

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



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AIRWORTHINESS

Group Chair's Factual Report

April 1, 2025

A ACCIDENT

Location: Plant City, Florida
Date: May 1, 2024
Time: 1610 eastern daylight time
Helicopter: Airbus Helicopters AS350 B3e, registration N413JM

B AIRWORTHINESS GROUP

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C SUMMARY

On May 1, 2024, about 1610 eastern daylight time, an Airbus Helicopters AS-350 B3e, N413JM, was substantially damaged when it was involved in an accident near Plant City, Florida (FL). The commercial pilot and the private pilot-rated copilot were not injured. The helicopter was operated by the Hillsborough County Sheriff's Office (HCSO) as a Title 14 Code of Federal Regulations Part 91 positioning flight. The helicopter departed Lakeland Linder International Airport (LAL), Lakeland, FL, about 1545 and was destined for the HCSO base at Tampa Executive Airport (VDF), Tampa, FL.

According to the flight crew, while the helicopter was about 50 ft above ground level, the helicopter entered an uncommanded left turn that the pilot flying (seat in the left seat) could not arrest. Specifically, the pilot stated that his control inputs were "ineffective" in stopping the left turn. Furthermore, the turn progressed into a left spin and the helicopter rotated 2 to 3 times before impacting the ground and coming to rest upright with the engine running. The pilot performed an engine shutdown and the crew performed a normal egress.

D DETAILS OF THE INVESTIGATION

1.0 Helicopter Information

1.1 Helicopter Description

The Airbus Helicopters AS350 B3e helicopter, also known as the H125, has a three-bladed main rotor system and a two-bladed tail rotor system. The helicopter has a high skid-type landing gear. The helicopter is equipped with one Safran Helicopter Engines Arriel 2D turboshaft engine that provides power to the rotor system. The AS350 B3e is type certificated under Federal Aviation Administration (FAA) Type Certificate Data Sheet (TCDS) No. H9EU.

1.2 Tail Rotor System

Engine power is transferred to the tail rotor via two tail rotor drive shafts (TRDS) and a tail gearbox. The forward TRDS, made of steel, is connected to a flange connected to the aft end of the freewheel shaft. The aft TRDS, made of aluminum, connects to the forward TRDS via a splined, steel flange adapter. Flexible couplings are located between each drive shaft attachment point to allow for minor misalignment. Five hanger bearings, mounted within support brackets along the tail boom, support the TRDS. These five hanger bearings and their supports are numbered 1 through 5, with No. 1 being the aft-most hanger bearing and No. 5 being the forward-most hanger bearing (**Figure 1**). The tail gearbox provides gear

reduction and changes the direction of drive. The tail rotor hub, connected to the tail gearbox output shaft, provides final drive to the tail rotor.

The two tail rotor blades share a common composite spar that is flexible in both the flapping and pitch change (torsional) directions. Two metal half-shells are clamped to the center of the spar. The inboard half-shell connects to the tail rotor hub and allows for the tail rotor to teeter. Tail rotor blade pitch is changed via pitch change links mounted between a pitch horn and a pitch change assembly (also known as the “spider”). The pitch horns rotate about a set of elastomeric bearings at the root end of each blade. The spider slides along the tail gearbox output shaft and is controlled by a pitch change bell crank. Each set of tail rotor blades and pitch change links are assigned a color for identification purposes; the assigned colors are ‘red’ and ‘blue’.

