Boeing 737-200, EI-CJE and BAe 146-100, G-UKJF, 30 September 1997

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Aircraft Type and Registration:	i)	Boeing 737-200, EI-CJE
	ii)	BAe 146-100, G-UKJF
No & Type of Engines:	i)	2 Pratt & Whitney JT8D-15 turbofan engines
	ii)	4 Lycoming ALF 502-R5 turbofan engines
Year of Manufacture:	i)	1982
	ii)	1983
Date & Time (UTC):		30 September 1997 at 1353 hrs
Location:		9 nm south west of London (Stansted) Airport
Type of Flight:	i)	Public Transport
	ii)	Public Transport
Persons on Board:	i)	Crew - 7 - Passengers - 103
	ii)	Crew - 5 - Passengers - 17
Injuries:		None
Nature of Damage:		None
Commander's Licence:	i)	Airline Transport Pilot's Licence
	ii)	Airline Transport Pilot's Licence
Commander's Age:	i)	38 years
	ii)	33 years
Commander's Flying Experience:	i)	7,390 hours (of which 3,747 were on this type)
		Last 90 days - 70 hours
		Last 28 days - 29 hours
	ii)	6,975 hours (of which 2,627 were on this type)

	Last 90 days -134 hours
	Last 28 days - 50 hours
Information Source:	AAIB Field Investigation

Synopsis

The incident involved a loss of separation between a Boeing 737,departing from London (Stansted), and a BAe 146, inbound to LondonCity Airport. The incident occurred some 5.4 miles north eastof the Brookmans Park (BPK) VOR.

History of the flight

The B737 was planned to operate a scheduled passenger servicefrom London (Stansted) to Dublin. As part of the pre-flight procedurethe crew had obtained the latest ATIS information which includeda surface wind of 250°/06 kt, a visibility of 6,000 metres, thesurface temperature was 19°C, the QNH 1023 mb and the cloud wasreported as 'few' at 900 feet, broken at 2,600 feet; Runway 23was the runway in use. At 1312 hrs the crew contacted the Stanstedground control frequency to acknowledge receipt of the relevantATIS and requested ATC clearance. A BUZAD FOUR ROMEOStandard Instrument Departure (SID) was allocated, as expected,and a transponder setting was also given.

The BUZAD FOUR ROMEO SID (see Jeppesen Guideextract, part 1 and part 2) requires that, after take off, the aircraftshould climb straight ahead and, at 11·5 DME from BrookmansPark (BPK), which is coincident with the 160° radial from Barkway(BKY), the aircraft should turn right to intercept the BKY 175°radial inbound to BKY by 8 DME from BKY. The aircraft is thenrequired to proceed inbound towards BKY. Separate routing instructionsthen apply for the remainder of the SID. The initial altitudeconstraint for this SID is to cross the 5 DME point from BKY at3,000 feet.

The commander was to be the handling pilot for this leg. He thereforeset the navigation aids as follows: BKY VOR on navigation box1, BPK VOR on navigation box 2, 355° was set on both omni-bearingselectors (OBSs) and both remote magnetic indicators (RMIs) wereset to dual VOR. These navigation aids were then checked by bothpilots for the correct aural identification.

The crew requested clearance to push back and start engines at1337 hrs after which clearance was given to taxi to the holdingpoint for Runway 23. Whilst taxying the flight was transferredto the frequency for the aerodrome control tower who cleared itfor take off at 1349 hrs. During this period there were no amendmentsto the original departure clearance.

Meanwhile control of the BAe 146, on a scheduled passenger servicefrom Edinburgh to London City Airport, had been passed to theNorth East sector of the London Terminal Control Area (LTCA) at1350 hrs at which time the aircraft was descending to FL70 on a radar heading of 120°M; this heading would take it about4 nm to the north east of BPK. This same controller was alsoresponsible for the Stansted departures at that time.

The B737 took off from Stansted at 1350:35 hrs and climbed straightahead as the BAe 146, descending through FL 90, was 21 nm to thewest maintaining the radar heading of 120°M. Stansted handedthe B737 over to the departure controller at 1350:55 hrs as theaircraft was passing through 1,500 feet, however, due to the amountof radio traffic on the new frequency, contact was not establisheduntil one minute later by which time the flaps were raised andthe aircraft had levelled at 3,000 feet. From the recorded flightdata it was determined that at this time the aircraft was alreadyone nautical mile past the start point for the right turn towardsBKY required by the SID. The BAe 146 had by now been clearedto descend to 4,000 feet.

