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

August 20, 2012

17 – Non-Volatile Memory Device Factual Report

by Joe Gregor

A. EVENT

Location:	Nashville, PA
Date/Time:	December 22, 2011 / 1735 Eastern Standard Time (EST)[1]
Aircraft Type/ID:	Cessna 441 / N48BS
Operator:	Private
NTSB Number:	ERA12FA120

B. GROUP - No Group

C. SUMMARY

On December 22, 2011, about 1735 eastern standard time, a Cessna 441, N48BS, was substantially damaged when it impacted terrain near Nashville, Pennsylvania, while approaching York Airport (THV), Thomasville, Pennsylvania. The airplane had been operating on an instrument flight rules (IFR) flight plan from Long Beach Airport - Daugherty Field (LGB), Long Beach, California, to THV; however, the pilot had cancelled the flight plan and was proceeding visually via the airport traffic pattern at the time of the accident.

D. DETAILS OF INVESTIGATION

On December 28, 2011 the NTSB Vehicle Recorder Laboratory received the following device:

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

Device Manufacturer/Model: Apple iPad
Serial Number: GB044RN6ETV

NVM Description: Apple iPad

The Apple iPad is a tablet computer with a high-resolution color touch-screen interface. All iPad devices support WiFi and Bluetooth connectivity, and use either 16, 32, or 64 MB, of non-volatile memory for storage (depending on model). Some devices also support data connectivity via existing cell-phone networks. The iPad2 also includes front and back cameras. The iPad implements its functionality by running programs called “Apps” capable of supporting web-browsing, email, audio/video playback, contact and calendar management, and numerous other specialized functions. User-installed Apps can be sued to support functionality for electronic flight bags, flight planning and filing, aviation weather depiction, and electronic flight charts. Application data is stored in non-volatile memory and may include image, video, and position location information. Specialized application data may be stored in a proprietary file structure using numerous proprietary file formats. The amount and type of data stored varies based on the software version and configuration of the specific device.

NVM Data Recovery: Apple iPad

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed that the unit had sustained significant impact damage (see figures 1 and 2). An internal inspection was performed and the internal processor and the main printed circuit boards (PCB) showed minor visual evidence of impact damage including spalling of the conformal coating over the electronic parts and integrated circuits. This conformal coating is applied to the board during manufacture, after parts placement, to protect the parts from moisture and environmental exposure. The main printed circuit board was evaluated using x-ray and microscopic analysis. This analysis indicated that the electronic bonds between the FLASH memory and microprocessor integrated circuits, and the main PCB, were likely to have been compromised due to impact damage and deformation.

The main printed circuit board was installed in a surrogate iPad and power was applied. No indications of operation were observed. Attempts to re-work the main

printed circuit board to restore proper electrical connection between the compromised integrated circuits and the PCB were unsuccessful.

NVM Data Description: Apple iPad

No data was recovered from the unit.

