

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

March 20, 2017

## **Electronic Devices Factual Report**

**Specialist's Factual Report**  
**By James Cash**

### **1. EVENT SUMMARY**

Location: Albrightsville, Pennsylvania  
Date: October 15, 2016  
Aircraft: Zenith CH701  
Registration: N3701M  
Operator: Private  
NTSB Number: ERA17LA016

On October 15, 2016, at 1535 eastern daylight time, an experimental amateur-built Zenith CH701, N3701M, was substantially damaged during a forced landing near Albrightsville, Pennsylvania. The private pilot sustained serious injuries and one passenger had minor injuries. The airplane was operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Day, visual meteorological conditions prevailed at the time, and no flight plan was filed. The flight originated from Benton Airport (PA40), Benton, Pennsylvania about 1450 and was destined for Pegasus Air Park (50PA), Stroudsburg, Pennsylvania.

### **2. DETAILS OF INVESTIGATION**

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following electronic devices capable of recording information to non-volatile memory (NVM)<sup>1</sup>:

Recorder Manufacturer/Model: **Dynon FlightDEK D180**  
Recorder Serial Number: **2492**

Recorder Manufacturer/Model: **Garmin GPSMAP 196**  
Recorder Serial Number: **6542285**

#### **2.1. Dynon FlightDEK D180 Description**

The Dynon FlightDEK D180 is a 7" wide screen display mounted in the cockpit of non-type certificated aircraft. The instrument integrates multiple flight instruments including airspeed, altitude, gyro-stabilized magnetic compass, turn rate, slip/skid ball, bank angle, pitch angle and vertical speed. The unit also has other functions that include a clock/timer, g-meter, voltmeter and a density altitude/true airspeed calculator. The unit contains an Air Data, Attitude and Heading Reference System (ADAHRS) to provide air data, attitude and heading

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<sup>1</sup> Solid-state memory that retains the stored data after electrical power is removed from the device.

information to the display. Depending on the installation in the operator's aircraft, certain parameters might not be displayed, for example angle-of-attack. The instrument also integrates up to 16 engine related instruments including manifold pressure, temperatures, RPM and fuel system information. Depending on the type of engine installed in the aircraft and pilot preferences, not all display options can be available.

Depending on the firmware version on the unit, the ability to log data to internal memory exists. According to the manufacturer, firmware versions 3.0 and later contain the ability to log certain engine parameters and firmware versions 5.0 and later contain the ability to log certain EFIS and GPS parameters. The data logging must be configured by the operator to enable logging and set the data log interval. The unit can also be configured to start logging data automatically at boot-up. The data logging interval can be set to store at 1,3,5,10,30 and 60 second intervals. The internal memory can store at least 30 minutes of cumulative data at a 1 second recording interval or at least 30 hours at a 60 second data recording interval. When the recording limit in the internal memory is reached, the oldest record is dropped and a new record is added.

#### **2.1.1. Dynon FlightDEK-D180 Data Recovery**

The recorder was in good condition and the data were downloaded using the manufacturer's procedure.

#### **2.1.2. Dynon FlightDEK D180 Data Description**

The FlightDEK-D180 received contained firmware version 5.0. Based on information from the manufacturer, the unit does store data. The operator had the datalog function enabled and it was set to record information at a 10 second interval and started recording at boot up. The recording contained approximately 5 hours of data. The accident/incident flight recording was approximately 46 minutes long.

#### **2.1.3. Dynon FlightDEK D180 Engineering Units Conversions**

The Dynon product support download program performs conversion of the data from the raw recorded information to engineering units.

Appendix A lists the Dynon FlightDEK D180 parameters verified and provided in this report.

### **2.2. Garmin GPSMAP 196 Description**

The Garmin GPSMAP 196 is a portable GPS unit equipped with a detachable antenna, and a 320 x 240 12-level grayscale LCD display. The unit is equipped with a built in base map and internal Jeppesen aviation database. The unit employs a parallel 12 channel WAAS-capable receiver and can be operated using external power, or alternatively by four standard AA-size batteries. The GPSMAP 196 is capable of storing date, route of flight, and flight time information for up to 50 individual flights in the form of a flight log. Flight logging begins when the GPS unit senses a speed increase to greater than 30 knots together with an altitude gain of greater than 500 feet. Recorded flight log data is saved when the speed is sensed to decrease to below 30 knots, and a new log is started if more than 10 minutes passes from this time. A detailed track log – including latitude, longitude, date, time, and GPS altitude information for an unspecified number of points – is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Track log position is

updated as a function of time or distance moved, depending on how the unit has been configured. Once the current track log memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured. The current track log can be saved to long-term memory and 15 saved track logs can be maintained in addition to the current track log. Track log storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory. The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in serial port using the NMEA 0183 version 2.0 protocol. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

