

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

April 9, 2014

Non-Volatile Memory Devices

Specialist's Factual Report Marie Moler

1. EVENT

Location: Canton, GA
Date: January 4, 2014
Aircraft/ID: FK Lightplanes FK9 / N611SP
Operator: Private
NTSB Number: ERA14LA089

2. DETAILS OF DEVICE INVESTIGATION

The NTSB Vehicle Recorder Division received the following devices:

Device 1: Dynon EFIS-D100
Device 1 Serial Number: 004605

Device 2: Dynon EMS-D120
Device 2 Serial Number: 002902

Both devices were found in good condition. Figure 1 shows the Dynon EFIS-D100 and Figure 2 shows the Dynon EMS-D120. Power was applied to each unit using NTSB laboratory equipment. Device startup was consistent with normal operation. Data was downloaded from both devices using normal methods.

2.1. Dynon EFIS-D100 Device Description

The Dynon EFIS-D100 is a panel-mounted Electronic Flight Instrumentation System (EFIS). The device is capable of displaying EFIS data on a 7" LCD display. Data is stored on *non-volatile* memory. An optional internal battery is capable of operating the unit for a minimum of 1.5 hours when power loss is detected.

2.1.1. Dynon EFIS-D100 Data Description

The data extracted included approximately 194 hours of data. The last 52 minutes and 54 seconds of data was determined to be related to the accident and is included in this report.

2.1.2. Dynon EFIS-D100 Parameters Provided

Table 1 describes data parameters provided by the EFIS device. Dynon products are configured to record the time and date from a connected GPS device. The EFIS-D100

aboard the accident aircraft was not connected to a GPS device, so each time the Dynon was powered on, it began recording the time from 00:00:00.

Table 1: Dynon EMIS-D100 Data Parameters

Parameter Name	Parameter Description
Time	Time in elapsed seconds past the powering on of device
Pitch	Pitch (deg)
Roll	Roll (deg)
Heading	Heading (deg)
Turn rate	Turn rate (deg/s)
Airspeed	Airspeed (m/s)
Altitude	Aircraft Altitude (m)
Vertical speed	Vertical speed (m/s)
Gz	Vertical load factor (g)
OAT	Outside air temperature (degF)

2.2. Dynon EMS-D120 Device Description

The Dynon EMS-D120 is a panel-mounted Engine Monitoring System (EMS). The device is capable of displaying EMS data on a 7" LCD display. Data is stored on *non-volatile* memory.

2.2.1. Dynon EMS-D120 Data Description

The data extracted included approximately 10 hours of data. The last 52 minutes and 55 seconds of data was determined to be related to the accident and are included in this report.

2.2.2. Dynon EMS-D120 Parameters Provided

Table 2 describes data parameters provided by the EMS device. Dynon products are configured to record the time and date from a connected GPS device. The EMS-D120 aboard the accident aircraft was not connected to a GPS device so each time the Dynon was powered on, it began recording the time from 00:00:00.

Table 2: Dynon EMS-D120 Data Parameters

Parameter Name	Parameter Description
Time	Time in elapsed seconds past the powering on of device
Fuel Pressure	Fuel system pressure (psi)
Eng RPM	Engine Speed (rpm)
Fuel Flow	Fuel Flow Rate (gph)
Gals Remaining	Fuel Remaining (gal)
EGT #	Engine Exhaust Gas Temperature - # Indicates Cylinder (degF)
CHT #	Engine Cylinder Head Temperature - # Indicates Cylinder (degF)
Oil press	Oil system pressure (psi)
Man pressure	Manifold pressure (inHg)
Oil temp	Oil temperature (degF)
Rotax cht R/L	Rotax Cylinder Head Temperature Left and Right (degF)

2.3. Time Correlation between Dynon Devices

The Dynon devices could not be time correlated to each other using the GPS time as it was not recorded by either device. However, the devices were powered on and off together for each flight, so the lengths of data sets were compared and correlated. The last flight recorded on the EFIS-D100 device was 52 minutes and 55 seconds long and recorded the aircraft climbing to altitude and then descending. The EFIS-D100 recorded data every 10 seconds on the four second mark (at 4 s, 14 s, 24 s, etc.). All later powering on-s of the device recorded short durations of time (less than 10 minutes) with no changes in altitude. This is consistent with the powering on of the device after it was removed from the aircraft to check that the device was working and to recover data.

