ACCIDENT

Aircraft Type and Registration:	Eurocopter AS332L2 Super Puma, G-REDL
No & Type of Engines:	2 Turbomeca Makila 1A2 turboshaft engines
Year of Manufacture:	2004
Date & Time (UTC):	1 April 2009 at 1255 hrs
Location:	In the sea approximately 11 miles north-east of Peterhead, Scotland
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 14
Injuries:	Crew - 2 (Fatal) Passengers - 14 (Fatal)
Nature of Damage:	Helicopter destroyed
Commander's Licence:	Airline Transport Pilot's Licence (H)
Commander's Age:	31 years
Commander's Flying Experience:	2,575 hours (of which 1,870 were on type) Last 90 days - 96 hours Last 28 days - 37 hours
Information Source:	AAIB Field Investigation

This Special Bulletin details the progress made towards identifying the initiating factor(s) and failure sequence of the epicyclic gearbox module, and follows the publication of two initial reports which contained four Safety Recommendations. This Special Bulletin contains two further Safety Recommendations.

History of the flight

The helicopter was operating a return scheduled passenger flight from Aberdeen to the Miller Oil Platform, situated in the North Sea approximately 145 nm north-east of Aberdeen. When it arrived from its previous flight to the Bruce Platform, approximately 190 nm north-east of Aberdeen, a 'rotors running' crew change was carried out. The helicopter was serviceable except for a deferred defect affecting a part of its ice detection system. The daily in-flight checks had already been completed satisfactorily by the off-going crew. The helicopter was refuelled, the passengers boarded, and it lifted off at 1040 hrs. The helicopter landed on the Miller platform, after an uneventful flight, at 1149 hrs, where it was refuelled again with the rotors-running. When the refuelling was complete, fourteen passengers boarded the helicopter for the return flight to Aberdeen. The weather conditions were benign with light south to south-easterly winds, good visibility with generally clear skies but with occasional broken cloud at 5,000 to 6,000 ft. Flying conditions were reported as smooth and the sea was calm.

The helicopter lifted from the Miller Platform at 1203 hrs and climbed to 2,000 ft, tracking inbound towards Aberdeen. Recorded information on the combined Cockpit Voice and Flight Data Recorder (CVFDR) shows that the crew were engaged in routine cockpit activities and there were no operational abnormalities. At 1254 hrs the co-pilot made a routine call on the company operating frequency stating that the helicopter was serviceable and the ETA was 1314 hrs. Twelve seconds later, one of the pilots made a brief MAYDAY call on the ATC frequency. This was followed by a similar call that included some position information, from the other pilot. The radar controller at Aberdeen acknowledged the MAYDAY call and tried unsuccessfully to contact the crew of G-REDL. He then asked the crew of another helicopter, outbound on a similar routing, to examine the sea in the area of the last radar position.

Recorded radar information showed the helicopter flying inbound towards Aberdeen at 2,000 ft, climbing momentarily to 2,200 ft and then turning right and descending rapidly. Surface visibility was good and an eye witness, working on a supply vessel approximately 2 nm from the accident site, heard the helicopter and saw it descend rapidly before it hit the surface of the sea. Immediately after impact he saw the four main rotor blades, still connected at their hub, strike the water. Around this time, he also heard two bangs close together. He immediately raised the alarm and the ship turned towards the accident site, which by now was marked by a rising column of grey then black smoke. The ship launched a fast rescue boat whilst making way towards the scene. The crew of this boat and the helicopter arrived promptly on the scene to discover an area of disturbed water, roughly 150 m in diameter containing debris from the helicopter. Other search and rescue vessels, aircraft and helicopters arrived on scene within 40 minutes. All persons on board G-REDL were fatally injured.

The Air Accidents Investigation Branch (AAIB) was notified of the accident within minutes and a team of inspectors, including engineers, pilots and flight recorder specialists deployed to Aberdeen that evening. In accordance with established International arrangements the Bureau d'Enquetes et d'Analyses Pour la Securitie 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 investigators from the BEA, Eurocopter (the helicopter manufacturer) and Turbomeca (the engine manufacturer). The EASA and the UK Civil Aviation Authority also provided assistance to the AAIB team.

Wreckage recovery

The availability of radar data, and the fact that the accident was witnessed by an observer working on a supply vessel some 2 nm distant, indicated the location where the wreckage was likely to be found. On the afternoon of 1 April, floating debris was recovered by several vessels which had positioned to the area and, by the evening of 2 April, a survey vessel which had been operating in the area on behalf of the Marine and Coastguard Agency, was tasked to survey the seabed using its high definition sonar system. By the afternoon of 3 April, the ship had identified the location of three main items of wreckage. A 'saturation diving recovery vessel' was chartered, and this was on station late on the afternoon of 4 April. That evening, the combined CVFDR was located and recovered to the AAIB and, by early morning on 5 April, all the wreckage that could be identified on the seabed had been recovered on-board. This was transported to the AAIB facility on 6 April, for a detailed examination of the helicopter.

