

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

February 24, 2021

Global Positioning System Devices

Specialist's Factual Report

By Michael Portman

1. EVENT SUMMARY

Location: Jackpot, Nevada
Date: November 22, 2019
Aircraft: Grumman AA-5B
Registration: N310PD
Operator: Private
NTSB Number: WPR20FA031

On November 22, 2019, about 1834 Pacific standard time (PST), a Grumman AA-5B Tiger airplane, N310PD, impacted terrain near Jackpot, Nevada. The commercial pilot and passenger were fatally injured, and the airplane was destroyed. The airplane was registered to and operated by the pilot under the provisions of Title 14 *Code of Federal Regulation* Part 91. Visual meteorological conditions prevailed, and a flight plan was not filed for the cross-country flight, which originated at 1834 and was destined for Rexburg, Idaho.

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) devices:

Device Manufacturer/Model:	Garmin Aera 796
Serial Number:	2CY015215

Device Manufacturer/Model:	Garmin 695
Serial Number:	1H7002887

3.1. Garmin Aera 796 Device Description

The Garmin aera 796 is a battery-powered, portable, multi-function display and GPS receiver with a 7-inch diagonal, high-resolution, LCD touch screen display. The unit

includes a built-in Jeppesen database and is capable of receiving XM satellite radio for flight information including NEXRAD Radar, lightning, METARs, TAFs, and TFRs. The unit can also perform and store weight and balance calculations. A built-in AOPA Airport Directory and SafeTaxi airport diagrams are included for selected airfields. With appropriate subscriptions, the unit is capable of storing and displaying geo-referenced VFR and IFR navigation charts, including IFR approach charts. The unit also has a “scratch pad” feature, allowing the user to hand write electronic notes.

The unit stores date, route-of-flight, and flight-time information for up to 50 flights. A detailed track log – 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 track log as a function of time or distance moved, depending on how the unit has been configured. Once the current track log memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured. The current track log can be saved to long-term memory. Track log storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory¹.

The unit contains hardware and software permitting the download of recorded waypoint, route, and track log 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.

3.2. Garmin Aera 796 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained significant impact damage, as shown in Figure 1. The front screen was shattered, and the device was unable to be powered on. An internal inspection revealed the memory chip appeared undamaged. Subsequently, the Samsung chip was removed from the main internal board, and the memory contents of the chip were successfully read and track log data points were decoded using laboratory equipment.

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

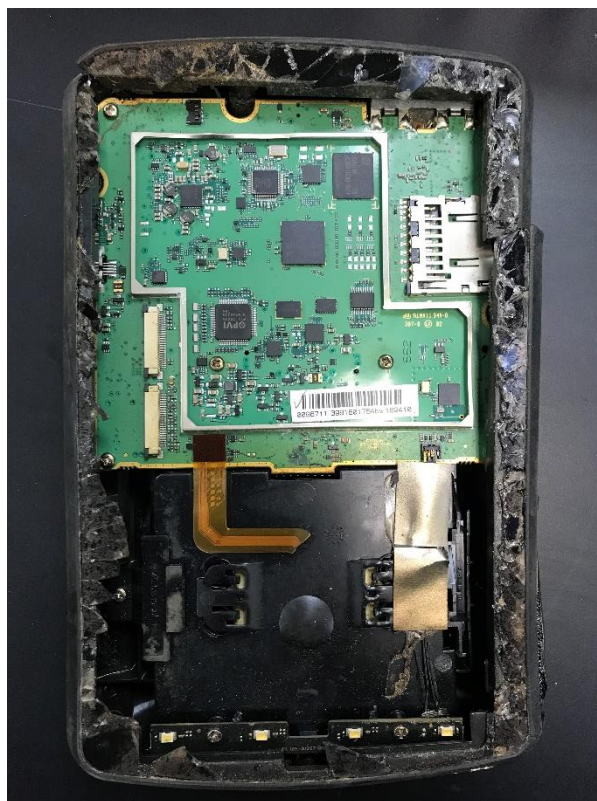


Figure 1. Photo of Garmin Aera 796 showing impact damage including shattered screen.