### **2.2.1 Data Recovery**

The recorder was in good condition and the data were downloaded using the manufacturers' procedure

### **2.2.2 Data Description**

The download data file was decoded and the resulting data consisted of 16 track logs/sessions recorded from July 17, 2016 through October 15, 2016. The accident flight was flown on October 15, 2016 and was the last tracklog recorded in the data.

### **2.3 Time Correlation**

The Garmin GPSMAP 196 data recorded time that is derived from the GPS satellite and is based on UTC time. The Dynon FlightDEK D-180 also records time, but it is manually set by the operator and may drift over time. The GPS time was used to establish a common time between the two units.

The GPS time is recorded in Universal Coordinated Time (UTC). The difference between Eastern Daylight Time and UTC is 4 hours. An offset of 4 hours was applied to display the data with the local time zone. Therefore, for the rest of this report, all times are referenced as Eastern daylight Time, not recorded time.

### **2.4 Plots and Corresponding Tabular Data**

Figure 1 is a graphical overlay generated using Google Earth for the accident flight. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The aircraft departed the Benton Airport, Benton, Pennsylvania at approximately 1454:23 EDT. The last recorded parameter was at 1539:20 EDT on October 17, 2016. Due to data buffering on the GPS unit, the data recording ended before the aircraft stopped moving after hitting the trees at the accident site.

Figure 2 is a graphical overlay generated using Google Earth zoomed in on the end portion of the accident flight.

Figure 3 is a graphical presentation of the combined flight data recovered from the GPS and the Dynon D-180 unit. Figure 4 is a graphical presentation zoomed in on the last 10 minutes of the flight data.

Figure 5 is a graphical presentation of the aircraft's engine data for the entire accident flight. Figure 6 is a graphical presentation zoomed in on the last 10 minutes of the engine data from the accident aircraft.

Tabular data used to generate figures 1 through 6 are included as Attachment 1. This attachment is provided in electronic comma-delimited (\*.csv<sup>2</sup>) format.

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<sup>2</sup> Comma Separated Value format.

