

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

October 21, 2019

Onboard Image, Audio and Data Recorder

Specialist's Factual Report By Sean Payne

1. EVENT SUMMARY

Location: Odanah, WI
Date: October 29, 2018
Aircraft: Airbus Helicopters AS350
Registration: N910S
Operator: Enbridge Energy Co., Inc
NTSB Number: CEN19FA018

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

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

Device Manufacturer/Model:	Appareo Vision 1000
Serial Number:	Unknown

3.1. Device Description

The Appareo Vision 1000 device is a small self-contained image, audio, and data recorder. The unit is typically mounted in the overhead of aircraft's cockpit and records a cockpit image at a rate of four times per second. In addition to cockpit images, the device is also capable of recording two tracks of audio that are synchronized with the image data. The unit also contains a GPS receiver that receives GPS satellite based aircraft time, position, altitude, and speed. In addition to the GPS position, the Appareo unit also has a self-contained real-time inertial measuring unit that provides 3-axis accelerations as well as aircraft pitch, roll and yaw data.

The two recorded audio tracks can be wired to record the following inputs: an external audio source such as the aircraft's intercom or radios and audio picked up by a microphone mounted internal to the Vision 1000 unit. In this installation no external aircraft audio was connected to track one and the track two microphone only picked up very loud engine and/or transmission sounds from the helicopter.

The Appareo unit records the image, audio and parametric data on a removable SD¹ memory card that is inserted into the unit. Depending on card size, this removable memory retains approximately the last two hours of image and audio data and about the last 100 hours of parametric data. In addition to the removable memory the Vision 1000 is also equipped with a memory module that is mounted internal to the unit. This internal memory contains an exact duplicate of the data stored on the removable card.

The Appareo unit on this aircraft was connected to the aircraft's electrical bus. Any time the battery switch is turned on the Appareo unit will start to record audio, images and data. The Vision 1000 unit creates a new file for every electrical power application and can create multiple files for the same power cycle if the recording time exceeds a certain time limit.

3.2. Device Condition

Upon arrival at the Vehicle Recorder Laboratory, an examination revealed the unit had sustained significant impact and thermal damage. The extent of the damage is shown in figure 1. The device also contains a removeable SD card, however, there was no SD card present.



Figure 1. Photo of damaged unit

The portion of the device that contains the internal memory chips was still attached to the device. The memory chips were removed from the device and evaluated. Figure 1 shows

¹ SD – Secure Digital – A type of nonvolatile memory card used extensively in portable devices.

the remnants of one of the two memory chips, figure 2 shows the remnants of the second memory chip.

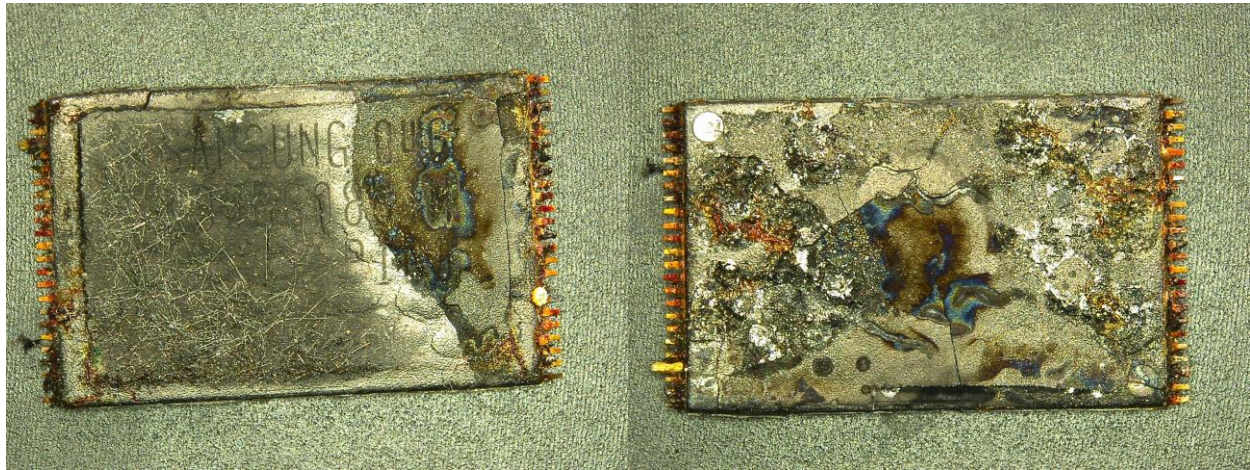


Figure 2. Photo of damaged internal memory chip #1. (front and back)

