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

July 24, 2012

17 - GPS Factual Report

by Joe Gregor

A. EVENT

Location:	Surprise, Arizona
Date/Time:	December 10, 2011 / 1258 Mountain Standard Time (MST)[1]
Aircraft Type/ID:	Vans Aircraft RV-7 / N724WD
Operator:	Private
NTSB Number:	WPR12FA059

B. GROUP - No Group

C. SUMMARY

On December 10, 2011, about 1258 mountain standard time, an experimental amateur-built Donohoe Vans RV-7A, N724WD, collided with terrain near Surprise, Arizona, shortly after the pilot reported a controllability problem in flight. The airplane was substantially damaged and the private pilot, who was also the builder and owner of the airplane, was fatally injured. The personal flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight.

D. DETAILS OF INVESTIGATION

On 12/20/2011, the NTSB Vehicle Recorder Laboratory received the following device:

[1] All times are given in Mountain Standard Time (MST) unless otherwise noted.

GPS Manufacturer/Model:	Garmin GPSMAP 296
Serial Number:	67008540

GPS Description: GPSMAP 296

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 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. 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 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. 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 sustained significant damage from impact forces (see figure 1). An

internal inspection was performed. Damage appeared to be limited to the LCD display, which is not required to accomplish a data download. Power was applied to the accident unit main PC board and recorded waypoint, route, and tracklog data was successfully downloaded from the unit via the USB port.

GPS Data Description

Data was downloaded using MapSource *v6.16.3*. Fifteen (15) user defined waypoints, thirteen (13) user defined routes, and nine (9) track logs dated from November 1 to December 10, 2011 were downloaded from the unit. One track log was recorded on the date of the accident. Downloaded track log data included the following parameters for each recorded data point: index, GPS date/time, GPS altitude, distance from previous update [leg length], time since last update [leg time], average groundspeed during the interval [leg speed], average course during the interval [leg course], and latitude/longitude position at the time of the update. Leg length, leg time, leg speed, and leg course information are all calculated by the download software and are not directly calculated and recorded within the GPS unit itself.

Track log data corresponding to the accident flight is provided in electronic (.csv) format as Attachment 1 to this report. A key to this data is given in Appendix A. This track log began at 1212:36 MST with a latitude/longitude position fix corresponding to Glendale Municipal Airport (KGEU), Glendale, AZ. The average GPS altitude during the first 13-minute(s) 34-seconds of recorded track log data was 1046 ft. Field elevation for KGEU as reported by AirNav[2] is 1071 ft (surveyed). The final GPS position location fix was recorded at 1257:20 MST and placed the aircraft at N33° 42.414' and W112° 22.205' with 1900 ft GPS altitude. The last calculated velocity and direction of travel was 47 knots groundspeed with a course of 109° true.

Figures 2 – 5 represent Google Earth overlays illustrating the track log history for the accident flight. Figure 2 depicts this information on a 2-D plot. Figures 3 and 4 depict this information on 3-D plots looking to the north-west, and to the east,

[2] www.airnav.com.

respectively. Figure 5 represents a 3-D plot looking to the north of the last approximately 5-minutes of the accident flight.

Figures 6 – 7 give measured GPS altitude and calculated groundspeed as a function of time using data using track log downloaded from the GPSMAP 296. GPS Altitude is recorded directly by the GPS unit. Groundspeed is calculated by the download software using the time-stamped and recorded position data. GPS altitude is depicted by a dashed red line referred to the left-hand scale. Groundspeed is depicted by a solid blue line referred to the right-hand scale. Figure 6 depicts GPS altitude and groundspeed for the entire flight. Figure 7 depicts this same information on a shorter timescale focusing on the last approximately 5-minutes of the flight.

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Figure 1. External view of the Garmin GPSMAP 296 (67008540) showing damage to the LCD display.

Figure 2. *Google Earth* 2-D overlay depicting aircraft position track log data downloaded from the Garmin GPSMAP 295 covering the period from approximately 1212:36 to 1257:20 MST. Track log data for this flight begins near the center of the figure, and ends near the bottom of the figure.

