

Piper PA-34-200T, G-OACG

AAIB Bulletin No: 6/98 Ref: EW/G98/03/08 Category: 1.3

Aircraft Type and Registration: Piper PA-34-200T, G-OACG

No & Type of Engines: 2 Continental TSIO-360-EB piston engines

Year of Manufacture: 1978

Date & Time (UTC): 16 March 1998 at 1715 hrs

Location: 20 nm south-east of Southampton, Hampshire

Type of Flight: Public Transport

Persons on Board: Crew - 1 - Passengers - 4

Injuries: Crew - None - Passengers - None

Nature of Damage: Loss of No 3 cylinder on right-hand engine

Commander's Licence: Commercial Pilot's Licence with Instrument Rating

Commander's Age: 49 years

Commander's Flying Experience: 8,500 hours (of which 2,000 were on type)
Last 90 days - 124 hours
Last 28 days - 34 hours

Information Source: Aircraft Accident Report Form submitted by the pilot and metallurgical examination of failed cylinder head

The aircraft was being operated as an air taxi for a sector from Goodwood to France. As the aircraft was climbing through FL 55 the pilot noted a sudden loss of power from the right-hand engine, associated with a rapid fall in manifold pressure from 33 to 35 ins Hg to about 25 ins Hg. The passenger sitting in the right-hand front seat heard a bang at the time of the power loss and a fine stream of mist was seen, appearing to come out of the louvred grill on top of the cowling on the right-hand engine.

The pilot had no problems in shutting down the engine and feathering the propeller in accordance with the emergency check list. There was no sign of fire although there was a film of oil over parts of the nacelle and wing. The pilot confirms that, up to the sudden loss of power, both engines had

performed normally through start-up, power checks, take off and climb. He also confirms that, although outside controlled airspace, London ATC assisted with an immediate diversion to Southampton where the aircraft was landed safely and the passengers disembarked.

Examination of the right-hand engine showed that the upper portion of the No 3 cylinder head had detached from the barrel portion of the cylinder. This failure had left the barrel portion of the cylinder intact and, as a result, the piston had still been able to move normally within the bore. Thus the failure had not mechanically affected the other cylinders, limiting the amount of engine damage.

The failure within the No 3 cylinder head had occurred around the upper portion of the threads where the cylinder head is screwed onto the cylinder barrel. Thus, the lower portion of the cast aluminium cylinder head had remained attached to the barrel. Detailed examination of the fracture surfaces showed that a fatigue crack had progressed across the wall of the cylinder head through some 120° of the circumference: the remaining 240° had then separated in mechanical overload. The fatigue had initiated at a number of sites around the inner, threaded, wall of the cylinder head. Event markers identified within the fatigue fracture surface suggested that the fracture had progressed for some 80 flights between breaking through the cylinder wall and final separation of the cylinder head. The maintenance organisation notes that the failure had occurred at 1,646 hours after rebuild and that the previous compression check was at 1,562 hours, suggesting 'break-through' at about the time of the compression check.

The mechanical properties and chemical composition of the cylinder head were not determined but there did not appear to be any mechanical discontinuities that would have reduced the basic fatigue strength of the head. Following the incident, when the replacement cylinder had been fitted at the No 3 position, the maintenance organisation noted that one magneto was faulty, with irregular running and internal arcing. However, it would seem unlikely that a faulty magneto would have contributed in the initiation of the fatigue crack, yet remain undetected through the intervening hours of operation.