

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

September 4, 2014

Electronic Devices

Specialist's Factual Report

By Bill Tuccio, Ph.D.

1. EVENT SUMMARY

Location: White Plains, New York
Date: June 13, 2014
Aircraft: Piper PA-46-500TP
Registration: N5335R
Operator: Private
NTSB Number: ERA14FA288

On June 13, 2014, at 0808 eastern daylight time, a Piper PA-46-500TP, N5335R, operated by a private individual, was destroyed when it collided with trees and terrain shortly after takeoff from Westchester County Airport (HPN), White Plains, New York. The private pilot was fatally injured. Instrument meteorological conditions prevailed and an instrument flight rules flight plan was filed for the personal flight, which was destined for Portland International Jetport (PWM), Portland, Maine. The flight was conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91.

2. DETAILS OF INVESTIGATION

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

Recorder Manufacturer/Model: **Apple iPad Air**
Recorder Serial Number: **DMPLN1TTFKYC**

Recorder Manufacturer/Model: **Meggitt Data Acquisition Unit (DAU) 85-254-1**
Recorder Serial Number: **0116-006**

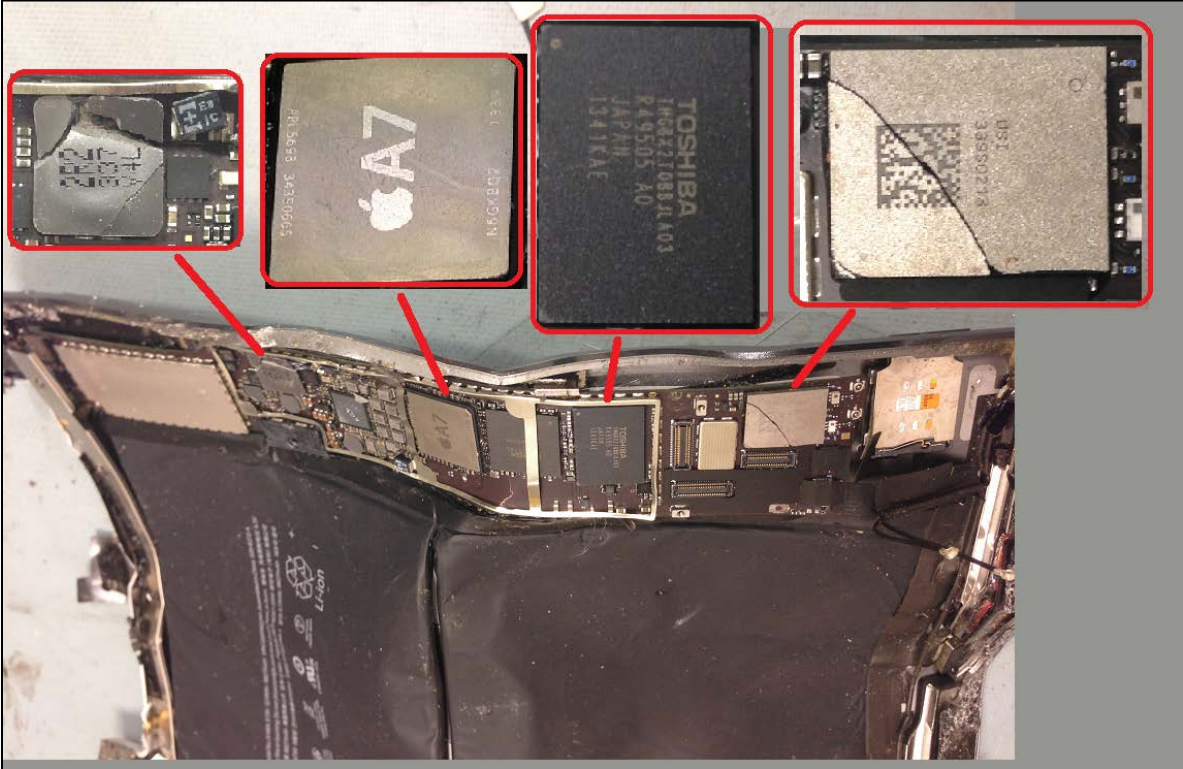
2.1. Apple iPad Air

The Apple iPad Air is touchscreen capable tablet device. Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained significant structural damage, as shown in figure 1. An internal inspection revealed damage to some internal components; figure 2 shows the main processor and main memory chips (center two chips) were undamaged, while the other chips were cracked. In agreement with the Investigator-in-Charge, no further recovery attempts were made.

Figure 1. Apple iPad Air.



Figure 2. Apple iPad Air internal components.



