Piaggio FW P149D, G-BPWW

AAIB Bulletin No: 10/98 Ref: EW/C98/05/13 Category: 1.3

Aircraft Type and Registration:	Piaggio FW P149D, G-BPWW
No & Type of Engines:	1 Lycoming GO-480-B1A6 piston engine
Year of Manufacture:	1959
Date & Time (UTC):	17 May 1998 at 1250 hrs
Location:	Near Lydd Airport, Kent
Type of Flight:	Air Race
Persons on Board:	Crew - 1 - Passengers - 1
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Mechanical damage to engine and damage to the wing and underside of the fuselage
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	3,050 hours (of which 300 were on type) Last 90 days - 15 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and strip examination of the engine

Introduction

The aircraft was a four/five seat all-metal light aircraft of Italian origin. The first example of this type flew in 1953 and the type was subsequently built in quantity as a liaison and training aircraft for the Federal German Air Force, latterly being built under licence by Focke-Wulf in Germany. This aircraft was taking part in an air race at Lydd when the engine lost power, ran roughly and then stopped. The pilot was forced to land in a field with resultant damage to the propeller, the underside of the wing and the fuselage.

Engine history

This engine was originally manufactured as a GO-480-B and delivered on 3 March 1958. It was a six cylinder, normally aspirated engine of 270 HP driving a three bladed propeller through an integral epicyclic gearbox. The engine records indicated that it had been overhauled in November 1971, during which five of the six conrods had been replaced with conrods from another engine of the same type and the sixth with a new conrod. In 1990, after a long period of storage, it was again stripped for inspection and modified to '-B1C' standard with the fitment of an angled generator drive. In 1991, it was further modified to '-B1A6' standard with fitment of an improved crankshaft, and overhauled to 'zero-life'. In September 1995, after the engine had run for only some 125 hours, this aircraft was damaged in a wheels-up landing accident which necessitated an engine strip for a shock-load inspection. Following this work and engine rebuild in August 1996, the engine was re-fitted to this aircraft in October 1996 and had accumulated only a further 38 hours up to the time of this failure. The last maintenance check had been an Annual Inspection which had been carried out in December 1997, after the engine had run 31 hours since re-fitment, and during which the No 2 cylinder and three spark plugs had been replaced. However, during the 38 hours running after the last engine rebuild, the aircraft owner and maintenance organisation recalled that they had noted an unusual noise whenever the engine had been running with the propeller 'unloaded'. Despite two visits by a representative of the company which had last rebuilt the engine to assess this noise, no defect had been diagnosed and the engine had continued in service.

Engine examination

Initial examination of the engine found that the No 5 cylinder conrod had failed due to overstressing as a result of loads induced by gross overheating of its big-end bearing. Severe secondary damage had occurred to the No 5 cylinder and adjacent crankcase. After the aircraft had been recovered to its maintenance organisation, the engine was removed and transported to the AAIB at Farnborough where it was subject to strip examination in conjunction with the engine overhaul organisation which had carried out its most recent re-build in August 1996. This examination failed to reveal any evidence of pre-failure defects, with the possible exception of unusual wear patterns on several of the cam followers. The sump contained a reasonable quantity of oil. The oil cooler, by-pass valve, associated hoses and oil pump, together with its drive gears, were serviceable and all filter screens and oil galleries/passageways throughout the crankcase and crankshaft were found free from obstruction. The oil pressure relief valve was also examined and found to be correctly installed and serviceable. The dowels associated with the crankshaft counterweights were inspected for evidence of engine overspeeding, but appeared satisfactory.

A strip examination of the crankshaft bearings established that all the nuts and bolts associated with the big-end and main bearings were tight and had been assembled correctly. When dis-assembled, most big-end bearings exhibited symptoms of a reduced oil supply, or possibly of oil starvation, in that all but one exhibited minimal 'wetting' by oil. Only the No 2 bearing appeared wetted to a degree that would be considered normal upon bearing shell removal. Big-end bearing Nos 1, 2, and 4 were free to rotate and exhibited no excessive radial play, but the No 3 big-end bearing showed distinct evidence of overheating, severe loss of bearing shell material and incipient failure of the conrod. Dimensional checks were conducted, where possible, on the pin and journal diameters of all the bearings on the crankshaft, and all those checked conformed to the sizes recorded in the

engine build records. However, due to the failure damage, the Nos 3 and 5 big-end bearings could not be dimensionally checked.

Discussion

The manufacturer's past experience of failures in Lycoming piston engines has shown that, in almost all cases, a big-end bearing is the first item to fail following oil starvation. All the evidence from this examination suggested that of a lack of oil supply to the crankshaft was the most likely reason for the failure of the Nos 5 and 3 big-end bearings, but no evidence was found to indicate any reason for such lack of supply. The engine records indicated that, following the re-build in August 1996, it had been satisfactorily run on a test bed, at high power, for approximately 45 minutes. Subsequent to this test run, the oil had been drained and the engine inhibited prior to shipment and re-installation in the aircraft.