

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	ERJ 170-200 STD, Embraer 175, G-FBJK
<b>No &amp; Type of Engines:</b>	2 General Electric Co CF34-8E5 Turbofan Engines
<b>Year of Manufacture:</b>	2013 (Serial no: 17000359)
<b>Date &amp; Time (UTC):</b>	11 August 2018 at 0743 hrs
<b>Location:</b>	Dublin Airport, Ireland
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)
<b>Persons on Board:</b>	Crew - 4                      Passengers - 74
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	None
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence
<b>Commander's Age:</b>	43 years
<b>Commander's Flying Experience:</b>	7,900 hours (of which 722 were on type) Last 90 days - 103 hours Last 28 days - 23 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

**Synopsis**

When advised that the takeoff runway had changed the pilots recalculated the takeoff performance from an intersection. This produced a different flap setting, which they did not notice, despite them cross-checking the information. The aircraft subsequently took off with an incorrect flap setting for the calculated takeoff performance data.

The operator is considering three safety actions to strengthen its procedures and prevent recurrence.

**History of the flight**

The aircraft was scheduled to fly from Dublin Airport, Ireland to Cardiff Airport. This was to be the pilots' second of four sectors for the day. The co-pilot was the PF.

During the turnaround, having noted that Runway 28 was in use, the pilots set up the aircraft's Flight Management System (FMS) and Electronic Flight Bag (EFB) for Runway 28. As the load sheet was not yet available, the co-pilot calculated the takeoff performance data on the EFB using an estimated takeoff weight; this was then cross-checked by the commander. The data, which specified FLAP 1 for takeoff, was then entered into the FMS.

When the pilots obtained the departure clearance, ATC specified Runway 10 for departure. The co-pilot recalculated the performance data for Runway 10 using Intersection Echo 7 (E7), as this was the most limiting normal takeoff distance on this runway. However, she inadvertently selected E7 TMP[Temporary]<sup>1</sup> on the EFB, which specified FLAP 4 for takeoff. The EFB was then passed to the commander for cross-checking, during which the dispatcher arrived with the load sheet and load instruction report<sup>2</sup>. The commander noticed a discrepancy with the loading information and discussed it with the dispatcher. Having resolved this, the commander returned to checking the EFB and noticed no anomalies. The data was then entered into the FMS.

While the crew had noticed the takeoff speeds had changed from the Runway 28 calculation, neither noticed that Intersection E7 TMP had been used to perform the calculation, or that it specified FLAP 4. Also, the commander did not crosscheck the EFB-generated speeds and flap setting against the Quick Reference Handbook (QRH), as specified in the operator's standard operating procedures (SOP). Additionally, the co-pilot did not mention she had used Intersection E7 as the basis of the calculations in her departure brief.

The aircraft commenced the takeoff on Runway 10, using the full length, with takeoff speeds for FLAP 4 but with FLAP 1 selected. As the aircraft rotated the co-pilot realised something was wrong when the takeoff speeds annunciated on the Electronic Flight Instrument System's (EFIS) airspeed tape changed colour to amber<sup>3</sup>, the Low Speed Awareness Line<sup>4</sup> (LSAL) appeared and the aircraft felt "sluggish". She therefore flew below the pitch attitude commanded by the flight director, in order to maintain a higher speed than commanded until the aircraft reached about 1,000 ft aal, where the flaps were retracted and the climb continued.

In the initial part of the climb, after the co-pilot had reviewed the performance page, she realised what had happened and brought it to the commander's attention. The aircraft landed at Cardiff without further event and the crew notified the operator of the incident. They were subsequently removed from further flight duties on that day.

## Pilots' comments

### *Commander's comments*

The commander commented that he did not notice FLAP 4 was specified on the EFB, probably because FLAP 1 was usually specified at Dublin due to the runway length. He added that he had difficulty in distinguishing and identifying the important performance data, on the EFB, as it had a similar size and style of font to most of the information on the page (Figure 1). He also noted that, as he was on his fourth consecutive early start, fatigue may have been a contributory factor.

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### Footnote

- <sup>1</sup> The takeoff run available from Intersection E7 TMP on Runway 10 would have been 1,660 m, due to work in progress at the threshold of Runway 28 but was not in use at the time.
- <sup>2</sup> The load instruction report indicates where the baggage is loaded in the aircraft's hold.
- <sup>3</sup> The airspeed tape and takeoff speeds change to amber on the pilots' EFIS when the IAS is approaching a low speed situation.
- <sup>4</sup> The LSAL indicates the aircraft's proximity to its stall speed.

### Co-pilot's comments

The co-pilot commented that the turnaround was busy. She felt she had rushed the performance calculations and did not notice the "TMP" suffix to the Intersection E7 selection.

### Aircraft performance

The EFB specified the following takeoff speeds for Runway 10 from Intersection E7 TMP with FLAP 4:  $V_1$  119 kt,  $V_R$  119 kt,  $V_2$  123 kt (Figure 1).

The correct takeoff speeds, using the full length of Runway 10 with FLAP 1 were:  $V_1$  145 kt,  $V_R$  145 kt,  $V_2$  147 kt.

