4,3,2,1. Hold hover. (The spacing of the numbers shall be even and consistent so the pilot can gauge the distance to the target that he can't see.)
- SO: RS has the hook.
- SO: RS~~1~~ is making the~~a~~ connection,
- SO: RS~~1~~ is connected I'm receiving ready for up signal.
- SO: cable is tensioning.
- SO: prepare for load.
- SO: taking the load (if possible hold the RS 1 to 2 feet AGL).
- SO: Power check

  ✓ Pilot: Power and CG are good
- SO: RS~~1~~ is coming in
- SO: RS~~1~~ is halfway in
- SO: RS~~1~~ is signaling he is clear of obstructions (when indicated by RS1)
- SO: RS~~1~~ is below the skid
- SO: RS~~1~~ is at the skid and on Orca strap
- SO: RS~~1~~ is coming in the cabin
- SO: RS~~1~~ is in the cabin hoist complete
- SO: hook is stowed, cargo door is closed, cabin secure
- SO: ~~free to go~~clear for forward flight
  ✓ Pilot: On the go

- A headset and intercom jack for the SO is available and operational.
- Certified serviceable safety harnesses and other fall restraint equipment are available for the SO and other aircrew.

- All safety checklists and personnel protective equipment checks are completed as required.

Section VI: PREFLIGHT/SAFETY CHECKLIST 1~~,~~ & PRE-RESCUE/ON SCENE CHECKLIST 2~~, ON SCENE CHECKLIST 3~~

Preflight/Safety Checklist #1
(Before Takeoff)

Pre-Flight & Mission brief complete.
Geared for mission type. For example, rescue, recovery, patient needs.
PPE donned & doubled check. ALL CREWMEMBERS!
Gloves, glasses, visors, NVG's backpacks as needed.
Auxiliary doors secured.
Loose equipment secured or removed for open door flight.
Restraints secured. ORCA straps, seatbelts, or secured to floor hard points.
Verify gates are closed on carabineers, and proper load sharing along anchor points.
Hoist pre-operational check complete.
Go Pro cameras in place and ready to go.
Safety checklist complete.

~~**Safety Checklist #1**~~

~~Pre-Flight & Mission brief complete.~~
~~Geared for mission type. For example, rescue, recovery, patient needs.~~
~~PPE donned & doubled check. ALL CREWMEMBERS!~~
~~Gloves, glasses, visors, NVG's backpacks as needed.~~
~~Auxiliary doors secured.~~
~~Loose equipment secured or removed for open door flight.~~
~~Restraints secured. ORCA straps, seatbelts, or secured to floor hard points.~~
~~Hoist pre-operational check complete.~~
~~Safety checklist complete.~~

Pre Rescue Checklist #2
(Before opening door)

Hot mike on for SO and Crew.
All unnecessary radios off.
SO or designee to verify that all radios (1,2,&3) are pinned down (off) unless needed for the mission or to monitor a backup frequency.
Primary radio is . SO and Crew audio panels set for primary radio.
SO or designee to verify that radio selector switch is selected for primary radio.
Identify backup radio frequency. (Depends on mission)
RS turn on portables to primary radio connect helmet and perform radio check.

SO should be able to hear RS over radio at this time
Necessary equipment is ready. Tagline, litter, medkits, etc.
SO and Crew are tethered, anchored and DOUBLECHECKED.
RS's on restraint. ORCA strap.
Aircraft entry and exit routes
Call to abort, anyone uncomfortable with the evolution call abort of the ICS.
RS give in trouble need assistance hand signal. SO recover the RS and conn aircraft to safe position as briefed.
PIC intentions in event of aircraft emergency and hoist shear authority.
PIC to identify intended emergency route and possible obstacles for hoist cable.
SO to manually cut cable in non time critical events.
Go Pro camera's On?
Set Hoist Power to on.
Any questions?
Rescue Checklist Complete

