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

November 18, 2013

Electronic Device Factual Report

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

A. EVENT

Location:	Wahiawa, Hawaii
Date:	August 27, 2013
Aircraft:	Champion 8KCAB
Registration:	N413JJ
Operator:	Private
NTSB Number:	WPR13LA389

B. GROUP - No Group

C. SUMMARY

On August 27, 2013, about 1708 Hawaiian standard time (HST), an American Champion 8KCAB, N413JJ, sustained substantial damage during a forced landing following a reported loss of engine power, near the Wheeler Army Airfield (PHHI) Wahiawa, Hawaii. The airplane was registered to J3 Engineering LLC and operated by the pilot under the provisions of Title 14 *Code of Federal Regulations* Part 91. The commercial pilot sustained minor injuries and the passenger was seriously injured. Visual meteorological conditions prevailed and no flight plan was filed for the personal flight. The local flight originated at Honolulu International Airport, Honolulu, Hawaii, at about 1655..

D. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Laboratory received the following device:

GPS Manufacturer/Model:	Electronics International MVP-50P
Serial Number:	112743

Electronics International MVP-50P Device Description

The Electronics International (EI) MVP-50P is a panel-mounted, active TFT matrix, color, electronic engine display allowing the operator to monitor and record

parameters related to engine operations and user customizable parameters. The device is available in both a TSO'd and non-TSO'd version[1]. Depending on the installation, engine parameters monitored may include: Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT), Oil Pressure and Temperature, Manifold Pressure, Outside Air Temperature, Engine Revolutions Per Minute (RPM), Fuel Flow, Fuel Levels, and Battery Voltage and Amperage. User customizable parameters may be defined by installation, examples include but are not limited to sensors for door states, annunciators, and flight control positions.

The unit can also calculate, in real time, percent of maximum horsepower, fuel used, fuel remaining, shock cooling rate, and EGT differentials between highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit contains non-volatile memory for data storage of the parameters recorded and calculated. The rate at which the data is stored is selectable by the operator. The recording function also records minimum and maximum values for each flight. The data is stored in engineering units in (.CSV) format on an internal CF card, using a Linux file system format. The (.CSV) data can be downloaded to a FAT16[2] USB memory device via a USB port on the front of the unit and MVP-50P built-in menu options. Each set of recorded data is grouped by power cycle and identified by an MVP-50P assigned sequential flight number.

Electronics International MVP-50P Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had not sustained any damage, as shown in figure 1. The dataplate on the rear of the unit, shown in figure 2, indicated the unit was a TSO'd version. Power was applied to the unit and the last 50 recording sessions were downloaded normally, without difficulty. The MVP-50P download screen is shown in figure 3.

When the unit was powered on, the internal clock's date and time were verified to be accurate within 5 minutes of UTC time.

[1] Equipment installed in a manufactured airplane is defined by a Technical Standard Order (TSO).
[2] FAT means File Allocation Table and is a method of organizing files on an electronic device. The FAT16 format is an older format using a 16-byte addressing scheme.

Figure 1. Photo of EI MVP-50P.

Figure 2. Photo of EI MVP-50P dataplate.

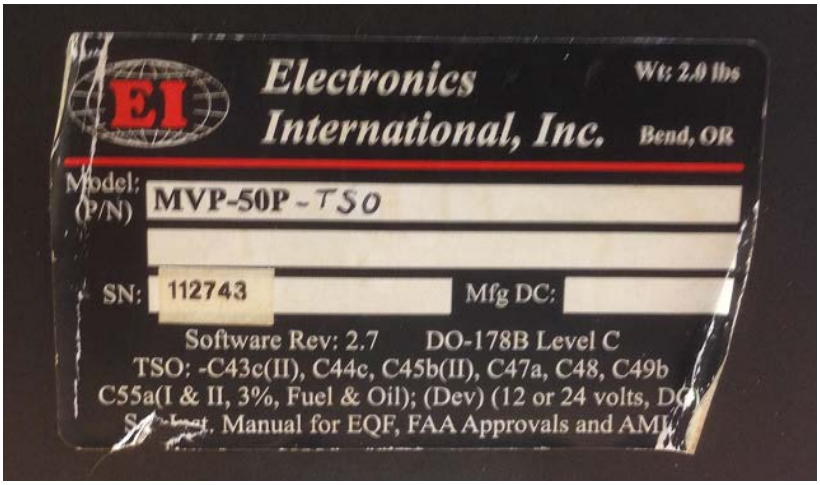

Figure 3. Photo of EI MVP-50P download screen.

