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

CEN22FA053

N59600 – AIRFRAME AND ENGINE EXAMINATION REPORT

November 10, 2022

TABLE OF CONTENTS

A. ACCIDENT

Location: Perry, Oklahoma
Date: November 28, 2021
Time: 1658 Central Time
Helicopter: N59600, Bell 206B

B. N59600 – AIRFRAME AND ENGINE EXAMINATION REPORT

IIC	Michael J. Hodges National Transportation Safety Board Aurora, Colorado
Party Coordinator	Jason Jaworsky, Aviation Safety Inspector (Airworthiness) Federal Aviation Administration Oklahoma City, Oklahoma
Party Coordinator	Jon Michael, Chief of Air Safety Rolls-Royce Indianapolis, Indiana
Party Coordinator	John Roberts, Senior Air Safety Investigator Transportation Safety Institute Oklahoma City, Oklahoma
Technical Advisor	Gary Howe, Air Safety Investigator Bell Flight Fort Worth, Texas

C. DETAILS OF THE EXAMINATION

1.0 Accident Site

The helicopter impacted private property in Perry, Oklahoma. On November 29, 2021, the NTSB IIC, FAA (Jason Jaworsky), and Bell (Gary Howe) responded to the accident site. On November 30, 2021, the NTSB IIC, FAA, TSI (John Roberts), Bell, and Rolls- Royce (Jon Michael) responded to the accident site. The accident site consisted of private property (rolling prairie) that is used as a cattle pasture. No signs at the accident site were observed of an obstacle impact (such as power lines, towers, wind turbines, fences, trees, etc.).

Two tail rotor blades strikes were observed. The first was about 5 ft. long (about 1 ft. wide and about 8 in. deep). The second was about 4 ft. long (about 1 ft. wide and about 8 in. deep). Between the first and second strikes was about a 6 ft. distance. From the second strike to the initial impact point, it was about 22 ft. on a 328° heading. The initial impact point to the final resting point was about 39 ft. on a 305° heading.

There was no damage to any structures on the property. There were no ground injuries. The wreckage was destroyed by a postimpact fire.

All major structural parts of the helicopter were accounted for at the accident site. A section of main rotor blade was found to the northeast of the accident site.

The components of the fuel system, including the fuel bladder, two electrically operated boost pumps, lower and upper tank indicating units, fuel/vent lines, fuel shutoff valve, airframe fuel filter, and an electrically operated sump drain valve were destroyed by the fire. A crash resistant fuel system was not installed. No airframe fuel samples were available.

The components of the hydraulic system, including the hydraulic pump and regulator assembly, 3 servo actuators, solenoid valve, tube assemblies, hose assemblies, and hydraulic filter were destroyed by the fire. The hydraulic servo actuator support suffered significant thermal damage. However, the left/right (cyclic) and collective (center) servo actuators were located.

The skid landing gear was found at the main wreckage site. The landing gear consists of two skids attached on the ends of two arched cross tubes that are secured to the fuselage by means of four strap assemblies. The skid tubes were fragmented into multiple pieces. The forward and aft crosstube was mostly consumed in the fire.

All windows and doors were destroyed by the fire.

Most of the forward and intermediate fuselage was consumed in the fire. The tailboom detached from the intermediate fuselage (approximately 11 in. aft of the intercostal support) and was found near the main wreckage.

The main rotor hub and blade assembly remained attached to the mast which fractured just below the hub. The mast nut and associated hardware were present. Both main rotor blades suffered various degrees of fracturing and bending. All remnants of the main rotor blades were accounted for. The tip weights for both blades remained in position.

The transmission case was partially consumed in the post-crash fire. The gears remained attached to the mast. Main drive continuity could not be demonstrated.

Chip detectors were consumed in the fire and were unable to be examined. The KAflex drive shaft (engine to transmission driveshaft) exhibited fracturing of the forward and aft flex frames.

The complete tail rotor assembly separated from the tail rotor gearbox output shaft. The crosshead, pitch links, pitch horns, and yoke assembly suffered thermal damage. Tail rotor blade, CS1632, had bending midspan of the blade with thermal damage to the blade tip. Tail rotor blade, CS1548, exhibited fracturing outside of the doubler with minor thermal damage. The tail rotor gearbox was able to be rotated by hand in both directions with no binding or abnormal sounds coming from the tail rotor gearbox. Oil was present in the tail rotor gearbox. The chip detector was removed and visually examined with no chips observed.

The forward short shaft (steel shaft) was located adjacent to the engine and was continuous to the spline adaptor. The splines did not exhibit wear. All five-aluminum tail rotor drive shaft segments (TRDS) were accounted for during the exam. The oil cooler blower shaft and blower were present adjacent to the engine deck and the drive splines did not exhibit excessive wear. The tail rotor drive system was continuous within the tail boom section found adjacent to the wreckage. The damage to the flexible couplings (disc packs) ranged from minimal damage to excessive warping/splaying. No tail rotor drive systems issues were suspected.

The components of the flight controls, including collective pitch controls, cyclic controls, and tail rotor controls were destroyed by the fire. One collective stick was present in the wreckage along with one pedal assembly. However, the cyclic stick(s) were not located in the wreckage.

Due to the extensive damage to the flight controls from the fire, flight control continuity could not be established.

The cockpit structure, dash panel, and two cockpit seats and restraints were destroyed. Remnants of an aft seat frame was in the wreckage. The exact seating configuration was undetermined. The father was in the front left seat and the son was in the front right seat.

