

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 737-436, G-POWS	
No & Type of Engines:	2 CFM CFM56-3C1 turbofan engines	
Year of Manufacture:	1992 (Serial no: 25853)	
Date & Time (UTC):	18 June 2021 at 1300 hrs	
Location:	London Southend Airport	
Type of Flight:	Commercial Air Transport (Cargo)	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	63 years	
Commander's Flying Experience:	9,800 hours (of which 4,900 were on type) Last 90 days - 165 hours Last 28 days - 40 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

While turning 90° between two narrow taxiways the right main landing gear left the paved surface, causing damage to taxiway infrastructure. The commander attempted to continue by selecting a high power setting but without success. The operator has updated its briefing sheet to raise crew awareness of the threat of a taxiway excursion when taxiing on narrow taxiways. The investigation also identified shortcomings in the operator's handling of the cockpit voice recorder, procedures for which it has now amended. Detail is provided to assist other operators in this area.

History of the flight

Background information

On the morning of the event the crew started their duty at 0340 hrs. They made their own way to Southend Airport to fly a cargo flight to Leipzig and back to Southend. The crew's normal home base was Stansted Airport. There had been inclement weather overnight and the apron was reported to be covered with standing water.

The flight to Leipzig was uneventful. The planned turn-around time in Leipzig was four hours, during which the crew were required to remain on board. Prior to departure, there was a technical issue with the commander's Electronic Horizontal Situation Indicator (EHSI). In consultation with the operator's maintenance engineer by phone, the commander removed all power from the aircraft. When the aircraft was re-powered,

the EHSI was operating normally and there were no fault indications. The flight departed Leipzig ahead of schedule.

Incident flight

The commander was PF and the co-pilot was PM. The flight to Southend was uneventful, although the commander reported a low level of distraction created by the perceived risk of the EHSI failure reoccurring. The cloud base at Southend was reported at 600 ft with a wind from 040° at 9 kt. The crew declined an offer from ATC to land on Runway 23 as the landing performance was more limited. This was due to the reported tailwind and a partially damp runway following earlier rainfall.

The aircraft flew an ILS approach to land on Runway 05. The aircraft was cleared by the ATCO to vacate the runway at Taxiway A and to then taxi via A and Z to hold short of Runway 05 at B1 holding point (Figure 2). The commander had not taxied this way previously and commented to the co-pilot they would be backtracking on the runway to D. The co-pilot had taxied on this route once before and the commander had taxied on several occasions at night in the opposite direction. The normal taxiway routing was via A and C1 before crossing the runway to D parking apron.

While taxiing along Z the aircraft reached a groundspeed of 17 kt, slowing to 8 kt to commence the turn. The commander reported that he did not adopt the procedure for taxiing on narrow taxiways as he was turning onto a wider taxiway and believed he was following the yellow taxi line. He recalled taxiing at a slow speed as all he could see ahead was grass.

While the aircraft was in the right turn onto Taxiway B, ATC cleared it to enter and backtrack Runway 05 to vacate at D. The co-pilot then commented on the aircraft's proximity to the grass at which point the commander believes it had already left the taxiway. The commander stated that the aircraft was still moving slowly and his natural reaction was to increase power in order to return to the taxiway. Simultaneously, ATC asked whether assistance was required but received the response "*I think we can power out*". The commander reported increasing the power but, by the time the engines had spooled up, the aircraft had lost momentum and subsequently came to a stop. ATC instructed the aircraft to hold position and wait for assistance. The crew complied, shut down the engines and secured the aircraft. Figure 1 shows where the aircraft came to rest, with its nosewheel approximately 2 m right of the yellow taxi line.

The fire brigade, aircraft engineers and handlers attended the aircraft in its location between Taxiways B and Z. The cargo was offloaded in situ and the crew were collected by an operations vehicle. Following guidance from the manufacturer, the aircraft was subsequently towed to a hangar and underwent a maintenance inspection. There was no damage found and the aircraft was released to service two days later. The lower portion of two taxiway edge lights - the stalks, frangible couplings and synthetic tripods - were damaged beyond repair, however the light fittings remained serviceable. Some cable ducting along the taxiway edge was damaged and a portion of the taxi edge was reinstated.