Electronics International MVP-50P Data Description

The downloaded data included the last 50 recording sessions. Data was sampled at a rate of once per second. The downloaded data covered the period from July 3, 2013 through August 27, 2013. The accident flight was the last session on the recording and was identified as flight 857 on August 27, 2013. Three additional flights were examined for this report: (a) the flight prior to the accident flight on August 26, 2013 (flight 856); (b) a flight on July 13, 2013 (flight 837) which had no data cut outs in the recording timeframe; and (c) the oldest flight data downloaded, which occurred on July 3, 2013 (flight 806).

Electronics International MVP-50P Parameters Provided

Table 1 describes data parameters provided by the MVP-50P used in this report, table 2 describes units abbreviations used in this report. According to the MVP-50P operating instructions manual (OI 1002051, Rev. D, 4/25/08), "The MVP not only measures and displays the fuel in the fuel tanks but it also displays the fuel on-board the aircraft calculated from the fuel flow" (p. 11). Based on this operating instruction and other information in the MVP-50P operating instructions manual, the parameters "Fuel L" and "Fuel R" are fuel levels in each tank based on fuel level sensors in the tanks; the parameter "F.Rem" (Fuel Remaining) is set by the pilot and decremented based upon the parameter "F.Flow" (Fuel Flow).

Table 1: MVP-50 Data Parameters

Parameter Name	Parameter Description
CHT, 1-4	Cylinder Head Temperature, Cylinders 1 through 4 (degF)
EGT, 1-4	Exhaust Gas Temperature, Cylinders 1 through 4 (degF)
F.Flow	Fuel Flow (gph)
F.Rem	Fuel Remaining (gal)
Fuel L	Fuel in Left tank (gal)
Fuel P	Fuel Pressure (psi)
Fuel R	Fuel in Right Tank (gal)
Groundspeed	Groundspeed (kts)
HP	Horsepower (%)
MP	Manifold Pressure (inHg)
Mstr_Wrn	Master Warning (on/off)
Oil P	Oil Pressure (psi)
Oil T	Oil Temperature (degF)
RPM	Propeller Revolutions per Minute (RPM)
Time	Time (HST) for recorded data point (HH:MM:SS)
Volts	Battery Voltage (Volts)

Table 2: Units Abbreviations

Abbreviation	Abbreviation Description
degF	degrees Fahrenheit
Fuel L	Fuel in Left tank (gal)
Fuel R	Fuel in Right Tank (gal)
gal	gallons
gph	gallons per hour
Groundspeed	Groundspeed (kts)
HH:MM:SS	hours:minutes:seconds
inHg	inches of Mercury
Mstr_Wrn	Master Warning (on/off)
psi	pounds per square inch
RPM	revolutions per minute
RPM	Propeller RPM (rpm)
Volts	Volts

E. PLOTS AND TABULAR DATA

The plots shown in figures 4 through 9 may contain data points with invalid data. The MVP-50P recording method represented invalid engine data as either COM, REF, or BUS string values. For the purpose of data analysis, these three string values were replaced with -100, -101, and -102, respectively, and referred to in this report as *periods of data cut out*. Before the groundspeed parameter was available to the MVP-50P, values of "---" were recorded, which were replaced with values of -999 for the purpose of data analysis. The replaced values are clipped from the reporting scales in figures 4 through 9, but are shown in the tabular data attachment of this report.

Figure 4 shows a plot of recorded values for the accident flight, flight 857. The power increased at about 1649 HST. Coincident with the power increase, a master warning began and continued for about a minute before stopping.

At about 1659:24 HST, the master warning began and continued for about 3 minutes, then fluctuated on and off for about the next 1 minute 45 seconds, then was on continuously until the end of the recording. When the master warning began, all the other engine related parameters began to experience data cutouts; only the groundspeed and master warning seemed not to experience data cut outs. These data cut outs continued until 1705:19 HST.