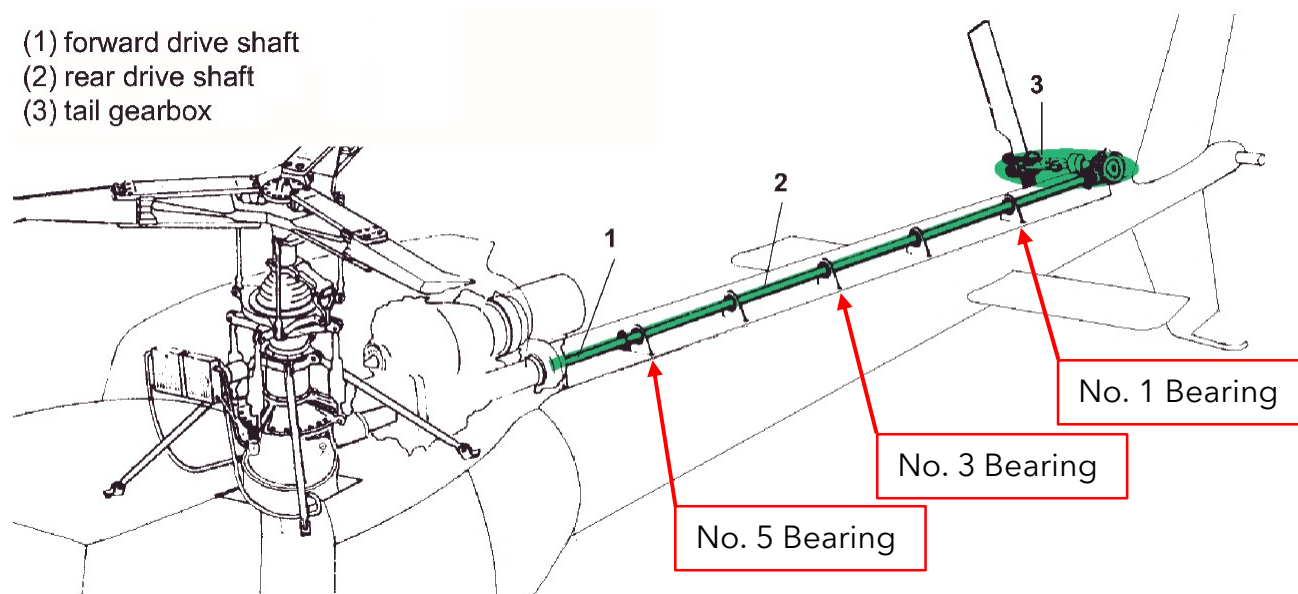


Figure 1. A diagram of the AS350-series tail rotor drive system and the numbering convention for the five TRDS hanger bearings. (Courtesy of Airbus, edited by the NTSB)

1.3 Accident Helicopter History

The accident helicopter, serial number (S/N) 8646, was manufactured in 2019. Engine S/N 53314 was installed on the accident helicopter. At the time of the accident, the helicopter had an aircraft total time (ATT) of 1,982.5 hours, a Hobbs time of 12.3 hours, and an engine total time (ETT) of 1,982.5 hours.

2.0 Accident Helicopter Examination

The helicopter was examined at the accident site by representatives from the Federal Aviation Administration (FAA) and HCSO on May 2, 2024. Later on May 2, 2024, the accident helicopter was recovered to the HCSO base in Tampa, FL.

2.1 On Scene Summary

The helicopter came to rest upright in a field with a slight right bank. The main rotor blades did not show evidence of ground contact damage. The tail boom skin exhibited a wrinkled appearance near where the tail boom attaches to the fuselage, below the engine exhaust. The lower vertical fin exhibited deformation due to ground contact. The tail rotor gearbox had separated from the airframe and was found on the ground near its normally installed location (**Figure 2**). The fairing that housed the tail rotor gearbox was partially fractured and deformed. The 'blue' tail rotor blade remained attached to the tail rotor head. The 'red' tail rotor blade was found on the ground about 40 feet south of the helicopter (**Figure 3**).



Figure 2. The accident helicopter and the separated tail rotor gearbox.



Figure 3. The separated tail rotor blade as found at the accident site.

