Piper PA-34-200T, G-BOSD, 19 June 1999 at 1030 hrs

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Aircraft Type and Registration:	Piper PA-34-200T, G-BOSD
No & Type of Engines:	2 Continental TSIO-360-E piston engines
Year of Manufacture:	1975
Date & Time (UTC):	19 June 1999 at 1030 hrs
Location:	Exeter Airport, Devon
Type of Flight:	Private (Training)
Persons on Board:	Crew - 2 - Passengers - 1
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Damage to nose and propellers
Commander's Licence:	Basic Commercial Pilot's Licence with Instrument and Instructor's Rating
Commander's Age:	51 years
Commander's Flying Experience:	3,170 hours (of which 1,200 were on type) Last 90 days - 220 hours Last 28 days - 80 hours
Information Source:	AAIB Field Investigation. This Bulletin contains the report of a similar accident to G-BOSD, which occurred at Exeter on 28 February 2000

History of the flight

The aircraft was engaged on an instrument training flight from Bristol to Exeter, with the commander and a second pilot, a CPL holder, with one passenger, who was also a pilot, on board. At Exeter two instrument approaches and go-rounds were conducted, followed by a visual circuit and landing on Runway 26. During the final approach to land the three persons on board each noted that all three green landing gear lights were illuminated. The landing was normal and the aircraft vacated the runway and had taxied via Runway 13/31 on to the southern taxiway for some distance when, while still taxiing at a fast walking pace with 1000 RPM set on both engines, the nose landing gear collapsed. Both propellers struck the ground and both engines stopped. The aircraft was secured and vacated.

Examination of the nose landing gear

Examination of the nose landing gear showed that the downlock spring link, which maintains the over-centre downlock position of the drag brace, was fractured at the lower eye end, and its telescopic section was jammed. [see Figure 1.] A metallurgical examination of the downlock link showed that the lower eye end had fractured in very low cycle reverse bending fatigue, with the final separation occurring as a result of stresses well above the elastic limit arising from compression loads during the final fracture. The downlock link consists of a plunger and a sleeve, which are retained with a transverse pin, and is spring loaded in the extended position [see Figures 2 &3]. The examination also found evidence that the downlock link had compressed over most of its travel at some time during its life. However, there was a lack of evidence of wear marks internally due to relative movement between the plunger and the sleeve, indicating they had become jammed after only a brief period of operation. The downlock link had been subjected to a degree of overloading in both tension and compression, which had caused distortion around the transverse pin, and it was this distortion which had caused it to jam. The downlock link was sectioned longitudinally and this clearly showed the distortion around the transverse pin, which had caused an interference jam between the sleeve and the plunger. No other damage was found which could explain the collapse of the nose landing gear. The aircraft had completed around 10,000 hours at the time of the accident. The time of the last maintenance or rigging of the nose landing gear drag brace and downlock link could not be ascertained, but it was not recent.

The jammed condition of the downlock link would not have prevented the nose landing gear from operating apparently normally, and gravity would have maintained the fore and aft sections of the drag brace in the locked over centre position. However, the downlock link would not have been able to apply the intended spring load to the rear drag brace. Although light, this spring load would have helped to maintain the over-centre condition against inertial loadings such as those due to taxiing over bumps, grass, etc. In this condition there was no assurance that the nose gear could not collapse at any time. Should the drag brace become unlocked to the extent that the downlock switch was released, then hydraulic pressure would have been applied to the jack to fully extend the gear, however large abnormal loads could be introduced into the downlock link if the gear became unlocked. The evidence of very low cycle fatigue in the downlock link eye end suggested that the nose gear may have become unlocked on previous occasions.

The distortion around the transverse pin, which led to the jamming of the downlock link, could only occur if the gear collapsed or if it was incorrectly rigged at some time. Due to the evidence that the downlock link became jammed early in its life, mis-rigging seems the probable cause of the jam. The Maintenance Manual provides only limited information regarding adjustment of the downlock link and, if this is rigged over length, damage of this type will result during retraction testing, possibly causing it to jam thus leading to inadequate over-centre loading of the drag links.

Other occurrences of Piper Seneca (PA34-200) nose landing gear collapse

The nose gear collapse of a Piper Seneca (G-BOCG), on 31 October 1997 was reported in AAIB Bulletin 3/98. This was also attributed to jamming of the downlock link due to mis-rigging. That report also commented on the limited information available in the Maintenance Manual, particularly regarding the operation of and need for accurate rigging of the downlock link.

Safety recommendation

The following safety recommendation is made:

Recommendation 2000-45

The New Piper Aircraft Company should review and amplify the instructions for rigging the nose landing gear downlock mechanism contained in the Piper PA-34 Maintenance Manual.

Follow up action to recommendation

The New Piper Aircraft, Inc. are of the opinion that the collapse of the nose landing gear was caused by a worn out down lock spring. They revised the maintenance manual in February 1997 and have no plans to redesign the drag brace at this time.