

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

July 12, 2016

## **Cockpit Display – Recorded Flight Data**

**Specialist's Factual Report**  
**By Bill Tuccio, Ph.D.**

### **1. EVENT SUMMARY**

Location: Scottsdale, Arizona  
Date: August 27, 2015  
Aircraft: Cirrus SR22  
Registration: N915TD  
Operator: Scottsdale Executive Flight Training  
NTSB Number: WPR15IA252

On August 27, 2015, about 1405 mountain standard time (MST), a Cirrus SR22, N915TD, sustained minor damage following a nose landing gear collapse during landing roll at the Scottsdale Airport (SDL), Scottsdale, Arizona. The commercial-rated flight instructor (CFI), the pilot receiving instruction, and one passenger were not injured. The airplane's registered owner was ESPBC LLC of Scottsdale, and operated by Scottsdale Executive Flight Training. Visual meteorological conditions prevailed for the instructional cross-country flight, which was being operated in accordance with 14 *Code of Federal Regulations* Part 91, and a flight plan was not filed. The flight departed Flagstaff, Arizona (FGL) about 1300, with SDL reported as its destination.

### **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 a secure digital (SD) card from the upper slot of the Garmin G1000 multi-function display (MFD).

#### **3.1. Garmin G1000 SD Data Card Description**

The Garmin G1000 Integrated Flight Deck is a collection of multiple avionics units which include flight displays, air data computers, attitude/heading reference system (AHRS), communications and other systems. A typical installation includes a primary flight display (PFD) and a MFD. Each display includes two SD card slots, an upper and a lower slot. The lower SD card slot is used by the system for software updates and various databases<sup>1</sup>.

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<sup>1</sup> Databases can include terrain data, obstacle data, SafeTaxi charts, flight charts and airport terrain databases.

Depending on the display unit software, the aircraft can include a data logging feature. The data logging feature must be enabled by the aircraft operator. If the data logging feature is available and enabled, a SD card has to be installed in the upper slot of the MFD. Depending on the airframe and engine combination as many as 64 parameters can be stored at a rate of one sample per second (1Hz). According to the manufacturer of the display unit, one flight hour can be stored in approximately 2 megabyte. The SD card typically used is 2 gigabyte in size and can store over 1,000 flight hours.

### **3.1.1. Data Recovery**

The SD card was in good condition and the data were extracted normally from the card.

### **3.1.2. Data Description**

The G1000 SD card stores flight data in individual flight logs. The SD card contained 298 log files from June 13, 2014, to August 27, 2015. The event flight recording was identified and was approximately 55 minutes in length.

### **3.1.3. Engineering Units Conversions**

The flight log data stored in the individual files was converted to engineering units by the display unit. Appendix A lists the parameters verified and provided in this report.

## **3.2. Time Correlation**

The G1000 records time with the first data sample based on the unit's internal clock. This clock is set and updated by the unit and is based on Global Positioning System (GPS) time. The recorded log converted the time to MST and no further corrections were applied for the event flight.

## **3.3. Plots and Corresponding Tabular Data**

The following four figures contain data recorded during the August 27, 2015, event flight. These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page. Satellite overlays were created using Google Earth. Lighting and weather conditions in the overlays are not necessarily representative of the accident flight.

Figures 1 and 2 show a satellite overlay of the accident flight from FGL to SDL. The recording began about 1315 MST and ended around 1410:02 MST. During the landing phase, lateral accelerations noticeably larger in magnitude than other lateral accelerations are highlighted in red with a unique icon.

Figure 3 shows a plot of parameters for the entire event flight and figure 4 focuses on the landing. At 1403:18 MST, while the aircraft was decelerating through 65 knots, a lateral acceleration of  $-0.31g$  was recorded, followed over the next 15 seconds by lateral accelerations of decreasing magnitude.

The corresponding tabular data used to create the accident flight plots are provided in electronic comma separated value (csv) format as attachment 1 to this report.

Figure 1. Google Earth overlay of event flight.

