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

August 17, 2016

Cockpit Display– Recorded Flight Data

Specialist's Factual Report
By James Cash

1. EVENT SUMMARY

Location: Warren, Idaho
Date: August 05, 2014
Aircraft: Zenith CH750
Registration: N32FZ
Operator: Private
NTSB Number: WPR14FA330

On August 5, 2014, about 1335 Pacific daylight time (PDT), an experimental David Fitzgerald, Zenith CH750, N32FZ, crashed in mountainous terrain in the wilderness area of Warren, Idaho. The owner/pilot was operating the airplane under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The sport pilot and passenger were fatally injured; the airplane was destroyed by impact forces. The cross-country personal flight departed Big Creek, Idaho, about 1440, with a planned destination of Dixie, Idaho. Visual meteorological conditions prevailed, and no flight plan had been filed.

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 displays/device capable of recording information to non-volatile memory (NVM):

Recorder Manufacturer/Model: **Dynon SV-D1000 (SkyView)**
Recorder Serial Number: Unknown

3.1. Dynon EFIS-D100 Description

The Dynon Electronic Flight Information System (EFIS) D100 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 operators' aircraft certain parameters might not be displayed, for example angle-of-attack.

Depending on the firmware version on the unit, the ability to log data to internal memory exists. According to the manufacturer, 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 2 hours of cumulative data at a 1 second recording interval or at least 120 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 SV-D1000 Data Recovery

The recorder was damaged in the event. The internal memory module was removed from the main processor board and the recorded data was recovered by using the labs forensic disk recovery software

3.1.2. Dynon SV-D1000 Data Description

The D100 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 20 records per second interval and start recording at boot up. The accident flight recording was approximately 23 minutes. Timing of the data is measured in seconds.

3.1.2.1. Dynon SV-D1000 Engineering Units Conversions

Conversion of the data from the raw recorded information to engineering units is performed by the Dynon product support download program.

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=+).[1]

APPENDIX A lists the SV-D1000 parameters verified and provided in this report.

[1] 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 = +.

3.1.3. Dynon SkyView SV-D1000 Data Recovery

The following 3 figures contain EDM data recorded during the 08/05/2014 event. Figure 1 depicts basic flight data from the accident flight. Figure 2 depicts data related to the engine during the accident flight. Figure 3 depicts the basic flight data during the last minute of flight.

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

[2] Comma Separated Value format.

Figure 1. Plot of basic parameters during entire flight.

