

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

September 9, 2020

Electronic Devices

Specialist's Factual Report By Gerald Kawamoto

1. EVENT SUMMARY

Location: Valley Center, CA
Date: May 31, 2020
Aircraft: Cubcrafters CCK-1865
Registration: N303KP
Operator: Private
NTSB Number: WPR20LA157

On May 31, 2020 at 1757 Pacific daylight time (PDT), an experimental Cub Crafters CCK-1865, N303KP, was substantially damaged when it was involved in an accident near Valley Center, California. The pilot sustained fatal injuries and the passenger was seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following electronic devices capable of recording information to non-volatile memory¹:

Recorder Manufacturer/Model: **Dynon FlightDEK-D180**
Recorder Serial Number: **002876**

Recorder Manufacturer/Model: **Delorme inReach**
IMEI: **300434061354660**

3.1. Dynon FlightDEK-D180 Description

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 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,

¹ Non-volatile memory (NVM) is semiconductor memory that does not require external power for data retention.

RPM, and fuel system information. Depending on the type of engine installed in the aircraft and pilot preferences, not all display options may be available.

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 Electronic Flight Information System (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, or 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.

3.1.1. Dynon FlightDEK-D180 Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had sustained impact damage resulting in damage to the display and exterior housing as shown in Figure 1. The interior was undamaged and the device powered on normally using surrogate parts.



Figure 1. Exterior of Dynon FlightDEK-D180 as received.

3.1.2. Dynon FlightDEK-D180 Data Description

The D180 received contained firmware version 5.4.0.233. Based on information from the manufacturer, the unit is capable of storing data. The operator had the datalog function enabled and it was set to record information at a 10 second interval. The recording contained data starting on August 31, 2018, recorded time. The unit records clock time, either external or internal. The time is set by the operator for the internal clock or, if the unit is connected to a GPS, the unit will use the GPS system time. The data does not indicate if the device was connected to a GPS source. The last flight recorded was determined to be the accident flight. The date recorded for the accident flight was found to be incorrect. The time recorded on the accident flight was compared to radar data and was determined to be in Coordinated Universal Time (UTC). The difference between PDT and UTC is 7 hours, or 25,200 seconds.

3.1.3. Dynon FlightDEK-D180 Engineering Units Conversions

Conversion of the data from the raw recorded information to engineering units is performed by the Dynon product support download program. Table 1 describes data parameters provided by the device.

Table 1. Dynon Data Parameters.

Parameter Name	Parameter Description
airspeed (kts)	Indicated Airspeed (knots)
altitude (ft)	Pressure Altitude (feet)
CHT # (degF)	Cylinder Head Temperature # (degrees Fahrenheit)
EGT # (degF)	Exhaust Gas Temperature # (degrees Fahrenheit)
fuel flow (gph)	Fuel Flow (gallons per hour)
gals rem	Fuel Remaining (gallons)
grnd spd (kts)	Derived Ground Speed (kts)
gz (g)	Vertical Acceleration (acceleration)
heading (deg)	Magnetic Heading (degrees)
grnd trk (deg)	Derived Ground Track (degrees)
man pres (inHg)	Manifold Pressure (inches of Mercury)
oil pres (psi)	Oil Pressure (pounds per square inch)
oil temp (degF)	Oil Temperature (degrees Fahrenheit)
pitch (deg)	Pitch (degrees)
roll (deg)	Roll (degrees)
RPM (rpm)	Engine RPM (revolutions per minute)
vert spd (fpm)	Vertical Speed (feet per minute)

3.2. Delorme inReach Explorer Description

The Delorme inReach Explorer is a two-way satellite communicator with GPS and navigation functions. The device is capable of route tracking and text messaging via satellite network. The device may be paired with a mobile device for additional function. Messaging, tracking, and SOS functions require an active satellite service subscription.

3.2.1. Delorme inReach Explorer Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit was in functioning condition but had sustained minor damage to the display. The device as received is shown in Figure 2. The device powered on normally and did not contain historical data.



Figure 2. Delorme inReach Explorer as received.

4. Plots and Corresponding Tabular Data

The following six figures contain Dynon FlightDEK-D180 data recorded during the May 31, 2020, event.

Figures 3 and 4 are graphical overlays generated using Google Earth. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 3 shows the entire accident flight.

