

# BAe.125-800B, G-RCEJ

<b>AAIB Bulletin No:</b> 5/2003	<b>Ref:</b> EW/C2002/08/01	<b>Category:</b> 1.1
<b>Aircraft Type and Registration:</b>	BAe.125-800B, G-RCEJ	
<b>No &amp; Type of Engines:</b>	2 Garrett Airesearch TFE731-5R turbojet engines	
<b>Year of Manufacture:</b>	1985	
<b>Date &amp; Time (UTC):</b>	22 August 2002 at 0817 hrs	
<b>Location:</b>	RAF Northolt, London	
<b>Type of Flight:</b>	Public Transport	
<b>Persons on Board:</b>	Crew - 3	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Damage to left wing tip fairing and flap	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	53 years	
<b>Commander's Flying Experience:</b>	9,000 hours (of which 1,112 were on type)	
	Last 90 days - 45 hours	
	Last 28 days - 16 hours	
<b>Information Source:</b>	AAIB Field Investigation	

## History of the flight

The first officer (FO), with 219 hours experience on type, was the handling pilot for the flight from Farnborough to pick up passengers at RAF Northolt. There was no significant weather at RAF Northolt where the reported wind was variable at 3 kt, there were a few clouds at 2,200 feet and the visibility was greater than 10 km. For their arrival the crew agreed to carry out a 'PAR' approach to facilitate controller training and were given radar vectors for Runway 25. The crew calculated the threshold speed to be 117 kt and the commander provided instructional assistance to the FO who was unfamiliar with the PAR procedure. The final descent, commenced from an altitude of 1,800 feet, followed the three and half degree glidepath.

A recording of the RT transmissions from the radar controller showed that the aircraft appeared to maintain the correct glidepath until at about one and half miles from touchdown when it was "slightly below the glidepath and not correcting". During the following 24 seconds the aircraft drifted "slightly above the glidepath" ending up "well above the glidepath". The aircraft touched down approximately 23 seconds later.

The crew reported that, as the FO flared the aircraft and at approximately 7 feet agl, the stick shaker activated, the left wing dropped rapidly and the aircraft landed heavily on the left main landing gear. The remainder of the landing run was normal. The landing and attendant wing drop was witnessed by numerous ATC personnel all of whom thought that the landing was heavy since they observed a pronounced bounce. Subsequent runway inspection found no damage or evidence that any other part of the aircraft had struck the runway surface.

After shut down the commander and a type rated engineer inspected the aircraft. They both noted minor damage to the underside of the left wing tip and the outer edge of the left flap but no apparent damage to the left main landing gear. After the inspection the commander completed a full functional check of the flaps and flight controls. He then contacted his company operations whereupon it was decided to fly the aircraft back to Farnborough, without passengers. The return flight was completed uneventfully.

The meteorological observation, carried out just after the landing, gave the surface wind as 320°/02 kt, with a temperature of +16°C and a QNH of 1020 mb.

## **Engineering examination**

### **Structure**

Examination of the damage showed that the left wing and aileron had evidence of a relatively light tip scrape, which had just abraded through the lower skin of the tip structure at the aft closing plate. The scrapes on the two components were consistent with the aircraft being in a fairly level pitch attitude with the aileron in a neutral to slightly trailing edge down position.

The left flap showed evidence of slight abrasion damage, upwards bending of the outboard aft corner of the trailing edge strip and local breaking of all the structural connections between the upper and lower skins and the outboard closing rib. The upper skin was also buckled locally. The abrasion and bend on the trailing edge strip formed an angle of about 40° to the flap underside.

The left main landing gear showed evidence of a recent severe compression which had almost reached the point of 'bottoming out' with the lower oleo seal moving to within 0.75 inch of maximum compression travel. The indications of the normal travel range found on both the left and right oleo legs showed that, in normal use, the lower seal reached to between 2.5 and 4 inches of maximum. There was an indication on both legs of a single recent compression to within 2.25 inches of maximum; this was the biggest recent compression experienced by the right oleo. Furthermore, the left gear had considerably more play in its sidestay than the right gear; though it is not certain that this can be attributed to the accident landing.