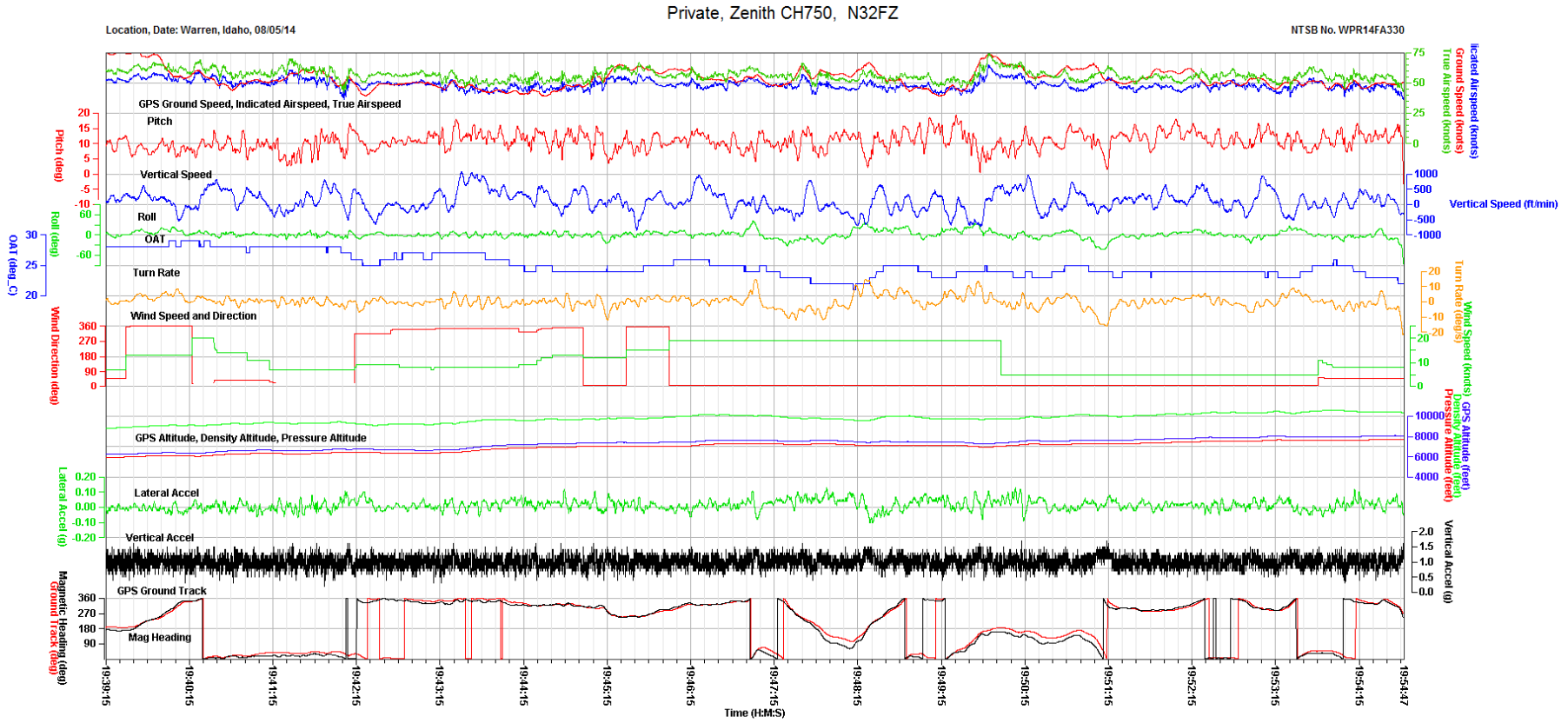


Figure 2. Plot of Engine information.

