SIKORSKY S-92A, G-WNSR	West Franklin wellhead platform, North Sea	28 December 2016	Accident

Investigation Synopsis

Summary

The helicopter was being operated from Aberdeen on a contract on behalf of an offshore oil and gas company. On 27 December 2016, during a flight on the day prior to the accident, the Health and Usage Monitoring System (HUMS) recorded vibration data which contained a series of exceedances related to the tail rotor pitch change shaft (TRPCS) bearing. Routine maintenance was carried out overnight which included a download and preliminary analysis of the HUMS data. While an anomaly for tail rotor gearbox (TGB) bearing energy was detected by the maintenance engineer, the exceedances were not identified, in part, due to the way they were presented in the analysis tool; the helicopter was released to service without further investigation.

On 28 December 2016, during the first sector of the day, the HUMS recorded further exceedances but these were not scheduled to be downloaded and reviewed until the helicopter returned to Aberdeen; there was no method in place for either the flight crew or maintenance personnel to be made aware of these further exceedances until then.

During lift off on the second sector, the helicopter suffered an uncommanded right yaw through 45° and the flight crew re-landed. The helicopter was again lifted into the hover and responded normally to the controls, so the event was attributed to a wind effect and the helicopter departed en route.

The five-minute flight to the West Franklin wellhead platform was uneventful but, in the latter stages of landing, yaw control was lost completely and the helicopter yawed to the right. The crew landed the helicopter expeditiously, but heavily, on the helideck. The helicopter continued to rotate to the right and the crew closed the throttles before it came to rest near the edge of the helideck having turned through approximately 180°. There were no injuries.

The investigation determined that the TRPCS bearing had degraded and failed. As a consequence, the tail rotor pitch change servo was damaged resulting in uncommanded and uncontrolled inputs being made to the tail rotor (TR). The manner in which the servo was damaged had not been previously identified.

The investigation identified the following causal factors to the loss of yaw control:

• The TRPCS bearing failed for an undetermined reason.

• The TRPCS bearing failure precipitated damage to the tail rotor pitch control servo.

The investigation identified the following contributory factors:

• Impending failure of the TRPCS bearing was detected by HUMS but was not identified during routine maintenance due to human performance limitations and the design of the HUMS Ground Station (GS) Human Machine Interface (HMI).

• The HUMS GS software in use at the time had a previously-unidentified and undocumented anomaly in the way that data could be viewed by maintenance personnel. The method for viewing data recommended in the manufacturer's user guide was not always used by maintenance personnel.

Despite being unable to determine the exact cause of the bearing failure, the helicopter manufacturer has

identified and introduced a number of changes intended to reduce the risk of a recurrence including: introducing HUMS software with enhanced diagnostic capabilities and improved user interfaces, tighter control of bearing manufacturing and assembly tolerances, consistency in lubricating grease quality and its application, and in-service temperature monitoring.

In this report, the AAIB makes two Safety Recommendation concerning the timeliness of acquiring, accessing, analysing and promulgating Vibration Health Monitoring (VHM) data, to enhance the usefulness of VHM data for the timely detection of an impending failure.

Safety Recommendation 2018-006

Justification

Therefore, the following safety recommendation was made:

> **Safety Recommendation 2018-006**
>
> It is recommended that the European Aviation Safety Agency commission research into the development of Vibration Health Monitoring data acquisition and processing, with the aim of reducing the data set capture interval prescribed in the Acceptable Means of Compliance to CS 29.1465 and thereby enhancing the usefulness of VHM data for the timely detection of an impending failure.

Date Safety Recommendation made: 13 March 2018

LATEST RESPONSE

Response received: 25 November 2020

EASA agrees with the intent of the recommendation and the research project proposal RES.011 "Helicopter, tilt rotor and hybrid aircraft Gearbox health monitoring- In-situ failure detection" has been added in the European Plan for Aviation Safety EPAS 2018-2022. One of the objectives of the research will be to investigate the feasibility of maximising the number of vibration health monitoring data acquisitions per flight (whatever the flight profile).

