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

January 8, 2018

Global Positioning System Device

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

1. EVENT SUMMARY

Location:	Fairbanks, Alaska
Date:	December 7, 2016
Aircraft:	Bellanca Citabria 7GCBC
Registration:	N88452
Operator:	Private
NTSB Number:	ANC17FA009

On December 7, 2016, about 1043 Alaska standard time, a tail wheel, ski-equipped Bellanca Citabria 7GCBC airplane, N88452, was substantially damaged after impacting snow-covered terrain about 17 miles southeast of Fairbanks, Alaska. The certificated airline transport pilot, the sole occupant, was fatally injured. The airplane was registered to the pilot and operated as a visual flight rules (VFR) personal flight conducted under Title 14 *Code of Federal Regulations* Part 91. A VFR flight plan was filed and activated. Visual meteorological conditions prevailed at the time of the accident. The flight departed Chena Marina Airport, Fairbanks, at 1026 destined for the Tanana Flats southern training area.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

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

Device Manufacturer/Model:	Garmin GPSMAP 296
Serial Number:	10C000771

3.1. 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 a track log. A detailed tracklog, including latitude, longitude, date, time, and GPS altitude information, 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. Tracklog storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory.[1] The unit contains hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC via a built-in serial port or mini-USB connection. 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.

3.2. Data Recovery

Upon arrival at the laboratory, it was evident that the device had not sustained any heat or structural damage and the information was extracted from the device normally.

3.3. Data Description

The data extracted included 24 recording sessions from August 2, 2016,[2] through December 8, 2016 (2,571 points). The accident flight was recorded starting 19:20:58 UTC and ending 19:43:41 UTC on December 7, 2016, consisting of 130 points. The additional data recorded after the accident were in roughly a stationary position and began at 20:33:12 UTC (the reason for the additional recording operation was not determined).

3.4. 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.

[1] Non-volatile memory is memory that does not require power to retain information.
[2] All dates and times are referenced to Coordinated Universal Time (UTC).

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)
Groundspeed	Average derived groundspeed (knots)
Track	Average derived true course (degrees)

3.5. OVERLAYS AND TABULAR DATA

The weather and lighting conditions in Google Earth overlays are not necessarily the weather and lighting conditions present at the time of the recording. Derived groundspeeds may not reflect actual groundspeed during turns, due to the spacing of the time-sampled latitude/longitude and the rate of turn.

Figures 1 through 7 show Google Earth overlays of the accident flight with different areas of focus. In figure 3, the overlay is displaced above the ground when the aircraft is on the ground; this may happen for a number of reasons, including Earth model discrepancies, or GPS vertical accuracy.

Overall, the recording shows the aircraft departed the Chena Marina Airport, climbed toward the southeast, crossed the Tanana River southwest of the Fairbanks International Airport at about 1,700 feet, and then proceeded southerly over the Tanana Flats. The aircraft maneuvered (i.e., 360 degree turns) over the Tanana Flats at about 1,500 feet. Towards the end of the flight, the aircraft was proceeding southeast. Specifically, these overlays show:

- The recording began at the Chena Marina Airport at 19:20:58 UTC. From about 19:22:23 UTC to 19:25:46 UTC, the aircraft was stationary near the north side of the runway. By 19:26:23 UTC, the aircraft had begun its takeoff.
- Between 19:33 UTC and 19:37 UTC, the aircraft performed three, 360 degree turns at about 1,500 feet over the Tanana Flats, and then continued southbound.
- At about 19:40:11 UTC, the aircraft started a left turn towards the southeast at a groundspeed of about 75 knots.
- Between 19:41:03 UTC and 19:42:28 UTC, the recorded GPS altitude decreased from 1,532 feet to 1,417 feet, with a groundspeed of about 75 knots.
- Between 19:42:28 UTC and 19:43:28 UTC, the recorded GPS altitude decreased from 1,417 feet to 981 feet, and the groundspeed decreased to 26 knots. Due to the straight path during this period, the derived groundspeeds are relatively accurate.

- Between 19:43:28 UTC and the end of the recording at 19:43:41 UTC, the recorded altitude decreased rapidly from 981 feet to 521 feet.

