European Union Aviation Safety Agency

Terms of Reference

for rulemaking task RMT.0711

Reduction in accidents caused by failures of critical rotor and rotor drive components through improved vibration health monitoring systems

RMT.0711

ISSUE 1

Issue/rationale

The use of vibration health monitoring (VHM) systems to monitor the condition of critical rotor and rotor drive components has been demonstrated to improve incipient fault detection capabilities by adding to those provided by traditional inspection techniques. However, the current certification specifications and the associated acceptable means of compliance are not sufficient to ensure that these systems can be used to optimise maintenance interventions for certain rotorcraft systems.

An amendment of the certification specifications and the associated acceptable means of compliance for large rotorcraft will clarify the means for establishing compliance with CS 29.1465 where VHM applications are used as a compensating provision for the rotor and rotor-drive system. In addition, this RMT will consider providing guidance to support the certification of VHM applications for on-condition maintenance of critical components. This should help to promote the development of VHM systems with improved fidelity and reliability.

Action area:	Rotorcraft Operations		
Affected rules:	CS-29		
Affected stakeholders:	DOA and POA holders		
Driver:	Safety	**Rulemaking group:**	Yes
Impact assessment:	Yes	**Rulemaking Procedure:**	Standard

1. Why we need to change the rules — issue/rationale

Rotorcraft are potentially more vulnerable to catastrophic mechanical failures than fixed-wing aeroplanes due to their reliance on the integrity of single-load-path-critical components within the rotor and rotor drive systems. Depending on the type certificate holder's (TCH) methodology and their designs, there can be more than a hundred critical parts within the rotor and rotor drive systems. A single failure of any of these critical parts can result in a catastrophic effect on the rotorcraft.

In the past, traditional methods for health monitoring were not able to provide a reliable early warning of certain failure modes, including fatigue cracking. It was this vulnerability and the high rotorcraft accident rate in the 1970s and 1980s that led to the development of VHM systems that are able to monitor the health and integrity of rotor and rotor drive systems.

Dedicated certification specifications (CSs) for VHM were included in CS-29 in 2012 (ref. CS 29.1465) along with the associated acceptable means of compliance (AMC). Since the development and introduction of these CSs and AMC for VHM systems, there have been improvements with regard to the capability of these systems, the processing techniques used, and the understanding of the dynamic behaviour of the components that are being monitored. Therefore, the potential now exists to place a greater level of reliance on these systems to help prevent failures in rotors and rotor drive systems, which necessitates changes to the CSs to facilitate this possibility. Additionally, certain updates and improvements of the AMC are considered necessary, based on experience that has been gathered from the application of CS 29.1465 in different certification projects.

Related safety issues

The following safety recommendation(s) (SRs), addressed to EASA, from aircraft accident investigation report(s) and published by the designated safety investigation authority[1] will be considered for this rulemaking task (RMT). New SRs related to this task may be considered after the publication of this ToR, where appropriate.

UNKG-2018-007:

> It is recommended that the European Aviation Safety Agency amend the regulatory requirements to require that Vibration Health Monitoring data gathered on helicopters is analysed in near real time, and that the presence of any exceedence detected is made available to the flight crew on the helicopter; as a minimum, this information should be available at least before takeoff and after landing.

This was related to an accident that occurred on 28 December 2016 at the West Franklin wellhead platform, North Sea, UK involving a Sikorsky S-92A helicopter registered G-WNSR.

Other SRs and safety review recommendations that have been addressed to EASA, but which are associated with VHM systems that are not directly related to the objectives of this RMT, will also be taken into consideration to ensure consistency.

There are no:

— exemptions that are pertinent to the scope of this RMT;

[1] Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC (OJ L 295, 12.11.2010, p. 35) (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1479716039678&uri=CELEX:32010R0996).

— direct references to ICAO Standards and Recommended Practices; or
— references to EU regulatory material that is relevant for this RMT.

2. What we want to achieve — objective

The overall objectives of the EASA system are defined in Article 1 of Regulation (EU) 2018/1139. This project will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 1.