Helicopter Usage Monitoring System (HUMS) data and recorded information

HUMS

The helicopter was equipped with a HUMS, which comprises a system of sensors around the engines, airframe and drive train. This system is a mandatory fit for offshore helicopter operations in the United Kingdom. Recorded information included vibration levels together with gearbox chip detection from a series of magnetic plugs. The data accumulated during helicopter operations is transferred, usually on a daily basis, to the operator's ground-based computer system. The data is then subjected to mathematical processes that establish basic signatures and enable trends to be monitored for individual components. Some of these signatures are subject to threshold limitations which will alert the ground crew to a rising trend.

Recorded information

The CVFDR was successfully recovered from the sea bed and downloaded as a priority at the AAIB. Data has also been recovered from a number of on-board sources including the Digital Engine Control Units (DECUs), Smart Multimode Displays (SMDs), Digital Flight Data Acquisition Unit (DFDAU), HUMS card, and on-board Helicopter Operations Monitoring Programme (HOMP) card. This data is being used collectively to build a sequence of events that occurred during the accident.

Recorded flight data identified G-REDL flying on a heading of 234°M, at an indicated airspeed of 142 kt and at a radio altitude of 2,000 ft. At approximately 1251:19 hrs a chip[1] was detected by the epicyclic gearbox magnetic chip detector plug. Over the next minute and 43 seconds, three further chips were apparently detected. The design of the chip detection system is such that the flight crew would not have been aware of these detections, although as noted earlier, they were logged by the HUMS.

At approximately 1254:01 hrs, the first officer made a radio call to company operations indicating that the helicopter was 'serviceable' and was expected to arrive in Aberdeen at 1314 hrs. Seventeen seconds later, a main rotor gearbox (MRG) low oil pressure warning was recorded on the CVFDR, with an associated reduction in recorded MRG oil pressure. After this, a deviation from cruise flight can be seen with the crew responding with flight control inputs which appeared to have had only a limited effect.

The CVFDR continued recording data for 5 seconds after the MRG low oil pressure warning but ceased at around 1254:23 hrs. The reason for this is as yet unknown. HUMS and other recovered avionics data, radio transmissions and radar continued to be recorded after the CVFDR stopped. This data is currently being analysed to establish the remainder of the accident sequence.

In addition, spectral analysis work on the audio recordings is underway to identify frequencies associated with the gearbox operation. Historic HUMS data will also be analysed using advanced statistical and data mining techniques.

General

The Eurocopter AS332L2, is a twin-engine helicopter, designed for passenger transport and aerial work, etc. It is constructed primarily from aluminium alloy, with many panels being made from a lightweight honeycomb material sandwiched between two thin skin sections. G-REDL was constructed in 2004 and was configured

Footnote

1 Chip - a small sliver or flake of metallic/magnetic material.

with seating for 14 persons in the cabin, and a flight crew of two.

Transmission

Two shafts, one from each of the two free turbine Turbomeca Makila 1A2 engines, drive the main and tail rotors through the MRG, where the high speed of these shafts (23,000 rpm) is reduced to the nominal main rotor speed (265 rpm).

The lower section of the MRG, referred to as the 'main module', reduces the shaft speed to around 2,400 rpm. The speed is further reduced to main rotor speed through a two-stage epicyclic gearbox. Each epicyclic stage is configured with eight planet gears, mounted on a planet gear carrier. Each gear contains a double row spherical roller bearing with a separate inner race; the rollers bear directly on the hardened inner spherical surface of the gear, which forms the outer race of the bearing. Integral with the first stage carrier is the sun gear for the second stage. The second stage carrier directly drives the main rotor mast, Figures 1 and 2.

The epicyclic module is located between the main module and the main rotor mast conical housing, Figure 3. The ring gear for both stages is integral with the circular housing. The MRG is fitted with three magnetic chip detector plugs. One is located in the sump area below the main module, one adjacent to the epicyclic gearbox module and one in the main rotor conical housing. These are designed to detect and retain any chips of magnetic material shed, for example, from the gears or their bearings. The sump magnetic plug provides a warning to the flight crew should a chip be detected, whilst the plug adjacent to the epicyclic stages provides evidence of chip detection to the HUMS system, when the aircraft is equipped with such a system, which was the case with G-REDL. The magnetic plug in the conical housing is not connected to any warning system and is only visually inspected.

|In previous variants of the AS332 there had been a number of main rotor gearbox removals as a result of distress within the epicyclic stages of the gearbox. In order to minimise these removals, the MRG of the AS332L2 was separated into 'modules' which allows the removal of the epicyclic reduction gearbox module without necessitating the removal of the complete MRG assembly. The magnetic chip detector was fitted in the epicyclic module and another in the conical housing to provide an indication of potential distress in these areas. The epicyclic module was separated from the main module by two concentric plates designed to channel the oil draining from the epicyclic module past a ring of magnets prior to it reaching the main module. This was to prevent metallic particles generated within the conical housing and epicyclic module from contaminating the main module.

