

HELICOPTERS

European Safety Promotion Network – Rotorcraft Hoist Operation

EASA – Michel Masson, Lionel Tauszig

Airbus Helicopters – Bernd Osswald, Alexander Weissenboeck

September 27th 2018

AIRBUS

AGENDA Helicopter Rescue Hoist Thematics and Safety Promotion

1. Welcome and Introduction - Alexander Weissenboeck, Airbus Helicopters
2. Hoist Safety Promotion: Why does it matter? - Michel Masson, EASA / Bernd Osswald, Airbus Helicopters
3. Mission **“Where and how can Hoist accidents and incidents occur...and how to prevent these?”** - Alexander Weissenboeck, Airbus Helicopters
4. Operations & Training - Alexander Weissenboeck, Airbus Helicopters
5. Design & Regulations - Lionel Tauszig, EASA
6. Maintenance & Training - Alexander Weissenboeck, Airbus Helicopters
7. Interactive session: Where do we go from here?

Contributor of the hoist operational task force:

Karl Mueller – Swiss Airforce
Christoph Hess – Swiss Airforce
Klaus Hopf – Bavarian Helicopter Police Squadron
Lionel Tauszig – EASA
Michel Masson - EASA
Patrick Meyer – Sécurité Civile
Dario De Liguoro - Leonardo Helicopter Company
Fauchère Patrick - Air Glaciers SA
Gorm Müller – Orsted
Simon Kremser – WIKING
Christian Tyrok– WIKING
Samuel Summermatter – Air Zermatt
Karl Hoefler – Rettungstechnik Hoefler
Casey Ping – Travis County TX

Peter Moeller – Luxemburg Air Rescue
Walter Traversa – Babcock Italy
Dirk Gockeler - Deutsche Rettungsflugwacht
Markus Rieder - REGA
Anthony M. Gange III - Goodrich
Nicholas Demogines – Goodrich
Alexander Suessmann – AHD
Rupert Gleissl – AHD & Bayerische Bergwacht
Bernd Osswald – AHD
Gabriele Dreher – AHD
Alexander Weissenboeck – AHD



Content

Helicopter Hoist History / Mission Evolution

Operations and Training Risks and Mitigations

Regulatory Developments addressing Design

Maintenance and Training Risks and Mitigations

Hoist History – early day's, mainly rescue hoist missions



Hoist History – early day's, mainly rescue hoist missions



Hoist History – 70's & 80's, mainly rescue hoist missions



Hoist History – 90's → today, mainly rescue hoist missions



Hoist History – 90's → today, mainly rescue hoist missions



Hoist History – 2000's - today



Hoist History – 2000's → today, harbor pilot transfer



Hoist History – 2000's → today, harbor pilot transfer



Hoist History – 2005's → today, windfarm technical staff transfer



Hoist History – 2005's → today, windfarm technical staff transfer



Military & Parapublic - SAR, MedEvac, Tactical OPS



Military & Parapublic - SAR, MedEvac, Tactical OPS



Other OEM's hoist installations



Content

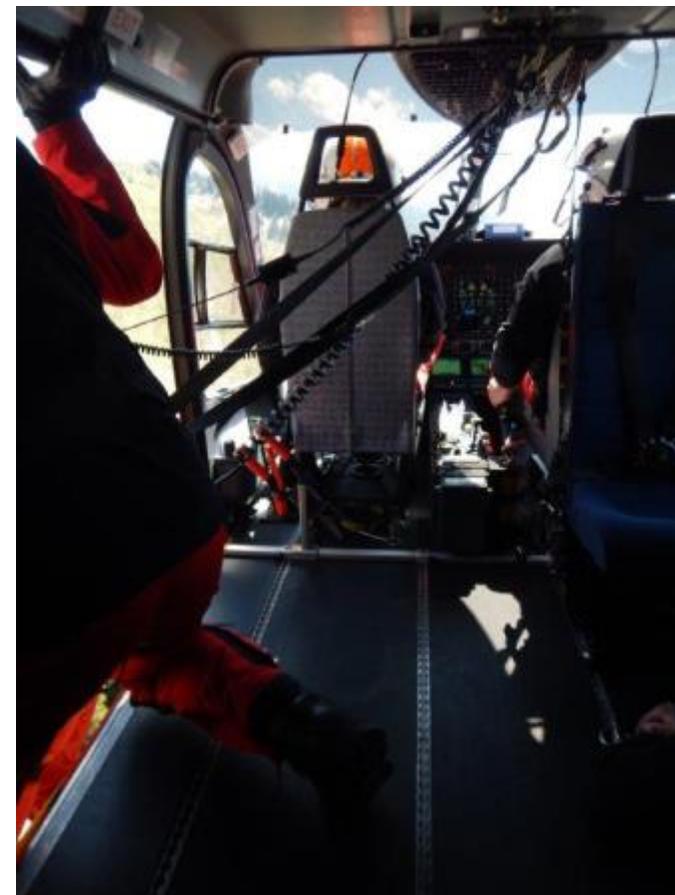
Helicopter Hoist History / Mission Evolution

Operations and Training Risks and Mitigations

Regulatory Developments addressing Design

Maintenance and Training Risks and Mitigations

Hoist operator not secured in cabin



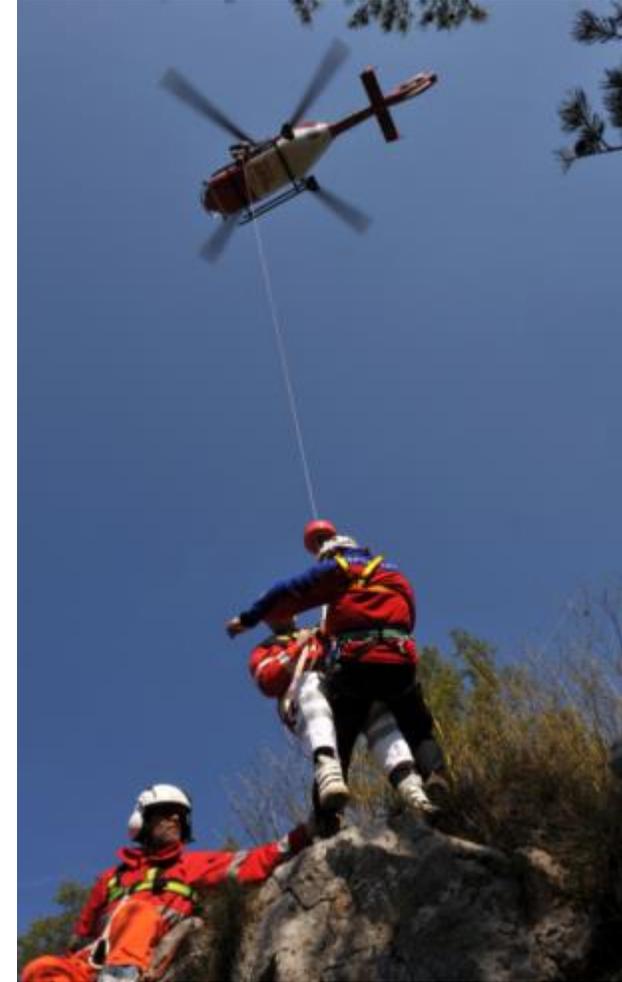
Hoist operator not secured in cabin → “confirm secured” question by PIC standardization / checklist “before hoist operation / opening of door” → four eye principle / **buddy check** as performed by scuba divers

Safety check prior to hoisting up



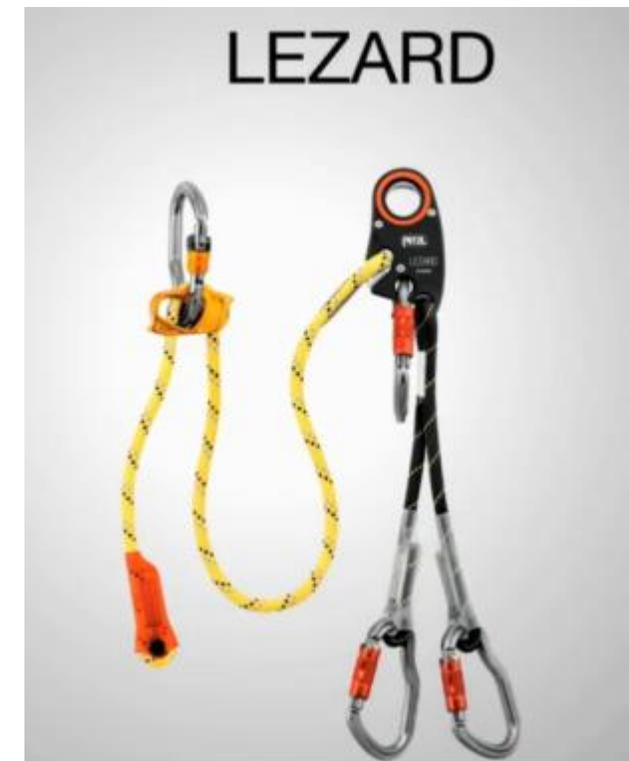
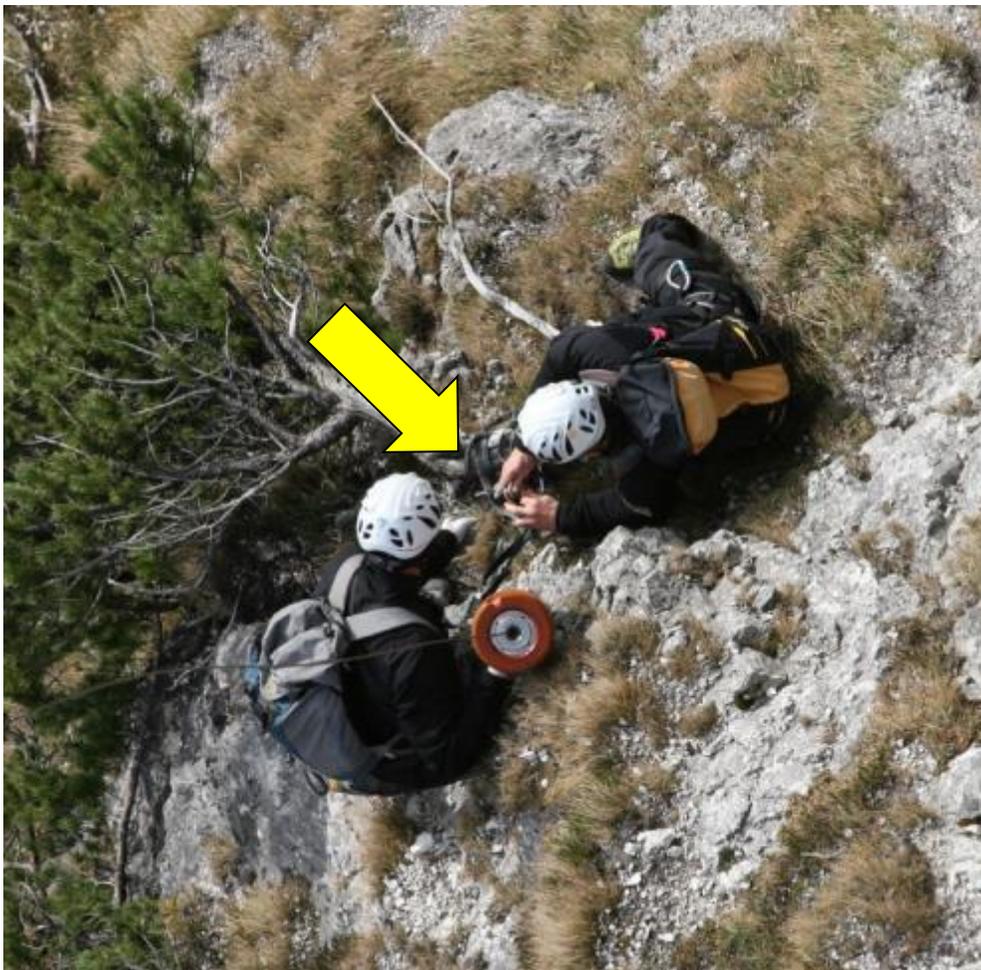
A safety check should be performed prior to the extraction of HEC. The aim of the safety check is to prevent entanglement unintended detachment during initial lift off (see D-LOK issue) by ensuring that the rigging and equipment has been checked and that the load is clear of obstructions. Once the pilot is satisfied that the check is complete, he is clear to depart the scene. The safety check shall prevent inadvertent entanglement / hooking of rescuer on alpinist securing harness, etc...