An emergency locator transmitter was not located in the wreckage. Remnants of the SATLOC display system was found (on the nose of the helicopter) but was in a destroyed condition from the fire.

All the cockpit gauges were destroyed by the impact sequence and postimpact fire and no readings were obtained.

The airframe data plate was not identified in the wreckage.

No records or logs were found in the airframe wreckage.

The pilot wore a surplus U.S. Army Gentex SP-4 series flight helmet that was damaged in the accident sequence. The flight helmet was found in the main wreckage area.

The engine was found securely mounted to the remnants of the airframe, which was destroyed and fire damage. Damage to the cockpit and fuselage prevented engine control continuity checks to the Fuel Control Unit (FCU) and Power Turbine Governor (PTG). The N1and N2 rotors could not be rotated. The helicopter transmission driveshaft was fractured at both ends (engine output and transmission input). The freewheeling unit was connected to the engine Power Take Off (PTO) gear, which was lying within a pile of ashes beneath the engine.

The engine gearbox was consumed by a post-crash fire and the gears were recovered from the wreckage. Although two of the gears (the fuel control and oil pump idler gearshaft and fuel control gearshaft) were thermally damaged with missing sections of the web and teeth, they did not present pre-impact anomalies. The other recovered gears were intact with no obvious tooth damage or loss of functionality.

Many of the external air, oil, and fuel lines were deformed and damaged from the event sequence, thus the torque of the connections could not be verified. However, none of the connections were visually loose. The airframe mounted oil reservoir was punctured during impact and retained some oil, which was dark in appearance. The scavenge oil filter was damaged and precluded inspection. Due to the thermal damage to the gearbox, neither the upper nor lower magnetic chip detectors were recovered. The engine pressure oil filter was disintegrated, and the filter element was exposed to the surrounding wreckage during impact. The airframe mounted fuel filter was compromised which precluded inspection of the filter element. No engine fuel sample was available. The engine fuel control components (PTG, FCU, and Fuel Pump) were disintegrated by the fire. The fuel nozzle was intact with no obvious abnormalities observed.

The compressor first stage wheel blades displayed Foreign Object Damage (FOD) consistent with ingestion of hard material during the accident. Several blade leading edges were bent opposite direction of rotation with varying degrees of severity. A compressor case half was removed, and the compressor axial stages were intact with no missing airfoils from the rotor or stators. The bleed valve was open and covered in soot. The combustion section was removed, and the combustion liner and Outer Combustion Case (OCC) were normal in appearance and displayed a uniform burn pattern. The left compressor discharge tube displayed two areas of thermal penetration and both discharge tubes were securely in place. The first stage turbine nozzle and nozzle shield appeared normal with no obvious hot streaks and the first stage turbine wheel blades were intact with no impact damage noted.

The power turbine support was removed from the exhaust collector to inspect the remainder of the turbine stages. The second, third, and fourth stage turbine wheels were undamaged with no missing blades or nozzle airfoils. The turbine to compressor coupling (N1 shaft) was intact and dark in appearance. A silver powder-like substance was observed on the first stage nozzle shield, third stage nozzle, and third stage turbine wheel. This substance is consistent with the compressor front diffuser coating and was likely liberated during the impact sequence, supporting engine operation at impact.

The engine data plate was found but was destroyed and the serial number could not be confirmed. The engine was not equipped with any electronic engine controls or data recording devices.

2.0 Airframe Examination (Bell 206B, serial number 1420)

The NTSB IIC, an air safety investigator from FAA AVP-100 (Matt Rigsby, only present on February 1, 2022), and an air safety investigator from TSI (John Roberts) traveled to Bell Helicopter in Fort Worth, Texas. Mona Polson, air safety investigator, from Bell Helicopter was present. Aaron Slager and Henry Trabue, both Bell Helicopter field investigation engineers were also present. The purpose of the trip was to examine various airframe components from N59600 (Bell 206B). The components included the main rotor head section, sections of a main rotor blade, three hydraulic actuators, tailboom, tail rotor gearbox and tail rotor blades. The examination started on January 31, 2022.

The left cyclic servo was received in the fully retracted position and the right cyclic servo was received in the fully extended position.

Fourier Transform Infrared Spectroscopy (FTIR) and mass spectroscopy analysis of fluid samples extracted from the hydraulic servo actuators revealed that the fluid did not match either MIL-H-5606 or MIL-H-6803 hydraulic oils that were listed in the engineering drawing. The actual identity of the fluid could not be determined but the results of the analysis indicated that it was a mixture of a petroleum based and synthetic based hydraulic fluid, combined with a third unknown component. It is unknown if the hydraulic fluid mixture could have caused the servos to malfunction.

Due to the findings of the servo fluid mixture, it was decided that the hydraulic servo actuators were to be sent out to the supplier for computed tomography (CT) X-ray scans and disassembly.

All the fracture surfaces on the accident parts received were consistent with overload fractures that were caused by the impact sequence.

3.0 Engine Examination (Rolls-Royce 250-C20B, serial number undetermined)

The engine was examined at the accident site and no further examination work was performed.

4.0 Maintenance Records

The student pilot checked multiple times and he was unable to locate the helicopter maintenance records. The maintenance records were not available for review.

Submitted by:

Michael J. Hodges
Investigator-In-Charge