During the data cut out timeframe, there were periods of valid data. The valid data suggests the RPM began to decrease as early as 1705:00 HST, at about the time the manifold pressure began a slight increase. By 1705:19 HST, the CHT, EGT, and RPM were decreasing and the fuel pressure decreased. At about 1706:04 HST, the fuel flow increased to values signifcantly higher than those observed in other flights (i.e., greater than 50 gph) and remained high for about the next 2 minutes and 45 seconds, then decreased to 0. Shortly after the fuel flow decreased to 0, at about 1708:51 HST, the oil pressure, RPM, and groundspeed decreased to 0, along with a slight decrease in voltage.

Figures 5 and 6 show plots of the flight prior to the accident flight, flight 856, on August 26, 2013. The flight is shown in two plots, as no data was recorded between about 0748:17 HST and 0759:00 HST. Figure 5 shows the first part of the flight experienced data cut outs similar to those of the accident flight. Figure 6 does not contain any data cut outs.

Figure 7 shows a plot of flight 837 on July 13, 2013. This flight contains no data cut outs during the 28 minute recording.

Figure 8 shows a plot of flight 806 on July 3, 2013. This was the oldest flight data downloaded for this investigation.

All the recorded flights show a master warning generated during power increases that are coincident with an increase in groundspeed and RPM.

Figure 9 shows a plot comparing the fuel level related parameters across all four recording sessions. The plot omits invalid data and only shows data points without connecting lines. For comparison purposes, the left and right fuel values are summed and shown on the same scale as the fuel remaining parameters. The accident flight

(857), and the flight prior to the accident flight (856), both have inconsistent values of fuel remaining compared to summed left and right fuel values. Flights 837 and 806 have differing values of fuel remaining and summed fuel values; however, both fuel level methods have similar trends in the rate of fuel reduction.

Tabular data used to generate figures 4 through 9 are included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

Figure 4. Accident flight on 8/27/2013 – flight 857.