No significant distortion of the airframe geometry was found during the subsequent required 'heavy landing check'.

### **Instrument and stall warning calibration**

A calibration of all three airspeed indicators was performed over the range from 80 to 140 kt for both rising and falling airspeed. The calibration of all three cockpit instruments was found to be within acceptable tolerances and matched to the calibration of the Flight Data Recorder (FDR) trace. It was found however that the FO's instrument tended to over-read by about 1 to 2 kt compared to the Commander's instrument.

Calibration of the stall sensing and warning systems showed that both were within limits at all flap settings. The right vane was found to be consistently triggered at a slightly lower incidence than the left but both sides triggered at or above the nominal incidence.

### **Touchdown geometry**

An analysis of the combination of the scraping damage on both the wing tip and flap indicated that the aircraft had attained a roll attitude of at least 7.6° to the left. This angle is achieved when the wing tip and the outboard corner of the flap, at the 45° setting, are in contact with the ground simultaneously. It is not known whether the angle increased beyond this, so that only the tip was in contact, but the absence of any roll angle above 5.5° being recorded on the FDR indicated that if any greater roll angle was achieved it was only briefly. The evidence of the travel achieved on the left oleo was a further

indication of a touchdown when the aircraft was substantially rolled to the left and the depth of travel was indicative of a hard touchdown.

## **Airfield details**

Runway 25 at RAF Northolt has a published landing distance of 1,684 metres, is 46 metres wide and has an asphalt surface. The runway is essentially level, falling just 18 feet from the threshold to the far end of the runway. It is equipped with high intensity approach lighting, threshold and runway edge lighting and the PAPIs, situated to the left of the runway are set to 3.5° to coincide with the nominal glidepath required by the PAR. The touchdown point for the 3.5° approach is 700 feet from the runway threshold. Thus the approach and its visual references were normal in every respect except for the slightly steeper approach angle.

## **Aircraft operation**

It was calculated that the aircraft weighed 22,608 lbs when it landed at RAF Northolt and at that weight, using certified data, the 'V<sub>AT</sub>' is 124 kt. The commander however reported that he had calculated and used a 'V<sub>AT</sub>' speed of 117 kt for the approach planning. There appeared to be no cross-check of this calculation by the FO.

The certified data for the 1g, power off, stalling speed indicates that with the landing gear extended and the flaps set to 45° the aircraft will stall at 98 kt. The stall warning and identification system fitted to the aircraft provides a stick shaker as a warning of an approach to the stall. Identification of the incipient stall stage is then provided by a stick pusher. In this instance the stick shaker operation correctly warned of the approach to the stall.

Airspeed, recorded on the FDR just before touchdown, was 101 kt. The Pressure Error Correction, associated with the static source that feeds the FDR airspeed, was +5 kt. Therefore, the Calibrated Airspeed (CAS) displayed on the cockpit main ASI would have been 106 kt. During the flare however, the normal acceleration was approximately 1.15 'g'. This increase in normal acceleration would have increased the speed at which the aircraft stalled from 98 kt to about 105 kt. Furthermore, there was a scatter of about ± 5 kt in the 1 'g' stall speeds obtained during British Aerospace flight tests. Allowing for this scatter, the Pressure Errors associated with the FDR airspeed parameter, and the increased normal acceleration at touchdown, it is concluded that the aircraft stalled just before touchdown.

## **Follow-up actions**

The company standard operating procedures concerning crew cross-checking have subsequently been clarified. The non-handling pilot is now required to calculate the aircraft weight and determine the appropriate 'V<sub>AT</sub>' and this is then to be checked and confirmed by the handling pilot.

The decision to return to Farnborough was arrived at after discussions between the aircraft commander, an engineer who was type rated but not associated with the company, and the company operations department. Enhanced procedures are now in place within the company to ensure that all relevant accountable managers are involved in such a decision.