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

November 25, 2019

Cockpit Display – Recorded Flight Data

Specialist's Factual Report
By Sean Payne

1. EVENT SUMMARY

Location: Calhoun, Georgia
Date: March 23, 2019
Aircraft: Commuter Craft Innovator
Registration: N257AR
Operator: Private
NTSB Number: ERA19FA134

On March 23, 2019, at 1535 eastern daylight time, an experimental amateur-built Commuter Craft Innovator, N257AR, was destroyed by collision with terrain during an uncontrolled descent after takeoff from Thomas B. David Field (CZL), Calhoun, Georgia. The pilot/owner/designer/builder was fatally injured. Visual meteorological conditions prevailed, and no flight plan was filed for the flight test which was conducted under the provisions of *Title* 14 *Code of Federal Regulations* Part 91.

2. RECORDED FLIGHT DATA GROUP

A recorded flight data group was not convened.

3. DETAILS OF INVESTIGATION

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

Recorder Manufacturer/Model: **Dynon SV-HDX1100**
Recorder Serial Number: **1741001201247 (Memory Module Serial Number)**

Recorder Manufacturer/Model: **Dynon SV-HDX1100**
Recorder Serial Number: **1741001201264 (Memory Module Serial Number)**

3.1. Dynon SV-HDX1100

The device has an 11" screen with both a touchscreen and softkey interface. The device can serve as either a Primary Flight Display (PFD) or a Multifunction Display (MFD) depending on installation. The unit has a solid-state Air Data and Attitude Heading Reference System (ADAHRS) and displays aircraft parameter data including altitude, airspeed, attitude, vertical speed, and heading. The unit also has external pitot/static inputs for altitude, airspeed, and vertical speed information. The device contains an internal flash memory device. The flash memory stores information sampled every 60 milliseconds for the last two hours of flight in

a file called a “Black_Box_Log,” detailed alert logs that show both caution, warning and aural alerts generated by the display in a file called “Alert_Data,” as well as a flight history log which is sampled at a lower rate that can record many more hours of operation. The flight history is recorded as a file called “User_Log” and is sampled about every 130 milliseconds.

3.2. Dynon SV-HDX1100 Data Recovery

One memory module was in fair condition and the data were downloaded using the manufacturer’s procedure via an M-SATA adapter. The second memory module exhibited impact damage and the memory chip was broken loose from the electronic circuit board it was mounted on. The second memory chip was examined and found to be cracked, thus rendering it unusable. It is unknown whether the working memory module belonged to the PFD or MFD. In a typical installation, both the PFD and MFD record the same data.

Files were extracted from the “Black Box Log,” the “Alert Data” log and the “User Log” from the first memory module.

3.2.1. Dynon SV-HDX1100 Data Description

The PFD’s “User_Log” contained records of various flights and power cycles between November 19, 2018, and March 23, 2019. The “Alert_Data” log contained caution and warning as well as aural alert records for the device between the dates of July 29, 2018 and March 23, 2019. The “Black_Box_Log” file contained high rate data between March 21, 2019, and March 23, 2019. The accident flight was associated with the logs created on March 23, 2019,[1] on all three data files. The “Alert Data” log show no triggered caution or warnings while the aircraft was in flight.

3.2.2. Dynon SV-HDX1100 Engineering Units Conversions

Conversion of the data from the raw recorded information to engineering units is performed internally by the device.

Where applicable, changes to the conversions have been made to ensure the parameters conform to the Safety Board’s standard sign convention that climbing right turns are positive (CRT=+).[2]

APPENDIX A lists the parameters verified and provided in this report.

3.3. Dynon SV-HDX1100 Time Correlation

Data was recorded in Universal Coordinated Time (UTC). The plotted information was left in UTC and was not converted to local time of the accident.

[1] During the normal data retrieval process, power is applied to the PFD. Therefore, the accident data is not necessarily the last power cycle recorded.

[2] CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Left Aileron Trailing Edge Down = -, Right Aileron Trailing Edge Up = +, Pitch Up = +, Elevator Trailing Edge Up = +.

3.4. Plots and Corresponding Tabular Data

The following plot contains data recorded during the March 23, 2019 event.

Figure 1 is a plot of basic flight parameters and most significant recorded engine parameters for the entire accident flight. In general, the data started recording as the aircraft was on takeoff roll. Upon being airborne, the data indicates the aircraft experienced multiple pitch oscillations between approximately -1 degree nose down and positive 12 degrees nose up. Engine parameters were nominal and show that the aircraft reached 100 percent power and stayed at a high power setting until the end of the recording around 19:33:55.