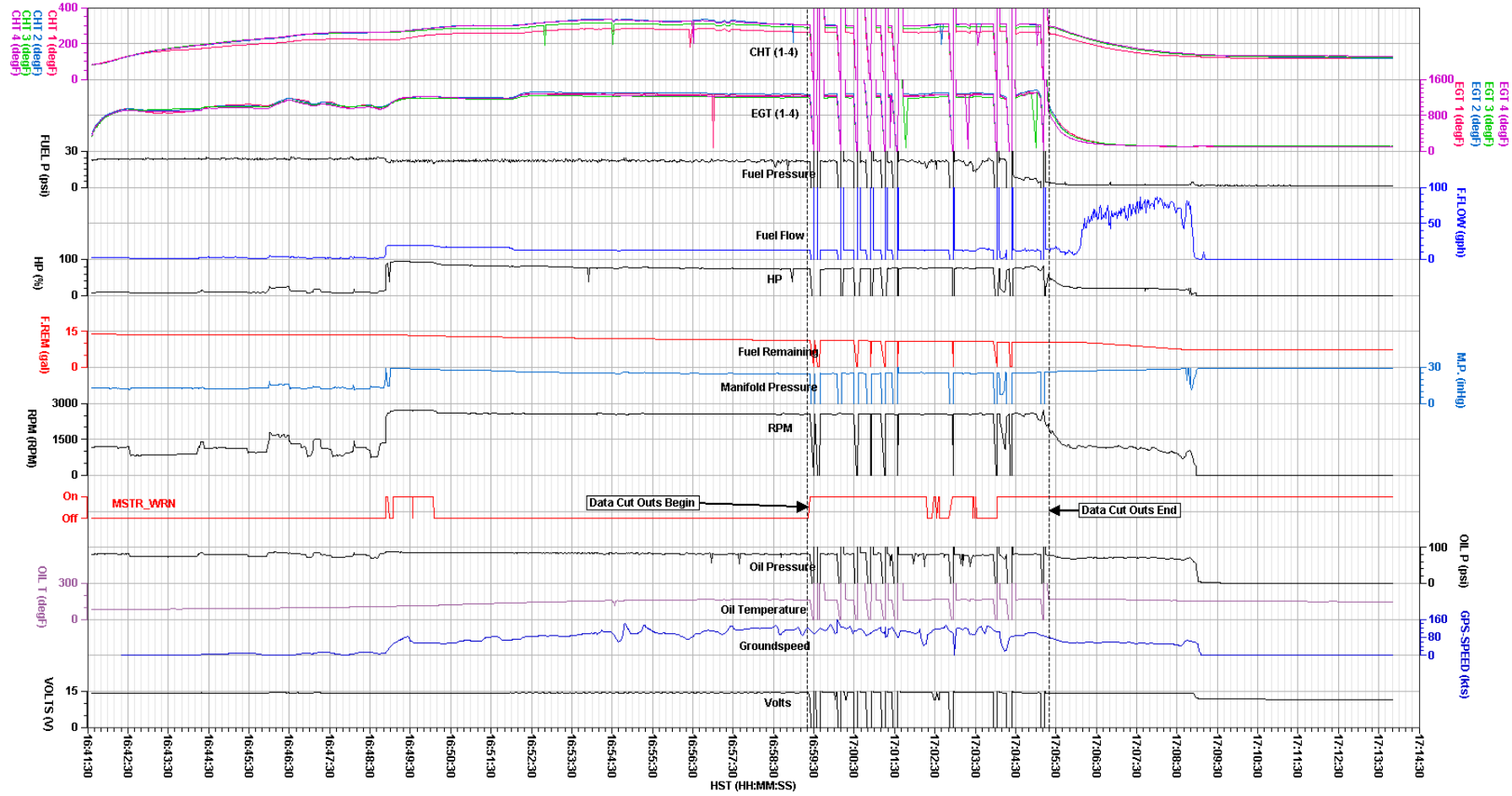

Figure 5. First part of flight on 8/26/2013 – flight 856.

