

National Transportation Safety Board

Office of Research and Engineering

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ELECTRONIC DEVICES - RECORDED FLIGHT DATA

Specialist's Factual Report

March 25, 2024

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A. ACCIDENT

Location: Porter, New York
Date: June 11, 2023
Time: 1506 eastern daylight time (EDT)
1906 coordinated universal time (UTC)
Airplane: Harmon Rocket, N85TP

B. ELECTRONIC DEVICES - RECORDED FLIGHT DATA SPECIALIST

Specialist: Gerald Kawamoto
Electronics Engineer - Recorder Specialist
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

A group was not convened. The NTSB Vehicle Recorder Division received the following electronic devices:

Recorder Manufacturer/Model: Advanced Flight Systems AF-4500
Part Number: AF-4500sEEp
Recorder Serial Number: 61519

Recorder Manufacturer/Model: Dynon EFIS-D10A
Part Number: 100321-000
Recorder Serial Number: 3632

1.0 Advanced Flight Systems AF-4500 Description

The Advanced Flight Systems AF-4500 is a multifunctional liquid crystal display (LCD) capable of displaying aircraft attitude, altitude, heading, navigation, moving map, engine information, and airway and approach databases, depending on options and installation. The units can record dynamic flight information at a pilot selectable interval. The unit records approximately 50 discrete data parameters to the internal non-volatile memory. The time in the units is set by the operator and maintained by an internal lithium-ion battery between power cycles. Displayed and recorded times are from the internal clock on each unit. However, when power is applied and the unit is connected to a GPS, the internal clock will automatically be set to GPS time. Thereafter the clock will advance based on the internal microprocessor. When connected to another Advanced Flight Systems Inc. device, discrete data parameters are shared and recorded (except time).

1.1 Advanced Flight Systems AF-4500 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the device sustained impact damage, as shown in Figure 1, rendering it inoperable. An internal examination revealed the circuit board containing the non-volatile memory was in good condition.¹ The memory board was installed in a functioning lab surrogate, and data were downloaded normally using the manufacturer's procedure.



Figure 1. Front and back of the AF-4500 as received.

1.2 Advanced Flight Systems AF-4500 Recording Description

The data extracted included sessions from March 16, 2023 UTC, through June 11, 2023 UTC. The accident session was the last recording and started at 19:04:06 and ended at 19:07:14 UTC, however the accident event did not appear to be captured. Data recorded to memory concluded as the aircraft appeared to be taking off, and the recording ended shortly after. Data were recorded once every 4 seconds. Table 1 shows AF-4500 parameters included in this report. Not all parameters recorded were validated by the recorder specialist.

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

Table 1. AF-4500 parameters.

Parameter Name (units)	Parameter Description (units)
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
LATITUDE (deg)	Recorded Latitude (degrees)
LONGITUDE (deg)	Recorded Longitude (degrees)
ALTITUDE (ft)	GPS Altitude (feet)
GROUND_SPD (kts)	Averaged derived ground speed (knots)
AIRSPPEED (kts)	Indicated Airspeed (knots)
PITCH (deg)	Pitch Angle (degrees)
ROLL (Deg)	Roll Angle (degrees)
VERTSPEED (fpm)	Vertical Speed (feet per minute)
CHT 1-6 (degF)	Cylinder Head Temperature # (degrees Fahrenheit)
EGT 1-6 (degF)	Exhaust Gas Temperature # (degrees Fahrenheit)
MANIFOLD (inHg)	Manifold Pressure (inches of Mercury)
FUEL_FLOW (gph)	Fuel Flow (gallons per hour)
FUEL_PSI (psi)	Fuel Pressure (pounds per square inch)
HP (%)	Horsepower (percentage)
RPM	Engine Revolutions Per Minute
OIL_PSI (psi)	Oil Pressure (pounds per square inch)
OIL_TEMP (degF)	Oil Temperature (degrees Fahrenheit)

2.0 Dynon EFIS-D10A Description

The Dynon Electronic Flight Information System (EFIS) D10A is a 4-inch cockpit display mounted in non-type certificated (experimental) aircraft. The instrument integrates multiple flight instruments including airspeed, altitude, gyro-stabilized magnetic compass, turn rate, slip/skid ball, bank angle, pitch angle and vertical speed. The unit also has other functions that include a clock/timer, g-meter, voltmeter, and a density altitude/true airspeed calculator. The unit contains an Air Data, Attitude and Heading Reference System (ADAHRS) to provide air data, attitude and heading information to the display. Depending on the installation in the operator's aircraft certain parameters might not be displayed, for example angle-of attack.

The data logging must be configured by the operator to enable logging. No data is stored within units with software below version 5.0. The unit can also be configured to start logging data automatically at boot-up. The data logging interval

can be set to store at 1, 3, 5, 10, 30 and 60 second intervals. The internal memory can store at least 2 hours of cumulative data at a 1 second recording interval or at least 120 hours at a 60 second data recording interval. When the recording limit in the internal memory is reached, the oldest record is erased, and a new record is added.

