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

December 2, 2011

17 - GPS Factual Report

Specialist's Factual Report
by Bill Tuccio

A.   EVENT

Location:	West Jordon, Utah
Date:	October 04, 2011
Aircraft:	Vaughn Pulsar
Registration:	N91BV
Operator:	Private
NTSB Number:	WPR12FA001

B.   GROUP - No Group

C.   SUMMARY

On October 4, 2011, about 1315 mountain daylight time, an experimental Vaughn Pulsar airplane, N91BV, impacted the terrain about one-quarter mile south of the departure end of Runway 16, at South Valley Regional Airport, West Jordon, Utah. Both the commercial pilot and his passenger received fatal injuries, and the airplane, which had been purchased earlier that day by the passenger, sustained substantial damage. The pilot of the 14 Code of Federal Regulations Part 91 personal flight was departing South Valley Regional Airport in visual meteorological conditions, with an intended destination of Nephi, Utah (U14). No flight plan had been filed.

D.   DETAILS OF INVESTIGATION

On November 22, 2011, the NTSB Vehicle Recorder Laboratory received the following device(s):

GPS Manufacturer/Model:	Garmin GPSMAP 196
Serial Number:	65405558

Garmin GPSMAP 196 Description

The Garmin GPSMAP 196 is a portable GPS unit equipped with a detachable antenna, and a 320 x 240 12-level grayscale LCD display. The unit is equipped with a built in base map and internal Jeppesen aviation database. The unit employs a parallel 12 channel WAAS-capable receiver and can be operated using external power, or alternatively by four standard AA-size batteries. The GPSMAP 196 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. Recorded flight log data is saved when the speed is sensed to decrease to below 30 knots, and a new log is started if more than 10 minutes passes from this time. A detailed track log – 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. Track log position is updated 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 15 saved 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[1]. The unit contains hardware and software permitting the download of recorded waypoint, route, and track log 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 not sustained any damage. Power was applied to the accident unit and recorded waypoint, route, and tracklog data was successfully downloaded from the unit via the serial port. Figure 1 shows the startup screen of the device indicating GPS database dates from October, 2002. Figure 2 shows the tracklog recording settings were set to wrap and resolution[2]. Figure 3 shows the goto waypoint was set to waypoint "U14."

---

[1] Non-volatile memory is semiconductor memory that does not require external power for data retention.
[2] The manufacturer describes Wrap as "records over the oldest tracks when the log reaches 100%." Resolution is described as "records track points based on the resolution. The higher the resolution entered, the more points the unit creates to make the track."
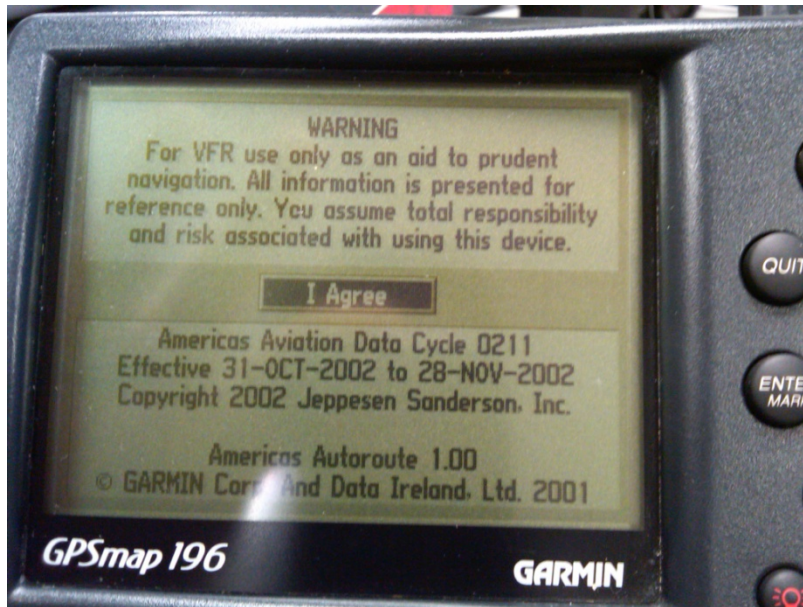
Figure 1. Device startup page.

Figure 2. Track record mode screen.

Figure 3. Active goto page.

GPS Data Description

The data extracted included 2,499 tracklog points from September 2, 2011[3] through October 4, 2011. A total of 45 tracklog points were recorded on October 4, 2011, the day of the accident. The first set of 15 points were from 1908:52 to 1918:17; the remainder of the points were from 1942:40 to 2029:32.

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, Course, and Distance are derived from the recorded parameters.

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)

---

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

Parameter Name	Parameter Description
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded Altitude (feet)
Groundspeed	Average groundspeed between current and previous data point (knots)
Course	Average course between current and previous data point (degrees)
Distance	Distance traveled down runway (only calculated for limited sections of selected flights)

OVERLAYS AND TABULAR DATA

Figure 4 is a graphical overlay generated using Google Earth on the day of the accident, October 4, 2011. The select points include the first point recorded that day at 1908:52 UTC and the last point within the airport boundary at 1915:50 UTC.

