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

July 11, 2012

Cockpit Display(s) – Recorded Flight Data

Specialist's Factual Report
By Bill Tuccio

1. EVENT SUMMARY

Location: Westminster, Maryland
Date: June 15, 2012
Aircraft: Flugzeubau Remos GX
Registration: N206GX
Operator: Private
NTSB Number: ERA12FA395

On June 15, 2012, about 1010 eastern daylight time (EDT), a Remos Aircraft GmbH Flugzeugbau Remos GX, special-light sport aircraft (S-LSA), N206GX, operated by a private individual, was substantially damaged when it impacted the ground during an emergency landing at the Carroll County Regional Airport (DMW), Westminster, Maryland. The certificated commercial pilot was fatally injured. Visual meteorological conditions prevailed and no flight plan had been filed for the flight that departed the Frederick Municipal Airport (FDK), Frederick, Maryland, and was ultimately destined for the Piseco Airport (K09), Piseco, New York. The personal flight 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 Safety Board's Vehicle Recorder Division received the following electronic displays/device capable of recording information to non-volatile memory (NVM):

Recorder Manufacturer/Model: **Dynon FlightDEK D180**
Recorder Serial Number: **002519**

3.1. Device Descriptions

The following sections contain descriptions of the devices received.

3.1.1. Dynon FlightDEK D180

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 information to the display. Depending on the installation in the operators' 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.

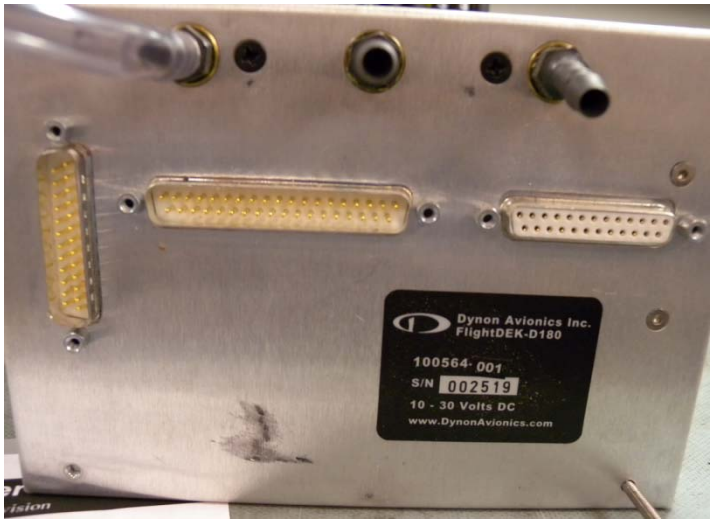
Depending on the firmware version on the unit, the ability to log data to internal memory exists. According to the manufacturer, firmware versions 3.0 and later contain the ability to log certain engine parameters and firmware versions 5.0 and later contain the ability to log certain EFIS and GPS parameters. 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, 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.

3.1.1.1. Device Condition

The device was in good condition with minimal housing damage (see figures 1 and 2) and the data were downloaded using the manufacturers' procedure.

Figure 1. Front of device.

Figure 2. Back of device.



3.1.1.2. Recording Description

The D180 received contained firmware version 5.2.B1. 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 1 second interval. The recording contained approximately 6 hours and 46 minutes of data. The accident was recording approximately 4 hours and 52 minutes into the recording. The accident flight was about 32 minutes in duration. Timing of the data is measured in seconds.

3.1.1.3. Engineering Units Conversions

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

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

3.2. Time Correlation

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. For the time periods covered in this report, GPS system time was valid and used.

The GPS time was recorded in Universal Coordinated Time (UTC). The difference between EDT and UTC was 4 hours, or 14,400 seconds. An offset was applied to display the data with the local time zone. Therefore, for the rest of this report, all times are referenced as EDT, not recorded time

3.3. Plots and Corresponding Tabular Data

The following seven figures contain data recorded during the June 15, 2012 event as well as the prior flight on June 14, 2012.