2.1 Dynon EFIS-D10A Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the device sustained impact damage, as shown in Figure 2, rendering it inoperable. The internal non-volatile memory chip was removed, read out, and attempted to be converted into engineering units using provided documentation from the manufacturer. After examining the contents of the chip image, it was determined that no historical data were present, thus, no accident-related data were recovered.



Figure 2. Dynon EFIS-D10A as received.

D. FIGURES AND TABULAR DATA

Figure 3 is a graphical overlay generated using Google Earth for the accident session. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording. The overlay shows the airplane traveling southwards and increasing groundspeed until it's final data point at 19:07:14 UTC. The reported wreckage location is marked with a red dot.

Figure 4 is a plot of parameters for the accident session. The time shown is 19:02:40 to 19:07:20 UTC.

The corresponding tabular data recovered from the Advanced Flight Systems AF-4500 unit used to create Figure 3 and Figure 4 are provided in electronic CSV format as attachment 1 to this report.

Submitted by:

Gerald Kawamoto
Electronics Engineer - Recorder Specialist



Figure 3. Google Earth overlay of the accident recording. The reported wreckage location is marked with a red dot.

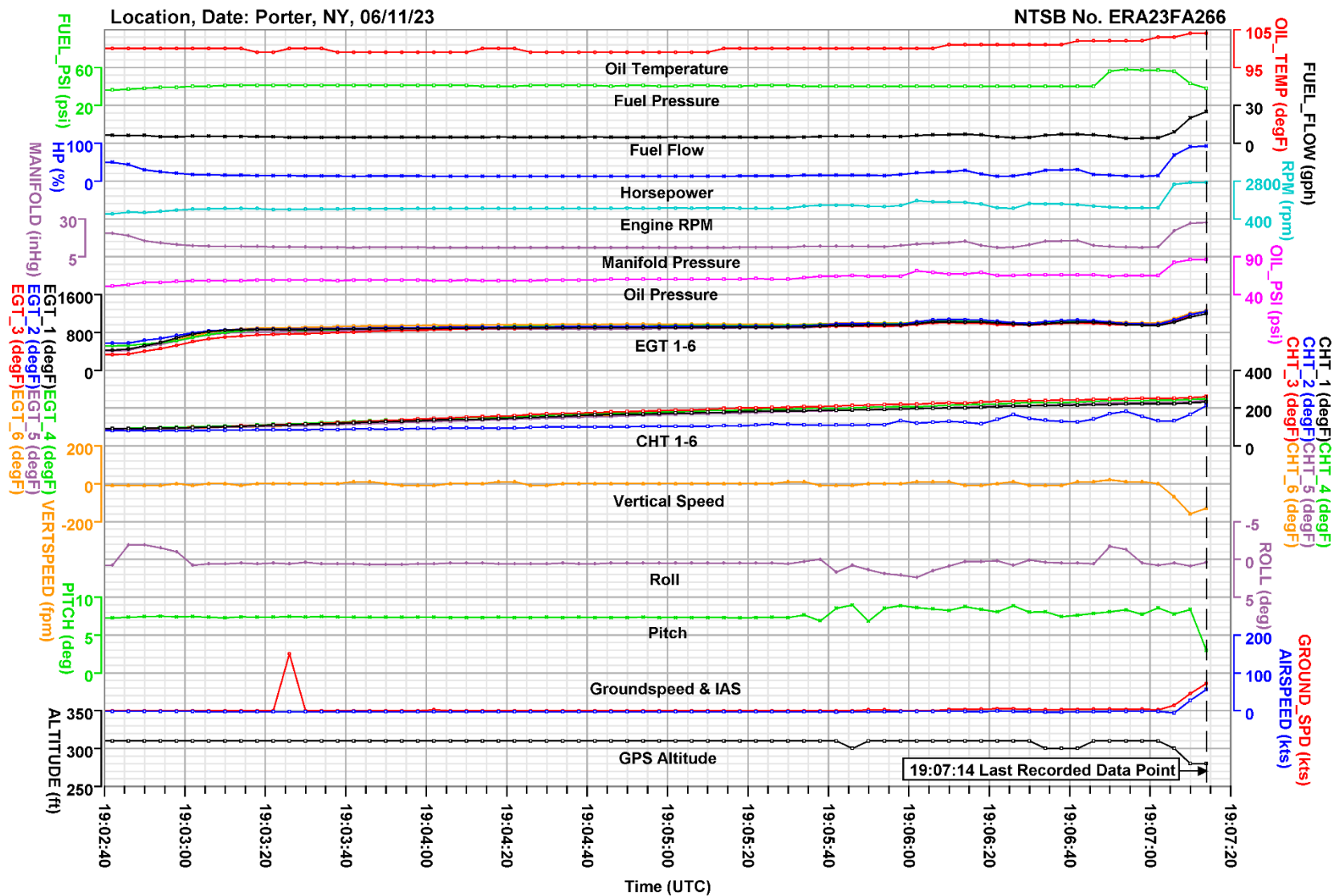


Figure 4. Plot of Advanced Flight Systems AF-4500 parameters.