Figure 1

Stopped position of the aircraft

Personnel information

The commander and co-pilot both held valid licences and their medicals were in date.

Airport information

Southend Airport has one runway 05/23. The LDA in both directions is 1,604 m and the runway is 36 m wide. The operators Operation's Manual Part A (OMA) defines a narrow runway as any runway with a width less than the standard 45 m. Standard and narrow taxiways are not defined. ICAO Doc 9157¹ lays out the minimum width of a taxiway pavement for a Code C aircraft with a wheelbase less than 18 m is 15 m – applicable to a B737-400 which has an outer main gear wheel span of 6.4 m – with a requirement of 3 m clearance from the outer main gears to the taxiway edge.

Taxiway F has a declared width² of 27 m. The Southend Airport Aeronautical Information Publication (AIP) aerodrome chart (Figure 2) depicts this width continuing through the runway intersection, along B to the B1 holding point, following which the taxiway appears to narrow.

Footnote

¹ International Civil Aviation Organization (ICAO), 2005. *Aerodrome Design Manual Part 2 Taxiway, Aprons and Holding Bays 4th Ed.* Montreal: ICAO.

² From electronic Aeronautical Information Publication (eAIP) available at <https://www.aurora.nats.co.uk/htmlAIP/Publications/2021-09-09-AIRAC/html/index-en-GB.html> [accessed 9 September 2021]



Figure 3

Aerial view of Taxiways B and Z and the representation of approved taxiway width north of B1 (Image from Google Maps)

Taxiway B is depicted as wider than Taxiway Z and of a constant width on both ground charts which were available to the crew (Figures 4a and 4b). However, Taxiway Z has a declared width of 15 m, which is the same as Taxiway B.

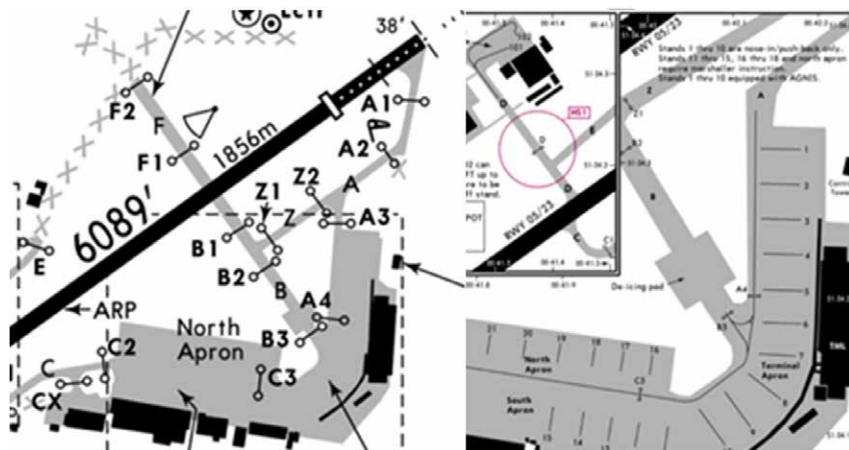


Figure 4a

Figure 4b

Taxiways Z and B intersection – Southend Airport Jeppesen Ground Chart (4a) and Parking Chart (4b)

The commander stated he believed Taxiway B was wider than Taxiway Z both from his assessment of the ground charts and his visual perception when taxiing.

Air Traffic Control

The operator ordinarily parks on the apron north of the runway and accessed by Taxiway D. The crew and ATC both reported that the normal taxi routing from Runway 05 to this parking area would be via A and C before crossing the runway to D.

ATC stated there is no airport restriction on the clearance they can issue for taxi routings. However, it was reported that a B737 from another operator had previously refused to taxi on Z and this was reported to the airport operator.

On this occasion, ATC issued what was described as a non-standard routing based on a preceding aircraft's request to assess weather before departure.

Procedures and manuals

Operations and aircraft manuals

The OMA states that crew of Boeing types are not required to undergo any specific training for narrow runway operations and there is no reference to taxiing on narrow taxiways. The Boeing 737 Classic Flight Crew Training Manual (FCTM) states that pilots should '*consider displacing the aircraft to the far side of the runway or taxiway before initiating the turn*' when making a sharp turn from a runway or wide taxiway to a very narrow taxiway. However, this guidance does not directly apply to this scenario, as the aircraft was turning to a taxiway of the same width and which had the appearance of being wider.

