NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

August 8, 2012

Cockpit Displays Factual Report

Specialist's Factual Report
By Christopher Babcock

1. EVENT

Location:	Moscow, Tennessee
Date:	July 11, 2012, 0907 Central Daylight Time (CDT)[1]
Aircraft:	Cirrus SR20, Registration N764RV
Operator:	Private
NTSB Number:	ERA12FA438

2. GROUP

A group was not convened.

3. SUMMARY

On July 11, 2012, a privately operated Cirrus SR20, registration N764RV, was substantially damaged from tree and terrain impact near Moscow, Tennessee. The aircraft was operating under Title 14 Code of Federal Regulations Part 91 and no flight plan was filed for the cross country flight from Millington, TN, to Panama City, FL. Instrument meteorological conditions prevailed at the time of the accident. The aircraft was equipped with an Avidyne Entegra EXP5000 Primary Flight Display (PFD) and an EX5000 Multi-function Display (MFD) capable of recording flight data. The equipment was removed from the aircraft and sent to the National Transportation Safety Board's Vehicle Recorder Laboratory for evaluation.

4. DETAILS OF INVESTIGATION

On July 16, 2012, the Safety Board's Vehicle Recorder Division received the following devices:

Manufacturer/Model:	**Avidyne Entegra PFD**
Serial Number:	**20046226**
Manufacturer/Model:	**Avidyne Entegra MFD**
Serial Number:	**23556176**

[1] All times in this report refer to the local Central Daylight Time of the accident

4.1. Device Description

4.1.1. Primary Flight Display

The PFD unit includes a solid state Air Data and Attitude Heading Reference System (ADAHRS) and displays aircraft flight data including altitude, airspeed, attitude, vertical speed, and heading. The PFD unit has external pitot/static inputs for altitude, airspeed, and vertical speed information. Each PFD contains two TSOP[2] Flash memory devices mounted on a riser card. The flash memory stores information the PFD unit uses to generate the various PFD displays. Additionally, the PFD has a data logging function which is used by the manufacturer for maintenance and diagnostics.

The PFD samples and stores several data streams in a sequential fashion; when the recording limit of the PFD is reached the oldest record is dropped and a new record is added. Data from the ADAHRS is recorded at 5 Hz. Air data information such as pressure altitude, indicated airspeed, and a vertical speed are recorded at 1 Hz. Global Positioning System (GPS) and navigation display and setting are recorded at a rate of 0.25 Hz, and information about pilot settings of heading, altitude, and vertical speed references are recorded when changes are made.

4.1.2. Multifunction Display

The MFD unit is able to display checklists, terrain/map information, approach chart information and other aircraft/operational information depending on the specific configuration and options that are installed. One of the options available is a display of comprehensive engine monitoring and performance data.

Each MFD contains a compact flash (CF) memory card located in a slot on the side of the unit. This memory card contains all of the software that the MFD needs to operate. Additionally, this card contains all of the checklists, approach charts, and map information that the unit uses to generate the various cockpit displays.

During operation, the MFD receives information from several other units that are installed on the aircraft. Specifically, the MFD receives GPS position, time, and track data from the aircraft's GPS receiver. The MFD also receives information from the aircraft concerning altitude, engine and electrical system parameters, and outside air temperature. This data is also stored on the unit's CF memory card.

The MFD generates new data files for each MFD power-on cycle. Similar to the PFD, the oldest record is dropped and replaced by a new recording once the storage limit has been reached. MFD data are sampled every six seconds, and are recorded to memory once every minute. If a power interruption occurs during the minute between MFD memory write cycles, data sampled during that portion of the minute are lost.

4.2. Flight Data Recorder (FDR) Carriage Requirements

The accident aircraft, N764RV, was operating as a 14 CFR Part 91 personal flight. Federal regulations regarding the carriage requirements of FDRs on aircraft can be found in 14 CFR 91.609. The accident aircraft was not required to be equipped with an FDR.