Figure 1. Google Earth depiction of the accident flight

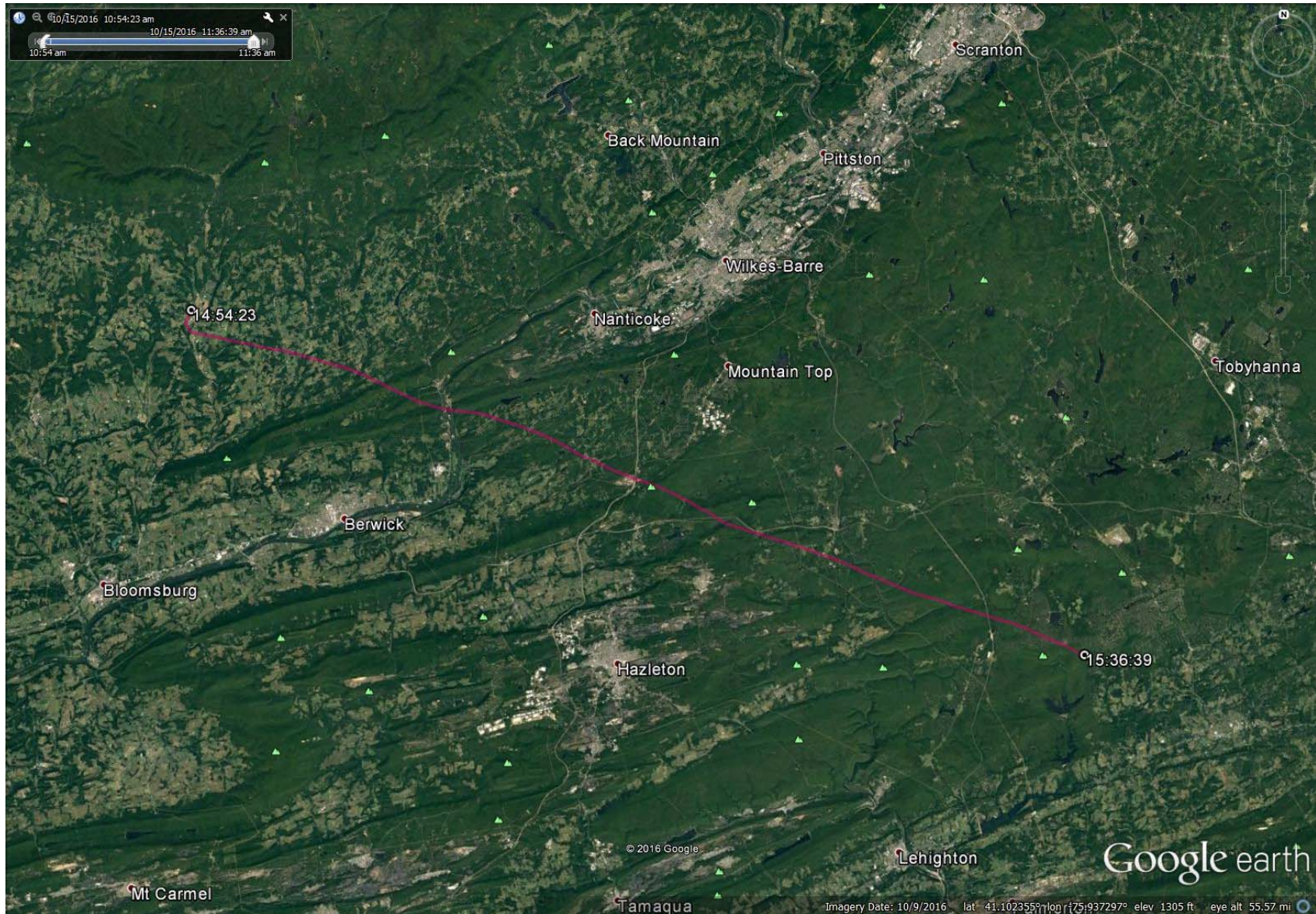
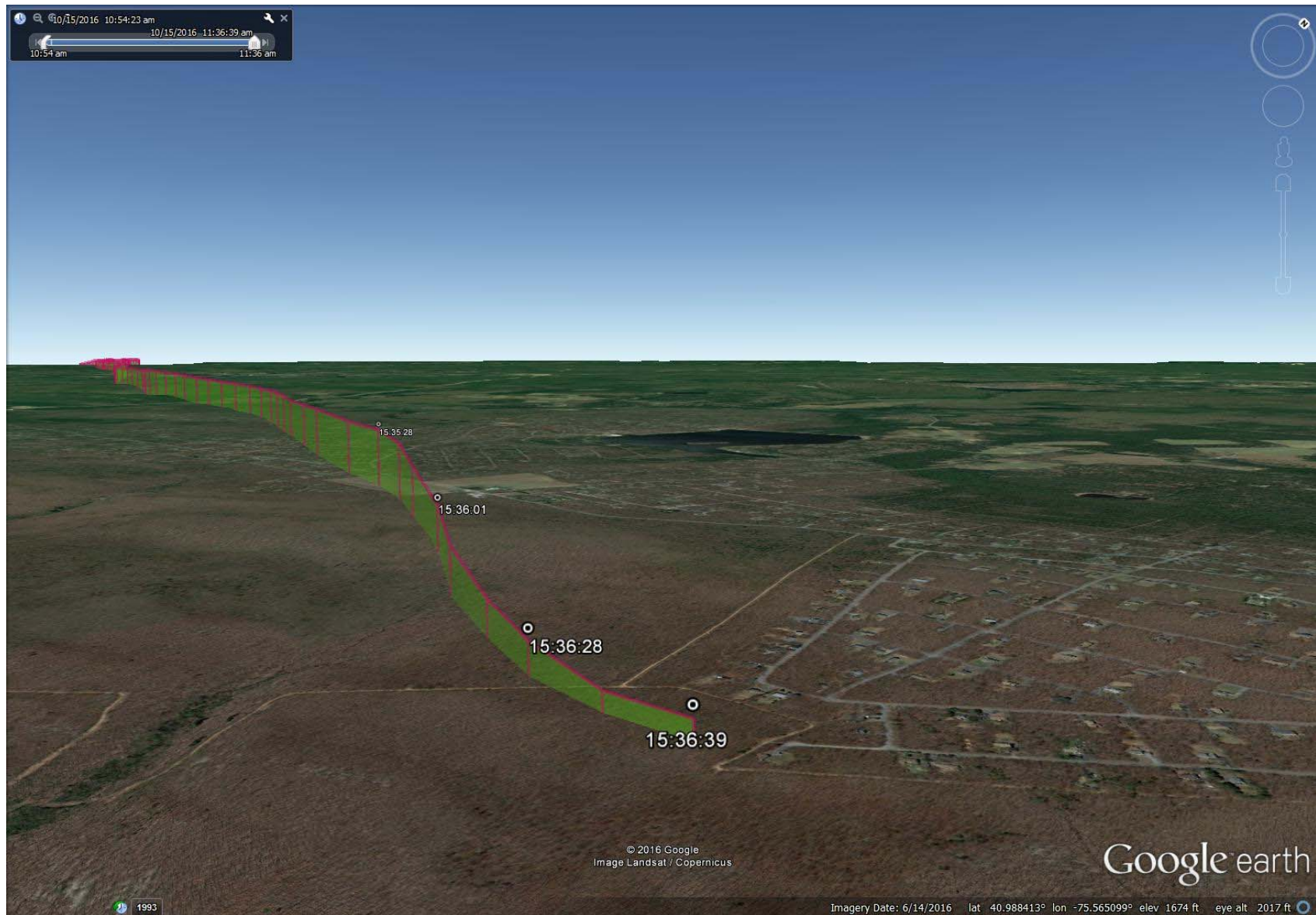


