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

May 16, 2012

17 - GPS Factual Report

by Bill Tuccio

A. EVENT

Location:	Brockton, Montana
Date:	March 5, 2012
Aircraft:	Bellanca 7GCBC
Registration:	N5524K
Operator:	Private
NTSB Number:	WPR12FA123

B. GROUP - No Group

C. SUMMARY

On March 5, 2012, about 1556 mountain standard time, a Bellanca 7GCBC, N5542K, was substantially damaged when it impacted terrain about 12 miles southeast of Brockton, Montana. The private pilot was fatally injured and the one passenger received serious injuries. The airplane was registered to and operated by the pilot as a 14 Code of Federal Regulations (CFR) Part 91 local personal flight. Visual meteorological conditions prevailed and no flight plan was filed. The flight originated from Sidney-Richland Municipal Airport (SDY), Sidney, Montana, at an unknown time.

Witnesses located outside and near the accident site, reported that the accident airplane flew over their location from the north and made a 360 degree left turn, followed by a 180 degree left turn. The airplane then departed to the west and ascended. Shortly thereafter, the witnesses observed the airplane in a left turn and descending to ground impact. The airplane "belly flopped" and then continued through a series of trees before it came to rest about 70 yards from the initial impact point.

D. DETAILS OF INVESTIGATION

On March 27, 2012, the NTSB Vehicle Recorder Laboratory received the following device:

GPS Manufacturer/Model:	Garmin GPSMAP 296
Serial Number:	67020060

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 serial port using the NMEA 0183 version 2.0 protocol. 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.

GPS Data Recovery

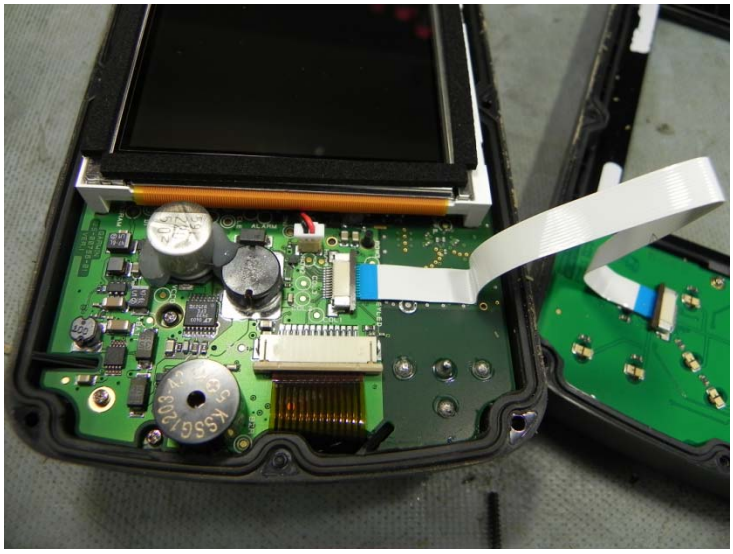
Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed that the unit had sustained minimal damage (figures 1-2). An internal inspection was performed and no damage discovered (figure 3). Power was applied to the accident unit and recorded waypoint, route, and tracklog data was successfully downloaded from the unit via the USB port.

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

Figure 1. Photo of front of device.

Figure 2. Photo of back of device.

Figure 3. Photo of unit internals.



GPS Data Description

The data extracted included 32 sessions from June 5, 2011[2] through February 19, 2012 (a total of 10,000 data points). An examination of the data revealed 11 of the sessions had dates interpreted by the Garmin download software as occurring in 1991 or 1992; the remaining 21 sessions had dates between June 5, 2011 and February 19, 2012. An examination of the data points compared to the accident flight, as reported by the IIC, found no paths consistent with the accident flight. In agreement with the IIC, select parts of prior recording sessions are included in this report.

GPS Parameters Provided

Table 1 describes data parameters provided by the GPS device. Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Groundspeed and Track are derived from the recorded parameters. Session ID is a sequential number identifying each recording session. Date is not reported due to the discrepancies discovered with this value during download.

[2] All dates and times are referenced to Coordinated Universal Time (UTC).

Table 1: GPS Data Parameters

Parameter Name	Parameter Description
Session ID	Sequential recording session
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded Altitude (feet) above Mean Sea Level (MSL)
Groundspeed	Average groundspeed between current and previous data point (knots)
Track	Average true course between current and previous data point (degrees)

OVERLAYS AND TABULAR DATA

Figures 2-8 show Google Earth overlays of various recorded data.