Shock Load on hoist cable and/or hoist passenger



Avoiding shock load is also a topic: either by falling into the rope or cable or by sustaining a rapid and uncontrolled departure

Helicopter attached to the ground



To prevent an entanglement where the helicopter is attached to the ground thru the rescuer, today specific device like the Norwegian ARS or the Petzl Lezard → Video [link](#)

Helicopter attached/tied to the ground, normal and emergency



Clear hand-signals to the hoist operator / flight crew when no radio communication available or possible and always maintain visual contact

Mission Briefing on the ground and in flight



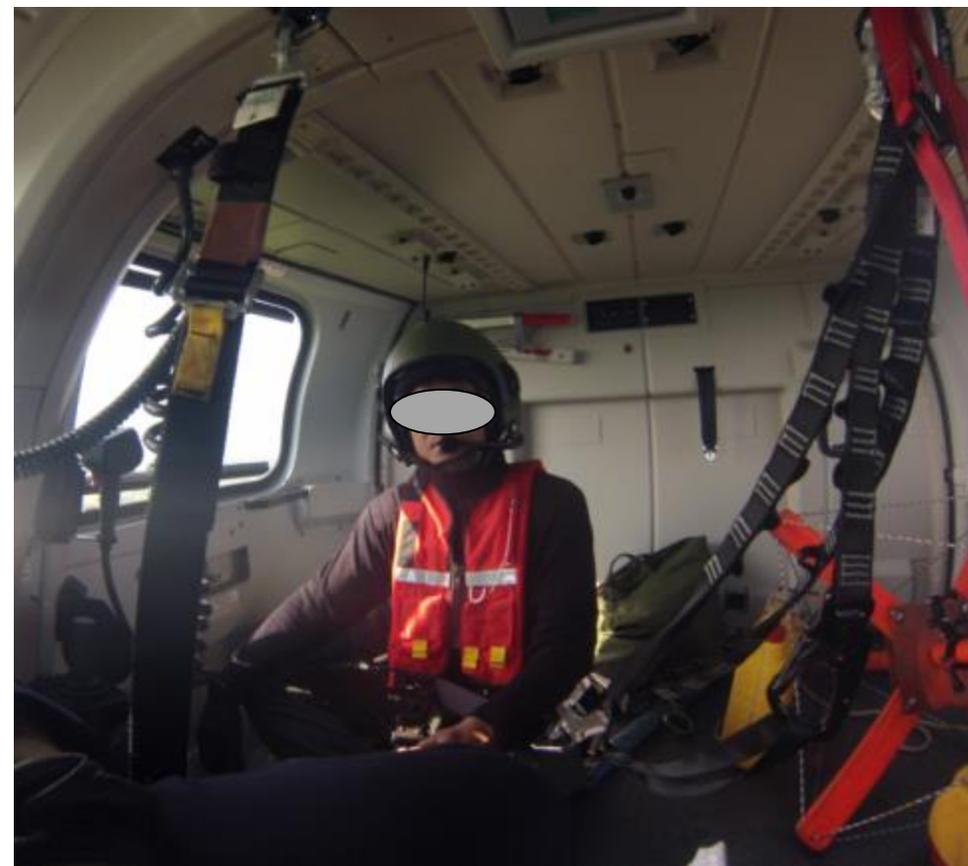
Lack of Mission Briefing concept → mitigation by simple questioning of crew member, such as: are we really going to location XYZ to motivate communication between crewmember to create situational awareness

Hoist Passenger training and briefing



Hoist Passenger training and briefing (no untrained / un-briefed personnel to be transported on the hoist hook) passenger check list for hoist operation, including cable handling to be made clear, such as: too much slack of cable to be avoided, “Danger of static electricity” and basics of the helicopter safety, performance, etc.

Cabin safety



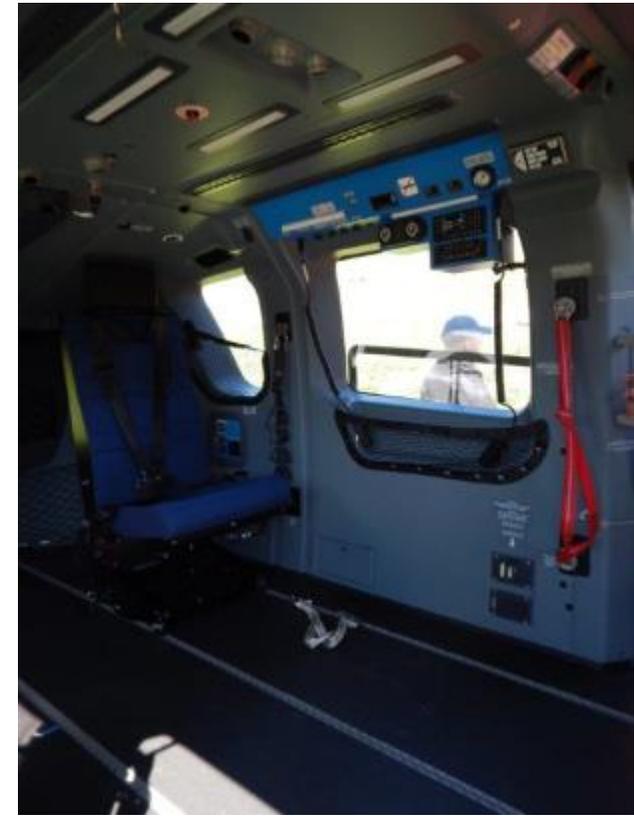
Cabin safety (non-secured jacket / backpack / loose equipment) → loose objects stowed & secured, seats to be taken by all passengers / crewmembers during T/O, Landing and flight and sliding door shall be closed whenever possible

Cabin safety



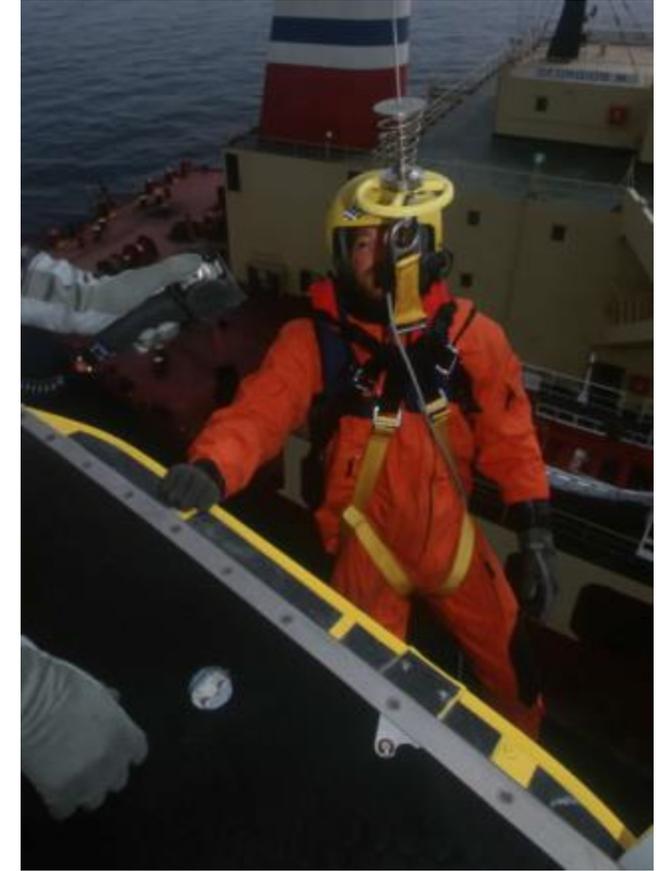
Cabin safety (non-secured jacket / backpack / lose equipment) → lose objects stowed & secured, seats to be taken by all passengers / crewmembers during T/O, Landing and flight and sliding door shall be closed whenever possible

Cabin safety



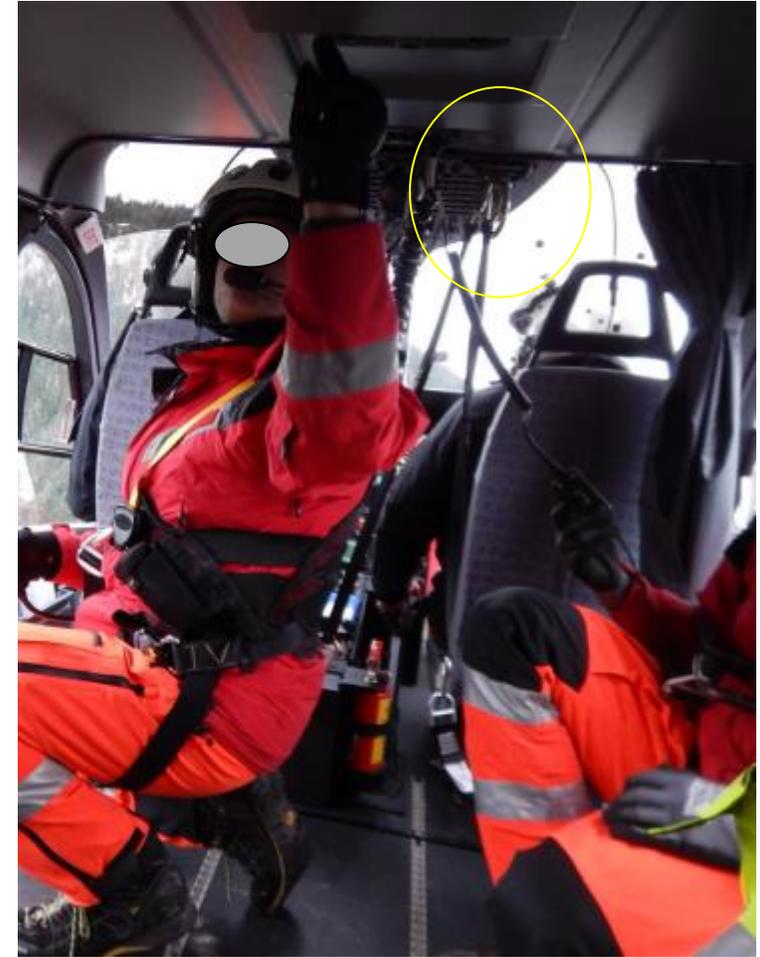
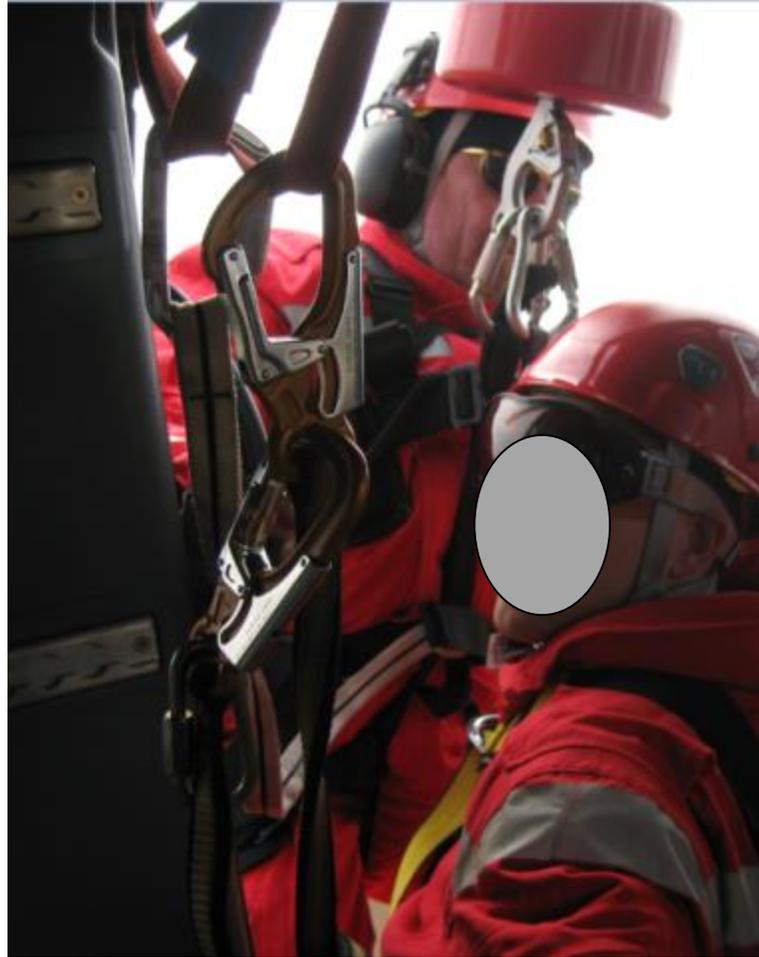
Minimum of additional mission equipment for flight crew → reduce to what is really essential / required to perform the mission, to avoid unnecessary items to be carried on the mission/ during this flight (not only for weight reduction)

Offshore Passenger Emergency Equipment Configuration



Incorrect Offshore Passenger Emergency Equipment Configuration, such as: wrong Vest, automatic life vest, wrong survival suit, too much lift/boost or automatic release (designed for vessel but utilized for helicopter transfer)

