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

April 21, 2014

Engine Monitor Report

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

A. EVENT

Location:	Wellington, Florida
Date:	September 23, 2013
Aircraft:	Beech A36
Registration:	N40KG
Operator:	Private
NTSB Number:	ERA13LA428

B. GROUP - No Group

C. SUMMARY

On September 23, 2013, about 1249 eastern daylight time (EDT), a Beech A36, N40KG, was substantially damaged during a forced landing following a total loss of engine power near Wellington, Florida. The commercial pilot was not injured. Visual meteorological conditions prevailed and the airplane was operating on an instrument flight rules flight plan. The flight had originated from Washington Dulles International Airport (IAD), Dulles, Virginia, about 0730, and was destined for Boca Raton Airport (BCT), Boca Raton, Florida. The personal flight was conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91.

D. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Laboratory received the following device:

Manufacturer/Model:	JPI EDM-700
Serial Number:	18892

JPI EDM-700 Device Description

The J.P. Instruments (JPI) EDM-700 is a panel mounted instrument enabling the operator to monitor and record up to 24 parameters related to engine operations. Depending on the installation, engine parameters monitored can include: exhaust gas temperature (EGT), cylinder head temperature (CHT), oil pressure and temperature,

manifold pressure, outside air temperature, turbine inlet temperature (TIT), engine revolutions per minute, compressor discharge temperature, fuel flow, carburetor temperature, and battery voltage.

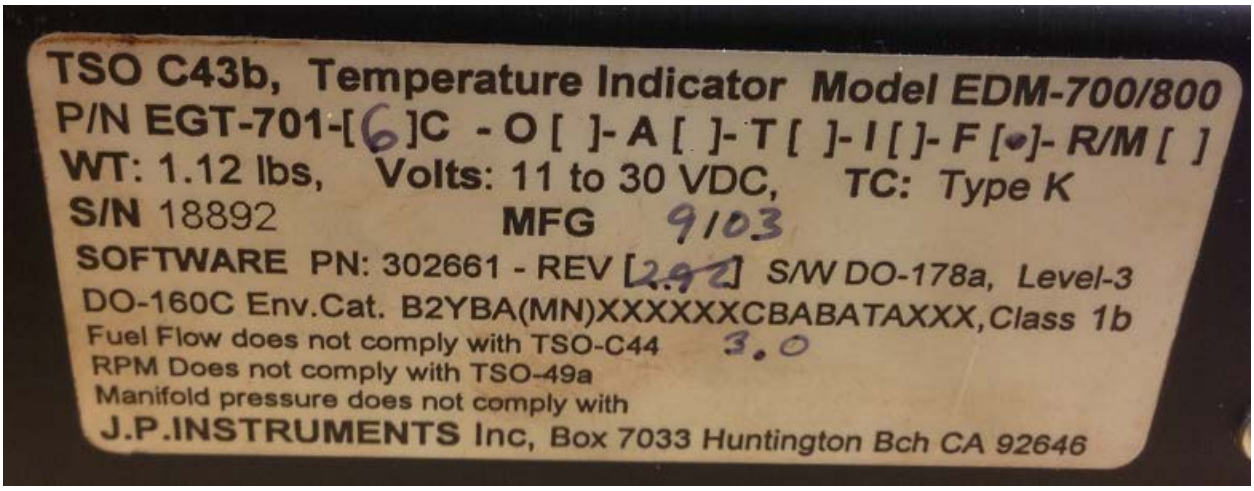
The unit can also calculate, in real-time, horsepower, fuel used, shock cooling rate and EGT differentials between the highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit contains non-volatile memory[1] for data storage of the parameters recorded and calculated. The rate at which the data is stored is selectable by the operator from 2 to 500 seconds per sample. The memory can store up to 20 hours of data at a 6 second sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

Data Recovery

The unit was in good condition and the data were extracted normally. Figure 1 shows a picture of the unit data plate, indicating the firmware revision of 3.0, the number "6" inscribed next to the letter "C," and a dot next to the letter "F." There were no entries on the data plate adjacent to the letters "O," "A," "T", "I," or "R/M." The number inscribed adjacent to "MFG" was "9/03".

