National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

ERA22FA279

AIRWORTHINESS

Group Chair's Factual Report

May 26, 2023

A. ACCIDENT

Location: Amherstdale, West Virginia
Date: June 22, 2022
Time: 1645 eastern daylight time
Helicopter: Bell UH-1B, registration N98F

B. AIRWORTHINESS GROUP

Group Chair	Chihoon Shin National Transportation Safety Board Washington, District of Columbia
Group Member	Todd Gentry Federal Aviation Administration Washington, District of Columbia

C. SUMMARY

On June 22, 2022, about 1645 eastern daylight time, a Bell UH-1B helicopter, N98F, was destroyed when it was involved in an accident in Amherstdale, West Virginia. The private pilot, two pilot-rated passengers, and three additional passengers were fatally injured. The helicopter was operated by MARPAT Aviation, LLC, as a Title 14 *Code of Federal Regulations* (CFR) Part 91 flight.

The helicopter impacted a rock face about 3.5 nautical miles east of Logan County Airport and came to rest partially inverted on its right side on an asphalt road. The wreckage spanned the 26-foot road and continued into a ditch at the base of the rock face. The main wreckage was 542 feet past a utility cable that crossed about 180 feet above the road. Two utility cables were fractured and displaced toward the main wreckage near the roadside at 220 feet and 397 feet from the remaining utility cable. All major components of the helicopter were located in the vicinity of the accident site.

On June 23-24, 2022, the Airworthiness Group Chair examined the wreckage at the accident site in Amherstdale, West Virginia. The wreckage was recovered on June 24, 2022, and transported to Atlanta Air Salvage in Griffin, Georgia. On June 26, 2022, the Airworthiness Group convened at Atlanta Air Salvage to examine portions of the recovered wreckage. From August 16-18, 2022, the Powerplants Group convened at Ozark Aeroworks facilities in Springfield, Missouri to conduct a teardown examination of the engine.

D. DETAILS OF THE INVESTIGATION

1.0 Helicopter Information

1.1 Helicopter Description

The Bell UH-1B is a former military helicopter that may be type certificated by the Federal Aviation Administration for civil operations. See Section 3.0 of this report for additional details of the type certification of the accident helicopter. The UH-1B has a two-bladed, semi-rigid rotor system that provides helicopter lift and thrust and a two-bladed tail rotor system that provides thrust for directional control of the helicopter. The UH-1B is equipped with an Ozark Aeroworks T53-L-11D engine.[1] The helicopter is equipped with a skid-type landing gear.

All left, right, up, and down orientations as well as clock positions referenced in this report are in the aft-looking-forward frame of reference unless otherwise specified.

1.2 Accident Helicopter History

The accident helicopter, N98F, had serial numbers (S/Ns) 488 and 62-1968, and was originally manufactured in 1962.[2] The engine installed on the accident helicopter was S/N LE-12411. At the time of the accident, the helicopter was certificated under the experimental exhibition category. Section 3.0 of this report discusses the airworthiness certification history of the accident helicopter.

According to helicopter records, the accident helicopter had an aircraft total time (ATT) of 9,029.3 hours on March 29, 2022. Based on statements from the operator, the helicopter had operated about 14 hours from March 29, 2022 until the accident for an ATT of 9,043.3 hours at the time the accident occurred.

2.0 On-Scene and Post-Recovery Wreckage Examination

2.1 Airframe

The helicopter came to rest on its right side, partially inverted, at a heading of 335° magnetic (**Figure 1**). The accident location was about 37°52’6” N by 81°50’35” W on an asphalt road that was adjacent to a steep rock face to the north. Near the top of the steep rock face, about 40 feet high, pieces of Plexiglas, a blue colored T-fitting, a segment of spring, the aft cap of the left skid, and a rock with green paint transfer

[1] Federal Aviation Administration (FAA) type certificate data sheet (TCDS) No. E1EA, applicable to the T53-series engine, was transferred from Honeywell to Ozark Aeroworks on May 6, 2022.
[2] The manufacturer’s (Bell) S/N was 488 and the customer’s (US Army) S/N was 62-1968.

was found north of the main wreckage (**Figure 2**). A section of tail rotor blade was also found on this steep rock face.

Figure 1. The main wreckage site with the steep rock face to the right in the image.

Figure 2. The red circle denotes the area where pieces of Plexiglas, the aft cap of the left skid, a tail rotor blade segment, and a green paint transfer onto a rock.

About 542 feet to the northeast of the wreckage, a single [inactive] powerline, about 180 feet high, remained suspended in the air and crossed the road (**Figure 3 and Appendix A**). Two severed [inactive] powerlines were found on the ground and displaced toward the wreckage, about 220 feet and 397 feet, from the single suspended powerline (**Figures 4 and 5**). Google Street View (images circa June 2021) of the location of the single powerline still suspended in the air showed there were previously three power lines spanning the road (**Figure 6 and Appendix A**). A piece of the main gearbox fairing (**Figure 7**) was found in the vegetation to the south of the road about 225 feet northeast of the wreckage.

Figure 3. A single suspended powerline about 542 feet northeast of the main wreckage.

Figure 4. The severed end of powerline about 220 feet away from the single suspended powerline.

Figure 5. The severed end of the powerline about 397 feet away from the single suspended powerline.

Figure 6. Three powerlines visible in Google Street View near the accident site.

Figure 7. A fractured piece of the main gearbox forward fairing found about 225 feet northeast of the main wreckage.

The cockpit and cabin had impacted the road and a guardrail, and both were consumed by the postcrash fire (**Figure 8**). The empennage, composed of the tail boom, vertical fin, and horizontal stabilizer, remained attached to the aft fuselage. The right horizontal stabilizer was impact deformed at its tip end and the left horizontal stabilizer was intact. The vertical stabilizer and tail boom exhibited wrinkling on its skin from impact. Additionally, at the lower portion of the vertical fin, where it attaches to the tail boom, the cowling was impact deformed, possibly due to main rotor blade contact.

The right landing skid was found adjacent to the aft fuselage, but according to first responders, this skid was moved to facilitate rescue efforts. The left landing skid was found to the northeast of the main wreckage in a ditch on the side of the road. The aft cap of the right skid remained attached to the right skid. An impact gouge on the road was present near the aft end of the empennage. This impact gouge had a linear gouge leading up to a deeper gouge which could be due to impact with a main rotor blade or skid tube.

Figure 8. The cockpit and cabin wreckage.

2.2 Main Rotor System

Both main rotor blades remained attached to their respective grips and drag braces, which remained attached to the hub. The hub remained attached to the main rotor mast. The pitch horn for the 'red' main rotor blade was separated at its grip. The pitch horn for the 'white' main rotor blade remained intact.

The main gearbox was present in its normally installed area but was separated from the airframe. The lower side of the main gearbox housing was partially melted, exposing the input pinion gear and the lower end of the main rotor mast. The input pinion gear and the mating bevel gear exhibited no missing gear teeth, gouges, or other anomalous wear.

The input driveshaft was separated from the main gearbox and the engine. The input driveshaft was found underneath the main gearbox. The majority of the splines at the forward end of the input driveshaft were fractured and separated. The aft end splines of the input driveshaft were generally intact. For the internal splines on the main gearbox (for the input driveshaft), about ¼ of the circumference was impact-separated but the remaining spline profiles were intact. For the internal splines on the engine (for the input driveshaft), the splines were all present and were intact.

2.2.1 'White' Main Rotor Blade

The 'white' main rotor blade was part number (P/N) 204-011-001-15 and S/N A00000010. The leading edge spar was continuous through the blade span. About 31 inches from the tip end of the 'white' blade, there was a chordwise fracture from the trailing edge, forward of the spar about 16 inches chordwise. At the spar, the fracture curved inboard for about 14 inches. Starting about 85 inches from the tip end, a 100-inch section of the afterbody was separated from the spar and the adhesive normally between the two was visible, with minimal afterbody attached to the exposed adhesive. Within this segment, about 41.5 inches inboard from the afterbody separation, there was a chordwise fracture only on the lower skin.

