

EC225 LP,
G-CHCN

32 nm southwest of
Sumburgh, Shetland
Islands

22 October 2012

Accident

Investigation Synopsis

While operating over the North Sea, in daylight, the crews of G-REDW and G-CHCN experienced a loss of main rotor gearbox oil pressure, which required them to activate the emergency lubrication system. This system uses a mixture of glycol and water to provide 30 minutes of alternative cooling and lubrication. Both helicopters should have been able to fly to the nearest airport; however, shortly after the system had activated, a warning illuminated indicating that the emergency lubrication system had failed. This required the crews to ditch their helicopters immediately in the North Sea. Both ditchings were successful and the crew and passengers evacuated into the helicopter's liferafts before being rescued. There were no serious injuries. The loss of oil pressure on both helicopters was caused by a failure of the bevel gear vertical shaft in the main rotor gearbox, which drives the oil pumps. The shafts had failed as result of a circumferential fatigue crack in the area where the two parts of the shaft are welded together. On G-REDW the crack initiated from a small corrosion pit on the countersink of the 4 mm manufacturing hole in the weld. The corrosion probably resulted from the presence of moisture within the gap between the PTFE plug and the countersink. The shaft on G-REDW had accumulated 167 flying hours since new. On G-CHCN, the crack initiated from a small corrosion pit located on a feature on the shaft described as the inner radius. Debris that contained iron oxide and moisture had become trapped on the inner radius, which led to the formation of corrosion pits. The shaft fitted to G-CHCN had accumulated 3,845 flying hours; this was more than any other EC225 LP shaft. The stress, in the areas where the cracks initiated, was found to be higher than that predicted during the certification of the shaft. However, the safety factor of the shaft was still adequate, providing there were no surface defects such as corrosion. The emergency lubrication system operated in both cases, but the system warning light illuminated as a result of an incompatibility between the helicopter wiring and the pressure switches. This meant the warning light would always illuminate after the crew activated the emergency lubrication system.

A number of other safety issues were identified concerning emergency checklists, the crash position indicator and liferafts.

Ten safety recommendations have been made. In addition, the helicopter manufacturer carried out several safety actions and is redesigning the bevel gear vertical shaft taking into account the findings of the investigation. Other organisations have also initiated a number of safety actions as a result of this investigation.

Safety Recommendation 2013-006

Safety Recommendation 2013-006

It is recommended that the European Aviation Safety Agency requires the manufacturers of aircraft equipped with a Type 15-503 Crash Position Indicator system, or similar Automatically Deployable Emergency Locator Transmitter, to review and amend, if necessary, the respective Flight Manuals to ensure they contain information about any features that could inhibit automatic deployment.

Date Safety Recommendation made: 18 March 2013

LATEST RESPONSE

Response received: 24 February 2014

The European Aviation Safety Agency has issued on 17 January 2014 the Airworthiness Directive EASA AD 2014-0019, regarding the Crash Position Indicator System (CPI), requiring temporary amendment of the aircraft flight manual (AFM) and installation of a placard, on installations where such an action has no detrimental effect on emergency locator transmitter (ELT) operation. This AD also requires replacement of the System Interface Unit with an improved part as a terminating action for the temporary AFM amendment and placard installation.

Safety Recommendation Status **Closed**

AAIB Assessment **Adequate**

RESPONSE HISTORY

Response received: 03 October 2013

EASA, in cooperation with the manufacturer, has re-examined the requirements of the Emergency Locator Transmitter EUROCAE ED-62 and studied the system specifications again and it was concluded that the equipment is not 100% compliant to the Minimum Operational Performance Standards (MOPS). The manufacturer is preparing an update to change the behaviour of the system to only allow deployment and activation as being one event. Once the Service Bulletin is available EASA will prepare a corresponding Airworthiness Directive to mandate the system update.

This proposed solution, meeting the intent of the requirements, is still under discussion with the applicant to reach a final design change as the ultimate fix for the problem.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2013-0006)

Safety Recommendation 2013-007

Safety Recommendation 2013-007

It is recommended that the Federal Aviation Administration requires the manufacturers of aircraft equipped with a Type 15-503 Crash Position Indicator system, or similar Automatically Deployable Emergency Locator Transmitter, to review and amend, if necessary, the respective Flight Manuals to ensure they contain information about any features that could inhibit automatic deployment.

