

# External Loads

Hoist and HEC, HEC platform, Fast-roping policy

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# General



# External Cargo categories

**NEW**

## Non-Human External Cargo (nHEC)



## Human External Cargo (HEC)



## Human External Cargo Platform (HEC-P)



# External fixture (**not** under 27/29.865)

## → External fixture

- A structure external to and in addition to the basic airframe that does **not have true jettison capability** and has **no significant payload** capability in addition to its own weight. An example is an agricultural spray boom. These configurations are not approvable as 'External Loads' under CS 29.865.



# Hoist

- Hoist ETSO based on SAE standard was published 08/2022
- Introduction of several safety improvements
  - Hoist Critical Parts
  - Cable requirements
  - Interaction Systems and Structures
  - Overload Protection Device
- Currently several projects for new hoists are in the EASA certification process



# Fatigue and Critical Parts

## → Fatigue Evaluation (27/29.865(f))

### → For HEC applications

Applies to Quick Release system, Complex PCDS and its attachments

### → For non-HEC

Parts which failure would result is hazard to the rotorcraft (e.g. shift of CG)

## → (Hoist) Critical Parts

### → Part which failure would lead to serious injury or fatality (including HEC)

### → Requirement identical to 27/29.602

# HEC-P



# HEC-P – Introduction through NPA 2022-11

- Included in the NPA 2022-11
  - Regular update of the Air Operations rules
  - SPO.SPEC.HEC.100 / .105 and associated AMC
  - Not yet in force, expected in 2025
- Introduced to promote best practices and providing means of compliance
- External platforms is part of HEC operations
- Person on external platform is “Task Specialist”
  - Accepting higher risk than “normal” occupants, not considered as occupant



European Union Aviation Safety Agency

## Notice of Proposed Amendment 2022-11

in accordance with Article 6 of MB Decision No 1-2022

Regular update of the Air Operations rules

*Lessons learnt from standardisation inspections*

*Helicopter operation issues*

*Transposition of several ICAO SARPs*

RMT.0392 (NPA A)

### EXECUTIVE SUMMARY

The objective of this Notice of Proposed Amendment (RMT.0392 (A)) is to maintain a high level of safety for air operations with aeroplanes and helicopters, to consider the lessons learnt from standardisation inspections, and improve the rules in line with the principles of better regulation.

The NPA proposes to:

- consider safety recommendation SR UNKG-2020-001 on rulemaking for the carriage or installation of carbon monoxide (CO) detectors on aircraft,
- transpose several Standards and Recommended Practices (SARPs) from ICAO Annex 6,
- improve the rules by considering the lessons learnt from standardisation inspections,
- update the rules on fuel planning and management to render them more performance based for aircraft that use engines running with electrical propulsion,
- update the rules on helicopter operations,
- update some rules on cabin crew and cabin safety, and
- improve the rules by updating references, aligning them with the regulations of other domains, and ensuring consistency among the different annexes to Regulation (EU) No 965/2012.

The proposed amendments are expected to maintain and even increase safety and cost-effectiveness, and ensure alignment with ICAO.

Action area:	Flight operations — aeroplanes and helicopters		
Related rules:	Commission Regulation (EU) No 965/2012 and related AMC and GM		
Affected stakeholders:	All aircraft operators; competent authorities		
Driver:	Efficiency/proportionality;	Rulemaking group:	No
Impact assessment:	Yes		



# HEC-P – Certification Requirements (CRI)

In addition to the “usual” structural requirements

- For 27/29.865 External Loads the following is applicable:
  - External Platform is considered as complex PCDS [27/29.865 (c)(2)(iii)]
  - Placards / Markings / Intercom / RFM [27/29.865 (c)(2)-(5) and (e)]
  - Fatigue evaluation for HEC [27/29.865 (f)]
  - AMC 2 and AMC 3 to 27/29.865
- Emergency dynamic landing conditions **do not** apply, since it is not to be used by an occupant during taxi, take-off and landing

# HEC-P – Certification Requirements (CRI)

- 27/29.865 (c)(2)(iii) complemented by
  - Weight to be considered for the task specialist is 101,2 kg for structural analysis and test, plus equipment weight
  - For PCDS, helicopter maneuvering load factor or the dynamic load factor in case of a fall, which ever is higher
  - The task specialist should be secured by a harness/belt
    - The fitting factor of CS 27/29.625(d) is applicable
    - The rotorcraft and HEC-P platform installation must be designed to withstand flight and ground loads and 27/29.561(d)

# HEC-P – Certification Requirements (CRI)

- The task specialist station and its supporting structure should not contact the ground under reserve energy landing conditions
- Task specialist must be able to assume a brace position at its station, in case of emergency landing
- Adequate clearance between the task specialist and the rotors
- Any item of mass carried on the external platform should be secured and to ensure an adequate clearance to the rotors
- If practical, the design should allow the task specialist to reach the cabin/cockpit for critical phases of flight.

