National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594

CEN22FA317

WRECKAGE EXAMINATION

Group Chair's Factual Report

October 26, 2022

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A. ACCIDENT

Location:	Chapelle, NM
Date:	July 16, 2022
Time:	1920 MDT 0220 UTC
Helicopter:	Bell UH-1H / N911SZ

B. WRECKAGE EXAMINATION GROUP

Group Chair	Van S. McKenny IV National Transportation Safety Board Washington, DC
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C. SUMMARY

On July 16, 2022, about 1920 mountain daylight time, a Bell UH-1H, N911SZ, was substantially damaged when it was involved in an accident near Chapelle, New Mexico. The pilot, two tactical flight observers, and the rescue specialist sustained

fatal injuries. The helicopter was operated as a Title 41 *Code of Federal Regulations (CFR)* "Public Use" aircraft flight. Two witnesses on a ridge about 0.5 mile east of the accident site were observing the sunset and reported the helicopter flew past their location westbound, then rapidly descended without making any turns. A large plume of dust occurred when the helicopter impacted the ground.

Initial on-scene field examination of the wreckage was completed by NTSB investigative personnel on July 20, 2022. A full wreckage layout and engine examination was conducted on October 10th and 11th, 2022, at a wreckage storage facility in Greeley, CO. Continuity of the helicopter's rotor drive system and flight control systems were confirmed. The engine exam revealed that the compressor was seized, and metal chips were identified in the accessory gear box. The engine was shipped to Ozark Aeroworks for a full teardown and examination[1].

D. DETAILS OF THE EXAMINATION

1.0 Helicopter Information

1.1 Helicopter Description

The UH-1H helicopter is a thirteen place single engine helicopter with a maximum gross weight of 9,500 pounds (lbs.) (Figure 1). It was equipped with a single Ozark Aeroworks (formerly Honeywell and Lycoming) T53-L-703; the engine has a power rating of 1,800 horsepower (hp) engine. The helicopter is of the conventional design with a two bladed main rotor and a two bladed tail rotor mounted on a tail boom.

[1] See the powerplants factual report located in the official docket of this investigation.

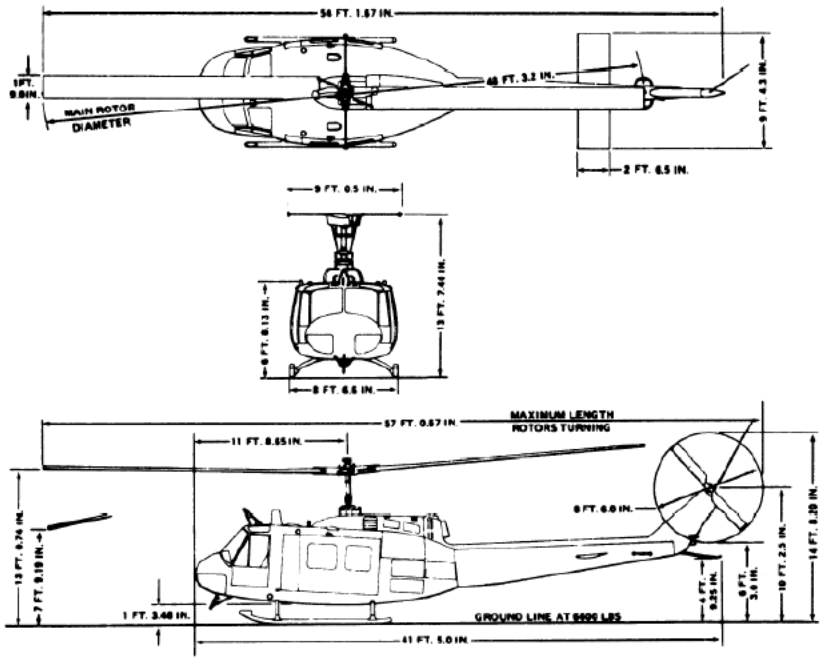

Figure 1. Principal dimensions diagram. (Figure source: US Army TM 55-1520-210-10)

1.2 Accident Helicopter History

The helicopter, serial number 70-16431, was manufactured as a UH-1H (Bell model 205, serial number 12736) by Bell Helicopter. It was purchased by the Bernalillo County Sheriff's Department from the US Army on March11, 1999. It was registered as a government aircraft, N600SD, on March 9, 2000. On August 16, 2007, the registration number was changed to N911SZ.