The TRDS covers were opened and the No. 1 TRDS hanger bearing support, near the trailing edge of the horizontal stabilizer, was found partially disconnected from its support mount. On the No. 1 TRDS hanger bearing support, the left attachment bolt and nut were not installed and was found within the tray area of the TRDS cover, while the right attachment bolt and nut remained installed but with minimal bolt threads visible (**Figure 4**). The six attachment bolts and nuts for the tail rotor control rod support remained installed on the No. 1 TRDS hanger bearing support mount. Additionally, the attaching hardware for the four remaining TRDS hanger bearing support mounts were reported by HCSO to have low torque.

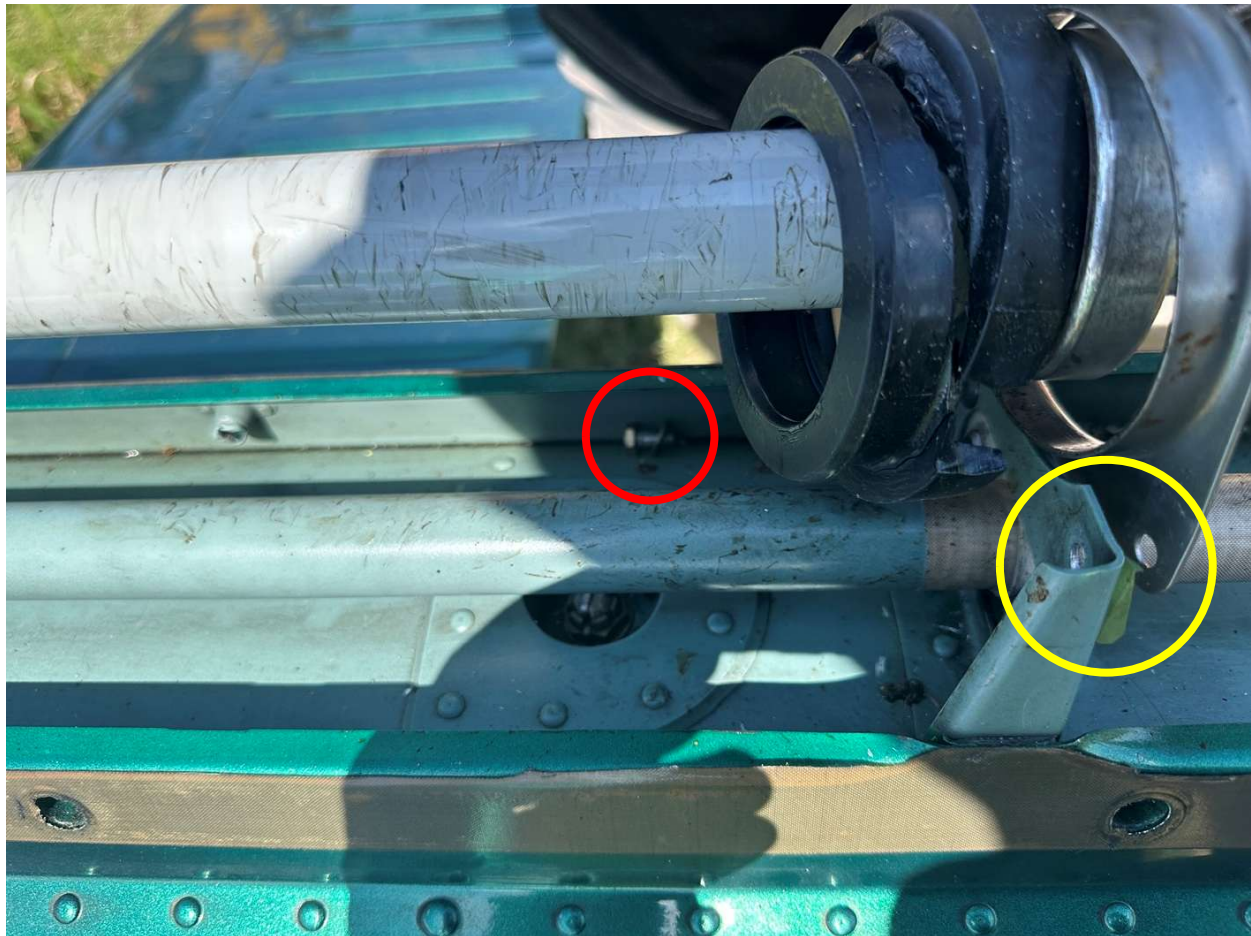


Figure 4. The separated left attachment bolt (red circle) found in the tray area of the TRDS cover and the location where this bolt is normally installed (yellow circle).

