

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

January 7, 2014

Electronic Devices Factual Report

**Specialist's Factual Report
by Bill Tuccio, Ph.D.**

1. EVENT

Location: Chadron, Nebraska
Date: June 11, 2013
Aircraft: Vans Aircraft RV-12
Registration: N666BE
Operator: Private
NTSB Number: CEN13LA340

On June 11, 2013, at 0640 central daylight time, N666BE, an experimental-homebuilt Vans RV-12 airplane, sustained substantial damage during a hard landing at the Chadron Municipal Airport (CDR), Chadron, Nebraska. The certified airline transport pilot/owner/builder was seriously injured. Visual meteorological conditions prevailed and no flight plan was filed for the personal flight conducted under 14 *Code of Federal Regulations* Part 91.

2. DETAILS OF DEVICE INVESTIGATION

The Safety Board's Vehicle Recorder Division received the following devices:

Device 1: Dynon FlightDEK D180
Device 1 Serial Number: 002917

Device 2: Garmin GPSMAP 496
Device 2 Serial Number: 19728566

2.1. Dynon FlightDEK D180

The Dynon FlightDEK D180 is a 7" wide screen display mounted in the cockpit of non-type certificated aircraft. The instrument integrates multiple flight instruments including airspeed, altitude, gyro-stabilized magnetic compass, turn rate, slip/skid ball, bank angle, pitch angle and vertical speed. The unit also has other functions that include a clock/timer, g-meter, voltmeter and a density altitude/true airspeed calculator. The unit contains an Air Data, Attitude and Heading Reference System (ADAHRS) to provide air data, attitude and heading information to the display. Depending on the installation in the operators' aircraft certain parameters might not be displayed, for example angle-of-

attack. The instrument also integrates up to 16 engine related instruments including manifold pressure, temperatures, RPM and fuel system information. Depending on the type of engine installed in the aircraft and pilot preferences, not all display options may be available.

Depending on the firmware version on the unit, the ability to log data to internal memory exists. According to the manufacturer, firmware versions 3.0 and later contain the ability to log certain engine parameters and firmware versions 5.0 and later contain the ability to log certain EFIS and GPS parameters. The data logging must be configured by the operator to enable logging and set the data log interval. The unit can also be configured to start logging data automatically at boot-up. The data logging interval can be set to store at 1, 3, 5, 10, 30, or 60 second intervals. The internal memory can store at least 30 minutes of cumulative data at a 1 second recording interval or at least 30 hours at a 60 second data recording interval. When the recording limit in the internal memory is reached, the oldest record is dropped and a new record is added.

2.1.1. Dynon FlightDEK-D180 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had not sustained any damage and information was extracted using the manufacturer's software normally, without difficulty.

2.1.2. Dynon FlightDEK-D180 Data Description

The unit was configured to sample data once every 60 seconds, as shown in figure 1. The sample rate was not frequent enough to yield information helpful to the investigation.

Figure 1. Dynon FlightDEK-D180 sample rate configuration screen.



2.2. Garmin 496 Device Description

The Garmin GPSMAP 496 is a battery-powered portable 12-channel GPS receiver with a 256-color TFT 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 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 500 feet, and ends when groundspeed drops below 30 knots for 10 minutes or more. 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 the 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 memory¹. 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. The unit can also communicate with external devices such as a computer using 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.

2.2.1. Garmin 496 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had not sustained any damage and information was extracted using the manufacturer’s software normally, without difficulty.

2.2.2. Garmin 496 Data Description

The data extracted included 31 sessions from June 17, 2010 through June 15, 2013 (4,753 total data points). The accident flight was the 27th session, recorded starting at 12:24:33 UTC and ending at 12:33:57 UTC on June 11, 2013 (20 total data points).

3. 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 and Track 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)

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

Parameter Name	Parameter Description
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded GPS Altitude (feet, MSL ²)
Groundspeed	Average groundspeed between current and previous data point (knots)
Track	Average true course between current and previous data point (degrees)

4. OVERLAYS AND TABULAR DATA

The graphical overlay in this report was generated using Google Earth.

Figure 1 shows select points from the accident flight recording. The recording began at 12:24:33 UTC near a hangar. The aircraft taxied to the departure end of runway 2 and remained there from about 12:26:44 UTC until about 12:33:21 UTC.

The take-off run began at about 12:33:21 UTC. The maximum average groundspeed calculated was 64 knots. The recorded track began on the runway centerline and moved progressively left of the centerline by the end of the recording at 12:33:57 UTC.

Tabular data used to generate figure 1 is included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

² MSL means altitude above mean sea level

Figure 2. Accident flight as recorded by Garmin 496.