[2] Thin Small Outline Packages are low profile, surface mount integrated circuits using Flash memory for data storage

4.3. Device Readout

The PFD was severely damaged and fragmented. The circuit card containing the two memory devices on the PFD was identified. An exemplar circuit card is shown in Figure 1. The card from the accident airplane was split in three and the two memory devices were missing from the card (Figure 2). They were not located within the wreckage.

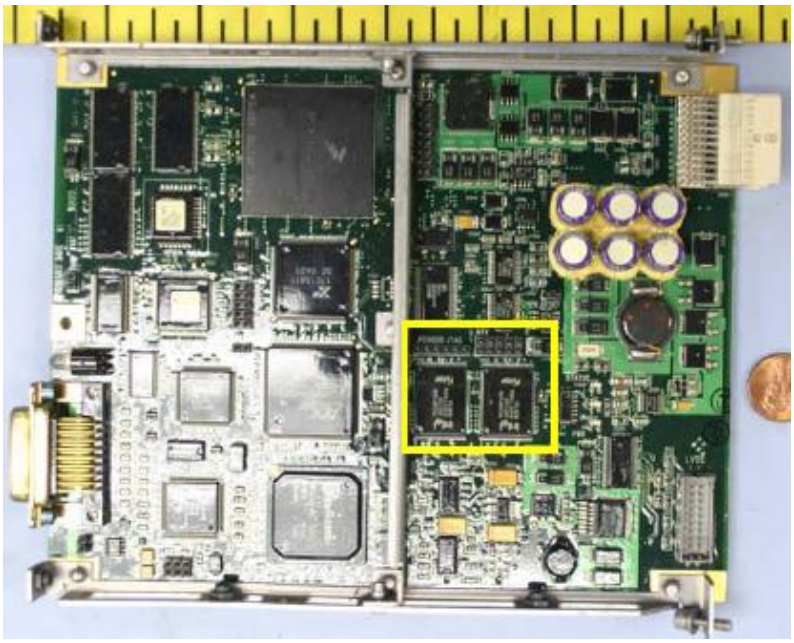

Figure 1. Exemplar circuit card (memory devices in yellow box).

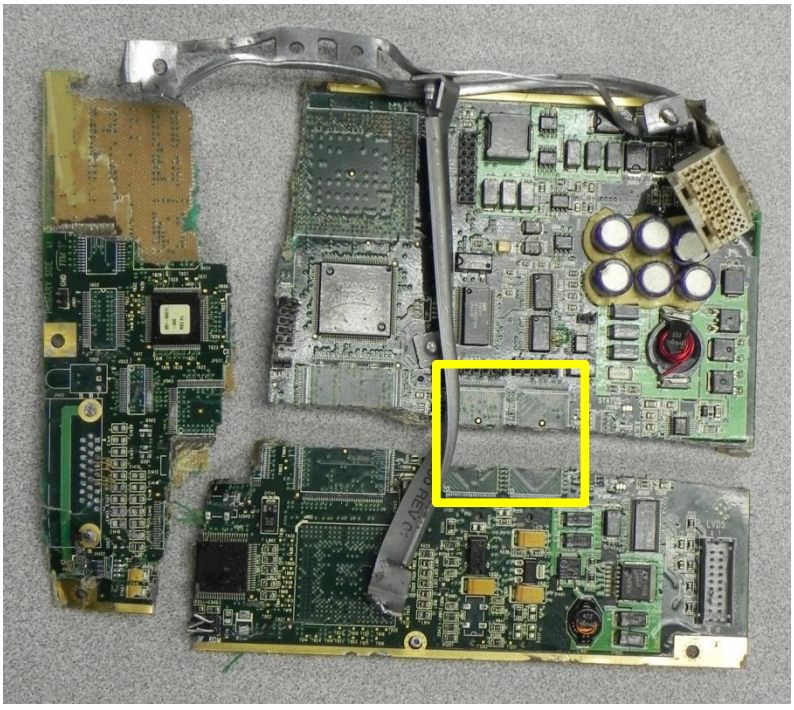

Figure 2. Accident circuit card showing missing memory devices.

