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

October 10, 2017

Multiple Electronic Devices

Specialist's Factual Report
by Bill Tuccio, Ph.D.

1. EVENT

Location:	Ocala, Florida
Date:	April 9, 2016
Aircraft:	Mooney M20K
Registration:	N96398
Operator:	Private
NTSB Number:	ERA16FA150

On April 9, 2016, about 0850 eastern daylight time, a Mooney M20K, N96398, was substantially damaged during a forced landing following a loss of engine power after takeoff from Ocala International Airport (OCF), Ocala, Florida. The commercial pilot was fatally injured, and the passenger was seriously injured. Visual meteorological conditions prevailed and no flight plan was filed for the flight intended for Lakeland Regional Airport (LAL), Lakeland, Florida. The personal flight was conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91.

2. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following devices:

Device 1:	Electronics International CGR-30P
Device 1 Serial Number:	155258
Device 2:	Garmin Aera 560
Device 2 Serial Number:	Unknown
Device 3:	Electronics International EDC-33P
Device 3 Serial Number:	155259
Device 4:	Electronics International R-1-6-G30R270
Device 4 Serial Number:	22930
Device 5:	JPI FS-450
Device 5 Serial Number:	2350

The Garmin Aera 560 did not capture the accident flight. Any engine and fuel flow data on the Electronics International EDC-33P and R-1-6-G30R270, as well as the JPI FS-450, did not further inform the engine data from the Electronics International CGR-30P; accordingly, only the Electronics International CGR-30P is considered in this report.

2.1. Electronics International CGR-30P Device Description

The Electronics International CGR-30P is a panel mounted instrument that can monitor and record up to 66 parameters related to engine operations. Depending on the installation engine parameters monitored can include:

- Exhaust Gas Temperature (EGT)
- Cylinder Head Temperature (CHT)
- Turbine Inlet Temperature
- Oil Pressure and Temperature
- Manifold Pressure
- Outside Air Temperature
- Engine Revolutions per Minute
- Fuel Pressure
- Battery Voltage
- Battery Amperage

The unit can also optionally be connected to an external GPS system to provide real time calculation of range and endurance. When connected to an external GPS source, the device can calculate additional fuel management parameters such as Gallons Remaining to Destination and other estimations of fuel usage.

The unit contains an internal non-volatile[1] micro SD[2] card for data storage of the parameters recorded and calculated. The data is stored at a rate of 3 samples per second. The amount of data stored is dependent on the size of the micro SD card installed on the device's internal board. The recording feature will begin to overwrite older flight files when it has stored 1,500 flights. For a non-damaged unit, the data can be downloaded by the operator using a USB flash drive and following the instructions on the unit when accessed from the "USB and Data Recording Screen."

2.1.1. Electronics International CGR-30P Data Description

Data recovered spanned from February 20, 2014, through and including the accident flight on April 9, 2016. Only the accident flight recording was pertinent to this investigation and is included in this report. All times are reported as recorded by the device. Table 1 shows the parameters included in this report.

Table 1. Provided parameters.

Parameter Name	Parameter Description	Units
1. CHT-# (degF)	Cylinder Head Temperature	Degrees Fahrenheit
2. EGT-# (degF)	Exhaust Gas Temperature	Degrees Fahrenheit
3. Fuel Flow (gph)	Fuel Flow	Gallons per Hour
4. Fuel REMAIN (gals)	Fuel Remaining	Gallons
5. Fuel USD (gals)	Fuel Used	Gallons
6. HP (%)	Horsepower	Percent

[1] Non-volatile – electronic memory that does not require power to retain data.
[2] Micro SD – Secure Digital – a non-volatile memory card format.

Parameter Name	Parameter Description	Units
7. MP (inHg)	Manifold Pressure	Inches of Mercury
8. OIL P (psi)	Oil Pressure	Pounds per Square Inch
9. OIL TEMP (degF)	Oil Temperature	Degrees Fahrenheit
10. RPM (RPM)	Engine RPM	Revolutions per Minute
11. TIT (degF)	Turbine Inlet Temperature	Degrees Fahrenheit

Note: # is a number from 1 to 6, indicating the cylinder of measurement.

