

HELICOPTERS

Human and Non Human External Cargo

Cargo Hook System and Fast Rope System

M. Behrens
04th and 05th December 2018

AIRBUS

Regulations baseline

Overview

Airworthiness Requirements

<p>CS* Certification Specification for https://www.easa.europa.eu/regulations</p>	<p>27 Small Rotorcraft</p>	<p>Europe</p>
	<p>29 Large Rotorcraft (> 3175 kg)</p>	
<p>FAR* Federal Aviation Requirements for</p>	<p>27 Small Rotorcraft</p>	<p>USA</p>
	<p>29 Large Rotorcraft (> 3175 kg)</p>	

*Advisory Circular (AC)
 Provides acceptable means of compliance for the different requirements out of the FAR and CS.



PDF-Datei

Acceptable means of compliance specially for the external loads are defined under § 27/29.865

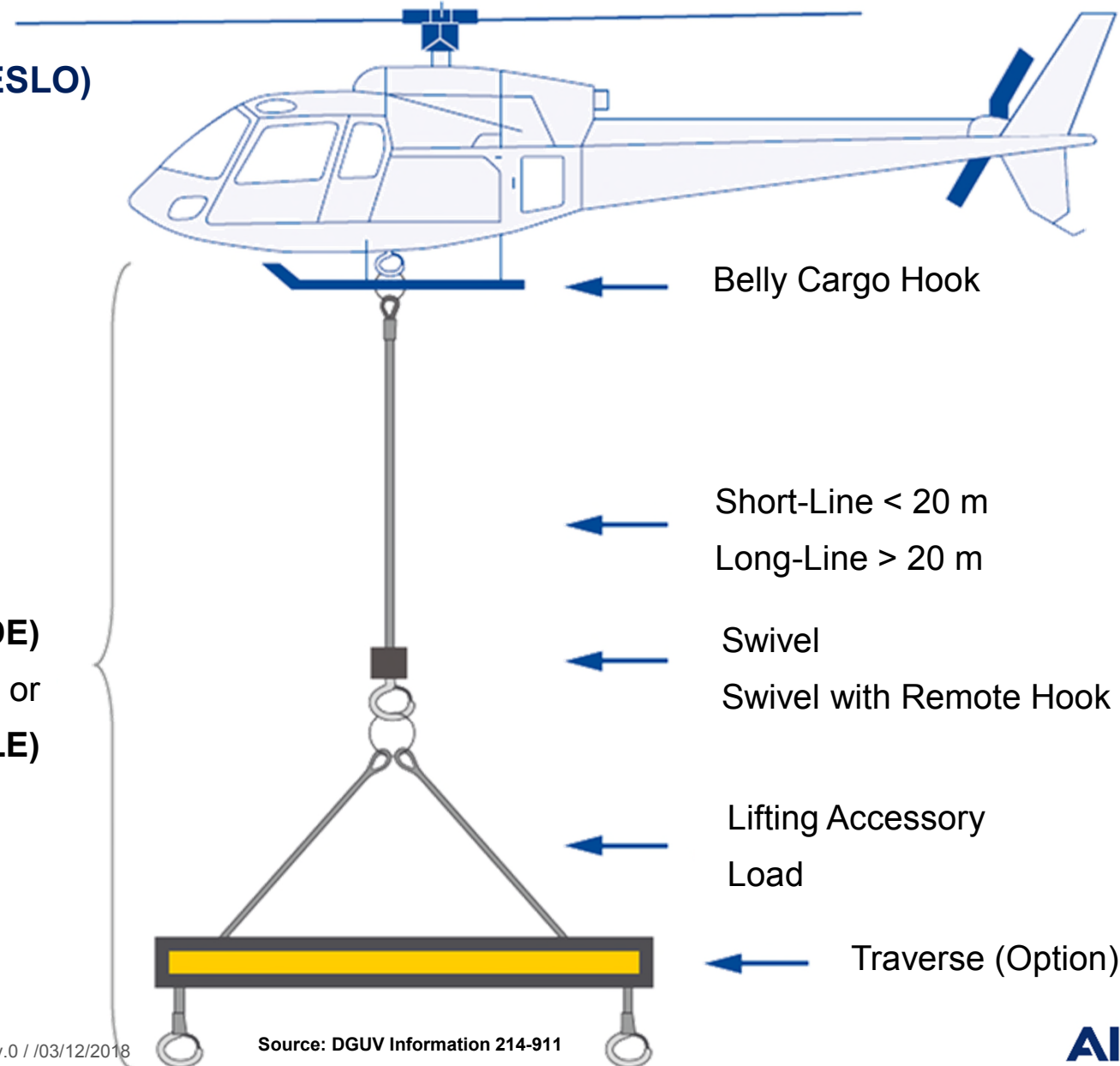
External load rope configuration

Overview

External Load Configuration

Helicopter External Sling Load Operations (HESLO)

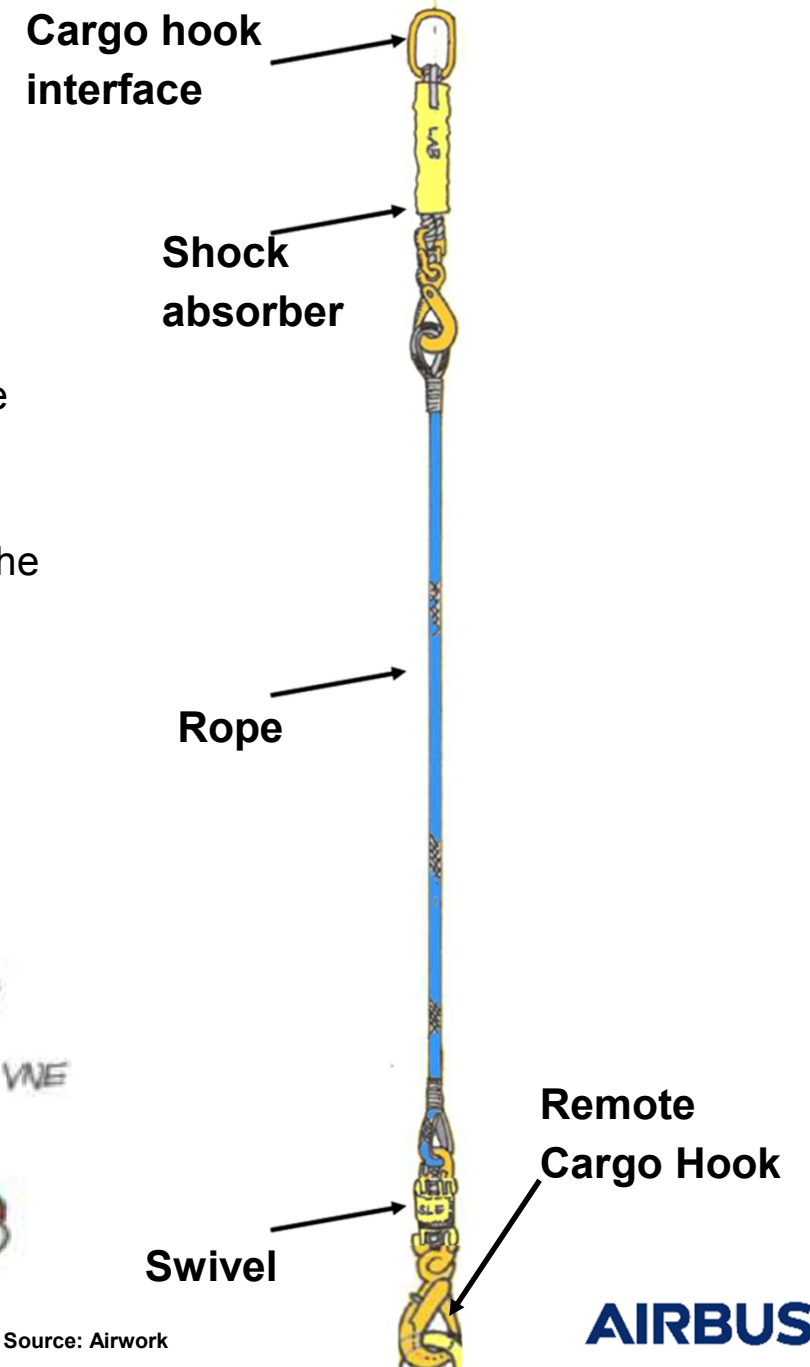
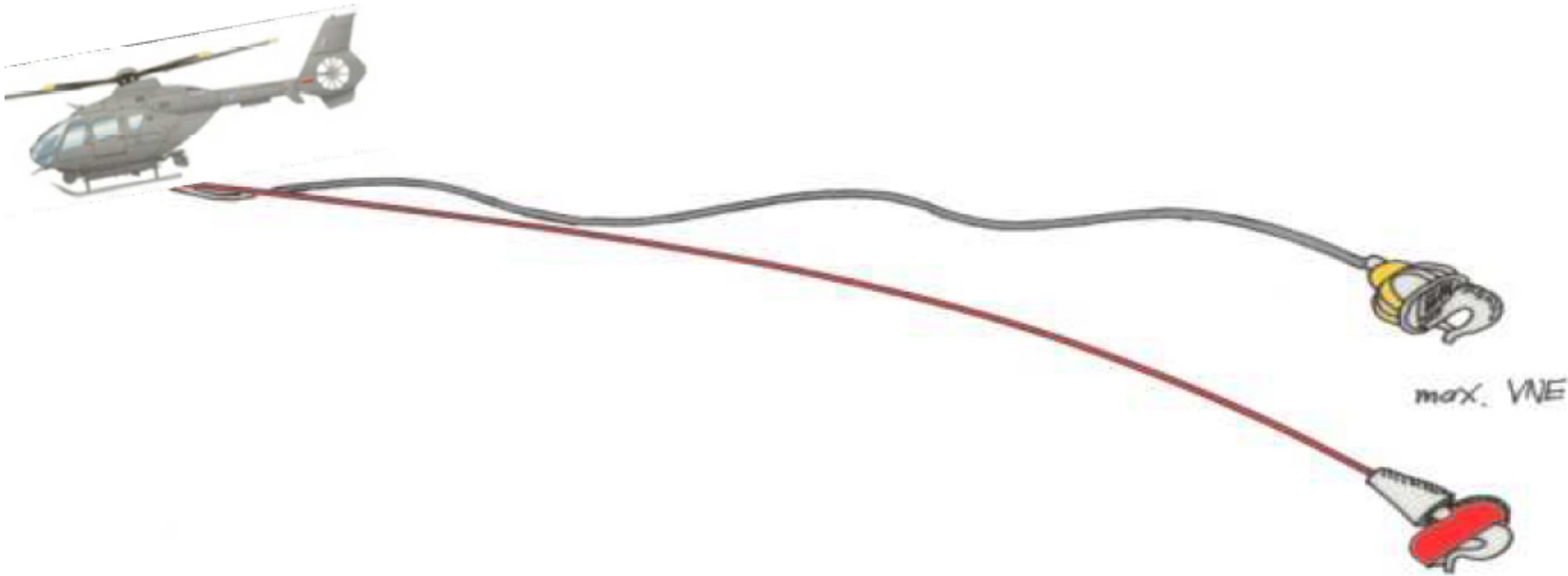
Aerial Deliver Equipment (ADE)
or
Helicopter Under Slung Load Equipment (HUSLE)



