

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR23FA083

COCKPIT DISPLAY - RECORDED FLIGHT DATA

Specialist's Factual Report

December 19, 2024

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A. ACCIDENT

Location: New Harmony, Utah
Date: January 4, 2023
Time: 1456 Mountain Standard Time (MST)
Airplane: Piper PA-34-220T, N814WT

B. DETAILS OF THE INVESTIGATION

A cockpit display - recorded flight data group was not convened.

The NTSB Vehicle Recorder Division received a data file from an SD card installed in a Garmin G1000, serial number unknown.

Electronic File #1: log_230104_143045_KSGU.csv

1.0 Garmin G1000 SD 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 multi-function display (MFD). Each display includes two secure digital (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.¹

Depending on the installed software, the display unit 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 generates approximately 2 megabytes (MB) of data. The SD card typically used is 2 gigabyte (GB) in size and can store over 1,000 flight hours of data.

1.1 Garmin G1000 SD Data Card File Description

The accident/incident flight recording was identified and was approximately 26 minutes in duration.

¹ Databases can include terrain data, obstacle data, SafeTaxi charts, flight charts and airport terrain databases

1.1.1 Garmin G1000 SD Data Card Engineering Unit 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.

1.2 Flight Data Log File Time Correlation

The G1000 SD card 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 off GPS time. Flight data is recorded in local time in the flight data log file so no further correlation was necessary.

C. FIGURES AND TABULAR DATA

Figures 1 to 5 contain display data recorded during the event on January 4, 2023. All the parameters listed in table 1 are plotted. Figure 6 contains a Google Earth image with an overlay of the flight track of the final 2 minutes of flight. Weather and lighting conditions may not reflect those present at the time of the accident.

Figure 1 shows basic flight data for the entire recording. Figure 2 basic flight data from the top of descent until the end of the recording. Figure 3 shows engine data from the top of descent until the end of the recording. Figure 4 shows autopilot and flight data for the entire accident flight. Figure 5 shows autopilot and flight data from the last 2 minutes of the recording.

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.

The aircraft departed from runway 19 at the Saint George Regional Airport at 1438:30 and turned to the northwest and climbed. The active waypoint at this time was "KSLC." The aircraft climbed with the vertical speed vertical and the heading select lateral autopilot modes engaged. The G1000 did not record the selected vertical speed or selected heading.

At 1446:59, when the aircraft was at 10,050 feet pressure altitude, the vertical autopilot mode switched to pitch hold, switching back to vertical speed select mode at 1447:11. The aircraft began descending at a rate of 500-600 feet per minute. The lateral autopilot mode remained in heading select mode.

At 1448:46, the flight director commanded a roll to the left which the aircraft followed. When the roll reached about 25 degrees left wing down, the flight director began to command a roll to the right. The aircraft remained at about 25 degrees left

wing down for about 8 seconds before beginning to roll toward the right to match the flight director commanded roll angle.

At 1449:44, the vertical autopilot mode switched to altitude hold for about 9 seconds before switching back to vertical speed. At 1452:08, the vertical autopilot mode switched to altitude hold and the aircraft leveled at about 7450 feet pressure altitude.

At 1454:21, the aircraft began a roll to the left. One second later the flight director began to command a left roll of about 12 degrees. At 1454:25, the autopilot disconnected and the flight director began to command a roll back to the right, but the aircraft remained in a left roll varying from 12 degrees to about 30 degrees left wing down.

At 1454:38, the autopilot reengaged in heading select and altitude hold mode. Over the next 82 seconds the aircraft experienced altitude excursions reaching about 5000 feet per minute in climb and 10000 feet per minute in descent. At 1454:22, the aircraft began rolling back to the right, reaching wings level about 6 seconds later.

