Air Accident Investigation Unit Ireland

FACTUAL REPORT

INCIDENT
Boeing 737-8AS, EI-ESZ
Dublin Airport
2 November 2015

An Roinn Iompair Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport

Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIU regarding the circumstances of this occurrence and its probable causes.

In accordance with the provisions of Annex 13[1] to the Convention on International Civil Aviation, Regulation (EU) No 996/2010[2] and Statutory Instrument No. 460 of 2009[3], safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Accordingly, it is inappropriate that AAIU Reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

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[1] **Annex 13**: International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.
[2] **Regulation (EU) No 996/2010** of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.
[3] **Statutory Instrument (SI) No. 460 of 2009**: Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulations 2009.

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In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 and the provisions of SI 460 of 2009, the Chief Inspector of Air Accidents on 2 November 2015 appointed Mr Paul Farrell as the Investigator-in-Charge to carry out an Investigation into this Incident and prepare a Report.

Aircraft Type and Registration:	**Boeing 737-8AS, EI-ESZ**	
No. and Type of Engines:	**2 x CFM56-7B**	
Aircraft Serial Number:	**34996**	
Year of Manufacture:	**2011**	
Date and Time (UTC)[4]:	**02 November 2015, 17.48 hrs**	
Location:	**Dublin Airport (EIDW)**	
Type of Operation:	**Commercial Air Transport**	
Persons on Board:	**Crew - 6**	**Passengers - 186**
Injuries:	**Crew - 0**	**Passengers - 0**
Nature of Damage:	**Nil**	
Commander's Licence:	**Airline Transport Pilot Licence (ATPL) issued by the Irish Aviation Authority**	
Commander's Details:	**Male, aged 49 years**	
Commander's Flying Experience:	**7,887 hours, of which 5,793 were on type**	
Notification Source:	**Duty Manager (DM), Dublin Airport Authority (DAA)**	
Information Source:	**Report Form submitted by the Pilot, AAIU Field Investigation**	

[4] **UTC**: Co-ordinated Universal Time. All timings in this report are quoted in UTC, which was co-incident with local time on the date of the event.

SYNOPSIS

Following a scheduled passenger flight, while the Boeing 737 aircraft was manoeuvring onto its parking stand at EIDW, two workers in a worksite behind the aircraft were blown over by jet blast from the aircraft. Both workers suffered bruising injuries as a result.

NOTIFICATION

The DAA DM advised the AAIU Inspector-On-Call (IOC) about the event by telephone shortly after it occurred.

1. FACTUAL INFORMATION

1.1 History of the Flight

The aircraft was on a flight from London Gatwick Airport (EGKK) to EIDW. It landed on Runway (RWY) 10 at EIDW at 17.38 hrs and taxied towards its assigned parking stand (111R). At 17.40 hrs, while the aircraft was taxiing, the right hand engine was shut down. At this time the Auxiliary Power Unit (APU) was started.

At 17.42 hrs the aircraft stopped adjacent to a worksite on the airport ramp, with the longitudinal aircraft axis roughly parallel to the worksite fence. The aircraft remained stationary at this position awaiting the arrival of the Operator's ground personnel to marshal the aircraft onto stand 111R. The Flight Data Recorder (FDR) data showed that the left hand engine N1 tachometer[5] registered 20% at this time.

At 17.48 hrs the left hand N1 tachometer reading increased, peaking at 55%, as the aircraft accelerated up to 8 kts ground speed while it manoeuvred into its final parking position on stand 111R. During this final manoeuvring the aircraft turned to the right. The worksite was then directly behind the aircraft and in the path of its jet blast.

Two workers within the worksite were in the process of reinstating the worksite fence on completion of the day's site works. They were blown backwards into the worksite by the jet blast; six fencing units were also blown into the worksite. One of the workers was initially thought to have suffered significant injuries. Both workers were taken by ambulance to a nearby hospital where examination revealed that neither had suffered any fractures, although both of them had sustained bruising. One worker returned to full duties on the following day. The other returned to light duties three days later and subsequently resumed full duties.

The Investigation was informed by the site contractor that the two workers were wearing the prescribed personal protection equipment (PPE) and were operating in accordance with the Contractor's approved methods statements.

[5] **N1**: The N1 rotor consists of a fan, a low–pressure compressor and a low–pressure turbine. Engine thrust increases with increasing N1 (rotational speed of the N1 rotor), but the relationship is not directly linear. The FDR records N1 values expressed as a percentage of a nominal maximum value. Consequently, while this report only refers to recorded N1 percentages, the higher the N1 value is, the greater the engine thrust will be.

1.2 Operator's Procedures

The Operator's Flight Crew Operations Manual (FCOM), *Taxi Procedures*, states "*Due to the restrictive nature of some of* [The Operator's] *destination aprons, keep breakaway thrust to a minimum. Normally, 30 to 35% N1 is all that is necessary to commence taxi*".

The Operator's Operations Manual contains the following:

> ***Taxi-in***
> *Taxiing comprises a relatively large proportion of engine running time for a short haul operation. While the Boeing 738 is normally taxied on both engines, the shutting down of an engine for taxi to the ramp/gate is acceptable and will generate a considerable fuel saving.*
>
> *Care must be taken to avoid excessive jet blast when taxiing on one engine, particularly if the aircraft has had to stop or when turning at low speed.*

1.3 Jet Blast Velocity Profiles

It is estimated that the workers were approximately 40 metres (m) away from the rear of the aircraft as it was turning. The aircraft manufacturer provided the Investigation with information regarding the engine exhaust velocity profiles for Idle, Breakaway[6] and Take-off thrust settings. The data indicates that at Breakaway thrust (corresponding to 30-35% N1), engine exhaust velocities of 50 miles per hour (mph) will be experienced at a distance of 40 m from the aircraft tail. In this case the FDR recorded a maximum left engine N1 reading of 55% during the time that the aircraft was manoeuvring on to stand 111R.

