

**AAIB Bulletin No: 6/94**

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**Category: 1.1**

## **INCIDENT**

**Aircraft Type and Registration:** Boeing 737-236, G-BKYL  
**No & Type of Engines:** 2 Pratt & Whitney JT8D-15A turbofan engines  
**Year of Manufacture:** 1985  
**Date & Time (UTC):** 15 February 1994 at 1237 hrs  
**Location:** East Midlands Airport  
**Type of Flight:** Public Transport  
**Persons on Board:** Crew - 6 Passengers - 8  
**Injuries:** Crew - None Passengers - None  
**Nature of Damage:** None  
**Commander's Licence:** Airline Transport Pilot's Licence  
**Commander's Age:** 38 years  
**Commander's Flying Experience:** 8,500 hours (of which 1,600 were on type)  
Last 90 days - 95 hours  
Last 28 days - 34 hours  
Duty time - Started duty at 0625 hours  
**Information Source:** AAIB Field Investigation

### **History of the flight**

The aircraft had landed at East Midlands Airport at 0958 hrs having arrived from Frankfurt. The commander started his pre-flight inspection for the next sector, to Brussels, at about 1130 hrs. Both the temperature and the dewpoint at the time were 0°C with the Relative Humidity around 100%. Although it was not snowing at the time of the commander's inspection, it had been snowing during the morning and the commander observed that there was frozen moisture on the flying surfaces with icicles on the leading edge of the wing. On the instructions of the commander, the flying surfaces of the aircraft were deiced using 120 litres of a 60/40 mix of Type II fluid at a temperature of 90°C. The fluid in the deicing rig was checked shortly after the incident and was found to have the correct ratio of deicer fluid to water (refractometer reading of 1.372). Deicing operations had started at 1220 hrs and, on completion, the commander was satisfied that flying surfaces were clear of any contamination.

There was no precipitation during the deicing operation but, shortly after the commander entered the flight deck, it began to snow moderately with large wet flakes. When the aircraft had arrived at East Midlands Airport the air temperature was  $-1^{\circ}\text{C}$  but as the aircraft departed from the stand it was rising through  $0^{\circ}\text{C}$ .

Runway 09 was in use and the SNOWTAM valid at the time gave a quarter to half cover of wet snow to a depth of 10 mm. The aircraft weight at takeoff was 38 tonnes (MTOW 49 tonnes) and the CG was in the mid-range. The stabiliser trim setting was correctly set at 4.8 units and the commander had set  $10^{\circ}$  of flap in accordance with the Company Operations Manual (OM) for operation from contaminated runways. Before entering the runway the commander had visually checked the left wingtip and noted that it appeared to be free from contamination. The wind for takeoff was  $180^{\circ}/08$  kt and the calculated rotation speed was 112 kt. The commander, who was the handling pilot, had previously completed several takeoffs in this configuration and with similar runway conditions. The take-off began at 1237 hrs, some 17 minutes after the start of deicing operations. The OM states that, under the prevailing conditions of temperature and precipitation, the takeoff should commence within 20 minutes of deicing. The take-off roll, using maximum engine pressure ratio (EPR) of 2.15, was uneventful up to the point where the commander rotated the aircraft to the climbing attitude at the correct airspeed.

The commander stated that on rotation, he had to fly the aircraft positively in pitch in order to maintain a steady rotation rate and that, on reaching a pitch angle of  $15^{\circ}$ , the aircraft continued to pitch up with no further pilot input. A graphical representation of the relevant parameters from the Flight Data Recorder (FDR) is shown in Figure 1. At this point the commander sensed airframe buffet through the control column and he checked forward to contain the pitch rate and stop the buffet. The buffet felt by the pilot was not felt by either the non handling pilot or any of the cabin attendants. During the recovery manoeuvre the commander trimmed fully forward to the limit of the electric stabiliser trim and then further forward by rotating the manual trim wheel a further 2 to 3 turns nose-down. As the pitch attitude reduced the buffet ceased and by the time that it was at  $10^{\circ}$  the aircraft was in trim. The commander considered that the aircraft was now under full control and began the flap retraction schedule while reducing the EPR to the normal climb setting. On engaging the autopilot with the aircraft in trim, the commander noticed that the stabiliser trim setting was further forward than it should have been, *ie* forward of the green segment. Over the next 90 seconds the trim gradually returned to its correct setting of about 4.0 degrees. Before continuing to the planned destination, the commander checked the upper surfaces of the wings through the passenger cabin windows and noted that the leading edges were clear but that there was a residue of deicing fluid towards the trailing edges. The wing anti-ice system had been selected on after flap retraction.

A check of the aircraft's longitudinal control and trim systems conducted some two weeks after the incident failed to reveal any defect.

## Flight Recorders

Neither of the accident recorders was removed from the aircraft because the cockpit voice recording had been overwritten and the data on the Quick Access Recorder (QAR), obtained from the operator, contained all the parameters normally recorded by the FDR. The operator also made available, for the purposes of comparison, data from the normal take off of another Boeing 737-236, G-BGDH (DH), at a weight within 300 kg of the incident aircraft's but with 6° of flap being used instead of 10°. Data from the two aircraft has been correlated in Figure 1 so that both rotations occur at the same point on the timebase which starts from an arbitrary datum just before the takeoff.

The initiation of rotation of G-BKYL (YL) occurred at 5 seconds to 6 seconds between 110 and 115 kt computed airspeed (CAS). At 8 seconds the pitch control column angle reached a maximum value of 4.2° nose-up and the pitch rate was 3.2° per second. Over the period 11 seconds to 17 seconds the pitch rate was 1.7° per second whilst the control column angle reduced from 4° nose-up to 0°. Two seconds later the pitch was still increasing despite a control column angle of 1° nose-down and a nose-down trim increase from 4.8 units to 4.6 units. In comparison, 'DH', trimmed to 6.4 trim units throughout the period of the figure, held a constant pitch rate of 2.5° per second from 9 seconds to 15 seconds with a control column angle which reached a maximum of 5.9° nose-up at 13 seconds. No overall pitch change occurred from 16 seconds to 21 seconds a period when the control column was within 1° of neutral.

At 21 seconds 'YL's' pitch angle was 20° and beginning to decrease, following a reduction in stabiliser trim from 4.6 units to 3.3 units and a maximum pitch control column angle of 2.6° nose-down the pitch angle reduced to 7° at 28 seconds. Over the next 7 seconds a control column input averaging 1° and a pitch increase from 7° to 9° were recorded. One minute later with flaps retracted the stabiliser trim position was recorded as 4 units.

### Further investigation

Further information on the performance aspects of this incident is awaited from the aircraft manufacturer. The AAIB is following an internal study by the operator of the validity of current hold over times specified by various agencies. This study has already recommended to the operator that consideration be given to amending the holdover tables currently published by the International Organisation for Standardisation (ISO), the Association of European Airlines (AEA) and the Society of Automotive Engineers (SAE), to reflect the below 0°C to -7°C times in the 0°C and above band. Company procedures are to be amended in line with the findings of the internal study before next winter. Any further relevant information will be published in a future AAIB Bulletin.



G-BKYL incident on 15 February 1994