The recording ends before the aircraft reached the accident site. The manufacturer stated that loss of data before the aircraft reaches the accident site is due to the electronic buffer schema of the device. The manufacturer added that the data is written to the NVM memory at no particular set schedule and data loss could range from a few seconds to "even a minute or more."

The "Alert Data" log showed no triggered caution or warnings while the aircraft was in flight.

Figure 2 is a plot of the same parameters as the accident flight, but using data from a previous flight on February 26, 2019.

The corresponding tabular data used to create this plot are provided in electronic (*.csv[3]) format as Attachment 1 to this report for the accident flight and Attachment 2 for the previous flight.

3 Comma Separated Value format.

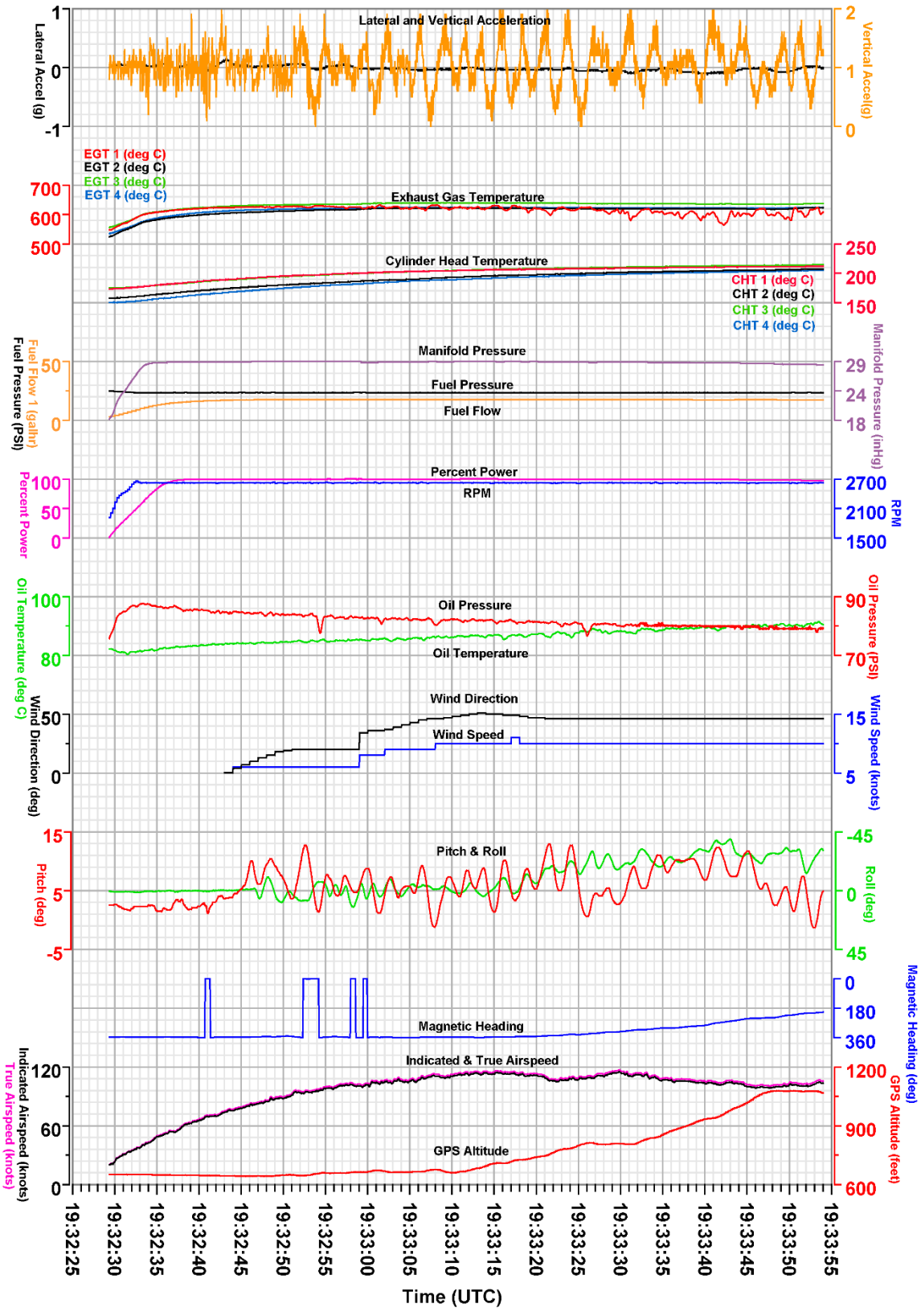

Figure 1. Plot of basic flight and engine parameters during the accident flight.

