



EASA

European Aviation Safety Agency

Rotorcraft Structures STCs

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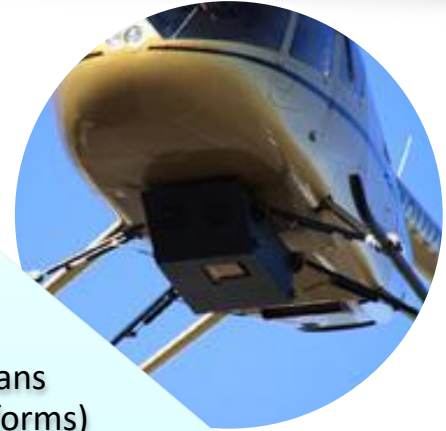


Typical STC applications



Internal devices:

- Avionics equipment,
- Seats
- Control station
- Medical Equipment
- Equipment rack, etc...



External devices:

- Ext. load attachment means (hoist*, cargo hook, platforms)
- Ext. equipment:
 - Light
 - Antenna,
 - Camera,
 - Mirror
 - Equipment box (etc...)

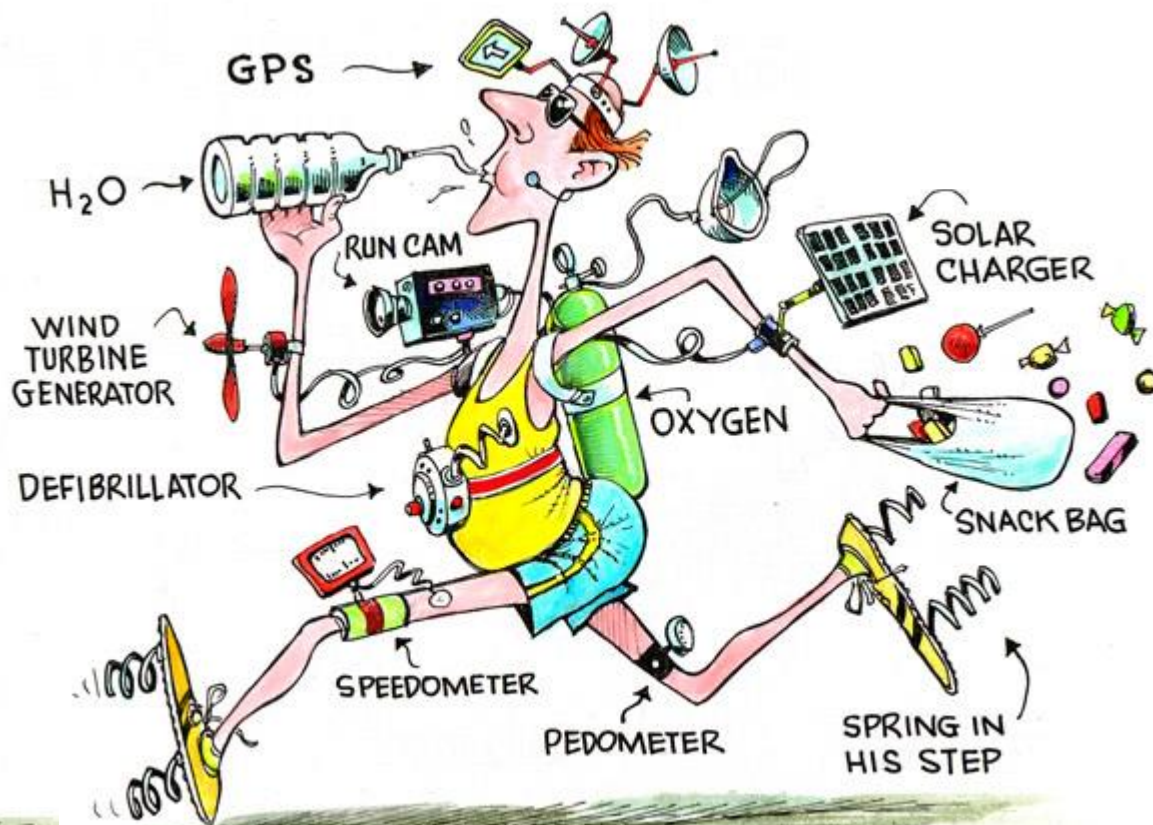
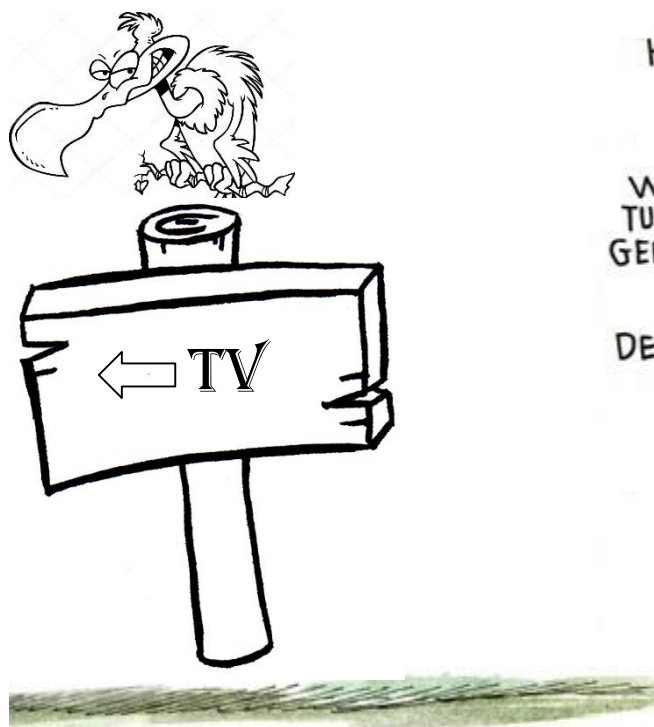