Date Safety Recommendation made: 18 March 2013

LATEST RESPONSE

Response received: 25 April 2013

Depending on the type of operation and operating airspace, the FAA may require rotorcraft to have an operating ELT. However, the FAA does not require the installation of a deployable ELT or CPI on helicopters; therefore, the loss of this function is not considered an unsafe condition. In addition, the FAA can only require a change to a design through an airworthiness directive, which requires the determination of an unsafe condition. As a result, the FAA lacks the justification to adopt safety recommendation 13.031, and they plan no further actions.

Safety Recommendation Status Closed

AAIB Assessment Not Adequate

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2013-0007)

Safety Recommendation 2014-013

Safety Recommendation 2014-013

It is recommended that the European Aviation Safety Agency provide Acceptable Means of Compliance (AMC) material for Certification Specification (CS) 29.1585, in relation to Rotorcraft Flight Manuals, similar to that provided for Aeroplane Flight Manuals in AMC 25.1581 to include cockpit checklists and systems descriptions and associated procedures.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 11 June 2021

This safety recommendation will be taken into account in the frame of rulemaking task RMT.0724 for which the Terms of Reference (ToR) (entitled 'Improvement of operating information provided to rotorcraft flight crew') and the Rulemaking Group Composition have been published on 12 March 2021 on the European Union Aviation Safety Agency (EASA) website: <https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0724>

The objective is to improve the operational information provided to the rotorcraft flight crew.

The ToR envisages to reach this objective as follows:

- A gap analysis will be conducted to identify the elements to be improved in the existing acceptable means of compliance (AMC) for the preparation of Rotorcraft Flight Manuals (RFM);
- The results of the gap analysis will be used to identify the points to be addressed by new AMCs, elements that could be relevant for flight crew operating manuals (FCOMs), and elements that cannot be addressed by this rulemaking task;
- A new AMC will be drafted in order to develop guidance for a more comprehensive RFM, with the objective of filling the gaps in the current material;
- This new AMC should ensure that rotorcraft manufacturers will provide more details regarding the procedures to be followed for rotorcraft operations, both for normal and emergency procedures, which take into account the number of crew members, the configuration and the operational environment. As a result, these additional details should help to clarify which elements belong to the airworthiness domain and which elements are related to the operational domain;
- The overall structure and the minimum contents of an FCOM will be defined, allowing type certificate holders (TCHs) to introduce it on a voluntary basis if they decide to publish part of the operational information in this manual;
- The applicability of the proposed material will be assessed, and simplified if necessary, to ensure a proportionate approach;
- An impact assessment will be prepared on the basis of the initial assessment already performed by EASA.

A Notice of Proposed Amendment (NPA) will be prepared and published for public consultation. The NPA will propose amendments of CS-29, CS-27 and, if considered necessary, CS-VLR. The publication is foreseen for Q1 of 2023 according to the European Plan for Aviation Safety (EPAS) 2021-2025.

EASA Status: Open

Safety Recommendation Status **Open**

AAIB Assessment **Partially Adequate**

Action Status **Planned Action Ongoing Update Due 01 August 2022**

Feedback rationale

It is acknowledged that the EASA has added the safety issues raised by this Safety Recommendation into Rule Making Task 0724. The AAIB awaits a further update as to the progress toward issuing the Notice of proposed amendment. (EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

Response received: 08 February 2019

This safety recommendation will be taken into account in the frame of rulemaking task RMT.0724 entitled 'Rotorcraft flight crew operating manuals (FCOMs)'.

This RMT is included in the EASA European Plan for Aviation Safety (EPAS) 2019-2023 published on 15th January 2019, with Terms of Reference planned to be issued in 2019Q3.

The objective of this RMT is to improve the operational information provided to rotorcraft flight crew in the aircrew manuals. This could be achieved by standardising the structure and approach used to present operational information in rotorcraft manuals, thereby improving the clarity of this information.

AAIB Assessment – Partially Adequate Open

Response received: 05 August 2014

An amendment of the Acceptable Means of Compliance where EASA would take into account the specificity of helicopter type and intended operations is under consideration.

An update will be provided as soon as any progress is available.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2014-0013)

Safety Recommendation 2014-014

Safety Recommendation 2014-014

It is recommended that the liferaft manufacturer, Survitec Group Limited, revises the Component Maintenance Manual for the Type 18R MK3 liferaft to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when packing the liferaft.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 08 October 2014

The CMM for the 18R Mk3 Heliraft (RFD 25-60-96) has been updated to Revision 5. This version includes clearer instruction on the packing procedures and routing of the mooring and equipment lines. The update was released to all registered holders of the CMM on 11th July 2014.

