

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Boeing 737-8B6, CN-RGJ	
<b>No &amp; Type of Engines:</b>	2 CFMI CFM56-7B26 turbofan engines	
<b>Year of Manufacture:</b>	2012 (Serial no: 33072)	
<b>Date &amp; Time (UTC):</b>	28 February 2020 at 1133 hrs	
<b>Location:</b>	London Gatwick Airport	
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)	
<b>Persons on Board:</b>	Crew - 6	Passengers - 139
<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>	56 years	
<b>Commander's Flying Experience:</b>	13,479 hours (of which 12,755 were on type) Last 90 days - 128 hours Last 28 days - 47 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the operator and further enquires by the AAIB	

**Synopsis**

During the takeoff roll the "V<sub>1</sub>" automatic call did not occur and the takeoff speeds were not displayed on the Primary Flight Display (PFD). The aircraft rotated 37 kt above the correct speed for this departure and 120 m from the end of the runway. It is likely that the flight crew did not enter speeds into the Flight Management Computer (FMC) or inadvertently deleted them after they had been entered.

The incident shows that automatic calls may not always work as the flight crew expect and they should be ready to respond appropriately.

**History of the flight**

The crew were scheduled to operate a return flight from Casablanca International Airport in Morocco to London Gatwick Airport (Gatwick). The outbound flight to Gatwick was uneventful.

The commander reported that the turnaround at Gatwick proceeded normally and the aircraft pushed back from stand at 1106 hrs. The co-pilot was the pilot flying for the return sector. Runway 26L was in use, with a light southerly wind and rain. The cloud was broken at 900 ft and the temperature was 6°C. The flight crew planned to depart from intersection A, using FLAP 1 and an assumed temperature of 55°C. They had calculated takeoff speeds of V<sub>1</sub> - 144 kt, V<sub>R</sub> - 152 kt, and V<sub>2</sub> - 155 kt. The commander reported that these takeoff

performance figures were loaded into the FMC on stand and no changes were required during the taxi to the runway.

The aircraft entered the runway at intersection A and was cleared for takeoff. At 80 kt the commander confirmed that the airspeed indications were normal and the flight crew were next expecting to hear the aircraft announce “V<sub>1</sub>” but, this automatic call did not occur. When the commander realised the automatic call had not occurred, he checked his PFD and saw the V speed bugs were not displayed on the speed tape. He felt “the aircraft was slow” so he allowed it to accelerate whilst he evaluated the situation. He did not recall if the speeds were still displayed on his Control Display Unit (CDU). As the end of the runway approached, he instructed the co-pilot to initiate a smooth rotation. The aircraft took off and the remainder of the flight proceeded without further incident. No aircraft caution or warning messages were seen at any stage.

The commander reported the lack of the automatic call in the aircraft’s technical log after the flight. Subsequent investigation by the operator did not find any aircraft faults. The automatic calls worked normally on the preceding and subsequent flights.

### Recorded information

The Cockpit Voice Recorder was not downloaded. However, the operator provided a copy of the Quick Access Recorder (QAR) data for the flight.

This showed that the nosewheel lifted off at 189 kt. The aircraft was airborne approximately 120 m prior to the end of the runway at 196 kt and 13 seconds after the planned rotation speed. Figure 1 shows the takeoff roll and highlights key speeds and heights. The data also showed the thrust was slightly increased just prior to the rotation.

The QAR records the assumed temperature and V speeds entered in the FMC, and the Mode Control Panel (MCP) selected speed (which is normally set to V<sub>2</sub> on the ground). However, for the incident flight, the V speeds were blank. The QAR started recording after engine start and the V speeds were blank throughout the taxi and takeoff. The QAR did record an assumed temperature of 55°C<sup>1</sup> and an MCP Selected Speed of 155 kt. The QAR files were checked, by the operator, for the previous and subsequent flights, and V speeds were recorded normally on these flights.

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### Footnote

<sup>1</sup> Most jet aircraft use less than full engine power for takeoff where runway length permits. On the Boeing 737 the takeoff power can be reduced by either entering a temperature above the actual temperature, known as an ‘assumed temperature’ or by using a fixed reduction in power, known as a ‘fixed derate’ or a combination of both.

