

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

September 12, 2019

Helicopter Terrain Awareness System (HTAWS)

Specialist's Factual Report

By Sean Payne

1. EVENT SUMMARY

Location: Hertford, North Carolina
Date: September 8, 2017
Aircraft: Eurocopter MBB BK-177 C2
Registration: N146DU
Operator: Air Methods Corporation
NTSB Number: ERA17FA316

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:	Honeywell MK XXI Helicopter Terrain Awareness System (HTAWS)
Serial Number:	Unknown ¹

3.1. Device Description

The Honeywell Mk XXI HTAWS provides terrain alerting and display functions. It combines navigation databases with aircraft inputs to provide warning of a potential conflict between the aircraft and obstacles in its path.

3.2. Device Condition

Upon arrival at the Vehicle Recorder Laboratory, an examination revealed the unit had sustained significant fire and impact damage. The outer case of the unit was charred and bent. Figure 1 shows the unit's condition upon arrival.

¹ The serial number markings on the unit were destroyed.

The unit was opened mechanically and the internal components, including any non-volatile memory (NVM) were found to be heavily fire damaged. Figure 2 shows the condition of the internal components after the device was opened with a shear.

The internal components were disassembled and laid out as show in figure 3.

A review of the internal components revealed obvious heat damage.



Figure 1. Photo of damaged unit



Figure 2. Photo of the device after being mechanically opened.

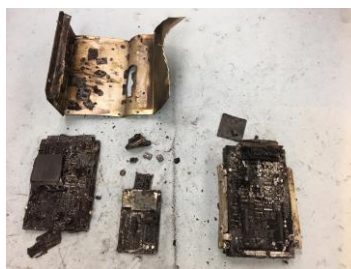


Figure 3. Photo of the device's internal components partially disassembled and laid out.

In collaboration with the manufacturer, Honeywell, individual NVM chips that would have potentially contained data were identified. The chips are Intel branded E28F320 J3A110 chips. Figure 4 shows the location of the flight history data chip, as identified by Honeywell. As evident in figure 4, the flight history data chip was missing.

