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

March 31, 2015

Global Positioning System Device

Specialist's Factual Report
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1. EVENT

Location:	Kingston, Oklahoma
Date:	January 28, 2015
Aircraft:	Vans RV-9A
Registration:	N708JE
Operator:	Private
NTSB Number:	CEN15FA127

On January 28, 2015, about 1100 central standard time, a kit-built Vans RV-9A airplane, N708JE, impacted the water of Lake Texoma near Kingston, Oklahoma. The student pilot, the sole occupant, was fatally injured and the airplane was substantially damaged. The airplane was registered to and operated by a private individual under the provisions of 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which operated without a flight plan. The local flight departed the Durant Regional Airport (DUA), Durant, Oklahoma, at an undetermined time.

2. DETAILS OF DEVICE INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following device:

Device:	Garmin GPSMAP 296
Device Serial Number:	67014788

2.1. Garmin GPSMAP 296 Device Description

The Garmin GPSMAP 296 is a hand-portable GPS unit equipped with a detachable antenna, a 256 color TFT LCD display, built in base map and an internal Jeppesen aviation database. The unit employs a parallel 12 channel receiver and can be operated using external power, or alternatively by using an internal Li-Ion rechargeable battery. The GPSMAP 296 is capable of storing date, route of flight, and flight time information for up to 50 individual flights in the form of a flight log. Flight logging begins when the GPS unit senses a speed increase to greater than 30 knots together with an altitude gain of greater than 500 feet. The record is saved when the speed is sensed to

decrease to below 30 knots, and a new log will be started if more than 10 minutes passes from this time. A detailed tracklog—including latitude, longitude, date, time, and GPS altitude information for an unspecified number of points—is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Position is updated within the tracklog as a function of time or distance moved, depending on how the unit has been configured. Once the current tracklog memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured. The current tracklog can be saved to long-term memory and 15 saved tracklogs can be maintained in addition to the current tracklog. Tracklog storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile[1] memory. The unit contains hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC via a built-in USB port. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

2.1.1. Garmin GPSMAP 296 Data Recovery

The unit was received at the NTSB Vehicle Recorder Division partially dried, wrapped in a plastic bag. Figure 1 shows the unit removed from the plastic bag, with residual damp sand. According to the Investigator-in-Charge (IIC), the unit was recovered from fresh water. The unit was disassembled; rinsed in deionized water and Methanol; and dried with compressed air. The main circuit board was installed in an NTSB surrogate unit and, when power was applied, started normally. Figure 2 shows a picture of the track setup page; the unit was set to record and overwrite older recordings.

The unit was connected to a computer via a serial cable (the USB port did not work) and information was downloaded using the manufacturer's software.

[1] Non-volatile memory is semiconductor memory that does not require external power for data retention.

Figure 1. Unit as received.

Figure 2. Device track setup page.

2.1.2. Garmin GPSMAP 296 Data Description

The data extracted included 31 sessions from October 7, 2014 through January 28, 2015 (10,000 total data points). The accident flight was the last session. In agreement with the IIC, flights known to be flown by the accident pilot on January 17, 2015;

January 27, 2015; and the accident flight, on January 28, 2015, are discussed in this report.

Altitude above ground level (AGL) was determined using the Google Map Elevation Application Programming Interface (API). Each latitude and longitude coordinate was provided to the Google Maps Elevation API to determine estimated terrain elevation, which was subtracted from GPS altitude to achieve an estimate of AGL.

3. GPS PARAMETERS PROVIDED

Table 1 describes data parameters provided by the GPS device. Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Groundspeed and Track are derived from the recorded parameters; terrain elevation and AGL were derived as described in section 2.1.2.

Table 1: GPS Data Parameters

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded GPS Altitude (feet, MSL[2])
Groundspeed	Average groundspeed (knots)
Track	Average true course (degrees)
GE_Elevation	Google Maps Elevation API derived terrain elevation(feet)
AGL_GE_Derived	Estimated AGL Altitude (GPS Alt – GE_Elevation) (feet, AGL)

4. OVERLAYS AND TABULAR DATA

All graphical overlays generated in this report were generated using Google Earth. Weather and lighting conditions in Google Earth are not necessarily representative of weather and lighting conditions at the time of the accident. The location of the pilot's house was provided by the IIC and is annotated on select overlays.

