

National Transportation Safety Board

Office of Aviation Safety

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ERA23FA352

POWERPLANTS

Group Chair's Factual Report - Attachment #1

BEA Technical Document No. BEA2023-0379_tec01

May 30, 2025

Technical document

Engine Control Units examination

Restricted release to the safety investigation members

Preliminary report

Document ID: **BEA2023-0379_tec01**
Registration number: **N109BC**
Aircraft type: EUROCOPTER - EC135 - T1
Date of occurrence: 28th August 2023
Place of occurrence: Pompano Beach (Florida)
Equipment examined:

ECU_1 Godrich EMC35B P/N: 70EMF01290 S/N: 8ALD0285CE	ECU_2_Dump Godrich EMC35B P/N: 70EMF01290 S/N: 8ALD0258CE
	ERA23FA352_AT28C6 4 (No 2-SN 8ALD0258CE).bin SHA256: <i>bc521374c2bfe7b631ea3e b640ee83276add22b0cfe0f f25409ea9d50c4c0070</i>

The ECU (Engine Control Unit) is a single module computer performing fuel regulation and engine parameters management. Eight maintenance blocks associated with parameters, can be stored in a non-volatile memory component for maintenance purposes.

Each block is dated with:

- the total flight time of the ECU (in hours)
- the time since power-on of the ECU (in seconds)

As it is a 8 blocks rolling memory, when a new block is created, it overwrites the former block (First In First Out logic).

Work performed:

- **ECU_1**

The ECU was visually examined. Evidence of thermal damages were observed on the external casing. The connectors and their pins were in good condition. A small bump was observed on the upper part of the casing.

The lower part of the casing was opened. The visible parts of the electronics boards were in good condition. No trace of heat was found. To prevent any additional damage on the ECU, only the CPU board (which contains the memory component) was removed from the computer for visual examination under magnification. The board and its components were in good condition. As it was not possible to dismantle all the boards without risking damaging the computer, an X ray examination was performed. It was noticed that two components were partially unsoldered from one of the electronic boards.



Figure 1 : Partially unsoldered components on ECU_1

• ECU_2_Dump

The dump of the memory component (referenced AT28C64) was performed by the NTSB and the raw data was shared with the BEA. The following 8ko file was received:

ERA23FA352_AT28C64 (No 2-SN 8ALD0258CE).bin

(SHA256: bc521374c2bfe7b631ea3eb640ee83276add22b0cfe0ff25409ea9d50c4c0070)

A preliminary decoding was performed using the BEA dedicated software and the manufacturer's proprietary documentation referenced **NT_1170-2001 Rev 12** and **NT_1171-2001 Rev 2**. The following file was generated: **N109BC_FADEC_2_Maintenance_Blocks.htm**. The decoding was tested and validated using the memory dump from another investigation.

Results:

The data from the ECU_2 was successfully decoded. Among the 8 recorded maintenance blocks, the last 5 (chronologically ranked) corresponded to the same flight.

Block number	EcuTotTime	PowerOnTime	N1	N2	P0	P3	T1	T4	XCP	TRQ	XR	N1Demand	FuelFlowDemand
6	7519.20 h	5 mn 7.00 s	96%	107%	1015 mbar	4 bar	43 °C	881 °C	48%	68%	12 °	73%	42 l.h-1
7	7519.20 h	5 mn 7.00 s	93%	113%	1016 mbar	4 bar	44 °C	888 °C	48%	73%	11 °	55%	40 l.h-1
8	7519.20 h	5 mn 36.00 s	79%	105%	1014 mbar	3 bar	78 °C	1100 °C	48%	81%	12 °	78%	46 l.h-1
1	7519.20 h	5 mn 46.00 s	82%	108%	1016 mbar	3 bar	76 °C	1100 °C	48%	81%	5 °	76%	24 l.h-1
2	7519.20 h	5 mn 47.00 s	78%	104%	1014 mbar	13 bar	15 °C	1100 °C	48%	81%	26 °	85%	78 l.h-1

The following status and failure codes were associated with each of the maintenance blocks:

Maintenance block 6: FLIGHT mode selected Degraded control Loss of redundancy Collective pitch failure External failure (harness or sensor) 28 Volts AIRFRAME failure	Maintenance block 7: FLIGHT mode selected Degraded control Loss of redundancy N2 Trim failure Collective pitch failure External failure (harness or sensor) 28 Volts AIRFRAME failure
Maintenance block 8: FLIGHT mode selected Degraded control Loss of redundancy N2 Trim failure Collective pitch failure T4 failure External failure (harness or sensor) 28 Volts AIRFRAME failure	Maintenance block 1: FLIGHT mode selected Degraded control Loss of redundancy N2 Trim failure Collective pitch failure T4 failure T1 failure External failure (harness or sensor) 28 Volts AIRFRAME failure
Maintenance block 2: FLIGHT mode selected Degraded control Loss of redundancy N2 Trim failure Collective pitch failure T4 failure T1 failure External failure (harness or sensor) 28 Volts AIRFRAME failure P3 Shift or engine flame-out	

These 5 maintenance blocks may correspond the flight of the event as the power on time is consistent with the event.

No OEI¹ blocks were recorded. Even if 2 engines fitted the aircraft, OEI blocks are never recorded on this model of EMC35B so the recording was working as per design for the OEI.

Next steps:

No further examination of the ECU_1 was done at this stage. No data was yet recovered.

As the decoding of the memory dump of ECU_2 was consistent, the BEA suggests proceeding with a chip-off data recovery process on the ECU_1. This would prevent any risk of data corruption while trying to power-up the ECU with damages on the electronic boards.

This step is pending approval of the IIC.

Document shared:

- ECU_2 maintenance blocks : ***N109BC_FADEC_2_Maintenance_Blocks.htm***

¹ One Engine Inoperative