Figure 8 plots the true track, derived groundspeed, and GPS altitude for the accident flight. The increase in derived groundspeed at the last datapoint may be inaccurate due to the sampling rate and other unknown dynamics.

Tabular data used to generate figures 1 through 8 are included as attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

Figure 1. Accident flight overlaid on aviation sectional.

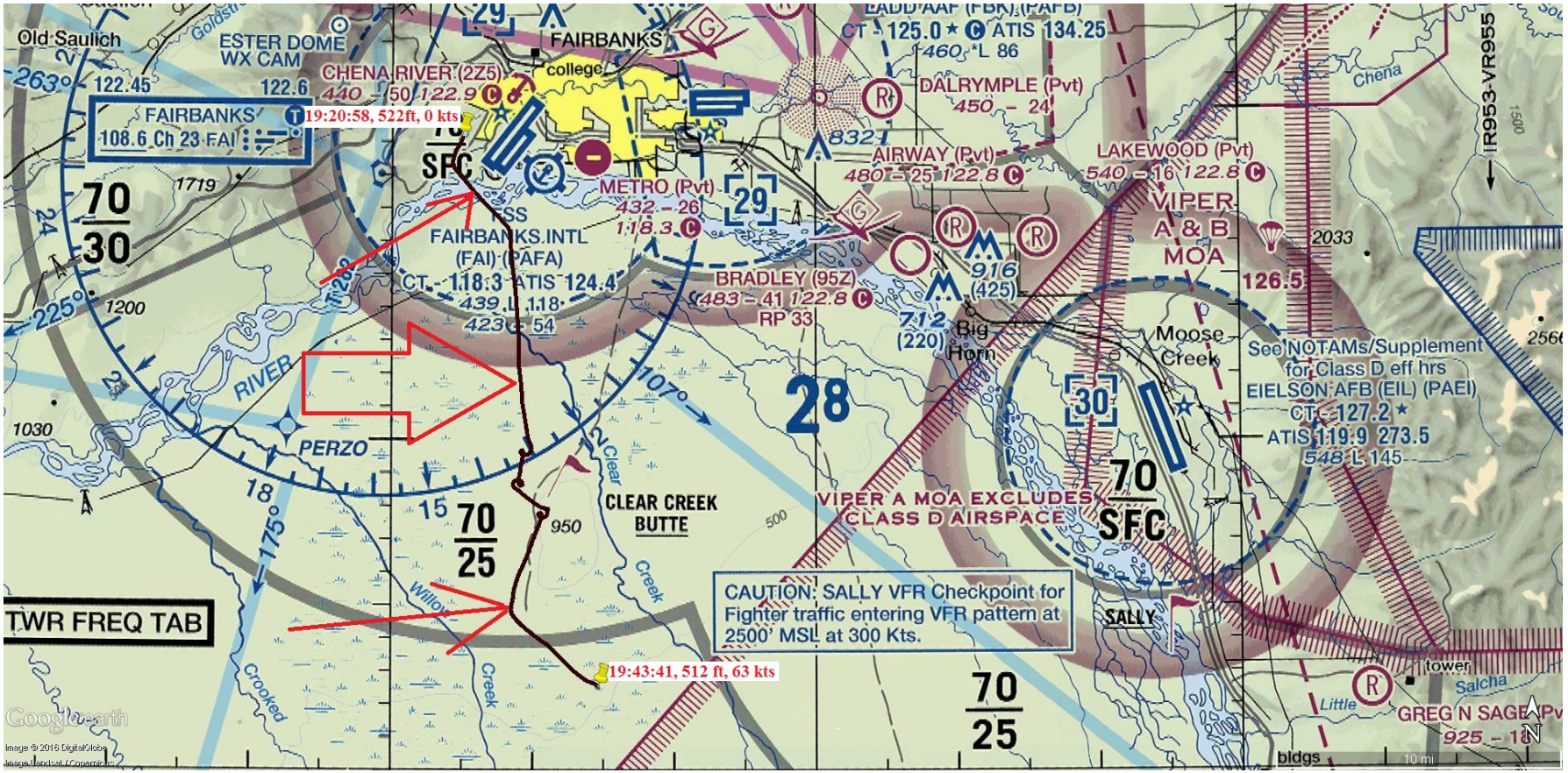

Figure 2. Accident flight overlaid on satellite imagery.