2.2.2 'Red' Main Rotor Blade

The 'red' main rotor blade was P/N 204-011-001-15 and S/N A00000015. The outboard half of the blade exhibited deformation in the direction opposite of normal rotation and the afterbody in this section was fragmented into multiple pieces. These afterbody pieces were found to the east of the main wreckage. The tip end had impact damaged that matched an impact gouge on the road (**Figure 9**). The impact gouge on the road was about 3 inches deep and generally oriented to the northeast. The leading edge spar was continuous to the tip. There was a chordwise upward bend near the inboard side of the main rotor blade.

Figure 9. Suspected ground and guardrail strike from the 'red' main rotor blade.

2.3 Tail Rotor System

2.3.1 Tail Rotor Drive System

The forward section of the tail rotor drive shaft, underneath the engine, was partially consumed by the postcrash fire but continuous through the forward hangar bearing. The tail rotor drive shaft was continuous through the tail boom to the intermediate (42°) gearbox input. The vertical fin tail rotor drive shaft was fractured and separated from the intermediate gearbox output, but continuous through the vertical fin to the tail gearbox input.

The tail rotor (90°) gearbox input housing remained attached to the vertical fin, but the remainder of the tail rotor gearbox was separated and found on the road [as a single assembly] near the vertical fin. The two tail rotor blades remained attached to their respective grips but were fractured chordwise at the outboard end of the root doublers. Manual rotation of the tail rotor resulted in a corresponding rotation of the tail gearbox output gear. The rotation was smooth with no evidence of binding.

2.3.2 Tail Rotor

The outboard section of one tail rotor blade, S/N ATR72106, was found on the side of the road about 10-20 feet away from the main wreckage. The pitch change link of tail rotor blade S/N ATR72106 remained attached to the pitch change crosshead but was separated from its pitch horn; the hardware was not present at the pitch change horn (**Figure 10**). However, the inboard metal boss, which mates to the pitch change link, exhibited an indent deformation localized to about 1/5 of its circumference (**Figure 11**).

The second tail rotor blade, S/N A2741, exhibited opening of its trailing edge at its inboard section. The outboard section of tail rotor blade S/N A2741 was found at the top of a steep rock face about 60 feet away from the main wreckage. The pitch change link of tail rotor blade S/N A2741 remained attached to both the pitch horn and the pitch change crosshead.

Figure 10. The separated pitch change link for tail rotor blade ATR72106.

Figure 11. The red arrow points to the visible indentation on the metal boss of the pitch link connection to tail rotor blade S/N ATR72106.

The pitch change mechanism was continuous from the spur gear (on the inboard end of the output shaft) and the crosshead. The tail rotor crosshead was removed from the pitch change quill and exhibited no anomalous damage. All hardware for the crosshead, [splined] slider, and hub and teeter installation were present. The splines for the slider and the hub and teeter assembly exhibited no anomalous wear. Remnant grease was present on all splines. The tail rotor blades were removed at their grips via removal of their retention bolts and balance washers.

The tail rotor head, pitch change crosshead, and pitch change links were retained and submitted to the NTSB Materials Laboratory for further examination.[3]

2.4 Flight Control System

The swashplate and control levers remained installed on the main rotor mast. The two control tubes remained attached to the swashplate but were fractured below the upper rod end connection. The stabilizer bar remained attached to the hub, but the side of the bar attached to the 'white' main rotor blade controls was fractured from impact.

A cyclic control and collective control were found in the cockpit wreckage but were thermally damaged. The twist grip throttle position from the collective control could not be determined. Remnant portions of the control system from the cockpit controls to the main rotor controls were fractured and consumed by the postcrash fire.

The tail rotor control tubes forward of the aft fuselage were fractured and consumed by the postcrash fire. Within the empennage, the tail rotor control tubes remained connected to their bellcranks back to the tail gearbox. The tail rotor pitch control mechanism was continuous through the tail rotor gearbox and to the tail rotor blade pitch horns.

2.5 Powerplant

The engine, S/N LE-12411, remained partially attached to the airframe but remained within its normally installed area (**Figure 12**). Pieces of the inlet screen were present but was separated from the engine's inlet duct. The engine inlet duct was present but was separated from the engine inlet housing. When viewing the power turbine blades through the engine exhaust diffuser, two blades had fractured and separated near the blade root (**Figure 13**). There was one intact turbine blade between the two separated blades. The remaining power turbine blades appeared intact, full length, and did not exhibit thermal damage. The investigation of the accident engine can be found in the Powerplants Group Chair's Factual Report, found in the docket for this investigation.

[3] NTSB Materials Laboratory Report No. 22-054 can be found in the docket for this investigation.

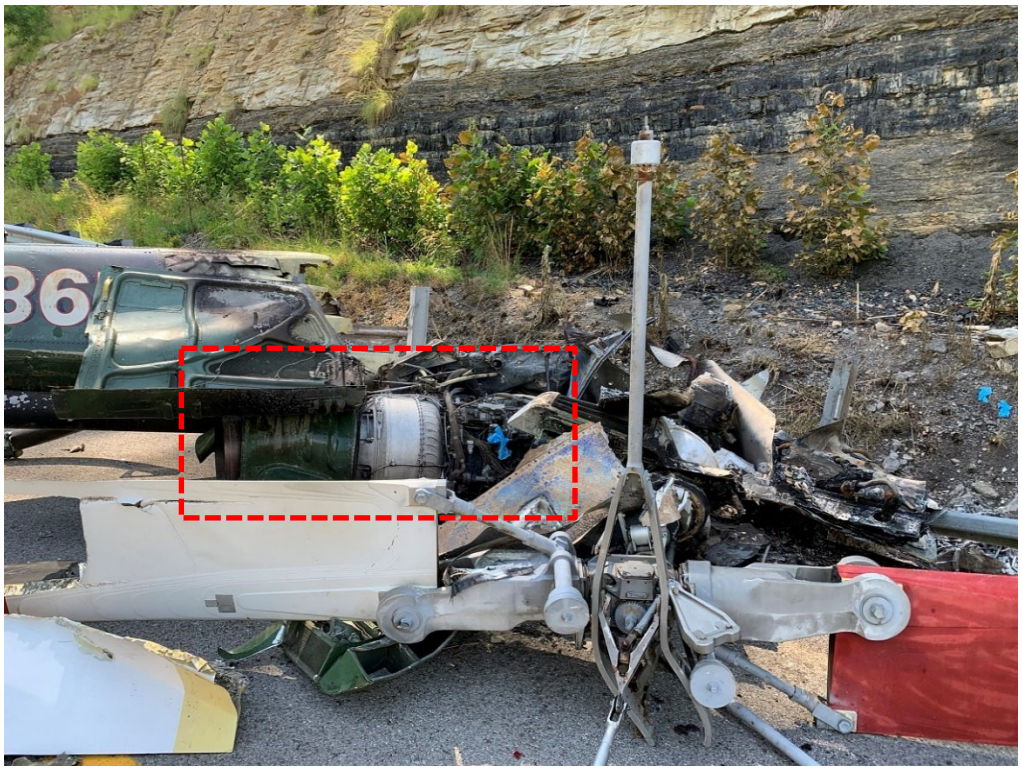


Figure 12. The red box identifies the engine within the wreckage.