Safety Recommendation Status **Closed**

AAIB Assessment **Adequate**

Action Status **Planned Action Completed**

Feedback rationale

(EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2018-0006)

Safety Recommendation 2018-007

Justification

Therefore, the following safety recommendation was made:

> **Safety Recommendation 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 exceedance detected is made available to the flight crew on the helicopter; as a minimum, this information should be available at least before take-off and after landing.

Date Safety Recommendation made: 13 March 2018

LATEST RESPONSE

Response received: 21 September 2022

Rulemaking task RMT.0711, which takes into account this safety recommendation, has been initiated with the publication of its Terms of Reference (ToR) and its Group Composition on 5 March 2020: https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0711

On 11 May 2022, the European Union Aviation Safety Agency (EASA) published Notice of Proposed Amendment (NPA) 2022-03 for public consultation.

The specific objective of this NPA 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 Vibration Health Monitoring (VHM) systems to be a more integral part of the continued airworthiness regime of the rotorcraft and by ensuring that 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.

The NPA proposes to amend CS-29 (Certifications Specifications, Acceptable Means of Compliance and Guidance Material for Large Rotorcraft).

New Acceptable Means of Compliance AMC1 29.1465 and Guidance Material GM1 29.1465 are proposed (replacing the existing AMC 29.1465) to accommodate the application and demonstration of adequate reliability and effectiveness of VHM systems that are used as the monitoring means in support of on-condition maintenance activities of elements of the rotor and rotor drive system. Additionally, some improvements to the existing AMC content are proposed to be introduced to clarify certain aspects of certification of VHM systems taking into consideration their intended application.

Paragraph (m) of the proposed amendment addresses VHM system applications relying on cockpit indications. Such features may be introduced by the applicant considering the characteristics of the failure condition(s) being monitored and customer needs. Dedicated certification guidance and considerations are provided for applicants depending on the specific purpose of the cockpit indications to be introduced. However, this material is not intended to address VHM systems that include in-flight cockpit indications requiring severe pilot actions such as landing immediately or landing within a limited interval.

This response will be updated once EASA has analysed the comments received on NPA 2022-03 and issued a Decision amending CS-29. This milestone is currently targeted for Q1 2023.

EASA Status: Open

Safety Recommendation Status	**Open**
AAIB Assessment	**Partially Adequate**
Action Status	**Planned Action Ongoing Update Due** 31 March 2023

Feedback rationale

It is noted that the European Union Aviation Safety Agency (EASA) Notice of Proposed Amendment (NPA) 2022-03 does consider real-time and near real-time VHM alerting together with the capability to conduct a complete VHM data review during rotors running turnarounds. However, it is also noted that whilst the NPA mentions the provision of a cockpit indication for flight crews for an exceedance, this feature is not intended to be a requirement. As a consequence, the proposed changes only partially satisfy the intent of SR 2018-007. An updated response is anticipated from EASA once a Decision, having considered the industry comments on the NPA, is issued by the end of March 2023. (EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

Response received: 25 November 2020

The European Plan for Aviation Safety (EPAS) 2018-2022 includes rulemaking task RMT.0711 in order to achieve a "Reduction in accidents caused by failures of critical rotor and rotor drive components through improved vibration health monitoring systems".
The primary objective of this task is to update the existing acceptable means of compliance relating to vibration health monitoring (VHM) in order to take account of advances in technology and current operational best practices. The scope of RMT.0711 will consider the improvement of the frequency of data collection and analysis and will also consider the possibility for provision of a cockpit indication to inform flight crew in the event of a VHM threshold exceedance.

AAIB Assessment – Partially Adequate Open

Response received: 15 November 2020

The European Union Aviation Safety Agency (EASA) confirms that the intent of the Safety Recommendation will be taken into account in rulemaking task RMT.0711. The rulemaking group has planned to evaluate the need for additional guidance in the acceptable means of compliance (AMC) 29.1465 regarding near real time vibration health monitoring (VHM) processing linked to cockpit indications to be provided before takeoff, after landing and during flight. The group, considering the criticality of the monitored system and the time from detection to failure, will:

• Decide if and when real time analysis is required and to what extent it is practical;

• Summarise the potential benefits and difficulties of providing flight crew with “information” before take-off, after landing and during flight;

• Propose additional guidance with regards to the application of VHM systems when real time analysis is

used and the flight crew needs to be informed/act.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2018-0007)