3. Plots and Tabular Data

Figures 1 through 4 show engine data recorded related to the accident flight. These figures show:

- The recording began at 07:41:04; engine parameters were consistent with the aircraft being operated at idle power on the ground.
- From about 07:48:48 until 07:49:14, the engine RPM was operated at about 1,700 RPM and other parameters also increased; this was consistent with an engine runup.
- At about 07:50:33, RPM increased to about 1,340 RPM.
- Between 07:50:49 and 07:51:04, RPM increased to 2,600 RPM; during this time oil pressure increased from 58 psi to a maximum of 66 psi (07:51:02) and then decreased to 62 psi by 07:51:04.
- At 07:51:04, fuel flow was about 22 gph, horsepower 110%, manifold pressure 36 inHg.
- By 07:51:28, oil pressure decreased to 55 psi, and fuel flow was decreasing through 20.5 gph.
- At 07:51:42, RPM began to decrease, followed 1 second later by a decrease in manifold pressure.
- By 07:51:50, RPM had decreased to 1,410 and fuel flow was 1.8 gph.
- The recording ended at 07:52:10.

By the time the recording ended, the total fuel used was recorded as 0.3 gallons.

Tabular data used to generate these figures are included as attachment 1. This attachment is provided in electronic comma-delimited (*.CSV) format.

Figure 1. Basic engine parameters, entire recording.