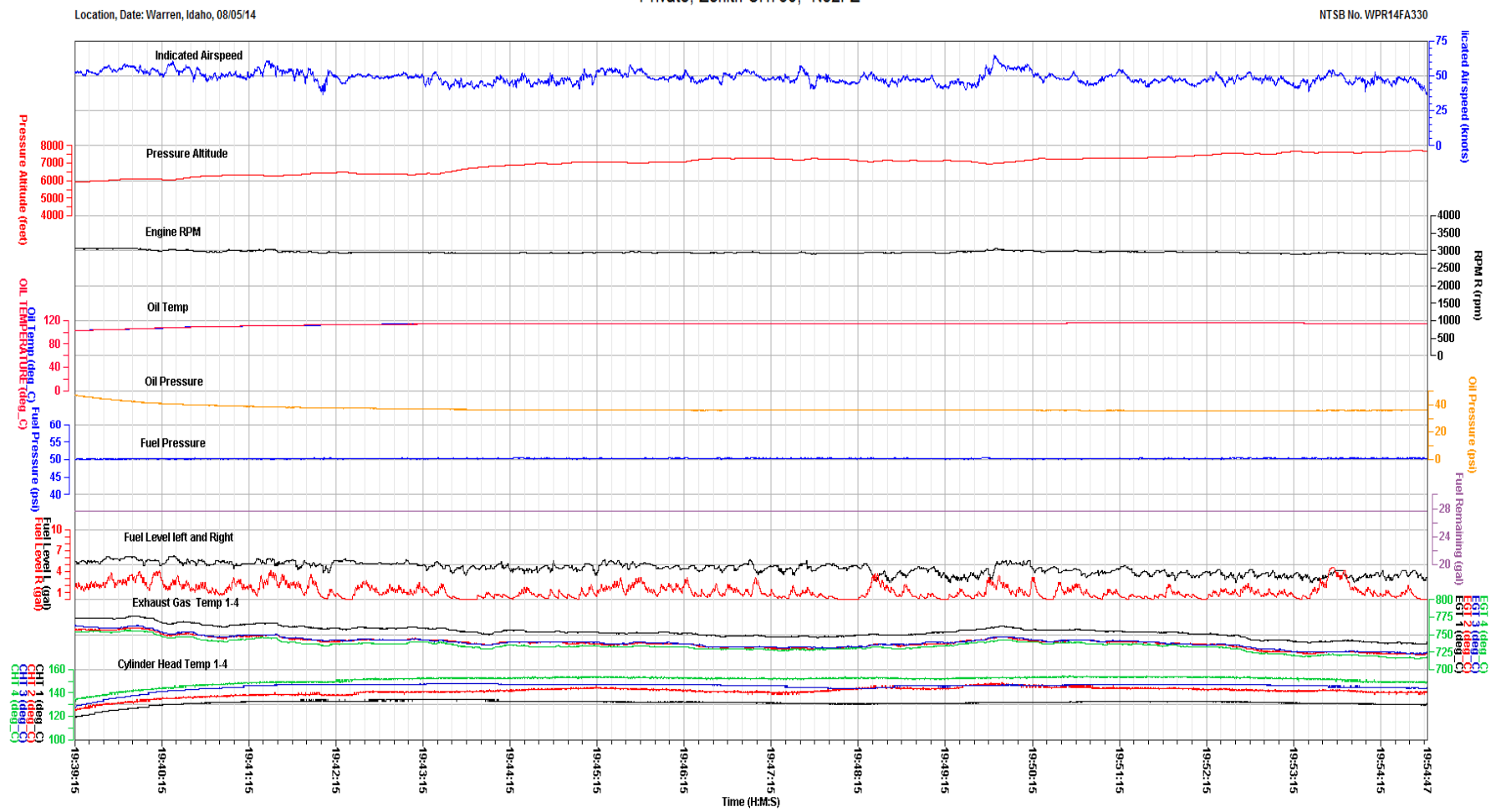
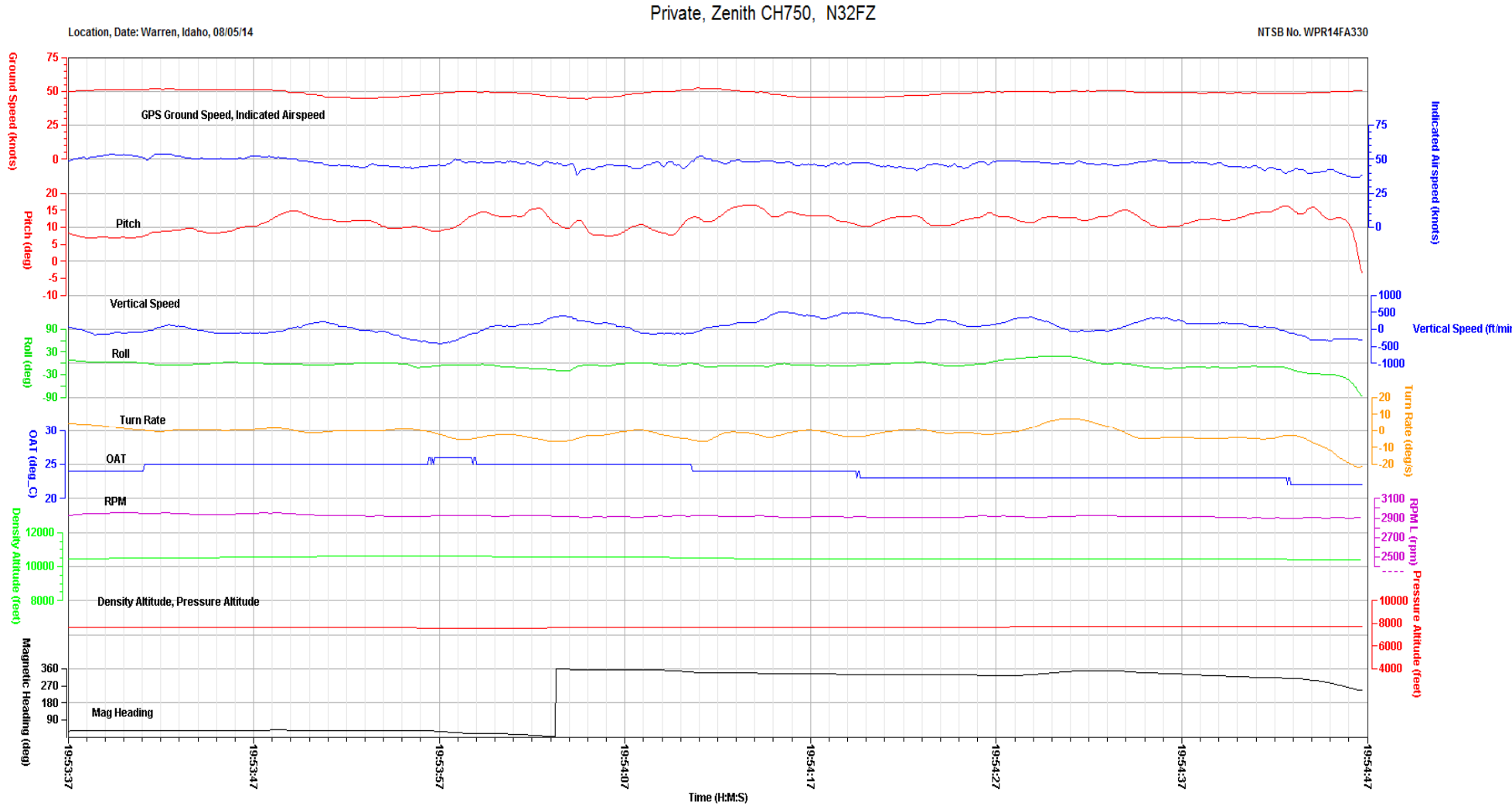


