National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594

ANC23FA031

RECORDED FLIGHT DATA

Specialist's Factual Report

October 10, 2023

TABLE OF CONTENTS

A.   ACCIDENT

Location: Nuevo, California
Date: March 24, 2023
Time: 12:17 Pacific Daylight Time (PDT)
Helicopter: Bell 407, private operator, N14Z

B.   RECORDED FLIGHT DATA SPECIALIST

Specialist   Kyle Garner
                          Sr. Aerospace Engineer – Recorder Specialist
                          National Transportation Safety Board (NTSB)

C.   DETAILS OF THE INVESTIGATION

A recorded flight data group was not convened. The NTSB Vehicle Recorder Division received the following Secure Digital (SD) cards removed from a Garmin G1000 cockpit display installed on the accident helicopter:

Recorder Manufacturer/Model: G1000 Supplemental Data SD Card
Part Number: 010-00330-4G
Recorder Serial Number: N/A

Recorder Manufacturer/Model: G1000 Maintenance SD Card
Part Number: 407-075-219-110
Recorder Serial Number: N/A

1.0   Device Description

The Garmin G1000 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 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 display unit software, the unit can include a data logging feature. The data logging feature must be enabled by the operator. If the data logging feature is available and enabled, an SD card must be installed in the upper slot of the MFD. Depending on the airframe and engine combination as many as 64

---

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

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 megabytes (MB). The SD card typically used is 2 gigabytes (GB) in size and can store over 1,000 flight hours of data.

1.1   Data Recovery

The two SD cards were in good condition and the data were downloaded via a write-blocker device to a lab workstation. The files on each SD card were reviewed for data relevant to the accident investigation.

The supplemental data SD card did not contain any flight data and is not discussed further in this report.

1.2   Data Description

The G1000 maintenance SD card stores flight data in individual flight logs. The SD card contained 1,914 log files. The accident flight recording was identified and was approximately 13 minutes in duration.

The data in the log file was provided in engineering units, thus, no further conversion was necessary.

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 GPS time. All times in this report are referenced as PDT.

D.   FIGURES AND TABULAR DATA

Figures 1 to 6 contain recorded G1000 parameters during the accident flight on March 24, 2023. All the parameters listed in Table 1 are plotted.

Figures 1 through 4 are Google Earth overlays of the accident flight recording. Note that the weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the accident.

Figures 5 and 6 are plots of basic and engine parameters, respectively, recovered from the G1000 from 12:08:00 to 12:16:59 on the day of the accident. Figures 5 and 6 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.

In summary, the data show the helicopter departed French Valley Airport in Murrieta/Temecula, California at about 12:08:30 and traveled towards the north-northwest. At about 12:14:00 the helicopter traversed a small hill. The helicopter continued to travel in a northwesterly heading until about 12:16:40 when it turned left to fly over the crest of another small hill. The final recorded data point was at 12:16:59 at a GPS altitude of 2482 feet and a groundspeed of 85 knots. The GPS data recovered from the G1000 ended prior to the helicopter's impact with terrain. For additional GPS data recovered from an onboard video recorder, see the *Onboard Video Recorder – Specialist's Factual Report*, which is available in the docket for this accident.

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

Submitted by:

Kyle Garner
Sr. Aerospace Engineer – Recorder Specialist
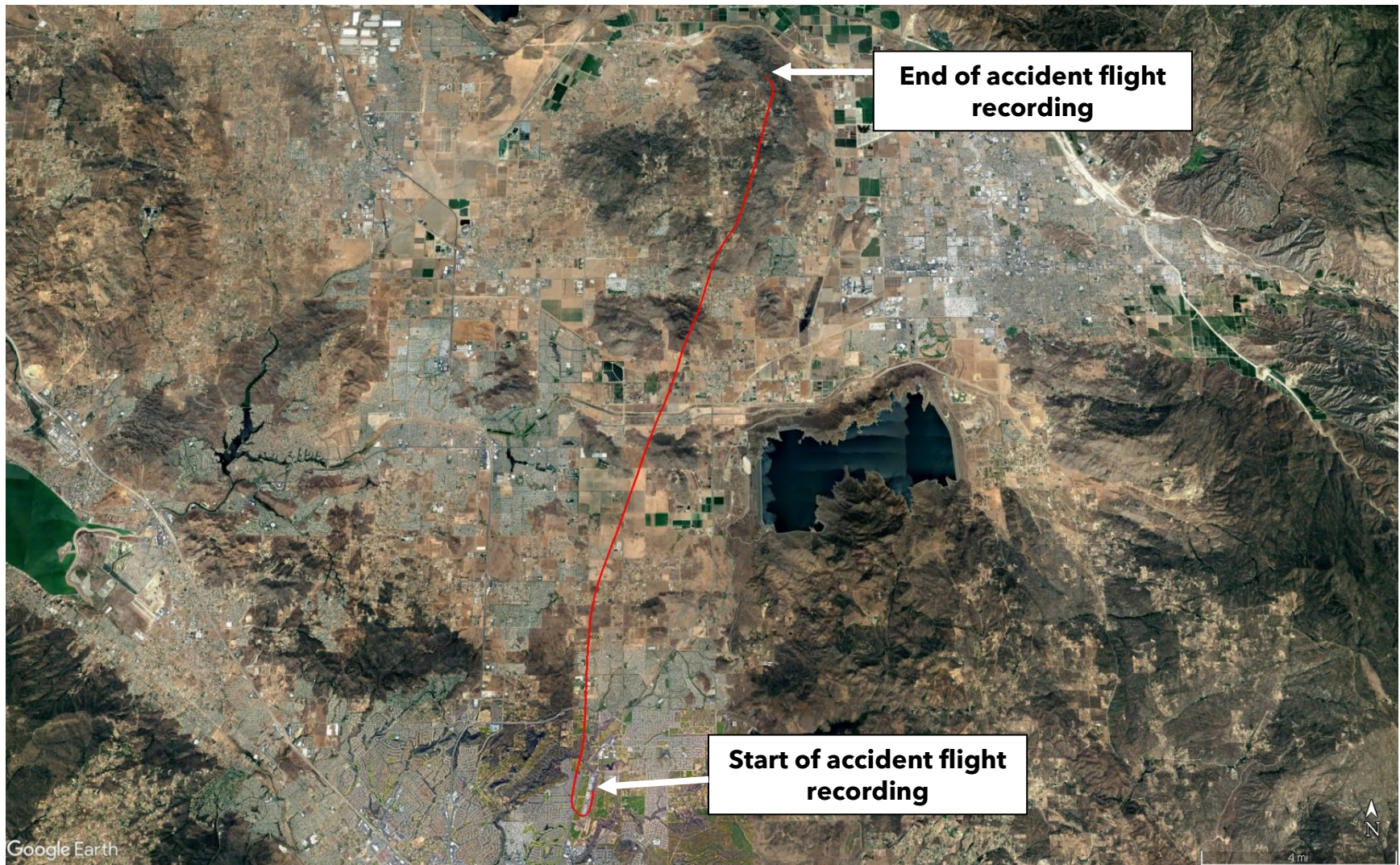
Figure 1. Google Earth overlay showing the path of the full