

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Boeing 737-33A, G-CELD	
<b>No &amp; Type of Engines:</b>	2 CFM56-3B1 turbofan engines	
<b>Year of Manufacture:</b>	1987	
<b>Date &amp; Time (UTC):</b>	21 February 2009 at 1401 hrs	
<b>Location:</b>	Runway 32, Leeds Bradford Airport	
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)	
<b>Persons on Board:</b>	Crew - 5	Passengers - 115
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Right engine cowling	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	54 years	
<b>Commander's Flying Experience:</b>	11,030 hours (of which 5,280 were on type) Last 90 days - 83 hours Last 28 days - 33 hours	
<b>Information Source:</b>	AAIB Field Investigation	

**Synopsis**

While landing on Runway 32 at Leeds Bradford Airport, G-CELD encountered windshear at about 30 ft agl and became unstable in the flare. As a result, and unbeknown to the crew at the time, the right engine nacelle contacted the runway. Inspection of the runway revealed a 15 m scrape mark on the threshold, with associated paint matching G-CELD's engine cowling.

**History of the flight**

G-CELD was flying a scheduled service from Paris Charles de Gaulle Airport to Leeds Bradford Airport (LBA). After an uneventful flight, it was positioned for an ILS approach to Runway 32.  $V_{REF}$  for the approach was 128 kt, but due to the wind a  $V_{APP}$  of 140 kt was bugged. During the approach the wind was observed

as strong, gusty and largely across the runway from the left; however, the IAS was stable until approximately 100 ft agl. The co-pilot was the pilot flying for the sector and the runway was dry.

As the aircraft approached the flare, at about 30 ft agl, a speed loss of 10 kt occurred. The commander called "speed slow" and placed his hand near the throttles, with the co-pilot applying a small amount of power. The commander then felt the aircraft sink so applied a "handful of power" covering the co-pilot's hands as he did so, adding "you'll need more than that". At some point after this, the co-pilot thought he heard the commander say "I have control" to which he responded by taking his hands off the controls in accordance with

the company SOP's. The co-pilot added that his "feet remained on the rudder pedals as there was no time to remove them". Both pilots then recalled a pronounced wing drop to the right, immediately prior to the aircraft touching down.

The commander informed ATC of the windshear as the aircraft taxied to stand. After the aircraft was shut down and the passengers disembarked the commander discovered damage to the right hand engine nacelle and informed ATC. A runway inspection revealed a 15 m scrape mark on the Runway 32 threshold, with associated paint matching G-CELD.

Another company aircraft commenced an approach five minutes later. The crew were warned by ATC of the potential for low level windshear and planned the approach accordingly. They too experienced a stable approach initially but found the speed difficult to control below 100 ft agl.

### **Meteorological information**

The following METARs were recorded at LBA:

211420Z 27023KT 9999 SCT015 06/04 Q1028=  
 211350Z 27030G40KT 9999 SCT009 07/03  
 Q1028=  
 211320Z 27032G42KT 9999 FEW007 SCT013  
 06/03 Q1028=

An aftercast was obtained from the Met Office. It stated that it was likely that there was no abnormal wind flow regime although the wind was strong and undoubtedly gusty. The gustiness was not abnormal, but reductions in speed of 10 to 15 kt over a short period of time/distance were likely. There was no indication of rotor streaming. Turbulence due to upwind buildings could not be determined, but this was not considered significant.

The aircraft's Flight Data Recorder (FDR) equipment recorded a wind of 271°/28 to 38 kt during the final stages of the approach. This gave a crosswind component of 23 to 30 kt from the left.

### **UK Integrated Aeronautical Information Package (UK IAIP)**

The following is taken from the LBA section of the UK IAIP titled Local Traffic Regulations:

#### ***'4 Warnings***

*b Pilots are advised to expect windshear and turbulence when the surface wind is between 190° and 280° above 20 kt. Some variations to reported wind readings may also occur.'*

### **Crew's comments**

The crew recalled a relatively smooth approach, with a pronounced crosswind, flown 12 kt above  $V_{REF}$  to allow for the gusty conditions. They added that the wind strength and direction was not unusual for LBA.

Although the co-pilot believed he heard the commander say "I have control" in the flare, the commander recalled saying this during the landing roll.

### **Recorded data**

The aircraft was fitted with a Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) which were removed from the aircraft and taken to the AAIB for downloading. The aircraft was also fitted with a Wireless Quick Access Recorder which was downloaded by the operator but subsequently found to have failed to record.