3.3. Garmin Aera 796 Data Description

The data extracted from the Garmin aera 796 device included 87 track logs from September 22, 2019, through November 23, 2019². It was determined that approximately half of these track logs were duplicates. The accident flight was the last track log recorded, and the starting at 01:34:01 UTC and ending at 01:37:54 UTC on November 23, 2019. In addition, four previous flights, one on September 22, 2019, starting at 20:06:43 UTC and ending at 21:32:12 UTC, one on October 4, 2019, starting at 01:45:11 UTC and ending at 03:07:31 UTC, and one on November 15, 2019, starting at 03:37:57 UTC and ending at 04:58:55 UTC, all originating from the accident airport, Jackpot, NV, as well as the inbound flight immediately preceding the accident flight on November 22, 2019, starting at 22:06:01 UTC and ending at 23:38:15 UTC, were determined to be of interest and are included in this report.

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.

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. Garmin 695 Device Description

The Garmin GPSMAP 695 is a battery-powered portable multi-function display and GPS receiver with a 7-inch diagonal high-resolution LCD display screen. The unit includes a built-in Jeppesen database and is capable of receiving XM satellite radio for flight information including NEXRAD Radar, lightning, METARs, TAFs, and TFRs. The unit can also perform and store weight and balance calculations. A built-in AOPA Airport Directory and SafeTaxi airport diagrams are included for selected airfields.

The unit stores date, route-of-flight, and flight-time information for up to 50 flights. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 250 feet and ends when groundspeed drops below 30 knots for 10 minutes or more. A detailed track log—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 track log as a function of time or distance moved, depending on how the unit has been configured. Once the current track log memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured. The current track log can be saved to long-term memory and additional track logs can be maintained in addition to the current track log. Track log storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory.

The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in USB port.

3.6. Garmin 695 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained minor thermal damage, as shown in Figure 2. However, the device appeared to be internally undamaged and was able to be powered on. Data were read out successfully, however, it was determined that the accident flight was not recorded. To evaluate the possibility of data being stored in the cache of the device, a chip off procedure was performed and the memory chip read; however, the procedure resulted in no additionally stored data.



Figure 2. Photo of Garmin 695 showing minor external thermal damage and sooting.

3.7. OVERLAYS AND TABULAR DATA

Data obtained from the Garmin Aera 796 was used to produce the following overlays and tabular data. Figure 3 is a graphical overlay generated using Google Earth for the accident flight. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The device began recording at approximately 01:34:01 UTC. The last recorded parameter was as at 01:37:54 UTC on November 23, 2019, with a GPS altitude of 5,468 feet above Mean Sea Level (MSL) and a ground speed of 95 knots. Due to data buffering on the GPS unit, the data recording may have ended before the accident event.

Figures 4 and 5 are graphical overlays generated using Google Earth of the September 22, 2019 flight. Figure 4 provides an overview of the entire flight, and figure 5 is a zoomed overlay detailing the takeoff and departure from Jackpot, NV.

Figures 6 and 7 are graphical overlays generated using Google Earth of the October 4, 2019 flight. Figure 6 provides an overview of the entire flight, and figure 7 is a zoomed overlay detailing the takeoff and departure from Jackpot, NV.

Figures 8 and 9 are graphical overlays generated using Google Earth of the November 15, 2019 flight. Figure 8 provides an overview of the entire flight, and figure 9 is a zoomed overlay detailing the takeoff and departure from Jackpot, NV.

Figure 10 is a graphical overlay generated using Google Earth of the inbound flight to Jackpot, NV on November 22, 2019.

Tabular data used to generate figure 3 are included as Attachment 1. Tabular data used to generate figures 4 and 5 are included as Attachment 2. Tabular data used to generate figures 6 and 7 are included as Attachment 3. Tabular data used to generate figures 8 and 9 are included as Attachment 4. Tabular data used to generate figure 10 are included as Attachment 5. These attachments are provided in electronic comma-delimited (.CSV) format.