The following is a table of significant maintenance actions over the previous 12 months of operation (Table 1).

Table 1. Significant Maintenance.

Date	ACTT[2]	Maintenance Activity
7/26/21	7,561.30	Airworthiness Directive (AD) 2016-23-09, main rotor blade (MRB) inspection complied with.
8/7/21	7,566.10	AD 2016-23-09, MRB inspection complied with.
8/26/21	7,567.80	AD 83-03-03 100-hour (hr) tail boom skin joint inspection. Complied with UH-1 -12-AMAM-02 tail boom longeron & interior support 25 hr inspection.
9/11/21	7,571.70	25 hr service. Tail rotor (TR) lubrication, oil samples from main gear box (MGB), engine, intermediate gear box (IGB), tail rotor gear box (TGB).

[2] Aircraft total time (ACTT)

9/12/21	7,573.40	Engine chip light repaired. Small chip and oil sample sent to lab.
10/9/21	7,577.12	AD 2016-23-09, MRB inspection complied with.
11/20/21	7,579.60	Performed power check.
6/8/22	7,583.20	AD 2021-26-16 KAFlex inspection. Replaced KAFlex with part number (PN): SKPC2281-103, serial number (SN): 2562 with TIS 2031 hrs.
6/24/22	7,583.20	Phase 5 inspection completed. Tail hanger bearings, 42° gearbox, MR head, MR blades, stabilizer bar, mast. 50 hr engine wash. R&R starter/gen. Track and balance. Landing gear inspection. 100 hr. Van Horn TR blade inspection. R&R pitch horns. Track and balance.
7/2/22	7,589.90	AD 2016-23-09, MRB inspection complied with.
7/15/22	7,590.60	Daily inspection

2.0 Wreckage Documentation

2.1 On Scene

The wreckage was located in high southwestern desert terrain at an elevation of about 5,800 feet mean sea level (msl) near Chapelle, New Mexico and was populated with scrub juniper bushes. The initial ground impact area was easily identified by disturbed ground in the shape of helicopter tail and fuselage. The tail boom had separated from the main fuselage, both resting about 122 feet west of the initial impact area (Photo 2).