Figure 4 shows the end of the accident flight and the wreckage location.

Figure 5 is a plot of basic parameters for the entire accident flight. The time interval shown is 00:32:00 to 00:58:00 UTC.

Figure 6 is a plot of basic parameters at the end of the accident flight. The time interval shown is 00:51:00 to 00:58:00 UTC.

Figure 7 is a plot of engine parameters for the entire accident flight. The time interval shown is 00:32:00 to 00:58:00 UTC. The Gallons Remaining parameter is included for trending purposes. Negative values may be attributed to the parameter being dependent on the user to reset the fuel counter appropriately to display an accurate value.

Figure 8 is a plot of engine parameters at the end of the accident flight. The time interval shown is 00:51:00 to 00:58:00 UTC.

The corresponding tabular data used to create these six plots are provided in electronic (*.csv²) format as Attachment 1 to this report.

² Comma Separated Value format.

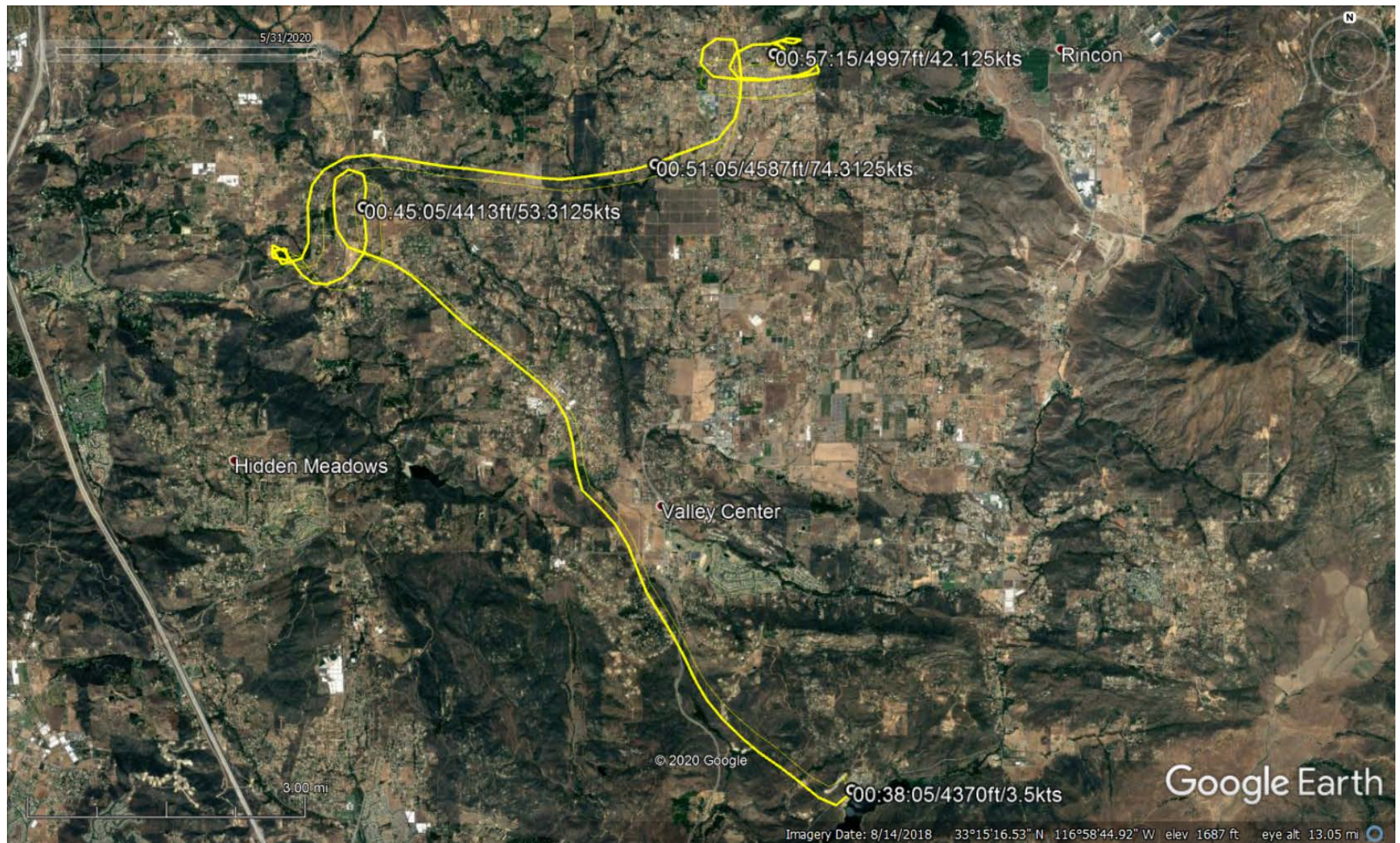


Figure 3. Google Earth overlay for the entire accident flight recorded on the Dynon FlightDEK-D180.



Figure 4. Google Earth overlay for the end of the accident flight recorded on the Dynon FlightDEK-D180.

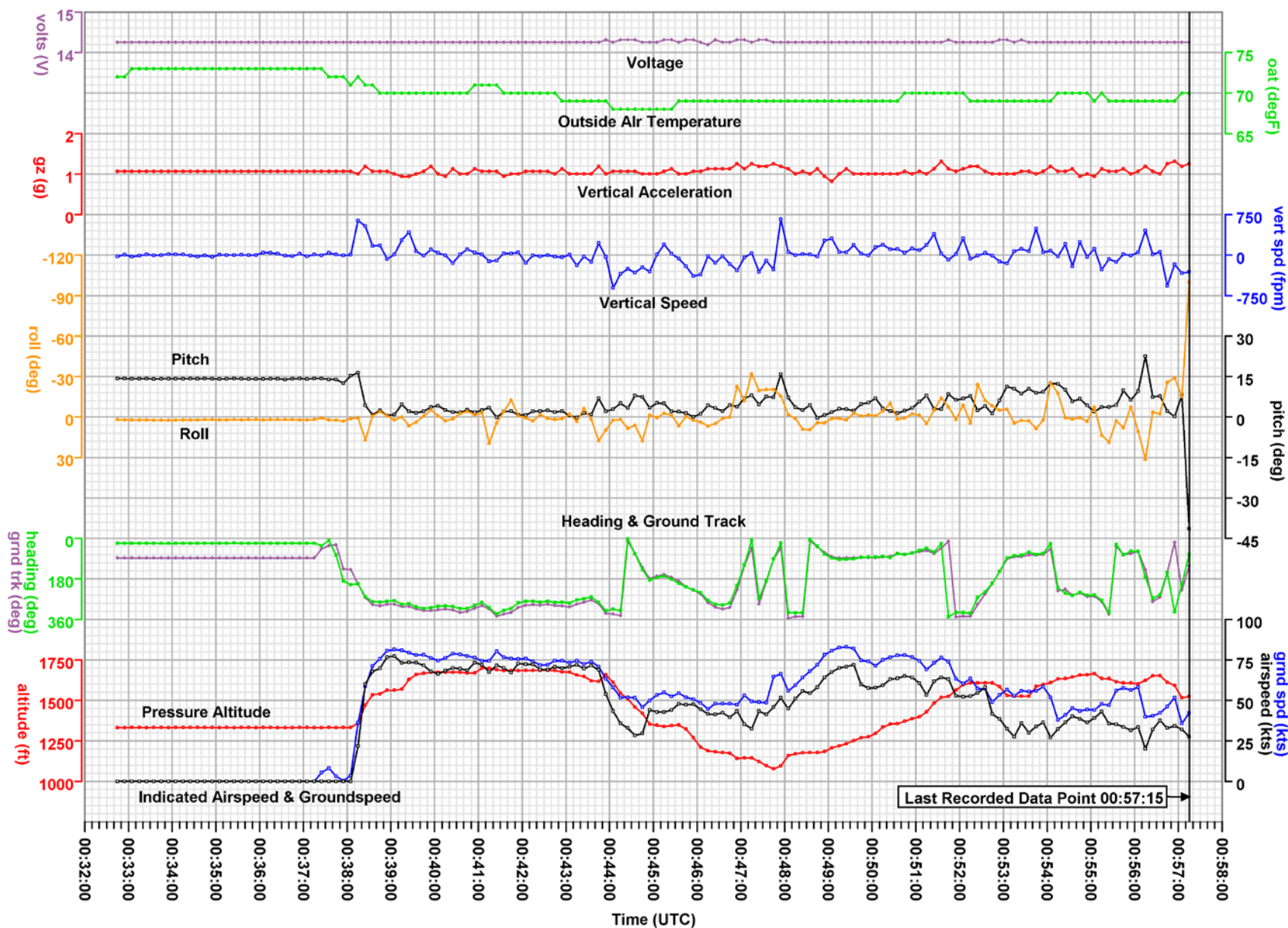


Figure 5. Plot of basic parameters for the entire accident flight recorded on the Dynon FlightDEK-D180.