The EMS-D120 also had a number of short recordings at the end of the data, but the last long data recording was 52 minutes and 54 seconds and recorded every 10 seconds on the five second mark (at 5 s, 15 s, 25s, etc.). All later powering on-s of the device recorded nonsensical temperature data, consistent with the device not being connected to temperature sensors. This is consistent with the powering on of the device after it was removed from the aircraft to check that the device was working and to recover data.

These last two 52 minute and 54/55 second flights were determined to be of the accident flight. The one second disparity is due to the time when the device marks its first data recording – 4 s for the EFIS-D100 and 5 s for the EMS-120.

3. OVERLAYS AND TABULAR DATA

Figure 3 is a plot of data downloaded from the Dynon devices for the accident flight.

Figure 4 is a plot of data downloaded from the Dynon devices showing detail of the end of the accident flight.

Tabular data used to generate Figure 3 and Figure 4 are included as Attachment 1 (EFIS-D100 data) and Attachment 2 (EMS-D120 data). These attachments are provided in electronic comma-delimited (.CSV) format.



Figure 1: Dynon EFIS-D100 (S/N 004605)

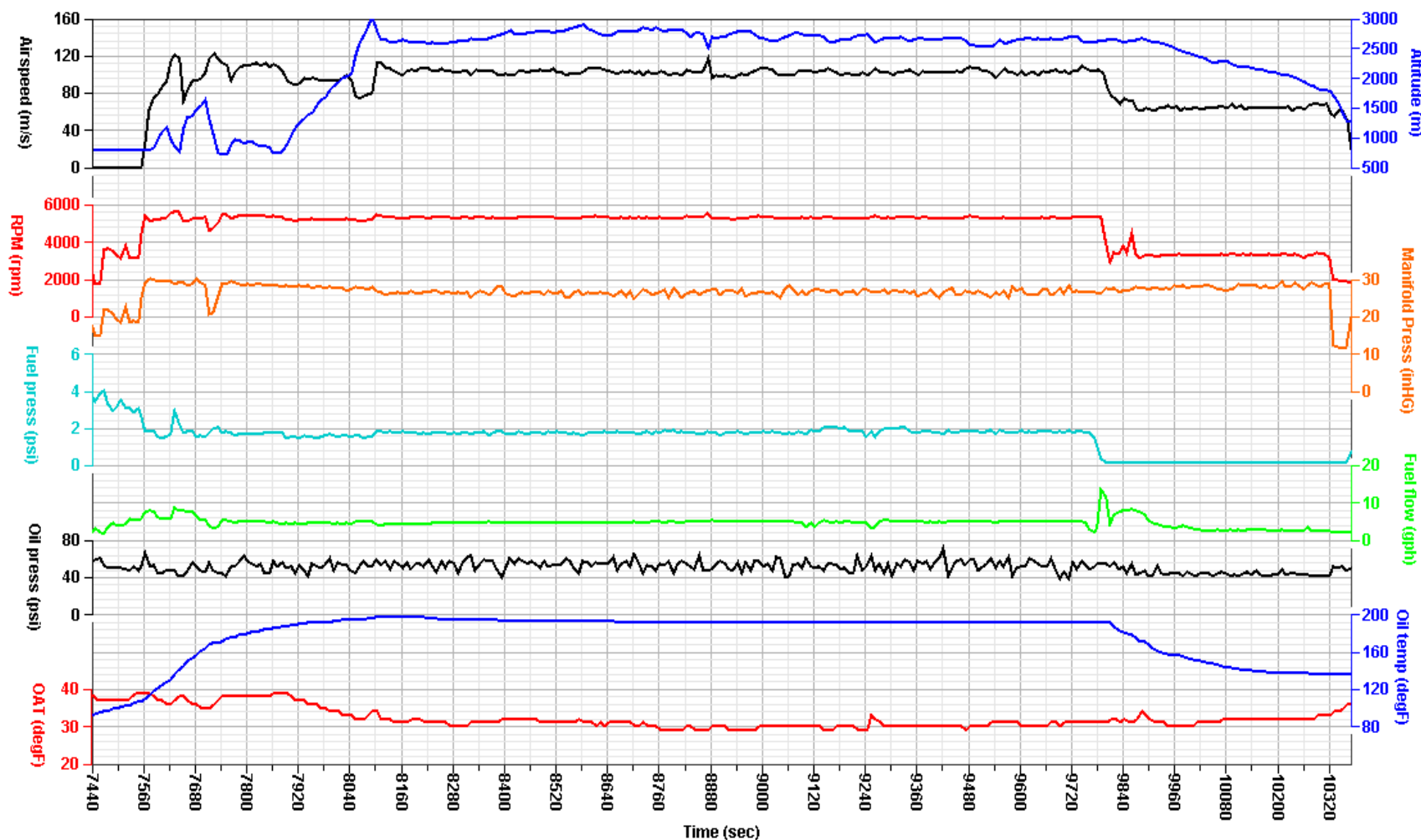


Figure 2: Dynon EMS-D120 (S/N 002902)