Figure 3 shows a plot of parameters from the entire accident flight. The aircraft recorded data for about 9 minutes before airspeed and altitude began to increase at 0933, consistent with take-off. The aircraft climbed to an altitude of about 2,500 feet and then maintained a north-northeast heading. The aircraft remained at about 2,500 feet until about 0954, when it began a descent.

At about 0953, the aircraft recorded oscillations in pitch between about +/- 6 degrees, followed by oscillations in angle of attack from 0 to about 8% of stall.

During the descent at about 0955, the aircraft began a right hand turn towards the south. While heading towards the south, the aircraft descended to a minimum altitude of about 1,735 feet.

A Google Earth overlay of the entire flight is shown in figure 4. The overlay shows the aircraft proceeding towards the north-northeast, over the DMW airport, before starting a right hand turn and ultimately heading back to the DMW airport.

Figure 5 shows the approach and attempted landing at the DMW airport. At about 0959, the aircraft was heading south westerly and climbed from about 1,735 feet to about 2,300 feet. At about 1001, the aircraft began a descent, while turning towards a heading of about 160 degrees at an airspeed of about 100 knots. At about 1003:30, at an altitude of about 1,600 feet, the pitch, angle of attack, airspeed, vertical acceleration, and propeller rpm began to oscillate. At about 1004:47, the oscillations reached extreme values. After 1004:47, the recorded values are of questionable accuracy.

Figure 6 shows a Google Earth overlay of the approach and attempted landing on runway 16 at DMW, with select data points annotated. Figure 7 shows the last few seconds of the recording up to the first extreme and questionable recorded value of 75 degrees pitch attitude.

Figures 8 and 9 show the prior flight of the aircraft on June 14, 2012 for comparison. Figure 8 shows fluctuations in recorded vertical acceleration, pitch, angle of attack, and roll throughout the flight. The aircraft cruised at an indicated airspeed of about 92 knots, and during the descent slowed to about 75 knots, before a decrease in speed, altitude, and propeller RPM consistent with landing.

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

[1] Comma Separated Value format.

Figure 3. Plot of parameters during entire accident flight.

