

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Boeing 737-35B, LY-SKA
<b>No &amp; Type of Engines:</b>	2 CFM56-3B2 turbofan engines
<b>Year of Manufacture:</b>	1988 (Serial No: 23972/1537)
<b>Date &amp; Time (UTC):</b>	21 September 2012 at 1211 hrs
<b>Location:</b>	Birmingham International Airport
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)
<b>Persons on Board:</b>	Crew - 6                      Passengers - 137
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	Nosewheels and tyres damaged
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence
<b>Commander's Age:</b>	45 years
<b>Commander's Flying Experience:</b>	7,520 hours (of which 4,500 were on type) Last 90 days - 150 hours Last 28 days - 62 hours
<b>Information Source:</b>	AAIB Field Investigation

**Synopsis**

The aircraft left the paved surface of the taxiway and came to rest on grass beside it, having turned to vacate the runway at approximately 20 kt ground speed. The commander was attempting to vacate the runway expeditiously to avoid causing the following aircraft to go around.

**History of the flight**

The aircraft was on a scheduled flight from Nice Airport, France, to Birmingham International Airport on behalf of a UK operator. The commander was the pilot flying.

During the arrival brief the commander selected Autobrake 2 and planned to vacate Runway 33 at Taxiway Bravo. Figure 1 shows the layout of Birmingham International Airport. After an uneventful

approach the aircraft landed in the touchdown zone, at the correct IAS; IDLE reverse thrust was then selected. The runway was wet and the wind was from 010° at 6 kt.

During the landing roll the commander judged the aircraft would not decelerate sufficiently to vacate at Taxiway Bravo without excessive braking, so he disconnected the Autobrake using the brake pedals just before Taxiway Bravo. He then cancelled thrust reverse, released the brakes and let the aircraft roll to the end of the runway to vacate at Taxiway Alpha.

As the aircraft rolled towards Taxiway Alpha, ATC informed a following aircraft "EXPECT LATE LANDING CLEARANCE PREVIOUS LANDER HAS GONE ALL THE WAY TO THE END." The commander stated he did not want

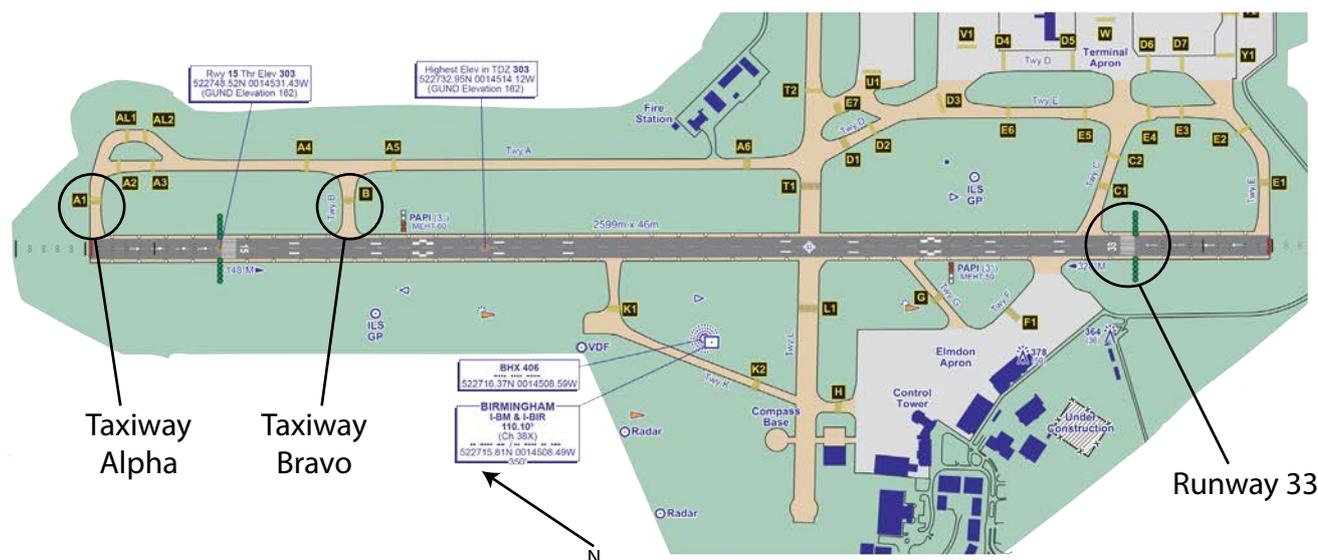


Figure 1

## Birmingham International Airport Layout

to delay vacating the runway and cause the following aircraft to go around. He added that as the aircraft approached Taxiway Alpha he started to turn the aircraft at “about 12 kt”. Initially the aircraft responded as expected but as the turn progressed the aircraft became “uncontrollable” and started to skid towards the left edge of the taxiway. The commander applied the brake pedals fully but the aircraft departed the taxiway onto adjacent grass and stopped. As ATC saw LY-SKA turn off the runway the following aircraft was cleared to land. Shortly thereafter the crew of LY-SKA informed ATC that they had stopped on the grass; the following aircraft was then instructed to go around.