**EMB175 / CF34-8E5 Takeoff Performance**

**Departure Information**

Flight Number: BEE  
 Aircraft Reg: G-FBJK  
 Departure Airport: DUB  
 Takeoff Runway: 10E7TMP  
 Runway Shortening: 0 m  
 Rwy Shortened from Threshold: No

**Takeoff Configuration**

Actual TOM: 33400 kg  
 Flaps Setting: Optimum  
 ECS: On  
 Anti Ice: Off  
 Power Setting / ATICS: TO-2 / On  
 Takeoff Flight Path: 2nd Segment  
 Brake Configuration: All Op  
 Thrust Reverser: Operative  
 Special Dispatch: Normal  
 MEL Drag Index: 0  
 Forward CG Limited to 16%: Alternate 1

**Engine Failure Procedure**

STD. At 1800 turn LEFT to DUB HP. D114.9 DUB HP:  
 Inbound 270°, RIGHT turn. If VOR/DME DUB U/S: STD.  
 At 1800 turn RIGHT to SORIN HP. SORIN HP:  
 R137.4/D24.6 D111.2 DAP: Inbound 346°, LEFT turn.

**Departure Met Data**

Wind: 120/4 kts  
 Temperature: 12 °C  
 QNH: 1018 hPa  
 Runway Conditions: Dry

**Dublin Data**

TORA: 1660 m Elevation: 242 ft  
 TODA: 1720 m Slope: -0.60 %  
 ASDA: 1660 m No. Obstacles: 0  
 W/C: 4 kts HW  
 X/W: 1 R

**Performance Data**

Performance Max TOM: 35942 kg  
 Performance Limit: Climb  
 Flex Rated Takeoff Flap: 4  
 V1: 119 kts 118 kts Rated R1: 85.98 %  
 VR: 119 kts 118 kts Flex R1: 84.64 %  
 V2: 123 kts 123 kts Flex Temp: 34 °C  
 VFS: 191  
 Acc Alt: 1209 ft

Connection Interrupted  
 Citrix Receiver will try to reconnect for  
 0:47 more minutes.

Buttons: Landing, Reset, Exit

Figure 1

EFB performance data as used by the pilots  
 (Information relevant to the occurrence are highlighted in red boxes for clarity)

### Recorded information

Information obtained by the operator for flight data monitoring purposes showed that the flight departed with FLAP 1 set. The aircraft accelerated along Runway 10 and started to rotate at 133 kt, 12 kt slower than the speed required for FLAP 1. The rotation appeared normal until it stopped at about 10°, with the landing gear still on the runway. Five seconds later the IAS had increased through 145 kts (the correct  $V_R$  with FLAP 1), the aircraft then became airborne and started to climb.

## Cross-checking of takeoff performance

*Operator's operations manual (OM)*

Part B of the operator's OM states:

### ***'Final Preparation***

*It is important that BOTH crew members check the load sheet to confirm it is correct and appropriate for their flight. As a minimum, the following items must be confirmed by both pilots:*

...

*Confirm the EFB performance calculation and, if necessary, amend the takeoff speeds.*

...

### ***CROSS-CHECKING***

...

*It is very important that crews carry out suitable cross-checking of any performance calculation....Finally, the Captain will conduct a gross error check on the Take-off V speeds by use of the performance pages in the QRH,..'*

*EASA regulations*

EASA's AMC [Acceptable Means of Compliance] 20-25, 'Airworthiness and operational consideration for Electronic Flight Bags (EFBs)<sup>5</sup> states:

### ***'F.1.3 Procedures***

*...specific care is needed regarding the crew procedures concerning performance or mass and balance applications:*

- (a) Crew procedures should ensure that calculations are conducted independently by each crew member before data outputs are accepted for use.*
- (b) Crew procedures should ensure that a formal cross-check is made before data outputs are accepted for use. Such cross-checks should utilise the independent calculations described above, together with the output of the same data from other sources on the aircraft.'*

At the time of this event the operator did not require its pilots to calculate takeoff performance data independently, before being cross-checked.

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### Footnote

<sup>5</sup> <https://www.easa.europa.eu/sites/default/files/dfu/2014-001-R-Annex%20II%20-%20AMC%2020-25.pdf> [accessed April 2019].

## Analysis

This serious incident was caused by an ineffective SOP and non-adherence to a SOP. The ineffective SOP was when the commander cross-checked the EFB calculations. The different flap setting was probably missed at this point as he was distracted by a discrepancy with the loading information. The lack of contrast in the size and font on the EFB may have contributed to this.

The pilots did not carry out a gross error check as required by SOPs. Also, had the co-pilot mentioned in her brief that she had calculated the performance data using Intersection E7, it might have drawn their attention to the fact that FLAP 4 was specified.

At the time of the incident it was not a requirement to do independent calculations at the time, as recommended by EASA. However, had the pilots done so, the selected intersection and flap setting would probably have been noticed after they were cross-checked.

The “sluggish” takeoff and low speed awareness cues on the EFIS alerted the co-pilot to the reduced aircraft performance. She responded by reducing the nose-up pitch to below the attitude commanded by the flight director. This allowed the aircraft to accelerate to above the correct  $V_R$  with FLAP 1, before getting airborne safely.

## Safety actions

The operator has taken the following safety actions:

Changed its SOPs on EFB performance calculation procedures, in OM Part A, to align them with the current EASA regulation where both pilots independently calculate the departure performance and cross-check the other pilots, before being accepted for use.

The operator has introduced the use of a takeoff and landing data card on their Embraer 175 fleet. It believes the process of transferring data from the EFB to the card could potentially act as an additional safety barrier.

The operator is considering the following safety action:

Changing the format, font or colour of the calculated takeoff speeds and flap setting on the EFB to make the calculated data stand out differently from the rest of the inputted data.

This change had not been made at the time of publication.