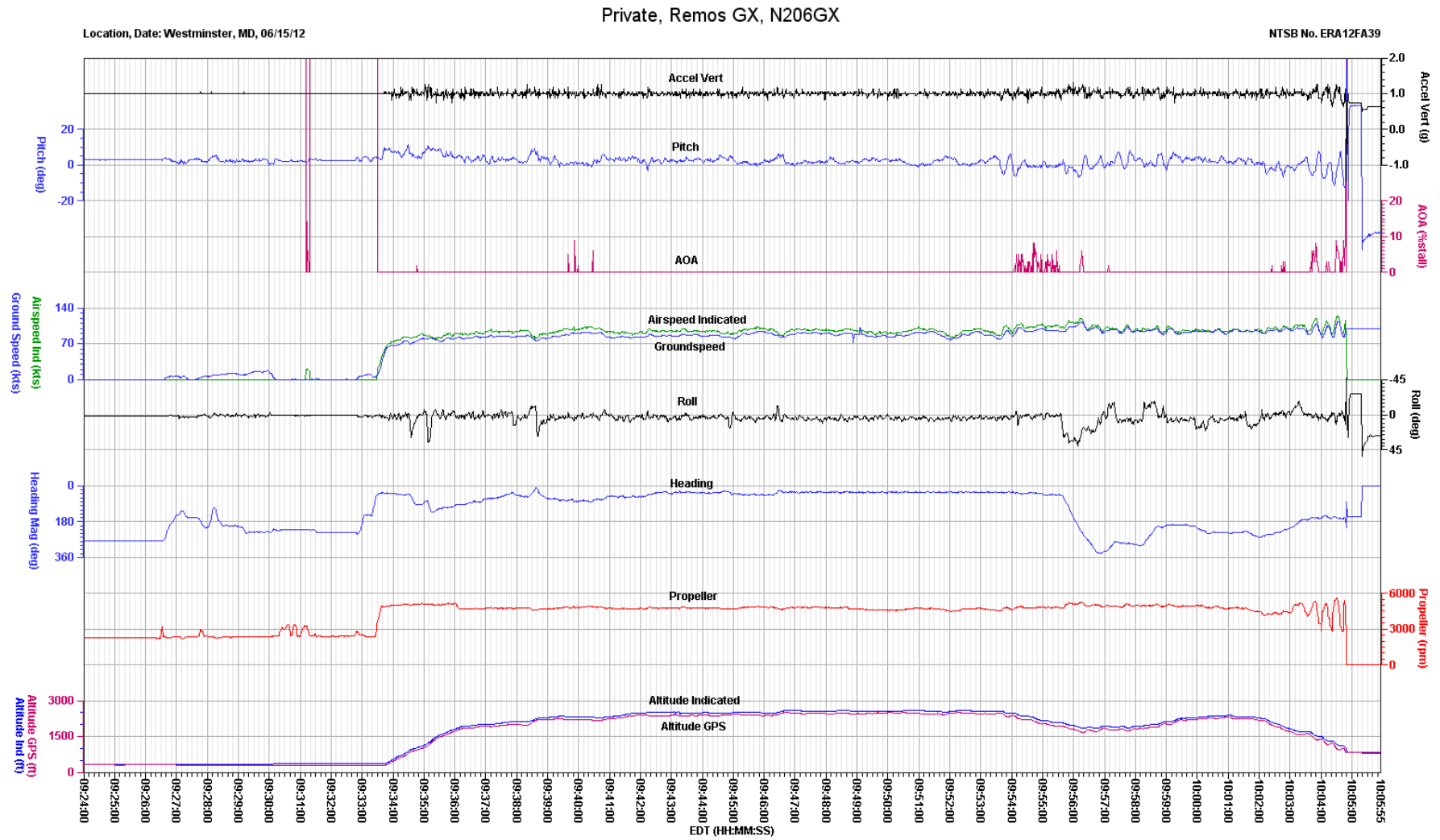


Figure 4. Google Earth overlay of accident flight.

Figure 5. Plot of parameters during accident landing.