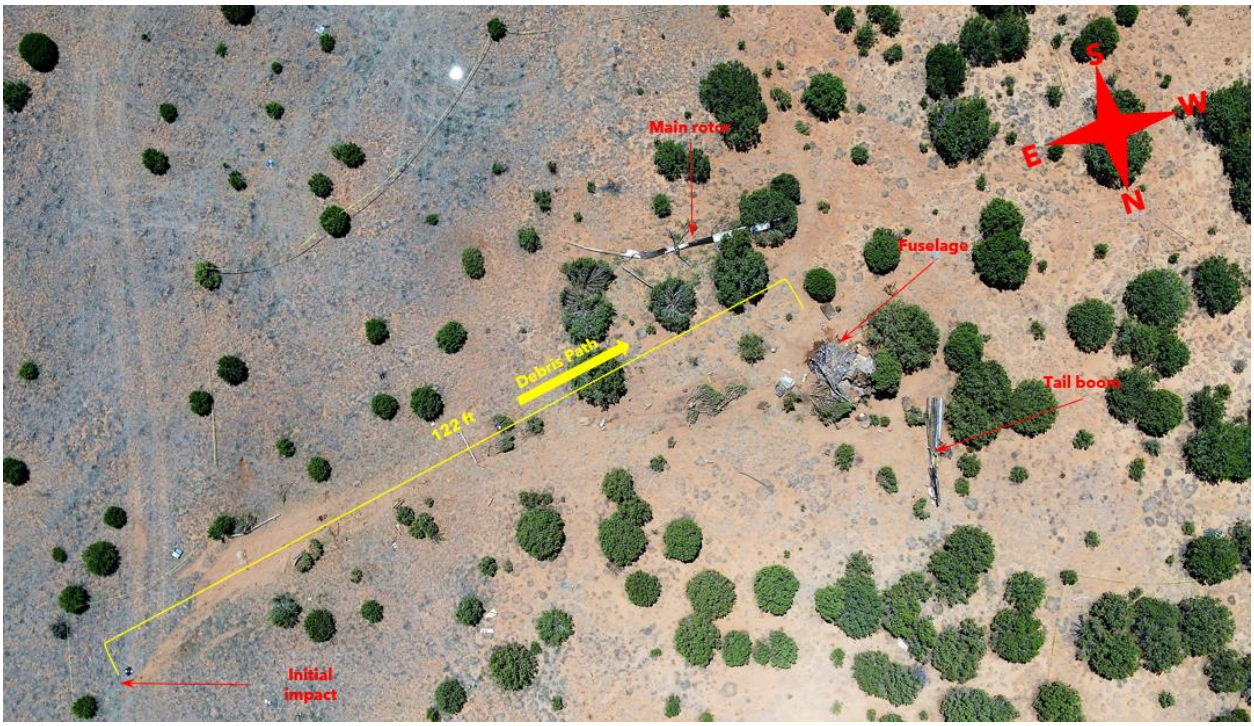

Figure 2. Overhead view of the accident site. (Photo source: Bernalillo County Sheriff Dept)

2.2 Airframe Examination

The front of the helicopter, from the nose to the top of the windshields, was destroyed and fragmented into barely recognizable parts. What remained of the fuselage was the roof, from the top of the windshield to the aft fuselage near the mount for the tailboom, and the floor. The floor of the helicopter began at the pedals and extended back to the aft end of the cabin. There were no seats installed in the cabin. The cockpit occupiable space was compromised by upward crushing of the floor and downward crushing of the roof. The pilot's seats remained attached at the floor mounts. The instrument panel remained intact and was partially attached by the instrumentation wiring. A Hobbs meter was installed in the cockpit and recorded 1,117.7 hours.

The tailboom separated from the fuselage and came to rest about 20 feet from the main wreckage. All the mounting points retained the mounting hardware and sections of the fuselage where it was mounted. The tailboom exhibited considerable upward crushing from the bottom of the tailboom upwards. The most severe crushing was observed at the end of the tailboom and extend forward toward the fuselage. The tail skid "stinger" was bent upwards significantly, consistent with a very hard contact with the ground. The left synchronized elevator separated from the tailboom and exhibited a contact mark on the underside, near the root, consistent with contact from one of the main rotor blades. An area of contact and damage was observed on the left side of the tailboom, consistent with contact from a main rotor

blade and coincided with the contact mark on the left synchronized elevator. The vertical stabilizer remained attached to the tailboom and exhibited significant downward bending sufficient enough to allow the tail rotor assembly to contact the ground.

The main landing gear sustained substantial damage. The left skid separated from the fuselage and was found in the wreckage closest to the first point of probable impact. The right skid separated from the cross tube at the mounts and was located further away. The aft cross tube separated from the fuselage. The forward cross tube remained attached to the fuselage and was displaced aft.

2.3 Rotor Drive System

The main transmission (PN: 204-0400331-5, numbers: A-1615) remained attached to the fuselage. The five support case mounts were attached to the airframe structure. The fifth mount beam was fractured at the center where the mount connects. The lift link remained attached at both ends. The transmission input quill rotated freely and turned the main rotor mast and the tail rotor output quill easily without noise or unusual sounds coming from the gears. The main generator mounting pad had a cover plate. The oil filter was not indicating bypass. The filter element was removed; no particulate or foreign material was observed in the filter folds. An area of the fuselage, directly below the input quill, exhibited rotational scoring, consistent with the rotating drive shaft contacting the area. The KAflex engine-to-transmission drive shaft had separated from both the engine output drive quill and the transmission input drive. The attachment flanges remained attached to the engine and transmission. The KAflex shaft with sections of the flexors attached to both ends, was located about 120 feet west of the main wreckage.