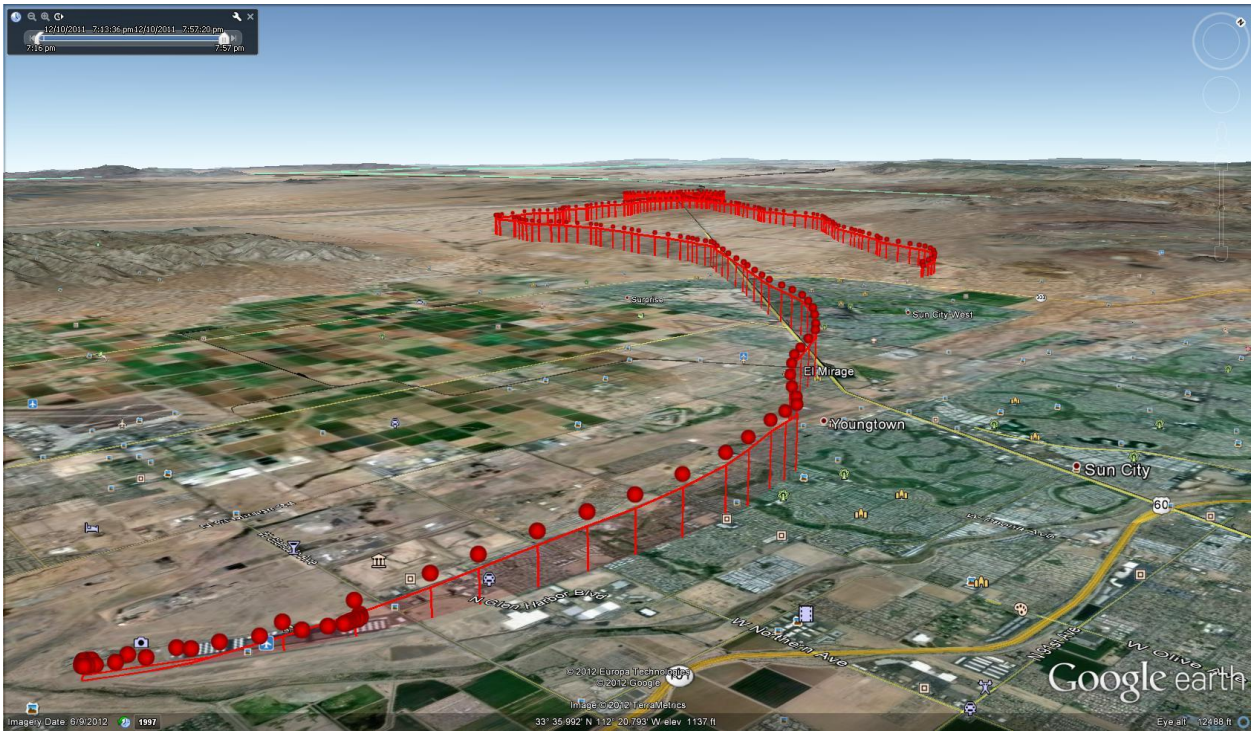

Figure 3. *Google Earth* 3-D overlay looking to the north west, depicting aircraft position track log data downloaded from the Garmin GPSMAP 295 covering the period from approximately 1212:36 to 1257:20 MST. Track log data for this flight begins near the bottom left of the figure.