Figure 1. Unit data plate.



Data Description

The unit contained recorded data over 12 power cycles, recorded at a sample rate of once every 6 seconds. The recorded data spanned dates of July 30, 2013, through the accident flight on September 23, 2013, as recorded by the unit internal clock. The parameters recorded were EGT, CHT, voltage, fuel flow, and oil

[1] Non-volatile memory is semiconductor memory that does not require external power for data retention.

temperature. Additionally, the calculated shock cooling rate, total fuel used, and maximum difference between EGT sensors were also recorded. No other parameters were recorded by the unit. The unit was configured such that 98 gallons was full fuel.

This report examined the last recorded activity on September 23, 2013.

Engineering Units Conversion

Data were downloaded in engineering units using the manufacturer's EzTrends software. Appendix A lists the EDM-700 parameters verified and provided in this report.

Time Correlation

The EDM-700 records time with the first data sample based on the unit's internal clock. This clock is set and updated by the operator. When the unit was powered on, the internal clock was compared to actual time. This comparison indicated the EDM-700 internal clock was set 11 hours and 30 minutes ahead of actual Coordinated Universal Time (UTC). As such, 11 hours and 30 minutes was subtracted from all EDM-700 recorded times to correct to UTC. Thereafter, 4 hours was subtracted to convert from UTC to accident local time (EDT). Therefore, for the rest of this report, all times are referenced as EDT.

Plots and Corresponding Tabular Data

Figure 2 shows a plot of the entire accident flight recording. Figure 3 focuses on the 40 minute period prior to the loss of power.

The entire accident flight recording was 5 hours and 31 minutes in duration. The duration when the fuel flow was greater than 9 gph was 5 hours and 13 minutes.

At about 11:58 EDT (4 hours and 40 minutes after the fuel flow first went above 9 gph), the engine parameters began to fluctuate slightly. At this time, the fuel used was 56 gallons. At 12:28:30 EDT, the CHTs and EGTs began a gradual decrease, coincident with a reduction in fuel flow from about 12 gph to 10 gph. At 12:29:48 EDT, the EGTs began to increase, peaking at 12:30:24 EDT. At 12:30:30 EDT, the fuel flow reduced to 0 gph for the remainder of the recording, and the CHTs and EGTs began to rapidly decrease. The recording ended at 12:37:48 EDT, 7 minutes and 48 seconds after the fuel flow first reduced to 0 gph.

The corresponding tabular data used to create figures 2 and 3 are provided in electronic (*.csv[2]) format as Attachment 1 to this report.

[2] Comma Separated Value format.

Figure 2. Plot of entire accident flight recording.

