

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

April 11, 2016

Digital Engine Control Unit (DECU)

Specialist's Factual Report
By Sean Payne

1. EVENT SUMMARY

Location: Frisco, Colorado
Date: July 3, 2015
Aircraft: Airbus Helicopter AS 350 B3E
Registration: N390LG
Operator: Air Methods Corporation
NTSB Number: CEN15MA290

2. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following device:

| | |
|----------------------------|------------------------------|
| Device Manufacturer/Model: | Turbomeca/Thales DECU |
| Serial Number: | Unknown |

2.1. Device Description

The Turbomeca/Thales Digital Engine Control Unit (DECU) is an electronic Full Authority Digital Engine Control Unit (FADEC) which regulates the engine's speed and operating parameters by modulating fuel flow based on environmental conditions, torque evolution and use case. The DECU contains two identical control channels, each capable of independently controlling the engine. The DECU can transfer control of the engine from one channel to the other if a channel is not functioning correctly. The unit contains a number of non-volatile memory¹ (NVM) chips that have the ability to retain electronic engine log records and electronic engine log record organization structures.

2.2. Device Condition

Upon arrival at the Vehicle Recorder Laboratory, an examination revealed the unit had sustained significant thermal and impact damage. Figure 1 shows the DECU as received by the laboratory. Figure 2 shows the device after its casing was opened using a rotary cutoff wheel. The unit's two sets of boards were removed from the device and

¹ Non-volatile memory is semiconductor memory that does not require external power for data retention.

photographed. Figure 3 shows the one side of the circuit board sets and figure 4 shows the reverse side. High temperature thermal damage was extensive throughout the device and many electronic chips had shed off their solder locations on their respective boards.

Discussion with the manufacturer led to the identification of a number of non-volatile memory chips potentially containing electronic records. The chips were identified as “MN30” from each set of boards (Figure 5) as well as “MN75” and “MN76” (figure 6) from the same boards.



Figure 1. The DECU as received by the laboratory.



Figure 2. The DECU after its external housing was carefully opened with a cutoff wheel.



Figure 3. Face one of the internal circuitry boards as removed from the device.



Figure 4. Face two of the internal circuitry boards as removed from the device.



Figure 5. "MN30" chips identified and extracted from their respective board sets.

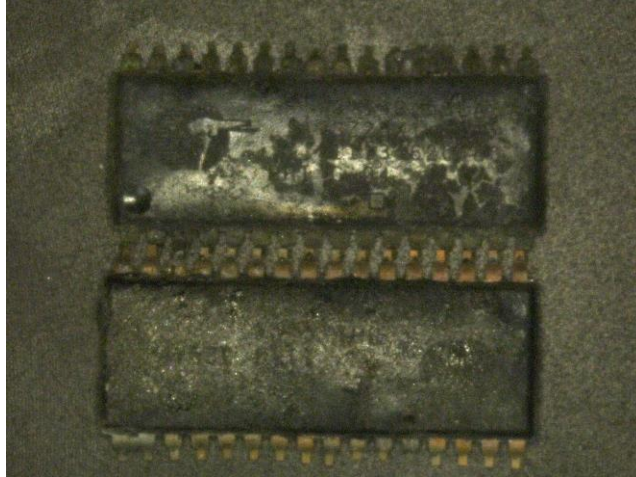


Figure 6. Chips “MN75” and “MN76” as found in the DECU debris packaging.

Additionally, all NVM chips discussed in this report were supplied to the Integrated Electronics Engineering Center (IEEC) at Binghamton University. A report was supplied that characterized the chances of recovery of three of the four chips examined as poor.

One “MN30” chip exhibited potentially zero internal damage; however, the chip contained significant damage to the lead frame structure. The damage was attempted to be corrected in the laboratory, but upon a readout attempt, the chip failed to produce successful readout results.

The IEEC report can be found in the public docket for this accident as Attachment 1 to Onboard Image Recorder Factual Report.

2.3. Data Description

The extent of the damage precluded normal recovery procedures and additional attempts were unsuccessful in yielding usable data. Therefore, no data pertinent to the event were recovered.