Figure 3. Google Earth overlay showing accident flight with approximate wreckage location.

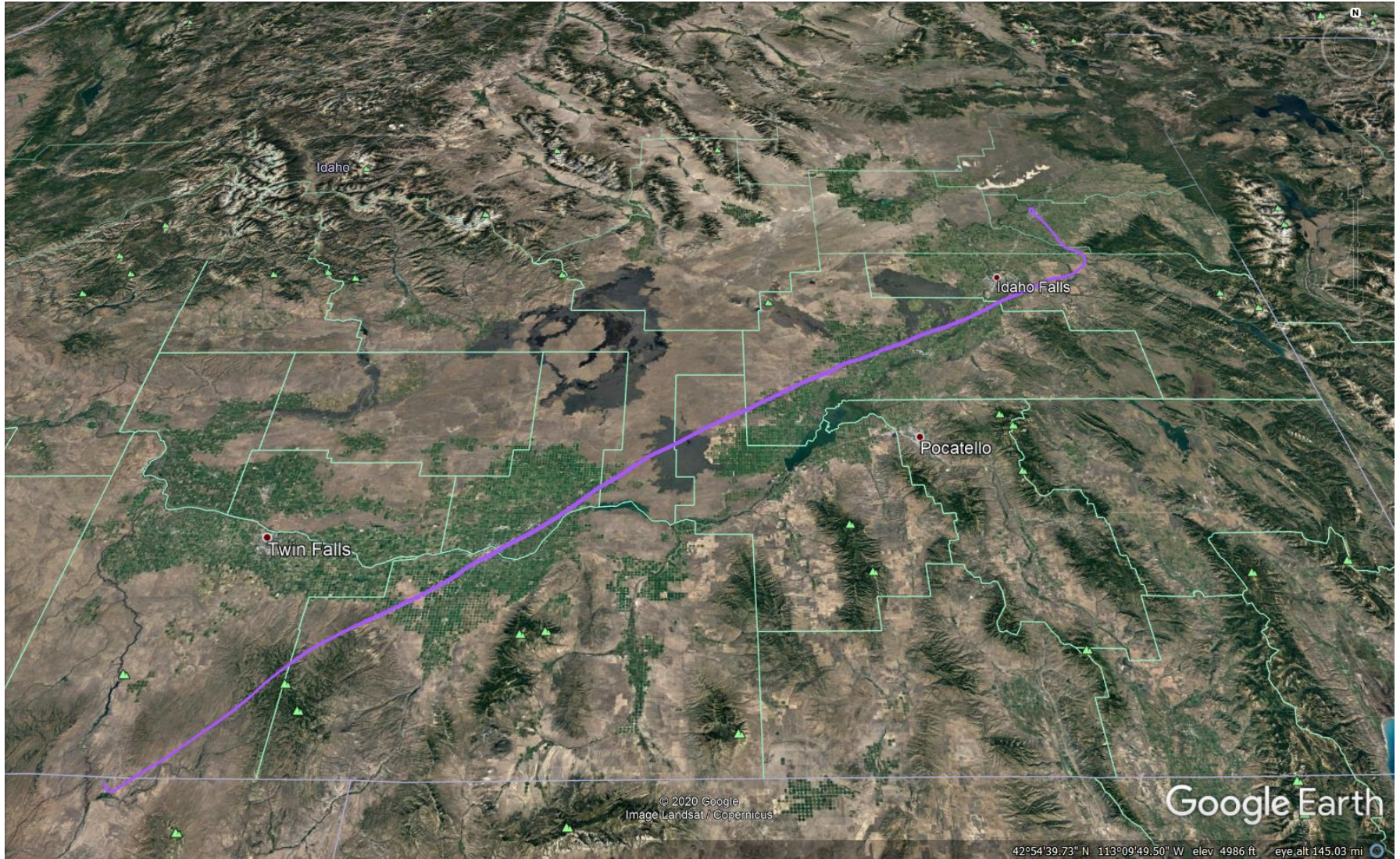


Figure 4. Google Earth overlay showing an overview of the September 22, 2019 flight.

