

SERIOUS INCIDENT

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| Aircraft Type and Registration: | Boeing 737-8K5, G-TAWY | |
| No & Type of Engines: | 2 CFM CFM56-7B27E turbofan engines | |
| Year of Manufacture: | 2012 (Serial no: 37246) | |
| Date & Time (UTC): | 9 March 2022 at 0840 hrs | |
| Location: | Manchester Airport | |
| Type of Flight: | Commercial Air Transport (Passenger) | |
| Persons on Board: | Crew - 8 | Passengers - 178 |
| Injuries: | Crew - None | Passengers - None |
| Nature of Damage: | Minor damage to the tail skid and paint damage on the aft drain mast | |
| Commander's Licence: | Airline Transport Pilot's Licence | |
| Commander's Age: | 63 years | |
| Commander's Flying Experience: | 22,000 hours (of which 6,000 were on type) Last 90 days - 62 hours Last 28 days - 20 hours | |
| Information Source: | Aircraft Accident Report Form submitted by the commander and further enquiries by the AAIB | |

Synopsis

During takeoff on a training flight the trainee co-pilot rotated the aircraft too rapidly, causing the aircraft's tail to strike the runway. The co-pilot had experienced several delays during his training which would have made it harder to learn the correct technique. His low experience coupled with a slight crosswind is likely to have exacerbated the situation.

History of the flight

The flight was the fifth line training sector for a new co-pilot¹. It was a scheduled flight from Manchester Airport to Fuerteventura in the Canary Islands. The co-pilot was the pilot flying. The weather conditions in Manchester included a surface wind from 170° at 13 kt giving an 11 kt crosswind on Runway 23R. The wind speed was forecast to increase later in the day.

Prior to the flight the commander and co-pilot discussed the takeoff including the required rotation rate and crosswind technique. Whilst on stand, with the aircraft hydraulics powered, the commander demonstrated, and the co-pilot practiced, the correct control inputs.

Footnote

¹ 'Line training' is training conducted during normal operations under the supervision of an authorised training pilot, to prepare the trainee for normal operations without such supervision.

The start-up and taxi to the runway were uneventful. The crew again discussed the takeoff technique at the holding point, as they waited to depart. Once lined-up on the runway the commander handed control to the co-pilot for the takeoff. The crew had used performance figures for a wet runway, which generated a lower V_1 .

The takeoff roll was normal until V_1 . The co-pilot was concentrating on applying rudder to maintain the centreline; he thought the wind was gusty as he needed to keep adjusting the pressure on the rudder pedals. After V_1 the aircraft started to drift slightly downwind. The commander considered that the gap between V_1 and V_R may not have been appreciated by the co-pilot, as it was greater than he had experienced previously, and it may have caused a degree of surprise and distraction. The co-pilot initiated the rotation at V_R . The commander described the initial rotation as “a bit quick but within the normal and safe range”. However, as the pitch attitude reached approximately 9° , the commander felt the rotation rate increase markedly. He had his hands on the controls and tried to reduce the rate but was unable to prevent the tail striking the runway. Both pilots felt a bump as it did so.

The pilots continued the takeoff and followed their cleared departure routing. There were no adverse indications, and the aircraft was flying normally. Initially the commander intentionally left the landing gear extended to focus on the flight path, but then omitted to retract it until after the flaps were retracted. Once established in the climb the commander contacted the cabin crew to confirm if they had heard anything abnormal on the takeoff. The cabin crew at the back of the aircraft confirmed they had heard “a very big bang” on takeoff.

The commander advised ATC that the aircraft’s tail had struck the runway and they were likely to be returning to Manchester. He declared a PAN and requested they stop the climb at FL100 and take up a suitable hold. Once established in the hold they reviewed what had happened, discussed their options, and consulted the tail strike checklist in the QRH². They decided to return to Manchester for an overweight landing. The commander decided not to depressurise the aircraft, contrary to the QRH, as he felt it was safer to allow the cabin to depressurise normally during the imminent descent³.