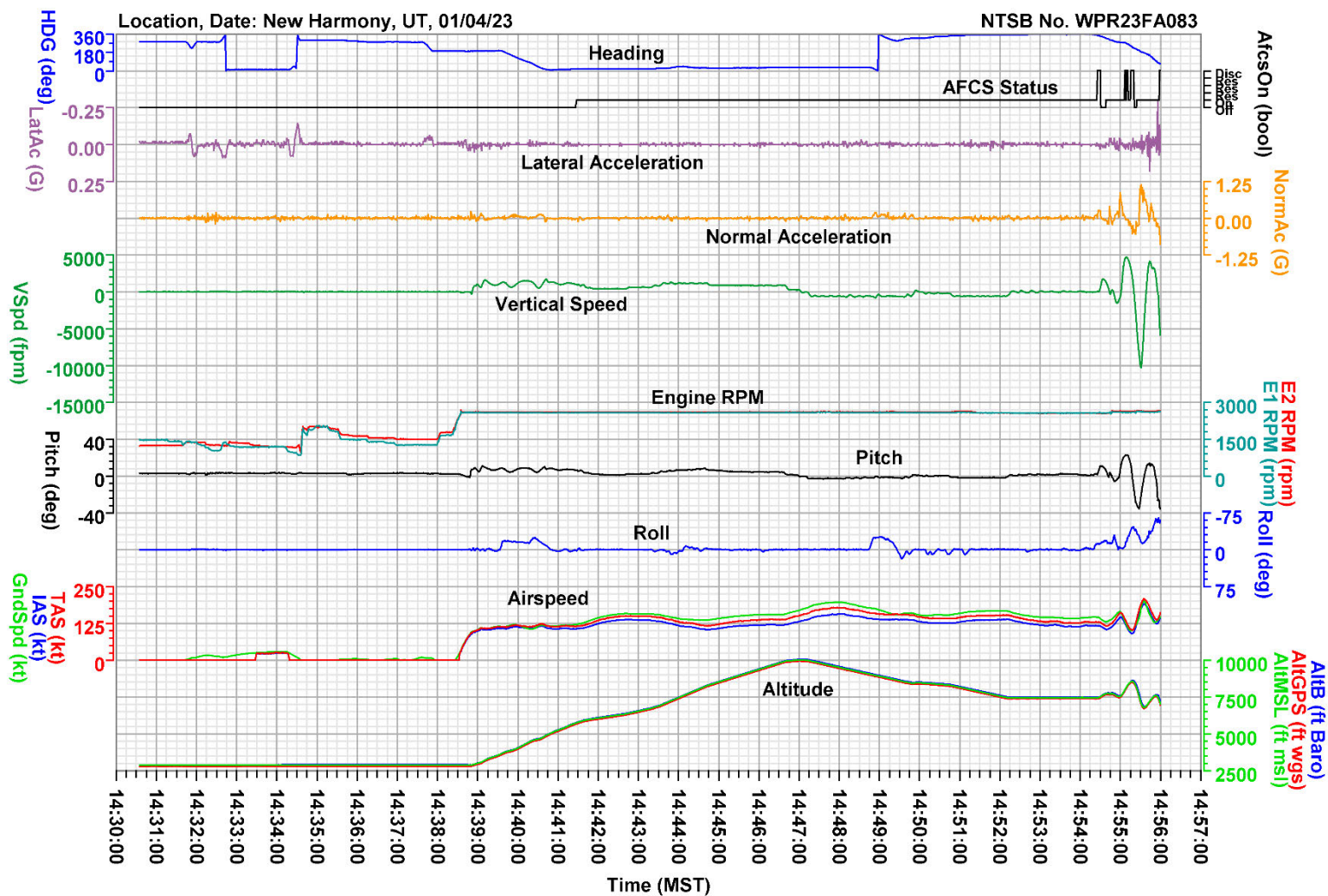
At 1455:08, the autopilot disconnected and reengaged briefly three times over the next 20 seconds before finally reengaging in level vertical and lateral mode. At 1455:58, the autopilot disconnected. The last data point was recorded at 1456:00 when the aircraft was at 7040 feet pressure altitude and descending at 5800 feet per minute with an attitude of 36 degrees nose down and 60 degrees left wing down.

The corresponding tabular data used to create Figures 1 through 6 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