The tail rotor drive shaft had separated from the output quill of the transmission. Drive shaft No. 1 was flattened inside the heat shield and the forward end with the coupling was missing. The aft end was visible inside the heat shield, its end coupling was also missing. About a 6-inch section of drive shaft with an end coupling was in the wreckage but it could not be positively associated with the No. 1 drive shaft. The No. 2 drive shaft was located within the wreckage, both end couplings were present, and temperature dots indicated normal. Nos. 3 and 4 drive shafts were in place on the tail boom, their temperature dots indicated normal. The No. 5 drive shaft forward end was separated at the hanger bearing and the shaft was fractured about 1 foot 9 inches from the forward end with the fractured end flattened and torn. About one foot of the aft end with its coupling still attached was found in the wreckage. The 42° gear box was in place on the tail boom and rotated freely by hand, no binding observed. The No. 6 drive shaft had been pulled from the 42° gear box and the tail rotor gear box (TRGB), otherwise remained intact.

The TRGB (90° gear box) had separated from the top of the vertical stabilizer. The control chain remained attached to control quill sprocket. The tail rotor hub remained attached to the drive shaft. Both tail rotor blades had separated from the hub near the root. The pitch change links remained attached at both ends. The chip detector was removed from the TRGB and exhibited no metal shavings. The chip detector for the 42° gearbox had pulled out of the port by the impact forces and exhibited no metal shavings. One tail rotor control cable remained attached at the bell crank and the control chain. The other cable fractured in the tailboom just forward of the 42° gearbox.

2.4 Flight Controls

2.4.1 Antitorque/Directional Control

The left and right-side pedals were present in the cockpit. The right-side pedals were unmovable due to fracturing. The left-side pedals were movable. Control continuity was confirmed between left and right-side pedals continuing back to the interconnect control tube that passes behind the cabin, which was fractured. Control continuity was confirmed by aligning various fractured elements from the aft cabin through to the tail rotor servo, and tail rotor control cable bellcrank. The tail rotor control cable ran thru the length of the tail boom to the TRGB. One end of the tail rotor chain was disconnected from the cable. The tail rotor control servo remained attached to structure and control linkages at both ends. The pressure and return hydraulic lines were connected. The servo piston rod was measured about 4.0 inches from the top of the servo cylinder to the bottom threaded portion of the piston shaft end.

2.4.2 Cyclic Controls

Both cyclics were present in the cockpit and fractured at the base. Control tube linkage connections were confirmed from cockpit to the servo actuators, although the control tubes through the aft cabin were fractured and the bell cranks had separated from structure. Control continuity was confirmed from both lateral servos to the stationary swash plate and rotating controls. The left and right lateral cyclic control servos servo remained attached to structure with its control linkages at both ends. The pressure and return hydraulic lines were connected. The servo piston rods were measured; about 5.75 inches (left lateral) and about 2.25 inches (right lateral) from the top of the respective servo cylinder to the bottom threaded portion of the piston shaft end. Portions of the left and right lateral control rods were attached to the stationary swash plate.

2.4.3 Collective Control

Both collectives were present in the cockpit. The twist grip positions were marked with red paint by investigators. Both twist grips moved in concert. The collective jackshaft had fractured under the center console and at the base of the pilot's collective. The collective control tubes were continuous thru the aft cabin and terminated in a fracture. The control tube connecting to the lower collective servo bell crank through to the upper control tube had been liberated. The collective controls continued at the servo actuator and were continuous up through the collective sleeve lever and the rotating flight controls. The collective control servo remained attached to structure with its control linkages at both ends. The pressure and return hydraulic lines were connected. The servo piston rod measured about 5.5 inches from the top of the servo cylinder to the bottom threaded portion of the piston shaft end. The collective control rod was attached to the collective lever which was attached to the swash plate support.

2.4.4 Synchronized Elevator

The elevator controls were connected form the stationary swashplate, thru the bulkhead support, and fractured above the bulkhead support bell crank. Control pushrods resumed the walking beam assembly at the tail boom attach point and continued to the elevator torque tube.

2.4.5 Hydraulic System

The hydraulic reservoir, pump, pressure relief valve, and filter remained attached to aircraft structure. The hydraulic filter was examined, and no debris or contamination was identified in the filter element.

2.4.6 Main Rotor Head

The stationary and rotating swash plates remained on the mast. The two trunnion bearings on the top of the cyclic servos (longitudinal and lateral) remained secured in the rotating swash plate. Both scissors and drive links were attached to the rotating swash plate. Both stabilizer control tubes were fractured mid span. The mast retained one stabilizer damper; the other damper had separated from the mast but was recovered.