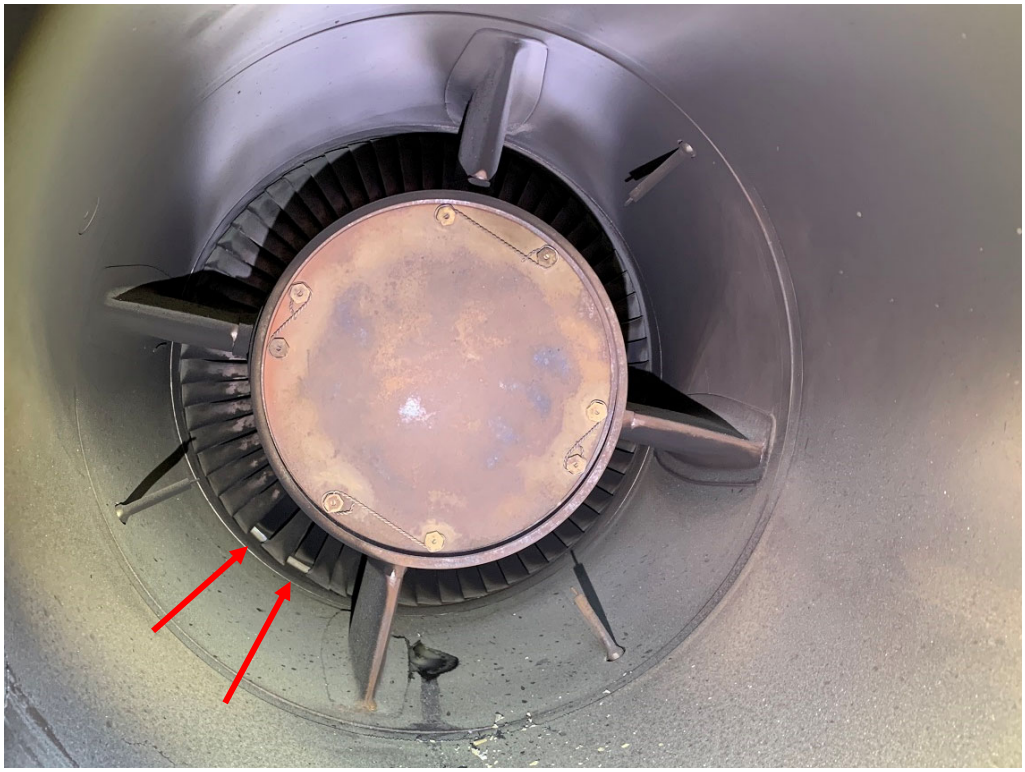


Figure 13. The power turbine blades viewed through the exhaust. The red arrows point to the two missing power turbine blades.

3.0 Experimental Category Special Airworthiness Certification

3.1 Special Airworthiness Certification

Federal Aviation Administration (FAA) Order 8130.2 establishes policies and procedures for issuing airworthiness certificates, export certificates of airworthiness, and special flight authorizations for aircraft. A letter is appended to order to indicate its version. A change to an order can be issued to modify the current version of the order, and generally the next version of the order will incorporate those changes. As of the date of this report, the current and active version is FAA Order 8130.2J, titled "*Airworthiness Certification of Aircraft*", dated July 21, 2017. FAA Order 8130.2J canceled and superseded Order 8130.2H, dated February 4, 2015, which in turn canceled Order 8130.2G, dated August 31, 2010, and all clarification and deviation memos as well as previous revisions dated February 4, 2015 or earlier.[4] **Table 1** shows the timeline in which the different versions of 8130.2 were issued, as well as changes and deviations that are discussed later in this section.

Table 1. A timeline of issuance of FAA Order 8130.2.

Document	Effective Date
8130.2G	August 31, 2010
8130.2G Memorandum of Deviation	December 21, 2011
8130.2G Change 1	July 2, 2012
8130.2H	February 4, 2015
8130.2J	July 21, 2017

In Order 8130.2G, 8130.2H, and 8130.2J, Chapter 4 contains guidance on special airworthiness certifications. In Chapter 4 of Orders 8130.2G and 8130.2H, Section 10 contained guidance on the certification and operation of aircraft under the experimental purpose of exhibition or air racing. Chapters 4 and 12 of Order 8130.2J contained guidance on the certification of aircraft under the experimental purpose of exhibition. When issuing a special airworthiness certificate, the FAA issued operating limitations that were enumerated on a separate sheet, dated, and signed by an FAA inspector.

3.1.1 FAA Order 8130.2G

In Order 8130.2G Chapter 4, Section 10, paragraph 4110 divided aircraft eligible for experimental airworthiness certification into seven Groups to establish standardized operating limitations and inspection requirements. Group 5 best fit UH-1B helicopters as a turbine-powered aircraft with a maximum gross takeoff weight less than 12,500 pounds.[5] Group 5 aircraft must be in full compliance with

[4] Order 8130.2G Change 1, dated July 2, 2012, incorporated changes to the guidance related to the certification process of light-sport aircraft.
[5] FAA TCDS No. H3SO states that the UH-1B helicopter maximum gross weight is 8,500 pounds.

manufacturer or country of origin life limits (if specified) and in full compliance with the manufacturer, country of origin, or FAA-approved maintenance and inspection program.

In the enumerated operating limitations (paragraph 4113), limitation Nos. 29, 30, 31, and 32 discussed inspection of the aircraft and stated the following:

> *(29) All large airplanes, turbojet airplanes, turbopropeller-powered multiengine airplanes, or turbine-powered rotorcraft must be maintained in with accordance an FAA-approved inspection program meeting the scope and content as described in 14 CFR §91.409(f). Completion of these inspections must be recorded in the aircraft maintenance records.*
>
> *(30) Inspections for all large airplanes, turbojet airplanes, turbopropeller-powered multiengine airplanes, and turbine-powered rotorcraft must be recorded in the aircraft maintenance records showing the following, or a similarly worded, statement: "I certify that this aircraft has been inspected on [insert date] in accordance with the scope and detail of [identify applicable inspection program] and found to be in a condition for safe operation."*
>
> *(31) No person may operate aircraft other than those described in limitations (29) and (30) of this paragraph unless within the preceding 12 calendar months it has had a condition inspection performed in accordance with the scope and detail of 14 CFR Part 43, Appendix D, or other FAA-approved programs, and was found to be in a condition for safe operation. This inspection will be recorded in the aircraft maintenance records.*
>
> *(32) Condition inspection for aircraft other than those described in limitations (29) and (3) of this paragraph must be recorded in the aircraft maintenance records showing the following, or a similarly worded, statement: "I certify that this aircraft has been inspected on [insert date] in accordance with the scope and detail of 14 CFR Part 43, Appendix D, and found to be in a condition for safe operation." The entry will include the aircraft's total time-in-service and the name, signature, certificate number, and type of certificate held by the person performing the inspection.*

Within paragraph 4113, Table 4-1 contains a matrix of operating limitations to be issued for each Group. For Group 5 aircraft, operating limitation Nos. 29 and 30 were required to be issued and operating limitations Nos. 31 and 32 were not required to be issued. **Attachment 1** contains FAA Order 8130.2G Chapter 4, Section 10.

3.1.2 FAA Memorandum of Deviation to Order 8130.2G, Chapter 4, Section 10

On December 21, 2011, a FAA memorandum for a deviation from Order 8130.2G, Chapter 4, Section 10, was issued by the Production and Airworthiness Division (AIR-200) to the Aircraft Maintenance Division (AFS-300) and General Aviation and Commercial Division (AFS-800). The memorandum authorized deviation from FAA Order 8130.2G, Chapter 4, Section 10 and served to clarify the operating limitations placed on experimental airworthiness certificates issued for the purpose of exhibition or air racing. Additionally, the memorandum stated that the procedures attached to the deviation must be used instead of Order 8130.2G.

In the memorandum, paragraph 4110 divided aircraft eligible for experimental certification into six Groups. Group 2 applied to UH-1B helicopters as a small rotorcraft with a maximum gross takeoff weight not more than 12,500 pounds. In paragraph 4111(c), "Records Inspection", sub-subparagraph (4) stated the following:

> *(4) For aircraft with a gross takeoff weight of more than 12,500 pounds or turbojet, or turbine-propeller powered multiengine airplane, or a turbine powered rotorcraft aircraft, verify that the applicant has an FSDO-approved inspection program that meets the requirements of §91.409. However, the owner or operator of a turbine-powered rotorcraft may elect to use the inspection provisions of §91.409(a), (b), (c), or (d) in lieu of an inspection option of §91.409(f).*

Within the memorandum, Table 4-1 contains a matrix of operating limitations to be issued for each Group. In the enumerated operating limitations, limitation Nos. 29, 30, 31, 32, and 33 were considered "if required"[6] for Group 2 aircraft and stated the following:

> *(29) All single engine turbojet airplanes and turbopropeller-powered airplanes must be maintained in accordance with an FAA accepted inspection program of such detail to encompass the entire aircraft. Completion of inspections must be recorded in aircraft maintenance records and include the following items: date, work performed, name and certificate number of persons returning aircraft to service.*
>
> *(30) All large airplanes, turbojet multiengine airplanes, turbopropeller-powered multiengine airplanes, or turbine-powered rotorcraft must be maintained in accordance with an FAA approved inspection program meeting the scope and content as described in 14 CFR §91.409(f). Completion of these inspections must be recorded in the aircraft maintenance records.*

[6] Within a note in Table 4-1 of the memorandum of deviation, "if required" is described as a condition or limitation that is included on the airworthiness certificate if required by the aircraft type.