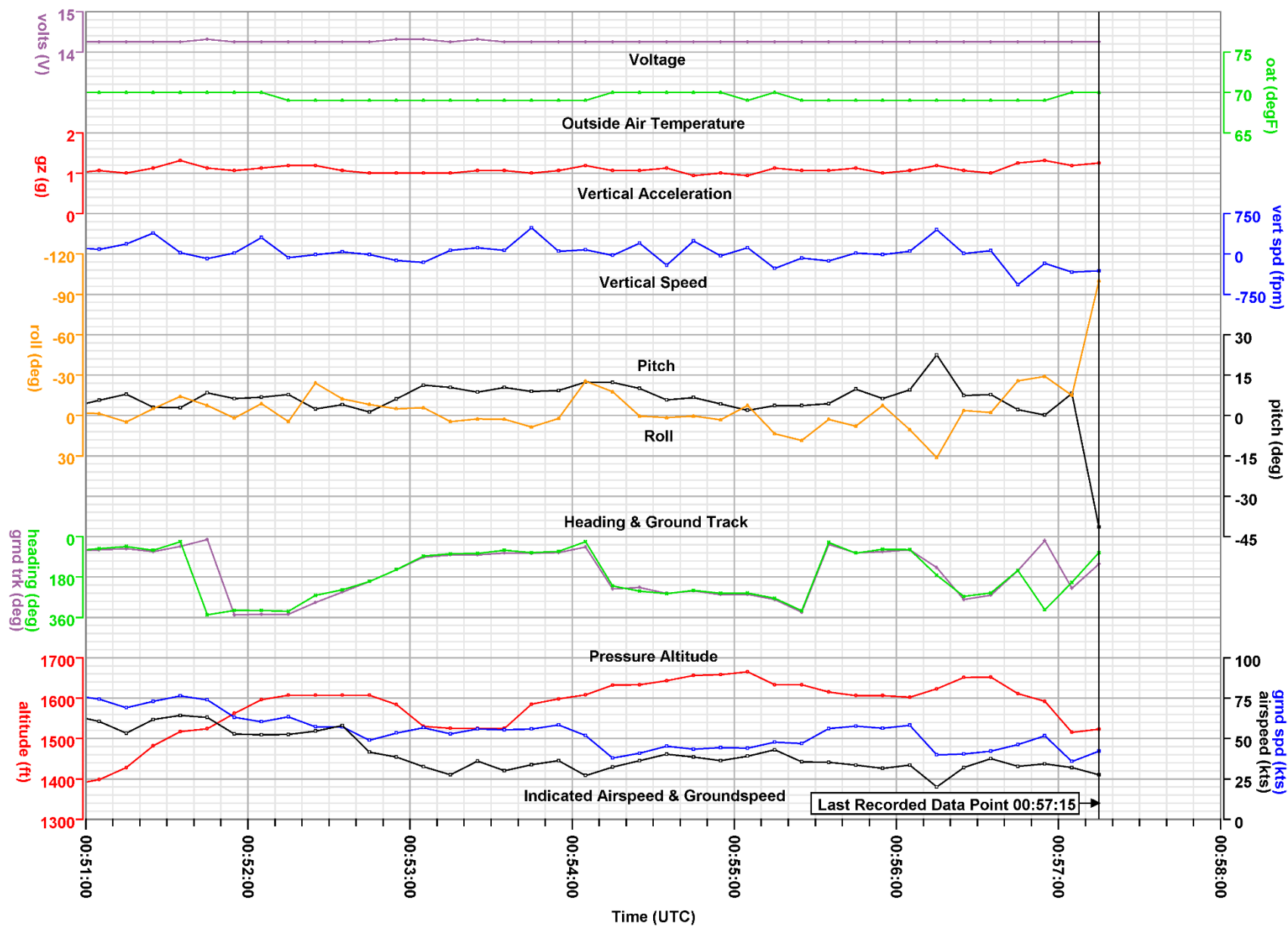


Figure 6. Plot of basic parameters for the last 7 minutes of the accident flight recorded on the Dynon FlightDEK-D180.