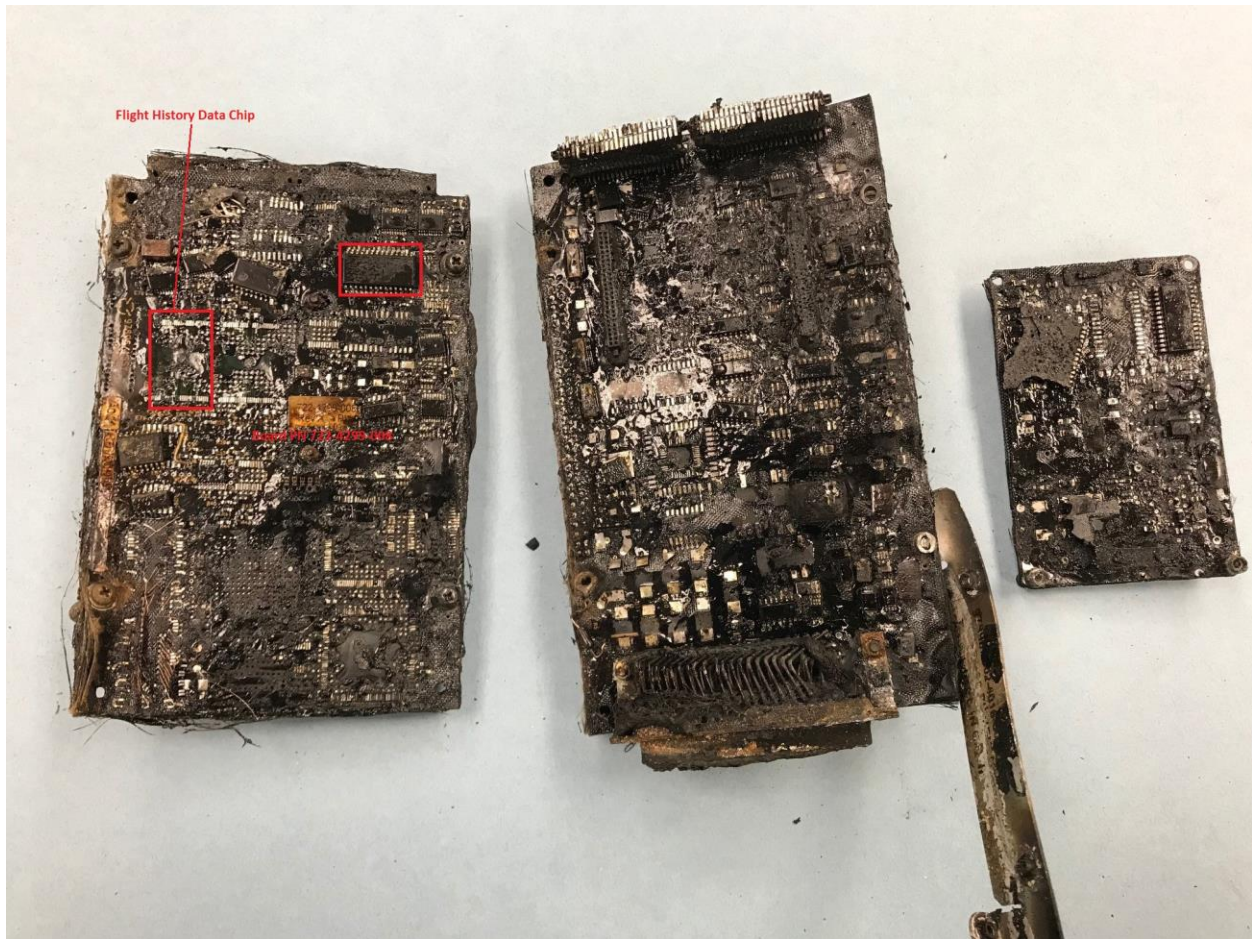


Figure 4. The location of the flight history data chip. The chip was missing from the board. The second marked box is the location of another NVM chip that is helpful in decoding the flight history data chip, but not required.

Three chips matching the description of the flight history data chip were recovered after examining the electronic wreckage further. The chips were labeled “A,” “B,” and “C.” Figures 5 through 7 show the condition of chips A, B, and C, respectively.

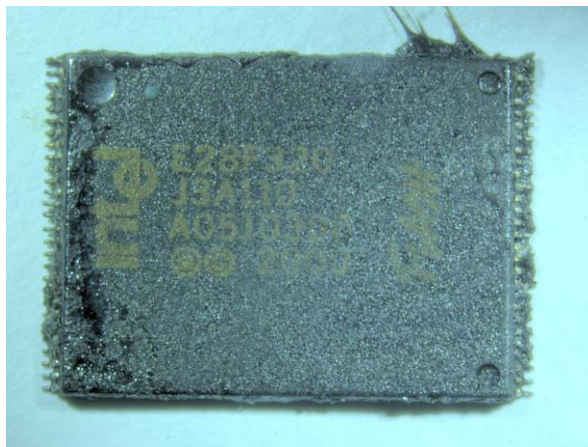


Figure 5. Stereoscopic microscopy photo of chip “A.”

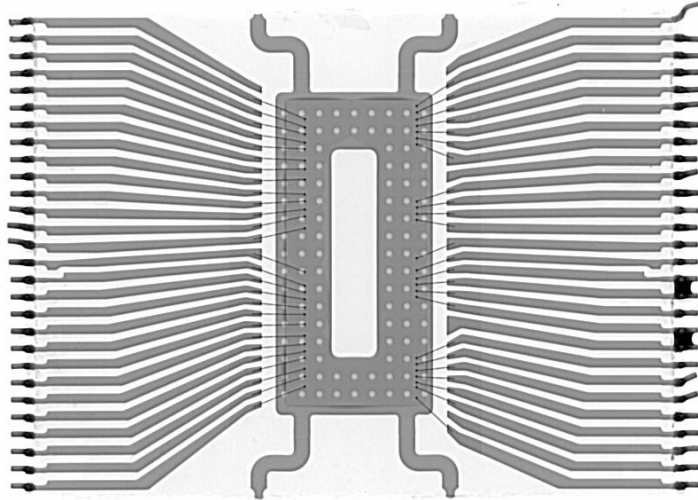


Figure 6. Stereoscopic microscopy photo of chip “B.”



Figure 7. Stereoscopic microscopy photo of chip “C.”

Chips A, B, and C were then examined using a microscopic x-ray system. The results of the x-ray examination are shown in figures 8 through 10 for chips A, B and C, respectively.