Joe Gregor
Electronic Engineer

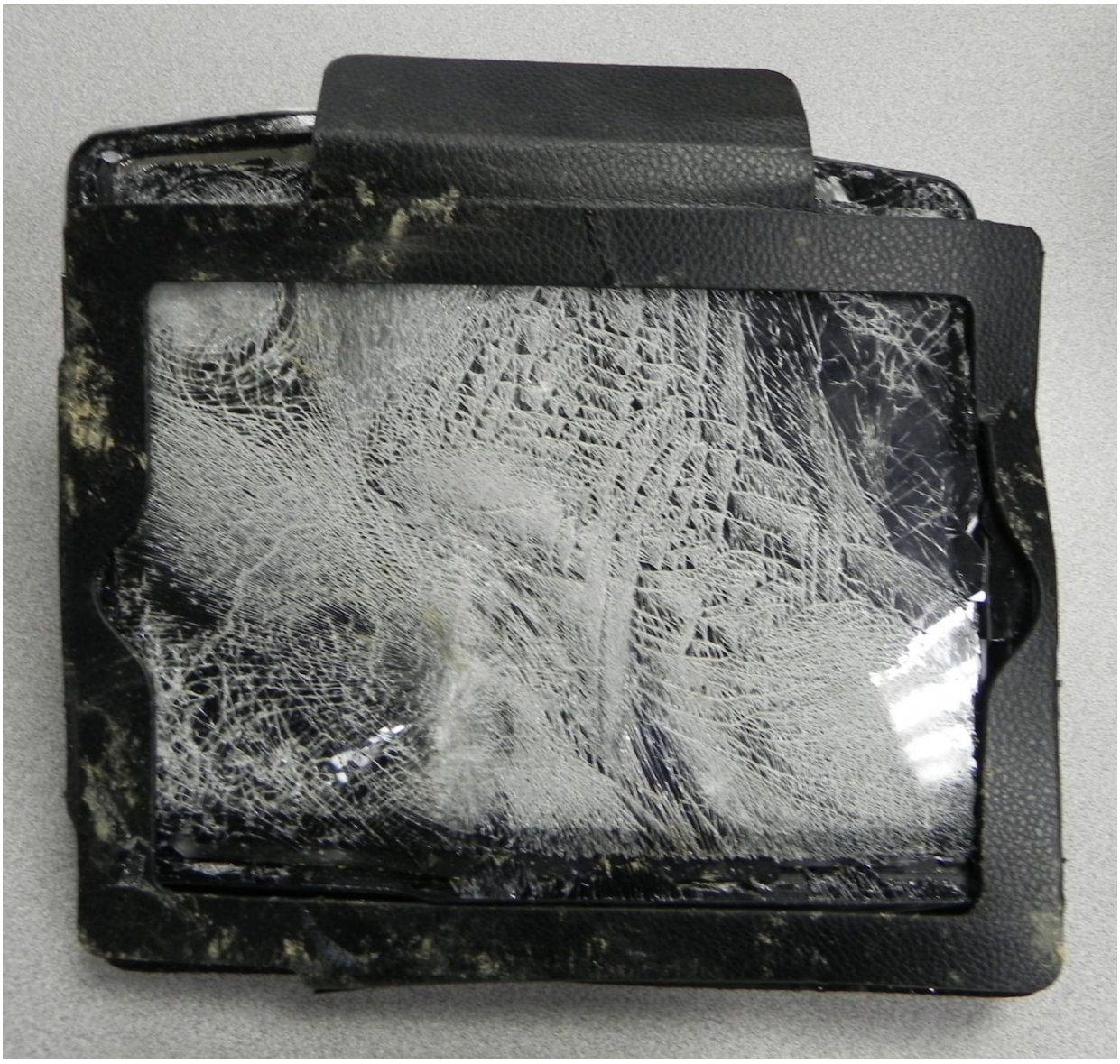

Figure 1. External front view of the Apple iPad (GB044RN6ETV) showing impact damage to the touchscreen.

Figure 2. External side view of the Apple iPad (GB044RN6ETV) showing impact damage and severe deformation to the aluminum outer shell. The main printed circuit board (PCB) is located to the right in the image.

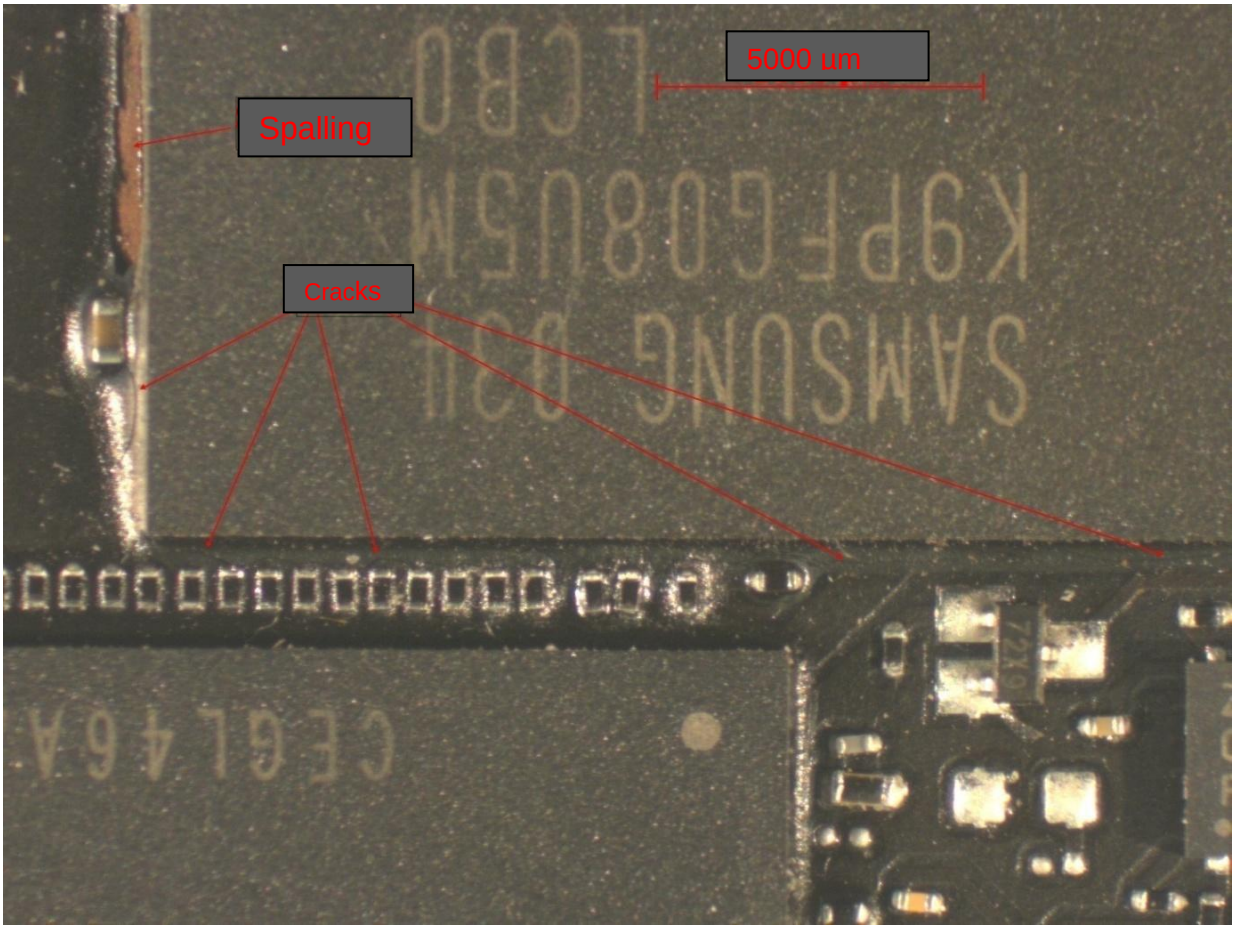

Figure 3. Microscope image of the main printed circuit board (PCB) around the region for one of the FLASH memory devices, showing spalling and cracks in the protective conformal coating applied to the board after parts placement.