AAIB Bulletin No: 9/93 **Ref: EW/G93/05/27** **Category: 1a**

Aircraft Type and Registration:	SC7 Skyvan 3A, G-ASZJ	
No & Type of Engines:	2 Garrett TPE 331-2-201A turboprop engines	
Year of Manufacture:	1967	
Date & Time (UTC):	31 May 1993 at 0839 hrs	
Location:	Near Daventry, Warwickshire	
Type of Flight:	Commercial	
Persons on Board:	Crew - 2	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Left side crew door detached; damage to propeller and left tail fin leading edge.	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	43 years	
Commander's Flying Experience:	4091 hours (of which 135 were on type) Last 90 days - 55 hours Last 28 days - 25 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot plus metallurgical examination of door hinge components.	

During a flight from Luton to Liverpool, the commander became aware of a wind noise from the left side cockpit door, leading him to check the security of the door. Upon taking hold of the handle in an attempt to ensure that it was in the fully closed position, the door, which on this type of aircraft is hinged about its trailing edge, detached itself from the aircraft. It was later found that the door had contacted the left propeller and left tail fin leading edge. The aircraft returned to Luton, where an uneventful landing was carried out. The left engine was shut down on vacating the runway, as a precaution and to improve crew communication.

The SC7 is a noisy aircraft and the commander was convinced that the door had not been fully secure, in that he was able to detect a different wind noise emanating from the door. Neither crew member recalls the door open warning light 'ON' until after the door detached.

Following discussions with maintenance personnel and after viewing the recovered door, the commander believes that the external door handle had not been in the normal streamline position,

leading to the noise. He also considers poor door open/shut markings were a contributing factor. Finally, on taking hold of the handle, there was a possibility that he inadvertently turned it in the wrong direction. The door open warning system was later examined, with no fault found, although the condition of the recovered door was such that it was difficult to determine the pre-detachment state. However, a fault was discovered on the right hand door system.

Examination of door hinge components

Each crew door is attached to the fuselage by three hinge assemblies each consisting of a tongue on the door and a fork on the fuselage. The door hinges about a shear pin passing through the fork and tongue. The upper and lower hinges castings had failed, and the components were subsequently examined by the Materials and Structures Department at DRA Farnborough. The centre hinge had remained intact and had torn off a piece of fuselage skin.

The lower hinge had failed in the tongue fitting, ie the part attached to the door, whilst the upper hinge had failed in the fork fitting, the part attached to the airframe. Both hinges contained considerable shrinkage porosity throughout the section and there was intergranular corrosion from the bores in which the shear pins were located. Additionally there was corrosion pitting on the steel bushings in the tongue fittings together with a general lack of lubrication. The fracture faces were generally brittle in nature, with no obvious evidence of pre-existing defects. However, microscopic examination revealed a small amount of fatigue close to the bores in the upper hinge forks. These features would have had a significant weakening effect and increased the susceptibility to fracture. Figures 1 and 2 show the hinge configuration and a section through one of the upper hinge castings in which the shrinkage porosity can be seen.

The door hinges had been the subject of a Service Bulletin, No 52-62, which introduced Modification No 1273, dated December 1974. The reason for the Modification was to '..... provide an alternative door hinge with an improved service life'. The pre-modification components had been manufactured from L52 material (casting), the modified components were made from L77 material (forging). The modification had been partially embodied on G-ASZJ in that the centre hinge on the subject door had been replaced, and which, as noted above, had remained intact.

Neither the aircraft manufacturer nor the CAA had any record of similar occurrences. It was not possible to obtain an accurate assessment of the percentage of the fleet on which Modification 1273 had been embodied, although it is known that some aircraft had the modification incorporated at build. The manufacturer's records of modification kits supplied date back only to 1990; since then only one hinge assembly has been supplied.