Figure 4 shows an overview of recording session number 29. The flight departed Sidney, flew to Fairview, and then arrived in Culbertson about 54 minutes later. The highlighted area shown at 17:56:59 is expanded in figure 5. Figure 5 shows a circular flight path between 2,365 and 2,467 feet MSL, in an area where the ground elevation is about 2,300 feet MSL.

Figure 6 shows all the recorded flight paths that converged over Richland, about 5.4 nautical miles south-southwest of the accident location. The ground elevation in the area of Figure 6 is about 2,300 feet MSL. The flight paths recorded altitudes as low as 2,388 feet in this area. Figure 7 highlights session number 30 from figure 6. The flight path shows the aircraft entering the area from the Northwest at about 3,500 feet, and 101 knots, then descending to 2,418 feet and an increased speed of 124 knots, followed by a circular path coincident with an altitude increase to about 2,844 feet, and then a decrease in ground speed to about 76 knots. The aircraft then descended towards the same spot, and then exited the area in a climb.

Figure 8 highlights the northeastern extent of session number 30. The aircraft entered the area from the southwest descending from about 2,595 feet. The aircraft then circled twice around an area at about 2,356 feet MSL, where the ground elevation was about 2,150 feet. After the two circles, the aircraft then descended further to about 2,277 feet, and then climbed out of the area, towards the southwest.

Tabular data used to generate figures 2 through 8 are included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format].

Figure 4. Google Earth overlay showing overview of session number 29.