Figure 3. Plot of Data from last minute of the Flight.



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 (g)	Vertical Acceleration
2. Airspeed Ind (kts)	Indicated Airspeed
3. Altitude Press (ft)	Pressure Altitude
4. Altitude-GPS (ft)	GPS Altitude
5. Altitude Rate (fpm)	Altitude Rate (Vertical Speed)
6. AOA	Angle of Attack
7. Eng1 Amps	Engine 1 Amps
8. Eng1 CHT Cyl#-MFD (degF)	Engine 1 Cylinder Head Temperature Cylinder #[3]
9. Eng1 EGT Cyl#-MFD (degF)	Engine 1 Exhaust Gas Temperature Cylinder #3
10. Eng1 Fuel Flow (gph)	Engine 1 Engine Fuel Flow
11. Eng1 Fuel Lvl-1	Engine 1 Fuel Level-1
12. Eng1 Fuel Lvl-2	Engine 1 Fuel Level-2
13. Eng1 Fuel Press	Engine 1 Fuel Pressure
14. Eng1 Fuel Remain	Engine 1 Fuel Remaining
15. Eng1 MAP (inHg)	Engine 1 Manifold Pressure
16. Eng1 Oil Press (psi)	Engine 1 Oil Press
17. Eng1 Oil Temp (deg)	Engine 1 Oil Temp
18. Eng1 RPM (rpm)	Engine 1 Revolutions Per Minute
19. Eng1 Volts (discrete)	Engine 1 Volts
20. Event (discrete)	Event Marker
21. Ground Spd (kts)	Ground Speed
22. Heading (deg)	Heading
23. Latitude (deg)	Latitude
24. Longitude (deg)	Longitude
25. Pitch (deg)	Pitch
26. Roll (deg)	Roll
27. Select Course (deg)	Selected Course
28. Temp OAT (deg)	Outside Air Temperature
29. Time GMT Sec (sec)	Time GMT Sec
30. Time Tach	Tachometer Time
31. Track (deg)	Track
32. Turn Rate (deg/sec)	Turn Rate
33. Vert Spd (fpm)	Vertical Speed

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

Table A-2 - Unit abbreviations.

Units Abbreviation	Description
%	percent
rpm	revolutions per minute
A	Amperes
deg	degrees
char	one character (A-Z, 0-9)
deg/min	degrees per minute
deg/sec	degrees per second
degC	degrees Celsius
degF	Degrees Fahrenheit
discrete	discrete
ft	feet
gal	gallons
gph	gallons per hour
hrs	hours
in	inches
inHg	inches of Mercury
kts	knots
psi	pounds per square inch
sec	seconds
V	Volts DC

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.