Figures 1 through 6 show data from the flight on January 17, 2015. The flight originated at Clarence E. Page Municipal Airport in Oklahoma and landed at DUA. As the aircraft approached the DUA area, the aircraft maneuvered at low altitudes over the pilot's house. The minimum estimated altitude during the maneuvering was 237 feet AGL.

Figures 7 through 10 show data from the local flight out of DUA on January 27, 2015. The aircraft made a low pass in the vicinity of the pilot's house, including a minimum

[2] MSL means altitude above mean sea level

estimated altitude of 156 feet AGL. The aircraft then maneuvered along and in the vicinity of Lake Texoma at altitudes below 100 feet AGL.

Figures 11 through 16 show data from local accident flight out of DUA on January 28, 2015. The flight operated along and in the vicinity of Lake Texoma, including low level maneuvering below 100 feet AGL. Figure 15 shows the end of the accident flight as the aircraft maneuvered over Lake Texoma, at altitudes below 500 feet AGL. After 16:59:35 UTC, the aircraft descended in a left turn towards the lake.

Tabular data used to generate figures 3 through 16 are included as attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

Figure 3. January 17 flight as recorded by Garmin 296.

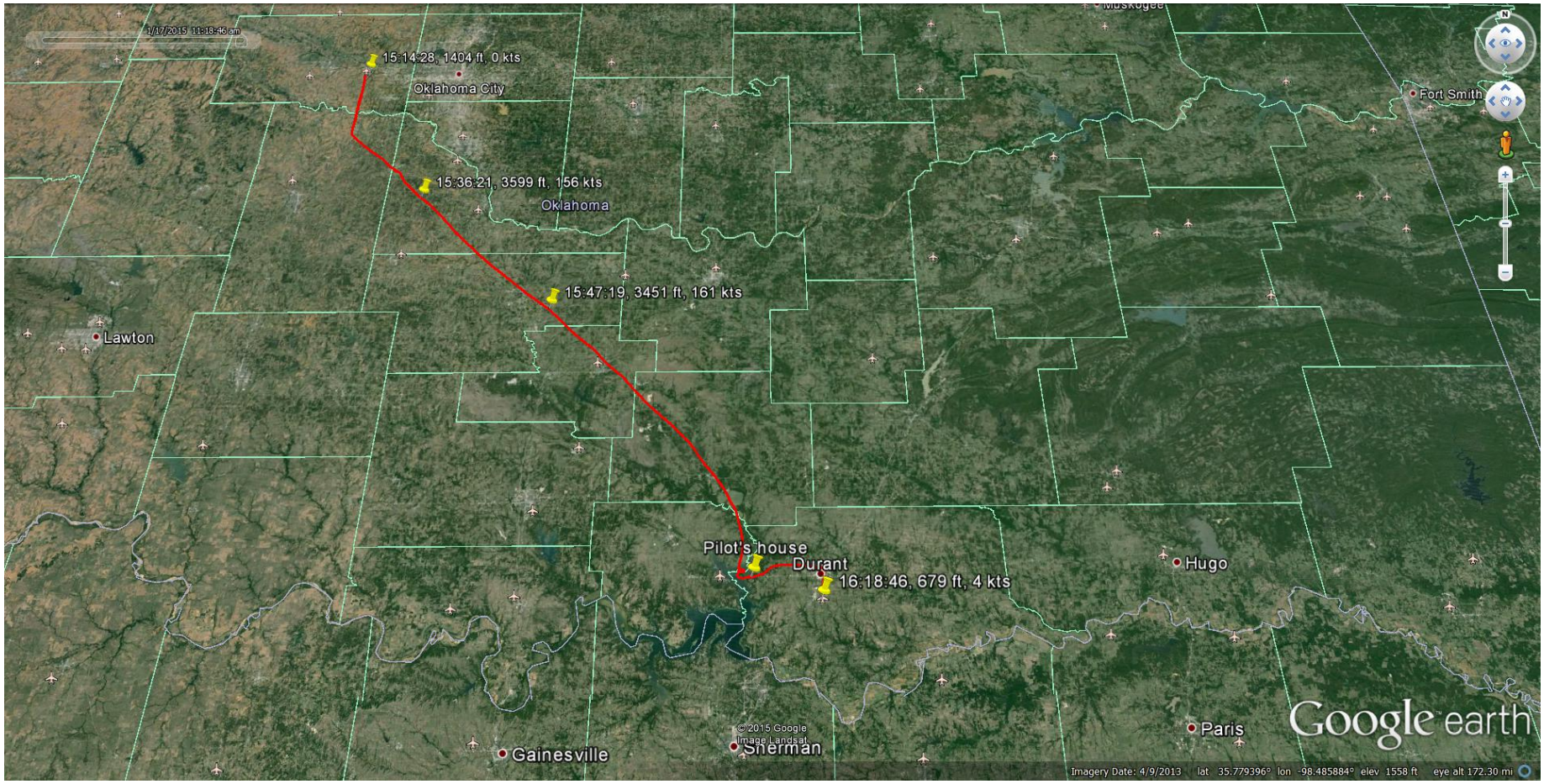

Figure 4. January 17 flight highlighting low level maneuvering near pilot's house.

Figure 5. January 17 flight highlighting part of low level maneuvering near pilot's house.

Figure 6. Overview of January 17 flight, including AGL profile.