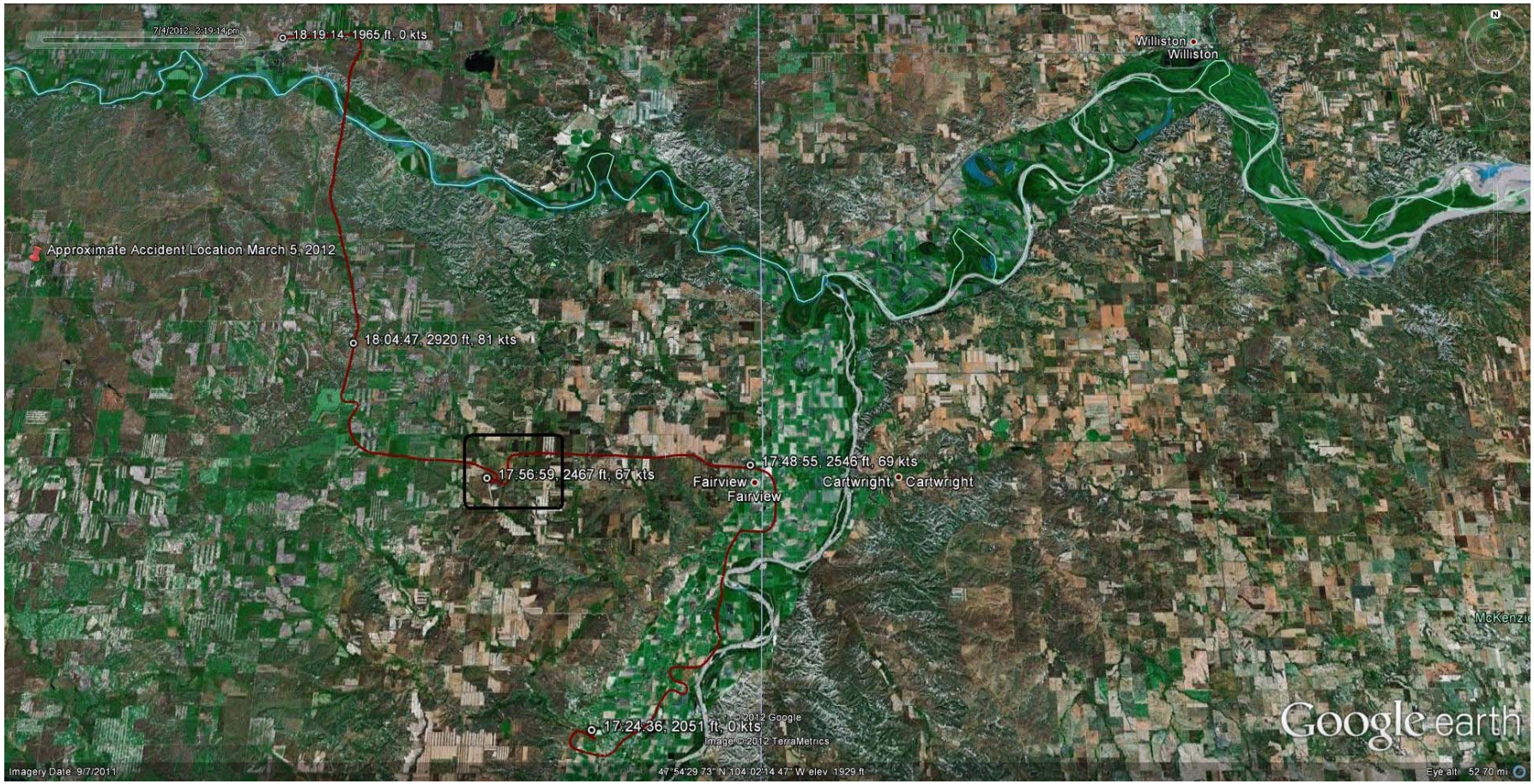


Figure 5. Google Earth overlay highlighting 17:54 time period of session number 29.