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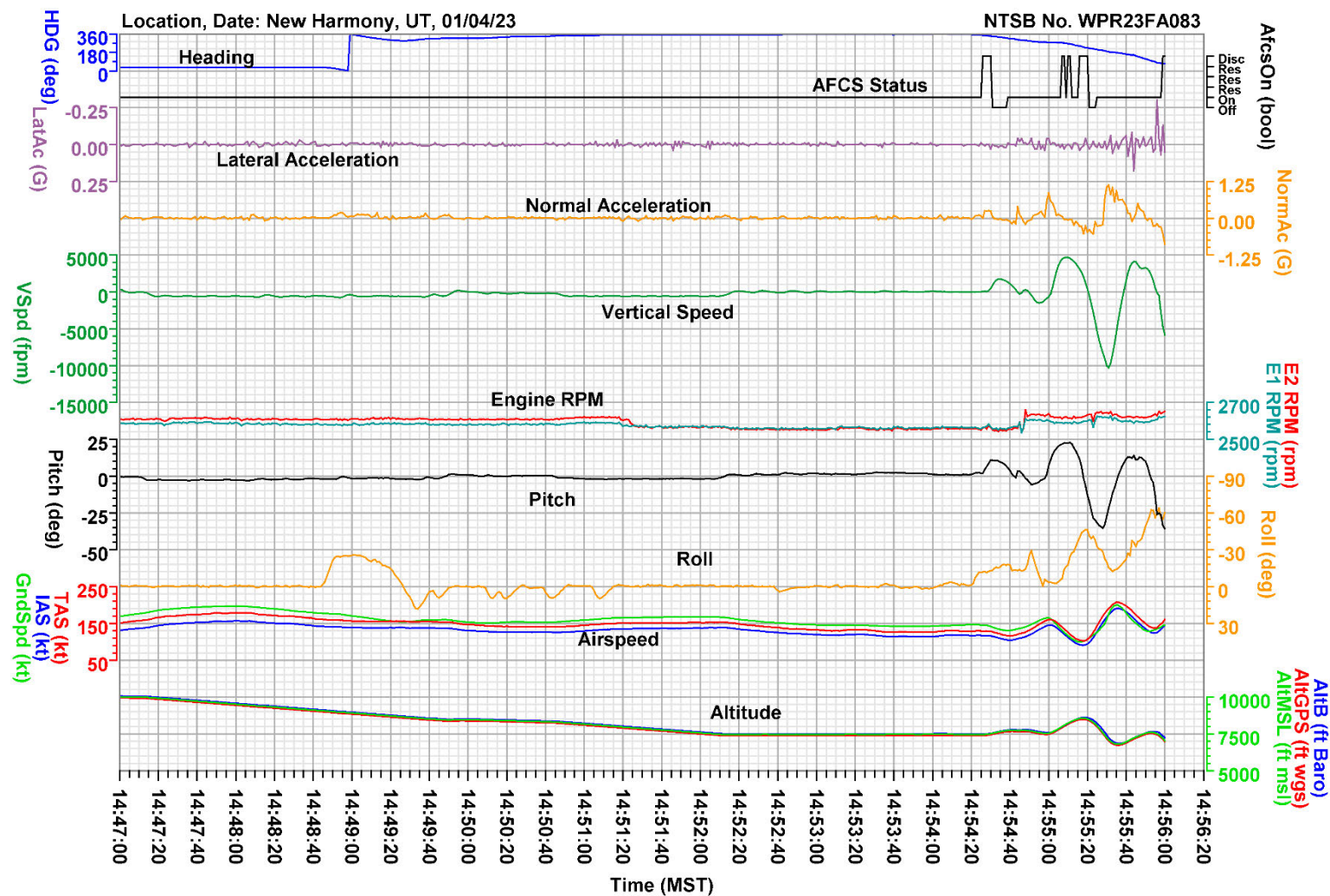
Private, Piper PA-34-220T, N814WT



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Figure 1. Plot of basic flight data for entire accident recording.