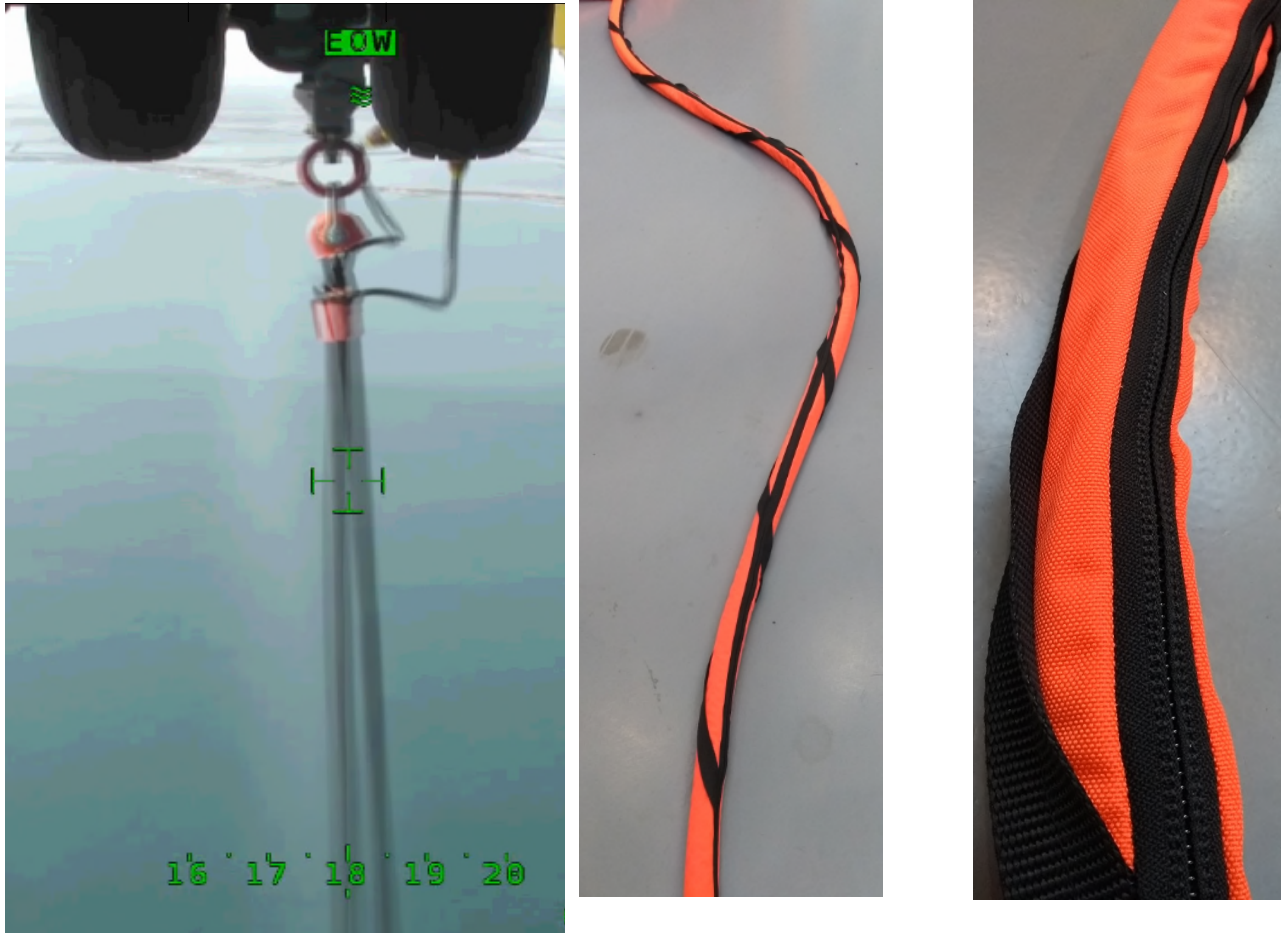
External load rope recommendations 1/2

Due to the fact that most of the loads are prone to rotate, a swivel should be included in the rope configuration. No rope is designed to transfer torque stress.


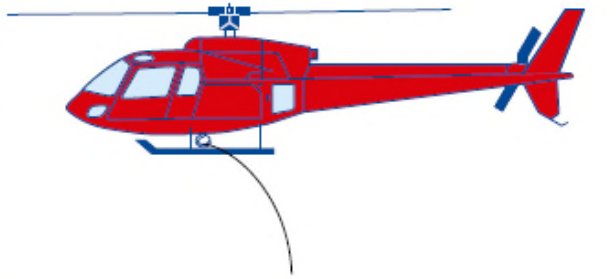

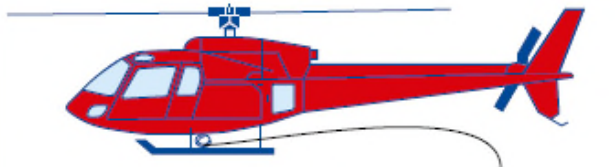

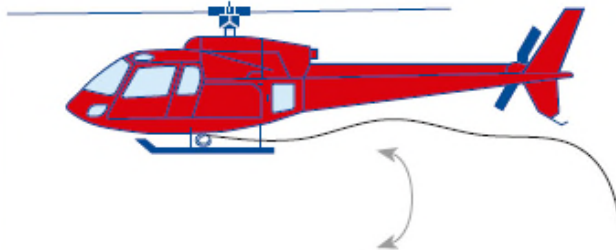
Experience has shown if the weight of the rope is too heavy compared to the remote hook, the rope is more prone to bouncing.



External load rope recommendations 2/2



Specific jacket, affectivity needs to be assessed

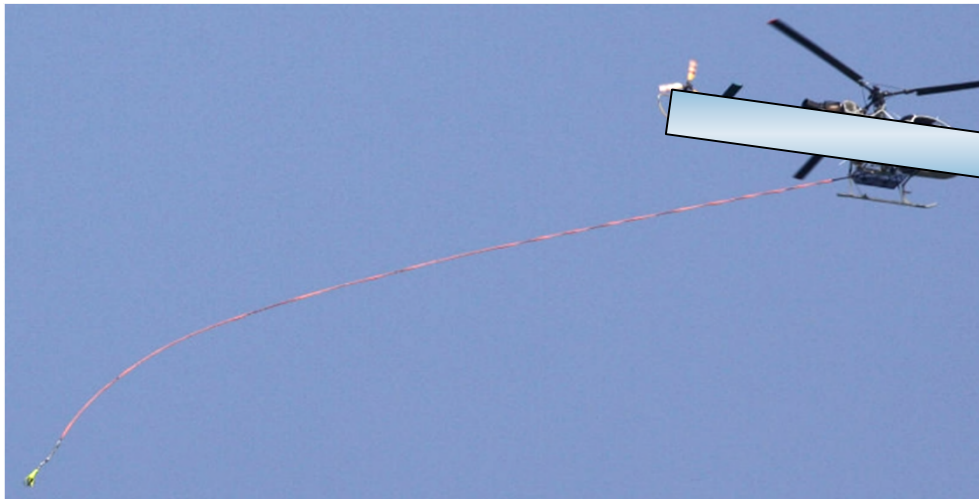
<p>Circular Cross-Section</p> 	
<p>Oval Cross-Section</p> 	
<p>Rectangular Cross-Section</p> 	

Source: DGUV Information 214-911

Empty sling deflection

For operational reasons it is common to fly with an empty sling.

Due to several issues, AIRBUS released a limitation to forbid flying with an empty sling or to adapt an operational procedure (weighted end of sling).