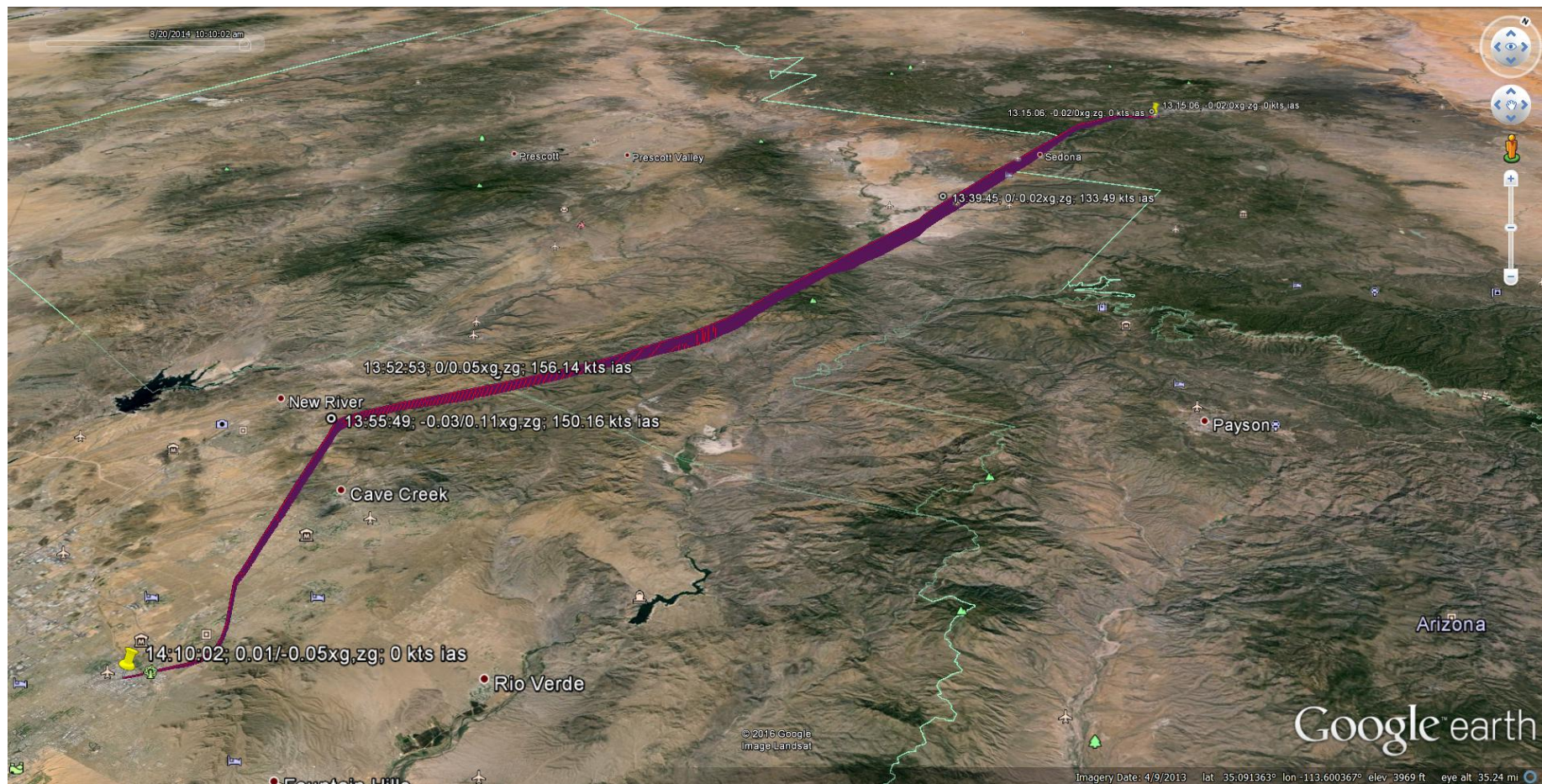


Figure 2. Google Earth overlay of landing and rollout.

