

## Shorts 360-100, G-BVMX

**AAIB Bulletin No: 3/2000      Ref: EW/C99/8/3    Category: 1.1**

<b>Aircraft Type and Registration:</b>	Shorts 360-100, G-BVMX
<b>No &amp; Type of Engines:</b>	2 Pratt and Whitney PT6A-67R turboprop engines
<b>Year of Manufacture:</b>	1988
<b>Date &amp; Time (UTC):</b>	8 August 1999 at 0900 hrs
<b>Location:</b>	Runway 09 Guernsey Airport, Channel Islands
<b>Type of Flight:</b>	Public Transport
<b>Persons on Board:</b>	Crew - 3 - Passengers - 31
<b>Injuries:</b>	Crew - None - Passengers - None
<b>Nature of Damage:</b>	Substantial to radome and under fuselage skin with minor damage to left main gear sponson
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence
<b>Commander's Age:</b>	55 years
<b>Commander's Flying Experience:</b>	16,715 hours (of which 42 were on type)  Last 90 days: 63 hours Last 28 days: 37 hours
<b>Information Source:</b>	AAIB Field Investigation

The aircraft was on a scheduled flight from Jersey to Guernsey with the first officer as the pilot flying (PF). The commander noted the airfield ATIS (coded 'Hotel') timed at 0850 hrs which gave the surface wind as 160°/09 kt, visibility greater than 10 km, few clouds at 1,000 feet, broken cloud at 1,600 feet and 25,000 feet with a temperature of 17°C and a dewpoint of 16°C.

The commander reported that the first officer carried out a normal touchdown on Runway 09 with the aircraft running straight down the centre of the runway. The first officer selected the power levers to 'ground fine' and then called for the 'fuel and props'. The commander responded by selecting the fuel levers to the ground position followed some 3 seconds later, by a deliberate movement of the propeller control levers to the taxi position. The commander then moved his left hand onto the nosewheel steering and began gentle braking. Almost immediately the aircraft entered a violent swing to the right and, despite the application of full left rudder, left steering and differential left brake, departed from the paved surface. The aircraft collided with the inboard set of

Precision Approach Path Indicators (PAPIs) positioned to the south of the runway and aligned for an approach on Runway 27.

The ATC aerodrome controller activated the crash alarm immediately but instructed the Airport Fire Service (AFS) to hold at the fire station as the aircraft had regained control, recovered to the runway and was taxiing to the airport terminal. The runway was closed for the recovery of debris and, 18 minutes later, reopened for normal operations. The meteorological observation taken after the accident gave the surface wind as 150°/13 kt, visibility greater than 10 km with few clouds at 1,000 feet, broken cloud at 1,600 feet, temperature 17°C, dew-point 16°C and a QNH of 996 mb.

### Company operations manual

The company operations manual includes a section on 'Normal landing with the co-pilot as the flying pilot'. The following table details the division of duties during the landing:

Captain	Co-pilot
Selects fuel to Ground, & props to taxi.  Before rudder becomes ineffective, calls <i>'I have control'</i> placing feet on the rudder pedals and right hand on power levers and left hand on nosewheel steering	After landing, selects Ground Fine and applies the brakes as required. In strong cross-wind, holds ailerons into wind. As speed falls, calls <i>'Fuel and Props'</i>
	Removes feet from rudder pedals and hand from power levers, but retains hold on control column. Acknowledges <i>'You have control'</i>
Calls <i>'Control Locks, and After Landing Checks'</i>	Engages the Control Locks, and completes the After Landing Checks. Calls <i>'After Landing Cxs Complete'</i>

### Flight data and cockpit voice recordings

The Flight Data Recorder (FDR), a Plessey type PV1584, and Cockpit Voice Recorder (CVR), a Fairchild A100 with a 30 minute duration, were both returned to the AAIB where successful replays were carried out.