2.2 Post-Recovery Examination

On June 18, 2024, members of the Airworthiness Group examined the recovered helicopter at the HCSO base in Tampa, FL.

2.2.1 Tail Rotor Drive System

Continuity of drive to the main rotor was confirmed when rotating the tail rotor drive shaft (**Figure 5**). Forward flange of tail rotor drive shaft to the engine reduction gearbox was intact and the flexible coupling did not exhibit splaying or fracture.



Figure 5. The tail rotor drive system. The red arrow identifies the tail rotor gearbox forward pinion.

The tail rotor gearbox had fractured and separated at the forward pinion housing's flanged attachment to the center housing. The fractures exhibited a mix of overload and smearing from secondary contact damage. The tail rotor gearbox output shaft and pitch change spider were able to be rotated manually and exhibited smooth rotation with no evidence of binding.

2.2.2 Tail Rotor Control System

Continuity of control from the cockpit pedals to the fractured aft end of the tail rotor control rod was confirmed. Rotational scoring was present on the fractured aft end of the tail rotor control rod consistent with contact with the aft-most flexible coupling at the tail rotor gearbox input flange. When the rotational scoring on the tail

rotor control rod was aligned with the flexible coupling, the pedal position in the cockpit showed the left-pedal slightly forward of neutral.

The 'blue' pitch change link was fractured near its lower connection to the pitch change spider, but the attaching hardware on both ends remained installed. The 'red' pitch link was whole and remained attached at both ends but the pitch change horn had separated from the 'red' tail rotor blade. The pitch change spider was able to be moved longitudinally along the output shaft and did not exhibit evidence of binding.

2.2.3 Tail Rotor

The 'blue' tail rotor blade remained attached to the tail rotor head and did not exhibit fragmentation. The 'blue' tail rotor blade exhibited coning deformation to aircraft-left direction. The 'red' tail rotor blade had separated at the tail rotor head due to its fractured spar. The 'red' tail rotor blade outboard tab had deformed inward and a V-shaped crack was present on its inboard skin.

2.2.4 Structures

The landing gear was previously removed from the airframe and the airframe was placed on a stand. The right skid had separated from the landing gear at the forward and aft cross-tubes.

The aft ring frame for the vertical fin and tail rotor gearbox was partially separated from the tail boom and had rotated to the right about 45 degrees (**Figure 6**). The aft ring frame exhibited overload signatures on the forward-upper portion of the ring frame to which the tail rotor gearbox mount was attached. The rivets that attach the ring frame to the tail boom skin were sheared and did not exhibit evidence of working loose over an extended period of time. The upper vertical fin did not exhibit anomalous damage. The lower vertical fin was deformed to the left. The stinger remained attached and did not exhibit significant upward deformation. The tail gearbox mounting bolts remained installed on the gearbox but had separated from the aft ring frame.