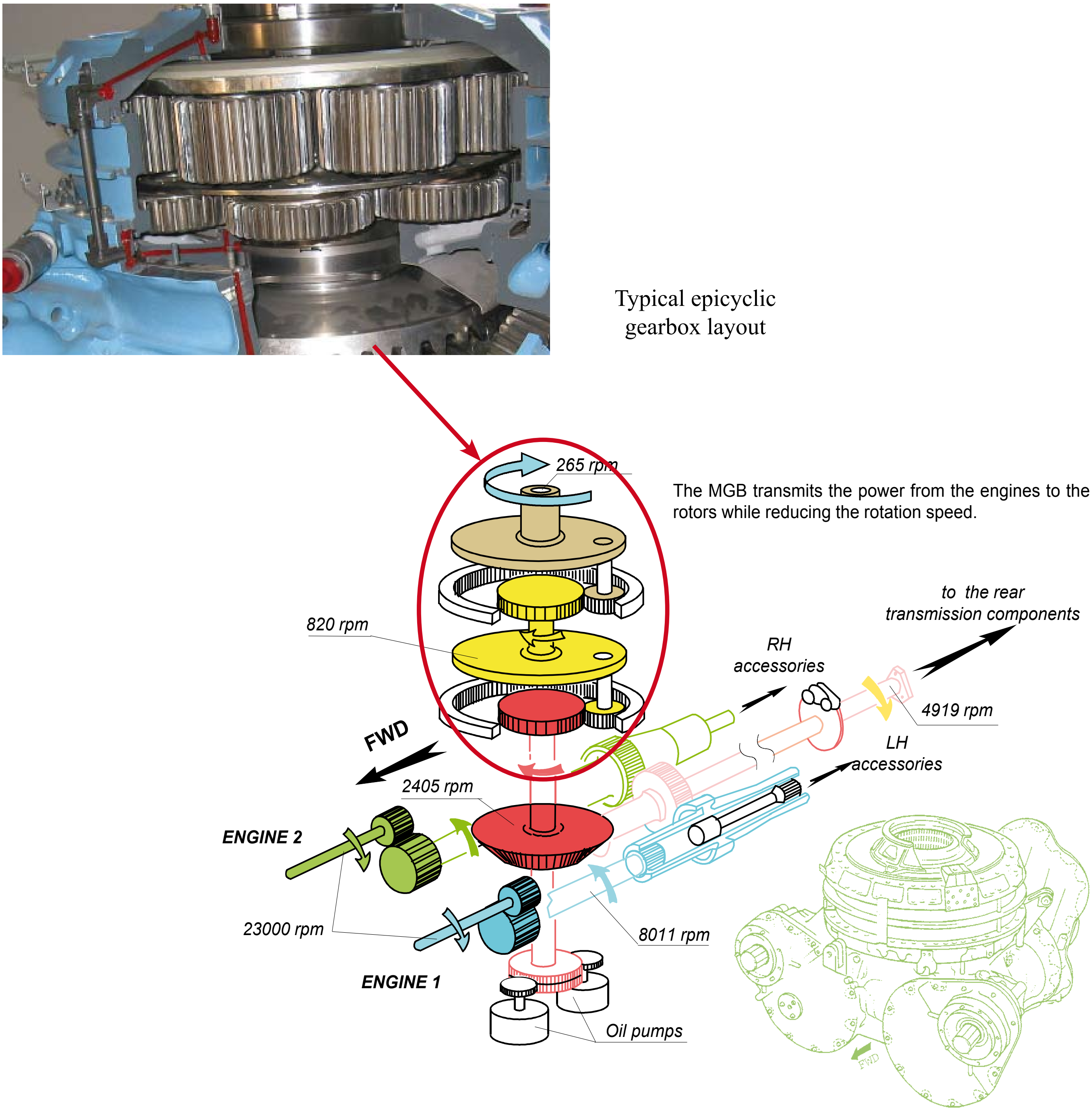
The investigation

The initial examination of the wreckage, in conjunction with radar, HUMS, CVFDR and witness data, determined that a failure within the epicyclic reduction gearbox module of the MRG resulted in the rupture of the gearbox case. This allowed the main rotor head, together with the upper section of the MRG, to separate from the helicopter.

Other areas of the gearbox, including the engines, the main module and the rotor head/mast have been examined, as follows.

Engines

The engines were taken to the manufacturers overhaul facilities for detailed examination under supervision of the investigation team. Both engines had suffered external damage consistent with the accident, which