Natural Disaster

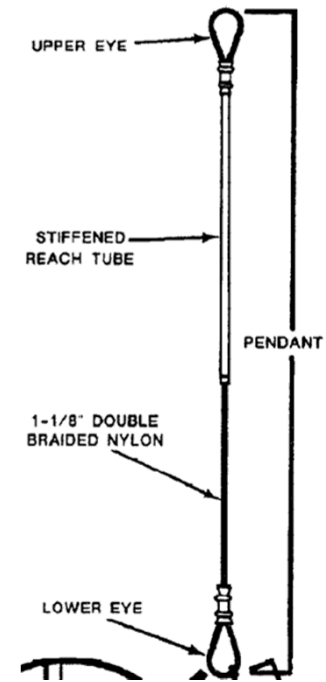
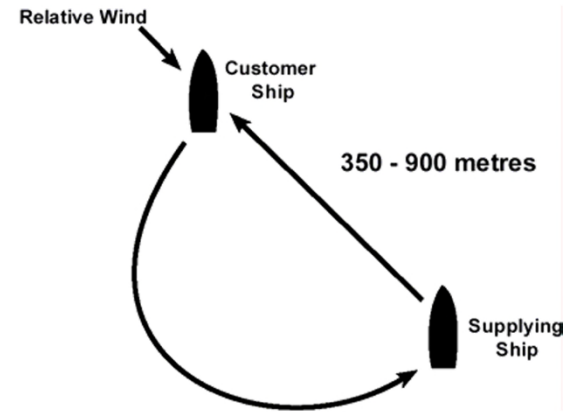
- It is common in Germany to try to close a broken dam by a helicopter.
- For this operation a so called “Big Bag” filled up with sand will be released in flight in the area of the broken dam.



HELICOPTERS

External Load Operation VERTREP

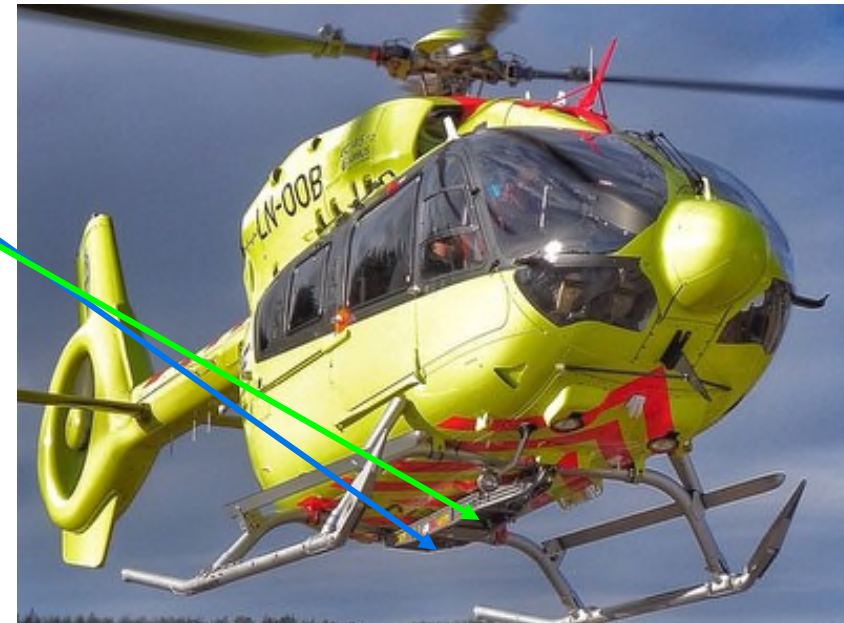
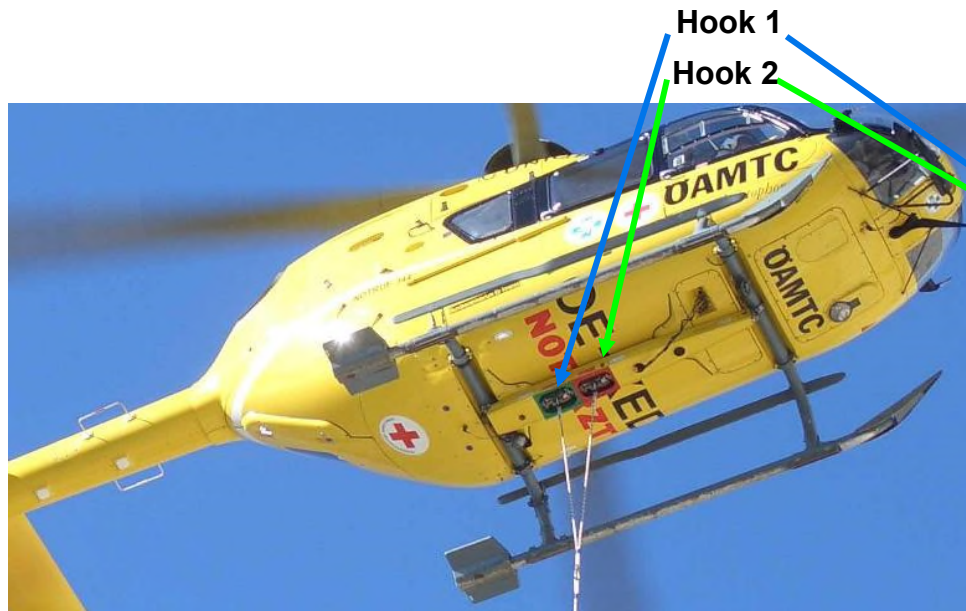
- **VERTREP** (Vertical Replenishment) operation means supplying cargo from one ship to another.
- **VERTREP** mission is not just one load, large amounts of cargo will be transported.



HEC (Human External Cargo) with the belly cargo hooks
Overview

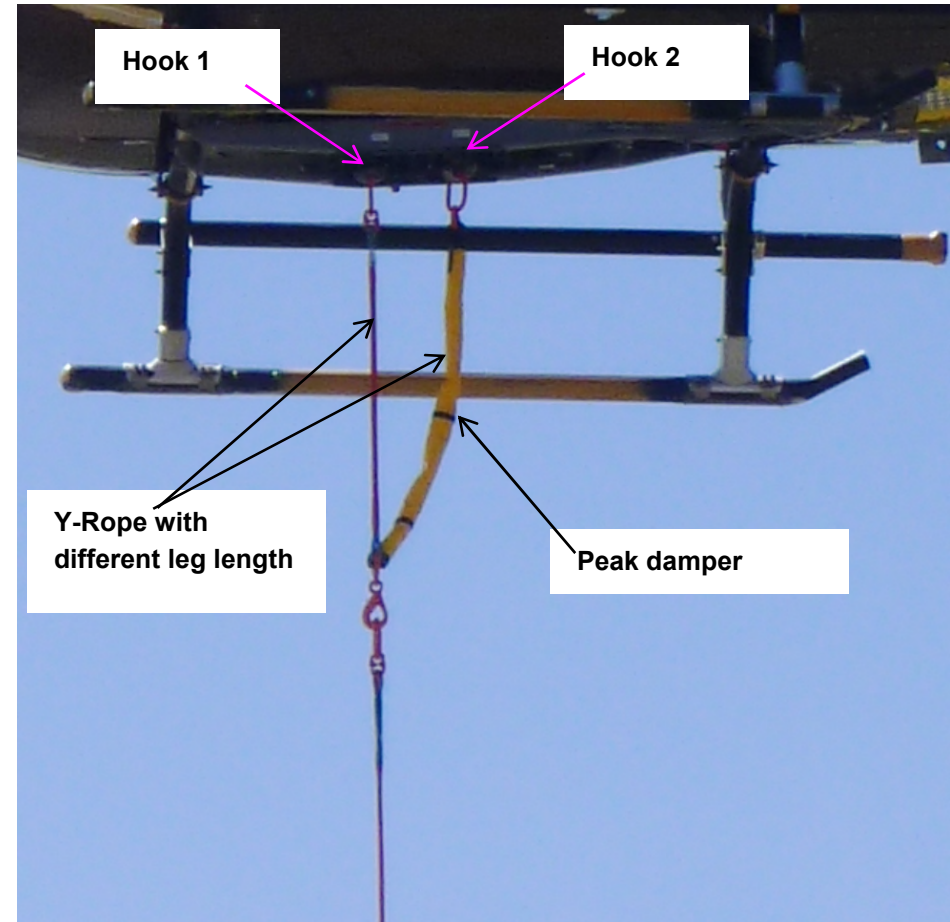
Dual Hook for HEC

- For HEC (Human External Cargo) operation is a dual hook design used on the H135 and H145.
- In order to fulfill the safety requirements the dual hook design has been selected.



Y-Rope design for dual hook operation

- For a proper function of the dual hook system is a Y-Rope configuration recommended.
- Recommended Y-Rope configuration:
 - The main load should be transferred via the hook 1 (aft hook)
 - The backup hook (hook 2, forward) should only take over the load in case of hook 1 failure
 - By means the rope leg for hook 1 should be shorter than the hook 2 rope leg.
 - In case of a hook 1 opening a damping system is recommended in the rope leg to reduce any peak load.
 - With this configuration is the weight indication more accurate because the load is not divided on both cargo hooks and the weight measurement system is installed in Hook 1.



Cargo Hook Operation HEC

- Depends on the operation procedure but it is more and more common to perform HEC (Human External Cargo) with the Cargo Hook instead of a hoist (e.g. direct maintenance cost , high load capability).