Figure 5 is a graphical overlay generated using Google Earth showing the last point within the airport boundary at 1915:50 UTC and the next recorded point in the vicinity of the crash site at 1918:17. There were no other points recorded between 1915:50 and 1918:17 UTC.

Figure 6 is a graphical overlay generated using Google Earth showing all points recorded including, and after, 1918:17 UTC. The pattern is consistent with GPS location scatter.

Tabular data used to generate Figures 4 through 6 are included as Attachment 1. These attachments are provided in electronic comma-delimited (.CSV) format.
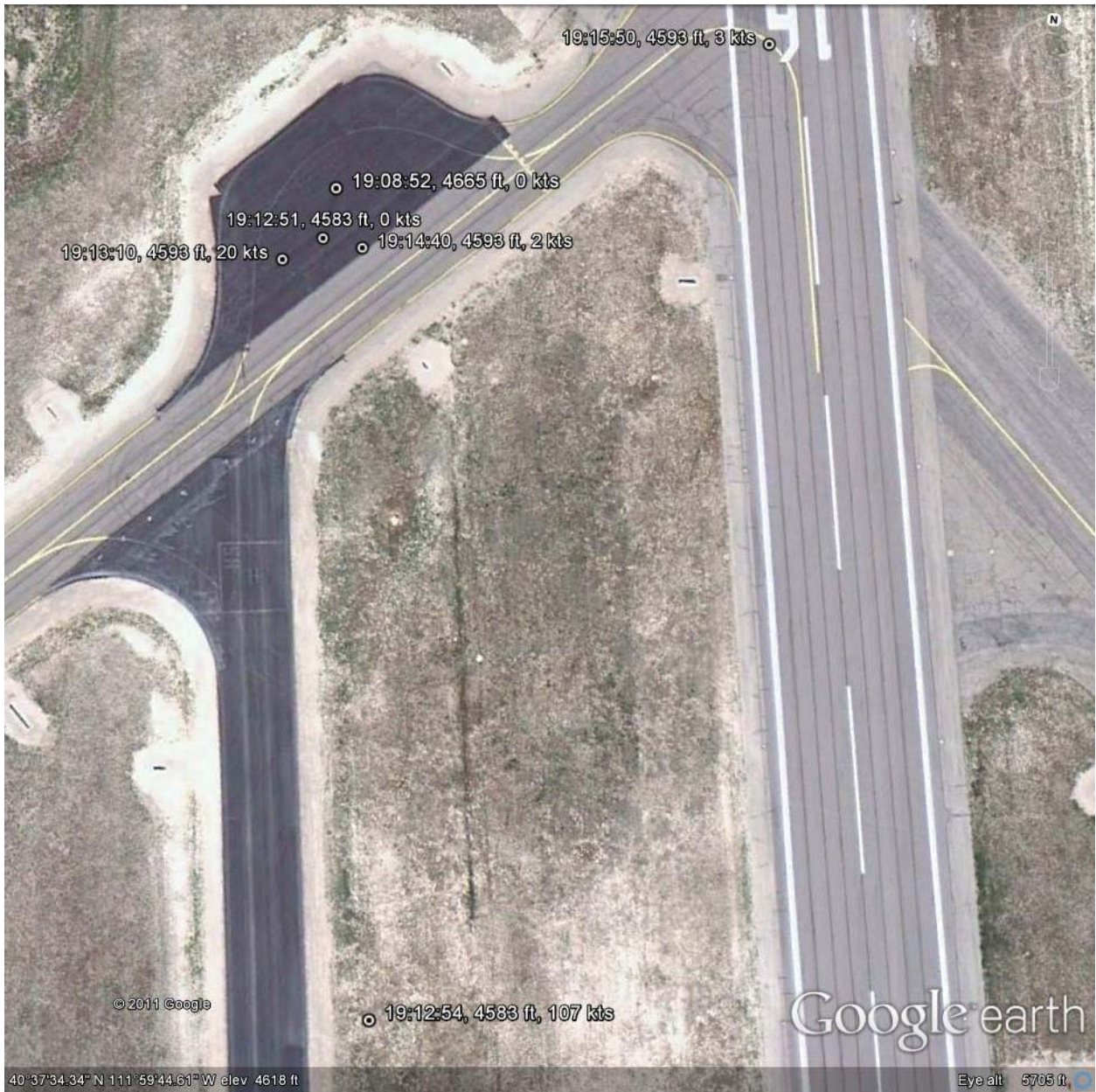
Figure 4. Select points at end of runway.

19:15:50, 4593 ft, 3 kts

19:08:52, 4665 ft, 0 kts

19:12:51, 4583 ft, 0 kts

19:13:10, 4593 ft, 20 kts

19:14:40, 4593 ft, 2 kts

19:12:54, 4583 ft, 107 kts

© 2011 Google

Google earth

40°37'34.34" N 111°59'44.61" W elev 4618 ft

Eye alt 5705 ft

Figure 5. Runway and crash site points.

Figure 6. Collection of data points in vicinity of crash site.