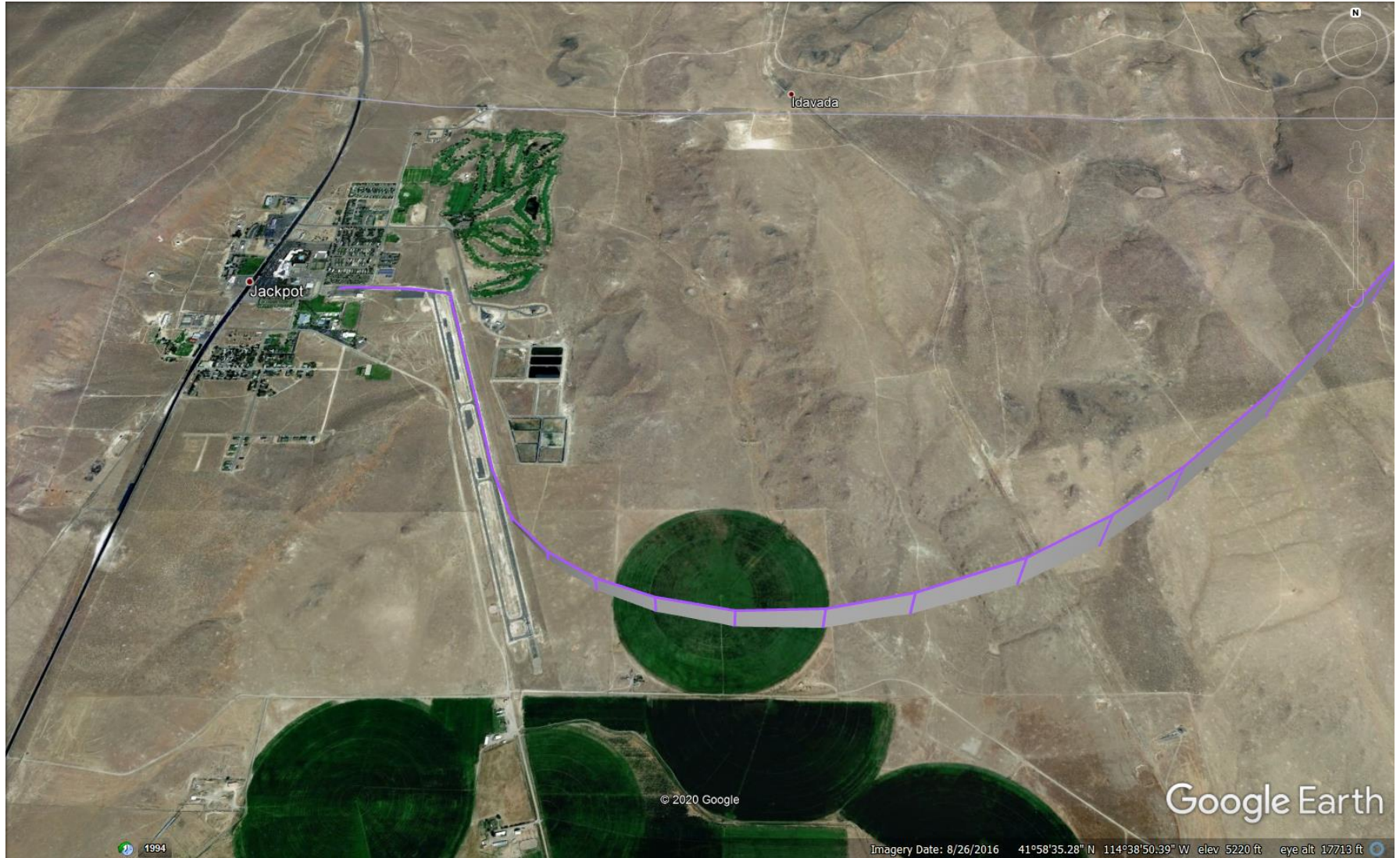


Figure 5. Google Earth overlay zoomed to show the takeoff of the September 22, 2019 flight.