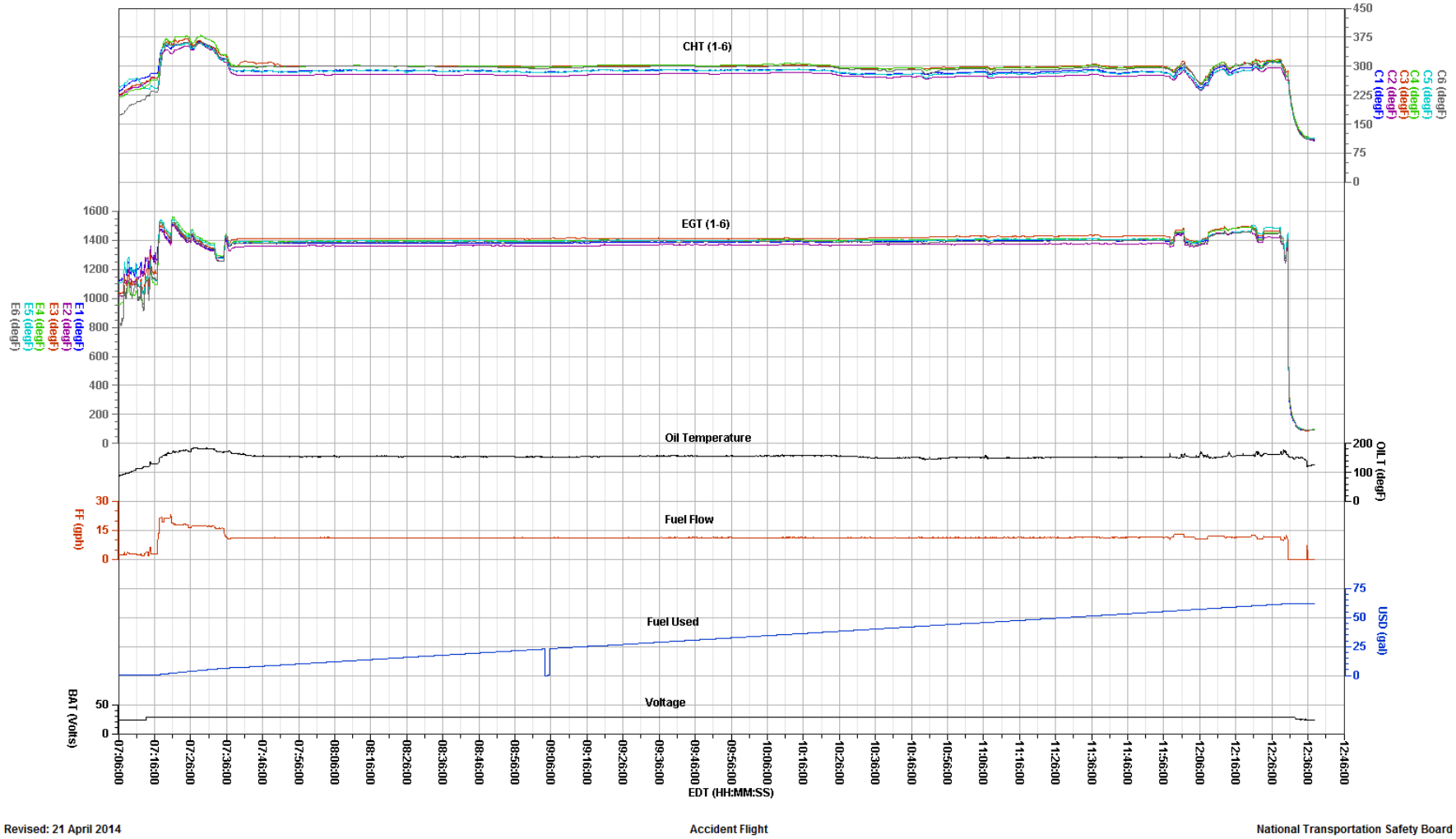
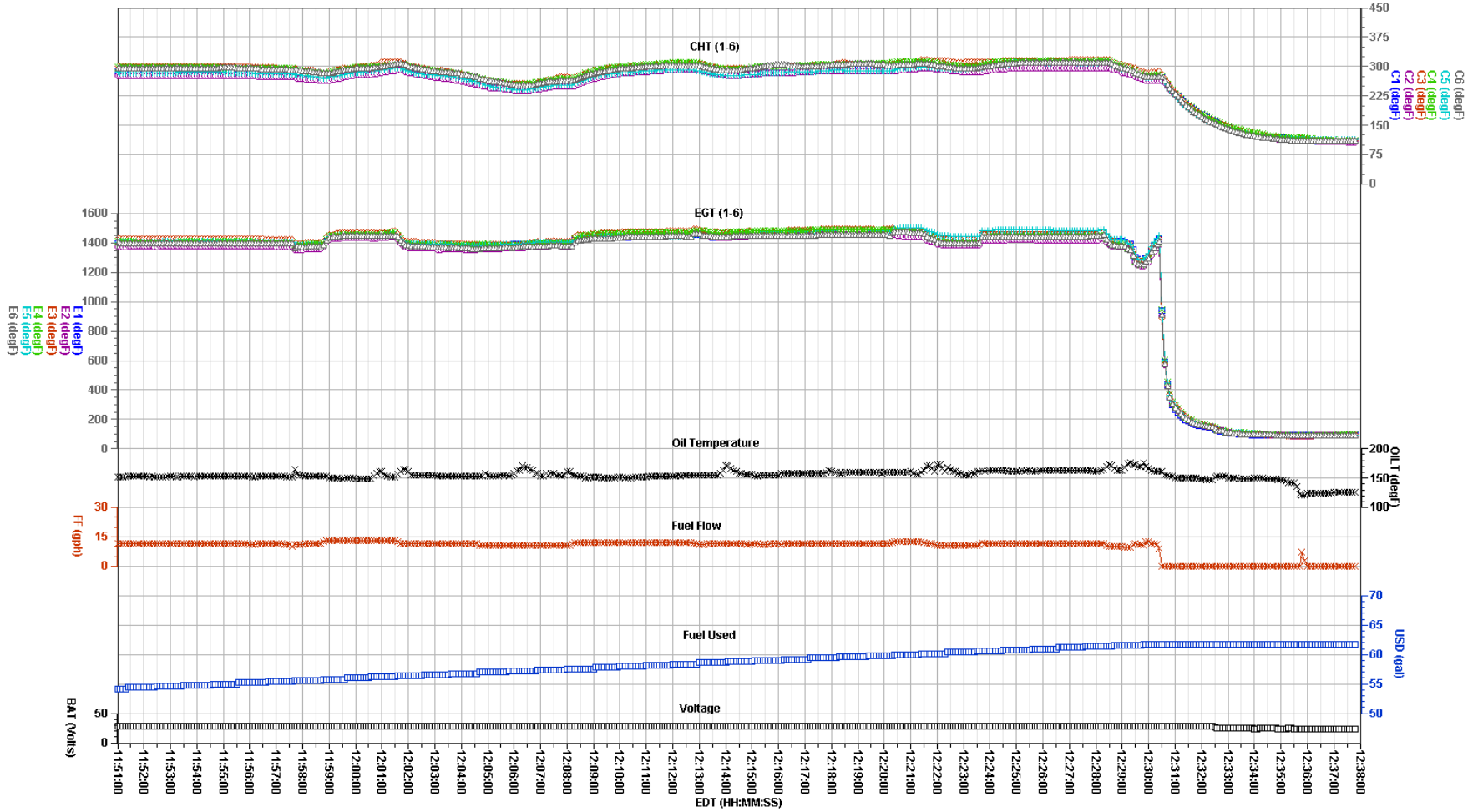


