

ERA24LA205

AIRWORTHINESS

Group Chair's Factual Report - Attachment 1

Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA) Technical Document (BEA2024-0134_tec02) for the analysis of the recovered engine data recorder (EDR) data from N413JM

Technical document

EDR dump analysis

Restricted release to the safety investigation members

Document ID: **BEA2024-0134_tec02**
Registration number: **N413JM**
Aircraft type: AEROSPATIALE > AS350 > B3
Date of occurrence: 1st May 2024
Place of occurrence: Plant city, Florida (United States)
Data examined:

Type	EDR dump file
Name	DUMP_ENG53314_9580119130_EDR03328_20240529_142717.dmp
SHA-256	fd15d7961bac9827f0fe239697b8518e4b78389dd41b1fa132f8ad3d017f6f01

The EDR (Engine Data Recorder) is a non-protected recorder that exclusively records data sent by the FADEC, in a non-volatile memory component for maintenance purposes. In case of an accident, the latest data from the FADEC may not be transmitted to the EDR.

For both channels, engine parameters, logical words and failure flags are recorded. Engine parameters are continuously recorded at a sample rate of 1 second (continuous recording) and at a sample rate of 20 ms for a limited duration when a failure occurs (context recording).

The EDR dump file was sent by Safran Helicopter USA to the BEA.

Glossary

- DN : Pedal position
- EDR : Engine Data Recorder
- EPC : Engine Power Check
- FADEC : Full Authority Digital Engine Control
- N1 : Gas generator rotation speed
- N2 : Power turbine rotation speed
- NR : Main rotor rotation speed
- PON : Power-On Number
- T4 : Engine high pressure turbine outlet temperature
- TRQ : Engine torque
- XPA : Yaw pedal potentiometer signal
- XPC : Collective pitch potentiometer signal

Work performed

The dump was converted using the manufacturer dedicated software and converted into CSV files :

- Continuous engine parameters recording channel A : *N413JM - EDR - Continuous A.csv*
- Continuous engine parameters recording channel B : *N413JM - EDR - Continuous B.csv*
- Context recording - engine running - channel A : *N413JM - EDR - Context running A.csv*
- Context recording - engine running - channel B : *N413JM - EDR - Context running B.csv*
- Context recording - engine not running - channel B : *N413JM - EDR - Context not running B.csv*

- Engine power checks¹ : *N413JM - EDR - EPC.csv*
- Overlimits² : *N413JM - EDR - Limits.csv*
- Flags³ : *N413JM - EDR - Flags.csv*

The following data generated an error during the conversion and therefore could not be downloaded:

- Context recording - engine not running - channel A
- EDR error analysis⁴

The duration of the last flight recorded in the continuous records was consistent with the flight duration of the event. Thus, flight of the event was identified as flight number 2885 in the EDR and corresponds to the Power-On Number (PON) 6047.

Results

No failure was recorded during this flight (included in the engine running data).

A subset of the relevant parameters of the continuous and context recordings were plotted (see Appendices)

The report **SafranHE_EDR Data Analysis RA 2024-111_Hillsborough County Sherriffs - N413JM.pdf** from Safran Helicopter has been validated by the BEA.

From the EDR parameters, we observe that the tail rotor potentiometer (XPA) does not move until the end of the flight where the XPA triggering threshold is exceeded during 1 second, reaching the value of 58.82%. This value corresponds to a right pedal position of 74.5% (0% is the full left pedal and 100% is the full right pedal).

The XPA is the EDR parameter traducing the tail rotor pedal position (DN). Nevertheless, the range of operation of this parameter is not complete, for this helicopter the triggering threshold is 50.9804%⁵ (which corresponds to a 68.3% tail rotor pedal position) and the maximum value is 90%. It means that from 0% to 68.3% of the tail rotor pedal position, the recorded XPA will remain steady and at the same value of 50.9804%. Then, an increase of the pedal position up to 100% (full right pedal position) will be recorded by the XPA signal up to a corresponding value of 90%.

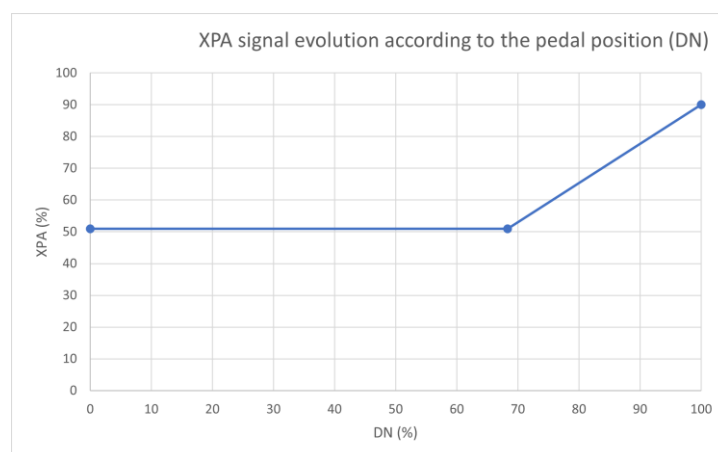


Figure 1 : XPA signal evolution according to the pedal position

¹ List of tests performed in flight to check the engine health according to the maintenance and flight manuals.

² List of limits overstepping recorded, related to engine limitations which are specified in the engine installation/operating manual.

³ List of failures related to the engine recorded.