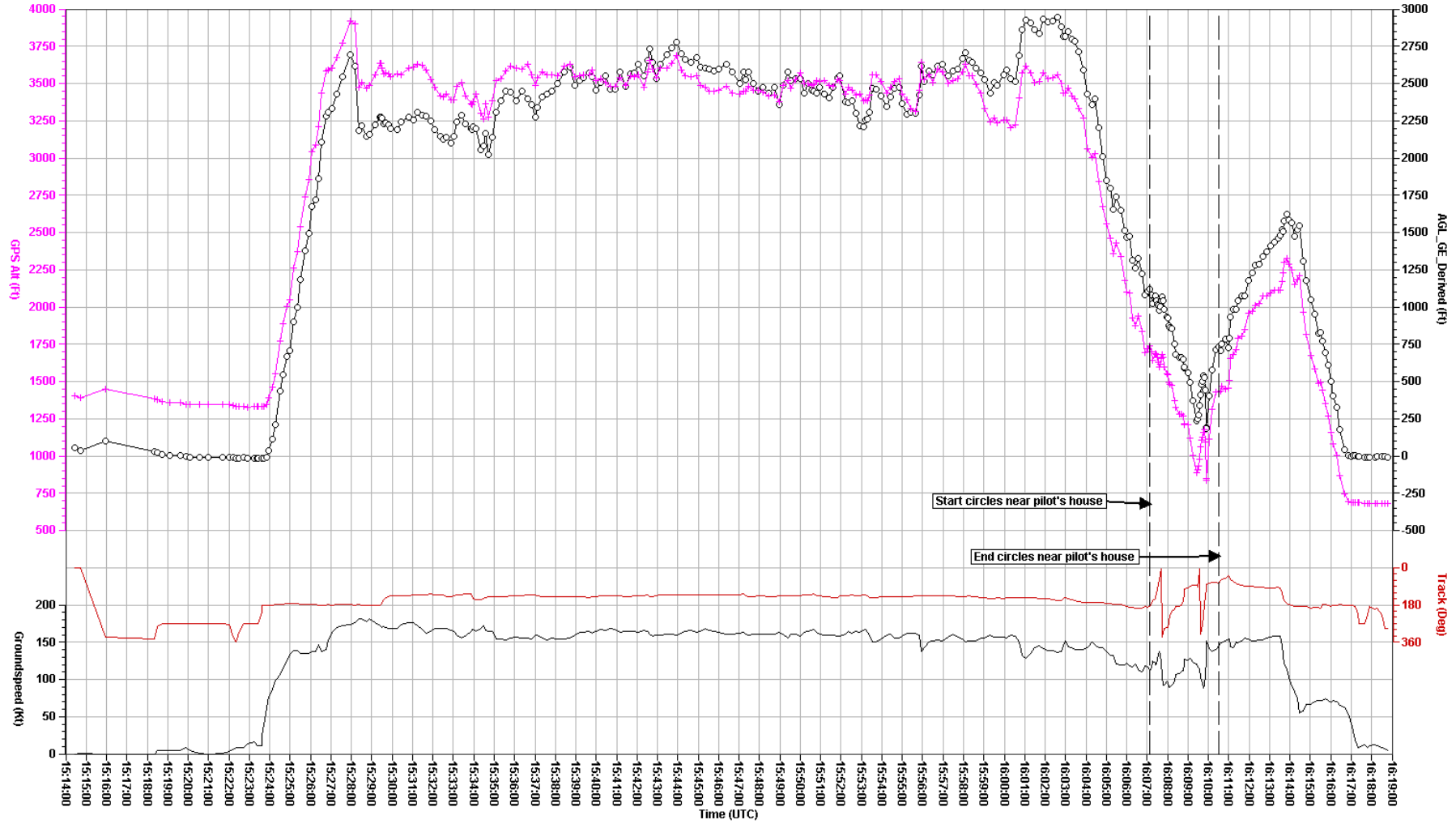

Figure 7. January 27 flight as recorded by Garmin 296..