(31) Inspections for all turbine airplanes and turbine-powered rotorcraft must be recorded in the aircraft maintenance records showing the following, or a similarly worded, statement: "I certify that this aircraft has been inspected on [insert date] [identify applicable inspection program] and found to be in a condition for safe operation."

(32) The inspections for aircraft must be recorded in the aircraft maintenance records showing the following, or a similarly worded, statement: "I certify that this aircraft has been inspected on [insert date] in accordance with the scope and detail of 14 CFR part 43, appendix D, and found to be in a condition for safe operation." The entry will include the aircraft's total time-in-service and the name, signature, certificate number, and type of certificate held by the person performing the inspection.

(33) No person may operate an aircraft unless within the preceding 12 calendar months it has had an inspection performed in accordance with the scope and detail of 14 CFR part 43, appendix D, or other FAA-accepted program, as applicable, and was found to be in a condition for safe operation. This inspection will be recorded in the aircraft maintenance records and include the following items: date, work performed, name, and certificate number of person returning aircraft to service.

The enumerated operating limitations within the memorandum added a new limitation (No. 41) that was not present in the original issue of Order 8130.2G, which stated:

(41) The aircraft may not be operated unless the replacement for life-limited articles specified in the applicable technical publications pertaining to the aircraft and its articles are complied with in one of the following manners as specified below:

(a) Type-Certificated Products: Replacement of life-limited parts required by 14 CFR §91.409(e) is only applicable to experimental exhibition aircraft when the required replacement times are specified in the U.S. aircraft specifications, or type certificate data sheets.

(b) Non-Type Certificated Products: Unless otherwise determined by the FAA, all articles installed in non-type certificated products operated in the experimental exhibition category, in which the manufacturer has specified limits, must include in their program an equivalent level of safety for those articles. Although the FAA recommends adherence to part replacements, achieving an equivalent level of safety for non-type certificated products is acceptable.

Manufacturers have historically assigned life limits to articles installed in non-type certificated products. These products were typically operated in a military environment which imposed different limitations based on the aircraft's operational and environmental use. Although these limitations are not regulatory by the FAA we have determined that these limits must be evaluated for their current operating environment and addressed in the accepted inspection program. All articles installed in non-type certificated products operated in the experimental exhibition category, in which the manufacturer has specified limits, must include in their program an equivalent level of safety for those articles. The article must be inspected to ensure that it is still in a serviceable condition for safe operation.

Attachment 2 contains the FAA Memorandum of Deviation to Order 8130.2G, Chapter 4, Section 10.

3.1.3 FAA Order 8310.2H

In Order 8130.2H, Chapter 1, paragraph 103 explains that the revised order contained policy changes that includes changes to the certification and operation of aircraft under the experimental purpose of exhibition or air racing (chapter 4, section 10) and additional information about program letters included with the application for a special airworthiness certificate and former military aircraft.

In Order 8130.2H, Chapter 4, Section 10, paragraph 468 discusses special initial certification requirements and contains a reference to FAA Advisory Circular (AC) 43-209A, titled "*Recommended Inspection Procedures for Former Military Aircraft*" dated April 12, 2013 (see Section 3.1.5 of this report for additional discussion of this AC). Additionally, paragraph 470 states that Appendix C of that order was to be referenced when issuing operating limitations for the experimental purpose of exhibition or air racing. Within Appendix C, Table C-1 contained the enumerated operating limitations. Operating limitation Nos. 14, 15, and 19 (**Figure 14**) would apply to experimental category certification for the purpose of exhibition. **Attachment 3** contains FAA Order No. 8130.2H, Chapter 4, Section 10 and Appendix C.

No.	Certification Basis (14 CFR part 21)	Notes/Applicability/ Responsible Office	Limit
14	191	All large airplanes, turbine engine airplanes, and turbine rotorcraft. AFS-300	No person may operate this aircraft unless it is maintained in accordance with an inspection program meeting the scope and content described in § 91.409(f). The operator must select and identify in the aircraft maintenance records one of the following programs for the inspection of the aircraft: (a) For type-certificated aircraft, a current inspection program recommended by the manufacturer; or (b) For former military aircraft, an inspection program recommended by the manufacturer or North Atlantic Treaty Organization (NATO) military service; or (c) An FAA-approved inspection program. Note: To extend an inspection interval, the owner/operator must submit a request for that extension with supporting documentation and data to the local FSDO and obtain concurrence from that FSDO. Inspections must be recorded in the aircraft maintenance records showing the following, or a similarly worded, statement: "I certify that this aircraft has been inspected on [insert date] per [identify applicable inspection program] and found to be in a condition for safe operation." (14)
		All other aircraft not described above. AFS-300	No person may operate this aircraft unless within the preceding 12 calendar months it has had a condition inspection performed in accordance with the scope and detail of part 43, appendix D, manufacturer or other FAA-approved programs, and was found to be in a condition for safe operation. The inspections must be recorded in the aircraft maintenance records showing the following, or a similarly worded, statement: "I certify that this aircraft has been inspected on [insert date] in accordance with the [insert either: scope and detail of part 43, appendix D; or manufacturer's inspection procedures] and was found to be in a condition for safe operation." The entry will include the aircraft's total time-in-service (cycles if appropriate), and the name, signature, certificate number, and type of certificate held by the person performing the inspection. (14)
15	191	Former military. AFS-300	This aircraft must not be operated unless it is operated, inspected, and maintained in accordance with appropriate military technical publications and/or manufacturer's recommendations. (15)
19	191(a), (b), (c), (d), (e), (f), (g), (h), & (i)	AFS-300	The aircraft may not be operated unless the replacement for life-limited articles specified in the applicable technical publications pertaining to the aircraft and its articles are complied with in one of the following manners: (a) Type-Certificated Products: Replacement of life-limited parts required by § 91.409(e) applies to experimental aircraft when the required replacement times are specified in the U.S. aircraft specifications or type certificate data sheets. (b) Non-Type-Certificated Products: All articles installed in non-type-certificated products operated under an airworthiness certificate issued for an experimental purpose, in which the manufacturer has specified limits, must include in their program an equivalent level of safety for those articles. These limits must be evaluated for their current operating environment and addressed in the approved inspection program. All articles installed in non-type-certificated products in which the manufacturer has specified limits, must include in their program an equivalent level of safety for those articles. The article must be inspected to ensure the equivalent level of safety still renders the product in a serviceable condition for safe operation. (19)

Figure 14. An excerpt from Table C-1 of FAA Order 8130.2H.

3.1.4 FAA Order 8130.2J

FAA Order 8130.2J Chapter 12, titled "*Experimental Purpose of Exhibition (§§21.191(d))"*, references Chapter 4, titled "*Issuing Special Airworthiness Certificates*". Chapter 4 references Appendix D for issuing operating limitations for non-standard aircraft. Operating limitation Nos. 15, 16, and 20 in Appendix D of Order 8130.2J is nearly identical to operating limitation Nos. 14, 15, and 19, respectively, in Appendix C of Order 8130.2H. **Attachment 4** contains FAA Order 8130.2J Chapters 4 and 12 as well as Appendix D.

3.1.5 FAA AC 43-209A

FAA AC 43-209A, dated April 12, 2013, provides guidance on the development of inspection program requirements for the certification of former military aircraft in the experimental category for the purpose of exhibition and/or air racing. Paragraph 5 of AC 43-209A, titled "*Inspection Program Content*", contained the following:

> *Owners/operators of former military aircraft requiring yearly condition inspections in accordance with the appropriate operating limitations must submit a program developed to the scope and detail of part 43 appendix D (or other FAA-accepted program) and guidance contained within this AC prior to the initial certification inspection of the aircraft.*

Paragraph 8 of AC 43-209A, titled "*Storage*", contained the following:

> *Extended periods of inactivity can have a negative effect on the airworthiness of an aircraft and its components. Inspection programs should consider time limitations as well as environmental conditions with procedures for preservation of the article.*

Paragraph 16 of AC 43-209A, titled "*Experimental Aircraft Inspection Program*", contained the following:

> *Inspection programs should encompass the scope and detail of part 43 appendix D using additional criteria based on guidance from this AC, from manufacturers, or country of origin's recommended maintenance and/or inspection guidelines.*

Attachment 5 contains FAA AC No. 43-209A.

