

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

May 8, 2020

Electronic Devices

Specialist's Factual Report

By Kyle Garner

1. EVENT SUMMARY

Location: Lady Lake, Florida
Date: September 06, 2019
Aircraft: Vans RV-12
Registration: N767FS
Operator: Yankee Flyers LLC
NTSB Number: ERA19FA265

On September 6, 2019, at 1312 eastern daylight time (EDT), a Vans Aircraft Inc. RV-12 airplane, N767FS, was destroyed when it impacted terrain in Lady Lake, Florida, shortly after takeoff from runway 27 at Love Field Airport (97FL), Weirsdale, Florida. The commercial pilot was fatally injured. The airplane was registered to and operated by Yankee Flyers LLC under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Day visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed for the local flight that originated at 1311.

2. RECORDED FLIGHT DATA GROUP

A recorded flight data group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following devices:

Device Manufacturer/Model: **Dynon FlightDEK-D180**
Serial Number: **002440**

Device Manufacturer/Model: **ESP32-D0WDQ6 Microcontroller**
Serial Number: **Unknown**

3.1. Dynon FlightDEK-D180 Description

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 operator's 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 can 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 and 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.

3.1.1. Dynon FlightDEK-D180 Condition

Upon arrival at the Vehicle Recorder Laboratory, an examination revealed the unit had sustained severe impact damage. The extent of the damage is shown in Figure 1.



Figure 1. Photo of damaged Dynon device.

3.1.2. Dynon FlightDEK-D180 Data Recovery

This device can store data in the non-volatile memory (NVM)¹. The location on the printed circuit board (PCB) where the NVM chip was installed on an undamaged unit is shown circled in Figure 2. Figure 3 shows the PCB recovered from the accident device with the NVM chip missing and a fracture where the NVM chip was originally installed. The NVM chip for the accident device could not be located, thus, no data pertinent to the event were recovered.

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



Figure 2. Photo of PCB with NVM installed - undamaged exemplar unit.

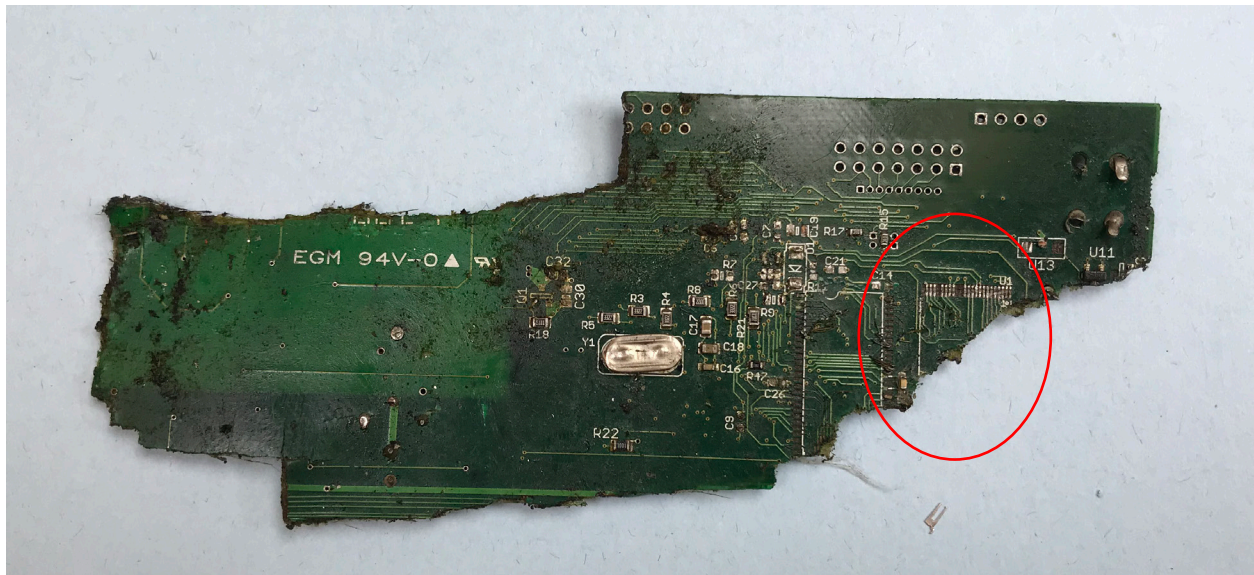


Figure 3. Photo of PCB where NVM was originally installed – accident unit.

3.2. ESP32-D0WDQ6 Microcontroller Device Description

The ESP32 microcontroller is a single 2.4 GHz Wi-Fi-and-Bluetooth combo chip designed for use in a wide variety of applications and power scenarios including mobile devices, wearable

electronics, and internet-of-things² applications. The microcontroller has 448 KB of read-only-memory (ROM) for booting and core functions; however, there is no other NVM for data storage located on the device.

3.2.1. ESP32-D0WDQ6 Microcontroller Device Condition

Upon arrival at the Vehicle Recorder Laboratory, an examination revealed the unit had sustained damage. The device in which the microcontroller was installed could also not be determined. The extent of the damage is shown in Figure 4.

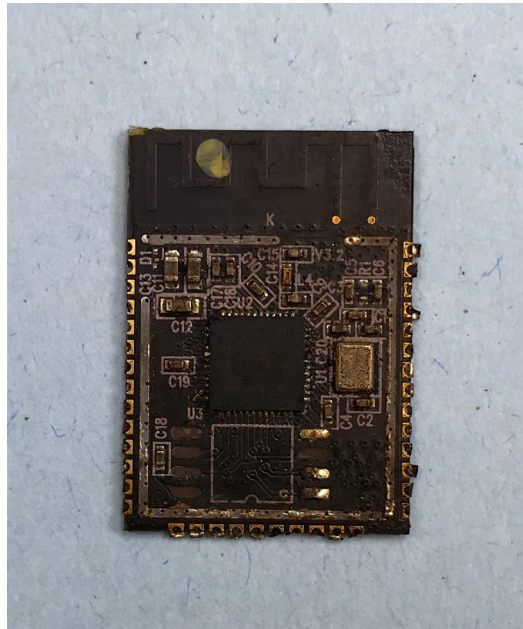


Figure 4. Photo of damaged microcontroller.

3.2.2. ESP32-D0WDQ6 Microcontroller Data Recovery

The ESP32 microcontroller does not have any NVM available for data storage, thus, no data pertinent to the event were recovered.

² Internet-of-things: the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.