The commander briefed the cabin crew for a precautionary landing and made an announcement to the passengers. Once they had completed their briefing the flight crew commenced an approach back to Runway 23R at Manchester. The commander elected to be pilot flying. The subsequent approach and landing were uneventful although the commander did report there was significant windshear just prior to touch down. The aircraft landed at 0921 hrs.

They briefly stopped the aircraft on the runway to speak to the airport fire service and confirm everything was normal, then taxied to stand without further incident.

Footnote

² QRH - Quick Reference Handbook

³ The operator commented that they believe the safest course of action would have been for the commander to complete the QRH tail strike checklist in full.

Once parked on stand, damage was found to the tail skid and the aft drain mast. A later detailed inspection showed that the damage was limited to the crushable cartridge in the tail skid. The tail skid shoe was worn but still within limits for continued operation. The damage to the aft drain mast was only paint damage.

Recorded information

The CVR and FDR were reviewed by the AAIB. Both contained recordings of the incident flight. The CVR was used to support the history of flight above.

The FDR data was used to create Figure 1. The plot shows pitch attitude, pitch rate, control column force, radio altitude and airspeed during the rotation on the incident flight and the aircraft's three previous flights. The plot also shows wind speed and direction and normal acceleration for the incident flight. The data showed the pitch rate peaked at 7.1°/sec and reached a maximum pitch attitude of 13° on the incident flight⁴. Roll inputs are not shown on Figure 1 but the data showed a left roll input, sufficient to deploy the left spoilers, was made as the aircraft started to rotate⁵.

The plot shows a marked difference between the steady pitch rate and control column force on the previous flights and the increasing force and rate on the incident flight.

After takeoff, the landing gear was retracted at 3,500 ft and 247 kt.

Co-pilot's training history

The co-pilot joined the operator in 2019 after obtaining his commercial pilot's licence. He completed a jet orientation course followed by a type rating course with a third-party training organisation. He completed an operator conversion course in March 2020, but his training was then interrupted by public health restrictions associated with the COVID-19 pandemic. He completed refresher training in the simulator followed by base training in the aircraft in July 2021. After a further delay and some additional refresher training in the simulator, his first two line training sectors were completed on 27 January 2022. His third and fourth line training sectors were completed on 7 March. This incident flight occurred two days later, on the co-pilot's fifth sector. He had 15 hours and 40 minutes on type.

The training notes from the co-pilot's first two sectors noted that his rotation rate had been slightly slow and gave guidance to achieve the required 2 to 2.5°/second rate. Notes from his third and fourth sectors mentioned not allowing the rotation to stagnate at 10° and ensuring a continuous rotation to the target 15° attitude.

Footnote

⁴ The Boeing 737 Flight Crew Training Manual states that the tail strike pitch attitude is 11°.

⁵ The Boeing 737 Flight Crew Training Manual crosswind takeoff section states – '*Use of excessive control wheel may cause spoilers to rise which has the effect of reducing tail clearance*'.