Safety Recommendation Status Closed

AAIB Assessment Adequate

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2014-0014)

Safety Recommendation 2014-015

Safety Recommendation 2014-015

It is recommended that the aircraft manufacturer, Eurocopter Group, revise the Super Puma Aircraft Maintenance Manual Task 25-66-01-061 'Removal-Installation of the Liferaft Assembly' to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when installing the liferaft.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 24 February 2016

Airbus Helicopters have issued Information Notice n° 2999-I-25 concerning the updating installation procedure for life raft with details of the amended Aircraft Manual Task 25-66-01-061 to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when installing the liferaft.

Safety Recommendation Status Closed

AAIB Assessment Adequate

RESPONSE HISTORY

Response received: 28 October 2014

Airbus Helicopters has considered this Safety Recommendation and the Aircraft Manual Task 25-66-01-061 will be revised to include clear instructions and diagrams on how to route the rescue pack lines and mooring lines when installing the liferaft.

A copy of the revised instruction will be provided to the AAIB as soon as available.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2014-0015)

Safety Recommendation 2014-016

Safety Recommendation 2014-016

It is recommended that the European Aviation Safety Agency review the installation of the Type 18R MK3 liferaft in the EC225 sponson to ensure that there is a high degree of deployment reliability in foreseeable sea conditions.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 15 February 2016

A thorough review of the design and functioning of the installation of the Type 18R MK3 liferaft in the EC225 sponsons was performed on production rotorcraft at the Airbus Helicopters facility. The assessment of the actual raft installation was performed by progressively removing and replacing items related to the raft installation in order to evaluate possible reasons for a raft to deploy incorrectly. The effects foreseeable in rough sea conditions such as the pitching/heaving/rolling of the rotorcraft, intermittent submerging of the sponson, or wind loading were considered but it was not feasible to perform an inflation test of a raft. However this was not considered to reduce the level of confidence that could be placed in the positive conclusion of the review.

The conclusion of the review was that the installation design considers the combination of inertia and physical interaction effects, and ensures the deployment is effective provided the liferaft is correctly packed and then installed into the helicopter sponson correctly.

The overall deployment reliability is then achieved when taking into consideration that the liferaft manufacturer, Survitec Group Limited, has included in July 2014, in Revision 5 of the Component Maintenance Manual for the 18R Mk3 liferaft, a clearer instruction on the packing procedures including how to route the mooring and rescue pack lines within the pack.

Safety Recommendation Status Closed

AAIB Assessment Adequate

RESPONSE HISTORY

Response received: 05 August 2014

In cooperation with Airbus Helicopters, EASA has initiated a review of the installation of the Type 18R MK3 liferafts in the sponsons of the EC225 helicopter with the aim of checking the actual degree of deployment reliability of the liferafts for the current certificated sea conditions. As part of this review, consideration will be given to liferaft deployment service experience on EC225 and other equivalent Super-Puma helicopters.

The outcome of the review will be provided when available.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2014-0016)

Safety Recommendation 2014-017

Safety Recommendation 2014-017

It is recommended that the European Aviation Safety Agency develop certification requirements for externally mounted liferafts fitted to offshore helicopters which ensure a high degree of deployment reliability in foreseeable sea conditions.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 05 August 2014

The drafting group of rulemaking task RMT.0120 is currently considering a broad range of helicopter ditching, water impact and survivability issues, with the objective of reviewing existing rules and ensuring that they are and remain appropriate to meet identified hazards. A review of existing equipment standards (ETSOs) forms part of this task, including those related to life rafts (ETSO-2C70b and ETSO-2C505). The drafting group is aware that neither of these standards was developed specifically with external mounting in mind, and therefore do not contain specific test provisions to ensure correct, effective and reliable deployment in all foreseeable sea conditions and fuselage attitudes. This safety recommendation is therefore taken into account.

The drafting group is also working to identify other shortcomings with the existing standards from previous accident investigations.

Once the overall review is complete, the drafting group will propose adequate changes to equipment standards and also possibly to rotorcraft certification specifications (CS-27 and CS-29).

Safety Recommendation Status **Closed**

AAIB Assessment **Partially Adequate**

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2014-0017)

Safety Recommendation 2014-018

Safety Recommendation 2014-018

It is recommended that the European Aviation Safety Agency amend the regulatory requirements to require that the long mooring line on liferafts fitted to offshore helicopters is long enough to enable the liferaft to float at a safe distance from the helicopter and its rotor blades.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 05 August 2014

The drafting group of rulemaking task RMT.0120 is currently considering a broad range of helicopter ditching, water impact and survivability issues, with the objective of reviewing existing rules and ensuring that they are and remain appropriate to meet identified hazards.

The issue mentioned in this safety recommendation is already known and taken into account by the drafting group, and it will form part of its proposed changes to the design requirements.