3.2 N98F Airworthiness Certificate History

At the time of the accident, the helicopter was certificated under the experimental category for the purpose of exhibition. The experimental category certificate was issued to the accident helicopter on December 5, 2014 by the FAA Charleston Flight Standards District Office (FSDO) in Charleston, West Virginia. Prior to the issuance of the experimental category certificate, the accident helicopter was certificated under a restricted category, issued by the Charleston FSDO on October 29, 2013. The accident helicopter was certificated under either experimental or restricted categories at various times in its history (**Table 2**). The accident helicopter's FAA registration file showed it was sold to the owner of the helicopter (at the time of the accident) on November 6, 2003.

Table 2. The airworthiness certificate issuance history for the accident helicopter.

Date	Category	Issuing Office	ATT (hours)
December 5, 2014	Experimental[7]	Charleston FSDO	8,814.3
October 29, 2013	Restricted[8]	Charleston FSDO	8,805.9
May 17, 2013	Experimental[7]	Charleston FSDO	8,792.0
April 10, 2013	Restricted[8]	Charleston FSDO	8,792.0
May 15, 2012	Experimental[7]	Charleston FSDO	8,790.3
September 24, 2010	Restricted[8]	Charleston FSDO	8,774.9
May 21, 2010	Experimental[7]	Charleston FSDO	8,755.2
November 20, 2003	Restricted[8]	Charleston FSDO	8,466.6
April 7, 1995	Experimental[7]	Fresno (California) FSDO	8,279.4[9]
July 24, 1984	Restricted[8]	Fresno (California) FSDO	6,883.4
December 1, 1981	Restricted[8]	Fresno (California) GADO[10]	6,249.2
October 30, 1981	Restricted[8]	Albany (Georgia) EMDO[11]	6,229.2
October 29, 1981	Experimental[12]	Albany (Georgia) EMDO	6,228.9

3.3 Operating Limitations Issued to N98F

Based on the airworthiness certificate history of the accident helicopter, discussed in Section 3.1 of this report, operating limitations were issued each time the helicopter was approved for a restricted category and experimental category

[7] The purpose was for exhibition.
[8] Certificated under FAA TCDS No. H3SO, which is currently held by Richards Heavylift Helo, Inc. as of October 18, 2005.
[9] Two Applications for Airworthiness Certificate, both requesting an experimental category certificate for the purpose of exhibition, were approved by the Fresno FSDO on April 7, 1995 by the same FAA inspector. One application, dated March 27, 1995, showed an ATT of 8,275.3 hours. The second application, dated April 7, 1995, showed an ATT of 8,279.4 hours.
[10] An FAA GADO was a General Aviation District Office.
[11] An FAA EMDO was an Engineering and Manufacturing District Office.
[12] The purpose was to show compliance with the Federal Aviation Regulations.

airworthiness certificate.[13] At the time of the accident, experimental exhibition operating limitations, issued by the Charleston FSDO on December 5, 2014, were in effect and is discussed in Section 3.3.1 of this report. The accident helicopter was last approved for restricted category certification on October 29, 2013, and the restricted category operating limitations, issued the same day by the Charleston FSDO, is discussed in Section 3.3.2 of this report.

3.3.1 Experimental Category Operating Limitations Issued to N98F

On December 5, 2014, operating limitations were issued as part of the special airworthiness certificate for N98F for the experimental purpose of exhibition. The operating limitations were issued per the FAA Memorandum of Deviation to Order 8130.2G, Chapter 4, Section 10 dated December 21, 2011. Of the 44 operating limitations enumerated in Table 4-1 of the memorandum, all were issued to the accident helicopter except for operating limitations Nos. 6, 7, 8, 19, 21, 23, 24, 26, 29, 30, 31, 39, and 43, as these were, according to the Memorandum of Deviation, considered to be either not required, prohibited, or "if required by the aircraft type" for Group 2 aircraft.

Operating limitation No. 41 for life-limited articles was issued to N98F. According to the FAA, once the experimental airworthiness certificate was issued to N98F, the helicopter was no longer considered "type-certificated" (under TCDS No. H3SO) since it would no longer be in the S/N list for that TCDS. Therefore, the provisions of operating limitation No. 41(b) for non-type certificated products applied for articles installed on the accident helicopter (while under an experimental airworthiness certificate) for which the manufacturer had specified a life limit.

3.3.2 Restricted Category Operating Limitations Issued to N98F

On October 29, 2013, operating limitations were issued as part of the restricted category special airworthiness certificate for N98F. The operating limitations were issued per FAA Order 8130.2G Change 1, Chapter 4, Section 2 dated July 2, 2012. Operating limitation Nos. 15 and 17 stated the following:

> *(15) This model rotorcraft must be serviced and maintained in compliance with TM[14] 55-1520-219-10 and TM 55-1520-219-20. Repairs to be made in accordance with TM 55-1520-219-34. Component overhaul intervals and replacement times shall be in accordance with the TBO/Replacement schedule found in TM 55-1520-219-20, unless superseded by appropriate Airworthiness Directive. Component life limits to be as specified in U.S. Army TM 55-1520-219-20. These and other applicable documents are specified in*

[13] Attachment 5 of the Operational Factors Group Chair's Factual Report contains the airworthiness records for N98F.
[14] TM is Technical Manual.

Richard's Heavylift Helo, Inc. Instructions for Continued Airworthiness Report, Report No. 001 dated May 16, 2007.

(17) FAA Airworthiness Directives for all UH-1B, & Bell 204 series aircraft and Lycoming engine model T53-L-11 or T5311 series must be reviewed for applicability and complied with accordingly. All applicable U.S. Army Modification Work Orders (MWO'S) and technical bulletins must be accomplished.

4.0 Maintenance

4.1 United States Army Technical Manuals (TM) for UH-1-series Helicopters

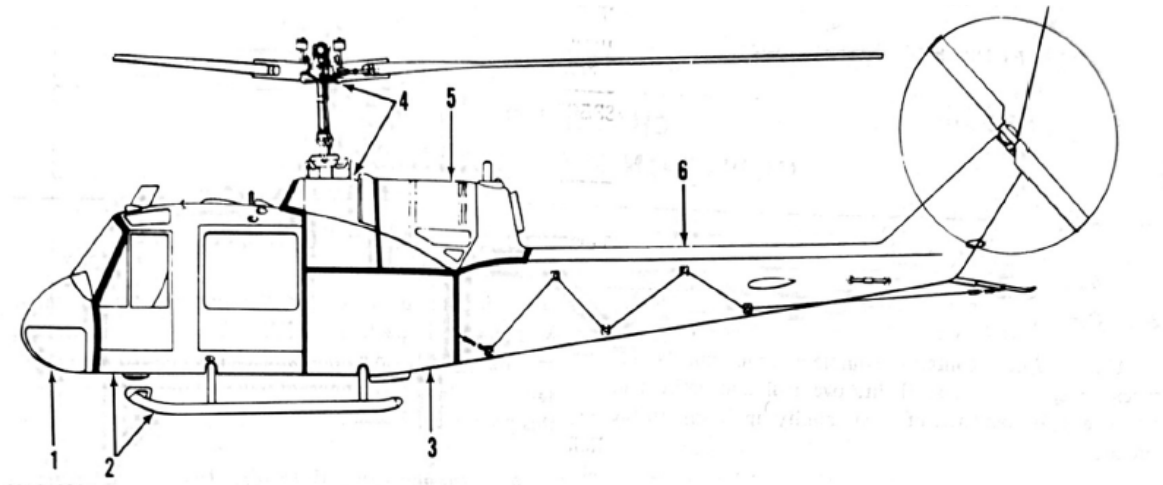
4.1.1 TM 55-1520-219-20

TM 55-1520-219-20, titled "*Organizational Maintenance Manual – Army Model UH-1B Helicopter*", dated June 30, 1972, had incorporated changes 1 thru 6 and superseded the same numbered manual dated January 16, 1969. Chapter 3 of this manual, titled *"Inspection Requirements"*, establishes what and when to inspect certain areas of the helicopter. Area No. 5 is the engine area (**Figure 15**). Special inspections are provided to supplement the preventative maintenance inspection checklists in TMs 55-1520-219-PMD, -PMI, and -PMP.[15]

Chapter 5, titled "*Power Plant and Related Systems"*, contains procedures on the removal, installation, inspection, and troubleshooting of the engine inlet, exhaust, fuel and oil systems, and engine controls. For the engine exhaust, the scope is specific to the tail pipe and does not contain inspection criteria for the exhaust diffuser.

