No: 9/89 **Ref: EW/G89/01/04** **Category: 1b**

Aircraft Type and Registration:	DHC-6 Twin Otter 310, G-JEAC
No & Type of Engines:	2 Pratt & Whitney PT6A-27 gas turbine engines
Year of Manufacture:	1979
Date and Time (UTC):	4 January 1989 at 2130 hrs
Location:	Southend Airport
Type of Flight:	Airline Scheduled Cargo
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Severe collision damage to right engine and propeller; debris damage to fuselage. Collision damage to two other aircraft
Commander's Licence:	Commercial Pilot's Licence with Instrument Rating
Commander's Age:	40 years
Commander's Total Flying Experience:	3048 hours (of which 161 were on type)
Information Source:	Aircraft Accident Report Form submitted by the pilot, and metallurgical examination of brake unit at RAE Farnborough

During the pre-flight inspection the commander used a torch to check the condition of the brakes and tyres, which appeared satisfactory. The engines were started using external power. Upon looking up to give the ground handler the signal to disconnect external power, the commander noticed that the aircraft had started to move, even though the brakes had not been released. Another aircraft was parked a short distance ahead and the commander had to use the nosewheel steering to steer to the left, in order to avoid a collision. The footbrakes proved ineffective in slowing the aircraft, and so both engines were shut down. By this time however the aircraft had turned through 120° to the left and was heading towards two other aircraft that were parked to its left. The left propeller struck a Britten Norman Trislander, causing slight damage to its left wing. The right propeller struck a Cessna 177, removing the outboard section of its right wing. G-JEAC then came to a halt and the pilot, who was uninjured, switched off the master switch and vacated the aircraft. It was subsequently found that the left brake calliper had failed through the casting and had separated from the disc. A calliper piston was found in a pool of hydraulic fluid, close to the original parking place.

A photograph of the failed calliper, which is manufactured from magnesium alloy, is shown at Fig. 1. The fracture surfaces were examined by the Materials and Structures Department of the Royal Aerospace Establishment at Farnborough. This examination revealed that the failure had occurred from

a fatigue crack, with multiple origins located around a 158 mm length of the blending radius, on one side of the calliper slot. Cracks were also found in the blending radius on the other side of the slot. In both cases the crack origins had initiated from corrosion attack on the horizontal surface of the slot. During manufacture, the component should have been corrosion protected in accordance with a process specification that included a chromate treatment. Qualitative X-ray analysis of the surface confirmed the presence of chromium , and also other elements which most probably resulted from brake wear debris. In particular there was a high level of iron, which is likely to have helped promote the corrosion process. Thus, although there was evidence that some corrosion protection had been applied, it was apparent that it had not remained effective.

The unit had a serial number which indicated that it had been manufactured in 1978. According to the operator, it was fitted to G-JEAC in November 1986 and had achieved a total life estimated at 8000 hrs/8000 landings. The brake unit was maintained 'on condition', *ie* there was no requirement for periodic maintenance.

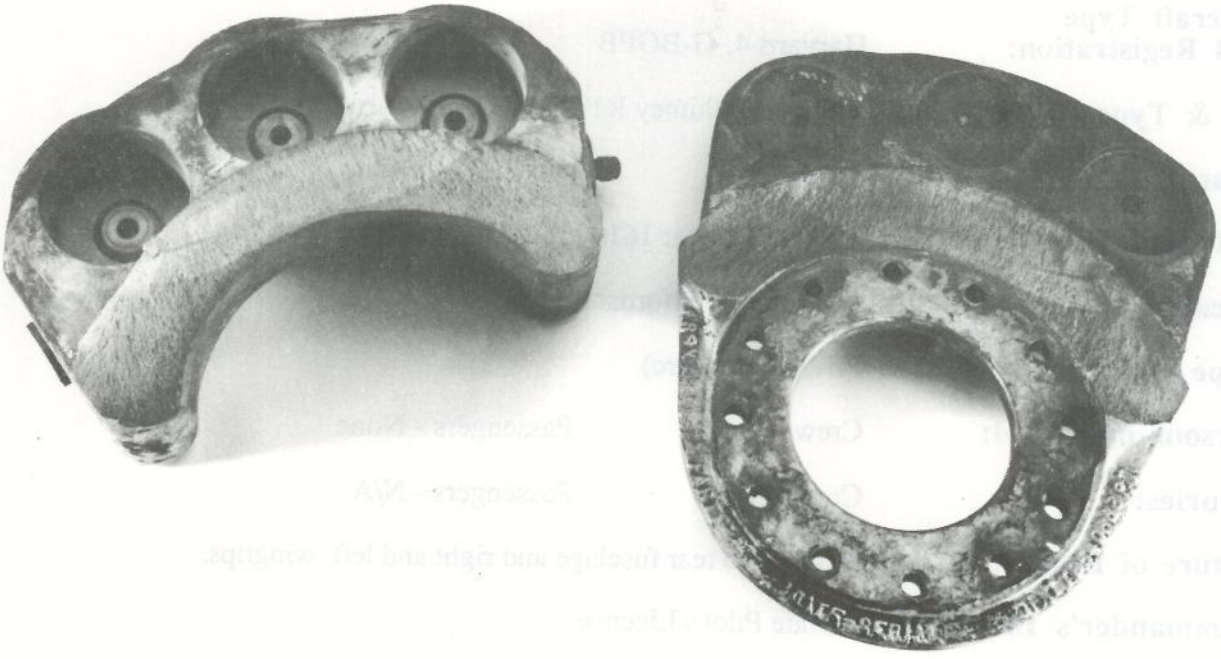

Figure 1. Failed brake calliper from G-JEAC