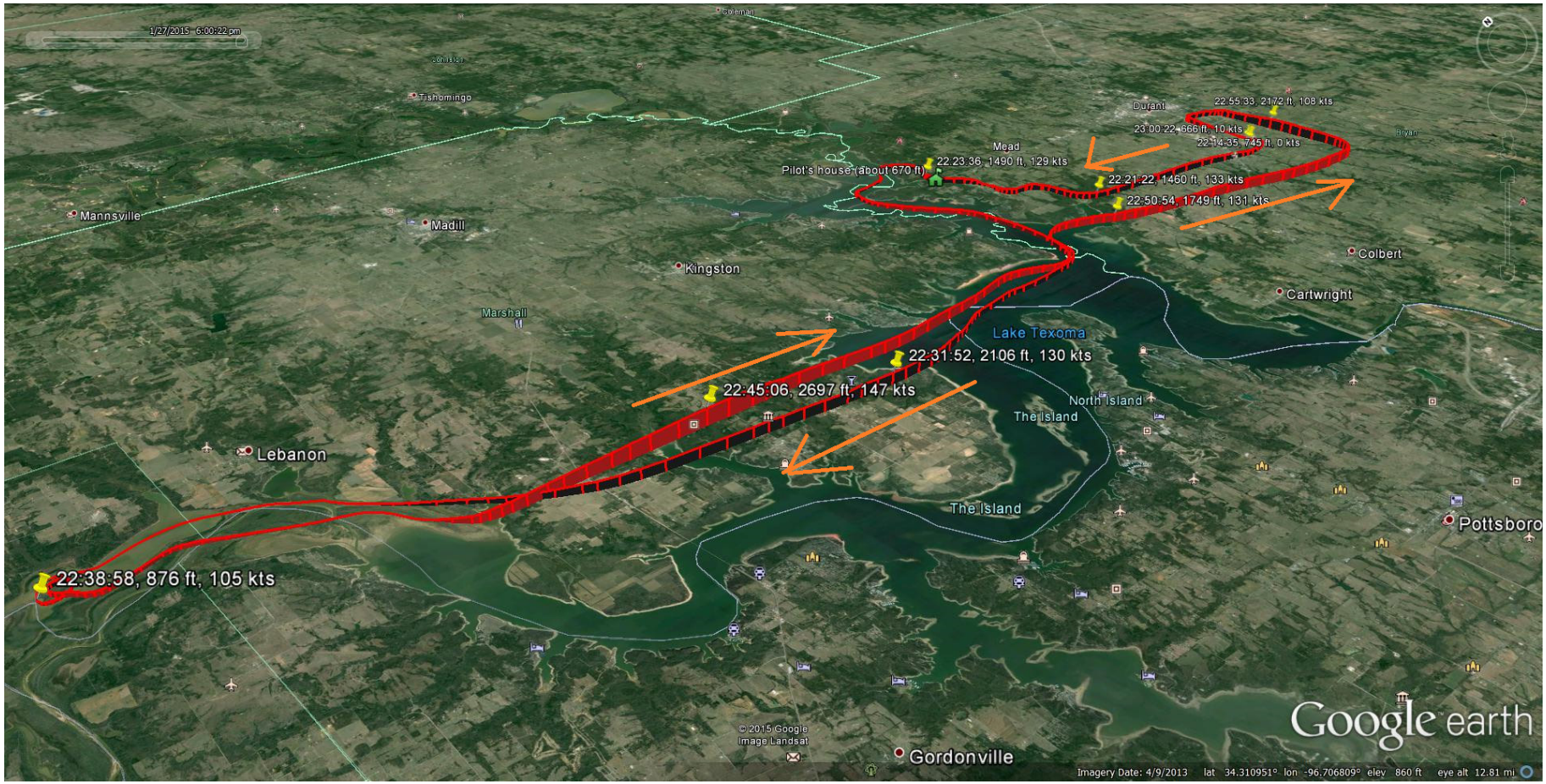

Figure 8. January 27 flight highlighting low level maneuvering near pilot's neighborhood.

