

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

August 27, 2019

Flight Data Monitoring (FDM) Device

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:	North Flight Data Systems (North FDS) – Outerlink Voice and Video Recorder (O.V.V.R)
Serial Number:	Unknown¹

3.1. Device Description

The North Flight Data Systems – Outerlink Voice and Video Recorder (OVVR) is a flight data monitoring and recording system that provides voice, video, GPS as well as analog, digital and ARNIC system information. The system can be used as a stand along system or interfaced with other satellite communications systems.

The device can record of video information from a lipstick style camera as well as up to six channels of audio information for up to an eight hour loop. The data are recorded to a compact flash (CF) card. The CF card is covered with a lightweight fire-proofing material, however, the device is not intended to be, or considered to be, a crash-worthy device.

¹ The serial number markings on the unit were destroyed.

The device's manufacturer provides a software playback solution which allows recorded video information to be played back with recorded audio, GPS derived data, and other flight information.

3.2. Device Condition

Upon arrival at the Vehicle Recorder Laboratory, an examination revealed the unit had sustained significant fire and impact damage. Figure 1 shows the unit's condition upon arrival.



Figure 1. Photo of damaged unit

The unit was opened mechanically. Four phillips style screws holding a larger component board were first removed. Under that component board, a CF card was exposed after removing a lightweight fireproofing-like material. The fireproofing-like material exhibited thermal damage surrounding the area of which the CF card was mounted. Figure 2 shows the internal condition of the device after the top component board was removed as well as the lightweight fireproofing-like material.



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

A bead of RTV silicon holding the CF card in place was removed and the CF card was able to be freed from its chassis. The CF card exhibited characteristics of high temperature exposure, but no obvious damage. The condition of the CF card is shown in figure 3 (front and back).



Figure 3. Photo of the device's internally mounted CF card.

After the CF card was extracted, the card was read via forensic write blocker and a PC. Upon read, a file system was not read on the CF card. Instead, a forensic image of the CF card was made.

Without a filesystem in place, digital contents of the card were unable to be read in the manufacturer's software, and thus, the CF card was unable to produce flight data.

An exploration of the CF card's image produced a data structure like what is to be expected of flight data, however, the values recorded in that data structure did not appear to describe the helicopter's accident flight. Potential ground track data was interpreted from the CF card's image and was compared with verified, satellite transmitted ground track data from the accident flight. When comparing the data sets, the parameters interpreted from the CF card's image did not match the satellite transmitted data in value or duration.

The card's image was sent to the Bureau d'Enquêtes et d'Analyses (BEA) for additional read out attempts. A review by the BEA suggested similar results to those mentioned above and no accident flight data was recovered.

Finally, the CF card was sent to a third-party data recovery lab in an attempt to produce a filesystem either from the physical CF card or the image data. The third-party data recovery lab was unable to produce a filesystem or usable data.

3.3. Correspondence with the FDM Manufacturer

Approximately six months prior to the accident, in a conversation about another investigation involving a helicopter equipped with an O.V.V.R, a representative of the manufacturer stated approximately 200 O.V.V.R units were installed, however, most of those units would be replaced with the Outerlink IRIS system, a newly developed FDM system by the same manufacturer. At the time of correspondence, the representative stated about 500 IRIS units were installed domestically.

Immediately following notification of the accident, and prior to receiving the device, the manufacturer was again contacted in order to obtain a methodology for downloading the device, as well as other best practices for handling the device. On September 13, 2017, a representative from the manufacturer replied to the NTSB. The representative stated that device could potentially have been non-functional at the time of the accident due to the operator of the device having not replaced an internal battery inside the O.V.V.R. The representative continued to explain that a failure to replace the internal battery on an annual basis could result in a corruption of the device's CF card, that would cause the unit to no longer have the ability to store flight data. The NTSB subsequently received the device and experienced the issues described in section 3.2 of this report.

The manufacturer continued to support the investigation, specifically attempts by the NTSB and BEA to convert image file data to useable flight data. As described in section 3.2, this effort was not successful.