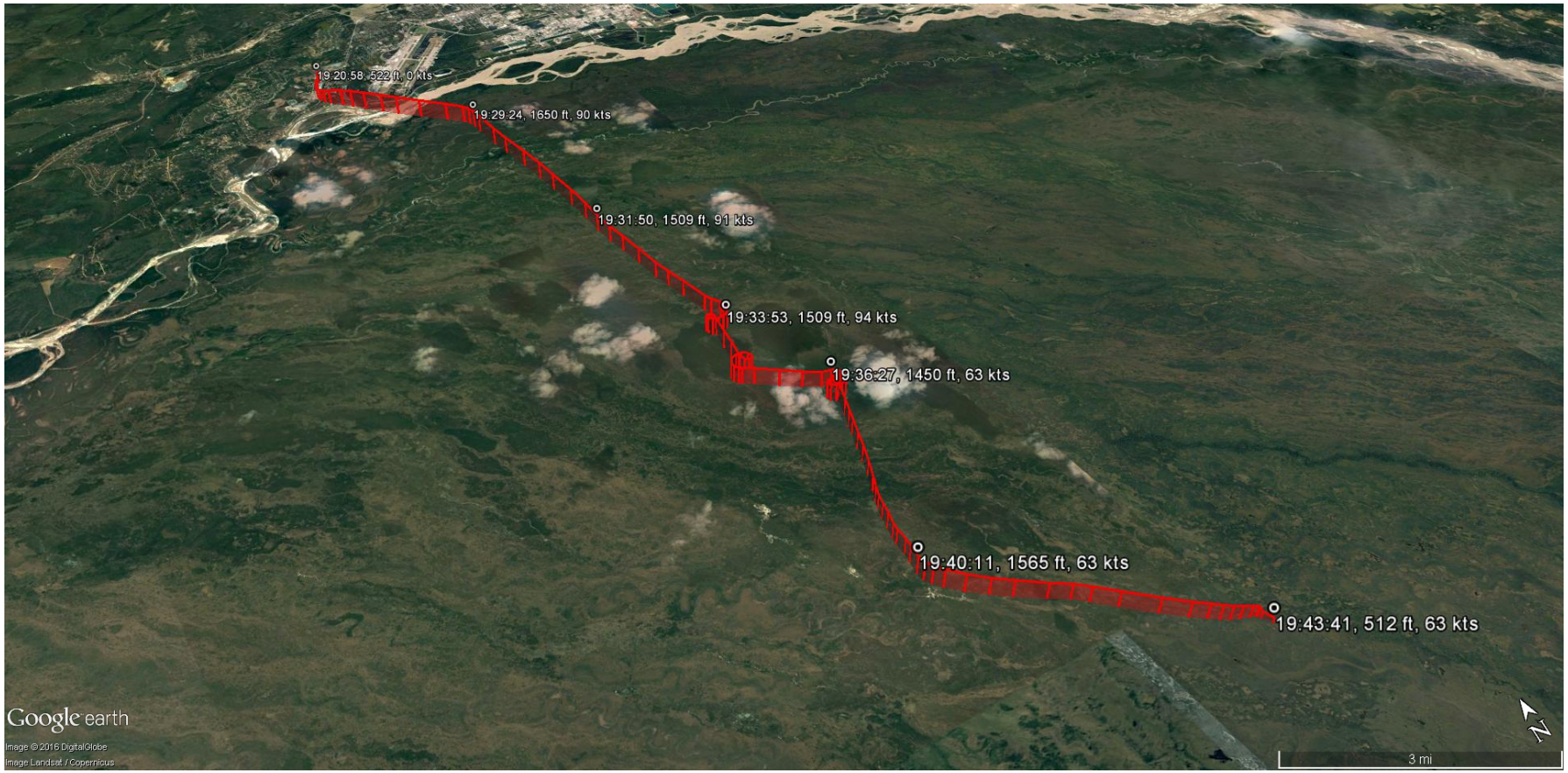

Figure 3. Start of accident flight recording.