When the crew of the B737 called level at 3,000 feet it was instructedto 'Squawk Ident', climb to FL 70 and the speed restrictionof 250 KIAS below FL 100 was removed. Ident was selected (causingthe aircraft transponder to transmit its code to the ground radar),and the aircraft recommenced the climb. However, the aircraftmaintained the runway heading until 13:52:43 hrs, when at an altitudeof 4300 feet and 6·8 nm from BPK, the aircraft commenceda right turn. Just as this aircraft entered the turn the ATCcontroller instructed the flight to 'TURN RIGHT IMMEDIATELYHEADING 360°'. The BAe 146 was then instructed to 'TURNRIGHT IMMEDIATELY HEADING 180° STOP YOUR DESCENT ALTITUDE 5500FEET'. The B737 was then told 'AVOIDING ACTIONDESCEND IMMEDIATELY ALTITUDE 4,000 FEET TRAFFIC OPPOSITE DIRECTIONSAME LEVEL'.

The commander of the B737 then reported being visual with theBAe 146 and the two aircraft passed at the closest proximity of0.91 nm horizontally and 200 feet vertically, calculated fromthe Stansted radar head. At the point of minimum separation,5.4 nm northeast of the BPK VOR, the BAe 146 was at 5,400 feetand climbing slightly to achieve 5,500 feet whilst the B737 wasat 5,200 feet and about to descend. Both aircraft were then ina right turn.

The B737 levelled at 4,300 feet QNH (FL 40) before requestingclearance to climb to FL 70. Both aircraft were subsequentlygiven radar vectors before they left the frequency.

This reconstruction was compiled using a combination of recordedradar data, recordings of the radio transmissions and informationfrom the Flight Data Recorder (FDR) from the B737. The FDR hadbeen removed from the aircraft upon the completion of the twelfthsector following the incident. The Cockpit Voice Recorder hadbeen operational throughout that time but, having only a 30 minuteloop facility, it had recorded audio data subsequent to the periodof the incident. Supporting evidence for the event was providedby recordings from the Stansted Airport Noise Unit and data fromthe Separation Monitoring Function at LATCC.

The navigation equipment on the B737 was serviceable for thisflight. There is no evidence of any unserviceability of the groundnavigation aids and all other aircraft allocated this SID in thesame period followed it correctly.

Pilot experience

The commander of the B737 had considerable experience on typeand was very familiar with this route and the associated SID. His First Officer held a Commercial Pilot's Licence, had a totalof 1,400 hours with 400 hours on this type and was also familiarwith this departure from Stansted. Both pilots were well restedat the time of the event.

Air Traffic control

The controller had started his duty at 1300 hrs and was well rested. At the time of the incident he was responsible for both the NorthEast sector of the LTCA as well as the departures from Stansted,he described his workload as moderate. He had accepted the BAe146 on a radar heading of 120° knowing that this heading wouldtake it close to BPK and had cleared its descent to 4,000 feetin preparation for the handover to the next agency who would controlthe approach to London (City). The controller knew that the B737had been allocated the BUZAD FOUR ROMEO SIDand, after the initial contact during which he cleared that aircraftto climb to FL 70, he directed his attention to other traffic. He became momentarily distracted when another aircraft failedto respond to three repeated transmissions after which he becameaware that the B737 was significantly to the west of the SID track,he immediately instructed it to turn to the right. He then instructedthe BAe 146 to turn to the right and stop the descent. Coincidentwith the Short Term Conflict Alert warning the controller issuedfurther avoiding action to the B737. Neither aircraft was requiredto be fitted with TCAS and neither had the system installed.

Analysis

The controller had cleared the BAe 146 to descend to 4,000 feetwhilst it was on a radar heading of 120°M, a heading that wouldtake it close to BPK. He then cleared the B737 to climb from3,000 feet to FL 70 whilst it was on a procedural departure fromStansted in the belief that the aircraft would follow the requiredtrack for the SID.

The B737 did not follow the SID, for reasons that the investigationhas been unable to determine. The pilots believe that they compliedwith the tracking requirements for the departure and cannot understandhow this deviation occurred. The ground and airborne navigationalaids were serviceable and there were no distractions for the flightcrew which was well rested. The weather was benign and both flightcrew members were familiar with the SID. It is therefore mostlikely that there was a significant breakdown in the managementof the cockpit resources on the flight deck during this departure,particularly with regard to the requirement for the pilot nonflying to monitor the performance of the pilot flying.