Figure 1 shows data from the FDR, with relevant comments from the CVR plotted against distance, calculated from the corrected IAS recording. The data shows that the aircraft touched down at an airspeed of 103 kt. Torque was reduced on both engines and propeller ground fine was selected first on No 2 engine and then 2 seconds later on No 1 engine. At this time the aircraft heading increased by 2° to 3°. The application of some 5° of left rudder however returned the aircraft back onto a runway heading. Some 2 to 3 seconds later, at a speed of approximately 75 kt, the aircraft's heading began to deviate to the right onto a heading of 119°. Full left rudder was applied but failed to prevent the aircraft leaving the runway at an airspeed of 60 kt. The aircraft then turned left to return to the paved surface.

### Runway examination

Examination of the runway (Figure 1) revealed tyre witness marks attributable to this aircraft made by all three tyres. These were first discernible close to, and parallel with, the runway centreline in the region of the 'east link' from the runway (Hold Bravo). Analysis of these marks indicated that the aircraft had made a sharp right turn, deviating from the runway heading by some 29° degrees by the time it was traversing the runway hard shoulder, before immediately executing a sharp left turn during which it went off onto the grass. During this turn the PAPI light unit closest to the runway was struck and demolished by the underside of the aircraft's nose. During both turns the aircraft's heading and track deviated by a maximum of 5° as partial skids were induced, indicating high speed in relation to the radius of turn and nosewheel steering angle. At the completion of the left turn, the aircraft ran along on the grass for a short period before it tracked back onto the paved surface, regaining the centreline at the final turnoff. The excursion occurred over approximately the last 380 metres of Runway 09.

### **Aircraft examination**

After parking on stand to disembark the passengers, the aircraft was towed to a nearby maintenance hanger for examination and repair. The more serious damage was confined to the immediate support structure of the radome and the nose wheel tyre, which was cut but remained inflated. There were several punctures in, and scuff marks on, the lower skin of the front fuselage and the main landing gear sponson fairings. The ice detector probe was also distorted. Both engines, propellers, main landing gear and rear fuselage were undamaged.

The relevant systems were examined and/or functionally tested. These included the nosewheel steering mechanical and hydraulic systems, the main wheel braking system and the rudder. All were found to perform normally. Tyre pressures were measured and found close to nominal and a calibration of both ASI systems showed both to be within acceptable limits.

Several 'accelerate/stop' runs to speeds of 50 kt and 70 kt were also carried out not only to establish the serviceability of the steering and the anti-skid function of the brakes but to function the engines and propeller control systems. No noticeable defects were seen during these tests which included heavy wheel braking and selection of the propellers to the ground fine pitch range as in a normal landing. Taxi trials showed that the steering system operated normally but finesse, for the inexperienced operator, in directional control was difficult to achieve.

Rigging checks, carried out on the propeller control levers, showed there to be no significant difference in the angular position of each lever in the cockpit at the point when the propellers move to the ground fine pitch setting.

Furthermore, tests carried out on another aircraft showed that a significant delay in the selection of ground fine for each engine produced a slight 'swing' which could easily be controlled by the application of rudder.

### **Discussion**

Following examination and testing of the aircraft, no technical defects were found that could explain the sudden and unexpected departure of the aircraft from the runway during the landing. The weather was fine and the cross-wind component of 6.5 kt was of little significance. The delay in selecting one of the propellers to ground fine produced a slight 'swing' to the right but, as can be seen from the FDR trace at figure 1, this was controlled by the application of left rudder. The significant deviation to the right of the runway occurred at a time when both propellers were

established in ground fine and at a time when the commander would have had his hand on the nosewheel steering. It is normal practice for the directional control of aircraft to be achieved by the application of rudder and/or differential braking until the speed of the aircraft has reduced to 'normal taxi speed'. Application of nosewheel steering at greater speeds can lead to over controlling.

The commander was relatively new to the operating company having recently retired from heavy jet long haul operations. He had successfully completed an Aircraft Type Rating test (Form 1179) on the Shorts 360 on 18 June 1999; a base check and instrument rating renewal on 29 June 1999 and a final line check on 23 July 1999.

It is probable that the commander, having applied left rudder to regain the centreline after the slight swing induced by the staggered selection of the power levers to the ground fine setting, inadvertently applied a small but significant input of right nosewheel steering tiller which, applied at a speed of 75 kt, induced an uncontrollable swing to the right.