

National Transportation Safety Board

Office of Aviation Safety
Central Region



CEN21FA330

WRECKAGE EXAMINATION SUMMARY

ACCIDENT

Location: Elgin, Minnesota
Date: July 19, 2021
Time: 1600 central daylight time (2000 UTC)
Airplane: Robinson R44 II, Registration No. N44BJ

PARTICIPANTS

Investigator-In-Charge	Andrew Todd Fox National Transportation Safety Board Denver, Colorado
Group Member	Nikolas Halatsis Federal Aviation Administration - Minneapolis FSDO Minneapolis, Texas
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ACCIDENT SYNOPSIS

On July 19, 2021, about 1600 central daylight time, a Robinson R44 II helicopter, N44BJ, was destroyed when it was involved in an accident near Elgin, Minnesota. The pilot was fatally injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 137 aerial-application flight.

WRECKAGE EXAMINATION TIMELINE

On July 20, 2021, National Transportation Safety Board (NTSB) Investigator Fox documented the accident site and wreckage with the assistance of Federal Aviation Administration (FAA) inspectors and a Lycoming Engines Investigator. The wreckage was recovered by the helicopter operator to one of their nearby facilities where additional layout, examination, and documentation was completed on July 21, 2021. The NTSB released the wreckage to the owner of the helicopter after the wreckage examination on July 21, 2021.

HELICOPTER DESCRIPTION

The helicopter was a 2007 Robinson R44 II, serial number (s/n) 11795, registration number N44BJ, and was powered by a Lycoming IO-540-AE1A5 reciprocating engine, s/n L-31987-48E, rated at 260 horsepower at 2,800 rpm.

According to the Robinson R44 II Pilot Operating Handbook, the helicopter height is 129 inches (10.75 ft), as depicted in figure 1.