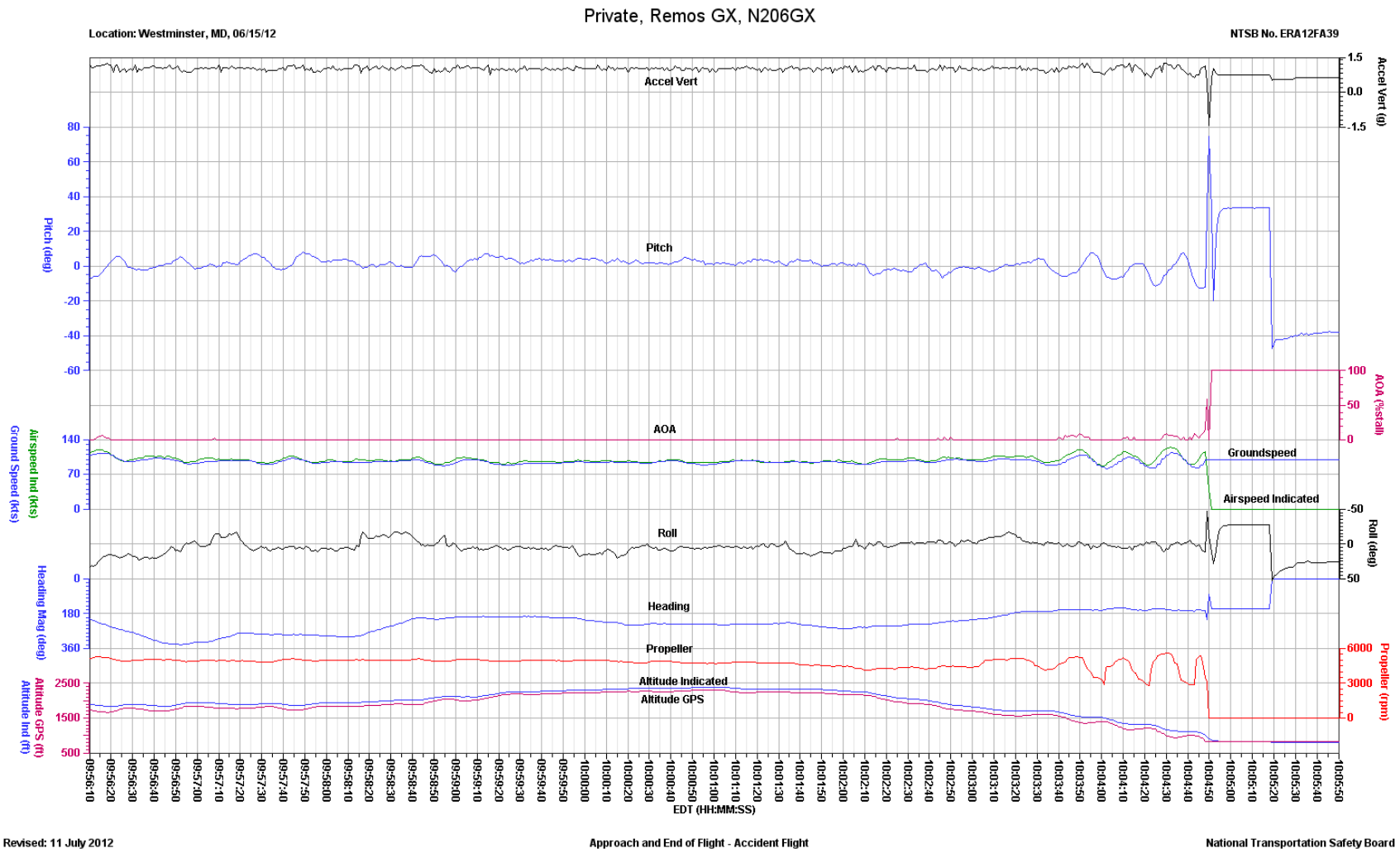


Figure 6. Google Earth overlay of final approach, select points annotated.

Figure 7. Google Earth overlay of select points at end of recording.

Figure 8. Plot of parameters during entire prior flight.

