

**Boeing 737,  
EI-GJT**

**In flight from Porto  
Airport, Portugal to  
Edinburgh Airport**

**09 October 2018**

**Serious Incident**

### **Investigation Synopsis**

Shortly after reaching cruise at FL360 the commander's attitude indicator malfunctioned affecting numerous aircraft systems, and the aircraft climbed 600 ft. After a significant time delay an irs caution was displayed. The Quick Reference Handbook (QRH) was followed by the crew and the left Air Data Inertial Reference Unit (ADIRU) was put into ATT mode. The left Primary Flight Display (PFD) continued to display erroneous attitude information to the pilot, and other systems were also affected. The aircraft was flown manually to Edinburgh where it landed safely.

The left Inertial Reference System (IRS) suffered a transient fault in one of its accelerometers which led to an erroneous calculation of position. False position information led to the incorrect attitude information on the commander's PFD, and the autopilot (AP) responded by initiating a slow climb.

One Safety Recommendation is made concerning the Boeing 737 QRH.

### **Safety Recommendation 2019-012**

#### **Justification**

An erroneous acceleration in the left IRS led to erroneous attitude information on the commander's PFD, and pitch and roll comparator annunciations on both PFDs. The QRH gave guidance to clear the IRS FAULT indication but no guidance to resolve the misleading attitude information. Selecting a different source of information for the commander's PFD would have restored valid attitude information.

Therefore, the following safety recommendation was made:

#### **Safety Recommendation 2019-012**

It is recommended that Boeing Commercial Aircraft amend the Boeing 737 Quick Reference Handbook to include a non-normal checklist for situations when pitch and roll comparator annunciations appear on the attitude display.

**Date Safety Recommendation made:** 24 October 2019

#### **LATEST RESPONSE**

**Response received:** 15 December 2022

On 28 July 2022, Boeing updated the AAIB to note that the recommendation, as worded, would not be certifiable under 14 Code of Federal Regulations (CFR) Part 25.1322, Flightcrew Alerting. At the time, Boeing noted that we would review the design of the 737 Air Data Inertial Reference Unit (ADIRU) logic involved in setting the Inertial Reference System fault light, IRS FAULT. We have completed that review and found that no changes are required to the current system architecture for the 737 ADIRU. Separately, Boeing updated the Quick Reference Handbook (QRH) guidance for the IRS FAULT light, as noted in the AAIB's final report for the subject event. This event, and the AAIB's recommendation, will be used to inform Boeing's design decisions for future products.

**Safety Recommendation Status**                      **Closed**

**AAIB Assessment**                                      **Partially Adequate**

**Action Status**                                        **Planned Action Completed**

**Feedback rationale**

The AAIB acknowledges the work Boeing has carried out following this recommendation. Although that work did not lead to a non-normal procedure as recommended, it is noted that relevant guidance has been included in the Quick Reference Handbook and the underlying issue will be used to inform decisions relating to future products.

**RESPONSE HISTORY**

Response received: 29 July 2022

On 27 July 2021, Boeing provided a previous response in which it was noted that the proposed QRH additions for PITCH and ROLL flags on the 737NG Primary Flight Display (PFD) had been approved for incorporation. As the approved changes were finalized for release, Boeing encountered additional challenges when attempting to show compliance of the proposed change to FAR 25.1322, Flightcrew Alerting. As a result, Boeing is evaluating other options to address the recommendation, including further review of the ADIRU logic involved in setting the IRS FAULT light. Boeing will provide a further update on the revised plan by 16 December, 2022.

AAIB Assessment – Adequate Open

Response received: 27 July 2021

On 20 October 2020, Boeing provided a previous response in which it was noted that non-normal procedures for flight crew action in response to PITCH and ROLL comparator annunciations had been drafted and submitted for review. Since that time, the company has formally approved changes to the 737 QRH and is proceeding with final drafts of the checklists to be added.

Boeing will update the AAIB on the QRH change once the final drafts are added to the QRH, or no later than 20 December 2021. Boeing will also provide a copy of the changes to the non-normal checklist upon their release.

AAIB Assessment – Adequate Open

Response received: 30 October 2020

On 31 July 2020, Boeing provided a previous response in which we agreed to provide an update by 30 Oct 2020. Our work to develop additions to the QRH for PITCH and ROLL comparator annunciations has continued and since that time, we have completed drafting of proposed non-normal procedures for flight crew to follow should the PITCH or ROLL comparator annunciations appear during flight. The next step is formal company approval of this change.

We will update the AAIB on the QRH change once a decision has been reached on final approval. Boeing will also provide the AAIB with a copy of any changes to non-normal procedures upon their release.

AAIB Assessment – Adequate Open

Response received: 31 July 2020

Boeing has reviewed the Quick Reference Handbook (QRH) procedures for the 737 and compared the handbook to other Boeing models. We are reviewing the benefits of adding explicit non-normal procedures for flight crew to follow should the PITCH or ROLL comparator annunciations appear during flight. In our review, we have found there may be certification implications regarding the classification of the comparator annunciations (“flags” vs. “alerts”). As a result, additional work is needed to fully understand the certification impacts which may affect deploying new non-normal procedures, as well as potential impacts to external systems.

We will update the AAIB on the QRH change status by October 31, 2020. Boeing will also provide the AAIB with a copy of any changes to non-normal procedures upon their release.

AAIB Assessment – Partially Adequate Open

Response received: 24 April 2020

Boeing has reviewed the Quick Reference Handbook (QRH) procedures for the 737 and compared the handbook to other Boeing models. The current PITCH and ROLL comparator annunciations are classified as flags in our certification documentation. Adding corresponding non-normal procedures to the QRH would require reclassifying the flags as alerts for certification purposes. Boeing is currently reviewing our certification documentation to understand all the potential effects of making the proposed changes.

We will update the AAIB on the QRH change status by July 31, 2020. Boeing will also provide the AAIB with a copy of any changes upon their release.

AAIB Assessment – Partially Adequate Open

Response received: 22 January 2020

Boeing has reviewed the Quick Reference Handbook (QRH) procedures for the 737 and compared the handbook to other Boeing models. We are evaluating whether the recommended change to the QRH is expected to provide a net safety benefit to the 737 fleet.

We will update the AAIB on the Quick Reference Handbook change status by April 30, 2020. Boeing will also provide the AAIB with a copy of any changes upon their release.

AAIB Assessment – Partially Adequate Open

(SRIS Reference: GB.SIA-2019-0010)