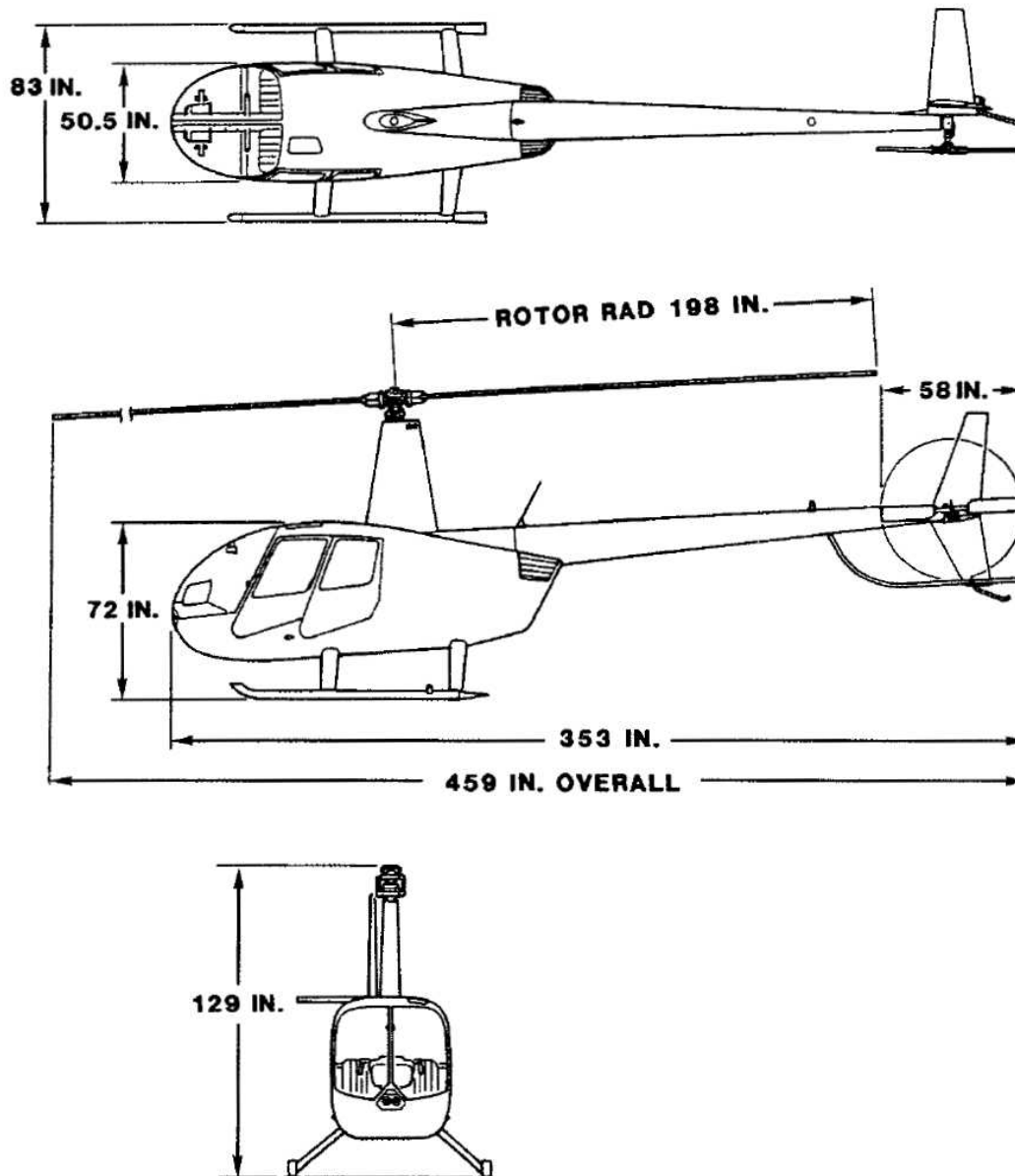


Figure 1. Robinson R44 II Dimensions

HISTORY OF OPERATION

A review of available maintenance documentation revealed that the FAA issued the helicopter a Standard Airworthiness Certificate on May 31, 2007. The agricultural helicopter was equipped with an aerial-application spray system and external product tank.

The operator stated that the helicopter is typically flown 10 ft above the crop to ensure optimal spray disbursement during aerial-application flights.

MAINTENANCE SUMMARY

According to maintenance documentation, the helicopter's last annual inspection was completed on June 24, 2021. At that time, the helicopter and engine had accumulated 2,029 hours since new. The helicopter's hour meter indicated 1,004.2 hours at the annual inspection.

After the accident, the helicopter's hour meter indicated 1,055.1 hours. Based on available information, the helicopter and its engine had accumulated 2,079.9 hours since new. The helicopter accumulated 50.9 hours since the last annual inspection completed on June 24, 2021.

Postaccident review of available maintenance documentation revealed no unresolved maintenance tasks or issues with the helicopter.

WRECKAGE EXAMINATION (JULY 20-21, 2021)

Accident Site and Main Wreckage

The initial impact location was a multi-phase power transmission line, as shown in figure 2. The western line remained intact, the center line exhibited fraying, and the eastern line was severed. The transmission lines consisted of 3 (477ACSR type) 24 aluminum conducting strands over 7 steel strands. The GPS elevation below the transmission lines was 1,080 ft. The frayed transmission line at the point of damage was about 28 ft above the ground. The height of the corn crop under the transmission lines was 8-10 ft tall. Portions of the swashplate yoke, a blade droop tusk, pilot's headset, sunglasses and ballcap, and plexiglass fragments were located under and immediately east of the power transmission lines.



Figure 2. Power lines above the cornfield with a red rectangle identifying the center power line that was damaged during the accident. A separate closeup photo shows the frayed center power line in more detail.

The wreckage debris path measured 292 ft between the power transmission lines and the main wreckage, as shown in figure 3. The wreckage debris path through the cornfield was on a 090° heading. The helicopter impacted terrain in a 15° descent angle, as shown by the severed corn crop. Fractured portions of the spray booms, cabin door, and plexiglass were scattered along the wreckage debris path.

