

# NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division  
Washington, D.C. 20594

March 14, 2013

## Electronic Devices Factual Report

Specialist's Factual Report  
by Bill Tuccio

### 1. EVENT

Location: La Grange, Texas  
Date: November 09, 2012  
Aircraft: Cessna 210L  
Registration: N732BL  
Operator: Private  
NTSB Number: CEN13LA056

On November 9, 2012, about 0715 central standard time, N732BL, a Cessna 210L, single engine airplane, was substantially damaged during a forced landing near Fayette Regional Air Center Airport (3T5), La Grange, Texas. The pilot and both passengers received minor injuries. The airplane was registered to and operated by a private individual. Visual meteorological conditions (VMC) prevailed at the time of the accident and an instrument flight rules (IFR) flight plan had been filed for the 14 *Code of Federal Regulations* Part 91 business flight. The airplane departed San Marcos Municipal Airport (HYI), San Marcos, Texas, about 0650 destined for Baytown Airport (HPY), Baytown, Texas.

### 2. DETAILS OF DEVICE INVESTIGATION

The Safety Board's Vehicle Recorder Division received the following devices:

Device 1: Quantity of 2 Garmin Front Loading Memory Cards  
Device 1 Serial Number: n/a

Device 2: JPI EDM-800  
Device 2 Serial Number: 14563

#### 2.1. Garmin Front Loading Memory Cards Description

Garmin panel mounted GPS navigation devices utilize front loading, removable memory cards for navigational information. The memory cards are a proprietary Garmin format. The information on the cards can be updated by subscription using proprietary memory card writers.

### **2.1.1. Garmin Front Loading Memory Cards Data Recovery**

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the memory cards had not sustained any damage. One card was labeled "IFRW" and the other card was labeled "TAWS." The cards were inserted into an operable Garmin 530 unit, and the database information on the cards was observed for this report.

### **2.1.2. Garmin Front Loading Memory Cards Data Description**

The IFRW card, "Aviation Database," expired November 15, 2012. The TAWS card, "Obstacle Database," expired October 25, 2007.

## **2.2. JPI EDM-800 Device Description**

The J.P. Instruments (JPI) EDM-800 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. For fuel used calculations, the unit requires the flight crew to enter the initial fuel on board the aircraft. All calculations and data provided by the unit are based on fuel flow.

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 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.

### **2.2.1. JPI EDM-800 Data Recovery**

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had not sustained any damage and information was extracted using the manufacturer's software normally, without difficulty.

### **2.2.2. JPI EDM-800 Data Description**

The unit had recorded 10 flights, including the accident flight. The accident flight data on November 9, 2012 was downloaded for this report. The accident flight data was recorded once every 6 seconds.

Upon arrival in the NTSB laboratory, the fuel used indicated 7.9 gallons, and the fuel remaining indicated 78.1 gallons. The unit was configured such that 86 gallons was full fuel.

### **2.2.3. JPI EDM-800 Engineering Units Conversion**

The engineering units conversions used for the data contained in this report are based on documentation from JPI, the manufacturer of the EDM-800.

Appendix A lists the EDM-800 parameters verified and provided in this report.

### **2.2.4. JPI EDM-800 Time Correction**

The time recorded by the EDM-800 is based upon a user set internal clock and consequently may not accurately reflect local or UTC time. In order to adjust the EDM-800 recorded time to UTC time, the unit was powered in the laboratory and the time compared to UTC time as reported by the U.S. Naval Observatory. As a result, 35 minutes, 45 seconds was subtracted from EDM-800 time to adjust times to UTC. All times in this report are UTC.

### **2.2.5. JPI EDM-800 Plots and Tabular Data**

Figure 1 shows data recorded for the accident flight. The recording began at 1247:19 UTC. The fuel flow, manifold pressure (MAP), exhaust gas temperatures (EGT), cylinder head temperatures (CHT), and other parameters increased rapidly at about 1254:13 UTC, similar to the application of take-off power.

The MAP remained at about 28 inHg from 1254:31 until 1255:05 UTC. After 1255:05 UTC, the MAP decreased to 25 inHg, and then continued on a decreasing trend to 23 inHg by 1315:23 UTC.

At about 1307:03 UTC, the fuel flow decreased from about 20 gallons per hour (gph) to 17 gph, coincident with an increase in EGT and CHT values.