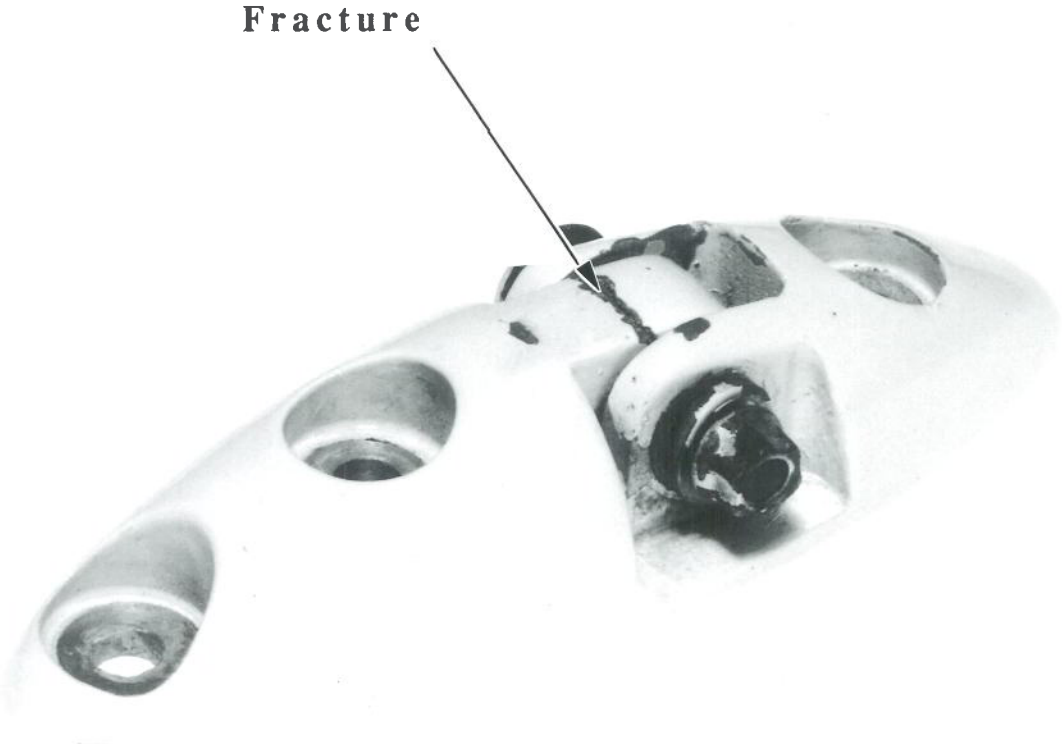

Fig. 1 Hinge configuration
(Lower unit shown)

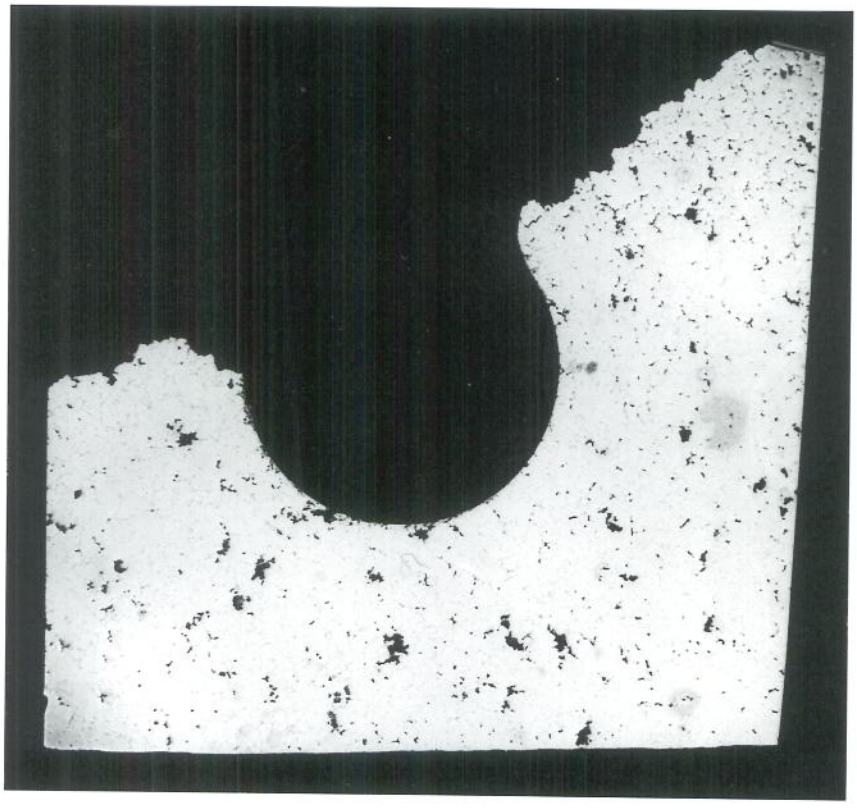

Fig. 2 Section through upper hinge lug showing shrinkage porosity (X6.3)