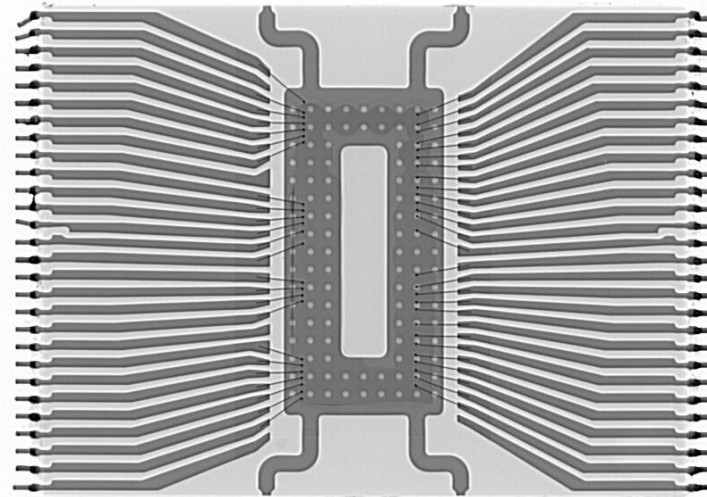


100 mil

100 kV 200 μ A Z0

NTSB

Figure 8. X-ray microscopy for chip "A"

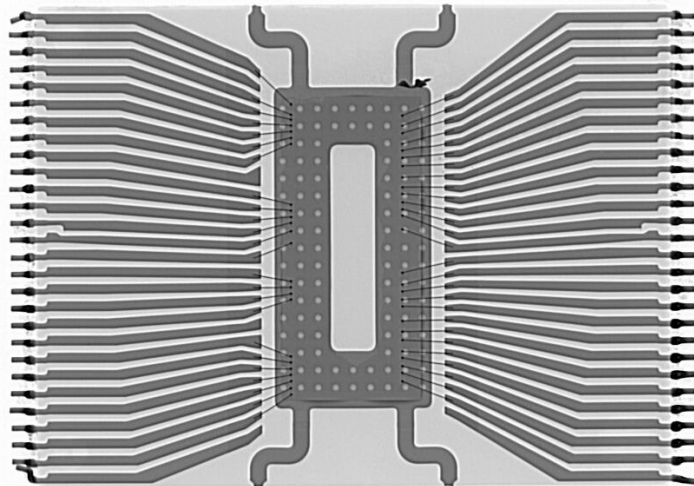


100 mil

100 kV 200 μ A Z0

NTSB

Figure 9. X-ray microscopy for chip "B"



100 mil

100 kV 200 μ A Z0

NTSB

Figure 10. X-ray microscopy for chip “C”

The x-ray examination revealed no obvious defects in the bond wires or lead-frame packaging for each chip. The die condition could not be conclusively determined using an x-ray examination.

Chips A, B, and C were then read using the appropriate socket type adapter via a Xeltek 6100 and a PC. Multiple reads for each chip were taken and compared. Chip A read out with only a pin error on pin 48. Chip B read out with a pin error on pins 18 and 48. Chip C read out with pin errors on pins 19, 22, 31 and 48.

Not knowing which of the three chips was the flight history data chip, all three chip image files were sent to Honeywell for decoding.

On April 17, 2018, Honeywell responded that they had decoded, or partially decoded each chip image file, and determined that chip B was the flight history data chip. The engineer from Honeywell stated the following:

“Chip B contains the EGPWS history data files. I was able to partially decode the data with our tools, but it has a lot of discontinuities and unreasonable values. The data that is usually of most interest is the EGPWS warning history. The EGPWS operating time wasn’t properly decoded in the warning history from this unit, so it isn’t apparent which data is the most recent. However, the latitude and longitude values for the data that was decoded appear to be mostly reasonable, and there are no records near Hertford, NC (Easternmost longitude that was recorded is -77.06 degrees).”

It is likely the pin error on pins 18 and 48 affected the read of the chip's memory, however, enough decoded data existed such that Honeywell was able to determine that no latitude and longitude records near the location of the accident were recorded. This could indicate that the device did not trigger near the accident site.

3.3. Data Description

This device is capable of storing data in the non-volatile memory (NVM)². No data records were recovered that would have been recorded near the vicinity of the accident.

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