

A close-up, low-angle shot of a helicopter engine, likely an EC135, showing the complex internal components of the compressor section. The engine is mounted on a white structure, and the background is a solid blue color. The image is overlaid with a semi-transparent blue rectangle containing text.

EC135
S/N 0359

Analysis of CPDS
memory dumps

Content

- 1 Description of CPDS recording function
- 2 Analysis of CPDS memory dumps
- 3 Conclusion

1) Description of CPDS recording function

- **Maintenance Mode; accessible only on ground**

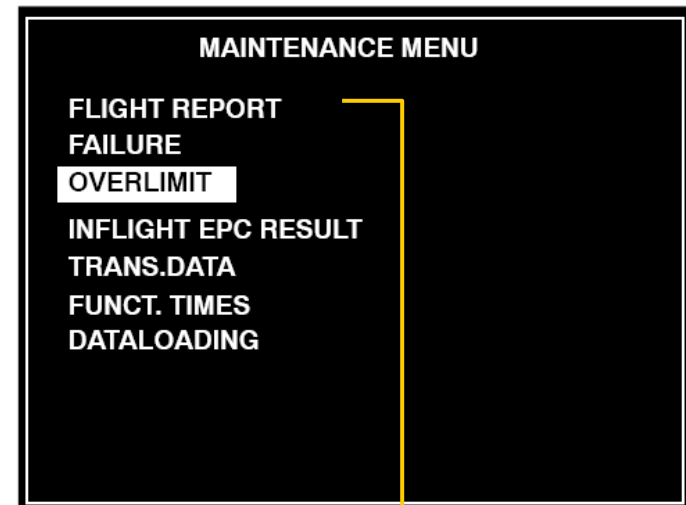
- Recorded data
- Maintenance functions

- **Flight Report History**

- Access to Flight Report Data:
 - Flight Number,
 - Flight Duration,
 - Mast Moment Exceeding,
 - Failure Flags

- **Failure Diagnosis**

- CPDS Failure Recording and Diagnosis



1) Description of CPDS recording function

Flight Number counting:

- One Flight is logged between the Appearance of two consecutive Flight Report Pages
- A Flight Report Page is generated by a transition Flight State → Ground State:
 - Ground State: Both $N1 < 50\%$ and main gearbox oil pressure (XMSN OP) < 1 bar
 - Transition Ground State → Flight State: IF ($N1$ eng. 1 $\geq 50\%$ or $N1$ eng. 2 $> 50\%$) and $XMSN\ OP \geq 1$ bar and collective pitch value $> 28.5\%$
 - Transition Flight State → Ground State: Both $N1 < 50\%$ and $XMSN\ OP < 1$ Bar
- With the transition Flight State → Ground State, a new flight number and the respective memory area is initialized (current flight is “closed” with last update of Flight Report data)

1) Description of CPDS recording function

Failure logging:

- **A failure is logged at the moment of appearance**
 - Flight number
 - Failure code
 - Type of snapshot data form
 - Start time
 - End time
 - System state
- **Snapshot data are recorded, depending on snapshot data form**

2) Analysis of CPDS memory dumps

VEMD1 :

EEPROM4 Flight Report

address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	Flight No	CPDS fail	AFCS / FCDS fail	overlim it yes/no	MM overlimit time in flight 66	MM overlimit value	Flight Time [h]	Flight Time [min]	cycles eng 1 N1 total	MM66 cumulat h	MM66 cumulat min	MM78 cumulat h	MM78 cumulat min
4980	4	34	0e	6f	0	1e	3f	ba	1	7e	a0	ec	1	2b	fd	e5	1	2b	e2	c0	0	3c	0	3e	0	86	0	86	0	0	0	0	1076	Yes	No	No	0	00	0	30	39923	0	5	0	5
0049a0	0	0	9b	f3	0	3	c4	f2	0	1	a5	60	0	9	d0	cf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													
0049c0	0	0	0	0	0	0	4	b9	0	0	2	a5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													
490F+01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													
004a00	4	35	7	ff	0	1e	3f	ba	1	7e	16	7d	1	2c	4d	df	1	2c	32	6b	0	0	0	0	0	0	0	0	0	0	0	0	1077	Yes	No	No	0	00	0	17	39923	0	5	0	5
004a20	0	0	9b	f3	0	3	c4	f2	0	1	a5	60	0	9	d0	cf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													
004a40	0	0	0	0	0	0	4	b9	0	0	2	a5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													
004a60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													

EEPROM3 Failure log

Failure Record	address	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	Flight No	Fail Code	fail form	Start Time [h]	Start Time [min]	EndTime [h]	End Time [min]
111	002dc0	4	33	6d	0	0	0	0	0	0	0c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1075	109	00	0	0	0	0
112	002de0	4	33	6d	0	0	0	0	0	0	0c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1075	109	00	0	0	0	0
113	2,00E+00	4	34	6d	0	0	0	0	0	0	0c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1076	109	00	0	0	0	0
114	2,00E+20	4	35	6d	0	0	0	0	0	0	0c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1077	109	00	0	0	0	0
115	2,00E+40	4	35	99	0	0	0	0	0a	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1077	153	00	0	0	0	0
116	2,00E+60	4	35	99	0	0	0	0	0a	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1077	153	00	0	0	0	0