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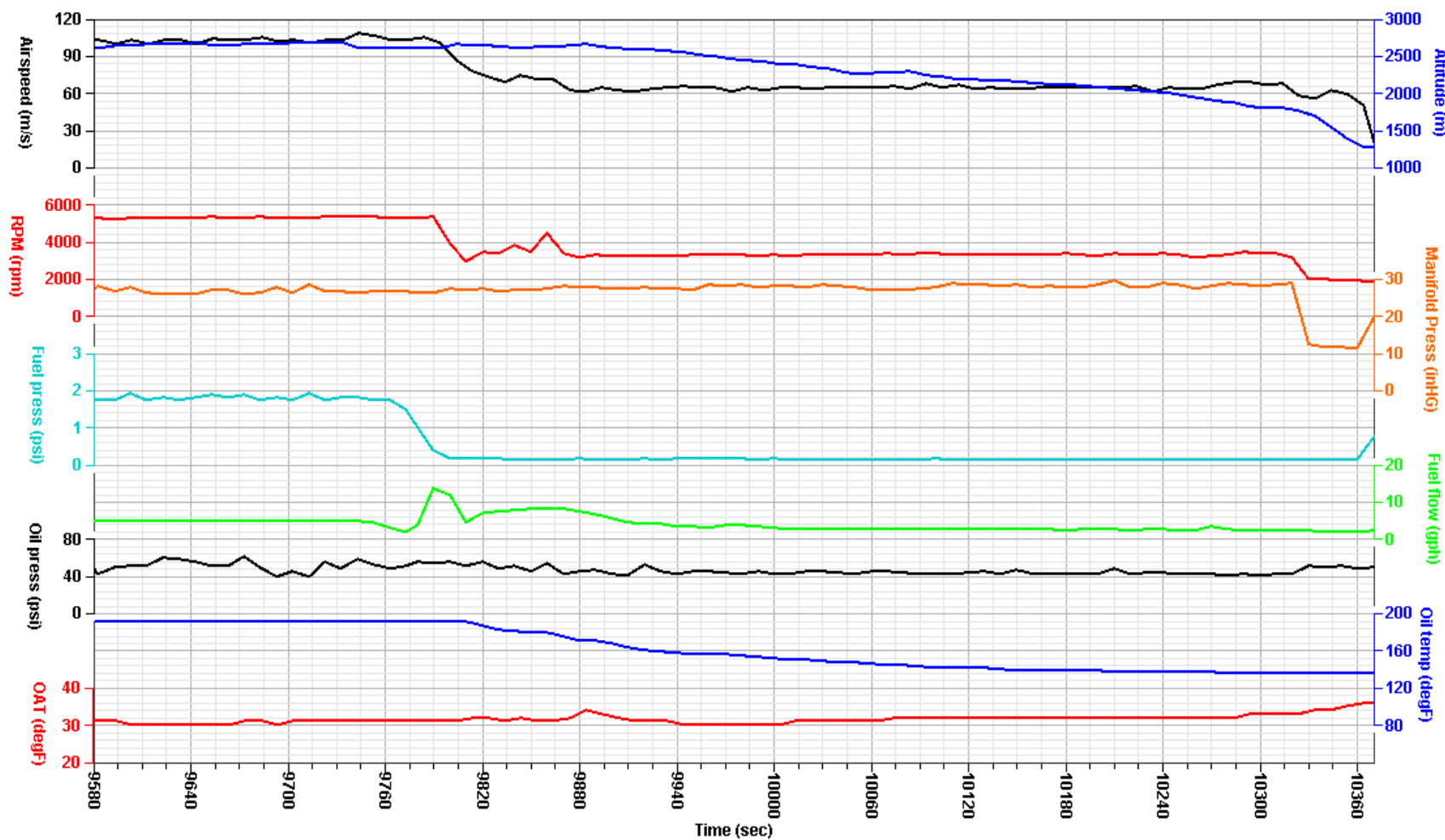
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Figure 3: Plot of Dynon Data from Accident Flight on January 4, 2014

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Figure 4: Detail Plot of Dynon Data from End of Accident Flight on January 4, 2014