Figure 2. Google Earth depiction of end of accident flight

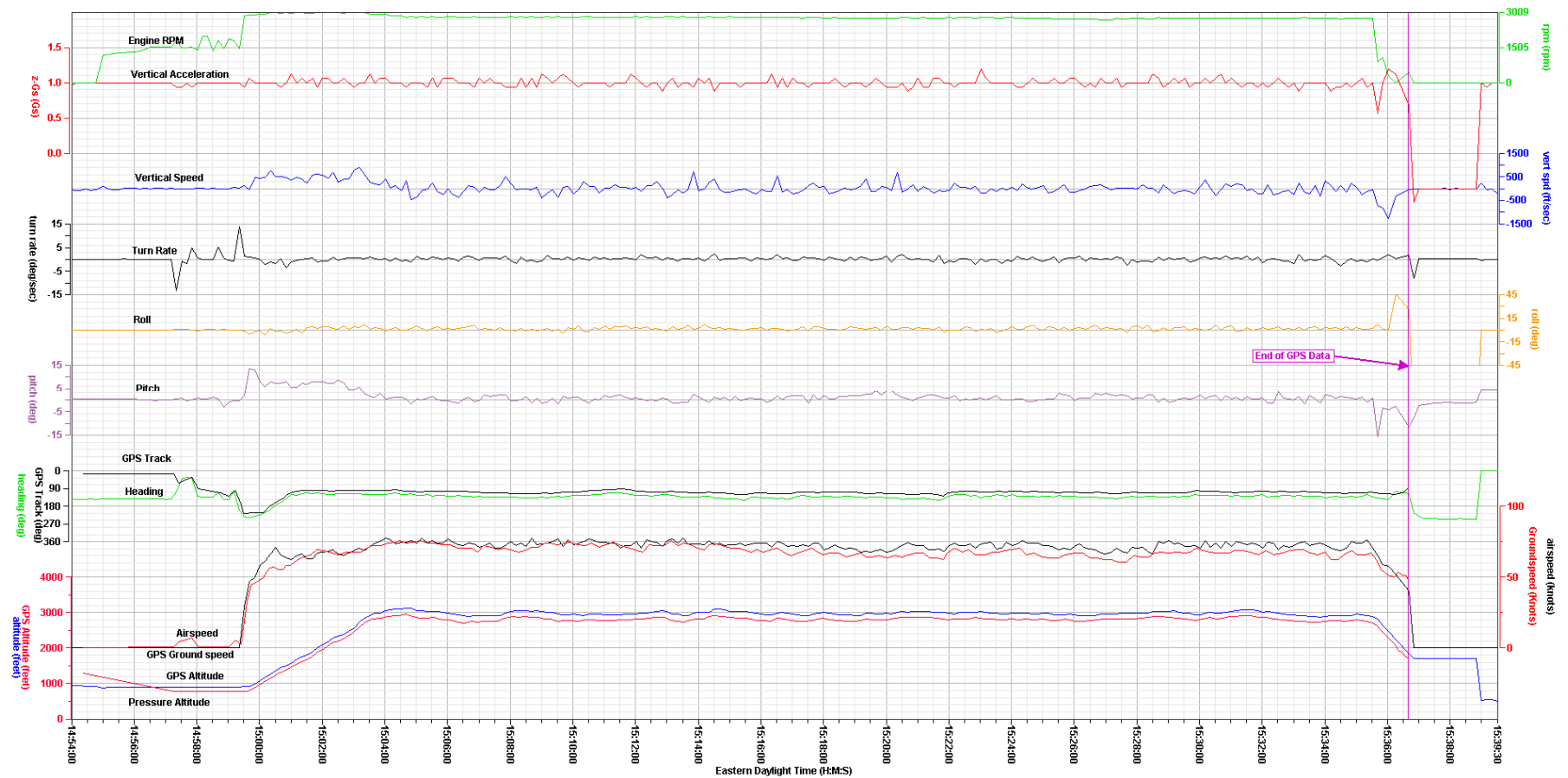


**Figure 3. Graphic presentation of the flight data for the accident flight**

Private, Zenity CH701, N3701M, Accident Flight Parameters