The specific objective of this proposal is to reduce the likelihood of hazardous and catastrophic failure modes by improving the incipient fault detection capabilities of current inspection procedures. This will be achieved by enabling VHM systems to be a more integral part of the continued airworthiness regime of the rotorcraft and by ensuring better and updated guidance is provided for the design as well as the routine and effective in-service use of these systems. It is considered that this will allow VHM systems to support the optimisation of maintenance of the rotor and rotor drive system and, thus, reduce the risk of maintenance errors.

3. How we want to achieve it

These objectives can be achieved by improving the available AMC for VHM systems that is included in CS-29. Amendments to AMC 29.1465 may also be considered to accommodate the application and demonstration of adequate reliability and effectiveness of VHM system that are used as the monitoring means in the support of on-condition maintenance activities of elements of the rotor and rotor drive system. Additionally, some improvements to the existing content may be considered to clarify certain aspects of VHM systems certification taking into consideration their intended application.

This will be achieved by:

— defining criteria for the acceptance of VHM systems as an airworthiness approved means for enabling the possibility for on-condition maintenance;

— defining high-level objectives to be achieved for VHM applications for on-condition maintenance (credit) purposes, and providing additional considerations regarding the characteristics to be demonstrated for elements of the rotor and rotor drive system and their failure modes that are being monitored for this purpose;

— establishing appropriate principles concerning the definition of adequate targets for controlled service introduction phases, taking into consideration the intended use of the different VHM system indicators, and additionally, clarifying the requirements for the performance assessment of VHM systems during these phases;

— clarifying the intent of VHM trend monitoring and the objectives of its implementation;

— defining advanced anomaly detection techniques, the scope of their application as part of VHM monitoring and provide associated guidance material for certification;

— defining recommended criteria for evaluating the performance of health indicators and the associated thresholds;

— improving the guidance material on alert management, taking into account relevant VHM best-practice guides; and

— clarifying the depth of initial and controlled service introduction (CSI) investigations expected for elements of the VHM system, such as ground stations, product support, and recommendations for training.

4. What are the deliverables

The expected deliverables for this RMT are:

— A notice of proposed amendment (NPA) that proposes changes to CS-29 as found necessary, including the associated AMC;
— An ED Decision that amends CS-29, including the associated AMC, based on the proposal consulted in the NPA and the comments received thereto.

5. How we consult

A public consultation will take place through an NPA in accordance with Article 7 of the Rulemaking Procedure[2].

6. Profile and contribution of the rulemaking group

The proposal shall be developed with the support of a rulemaking group. The profile of the rulemaking group and its members is as follows:

Expertise required:

— Experience in the design and development of rotorcraft VHM systems;

— Experience in the development of VHM algorithms and the associated threshold setting techniques;

— Experience in the analysis and post-processing of VHM data in support of a helicopter fleet;

— Experience in operator, continued airworthiness management organisation/approved maintenance organisation (CAMO/AMO) activities and approvals;

— Authority experience relating to the flight standards aspects of VHM systems; and

— An extensive awareness of the design of rotorcraft drive systems and their associated failure modes.

The rulemaking group shall be composed of:

— Authority representatives from EASA, the FAA (if appropriate), TCCA (if appropriate) and National Aviation Authorities (NAA)s;

— Large rotorcraft manufacturers;

— VHM systems manufacturers; and

— Rotorcraft operators and CAMO/AMO personnel with extensive experience of the use of VHM systems.

[2] EASA Management Board Decision N°18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications, acceptable means of compliance and guidance material ('Rulemaking Procedure').

The role, responsibilities, and duties of the rulemaking group members specific to this task are as follows:

— Preparing the proposed amendments to the CS relating to VHM systems;

— Preparing the proposed AMC related to VHM systems; and

— Preparing the proposed amendments to the associated AMC related to on-condition maintenance, and the instructions for continued airworthiness (ICA) stemming from the amendments above.

7. Reference documents

7.1. Affected decisions

— DECISION NO. 2003/16/RM of 14 November 2003 on Certification Specifications and Acceptable Means of Compliance for Large Rotorcraft (« CS-29 »);

7.2. Reference documents

— AC 29 MG 1 Certification Procedure for Rotorcraft Avionics Equipment

— AC 29 MG 15 Airworthiness Approval of Rotorcraft Health Usage Monitoring Systems (HUMS)