2.2. Meggitt DAU Device Description

The DAU¹ is part of the Meggitt Avionics, Inc. MAGIC engine instrument display system that also includes dual instrument panel mounted displays (EDU) and various engine and fuel tank sensors.

The DAU is a microprocessor-based signal-conditioning device. The unit will accept aircraft sensor data, perform signal conditioning and validation, and then present this information to the EDUs via RS-422, RS-232, and ARINC 429 compatible serial data buses. The system will also receive, via ARINC 429 compatible serial data buses, global positioning and air data information to support the exceedance and engine condition trend monitoring (ECTM) processing functions of the DAU. The DAU configuration is based upon multiple channel architecture. Independent primary processing channels interface with non-fuel quantity sensors providing for signal input processing and output of sensor data for which the channel interfaces. In addition, independent fuel quantity-processing channels provide for excitation, sensing, and data processing of multiple tank groups.

The DAU supports four dual ARINC 429, two RS-422, and two RS-232 serial data buses. Information received includes altitude, airspeed, and global positioning data. Information transmitted includes engine parameters (tachometer(s), torque, inter turbine temperature, oil pressure, oil temperature, vacuum pressure, and fuel flow), fuel quantity (left and right tank groups), and global positioning data. Fuel quantity sensing and reporting functions are accomplished by independent (isolated) fuel quantity processing electronics. In addition, the DAU includes built-in test, performance, and self-test functions.

2.2.1. DAU Data Description

The DAU records and stores up to 256 engine exceedance events in non-volatile memory. The system also provides for and automatically gathers information for Engine Condition Trend Monitoring (ECTM). Up to three ECTM records are stored per power cycle if either "Cruise 1" or "Cruise 2" states are achieved. One record for each of the following altitude ranges is stored:

- 15,000 to 20,000 feet
- 20,000 to 25,000 feet
- Above 25,000 feet

"Cruise 1" state is achieved when one of the above-mentioned altitude ranges is reached and the altitude has stabilized within ± 300 feet, airspeed of greater than 140 knots is reached and has stabilized within ± 10 knots, and engine torque is greater than 49.5%. If "Cruise 1" conditions are met for a period of two minutes, an ECTM record is stored for that particular altitude range.

"Cruise 2" state is achieved when "Cruise 1" conditions are valid, the altitude variation is within ± 100 feet, the airspeed variation is within ± 8 knots, engine torque variation has stabilized to within $\pm 3.8\%$, prop tachometer variation has stabilized to within $\pm 1.25\%$, and

¹ DAU description and recorded data information were obtained from Meggitt Avionics, Inc. EIDS Installation Manual (Part Number 1031235) released on November 1, 2000, and Piper PA-46-500TP Airplane Manual Part Number 767-005 released on July 1, 2009.

turbine tachometer has stabilized to within $\pm 1.0\%$. If these conditions are maintained for a period of two minutes, the "Cruise 1" data is over-written for that particular altitude range.

Each ECTM record includes the following parameters and units:

- Date/Time
- Mode ("Cruise 1" or "Cruise 2")
- Altitude – feet (ft)
- Airspeed – knots (kt)
- Static Air Temperature - degrees Celsius ($^{\circ}\text{C}$)
- Torque – pound-foot (lb-ft)
- Propeller Speed (N_p) – percent (%)
- Turbine Speed (N_g) – percent (%)
- Inter Turbine Temperature (ITT)- degrees Celsius ($^{\circ}\text{C}$)
- Fuel Flow – pounds per hour (pph)

In the event an engine parameter exceeds a preset value for a predetermined time an exceedance is recorded. The following is a list of parameters monitored and recorded if an exceedance occurs:

- Torque
- Inter Turbine Temperature (ITT)
- Propeller Speed (N_p)
- Turbine Speed (N_g)
- Engine Oil Temperature
- Engine Oil Pressure

Each exceedance record includes the following parameters:

- Date/Time
- Exceedance Parameter
- Duration of Exceedance
- Peak Value
- Data Bus Label

2.2.2. DAU Date and Time

Date and time values recorded are based on global positioning system (GPS) data input to the DAU. If the GPS is not available or not installed the date and time are recorded using a default value of "----".

2.2.3. DAU Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the DAU had sustained minimal damage, as shown in figure 3. An interior inspection revealed some of the internal connections were loose. The internal connectors were tightened. The ECTM and exceedance data from both channels of the DAU were downloaded at the NTSB's Vehicle Recorders Laboratory using the Meggitt Avionics, Inc. download software; the download software also converted the data to engineering units.