Location, Date: Albrightsville Pennsylvania, 10/15/16

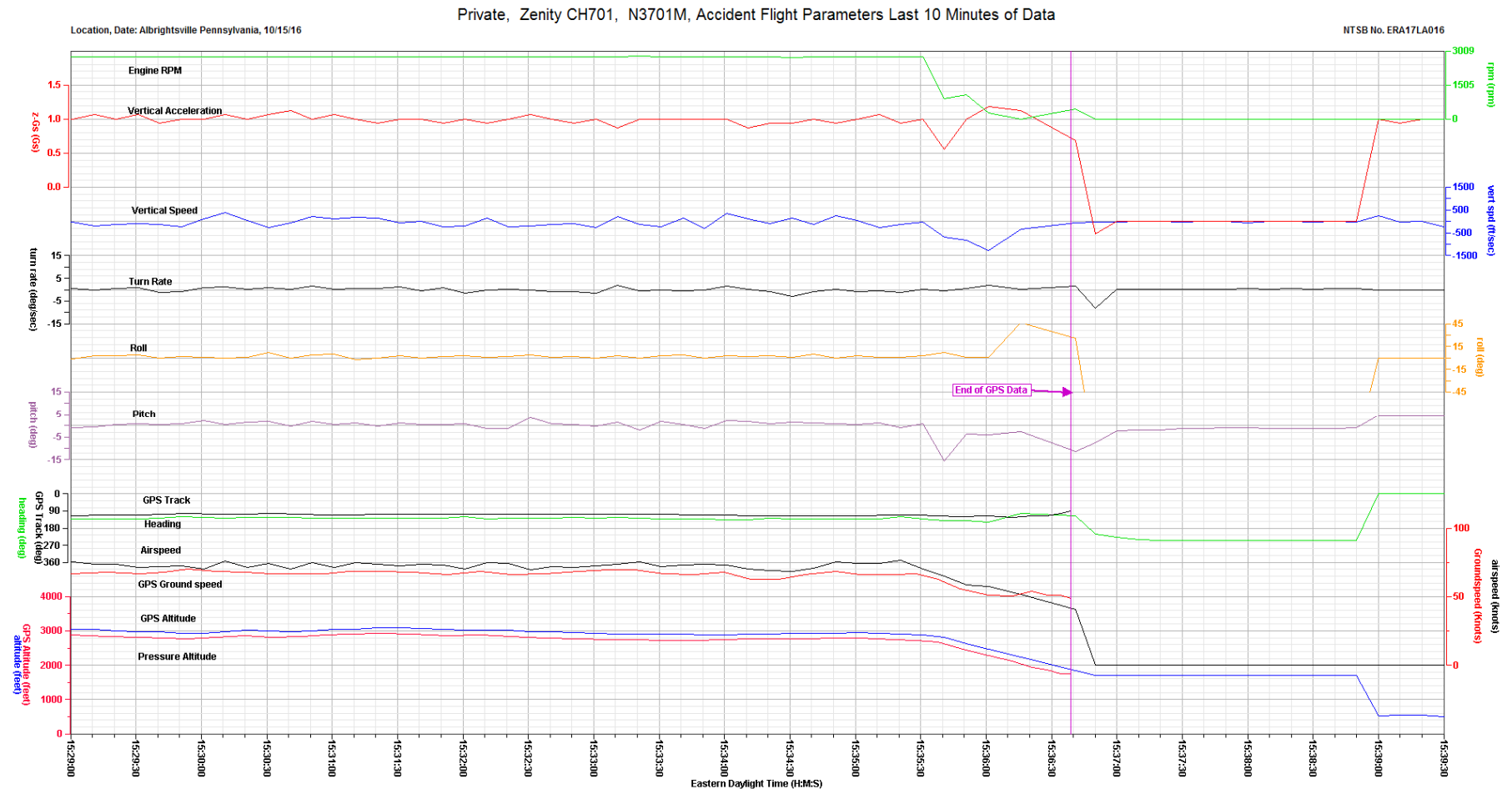
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**Figure 4. Graphic presentation of the flight data zoomed in on the last 10 minutes of the accident flight**