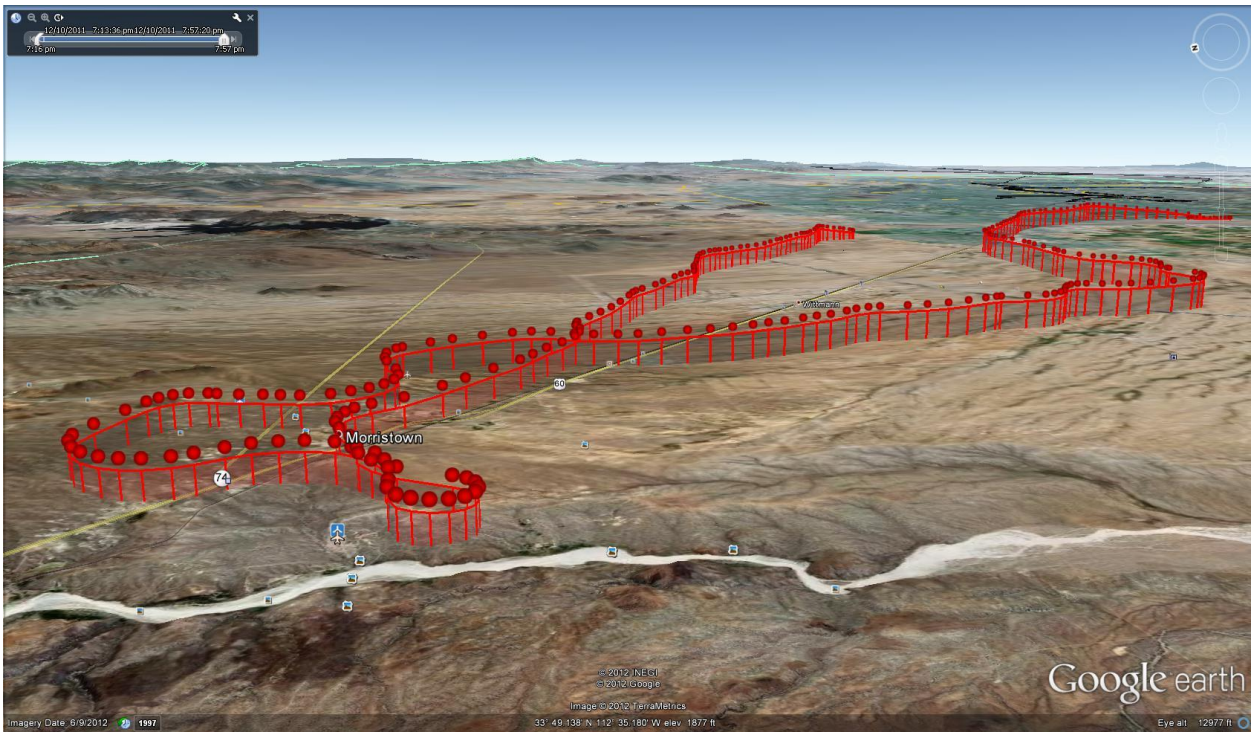

Figure 4. *Google Earth* 3-D overlay looking to the east, depicting aircraft position track log data downloaded from the Garmin GPSMAP 295 covering the period from approximately 1212:36 to 1257:20 MST. Track log data for this flight begins near the center right, and ends near the far right edge of the figure.

