

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

March 31, 2017

Electronic Devices

Specialist's Factual Report by Sean Payne

1. EVENT

Location: Granbury, Texas
Date: September 24, 2015
Aircraft: Bushby Mustang II
Registration: N929DS
Operator: Private
NTSB Number: CEN15FA422

On September 24, 2015, at 1908 central daylight time (CDT), a Bushby Mustang II, single-engine airplane, N929DS, impacted terrain during initial climb at Granbury Regional Airport (KGDJ), Granbury, Texas. The pilot and the passenger were fatally injured, and the airplane was destroyed. The airplane was registered to and operated by a private individual, as a 14 *Code of Federal Regulations* Part 91 personal flight. Day visual meteorological conditions (VMC) prevailed and a flight plan had not been filed. At the time of the accident the airplane was departing KGDJ for a local flight.

2. DETAILS OF INVESTIGATION

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

Device 1: **GoPro Hero 2**
Device 1 Serial Number: **H214A1011031244**

Device 2: **JPI EDM-700**
Device 2 Serial Number: **Unknown**

Device 3: **Becker VHF AR-4201**
Device 3 Serial Number: **Unknown**

Device 4: **Electronics International FL-2RA-12**
Device 4 Serial Number: **Unknown**

Device 5: **Unknown Device**
Device 5 Serial Number: **Unknown**

Device 6: **Davtron M800 Digital Clock/Timer**
Device 6 Serial Number: **Unknown**

Device 7: **Horizon Instruments P-1000 Tachometer**
Device 7 Serial Number: **Unknown**

2.1. GoPro Hero 2 Device Description

The GoPro Hero 2 is a compact, lightweight, point of view (POV)¹ digital camera enclosed in a ruggedized housing that allows the camera to be mounted in a variety of positions using an array of supported accessories. The camera supports 1080 high definition (HD)² as well as other lower quality recording resolutions at higher frame rates. The camera can be set to record still images in lieu of a video stream at a resolution of up to 11 megapixels.³ The camera includes a wide angle aspherical f/2.8 glass lens that provides a maximum of 170 degrees viewing angle. The camera supports recording to micro Secure Digital (SD)⁴ cards up to 64 GB in size. An optional Wi-Fi⁵ module allows users to connect to the camera either via an accessory remote control or via a smart phone app that permits camera control and image transfer.

2.1.1. GoPro Hero 2 Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had not sustained any damage and image recording information was extracted the associated SD card via a PC. Additionally, a binary copy of the card was made and examined forensically for corrupted video files.⁶ Figure 1 shows the GoPro Hero 2 and the associated SD card after being removed from the camera's protective case.



Figure 1. The GoPro Hero 2 and the associated SD card.

¹ POV – Point of View Shot – A photography technique that records the character's viewpoint from a singular camera location mounted in a manner that represents the character's field of view.

² HD – High Definition – A resolution generally consisting of greater than 480 lines of horizontal resolution.

³ Megapixel – (MP) – A count of a million pixels in an image or used to express the number of individual image sensor elements on a digital camera image sensor.

⁴ SD – Secure Digital – a standard for nonvolatile memory card used in portable devices.

⁵ Wi-Fi – A local area wireless technology that allows electronic devices to exchange data over a network.

⁶ Image recorders exposed to high impact scenarios have the potential to produce corrupted, missing or unplayable media files due to abrupt cessation of power to the recording device or the ejection of the device's removable media card. A standard laboratory procedure is used to examine the device's media for potentially missing video and image files from devices involved in high impact scenarios.

2.1.2. GoPro Hero 2 Data Description

A normal read out of the device's SD card via a PC produced 26 aviation related video files. Of the 26 video files, 18 were determined to have been recorded in the accident airplane. None of the 18 video files recorded in the accident airplane contained a recording of the accident flight.

Of the 18 video files, eight recordings contained a maneuver similar to the maneuver described by witnesses in the preliminary report. In the eight recordings, the aircraft began a takeoff roll after which time it became airborne and remained at a low altitude as it traveled down the runway. Near the departure end of the runway, the aircraft climbed quickly and subsequently was brought to a level attitude. In most recordings where this maneuver was conducted, the aircraft exhibited a varying degree of right roll, either at the same time the aircraft was brought to a level attitude or within moments thereafter. During the eight recordings when this maneuver was conducted, the aircraft's airspeed indicator never displayed a value of less than 80 mph. During one recording in which this maneuver was conducted, an electronic tone was heard on the audio track. The electronic tone was consistent with the stall warning tone heard on the aircraft's previous landings. The indicated airspeed at the time of this tone was approximately 105 mph and the aircraft's attitude was about 10 degrees in pitch and 45 degrees in roll to the right. At this time, the pilot was exiting the climb maneuver and leveling the airplane. Though the stall warning horn did briefly sound, there were no other indications the aircraft was approaching a stalled condition. A stall recovery was not required by the pilot to level the aircraft.

Upon review of additional recordings, the pilot used his right hand to cover the throttle during the abrupt pull up maneuvers. The action of the pilot's right hand covering the throttle during the climb portion of the maneuver is consistent with an operation to inhibit the throttle from slipping to a lower power setting. The ability for the throttle to slip to a lower power setting is typically dependent on the adjustment to the throttle control's throttle friction lock. None of the recordings showed evidence of the throttle friction lock exhibiting a slip condition during any of the climb maneuvers.