~~Rescue Checklist #2~~

~~Hot mike on for SO and Crew.~~
~~All unnecessary radios off.~~
~~Primary radio is _____. SO and Crew audio panels set for primary radio.~~
~~Identify backup radio frequency. (Depends on mission)~~
~~RS turn on portables to primary radio connect helmet and perform radio check.~~
~~Necessary equipment is ready. Tagline, litter, medkits, etc.~~
~~SO and Crew are tethered, anchored and DOUBLECHECKED.~~
~~RS's on restraint. ORCA strap.~~
~~Set hoist power to on.~~
~~Rescue checklist complete.~~

~~On Scene Checklist #3~~

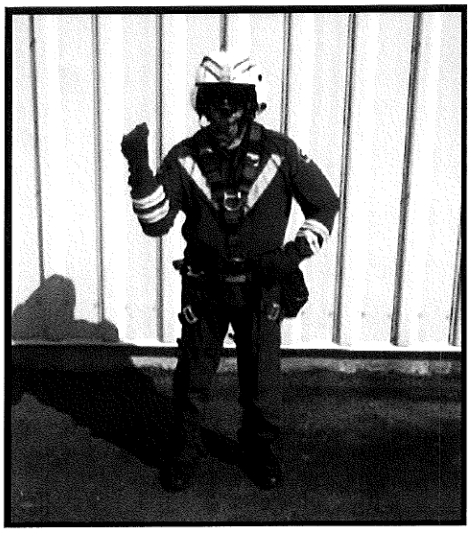
~~1. Power available vs power required.~~
~~Minimum 10% extra power required to perform the evolution.~~
~~2. Wind effects including turbulence, updrafts and downdrafts.~~
~~Identify wind direction and speed.~~
~~3. Aircraft entry and exit routes.~~
~~Identify a safe position and emergency rendezvous point for RS.~~
~~4. Effects of rotor wash on patient.~~
~~Conn the aircraft away from the patient if there are any negative effect from the rotor wash.~~
~~5. RS traverse route.~~
~~Identify RS traverse route, Avoid approaching patient from directly overhead.~~
~~Avoid overhangs that could damage the hoist cable.~~
~~6. Who will fly and hover references to be used.~~
~~7. Assign obstacle clearance responsibilities and crew duties.~~
~~Identify if obstacles will affect the evolution.~~
~~8. Call to abort, anyone uncomfortable with the evolution call abort of the ICS.~~
~~RS give in trouble need assistance hand signal. SO recover the RS and conn aircraft to safe position as briefed.~~

~~9. PIC intentions in event of aircraft emergency and hoist shear authority.~~
~~PIC to identify intended emergency route and possible obstacles for hoist cable.~~
~~SO to manually cut cable in non time critical events.~~
~~10. Go Pro camera's On?~~
~~11. Any questions?~~
~~12. On scene briefing complete .~~
~~Validate rescue checklist. Begin the evolution.~~

SECTION VIII: HAND AND ARMS SIGNALS

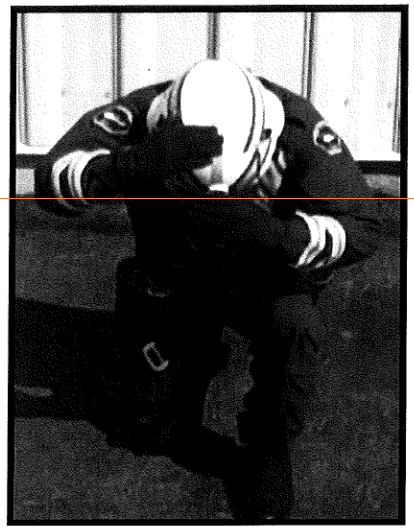
Abort

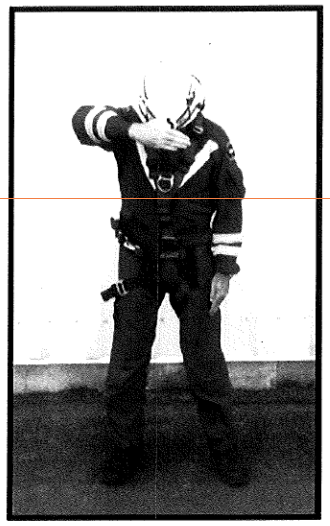
(sweep open palm across neck)