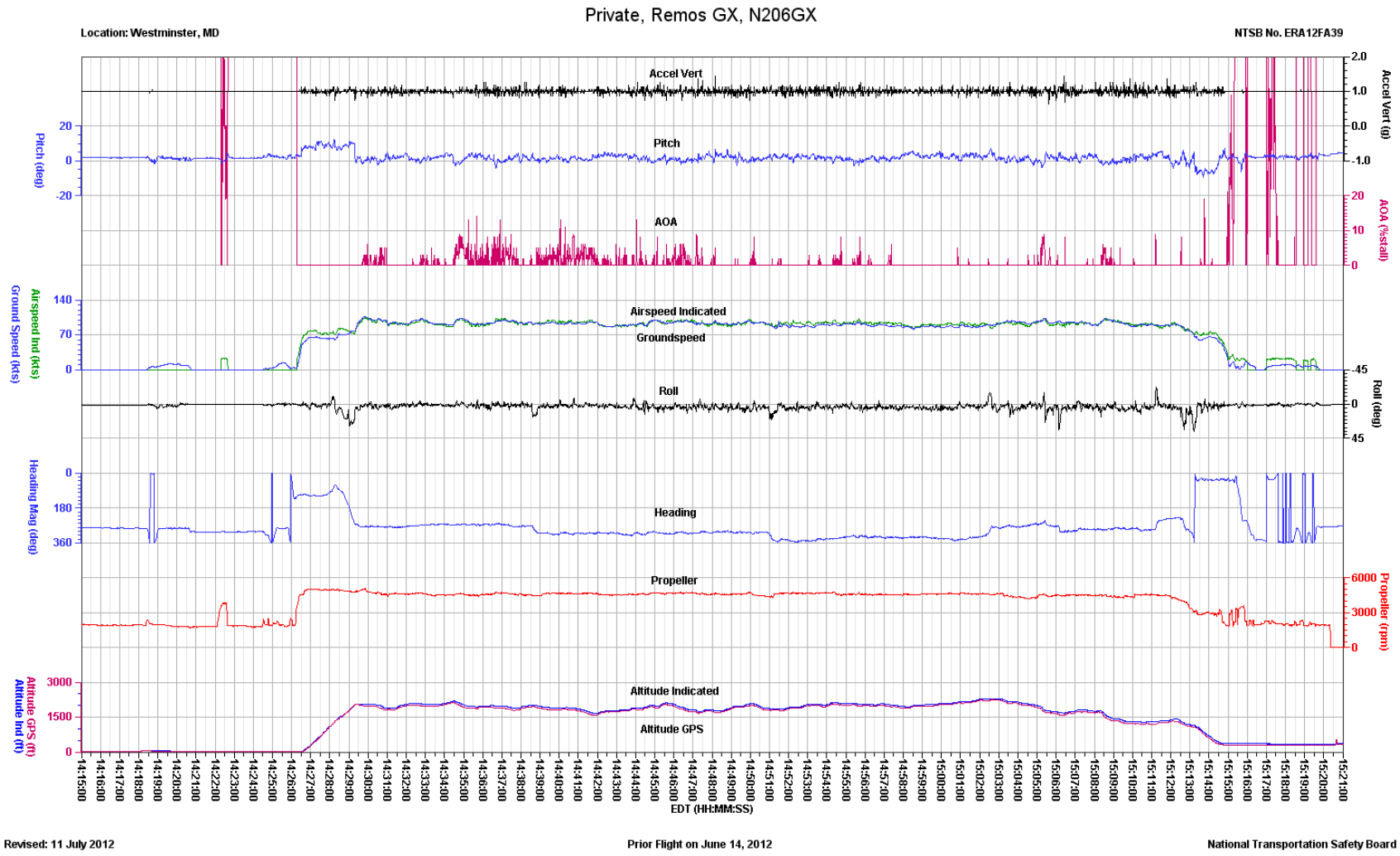
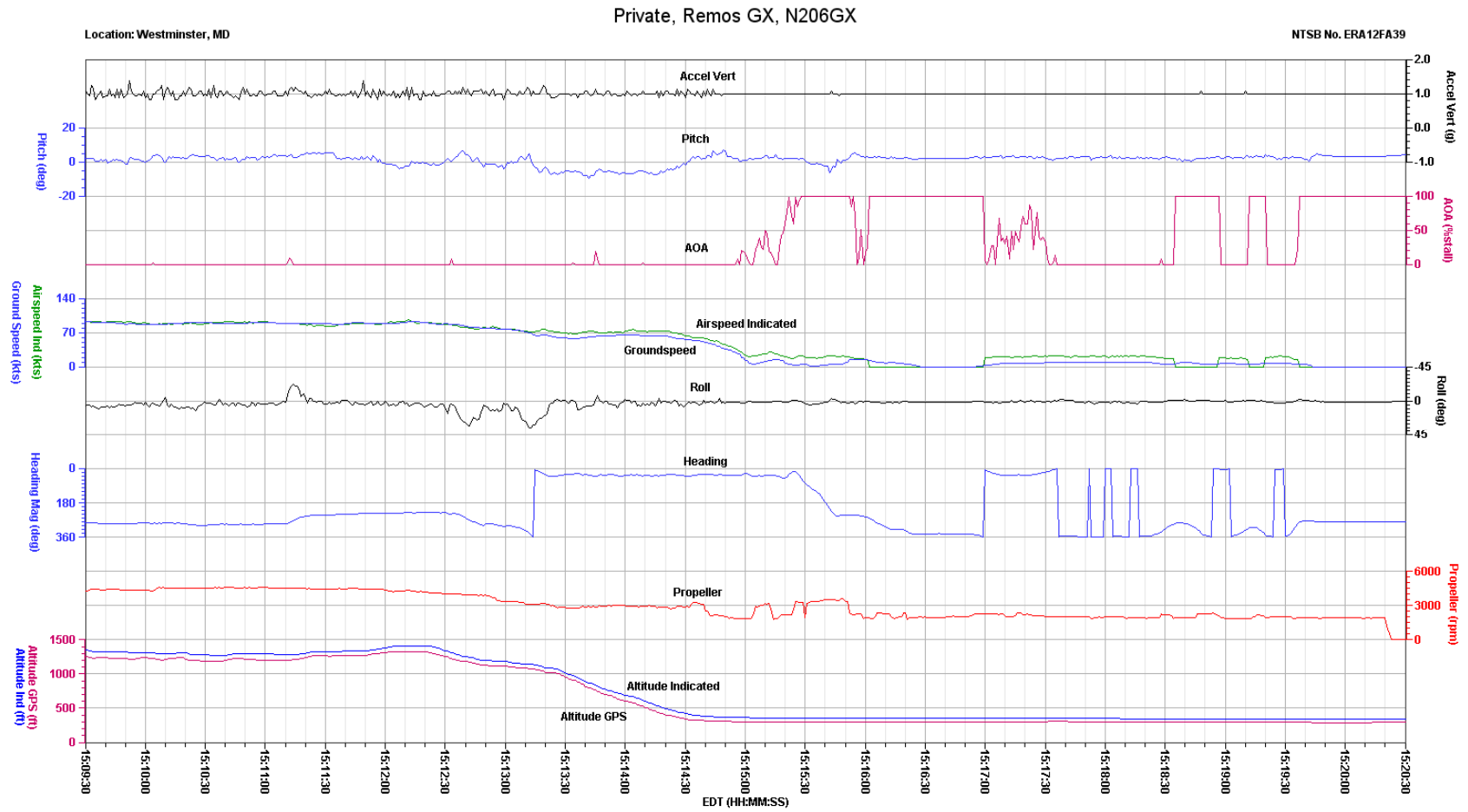


Figure 9. Plot of parameters during prior landing.



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 GPS (ft)	GPS Altitude
4. Altitude Ind (ft)	Indicated Altitude
5. AOA (%)	Angle of Attack Percent of Stall
6. Date Valid (discrete)	Date and Time are Valid
7. GPS Alt Valid (discrete)	GPS Altitude is Valid
8. GPS Valid (discrete)	GPS is Valid
9. Ground Speed (kts)	Ground Speed
10. Heading Mag (deg)	Magnetic Heading
11. Hour (hr)	Time GMT Hrs
12. Latitude (deg)	Latitude
13. Longitude (deg)	Longitude
14. Min (min)	Time GMT Min
15. Pitch (deg)	Pitch
16. Propeller (rpm)	Propeller Revolutions Per Minute
17. Roll (deg)	Roll
18. Sec (sec)	Time GMT Sec
19. Zulu - Day (day)	Time - Day
20. Zulu - Month (month)	Time - Month
21. Zulu - Year (year)	Time - Year

Table A-2 - Unit abbreviations.

Units Abbreviation	Description
%	percent
rpm	revolutions per minute
deg	degrees
discrete	discrete
ft	feet
hr	hour
kts	knots
sec	seconds

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.