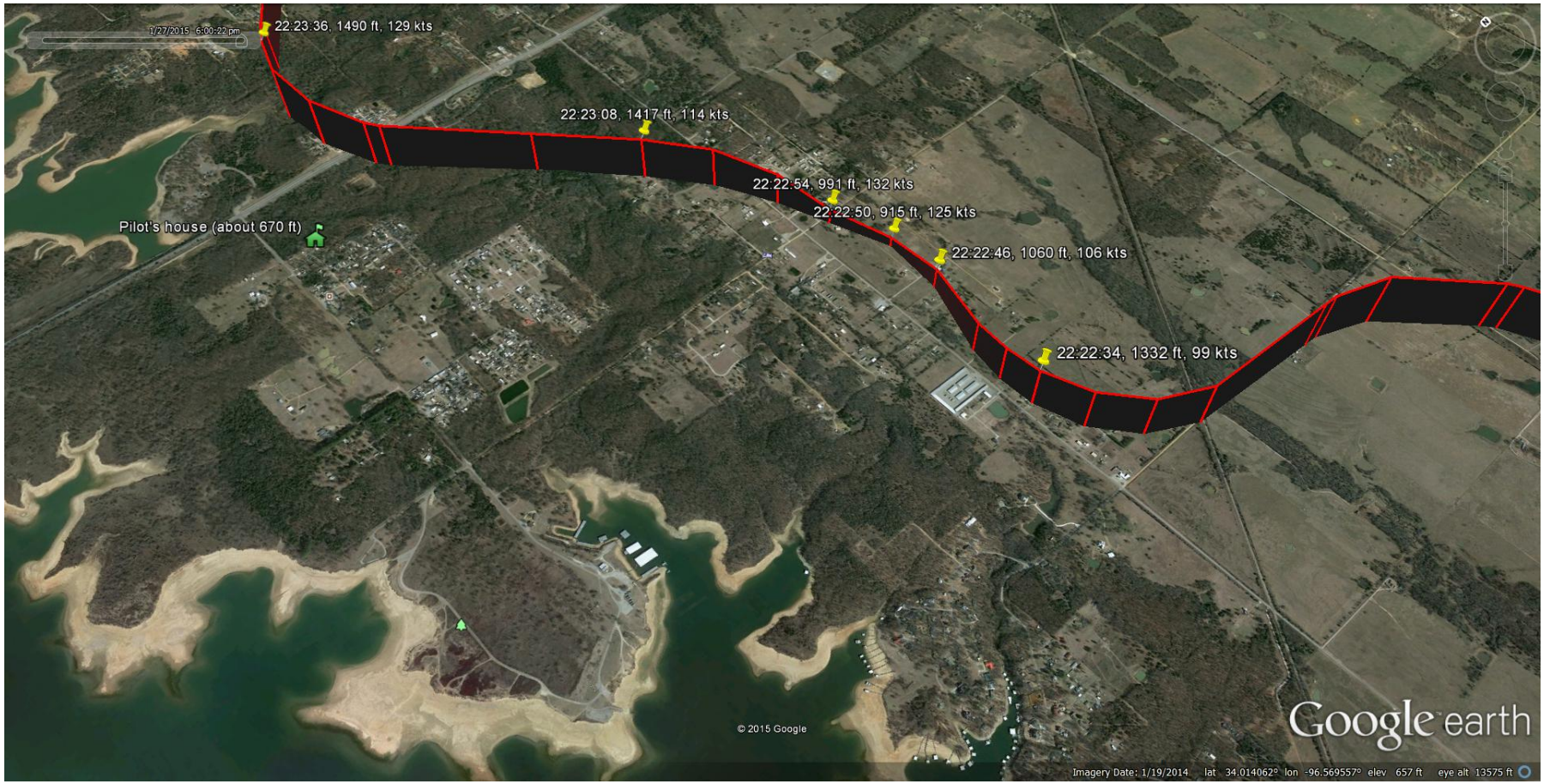

Figure 9. January 27 flight highlighting low level maneuvering along Lake Texoma.