Figure 3. Plot of end of accident flight recording.



Revised: 7 February 2014 | End of Accident Flight | National Transportation Safety Board

APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the parameters and table A-2 describes the unit abbreviations used in this report.

Table A-1. Verified and provided JPI parameters.

Parameter Name	Parameter Description
1. BAT (Volts)	Voltage
2. C1 (degF)	Cylinder Head Temperature Cylinder 1
3. C2 (degF)	Cylinder Head Temperature Cylinder 2
4. C3 (degF)	Cylinder Head Temperature Cylinder 3
5. C4 (degF)	Cylinder Head Temperature Cylinder 4
6. C5 (degF)	Cylinder Head Temperature Cylinder 5
7. C6 (degF)	Cylinder Head Temperature Cylinder 6
8. E1 (degF)	Exhaust Gas Temperature Cylinder 1
9. E2 (degF)	Exhaust Gas Temperature Cylinder 2
10. E3 (degF)	Exhaust Gas Temperature Cylinder 3
11. E4 (degF)	Exhaust Gas Temperature Cylinder 4
12. E5 (degF)	Exhaust Gas Temperature Cylinder 5
13. E6 (degF)	Exhaust Gas Temperature Cylinder 6
14. FF (gph)	Fuel Flow
15. OIL T (degF)	Oil Temperature
16. USD (gals)	Fuel Used

Table A-2. Unit abbreviations.

Units Abbreviation	Description
degF	degrees Fahrenheit
gph	gallons per hour
Volts	Volts
gals	gallons