

**NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, D.C. 20594**



GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

CEN18FA259

**By
Sean Payne**

WARNING

The reader of this report is cautioned that the transcript of an audio recording is not a precise science but is the best product possible from a Safety Board group investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

November 4, 2019

Flight Data Monitoring (FDM) Device - Audio

Group Chairman's Factual Report By Sean Payne

1. EVENT SUMMARY

Location: Chicago, Illinois
Date: July 7, 2018
Aircraft: Eurocopter EC135 P1, Registration N312SA
Operator: Pentastar Aviation Charter
NTSB Number: CEN18FA259

On July 7, 2018, about 2123 central daylight time (CDT), a Eurocopter EC135 P1 helicopter impacted terrain during an autorotation following a dual engine failure while maneuvering near Chicago, Illinois. The pilot and paramedic sustained minor injuries, the flight nurse sustained serious injuries, and the patient was not injured during the accident. The helicopter sustained substantial damage to the fuselage, tailboom, and main rotor blades. The helicopter was owned by Bennett Aviation, LLC, Elmhurst, Illinois, and operated by Pentastar Aviation Charter under the provisions of Title 14 *Code of Federal Regulations* (CFR) Part 135 as an air ambulance flight. Night visual meteorological conditions prevailed at the time of the accident, and the flight was operated under a visual flight rules flight plan. The flight departed St. Mary Medical Center, Hobart, Indiana, at 2110, and was destined for Advocate Christ Medical Center, Oak Lawn, Illinois.

2. GROUP

An audio transcription group was convened on August 21st and 22nd, 2018 at the Vehicle Recorder Division Laboratory at the NTSB headquarters in Washington, DC. The group members who participated are listed below:

Chairman:	Sean Payne Mechanical Engineer National Transportation Safety Board (NTSB)
Member:	Aaron Sauer Investigator-In-Charge (IIC) NTSB
Member:	Eric West Senior Air Safety Investigator Federal Aviation Administration (FAA)

Member: Merryn Spielman
Crash Investigator
Pratt and Whitney Canada

Member: Scott Traylor
Pilot
Pentastar Aviation

Member: Seth Buttner
Senior Accident Investigator
Airbus Helicopters

Member: Christian Bernhardt
Accident Investigator
Airbus Helicopters Deutschland

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following Flight Data Monitoring (FDM) Device:

Recorder Manufacturer/Model: **Outerlink IRIS**
Recorder Serial Number: **00181**

3.1 Flight Data Monitoring (FDM) Device Carriage Requirements

Per federal regulation 14 CFR 135.607, helicopters in air ambulance operations must be equipped with an approved flight data monitoring system capable of recording flight performance data. The system must receive electrical power from the bus that provides the maximum reliability for operation without jeopardizing service to essential or emergency loads and be operated from the application of electrical power before takeoff until the removal of electrical power after termination of flight. This rule went into effect on April 23, 2018. The rule does not include a requirement that the helicopter air ambulance operators perform periodic reviews of the flight data to ensure the data is valid, or use the flight data in any kind of flight operations quality assurance (FOQA) program. Additionally, there is no requirement that the FDM devices be certified to any crashworthiness standard.

3.2 Outerlink IRIS Device Description

The Outerlink IRIS is a lightweight flight data monitoring, recording and satellite communications device. The system consists of two main components, a control head that is installed in the aircraft's instrument panel as well as a second processing device which is installed in the aircraft's avionics bay. The system provides instantaneous two way communication between the aircraft's flight crew and any equipped ground operator (IP or telephone) via a global satellite network.

In addition to communications features, the device provides flight data monitoring functions and the ability to record these functions. The unit contains an internal Attitude Heading Reference System (AHRS) as well as components that facilitate the input of

ARINC¹ avionic data streams. A typical configuration will record native AHRS data as well as a variety of ARINC labeled messages that could potentially record engine information.

The system can also record voice and video data. In a typical configuration, the aircraft's intercom system (ICS) is configured to interface with the IRIS device. The pilot's headset hot mic and ear cups are recorded to the IRIS through the ICS system. Additionally, a lipstick style video camera interfaces with the system and is set to record a view over the pilot's shoulder of the aircraft's cockpit, including the pilot's control stick inputs as well as portions of the instrument panel and windscreen.

Data is recorded in three places on the IRIS system. The pedestal mounted control head contains a removable SD card which records only flight data. Inside the control head and the processor unit, a solid-state hard drive (SSD) is configured to record flight data, audio and video data. The SSD can be accessed through a hardwire ethernet connection on the back of each device or the unit can be disassembled and the SSD can be read independently. The IRIS system runs on a version of the Linux operating system.