In Trouble – Impaired Vision

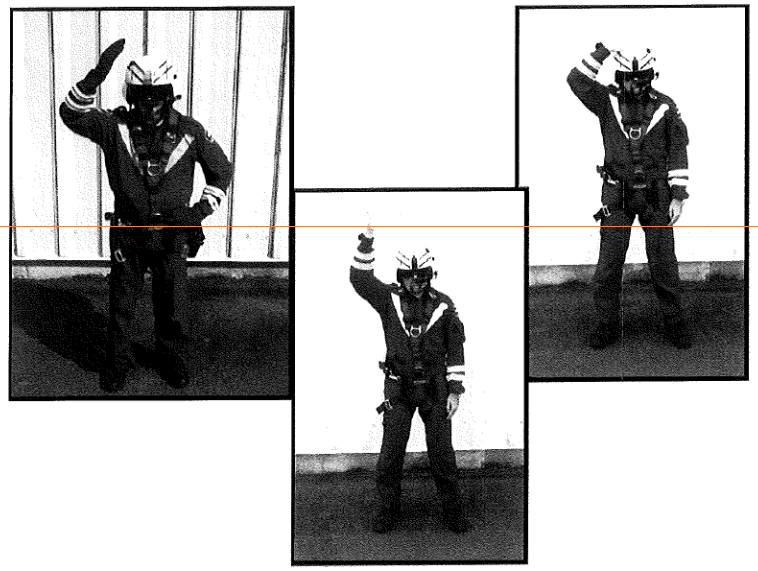
(sweep open palm hand back and forth across top of head with other hand covering eyes)





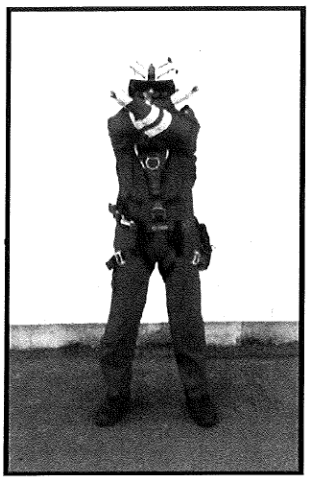
I'm Okay

(pat the top of your head with open palm)



Lost Communication

(First: cross forearms in an 'X' in front of face. Second: 'Monitor Radio' hand signal)



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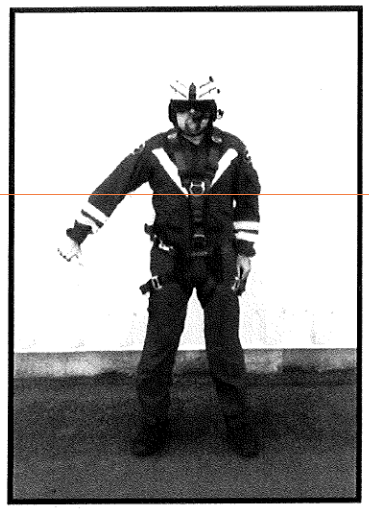
Not Ready

('thumbs down' hand held out to the side of body)



Ready

('thumbs up' hand held overhead)

Stop Hoisting

(flat hand, palm down at shoulder height across chest – sweep hand directly out to side of body)

10 feet off the ground (on the hook) –

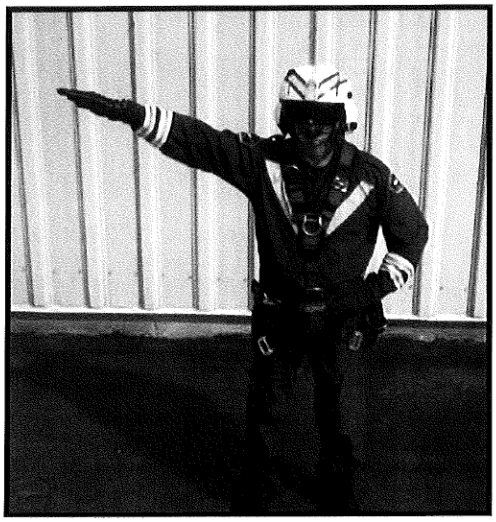
(Open and close legs (heel click) to signal 10 feet off of the ground)

