

No: 11/92

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Category: 1c

Aircraft Type and Registration: Piper PA-34-200T Seneca II, G-FILE

No & Type of Engines: Continental TSIO-360-EB1 piston engine (left)
Continental LTSIO-360-EB1 piston engine (right)

Year of Manufacture: 1980

Date & Time (UTC): 15 June 1992 at 1305 hrs

Location: Little Gransden Airfield, Bedfordshire

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - 1

Injuries: Crew - None Passengers - None

Nature of Damage: Left mainleg broken. Damage to propeller tips, engine shock loaded, left flap buckled, light damage to underside of left wing, cowl and rear fuselage.

Commander's Licence: Senior Commercial Pilot's Licence with Instrument and Instructor ratings

Commander's Age: 43 years

Commander's Flying Experience: 1,952 hours (of which 22 were on type)
Last 90 days - 108 hours
Last 28 days - 38 hours

Information Source: Aircraft Accident Report Form submitted by the pilot and examination of failed component by AAIB.

The aircraft made a normal approach to land at Little Gransden with full flap selected. Speed just prior to the flare was 85 kt. Just after touchdown the pilot noticed the left wing drop slightly and corrected this with aileron. An eyewitness reported that he saw the left mainleg fail just after touchdown and noticed the wingdrop being corrected. Initially the aircraft continued along the centreline of the runway but then it slowly veered to the left as the wing dropped and then contacted the surface. The aircraft came to rest at the edge of the runway. An instructor in another aircraft had seen the accident and summoned the rescue and fire-fighting crew. The pilot and passenger evacuated the aircraft from the right hand door.

The grass runway being used at Little Gransden, runway 28, is 570 metres long. For the declared aircraft weight of 4081 lb, an ambient temperature of +20°C and zero wind the landing distance obtained from the PA 34 Flight Manual is 995 metres on grass. This figure assumes an approach speed of 76 kt and 'full stall touchdown'. G-FILE had previously been successfully flown into Little

Gransden and two witnesses who saw the leg collapse at touchdown commented that the landing itself did not appear to be heavy or in any way unusual.

The failure had occurred near the lower end of the oleo housing in the leg's main trunnion assembly (Part No 67926 in Fig 46 of current Illustrated Parts Catalogue - see attached Figure). A section of the aluminium alloy forging containing one face of the fracture was received by AAIB and subjected to metallurgical examination by DRA, Farnborough. The oleo housing had failed in forward bending and some fatigue cracks were found at the initiation of the rupture. These cracks were in an area which is subject to mandatory inspections at 100 hr intervals under Piper Service Bulletin 787A, initially issued in 1985, and CAA AD 002-01-88 both of which also apply to PA 44 Seminole aircraft. The affected area is on the aft side of the housing at the lower end of a large fillet. The fillet edge also corresponds to the forging flash line of the assembly. On the subject housing the fillet ran out about 4.3 inches above the bottom of the oleo housing; on later, modified, trunnions the fillet extends 1 in further down the oleo housing. SB 787A requires the suspect area to be cleaned of dirt and paint and inspected visually with the use of a x10 magnifier. There is no instruction for re-protection of the cleaned area.

Metallurgical examination identified four closely spaced fatigue cracks at the initiation of the final rupture spanning a circumferential distance of 22 mm with a maximum penetration of 2 mm. These cracks crossed the forging flash line. The outer surface of the housing in the area of the pre-existing cracking was only partially covered with paint. The original paint had been removed locally, presumably in order that SB 787A might be carried out. The area was partially coated with green primer paint but some of the surface was bare. There was some microscopic surface corrosion pitting associated with the fatigue origins and some adjacent but separate fatigue and intergranular corrosion cracking. There was evidence also of local plastic deformation signifying that stresses had exceeded the materials elastic limit either through overload in the forward bending mode or through residual stresses from the manufacturing process. Hardness measurements on the alloy indicated that it was fully heat treated and that deficiency of material strength was not a factor in the failure.

The engineering records showed that G-FILE had been subjected to SB 787A nine times since 1987 and within the required 100 hour periods. The final inspection had been carried out one month and less than two operating hours, and two flights, before the accident. The previous inspection had been seven months and 54 hours earlier.

Since 1985 three similar failures in PA 34 aircraft have resulted in accidents and have been reported in AAIB Bulletins. These housings did not feature the modified, extended, fillet. The findings of the metallurgical examination of the housing from G-FILE, including those of plastic deformation and corrosion, are similar to those from the examination of a housing from another PA 34, G-TEST (see below). A microsection through the forging flash line in the housing from G-TEST showed a disturbed grain flow associated with the surface cracking and, reportedly, in other cases a stress-corrosion process had been identified in the initiation of fatigue cracks. Cracks have also been detected in modified housings and reported through the CAA occurrence reporting system but none resulted in a reportable accident. A summary of the available information is presented below.

Previous accidents:-

G-BBZJ	5 April 1987	Bulletin 9/87, unmodified fillet, inspected 30 hours before failure
G-CJWS	6 July 1991	Bulletin 10/91, unmodified fillet, inspected 7 hours before failure
G-TEST	25 August 1991	Bulletin 10/91, unmodified fillet, inspected 93 hours before failure

Previous occurrences (cracks detected before failure of component):-

G-BEJV	19 September 1986	Inspected 134 hrs before crack detected due to oil leak.
G-BHYF	27 April 1987	Modified fillet, housing life 1,914 hours
G-BHYG		Modified fillet, housing life 1,900 hours
G-BEJV	30 April 1987	Modified fillet, housing life 1,438 hours
G-BGFT	29 May 1987	Modified fillet
G-MAIR	23 August 1989	Inspected 1.3 hours, 9 landings before oleo deflation due to crack

The issues which were raised by these accidents and occurrences were the mainleg housing's susceptibility to cracking from corrosion pitting, stress corrosion or other surface damage and possible overloading during operations. There had also been a significant number of failures soon after an inspection had been carried out and within the 100 hour periodicity which raised questions about the practical effectiveness of the current inspection requirement. During G-TEST's investigation a metallurgist recommended that the housing's fatigue strength be increased by further machining of the forging flash area and shot peening of the surface. In October 1991, following the investigation of the mainleg housing failure in G-TEST AAIB made a recommendation that,

'The CAA review the requirements of AD 002-01-88 with particular reference to the quality of the required inspection, its periodicity and reprotection of the affected area after each inspection.'

The CAA accepted this recommendation but pointed out that the FAA are also reviewing the matter and the Authority is, therefore, awaiting notification of any FAA action. This recommendation remains valid and action outstanding.