Cargo Hook interface

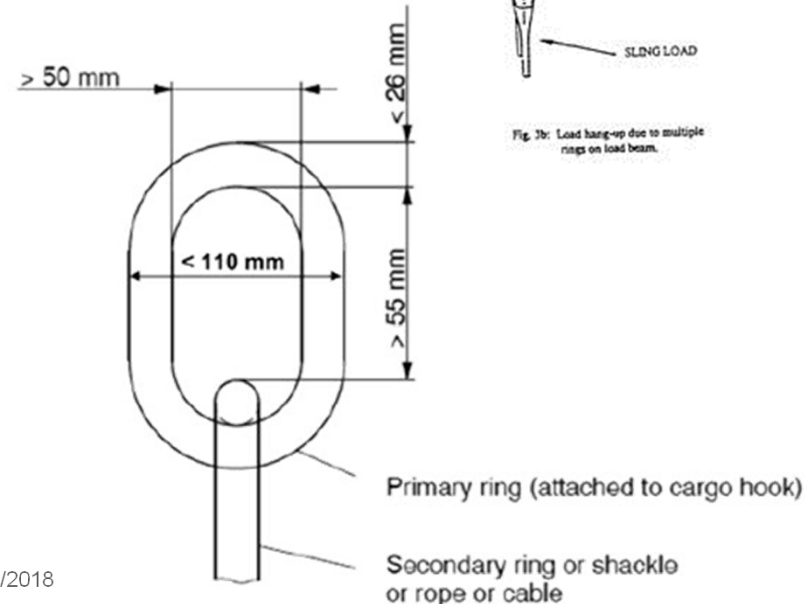
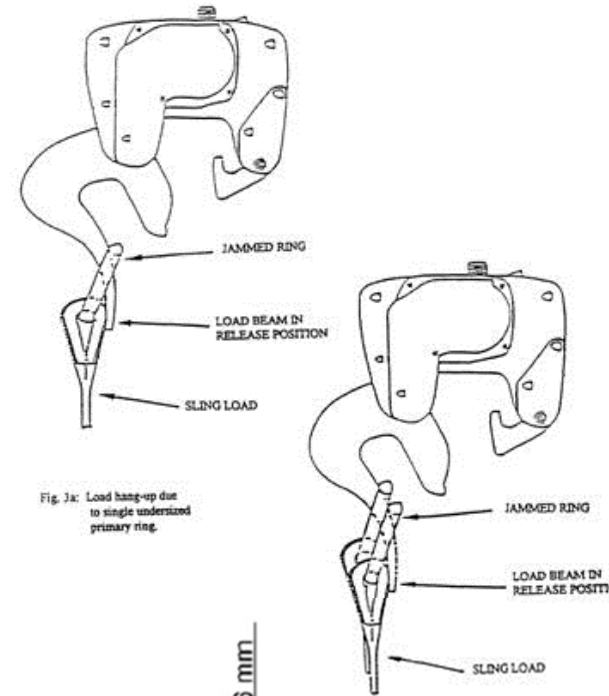
Encountered Problems and Lesson Learned

Cargo Hook Interface

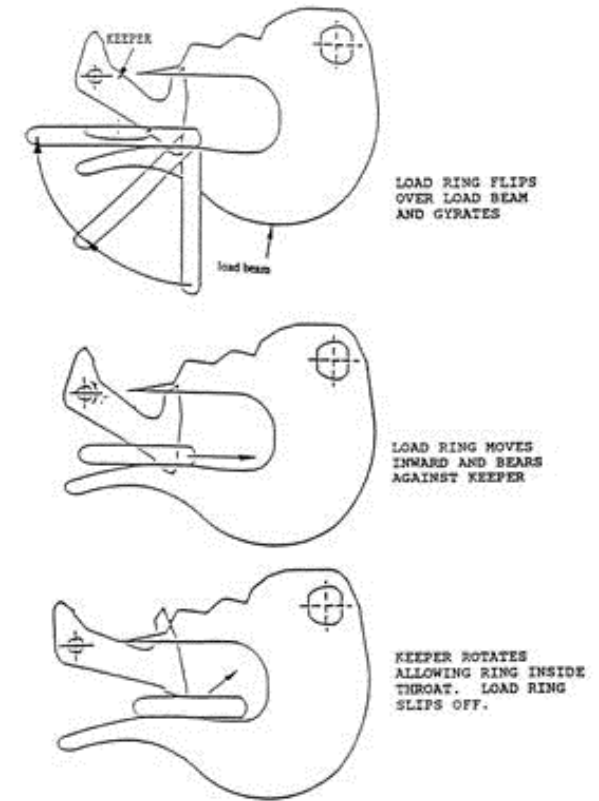
For each Cargo Hook a special dimension for the attachment means are defined in the Flight Manual to avoid a so called “roll out” and/or jamming.

- It is importance of making sure that ring/shackle is properly maintained and inspected before flight to ensure they are in
- good condition
 - within the dimensions for the rigging interface
 - strong and secure enough for the lifting task

Jamming



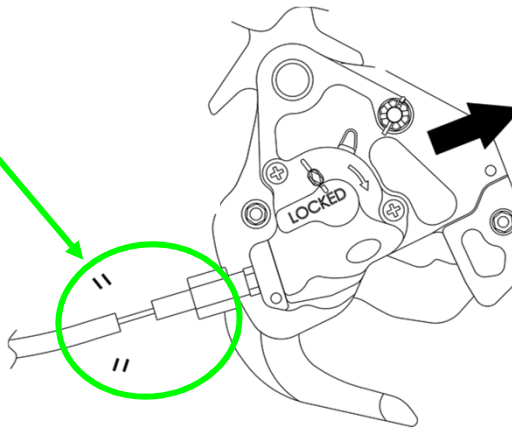
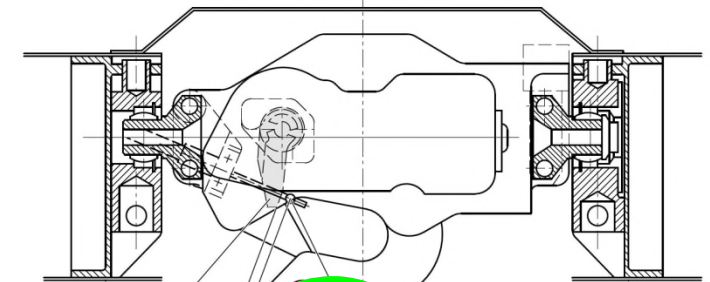
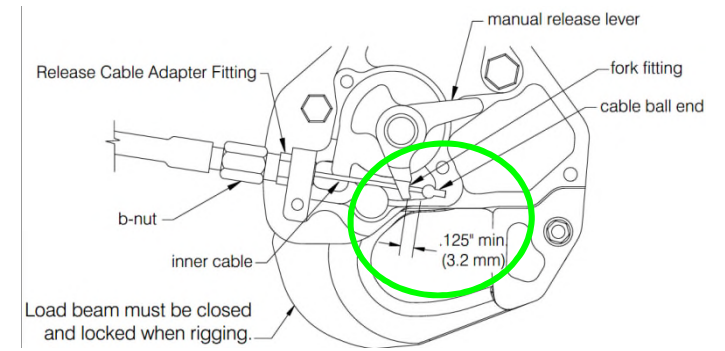
Roll Out



Cargo Hook Bowden cable rigging

Incorrect mechanical release cable rigging can lead to an unintended release

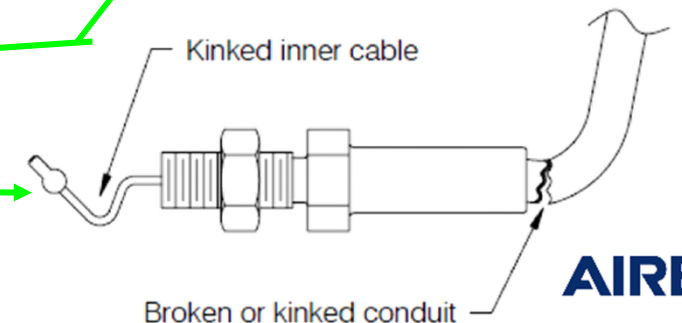
The final free length of unsecured release cable between the fuselage and the hook assembly should allow the hook to swing freely. When the cable assembly is left too short, under certain hook and sling angles, the hook can swing beyond the limit of the release cable assembly length and operate the mechanical release, mechanically opening the hook and releasing the load without the pilot's action.



Prior to every external load operation or change of any part the cargo hook

Bowden cable must be inspected for

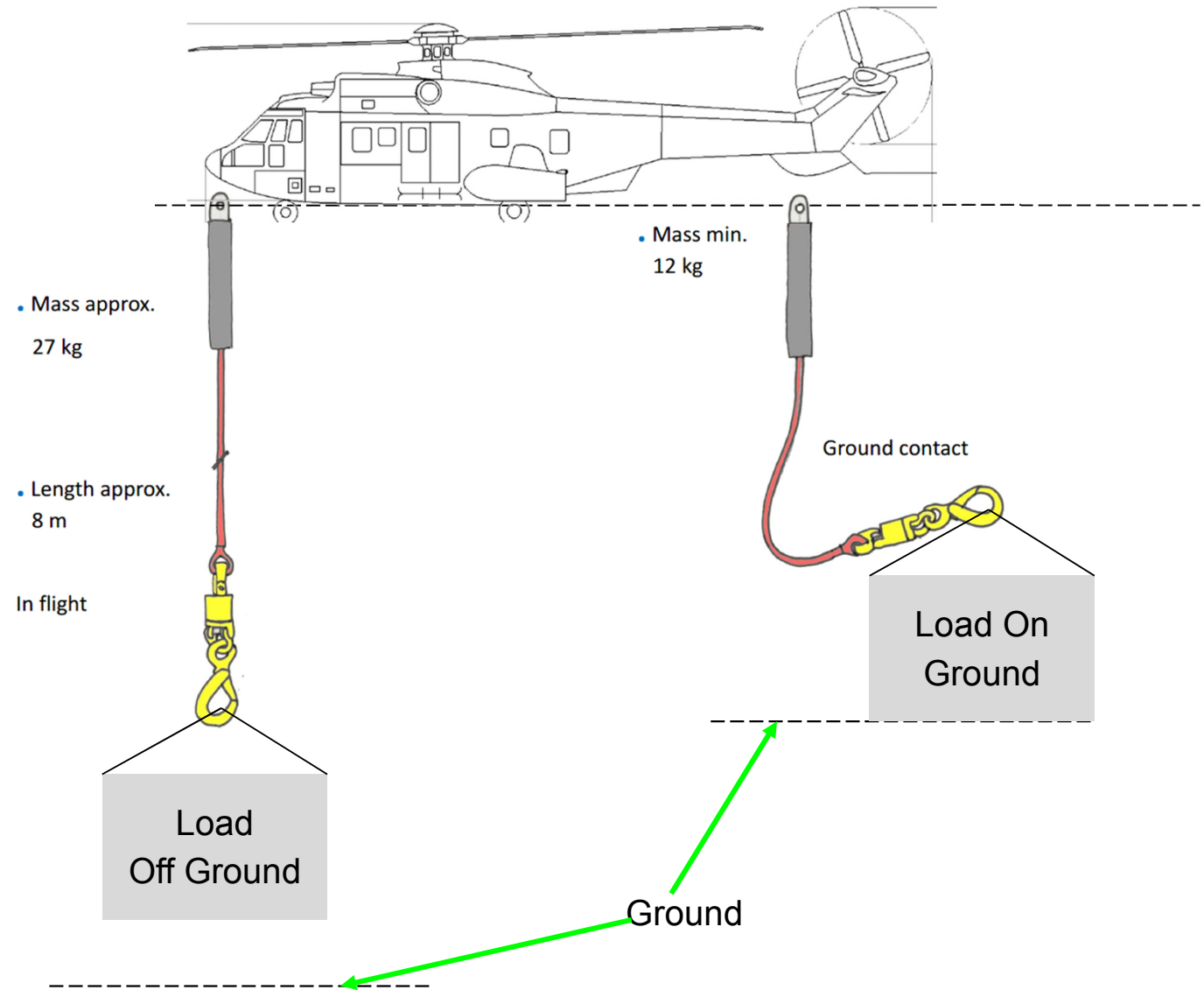
- broken or kinked conduit
- route to avoid strain
- rig with proper free play
- inner cable kinks



