No: 1/91 **Ref: EW/C1178** **Category: 1a**

Aircraft Type and Registration:	BAC One Eleven 301L AG, G-ATPK
No & Type of Engines:	2 Rolls-Royce Spey 511-14 turbofan engines
Year of Manufacture:	1966
Date and Time (UTC):	29 September 1990 at 1447 hrs
Location:	Inverness Airport, Morayshire
Type of Flight:	Public Transport
Persons on Board:	Crew - 5 Passengers - 77
Injuries:	Crew - None Passengers - None
Nature of Damage:	Left wing tip, left flap and flap track fairing
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	47 years
Commander's Total Flying Experience:	9,972 hours (of which 5,291 were on type)
Information Source:	AAIB Field Investigation

History of Flight

G-ATPK was operating a scheduled passenger service from London Heathrow to Inverness with the First Officer as the handling pilot. The total fuel on board at departure was 6400 kgs. Planned sector fuel was 2800 kgs and the fuel required for diversion to the planned alternate, Glasgow, was 2200 kgs. The weather at Inverness on arrival was:

Surface wind	040°/5 kt
Visibility	2300 metres
Cloud	4 octas at 300 feet
Weather	Rain

The runway in use was 06 and the Commander elected to carry out a VOR approach with a Minimum Descent Height (MDH) of 400 feet. On reaching MDH the First Officer did not have sufficient visual reference for landing so executed the Missed Approach Procedure. G-ATPK then entered the holding

pattern while another aircraft made an approach to Runway 24. The approach on this runway is a VOR/DME procedure with an MDH of 350 feet. As the slight tailwind component on Runway 24 would not present any landing distance problems, the commander elected to fly an approach to this runway and take advantage of the lower MDH available. Shortly after G-ATPK became established on the outbound leg of the procedure the pilot of the aircraft landing on Runway 24 reported that he had seen the runway lights at 380 feet.

The Commander states that the First Officer flew a satisfactory approach and analysis of the Flight Data Recorder (FDR) readout indicates that the IAS was steady at 130 kts, the target threshold speed (V_{ref} + 10 kts), and that the heading was generally stable on 230°M. The rate of descent, however was high, corresponding to an approach angle of 4.6°. The aircraft was above the minimum height for range at 3 nm DME but because the approach angle was higher than normal, G-ATPK levelled off at MDH some 1.45 nm from touchdown rather than the 0.9 nm that would have been achieved had the approach been flown at the 3.5° on which the procedure is based.

Having levelled at 350 feet, the First Officer maintained height for 15 seconds after which period both pilots saw the approach lights and the runway. At this point the aircraft was about 0.8 nm from touchdown and displaced slightly to the left of centre line. The Commander reports that tracking of the VOR had been good but that there was a slight discrepancy between the two VOR indications. Assuming that the aircraft was on track for the VOR, the 5° difference between the inbound track for the procedure (232°) and the runway centre line (237°) would have placed it left of the centre line because the aircraft was now some distance beyond the point where the two tracks intersect. Had the aircraft been flying the correct angle of approach, it would have reached the intersection at MDH.

Having gained visual reference for landing, the Commander asked the First Officer if he was happy to land. The First Officer said that he was not and the Commander took control of the aircraft with the intention of landing. At 0.7 nm he reduced power to flight idle and commenced a turn to the right using up to 20° bank in order to regain the centre line. During this manoeuvre the IAS fell to (V_{ref} - 5 kts) and remained at this value until the flare. The approach continued at an angle of 5.4° (1178 feet/min) and the aircraft flew through the centre line of the runway at which point the commander reversed his turn using 16° of bank to regain the centre line. As the aircraft approached the runway from the right, the commander initiated a flare to 15° of pitch. The aircraft contacted the runway with the left outer flap track fairing followed shortly by the left wing tip while the aircraft was on a heading of 230° and a speed of (V_{ref} - 12 kts). The main wheels then contacted the runway subjecting the aircraft to a vertical acceleration of 1.2g. Analysis of the FDR and witness marks on the runway indicated that the aircraft had struck the runway at a bank angle of 16° to the left when the left wing tip was 12 feet to the right of the runway centreline. The subsequent roll-out and taxi to the stand were uneventful. The fuel remaining on landing was 2600 kgs, 400 kgs more than that required for diversion.

Neither pilot considered that the landing could have caused any damage to the aircraft and therefore did not inspect the aircraft after shut-down. Damage to the left wing tip and left outer flap track fairing was discovered by maintenance personnel during the routine turn round after flight inspection. Since the

crew did not consider that anything untoward had happened, the CVR was left running and produced no useful data.

The company operation manual states that "on a non-precision approach, if the specified visual reference for landing is not established before the aircraft reaches Decision Height on a descent, the aircraft may be levelled off at Decision Height and heading may be maintained towards the runway" until the specified visual criteria for landing is obtained or the specified Missed Approach Point is reached. When flying an offset approach as at Inverness, the pilot has no guidance to the runway and cannot therefore comply with the guidance given in the operations manual. Perusal of the operation manuals of other UK operators indicate that no specific guidance is given to pilots regarding missed approach procedures for offset approaches. A survey of UK airfields having offset approaches indicates that offsets of up to 16° exist at airfields used by public transport aircraft. A recommendation has been made to the Civil Aviation Authority regarding the content of operation manuals in relation to missed approach procedures following an offset approach.