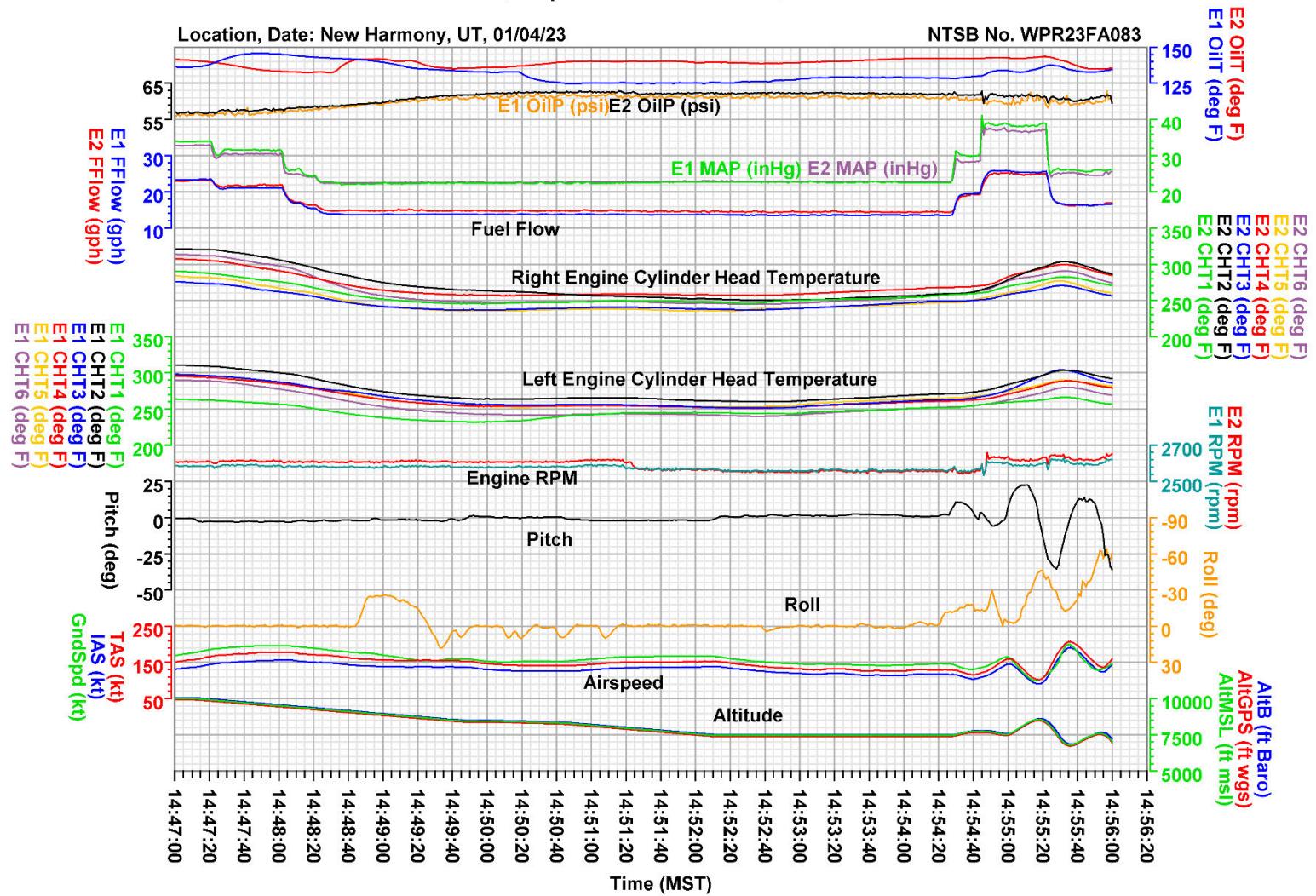
Private, Piper PA-34-220T, N814WT



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Figure 2. Basic flight data from top of descent.