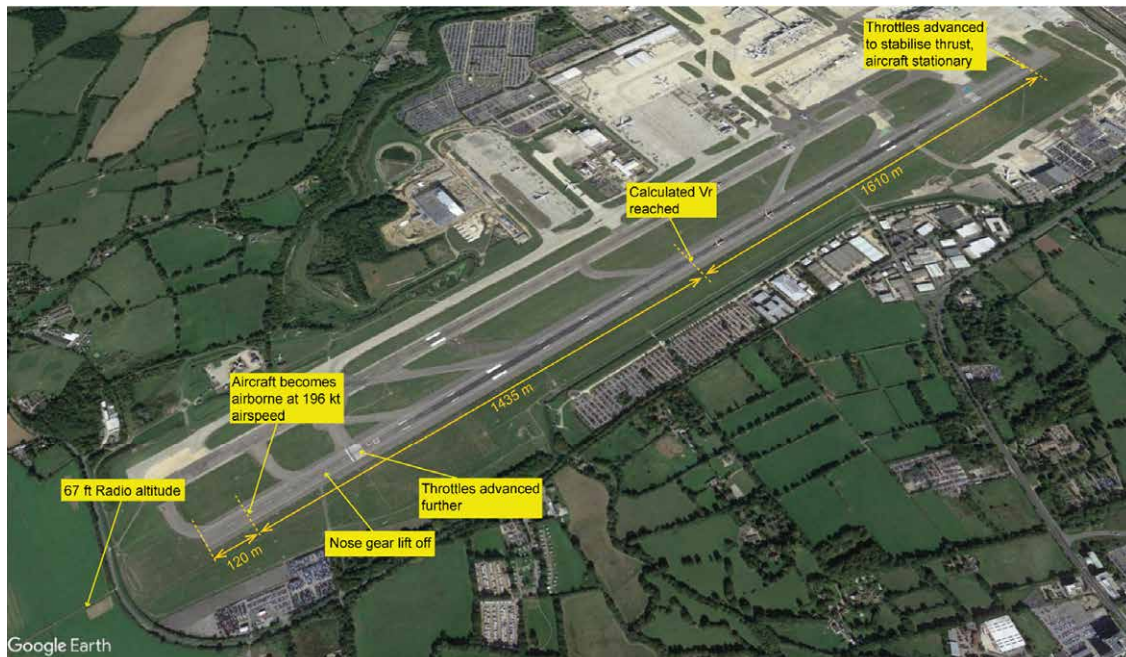


Figure 1

CN-RGJ's takeoff roll showing significant heights and speeds

**Aircraft information**

Takeoff V speeds are normally loaded into the FMC during the preflight procedure after the takeoff performance has been calculated. The procedure requires the crew to enter the aircraft weight, enter any assumed temperature or fixed derate and then enter the planned takeoff flap setting and V speeds. The  $V_2$  speed is then selected on the MCP. The  $V_1$  and  $V_R$  speed are displayed on the speed tape as shown in Figure 2. If the V speeds are not entered a NO VSPD message is displayed in amber on the PFD.

