

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	EC225 LP Super Puma, G-CHCN
<b>No &amp; Type of Engines:</b>	2 Turbomeca Makila 2A1 turboshaft engines
<b>Year of Manufacture:</b>	2007 (Serial no: 2679)
<b>Date &amp; Time (UTC):</b>	22 October 2012 at 1425 hrs
<b>Location:</b>	In the North Sea, approximately 32 nm southwest of Sumburgh, Shetland Islands
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)
<b>Persons on Board:</b>	Crew - 2                      Passengers - 17
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	To be assessed following salt water immersion
<b>Commander's Licence:</b>	To be advised
<b>Commander's Age:</b>	To be advised
<b>Commander's Flying Experience:</b>	To be advised
<b>Information Source:</b>	AAIB Field Investigation

This bulletin provides initial information on the progress of the investigation.

system. All passengers and crew evacuated the helicopter and were subsequently rescued without injury.

**Summary**

The crew of the helicopter carried out a controlled ditching following indications of a failure of the main gearbox (MGB) lubrication system and, subsequently, a warning indicating failure of the emergency lubrication

**History of the flight**

The aircraft was on a planned flight from Aberdeen International Airport to the West Phoenix drilling rig, approximately 226 nm to the north.

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The crew reported that, whilst in the cruise at about 140 kt and 3,000 ft amsl with approximately 81% total torque applied, the XMSN (transmission) caption illuminated on the Central Warning Panel (CWP). They added that the M.P (main pressure), MGB.T (main gearbox oil temperature) and the S/B.P (standby oil pump pressure) captions on the Vehicle Management System (VMS) also illuminated and the main gearbox oil pressure indicated zero. The MGB.P (main gear box oil pressure) caption then illuminated on the CWP. The crew actioned the '*Total Loss of MGB (Main Gear Box) Oil Pressure*' checklist, which required the activation of the MGB emergency lubrication system (EMLUB). However, within a minute the MGB EMLUB caption illuminated on the CWP indicating that the emergency lubrication system had failed.

As a result of the MGB EMLUB caption illuminating, the crew carried out the '*Emergency Landing – Power ON*' checklist and successfully ditched the helicopter in the sea, close to a ship. The passengers and crew evacuated the helicopter and boarded two life rafts before being rescued and transported to the ship. There were no reported injuries.

The helicopter has been recovered from the sea and transported to Aberdeen for examination. The Digital Voice and Data Recorder (DVDR) and other items of avionics have been removed and transported to Farnborough for further analysis.

### **Composition of the investigation**

The AAIB dispatched a team of investigators and support staff to Aberdeen. In accordance with established International arrangements the Bureau d'Enquetes et d'Analyses Pour la Sécurité de l'Aviation Civile (BEA), representing the State of Manufacture of the helicopter, and the European Aviation Safety Agency (EASA),

the Regulator responsible for the certification and continued airworthiness of the helicopter, were informed of the accident. The BEA appointed an Accredited Representative to lead a team of advisors from the BEA and Eurocopter (the helicopter manufacturer).

### **Helicopter information – lubrication of the main gearbox**

The main gearbox lubrication system includes two mechanically-driven oil pumps and a crew-activated emergency lubrication system. The gearbox normally contains 22 litres of oil. The oil pumps (a main pump and a standby pump) are driven by the oil pump drive pinion located on the lower part of the bevel gear vertical shaft within the main gearbox. Vertical shafts of this type are fitted to all EC225 and some AS332 L1 and L2 helicopters. The bevel gear vertical shaft is manufactured from two sections welded together.

The emergency lubrication system includes an 11 litre tank, containing a mixture of glycol and water (Hydrosafe 620), and an electric pump. When activated, Hydrosafe 620 is pumped into a distributor, mixed with engine bleed air, and sprayed into the main gearbox. The spray is designed to provide a minimum of 30 minutes of main gearbox cooling and lubrication in the event of total loss of oil lubrication. The MGB EMLUB caption illuminates if the system fails.

### **Recorded data**

The helicopter, in addition to carrying the DVDR, was also equipped with a Vibration Health Monitoring (VHM) system that recorded vibration signatures from around the airframe, engines, main rotor gearbox and transmission; this information was recorded on a removable memory card. During the evacuation of the helicopter, the flight crew removed this memory card and the data it contains has been subject to an initial investigation.

The operator had last downloaded the VHM data card on Sunday 21 October at 1107 hrs (UTC). The memory card recovered from the helicopter, following the ditching, contained vibration data for two sectors flown that Sunday afternoon and also the two sectors flown prior to the accident flight on Monday 22 October. The data on the memory card did not contain vibration information from the accident flight but this information may be retained within some of the avionics still to be examined. It should be noted that the VHM uses an internal clock which is checked every 90 days and consequently the detailed timings stated below are provisional and subject to revision.

Vibration data prior to the accident flight was examined and the vibration signatures known as the MOD 45 indicator, which monitors the meshing frequency of the bevel gear and the MOD 70 indicator, which monitors the meshing frequency of the oil pump wheels, show some exceedances. These two indicators each have two alert thresholds; a lower threshold designated AMBER, and a higher threshold designated RED.

During the first two sectors, on Monday 22 October, the helicopter flew for approximately 3 hours 50 minutes. During the first sector, the MOD 45 indicator showed an increasing trend that then exceeded the AMBER trigger threshold followed, later during that sector, by an exceedance of the RED threshold. During the second sector three further data points were recorded, all above the RED threshold and increasing in magnitude. The MOD 70 data showed one exceedance; a value in excess of the RED threshold which occurred during the second sector at the same time as the final MOD 45 point. Indicators Kg and Kr, which are also associated with the bevel shaft and wheels, also showed increasing trends and exceeded their AMBER thresholds.

Data from the first two sectors flown on Monday 22 October was not downloaded by the operator and there was no requirement to do so.

### **Preliminary engineering investigation**

The main gearbox was drained. An initial visual examination has identified a 360 degree circumferential crack on the bevel gear vertical shaft, in the vicinity of the weld that joins two sections of the shaft. Therefore, the main and standby oil pump gears were no longer being driven.

### **Related information**

On 10 May 2012 there was an accident to an EC225 LP (G-REDW) in which the bevel gear vertical shaft failed. That investigation is ongoing and the manufacturer issued a Service Bulletin, which was subsequently mandated by Airworthiness Directive (AD2012-0115E) and contained requirements applicable to EC 225 LP helicopters fitted with bevel gear vertical shafts of a certain part number and serial number. The requirement was to monitor, at set intervals, the MOD 45 and MOD 70 indicators. The vertical shaft (part number 332A32-5101-00, serial number M122) fitted to G-CHCN was not within the applicability of the AD.

### **Safety action taken**

Based on these preliminary findings, the EASA and the helicopter manufacturer are urgently reviewing the effectiveness and scope of Airworthiness Directive AD 2012-0115E, AS332 ASB No 01.00.82 and EC225 ASB No 04A009 with a view to reissuing these to widen the applicability and modify the monitoring intervals.

### **Further investigation**

A detailed engineering investigation of the helicopter is continuing with the full assistance of the helicopter

manufacturer and operator. In addition to a detailed analysis of recorded data, further work will also address the survival and search and rescue aspects. The AAIB will report significant developments as the investigation progresses.

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