

3 November 2021

Scott Warren

Team Leader, Aircraft Systems Investigators
Aviation Engineering Division, AS-40
National Transportation Safety Board
490 L'Enfant Plaza East, SW
Washington, DC 20594NTSB

Subject: BCU PN 90005034-7 SN NOV11-1421 FTI Report Explanation
Meggitt Ref. No.: 495885

Scott,

As noted via email on June 17, 2021, our findings show no faults with the subject BCU 90005034-7 NOV11-1421. The following will explain.

All sections of FTI90005034-7 passed with the exceptions noted below for each of the following tests. Each of these tests create a particular fault condition, and the FTI checks to make sure the fault messages displayed are proper.

4.10.2.1.1

- SEC – Va: Short – 270 W: 13. Antiskid Fail showed on display PC but was not listed in the FTI or the logsheet. - FAIL.

4.10.2.1.2

- SEC – Va: Short – 270 W: 13. Antiskid Fail showed on display PC but was not listed in the FTI (was on logsheet) - FAIL.

4.10.2.1.3

- SEC – Va: Short – 270 W: 13. Antiskid Fail showed on display PC but was not listed in the FTI or the logsheet - FAIL.

4.10.2.1.4

- SEC – Va: Short – 270 W: 13. Antiskid Fail showed on display PC but was not listed in the FTI (was on logsheet) - FAIL.

4.10.2.1.3

- PRI – Exc: Open – 352 F: 23. Lt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.
- SEC – Va: Short – 352 F: 23. Lt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.
- SEC – Va: Open – 352 F: 23. Lt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.
- SEC – Vb: Short – 352 F: 23. Lt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.

4.10.2.1.4

- PRI – Exc: Open – 352 F: 25. Rt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.
- SEC – Va: Short – 352 F: 25. Rt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.
- SEC – Va: Open – 352 F: 25. Rt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.
- SEC – Vb: Short – 352 F: 25. Rt ch-2 LVDT fail showed on display as per FTI and logsheet but the display was intermittent – FAIL.

FTI90005034-7 was later run on another known fully functional (“good”) 90005034-7 BCU. The exact same faults as above occurred. This suggested that the test setup, equipment and documents needed to be examined.

There were 2 areas of focus in our examination of these faults: **Intermittent display** issue and **#13 Antiskid fault**.

Intermittent Display:

MABS engineering had a video conference call to have PUI demonstrate the above faults on the “good” BCU and for general Q&A.

MABS did some testing in our lab and were able to reproduce the exact behaviors seen in the units at PUI - showing the CH1 faults appearing immediately and staying displayed, while the CH2 faults were slightly delayed in being displayed and then were intermittent (slowly displaying on and off) after that.

To dig a little deeper MABS used SPA Vortex software (ARINC data recorder that allows the entire label to be viewed in real time), and it was seen that bits 352-23 and 352-25 communicated from the BCU were set high immediately upon switching CH2 PRIs to open. There was no flickering or intermittency in either of the bits. The CH1 and CH2 LVDT failure bits behaved exactly the same.

It has been determined the issue was a LabVIEW monitor SW communication/timing issue on the CH2 side. Our findings indicate the delayed or intermittent display of the fault is acceptable and should be considered a pass. Work orders are in place to fix the LabVIEW monitor application.

PUI suggested that this intermittency was not noticed in previous 90005034-7 FTIs because once the first display of the fault is observed – it is checked off as a pass and they move on to the next step of the test before the display of that fault became intermittent.

#13 Antiskid Fault:

MABS engineering confirmed that #13 Antiskid Fault is the correct display for those faults listed and was an omission in the text of the FTI document. It was noted that these same faults occur and are properly listed in the FTI and logsheet for the 90005034-8 BCU. MABS engineering is tasked to correct these omissions in the FTI and logsheet for the 90005034-7 BCU.

The supplier indicated they executed the FTI for this investigation exactly in accordance to the wording of the FTI90005034-7. But in previous executions of the FTI, for these 4 tests in question, PUI would have considered the presence of the #13 Antiskid Fault as a “nuisance” fault and if all other conditions of that test were met then it was considered a pass. PUI internal investigation determined that fault #13 was present for all other 90005034-7 units and their FTIs were accepted as passed. Because it was regarded as a nuisance fault there is no record in the FTI report for a given BCU, if #13 Antiskid Fault displayed as it should, or if it did not.

Analysis of the systems software by MABS engineering derived that if the other fault and status words for each of the 4 tests in question were correctly displayed per the FTI, and if the other tests in the FTI that were supposed to display #13 Antiskid Fault did so, then NOT displaying the #13 Antiskid test is not possible. So regardless if the supplier did not note the presence of #13 Antiskid for these 4 tests – all 90005034-7 BCU FTIs would have successfully passed these 4 tests and would have displayed the #13 Antiskid fault.

As noted earlier the only fault found in the NVM pertaining to the landing was a ***Lt whl not turning*** which would have been caused when the park/emergency brake was actuated. The fault message the BCU would have sent to the cockpit for annunciation would have been Antiskid Fault. The fault message in the case of this incident has nothing to do with or correlation to a BCU NOT displaying the #13 Antiskid fault in the 4 pedal tests.

Best regards,

Scott LeHoty
Technical Support Engineering

Meggitt Aircraft Braking Systems (MABS)
1204 Massillon Road
Akron, OH 44306-4186
USA

Office: [REDACTED]
Mobile: [REDACTED]
[REDACTED]

www.meggitt.com