Figure 6. Google Earth overlay showing an overview of the October 4, 2019 flight.

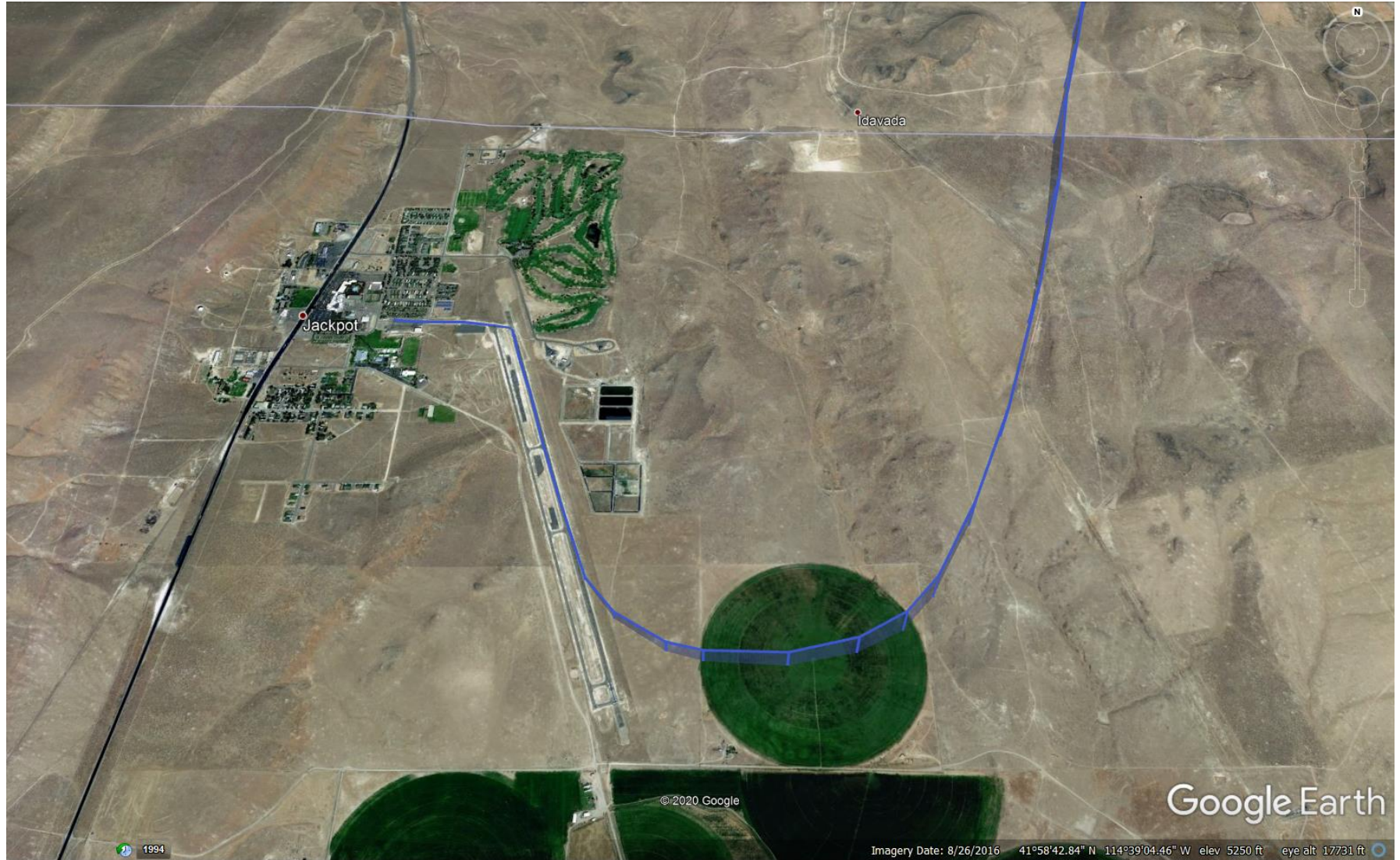


Figure 7. Google Earth overlay zoomed to show the takeoff of the October 4, 2019 flight.