Cabin safety



Cabin safety: There is more than one hard (SAFETY POINT) point in the helicopter for the HO to attach his harness. In flight, prior to open the door, the cabin shall be secured and the HO harness shall be attached on one hard point and crosschecked by the other Crew Members.
ONE HARD POINT (SAFETY POINT) = ONE HARNESS ONLY

Pilot loss of visual reference



PIC loss of visual reference / HMD (helmet mounted display) / information overload – weight of information provided of PIC (fear of chime / Gong) → reduction of radio communication (temporary on hoist mission – info to ATC) Example for off-shore harbor pilot transfer: during vessel hoist maneuver: PF only Intercom and hoist commands vs. PNF ATC and vessel communications

Hoist not possible to reel in with HEC attached



Hoist not possible to reel in with HEC attached, crew not prepared/briefed for this incident (due to a technical failure of the hoist) → crew briefing to address this type of emergency to be prepared in case of hoist failure / alternate plan / missed approach

Grounding cable lost in operation due to incorrect sequence of attached hardware



Grounding cable lost in operation due to incorrect sequence of attached hardware → combination of used hardware to hook must match / use of appropriate hardware for this type of hook

Grounding cable lost



Grounding cable lost in operation due to entanglement with ground structure → use of appropriate equipment (anti-static line without weight) to prevent entanglement and a predetermined breaking point shall be existing

Uncontrolled rotation of passenger → video [link](#)



Uncontrolled rotation of passenger during hoisting up → mitigation: check of equipment / briefing - mostly vertical position, no heavy or large backpacks – eventually put in front and not on back / increase of forward speed of HC / critical cable length between 15 to 22 meter → avoid this cable length, either longer or shorter winch / personal position (“Scheißhocke” or toilet position) / potential rotational vertigo when spinning and potential risk drop / fall from height due to dizziness when set down in mountainous terrain → video [link](#)

With faster hoist cable speeds, critical cable length can be passed faster/safer – hydraulic (slower 0,9 m/s) vs. electric (1,25 m/s) (faster)

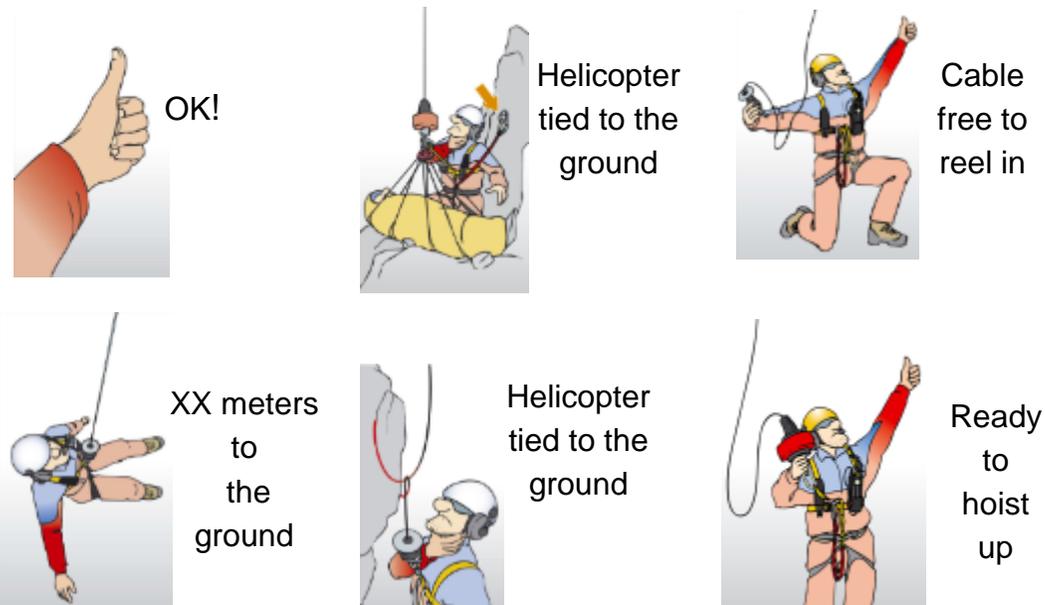
Use of anti-rotation line or rudder aerodynamic anti-torque system



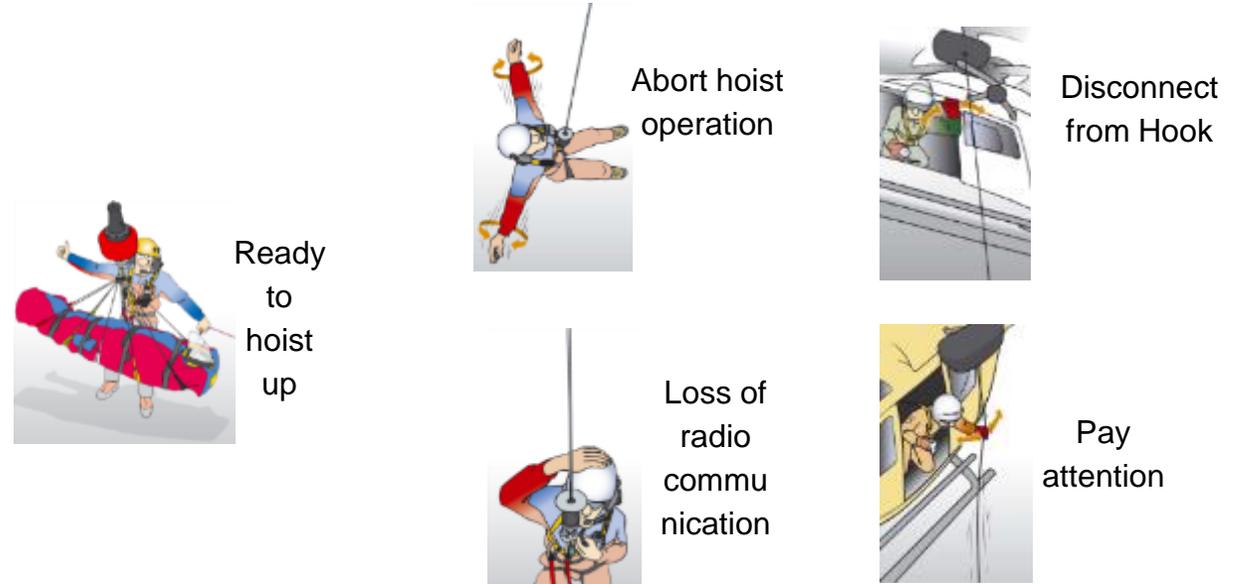
In the situation where a stretcher procedure is needed, an anti-rotation line system should be used, alternate means, such as aerodynamic type rudder → [video link](#)

Voice and visual commands for rescuer on the ground

Normal



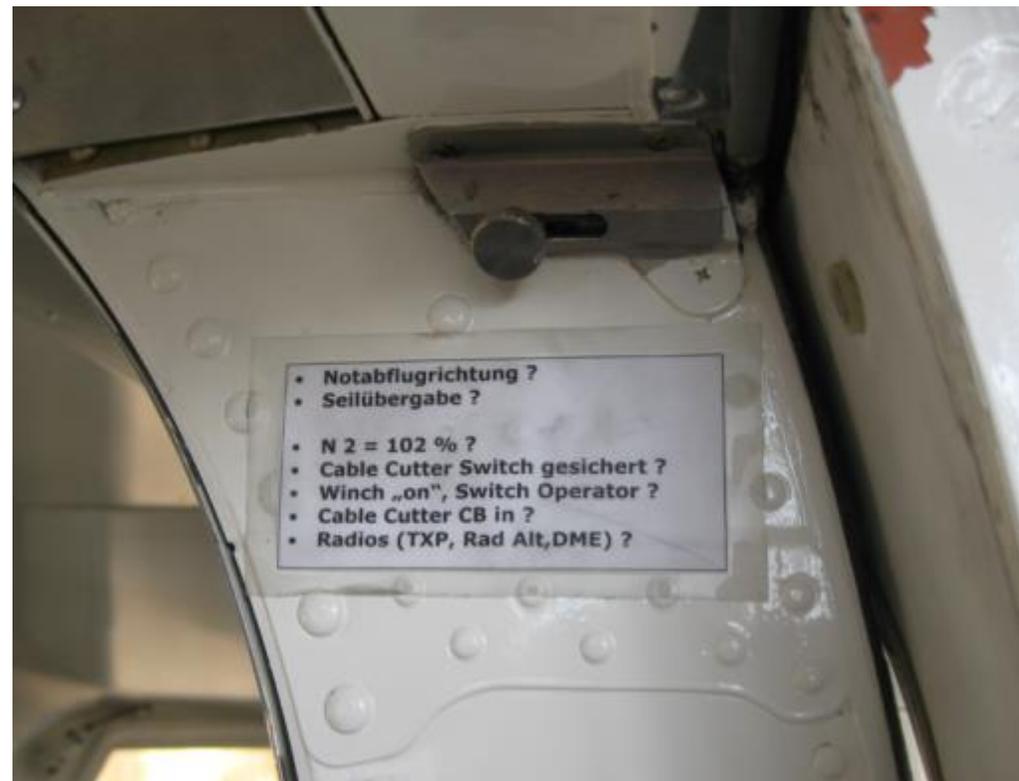
Emergency/abnormal



Voice and visual commands for all involved in the hoist operation must be clear, limited and standardized to provide essential and minimum information → to be intensively trained in initial training and re-trained at recurrent training.

CRM concept to be revised as CRM concept has been created for a cockpit of 2 or more crew (pilots, Flight Engineer and Navigator) as it did not take into account specific mission and crew involves in rescue, law enforcement and other missions. Writing a strong document related to the CRM in HEMS/HHO...is now a necessity. Not only should the hoist operator be involved but also the other crew member such as HEC.

Checklists



- Notabflugrichtung ?
- Seilübergabe ?
- N 2 = 102 % ?
- Cable Cutter Switch gesichert ?
- Winch „on“, Switch Operator ?
- Cable Cutter CB in ?
- Radios (TXP, Rad Alt,DME) ?

Establish short and pragmatic checklists to create operational & situational awareness

Standardized wording / commands for external loads

PCDS - Personnel Carrying Device System



PCDS for persons transported on the hoist hook to be standardized and no textile interfaces / loops allowed in hoist hook → CM CS 005 issue 1 / CS27 Amd.5 & CS29 Amd.5 to be enforced → link [here](#)

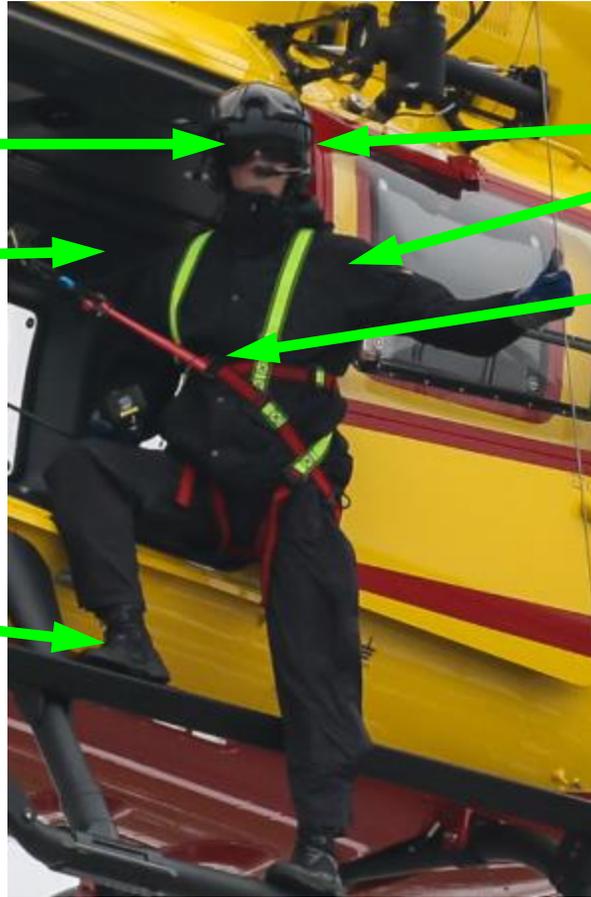
PSE - personal safety equipment for Hoist Operator

Appropriate head & eye protection,

flight or survival suit

Rescue / emergency knife

shoe's



Protection against environmental conditions, wind, rain, dust, particles, water, etc.