Typical missions: HEMS, VIP, External cargo operations....

Note*: Hoist development by STC will be challenging (issue with existing hoist compliance)

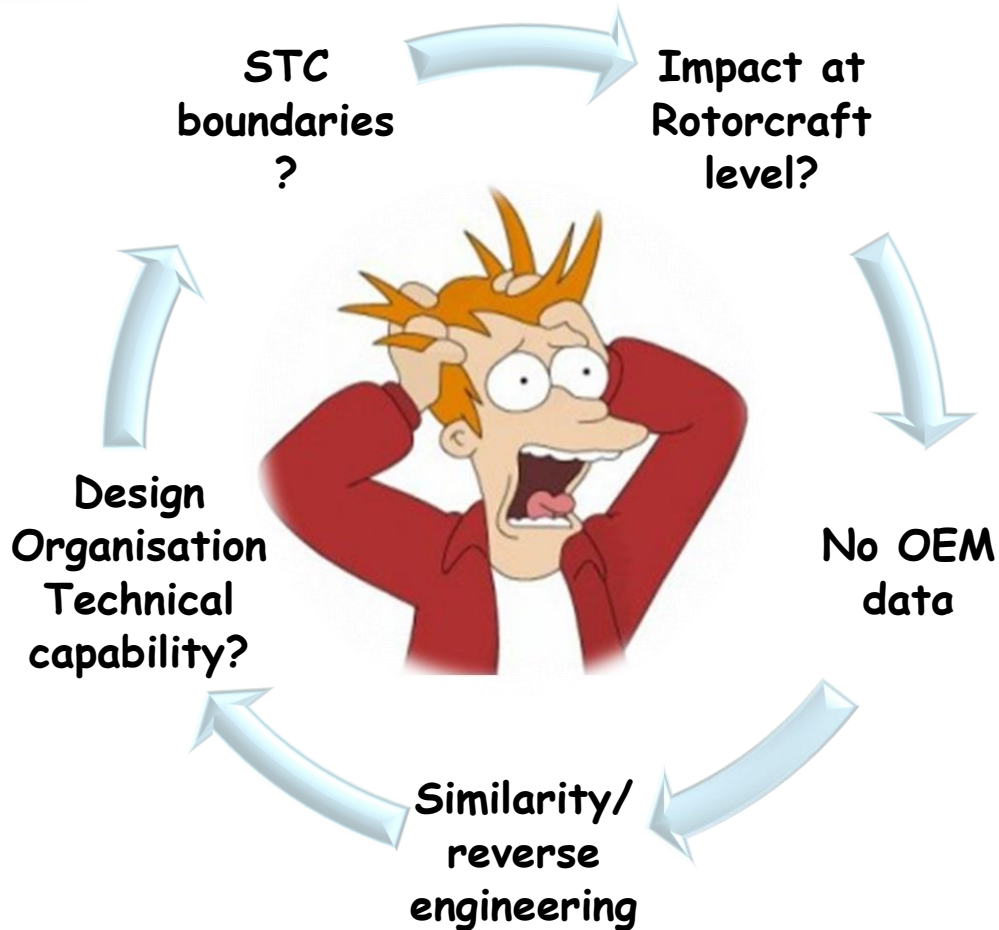


STC Marathoner...!?