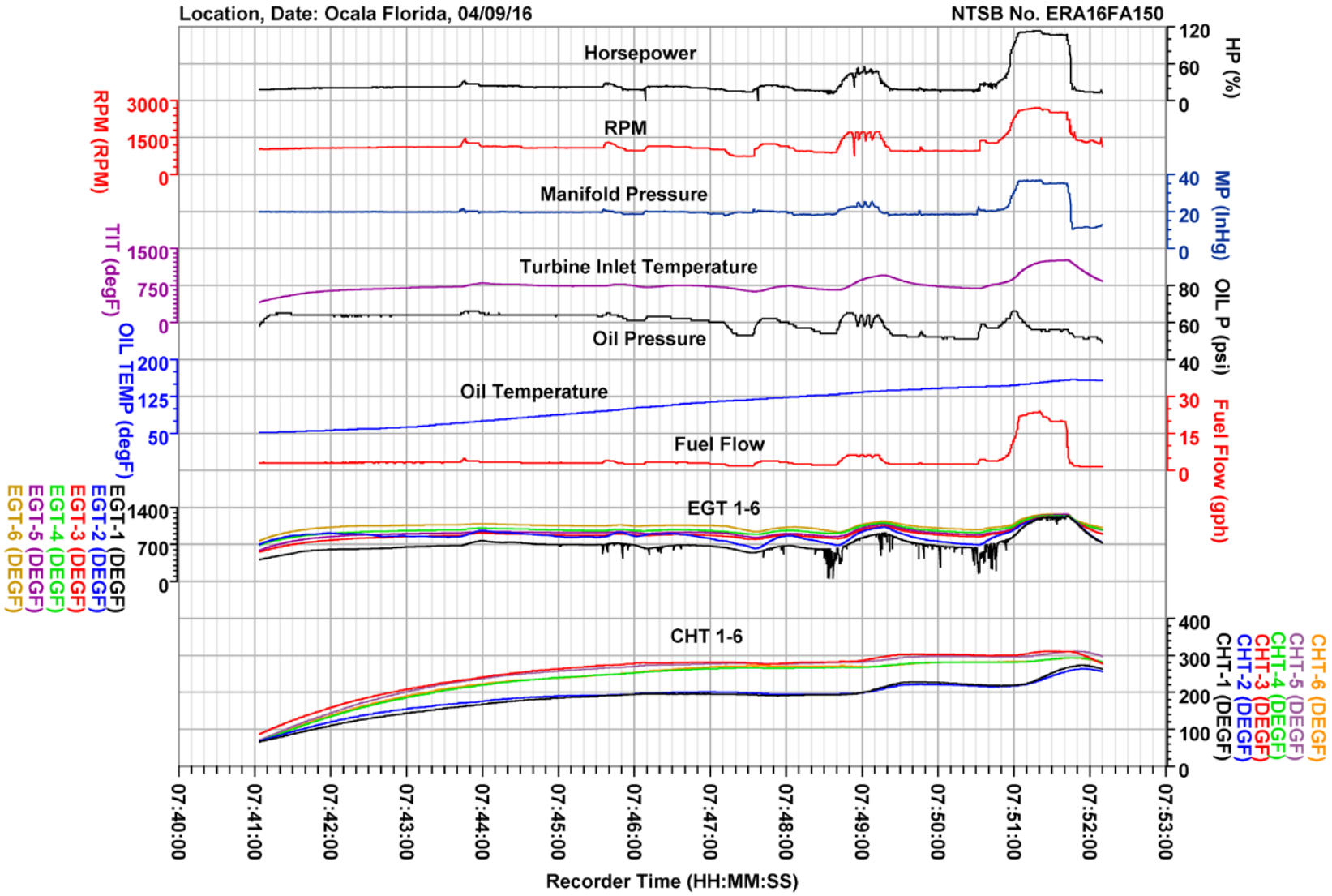

Figure 2. Fuel-related engine parameters, entire recording.

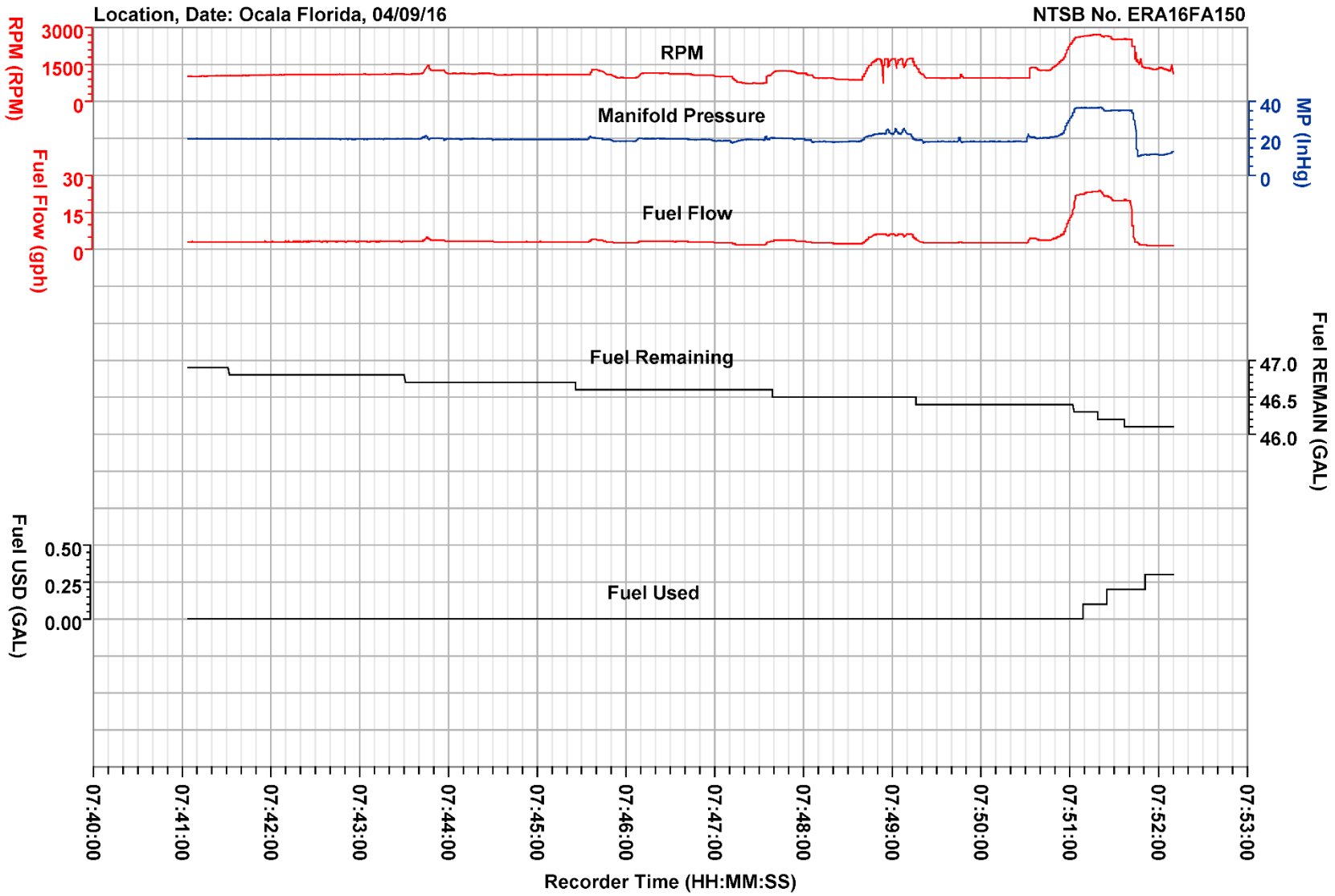

Figure 3. Basic engine parameters, end of recording.