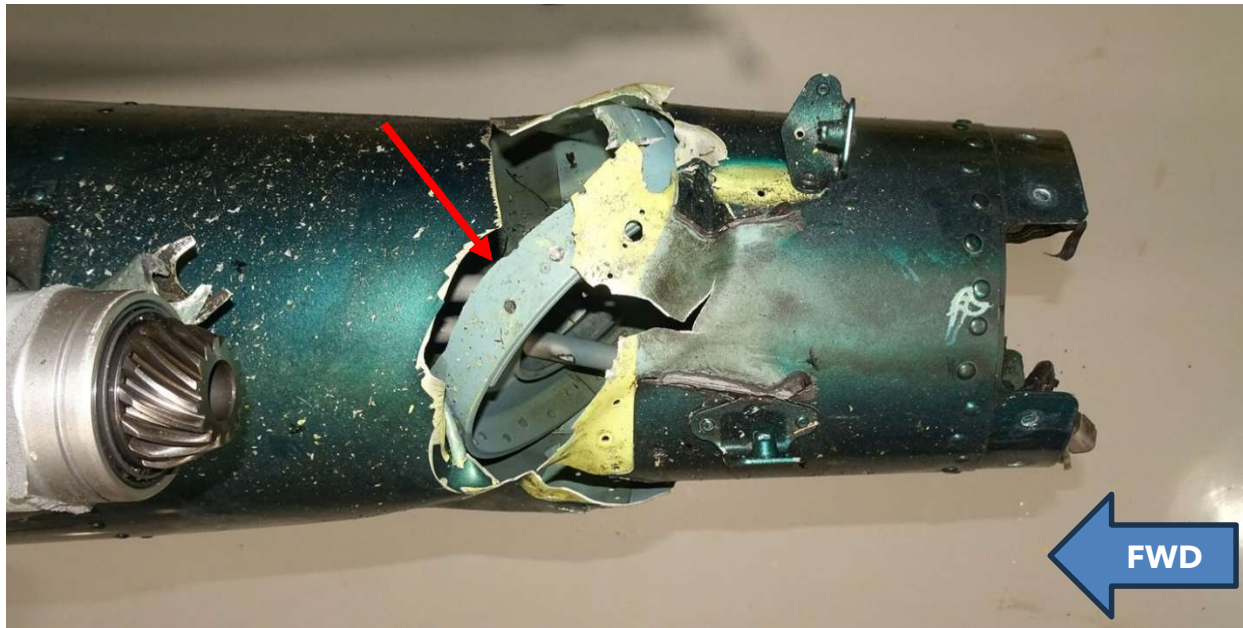


Figure 6. The aft ring frame (red arrow) that rotated to the right about 45 degrees. This view is top-looking-down.

3.0 Engine Data Recorder (EDR) Review

Data from the accident helicopter's EDR was downloaded by a representative from Safran Helicopter Engines after the helicopter was recovered to the HCSO base. The data was transmitted to and processed by Safran Helicopter Engines and the Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA). The downloaded EDR data included the accident flight. The accident flight EDR data showed no record of faults.¹ The EDR data for the accident flight spanned about 21 minutes and 39 seconds, which represents the duration from which the EDR was powered on until the EDR was powered off after the pilots shut down the engine after the accident. The engine control selector was moved from flight to idle at about 21 minutes and 5 seconds from the start of recorded data. The engine control selector was moved from idle to stop about 21 minutes and 16 seconds from the start of recorded data. **Table 1** shows these events noted from the EDR data along with a snapshot discussed in the next paragraph regarding the tail rotor potentiometer (XPA) parameter.

¹ The EDR normally records parameters at a sampling rate of 1 Hz, or once per second. However, when a fault is recorded by the EDR, the sampling rate increases to 50 Hz, or once every 20 milliseconds.

Table 1. Notable events near the end of the EDR data.

<i>EDR Time</i> <i>(mm:ss)</i>	<i>Observation</i>
20:51	XPA parameter peak value
21:05	Engine control selector moved from flight to idle
21:16	Engine control selector moved from idle to stop
21:39	End of EDR data

The XPA parameter in the EDR data is used by the electronic engine control unit (EECU) to anticipate the need for additional engine power when the pedal position increased above 68%.² About 20 minutes and 51 seconds from the start of recorded data, about 14 seconds before the engine is switched from flight to idle, a peak XPA value of about 58.82%, equating to a pedal position value of about 74.5%, was observed in one frame of data (of a 1 second duration). **Table 2** contains additional parameters from this data frame.