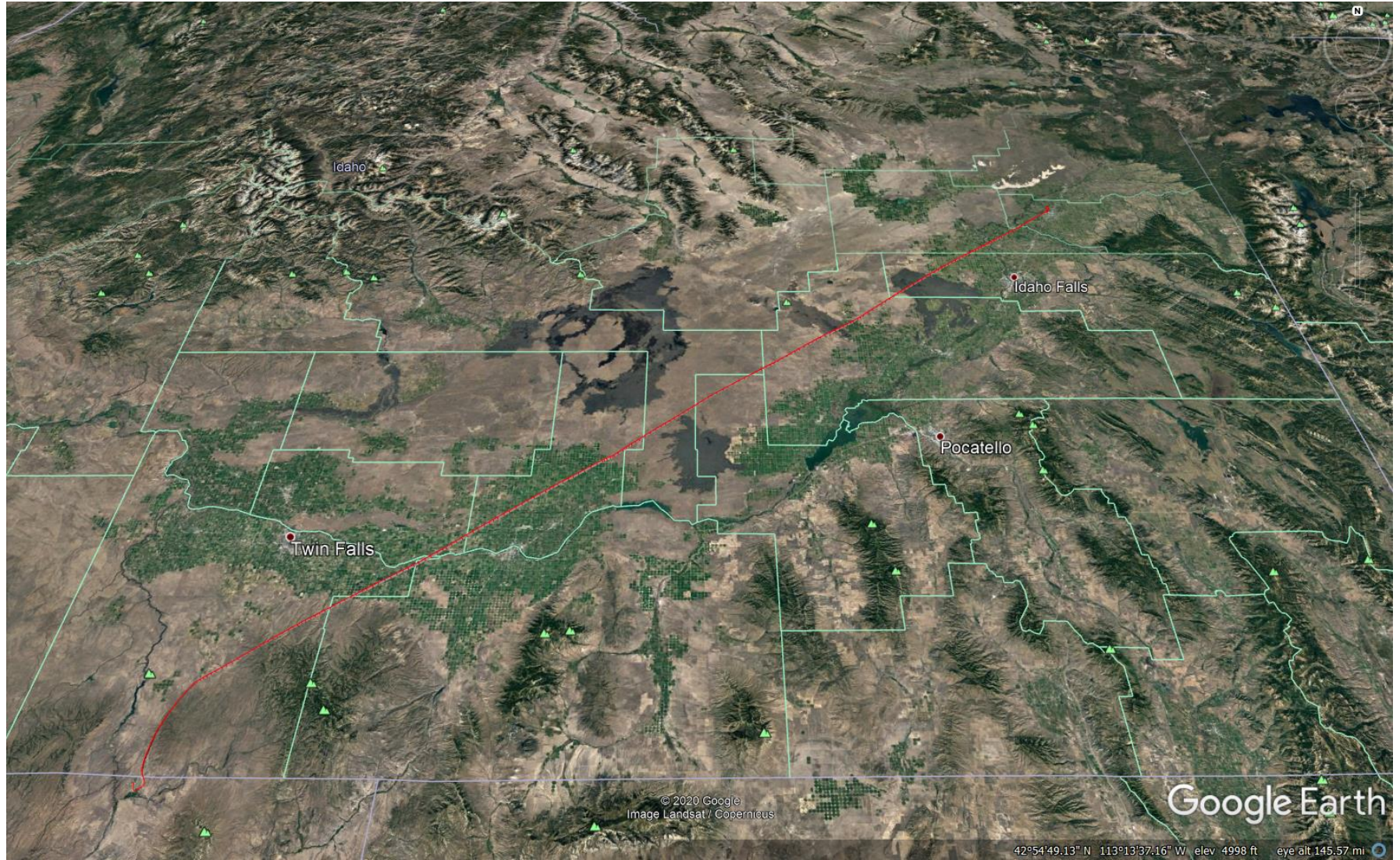


Figure 8. Google Earth overlay showing an overview of the November 15, 2019 flight.