Failures were recorded during power up test before flight

3) Analysis of CPDS memory dumps

VEMD 2:

EEPROM4 Flight Report

[illegible]

EEPROM3Failure log

address																																				Flight N	Fail Code	fail form	Start Time [h]	Start Time [min]	EndTime [h]	End Time [min]
3360	4	34	6d	0	0	0	0	0	0	0c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1076	109	00	0	0	0	0	
3380	4	34	6d	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1076	109	00	0	0	0	0	
0033a0	4	35	6d	0	0	0	0	0	0	0c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1077	109	00	0	0	0	0	
0033c0	4	35	99	0	0	0	0	0	0a	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1077	153	00	0	0	0	0	
3,30E+01	4	35	99	0	0	0	0	0	0a	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1077	153	00	0	0	0	0	

Failures were recorded during power up test before flight

3) Analysis of CPDS memory dumps

VEMD Failure Codes

Failure Code	Test name	Failure Description	Failure type	Possible Failure sources
109	TEST_MMO	Test Mast moment	external	MM device or Wiring VEMD Mast moment test output -> MM device or Wiring MM device-> VEMD
153	CROSS_FLI	Dissimilarity check between FLI value computed by a module and value received through the crosstalk	internal	VEMD

3) Analysis of CPDS memory dumps

CAD:

EEPROM1

CAD P/N and S/N

address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	P/N	S/N
0x500000+	0	36	7b	c5	72	0b	e9	23	44	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	43	31	39	32	34	33	42	43	4	24	ff	ff	C 1 9 2 4 3 B C	1060



3) Analysis of CPDS memory dumps

CAD:

EEPROM3 Misc Data

address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	Last Flight No
2000	4	35	0	64	f9	29	0	0	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	1077
2020	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff	

EEPROM4 Failure records

address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	Flight No	Fail Code	fail form	Start Time [h]	Start Time [min]	End Time [h]	End Time [min]
6140	ff	ff	e5	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65535	229	00	0	0	0	0
6160	ff	ff	e9	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65535	233	00	0	0	0	0
6180	2	f4	9e	1	0c	72	0	0	0	16	0	0	0	0	0	0	0	c2	92	30	0	fe	7f	13	0d	0	0	0	0	0	0	0	756	158	01	0	26	0	0
0061a0	2	f4	1e	1	0c	72	0	0	0	16	0	0	0	0	0	0	0	bc	0	0	0	fb	99	13	8d	0	0	0	0	0	0	0	756	30	01	0	26	0	0
0061c0	2	f4	61	1	0c	72	0	0	0	16	0	0	0	0	0	0	0	bc	0	0	0	f7	9c	14	58	0	0	0	0	0	0	0	756	97	01	0	26	0	0
6,10E+01	2	f4	0c	0	0c	72	0c	73	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	756	12	00	0	26	0	26
6200	1	fb	1e	1	5	39	5	3c	0	16	0	0	0	0	0	0	0	30	0	bc	0	0	0	f7	9c	0	0	0	0	0	0	0	504	30	01	0	11	0	11
6220																																	504	30	01	0	11	0	11
6240																																	504	97	01	0	11	0	11
6260																																	362	158	01	0	9	0	0
6280																																	362	97	01	0	9	0	0
0062a0																																	411	30	01	0	20	0	0
0062c0	1	9b	9e	1	9	89	0	0	0	16	0	0	0	0	0	0	0	bc	0	bc	0	fa	fb	fa	f3	0	0	0	0	0	0	0	411	158	01	0	20	0	0
6,20E+01	1	9b	61	1	9	8a	0	0	0	16	0	0	0	0	0	0	0	bc	0	bc	0	f7	9c	f7	9c	0	0	0	0	0	0	0	411	97	01	0	20	0	0
6300	1	9b	e1	1	9	8a	0	0	0	16	0	0	0	0	0	0	0	bc	0	bc	0	f7	9c	f7	9c	0	0	0	0	0	0	0	411	225	01	0	20	0	0
6320	1	df	9e	1	8	13	0	0	0	16	0	0	0	0	0	0	0	bc	d2	bc	0	fc	de	fb	e7	0	0	0	0	0	0	0	479	158	01	0	17	0	0

**No failure record written for Flight No. 1077
or corrupted EEPROM data**

4) Conclusion

CPDS:

- The CPDS DATA have been analysed
- The VEMD EEPROM data seem to be consistent:
 - VEMD failure log (FAIL) memory lane 1 and 2
 - VEMD Flight Report (FLIR) memory lane 1 and 2
- The CAD EEPROM data seem to be not consistent or corrupted
 - CAD misc memory (MISC) → OK
 - CAD Failure Record (FLILR) memory → No data recorded or corrupted
- The flight of the accident is identified as Flight number 1077, flight was not “closed” by a transition flight to ground
- The duration of the flight was approx. 17 min
- CPDS failure were recorded (see VEMD 1&2 memory dumps)
- No failure related to FCDS/AFCS was logged