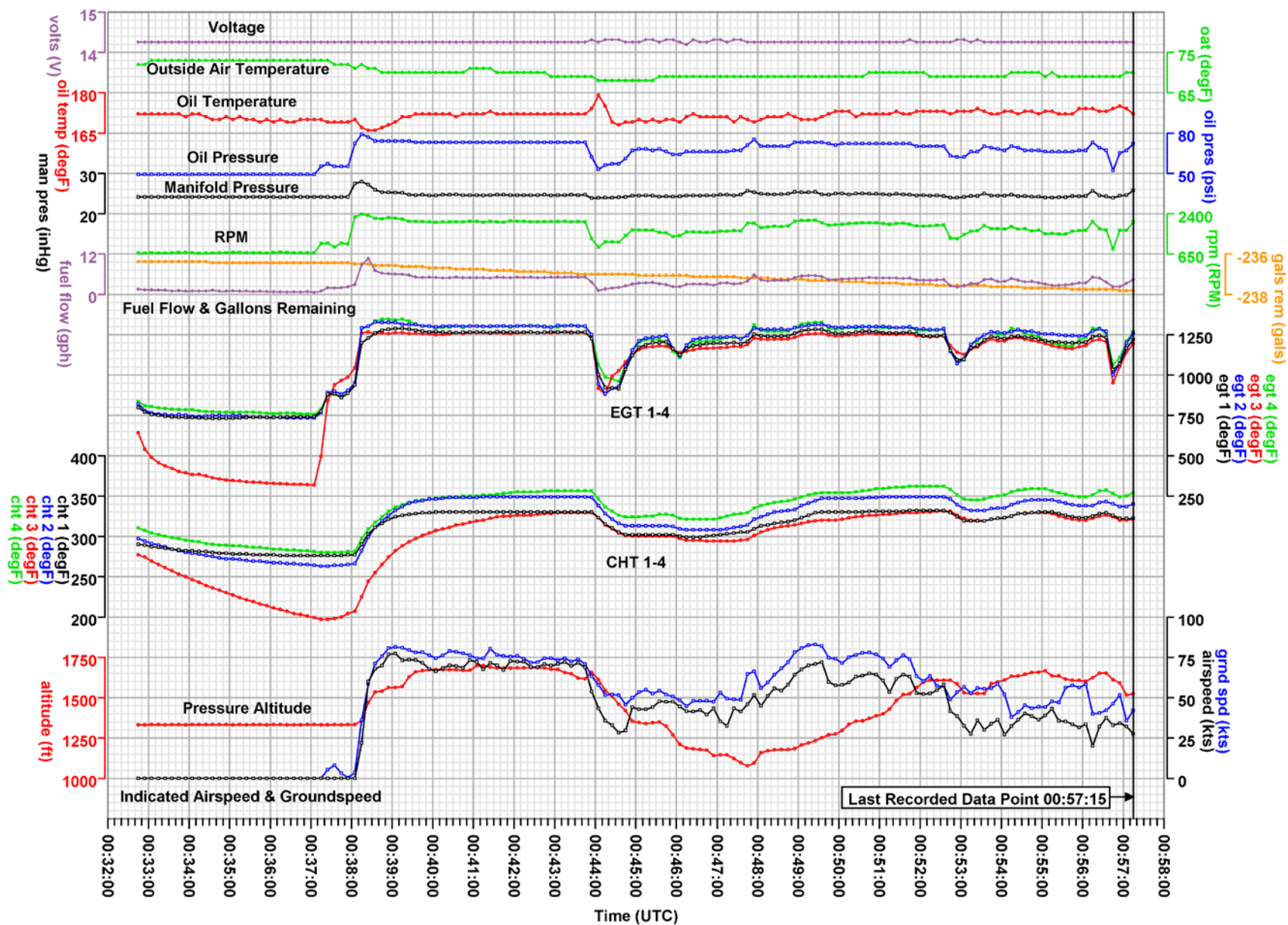


Figure 7. Plot of engine parameters for the entire accident flight recorded on the Dynon FlightDEK-D180.

