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

GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

CEN15FA210

By
Bill Tuccio, Ph.D.

WARNING

The reader of this report is cautioned that the summary of onboard audio and video recordings is not a precise science but is the best product possible from a Safety Board group investigative effort. The summary or parts thereof, if taken out of context, could be misleading. The summary 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 summary as the sole source of information.

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June 8, 2015

Onboard Image Recorder

Group Chairman's Factual Report
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1. EVENT SUMMARY

Location:	Austin, Texas
Date:	April 27, 2015
Aircraft:	Eurocopter MBB BK 117, N392TC
Operator:	Travis County STAR Flight
NTSB Number:	CEN15FA210

On April 27, 2015, about 2150 central daylight time (CDT), a helicopter rescue specialist (HRS) was fatally injured when she fell from a helicopter hoist during external hoist operations. The Eurocopter MBB BK 117 helicopter, N392TC, was not damaged during the accident. The pilot, crew chief (CC) (hoist operator), and patient were not injured. The helicopter was registered to the Travis County Purchasing office and operated by STAR Flight, Travis County, Austin, Texas as a public use operation. Night visual meteorological conditions prevailed during the local rescue flight. Onboard audio and video recordings from the cockpit and hoist were provided to the National Transportation Safety Board (NTSB).

2. GROUP

Chairman:	Dr. Bill Tuccio Aerospace Engineer NTSB
Member:	Craig R. Hatch Air Safety Investigator NTSB
Member:	Scott T. Tyrrell Continued Operational Safety Specialist Federal Aviation Administration
Member:	Casey Ping Program Director STAR Flight

Member: James R. Esquivel
Helicopter Rescue Specialist (HRS)
STAR Flight

Member: Seth D. Buttner
Manager, Accident Investigation
Airbus Helicopters, Inc.

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following items:

Device 1: **MicroSD Card**
Video Perspective 1: **Cockpit**

Device 2: **USB Drive**
Video Perspective 2: **Hoist**

3.1. Recorder Descriptions

STAR Flight records aerial rescue operations and uses the recordings for operational debriefings and training. Two video perspectives were provided.

3.1.1. Perspective 1: Cockpit

Cockpit audio and video was recorded by a North Flight Data Systems Outerlink Voice and Video Recording (OVVR) system. In addition to recording cockpit imagery from a camera located behind the pilot and facing forward, the system also recorded six separate audio channels and time synchronized GPS data. Proprietary OVVR software was used to recover and playback the video, audio, and GPS data.

The video was recorded in color, at 720 x 480 pixels at 30 frames per second (fps).

3.1.2. Perspective 2: Hoist

A camera was mounted above the external hoist, pointed straight down. In addition to recording video of hoist operations, merged audio from multiple sources was also recorded.

The video was recorded in color, at 720 x 480 pixels at 30 frames per second (fps).

3.2. Video Files

For this investigation, the hoist video was the primary source used by the group. The first four minutes of the cockpit video and audio recording were also

reviewed by the group; after four minutes, pertinent cockpit audio was duplicated on the hoist video recording.

3.3. Timing and Correlation

The times used in this report are expressed as local time of the accident (CDT).

Timing of the report was established by correlating OVVR GPS data recorded once per second with the OVVR cockpit recording. Specifically, review of the OVVR cockpit video and audio with GPS data confirmed all sources started at the same time.

Audio common to the OVVR cockpit recording and the hoist video was identified. Specifically, a statement uttered by the HRS at 0000:05 hoist video elapsed time was also recorded on the OVVR cockpit audio at 2042:39 CDT. Accordingly, 2042:34 was added to the hoist video to convert to CDT.

3.4. Acronyms and Definitions Used in this Summary

The following acronyms and definitions are used to describe audio and video events:

- **STAR Flight 1.** The accident helicopter flight call sign.
- **CC**. Crew Chief (who also operated the hoist).
- **Pilot**. Pilot of accident helicopter.
- **HRS**. Helicopter Rescue Specialist (who fell from the hoist).
- **Patient.** The person who was being rescued by STAR Flight 1.
- **Ground Resources.** Collectively, fire, emergency medical services, and police.
- **AFD.** Austin Fire Department.
- **Rescue 20.** Ground rescuer.

3.5. Summary of Recording Contents

The OVVR cockpit video and audio began at 2038:29 CDT, 3 minutes and 58 seconds before the hoist video and audio. The cockpit video and audio began when the aircraft was on the ground at University Medical Center at Brackenridge, Austin, Texas and recorded the pilot, CC, and HRS. There was no mention of CC or HRS safety checks[1]. The remainder of the OVVR cockpit video and audio was not pertinent to the investigation.