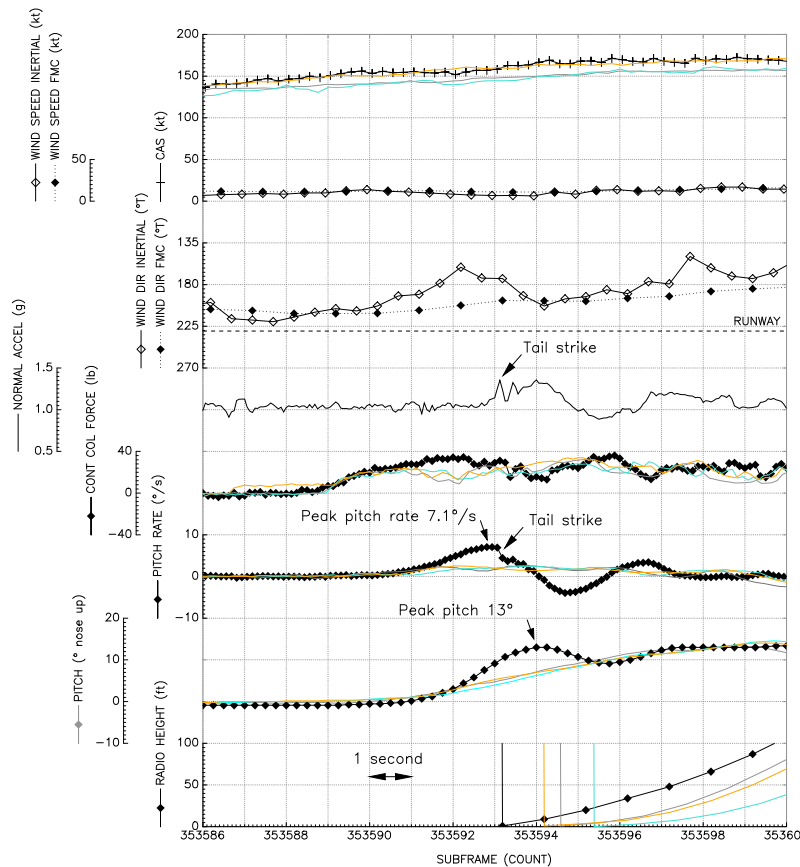


Figure 1

Takeoff plot for the incident flight (black) and the aircraft's three previous flights (grey, orange, and blue) (vertical lines on the radio height scale indicate the lift-off point)

Operator's comments

The operator commented that the training the co-pilot received was compliant with its training policy which, due to the pandemic, required a bespoke training package which was assessed and managed by a training manager. As well as additional simulator time, the co-pilot's training included flying the first ten sectors with a line training captain qualified to a Zero Flight Time (ZFT) standard⁶.

The operator recognised that the delays during his training had not been ideal, but this had been considered when assessing his training need. It is possible that recency was a contributory factor, but the co-pilot had flown two days prior to the incident and his last takeoff and landing prior to the event was at the minimum company standard expected for someone at his stage of training and with his experience. The policy to continue

Footnote

⁶ A Zero Flight Time (ZFT) type rating course allows trainees who meet specified minimum experience requirements to commence line flying without first being required to fly the aircraft without passenger (known as base training). Training captains need additional training to be authorised to supervise the first few line sectors of a pilot undertaking a ZFT course. The co-pilot involved in this incident was not undertaking a ZFT course, as he did not meet the minimum experience standard, and had completed base training.

flight training with an experienced training captain from a long runway was deemed appropriate.

The operator is aware that training pilots in a long body aircraft like the B737-800 poses a tail strike risk and has this risk on its risk register. It provides additional intervention training to training captains. It has also re-emphasised to its training captains the need for caution when conditions are not suitable for low experienced trainees to operate as pilot flying during the takeoff and landing, even if this results in the training objectives for that flight not being achieved. However, the operator noted that the reported wind for this departure was suitable at the time the takeoff run was commenced. It has also taken action to ensure better training continuity.

Average rotation rates are monitored monthly as part of the operator's Safety Management System and there is currently no concern on the overall rotation rates data on the 737 fleet.

Analysis and conclusion

On takeoff, during a line training flight, the trainee co-pilot rotated the aircraft too rapidly causing the aircraft's tail to strike the runway. The trainee had experienced disjointed training due to public health restrictions, which is likely to have made it harder to learn and retain the correct takeoff technique. During his first few sectors on the aircraft, it had been noted that his rotation rate was slightly slow, and he was allowing the rotation to stagnate. It is likely that trying to correct these issues contributed to the rapid rotation rate. The crosswind on the takeoff might have further added to co-pilot's workload.

Bulletin Correction

The following sections of the report have been amended post-publication:

Operator's comments (first paragraph, last sentence)

Original text:

The operator considered this was more than required by the regulations.

The sentence is deleted.

Operator's comments (third paragraph, first sentence)

Original text:

The operator is aware that training low experience pilots in a long body aircraft like the B737-800 poses a tail strike risk and has this risk on its risk register.

Corrected text:

The operator is aware that training pilots in a long body aircraft like the B737-800 poses a tail strike risk and has this risk on its risk register.

The online version of this report was corrected when published on 11 August 2022 and a correction was also published in the October Bulletin.