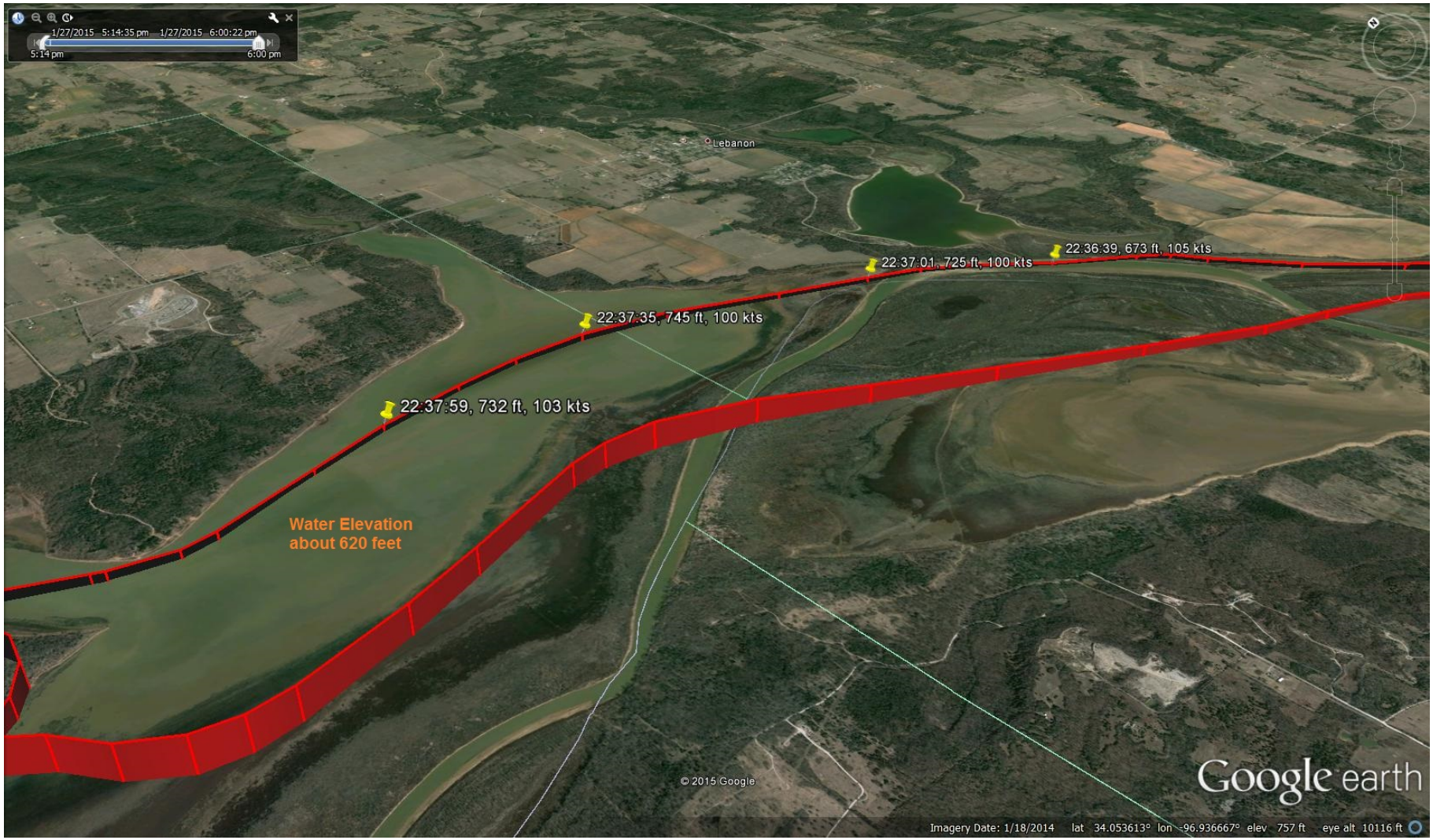

Figure 10. Overview of January 27 flight, including AGL profile.

