Cessna 310R Seneca, G-SOUL

AAIB Bulletin No:	**Ref: EW/G2002/08/26**	**Category: 1.2**
Aircraft Type and Registration:	Cessna 310R Seneca, G-SOUL	
No & Type of Engines:	2 Continental Motors Corp IO-520-M piston engines	
Year of Manufacture:	1975	
Date & Time (UTC):	24 August 2002 at 0900 hrs	
Location:	Nottingham Tollerton	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Left hand main landing gear and gear door damage	
Commander's Licence:	Commercial Pilots Licence	
Commander's Age:	48 years	
Commander's Flying Experience:	1,767 hours (of which 140 were on type)	
	Last 90 days - 150 hours	
	Last 28 days - 61 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB investigation	

History of the flight

The flight was for the purpose of training for the Multi-Engine Piston rating and a practice short field approach was being flown on Runway 21. The weather conditions were good, with no wind and 9 km visibility. The aircraft touched down about 50 feet beyond the runway designation numbers and was slowed using gentle braking. As the speed reduced, it began to veer to the left, before finally slewing 270? to the left and coming to rest. The engines were shut down and the occupants exited the aircraft in the normal manner.

Initial examination revealed that the left main landing gear torque links were disconnected at the centre joint. Tyre marks from the left main wheel tyre were found on the runway and damage was sustained by the left wheel, tyre and main landing gear door.

Engineering investigation

Closer examination of the left main gear showed that the head of the torque link centre hinge bolt had pulled through both the washer and the torque link, allowing the upper and lower torque links to become disconnected. The damaged washer, part number 5045018-1, was sent to the AAIB for examination.

The hexagonal impression of the bolt head was clearly visible where the bolt had forced its way through the centre of the washer, Figure 1 *(jpg 47kb)*. The centre of the washer had been partly drawn into the bore of the torque link. No evidence of hammering of the face of the washer was found, such as might be produced by wheel shimmy if the clearances between the torque links had been excessive. The torque links contain plain bushes, which are not designed to carry an axial load, and once the head of the bolt had pulled through the washer, it was inevitable that the bolt would also pull the bush out of the torque link as the maximum diameter of the bolt head was similar to the bore dimension in the links. This subsequently allowed the torque links to become disconnected, Figure 2 *(jpg 36kb)*.

Measurements of the damaged washer confirmed that it was the correct outside diameter (3/4-inch) and thickness (0.032-inch), as specified in the manufacturing drawing. This specifies that the steel washer shall be heat treated to provide a material tensile strength of 125,000 to 150,000 lbf/sq in (55 to 67 tonf/sq in). Hardness checks were performed on both the damaged washer and a new, undamaged washer. The results showed the material strength of the new washer to be within specification, but the strength of the damaged washer was well below the minimum specification at only 31 tonf/sq in.

Neither of the washers showed any part number markings and, damage aside, appeared identical with the same dimensions and cadmium plate surface finish. It was not possible to establish the origin of the failed washer. Immediately after this incident, the operator concerned took the decision to install thicker AN970-3 washers, with the centre hole opened out to take a 5/16-inch torque link bolt, on both the main landing gears and the nose landing gear. This was accomplished under a minor modification, with CAA approval. The operator has also introduced a specific pre-flight inspection of the torque links to ensure their serviceability.

In discussions with the aircraft manufacturer, it transpired that the 5045018-1 washer had been superceded by a 5045018-2 washer, which is much thicker, and that this was introduced at some time in the past as a product improvement. However, the 2 washer is neither currently listed in the C310 Illustrated Parts Catalogue (IPC), nor have operators been informed of the availability of the improved washer. The aircraft manufacturer has agreed to update the IPC to include the part number of the new washer.

Previous occurrence

The AAIB investigated an accident to another Cessna 310R on 06 June 2001, reported upon in AAIB Bulletin 12/2001, in which the torque links on the right main landing gear became disconnected due to the apparent omission of the washer under the head of the bolt. In light of this more recent incident, it is entirely possible that a washer may have been installed under the bolt

head and that the torque link bolt might have pulled through the washer as in this more recent incident, except that the washer was not recovered. As a result of the previous investigation, it was recommended that the maintenance manual procedure for assembling the main landing gear torque link be amended to clarify the correct method for assembling the torque link centre joint. The aircraft manufacturer has since updated the maintenance manual accordingly and has also issued Service Bulletin MEB02-12, dated 04 November 2002, which calls for an inspection of the torque link joints to verify that they have been correctly assembled.

Conclusions

The accident was caused by the disconnection of the torque link centre joint on the left main landing gear, which allowed the wheel to castor, resulting in the loss of directional control of the aircraft at low speed. A key factor was that the washer under the head of the bolt was of a much lower strength than specified in the manufacturing drawing, which allowed the bolt head be pulled through the washer under normal landing loads.