accident flight recording.
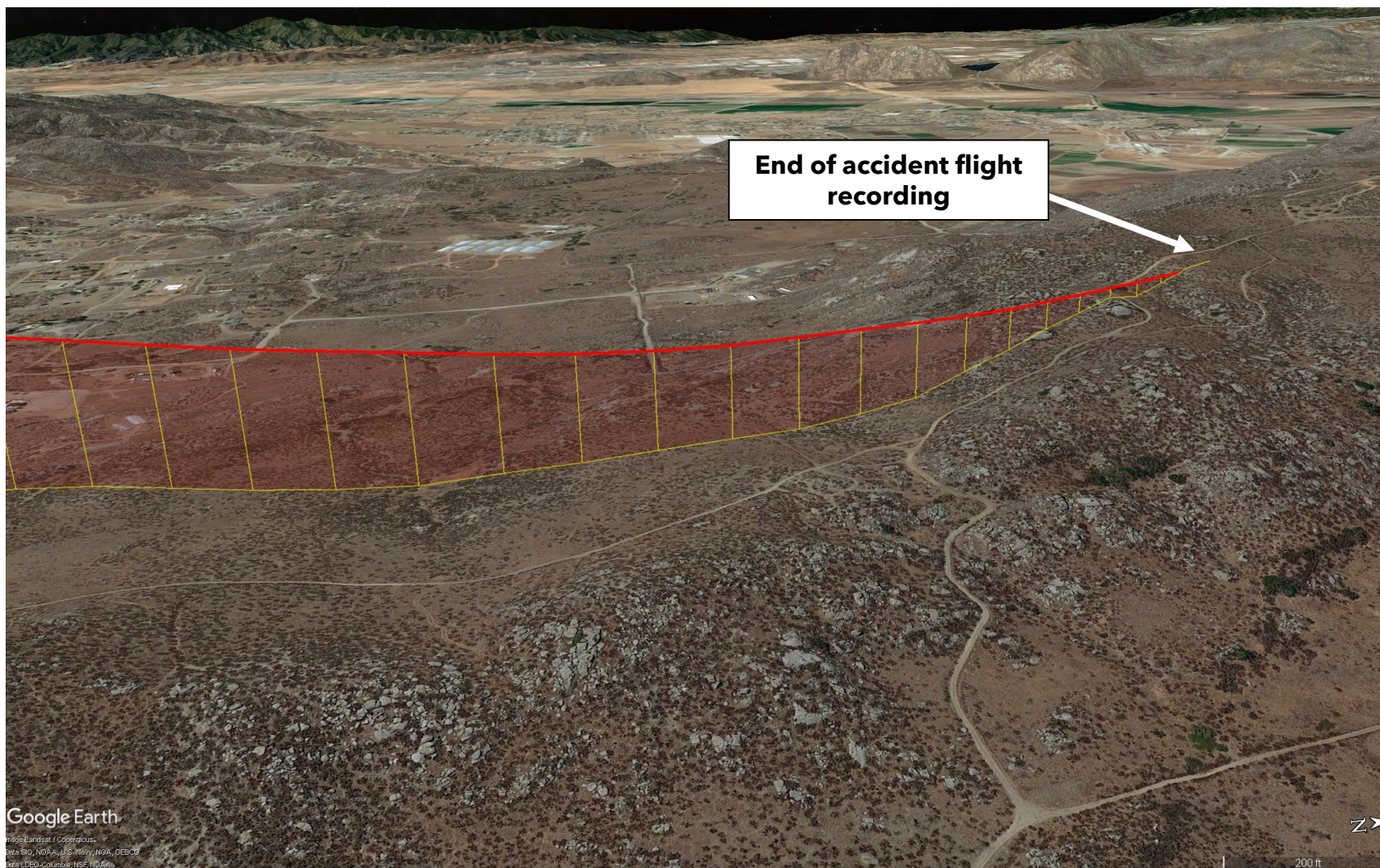
Figure 2. Google Earth overlay showing the start of the accident flight recording.