The Civil Aviation Authority's CAP 637³ provides the following guidance:

'At major aerodromes in the UK, the taxiway width is determined to ensure a specified minimum clearance between the outer wheels of the largest aircraft that the taxiway is designed to accommodate and the taxiway edge. The minimum wheel to edge clearance is assured in turns provided that the pilot keeps the 'Cockpit' over the taxiway centreline.'

Based on the guidance in Boeing FCTM and CAP 637, there was no requirement for the crew to adopt a non-standard approach to this taxi routing.

Operator's briefing sheet

London Southend Airport is categorised by the operator as a category B+ aerodrome due to its narrow runway. A company briefing sheet is required for all narrow runway operations and one is published for Southend Airport. The briefing sheet refers to OMA guidance on narrow runway operations. At the time of the event, the briefing sheet required crew to vacate the runway at Taxiway B due to what it refers to as taxiway restrictions of 15 m to the south of the airfield, despite Taxiway B also having an approved width of 15 m. On this flight, the aircraft was instructed by ATC to vacate the runway at Taxiway A.

Footnote

³ Civil Aviation Authority (CAA), 2007. *CAP 637 Visual Aids Handbook, 2nd Ed.* Norwich: TSO.

Use of thrust during ground operations

There is no limitation in the operator's manuals on the use of thrust during ground operations. However, the B737 FCTM states that thrust use during ground operation demands sound judgement and technique.

Crew resource management

The pilots both commented that they had worked effectively together throughout the duty period. The co-pilot stated he felt comfortable to raise any concerns. The co-pilot further stated that he realised the aircraft was close to the grass too late and that he recognised the responsibilities of the PM to call any deviation from the planned flight or taxi path.

Other information

ICAO definition of accident and serious incident

Annex 13 to the Convention on International Civil Aviation⁴ (Annex 13) defines an accident as an occurrence in which an aircraft is missing, inaccessible, or significantly damaged; or in which a person is fatally or seriously injured by, among other things, direct exposure to jet blast. It defines a serious incident as an occurrence involving circumstances indicating that there was a high probability of an accident.

Notification and response

Southend Airport notified the AAIB of the serious incident involving G-POWS at 1553 hrs on the day of the occurrence. The aircraft operator did not notify the AAIB, stating that it did not classify the occurrence as a serious incident.

Based on the information it received, the AAIB determined that a safety investigation was required, and that it was not necessary to attend the scene immediately. The operator was advised and it acknowledged by email that evening that the AAIB was conducting an investigation.

Investigation by the operator

The operator determined from recorded flight data that power settings of up to 86.2% N₁ were applied during the taxiway excursion, the maximum being applied for less than two seconds. Though this did not result in significant damage or injury, the operator considered that the use of high power during the taxiway excursion represented a risk of major accident for which the remaining barriers were not effective, including the risk to people behind the aircraft of exposure to jet blast.

The operator stated that it listened to the cockpit voice recorder following the occurrence. This is prohibited if an investigation has been opened by a State safety investigation authority such as the AAIB, as in this case.

Footnote

⁴ Annex 13 to the Convention on International Civil Aviation - *Aircraft Accident and Incident Investigation*, 12th Ed, July 2020, published by the International Civil Aviation Organization (ICAO), which sets out the standards and recommended practices for aircraft accident inquiries.

Regulations on the disclosure of cockpit recordings

Because of their sensitive nature and importance in safety investigation, cockpit voice and image recordings are accorded a high level of protection internationally.

Note 1 to Appendix 2 of Annex 13 states:

'The disclosure or use of [records listed in Chapter 5.12 of Annex 13, including cockpit voice recordings and airborne image recordings and any transcripts from such recordings], in criminal, civil, administrative, or disciplinary proceedings, or their public disclosure, can have adverse consequences for persons or organizations involved in accidents and incidents, likely causing them or others to be reluctant to cooperate with accident investigation authorities in the future. The determination on disclosure or use required by 5.12 is designed to take account of these matters.'