10 feet off the ground (from the ground) –

(Open and close arms to signal 10 feet off of the ground)

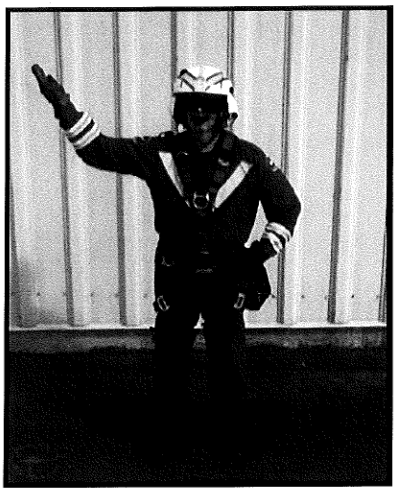
Move in this Direction

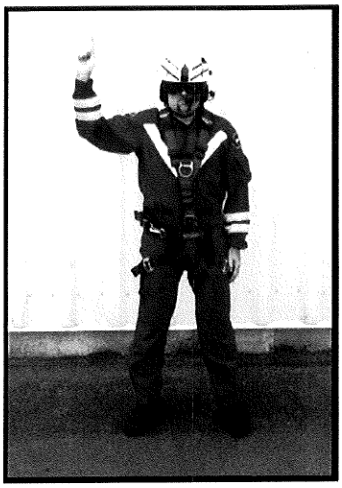
(small circles with entire arm in the desired direction)



Up

(with arm bent at elbow, circle hand upward)



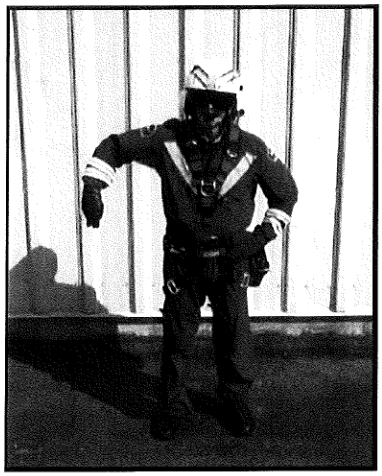


Head Signal – Up

(Nod your head up and down as if you were saying "yes"

Down

(with arm bent at elbow, circle hand downward)



Head Signal – Down

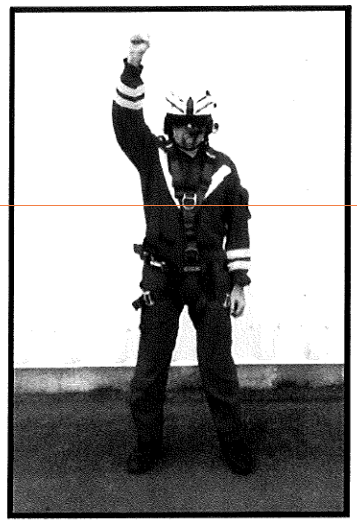
(Shake head side to side as if you were shaking your head "no")

Clear

(both arms shoulder height, sweep hands outward from chest)

Hold

(hold one fist overhead)

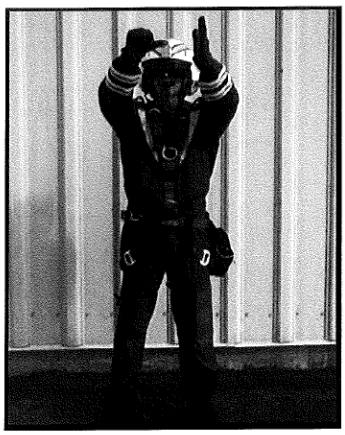


Disconnect From Device

('thumbs up' hand with pinky side to the flat palm of the other hand – move 'thumbs up' hand away from open palm hand)

Connect to Device

('thumbs up' hand with thumb side to the flat palm of the other hand – move 'thumbs up' hand towards the open palm hand)



SECTION IX: HOIST EMERGENCY PROCEDURES

The following procedures are recommended solutions to problems that may occur. There are many other scenarios that can happen that may not be addressed below. Staying calm, communicating and taking the appropriate action are keys to success. Also, crewmembers are reminded that doing a go-around and/or calling to abort when all aspects of the operation are not going as planned is an acceptable option and shall be considered.