3.3 Recorder Damage

Upon arrival at the laboratory, it was evident that the FDM device had not sustained any heat or structural damage and the audio information was extracted from the system's processor unit normally, without difficulty, using a direct connection to the powered device via an ethernet cable. Representatives from the manufacturer traveled to the Vehicle Recorder Division laboratory and performed the download under the supervision of an NTSB engineer.

3.4 Audio Recording Description

Each channel's audio quality is indicated in Table 1.² Additionally, the source of each channel was identified with assistance from the manufacturer. The source of each channel is also noted in table 1. Channels 2, 3 and 4 appeared to be a recording through the helicopter's intercom system (ICS) of audio data that was mixed to each flight crew's earcups. Channel's 2, 3 and 4 did not record hot mic audio data from those crew stations and instead audio would only be recorded if the input to the crew station's headset boom mic met a particular threshold that would operate a voice operated exchange (VOX) switch through the ICS.

Table 1: Audio Quality.

Channel Number	Content/Source	Quality	Duration
1	Pilot Hot Mic and Headset	Good	17m 54s
2	Flight Crew 1 Headset	Fair	17m 54s
3	Flight Crew 2 Headset	Fair	17m 54s
4	Flight Crew 3 Headset	Fair	17m 54s
5	Cockpit Area Mic (Left)	Fair	17m 54s
6	Cockpit Area Mic (Right)	Fair	17m 54s

¹ ARINC – Aeronautical Radio Incorporated – A subset of standards for electronic communications between avionics.

² See attached Audio Quality Rating Scale.

3.5 Video Recording Description

The video device contained two video files, neither one captured the accident. Additionally, the two video that were present were blurry. The manufacturer of the device attributed this to the set screw style design that set the focal length and focus of the lens. For additional details about the video data recovered from this accident, refer to the Flight Data Monitoring (FDM) Device - Data - Specialist's Factual Report, which can be found in the public docket for this accident.

3.6 Timing and Correlation

Timing on the transcript was established by correlating an audio event to a corresponding recorded data event from the FDM. Specifically, the recorded discrete parameter for rotor rpm above 112% NR triggered a recorded data point at 02:23:26.0 UTC on the data recording. The audio recording portion of the FDM device recorded a continuous high frequency tone at 00:15:09.62 elapsed. The time offset was constructed using the formula below to bring the audio recording to UTC time.

$$\text{Recorded Audio Elapsed Time} + 7696.3 \text{ seconds} = \text{UTC}$$

For additional timing information, refer to the Flight Data Monitoring Device – Recorded Data Factual Report.

3.7 Description of Audio Events

The recording began as the helicopter was powered and idling on the ground at 02:08:16.3 UTC. The transcription began at the recording's start as the medical crew were discussing patient injuries. The recording lasted the entire duration of the flight, through impact and continued recording until 02:26:10.3 UTC.

3.8 Surviving Crew Commentary

As part of the Safety Board's accident investigation process, the flight crew was invited to review the FDM audio transcript and suggest corrections or additions. They have not responded to the invitation.

Transcript of an Outerlink IRIS FDM device, serial number 00181, installed on a Bennett Aviation Eurocopter EC135 (N312SA), which crashed after experiencing an in flight emergency near Chicago, IL.

LEGEND

ATIS	Automated Terminal Information System
CAM	Cockpit area microphone voice or sound source
DISP	Dispatch
GYG	Gary Airport, Gary, Indiana (KGYG)
HTAWS	Helicopter Terrain Awareness and Warning System
MC1	Helicopter medical crew member number 1
MC2	Helicopter medical crew member number 2
MDW	Chicago-Midway International Airport, Chicago, Illinois
MEDCRW	Medical crew members (A conversation between both crew members)
Pilot	Flight crew audio panel voice or sound source
RDO	Radio transmissions from N312SA
SUP	Superior Dispatch
TWR	Radio transmission from the airport tower controller
-?	Voice unidentified
*	Unintelligible word
#	Expletive
@	Non-pertinent word or a person's name
()	Questionable insertion
[]	Editorial insertion

Note 1: Times are expressed in universal coordinated time (UTC).

Note 2: Generally, only radio transmissions to and from the accident aircraft were transcribed.

Note 3: Words shown with excess vowels, letters, or drawn out syllables are a phonetic representation of the words as spoken.