Cargo Hook Interface

Low Load release

- Some cargo hooks need a minimum load to release more than 10kg.
- As soon as the load is set on ground the remaining weight of the sling is too less, so that the belly cargo hook does not release.
- In order to ensure always a release even if the load is on ground, it is possible to add a weight on the first part of the rope.
- Some suppliers have this in his portfolio and needs to be addressed during ordering.



Operational feedback Remote Hook Interface

Different remote hooks are used.

It is possible that the tip of the remote hook

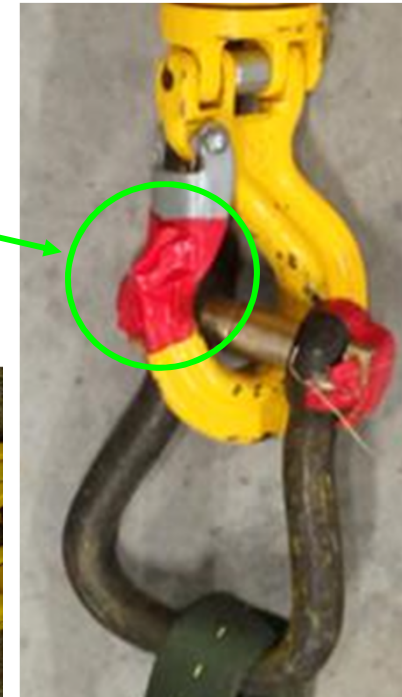
- Get caught special if a net is used
- A „roll-out“ occurs



Based on this, some operators/suppliers

- Cutting the tip
- Wrapping a tap around the tip and keeper
- Selecting a remote hook without this tip

Any modification is not recommended (product liability)



Remote Hook operation Lanyard operation

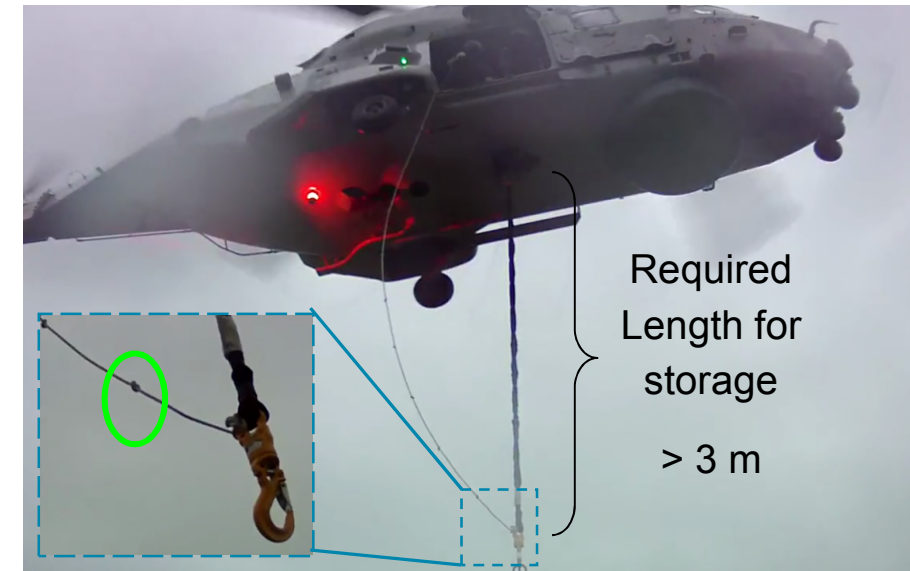
For operational reason some customer pulling the lower end of the remote hook in the cabin.

This improves

- Guidance by the cabin operator during load application on the remote hook
- The cycle time (fast flight back to the load application point as empty sling does not swings around).

In needs to be considered that

- a break away point/fuse is in the included in the upper part of the lanyard rope for an emergency release in flight.
- some knots which improve the pulling up procedure within the cabin.

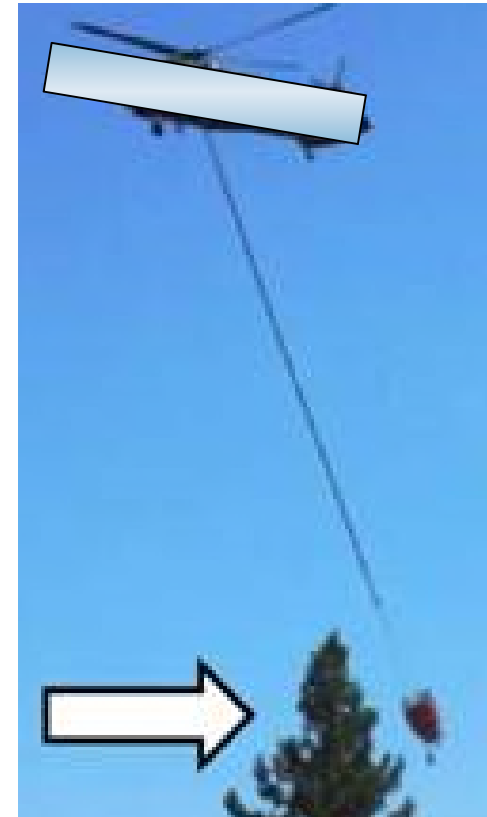


Lanyard with
handhold knots



External Load operation

After a long day of flying, it should not be forgotten that a long line is attached during approach.



National Transportation Safety Board
Washington, DC 20594

Printed on : 09/23/2016 04:07:16 AM

Brief of Accident

Adopted 06/01/2016

GAA16CA179
File No. 35276

04/06/2016

Supai ,AZ

Aircraft Reg No. N73AW

Time (Local): 16:10 MDT

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:
The pilot's decision to fly a normal approach and forgetting that the long line remained attached to the helicopter, which resulted in the line snagging on a ridgeline, a loss of lateral control, and a rollover.

Safety Information Notice

External load operation



No. 3170-S-00

SAFETY INFORMATION NOTICE

SUBJECT: GENERAL

External load operations

For the attention of



AIRCRAFT CONCERNED	Version(s)	
	Civil	Military
EC120	B	
AS350	B, BA, BB, B1, B2, B3, D	L1
AS550		A2, C2, C3, U2
AS355	E, F, F1, F2, N, NP	
AS555		AF, AN, SN, UF, UN, AP
EC130	B4, T2	
SA365 / AS365	C, C1, C2, C3, N, N1, N2, N3	F, Fe, Fi, K, K2
AS565		MA, MB, SA, SB, UB, MBe
SA366		GA
EC155	B, B1	
SA330	J	Ba, L, Jm, S1, Sm
SA341	G	B, C, D, E, F, H
SA342	J	L, L1, M, M1, Ma
ALOUETTE II	313B, 3130, 318B, 318C, 3180	
ALOUETTE III	318B, 318C, 3180, 319B	
LAMA	315B	
EC225	LP	
EC725		AP
AS332	C, C1, L, L1, L2	B, B1, F1, M, M1
AS532		A2, U2, AC, AL, SC, UE, UL
EC175	B	
EC339		KUH/Surion
BO105	C (C23, CB, CB-4, CB-5), D (DB, DBS, DB-4, DBS-4, DBS-5), S (CS, CBS, CBS-4, CBS-5), E-4, LS A-3	CBS-5 KLH
MBB-BK117	A-1, A-3, A-4, B-1, B-2, C-1, C-2, C-2e, D-2, D-2m	D-2m
EC135	T1, T2, T2+, T3, P1, P2, P2+, P3, 635 T1, 635 T2+, 635 T3, 635 P2+, 635 P3	
EC135H	T3H, P3H, 635 T3H, 635 P3H	

Revision 0 2017-06-26
Revision 1 2017-10-03

Page 1/7
This document is available on the internet: www.airbus helicopters.com/techpub/

Fast Rope and Rappelling System Overview

Fast rope operation general requirements

Operational requirements:

- Quick Release System (mechanical and/or electrical)
- Up to 4 Ropers per rope (up to 150 kg per person)
 - Thick rope is used
- One person per rope for Rappellers
 - Thin rope with hand break is used



•Used by special forces
•Own operational requirements
•STC`s (Supplement Type Certification) are also available