PCDS with quick disconnect link



The PPE shall be standardized also other personnel than HO, including the hoisting gloves. The Hoist Operator harness should be provided generally with a quick release system to be able to detach and escape the cabin even under load conditions on the harness → quick mitigation to equip passengers with rescue knife

PSE - personal safety equipment for rescuer / Hoist Passenger

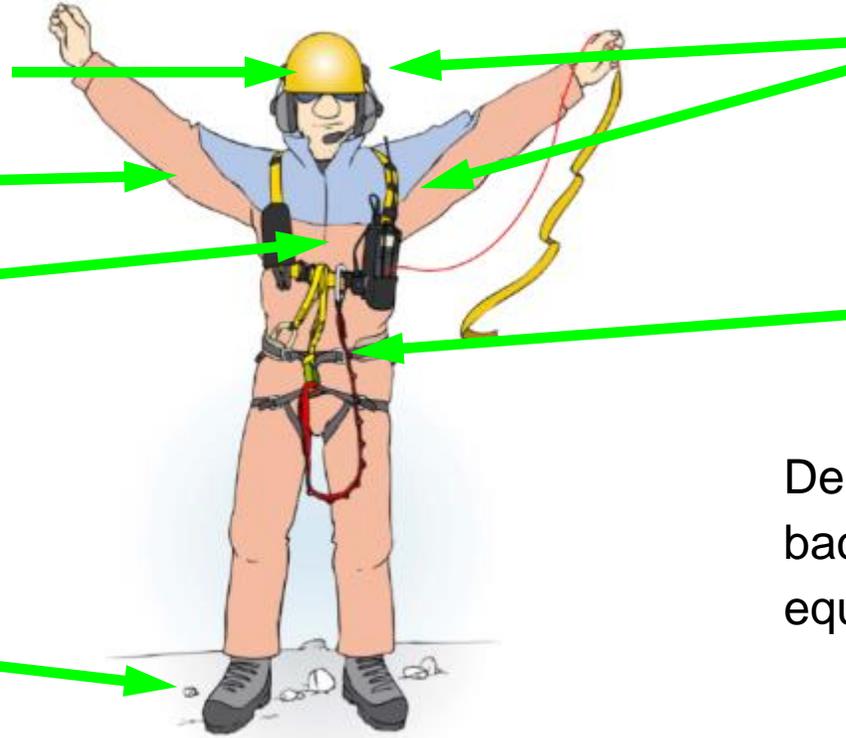
Appropriate head and eye protection

Flight or survival suit

Radio equipment

Rescue / emergency knife

Shoe's



Protection against environmental conditions, wind, rain, dust, particles, water, etc.

PCDS

Depending on the mission: backpack with specific mission equipment...

Not appropriate PSE (personal safety equipment), hoist operator not wearing appropriate protection, such as flight suit, helmet, shoes, survival suit, etc., no standardization of PCDS. The PPE shall be standardized also other personnel than HO, including the hoisting gloves. The Hoist passenger cabin securing harness for off shore POS should be also provided with a quick release system to be able to detach and escape the cabin even under load conditions on the harness → quick mitigation to equip passengers with rescue knife

PSE - personal safety equipment for victim



Rescue Stretcher / Bag



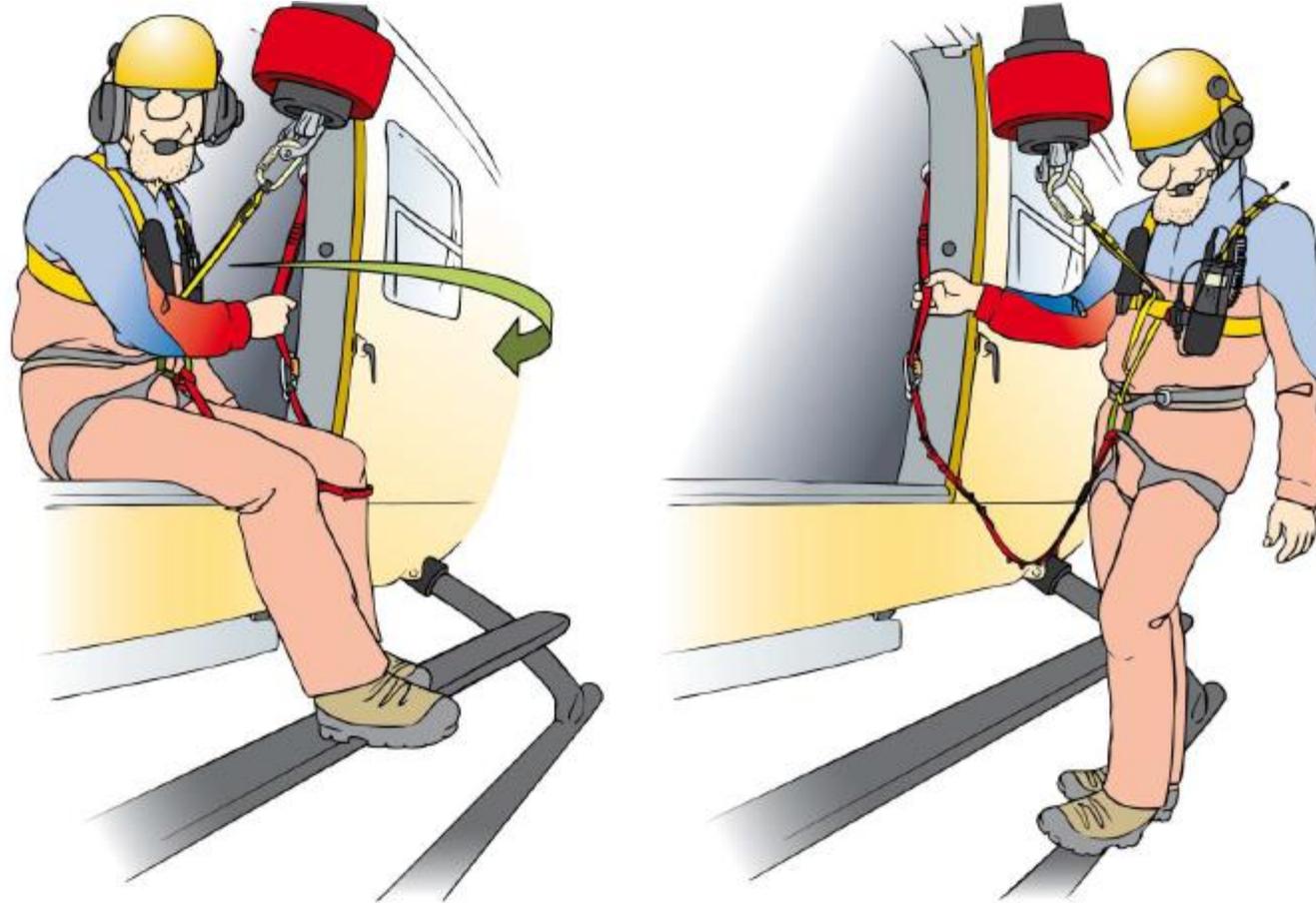
Rescue Triangle



Rescue Sling – mainly for water rescue – with potential risk of loss of load and NOT recommended for HEC

Rescue equipment for victims to be standardized within organizations, to ensure safe, quick and easy application to the person being hoisted. General recommendation: no untrained (or incapacitated / unconscious) persons to be hoisted unattended.

Standardized motion sequence during boarding and disembarking



Motion sequence during boarding and disembarking has to be standardized in SOP's, equipment (backpack, ski, dog, etc.) must be secured and sequence of loading in advance clear and briefed to avoid entanglement, confusion and potential loss of load

Reconnaissance fly-over



Reconnaissance fly-over before initiation of hoist operation to evaluate terrain, wind, visibility, briefing of hoist operation, e.g. power setting, emergencies and escape path, alternate, etc. No hoist ops should be performed without a situation assessment before to be committed in hover. A high reconnaissance fly-over in order to understand the operating zone (wind, main obstacles as Powerlines, High threes, animals or crowd on ground etc., Way in, way out/ Escape route, clearance to descend), a low recce to understand the hoisting area and confirmed A/C performances, winching height, escape route

Persons on the ground



Do not rely solely on persons on the ground providing information (wind, clearance of landing / operation area, etc.) as they may not be experienced / trained enough → to be confirmed by the flight crew during the situation assessment/ reconnaissance fly-over

Untrained persons (by-standers) approaching a helicopter



Untrained persons (by-standers) approaching a helicopter with engines on and rotor turning, may have less useful awareness / consciousness

Guard/escort hoist passengers when possible - (similar to operations at public heliports)

Helicopter configuration not correctly tracked in IT system



Helicopter configuration not correctly tracked in IT system – mission planning not correctly to be performed , but no safety impact

Off-shore hoisting - cabin securing devices shall be capable to be releasable under load



For off-shore OPS, cabin securing devices shall be capable to be releasable under load (e.g. after ditching and under water) may also be considered in OPS regulations. Alternatively, a rescue knife / belt cutter may be used

Hoist Operator positioning in helicopter (with wheel landing gear)



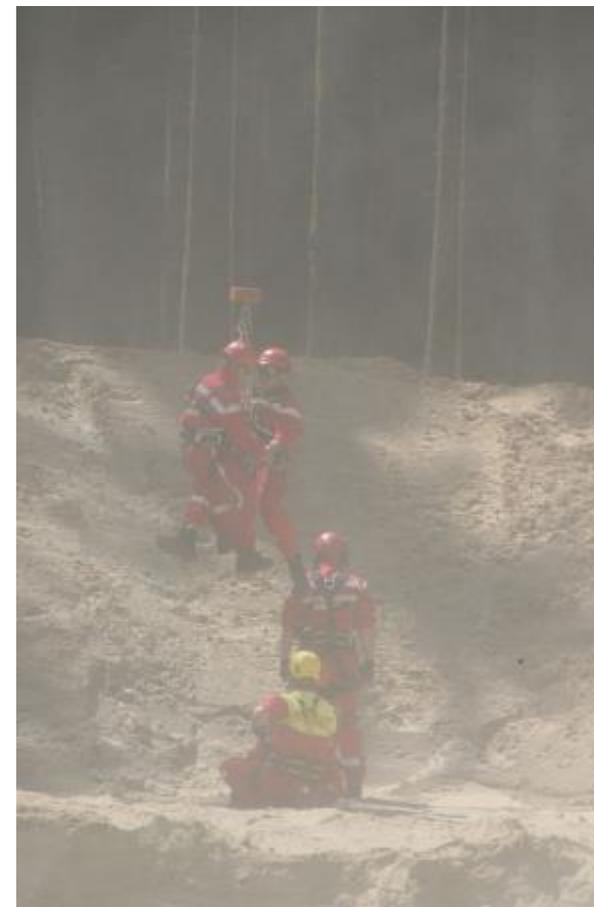
Hoist Operator positioning: HO shall not have the full body outside the cabin with the two feet on the footstep. Also the Lanyard of the HO harness must be set to avoid the HO to fall outside the cabin. The best positions are for helicopter with retractable landing gear (and no articulating boom): one knee (or foot on the cabin floor and one foot on the step; or two knees (or feet) on the cabin floor

Hoist Operator positioning outside helicopter (with skid landing gear)