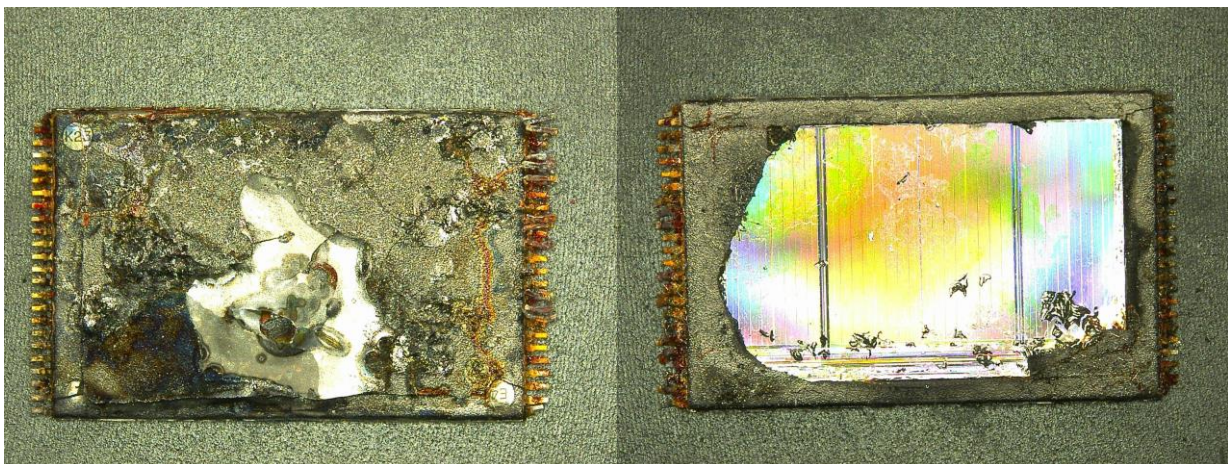


Figure 3. Photo of damaged internal memory chip #2. (front and back)

Chip #1 showed significant thermal deformation as well as potential impact damage. Multiple cracks in the chip's packaging were present. Chip #2 showed similar thermal deformation and multiple crack locations. A large portion of Chip #2's die was exposed.

Both chips #1 and #2 were sent to The Small Scale Systems Integration and Packaging Center (S3IP) at SUNY Binghamton University. The results of the evaluation are attached to this report as attachment 1.

S3IP performed detailed visual, x-ray inspection and discussed acoustic microscopy on the two chips.

Visual inspection by S3IP revealed that both chips were not “good candidate(s) for data retrieval. The report from S3IP details damage to both chips that supports this conclusions.

All information obtained from this exercise, including S3IP’s report, were then forwarded to the Department of Defense’s Cyber Crime Center (DC3). The DC3 lab evaluated the report from S3IP and concurred with the conclusion that the chips were not good candidates for data retrieval.

In consultation with other members of the NTSB’s Vehicle Recorder laboratory and the Investigator-In-Charge, no further recovery efforts were pursued. The extent of the damage to the NVM chip’s precluded normal recovery procedures and additional attempts were unsuccessful in yielding usable data.

3.3. Data Description

This device is capable of storing data in the non-volatile memory (NVM)². The extent of the damage precluded normal recovery procedures and additional attempts were unsuccessful in yielding usable data. Therefore, no data pertinent to the event were recovered.

² Non-volatile memory is semiconductor memory that does not require external power for data retention.