Note 4: A non-pertinent word, where noted, refers to a word not directly related to the operation, control or condition of the aircraft.

Intra-Cockpit Communications

Air to Ground Communications

02:08:16.3 [Start of recording. Start of Transcript.]

02:08:16.3 [Discussion of patient injuries.]
MEDCRW

02:08:34.1 HTAWS test okay. [Automated voice]
HTAWS

02:08:44.0 (I see you when we get here, St. Catherine's
DISP-RDO out)

02:08:57.3 ***.
MEDCRW

02:09:10.1 [sound similar of helicopter engines transitioning
CAM from IDLE to FLY.]

02:09:33.8 we all good @pilot
MC1

02:09:34.9 Ya.
Pilot

02:09:35.6 (okay).
MC1

02:09:38.1 almost there
Pilot

Intra-Cockpit Communications

02:09:41.2 alright. flight guarded - cautions - warnings - all
Pilot good.

02:09:44.2 * *. [unintelligible due to audio corruption issue.]
Pilot

02:09:46.2 * * *.
MC1?

02:09:48.0 (hazards) seatbelts and doors.
Pilot

02:09:49.8 they are secure.
MC1

02:09:50.8 patient and litter?
Pilot

02:09:51.7 (good/it's) secure.
MC1

02:09:52.3 drugs?
Pilot

02:09:52.8 we got 'em
MC1

02:09:54.2 charts and films?
Pilot

Air to Ground Communications

Intra-Cockpit Communications

02:09:55.2 got 'em.

MC1

02:09:55.7 medical (equipment)?

Pilot

02:09:56.4 (have them) and stowed.

MC1

02:09:58.0 electronic devices?

Pilot

02:09:59.1 they are off.

MC1

02:10:01.1 ahh - your walkaround?

MC1

02:10:02.9 it's complete.

Pilot

02:10:03.6 cords and covers?

MC1

02:10:04.7 removed.

Pilot

02:10:05.4 instruments?

MC1

Air to Ground Communications

Intra-Cockpit Communications

02:10:07.5 everything's in the green.

Pilot

02:10:08.4 good.

MC1

02:10:09.8 uhh we have two twenty two kilograms in the main
Pilot - sixty five minutes.

02:10:13.5 caution warning lights?

MC1

02:10:15.7 everything is out.

Pilot

02:10:16.8 one and two engine switches?

MC1

02:10:17.6 in flight - guarded.

Pilot

02:10:18.7 alright you're checklist is complete we'll head to
MC1 Christ. [Advocate Christ Medical Center]

02:10:34.9 [sound similar to helicopter transitioning to hover.]

CAM

02:10:44.0 alright hover check looks good here we go.

Pilot

Air to Ground Communications

Intra-Cockpit Communications

Air to Ground Communications

02:11:02.6 **KGYY-ATIS** [Pilot received Gary (KGYY) ATIS in two transmissions, the ATIS was as follows: Gary (KGYY) Tower ATIS information kilo two two four five (2245) zulu – winds zero seven zero (070) at eight (08) - visibility ten (10) – sky clear - temperature two four (24) – due point one three (13) altimeter three zero three zero (3030) -expect visual approach runway one two (12) - landing and departing runway one two (12) - MALSR (Medium Intensity Approach Lighting System With Runway Alignment Indicator Lights) out of service until further notice.]

02:12:09.2 **Pilot-RDO** SAM - SAMCOM - SAM Two.

02:12:19.3 **SUP-DISP** SAM Two go ahead.

02:12:21.0 **Pilot-RDO** departed Ho- departed Hobart - four souls on board we have about sixty five minutes in the main - and we have four souls on board.

02:12:29.0 **RDO** [Sound of blocked transmission to another aircraft.]

02:12:36.6 **Pilot-RDO** Gary Tower medivac helicopter three one two sierra alpha.

Intra-Cockpit Communications

02:13:18.9 [Unintelligible comments likely due to audio
MEDCRW corruption.]

02:13:49.5 * * * .
MC2?

02:13:55.8 * * * what did you say? ten minutes (ago)?
MC1

Air to Ground Communications

02:12:40.1 on board - sixty five minutes of fuel - * * * .
SUP-DISP [Transmission was stepped on and was incomplete.]

02:12:42.3 medivac copter callin' Gary say again.
GYT-TWR

02:12:43.7 three one two sierra alpha off of Hobart uhh we
Pilot-RDO have your information and like to go to uhh Chicago Christ.