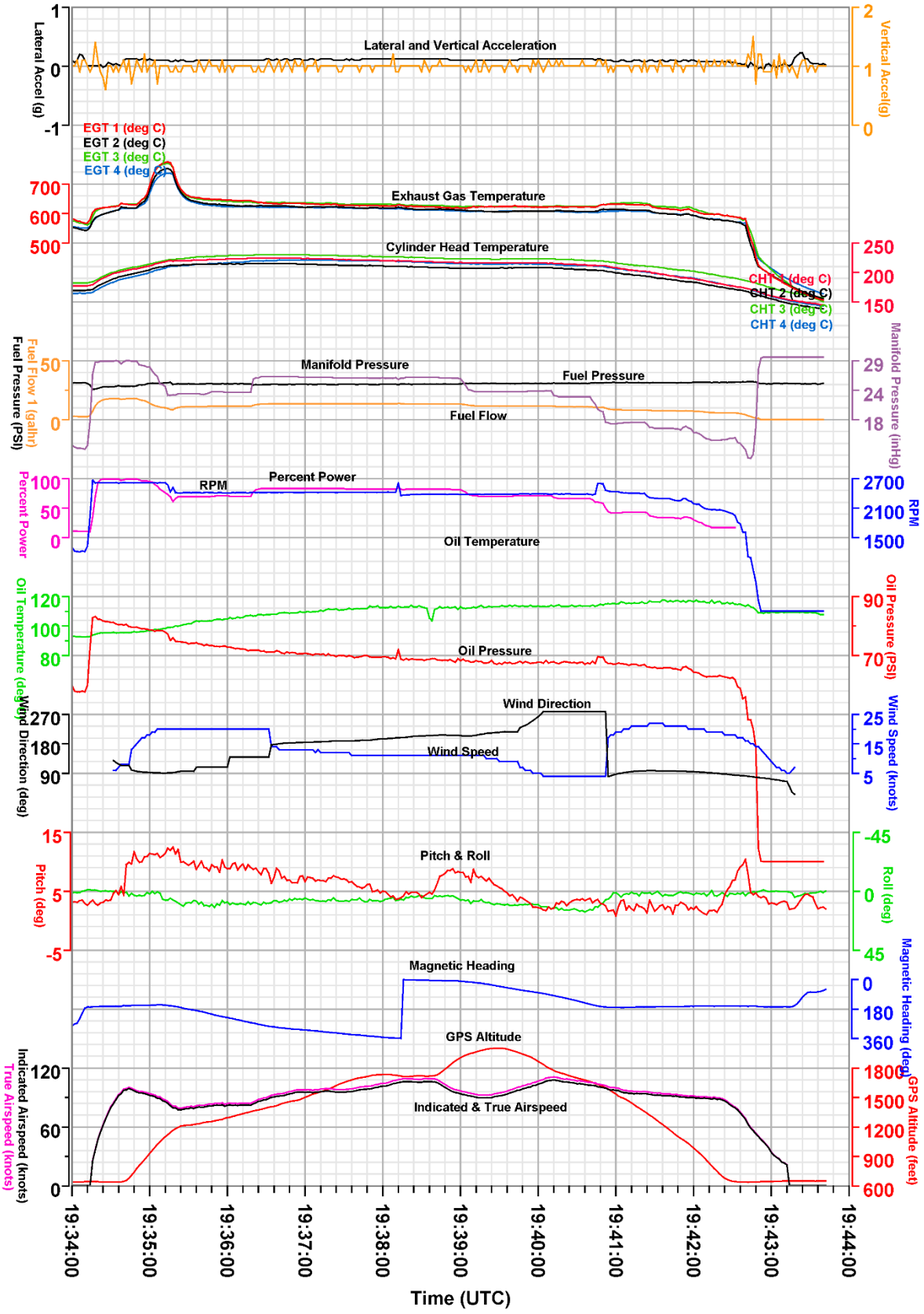

Figure 2. Plot of basic flight and engine parameters during the previous flight to the accident.