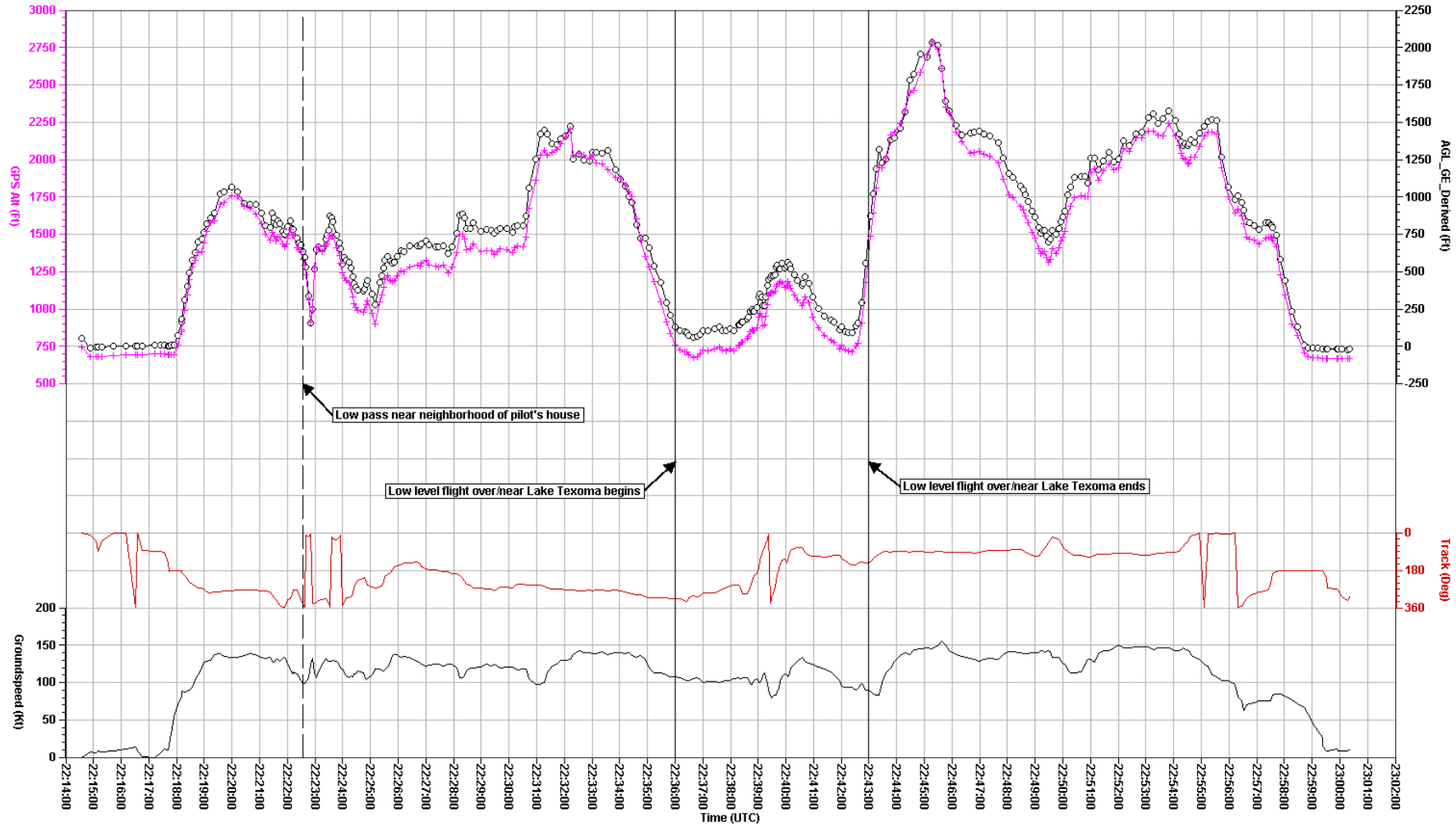

Figure 11. January 28 accident flight as recorded by Garmin 296..