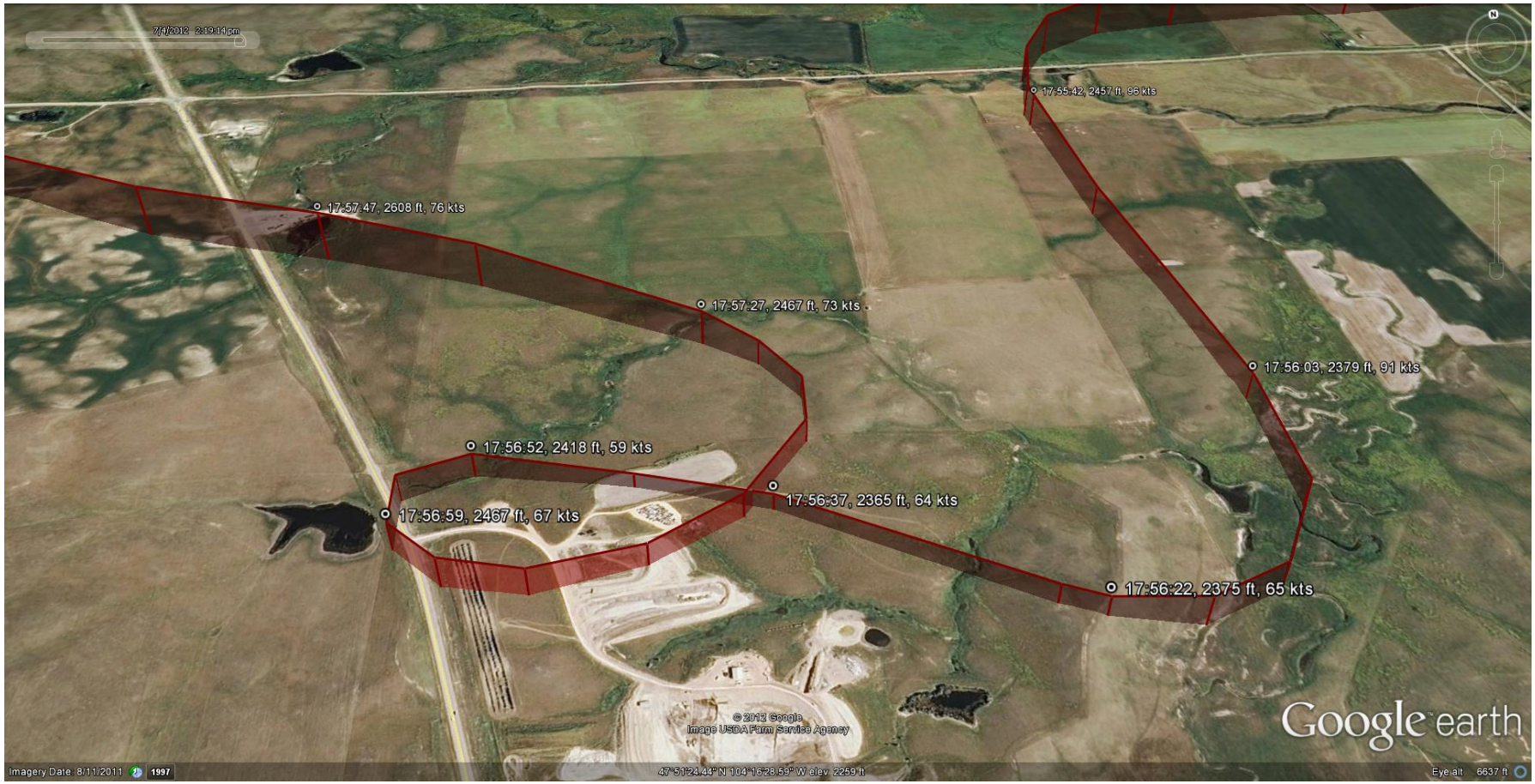


Figure 6. Google Earth overlay of various sessions converging over Richland.

