

ACCIDENT

Aircraft Type and Registration:	Piper PA-28R-200-2 Cherokee Arrow II, G-EDVL	
No & Type of Engines:	1 Lycoming IO-360-C1C piston engine	
Year of Manufacture:	1972 (Serial no: 28R-7235245)	
Date & Time (UTC):	18 June 2018 at 1735 hrs	
Location:	Redhill Aerodrome, Surrey	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Right main landing gear trunnion failed, right wing skin damaged	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	11,034 hours (of which 200 were on type) Last 90 days - 168 hours Last 28 days - 76 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft suffered a failure of the right main landing gear forward trunnion while taxiing from the taxiway onto a grass area used for pre-takeoff power checks. The failure of the trunnion was caused by the progression of a fatigue crack within the trunnion and subsequent failure of the trunnion in overload. The most probable reason for the initiation of the fatigue crack is likely to have been an unreported heavy landing.

History of the flight

The aircraft was scheduled to carry out a flight as part of the student pilot's training to obtain a 'complex' aircraft rating on his PPL. No defects were observed during the pre-flight inspection and after the completion of the start-up procedure ATC cleared the aircraft to taxi on the grass across Runway 18/36 and onto Taxiway A to the A2 holding point in preparation for takeoff from Runway 26R. The aircraft was taxied slowly across the grass, which the student reported was somewhat uneven, onto Taxiway A. As the aircraft approached the A2 holding point the student slowed the aircraft and turned the aircraft onto a grass area used for carrying out pre-takeoff power checks. He reported hearing a "thump", followed shortly by the aircraft's right wing dropping. The aircraft was brought to a halt, ATC were informed of the problem and the instructor left the cockpit to inspect the aircraft. Looking under the wing, from the leading edge of the wing outboard of the fuel tank, the instructor observed that the landing gear leg had moved from its

normal position, at which point the student noticed a small hole in the upper surface of the wing. The aircraft was shut down and ATC informed of the situation. The aircraft was subsequently recovered to a hangar by its maintenance organisation.

Piper PA-28R landing gear

The Piper PA-28R is a variant of the PA-28 fitted with retractable tricycle landing gear, designed to operate from paved and unpaved surfaces. The main landing gear retracts inboard, into bays within the wing structure. Each main landing gear leg is held in place by two trunnions, secured to the rear face of the forward wing spar and the forward face of the rear spar (Figure 1).