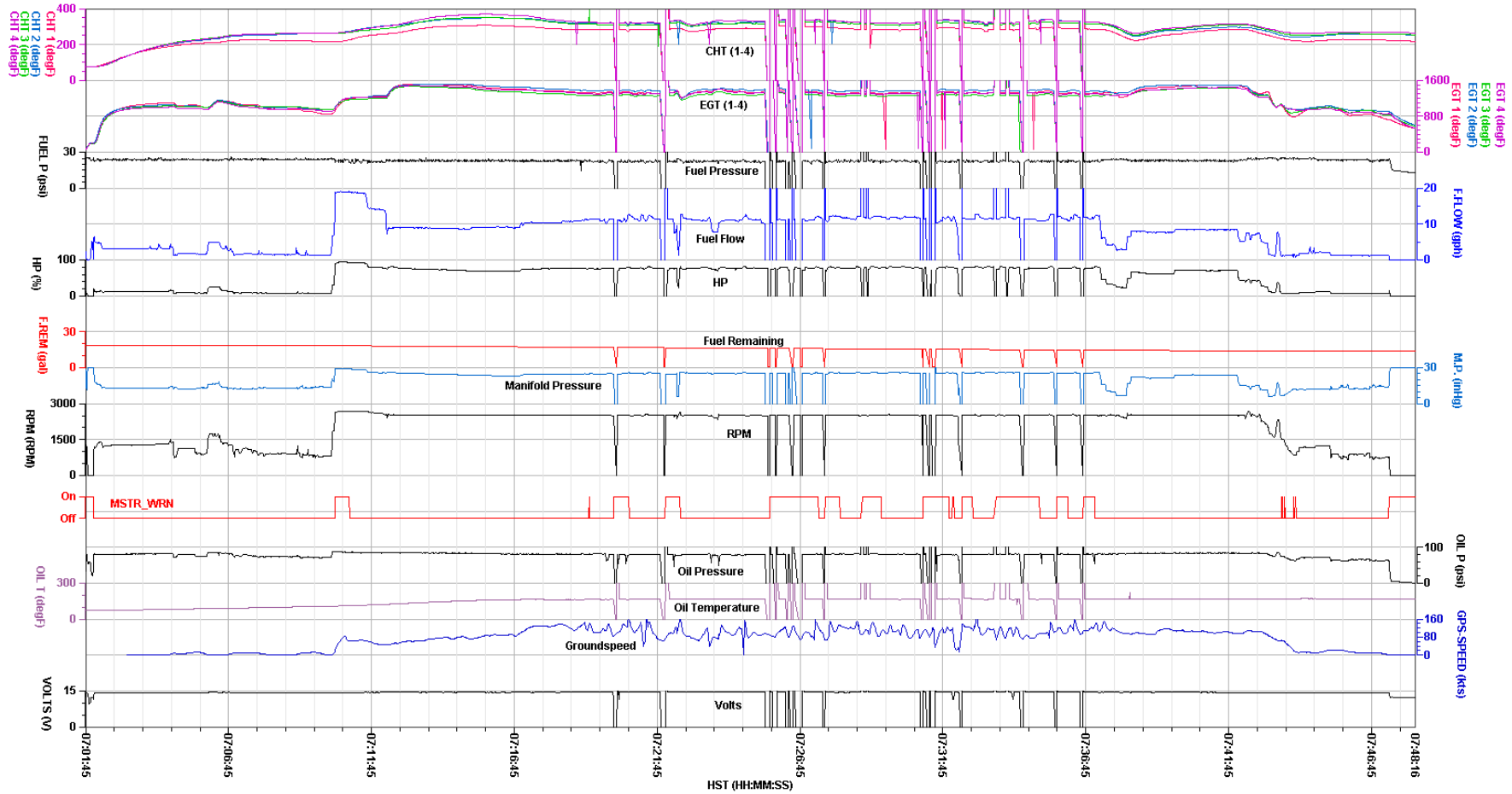

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Figure 6. Second part of flight on 8/26/2013 – flight 856.