STC certification: EASA General concerns



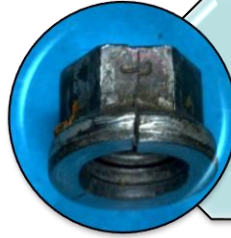
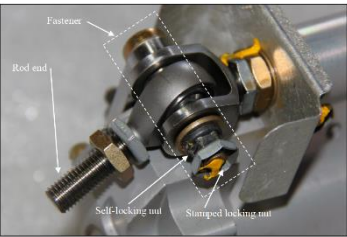


External Devices: Design precautions

Initial main rotor blade contact



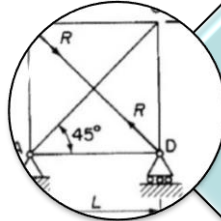
Figure 8: Lower flight control push-pull tube rod end



Defective Standard fasteners

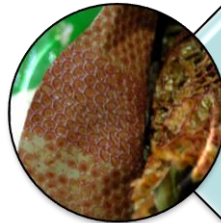
EASA SIB

Replacement or inspection expected



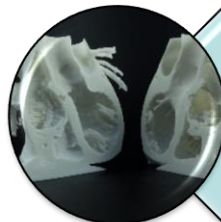
Fail safe design

for heavy equipment installation



Composite structures

Sound structures/good design values

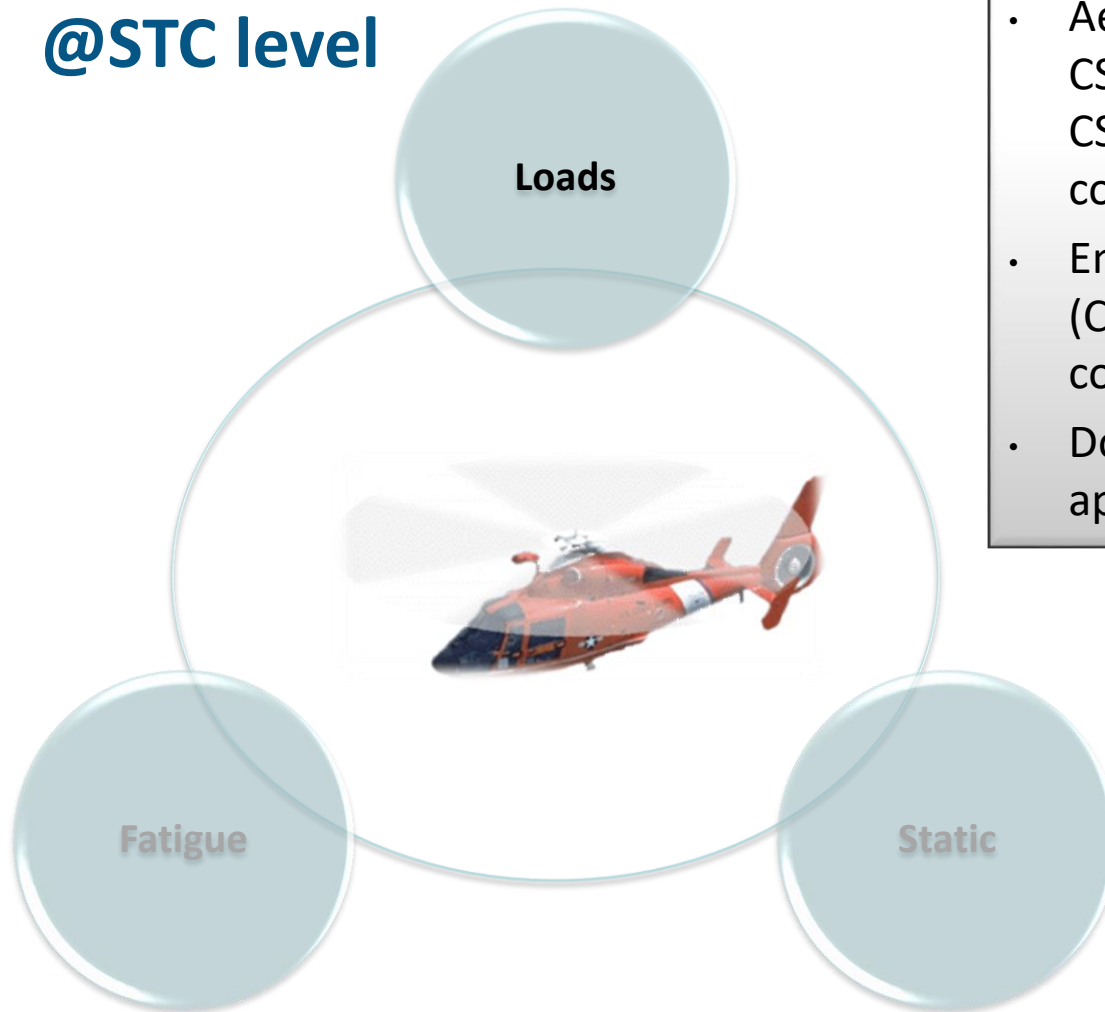


