

Piper PA-38-112 Tomahawk, G-BMVM

AAIB Bulletin No: 12/2003	Ref: EW/C2003/06/08	Category: 1.3
Aircraft Type and Registration:	Piper PA-38-112 Tomahawk, G-BMVM	
No & Type of Engines:	1 Lycoming O-235-L2C piston engines	
Year of Manufacture:	1979	
Date & Time (UTC):	15 June 2003 at 1315 hrs	
Location:	Wycombe Air Park, Booker, Buckinghamshire	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Extensive damage to nose cowl and engine	
Commander's Licence:	Student Pilot	
Commander's Age:	22 years	
Commander's Flying Experience:	47 hours (all on type)	
	Last 90 days - 12 hours	
	Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent enquiries by the AAIB	

Synopsis

Following the completion of a training flight, the pilot experienced an unusual vibration on his first approach to Wycombe. He aborted the landing and continued in the circuit. On a subsequent landing, the nose of the aircraft continued to drop after touchdown, and so he raised the nose and took off again. He was asked by ATC to remain in the circuit and was also informed that the nose landing gear had detached from the aircraft. He was then talked through the subsequent approach and landing by the CFI of his training organisation. An engineering investigation revealed that the leg had failed as a result of a fatigue crack at a lubrication groove at the base of the nose gear strut housing, and that this mode of failure had happened on previous occasions to other PA-38 aircraft. An inspection of the groove may not have been carried out due to previous confusion over the insertion of the requirement into the Maintenance Manual by the manufacturer.

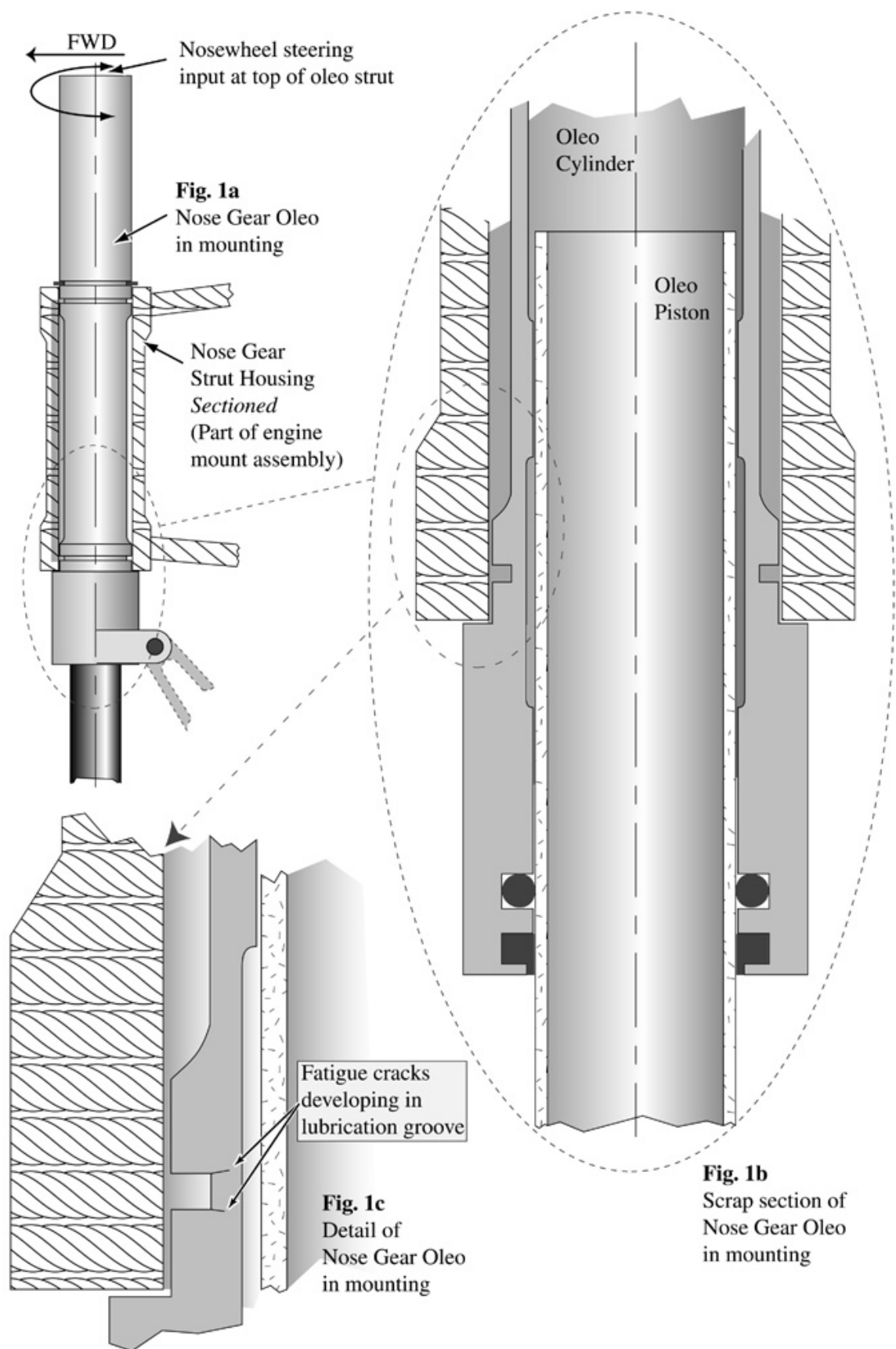
History of Flight

The student pilot was making a solo training flight in the local area of Wycombe Air Park. Prior to the flight the pilot was briefed by his instructor and he carried out a thorough inspection of the aircraft, which was reported free from any obvious significant defects. The training flight was