# PCDS

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# Personal-carrying device system (PCDS)

PCDS: A device systems to transport occupants external to the helicopter or to restrain occupants inside the cabin

## Simple

- meets an EN standard under EC Directive 89/686/EEC, or Regulation (EU) 2016/425
- Max 2 Pax outside / 1 Pax inside cabin
- No rigid structure

- Static: Load factors given in AMC
- Fatigue: covered by static factors (>10)

## Complex

- All PCDS not simple

- Full static and fatigue (damage tolerance) evaluation

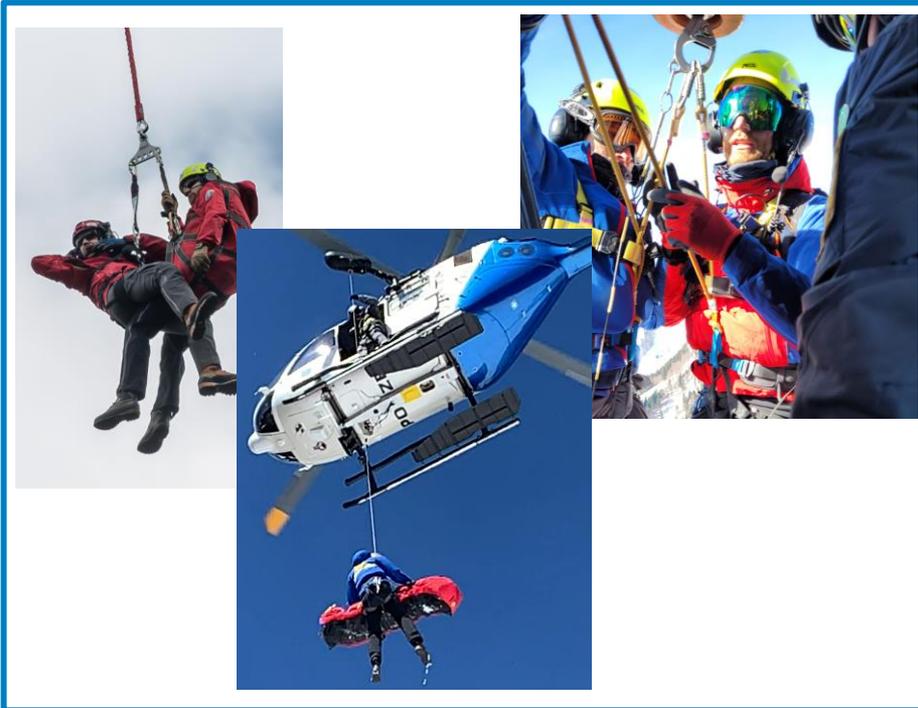
# Personal-carrying device system (PCDS)

Simple

- Max 2 Pax outside
- No rigid structure

Complex

- Everything not being simple PCDS



<https://www.facebook.com/Boostsystems/>

<https://colleyaerospace.com/>

<https://www.jbmdl.jb.mil/>

# Loads



# HEC and nHEC loads

## Non-Human External Cargo

- Load factor **2.5 g**, or lower approved under 27/29.337
- Fatigue, if failure would result in hazard to the rotorcraft

## Human External Cargo

- Load factor **3.5 g**, or lower approved under 27/29.337,
- BUT not less than 2.5 g
- Fatigue evaluation

## → Dynamic (shock) loads

- pick up / release of load
- Person falling into cable, including possible slack can occur
- Must be supported by test