02:12:53.3 * * three one two sierra alpha transition
GYT-TWR approved as requested altimeter three zero two eight.

02:12:58.7 three zero two eight.
Pilot-RDO

02:13:45.2 * * * E T A to Christ?
SUP-DISP?

02:13:51.1 * SAM Two * * eleven minutes from now
Pilot-RDO

Intra-Cockpit Communications

02:13:59.8 * * yeah * eleven minutes.

Pilot

02:14:01.6 alright we're gunna go ahead and call * * .

MC1

02:14:08.1 so I gotta switch you back to - ?

Pilot

02:14:09.6 [comments related to setting the radio.]

MEDCRW

02:14:13.2 yep.

Pilot

02:14:14.5 [comments related to the Pilot having set up the
MEDCRW radio for a medical transmission.]

02:14:20.3 Advocate Christ - Advocate Christ
MC1-RDO

02:14:25.0 * #. [spoken under breath]

Pilot

02:14:32.1 we turnin' up?

MC1

02:14:33.2 Maybe.

MC2

Intra-Cockpit Communications

02:14:40.3 gunna be loud when they answer.

MC1

02:14:47.2 on MERCI. [Medical Emergency Radio
MC1? Communication for Illinois.]

02:14:50.0 [sound of increasing engine power.]

CAM

02:14:51.1 I was like "where is this coming from?"

MC1

02:14:55.1 * * *.

?

02:15:14.7 [brief conversation between medical crew.]

MEDCRW

02:15:28.4 alright try again.

MC2?

02:15:36.7 it shows that its transmitting.

MC1

Air to Ground Communications

02:14:43.2 Advocate Christ - Advocate Christ - this is
MC1-RDO Superior Air Med Two.

02:14:48.2 on MERCI.
MC1-RDO

02:15:30.0 Advocate Christ - Advocate Christ - this is
MC1-RDO Superior Air Med two on MERCI.

Intra-Cockpit Communications

02:15:48.3 lot of times they don't answer until you're on the
Pilot west side of Gary.

02:15:52.5 okay.

MC1?

02:15:54.1 [Medical crew comments related to confirming
MEDCRW Pilot's statement about helicopter's position as
stated above.]

02:18:12.9 [Medical crew discussed patient care.]
MEDCRW

02:19:22.2 you can try 'em from here.
Pilot

02:19:24.6 okay.
MC1?

02:19:26.3 [Medical crew discussed patient care.]
MEDCRW

Air to Ground Communications

02:16:14.6 [A mostly unintelligible ATIS transmission from
MDW-ATIS MDW. Unintelligible quality likely attributed to
a recording issue with the flight recorder audio
corruption.]

02:20:09.1 Midway tower medivac helicopter three one
Pilot-RDO two sierra alpha.

02:20:17.6 medivac helicopter three one two sierra alpha
MDW-TWR - alpha sierra - midway tower.

Intra-Cockpit Communications

Air to Ground Communications

02:20:22.2
Pilot-RDO yeah three one two sierra alpha just departed Gary's airspace we have kilo landing Christ.

02:20:33.5
MDW-TWR (alright) three one two sierra alpha ident say altitude squawk five one three one.

02:20:38.1
Pilot-RDO five one three one one thousand six hundred and ident.

02:20:59.0
MDW-TWR medivac helicopter two sierra alpha radar contact maintain V-F-R below two thousand monitor (southside/across) airspace on course is approved Midway altimeter three zero two six Midway winds zero nine zero at seven report landing assured at Christ.

02:21:12.6
Pilot-RDO three zero two six report landing assured medivac two sierra alpha

02:21:25.8 [Brief unintelligible Medical crew comments
MEDCRW related to patient care.]

02:21:54.5 [sound of four quick high frequency beeps,
CAM possibly attributed to a navaid.]

02:21:57.0 hey guys.
Pilot

02:21:58.1 * * *.
MC1?

Intra-Cockpit Communications

02:22:00.2 * * hold on guys.

Pilot

02:22:03.2 we gotta re-return to uh Gary you guys are gunna
Pilot have to go by ground I got a manual twist grip
here.

02:22:09.2 ohhh. okay.

MC1?

02:22:10.3 sooo I also - might need you guys to look- look it
Pilot up.

02:22:15.9 alright. I'll try to * Gary and uhh.

MC1?

02:22:16.8 uh uh one second.

Pilot

Air to Ground Communications

02:22:20.3 Midway Tower medivac three two sierra alpha
Pilot-RDO request.