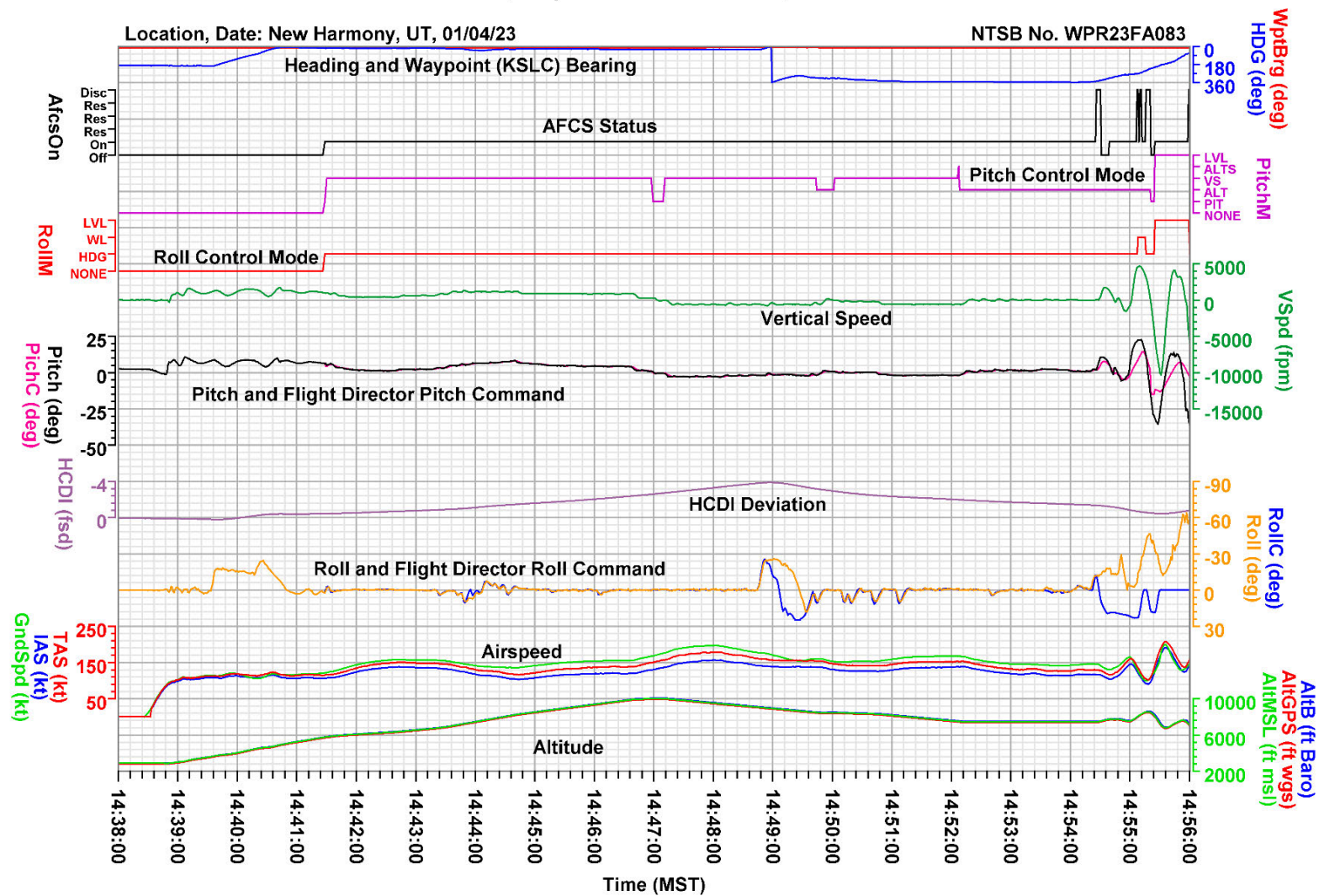
Private, Piper PA-34-220T, N814WT



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Figure 3. Engine data from top of descent.