Courtesy of Eurocopter

Figure 1

Schematic of the Main Rotor Gearbox

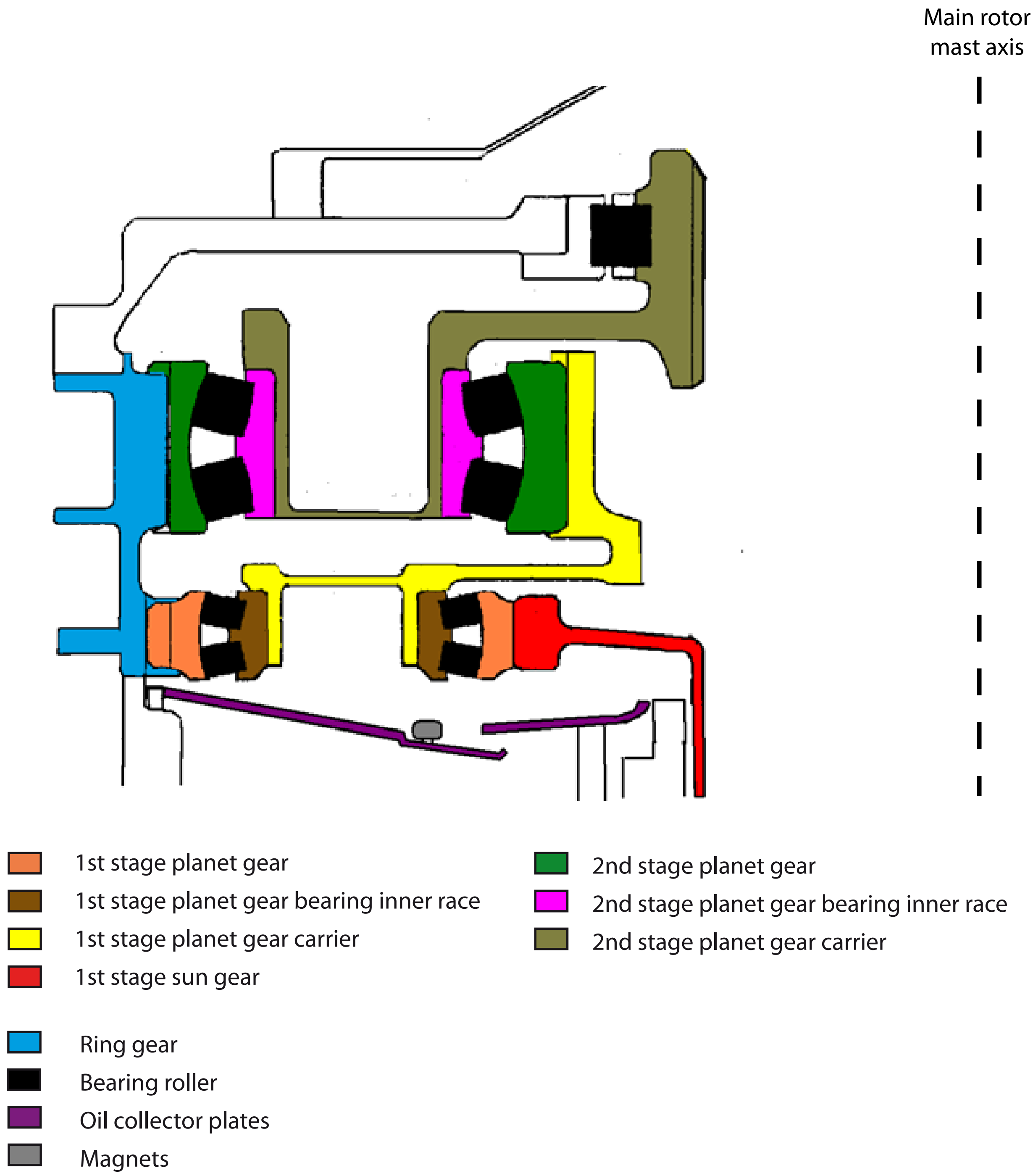


Figure 2

Schematic cross-section of epicyclic module

included deformed casings, damaged engine mounts and accessory mounting flanges.

Internal damage to both engines indicated that they were rotating at the time of the casing deformations. Foreign object impact damage to the first stage compressor blades and airframe debris in the internal air paths of the engines confirmed rotation at the time of the impact with the sea.

