SUMMARY

The accident with LN-OJF

On 29 April 2016 the main rotor suddenly detached from an Airbus Helicopters EC 225 LP Super Puma, operated by CHC Helikopter Service AS. The helicopter transported oil workers for Statoil ASA and was en route from the Gullfaks B platform in the North Sea to Bergen Airport Flesland.

The helicopter had just descended from 3,000 ft and had been established in cruise at 140 kt at 2,000 ft for about one minute. The flight was normal and the crew received no warnings before the main rotor separated from the helicopter.

The helicopter impacted a small island near Turøy, northwest of Bergen. Wreckage parts were spread over a large area of about 180,000 m^2 both at land and in the sea. The main rotor fell about 550 meters north of the crash site. The impact forces destroyed the helicopter, before most of the wreckage continued into the sea. Fuel from the helicopter ignited and caused a fire onshore. All 13 persons on board perished.

Investigation findings

An extensive and complex investigation revealed that the accident was a result of a fatigue fracture in one of the eight second stage planet gears in the epicyclic module of the main rotor gearbox (MGB). The fatigue fracture initiated from a surface micro-pit in the upper outer race of the bearing, propagating subsurface while producing a limited quantity of particles from spalling, before turning towards the gear teeth and fracturing the rim of the gear without being detected.

The investigation has shown that the combination of material properties, surface treatment, design, operational loading environment and debris gave rise to a failure mode which was not previously anticipated or assessed.

There are no connections between the crew handling and the accident. Nor is there any evidence indicating that maintenance actions by the helicopter operator have contributed to this accident. The failure developed in a manner which was unlikely to be detected by the maintenance procedures and the monitoring systems fitted to LN-OJF at the time of the accident.

Certification and continued airworthiness

The design of the EC 225 LP satisfied the requirements in place at the time of certification in 2004. However, the AIBN has found weaknesses in the current European Aviation Safety Agency (EASA) Certification Specifications for Large Rotorcraft (CS-29).

The accident has clear similarities to an Airbus Helicopters AS 332 L2 Super Puma accident off the coast of Scotland in 2009 (G-REDL). This accident was also identified to be the result of fatigue fracture in a second stage planet gear, however the post-investigation actions were not sufficient to prevent another main rotor loss.

The investigation has found that only a few second stage planet gears ever reached their intended operational time before being rejected during overhaul inspections or non-scheduled MGB removals. The parts rejected against predefined maintenance criteria were not routinely examined and analysed by Airbus Helicopters in order to understand the full nature of any damage and its effect on continued airworthiness.

Lessons learned

From this investigation there are significant lessons to be learned related to gearbox design, safety assessment, fatigue evaluation, condition monitoring, certification requirements and continued airworthiness of the AS 332 L2 and the EC 225 LP helicopters, which also could be valid for other helicopter types.

Based on this investigation, the AIBN issues 12 safety recommendations.