# Load application

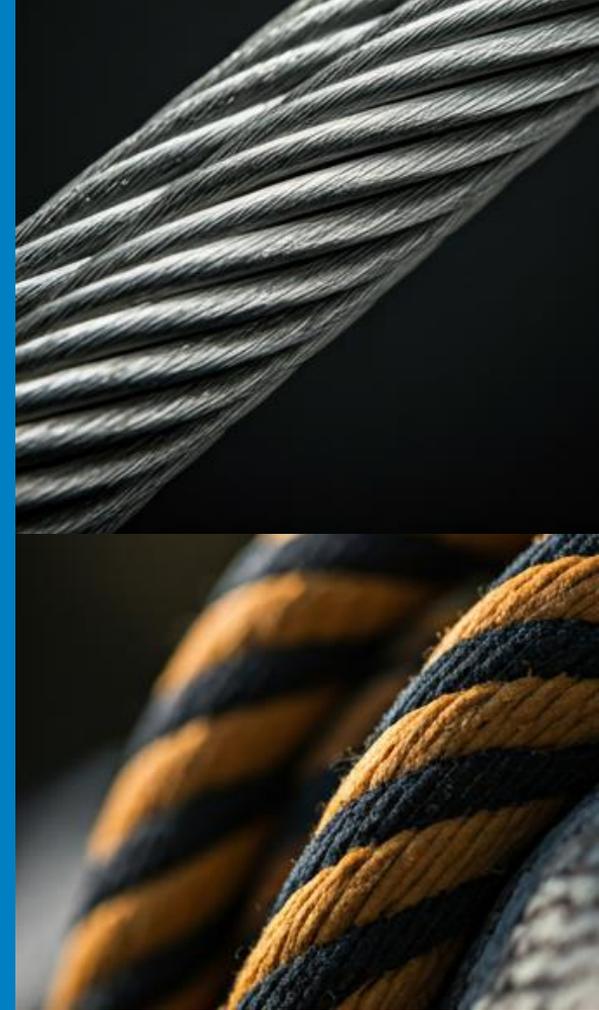
- **Maximum** angle achievable in service must be substantiated (min. 30°)
- Lesser angles than 30° only if shown that the lesser angle can **physically not be exceeded** in service
- If angle is limited in the RFM, exceedance has to be indicated to the flight crew
- Limit and Ultimate Load application within the entire cone



# Wide operational spectrum



# Cables

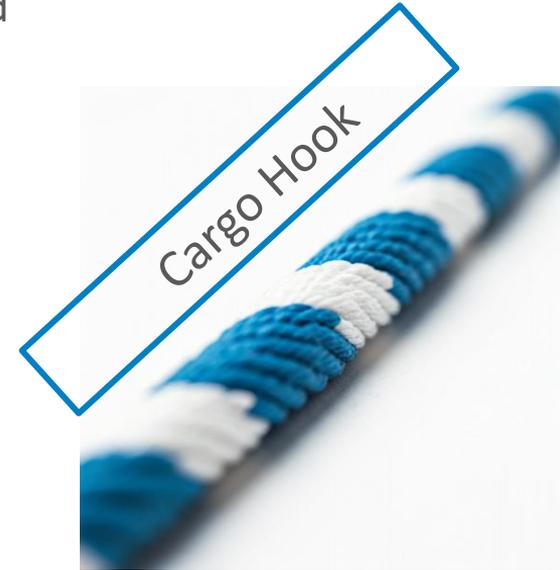


# Cables – General remarks

- On cargo hooks, often synthetic cable are used
- On hoists, currently only metallic cables are used
- Cable rebound should not have a catastrophic effect on the rotorcraft
- Guidance: AMC 20-29 has a lot of useful guidance also for metallic cables
- Static test needs to be performed as installed (one end free swiveling)
- Cable needs to conform to the minimum acceptable manufacturing quality during test

# Cable - metallic and textile

- Effect on static and fatigue strength has to include as a minimum:
  - A damage threat assessment needs to be performed
    - Normal fatigue (tension, bending and torsion)
      - Change in load distribution within the cable under load
      - Abrasion resistance and wear
        - Damage types after shock loading
        - Environmental effects / Contamination
        - Bending effects on static strength
        - Manufacturing variability
        - Effects on worn out rollers
        - Thermal effects



# Synthetic cables specifics

- If synthetic cables are put on the drum under significant load, they could deform permanently
- More sensitive to environmental conditions
  - Temperature
  - Humidity
  - Fluids such as oil, hydraulic fluids, fuel, salt water, glycol, cleaning agents
  - Exhaust gases
  - Solar radiation
- Less resistant to abrasion / damage during usage

# Metallic cable specifics areas of interest

- Corrosion
- Salty environment
- Sand and dust
- Needs lubrication, especially for fatigue
- Fatigue damage may start on the inner core → Not easily inspectable
- Manufacturing variability