After the aircraft stopped, the pilots started the APU and shut down the engines. They then established that there were no injuries. The passengers and crew eventually disembarked by the right rear door using steps provided by the airport operator and were transferred to the terminal by buses.

No other aircraft landing on Runway 33 in the wet that day reported any difficulties taxiing from the runway.

**Examination of the aircraft**

An examination by the engineering organisation that usually conducted turn-round checks for the operator revealed cuts in the tyre tread which probably occurred when travelling over the grass. The nosewheels and tyres were replaced.

There were no hydraulic leaks and the brake system components were undamaged. The brake wear pins were all found to be within limits. A built-in test of the anti-skid system revealed no faults and the main gear oleo extensions, checked following a report that the aircraft had adopted a ‘right wing low’ stance prior to departure, were found to be the same on each side.

**Runway friction measurements**

Chapter 10 of Annex 14 to the International Civil Aviation Organisation (ICAO) - ‘*Aerodrome Standards*’, outlines the requirement for airfield operators to undertake regular assessments of runway surface friction characteristics and to ensure that friction is maintained at an acceptable level. Civil Aviation

Publication 683 - *'The Assessment of Runway Surface Friction Characteristics'*, published by the CAA, describes how runway friction assessments should be conducted using the three types of equipment currently accepted for use in the UK, and states target values for surface friction levels that should prompt maintenance or NOTAM action following an assessment, together with a Minimum Friction Level (MFL).

Birmingham International Airport (BIA) used a Grip Tester Mark II, which is equipped with a measuring wheel and an automatic watering system that delivers a 0.25 mm layer of water beneath the wheel. The Design Objective Level friction value using this equipment is 0.80 or greater, the Maintenance Planning Level is 0.63, and the MFL is 0.55.

BIA conducted a surface friction assessment following the incident. The results indicated that the overall friction level for the entire runway paved surface was 0.80, although the central portion was slightly less. There was no point on the runway where the friction level fell below the Maintenance Planning Level value for more than 100 m. The results showed there was no material change from the previous assessment, which was conducted in June 2012.

BIA also conducted a friction assessment of the taxiway surfaces<sup>1</sup> at each end of the runway. The start point for each Grip Tester run was the western edge of the runway, with the end point the 'Alpha One' or 'Echo One' stop-bar, giving a run length of 130 and 160 m respectively. As this was less than the minimum of 500 m required by the Grip Tester software, a non-standard method was employed to record the results. A small

area of the surface was found to be under the MFL value on Alpha One. However, the average value for the surveyed area was in excess of 0.70.

Figure 2 shows the approximate track of LY-SKA's wheels and the area of reduced friction. The nose and right main gear traversed a maximum distance of approximately 5 m in this area.

Taxiway Echo results generally indicated slightly higher friction values, with no part falling below the MFL value.

### Commander's comments

The commander commented that he was reluctant to cause the following aircraft to go-around because, on a previous occasion that he had been slow to vacate a runway, he had been admonished by the pilot of an aircraft that was instructed to go-around as a result.

### Operations Manual

The operator's operations manual stated:

#### *'Taxi Speed*

*When approaching a turn, speed should be slowed to an appropriate speed for conditions. On a dry surface, use approximately **10 knots** for turns greater than those typically required for high speed runway turnoffs [Rapid exit taxiways<sup>2</sup>].'*