Figure 4. Initial departure path of accident flight.

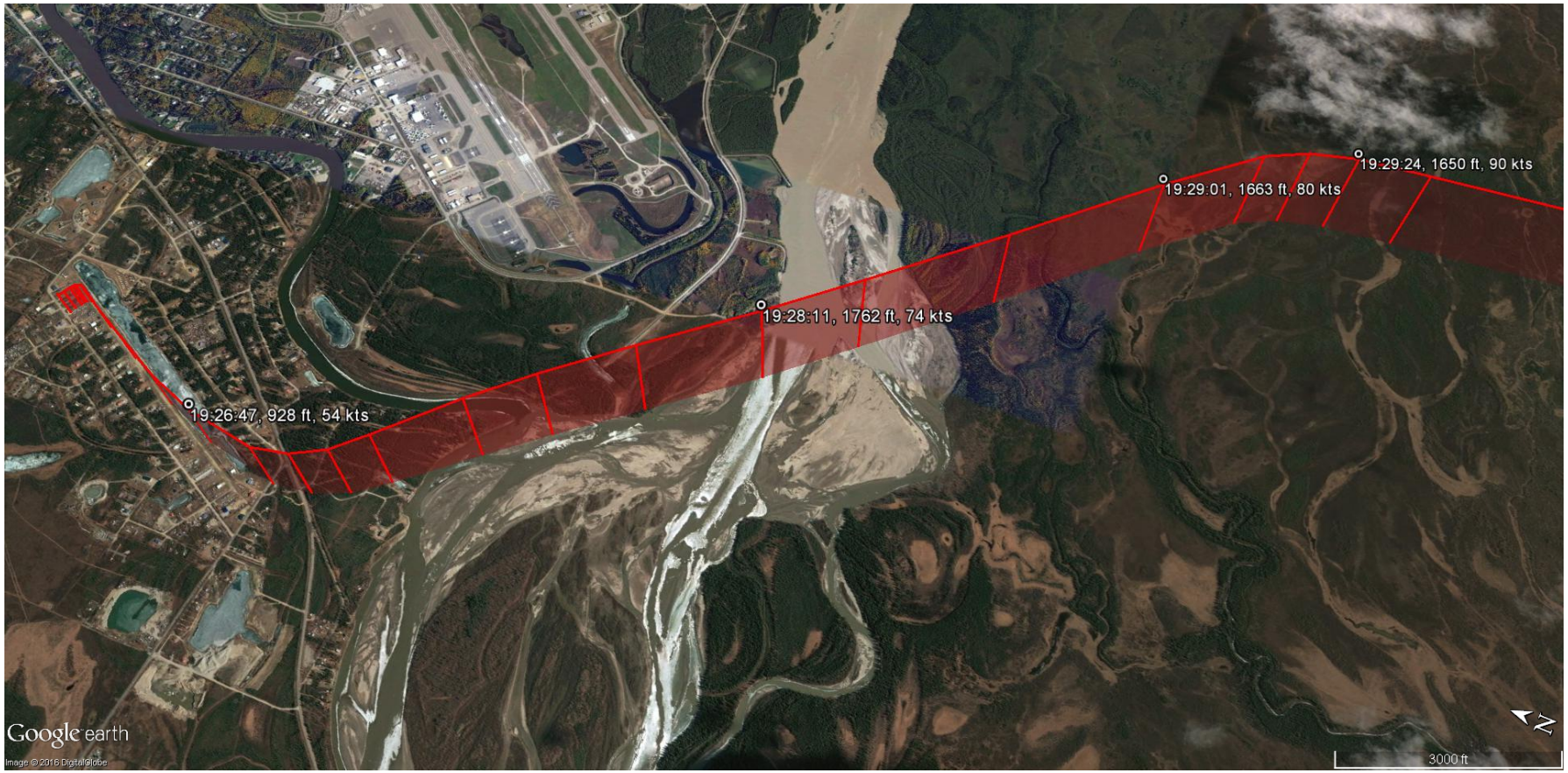

Figure 5. Enroute maneuvering of accident flight.