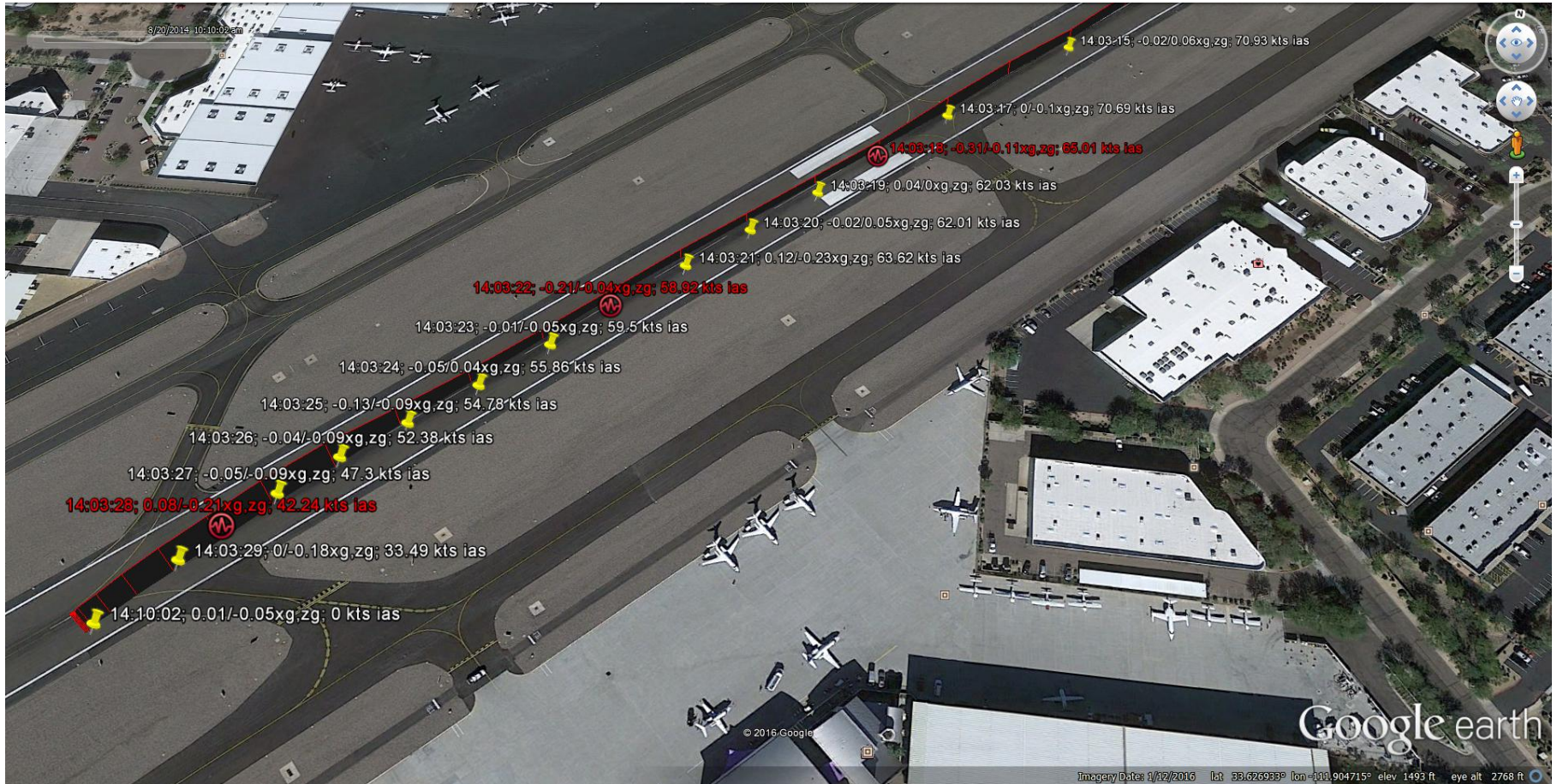
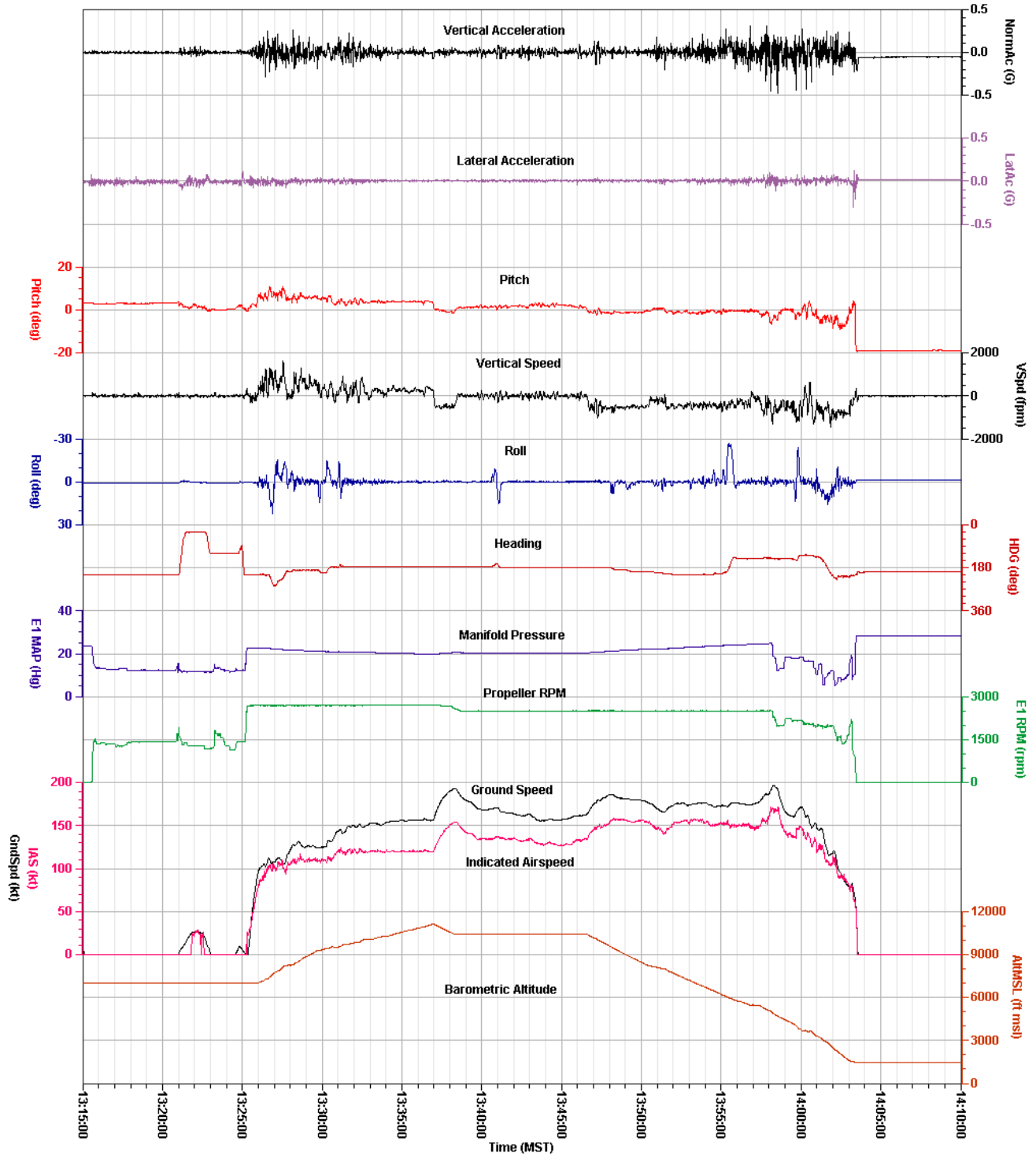