Chapter 16 contains procedures on the storage of UH-1B helicopters. The scope of the procedures is for placing the helicopter in storage for a period of 6 months or less as well as the necessary depreservation procedures. The storage categories are 1) flyable storage, 2) short term storage (from 1 to 45 days), and 3) long term storage (from 46 to 180 days). Flyable storage is defined as temporary, where the helicopter can be made ready for flight on short notice. For flyable storage, the engine is run for about 10 minutes at idle, after which protective covers (or barrier material and tape) are installed on the engine inlet and exhaust. Inspections to be conducted while in flyable storage include applicable portions of daily inspections (TM 55-1520-219-PMD) and to operate the engine for about 10 minutes at idle, both at least once every 7 days.

[15] TM 55-1520-219-PMD, TM 55-1520-219-PMI, and TM 55-1520-219-PMP were not available to investigators.



AV 010804

AREA No. 1	Nose Area	All surfaces, components, and equipment in nose compartment and on exterior ahead of crew doors.
AREA No. 2	Cabin and Landing Gear	All surfaces, components, and equipment inside cabin and on cabin exterior between forward sides of crew doors and cabin bulkhead at Station 123. Includes complete landing gear.
AREA No. 3	Center Fuselage Area	All surfaces, components, and equipment in fuselage below engine deck level, between cabin aft bulkhead and tail boom attachment bulkhead. Includes fuel cells, compartment below main transmission, and compartments accessible through side doors on fuselage.
AREA No. 4	Pylon Area	All surfaces, components, and equipment of the main rotor pylon group, from top of mast to bottom of transmission and work deck area under forward cowling. Includes main rotor, mast and rotating controls, transmission with accessories and mounts, and main (input) drive shaft.
AREA No. 5	Engine Area	All surfaces, components, and equipment associated with engine installation, located above engine work deck and within engine cowling, tailpipe fairing, and air intake area.
AREA No. 6	Tail Boom Area	All surfaces, components, and equipment located in or on the tail boom and vertical fin structure. Includes tail rotor, synchronized elevator, and control linkages; also the complete drive train of shafts and gear boxes between main transmission and tail rotor.

Figure 15. The inspection areas of the UH-1B.

4.1.2 TM 55-1520-210-23

TM 55-1520-210-23 titled "*Aviation Unit and Intermediate Maintenance Instructions - Army Model UH-1H/V/EH-1H/X Helicopters*", change 36, dated November 19, 1999, was printed in three volumes:[16]

TM 55-1520-210-23-1 Chapters 1 through 6.
TM 55-1520-210-23-2 Chapters 7 through 17.
TM 55-1520-210-23-3 Appendix A through F, and Index.

The scope of TM-55-1520-210-23 is similar to that of TM 55-1520-219-20.

[16] TM 55-1520-210-23-series manuals are listed in the Richards Heavylift Helo Instructions for Continued Airworthiness (ICA) Report No. 001, dated May 16, 2007, as publications that must be delivered with the helicopter.

4.1.3 TM 55-1520-219-10

TM 55-1520-219-10 titled "*Operator's Manual Army Model UH-1B Helicopter*", dated January 1968, contains helicopter information and performance data, including normal procedures and emergency procedures.

In Chapter 3 titled "*Normal Procedures*", Section II. titled "*Flight Procedures*", the preflight inspections area for the engine are defined in Section 3-7 titled "*Pre-Flight Check*". Paragraph 3-12 contains instructions to inspect Area 3 (**Figure 16**) with a general visual inspection for condition of the engine, evidence of leaks, and no obstructions.

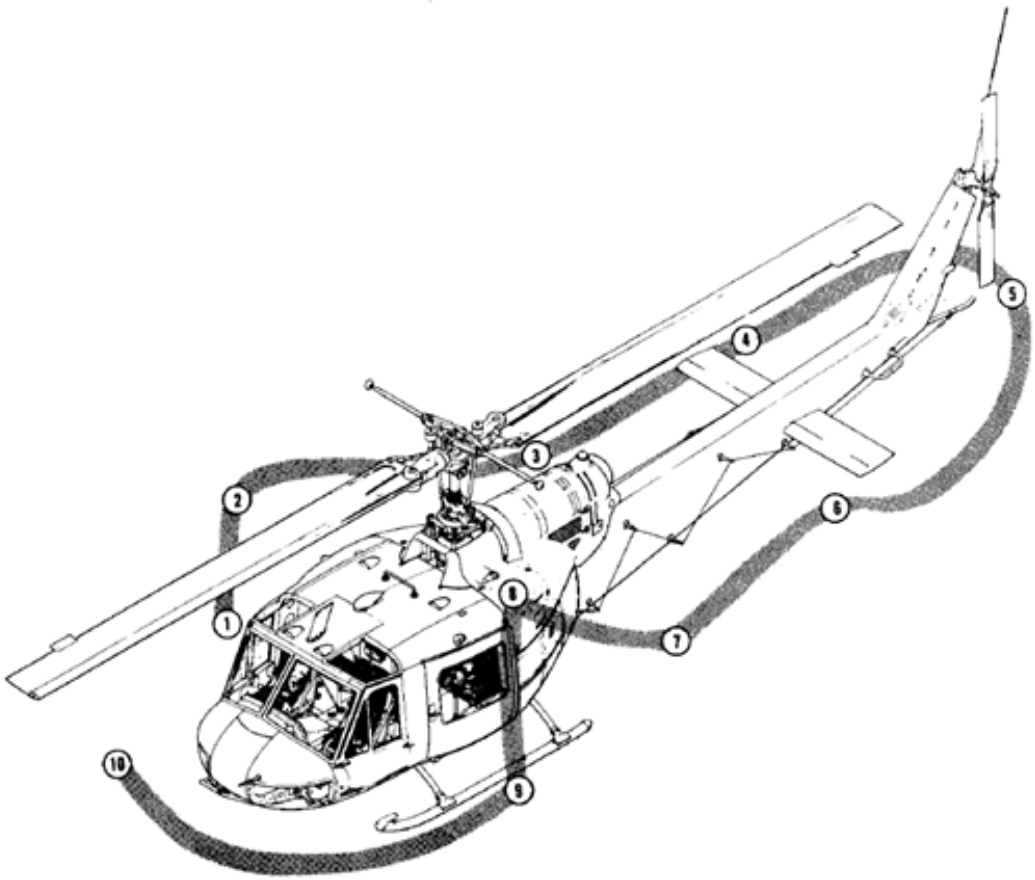


Figure 16. Inspection areas as defined in TM 55-1520-219-10.

4.1.4 TM 55-1520-210-PMD[17]

TM 55-1520-210-PMD titled "*Technical Manual UH-1H/V Helicopter Preventative Maintenance Daily Inspection Checklist*", change 14, dated April 30,

[17] TM 55-1520-219-20 contains references to TM 55-1520-219-PMD, but investigators were unable to obtain a copy of the latter. However, investigators were able to obtain a copy of TM 55-1520-210-PMD. Richards Heavylift Helo ICA Report No. 001, dated May 16, 2007, lists TM 55-1520-211-PMS, referenced as a preventative maintenance service inspection program, and states the inspection

2009, contains complete requirements for daily inspection for UH-1/V aircraft. Section 6, titled "Inspection Areas" shows the various zones for inspection (**Figure 17**).