Additive manufacturing: Novel , long certification process.



External devices: Loads

@STC level

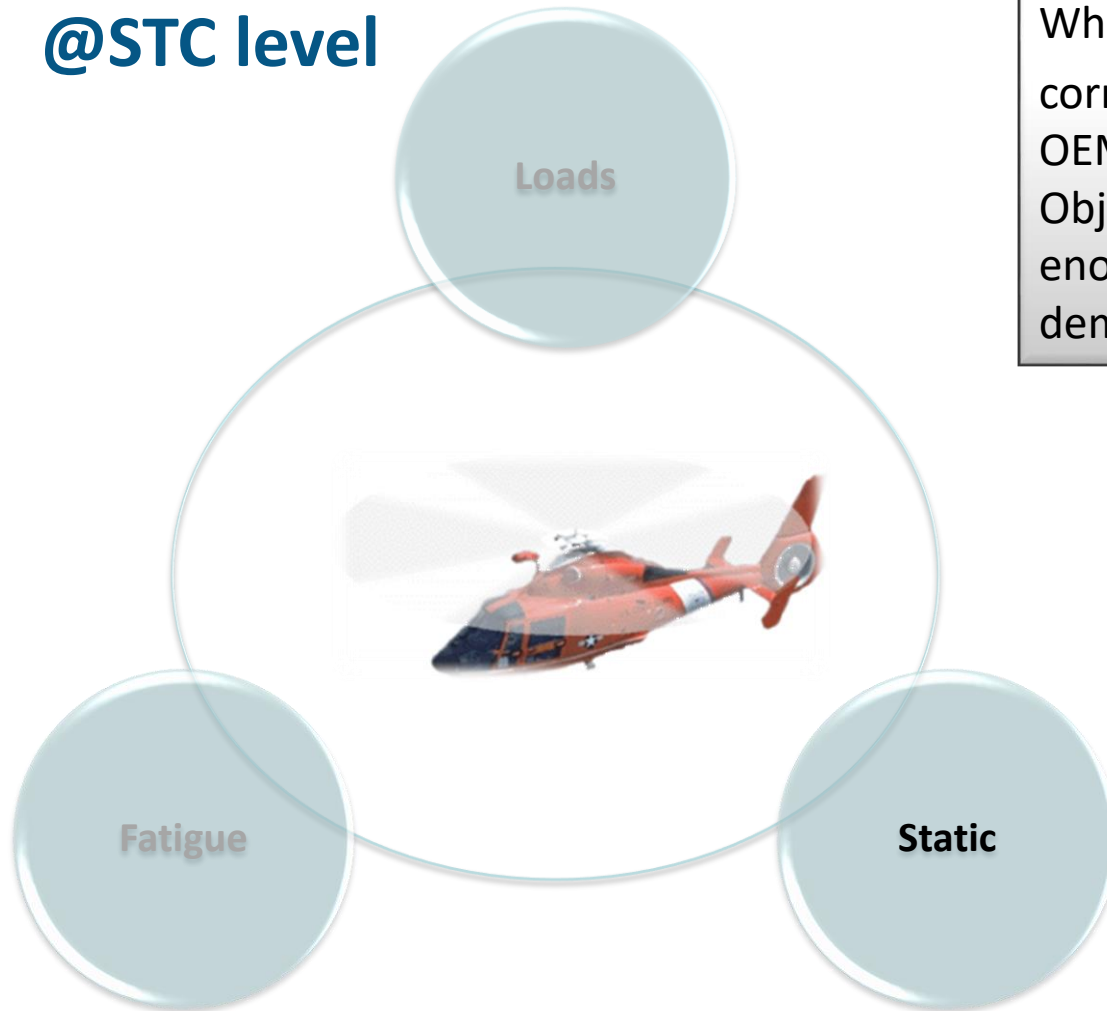


- Aerodynamic + manoeuvre CS27/29.337, gust loads CS27/29.341 and yawing conditions CS27/29.351 loads x 1.5
- Emergency landing conditions (CS27/29.561) can be used (when conservative)
- Don't forget special [factors](#) (see appendix 1)



External Devices: Static

@STC level



When analysis is not shown reliable correlation by test is required. OEM position in Non Technical Objection (NTO) should be detailed enough to read compliance demonstration through.



