

**Safety Regulation Group**  
Applications and Certification Section

4 March 2003

Our Ref 9/97/CtAw/CtAw/261

**LETTER TO OWNERS/OPERATORS NO 2420**  
**ROLLS-ROYCE DERWENT MK 8 AND MK 9 ENGINES FITTED TO GLOSTER**  
**METEOR AIRCRAFT**  
**ENGINE CRITICAL PARTS CYCLIC LIFE**

It is recognised that there are Gloster Meteor aircraft powered by Rolls-Royce Derwent Mk 8 and Mk 9 engines operating privately on the UK register.

Derwent engines do not have formally defined critical parts as modern engines would. Those parts that are considered to be critical are the impeller, the turbine disc and the turbine shaft. It is known nowadays that failure of these parts is caused by metal fatigue, which is driven by cyclic usage. A failure of these parts could lead to uncontained engine debris with high release energy. There was no cyclic life control applied to these critical parts as the inspection of these components for evidence of cracks were carried out frequently at overhaul or during hot end change. Thus, the inspection interval for these critical parts would have been up to 450 hours for the turbine disc and up to 900 hours for the impeller and shaft sections, the number of cycles accumulated would have been very small.

Rolls-Royce undertook recently extensive lifing studies on the turbine disc, turbine shaft and impeller to derive cyclic lives. Because the last inspection of some engines is up to 40 years ago and that inspection standards were very rudimentary at that time (the impeller would have been inspected using red dye, which could not guarantee to reveal a crack of less than 0.2" long), no realistic safe life can be derived for any of these components.

With the lack of information of the internal condition of the engine, the operator should be alerted of the high risk of failure if the critical components have not been subjected to a high sensitivity crack inspection.

It is important that the usage of the engine critical parts (impeller, turbine disc and turbine shaft) is appropriately recorded in order to minimise the risk of a hazardous failure. An assessment of the cyclic exchange rate for typical mission profiles enables cyclic usage to be related to flight hours. Rolls-Royce have carried out this assessment for Derwent engines, which indicates that the rate of cycles per engine hour may be greater in private operation than originally expected in a typical military operation. The private operators should take steps to ensure that the aircraft would be flown in a benign regime. Whilst Rolls-Royce cannot advise on any cyclic exchange rate applicable to private operations, it will consider calculating the exchange rate for a selection of mission profiles.

continued overleaf

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In order to advise on an appropriate cyclic exchange rate applicable to private operations, the operator should provide the CAA Propulsion Department with a profile data in a form of complete engine RPM versus Time for each flight profile. This profile data should be underwritten by an approved BCAR A8-20 (E4) organisation.

Additionally, the few Derwent engines both installed and spares for the Gloster Meteor aircraft may be over 40 years old and due to concerns about the adverse effect of corrosion on the critical parts and concerns for the integrity of elastomers, Rolls-Royce recommends that a 15 year calendar life be imposed after which an appropriate overhaul should be carried out.

The CAA is currently reviewing with Rolls-Royce maintenance instructions for inspection of these critical parts to determine appropriate safe cyclic lives for continued operation.

Enquiries regarding this LTO should be referred to Mr C Denis, Propulsion Department (Telephone No 01293 573641) at the address shown.

**R J TEW**

Airworthiness Directive Co-ordinator