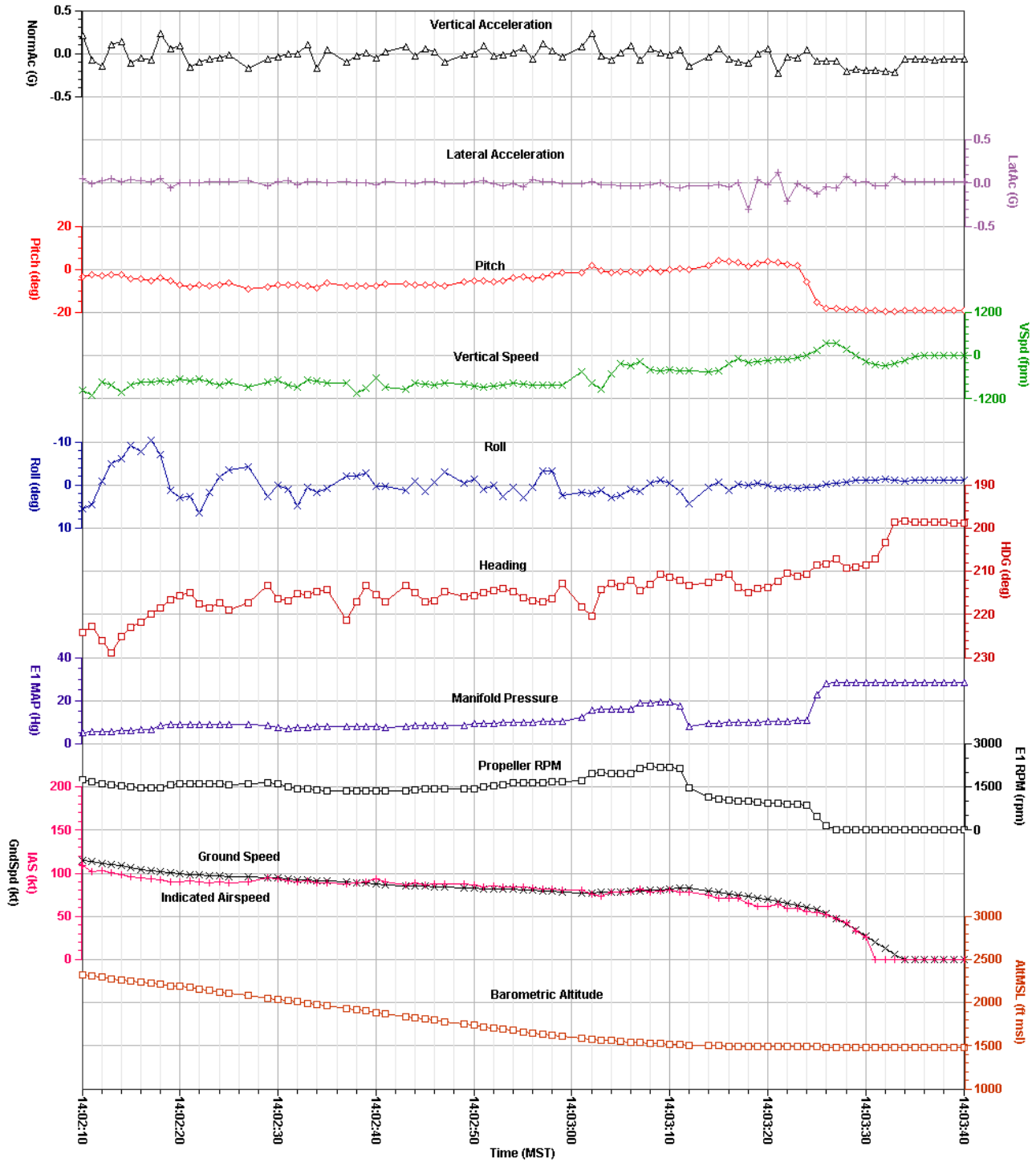
Figure 3. Plot of basic parameters during entire flight.