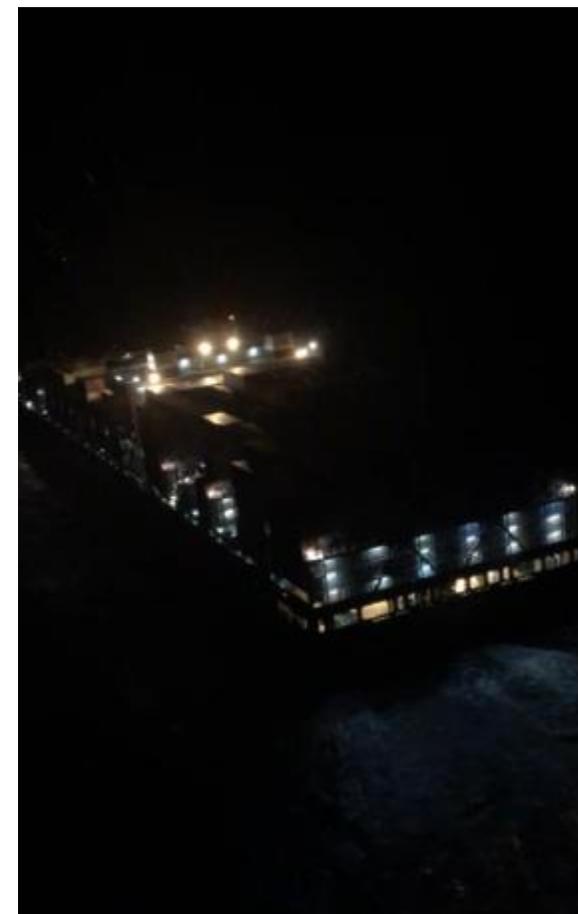
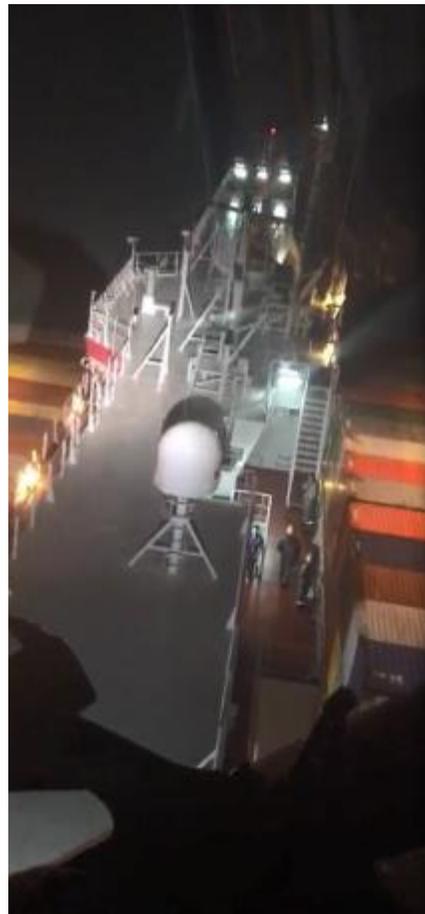
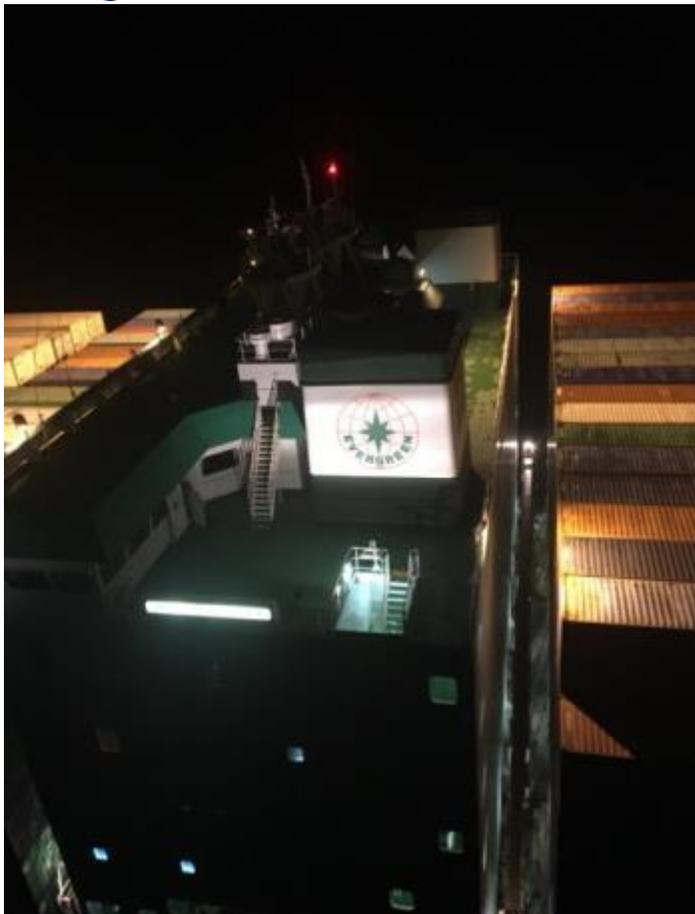
For aircrafts with skids (and an articulating boom), it is possible to have the two feet outside the cabin using a step designed for these types of operations.

Hoist maneuvers at night on shore



For hoist maneuvers at night on shore: in an environment with limited visual reference for the flight crew (e.g. mountainous terrain with no light pollution – extreme darkness, snowing weather conditions, etc.) → to be performed with helicopter autopilot in automatic mode of flight director position, hold/auto hover, where available

Hoist maneuvers at night off shore



For hoist maneuvers at night off shore: in extreme dark environment with limited visual reference for the flight crew (as off shore and only illumination of the vessel) → highly skilled and trained flight crew necessary, as helicopter autopilot in automatic mode of flight director position, attitude and altitude hold/auto hover is nor able to use the ship as reference due to relative track & motion

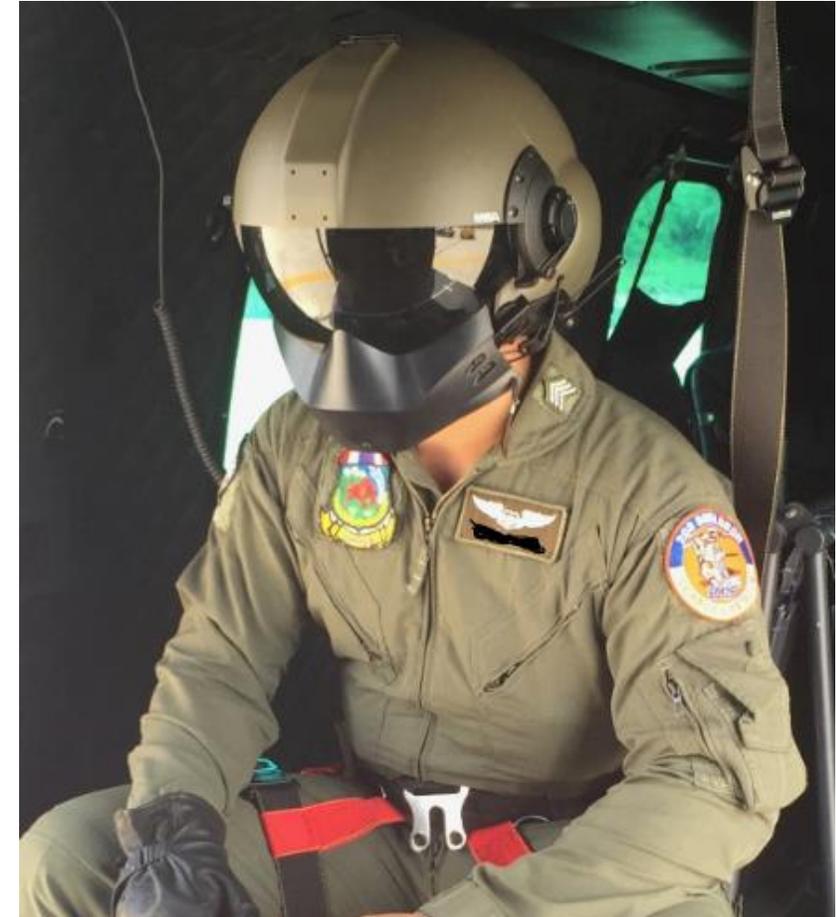
Night Hoist operations white light vs. NVG



Night Hoist operations - ground scene illumination insufficient. Most on board search lights are not enough to illuminate the hoist mission area. Potentially a tactical high intensity light such as Trakka may be used to increase visibility for helicopter crew.

Rescuer on hoist is unable to see hand signal from the Hoist Operator due to the light beam under the fuselage. Standardization or lighting signals, to be introduced / developed for normal, abnormal and emergency procedures for hoist operations in case of loss of radio communications. Hoist operations under NVG conditions – special training necessary and proficiency has to be demonstrated to remain current / mission ready

Background Wind Noise in Intercom



Due to strong winds hot mic is open of hoist operator and communication / commands hard to understand → Standard wording for commands and wind deflector or full face mask for intercom microphone

Training – theoretical and operational



Hoist operator basic requirements / assessment / qualification / certification → AOC to reflect qualification procedure / syllabus

Initial, Proficiency / recurrent check concept NORM & EMERG procedures → informational briefing of FLM, regulations, organizational, equipment, etc. changes (classroom & operational tasks)

Training – theoretical and operational



Annual proficiency / recurrent check concept NORM & EMERG procedures → informational briefing of FLM, regulations, organizational, equipment, etc. changes (classroom & operational tasks)

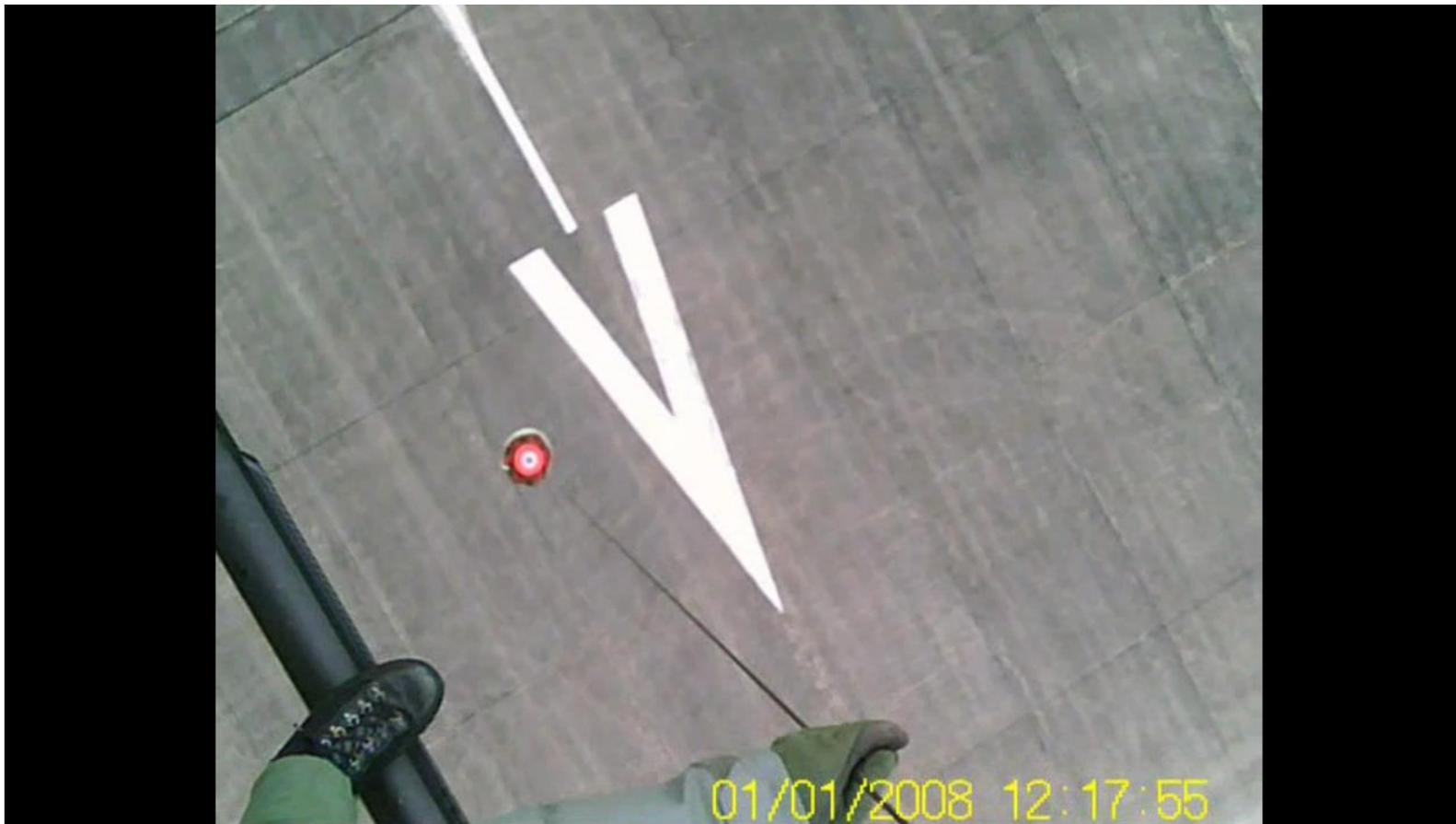
Emergency training concept



Emergency training concept, all EMERGENCY scenarios to be trained under real conditions, e.g. OEI training → awareness of potential risks such as height loss, pendulum, loss of intercom & radio etc. and to be performed under “safe” conditions

- Training objectives should include A/C performances (OEI consideration), action in case of fly away etc....
- Operators with multiple platforms and potential risk of lack of knowledge or familiarity of control panel location in cabin
- Training concept of pilot and hoist operator training / combined (at the same time) not ideal, as two newcomers are trained at the same time → mitigation by splitting the trainings

Emergency training concept



OEI training → awareness of potential risks such as height loss, pendulum, etc. and to be performed under “safe” conditions
Training objectives should include A/C performances (OEI consideration), action in case of fly away etc....