1.4 Operator's Follow-up Safety Actions

The Operator conducted its own Safety Management System (SMS) investigation into the circumstances of this event. Subsequently, the Operator published Safety Reminders to Flight Crew cautioning about the hazards of jet blast and stressing that, during manoeuvring, minimum power should be used for safety reasons.

The Operator also produced a safety video which was played on its internal Safety TV system. This video, in addition to warning of the general safety hazard posed by jet blast, dealt specifically with the issues associated with the worksite at EIDW where the subject event occurred. The Operator included specific guidance that single engine taxi-in procedures should not be employed when parking on stands adjacent to the EIDW worksite, and that minimum thrust should be used for all breakaway manoeuvres.

1.5 Worksite Safety Management

All construction projects within the manoeuvring area are presented and discussed at the Dublin Airport Operations Planning Group (DAOPG) in advance of, and during, any site works. Operators attend the DAOPG meetings.

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[6] **Breakaway Thrust**: The minimum thrust required to initiate aircraft movement from rest.

The Investigation was provided with copies of DAOPG meeting minutes from 17 June 2015 and 21 October 2015. The aircraft Operator attended both of these meetings and presentations were made at these (and other) meetings regarding the works/worksite. The DAA informed the Investigation that Aerodrome and Airside Ops Notices about the works were issued to all operators, a total circulation of over 480 email addresses from more than 40 companies and agencies.

The DAA provided the Investigation with a copy of the airside risk assessment for the worksite, which identified, inter alia, the jet blast risk. Jet blast was assigned a risk level of "*3C*" which means that the risk severity was deemed to be "*Major*" (C) while the likelihood of the risk occurring was deemed to be "*Remote*" (3). Risk level 3C falls within the "*Tolerable*" region. For Code E[7] aircraft, a jet blast hazard mitigation was specified that "*the Contractor pulls back and adequately covers the work area prior to an* [Code E] *aircraft arriving and pushing back from relevant stands abeam the work site.*" The occurrence aircraft was a Code C aircraft.

Prior to the subject event, there had been one jet blast incident at the worksite; some boundary fencing was knocked over by a Code E aircraft, following which concrete blocks were added to the back of the worksite boundary fencing, and the spacing of these blocks was decreased.

Since the event the DAA has amended the policy for airside construction projects to include the installation of jet blast fence as a pre-cursor to site set up, where a jet blast risk exists. The DAA has ordered 650 m of jet blast fencing which will be made available free of charge to contractors for future projects. A jet blast safety notice was prepared and issued to all operators. Finally, following a request from the Operator, the DAA agreed that it will invite affected operators to attend risk assessments for work that would affect them or their operation.

2. AAIU COMMENT

Exposure to aircraft jet blast is a known and serious hazard when working in and around aircraft. Jet blast velocities increase with engine thrust and for this reason minimum thrust should be used when operating in or near areas where personnel, or equipment, is situated. The Operator recognises the risk and includes a specific mention of it in its FCOM, "*Due to the restrictive nature of some of* [The Operator's] *destination aprons, keep breakaway thrust to a minimum."* The Operator's Operations Manual includes a specific warning which is pertinent to the subject event "*Care must be taken to avoid excessive jet blast when taxiing on one engine, particularly if the aircraft has had to stop".*

[7] **Aircraft Codes**: ICAO defines six Airport Design Group classification codes based on the relative sizes of aircraft. **Code A**, Wingspan < 15m, Gear width < 4.5 m, Typically single engine aircraft, some business jets; **Code B**, Wingspan 15 to < 24m, Gear width 4.5 to < 6 m, Typically Commuter aircraft, Large Business jets (EMB-120, Saab 2000, etc.); **Code C**, Wingspan 24 to < 36 m, Gear width 6 to < 9 m, Typically Medium range transports (B727, B737, MD-80, A320); **Code D**, Wingspan 36 to < 52 m, Gear width 9 to < 14 m, Typically Heavy transports (B757, B767, A300); **Code E**, Wingspan 52 to < 65 m, Gear width 9 to < 14 m, Typically Heavy transport aircraft (Boeing 747, L-1011, MD-11, DC-10); **Code F**, Wingspan 65 to < 80 m, Gear width 14 to < 16 m.

In this case the aircraft was operating at 20% N1 throughout most of its taxiing and during the time it was forced to stop to await the arrival of a marshaller. When the marshaller arrived, the Flight Crew recommenced taxiing, and applied thrust corresponding to 55% N1. Manufacturer's data suggests that the area where the two workers were employed was probably exposed to engine exhaust velocities in excess of 50 mph. Consequently, the exhaust gas velocity behind the aircraft was higher than that which was appropriate when operating in close proximity to the worksite. If the aircraft had been able to continue directly onto stand, the thrust level would have remained in the region of 20% N1 and the jet blast risk would have been minimised. However, once forced to stop, breakaway thrust gave rise to an increased jet blast hazard. The situation was compounded by the fact that the right hand engine had been shut down and the use of left engine thrust in excess of the minimum required to breakaway exacerbated the hazard. In the circumstances, with the aircraft stopped in close proximity to the worksite, it would have been prudent to ensure minimum thrust was used or to consider re-starting the second engine or using a tug to manoeuvre the aircraft onto its stand.

The Investigation notes the steps taken by the Operator to reinforce the safety message around jet blast and to ensure that single engine taxi-in procedures are not employed when parking on stands adjacent to the EIDW worksite. Furthermore, the Investigation notes the procedural changes which the DAA has introduced.

- END -

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

Produced by the Air Accident Investigation Unit

AAIU Reports are available on the Unit website at www.aaiu.ie

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