Both main rotor blade roots were attached to the blade grips. The blades had been cut chordwise outboard of the blade grips by recovery personnel. The mast nut was in place with all associated hardware. Both drag braces were attached to the blade grips. Both pitch horns had been pulled out of their grips. One stabilizer bar (red) was bent about a 30° angle. The mixing lever associated with the red blade had the retaining bolt on one side pulled out, the other was attached. The mixing lever

associated with the white blade had one retaining bolt misaligned with the mounting hole and the stabilizer bar control tube attach point was bent and fractured at the top. Additionally, the stabilizer bar control tube had been liberated from the mixing lever, the upper portion and the clevis of the tube was recovered. The mast had fractured across its diameter about 3.5 inches below the rotor hub. The majority of the fracture surface was about a 45° angle about the mast circumference. The mast was displaced towards the red blade with a crush aligned with the inside of the rotor hub along with a static stop witness mark on the mast. The opposite side of the mast also had a static stop witness mark. Both static stops on the underside of the rotor head had sheared off, leaving the attachment bolts shaft flush with the bottom of the rotor head.

2.5 Main Rotor Blades

The red blade (PN: 2042200-10, SN: A379) had been cut about 10 inches outboard from the blade pin. At about the 4-foot 6-inch location, there were 45° white scuff marks, a linear gouge, blade spar fracture, and downward bending evident. The blade after body had separated from blade spar starting at about 8 feet 6 inches out to the blade tip. Total length of the blade was about 20 feet 5 inches, the tie down was in place on the blade tip and the blade weights remained installed.

The white blade (PN:2042200-101, SN: A474) had been cut about 2 feet 9 inches outboard of the blade pin. The blade spar was fractured at the 17 feet 2 inch location. About one foot 8 inches of the blade tip afterbody had separated. The blade tip tie down cover was not present, but the plate attachment screws were in place. The blade weights interior to the blade tip spar had been liberated.

2.6 Tail Rotor

The tail rotor head (PN: 204-011-722-005, SN: A-FS5713) remained attached to the mast. The flapping stops exhibited hard contact marks. All tail rotor control hardware is present and connected. The tail rotor head and mast rotated freely by hand, and drive continuity from gearbox input quill through the gearbox to tail rotor was established.

About 1 foot 5 inches of the red blade (PN: 2042200-101, SN: A379) was retained in the blade grip. The fracture was chordwise initiated at a leading-edge gouge. The leading-edge erosion strip remained attached for the remaining length of the blade. The outboard section of blade was not with the wreckage.

About 11 inches of the white blade (PN: 2042200-101, SN: A474) remained in the blade grip with a 45° fracture line. The remaining about 2 feet 10 inches of the blade was recovered with the wreckage.

2.7 Fuel System

The vertical fuel bladder, consisting of three cells, and two main lower left and right fuel bladders had been removed from the wreckage by recovery personnel. All fuel bladders appeared intact with no observable holes or cuts. The main filler cap was in place. The vertical bladder inspection panel and left vent cover plates had been removed by recovery personnel. The left lower fuel bladder fuel pump and cover had been removed by recovery personnel. The right bladder inspection cover plate was removed by investigative personnel. The two lower bladders were cut open to facilitate internal inspection. The vertical bladders were examined internally by viewing through the vent port, center inspection panel, and filler port. No debris or foreign object were observed in any of the fuel cells.

2.8 Cockpit Instruments

Table 2. Pilot's Instruments

Airspeed	0 knots (kts)
Dual tachometer	Rotor (R): 0% rpm, Engine (E): 0% rpm
Torque	0 pounds per square inch (psi)
N2	0 %
Exhaust temperature	100ºC
Attitude Gyro	25° nose down, left wing down
Altimeter	Inches of Mercury (In-hg) 30.17, 6450 feet
Vertical Speed Indicator (VSI)	-550 feet per minute (fpm) rate of descent
Compass	065°
Turn/Slip	Left turn, ball free

Table 3. Center Console Instruments

Fuel Quantity	1,050 lbs
Engine oil pressure	0 psi
Trans oil pressure	0 psi
DC Volts	0

AC Volts	0
Standby Generator	0
Main Generator	Inop sticker
Transmission Oil Temperature	-60° C
Engine Oil Temperature	-60° C
Fuel Pressure	17 psi