Table 2. A snapshot of parametric data from the EDR at 20 minutes and 51 seconds from the start of recorded data, rounded to the nearest tenth.

<i>EDR time: 20 minutes 51 seconds</i>	
Rotor speed (Nr)	99.4%
Power turbine speed (Nf)	101.2%
Gas generator speed (Ng)	98.7%
Torque	91.0%
XPA	58.8%
Equivalent pedal position	74.5%

Attachment 1 contains the BEA Technical Document for the analysis of the recovered EDR data.

4.0 Appareo Vision 1000 Cockpit Image Recorder

After the accident occurred, the NTSB authorized HCSO to download the secure digital (SD) card installed on the accident Vision 1000 cockpit image recorder. The latest recorded file on the SD card was dated February 4, 2021. The Vision 1000 and SD card were subsequently removed from the accident helicopter by HCSO and submitted to the NTSB Recorders Lab in Washington, District of Columbia (DC).

² XPA and pedal position values, represented in percentages, are related but not the same. Pedal position values represent the physical position of the pedals in the cockpit. For the pedal position values, 0% represents full left pedal forward, 50% represents neutral pedals, and 100% represents full right pedal forward. The XPA value stays at about 50.98% for pedal positions at and below 68%. The XPA value increases linearly from about 51% to 90% as pedal position values increase from 68% to 100%.

A functional test of the Vision 1000 was conducted by the NTSB Recorders Lab. However, the Vision 1000 status indicator light remained solid blue and did not change past this status light indicator state.³ The internal memory was recovered by the NTSB Recorders lab and the contents of the internal memory data mirrored the data that was contained in the SD card provided with the Vision 1000. Specifically, the last recorded file was also dated February 4, 2021, and the accident flight was not contained in the Vision 1000's internal memory.⁴

5.0 Maintenance

The last aircraft logbook entry, dated April 30, 2024 and an ATT of 1,982.2 hours, was for the painting of the registration number (N413JM) onto the helicopter at a facility located at LAL.⁵ **Figure 7** shows the location of LAL, the HCSO base in Tampa, and the accident location, about 6 miles away from a straight-line between LAL and the HCSO base.