### Recorded information

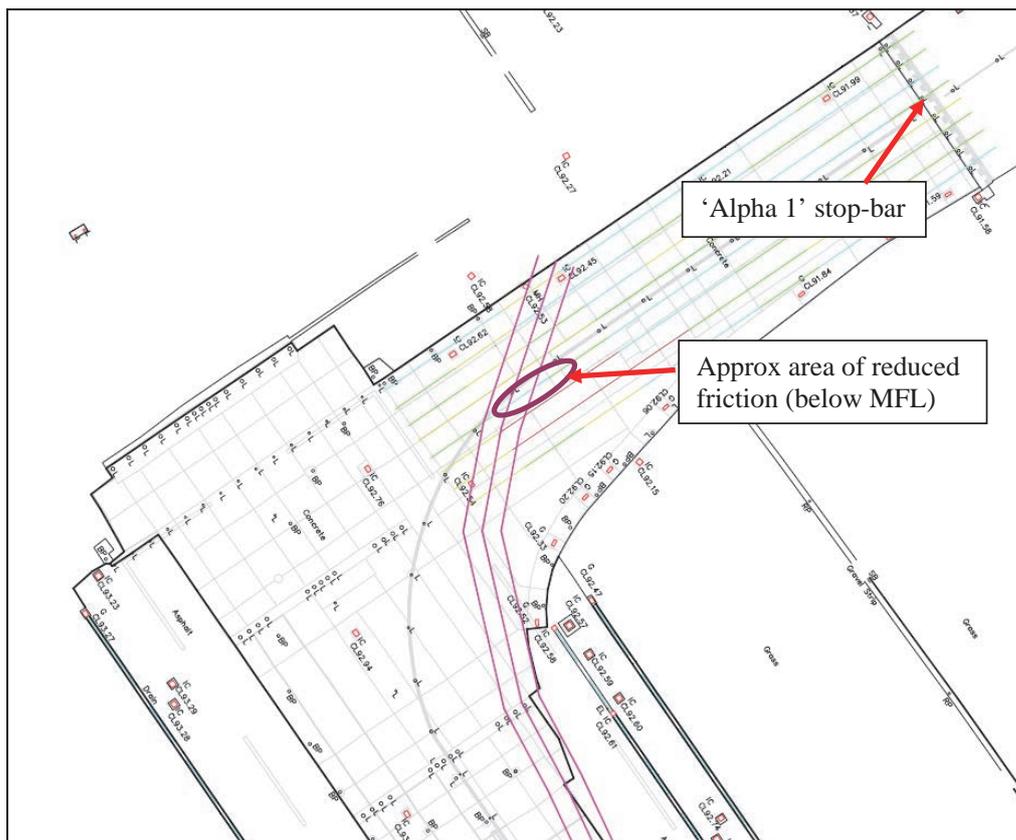
The aircraft was fitted with a Flight Data Recorder (FDR) and a two-hour CVR which both captured the landing event. The FDR recorded 18 parameters which did not include any thrust reverser, braking, steering or ground speed parameters.

#### Footnote

<sup>1</sup> This assessment was conducted to assist the AAIB; there are currently no requirements, procedures or standards for the assessment of friction on taxiways.

#### Footnote

<sup>2</sup> Annex 14 'Aerodrome Standards' states: *'The intersection angle of a rapid exit taxiway with the runway shall not be greater than 45° nor less than 25° and preferably shall be 30°.'*



**Figure 2**

Northern end of Runway 33 showing approximate track of LY-SKA's wheels and area of friction below MFL

Closed-circuit television provided by the airport operator showed that the aircraft touched down within the Runway 33 touchdown zone. At the same time the FDR recorded an airspeed of 137 kt, which in the prevailing conditions indicates a groundspeed of 132 kt. The groundspeed for the remainder of the landing was calculated using longitudinal acceleration because airspeed becomes inaccurate at low speed.

FDR data confirmed deceleration after touchdown at around the Autobrake 2 deceleration target of 0.155g. Approximately 25 seconds after touchdown, the deceleration profile suggested a pedal braking override of Autobrake, followed by release of the brake pedals for 18 seconds as the aircraft coasted towards

Taxiway Alpha. Figure 3 shows that at a calculated groundspeed of 36 kt, further deceleration, from pedal braking, was applied just prior to the turn. When the rate of turn was at a maximum, the calculated aircraft groundspeed was  $21 \pm 3$  kt which reduced to  $14 \pm 3$  kt as the nosewheel left the taxiway onto the grass.

The Air Traffic Service Unit (ATSU) at Birmingham stated that as LY-SKA touched down, the next aircraft to land was 4.5 nm from touchdown at an altitude of 1,900 ft. As LY-SKA began to vacate the runway, the next aircraft was 2.5 nm from touchdown at 1,100 ft and was instructed to go around when at 600 ft and  $\frac{2}{3}$  nm from touchdown.