External Devices: Do not underestimate fatigue loads

@STC level

Human External
loads PCDS (par
865f)

Non- Human
external loads
attachment (HAZ)
(par 865f)

Provision
expected for
external
equipment(HAZ)

Fatigue substantiation

•Static failure



•initiation

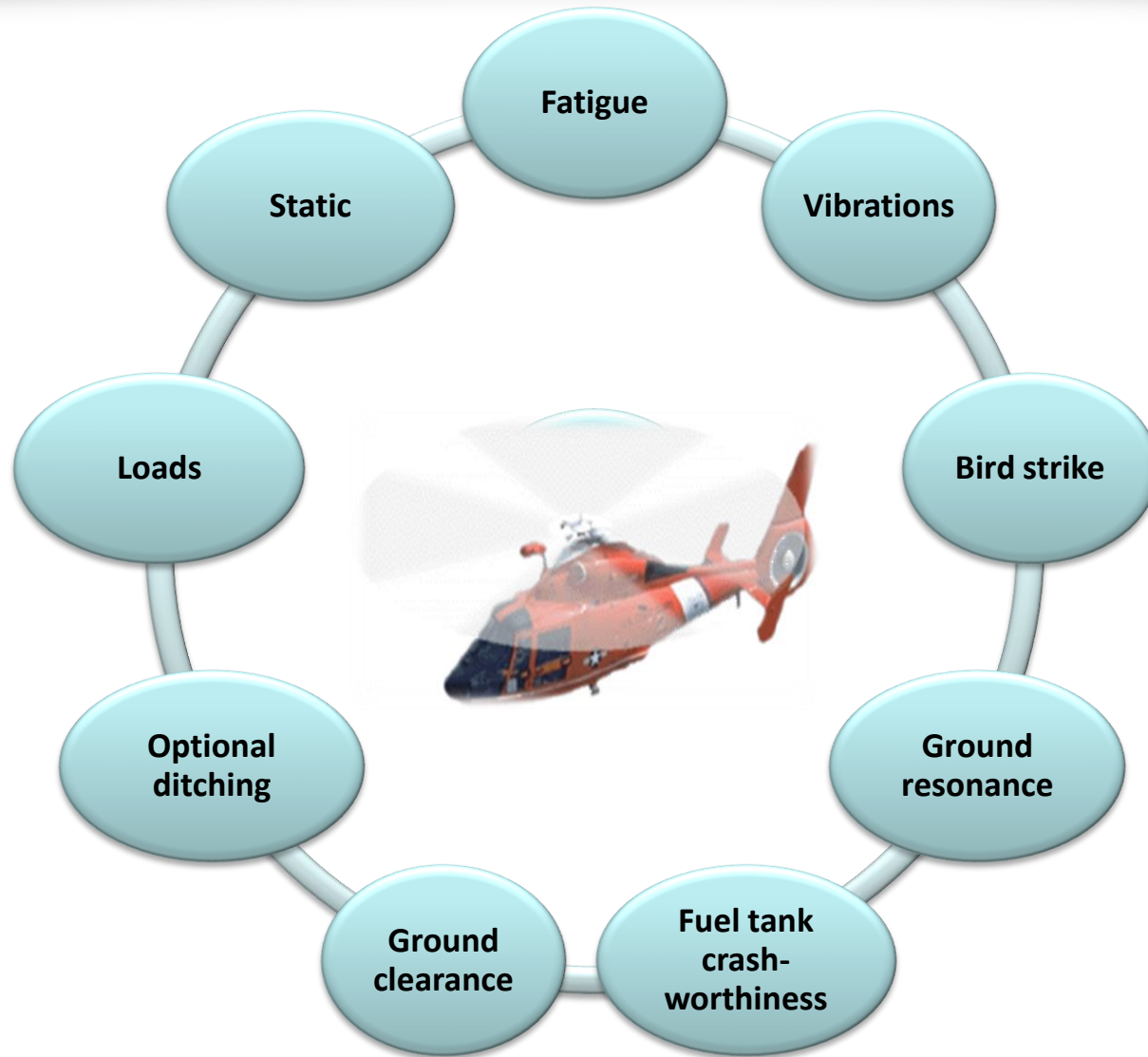
•propagation

Guidances:

