

**INCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA-28-181 Cherokee Archer II, G-BNGT	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-360-A4M piston engine	
<b>Year of Manufacture:</b>	1985	
<b>Date &amp; Time (UTC):</b>	17 December 2005 at 1130 hrs	
<b>Location:</b>	Edinburgh Airport	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 2	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Damage to nose landing gear assembly and propeller tips	
<b>Commander's Licence:</b>	Commercial Pilot's Licence	
<b>Commander's Age:</b>	53 years	
<b>Commander's Flying Experience:</b>	5,729 hours (of which 1615 were on type) Last 90 days - 39 hours Last 28 days - 12 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and metallurgical examination of components returned to the AAIB	

**Synopsis**

Prior to takeoff the aircraft suffered a nose landing gear collapse. Stress corrosion was identified in the failed component.

assembly. The propeller tips struck the taxiway surface; the engine did not stop but was shutdown by the pilot.

**History of the flight**

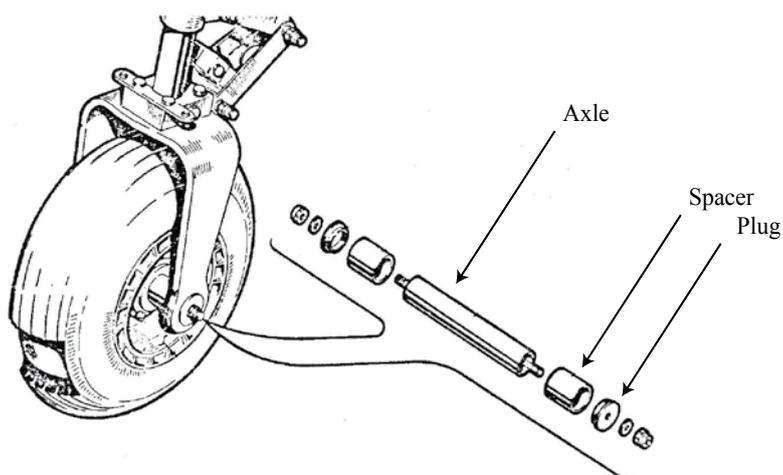
The aircraft had taxied to the holding point Uniform 1 at Edinburgh Airport where it had completed a 180° turn into wind to carry out the pre-takeoff power checks. There were no apparent problems with the steering during the taxi and turn and the checks were completed satisfactorily. However, while turning through 180° following the power checks to line up at the holding point, the nose wheel detached from the nose landing gear

Examination of the aircraft by the maintenance organisation revealed that one of the axle plugs on the nose landing gear axle rod assembly had failed causing the nose wheel to detach.

**Nose landing gear axle rod assembly**

The landing gear is a fixed tricycle type; the nose landing gear assembly consists of a strut and fork onto which the wheel and tyre are fixed by an axle rod assembly.

This contains a through-bolt, a spacer and an axle plug on each end, which are fastened with a washer and nut (see Figure 1). The aircraft maintenance manual contains information for the assembly and installation of the nose wheel. It states '*tighten nuts until no side play is felt (allow wheel to rotate freely)*'. It is necessary to remove the axle rod assembly whenever the wheel is removed.



**Figure 1**

PA-28-181 Nose wheel axle assembly

### Metallurgical examination

The failed axle plug was returned to the AAIB for metallurgical examination. The end of the plug had been plastically deformed prior to being separated from the remains of the plug, the final failure being mainly in shear (see Figure 2). Paint was present on parts of the fracture faces indicating that the separation had been progressive and that the cracks were present when the component was last painted. Examination of the failure surfaces indicated that multiple progressive, intergranular corrosion paths were present, which is

typical of a slow stress corrosion mechanism in extruded aluminium alloys. Stress corrosion occurs under the simultaneous action of a tensile stress and a corrosive environment. The general direction of progression was normal to the radial tension stresses induced by the plastic deformation. It is considered that the deformation resulted from over tightening of the nut on the wheel through bolt.



Radial and circumferential cracking on similar axle plug

Failed plug with plastic deformation of the end piece and 'castellated' nature of fracture

**Figure 2**

Failed axle plug (right) and plug (left) showing similar cracking

**Previous occurrences**

Several other axle plugs were also returned to the AAIB by the maintenance organisation. All showed some distortion similar to the accident axle plug, and one showed similar radial and circumferential cracking (see Figure 2) although it had not failed. The maintenance organisation policy is now to change the axle plugs whenever distortion is observed during any disassembly of the axle.

This design of axle plug is similar on other Piper aircraft and also some Cessna aircraft. However, on the latter aircraft, the axle plug is made from steel rather than aluminium and is therefore less susceptible to this type of failure. An identical previous incident was identified on the CAA MORS database which had occurred to a PA-28 Cherokee in October 1981 and was the subject of an article in GASIL 1/82. It was additionally noted in that incident that two other aircraft also had similarly cracked axle plugs.