H145 D-2m Version: Fast Rope & Rappelling Device

Operation	Extended for Fast Roping Retracted for Rappelling
-----------	--

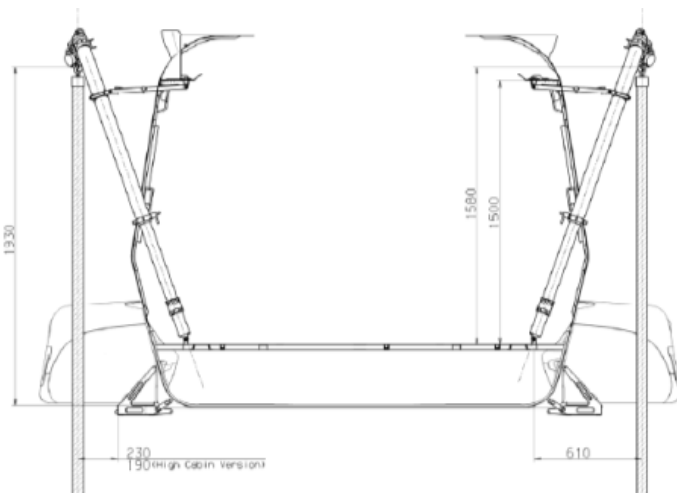


- 1 Fast rope device EAD03
- 2 Rear coupling
- 3 Retractable interface adapter
- 4 Forward coupling

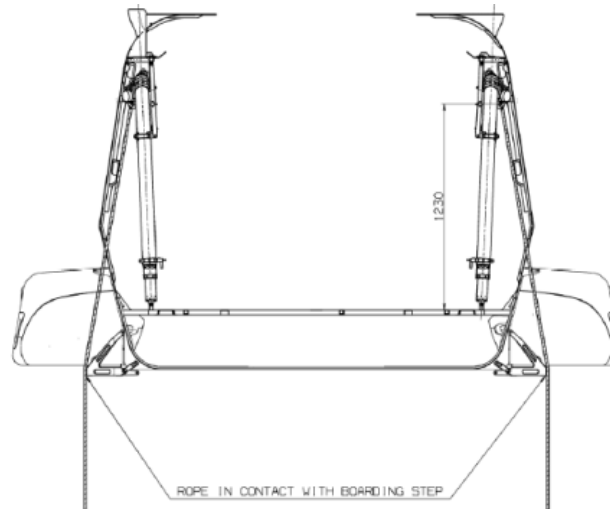


NH90 Version: Fast Rope & Rappelling Device

Operation	Extended for Fast Roping Retracted for Rappelling
-----------	--



Front view – beams extended



side view – beams retracted

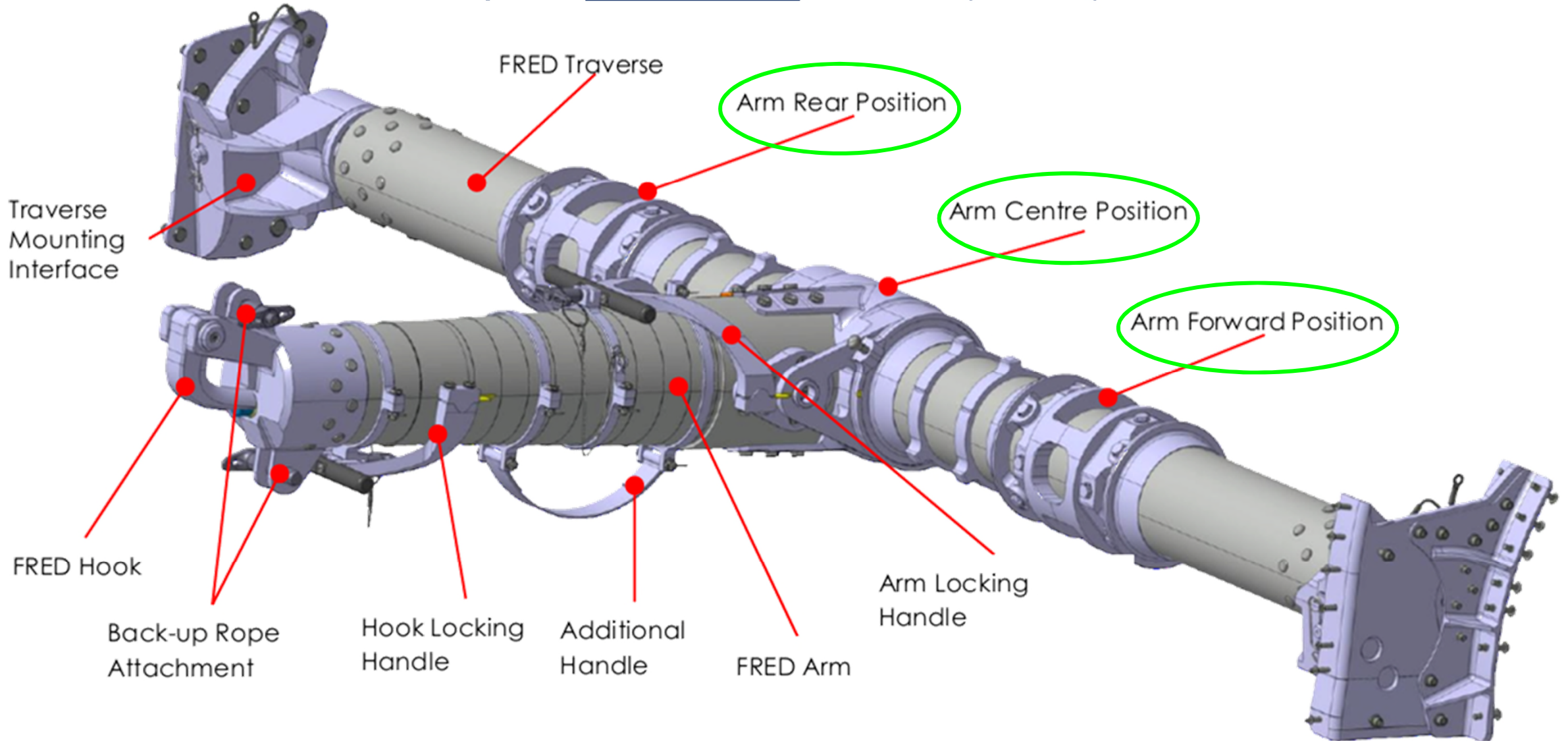


NH90 Version: Fast Rope & Extraction Device (FRED) 1/2

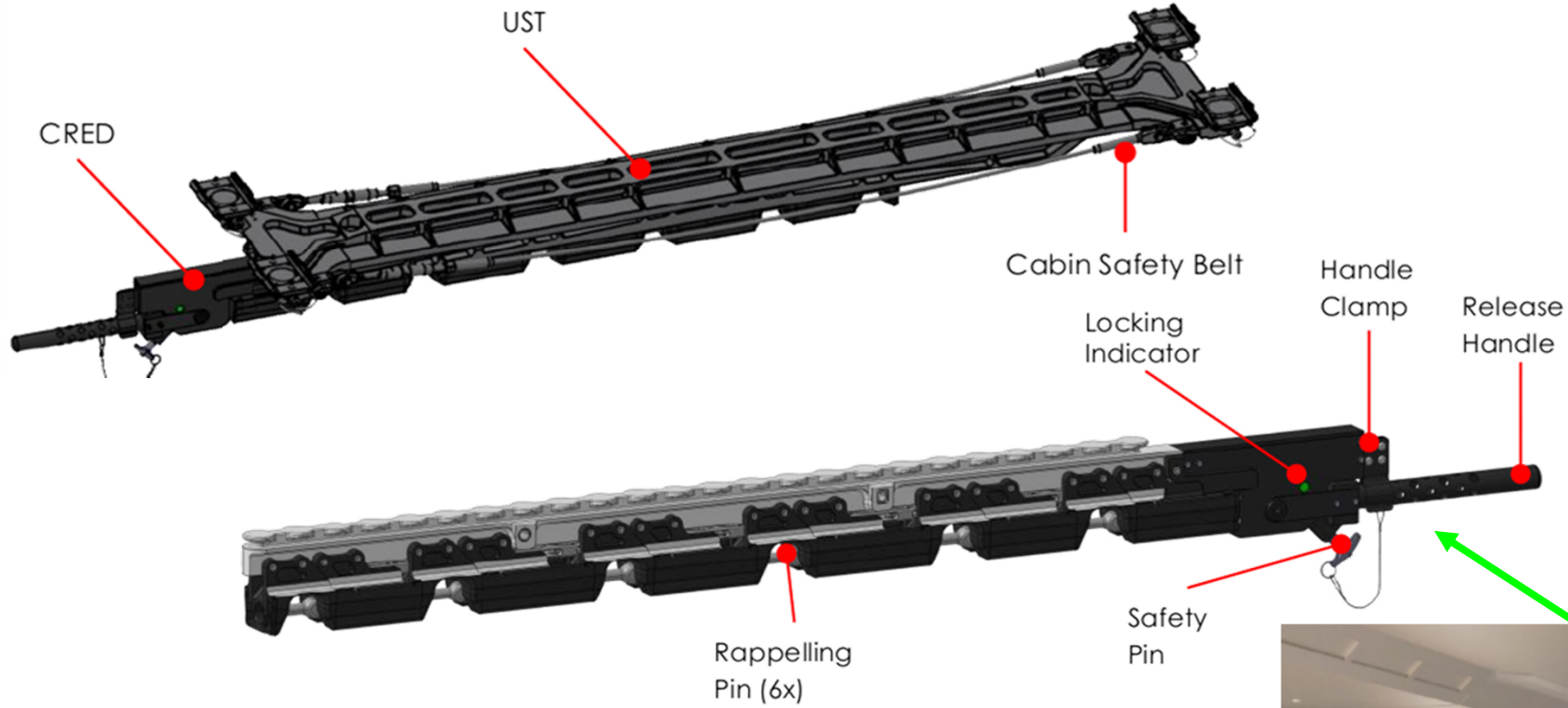


Symmetrical kit (LH = RH)	Fast and easy exchangeable between H/C
3 different arm position	Extended, vertical and retracted
Operation	Extended for Fast Roping and Extraction Vertical for Extraction