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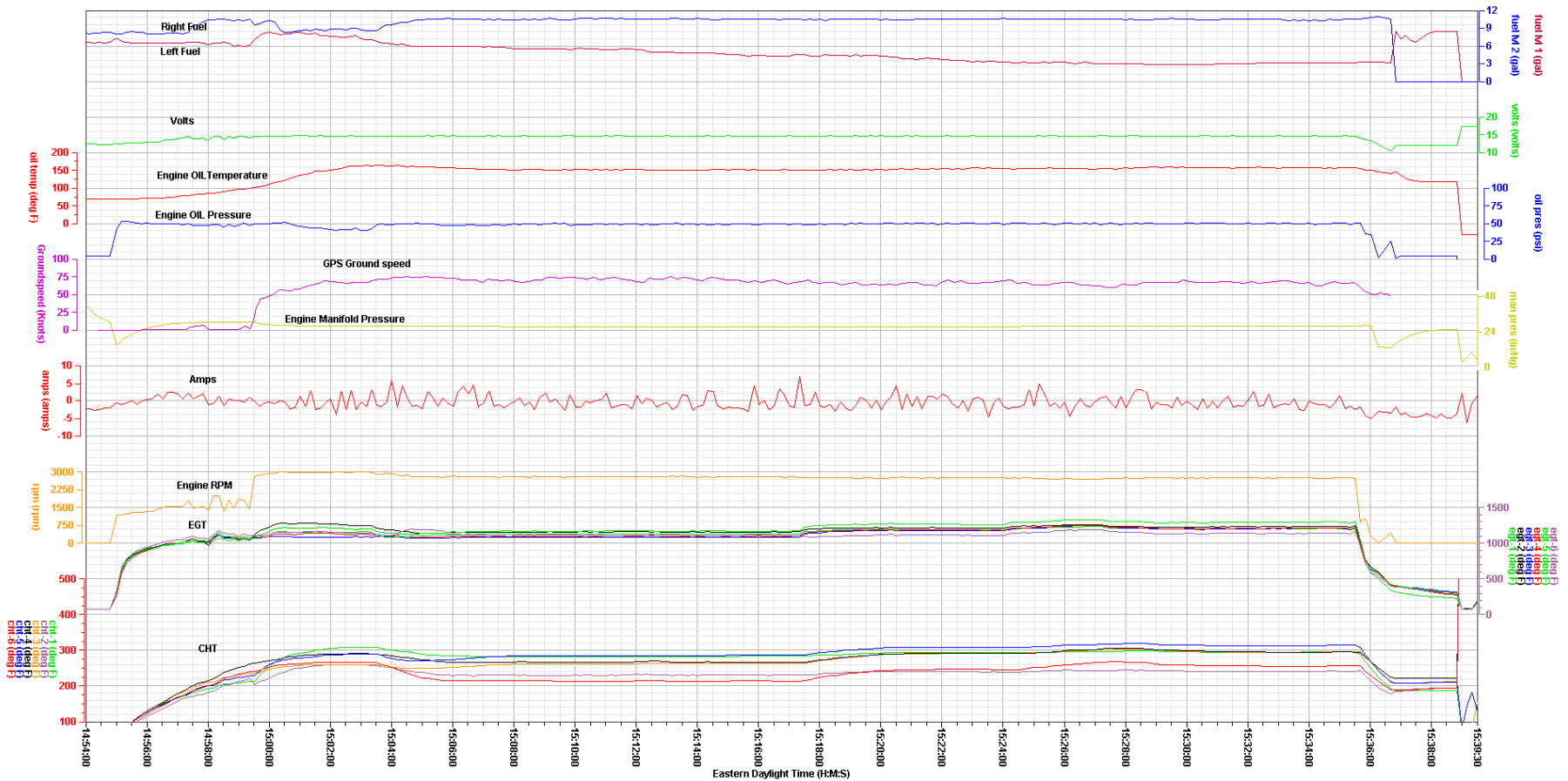
National Transportation Safety Board