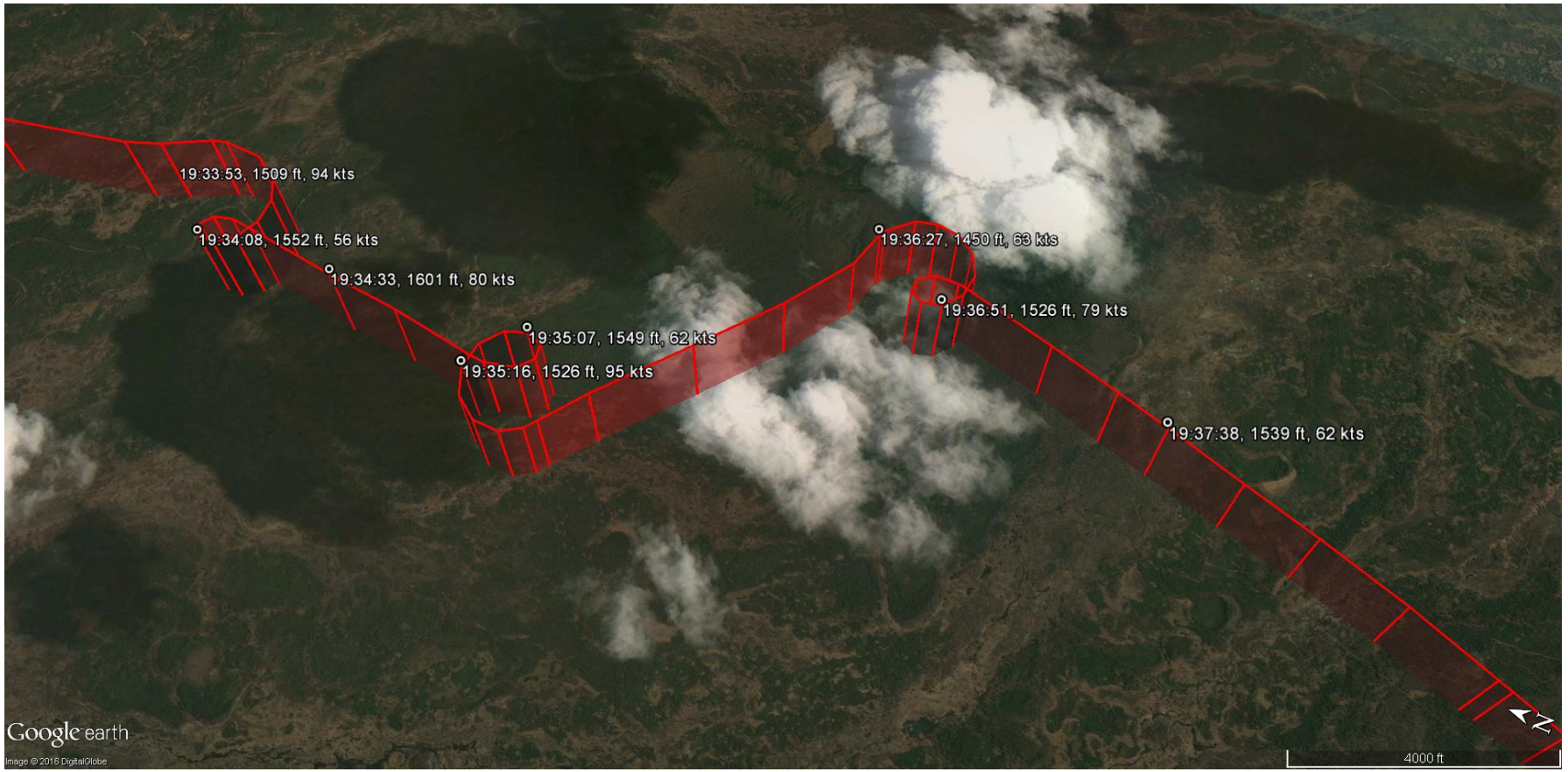

Figure 6. Broad view of end of accident flight recording.