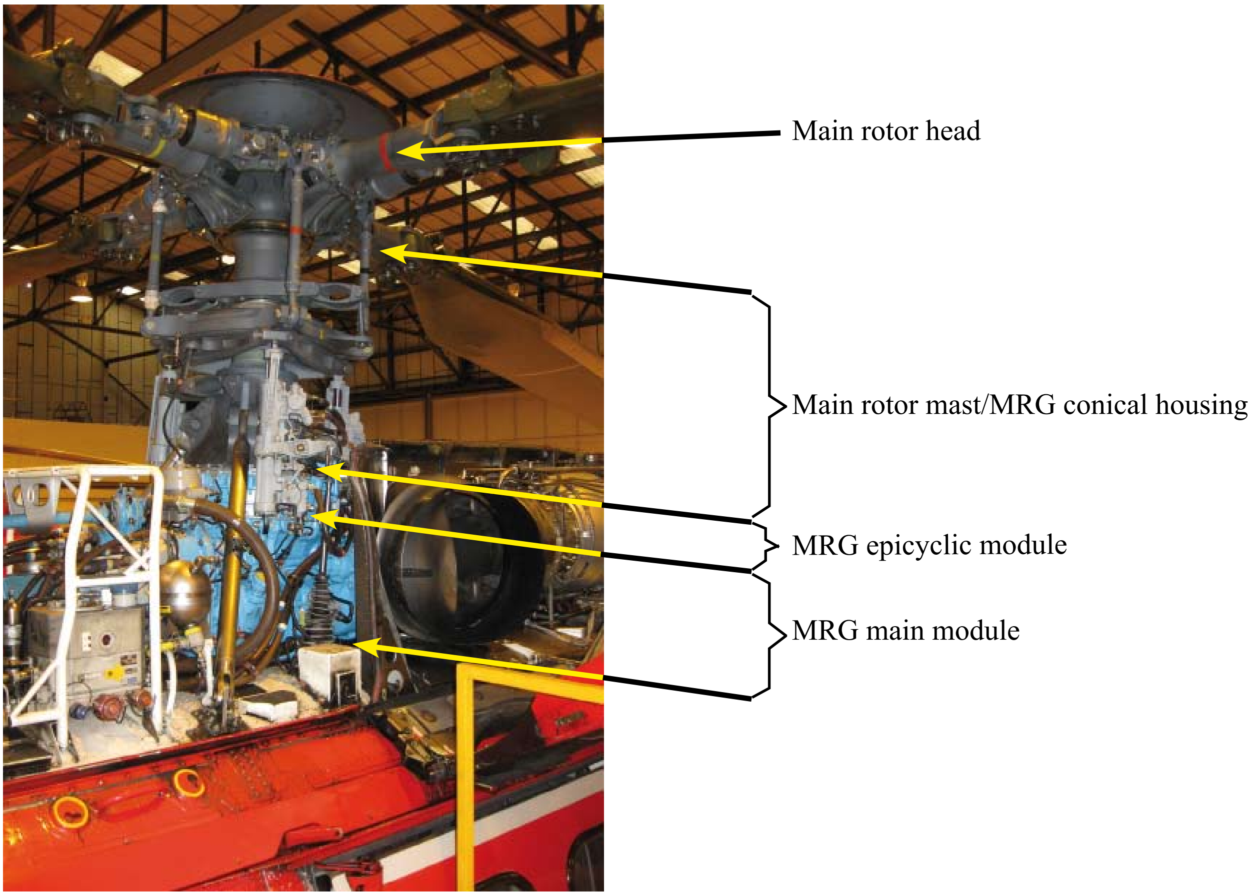


Figure 3

MRG installation

A rupture in the right (No 2) engine power turbine containment casing was of particular interest. Examination showed that this rupture originated at a large deformation and grew due to the rotating turbine blades contacting the casing. A number of turbine blades were 'cropped' to the level of this deformation. The deformation was consistent with being formed as the fuselage struck the sea.

Both engines DECUs were downloaded. Analysis showed that there were no recorded parameter exceedences. The One Engine Inoperative (OEI) mode indicated that it had not been activated and this was confirmed by the position of the overspeed relays.

Both engines were assessed to have been in good condition prior to the accident and no signs of pre-existing anomalies or over-temperature were found.

Main module

The gearbox had remained attached to the airframe by the flexible titanium mounting plate (the 'barbecue plate'), which is designed to react the gearbox torque. The mounting plate had sustained little damage in the accident (although some distortion had occurred during the removal and inspection process). This observation was pertinent in that it helped to exclude the possibility of a suspension (lift) strut failure as being a primary cause of the accident, since such an event would tend to transfer excessive loads, via the gearbox, into the mounting plate.

The first stage sun gear had remained engaged, via its splined connection, with the bevel gear in the main module and it was established that there was little measurable run-out. This suggested that little if any disruption had occurred upstream of the sun gear. However, the teeth had sustained heavy damage, which was more severe than that seen on the first stage planet gears. It was separately established that the sun gear had most probably contacted the first stage planet gear inner races following the break-up/release of the planet gears, whilst turning at speed. The sun gear was extracted easily, at which point some comparatively minor damage was observed on the splines.

A breach in the circumference of the bevel gear support plate at the approximate 5 o'clock position[2], matched the location of the vertical split in the epicyclic ring gear. Gear teeth marks were visible in the surface of the plate adjacent to the breach, together with significant abrasion around the entire circumference; this had resulted in smearing of several of the bevel gear support plate attachment bolt heads. In addition, most of the chip collector tray containing the magnets had been abraded away. All this damage is likely to have been caused by the first stage planet gears during the break-up sequence.

The bevel gear chamber was severely contaminated by the products of corrosion arising from seawater immersion. However, the bevel gear, its drive pinion and components such as the main and emergency oil pumps showed no evidence of running distress. The reduction gears at the engine input side of the gearbox, together with the accessory gearbox components, similarly showed no evidence of running distress. The only noteworthy feature was that the right hand torque meter shaft showed evidence of a permanent set in the over-torque direction. This may have resulted from the right engine continuing to apply torque during the series of temporary seizures that probably occurred during the break-up of the epicyclic gear stages.

During the examination, metallic particles and a number of planet gear bearing rollers were recovered from within the main module sump.

Rotor head/mast

The rotor head, mast and gearbox conical housing (complete with the lift bars) were stripped and inspected at the manufacturer's facility under AAIB supervision. Examination of the components showed that all of the damage was consistent with it being produced as a result of the failure of the epicyclic module. There was no evidence of a primary failure within any of the components examined.

Epicyclic module

As no pre-existing defects or failures have been identified in the above areas, the investigation continues to be centred on understanding the gearbox epicyclic module failure.