Cable Handling procedures



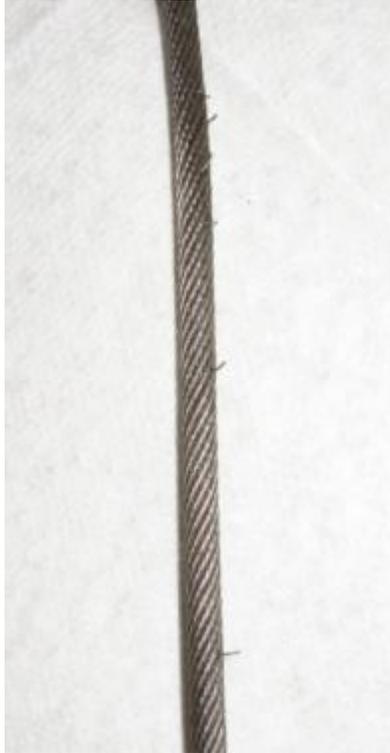
Cable Handling procedures to avoid

- severe hook damper oscillations → to keep the hand always on the cable and be aware that during reeling in, the shorter the cable, pendulum angle, frequency / oscillation will increase
- Load rotation on the hook → increase helicopter forward speed as soon as flight path is free of obstacles → flight crews are often not aware due to high workload

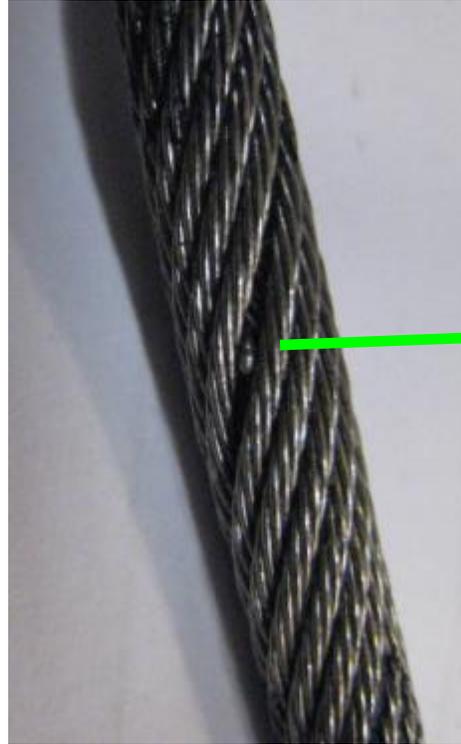
Cable damages during hoist operation



Birdcaging



Severe Abrasion



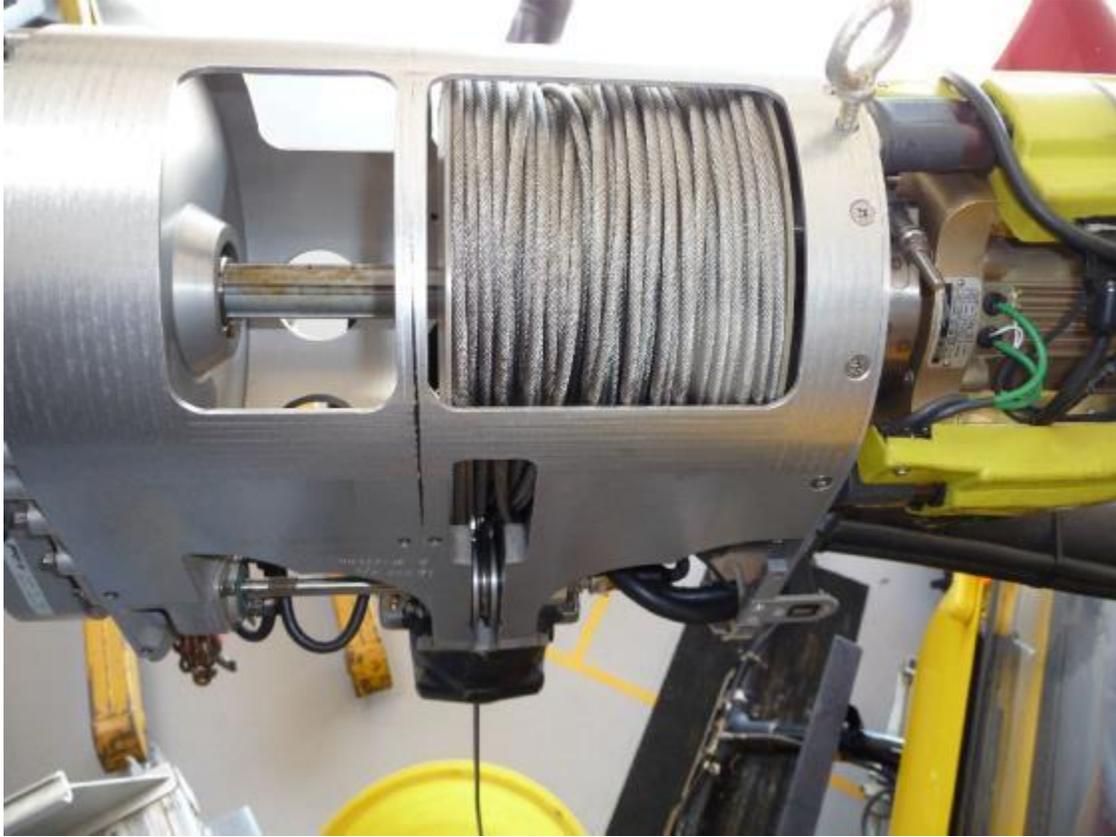
Shock Load



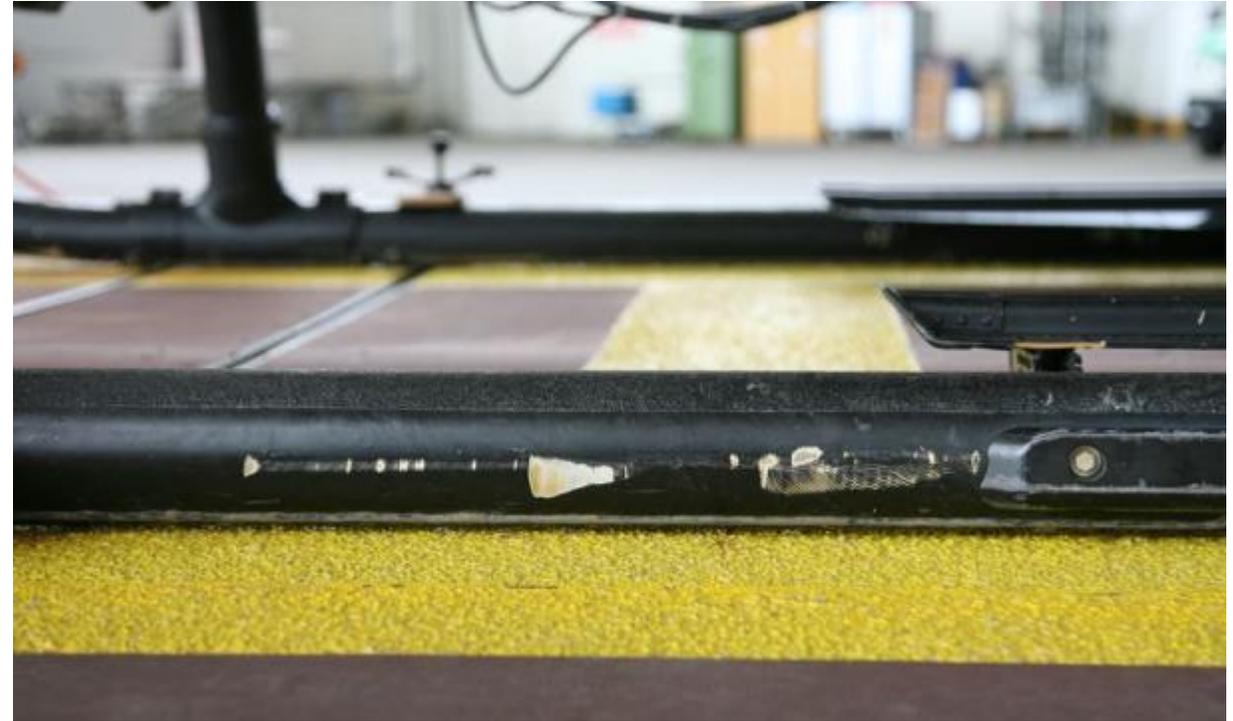
Kink

Training of hoist operator of hoist cable damages during hoist operation to avoid potential loss of load and substantial damage of equipment

Cable damages during hoist operation



Cable Misswrap



Cable Chafing on Landing Gear Skid Tube

Training of hoist operator of hoist cable damages during hoist operation to avoid potential loss of load and substantial damage of equipment and awareness of hoist operator of basic hoist technical theory to better understand consequences in a case of hoist emergency or malfunction

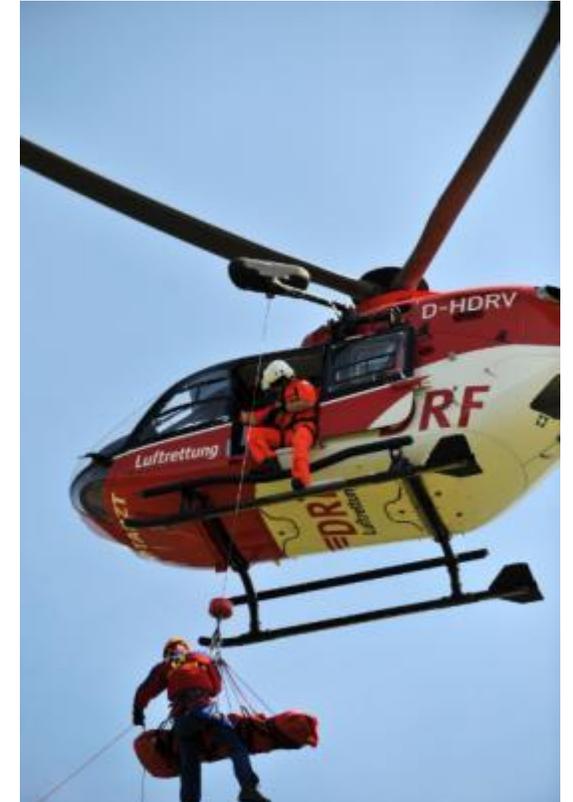
Normal procedure training with HEC



Normal procedures also to be trained with trained human cargo (personnel) to ensure situational awareness of hoist operator

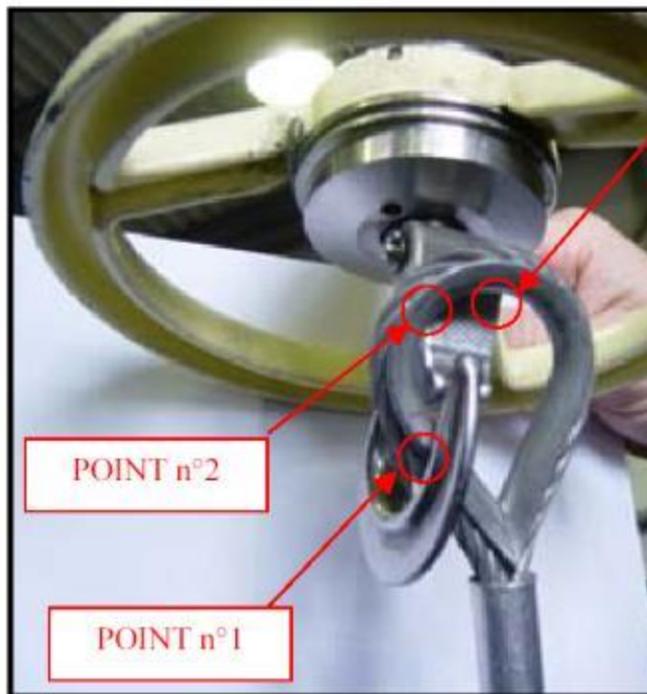
Also pilots to be trained / attached on the hoist hook (not as pilot) to improve many aspect of the hoist operations including crew coordination...and by the way, rescue dogs shall wear a muzzle (dog biting protection) → painful experience

Training cooperation of various hoist operators /organizations



Training cooperation of various hoist operators /organizations with rescuers / ground forces with the hoist to be done to work together and applying standardized procedures

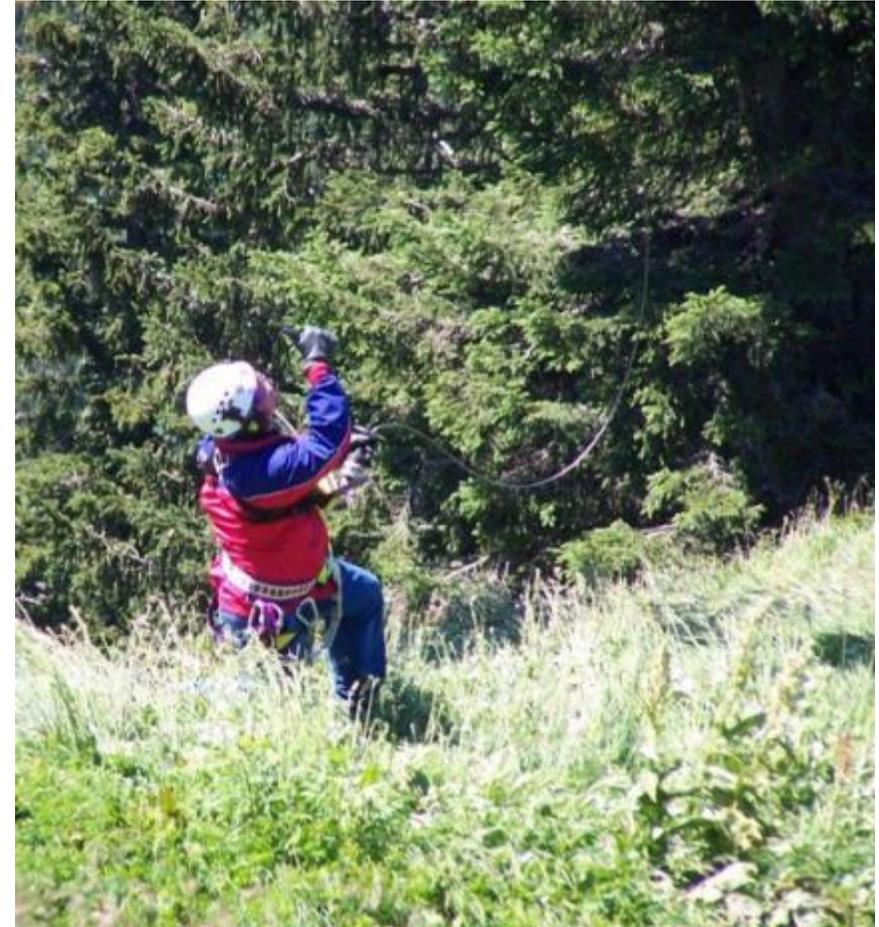
Dynamic rollout phenomena on hoist hooks