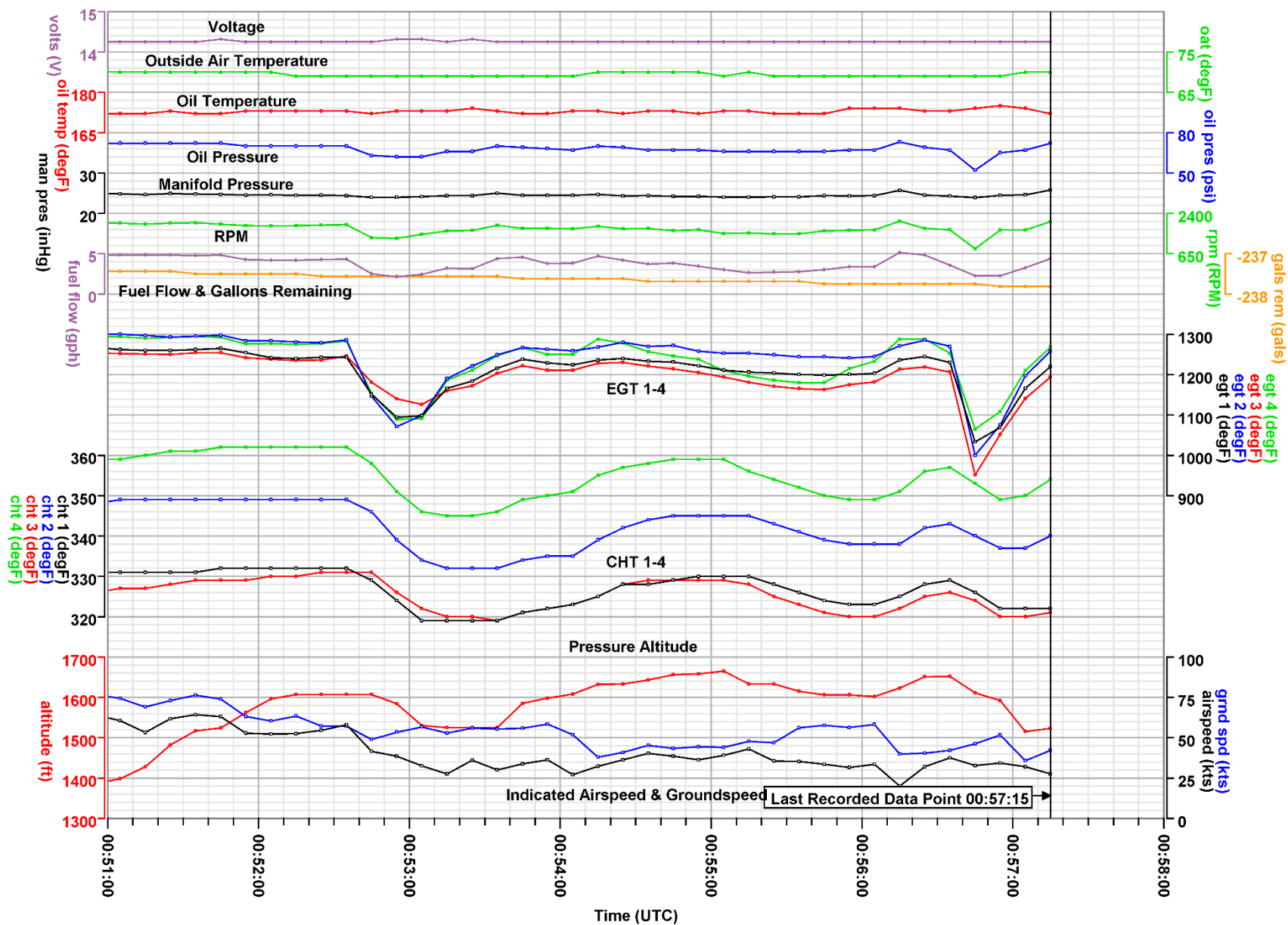


Figure 8. Plot of engine parameters for the last 7 minutes of the accident flight recorded on the Dynon FlightDEK-D180.