This is reflected in the legislative scheme in the UK.

Division CAT.GEN.MPA.195 of retained Regulation EU 965/2012⁵ (EU 965) addresses the disclosure of audio recordings from flight recorders:

'(f) Without prejudice to Regulation (EU) No 996/2010⁶ and Regulation (EU) 2016/679 of the European Parliament and of the Council:

(1) Except for ensuring flight recorder serviceability, audio recordings from a flight recorder shall not be disclosed or used unless all of the following conditions are fulfilled:

- (i) a procedure related to the handling of such audio recordings and their transcript is in place*
- (ii) all crew members and maintenance personnel concerned have given their prior consent*
- (iii) such audio recordings are used only for maintaining or improving safety'*

Retained Regulation EU 996/2010 (EU 996) on the investigation and prevention of accidents and incidents in civil aviation addresses the protection and disclosure of cockpit voice recordings in the context of an accident or serious incident investigation conducted in accordance with Annex 13 (an "Annex 13 investigation"). The relevant provisions of EU 965 are explicitly '*without prejudice to*' (and therefore subordinate to) EU 996.

In EU 996, a 'safety investigation' is specifically one carried out by a State safety investigation authority such as the AAIB, and not by any other person or organisation such as an operator.

Footnote

⁵ EU965/2012 CAT.GEN.MPA 195 (f) <https://www.legislation.gov.uk/eur/2012/965/annex/IV/division/SUBPART/section/1/division/CAT.GEN.MPA.195> [accessed on 13 Jan 2022].

⁶ <https://www.gov.uk/government/collections/aaib-regulations-and-mous> [accessed June 2022]

Article 13(2) of EU 996 prohibits removal of or sampling from an aircraft and its contents except for specific purposes in relation to a State safety investigation. Article 13(3) states that any person involved in an accident or serious incident shall take all necessary steps to preserve documents, material and recordings relating to the event, in particular to prevent erasure of recordings of conversations and alarms after the flight.

Article 14(1)(g) of EU 996 specifies that cockpit voice and image recordings shall not be made available or used for purposes other than safety investigation.

Regulation 24 of the Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2018 (the UK Regulations)⁷ states that any person who, without reasonable excuse, contravenes any of the prohibitions in Article 13(2) or fails to take the necessary steps described in Article 13(2) also contravenes the UK Regulations.

Failure to protect sensitive safety information may also be an offence under Regulation 25 of the UK Regulations.

Operator handling of CVR

The operator's safety department stated in email and telephone correspondence with the AAIB, on the day of the occurrence and subsequently, that it was aware the AAIB was conducting an investigation. It also stated that when it accessed the CVR in relation to this occurrence, it did so in accordance with EU 965. It later indicated that it was not sure the AAIB investigation was of a sort that brought EU 996 into force.

Given its own uncertainty, the operator suggested that a description of the circumstances in which it listened to the CVR in this case might help others understand the effect of the regulations. Accordingly:

Operators should note that the prohibitions in EU 996 on the disclosure of protected information are in force for all AAIB investigations, whether or not an AAIB Inspector visits the site of an occurrence and remain in force after the conclusion of its safety investigation.

EU 965 does not permit an operator to use material, such as a CVR recording, that is protected by EU 996. Use of a CVR recording is only permitted in accordance with EU 965 once it is established that no State safety investigation will take place.

The operator's safety department told the crew of G-POWS in written correspondence that it wished to listen to the CVR because the AAIB had asked it to investigate. The AAIB had not asked it to do so. The operator's safety department also told the crew of G-POWS that it wished to interview them to '*ensure all items are covered off for the MOR and the AAIB*' and stated that the information it sought was required for '*the official ICAO Annex 13 report*'. These communications are likely to have given the impression to the crew that the operator was acting on behalf of the AAIB, which was not the case.

Footnote

⁷ <https://www.gov.uk/government/collections/aaib-regulations-and-mous> [accessed June 2022]

The AAIB seeks the information it requires directly from those able to provide it and does not ask operators to act on its behalf. In particular, the AAIB never asks operators to listen to a CVR or interview crew on its behalf.