There is evidence of damage throughout the epicyclic module, consistent with it operating for a period whilst contaminated with sizeable debris. Several imprints of rollers from the first stage planet gear bearings are evident on second stage gears.

The ring gear (which had burst open), both sun gears, all eight of the planet gears in both stages, together with the planet gear carriers, were recovered, with the exception of approximately 33% of one planet gear from the second stage. This was the only gear in that stage to have failed.

Footnote

[2] The twelve o'clock position equates to the longitudinal axis of the helicopter looking forward.

Two gears in the first stage also suffered failures; one had suffered a single fracture, the other had broken into four sections. All first stage planet gears had separated from the carrier, releasing their rollers; only a proportion of which have been recovered. The inner raceways from all the planet gear bearings have been recovered, with none exhibiting 'classic' evidence of pre-accident failure or degradation. However, one raceway associated with a first stage planet gear exhibited damage over a limited area of its circumference.

It is considered that a section of the failed second stage planet gear became jammed between the ring gear and a planet gear, precipitating the ring gear failure, (Figure 4). There is evidence on all gear teeth of damage caused by debris being present, consistent with the gearbox running in an abnormal condition prior to the separation of the main rotor head. However, no evidence has indicated that the flight crew were aware of any problem with the MRG until shortly before the accident, when the loss of MRG oil pressure occurred, and a noise became evident on the CVR. This was likely to have been at the time the ring gear burst open.

The initiating cause of the epicyclic gearbox module failure remains to be established, and work continues at the AAIB in the UK and, under AAIB supervision, at the manufacturer's facility in France. This work includes detailed metallurgical examination of all the components from the epicyclic gearbox module from the accident helicopter and similar components from another MRG.

Three sections of the failed second stage planet gear were recovered, amounting to approximately 66% of the complete gear. Detailed examination of these sections has revealed several areas of particular interest. The most significant of these is a complex fracture surface on one of the gear sections consisting of five conjoined cracks, with the majority showing characteristics of propagation in fatigue. One of these conjoined cracks, believed to have been the first one to form, appears to have originated from a single origin in a region at or close to the outer race surface. The precise origin has not been determined due to the severe mechanical damage occasioned in this region during the break-up of the module. However, the nature of the fracture surface would suggest that the origin is aligned with a position on the wear track of the lower set of rollers where the highest surface loading is imparted by the rollers.

Extensive non-destructive examination and testing has been carried out with the assistance of Eurocopter, QuinetiQ, the National Physical Laboratory, the Open University materials laboratory and Mertis(X-Tech), a manufacturer of X-ray Tomography equipment. These have included surface laser mapping, 3D tomography, residual stress measurement, 3D laser microscopy, Scanning Electron Microscopy and conventional optical microscopy. Results have provided significant evidence regarding these fractures and allowed the development of a programme of destructive tests and examinations which are currently being undertaken. These tests are designed to identify, if possible, the initiation point of these fractures and the reason for their initiation.

Further work is planned to examine the remaining intact second stage gears, and a selection of 'time-expired' gears removed from service, with the intention of identifying any defects which may exist.

Detailed examination continues to be performed on the metallic chip removed from the G-REDL epicyclic module magnetic chip detector on 25 March 2009, 34 flying hours before the accident. It has been identified as planet gear material and the nature of this chip