⁴ List of internal EDR errors

⁵ The thresholds of XPA and DN can slightly differ between helicopters depending on the helicopter settings.

For this event, considering helicopter weight, temperature and pressure altitude at the time of the event, the DN corresponding to a hover flight (stationary) was about 67%, which is below the DN threshold of 68.3%. It is the reason why the XPA signal remained steady at the threshold value of 50.9804% during most of this flight.

Therefore, if the aircraft started to engage a left side rotation as reported by pilot with an increasing left spinning speed (2 or 3 left side complete rotations reported), there is no sign on XPA evolution showing a sufficient pilot reaction to counter the rotation (using right pedal, which was not fully extended to the right).

In addition, at around 00:20:50 of EDR flight time, a significant increase of the torque and XPC (signal linked to the collective stick position) is observed and is followed by a quick decreasing of these parameters, which may correspond to the tail rotor impact. In that case, the increase of XPA observed at this moment is likely to be induced by the impact.

Proposed next steps

An analysis of the Vision 1000 data should be performed to confirm the EDR analysis.

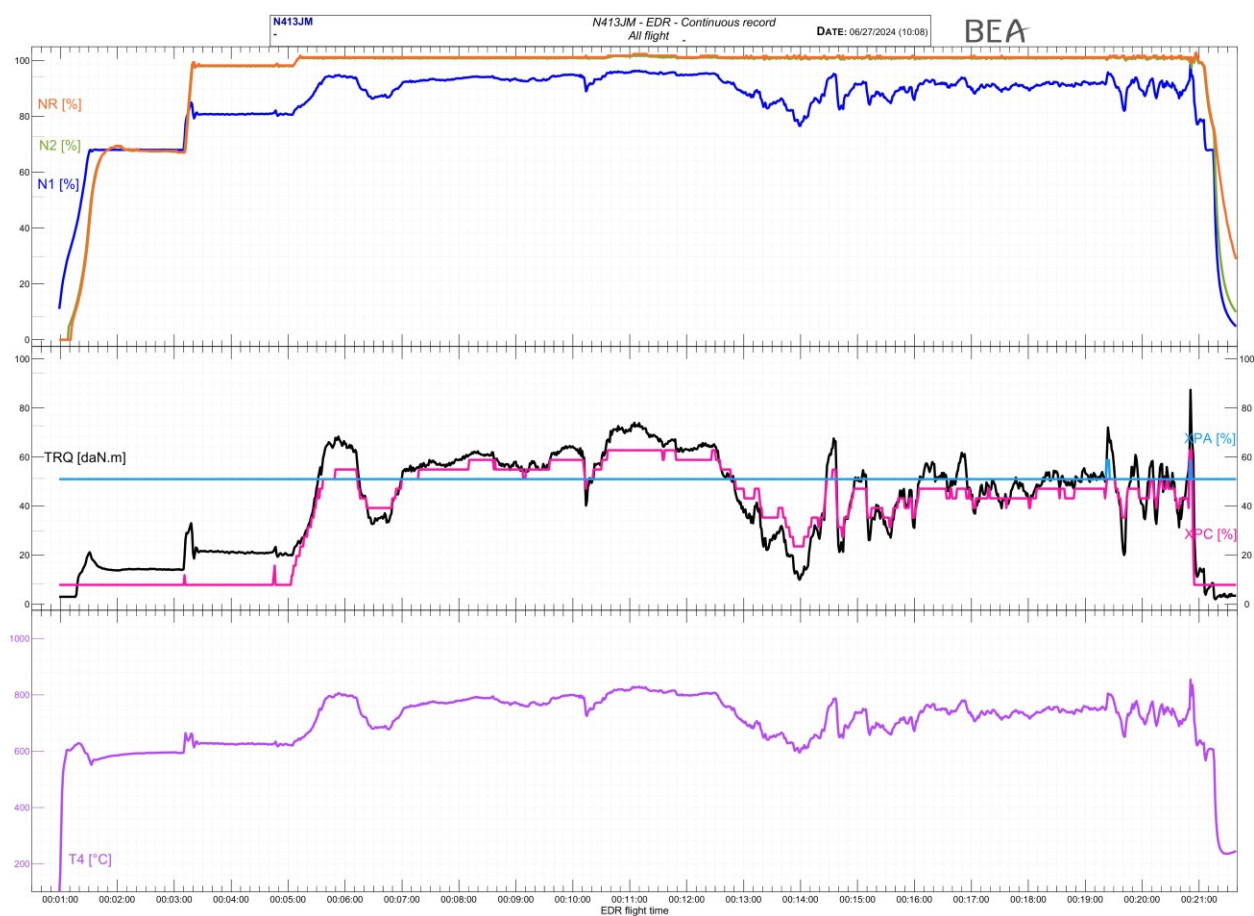
Files shared

Export of the EDR data, in .csv format :

- Continuous engine parameters recording channel A : *N413JM - EDR - Continuous A.csv*
- Continuous engine parameters recording channel B : *N413JM - EDR - Continuous B.csv*
- Context recording - engine running - channel A : *N413JM - EDR - Context running A.csv*
- Context recording - engine running - channel B : *N413JM - EDR - Context running B.csv*
- Context recording - engine not running - channel B : *N413JM - EDR - Context not running B.csv*
- Engine power checks : *N413JM - EDR - EPC.csv*
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Appendices

EDR complete flight



EDR end of flight

