

AAIB Bulletin No: 12/94 **Ref: EW/G94/10/03** **Category: 1.3**

Aircraft Type and Registration: Isaacs Fury, G-RODI

No & Type of Engines: 1 Lycoming O-290-C piston engine

Year of Manufacture: 1986

Date & Time (UTC): 5 October 1994 at 1305 hrs

Location: Burgate Manor Farm near Fordingbridge, Hampshire

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - None

Injuries: Crew - None Passengers - N/A

Nature of Damage: Serious damage to the engine; minor damage to landing gear

Commander's Licence: Private Pilot's Licence

Commander's Age: 45 years

Commander's Flying Experience: 1,845 (of which 545 were on type)
Last 90 days - 22 hours
Last 28 days - 9 hours

Information Source: Aircraft Accident Report Form submitted by the pilot

Whilst en route from Sandown to Compton Abbas, the pilot heard an unusual noise from the engine which was accompanied by a loss of power. His view ahead then became obscured as oil covered the windscreen and he was aware of white smoke streaming from the exhaust. After shutting down the engine, following which the propeller continued to windmill, the pilot was able to carry out a successful forced landing into a reasonably smooth field, with minimal damage to the aircraft.

Initial examination of the engine revealed that the top of one cylinder had separated and subsequent metallurgical examination of this cylinder revealed the fracture faces to be typical of those which occur under overload conditions. No associated material defects were found. The inlet valve was still in position in the cylinder head and had been correctly assembled. This valve was removed and the end face of the cylinder, valve seats, inlet and exhaust ports were examined in detail. It was noted that the exhaust valve head, which was not recovered, had separated from its stem and had subsequently become trapped in a small number of positions between the piston and end face of the cylinder, as indicated by associated witness marks. The exhaust valve seat insert had been grossly plastically deformed around part of its circumference but no evidence was found to indicate that the valve had not been seating correctly. It was apparent that the loads which had resulted from the exhaust valve head entrapment had been sufficiently high to cause the cylinder head separation.

With reference to Figures 1 and 2, examination of the exhaust valve stem showed that it was a very loose fit in the guide and that the guide bore was heavily 'coked' with the combustion products. The stem was also heavily coked adjacent to the fracture and this coke layer had been compacted on that part of the stem which slid in and out of the guide when the engine had been running. The valve stem fracture face was also covered in a layer of coke, except where mechanical damage had occurred during the final failure. Plastic deformation of the stem material was only associated with a small area of the fracture face, the rest of the surface being generally typical of that resultant from a cyclic tension fatigue mechanism, with slight superimposed axial bending. A specific origin for the crack was not established, or for how many hours the crack had been growing, but it was estimated that many millions of load cycles would have been required to produce the type of damage present.

The aircraft had been constructed in 1986 and fitted with this engine at that time, since when it had accumulated some 586 hours. Engine maintenance records showed that it had run for some 198 hours since 'overhaul', and that it had been subject to a shockload inspection in March 1985 at which time all valves and valve seats had been lapped and recut respectively. In April 1989, at a recorded time of 249 hours, the engine had been partially stripped following reports of low compression. At that time the valves had been again removed, refaced and their seats recut. The total time for the engine and its component parts, or its calendar age, could not be established from the available records but the owner believed that it dated back to a batch of 'lease' engines supplied to the UK from the USA towards the end of the second World War. The aircraft was operating under a Permit to Fly, which had most recently being renewed in August 1994.

G-RODI EXHAUST VALVE FAILURE

Valve stem failure region



Figure 1

Stem fracture face before removal from valve guide

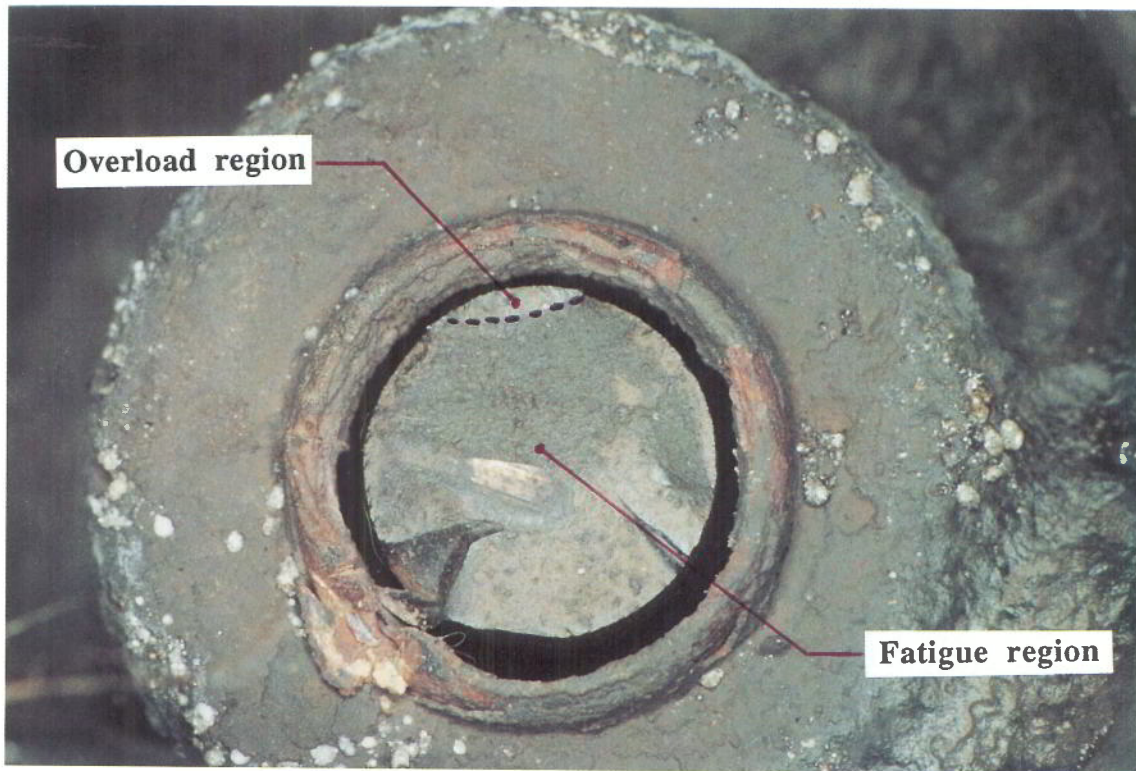


Figure 2