Aviation Safety Investigation Report 199402417

Piper Aircraft Corp Chieftain

11 August 1994

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Aviation Safety Investigation Report

199402417

The Bureau did not conduct an on scene investigation of this occurrence. The information presented below was obtained from information supplied to the Bureau.

Occurrence Number: 199402417 **Occurrence Type:** Incident
Location: Moorabbin
State: VIC **Inv Category:** 4
Date: Thursday 11 August 1994
Time: 1615 hours **Time Zone** EST
Highest Injury Level: None

Aircraft Manufacturer: Piper Aircraft Corp
Aircraft Model: PA-31-350
Aircraft Registration: VH-OZV **Serial Number:** 31-7405470
Type of Operation: Air Transport Domestic Low Capacity Passenger Scheduled
Damage to Aircraft: Minor
Departure Point: Moorabbin VIC
Departure Time: 1615 EST
Destination: Wynyard TAS

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	ATPL 1st Class	259.0	3322

Approved for Release: Tuesday, February 14, 1995

The aircraft was conducting a routine passenger flight. Shortly after takeoff from runway 35, at about 200 ft, the aircraft suffered a power loss on the left engine. The pilot carried out the engine failure emergency procedures and ascertained that the power loss was partial. He climbed the aircraft, flew the downwind leg at about 700 ft and landed safely on runway 35 left.

Engineers discovered that the number six cylinder head had separated from its barrel. The CAA Materials Evaluation Facility examined the cylinder head and reported that although weld repairs to the spark plug hole, the exhaust port flange and the exhaust valve seat recess were found, these were not a factor in the cylinder failure. The nature of the fatigue cracking indicated that cracking occurred under conditions of a stress gradient in the wall of the cylinder head, with the higher stress at the inner surface of the cylinder wall. The crack had propagated over approximately 600 to 700 engine start/stop cycles and had worked its way around almost half the cylinder circumference before the cylinder head separated. The crack appeared on the outer surface during the last 20 cycles. This indicated that the material toughness was good.

The crack had propagated around the circumference of the cylinder head combustion chamber at the head to barrel thread connection. The cylinder barrel hid the crack from view. There were no marks in the area of the fatigue propagation to indicate the cylinder had leaked exhaust gasses, nor was there any blackening of the fins on the outer surface which would have enabled detection during maintenance.

The total time in service of the cylinder could not be determined but was estimated to be one overhaul life, or 2000 hours. Time since overhaul was 628 hours.

On the 27 July 1994, approximately 28 hours before the power loss, the company carried out a 100 hourly inspection. A compression test was performed which revealed cylinder number six to have a low reading, but not the lowest at 66/80. Cylinder five read 60/80. Leakage past the piston rings due to gap alignment was thought to be the reason for the low compression.

The exact initiator for the cylinder head failure was not found. However, harsh handling of the engine could have contributed to the failure. Not allowing the engine to warm sufficiently before applying high power or not allowing the engine to cool sufficiently before shutting down could have caused the thermal stress gradients.

Cylinder head separation was considered to be unusual for the Lycoming TIO-540 engine. According to the BASI data base, this was the first occurrence of a cylinder head separation in more than five years.

CONCLUSIONS

Findings

1. The cylinder head failed due to a fatigue crack.

2. The location of the crack prevented its detection during visual inspections.

Significant Factors

The following factors were considered relevant to the development of the accident:

1. Harsh engine handling may have caused thermal stress resulting in the fatigue crack.