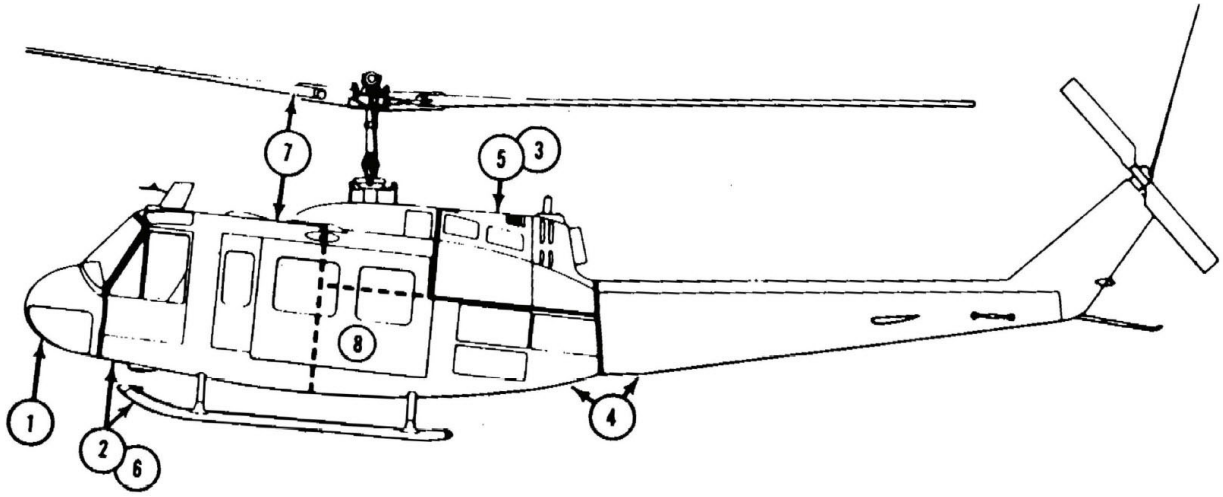


Figure 17. Inspection areas as defined in TM 55-1520-210-PMD.

Areas 3 and 5 titled "*Engine Area Left Side*" and "*Engine Right Side*" calls out the same general inspections – All surfaces, components, and equipment associated with the eigne installation, located above the engine work deck and within the engine cowling, tailpipe fairing and intake fairing.

In the Preventative Maintenance Daily Checklist, sequence numbers 3.9 and 5.5 call out the inspection of the engine combustion chamber housing, exhaust diffuser, support cone, fireshield, firewall gaskets and seals, and tailpipe for cracks, dents, and burned or buckled areas. In sequence number 3.11, it calls out turbine blades; inspection through tailpipe and through exhaust diffuser for cracks, burns, dents, or missing blades.

4.1.5 TM 55-2840-229-23

TM 55-2840-229-23 titled "*Technical Manual Aviation Unit and Aviation Intermediate Maintenance Manual Engine Assembly Model*" was printed in two volumes. Volume -1, change 25, dated March 25, 1999, consists of Warning Pages, Chapters 1 through 3 while the volume -2, change 26, dated January 27, 2000 consists of Chapters 4 through 9, Appendixes A through H, Glossary and Alphabetical Index.

In Volume 1, Chapter 1 titled "*Engine - General*", Section V. titled "Preventative Maintenance Inspections", there is a combustion turbine assembly (hot end) Special

program has changed from a daily inspection due after the last flight of the day to a 10-hour/14-day requirement. Investigators were unable to obtain a copy of TM 55-1520-211-PMS.

Inspection instruction called out in Subsection 1-52 titled "*Combustor Turbine Assembly (Hot End) (T53-L-11 Series Engines) - Special Inspection*" and in Table 1-6 titled "*Internal (Hot End) Inspection Checklist (T53-L-11 Series Engines)*". If performance degradation is noted and if the cause is not found in other areas of the engine or in the engine instrumentation the inspections called out in Subsection 1-52 and Table 1-6 are to be performed; however, most of the inspections are aviation intermediate maintenance level tasks requiring engine removal except for possibly the power turbine blade inspection for damage and the exhaust diffuser for cracks, burns and buckling. The Special Inspection called out in Subsection 1-52 and Table 1-6 was for troubleshooting for a known engine issue and not as a preflight inspection.

Subsection 1-66 titled "Inspections and Source Determination of Contaminated Oil - Special Inspection" calls for information and actions when a spectrometric inspection of engine oil indicates the presence of metal contamination. This Special Oil Inspection does not provide a frequency for the oil inspection.

In Volume 1, Chapter 3, titled "*Combustion Section"*, the overview states that "procedures requiring maintenance on the aviation intermediate maintenance level are specified and must be performed as such". Furthermore, the overview states that "paragraphs in which the maintenance level is not specified shall be considered aviation unit maintenance level and may be performed at this level or a higher level of maintenance." Section 3-26, titled "*Exhaust Diffuser (T53-L-11 Series Engines) – Inspection"* contains inspection criteria for the exhaust diffuser subcomponent including, but not limited to, the outer, mid, and inner cones, the outer strut, and the inner strut flange.

In Volume 2, Chapter 4, titled "*Turbine Section",* and Chapter 8, titled "*Oil System"*, all inspections are at the aviation intermediate maintenance level.

4.1.6 UH-1-Series References at MARPAT Aviation

MARPAT Aviation had the following UH-1-series references available:

- TM 55-1520-210-10
- TM 55-1520-210-23-1, -2, and -3
- TM 55-1520-210-23-P1, -P2, and -P3
- TM 55-1520-210-PM
- TM 55-1520-219-10
- TM 55-1520-219-20
- TM 1-2840-260-23P
- TM 1-1520-256-23

- Interagency Committee for Aviation Policy – Inspection Planning Guide, UH-1 Series[18]
- N98F Main Rotor Head/Tail Rotor Inspection Guide[19]
- T53-L11 Compressor Wash Instructions[20]

4.1.7 Interagency Committee for Aviation Policy Inspection Planning Guide

The Interagency Committee for Aviation Policy[21] Inspection Planning Guide (IPG) for the UH-1-series helicopter provides operators with an inspection program "developed as an alternative reasonable basis for inspection program development." The UH-1 IPG was published on March 26, 1996, with Revision 1 published March 12, 1997, and Revision 2 published March 1, 2002. This section will discuss content present in both the draft version of the UH-1 IPG at MARPAT Aviation as well as Revision 2 of the UH-1 IPG.

Chapter 2 of the IPG contains a list of recurrent inspection (**Figure 18**): 1) a preventive maintenance inspection (PMI) to be accomplished every 10 hours or 14 days, whichever comes first; 2) a Detail #1 inspection, to be accomplished every 50 hours; 3) a Detail #2 inspection, to be accomplished every 100 hours; and 4) a Detail #3 inspection, to be accomplished every 150 hours. Special conditional inspections for the airframe and engine are also listed. A note associated with the inspection schedule chart (**Figure 18**) discusses actions to be accomplished when the helicopter is out of service for more than 14 days and more than 30 days.

Chapter 3 of the IPG contains instructions on how to accomplish a PMI. Various areas of the helicopter are grouped into inspection sections. Section VI of the PMI contains instructions on inspection of the engine. Step 52 of this inspection states the following:

> *52. Inspect power turbine blades through exhaust diffuser and inspect exhaust diffuser for, cracks and burnt areas.*

Attachment 6 contains a copy of the Interagency Committee for Aviation Policy UH-1 Inspection Planning Guide, Revision 2.

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[18] The cover page showed a "DRAFT" stamp and stated the guide contained all changes as of November 6, 1995.
[19] This guide was created by the operator from selected pages from TM 55-1520-210-23-1.
[20] This guide was created by the operator from selected pages from TM 55-2840-229-23 and T.O. 2J-T53-16.
[21] The US General Services Administration (GSA) established the Interagency Committee for Aviation Policy and is composed of representatives from across the US Government.

INSPECTION SCHEDULE CHART

INSPECTION SCHEDULES

Inspection	Flight Hours / 50	100	150	200	250	300
P.M.I.	Every 10 Flight Hours or 14 Days, whichever occurs first.					
DETAIL #1	X	X	X	X	X	X
DETAIL #2		X		X		X
DETAIL #3			X			X

NOTE

1. IF AN AIRCRAFT WILL BE OUT OF SERVICE MORE THAN 30 DAYS, A P.M.I. SHALL BE PERFORMED PRIOR TO RETURNING THE AIRCRAFT TO SERVICE.

