

**AAIB Bulletin No: 12/96**

**Ref: EW/G96/10/16**

**Category: 1.3**

**Aircraft Type and Registration:** Slingsby T67B Firefly, G-BLLS

**No & Type of Engines:** 1 Lycoming O-235-N2A piston engine

**Year of Manufacture:** 1984

**Date & Time (UTC):** 22 October 1996 at 1245 hrs

**Location:** Thruxton Airport

**Type of Flight:** Private (Training)

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

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

**Nature of Damage:** Damage to nose landing gear and propeller

**Commander's Licence:** Student pilot

**Commander's Age:** 59 years

**Commander's Flying Experience:** 20 hours (of which 17 were on type)  
Last 90 days - 8 hours  
Last 28 days - 8 hours

**Information Source:** Aircraft Accident Report Form submitted by the pilot and  
AAIB examination of the nose landing gear

### **History of the flight**

The student pilot of this aircraft had been checked by his instructor and briefed to fly solo circuits, under his supervision, and to carry out 'full stop landings'. During the check, the instructor assessed his pupil's performance as good, the pilot having coped very well with the slight crosswind. On the second landing, he was seen to touch down normally on the runway centreline on both mainwheels before the nose wheel and fork assembly detached from the oleo strut just after this wheel had made contact with the runway. The aircraft slid for a short distance towards the left side of the runway, supported by the mainwheels and the broken end of the oleo strut, and the engine stopped as the propeller came into contact with the surface. After switching off the magnetos and fuel the pilot, who was uninjured, vacated the aircraft. The airport fire service was quickly on the scene, but there was no fire.

### **Noseleg Examination**

The nose gear components were forwarded to the AAIB for detailed examination. It was evident that the fracture surface at the end of the oleo strut had been ground away by the surface of the runway.

The mating fracture face, however, had survived without damage and was available for detailed examination. The nose wheel fork on this version of the T67 is attached to the lower end of the nose gear oleo strut by means of a bolted connection. As shown in Figure 1, the lower end of the strut is located over a steel spigot, which itself is part of a circular base plate, these two items being welded together in the manner indicated. Thus the plate forms a flange at right angles to the strut axis and the nose wheel fork is attached to this plate by four bolts. The failure had occurred in the area of the welded joint between the strut and spigot, metallurgical examination of the fracture face indicating that approximately 75% of the welded section had failed as a result of a tension fatigue cracking mechanism, the remainder through overload. It was noted that the fatigue cracks had originated from the inner boundary of the weld at multiple sites. It was also apparent that the weld penetration into the parent material of both strut and spigot was small in relation to the interface area. The hardness of the weld material was greatly in excess of the parent material. The parent steel material from which these items are made is welded in the 'softened' (annealed) condition. It requires heat treatment after welding to produce the required properties, in particular, within the heat affected zone adjacent to the weld. This zone can cool sufficiently quickly immediately after welding to produce untempered 'martensite', which has a hard and brittle microstructure containing high internal stresses.

#### **Noseleg history**

An earlier standard of this nose gear, which did not contain the spigot feature but where the strut was welded directly into the base plate, was prone to cracking in this area. This problem was addressed by the issue of Service Bulletin (SB) 036 by the manufacturer in June 1990, which was made mandatory by the CAA in AD 018-06-90. SB 036 required that before next flight, and after each 150 flying hours, a specific crack check should be carried out using a dye penetrant technique. If no cracks were found, the aircraft could continue to each 50 hour check whereupon a visual check was to be performed. However, if any cracks were found, the aircraft was not to be flown until either the component was replaced, or repaired in accordance with a technique detailed in the Service Bulletin. The SB 036 inspection was performed on this aircraft over the period up to August 1991 (2959.4 hours total time), at which time a cracked weld was detected. The maintenance records showed that at that time the lower part of the strut was replaced by a new, modified, item, Pt No 126-35-246, in compliance with Slingsby Modification 425 and CAA AD 018-06-90.

It was also stated in SB 036 that if the base plate - "is circular with 6 bolts securing the nose wheel fork, then this SB. does not apply. In all other cases the weld joining the tubular leg to the rectangular (4 hole) plate is the suspect area." The base plate from G-BLLS was circular and attached with four bolts. Thus, although the configuration of the 'modified' lower section of the strut did not apparently agree with the description contained in SB 036, the presence of the spigot (according to the aircraft manufacturer) identified it as a modified item, and as such it should not have been subject to the repetitive inspections detailed in SB 036. Since the last recorded inspection, the aircraft had accumulated some 4050 hours up to the time of the accident and, as the aircraft has been used for training for most of its life, the number of landings accomplished was likely to have been high.

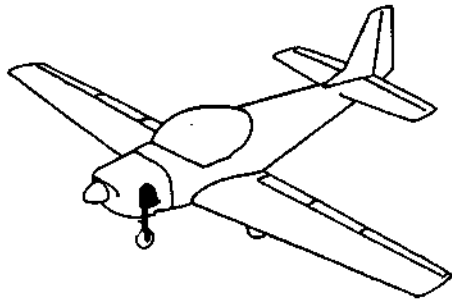
As a result of this accident the manufacturer, in conjunction with the CAA, is considering renewed inspection/rectification action.