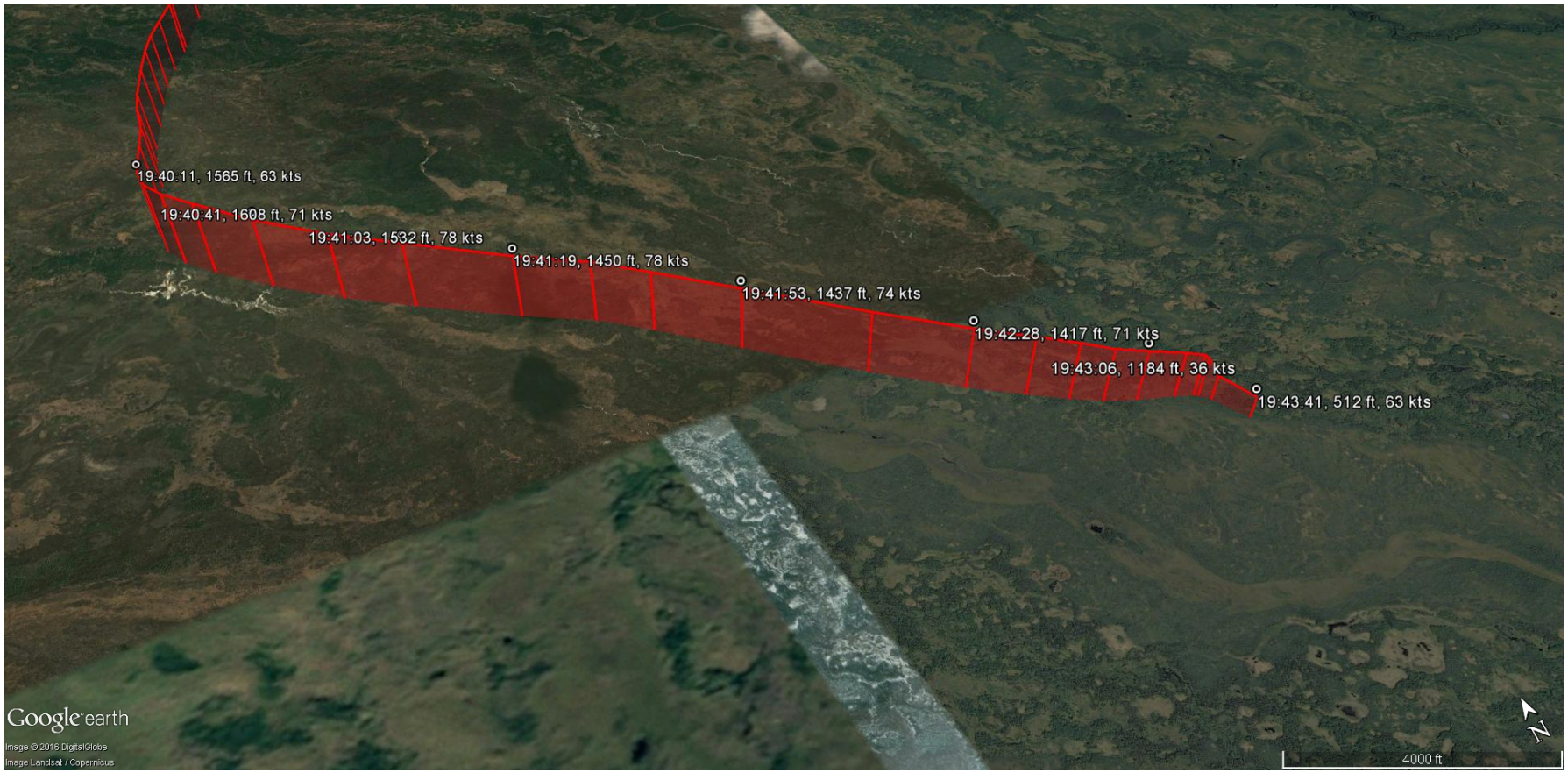

Figure 7. Detail view of end of accident flight recording.