2. IF AN AIRCRAFT IS OUT OF SERVICE MORE THAN 14 DAYS, A RUN-UP IN ACCORDANCE WITH APPROPRIATE MANUALS IS STRONGLY RECOMMENDED.

3. THE COMPLETE AIRCRAFT MUST BE INSPECTED WITHIN 12 CALENDAR MONTHS, WHICH MEANS ALL THREE DETAILS MUST HAVE BEEN PERFORMED. IF AN AIRCRAFT FLIES LESS THAN 150 HOURS IN 12 CALENDAR MONTHS, THE REMAINDER OF THE DETAIL INSPECTIONS MUST BE PERFORMED. IF AN AIRCRAFT FLIES GREATER THAN 150 HOURS, THE INSPECTION CYCLE IS CONTINUED. THE "ANNUAL CYCLE" STARTS AGAIN WHEN ALL INSPECTIONS ARE COMPLETED. SEE INSPECTION SCHEDULE CHART ABOVE.

4. ENGINE INSPECTIONS AND RETIREMENT LIFE LIMITED INTERVALS - REFER TO MILITARY MAINTENANCE DOCUMENT OR THE ALLIED SIGNAL LYCOMING MAINTENANCE DOCUMENT.

5. COMPONENT OVERHAUL AND RETIREMENT LIFE LIMITED INTERVALS - REFER TO APPLICABLE MILITARY MAINTENANCE DOCUMENT OR MANUFACTURERS MAINTENANCE DOCUMENT.

Figure 18. The inspection schedule chart as seen in Revision 2 of the UH-1 IPG.

4.2 Inspection and Maintenance Accomplished on N98F

According to the aircraft logbook, the accident helicopter and its engine were last inspected on March 29, 2022 at an ATT of 9,029.3 hours at MARPAT Aviation. Several actions were completed, the details of which are provided in **Attachment 7**. The entry for the last inspection stated the following:

> *"Aircraft and engine have been inspected in accordance with FAR[22] 43 appendix D annual inspection, and were determined to be in airworthy condition. Details of other maintenance performed are on file at Marpat Aviation CRS# ZWMR912K[23] under work order 22-02."*

According to MARPAT Aviation work order No. 22-02, the engine oil and engine fuel filter were replaced. A compressor wash was performed and the engine

[22] FAR is Federal Aviation Regulations, or Title 14 CFR.
[23] CRS is certified repair station.

was subsequently ground run with no noted anomalies. The work order also contained an extract of Appendix D to Part 43 that was used as a checklist, with initials next to each applicable item within Appendix D.

The second-most recent entry in the aircraft logbook was dated June 17, 2021, at an ATT of 8,968.5 hours. Several maintenance and inspection actions were completed at MARPAT Aviation, the details of which are provided in **Attachment 7**. The entry referenced MARPAT Aviation work order No. 21-06. According to this work order, the engine oil and engine fuel filter were replaced. The torque pressure transducer was found to be leaking and was also replaced. A compressor wash was performed and the engine was subsequently ground run with no noted anomalies.

Attachment 7 contains MARPAT Aviation work order Nos. 22-02 and 21-06.

According to MARPAT Aviation, the engine times and cycles were tracked on a sheet that was kept with the accident helicopter. MARPAT Aviation estimated the accident helicopter accumulated about 14 hours from the last inspection (on March 2022) until the accident.

Table 3 shows a general timeline of the maintenance and inspection history of the accident helicopter. A review of the aircraft and engine logbook found no entries regarding the storage or preservation of the accident helicopter and its engine within the timeframe of **Table 3**.[24] The details of the maintenance and inspections performed within this timeline found within **Attachment 8**.

According to the aircraft logbook, on April 9, 2013, tail rotor blade P/N 204-011-702-15 and S/Ns ATR-72106 and ATR-2741[25] were installed at an ATT of 8,792 hours. According to the entry, blade S/N ATR-72106 had 175 hours (of life) remaining and blade S/N ATR-2741 had 183 hours remaining. According to the component log card for blade S/N A-2741, the component total time (CTT) was 1,017 hours at the time of installation on N98F with a scheduled retirement time (life limit) of 1,200 hours. According to the component log card for blade S/N ATR-72106, the CTT was 1,025 hours at the time of installation on N98F with a scheduled retirement time of 1,200 hours. **Attachment 8** contains the component log cards for the tail rotor blades. TM 55-1520-219-20 reflected a retirement time of 1,200 hours for tail rotor blade P/N 204-011-702-15.[26] From the time of installation of these tail rotor blades

[24] NTSB investigators asked the FAA to request MARPAT work order Nos. 22-02, 21-06, 20-13, 19-06, and 18-06. The FAA received work order Nos. 22-02 and 21-06, but work order Nos. 20-13, 19-06, and 18-06 were not available. FAA-certified repair stations are only required to maintain records for the last two years.

[25] The aircraft logbook entry reflected S/N ATR-2741. However, the component log card and the data plate reflected S/N A-2741 and S/N A2741, respectively.

[26] In Richards Heavylift Helo ICA Report No. 001, dated May 16, 2007, Section II lists the airworthiness limitation schedule that shows tail rotor blade P/N 204-011-702-15 had a retirement time of 1,200 hours.

(ATT of 8,792 hours) to the time of the last inspection prior to the accident (ATT of 9,029.3 hours), about 237.3 hours had elapsed. According to the experimental category airworthiness certificate issued to N98F, products that are not type-certificated, but which have manufacturer's recommended life limits, are to document an equivalent level of safety for those life limited items. No separate documentation of an equivalent level of safety for the tail rotor blades was found in the documentation available to investigators.

Table 3. Recent maintenance performed on N98F.

Date	ATT (hrs)	Maintenance/Inspection
March 29, 2022	9,029.3	Annual inspection per Part 43 Appendix D
June 17, 2021	8,968.5	Annual inspection per Part 43 Appendix D
June 22, 2020	8,916.1	Annual inspection per Part 43 Appendix D
August 9, 2019	8,916.1	Replaced main drive shaft and 50-hr lubrication
April 22, 2019	8,866.8	Annual inspection per Part 43 Appendix D
April 13, 2018	8,858.4	Annual inspection per Part 43 Appendix D
April 25, 2017	8,850.4	Annual inspection per Part 43 Appendix D
September 29, 2016	8,847.2	Replaced main rotor blade
July 14, 2016	8,835.1	Repaired left rear skid hanger bracket and skin
March 30, 2016	8,824.7	Annual inspection per FAR 43 Appendix D
December 5, 2014	8,814.3	Experimental category certificate issued
November 10, 2014	8,814.3	Annual inspection per FAR 43 Appendix D
April 3, 2014	8,807.8	Replaced one tail rotor blade grip bolt
October 29, 2013	8,805.9	Restricted category certificate issued
August 17, 2013	8,803.4	Annual inspection per FAR 43 Appendix D
May 17, 2013	8,792.0	Experimental category certificate issued
April 10, 2013	8,792.0	Restricted category certificate issued
April 9, 2013	8,792.0	Replaced tail rotor blades, annual inspection per FAR 91.409(a)
October 31, 2012	8,791.5	Annual inspection per FAR 43 Appendix D
May 15, 2012	8,790.3	Experimental category certificate issued
May 15, 2012	8,790.3	Annual inspection per FAR 91.409(a)
July 19, 2011	8,790.3	Annual inspection per Part 43 Appendix D

E. LIST OF ATTACHMENTS

Attachment 1 – FAA Order 8130.2G Chapter 4 Section 10

Attachment 2 – Memorandum of Deviation to FAA Order 8130.2G

Attachment 3 – FAA Order 8130.2H Chapter 4 Section 10 and Appendix C

Attachment 4 – FAA Order 8130.2J Chapters 4 and 12 and Appendix D

Attachment 5 – FAA Advisory Circular 43-209A

Attachment 6 – Interagency Committee for Aviation Policy UH-1 Inspection Planning Guide, Revision 2

Attachment 7 – MARPAT Aviation Work Order Nos. 22-02 and 21-06

Attachment 8 – Select maintenance records and component log cards for N98F

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APPENDIX A

Figure A-1. A larger image of the single suspended powerline about 542 feet northeast of the main wreckage.

Figure A-2. A larger image of the three powerlines visible in Google Street View near the accident site.