

CONSIDERATIONS ON HELICOPTER AIRWORTHINESS

The object of this introduction to the Symposium is to provide some information regarding the actions being taken by the Agency - and other authorities - following some recently occurred helicopters incidents and accidents (including the S92, AW139 and EC225LP), which attracted attention of the helicopter community.

Following the Cougar Helicopters Flight 91, involving a Sikorsky S-92A (registration C-GZCH) which ditched on 12 March 2009 off the coast of Newfoundland, Canada, where only one of the eighteen people aboard survived the sinking, a Joint Cooperation Team was established by EASA, FAA and TCCA to address Transportation Safety Board of Canada (TSC is the agency responsible for conducting that investigation) safety recommendations, specifically to review the Part / CS 29 requirements which affect loss of rotor drive system gearbox lubrication.

The TSC report had highlighted the following Safety Issues

- Category A rotorcraft certified under the "extremely remote" criteria may not be capable of continued operation for 30 minutes with only residual main gear box lubrication.
- Given today's operating environments, it may now be technically feasible and economically justifiable to produce a helicopter that can operate in excess of 30 minutes following a massive loss of main gear box lubricant.
- Helicopter crews and passengers in Canada remain at risk where helicopters are operated over sea states exceeding the capability of their Emergency Flotation Systems.
- Without a supplemental breathing system, occupants have very little time to egress from a submerged or capsized helicopter before breaking their breath-holds in cold water.

And the following recommendations were issued by TSB:

- The Federal Aviation Administration, Transport Canada and the European Aviation Safety Agency remove the "extremely remote" provision from the rule requiring 30 minutes of safe operation following the loss of main gearbox lubricant for all newly constructed Category A transport helicopters and, after a phase-in period, for all existing ones.
- The Federal Aviation Administration assess the adequacy of the 30 minute main gearbox run dry requirement for Category A transport helicopters.
- Transport Canada prohibit commercial operation of Category A transport helicopters over water when the sea state will not permit safe ditching and successful evacuation.
- Transport Canada require that supplemental underwater breathing apparatus be mandatory for all occupants of helicopters involved in overwater flights who are required to wear a Passenger Transportation Suit System.

The JCT has issued a report entitled "Report of the Joint Cooperation Team (JCT) on the Review of Helicopter Main Gearbox Certification Requirements for TCCA/FAA/EASA". This report has been agreed by those authorities. As the prime focus of TSB's conclusions and Safety Recommendations concerned the capability of a helicopter to continue operation after loss of oil from the MGB - which is normally addressed during certification by the loss of oil test requirement 29.927(c) – this

was therefore one of the main considerations of the JCT. However, the JCT also considered that reliability of rotor drive system lubrication systems, particularly with respect loss of oil, was also a major contributory factor affecting the above accident. Accordingly, the JCT also reviewed; 29.901(c), *Powerplant installation*, 29.917(a), *rotor drive system definition*, 29.917(b) *rotor drive system design assessment* and 29.1309, *Equipment, systems, and installations*, which can all influence lubrication system reliability.

The JCT report makes a number of recommendations affecting the above requirements and considers that the effect of these proposed changes to Part / CS 29 could have a significant influence on the design - and cost - of future helicopter types. Consequently the JCT recommends that a rulemaking task be carried out by a rulemaking group, involving representatives from the helicopter industry. These industry representatives would also be able to advise on the capability of 'state of the art' transmission design which may have the potential to improve lubrication system reliability and also the capability of a helicopter to continue operation after loss of rotor drive system gearbox oil.

EASA is currently evaluating the appropriate implementation times for the regulatory activity. Meanwhile, the Agency has drafted a special condition dealing with the gearbox certification, and which addresses the reliability of the lubrication system, making reference to differently capable gearboxes in performing continued operation after having suffered a total loss of oil.

Consistently, the EASA seminar on Ditching, organised in December last year together with the 5th Rotorcraft Symposium, is another example of an initiative undertaken by EASA to ultimately improve helicopter and occupant survivability following ditching. As a result, an Authorities-Industry regulatory working group, led by EASA, has been created with the task of studying and proposing regulatory improvements in the following areas: emergency floatation automatic activation, risk avoidance of crew disabling the system, floats redundancy to improve trim and stability - and safety in case of float bag puncturing, side floating via different design criteria like float asymmetric configuration or highly located floats, emergency breathing systems and the relevant training, cabin configuration improvements, fuselage 'delethalisation' in case of water impact, rotorcraft flight manual various improvement (e.g. stating sea state limitations), defining sea state certification conditions in normal and 'hostile' environment.