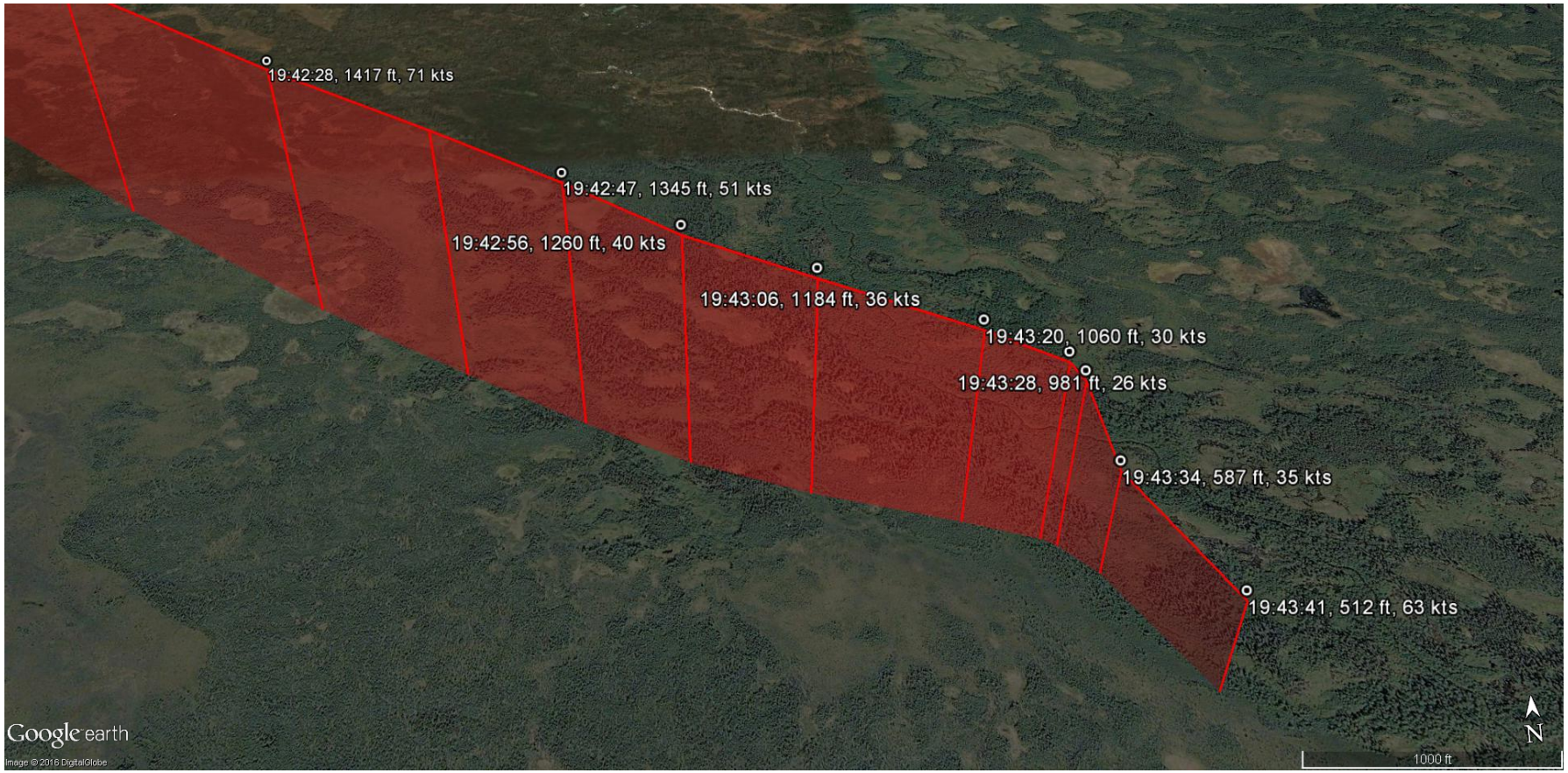

Figure 8. Plot of track, groundspeed, and altitude.