Video link → [here](#)

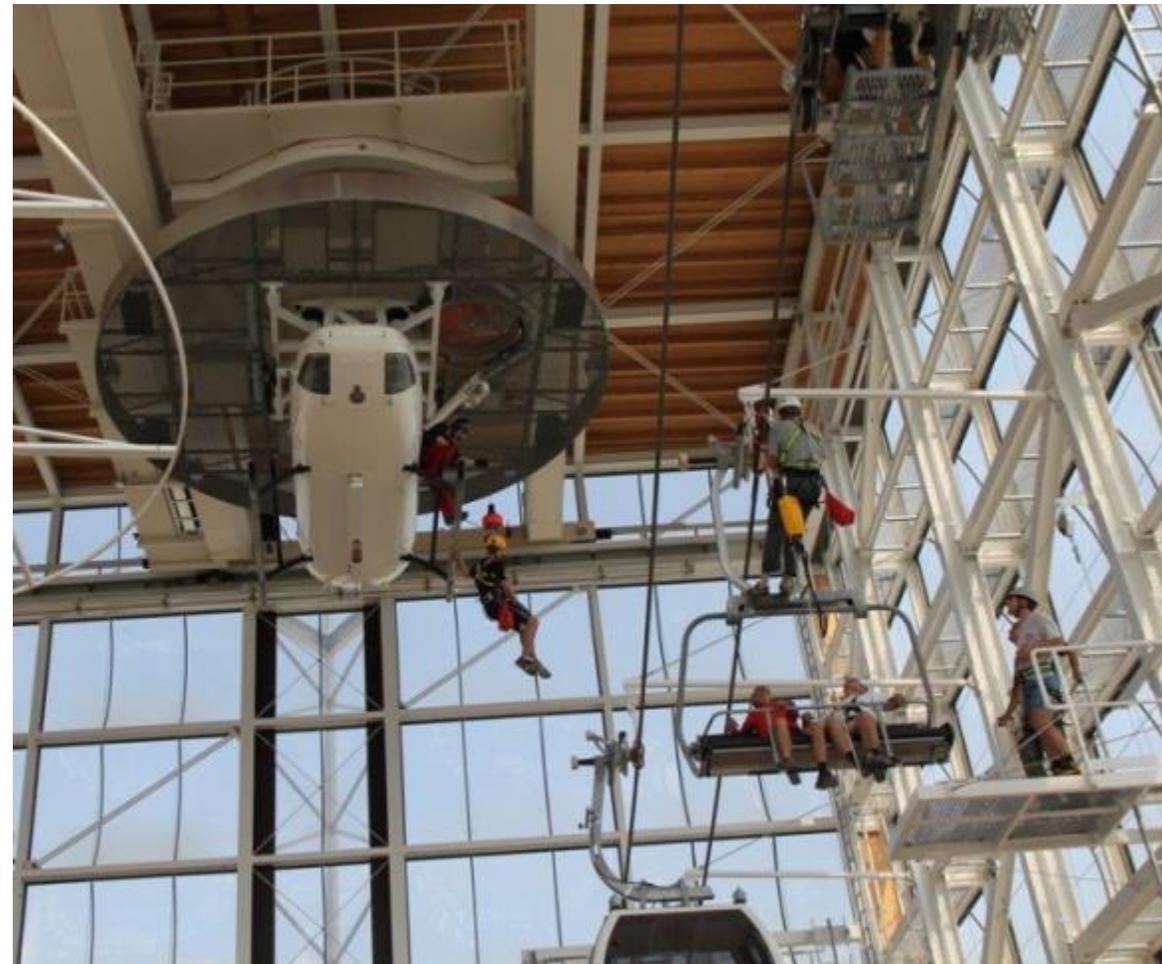
All crew members involved in hoist and/or external sling load operation shall be attentive to the dynamic rollout (ring reversal) phenomenon → hook and equipment shall be checked for compatibility

Training of slack of cable management



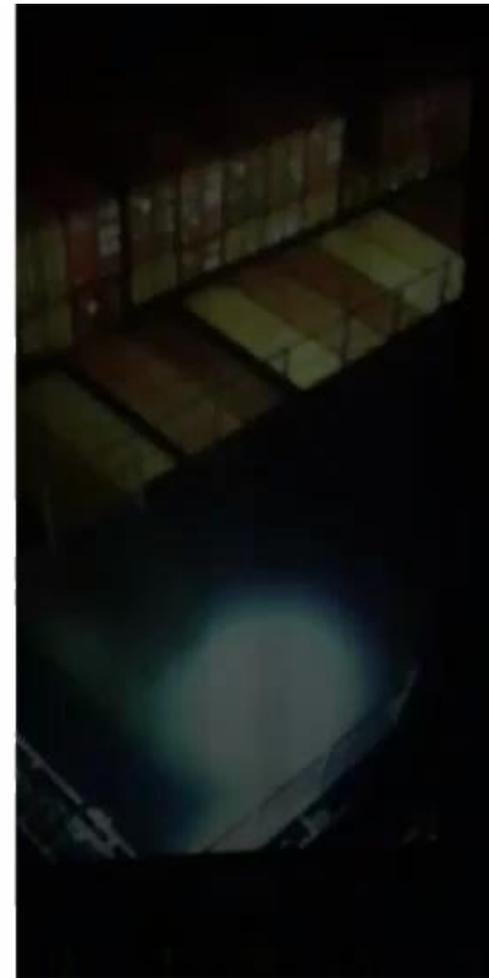
Promote the slack of cable management during training. The Hoist Operator must be trained on how to manage the quantity of cable reeling out/in when load may be attached to the ground or the hook lowered to a rolling / unsteady target / ship

Recurrence training on synthetic flight trainer



Annual recurrence training: crew to receive training in simulator or similar device to reproduce various kind of emergencies

Night hoist Operations Training



For Night hoist Operations: pilots and crew member need to be trained constantly using manually techniques (hands on flying) and automatic mode (helicopter autopilot in automatic mode of flight director hold/auto hover)
Radio communication between hoist operator / flight crew and hoist passenger / ground crew shall be mandatory for night hoisting operations, as hoist passenger / ground crew may not be able to see hoist operator when search lights from helicopter illuminating the scene – may be different for off-shore harbor pilot transfers, when vessel is illuminated

Dry Ground PCDS / PSE Training



Ground training for hoist operator and passenger frequently to be performed / briefed

SAR-Training „Training for the unexpected“

“In the rescue-business it is important to note, that no matter how long a course, we can never train for every eventuality. The training philosophy shouldn't be to give students a quick and shallow look at numerous scenarios, but to instill them into the basic skills which, combined with experience, can be used to solve every challenge they will encounter.”

Testemorial of Klaus Hopf, Bavarian Police Helicopter Sqd.

Content

Helicopter Hoist History / Mission Evolution

Operations and Training Risks and Mitigations

Regulatory Developments addressing Design

Maintenance and Training Risks and Mitigations

Regulatory Developments addressing Design

Presented by Lionel Tauszig / EASA – Project Certification Manager - Rotorcraft

Content

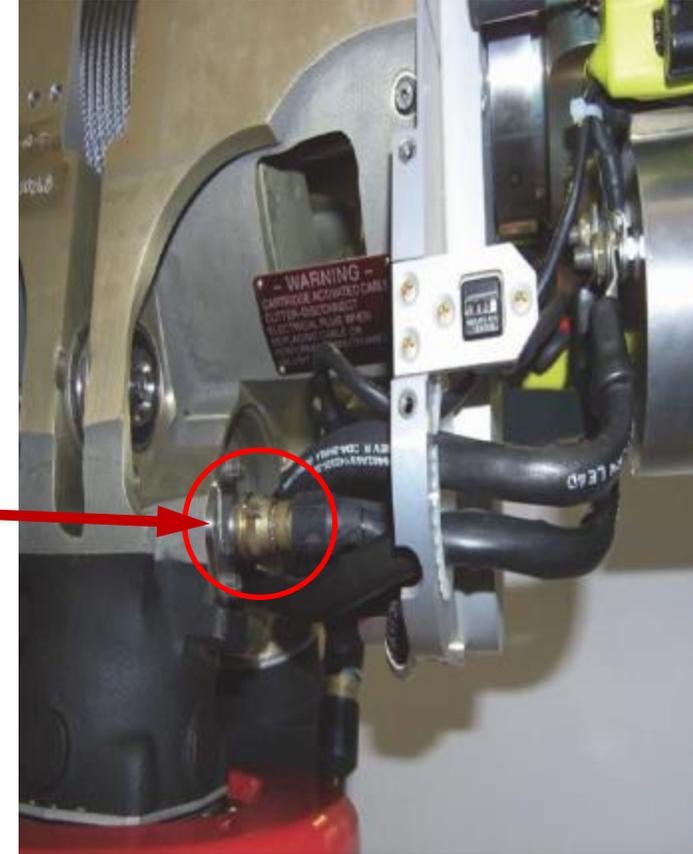
Helicopter Hoist History / Mission Evolution

Operations and Training Risks and Mitigations

Regulatory Developments addressing Design

Maintenance and Training Risks and Mitigations

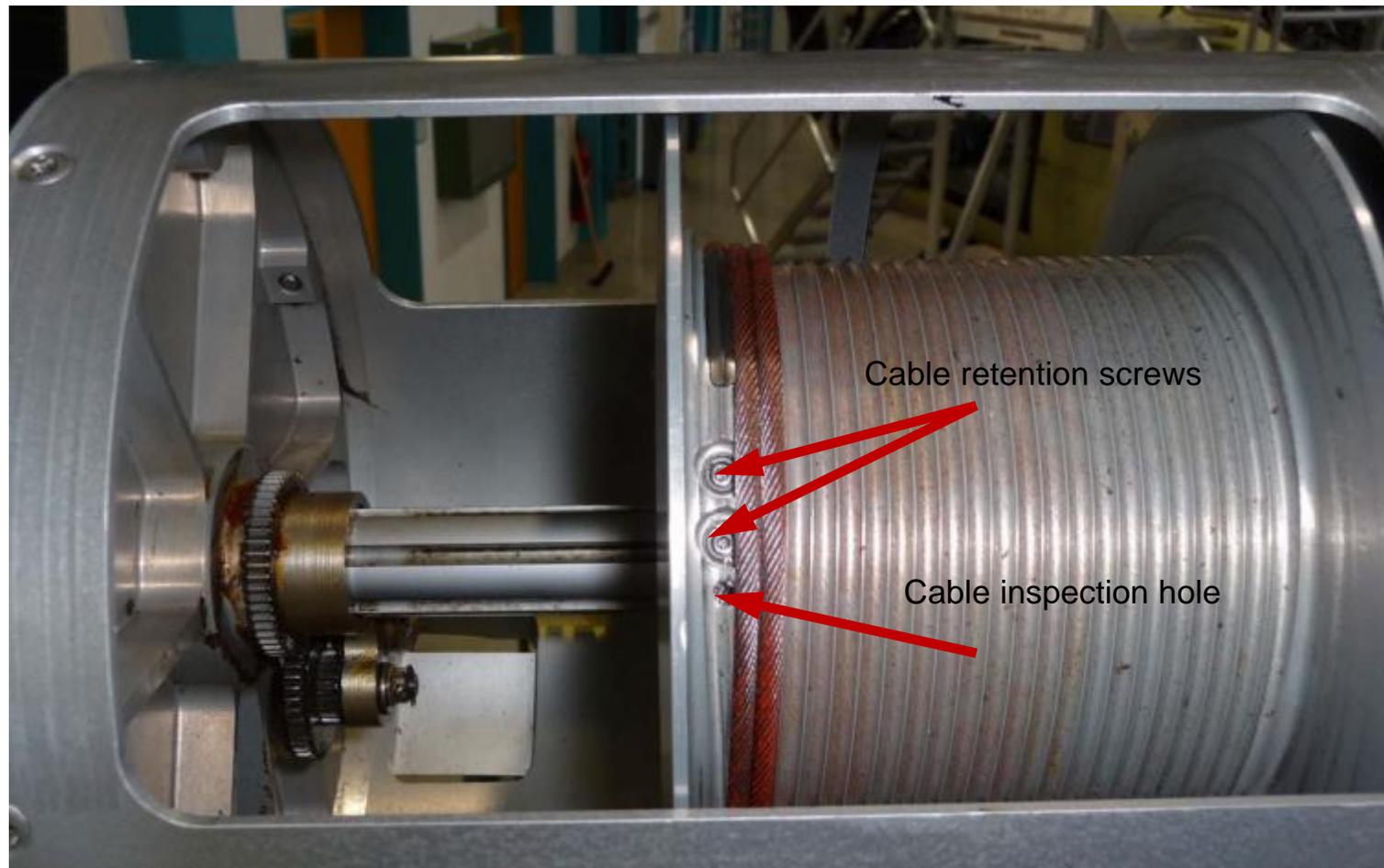
Maintenance Procedures not applied as per documentation