Abort Hoist (RS Attached to Hoist Hook)

- RS signal "abort" and "up" or "down" (dependent on nearest safety location)
- SO recover RS into Airship or to safety location

Broken Cable/Cable Chatter/Mis-Wrap/ or Fouled Cable

- SO detects a cable malfunction or feels a unusual vibration on the cable during a hoist operation
- SO Emergency Stop
- Pilot or SO select Hoist Power to OFF position
- SO conn PIC for hover descent to place load on ground if practicable
- If necessary, conduct Fixed Line Transport Procedure

If unable or impracticable to place the load on ground and there is significant distance to the safe area:

- SO attach a safety lock carabineer to the spare tagline
- SO clip carabineer to hoist cable and lower to RS
- RS removes emergency tagline carabineer and secures carabineer and tagline to harness
- SO tie a figure eight to the standing end of the rope to a designated Airship hard-point
- Conduct Fixed Line Transport Procedure to nearest safe area.
- Ensure knife is out and ready in case cut-away is required

In the case of the cable being wrapped around skid or stuck to the skid guard:

- Hoist power off.
- SO should position themselves so they can reach below the skid and attach the emergency tagline below the point of entanglement and then secure the tagline to the aircraft as described above.
- Conduct a fixed line transport to safe LZ.

Center of Gravity Emergency – Helicopter cannot accommodate the load due to center of gravity

- SO immediately place the load on the ground or area of safety
- If the situation progresses rapidly, conduct Hoist Cutaway (Shear) Procedure

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Emergency Pull-in

RS on Hoist Hook Outside of Cabin

- SO signal RS with a slashing motion across the neck
- SO connect RS to the Orca/Scorpion strap
- SO pay out slack and manage hoist cable to allow RS to re-enter the cabin
- RS disconnect from the Hoist Hook, SO stow Hook

Entangled Hoist Hook/Cable

WARNING: Tensioned cable may cause dynamic roll-over, break in cable, or whip-lash of cable with damage to aircraft

- SO pay out slack to prevent tensioning and notify pilot of situation
- SO attempt to free cable by manipulating the cable by hand or by carefully repositioning the airship. If available, have ground personnel assist to free cable.
- If all efforts to free cable are unsuccessful, use manual cable cutter to separate airship from fouled cable.
- If there is any chance the cable tensions and endangers the aircraft, cut cable
- Consider use of the 'Emergency Hook Replacement Kit' (only when cable manually cut)

Fixed Line Transport Procedure (Hoist cable extended (with load) and hoist malfunction

- Pilot or SO select Hoist Power to Off position
- SO conn PIC to nearest safe landing area
- For long distance transport- consider sending down the emergency tagline and carabineer (on hoist cable) as secondary safety tether
- Once established in hover over intended landing area, SO conn Pilot to lower load to the ground
- If available, ground crew disconnect load
- Airship lands while SO manually retrieves hoist cable into cabin

Hang-Up – RS Encounters obstructions or becomes entangled during hoist

- RS signal "hold" and attempts to free self with assistance from SO using hand signals
- If able to free self, RS signals "All Clear"
- If unable to free self, RS activate QRD (if equipped) and strike cable 3 times in slashing motion
- SO continue with "Entangled Hoist Hook/Cable" Emergency Procedure

Hoist Cut-Away
During hoisting evolutions, the non-flying pilot is normally responsible for activating the cable cutter system when deemed necessary during an emergency situation.