NH90 Version: Fast Rope & Extraction Device (FRED) 2/2

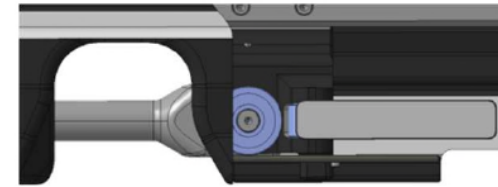
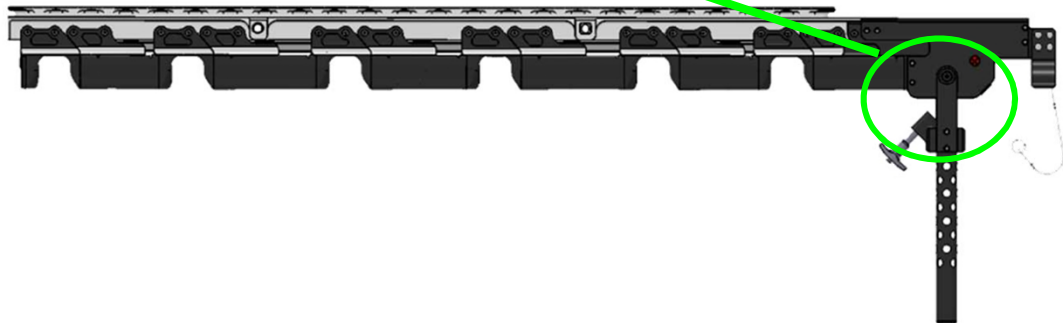
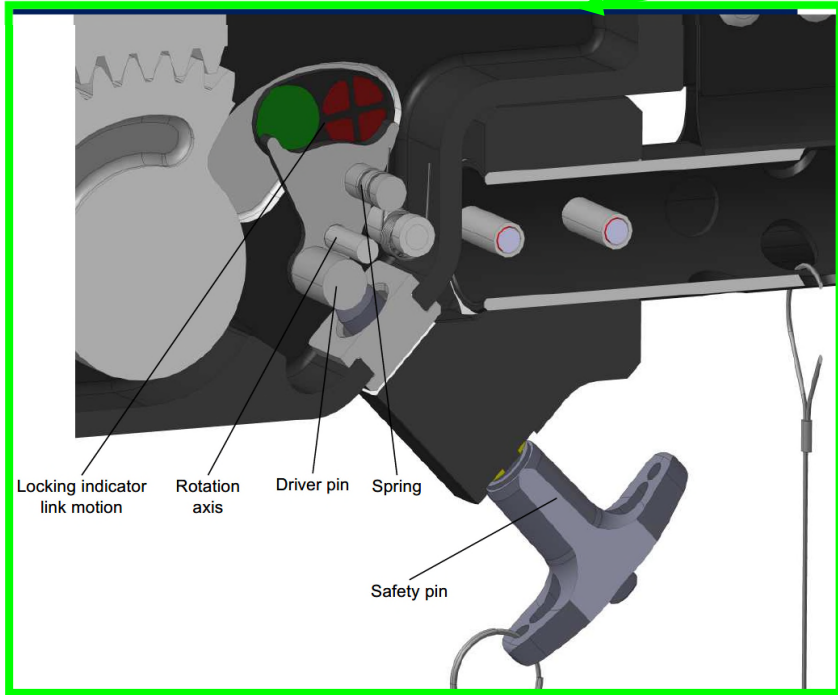
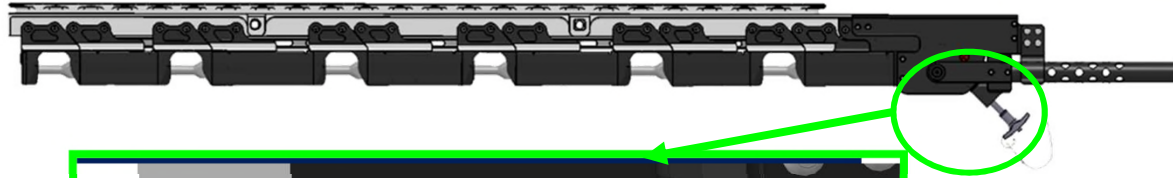


NH90 Version: Central Rappelling & Extraction Device (CRED) 1/2

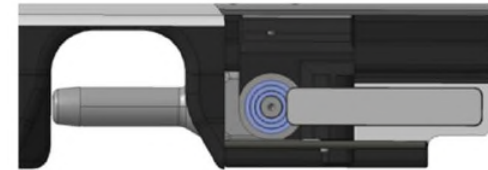


Implementation	Beam integrated in the center of the cabin on existing interface
2 different position	Release handle forward or rear position
Operation	Rappelling Extraction

NH90 Version: Central Rappelling & Extraction Device (CRED) 2/2



Closed Rappelling Pin



Rappelling Pin Retracted

- Handle rotation of approx. 15°
- Rappelling pin retracts approx. 11mm
- Spring holds pin in position (at loads less than 1kg)



Emergency Release

- At higher loads rappelling pin will rotate and rope will be released
- Pin automatically jumps back due to spring

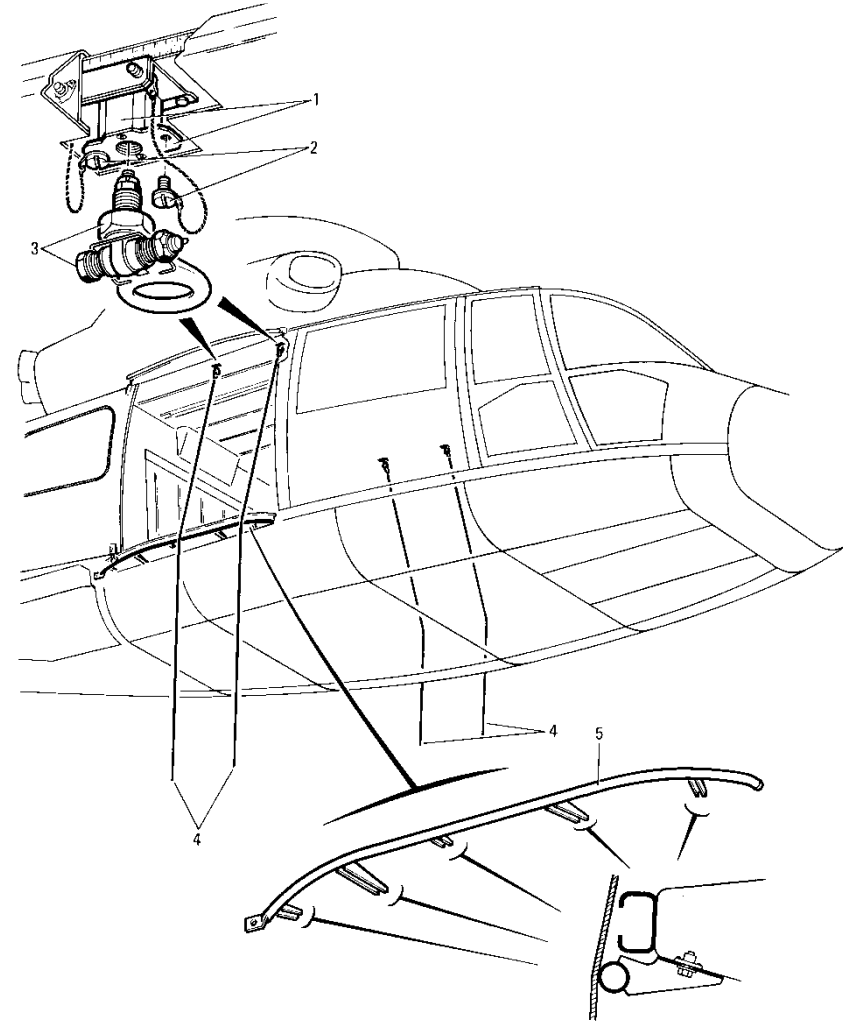


Fully Retracted Rappelling Pin

- Handle rotation of 90°
- Rappelling pin retracts fully (60mm)