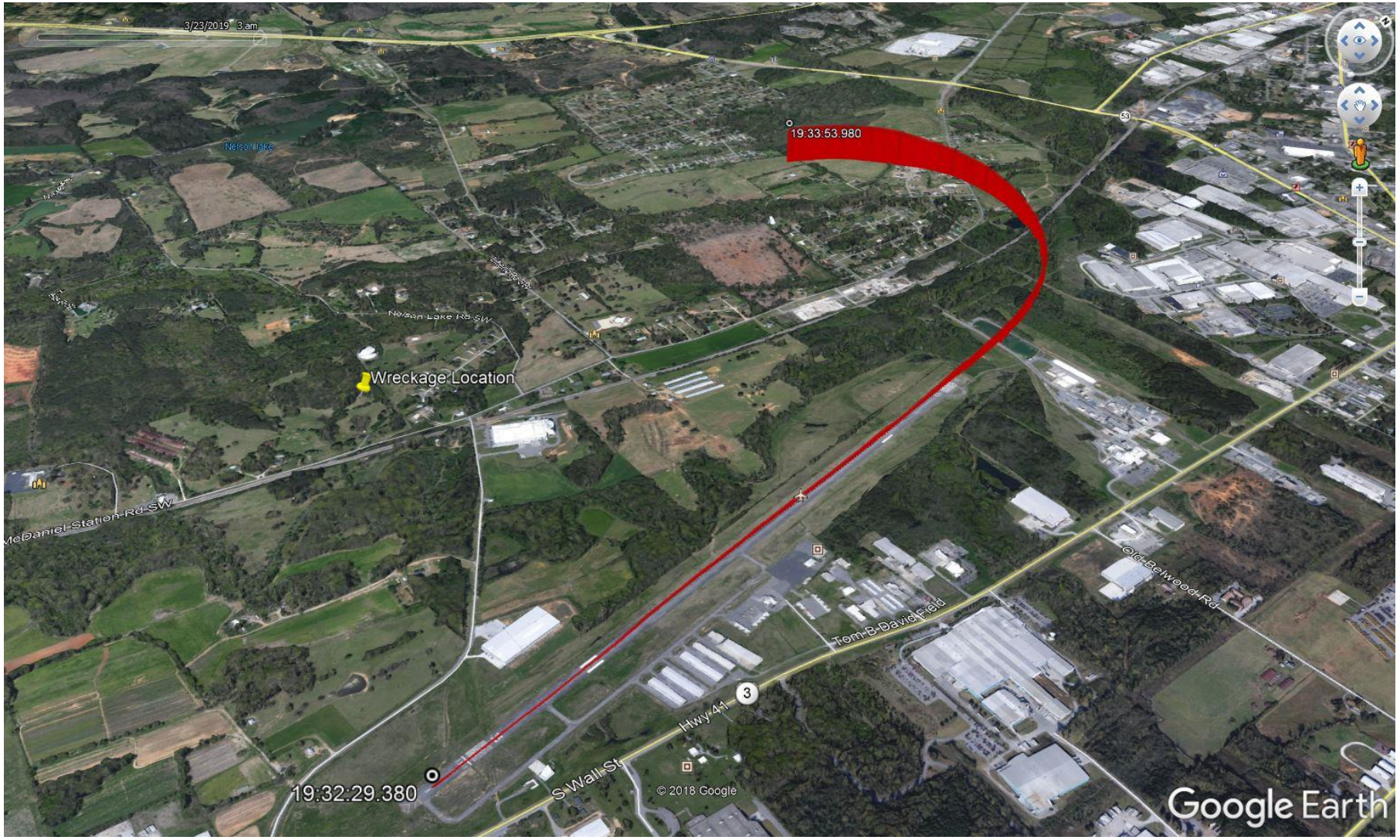

Figure 2. Google Earth overlay of the entire accident flight. The yellow pin denotes the wreckage location.

APPENDIX A - PFD 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
CHT (deg C)	Cylinder Head Temperature
EGT (deg C)	Exhaust Gas Temperature
Fuel Pressure (psi)	Fuel Pressure
Fuel Flow (gal/hr)	Fuel Flow
GPS Altitude (feet)	GPS Altitude
Groundtrack (deg. True)	Groundtrack
Indicated Airspeed (knots)	Indicated Airspeed
Lateral Acceleration (g)	Lateral Acceleration
Latitude (deg)	Latitude
Longitude (deg)	Longitude
Magnetic Heading (deg)	Magnetic Heading
Manifold Pressure (inHg)	Manifold Pressure
Oil Pressure (psi)	Oil Pressure
Oil Temperature (deg. C)	Oil Temperature
Percent Power (%)	Calculated Engine Percent Power
Pitch (deg)	Pitch
Pressure Altitude (ft)	Pressure Altitude
Roll (deg)	Roll
RPM	Propeller RPM
Throttle Position (%)	Throttle Position
True Airspeed (knots)	True Airspeed
Wind Direction (deg)	Wind Direction
Wind Speed (knots)	Wind Speed
Vertical Acceleration (g)	Vertical Acceleration

Table A-2 - Unit abbreviations.

Units Abbreviation	Description
%	Percent
deg	degrees
deg C	degrees Celsius
ft	feet
gal/hr	gallons per hour
inHg	inches of mercury
knots	knots
psi	pounds per square inch

NOTE: For parameters with a unit description of discrete, a discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.