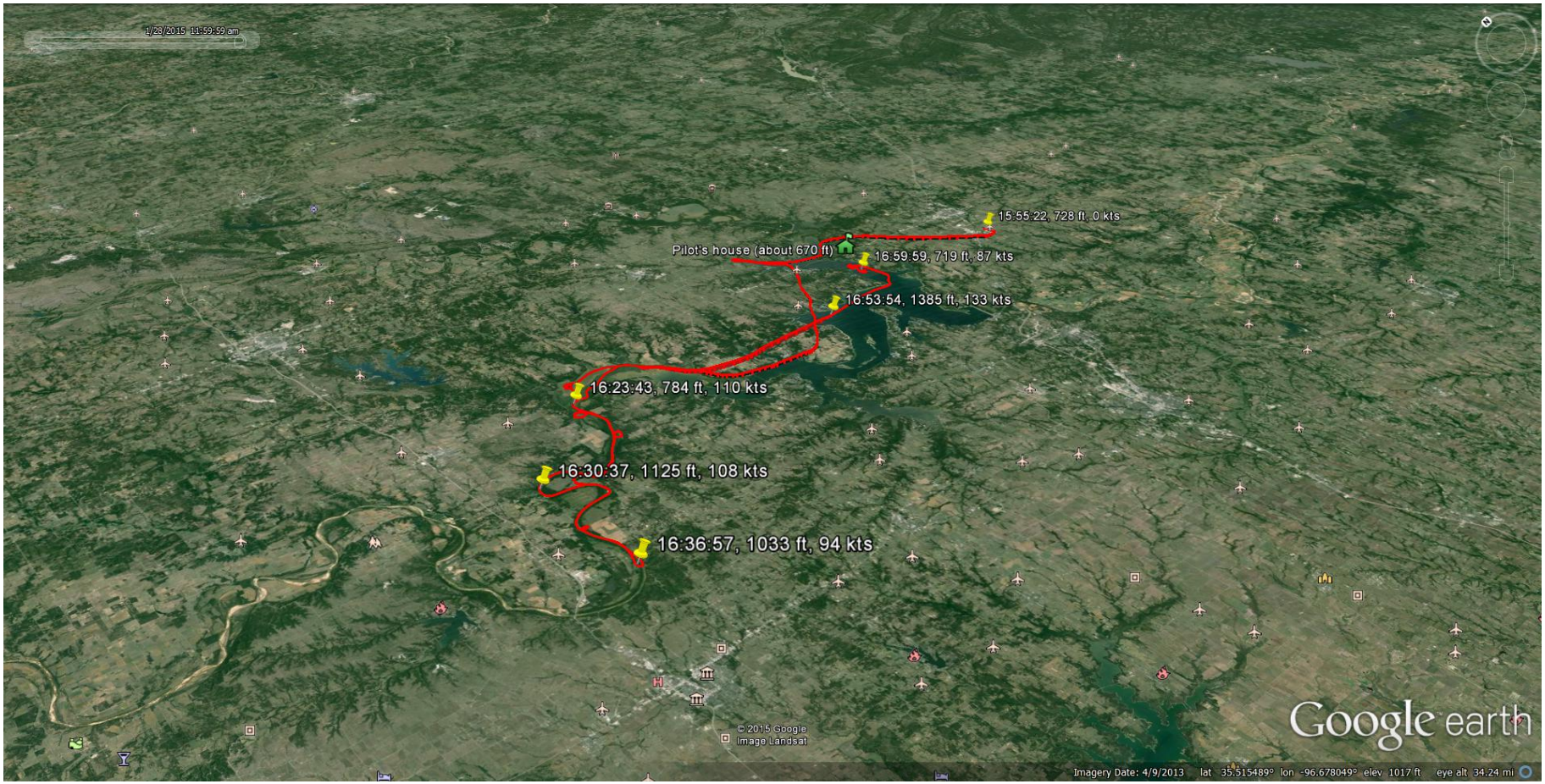

Figure 12. January 28 accident flight highlighting low level maneuvering over Lake Texoma in the vicinity of pilot's house.

Figure 13. January 28 accident flight highlighting low level maneuvering along Lake Texoma.

Figure 14. January 28 accident flight highlighting low level maneuvering along Lake Texoma.

Figure 15. January 28 accident flight highlighting low level maneuvering over Lake Texoma and end of recording.

Figure 16. Overview of January 28 accident flight, including AGL profile.