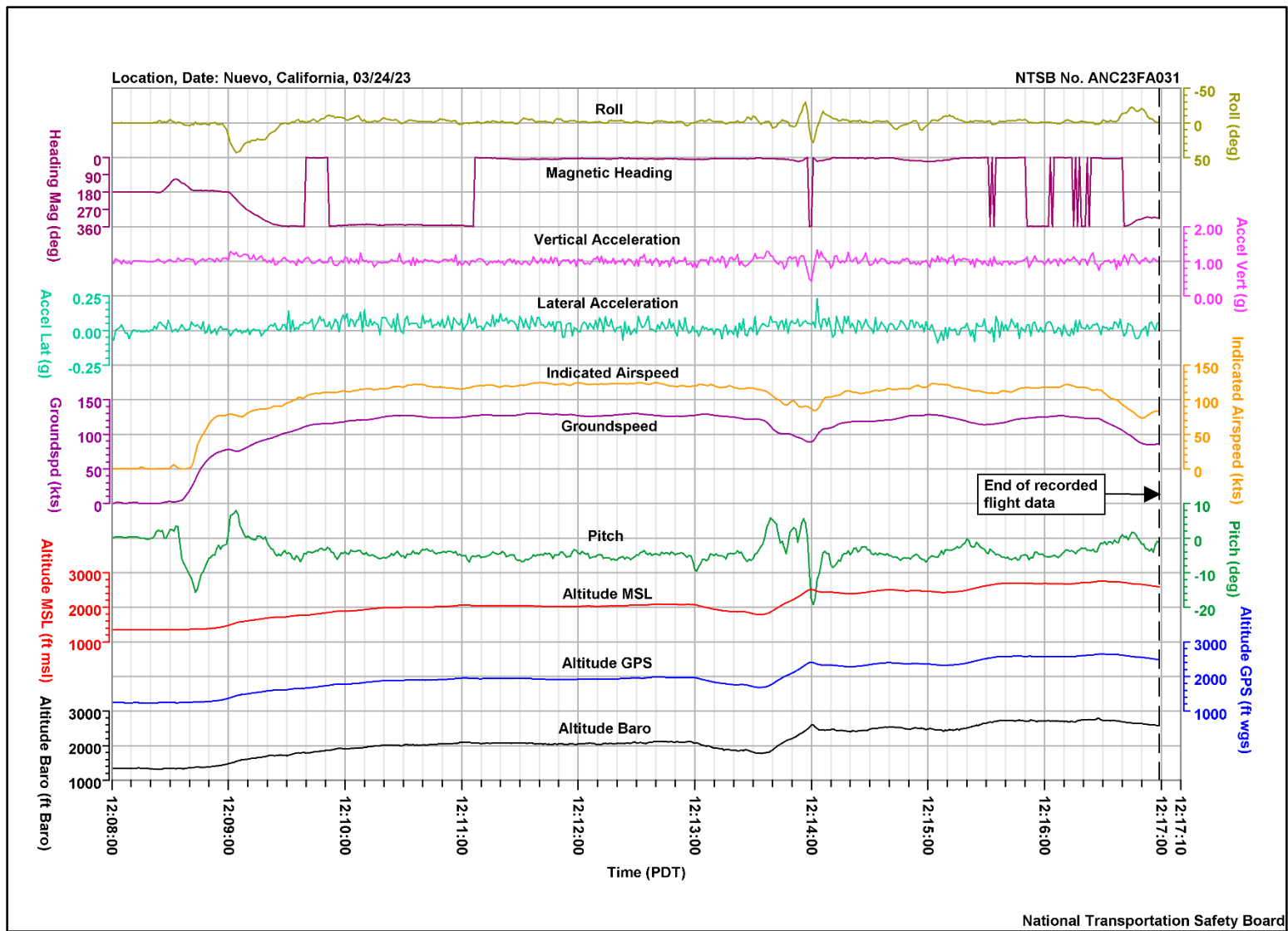
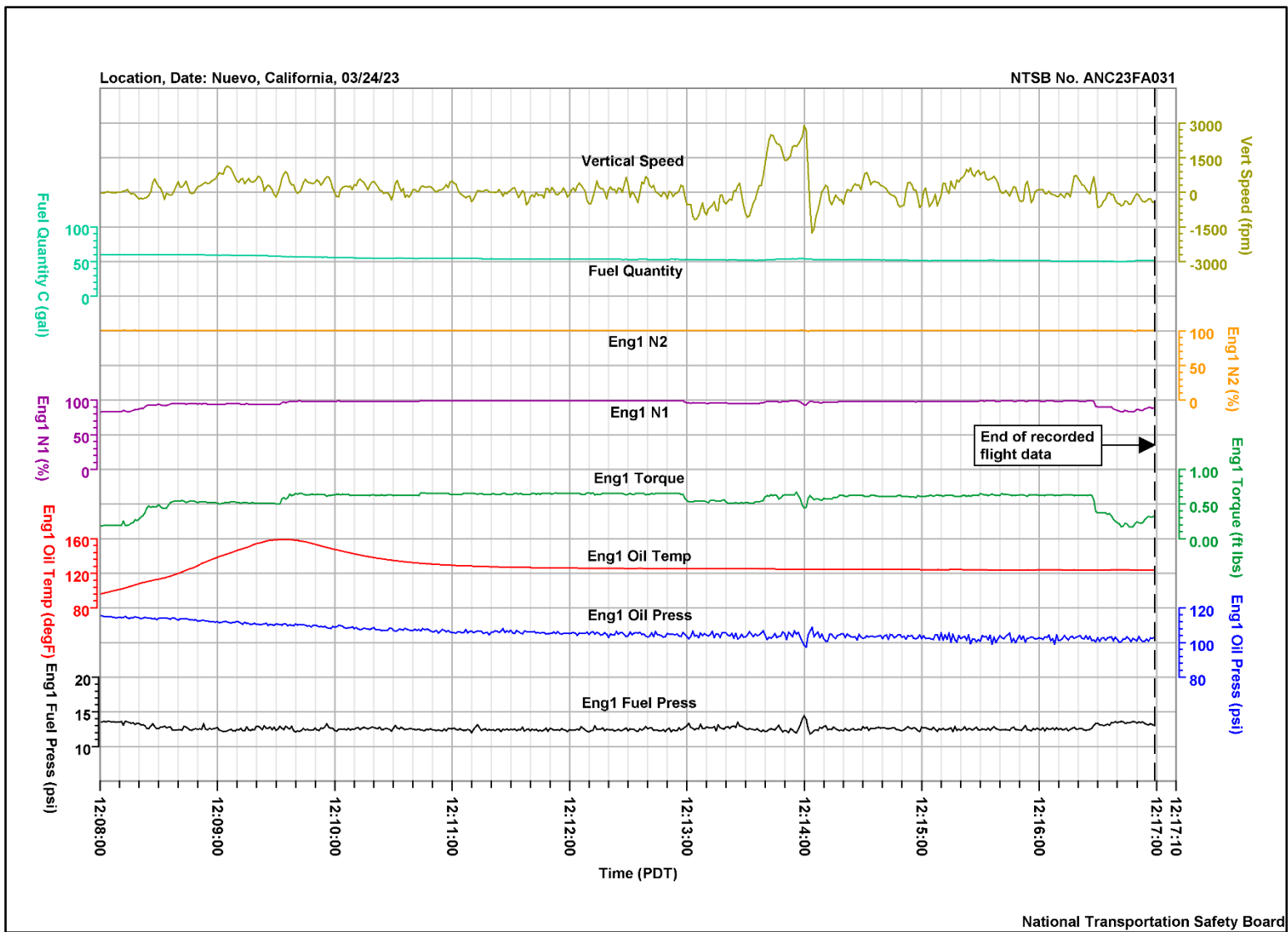**Figure 3.** Google Earth overlay showing the end of the accident flight recording.