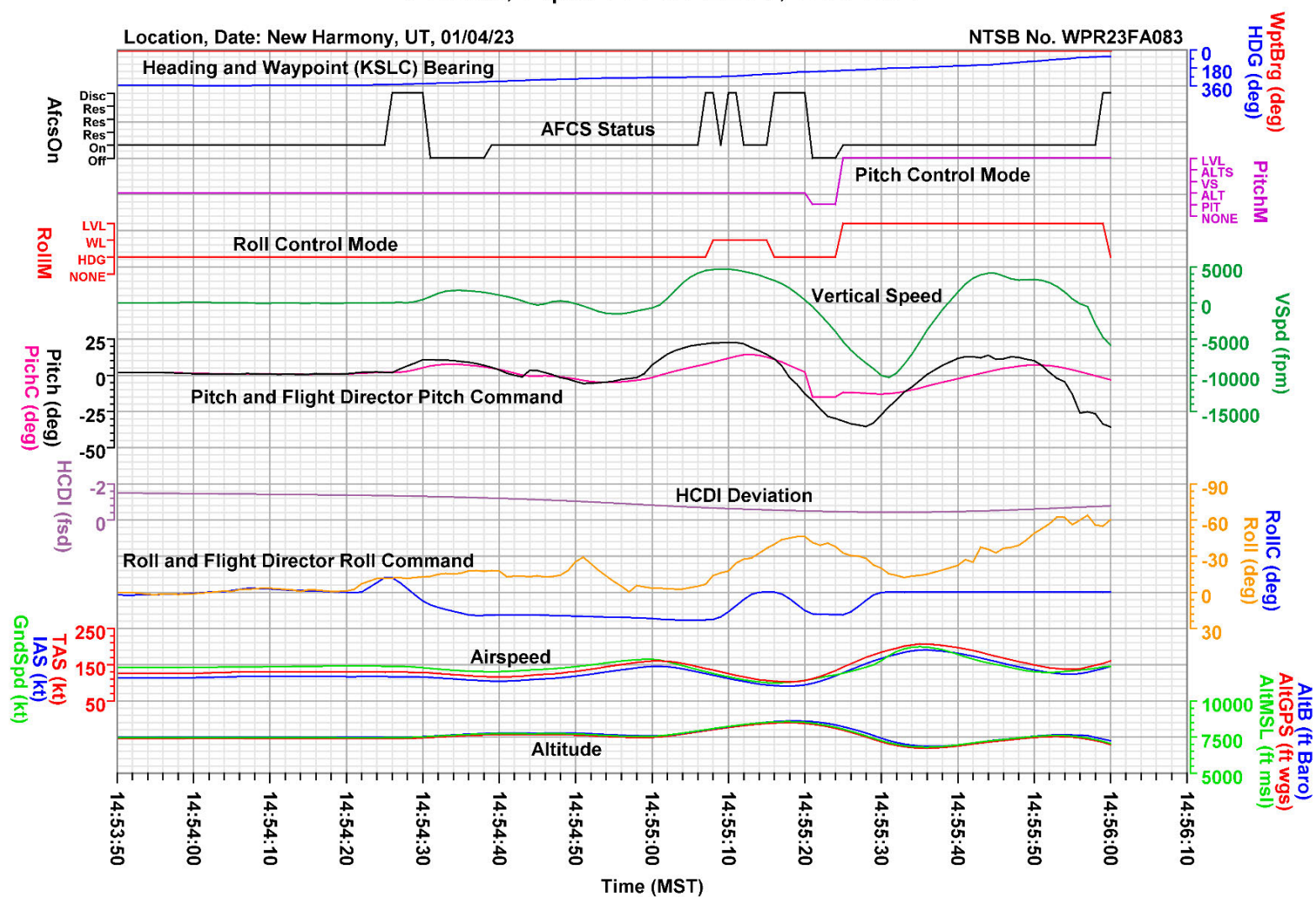
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Figure 4. Autopilot and flight data for entire accident flight.

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Figure 5. Autopilot and flight data from last 2 minutes of recording.