- SO or Pilot announces "Cut Cable, Cut Cable, Emergency Cut Cable"
- Pilot or SO activates cable cutaway switch

NOTE: Activating the Cable Cutter System will immediately sever the hoist cable with life-threatening consequences. In some emergency situations, cutting the cable is the best alternative available. Activating the Cable Cutter System switch will make the hoist cable unusable and in most cases NOT repairable.

Hoist Power Failure – During Live Hoist (RS and/or Patient Attached to Hoist Cable)

- SO immediately notifies Pilot of hoist failure
- SO signal RS "abort" and if on ground "disconnect"
- Pilot and SO attempt to restore hoist power by checking the following:
  1. Hoist Controller switch
  2. Circuit breakers
  3. Hoist Power Control switch
  4. Bus-tie(s) (as appropriate)
  5. Pendant Control Assembly (PCA) Connections

If Hoist Power Failure Not Resolved - Aircrew must consider "risk versus gain" in determining the course of action

- Hoist Control switch- select OFF
- Hover descent to lower RS to ground (or water)
- SO signal RS disconnect
- SO manually *retrieve* the cable into Airship (use caution to prevent physical damage to the cable or entanglement)
- If the situation requires immediate evacuation, conduct Fixed Line Transport Procedure

Loss of Communications (During Hoist) – SO and flying pilot are unable to communicate with each other.

- SO slap the side of airframe three (3) times (signifies loss of ICS communication)
- SO gives co-pilot hand signal for lost communications if applicable
- SO continue with "loud" vocal commands and advisories
- SO Troubleshoot- check helmet ICS cord connection, check ICS cord connection to aircraft, check radio control head
- If communications not restored
  - If committed: Continue hoist using "loud" vocal commands
  - If Not committed: Abort hoist

Over-Temp Hoist – Over temperature condition indicated on the pendant

- SO complete the hoist in progress
- Allow the hoist to cool prior to continuing hoist operations
- If equipped with a cooling fan, ensure fan is operating, leave hoist on; fly patterns to allow hoist to cool if possible and safe.

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NOTE: Prolonged use during an over-temp condition may damage the hoist

Oscillation – A combination of a spin and a pendulum, often a result of an off-center lift combined with a wind induced spin exacerbated by improper hoist cable management

- SO lower load to ground

If not possible:

- G- load the hoist cable by having the pilot apply positive vertical climb to pull the load plumb

Rotation – RS encounters a rotation during deployment recovery

- RS attempt to use arm to counter the rotation by 'grabbing air' in the opposite direction
- RS make drag signature as small as possible

RS Incapacitated (Landing aircraft not possible) – RS Incapacitated after hitting ground during hoist

- SO payout slack in hoist cable and notify the pilot of the situation
- Attempt to have ground personnel assist (if available)
- If no ground assist is available, SO carefully recover RS into airship

Runaway Hoist – SO unable to control hoist cable using hoist pendant

- SO immediately advise pilot
- Pilot or SO select hoist power to OFF position
- SO conn Pilot for hover descent to place load on ground if practicable
- If necessary, Conduct Fixed Line Transport Procedure

Shock Load – Load attached to hoist falls on slack cable

- SO immediately lowers load to ground or safe area
- If safe area not available, SO recover load into the cabin and cease the hoist evolution

Spin – Rotation progresses into a spin

- SO place the RS back on the ground, water or area of safety
- If clear of obstructions, SO direct Pilot "easy forward" to gain airspeed and mitigate spin
- RS "headlock" hoist hook (closing eyes *may* reduce effects of vertigo)

Swinging/Pendulum Load

Pendulum usually can be prevented by ensuring airship is plumb over load prior to lifting

WARNING: Never attempt to recover the hoist cable during an active pendulum. The pendulum will likely increase and there is a possibility of severely damaging the cable on the skid

- SO lower load back on the ground or area of safety; if not possible,
- SO "catch" load with shoulder as the load is swings inward; if ineffective,
- SO pay out cable during inward motion and stop before plum (allow gravity to pull the load plumb); if ineffective and clear from obstructions;
- SO time the swing and conn Pilot to move Airship plumb over the load
- As last resort, SO conn Pilot to "G load" the hoist cable *by* having Pilot climb airship