- AC 29.571
- AC 27.571 MG-11
- CM-CS-005 for PCDS



External Devices-Impact at Rotorcraft level





External Devices: Loads

@Rotorcraft level



**Changes in load
distribution and
spectrum**

**Are H/C Static &
Fatigue substantiations
still valid ?**



External Devices: Review static and fatigue docs

@Rotorcraft level

OEM NTO's office



H/C justification

STC
justification

Loads
Weight&CG
flight spectrum

Affected Rotorcraft
structures/ PSE
(Loads, design)

Rotorcraft
Airworthiness
limitation

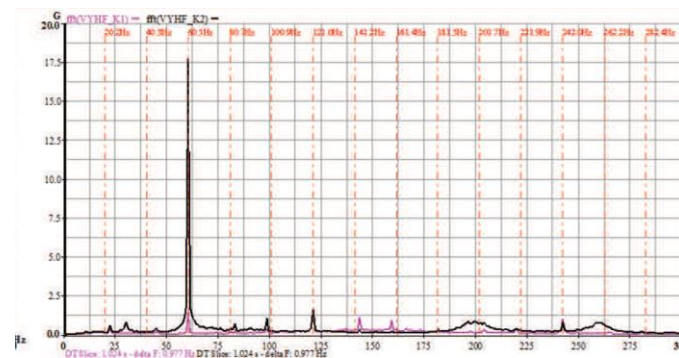
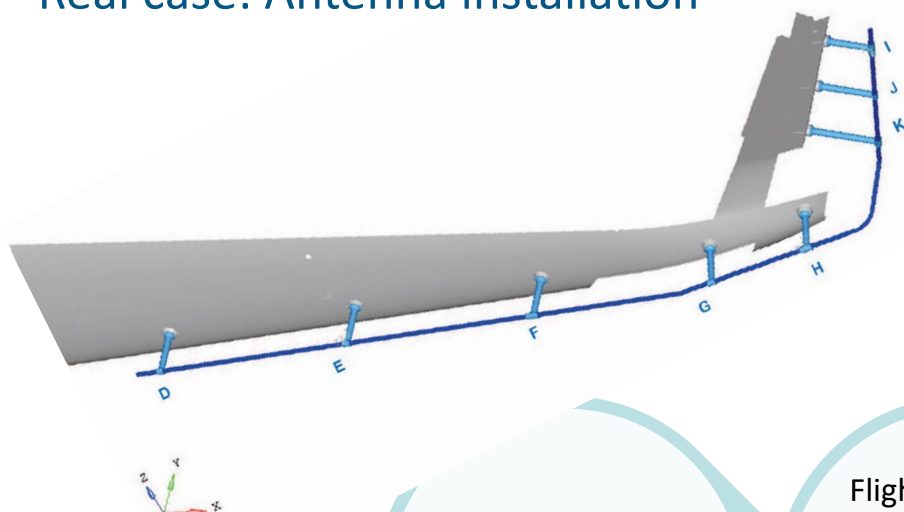




External Devices: Vibration@Rotorcraft level

@Rotorcraft level

Real case: Antenna installation



Bang test: E , G, K
sensitive to tail
rotor frequency

Flight test :up to
18g measured
on I, H, K due to
the TR response
with limited
displacement

Static
substantiation
+dedicative
fatigue analysis
to substantiate
infinite life.

How to address compliance with 27/29.251 (Vibration)? → <https://www.easa.europa.eu/the-agency/faqs/rotorcraft>



External devices: Bird strike

@Rotorcraft level



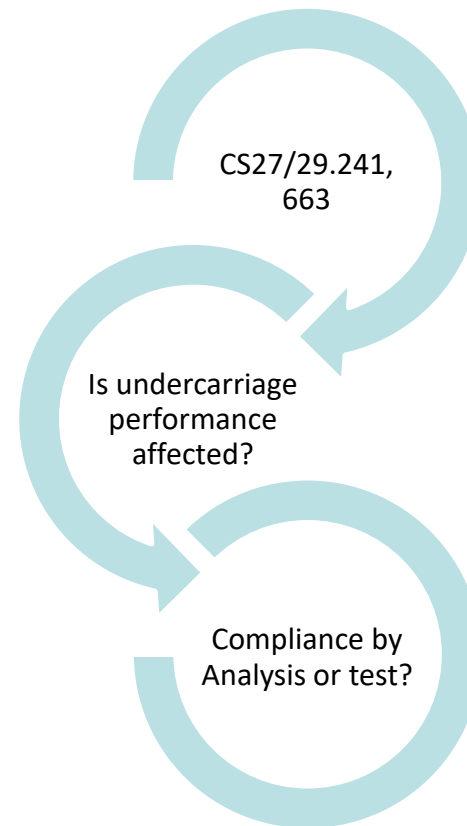
Continuous safe flight
and landing
compromised after a
bird impact?