02:22:23.9 go ahead sir.
MDW-TWR

02:22:25.3 yeah I'd like to return to uh Gary airspace um
Pilot-RDO medivac two sierra alpha.

02:22:30.3 go ahead two sierra alpha on course approve
MDW-TWR back (towards/direct) Gary.

02:22:32.9 two sierra alpha.
Pilot-RDO

Intra-Cockpit Communications

02:22:34.3 we're aborting the flight. [sounds similar to a
MC1? raised voice off of ICS system.]

02:22:38.1 alright here guys.

Pilot

02:22:41.1 I'mma hand this back to you.

Pilot

02:22:47.9 can you guys hear me?

Pilot

02:22:49.0 uhh barely. whatdya got?

Pilot

02:22:51.1 take this book.

Pilot

02:22:52.0 uh yeah hold on one second.

MC1

02:22:58.5 okay - what are we looking up?

MC1?

02:23:00.9 engine manual twist grip.

Pilot

02:23:20.9 [sound of electronic warning gong]

CAM

Air to Ground Communications

Intra-Cockpit Communications

02:23:22.4 say it again.

MC1

02:23:26.0 [start of sound similar to high rotor rpm alarm

CAM begins and last until 2:24:01.5]

02:23:27.3 [sound of heavy breath.]

Pilot

02:23:29.6 [sound similar to increase of rotor RPM]

CAM

02:23:32.5 (oh my god) * * *. [was not transmitted over ICS.]

MC1?

Air to Ground Communications

02:23:31.3 mayday mayday mayday.

Pilot-RDO

02:23:33.6 three one two sierra alpha.

Pilot-RDO

02:23:35.4 three one two sierra alpha what can I do for
MDW-TWR you sir?

02:23:39.1 uhh we just need to find a place to land.

Pilot-RDO

02:23:44.4 two sierra alpha can I get you any assistance?

MDW-TWR

02:23:47.2 uhh not at the moment we're going down.

Pilot-RDO

Intra-Cockpit Communications

02:23:50.0 warning. terrain. *.

HTAWS

02:23:50.1 [sound similar to brief increase in engine or rotor
CAM RPM.]

02:23:51.1 [sound similar to decrease engine or rotor RPM]

CAM

02:23:52.8 Lord help us.

MC1?

02:23:54.1 warning. terrain. *.

HTAWS

02:23:54.8 [sound of two heavy breaths.]

Pilot

02:23:58.0 warning. terrain. terrain.

HTAWS

02:23:59.6 [sound of wailing alarm.]

HTAWS

02:24:01.5 [sound of electronic warning gong.]

CAM

Air to Ground Communications

02:24:00.0 two sierra alpha do you know where you're
MDW-TWR gunna be landing at?

02:24:02.0 in a field.
Pilot-RDO

Intra-Cockpit Communications

02:24:03.9 [sound of heavy breathing.]

Pilot

02:24:05.0 warning. terrain.

HTAWS

02:24:06.3 [sound similar to low rotor RPM alarm, continues

CAM until 2:24:28.4]

02:24:06.4 * * .

MC1?

02:24:07.7 (stay calm) * * .

MC1?

02:24:08.4 [sound similar to decrease in engine or rotor RPM

CAM noise.]

02:24:08.7 [Unintelligible HTAWS alert, sounds similar in

CAM cadence to a sink rate warning.]

02:24:12.5 [Unintelligible HTAWS alert, sounds similar in

CAM cadence to a terrain warning.]

02:24:15.5 oh #.

Pilot

02:24:16.6 [sound of impact]

CAM

02:24:16.8 [sound of grunt.]

Pilot

Air to Ground Communications

Intra-Cockpit Communications

02:24:17.3 ahhh #.

Pilot

02:24:19.4 #.

Pilot

02:24:21.5 HTAWS not available.

HTAWS

02:24:28.4 [sound of quick electronic tone.]

CAM

02:24:42.2 [unintelligible crying and shouts. the pilot was
MEDCRW heard saying "yeah."]

02:24:42.8 [sound similar to electro-mechanical switch.]

CAM

02:24:58.0

Pilot-RDO

mayday mayday mayday - we're on the ground
- uhhh had an accident - three one two sierra
alpha.

02:25:59.0 [sound similar to ELT activation. The ELT may
CAM have triggered earlier but was only heard as other
equipment had shutdown.] **[End of Transcript.]**

[End of recording]

02:26:10.3