Basic Parameters - Event Flight

National Transportation Safety Board

Figure 4. Plot of basic parameters during landing.



Basic Parameters - Landing

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## APPENDIX A

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.**

| <b>Parameter Name</b> | <b>Parameter Description</b>     |
|-----------------------|----------------------------------|
| 1. AltMSL (ft)        | MSL Altitude                     |
| 2. E1 MAP (inHg)      | Engine Manifold Pressure         |
| 3. E1 RPM (rpm)       | Propeller Revolutions per minute |
| 4. GndSpd (kts)       | Ground Speed                     |
| 5. HDG (deg)          | Magnetic Heading                 |
| 6. IAS (kts)          | Indicated Airspeed               |
| 7. LatAc (g)          | Lateral Acceleration             |
| 8. Latitude (deg)     | Latitude                         |
| 9. Longitude (deg)    | Longitude                        |
| 10. NormAc (g)        | Vertical Acceleration            |
| 11. Pitch (deg)       | Pitch                            |
| 12. Roll (deg)        | Roll                             |
| 13. VSpd (fpm)        | Vertical Speed                   |

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

| <b>Units Abbreviation</b> | <b>Description</b>     |
|---------------------------|------------------------|
| deg                       | degrees                |
| ft                        | feet                   |
| g                         | acceleration           |
| inHg                      | inches of Mercury      |
| kts                       | knots                  |
| fpm                       | feet per minute        |
| rpm                       | revolutions per minute |