

Grob G115E Tutor, G-BYUG

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Category: 1.3

**Aircraft Type and
Registration:**

Grob G115E Tutor, G-BYUG

No & Type of Engines:

1 Lycoming AEIO-360-B1F piston engine

Year of Manufacture:

1999

Date & Time (UTC):

11 December 2002 at 1525 hrs

Location:

1.5 miles south-east of Loch Lomond

Type of Flight:

Training

Persons on Board:

Crew - 2

Passengers -
None

Injuries:

Crew - 2 (Minor)

Passengers -
N/A

Nature of Damage:

Engine, propeller, pitot mast and right wing leading edge

Instructor's Licence:

Airline Transport Pilots Licence

Instructor's Age:

41 years

**Instructor's Flying
Experience:**

3,210 hours (of which 230 were on type)

Last 90 days - 52 hours

Last 28 days - 27 hours

Information Source:

Aircraft Accident Report Form submitted by the pilot and subsequent Field investigation.

Synopsis

During a training flight, whilst climbing through 2,800 feet, the engine stopped and a forced landing was accomplished with only minor injuries to the occupants. Engine examination revealed that one of the No 4 big end bolts had either failed, or the associated nut had become detached, and that the remaining bolt had then failed by a bending fatigue mechanism. The No 4 connecting rod had then caught on the rotating crankshaft, pulling the piston pin from the piston, which had then punched a hole through the top of the crankcase.

History of flight

The aircraft was being operated by the Royal Air Force University of Glasgow Air Squadron on a training flight and, as is standard practice, both occupants were wearing parachutes and helmets.

The intention of the flight was to carry out training on the effect of flying controls. The aircraft took off from Glasgow and climbed to an initial altitude of 2,000 feet, without any problems, and a request for a further climb was then granted. As the throttle was fully opened for the climb, the instructor noticed a slight vibration and heard a noise from the engine. Despite this, there were no abnormal indications from the engine instruments and so he continued the climb. At approximately 2,800 feet, the vibration rapidly increased to an extent that the engine instruments became difficult to read and, a few seconds later, there was a loud bang from the engine. The oil filler access panel opened, issuing smoke, there was a smell of burning and the propeller then stopped turning.

The instructor transmitted a mayday call to Glasgow approach, but this caused some confusion as to whether the emergency was real or if the call was for a practice emergency. After clarifying that it was real, the instructor elected to carry out a forced landing rather than abandon the aircraft. This decision was made as they were currently close to both a built-up area and Loch Lomond. As the aircraft passed 1,500 feet in the glide descent, an appropriate field was selected. The aircraft had developed a higher rate of descent than expected by the instructor, and it became apparent that they would not make the selected field. So, after flying crosswind for a short distance, the instructor selected another, smaller, field, the orientation of which would enable him to land into wind. The wind was estimated at the time to be 090° at 20kt and, after turning on to final approach, the flaps were selected down. The touch down was approximately one third of the way into the field, after which the brakes were applied in an attempt to stop the aircraft. However, the aircraft skidded and hit a small ridge just before the far boundary, before passing through a hedge and striking the wooden posts of a concealed fence. The aircraft then crossed a small farm track, beyond the hedge, before finally stopping in a barbed wire fence on the far side of the track.

The instructor and student, who were both wearing five point harnesses and protective helmets, exited the aircraft and were met by rescue vehicles about 15 minutes after the accident. Both pilots had suffered minor back injuries as a result of the landing.

Engine Description

The Lycoming AEIO-360-B1F is a four cylinder, horizontally opposed, air cooled engine. On the Grob 115E this drives a wooden variable pitch three bladed Hoffman propeller. It is fitted with an oil system for continued lubrication during inverted manoeuvres.

Engine Examination

Initial inspection of the engine revealed that the No 4 connecting rod and piston pin had broken free and punched a hole through the crankcase, Figure 1 (*jpg 117kb*). The engine was removed from the aircraft and strip examined at a specialist engine overhaul organisation, under the supervision of the AAIB. This revealed that the No 4 connecting rod had become detached at its big end, that the No 4 piston pin was still attached to its little end and that this had been pulled free of its piston. The No 4 connecting rod was found wrapped around the crankshaft cheek, located between the No 3 and 4 crankpins, and was at the top of the engine, jammed between the camshaft and crankshaft. The piston pin had rotated through approximately 90° from its normal position in the piston and had punched a large hole in the crankcase above and around the No 4 cylinder. Inspection of the No 4

piston revealed several areas of cracking and fractures associated with the location holes for the piston pin.

The fragments of the No 4 connecting rod, piston, big end and associated bolt fragments were metallurgically examined in detail. This revealed that the prime failure had been at the big end of the No 4 connecting rod and that, either, the loss of a retaining nut from one of the two big end bolts, or a failure of the bolt itself, had initiated this failure. The nut was not recovered and the condition of the bolts fragments did not permit determination of their condition prior to the failure. The other big end bolt had failed by a high stress bending fatigue mechanism and it was notable that the retaining nut on this bolt was found engaged by only one thread. As a result of the first bolt failure, the big end cap had become detached and allowed the inner end of the connecting rod to become trapped by the rotating crankshaft. The piston pin had then been pulled upwards causing it to break away from the piston. All the fractures and cracks in the piston had been due to overload, and were judged not to have existed prior to the big end failure.

The rest of the engine was examined and no signs were evident of any other pre-existing defects. There was no evidence of oil loss and the only heat damage seen was associated with the big end failure on the No 4 crankpin. The inverted oil system was also checked and found to be satisfactory.

The engine had completed 892.4 hours from new and had not been subjected to any work in the area of the No 4 connecting rod. The time between overhaul on these engines is currently 1,600 hours.

The failure is similar to one that occurred to a Lycoming 0-540-E45C engine fitted to a Trislander aircraft, G-AZLJ, and reported upon in AAIB Bulletin 11/98 (ref: EW/G98/06/04). In this case one of the No 6 connecting rod big-end retaining nuts had become unscrewed from its attachment bolt. It was also not determined why this nut had become detached. The engine concerned had completed 717 hours since overhaul.