### **Additional information**

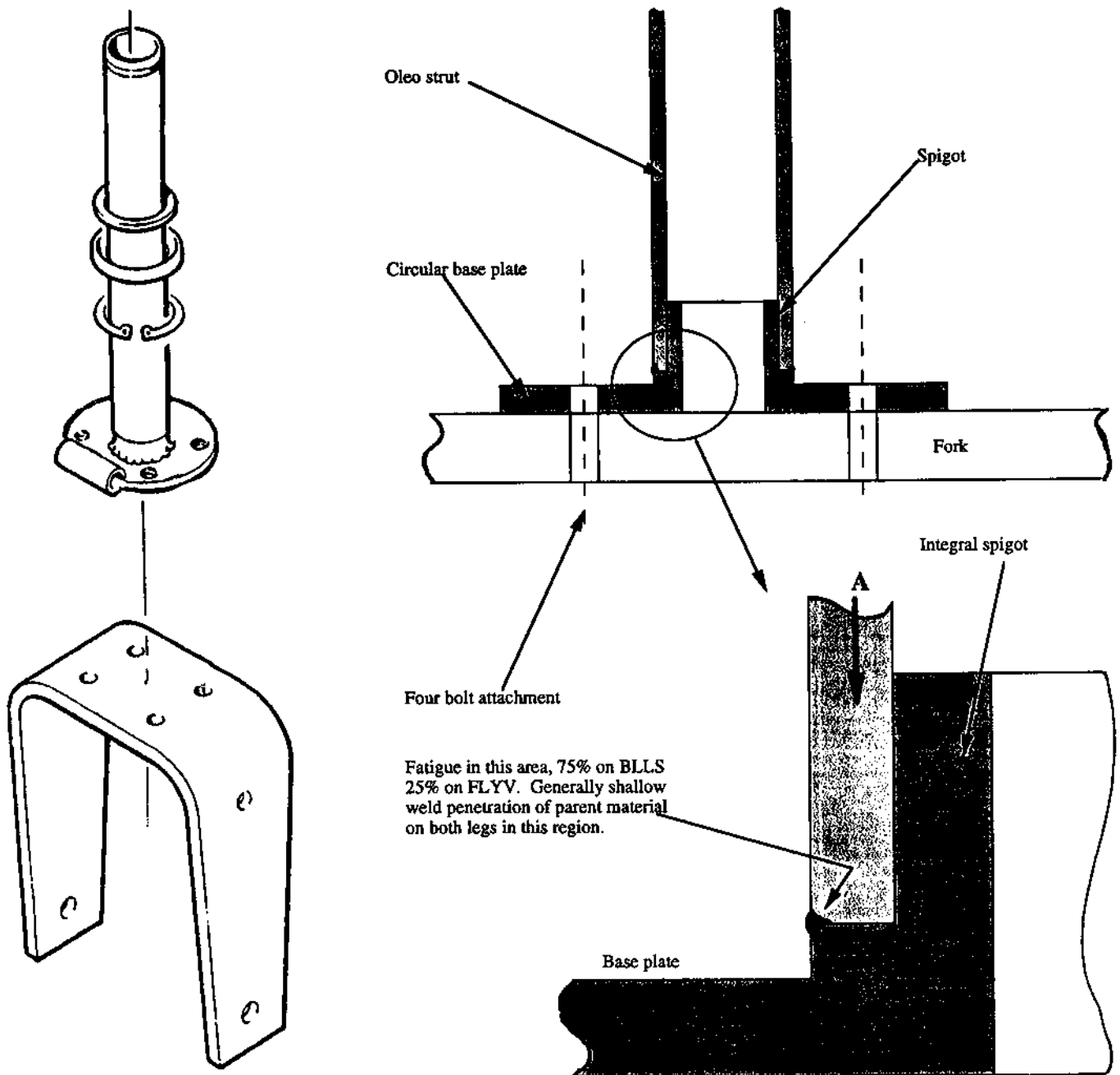
In May 1996, an accident occurred to another T67, G-FLYV, during a flying display (Ref: AAIB Bulletin 10/96, EW/C96/5/1) where the aircraft was destroyed. The nose wheel fork attachment on this aircraft was examined and found to be the same as on G-BLLS, and to have failed in a similar manner. This examination revealed the presence of a fatigue crack around approximately 25% of the weld's circumference, again starting from the inner boundary of the weld, but not intersecting the outer surface. Separation had occurred, however, due to overload of the remaining 75% of the weld as a result of the accident.

G-BLLS was involved in an incident on 12 September 1996, (ref: AAIB Bulletin 12/96), when it was landed in a field after the canopy came open in flight. No apparent damage was caused to the aircraft and it was not thought that any undue stresses had been applied to the landing gear at that time.

A colour photograph of the Fatigue failure can be seen in this Report on the Internet.



**Nose Gear Lower Strut Configuration, G-BLLS**



**Figure 1**