Large Rotorcraft only



External devices: Ground resonance

@Rotorcraft level





External devices: Hazard to rotorcraft Fuel tank

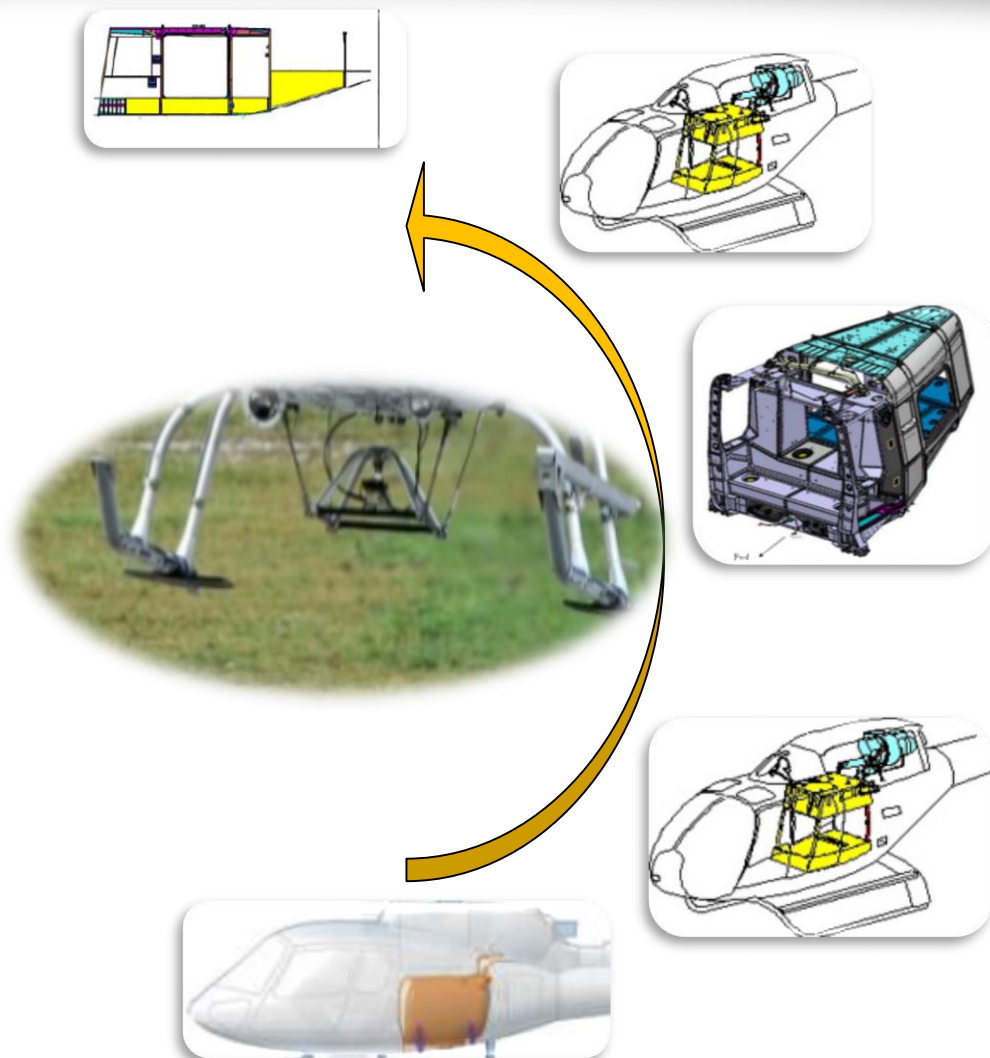
@Rotorcraft level

STC can cause Rotorcraft non compliance to CS27/29.952

Proposed Cert. Memo to give guidance to STC holders

ARAC working group project to have pre-amendment rotorcraft compliant to this requirement for safety benefit.

Challenge for STCH?