The duration of the CVR was 30 minutes and the period covering the incident landing had been overwritten. Data for the landing was available from the FDR, and a number

of salient parameters for the landing, some of which are presented at Figure 1, were analysed. However, rudder pedal angle and rudder deflection parameters were not recorded. Rudder pedal was originally recorded on the FDR but subsequently removed during a modification to make space for right-flap position. This modification was deemed acceptable by the CAA as the regulations applicable to this aircraft only required primary flight controls to be recorded “when sufficient capacity is available” on the flight recorder system. The CAA is now recommending to the operator to re-instate the rudder position input as they believe this to be a more important parameter to record than right-flap position given the documented history of Boeing 737 rudder system problems, and the fact that left-flap position is recorded.

Figure 1 starts with the aircraft established slightly low on the ILS to Runway 32 and with the autopilot disconnected. The aircraft continued on or below the glideslope, wings level and decelerating, until 50 ft agl, when it started to roll left wing down (see Point A), reaching 12° three seconds later as the aircraft passed through 20 ft agl. The airspeed reached 124 kt as opposite control wheel was applied (Point B) and thrust was applied (point C). The thrust levels increased from a nominal 55%  $N_1$  to 80%  $N_1$  causing the aircraft to pitch up (Point D) and accelerate. However, as the aircraft responded in roll it also started to yaw to the right (Point E).

As the aircraft’s left-roll attitude reduced and passed through wings level, the pitch attitude and thrust were reduced but the aircraft continued to roll and yaw to the right until the point of touchdown. The maximum roll and yaw rates recorded were 13°/second and 8°/second respectively. The aircraft touched down with approximately 12° of right bank and just under 0.2° of

nose-down pitch, at about 145 kt computed airspeed, just as some left-hand control wheel was being applied.

Figure 2, taken from the Boeing 737 (B737) Crew Training Manual, illustrates body angles required on landing to contact various parts of the airframe. When the parameters recorded by FDR above are plotted, a probable nacelle impact is indicated (arrowed).

### **Boeing 737 handling characteristics**

The B737, in common with similarly configured passenger aircraft, displays a marked tendency to roll when large yaw rates are induced. This results from the forward moving wing generating more lift than the other, therefore causing the aircraft to roll in the same direction as the yaw. Because of the positioning of the B737 engines relative to the wing, the application and reduction of power can have a pronounced effect upon the aircraft’s pitch attitude.

The operator’s crosswind limit for landing on a dry runway is 35 kt.

### **Analysis**

In the final part of the approach, a significant amount of thrust was applied to counter the speed reduction induced by the wind. This resulted in the aircraft pitching up initially and when the thrust was rapidly reduced, the pitch attitude reduced, leading to some pitch instability.

The aircraft had maintained 8-10° of starboard drift during the approach and this drift was ‘kicked off’ in the flare to align the aircraft with the centreline; this induced a right roll. The FDR recorded that this roll was not anticipated with an opposite aileron input. As a result, this roll, induced by the yaw, caused the aircraft to achieve sufficient right bank for the nacelle to strike the ground. Confusion as to which pilot had control,