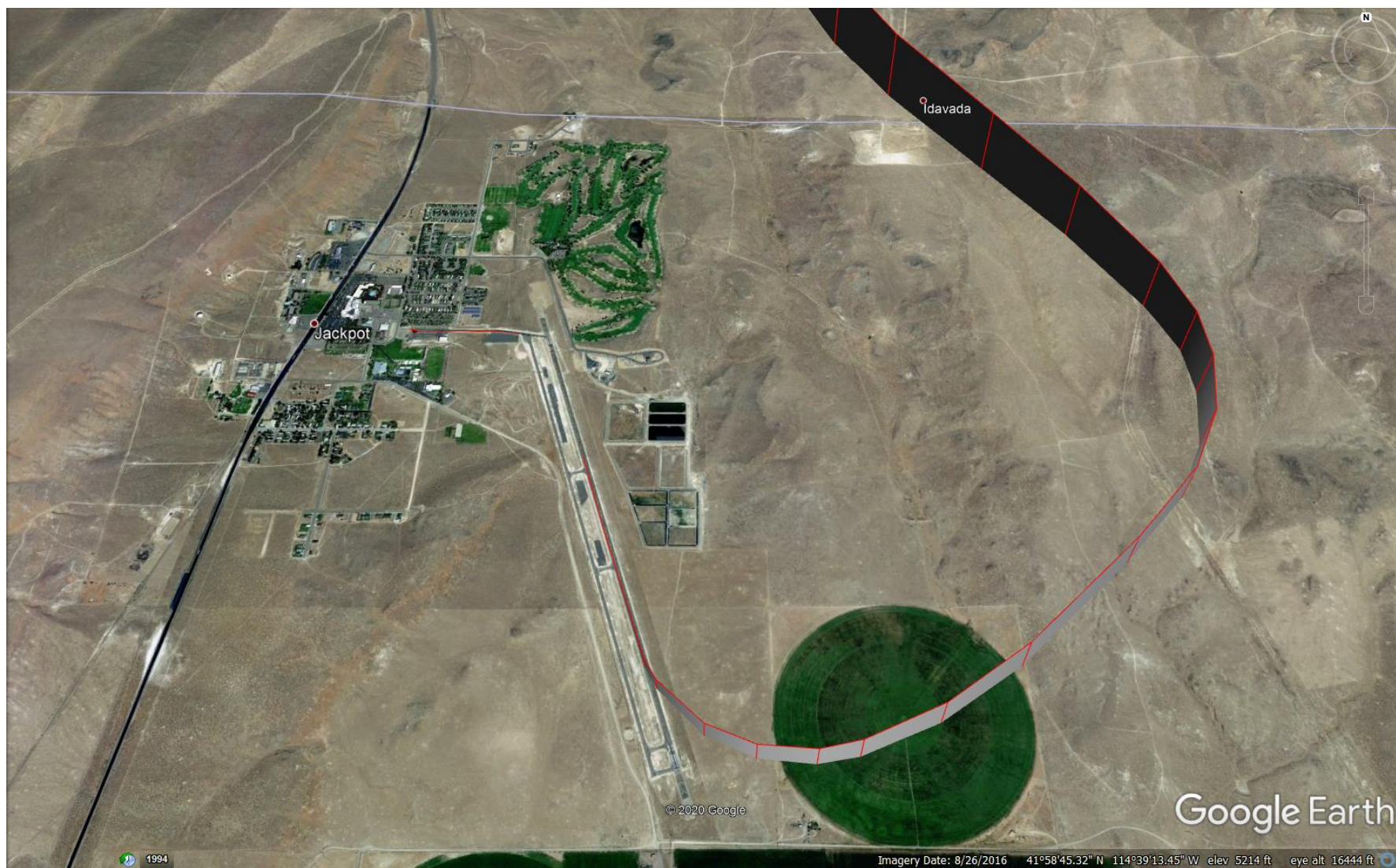


Figure 9. Google Earth overlay zoomed to show the takeoff of the November 15, 2019 flight.