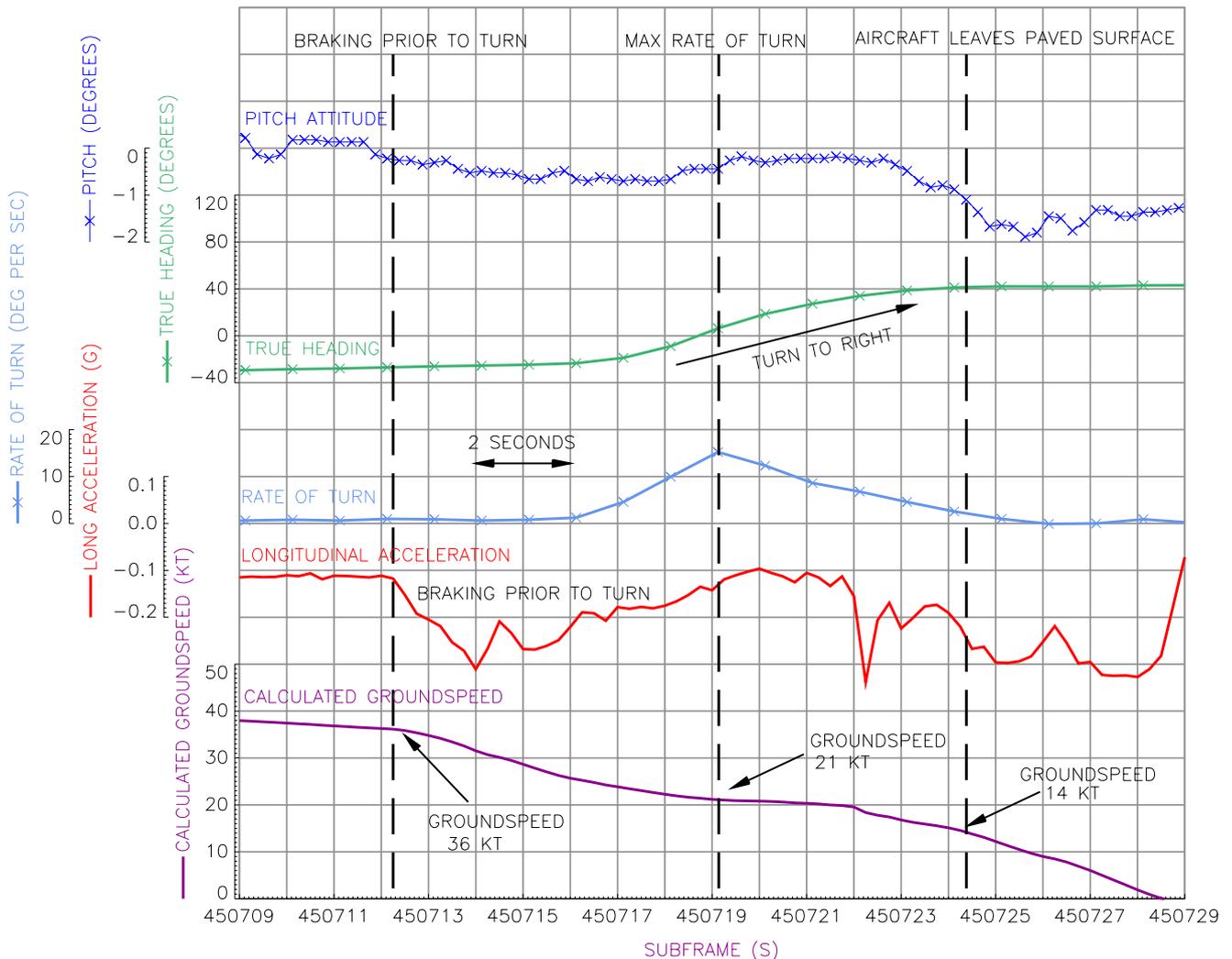


Figure 3

LY-SKA FDR parameters

### Analysis

The operator's operations manual stated that a ground speed of approximately 10 kt should be used for making a turn from runway on to a non high-speed taxiway in the dry, such as Taxiway A at BIA. As the runway and taxiway were wet a lower speed would have been appropriate. The aircraft commenced the turn from the runway above 20 kt. It is unlikely the area of reduced friction on Taxiway Alpha had a significant effect on the outcome because the nose and right main gear encountered it for a maximum distance of approximately 5 m.

The commander stated that he did not want to cause the following aircraft to go-around by occupying the runway for too long. However, the commander would not have known how far behind the following aircraft was or how much time remained to vacate the runway without affecting its approach. In the event, the following aircraft was instructed to go-around because LY-SKA had not completed the turn successfully.

### Conclusion

The aircraft departed the paved surface of the taxiway because it turned to vacate the runway at a speed inappropriate for the conditions.