**Figure 5. Graphic presentation of the engine data for the accident flight**

Private, Zenity CH701, N3701M, Engine Parameters Accident Flight

Location, Date: Albrightsville Pennsylvania, 10/15/16

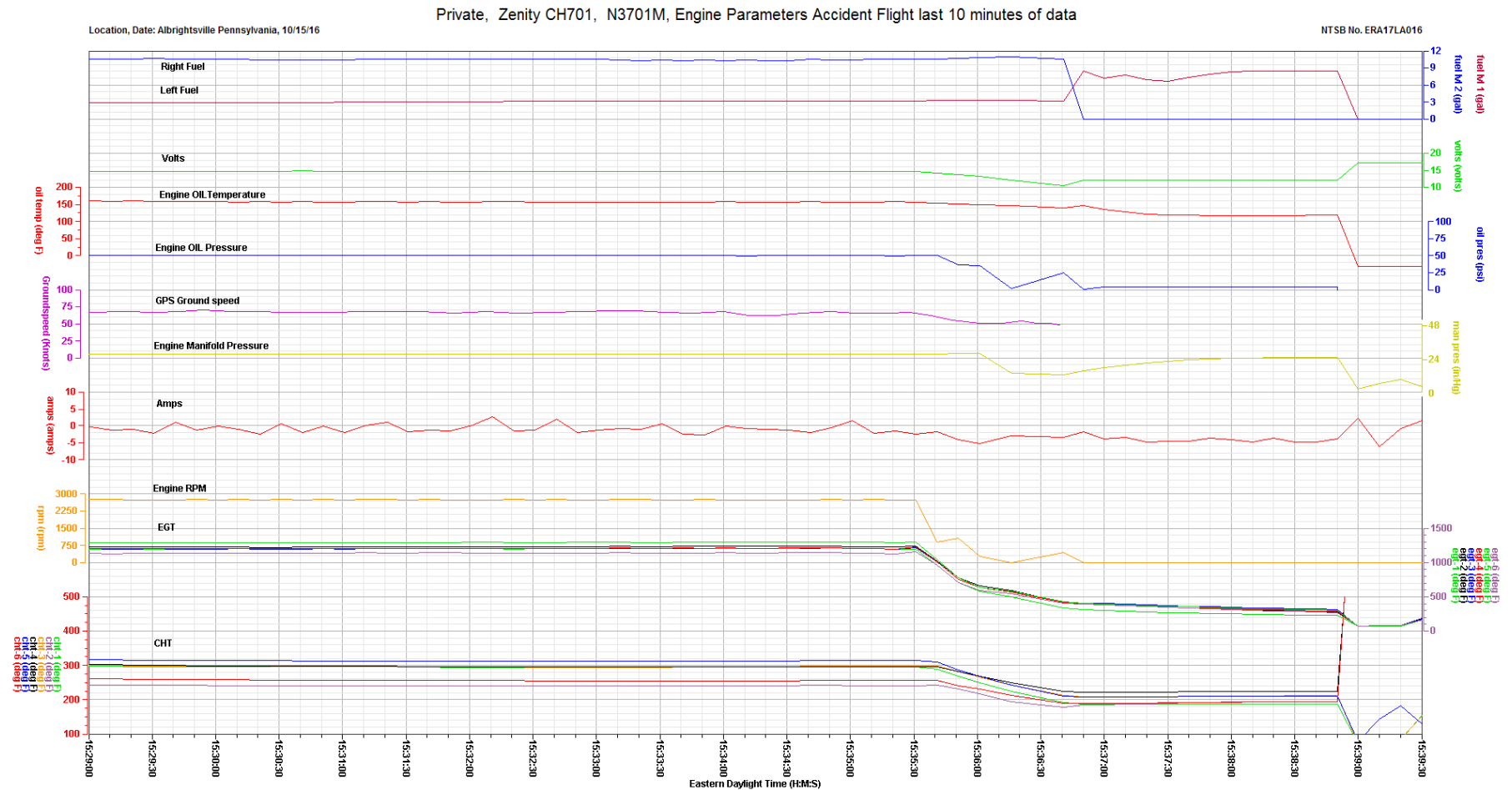
NTSB No. ERA17LA016



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**Figure 6. Graphic presentation of the engine data zoomed in on the last 10 minutes of the accident flight**



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## APPENDIX A - Dynon Parameters

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 parameters.**

| Parameter Name              | Parameter Description                                      |
|-----------------------------|------------------------------------------------------------|
| 1. Accel Vert (Z axis) (g)  | Vertical Acceleration                                      |
| 2. Airspeed Ind (kts)       | Indicated Airspeed                                         |
| 3. Altitude Press (ft)      | Pressure Altitude                                          |
| 4. Eng1 Amps (A)            | Engine 1 Amps                                              |
| 5. Eng1 CHT Cyl#-MFD (degF) | Engine 1 Cylinder Head Temperature Cylinder # <sub>3</sub> |
| 6. Eng1 EGT Cyl#-MFD (degF) | Engine 1 Exhaust Gas Temperature Cylinder # <sub>4</sub>   |
| 7. Eng1 Fuel Lvl-1 (gal)    | Engine 1 Fuel Level-1                                      |
| 8. Eng1 Fuel Lvl-2 (gal)    | Engine 1 Fuel Level-2                                      |
| 9. Eng1 MAP (inHg)          | Engine 1 Manifold Pressure                                 |
| 10. Eng1 Oil Press (psi)    | Engine 1 Oil Press                                         |
| 11. Eng1 Oil Temp (degF)    | Engine 1 Oil Temp                                          |
| 12. Eng1 RPM (rpm)          | Engine 1 Revolutions Per Minute                            |
| 13. Volts (volts)           | Volts                                                      |
| 14. Heading (deg)           | Heading                                                    |
| 15. Pitch (deg)             | Pitch                                                      |
| 16. Roll (deg)              | Roll                                                       |
| 17. Temp OAT degF)          | Outside Air Temperature                                    |
| 18. Time GMT (hr)           | Time GMT Hrs                                               |
| 19. Time GMT Min (min)      | Time GMT Min                                               |
| 20. Time GMT Sec (sec)      | Time GMT Sec                                               |
| 21. Time Hobbs (hrs)        | Hobbs Time                                                 |
| 22. Time Tach (hrs)         | Tachometer Time                                            |
| 23. Turn Rate (deg/sec)     | Turn Rate                                                  |
| 24. Vert Spd (fpm)          | Vertical Speed                                             |

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

| Units Abbreviation | Description            |
|--------------------|------------------------|
| g                  | G's                    |
| rpm                | revolutions per minute |
| A                  | Amperes                |
| deg                | degrees                |
| deg/sec            | degrees per second     |
| degF               | degrees Fahrenheit     |

<sup>3</sup> Depending on aircraft configuration, the number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID.

<sup>4</sup> Depending on aircraft configuration, the number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID.

| <b>Units Abbreviation</b> | <b>Description</b>     |
|---------------------------|------------------------|
| ft                        | feet                   |
| fpm                       | feet per minute        |
| gal                       | gallons                |
| hrs                       | hours                  |
| min                       | minutes                |
| inHg                      | inches of Mercury      |
| kts                       | knots                  |
| psi                       | pounds per square inch |
| sec                       | seconds                |
| V                         | Volts DC               |