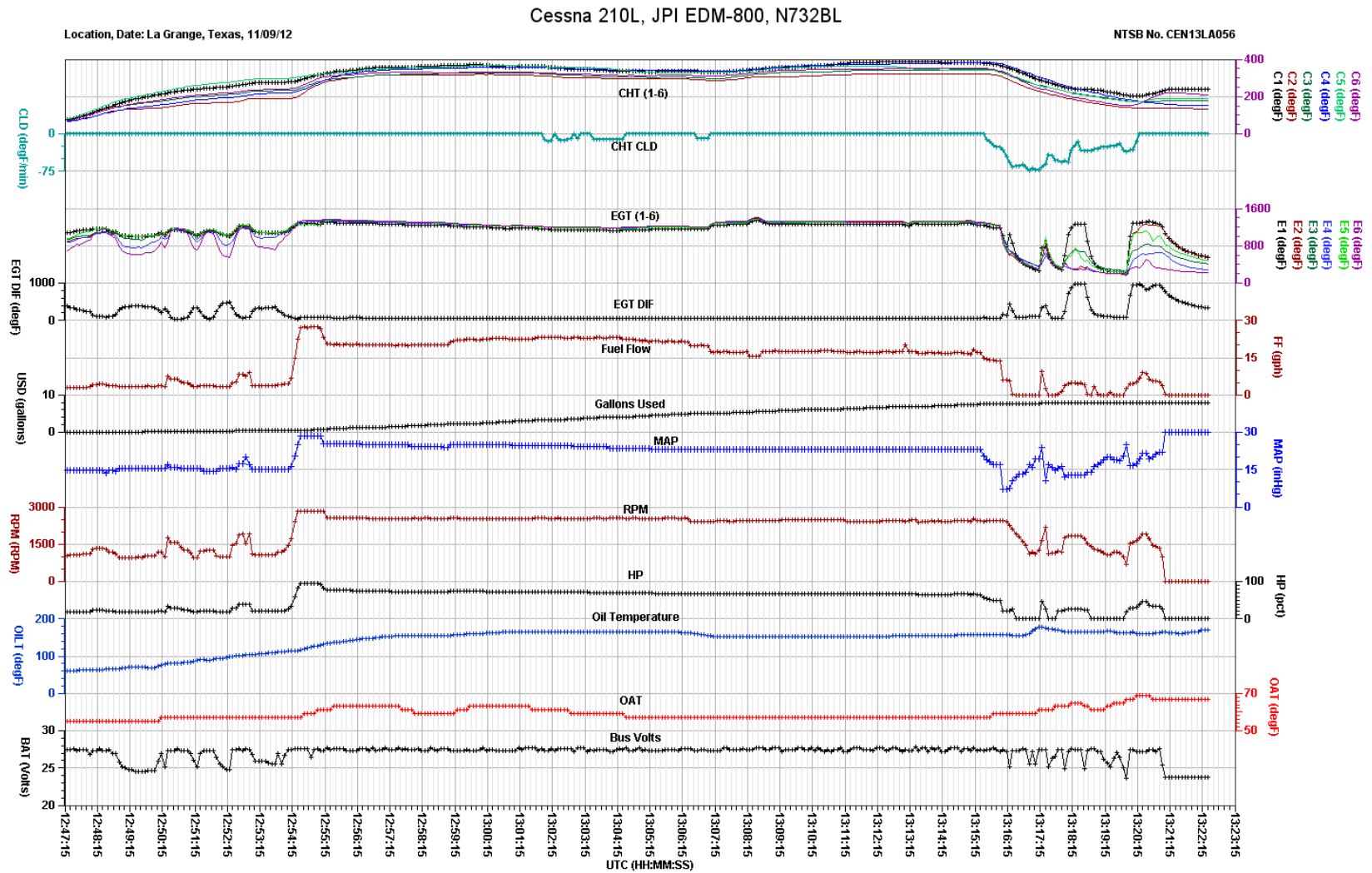
Figure 2 shows data recorded after 1313:00 UTC. At about 1315:23 UTC, the MAP and fuel flow began to decrease. By 1315:59 UTC, the MAP had decreased from 23 inHg to 17 inHg, the fuel flow from 16 gph to 14 gph.

At about 1315:59 UTC, the MAP and fuel flow decreased further, fuel flow reducing to 0 gph by 1316:25 UTC. At 1316:06 UTC, the RPM began to decrease from about 2,430 RPM to 1,100 RPM by 1316:58 UTC.

After 1316:58 UTC, most parameters continued to fluctuate until the end of the recording. After 1321:07 UTC until the end of the recording at 1322:25 UTC, the bus voltage was a constant 24 volts, the RPM a constant 0, the fuel flow a constant 0, and the MAP a constant 30 inHg.

The corresponding tabular data used to create figures 1 and 2 is provided in electronic comma-separated value (\*.csv) format as Attachment 1 to this report.

Figure 1. Accident flight as recorded by JPI EDM-800.