On September 12, 2019, the NTSB discussed with the representative a service bulletin issued by the manufacturer in 2013. The service bulletin is attached to this report as attachment 1. The service bulletin states the following:

Description: The condition of the CV2R/OVVR and MFDAU internal batteries and the recording capabilities of the QAR SD and OVVR/ CV2R Compact Flash (CF) cards are critical to the functionality of the North Flight Data Recording system. Operators should develop and include scheduled routine tasks into their maintenance program to ensure these items are functioning properly. These tasks should include checking battery capacity, periodic battery replacement, downloading and clearing data from the QAR SD card(s). Failure of files to close properly can prevent the OVVR/CV2R CF and QAR SD cards from recording data.

Recommended Tasks: Batteries in both the OVVR/CV2R and the MFDAU should be changed each 12 calendar months. Furthermore, tests should be performed routinely to ensure the batteries have sufficient capacity to properly close all files after aircraft power has been turned off or lost. Please see NFDS Document D009-0002 Rev 1.9 or later approved revision for details on checking, replacement and charging of these batteries. It is recommended that each SD card be removed from the QAR, downloaded to a secure company computer, checked to ensure there are no Zero (0) length files on the card, cleared and reinstalled into the QAR.

It is recommended that SD cards containing Flight Data and/or Voice Only be downloaded and cleared at three (3) month intervals.

If Video is used SD cards containing Voice and VIDEO be downloaded every twelve (12) hrs of flight time.

E. Compliance: At the next maintenance opportunity

In the same correspondence on September 12, 2018, the representative stated the manufacturer intended to make the service bulletin mandatory.

On October 19, 2018, a representative from the manufacturer stated that the manufacturer's opinion regarding the failure of the accident O.V.V.R. to not produce flight data was due to the device having not been maintained and that the internal battery failure caused the internal memory to stop recording.

On August 15, 2019, the NTSB contacted the manufacturer once more. During this correspondence the manufacturer stated that there would not be a mandatory service bulletin issued for the existing O.V.V.R units. The manufacturer went on to describe the O.V.V.R. as "end of life." The manufacturer continued to explain that the battery issue with O.V.V.R units could be in part due to the nature of Helicopter Emergency Medical Services (HEMS) operations. The manufacturer stated that HEMS flight are often short, and thus the duration of the power applied to the O.V.V.R system is not long enough in duration in order to provide a sufficient charge to the O.V.V.R's internal battery.

The manufacturer continued to explain that the O.V.V.R's replacement, the IRIS system also in part relies on an internal battery to ensure proper closure of files post-flight as well as other limited operational characteristics of the unit. An internal battery is present in two parts of the IRIS system, those parts are the processing unit and the dialer unit. The manufacturer stated that field replacement of the batteries inside the processor unit is too complex and as such, the manufacturer's Instructions for Continued Airworthiness (ICA) states that the processor be returned to the manufacturer's facility for battery replacement every two years. Additionally, the ICA for the dialer unit prescribes one year replacements for internal batteries inside the dialer unit. The batteries inside the dialer unit are field replaceable. The manufacturer continued to state they are working on a product solution which eliminates internal batteries entirely.

3.4. Operator Maintenance Actions (FDM Device)

Maintenance records obtained from Air Methods show a log entry on December 23, 2016, which states the following:

"Complied with ADM Automatic Flight Following System and Flight Data System 12 month and periodic inspection IAW Doc 117N1CA31301. Op check good."

Document 117N1CA31301 was dated April 24, 2012. Section 3.2.1, titled “CV2R/OVVR & MFDAU Internal Battery, of Document 117N1CA31301 states the following:

The internal batteries for the CV2R/OVVR & MFDAU should be replaced on an annual basis. There is no requirement for battery testing. To remove and replace the batteries for these equipment, please refer the instructions beginning on the next page.

Section 3.2.1.1. then goes on to detail instructions regarding replacement of the internal battery.

Relevant maintenance records discussed above, Document 117N1CA31301, and installation instructions for the North O.V.V.R. system on the Eurocopter Duetschland BK117C-2 (EC-145) are attached to this report as attachment 2.

3.5. Data Description

This device is capable of storing data via an internally installed CF card. A failure of the internal battery caused the CF card to be corrupted. A search of recovered CF card data failed to produce data related to the accident. It is inconclusive how long prior to the accident that the internal battery failed. No data was recovered from the device.