Change of Fuel tank location



External devices- Ground clearance



- Do belly mounted equipment have sufficient ground clearance?
- Verify compliance to CS27/29.727 (c) Reserve energy absorption drop.
- Some guidance for compliance in AC27/29 MG6 emergency medical service.



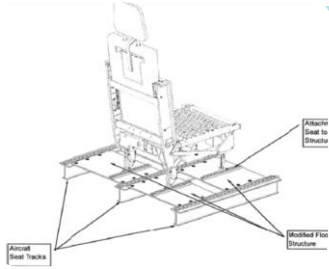
External devices- Ditching



To limit interaction with ditching provisions (structures, floats...)?
(CS 27/29.563, CS 27/29.801 Ditching)



Internal installations



Adapter plates to fit to the existing seat track layout (e.g. for HEMS installation). Generic Part 25 CRI helps to define if the adapter plate needs to be dynamically tested (CS27/29.562) with the seat or not.



Wear and tear (1.33 or 1.15), fitting (1.15) or special factors applies to loads (CM-S-002: CS 25.561).



Only compliance to CS27/29.561 is requested for stretchers



Vibration on internal equipments to be addressed.



Requirements/guidance: what is new?

• Certification Memoranda

(*)Can be used for CS27/29 applications.

Published

- CM-S-001: CS-25 Bird Strike Requirements(*).
- CM-S-002: CS 25.561 (c)(2) 1.33 'Wear and Tear' Factor(*).
- CM-S-003: Standard Fasteners (nuts and bolts).
- CM-S-004: Composite Materials - Shared Databases.
- CM-S-005: Bonded Repair Size Limits.
- CM-S-007: Continued Integrity of Rotorcraft Critical Parts (post-cert).
- CM-CS-005: H/C External Loads Personnel Carrying Device System.

To be issued

- CM-S-009: Cabin Interior Abuse Loads.
- CM-S-008: Additive Manufacturing_draft.
- CM-S-010: Composite Materials - Monocoque Sandwich Structures.
- CM-S-XXX: Compliance to CS27/29.952 a(4) for changes affecting surrounding structure.

- <https://www.easa.europa.eu/document-library/public-consultations/certification-memoranda>



New challenges

Increase of rotorcraft occupant protection safety for:

- Seats crashworthiness
- fuel tank crashworthiness
- Bird strike impact dynamics

Safety emphasis items (Validation differences):

<https://www.easa.europa.eu/sites/default/files/dfu/SSD.SEICombinedlistforrotorcraftrev1.pdf>

FAA validation items:

https://www.faa.gov/aircraft/air.../rot_type_val_GVIPart29.pdf



Conclusion and way forward

- EASA Rotorcraft department has the objective to support STC holder in their certifications.
- Impact of STC @Rotorcraft level have to be anticipated by STC holders
- **Upcoming events:**

STC holders will have opportunities to share concerns and present novel designs @:

- Rotorcraft Symposium (end 2018)
- CS27-29 Structures workshop planned in February 2019 will detail the different topics highlighted.

Questions, comments or suggestion for topics:

Structures.Workshop@easa.europa.eu or <https://www.easa.europa.eu/contact-us>



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European Aviation Safety Agency

Thank you.

Questions ?

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Appendix 1

Static substantiation-Don't forget special factors (§619).

- Special factors to be applied in addition to safety factor of 1.5.
- Some special factors need not be combined.

CS27/29.621 Casting factor

- 1.0-2.0 (or greater)

CS27/29.623 Bearing factor

- Large enough to account for relative movement
- parts with clearance subject to pounding or vibration.

CS27/29.625 Fitting factor

- 1.15 except on tested joints
- 1.33 for seat, berth, litter, safety belt, and harness attachment
- 1.33 to address wear and tear due to frequent removal (CM-S-002) or 1.15



Appendix 2

List of Abbreviations

AC	Advisory Circular
AMC	Alternative means of compliance
CRI	Certification Review Item
CS	Certification Specifications (www.easa.europa.eu/document-library/certification-specifications)
EASA CM	EASA Certification Memorandum (www.easa.europa.eu/document-library/public-consultations/certification-memoranda)
EMS	Emergency Medical Service
NTO	Non Technical objection
OEM	Original Equipment Manufacturer
PCDS	Personal Carrying Device System
PSE	Primary Structure element
STC	Supplemental Type Certificate (www.easa.europa.eu/document-library/type-certificates/supplemental-type-certificates)
W&CG	Weight and center of Gravity