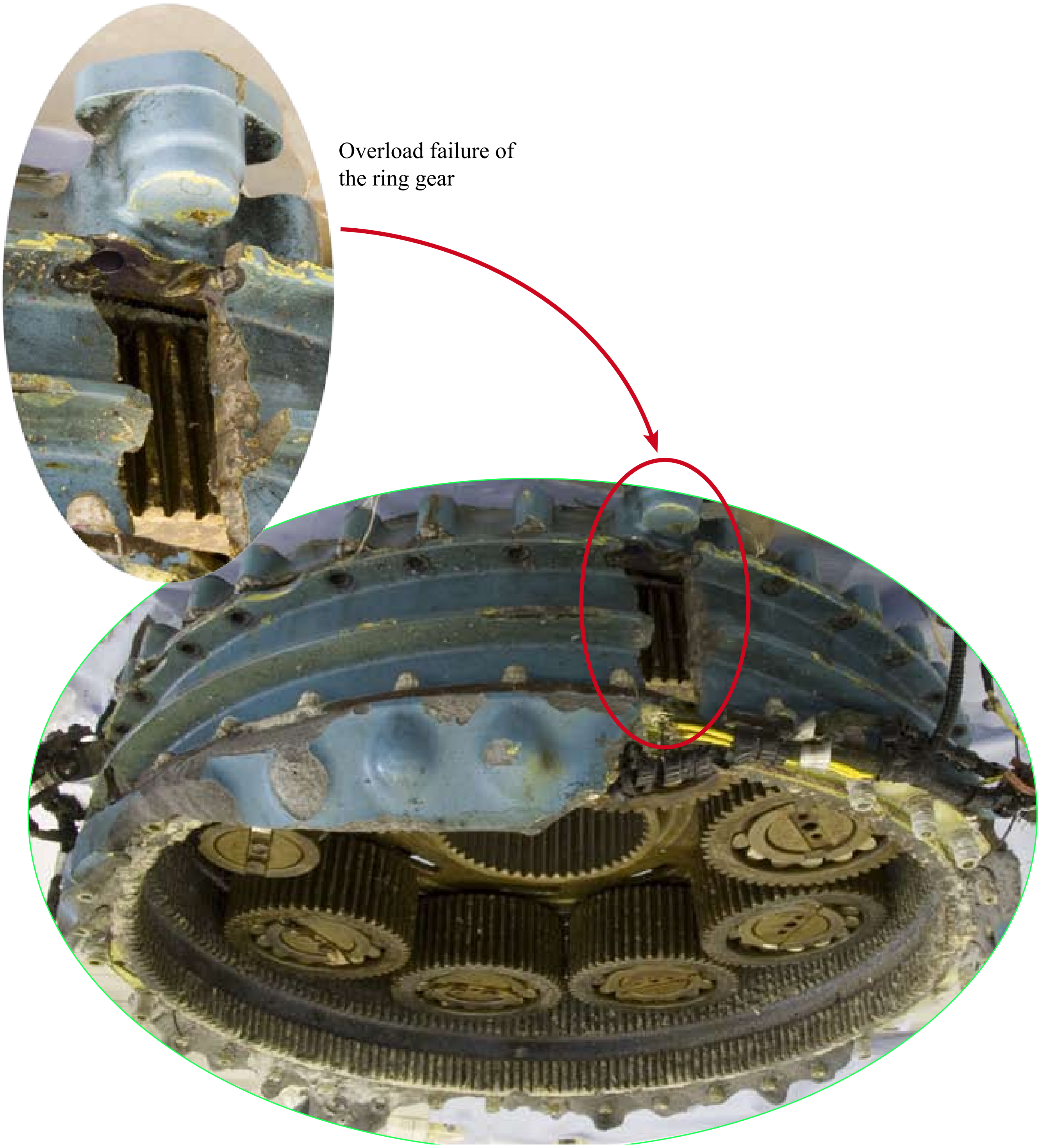


Figure 4

Failed ring gear details with second epicyclic stage reinstalled - viewed from below.

suggests that it may have been released by the process of spalling[3], or possibly by some other unidentified phenomena. On one side, the chip exhibited evidence of manufacturing marks characteristic of the surface of the 'outer race' of a second stage planet gear bearing. Comparison of these marks with an intact second stage planet gear established that it came from a location on the raceway in the wear track of one set of rollers, close to where the maximum surface loading from the rollers is to be expected. The absence of 'in-service' damage[4] on any of the other inner or outer races of the planet gear bearings strongly indicates that the chip came from the outer race of the broken second stage gear. However, due to mechanical damage on the available gear segments, and the absence of approximately 33% of the broken gear, it has not been possible, so far, to establish any link between the fracture surface containing the area of conjoined cracks, and the chip.

As reported in Initial Report No 2, Issued by the AAIB on 17 April 2009, on the morning of 25 March the HUMS system detected a chip on the epicyclic module magnetic plug whilst in flight. After the helicopter's return to Aberdeen, the plug was removed and visually examined, but no evidence of any chips was reportedly found. The helicopter was due for a 25 hour check that evening but, as it was already at its maintenance base, the operator decided to bring this forward. Part of this check, defined in the Aircraft Maintenance Manual, calls for the examination of the magnetic chip detector plugs and, when the epicyclic module plug was re-examined as part of the check, a particle was found.

Footnote

[3] SPALLING: The flaking-off of material from the bearing raceways in areas of high loading. High cyclic loads generated by the movement of the rollers within the bearing can initiate cracking in the material immediately below the surface of the raceway. Progression of these cracks can then allow the liberation of 'flakes' from the raceway surface.

[4] Micro-pitting/spalling, for example.

The clarity of relevant information available to the operator and helicopter manufacturer, used to inform the decisions taken following this discovery, continues to be investigated; however, the outcome was that the MRG remained in service. It was concluded, at that time, that the particle was of a type that did not require further investigation of the epicyclic module. In addition, the operator drained the MRG oil system and, after filtering the oil and examining the filters, identified no other contamination. As a result of the discovery of this particle, a daily inspection of the epicyclic gearbox magnetic chip detector was initiated by the operator and the HUMS data was downloaded and analysed each time the helicopter returned to its base at Aberdeen for the following 25 flying hours. This concluded on the 31 March, the day before the accident and, as no further abnormalities were identified during this period, this served to reinforce the view that a correct diagnosis of the chip had been made. However, had a different diagnosis of the chip type been made on 25 March, it is possible that the operator would have removed the MRG for further investigation.

The assessment of particles, their quantity and significance is carried out in accordance with the AS332L2 Standard Practices Manual procedure, MTC.20.08.01.601. This assessment procedure was contained in a generic 11 page text only, block diagram, document covering most of the helicopters currently and previously produced by the manufacturer. This deals with the assessment of chips discovered on the magnetic chip detector plugs in the power transmission assembly.