# Fast Roping



<https://en.wikipedia.org/>

# Fast Roping vs Rappelling

## Fast Roping – not HEC

- Person not attached to rope/rotorcraft
- Usage not able under civil certification
- However: rotorcraft attachment should be certified for loads in static and fatigue
- CRI has been raised



## Rappelling – HEC

- Person is attached through PCDS all time
- Device with emergency brake
- Certifiable under 27/29.865



# Fast Roping

- Only structural provisions are addressed
- Functional aspects are excluded
- Following 27/29.865 subparagraphs are applicable
  - (a) addressing load factors and load application direction
  - (f) addressing fatigue evaluation
  - (e) addressing placards and limitations

# Fast Roping – Static Strength

## → Load factor:

→ As for HEC operations

3.5g, not less than 2.5g, approved under 27/29.337-27/29.341

→ Should withstand limit loads for maximum allowable external load

→ Load should be applied to maximum angle achievable in service, but not less than 30°

→ Dynamic loading should taken into account, if higher than static loads

# Fast Roping – Fatigue Evaluation

- CS 27/29.571 and CS 27/29.573 is applicable to the entire structural external load system and local rotorcraft structure
- Fast roping fatigue spectrum should be established in accordance with
  - Operational limitations
  - Instructions
  - Conservative usage spectrum

# Fast Roping – Placards and Limitations

→ Fast roping installation must be marked with

If full compliance to non-HEC:

**DO NOT USE FOR HEC**

Otherwise:

**NO EXTERNAL LOAD  
UNDER EASA SYSTEM**

→ The major change approval will include

- Maximum allowable external load
- Clarification that only structural provisions are covered
- No HEC is permitted / no use under EASA system
- Functional aspects are not addressed

# MOC/IM Text from Fast Roping CRI

## MOC/IM: Structural Provisions for Fast-Roping Operations

### 1. Means of compliance with 29.865(a)

For fast roping operations, a PCDS is not applicable. However, 3.5 or some lower load factor, not less than 2.5, approved under CS 29.337 through 29.341, as applicable to HEC operations is applicable to the fast-roping installation. When determining a lower load factor, in accordance with CS 29.337 through 29.341, operational limitations such as rotorcraft velocity may be taken into account.

The fast-roping installation must be shown to withstand a limit static load equal to this load factor multiplied by the maximum external load based on the fast-roping limitations. This limit static load must be applied in the vertical direction and any direction making the maximum angle with the vertical that can be achieved in service, but not less than 30°, unless this angle is reduced following the criteria of 29.865(a)(1) or (2).

Dynamic loading should be taken into account, if the resulting load on the system exceeds the limit static load determined above.

### 2. Means of compliance with 29.865(f)

As human operations cannot be assumed to be excluded, the fatigue evaluation of CS 29.571 and CS 29.573 is applicable to the entire external load system and rotorcraft attachment structure. In accordance with CS 29.571 and CS 29.573, inspections and retirement times, or approved equivalent means, must be included in the Airworthiness Limitation Section of the ICA.

The fast-roping fatigue spectrum should be developed in accordance with the operational limitations, instructions and conservative usage assumptions.

### 3. Placards and limitations; means of compliance with 29.865(e)

If 29.865 is fully demonstrated for NHEC but the functional aspects of 29.865(b), (c) and (d) for HEC operations are not fully addressed, the fast-roping installation must be placarded: “DO NOT USE FOR HEC” and this limitation also reported in the RFMS.

In other cases where 29.865 compliance is not fully demonstrated for NHEC, the fast-roping installation must be placarded: “No external load under EASA system” and a clear limitation also reported in the RFMS.

The maximum external load structurally substantiation for HEC operations will be reported in the Major Change Approval, with the clarification that this covers the structural provisions only and does not permit HEC operations until the functional aspects are also addressed.

# LOI and change classification

# 4. Lol and change classifications

## Level of Involvement:



Novelty



Complexity



Criticality

- **May be novel.** HEC-P, fast roping or hoist installations
- **Non-complex to complex**, ranges from simple external installation to complex hoists
- **Critical for HEC**, nHEC can be non-critical.

## Change classification:

**Major?** If F&DT substantiation is needed / significant for first HEC installation / application

**Minor?** Changes to simple PCDS / changes to nHEC / not affecting flight characteristics

# Conclusion

- Guidance is available for certification of:
  - HEC-P
  - Fast Roping
  - Cables (metallic and synthetic)
- External loads has a significant diversity needing special attention during certification



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