Video was recorded at night. The hoist was intermittently illuminated by lights on the helicopter and/or from lights on the ground.

At 2042:34 CDT, the hoist video began when the helicopter was enroute to the patient. The STAR Flight 1 crew discussed rescue operations internally and with ground resources. Conversations included: patient injuries, ground vs. air rescue options, extraction options, hazards, and mission planning.

[1] It is possible safety checks were performed before any recording devices were operating.

At 2106:34 CDT, HRS rescuer began to prepare for hoist insertion[2]. At 2106:46 CDT, the hoist camera captured the HRS' tri-link attachment (see other documents in the accident docket for photos) on the HRS' tac-air vest; the tri-link attachment was closed. At 2107:13 CDT, the crew verified the HRS UHF radio operability.

At 2108:05 CDT, the HRS was inserted via the hoist to the ground with a med-bag and Bauman Bag[3]. During the hoist-lowering operation, the HRS provided hand and radio signals. At 2109:13 CDT, the HRS spoke on the radio saying, "tree tops."

At 2109:29 CDT, the HRS spoke on the radio saying, "ten feet." The CC told the pilot he was going to lift the HRS up to bring the HRS further up the ridge line. At 2109:58 CDT, the HRS said "hook free." The hoist was then retracted by the CC.

At about 2112 CDT, as the hoist was retracting, a tree branch was caught in the hoist cable. As the hoist continued to retract, the tree branch got closer to the CC and the tree branch detail was discernible to include a Y-fork; the tree Y-fork was caught above the hoist bumper. The CC removed the tree branch from the hoist, did a cursory inspection of the hoist cable, coordinated with the pilot to safely drop the tree branch, and then dropped the tree branch from a low altitude on an uninhabited area free of man-made structures.

At about 2120 CDT, the HRS radioed STAR Flight 1 advising she would be "off the helmet" (i.e., off her personal UHF radio) and advising STAR Flight 1 she could be contacted through other nearby ground rescuers.

STAR Flight 1 then maneuvered and coordinated to use a trail line to lower a backboard to the ground rescuers.

At 2125:31 CDT, the CC did a visual and tactile inspection of the hoist cable for about two minutes. The pilot said he would advise maintenance about the tree branch incident at the conclusion of the mission.

At 2129:09 CDT, the HRS communicated over the radio asking STAR Flight 1 to please move away from the rescue site. The pilot and CC then discussed the request and moved the helicopter away from the rescue site[4].

At 2140:07 CDT, the HRS spoke on the radio saying, "we're ready for pickup."

STAR Flight 1 maneuvered over the rescue site, hovered, and lowered the hoist. Table 1 provides an audio and video transcript of the extraction operation and the

[2] Hoist insertion means the HRS exits the helicopter using the hoist.
[3] A Bauman Bag provides a single-point suspension for lifting a patient during a hoist or short-haul evacuation (http://www.cmcrescue.com/equipment/bauman-bag/).
[4] It is common during rescue operations for ground personnel to ask a helicopter to stand off for noise reasons.

HRS' fall from the hoist; table 2 provides a legend of symbols used in the transcript. From the time the HRS was inserted at 2109:58 CDT until the HRS was extracted at 2142:56 CDT was about 33 minutes. From the time the HRS said, "we're ready for pickup" to the time the HRS said, "ready for extraction," was about 2 minutes and 20 seconds. From the time the CC noted, "load off the ground" until the HRS fell from the hoist was about 52 seconds.

Table 1. Audio and video transcript of HRS extraction and subsequent fall from the hoist.

Time (CDT)	Audio Source	Audio	Video
2142:19	CC	rescuer has the hook. hold your hover.	CC was wearing night vision goggles.
2142:24	CC	they're still hooking up.	
2142:26	HRS	ready for extraction.	Two helicopter belly lights were illuminating the tree canopy. White lights (similar to flashlights) were visible on ground. Hoist was deployed and was already lowered to the HRS.
2142:27	CC	good position. hold your hover.	CC had right hand on cable. CC was on the helicopter skid, head was such that CC was looking down at HRS.
2142:29	CC	cable coming taut.	CC continued to have right hand on cable.
2142:34	CC	come forward (one). stop back. stop back. forward one.	
2142:39	CC	(come) forward. hold your hover.	
2142:43	CC	stop forward. hold your hover.	
2142:47	SOUND	[sound of electromechanical hum, similar to hoist motor operation]	
2142:49	CC	come left one.	Tree canopy was waving in response to rotor wash. Helicopter movement was consistent with CC callouts throughout this report.
2142:50	PILOT	left one.	
2142:51	CC	left one.	
2142:53	CC	stop left. hold your hover. hold your hover.	
2142:56	CC	lo-load is off the ground.	
2142:57	SOUND	[Static on unknown communication channel began and continued for 11 seconds]	
2142:58	PILOT	hoist up.	
2142:59	CC	hoist running.	
2142:59			HRS and Bauman Bag (containing the patient) were first discernible in the video. Helicopter two belly lights were not yet fully illuminating the Bauman Bag.