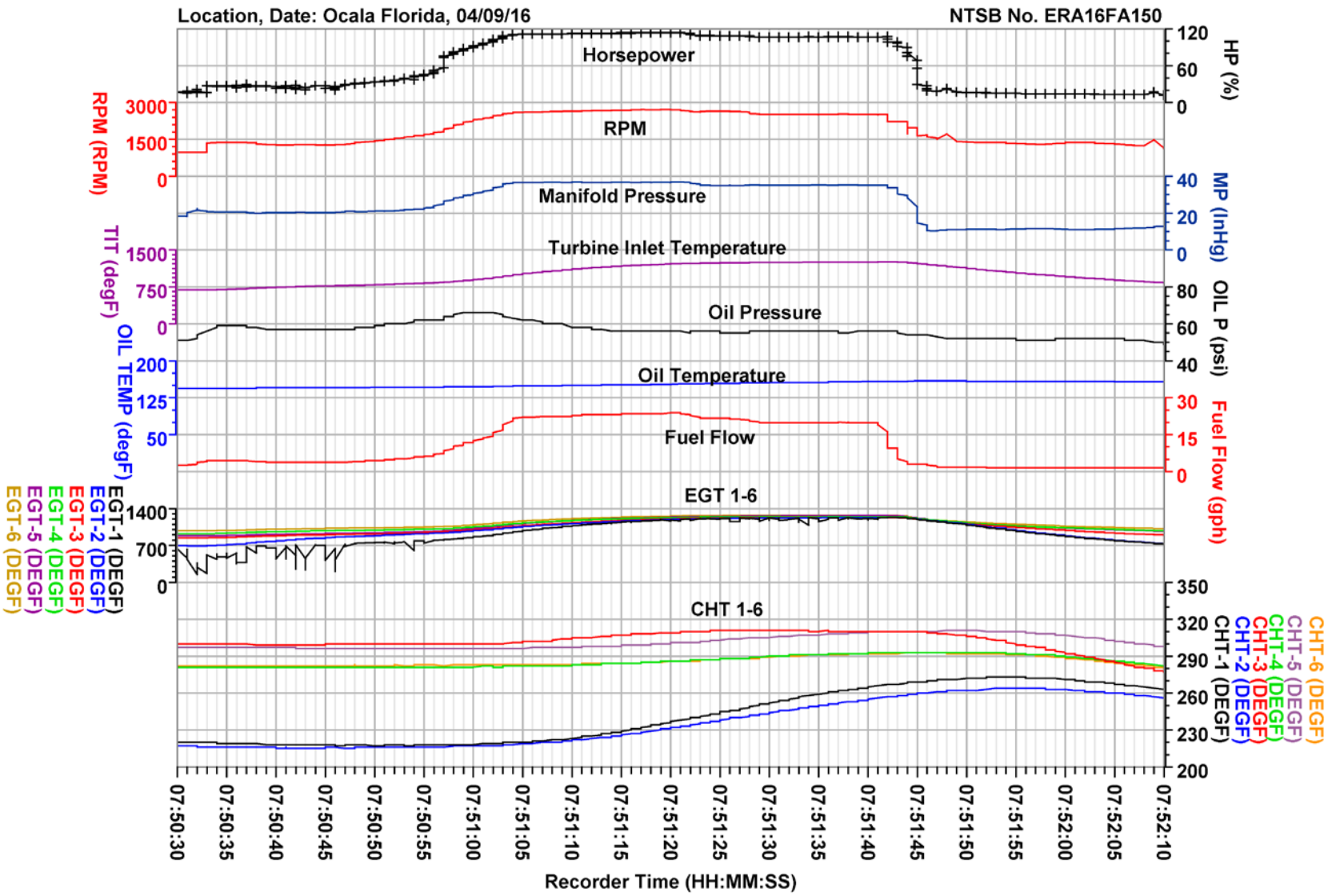

Figure 4. Fuel-related engine parameters, end of recording.