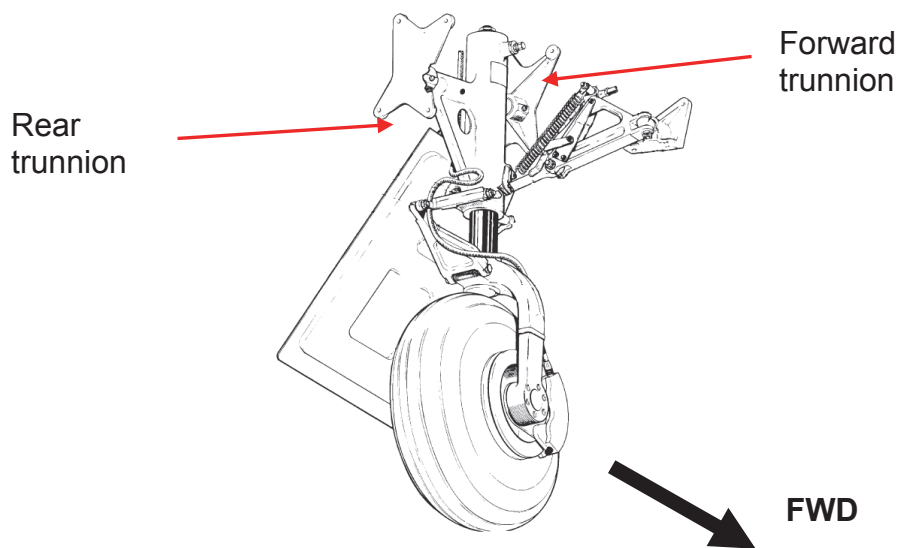


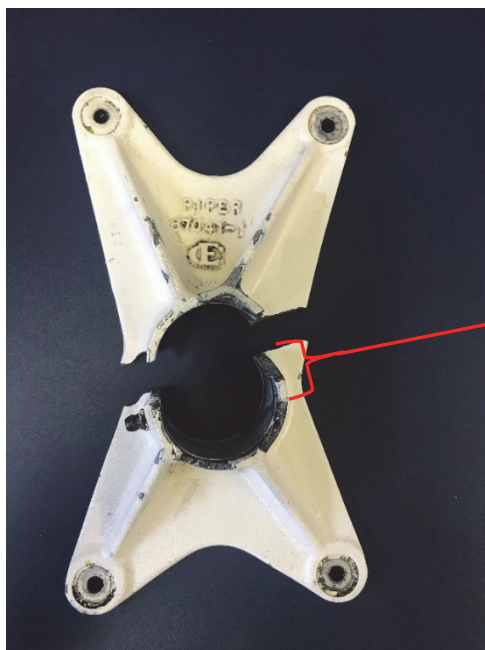
Figure 1

PA-28R main landing gear

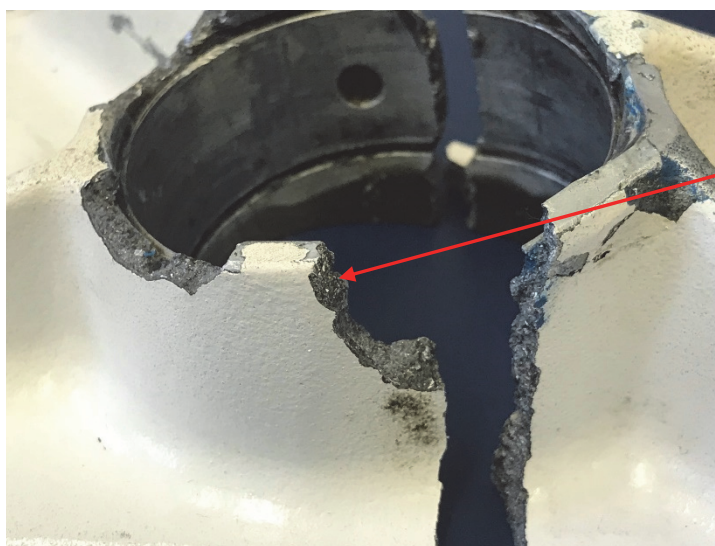
Investigation

Examination of the aircraft showed that the forward trunnion of the right main landing gear leg had failed (Figure 2), which allowed the landing gear leg to rotate rearwards, which resulted in the right wing dropping and the top of the landing gear leg piercing the wing skin. A small section of material had separated from the trunnion and was not recovered. The remains of the trunnion were removed and examined by the AAIB.

Examination of the fracture faces showed that most of the fracture surfaces had suffered from mechanical damage but appeared to show the characteristics of failure in overload. One area was identified which showed the characteristics of crack propagation in fatigue (Figure 3) although damage to the fracture face prevented the identification of the crack initiation site. This area was associated with the area of missing material.

**Figure 2**

Failed right main landing gear forward trunnion

**Figure 3**

Area of missing material from trunnion

The maintenance organisation confirmed that a visual inspection of the trunnions was completed during the annual inspection, carried out on 6 March 2018. No evidence of cracking or deterioration was observed during this inspection. The location of the forward trunnion means that a visual inspection of the trunnion during a pre-flight inspection is not practical.

Aircraft operation

Redhill Aerodrome has three grass-surfaced runways and several paved taxiways and aircraft stands. It is normal practice for aircraft to be cleared by ATC to taxi to and from their parking areas across the grassed areas and runways. Whilst the runway surfaces are maintained, the surrounding grassed areas can be uneven, typical for a grass-surfaced airfield.

Operation from uneven ground such as unpaved or grass surfaced airfields presents an increased risk of propeller ground strikes and landing gear damage. The flying club which operated G-EDVL had published instructions requiring pilots to taxi at a '*walking pace*' over such ground to minimise this possibility.

Examination of the aircraft's log book showed that on many occasions the aircraft operated from other grass-surfaced airfields in addition to Redhill. The maintenance organisation was not aware of any damage to the aircraft caused as a result of operating from grass airfields and there had been no reports of hard landings or operation from runways with unusually uneven surfaces.

Analysis

The accident was caused by the failure of the right main landing gear forward trunnion while the aircraft was taxiing. The failure allowed the landing gear leg to pivot forwards piercing the right-wing skin and causing the right wing to drop.

The fracture faces of the failed trunnion showed evidence of failure in overload together with one area which showed the characteristics of crack progression in fatigue. The initiation of the fatigue crack could not be identified due to mechanical damage of the fracture surface.

It is likely that the crack then progressed through the parent material with the normal loads experienced during the aircraft's operation. When the crack had reached a sufficient length to compromise the overall strength of the trunnion, the remaining material failed in overload.

No evidence of cracking within the trunnion had been observed during the aircraft's annual inspection and the location of the trunnion means that it is not possible to carry out a visual inspection of it during a pre-flight check.

The PA-28R landing gear was designed to allow the type to operate from unpaved airfields. It is therefore probable that the initiation of the fatigue crack within the trunnion was the result of an unreported abnormal event, such as a heavy landing or rapid taxiing across uneven ground.