Dauphin Family Rappelling Version

Operation	Rappelling Up to 4 attachment rings
------------------	--



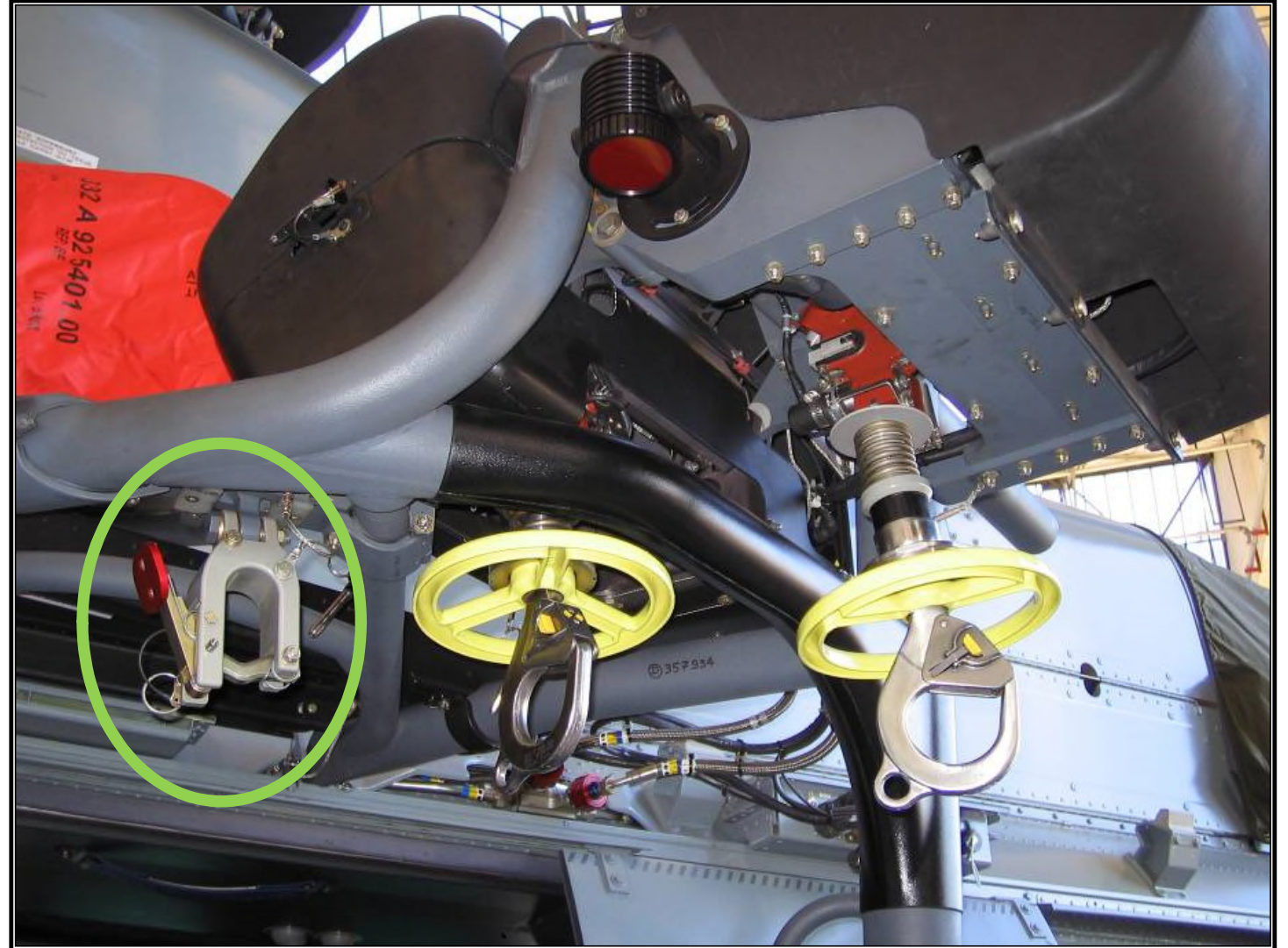
Puma Family: Version Fast Roping Beam

Operation	Fast Roping One beam per side
-----------	----------------------------------



Puma Family Version: Fast Roping via Rescue Hoist Beam

Operation	Fast Roping on the hoist beam
-----------	-------------------------------



Puma Family Version: Fast Roping or Extraction Insertion Operation

Operation	Fast Roping and Extraction
-----------	----------------------------

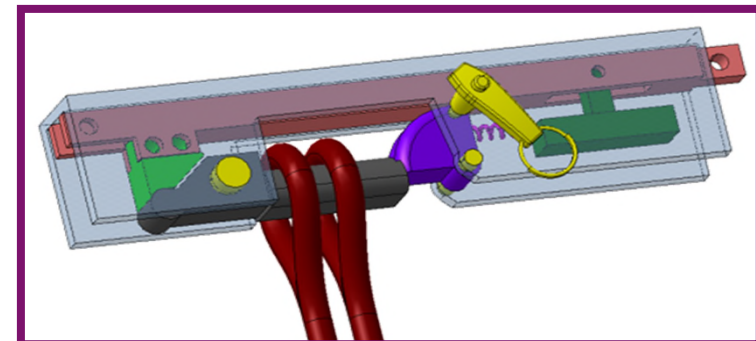
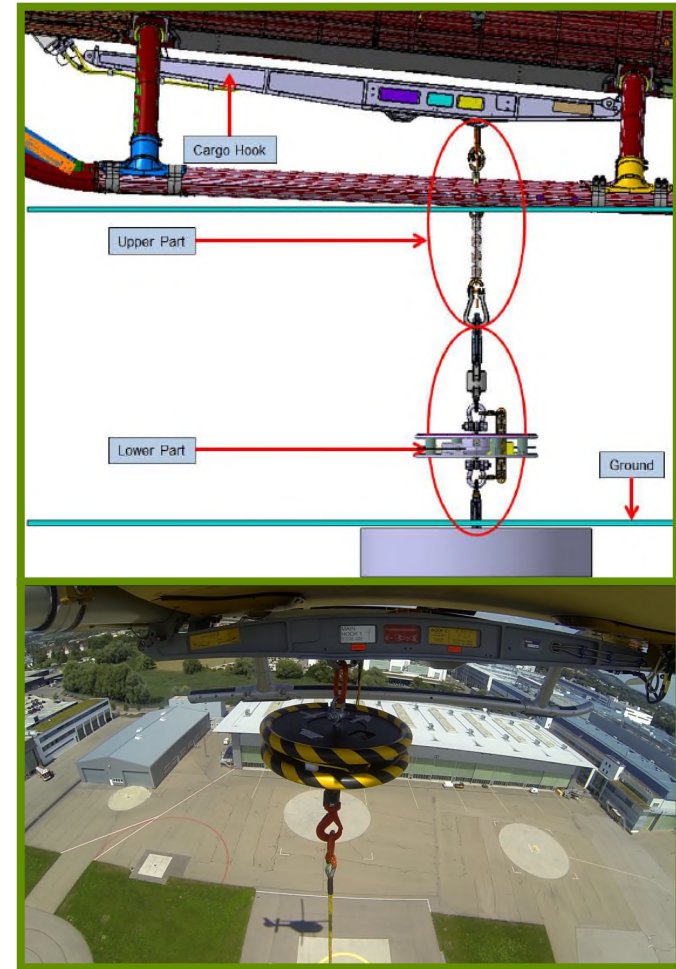


Future vision Overview

Future vision

The future vision includes

- Sling load stabilization
- Less critical parts in the release unit to increase the safety
- Fail Safe design to increase the safety
- Tethered Hover
- Dual electrical release for the cargo hook
- Standardized cargo hook interface to the aerial delivery equipment
- No cycle counting
- No tracing of flight hours
- TBO (Time Between Overhaul) extension

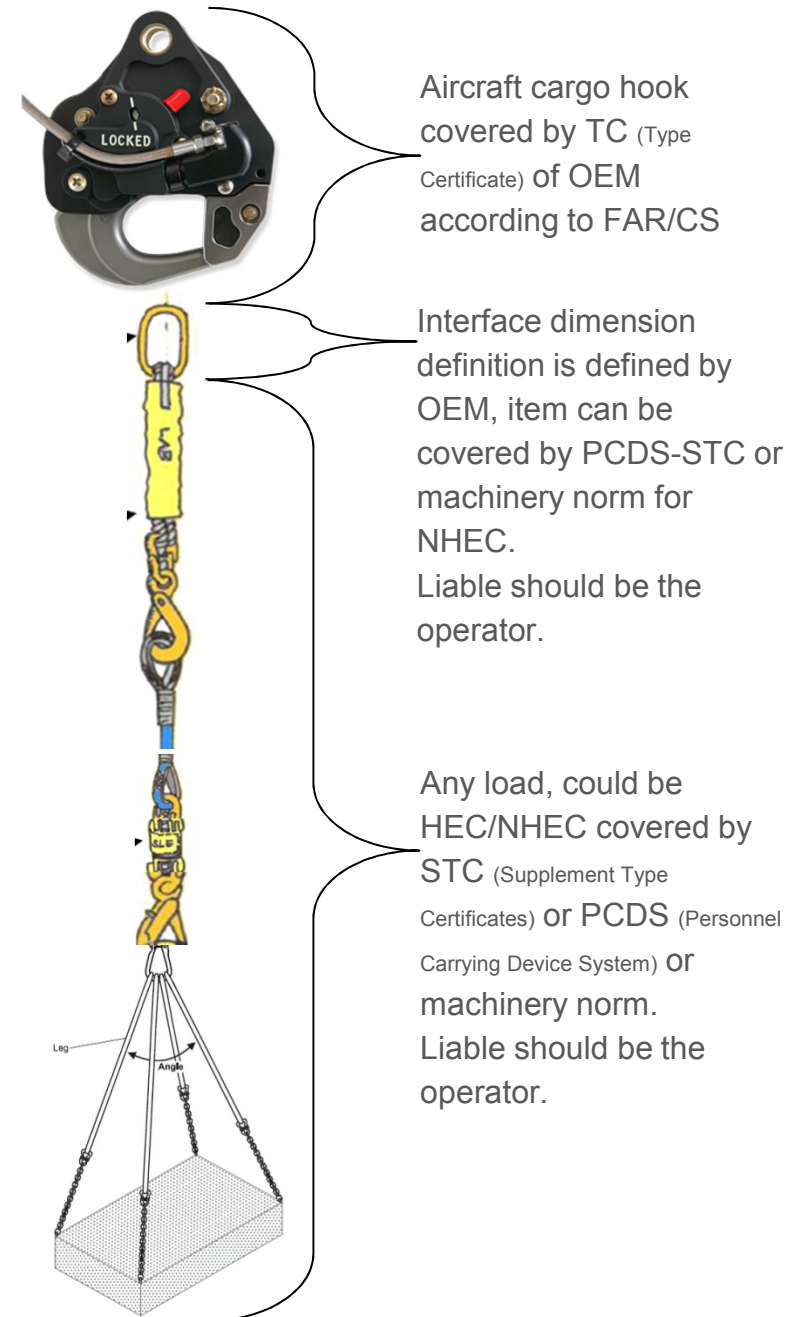


Liability for external loads

Liability of External Load

The common approach is:

- The responsible as OEM (Original Equipment Manufacturer) stops at the cargo hook / hoist hook (exceptions exists).
- The OEM provides the interface definition to allow safe operation of the external load system.
- The maximum speed with external load will be defined by flight stability of load. Any other load should be assessed case by case and depending on the pilot decision.





Thank you