

Piper PA-38-112, G-LFSD, 10 August 1999

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Aircraft Type and Registration:	Piper PA-38-112, G-LFSD
No & Type of Engines:	1 Lycoming O-235-L2C piston engine
Year of Manufacture:	1982
Date & Time (UTC):	10 August 1999 at 1541 hrs
Location:	Liverpool Airport
Type of Flight:	Private (Training)
Persons on Board:	Crew - 2 - Passengers - None
Injuries:	Crew - None - Passengers - N/A
Nature of Damage:	Nose leg landing gear failed, damage to propeller, engine and underside of cowling
Commander's Licence:	Commercial Pilot's Licence with Instrument and Instructor Ratings
Commander's Age:	39 years
Commander's Flying Experience:	1,684 hours (of which 1,146 were on type) Last 90 days - 161 hours Last 28 days - 60 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional tests by AAIB

History of the flight

The aircraft was being used for a training flight to check a student pilot prior to his first solo flight. All of the pre-flight checks were performed satisfactorily and so, with the student handling, the aircraft was then flown around the circuit for a 'touch and go' landing on Runway 27. The instructor considered that the circuit was well flown by the student, but thought that 'the aircraft touched down a little heavily'. There was, however, no indication that any damage had been done and the aircraft was then accelerated and climbed away normally.

The instructor considered that the second circuit was also well executed and the touchdown, on the main wheels, much better than the previous one. However, when the student lowered the nose of the aircraft, the nose leg collapsed as the nosewheel made contact with the runway. The nose struck

the runway and the aircraft then slewed slightly to the right and came to a stop. Both occupants were uninjured. Subsequent inspection showed that the nose landing gear oleo strut had broken just above the lower swivel journal. The oleo piston, together with the wheel and the lower end of the oleo cylinder, had detached and were found about 50 yards behind the position where the aircraft had come to rest. At the request of the AAIB, the parts of the broken oleo strut cylinder were forwarded to the AAIB for further investigation.

Metallurgical examination of the failed oleo strut cylinder

Metallurgical examination revealed that the final failure of the cylinder had been as a result of a high load application which had exploited a pre-existing fatigue crack which had propagated from the cylinder bore, at the change in wall thickness at the lower end of the oleo piston upper guide, as shown in Figures 1 and 2. The fatigue had initiated not only in the forward arc of the cylinder but also at several locations, around its bore, in the same plane. The opportunity was also taken to inspect the corners of the external lubrication groove in the lower swivel journal of the oleo for associated cracking, which had been the subject of a previous AAIB Safety Recommendation, No 93-07. The presence of fatigue cracking was confirmed in the upper corner of the groove.

Previous similar accident

A previous nose leg failure accident had occurred to another PA-38 Tomahawk, G-BNSL, on 24 June 1999 at Edinburgh Airport. That failure had also been caused by a pre-existing fatigue crack emanating from the same area of the bore of the nose leg oleo strut cylinder, and the associated report is included in this issue of the AAIB Bulletin.

Safety recommendations

This nose leg failure occurred very shortly after that which occurred to the above aircraft, G-BNFL, and stemmed from essentially the same cause, fatigue cracking of the oleo strut bore. These accidents indicated that there may be a general tendency for nose landing gears of this design, which have been subjected to a large number of landing cycles, to develop fatigue cracking in the oleo cylinder. The PA-38 Tomahawk is an aircraft type used extensively for initial training and, as such, is more likely to be exposed, frequently, to heavier than normal loading of the nose landing gear. Although occasional severe loading must be expected in any use, the greater frequency of high load application to be expected when an aircraft is used for initial training should reasonably necessitate an appropriately load tolerant design.

The findings from these two investigations indicated that there is a stress raiser in the oleo cylinder bore at the lower end of the 'oleo piston upper guide', in addition to those at the corners of the external lubrication groove in the lower swivel journal of the oleo. Such fatigue cracks which initiate in the cylinder bore appear to be more critical than those which occur in the lubrication groove, and are not so readily inspected by the dye penetrant techniques used to detect the latter.

The occurrence of these two similar failures indicated that the in service problem of such fatigue cracking should be addressed by the manufacturer as soon as practicable, and in this context the two relevant Safety Recommendations made in the AAIB report on the earlier accident to G-BNSL are reproduced below:

Recommendation 2000-7

In order to ensure that fatigue cracks in the external lubrication groove of Piper PA-38 Tomahawk nose leg oleo strut cylinders are detected during the required repetitive dye penetrant inspections in service, the associated procedure previously in the Maintenance Manual, and all references to it, should be revised by New Piper Aircraft Inc. to eliminate any confusion regarding the description of the Part which is the subject of this inspection and re-instated in the Maintenance Manual.

Recommendation 2000-8

In order to ensure that potential fatigue cracks emanating from the internal bore of the nose leg oleo strut cylinder on Piper PA-38 Tomahawk aircraft are detected in service before leg failure occurs, the FAA in conjunction with New Piper Aircraft Inc. should devise and introduce a suitable in service inspection procedure to identify such cracking, or alternatively specify a service life for such strut cylinders.