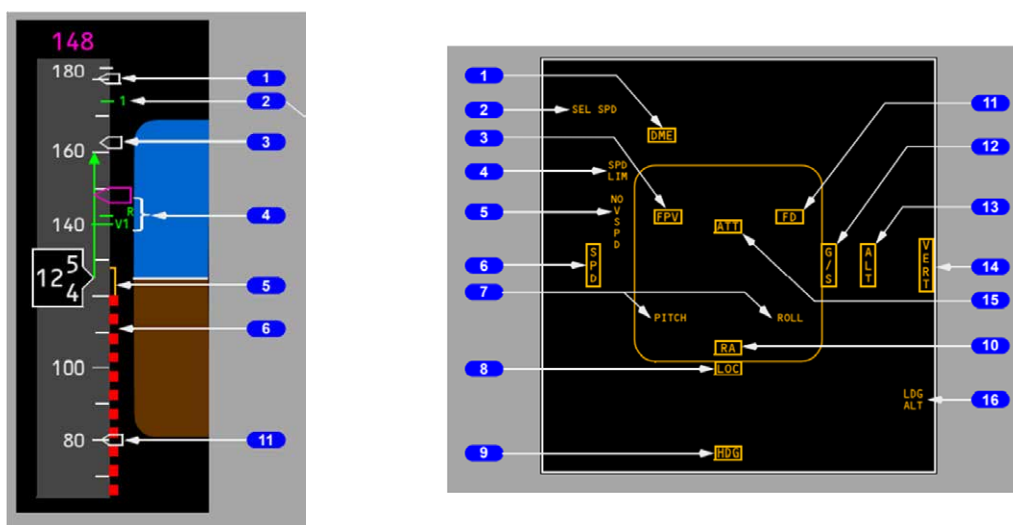


Figure 2

PFD speed tape showing V speeds (label 4) and PFD fail flags showing NO VSPD (label 5)

After the speeds have been entered, if any changes are made to the FMC data (for example, zero fuel weight, takeoff thrust or outside air temperature) the takeoff speeds are automatically deleted. If this happens the FMC will display a message on the CDU, the CDU message light will illuminate, the amber FMC light above the navigation display will illuminate and the NO VSPD message will be displayed on the PFD. The manufacturer stated that it was not aware of any situation in which the V speeds can be deleted without these warnings appearing.

The Boeing 737 Flight Crew Training Manual (FCTM) contains the follow information regarding V speeds:

*'The PF normally displays the takeoff reference page on the CDU. Display of the takeoff reference page allows the crew to have immediate access to V-speeds during takeoff in the event that V-speeds are inadvertently removed from the airspeed display.'*

*'There have been incidents where pilots have missed FMC alerting messages informing them that the takeoff speeds have been deleted or they have forgotten to set the airspeed bugs. If, during a takeoff, the crew discovers that the V speeds are not displayed and there are no other fault indications, the takeoff may be continued. [...] In the absence of displayed V speeds, the PM should announce V1 and VR speeds to the PF at the appropriate times during the takeoff roll. The V2 speed should be displayed on the MCP [Mode Control Panel] and primary airspeed indicators. If neither pilot recalls the correct rotation speed, rotate the airplane 5 to 10 knots before the displayed V2 speed.'*

## Automation

Many commercial aircraft have systems to automatically announce various parameters. These systems tend to be reliable and pilots might fly thousands of hours during which the calls work as expected. It is therefore likely that pilots will expect the system to work and may take time to react if it does not behave as expected<sup>2</sup>.

## Analysis

During the takeoff roll the automatic "V<sub>1</sub>" call did not occur and the commander realised the speed bugs were not displayed on the PFD. As he felt the aircraft was slow and thought it was better to have more airspeed than less, he allowed the aircraft to accelerate whilst he evaluated the situation. The aircraft lifted off the runway 13 seconds after the planned rotate speed with 120 m of runway remaining.

It is likely the automatic call and speed bugs were absent because the V speeds were not present in the FMC. No V speeds were recorded on the QAR which suggests they were not

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### Footnote

<sup>2</sup> Parasuramin, R. and Riley V. (1997) 'Humans and Automation: Use, Misuse, Disuse, Abuse', Human Factor, 39(2), pp 230-253. Available at <https://doi.org/10.1518/001872097778543886> [accessed 29 April 2020].

loaded into the FMC when the engines were started. It is possible that the flight crew did not enter them, but the commander believes that they loaded the FMC correctly. The aircraft weights and the assumed temperature had been entered into the FMC and the MCP speed had been set to  $V_2$ , both of which are part of the same procedure as entering the V speeds. This suggests most of the preflight procedure was completed. It is also possible that the speeds were entered correctly and then inadvertently deleted, but the flight crew did not recall seeing the FMC alerting messages or the NO VSPD message on the PFD. Boeing are not aware of any way to delete the V speeds without these messages appearing.

The FCTM provides guidance on how to manage a lack of automatic calls or loss of speed bugs. However, these systems are normally reliable, so it was not exceptional for the flight crew to take a few seconds to react when the automatic call did not occur. The commander also felt the aircraft was slow and thought it was better to have more speed than less. However, 189 kt is considerably more than the typical rotation speed.

### **Conclusion**

During the takeoff roll, the “ $V_1$ ” automatic call did not occur and the takeoff speeds were not displayed on the PFD. This led to a late rotation.

The incident shows that automatic calls may not always work as the flight crew expect and they should be ready to respond appropriately.