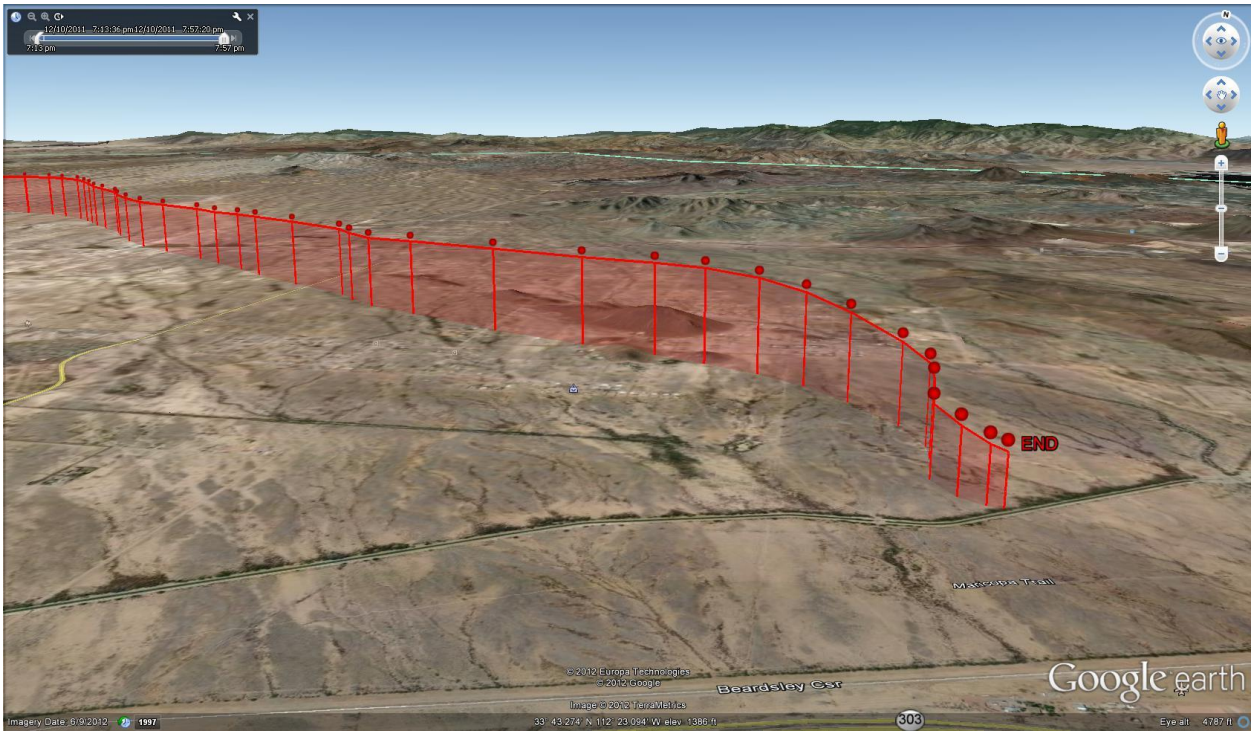

Figure 5. *Google Earth* 3-D overlay looking to the east, depicting aircraft position track log data downloaded from the Garmin GPSMAP 295 covering the period from approximately 1252 to 1257:20 MST. Track log data for this flight begins near the center right, and ends near the far right edge of the figure.

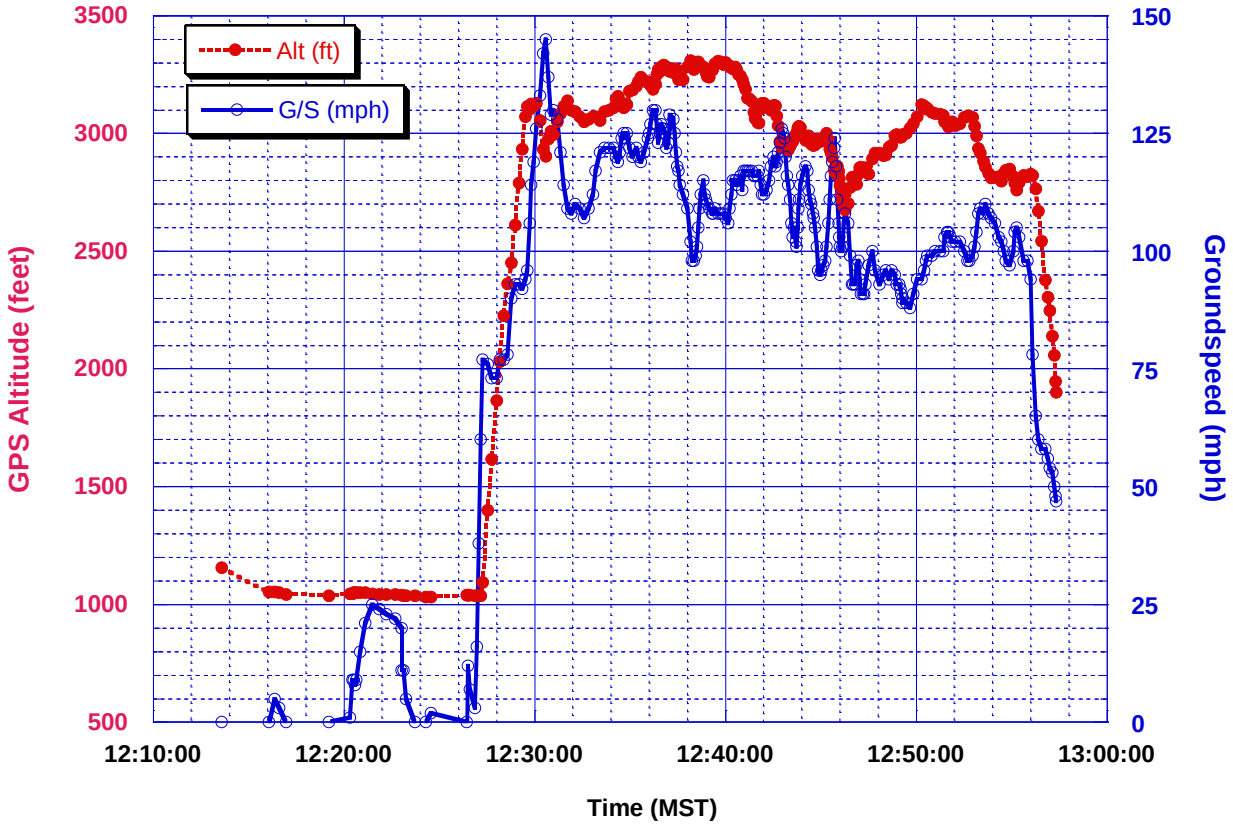

Figure 6. Measured GPS altitude (in feet) and calculated ground speed (in knots) during the time period from 1212:36 to 1257:20 MST. The horizontal axis depicts time in UTC with each minor division corresponding to a 2-minute interval.

