

Cessna 310R, G-SOUL, 22 November 1995

AAIB Bulletin No: 5/96 Ref: EW/C95/11/6 Category: 1.2

Aircraft Type and Registration:Cessna 310R, G-SOUL

No & Type of Engines:2 Continental IO-520-BCM piston engines

Year of Manufacture:1975

Date & Time (UTC):22 November 1995 at 1230 hrs

Location:Belfast International Airport

Type of Flight:Positioning

Persons on Board:Crew - 1 Passengers - 3

Injuries:Crew - None Passengers - None

Nature of Damage:Right wingtip abraded, right tailplane abraded and wrinkled and rear fuselage slightly twisted. Right propeller blade tips bent

Commander's Licence:Basic Commercial Pilot's Licence with Instrument and Night Ratings

Commander's Age:26 years

Commander's Flying Experience:716 hours (of which 17 were on type)

Last 90 days - 103 hours

Last 28 days - 16 hours

Information Source:AAIB Field Investigation

The aircraft was being used for a flight from Coventry to Belfast. Having selected the landing gear to retract, shortly after takeoff, the pilot noticed that both the gear unsafe and the nose gear green light took longer than usual to extinguish but that both did so without his having to take any further action.

During approach to Belfast, after the pilot had selected the landing gear to extend and the flaps to fully down, the gear warning horns sounded. He observed green light indications for the nose and left main gears, no indication for the right main gear and a red gear unsafe indication. The pilot immediately executed a 'go round' and flew low past the control tower, who informed him that the landing gear appeared to be fully down. The landing gear was cycled three times, once using a normal selection and twice using the emergency procedure and on each occasion he obtained the same indications as he had on his initial approach.

After a further fly-by of the tower, when the gear was again reported to be apparently fully down, the aircraft was flown in a holding pattern whilst advice was sought from the operator as to where the aircraft would be landed. Subsequently it was decided that the aircraft should be landed at Belfast.

After a normal approach, the landing flare was prolonged to reduce speed as much as possible and after touchdown, both engines were shut down and full left aileron applied to minimise the load on the right main landing gear. Almost immediately after touchdown, a slight 'crack' was heard and the right main gear began to collapse. The right wing began to drop and the right propeller, still rotating slowly, touched the runway. The aircraft slewed off the right hand side of the runway and came to rest with its right wing tip and tailplane resting on the ground.

After lifting the right wing, the right landing gear was extended by hand and the aircraft recovered to the apron. Following an inspection to assess its condition, the right gear was ground-locked into the extended position. During this inspection, it had been observed that the torque tube of the gear actuating linkage was cracked and distorted at its aft end. Following further temporary remedial work, the aircraft was ferried, gear down, to the operator's maintenance base at Coventry.

Subsequent detailed examination revealed that the torque tube in the right main gear actuation linkage (see diagrams and photographs) had partially failed in torsion in such a way that the normal locking linkage would no longer drive the landing gear to its correct full travel position in the extending sense. The direction of torsional failure was consistent with it having been caused by loads resisting the movement of the landing gear into the locked down condition. Tests on the landing gear mechanism revealed that the right main gear required an exceptionally high force to drive it into the locked condition whilst, by comparison, the left gear operated freely, achieving the locked down condition by gravity alone. The source of the stiffness in the right main gear linkage was established to be the pivot of the lower side brace on the landing gear strut. The grease nipple for that joint, a press in type of fitting, was found to have fallen out of its housing in the lower side link. The surface finish of the pivot bolt had deteriorated.

The main torsional failure had developed from an area of fatigue failure which had multiple origins in the base of the weld joining the landing gear actuating fork bolt attachment to the torque tube. The positions of the fatigue origins were all consistent with loads resulting from driving the main gear into the locked down position. It was not possible to determine the order of the number of gear actuations which had occurred between the initiation of the fatigue and the eventual torsional rupture.

This aircraft was subject to a CAA Additional Airworthiness Directive (AAD), which is as follows:-

CESSNA 010-10-90

Applicable to 310 R aircraft

Compliance is required not later than 50 flight hours from the effective date of this Directive which is 6 November 1990.

Inspect by visual or dye penetrant method, the main landing gear torque tubes Part No. 5045010-24 and 5045010-25 for evidence of cracks. REPLACE cracked parts with Part No. 5045010-32 or 5045010-33 prior to further flight. REPEAT INSPECTION at intervals not exceeding 150 flight

hours. MODIFICATION by replacement with Part No. 5045010-32 or 5045010-33 terminates the need for repetitive inspections.

The operator had incorporated this AAD into the scheduled 100 hr inspection for this aircraft.

At the time of the accident, G-SOUL had a total flying time of 4564 hours and the latest compliance with the AAD had been during the 100 hour inspection on 15 August, at an airframe total flying time of 4527 hours. The aircraft had also been subjected to its 3 yearly Certificate of Airworthiness renewal inspection on 15 June 1995 at 4502 hours. During these inspections, neither the presence of a crack in the torque tube nor the absence of the grease nipple from the lower side brace, had been detected.

AAD 010-10-90 had stemmed from three previous fatigue failures found in the weld between the torque tube and the actuating fork bolt attachment; one being found during a routine inspection and the other two following separate incidents when one main gear had failed to fully retract after take off. In none of these three incidents was the gear prevented from locking 'down' when so selected. The wording of this AAD does not draw attention specifically to the area of the fork bolt attachment weld.

In view of these findings, the following safety recommendation is made:-

96-19: The CAA, in conjunction with the FAA, should revise the wording of AAD CESSNA 010-10-90 to highlight the need to inspect the entire weld between the fork bolt attachment and torque tube for fatigue cracking, whilst not excluding the need to examine the complete torque tube assembly.