Safety Recommendation Status Closed

AAIB Assessment Partially Adequate

Action Status

Feedback rationale

(EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

N/A

(SRIS Reference: GB.SIA-2014-0018)

Safety Recommendation 2014-019

Safety Recommendation 2014-019

It is recommended that the European Aviation Safety Agency commission research into the fatigue performance of components manufactured from high strength low alloy steel. An aim of the research should be the prediction of the reduction in service-life and fatigue strength as a consequence of small defects such as scratches and corrosion pits.

Date Safety Recommendation made: 11 June 2014

LATEST RESPONSE

Response received: 28 November 2024

In the context of rotorcraft design and certification activities, an evaluation by Type Certificate Holders and the European Union Aviation Safety Agency (EASA) of the effect of corrosion on fatigue strength for high-strength steels had been carried out. This had already resulted in changes to the means provided by applicants to show compliance with CS 29.571 fatigue tolerance requirements.

EASA has completed the research project into "Integrity Improvement of Rotorcraft Main Gear Box (MGB)" (ref. European Plan for Aviation Safety RES.0008).

The outcome of the research project is published at <https://www.easa.europa.eu/en/research-projects/integrity-improvement-rotorcraft-main-gear-box-mgb>.

EASA Status: Closed – Agreement

Safety Recommendation Status Closed

AAIB Assessment Partially Adequate

Action Status Planned Action Completed

Feedback rationale

The EASA response points to research that had been carried out on improving the integrity of rotorcraft gearboxes. The research appears to concentrate on reliability and tolerance to flaws in rotor and rotor drive system gears and bearings when subject to rolling contact fatigue following recommendations from AIB-Norway after the investigation into the accident involving LN-OJF. It is not entirely clear how this research related to the issue identified in the report into the accidents to G-REDW and G-CHCN that led to this Safety Recommendation. The AAIB's recommendation was to address the effect on the high cycle fatigue life of defects, such as corrosion pits and scratches, on highly stressed components manufactured from high strength low alloy steel, such as 32CDV13. The first part of EASA's research has reviewed design criteria to prevent single point catastrophic failure, but it is not clear if this considered the effect of flaws in high strength steels in any application and in particular in the drive systems such as the bevel gear vertical shaft. It therefore remains, although research has been undertaken, whether there is a need for further detailed research into the fatigue performance of components to enable the assessment of service life of highly stressed components with small defects. For that reason the AAIB has assessed the response as partially adequate. (EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

Response received: 30 April 2020

The European Union Aviation Safety Agency (EASA) has published the European Plan for Aviation Safety (EPAS) 2020-2024 which includes the research project RES.008 "Integrity improvement of rotorcraft main gear boxes (MGB)".

The main objectives of the research are the following:

1. Enhancement of new design features for helicopter MGB and attachments, to prohibit separation of the mast and main rotor from the helicopter at any time, and allow the helicopter to autorotate in case of any major failure of main gear box components.

2. Understand threats to the integrity of critical components in the rotor drive system and assess methods to design and substantiate the design of flaw-tolerant critical components.

The second objective will include investigation of the effects of small defects including scratches, dents and corrosion pits.

The final report is expected for Q1 2023.

AAIB Assessment – Partially Adequate Open

Response received: 26 March 2018

In the framework of rotorcraft design and certification activities there is an ongoing evaluation by Type Certificate Holders and EASA of the effect of corrosion on fatigue strength for high strength steels. This has already resulted in changes to the means provided by applicants to show compliance with CS 29.571 fatigue tolerance requirements.

Nonetheless, as further research in this field and other related areas is considered beneficial, the Agency has introduced the research project RES.008 "Rotorcraft main gear box (MGB) design to guarantee integrity of critical parts and system architecture to prevent separation of the main rotor following any MGB failure" in the European Plan for Aviation Safety (EPAS) 2018-2022.

One of the objectives of this research project is to understand threats to rotor drive system critical component integrity and methods to design and substantiate flaw tolerant critical component designs. This will include investigation of the effects of small defects including corrosion pits, dents and scratches.

AAIB Assessment – Adequate Closed

Response received: 05 August 2014

In 2012 EASA commissioned a research project, Engine Rotor Material Damage Tolerance (EROMDAT), addressing damage resistance and fatigue tests for high-strength materials used for engine rotating parts.

A final project meeting is planned with the engine manufacturers involved in the project in September 2014.

EASA will take the opportunity of this meeting to discuss with the participants about the applicability of proposed test methods on other metallic materials (low alloy steel) used for rotorcraft main gearbox design.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2014-0019)