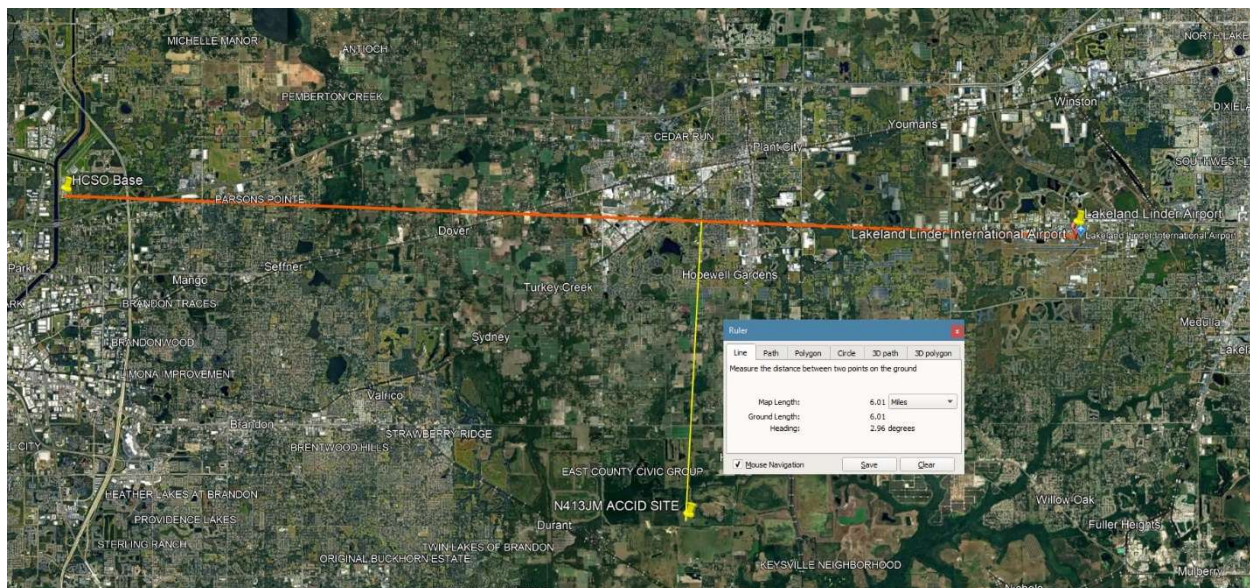


Figure 7. A Google Earth map showing the HCSO base (left), LAL (right), and the accident site (bottom).

HCSO work order No. 1461, dated August 17, 2023, and an ATT of 1970.2 hours, showed numerous maintenance items that were completed. The work order

³ A solid blue status indicator light on the Vision 1000 occurs embedded software update file is being processed. When the status indicator light is solid green indicator light occurs when the Vision 1000 is receiving power and is recording flight data. A blinking green status indicator light occurs when an internal memory dump is in progress or when an embedded update file is being updated.

⁴ When the Vision 1000 is recording, the video recording is stored on its internal memory (which is not normally accessible by an operator) while the video recording is continuously copied to the installed SD card.

⁵ The accident helicopter was previously registered as N101DL.

contained five separate entries (Nos. 13 thru 17) for replacement of the five tail rotor drive shaft hanger bearings. **Attachment 2** of this report contains a copy of HCSO work order No. 1461.

In an aircraft logbook entry dated April 4, 2024, at an ATT of 1,970.2 hours, numerous maintenance items, including airworthiness directives and scheduled inspections, were listed as having been completed.⁶ These maintenance items included replacement of the tail rotor drive shaft hanger bearings and a functional check of the Appareo Vision 1000 cockpit image recorder. In an aircraft logbook entry dated April 5, 2024, at an ATT of 1,972.2 hours, a main rotor track and balance as well as a tail rotor balance were accomplished with no noted anomalies.

Attachment 3 of this report contains a copy of the April 4 and 5, 2024 aircraft logbook entries.

The 12-month inspection checklist, found in the AS350 Master Servicing Manual (MSM) Section 05-21-02, contains a requirement to perform a functional check of the Appareo Vision 1000 cockpit image recorder. This functional check references the AS350 Aircraft Maintenance Manual (AMM) Section 25-10-40, 5-2 for the procedures to conduct this check. After the Vision 1000 is powered and recording has commenced, these procedures require a verification of the recording by removing the SD card and accessing its contents using the Vision 1000 playback software on a computer. **Attachment 4** contains a copy of the 12-month inspection checklist accomplished as part of the April 4, 2024, aircraft logbook entry.

Attachment 5 contains the AMM procedures for the functional check of the Appareo Vision 1000. According to HCSO, videos recorded during the 12-month functional check of the Vision 1000 are not retained beyond the Vision 1000 itself. Additionally, recordings from the Vision 1000 were not reviewed on a scheduled basis.

E LIST OF ATTACHMENTS

1. BEA Technical Document (BEA2024-0134_tec02) for the analysis of the recovered EDR data from N413JM
2. HCSO Work Order No. 1461
3. Aircraft logbook entries dated April 4 and 5, 2024 for N413JM
4. 12-month inspection checklist (MSM 05-21-02) accomplished on N413JM dated April 4, 2024

⁶ The April 4, 2024, aircraft logbook entry included many of the same items that were also found in work order No. 1461.

5. AS350 AMM 25-10-40, 5-2 procedures for the functional check of the Appareo Vision 1000 cockpit image recorder

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