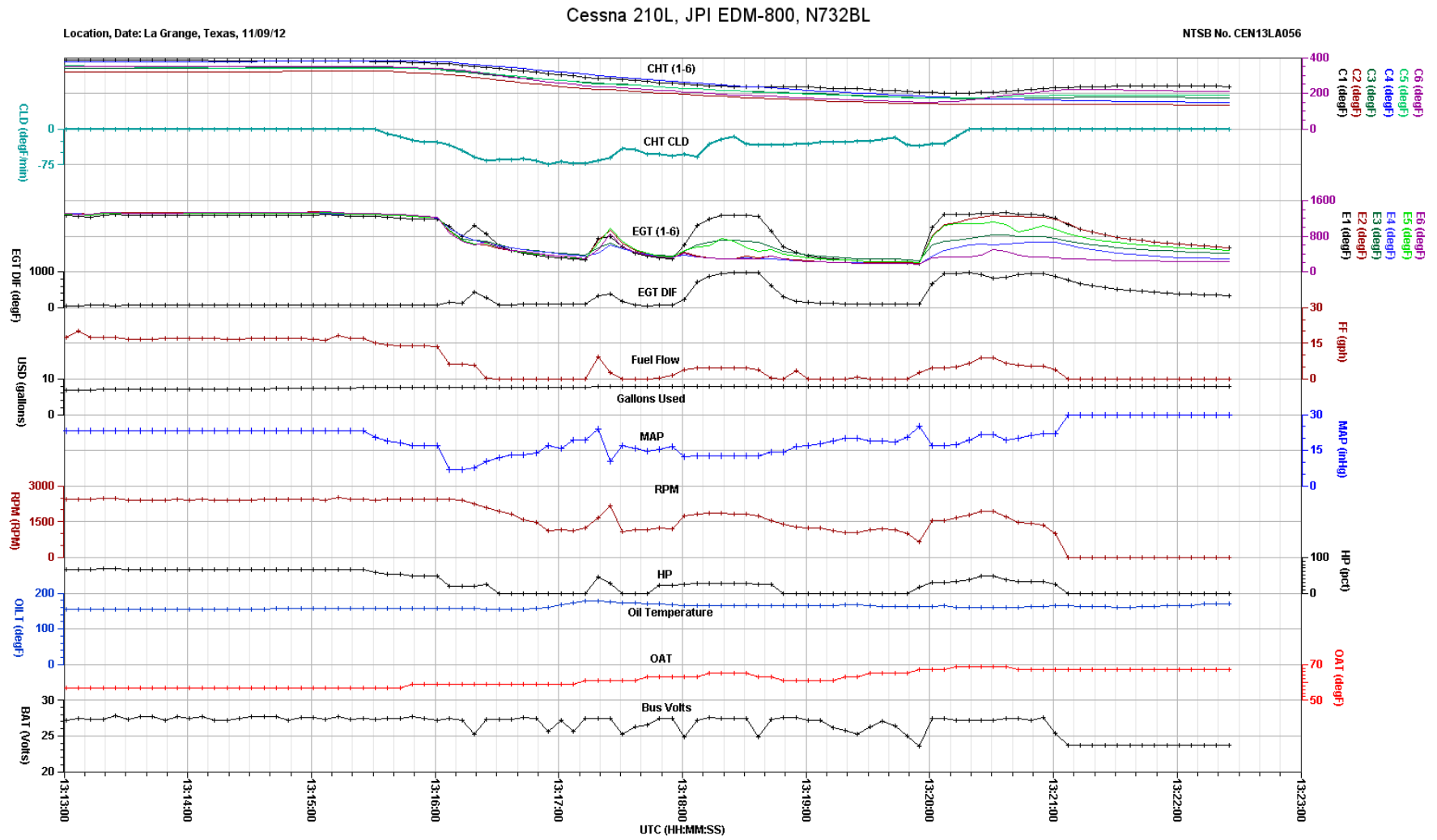


Revised: 12 February 2013

Accident Flight All Parameters

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Figure 2. End of accident flight as recorded by JPI EDM-800.



Revised: 12 February 2013

End of Accident Flight All Parameters

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## 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 (V)         | Bus 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. CLD (degF/min)  | Cylinder Head Temperature Cooling Rate              |
| 9. E1 (degF)       | Exhaust Gas Temperature Cylinder 1                  |
| 10. E2 (degF)      | Exhaust Gas Temperature Cylinder 2                  |
| 11. E3 (degF)      | Exhaust Gas Temperature Cylinder 3                  |
| 12. E4 (degF)      | Exhaust Gas Temperature Cylinder 4                  |
| 13. E5 (degF)      | Exhaust Gas Temperature Cylinder 5                  |
| 14. E6 (degF)      | Exhaust Gas Temperature Cylinder 6                  |
| 15. EGT DIF (degF) | Exhaust Gas Temperature Cylinder Maximum Difference |
| 16. FF (gph)       | Fuel Flow   |
| 17. HP (%)         | Horsepower  |
| 18. MAP (inHg)     | Manifold Pressure                                   |
| 19. OAT (degF)     | Outside Air Temperature                             |
| 20. Oil T (degF)   | Oil Temperature                                     |
| 21. RPM (RPM)      | Engine RPM  |
| 22. USD (gals)     | Fuel Used   |

**Table A-2. Unit abbreviations.**

| Units Abbreviation | Description                   |
|--------------------|-------------------------------|
| degF               | degrees Fahrenheit            |
| V                  | Volts DC                      |
| degF/min           | degrees Fahrenheit per minute |
| gph                | gallons per hour              |
| gals               | Gallons                       |
| inHg               | inches of Mercury             |
| %                  | percent                       |
| RPM                | revolutions per minute        |