

INCIDENT

Aircraft Type and Registration:	Piper PA-23-250, G-BBHF	
No & type of Engines:	2 Lycoming IO-540-C4B5 piston engines	
Year of Manufacture:	1973	
Date & Time (UTC):	4 July 2006 at 1440 hrs	
Location:	Between Lands End and St Mawgan	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage limited to left engine	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	52 years	
Commander's Flying Experience:	1,980 hours (of which 27 were on type) Last 90 days - 208 hours Last 28 days - 68 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot, engine strip examination in the presence of the AAIB and further detailed metallurgical examination	

Synopsis

The aircraft suffered an engine failure during the cruise, diverted and subsequently landed safely at St Mawgan.

Initial examination of the left engine revealed that a connecting rod had been ejected through the crankcase but had been retained within the engine cowling.

History of the flight

The aircraft had taken off from Lands End Airfield and was cruising at about 2,000 ft when the left engine failed. The pilot feathered the propeller and carried out the engine failure checks. He secured the engine and decided to divert to St Mawgan. The aircraft hydraulic system, which operates both the landing gear and flaps, was by now inoperative; consequently the pilot performed an orbit on final approach in order to manually lower the landing gear. He then carried out a successful flapless landing without further damage or injury.

Aircraft description

G-BBHF was fitted with two Lycoming IO-540-C4B5 fuel injected six cylinder, direct drive, horizontally opposed, air cooled engines. This aircraft type has a hydraulically actuated retractable tricycle landing gear system; each landing gear leg is individually actuated by a hydraulic actuator powered by a pump driven by the left engine. If the engine driven hydraulic pump fails, an emergency hand pump can be used in its place. In the event of a hydraulic system failure caused by a line

rupturing, an emergency CO₂ bottle can be activated to blow the landing gear down. The flaps are also hydraulically actuated.

Aircraft and maintenance history

Both engines had been subject to an overhaul to zero hours in January 2002 and were refitted to G-BBHF in July 2002. In November 2002 the aircraft was grounded awaiting the embodiment of an Airworthiness Directive (AD 2004-05-24) which required the replacement of the crankshaft gear retaining bolt on both engines. This work was completed in January 2003 and carried out 'in-situ' by hoisting the engines without complete removal. However, following this work there were pilot reports that the aircraft 'would not fly straight' and in May 2003 it was found that the left engine mounts had been incorrectly fitted. Rectification work was carried out as a result.

Since the overhaul both the left engine (serial number L11064-48) and the right engine (serial no L-1545-40) had completed around 130 hours. The most recent maintenance was a 50-hour check carried out on 23 January 2003, 30 hours prior to the engine failure. At that time a note in the left engine log book stated: 'very small amount of alloy particles found in oil filter, considered fit to continue and to be re-inspected at next 50-hour inspection'.

Engine strip examination

The left engine was removed from the aircraft and stripped in the presence of the AAIB. There was a hole in the crankcase which had been caused by the No 4 cylinder connecting rod being forced through it. The connecting rod and remains of the bolts were found retained within the engine cowling. Pieces comprising the complete connecting rod assembly and bolts were found but not the No 4 crankshaft bearing shell. All the fractures of

the recovered components were consistent with overload failure and there was no evidence of fatigue.

The oil filter was removed, disassembled and was found to contain a large amount of metallic debris. The oil pump had seized due to the presence of additional metallic debris; once this had been cleared the oil pump was free to rotate. The engine oil sump was removed and the sump filter found almost full of similar debris.

The crankshaft and its main bearings exhibited some wear consistent with the amount of debris which had been circulating in the oil. The connecting rods from all the other five cylinders were undamaged and the bolts found to be correctly torque tightened. The piston crowns exhibited a normal amount of combustion deposits although the piston skirts did show some scoring, again consistent with circulating debris. The piston rings were intact, free in their grooves and exhibited normal operating wear. The piston pin and plug assemblies were intact and undamaged and showed only a small amount of wear, consistent with the low number of engine hours. The crankshaft bolt, which had been the subject of the AD, was found to be correctly torque tightened.

The debris from the oil was examined using a Scanning Electron Microscope and found to be consistent with crankshaft bearing shell material. The oil filter from the right engine was removed for examination and found to be clean.

Both magnetos were tested satisfactorily. The spark plugs were in serviceable condition; the electrodes were clean and had only light deposits.

Discussion

The final uncontained failure of the connecting rod could be attributed to the break-up of the No 4 crankshaft

bearing. The other connecting rods had been correctly torqued and although the torque on No 4 could not be checked all the fracture surfaces were consistent with overload failure so it was unlikely that the bolts had been loose. The wear in the other bearings was consistent with the debris circulating in the oil and so it is possible

that some debris was already circulating, which led to the break up of the No 4 bearing. At the last 50-hour check the presence of some particles had been noted. It was not possible to identify the source of the initial contamination from the large amount of debris now present in the oil.