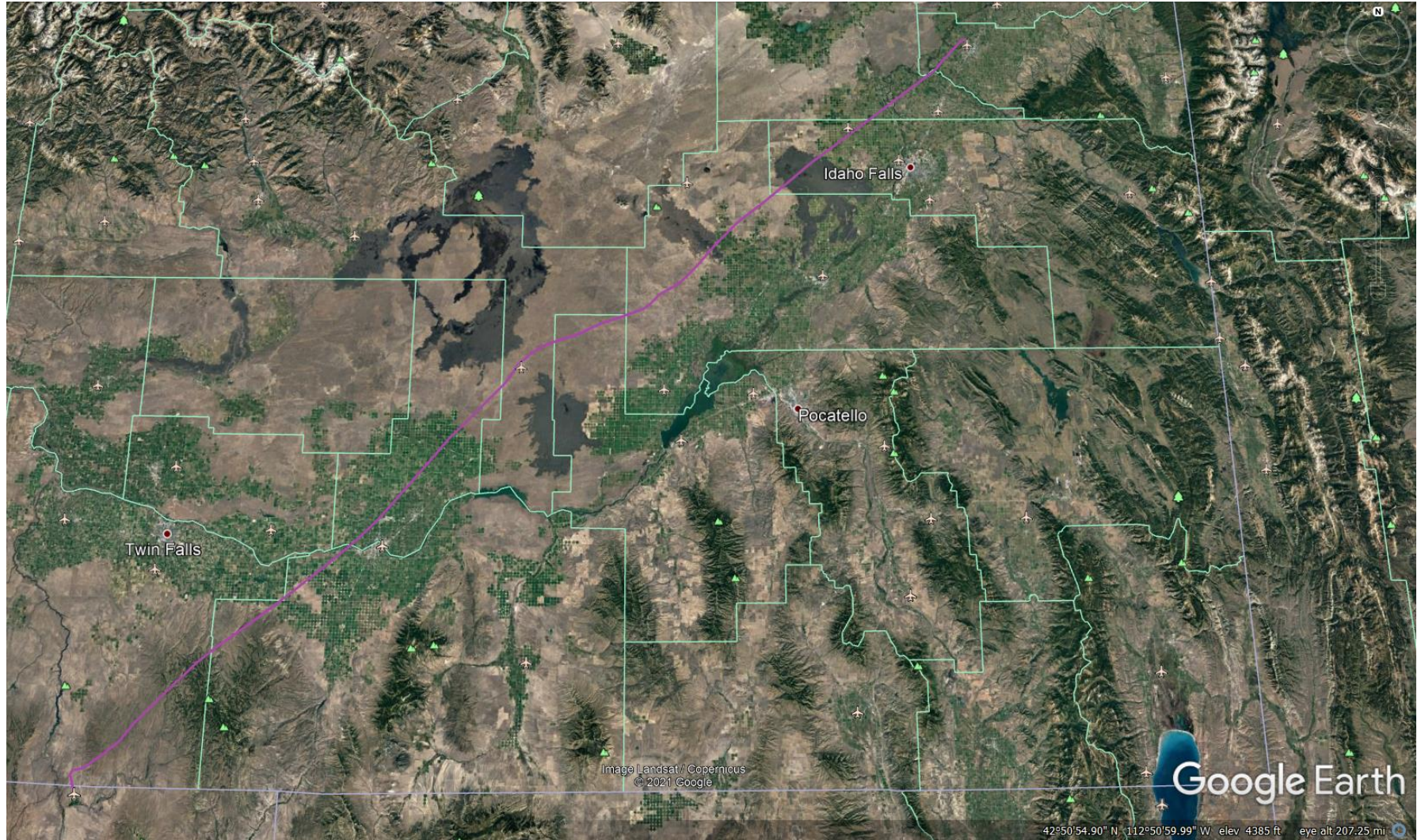


Figure 10. Google Earth overlay showing an overview of the inbound flight on November 22, 2019.