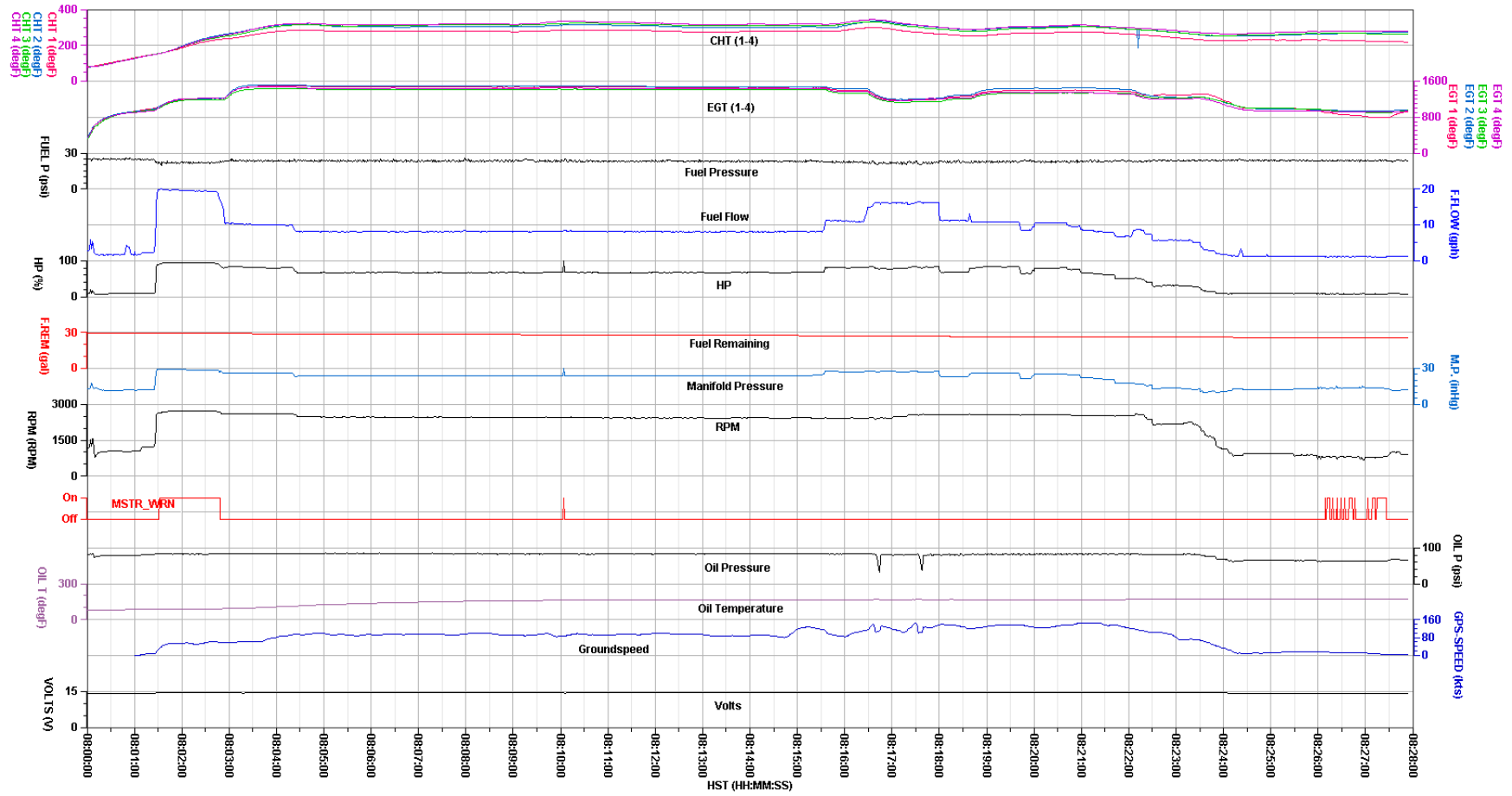

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Figure 7. Flight on 7/13/2013 – flight 837.

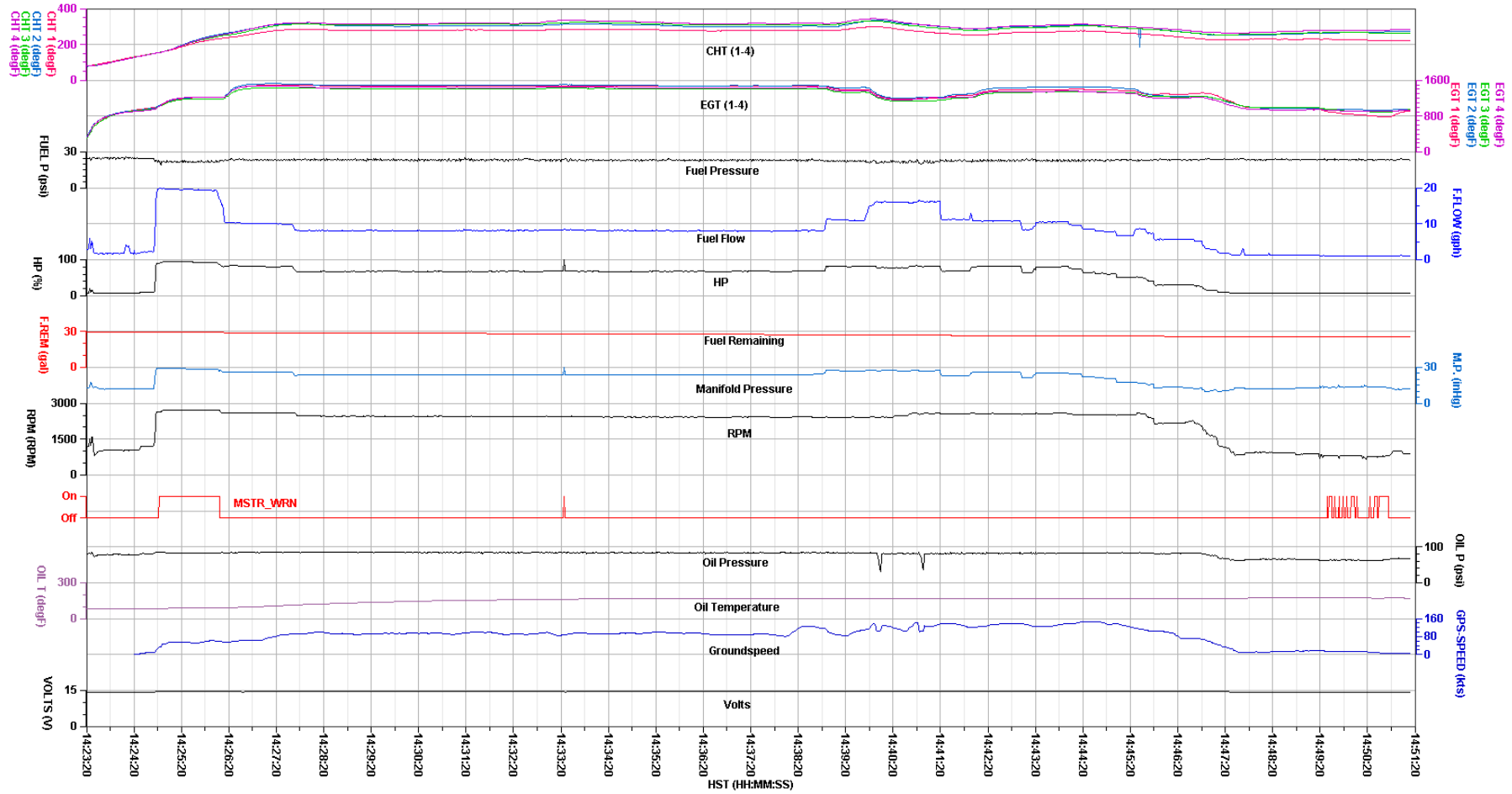

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Figure 8. Flight on 7/3/2013 – flight 806.