without incident until he returned to Wycombe. Whilst descending toward the airfield he noticed an unusual vibration in the controls and, with this in mind, he elected to continue with the approach. He joined the circuit for Runway 24 and was aware of a Cessna which was already in the circuit. On the final approach the vibration began to worsen and, just prior to touchdown, the pilot felt unhappy with the situation and so carried out a go-around. On the next circuit he was too close to the Cessna already in the circuit and, as a result he delayed his approach to gain extra spacing. Another aircraft now joined the circuit and was judged to be even closer than the Cessna and, as the circuit was now quite busy with other aircraft joining, he was told to go around by ATC on his final approach, which he duly did. On the third circuit, everything was fine until the final approach when the vibration started again. After the pilot felt the main wheels contact the ground normally, he eased the nose of the aircraft down, as usual. However, the nose continued to drop further than normal and, in a panic, the pilot applied full throttle and called the tower announcing his intention to go-around. Initially the tower did not respond but replied to his second call. The pilot was aware that something had happened to the aircraft during the previous approach and landing and, on the downwind leg, he was told to maintain 1,000 feet and to continue around the circuit once more. At this point all traffic at Wycombe was diverted to the nearby airfield at White Waltham. The Chief Flying Instructor (CFI) then contacted G-BMVM and explained to the pilot that the nose landing gear (NLG) had detached. He then gave him instructions on what to do during the impending landing and 'talked the pilot down' throughout the final approach and landing. The aircraft touched down on the main wheels and the nose was held up for as long as possible, until it lowered and the propeller blades contacted the ground. The aircraft came to a halt, the pilot shut the aircraft down and exited uninjured.

NLG Examination

The lower section of the NLG was recovered from Runway 24. The cylinder had fractured at the position of a lubrication groove at its lower end which is located just above the lower support flange, Figure 1.



The fracture surface exhibited a small area of fatigue cracking around its outer circumference, together with a larger area associated with overload failure, Figure 2. It was also evident that there had been other pre-existing fatigue cracks propagating around the groove. The NLG had been fitted to the aircraft since November 2000 and had completed 674 hours prior to the failure.



Failed NLG with New NLG



Failed NLG viewed from above



Fracture surface showing narrow fatigue failure and overload region

Figure 2 Failed NLG

Inspection Requirements

In 1993, following similar incidents to aircraft G-BMVL (AAIB Bulletin 3/91) and G-BSVW (AAIB Bulletin 2/93), in which the NLG failed in exactly the same manner as G-BMVM, the AAIB made the following Safety Recommendation (93-7):

The CAA should introduce a service maintenance requirement for a periodic dye penetrant inspection of the lubrication groove at the lower end of the nose leg oleo cylinder on Piper PA-38 Tomahawk aircraft, in order to reduce the incidence of associated nose leg failure due to fatigue cracking initiation from the sharp radii at the base of the groove.

Piper addressed this recommendation in September 1983 by introducing into the Maintenance Manual (MM) a requirement to carry out a dye penetrant inspection of the 'Nose Gear Strut Housing' at an initial 1,000 hour interval from the fitting of the NLG. This was to be repeated every 500 hours. This requirement was not made mandatory by the CAA. However, following an investigation into an accident to G-BNSL (Bulletin 4/2000), which had suffered a dissimilar NLG failure, but exhibited cracking at the lubrication groove, it was discovered that the MM amendment had not been correctly inserted. Due to this, inspections were not being carried out on the correct item of the NLG, ie, the cylinder. As a result, a recommendation (2000-7) was made to highlight the need to amend the MM. Piper accepted this recommendation and the manuals were amended, but no other service documentation was issued to highlight this error, or to inform maintenance organisations of the change.

As the leg for G-BMVM had only completed 674 hours there was no requirement to inspect its NLG for another 326 hours. The maintenance organisation for this aircraft was consulted on the dye penetrant inspection of the NLG housings of all the Tomahawk aircraft they maintain. They were open and honest in stating that they were "not clear about the requirement and were not sure of its existence". It was therefore concluded that they had not been carrying out the inspections as prescribed in the MM. They also commented that if the requirement had been mandatory, or had been communicated by some form of service information document, then the inspections would have been carried out.

Safety Recommendations

The Tomahawk aircraft, as typified by G-BMVM, is used pre-dominantly for training and in that regard is likely to experience a greatly increased number of landings per hour, in the hands of student pilots, when compared, for example, with a privately operated light aircraft. Therefore, the NLG is at risk of experiencing more landings where the loads on the NLG are higher than those normally to be expected on a private general aviation aircraft. The fact that all the failures have been due to fatigue cracking mean that any form of inspection for such cracking would be best based on the number of stress cycles the NLG receives, ie, landings, and not on the number of hours the aircraft is in operation, as presently required by the manufacturer. This accident has shown that a 1,000 hour inspection is not adequate for, particularly, a training aircraft, as the leg failed at 674 hours, having probably carried out a high number of landings. Also, despite the hours based inspection being incorporated into the MM, because of the original error in its insertion, some maintenance organisations and owners may not be aware of its existence and the need to carry out an inspection of the lubrication groove. Therefore, the following recommendations are made:

Safety Recommendation 2003-94

In order to prevent failure of the NLG on the Piper PA-38 Tomahawk, the aircraft manufacturer should change the requirement for conducting a dye penetrant inspection of the NLG cylinder lubrication groove, such that the interval between inspections takes into account those aircraft which experience high numbers of landings per hour, but particularly those aircraft used to conduct basic flight training, and to communicate that such an inspection exists through appropriate service information documentation.

Safety Recommendation 2003-95

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The CAA should consider making the requirement to carry out a dye penetrant inspection of the Piper PA-34 Tomahawk NLG cylinder lubrication groove, in accordance with the manufacturer's documentation, mandatory.