Process where EU 965 is applicable

In this case, because the AAIB was conducting a safety investigation, the protections of EU 996 were in force and EU 965 could not provide for the operator to listen to the CVR. Had the AAIB not been investigating, the operator would still be prohibited from disclosing or using the audio recordings from the CVR, except under the conditions specified in EU 965.

Guidance documents produced by the operator, in force when it listened to the CVR, did not contain a procedure for the handling of the recording or its transcripts as required by EU 965. The operator subsequently incorporated such a procedure into its manuals, including a consent form which must be signed by all crew members before a CVR recording can be accessed.

Oversight

Regarding the process by which the operator accessed the CVR in this case, the CAA found that the operator was unable to demonstrate an adequately robust procedure for the handling of CVR data following a safety incident. The operator has amended its procedures as described above.

The CAA stated that it has written to the Safety Managers and Nominated Persons for flight operations of all air operator certificate holders, providing additional guidance on the proper handling of cockpit recordings, including on the primacy of EU 996 over EU 965. This guidance specifies that, before listening to a CVR in accordance with EU 965 following an occurrence, operators will seek written confirmation from the AAIB of the status of any safety investigation into that occurrence.

Analysis

Visual illusions

There were several cues which led the pilots to believe the taxiway onto which they were turning was wider than it was. This included the inaccurate ground charts, the operator's briefing sheet and the colour of the taxiway surfaces. This contrasting colour of the taxiways may have exposed the pilots to the irradiation illusion⁸, where a light or bright object appears larger than it is when contrasted with a dark object of the same size. These cues were further compounded by the physical widening of the paved surface beyond the turn, which would have been visible from the flight deck when the aircraft was approaching the turn, perhaps to a greater extent than the narrower portion of Taxiway B.

Footnote

⁸ An optical illusion which is defined by Oxford Reference as '*any visual illusion arising from the fact that light areas of an image tend to appear larger than dark areas*' at <https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100011483> [accessed 9 September 2021]

Use of thrust

Setting a N_1 thrust as high as 87.4%, even if momentary, poses a jet blast risk to other aircraft, vehicles, and personnel in proximity to the aircraft. Foreign object damage caused by high engine thrust can affect airport operations as it relates to airplane structure, flight controls, equipment and personnel.

The commander recalled his instinct to ‘power out’ of the grass, and if the ground had not been sodden following a period of significant rainfall, the wheel may not have become stuck in the soft ground. The crew did not verbalise any consideration given to jet blast, and no operator or manufacturer limit was exceeded. The guidance in the FCTM requiring ‘*sound judgment and technique*’ could be interpreted to allow for the selection of high thrust setting in circumstances where safety is not compromised.

Research carried out by Boeing⁹ indicates that the effect of jet blast can be experienced up to 1,900 ft behind the aircraft, it also details the reduction in the severity from a typical exhaust wake speed of 260 kt at the empennage to between 43 kt – 88 kt beyond 200 ft. The aircraft was positioned 660 ft from the nearest movement area and the crew confirmed they were aware that their position on the airfield was clear of other aircraft movements and apron operation. The company report confirmed the aircraft was still moving, albeit at 1 kt, when the maximum power was set. This suggests the aircraft had some momentum which may have encouraged the crew’s belief that they could resolve the situation by applying more power.

Conclusion

It is probable that the departure of the right main gear from the paved taxiway was due to the crew’s incorrect belief they were turning onto a wider taxiway. A combination of unfamiliarity with the routing, inaccurate charting, visual illusions, and a misleading company briefing sheet are likely to have been contributory factors.

In response to this event, the operator promulgated a memo to aircrew which contained updated text for the company briefing sheet for Southend Airport. An additional paragraph on the threat of a taxiway excursion was added to the briefing sheet, which warns crews to exercise ‘*extreme caution*’ when taxiing from Taxiway B and Taxiway Z. The memo further stated ‘*All B737 Flight Crew shall review ALL of Chapter 2.5 “Ground Operations” from the 737 Classic Flight Crew Training Manual...*’.

Footnote

⁹ https://www.boeing.com/commercial/aeromagazine/aero_06/textonly/s02txt.html [accessed 7 October 2021]