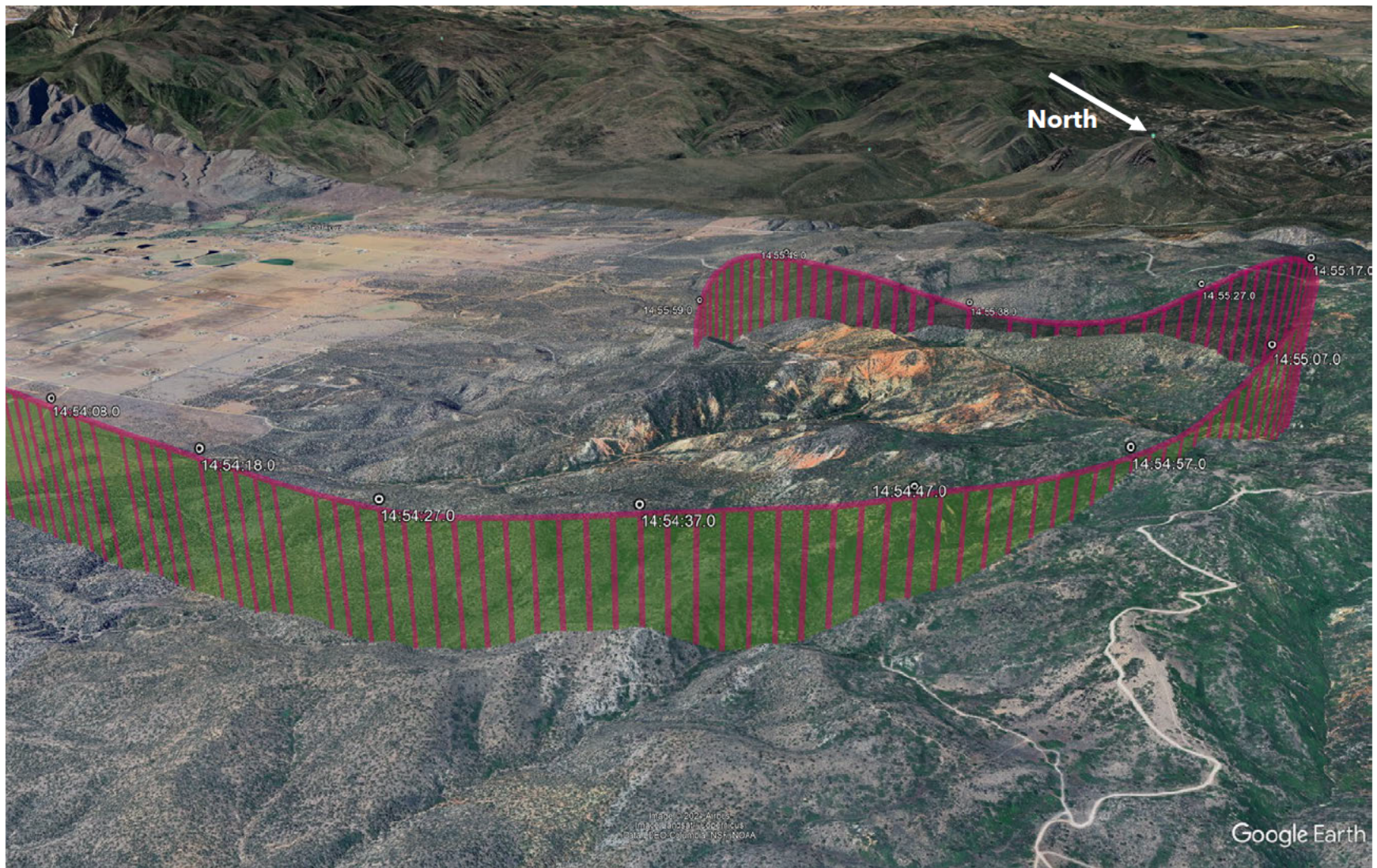


Figure 6. Google Earth with flight track overlay of final 2 minutes of flight.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the parameters provided and verified in this report. Table 1 lists the G1000 parameters and table 2 describes the unit abbreviations used in this report.

Table 1. Verified and provided parameters.

Parameter Name (units)	Parameter Description
AfcsOn (discrete)	Automatic Flight Control System On
AltB (ft)	Barometric Altitude
AltGPS (ft)	Geometric Altitude
AltMSL (ft msl)	Pressure Altitude
E1 CHT# (deg)	Cylinder Head Temperature Cylinder # ²
E1 FF (gph)	Engine 1 Fuel Flow
E1 MAP (inHg)	Engine 1 Manifold Pressure
E1 OilP (psi)	Engine 1 Oil Pressure
E1 OilT (deg F)	Engine 1 Oil Temperature
E1 RPM (rpm)	Engine 1 Revolutions per minute
E2 CHT# (deg)	Cylinder Head Temperature Cylinder # ³
E2 FF (gph)	Engine 2 Fuel Flow
E2 MAP (inHg)	Engine 2 Manifold Pressure
E2 OilP (psi)	Engine 2 Oil Pressure
E2 OilT (deg F)	Engine 2 Oil Temperature
E2 RPM (rpm)	Engine 2 Revolutions per minute
GndSpd (kts)	Ground Speed
HCDI (%)	Horizontal Course Deviation Indicator
HDG (deg)	Magnetic Heading
IAS (kts)	Indicated Airspeed
LatAc (g)	Lateral Acceleration
Latitude (deg)	Latitude
Longitude (deg)	Longitude
NormAc (g)	Normal Acceleration
Pitch (deg)	Pitch
PitchC (deg)	Flight Director Pitch Command
PitchM	AFCS Pitch Control Mode
Roll (deg)	Roll
RollC	Flight Director Roll Command
RollM	AFCS Roll Control Mode
TAS (kts)	True Airspeed
VSpd (fpm)	Vertical Speed
WptBrg (deg)	Waypoint Bearing

² Depending on aircraft configuration number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID.

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

Table 2. Unit abbreviations.

Unit Abbreviations	Descriptions
deg	degrees
deg F	Degrees Fahrenheit
disc	disconnect
ft	feet
fsd	full scale deflection
gph	gallons per hour
inHg	inches of Mercury
kts	knots
psi	pounds per square inch
res	reserved
rpm	revolutions per minute

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.