Several events occurred linked with the AgustaWestland AW139 tail rotor, for which at an initial stage operational causes were suspected. Manufacturer Investigation on the failed parts, on the other side, could initially not explain why parts that had passed with success the prescribed fatigue tests would have then failed under a number of cycles much lower than the ones demonstrated during certification.

On August 19, 2011, AgustaWestland AW139 PR-SEK, of Malaga Taxi Aereo, crashed in the sea of Macaé, Rio de Janeiro, Brazil killing the four occupants. The aircraft had departed from an offshore oil platform and was en route to firm land at the time of the accident. The crew declared an emergency with hydraulic problems shortly before contact with the helicopter was lost. When the wreckage was found, evidence was shown of tail rotor blade failure.

An in-depth design and manufacturing review, together with a number of tests and analyses starting from the failed blade examination, all under the deep scrutiny of the authority engineers, did ultimately show that only the concurrence of several design and manufacturing issues could create the conditions for the onset of such catastrophic tail rotor failure.

As part of the risk mitigation actions undertaken to extend the initially issued severe quarantine limitations for the tail rotor blades, following re-evaluation of quality production documentation, AW identified and withdrew from service a batch of blades at the highest straps manufacturing scatter. In accordance with EASA it was established to use such batch to create the data base necessary to qualify a 'limits extension' process. Those blades were to be used to derive specimens for fatigue and static tests, to define specific NDI inspection method, and for qualified personnel training.

While the test campaign on the samples allowed a limited relaxation of the initially imposed limitations for the existing blade design, in parallel with an improvement in the manufacturing process and restriction of its acceptability criteria, a new tail rotor blade, fit-form-function with the existing blade, was rapidly designed and certified. Such standard is today the AW139 tail rotor blade design and manufacturing standard. Furthermore, the 'lessons learned' from the AW139 case are currently being applied in the certification of other products.

This year, two ditching events occurred, respectively in April and October, off the coast of Scotland.

On May 10th a helicopter of Bond Offshore Helicopters Ltd (G-REDW Eurocopter EC225LP) made a controlled ditching in the North Sea 25 nm off Aberdeen, Scotland, United Kingdom. The pilots declared a low gearbox oil pressure warning; activation of the emergency lubrication system generated a warning of such emergency system failure too, which led to the ditching decision. The 14 occupants of the helicopter made it into a life-raft and their rescue was successfully carried out. The helicopter was also recovered, which allowed an in-depth investigation of the gearbox. The investigation is carried out by the Air Accident Investigation Branch of UK. The AAIB issues regular reports as long as its investigation progresses. Cause of the event was failure of the main shaft which drives the lubrication pumps, with consequent gearbox low pressure; associated with it, the emergency lubrication system apparently operated correctly but a malfunction warning message was displayed. Examination of the shaft showed a fatigue crack propagation in the area of the welding between the upper and lower elements of it. A batch of suspected parts was identified and the helicopters installing such shafts were subject to a dedicated, tighter scrutiny with the assistance of the VHM, adding limitations for the ones not VHM equipped, as mandated by the relevant EASA Airworthiness Directive.

The most recent ditching occurred on 22nd October 2012 (EC225LP G-CHCN from CHC Scotia), still in the North Sea off Scotland. While performing an offshore flight, from Aberdeen airport to West Phoenix Drilling rig, with 17 passengers on board, the crew noticed a low gearbox oil pressure warning. The pilots decided to perform a controlled ditching in the North sea after a MGB lubrication warning. The ditching was successful. All persons on board evacuated the aircraft

safely using life raft. Also in this case, the helicopter was recovered, which allowed the AAIB and Eurocopter investigation on the parts. The event shows a marked similarity with G-REDW's one, and the AAIB investigation is ongoing.

Whereas the investigation proceeds, EASA has been able to progressively issue Airworthiness Directives that address safe utilization of the EC225LP, as well as AS332, where used in different environments subject to the limitations and inspection regime predicated in the relevant Emergency Airworthiness Directive.

I would want to remind here that continued airworthiness is a standard process carried out by the Agency in compliance with the Basic Regulation and with Regulation 1702/2003 (today, 748/2012). The above actions are to be considered as part of this process. The duty of investigating on accidents and incidents, and provide - where necessary - recommendations to the Industry as well as Aviation Authorities remains with the Accident Investigation Bodies, whereas EASA supports the subject investigations as the Authority in charge today of the Type Design of the aircraft certificated in Europe, taking actions as appropriate.

My concluding remarks are to state that EASA participates, and is a strong driver, in the efforts to make the aeronautical products safer. It is important to highlight that EASA also promotes and participates in the IHST and EHST safety initiatives, as you will hear in the next presentations.

Thank you for your attention.