As it appears that the process of assessing the relevance of a magnetic chip may, in this case, have led to an inappropriate diagnosis, consideration should be given to introducing appropriate methods of information exchange between an operator and the manufacturer to facilitate the accurate determination of a chip type. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2009-074

It is recommended that the European Aviation Safety Agency, in conjunction with Eurocopter, review the instructions and procedures contained in the Standard Practices Procedure MTC 20.08.08.601 section of the EC225LP and AS332L2 helicopters Aircraft Maintenance Manual, to ensure that correct identification of the type of magnetic particles found within the oil system of the power transmission system is maximised.

In response to this safety recommendation, the manufacturer is issuing Safety Notice No 2075-S-63, introducing a revised, more comprehensive, version of the Standard Practices Procedure MTC 20.08.01.601. This revised document contains many colour illustrations of types of chip and debris likely to be encountered to aid operators in determining the significance a chip.

The Alert Service Bulletins and Emergency Airworthiness Directives issued following previous safety recommendations made during this investigation, have addressed the timely detection of debris/chips produced by the epicyclic gearbox module. This has been achieved by enhanced monitoring of the MRG chip detectors and the removal of the ring of magnets and the flanged edge from the oil collector plates fitted below the module. Whilst this improves the chances that the 'normal' precursors of a bearing failure will be detected, (ie, the release of metallic particles over a period of time), the evidence from the 34 hours of operation of G-REDL prior to the accident, and the general absence of evidence of distress on the bearing inner and outer races of all the planet gear bearings available for inspection, suggested that few, if any, further chips were generated during that period. At this stage of the investigation, it is not known if debris generation was associated with the observed cracks on the failed gear. However, as the ring of magnets was not examined after the discovery of the chip on 25 March, the possibility cannot be dismissed that further chips, which may have been generated from localised areas of the missing or damaged sections of the failed gear, became trapped by these magnets.

Examination of the failed components continues, in particular, in the region of the cracks on one section of the failed second stage planet gear. It is likely that one or more cracks were present prior to the module failure. However, as it is not presently known if the enhanced monitoring of in-service MRGs for chips will identify any potential cracks in the planet gears, and the initiating factor of the epicyclic module catastrophic failure remains to be established, the following Safety Recommendation is made:

Safety Recommendation 2009-075

It is recommended that the European Aviation Safety Agency, in conjunction with Eurocopter, urgently review the design, operational life and inspection processes of the planet gears used in the epicyclic module of the Main Rotor Gearbox installed in AS332L2 and EC225LP helicopters, with the intention of minimising the potential of any cracks progressing to failure during the service life of the gears.

In response to this recommendation, the EASA have stated that significant work has already been carried out with respect to re-assessing the planet gear design, safe operating life and methods of inspection. The manufacturer is also undertaking a comprehensive review of the planet gears.

Safety action to date

An initial report on the circumstances of this accident was published by the AAIB on 10 April 2009; this report contained three Safety Recommendations relating to additional inspections and enhanced monitoring of the main rotor gearbox. EASA responded immediately to these recommendations by issuing the Emergency Airworthiness Directive No 2009-0087-E, dated 11 April 2009.

In Initial Report No 2, published by the AAIB on 17 April 2009, Safety Recommendation 2009-051 was issued to EASA, which stated:

> *'It is recommended that Eurocopter, with the European Aviation Safety Agency (EASA), develop and implement an inspection of the internal components of the main rotor gearbox epicyclic module for all AS332L2 and EC225LP helicopters as a matter of urgency to ensure the continued airworthiness of the main rotor gearbox. This inspection is in addition to that specified in EASA Emergency Airworthiness Directive 2009-0087-E, and should be made mandatory with immediate effect by an additional EASA Emergency Airworthiness Directive.'*

The EASA responded by issuing Emergency Airworthiness Directives Nos:2009-0095-E, dated 17 April 2009, and 2009-0099-E, dated 23 April 2009, and stated the following reason.

> *Emergency Airworthiness Directives 2009-0087-E and 2009-0095-E were issued following the accident of the AS 332 L2 helicopter registered G-REDL that occurred on April 1, 2009, off the coast of Scotland near Aberdeen. Early investigations showed that a failure within the epicyclic reduction gear module of the Main Gear Box (MGB) resulted in the rupture of the MGB case, which allowed the main rotor head to separate from the helicopter. In the light of this information, enhancement of the means for detection of MGB contamination was deemed of the utmost importance. As an initial precautionary measure AD 2009-0087-E dated 11 April 2009 was published with that aim. Additionally, AD 2009-0095-E dated 17 April 2009 was issued to require a one-time inspection for absence of particles in the MGB epicyclic reduction gear module on the entire fleet. While the investigation is still in progress with the aim of determining as soon as possible the sequence of the failure(s) and initiating cause(s), this new AD, which retains the main requirements of the superseded ADs 2009-0087-E and2009-0095-E, requires modifying the chip collector inside the MGB – located between the epicyclic module and the main module – to enhance the early detection capability of the magnetic plugs of the gearbox sump and the epicyclic module. To that aim, this AD requires removing the magnetic elements installed on the chip collector, and the flanged edged from the chip collector (MOD 07.52522). After accomplishment of the modification, this AD specifies also how to further monitor the MGB epicyclic reduction gear module magnetic plug.'*