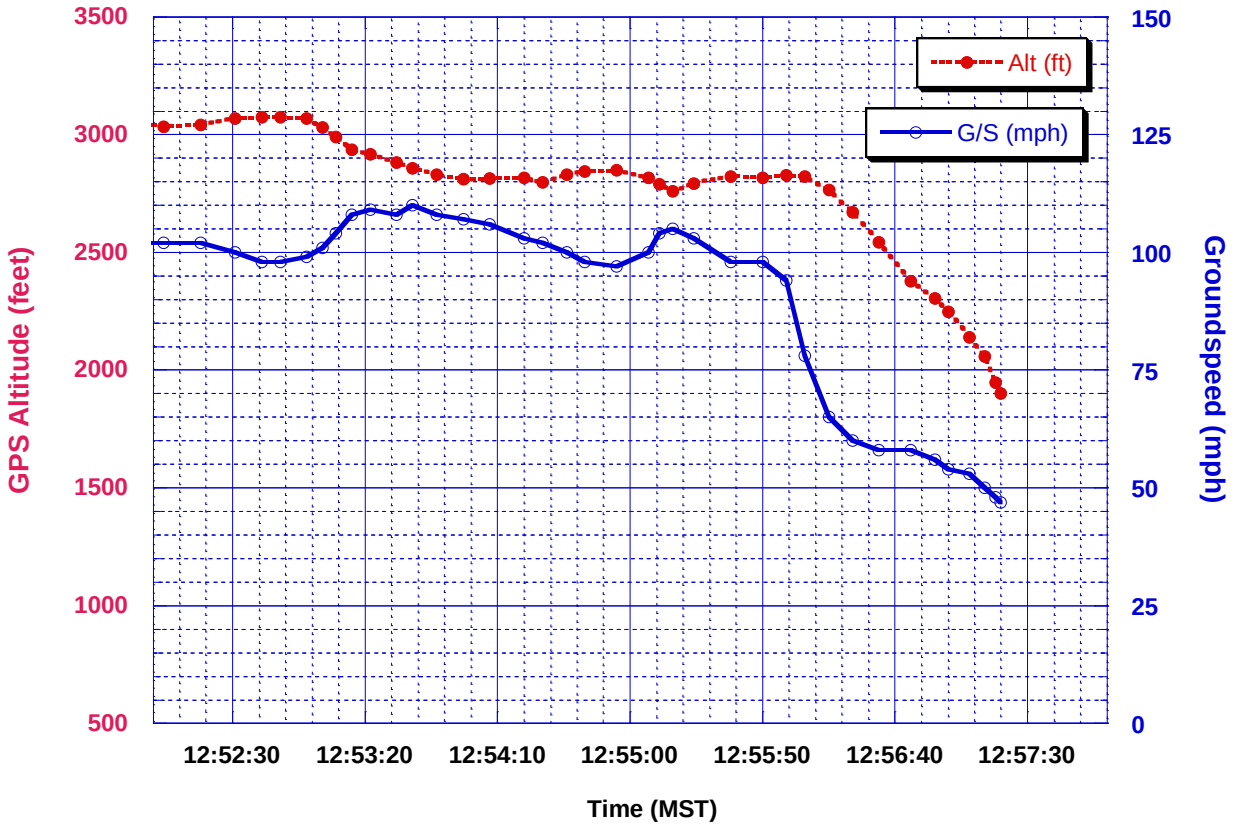

Figure 7. Measured GPS altitude (in feet) and calculated ground speed (in knots) during the time period from approximately 1252 to 1257:20 MST. The horizontal axis depicts time in UTC with each minor division corresponding to a 10-second interval.

ATTACHMENTS

Tabular data corresponding to the accident flight downloaded from a Garmin GPSMAP 296 (s/n 67008540) recovered from a Vans Aircraft RV-7 (N724WD) that crashed near Surprise, Arizona on December 10, 2011 is contained in Attachment 1.

LEGEND

Date	Date of recorded data point
Time	Time (MST) of recorded data point
Longitude	Longitude coordinate in degrees
Latitude	Latitude coordinate in degrees
GPS Altitude	GPS altitude in feet
Groundspeed	Average groundspeed in knots from previous data point
Course	Average course in degrees true from last previous point