

**AAIB Bulletin No:** 9/94

**Ref:** EW/G94/07/20

**Category:** 1.3

**Aircraft Type and Registration:** Piper PA-18-180 Supercub, G-BEUA

**No & Type of Engines:** 1 Lycoming O-360-A4 piston engine

**Year of Manufacture:** 1964

**Date & Time (UTC):** 13 July 1994 at 1820 hrs

**Location:** Dunstable Airfield, Bedfordshire

**Type of Flight:** Glider towing

**Persons on Board:** Crew - 1                      Passengers - None

**Injuries:** Crew - None                      Passengers -N/A

**Nature of Damage:** Damage to left main gear

**Commander's Licence:** Private Pilot's Licence

**Commander's Age:** 32 years

**Commander's Flying Experience:** 735 hours (of which 159 were on type)  
Last 90 days - 215 hours  
Last 28 days - 102 hours

**Information Source:** Aircraft Accident Report Form submitted by the pilot and  
AAIB examination of failed components

This aircraft, which was almost exclusively employed as a glider tug, was taking off with a glider in tow when the pilot heard an unusual noise. Although the aircraft became airborne successfully, he became suspicious that something might have occurred within the landing gear but, as far as he could ascertain from his fairly limited view from the cockpit, the mainwheels appeared to be in their usual position. The flight was continued until the glider released from tow at a height of approximately 1,000 feet agl and the pilot, who elected not to divert to an airfield with full emergency facilities, subsequently returned to the airfield at Dunstable. Taking care not to load the landing gear any more than necessary, the aircraft was landed without incident but, as it came to a halt, the right wing slowly dropped. The engine was shut down and the propeller remaining clear of the ground.

An initial examination of the aircraft revealed that a failure had occurred to a pair of lugs on the forward left main landing gear fitting, which is welded to the fuselage lower left longeron. These lugs provide one of two location points for an inverted A-frame, the apex of which provides an anchor point for the main gear bungee suspension units, as illustrated in Figures 1 and 2. The fuselage fitting, Piper Part No 21272-03, is fabricated from a weldable (nominal 30 ton) steel, each lug being locally thickened on

its inner face by the addition of a washer around the A-frame attachment bolt hole. These washers are attached by welding, but only around the outer  $\frac{2}{3}$  of their circumference. Metallurgical examination of the two fractures revealed that both had failed as a result of a fatigue mechanism, the aft lug exhibiting characteristics of long term crack growth over many hundreds of thousands of tension cycles, the forward lug exhibiting short term growth. It was also apparent that the aft lug had probably failed completely before fast fracture of the uncracked portion of the forward lug had occurred. The origin of both fatigue cracks was associated with the run-out of each weld, areas where significant stress concentrations might be expected to occur (see Figures 3 and 4). The quality of the weld and weld material was not in question. The landing gear fittings on the Piper Cub series of aircraft are located in an area which often becomes contaminated with oil/dust/dirt etc which, in addition to the compact nature of this particular joint, mitigates against the likelihood of a crack being readily detected during, for example, a daily inspection.

There was evidence on the aft lug fracture face, close to the origin of the fatigue crack, of black paint similar to that applied over the fuselage tubular steel structure, as arrowed in Figure 4. The aircraft had been completely refurbished in December 1992, some 430 flying hours prior to the failure, and had been operating from the airfield at Dunstable since 1979 when its total flight time was 2,856 hours. Its total time up to this failure was recorded as 8,970 hours, during which time it is estimated to have made 36,700 flights. The surface of the gently undulating field at Dunstable, whilst being acceptable for the gliding/winchng/aerotowing operation which has taken place there for some sixty years, is not generally considered to be as smooth as most airfields used by powered aircraft and, as such, the landing gear of aircraft regularly operating from this surface can be expected to sustain consistently high loads and load cycles. This is not an uncommon feature of aircraft operated from airfields used primarily by gliding clubs.



*Inverted A-Frame*

*Bungee Suspension Units*

Figure 1



*Failed Lugs*

*MLG Forward Strut*

Figure 2

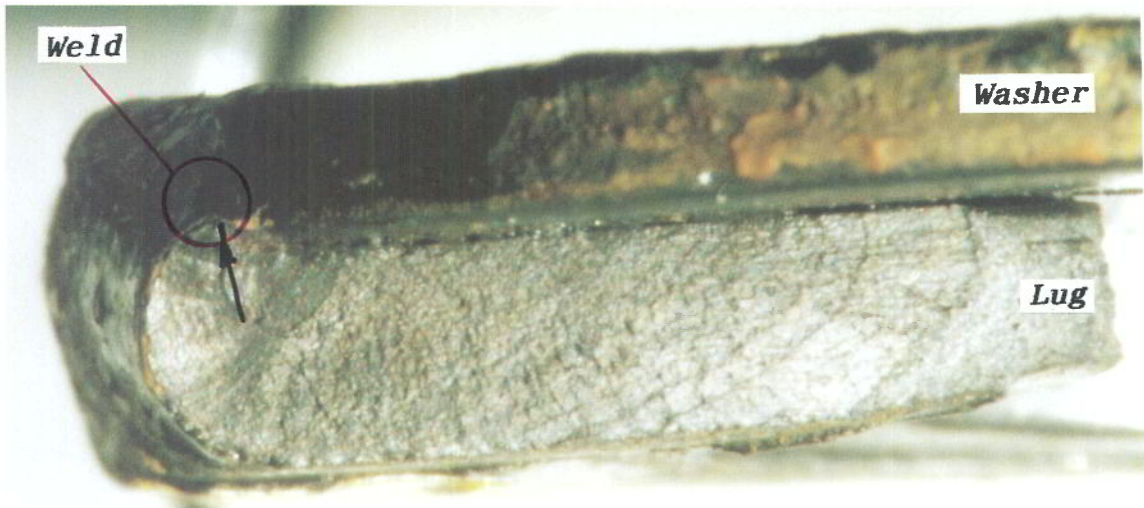


Figure 3

*Short term fatigue fracture face. Initiation region arrowed*



Figure 4

*Close up of long term Fracture face - initiation region arrowed B. Traces of black paint on fracture face along edge arrowed A*