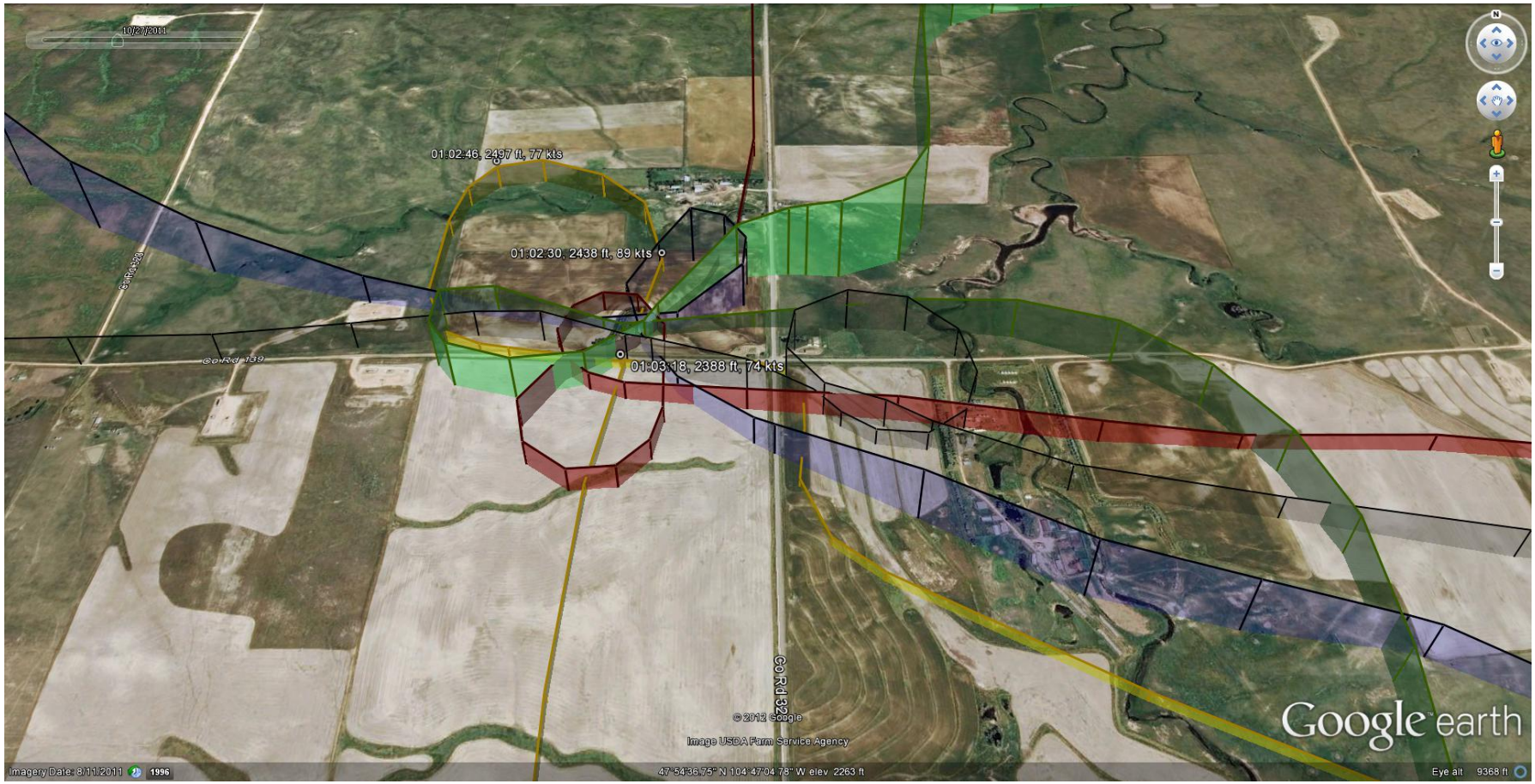
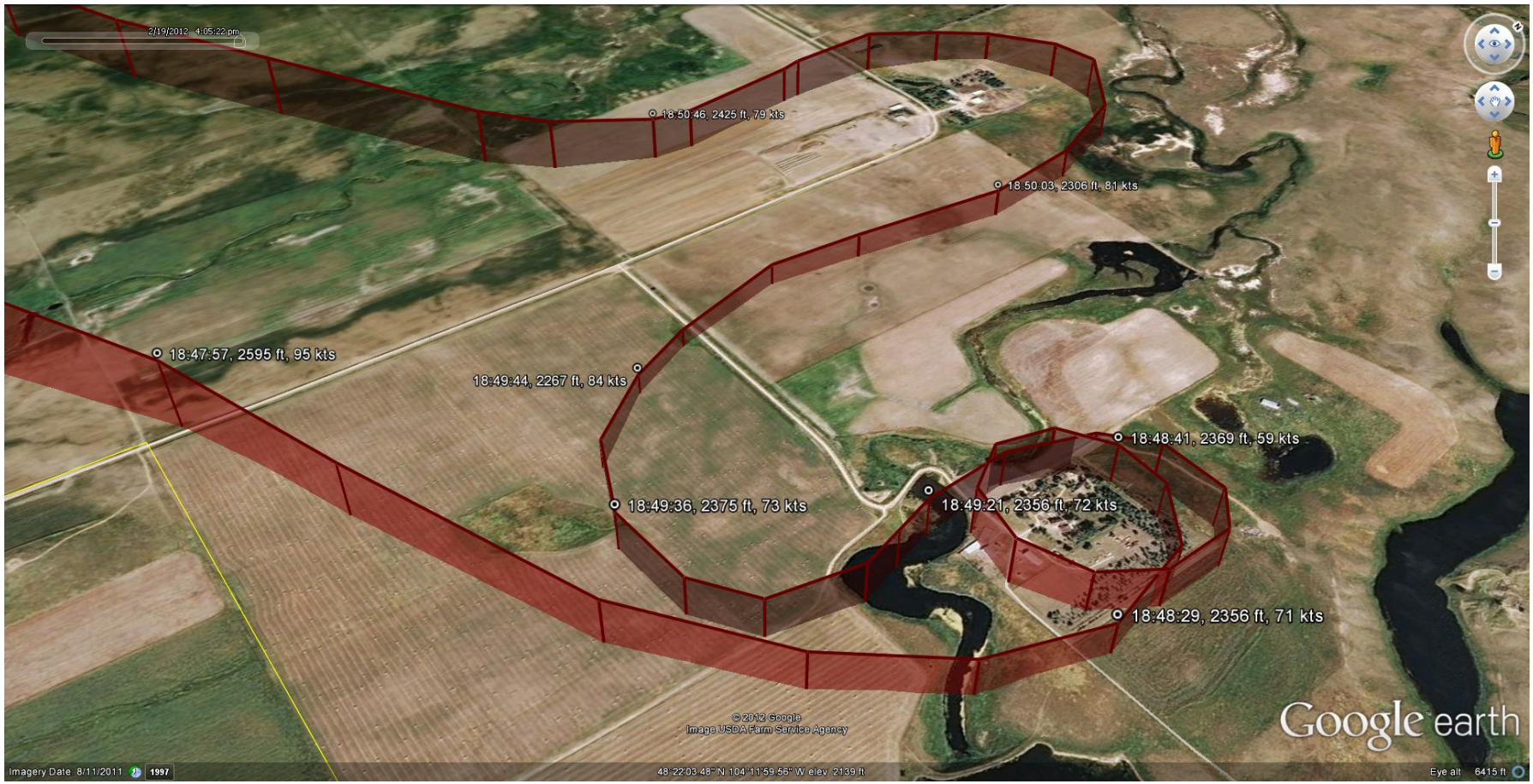


Figure 7. Google Earth overlay of session number 30 over Richland.

Figure 8. Google Earth overlay of northeast area of session number 30.



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