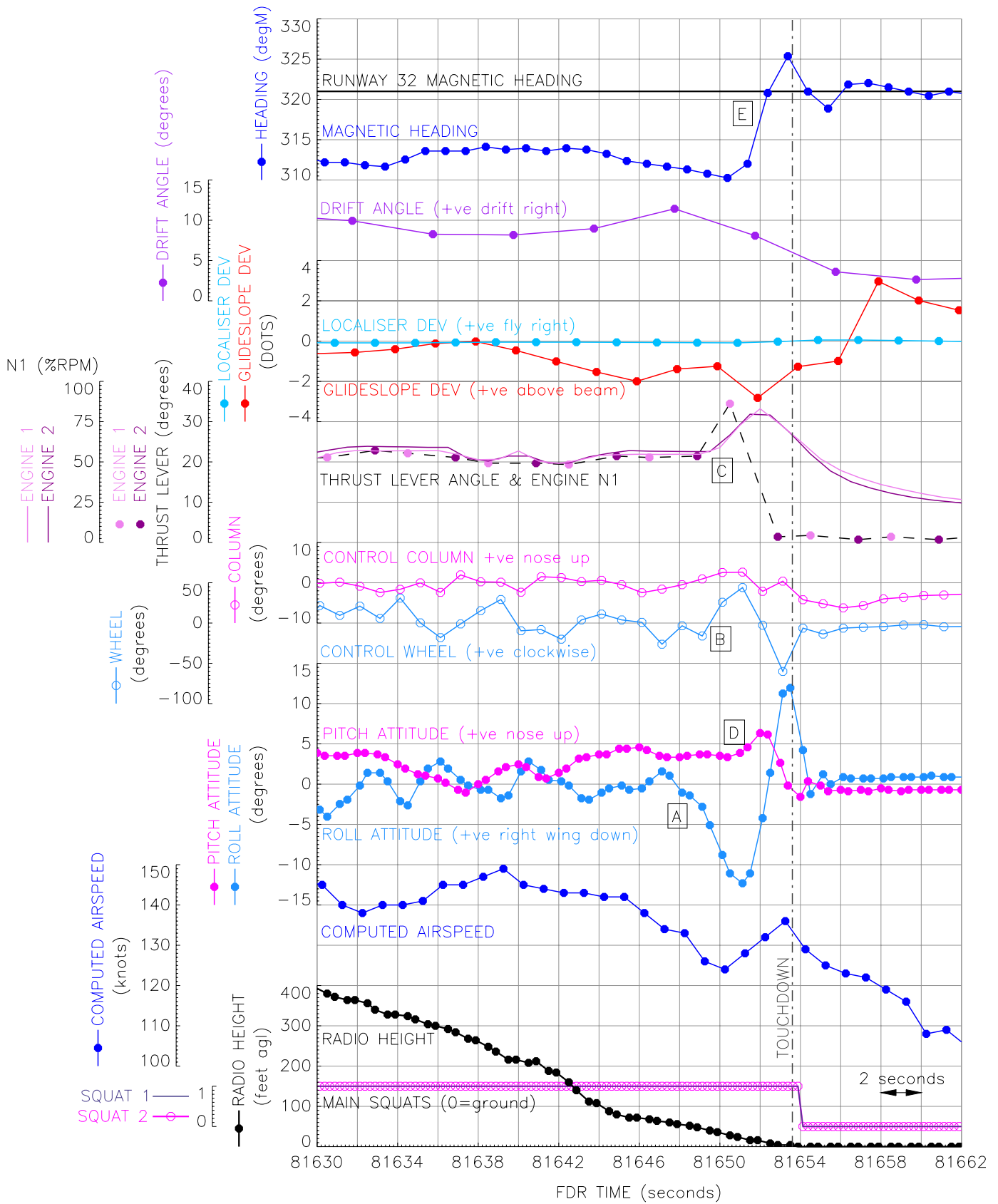
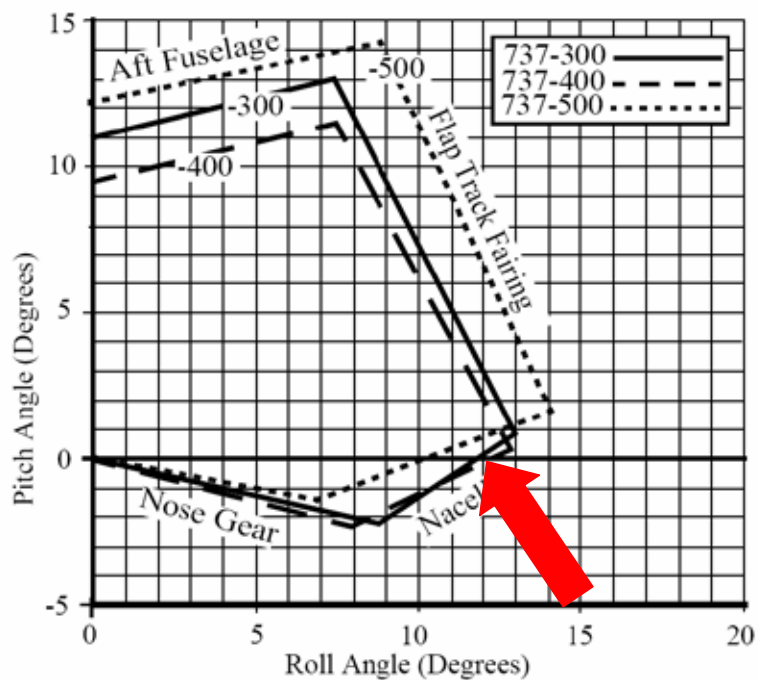


Figure1

Salient FDR Parameters for Incident Landing to G-CELD



**Figure 2**

combined with encountering significant windshear, will contribute to the control instability at this critical time.

### Safety action

As a result of this incident the crew received additional training on crosswind landings in a simulator and the operator issued an Operating Staff Instruction

highlighting the need for a formal handover of control and acknowledgement from the other pilot. The instruction also added that, in normal circumstances, it is not appropriate for the PNF to make flying control or throttle inputs without a request from the PF.