Maintenance procedures not correctly applied, e.g. pyrotechnic cartridge not installed → dual inspection to be performed

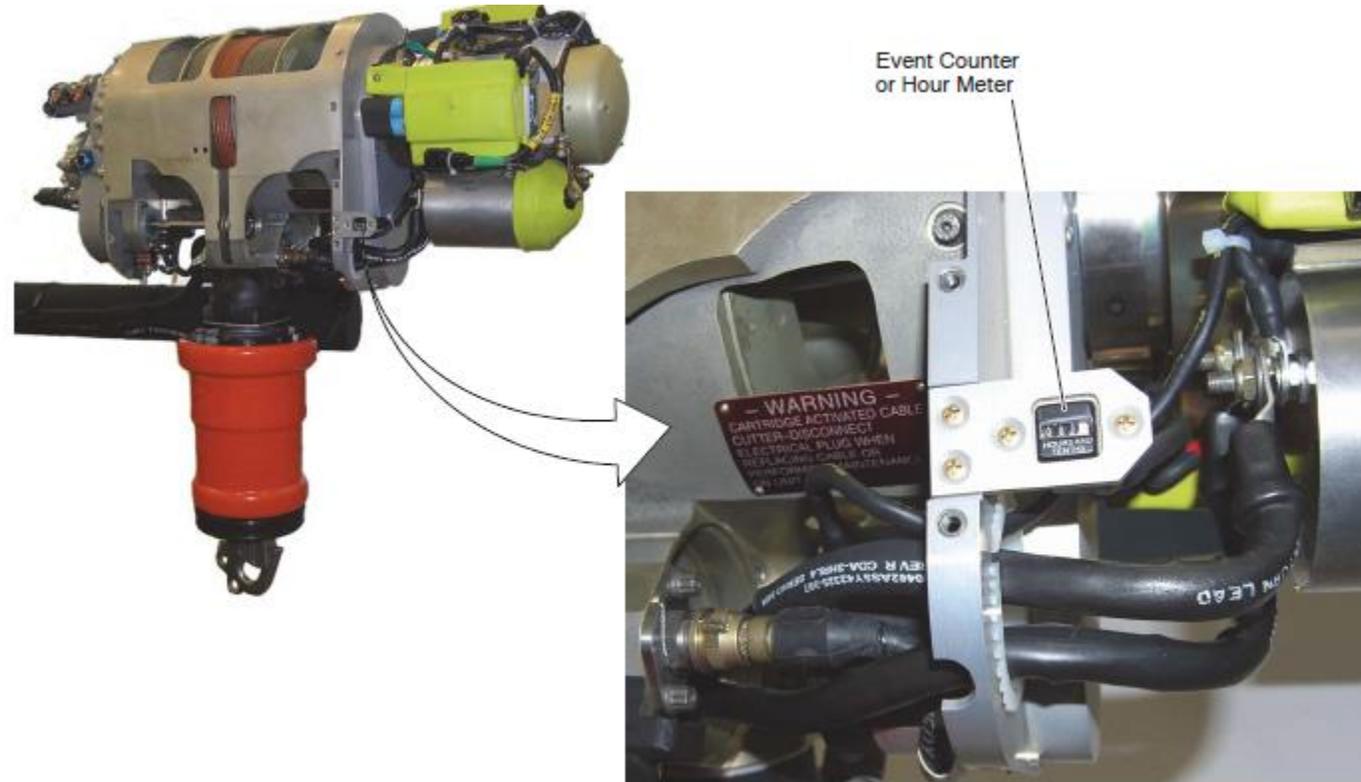
Maintaining the hoist equipment requires the same safety, quality, training, tools, etc. as working on main rotor blades, engines, etc.

Critical tasks / maintenance procedures in the hoist load path



Critical tasks during servicing / maintenance / repair to be performed with four eye principle, e.g. hoist cable change, micro-switch setting, etc.

Hoist usage (hrs / cycles) information not correctly tracked



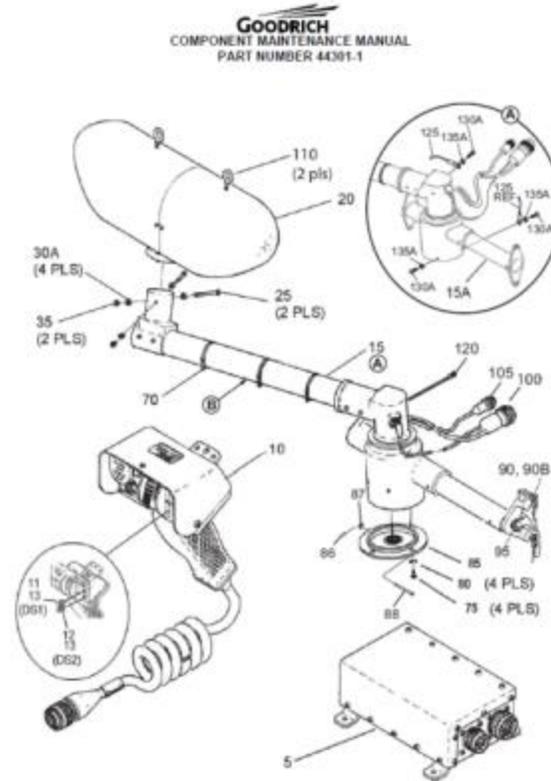
Hoist usage (hrs / cycles) information not well monitored by flight crew, maintenance staff and not correctly tracked in IT system – mission planning could not performed well, no safety impact → stick to procedures and live the processes, besides the requirement of the regulations

Hoist maintenance training



Maintenance training shall be mandatory – and: it's fun!

Awareness of approved configuration of sub systems, such as boom, hook, etc.



GOODRICH
COMPONENT MAINTENANCE MANUAL
PART NUMBER 44301-1

FIG. ITEM NO.	PART NUMBER	AIRLINE STOCK NUMBER	NOMENCLATURE							EFF CODE	UNITS PER ASSY
			1	2	3	4	5	6	7		
PL T											
-1	44301-1-1		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							A	RF
R -1A	44301-1-2		HOIST SYSTEM, EXTERNAL MOUNTED (BK117C2/BK117D2)							B	RF
-1B	44301-1-3		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							C	RF
-1C	44301-1-4		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							D	RF
R -1D	44301-1-5		HOIST SYSTEM, EXTERNAL MOUNTED (BK117C2/BK117D2)							E	RF
-1E	44301-1-12		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							F	RF
-1F	44301-1-14		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							G	RF
R -1G	44301-1-10		HOIST SYSTEM, EXTERNAL MOUNTED (BK117C2/BK117D2)							H	RF
R -1H	44301-1-11		HOIST SYSTEM, EXTERNAL MOUNTED (BK117C2/BK117D2)							J	RF
R -1J	44301-1-15		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							K	RF
R -1K	44301-1-17		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							L	RF
R -1L	44301-1-18		HOIST SYSTEM, EXTERNAL MOUNTED (EC135)							M	RF
R 5	44301-700		. JUNCTION BOX ASSEMBLY (PRE-SB 44301-700-05)								1
R -5A	44301-700-1		. JUNCTION BOX ASSEMBLY (POST-SB 44301-700-05)								1
R 10	44301-720		. CONTROL PENDANT ASSEMBLY							A-G, K, L, M	1
R -10A	44301-721		. CONTROL PENDANT ASSEMBLY							H, J	1
R 11	102-STD-A		. . LENS, AMBER (DS1) (V08717) (USE WITH ITEM 10 ONLY)							A-G, K, L, M	1
R 12	102-STD-R		. . LENS, RED (DS2) (V08717) (USE WITH ITEM 10 ONLY)							A-G, K, L, M	1
R 13	FB59		. . LAMP (V08717) (USE WITH ITEM 10 ONLY)							A-G, K, L, M	2
R 15	44301-500		. BOOM AND SUPPORT ASSEMBLY							A	1

- ITEM NOT ILLUSTRATED

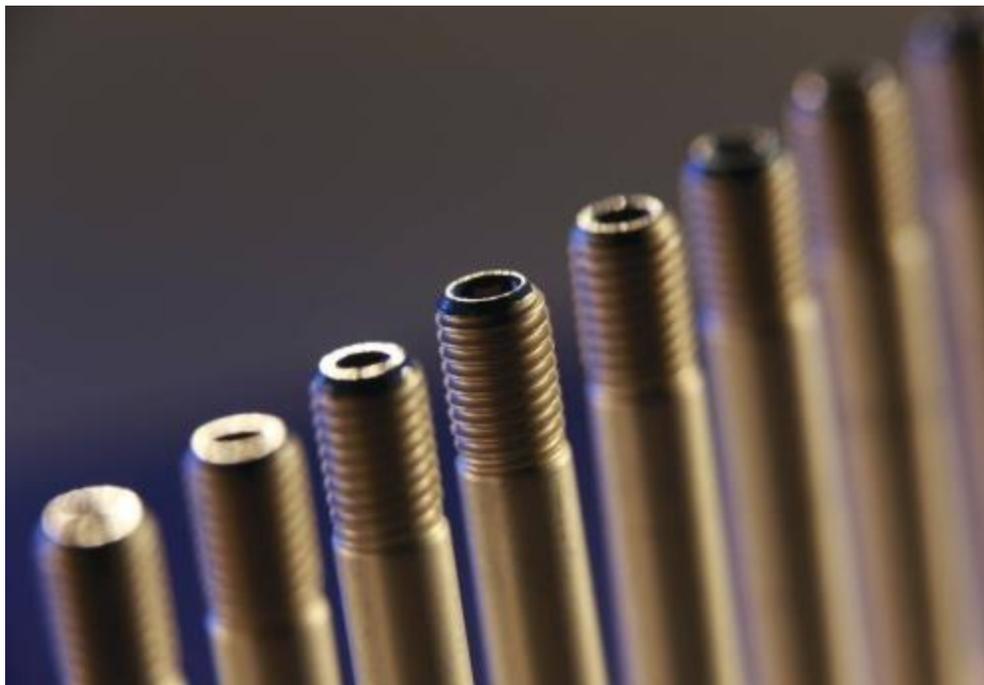
If you are not sure about the configuration – ask your OEM or TechRep for clarification!

Hoist Tools and Ground Support Equipment



Dedicated ground support equipment shall be available by the OEM to ensure correct application of maintenance procedures

Spares, Technical Support and MRO



OEM shall have outstanding AOG spares service, technical & logistical single point of contact, industry leading quality, reliable / fixed turnaround times, rental- / exchange units pool

Spares, Technical Support and MRO



A minimum spares kit for operators starting the hoist operation, shall be available by the OEM

The rescue hoist was intended to save and rescue life's and had developed new fields of operation/missions.

All who work on and with the hoist, shall have **full awareness** of potential hazards caused by non-complying with regulations, procedures, recommendations, lack of communication, (etc.) which may lead to injuries and loss of life.

Interactive session

Where do we go from here?

Do you agree with the content?

Do you have any comments?

Can you share your best practice with us?

What is your expectation?

What do you think is the best way to spread the information?

...any further questions or input?



Thank you, for helping us to
increase safety on hoist operations

alexander.weissenboeck@airbus.com

Mobile: +49 151 171 26085

Photo and Illustration Credits by: Klaus Hopf, Karl Mueller, Airbus Photo Library, Rupert Gleissl, Christian Keller, Bernd Wuestenbecker, Bergwacht Bayern, WIKING Helikopter, DRF, ADAC, Goodrich