A forensic search for corrupted, deleted and potentially missing media files produced an additional 8 video records. Some of the video files were aviation related, but none were pertinent.

2.2. JPI EDM-700 Device Description

The J. P. Instruments EDM-700 is a panel mounted gauge that the operator can monitor and record up to 24 parameters related to engine operations. Depending on the installation, engine parameters that are monitored include:

- Exhaust Gas Temperature (EGT)
- Cylinder Head Temperature (CHT)
- Oil Pressure and Temperature
- Manifold Pressure
- Outside Air Temperature

- Turbine Inlet Temperature
- Engine Revolutions per Minute
- Compressor Discharge Temperature
- Fuel Flow
- Carburetor Temperature
- Battery Voltage

The unit can also calculate, in real-time, horsepower, fuel used, shock cooling rate and EGT differentials between the highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit contains non-volatile memory⁷ (NVM) for data storage of the parameters recorded and calculated. The rate at which the data is stored is selectable by the operator from 2 to 500 seconds per sample. The memory can store up to 20 hours of data at a 6 second sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

2.2.1. JPI EDM-700 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained significant impact and thermal damage. An internal examination revealed that circuitry and NVM associated with the device were destroyed by fire. Figure 2 shows the device after disassembly and inspection.



Figure 2. The JPI EDM-700 after disassembly and inspection.

⁷ Semi conductor memory that does not require power to retain electronic data.

2.2.2. JPI EDM-700 Data Description

No data was recovered from the JPI EDM-700.

2.3. Becker VHF AR-4201 Device Description

The Becker VHF Transceiver AR-4201 enables voice communication on 760 channels in the 118.000 MHz to 136.975 MHz range with a channel spacing of 25 kHz. The VHF transceiver is designed with sufficient mechanical strength to enable it to be fitted in an aircraft without any limitations.

2.3.1. Becker VHF AR-4201 Data Recovery

The Becker VHF AR-4201 did not record electronic data and was determined to have no added value to the investigation. Figure 3 shows the Becker VHF AR-4201 as received.



Figure 3. The Becker VHF AR-4201 as received.

2.3.2. Becker VHF AR-4201 Data Description

No data was recovered from the Becker VHF AR-4201.

2.4. Electronics International FL-2RA-12 Device Description

The FL-2 is a fuel level instrument featuring dual an LED analog display and a digital display. The FL-2 can display in gallons (one or one-half gallon increments), pounds or liters. The FL-2 has a 2 1/4" mount form factor and is viewable in direct sunlight.

2.4.1. Electronics International FL-2RA-12 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained significant impact and thermal damage. An internal examination

revealed that circuitry and non-volatile memory associated with the device were destroyed by fire. Figure 4 shows the device as received.



Figure 4. The Electronics International FL-2RA-12 as received.

2.4.2. Electronics International FL-2RA-12 Data Description

No data was recovered from the E.I. FL-2RA-12.

2.5. Unknown Device

Figure 5 shows the 5th electronic device associated with the investigation. The device could not be identified with corresponding records or comparison to recorded video material. The device was damaged beyond potential data extraction and determined to have no value to the investigation.

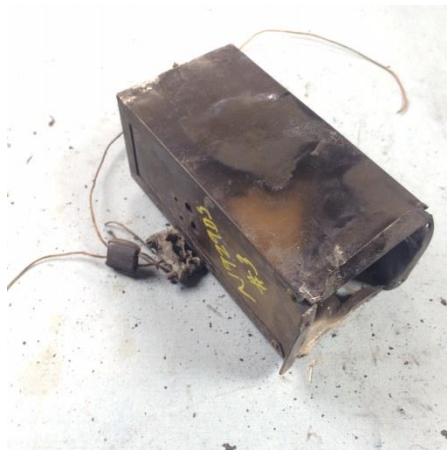


Figure 5. The 5th device examined associated with the investigation.

2.6. Davtron M800 Digital Clock Device Description

The Davtron M800 digital clock is a digital timer for aeronautical use. It has a two button control system which control functions for keeping Universal Time (UTC), local time, elapsed time, elapsed time alarm and night illumination.

2.6.1. Davtron M800 Digital Clock Data Recovery

No data was recovered from the Davtron M800. Figure 6 shows the device as received by the laboratory.



Figure 6. The 6th device examined associated with the investigation.

2.7. Horizon Instruments P-1000 Tachometer Device Description

The Horizon Instruments P-1000 is a digital tachometer which provides diagnostic and performance information about the aircraft's engine and ignition system. The system provides a means to electronically monitor engine rpm in a digital representation. The device also records aircraft engine hours. The device can store engine hour information and highest RPM achieved during a power cycle.



Figure 7. The 7th device examined associated with the investigation.

2.7.1. Horizon Instruments P-1000 Tachometer Data Recovery

The unit was destroyed by fire and impact damage. The unit's internal NVM was also damaged and unreadable. No data was recovered from the device.