The CF card containing data from the MFD was also damaged. The cover was removed and both memory devices on the card were evaluated and found to be damaged with visible cracks stretching the width of both devices (Figures 3-4). X-ray images of the card were made showing the cracks in greater detail (Figures 5-6). The memory devices are placed exactly opposite each other on either side of the card and the x-ray images show the cracking on both devices. Because the cracks extend through the die of both devices, data recovery is not viable.

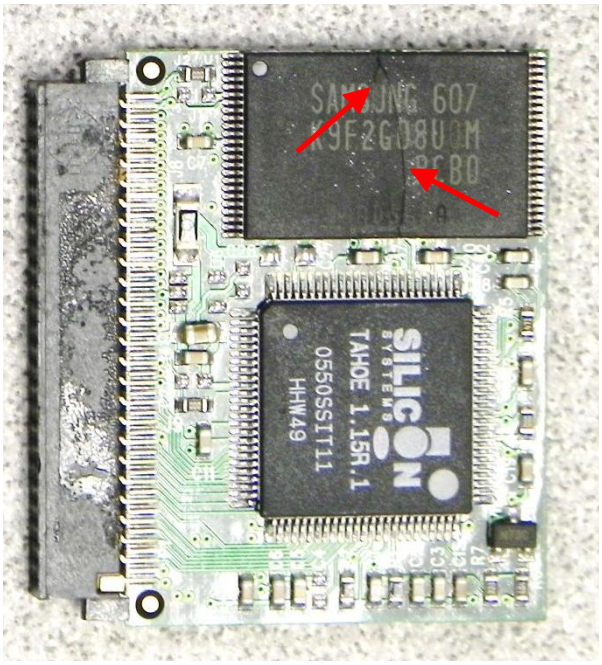

Figure 3. Obverse side of card showing cracks.

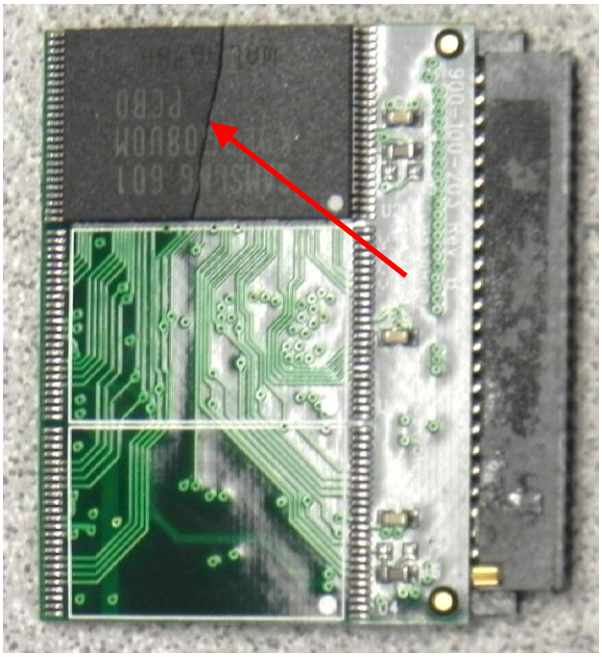

Figure 4. Reverse side of card showing cracks.