Table 4. Copilot's Instruments

Altimeter	In-hg 30.38, 2200 feet
Attitude Gyro	Left wing low, OFF flag
Vertical Speed Indicator (VSI)	750 fpm rate of climb
Airspeed	Needle broken off

Table 5. Center Console Switches

Chip det	Both
Hoist cut	Covered and safety wired
Force Trim	OFF
Hydraulic	ON
Start fuel	ON
Fuel	ON
Low RPM	ON
Int Aux Fuel Left	OFF
Int Aux Fuel Right	OFF
Deice	OFF
Governor	Auto
Search Light	NORMAL
Light Switch	Down position

2.8.1 Caution/Warning Panel Examination

The caution/warning panel (Figure 3) and three (3) master caution lights from the accident aircraft were submitted to the Materials Laboratory for examination. The caution/warning panel consisted of twenty (20) individual annunciators containing two (2) bulbs each. The panel was intact and exhibited only minor impact damage. The left and right master caution lights each contained three (3) bulbs and the center master caution contained two (2) bulbs. No hot filament stretch was found in any of the bulbs for the annunciator panel (Attachment 1). The status of the lights ("on" or "off" at impact) is inconclusive. It is possible that the panel was not subjected to sufficient impact force needed to stretch the bulb filaments.

Figure 3. Caution/Warning Panel

The master caution lights were examined, and no hot filament stretch was found in any of the master caution lights. The status of the lights ("on" or "off" at impact) is inconclusive. It is possible that the panel was not subjected to sufficient impact force needed to stretch the bulb filaments.

E. LIST OF ATTACHMENTS

Attachment 1 – Email report-CEN22FA317 (Annunciator panel and master caution lights)

Submitted by:

Van S. McKenny IV
Aerospace Engineer (Helicopters)

FACTUAL REPORT – ATTACHMENT 1

Caution/Warning Panel Examination

WRECKAGE EXAMINATION

CEN22FA317

From: [redacted]
To:
Cc:
Subject: Email report-CEN22FA317 (Annunciator panel and master caution lights)
Date: Monday, November 7, 2022 2:47:08 PM

Van, Michael, and Matthew,

The annunciation panel and three (3) master caution lights from the accident aircraft were submitted to the Materials Laboratory for examination. The annunciator panel consisted of twenty (20) individual annunciators containing two (2) bulbs each. The panel was intact and exhibited only minor impact damage. The left and right master caution lights each contained three (3) bulbs and the center master caution contained two (2) bulbs. The layout of the annunciator panel with the status of each bulb filament is listed below.

ENGINE OIL PRESS BNS INS	**AUX FUEL LOW** INS INS
SPARE INS BNS	**XMSN OIL PRESS** INS INS
SPARE INS INS	**XMSN OIL HOT** INS INS
ENGINE CHIP DET INS INS	**HYD PRESSURE** BNS BNS
LEFT FUEL BOOST BNS BNS	**ENGINE INLET AIR** INS INS
RIGHT FUEL BOOST INS INS	**INST INVERTER** BNS BNS
ENG FUEL PUMP INS INS	**DC GENERATOR** BNS BNS
20 MINUTE FUEL INS INS	**EXTERNAL POWER** INS INS
FUEL FILTER INS INS	**CHIP DETECTOR** INS INS
GOV EMER	**IFF**

INS INS	INS INS

Table Legend:

INS-Intact, Not Stretched
BNS-Broken, Not Stretched.

No hot filament stretch was found in any of the bulbs for the annunciator panel. The status of the lights ("on" or "off" at impact) is inconclusive. It is possible that the panel was not subjected to sufficient impact force needed to stretch the bulb filaments.

The status of the bulbs for the master caution lights are listed below. No hot filament stretch was found in any of the master caution lights.

Left Master Caution- INS BNS INS
Center Master Caution- INS INS
Right Master Caution- INS INS BNS

Legend:

INS-Intact, Not Stretched
BNS-Broken, Not Stretched.

The status of the lights ("on" or "off" at impact) is inconclusive. It is possible that the panel was not subjected to sufficient impact force needed to stretch the bulb filaments.

If you have any questions, please let me know.

Nancy B McAtee
Senior Chemist
RE-30