Time (CDT)	Audio Source	Audio	Video
2143:00	AFD	[garbled communication by AFD Battalion 6, ending with "let me know" when STAR Flight had landed at the school.]	
2143:06	CC	and axis is clear @.	Counterclockwise rotation of load (Bauman Bag and HRS); in and out of view of camera (due to lighting restrictions). About 1 full rotation per second.
2143:08	PILOT	axis is clear. moving forward.	
2143:08	SOUND	[Static that started 11 seconds earlier, stopped.]	Helicopter began forward flight. Load continued to move upward, closer to helicopter (i.e., hoist was retracting).
2143:09	CC	roger.	
2143:10	CC	got a little bit of a spin. not terrible.	
2143:14	CC	holding the cable out[5].	
2143:20	PILOT	got some good forward speed for you there.	
2143:21	CC	yeah.	
2143:21			Load rotation slowed to about 1 full rotation every 2.5 seconds.
2143:23	PILOT	nice gradual climb out.	
2143:24	CC	okay. spin is dissipating. I'm still leaving the cable out. I've got eighty feet of cable out.	
2143:27			Load rotation slowed to about 1 full rotation every 3 seconds.
2143:28	Rescue 20	[on radio discussing ground exit with AFD and two civilians.]	
2143:36	CC	spin is stopped.	Load rotation slowed to about 1/2 full rotation in 5 seconds.
2143:40			HRS leg movement was visible below the Bauman Bag and to the left side (see figure 1 for definition of left and right).
2143:41	CC	forty feet of cable out.	Helicopter belly lights illuminated the Bauman Bag, HRS, and hoist bumper such that the position of these three elements was clear. HRS was positioned on the left side of the Bauman Bag and HRS' head was in near proximity to head opening in the Bauman Bag. HRS' head was forward of the hoist bumper. HRS' helmet orientation was towards the aft of the Bauman Bag (see figure 1).

[5] "Holding the cable out" means the cable will not be retracted by the hoist operator.

Time (CDT)	Audio Source	Audio	Video
2143:43			Excess end of strap (about 2 to 3 feet) on forward part of Bauman Bag was fluttering in the wind on the right side of the Bauman Bag.
2143:44			Load rotation slowed to about 1 full rotation in last 11 seconds (and this was end of rotation).
2143:44			From 2143:06 until now, 11 total rotations (counterclockwise) of Bauman Bag and HRS were continuously visible; during the entire time the rotational velocity decreased.
2143:45	CC	rescuer and victim are ten feet below the skid.	Both arms of HRS appear to be extended forward and over the HRS' head, similar to grasping at a point below the hoist bumper.
2143:45	PILOT	I'll maintain my heading into the wind until we get--- [stops talking when CC begins to exclaim, "oh #"]	HRS fell from the hoist, with HRS's head looking up at the helicopter. Just prior to falling, each HRS' boot was visible and moving back and forth. As the HRS fell from the Bauman Bag, the Bauman Bag shifted position.
2143:47			As HRS fell, both hands came into view, in front of the HRS' torso; the hands were in close proximity to each other. As the fall continued, the HRS was obscured by the Bauman Bag (relative to the camera field of view).
2143:48	CC	oh # [exclaiming]. @ just fell. oh my God.	
2143:49	PILOT	what?	
2143:49			At this point, the HRS was no longer identifiable in the camera.
2143:52	CC	@ just fell. oh #.	

Table 2. Symbols used in transcript.

Symbol	Meaning
*	Unintelligible word
#	Expletive
( )	Questionable insertion
[ ]	Editorial insertion
@	Non-pertinent word

STAR Flight 1 continued to deliver the patient to the landing zone (LZ) and, as they flew to the landing zone, they attempted to notify various parties that the HRS had fallen from the hoist. During the delivery of the patient at the LZ, STAR

Flight 1's crew successfully notified various parties that the HRS had fallen from the hoist. The remainder of the video was not pertinent to the investigation.

Figure 1. Schematic overhead orientation of various elements described at about 2143 CDT.