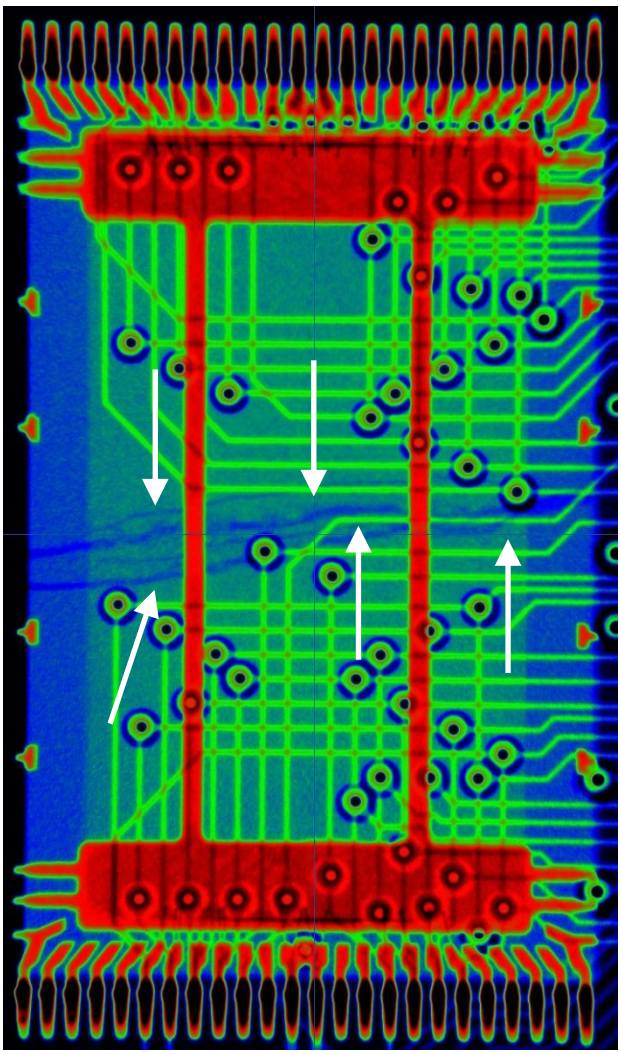

Figure 5. X-ray of obverse side of memory device.

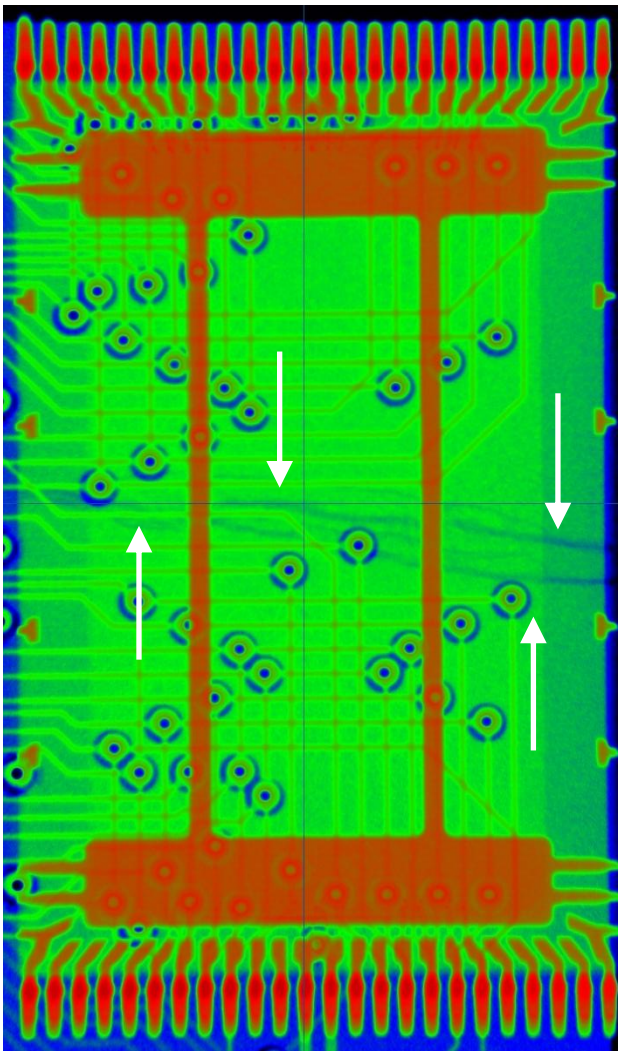

Figure 6. X-ray of reverse side of memory device.

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