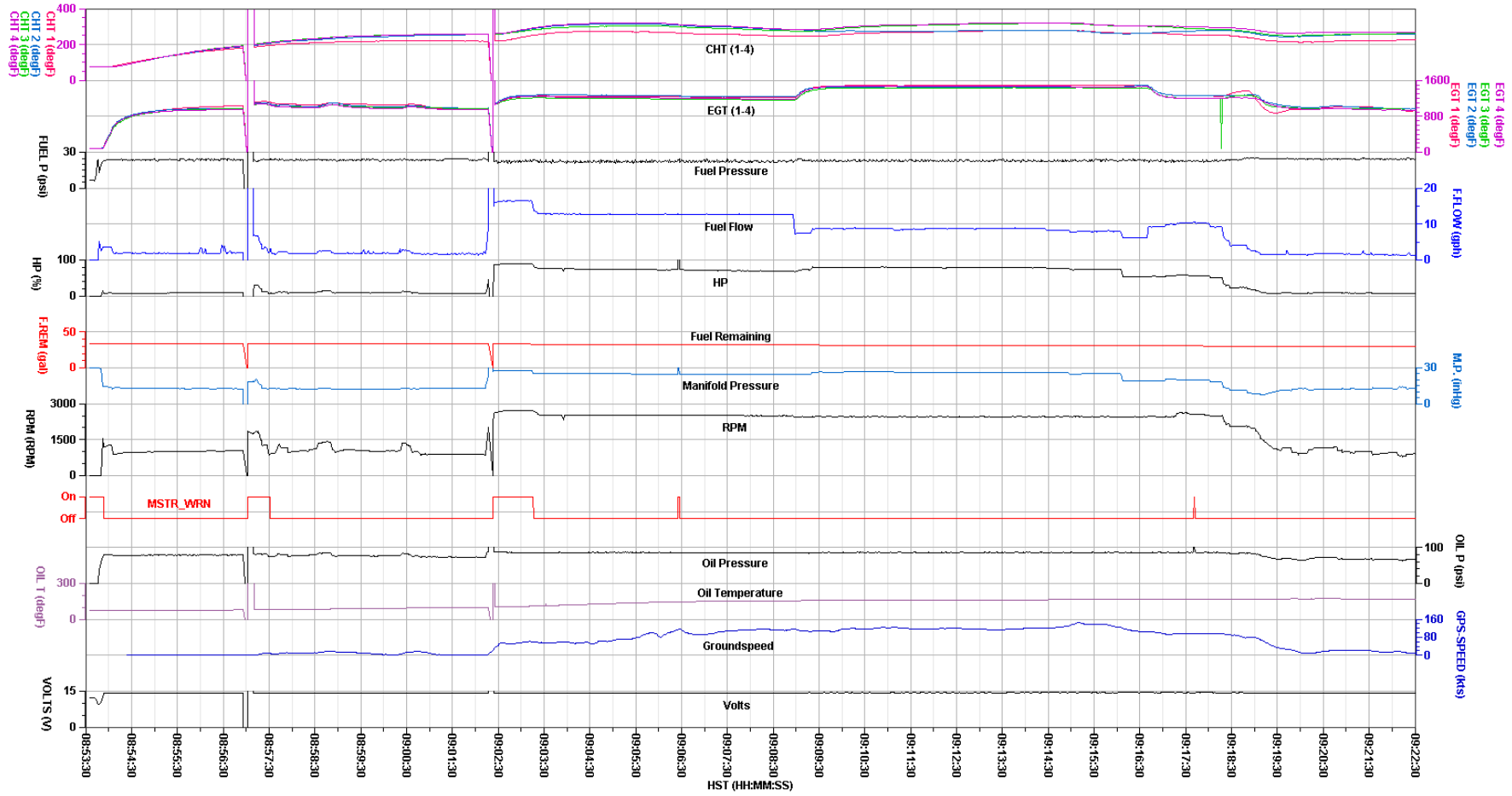

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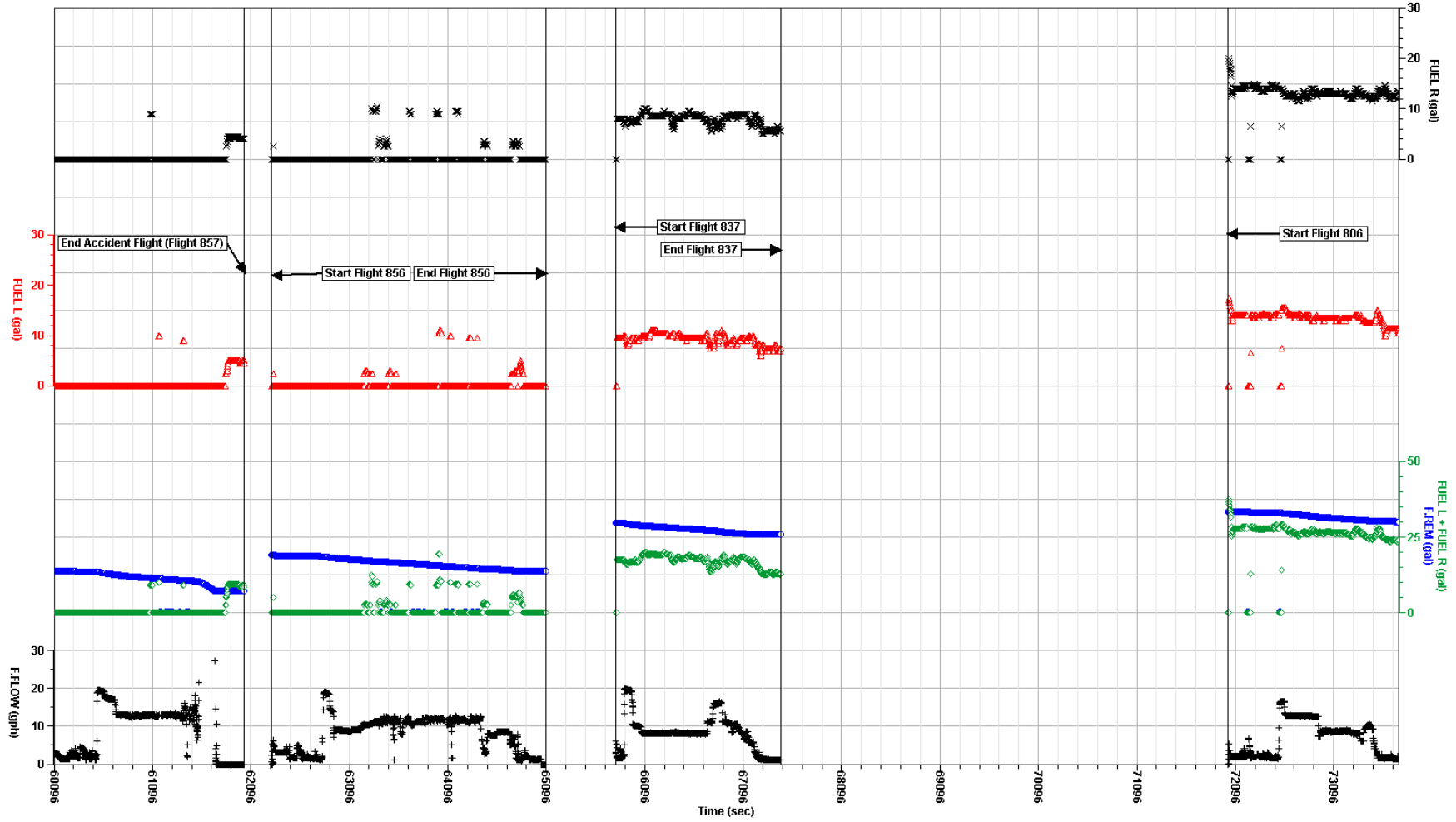
Figure 9. Fuel level related parameters across all flights.



Revised: 7 November 2013 Parameters Related to Fuel Levels National Transportation Safety Board