Figure 4. Google Earth overlay showing a side profile of the end of the accident flight recording.

Figure 5. G1000 basic parameters for the accident flight from 12:08:00 to 12:16:59 PDT.

Figure 6. G1000 engine and vertical speed parameters for the accident flight from 12:08:00 to 12:16:59 PDT.

APPENDIX A. G1000 VERIFIED AND PROVIDED PARAMETERS

This appendix describes the parameters provided and verified in this report. Table 1 lists the plot/table labels, parameter names, and units. Additionally, table 2 describes the unit abbreviations used in this report.

Table 1. Verified and provided parameters.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Vert	Vertical Acceleration	g
Altitude Baro	Barometric Corrected Altitude	ft Baro
Altitude GPS	GPS Altitude	ft wgs
Altitude MSL	Altitude Mean Sea Level	ft msl
Eng1 Fuel Press	Engine 1 Fuel Pressure	psi
Eng1 N1	Engine 1 N1	%
Eng1 N2	Engine 1 N2	%
Eng1 Oil Press	Engine 1 Oil Pressure	psi
Eng1 Oil Temp	Engine 1 Oil Temperature	degF
Eng1 Torque	Engine 1 Torque	ft lbs
Fuel Quantity C	Fuel Quantity - Center	gal
Groundspd	Groundspeed	kts
Heading Mag	Magnetic Heading	deg
Indicated Airspeed	Indicated Airspeed	kts
Latitude	Position Latitude	deg
Longitude	Position Longitude	deg
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Vert Speed	Vertical Speed	fpm

Table 2. Unit abbreviations.

Unit Abbreviation	Description
%	percent
deg	degrees
degF	degrees Fahrenheit
fpm	feet per minute
ft Baro	feet barometric
ft lbs	foot-pound
ft msl	feet mean sea level
ft wgs	feet World Geodetic System
g	unit of acceleration
gal	gallons
kts	knots
psi	pounds per square inch