The main wreckage, as shown in figure 4, included remnants of the cabin, landing skids, cockpit, engine, main rotor transmission, main rotor head, main rotor blades, aft fuselage, sheaves, tail rotor drive shaft, tailboom, tail rotor gear box, and tail rotor blades. The relatively intact product tank and its support frame was located about 15 ft north of the main wreckage.



Figure 3. Wreckage debris path with red circle showing the location of wire strike



Figure 4. Main wreckage at the accident site

Airframe Examination

Most of the cabin and cockpit were destroyed by the postimpact fire, as shown in figure 5. Flight control continuity could not be established due to extensive damage sustained during impact and postimpact fire. The firewall remained intact with the engine partially attached to the mounts. The upper and lower instrument panel remained attached through electrical wires.

HOBBS Meter = 1,055.1 hours

Master Battery = ON

Alternator = ON

Ignition Switch = BOTH

Clutch Switch = ENGAGED and GUARDED

Strobe Light = ON

Navigation Light = OFF

The lower sheave and cooling fan remained attached to the engine crankshaft flange. The upper sheave remained attached to the tail rotor drive shaft and to the input shaft to the transmission. The input shaft to the transmission had fractured at the flex plate coupling. A functional test of the sprag clutch revealed no anomalies. The rubber V-belts and composite fan shroud were destroyed during the postimpact fire.

The main rotor transmission remained attached to its structural airframe mounts. The three hydraulic flight control actuators exhibited extensive thermal damage from the postimpact fire and could not be tested, as shown in figure 6. The lower connections of each hydraulic actuator exhibited impact related separations. The control tubes were bent within the main rotor mast housing but remained attached at the non-rotating portion (lower) swashplate. The rotating portion (upper) swashplate exhibited significant damage and the main rotor pitch control links were fractured. The upper portion of the main rotor mast above the swash plate was bent about 15°. Main rotor transmission continuity was established as the main rotor head was rotated by hand.

The tailboom separated into two sections. The forward section of the tailboom remained mostly attached to the fuselage support structure and contained a portion of the tail rotor drive shaft and upper sheave with sprag clutch, as shown in figure 7. The vertical stabilizer, horizontal stabilizer, stinger, tail rotor gearbox, remained attached to the remaining tailboom, as shown in figure 8. The tail rotor blades remained attached to the tail rotor gear box output shaft. The tail rotor blade pitch change links remained intact and moved freely. Rotation of the tail rotor blades established continuity through the tail rotor gear box. The tail rotor drive shaft and tail rotor blade pitch control tube exhibited bending overstress fractures, as shown in figure 9.



Figure 5. Main cabin and cockpit



Figure 6. Hydraulic flight control actuators



Figure 7. Forward section of tailboom



Figure 8. Aft section of tailboom



Figure 9. Tailboom boom separation about midspan

Both main rotor blades were cut about 18 inches from the main rotor head to facilitate wreckage recovery. One of the two main rotor blades remained intact but folded in half during impact, as shown in figure 10. The outboard 3 ft of the other main rotor blade was not located during the on-scene investigation. The blade fracture exhibited damage consistent with impact with a power transmission line, as shown in figure 11. On October 5, 2021, the missing outboard 3 ft of the main rotor blade was located by a farmer during harvest. The outboard 3 ft blade section, as shown in figure 12, was located about 465 ft south of where the helicopter impacted the power transmission line.

Postaccident examination revealed no evidence of a mechanical malfunction of the helicopter that would have prevented normal flight.



Figure 10. Main rotor blade



Figure 11. Main rotor blade fracture with the severed power transmission line



Figure 12. Outboard 3 ft of main rotor blade found on October 5, 2021 (photo provided by helicopter operator)

Engine Examination and Disassembly

The engine remained partially attached to the engine mounts, which were cut at the accident site to facilitate engine recovery. The engine then was placed on a steel cart for the examination, as shown in figure 13 and figure 14. An external examination of the engine case and accessory section revealed significant thermal damage due to prolonged exposure to the postimpact fire, as shown in figure 15. The oil filter had separated from the rear accessory case. The throttle linkages forward of the firewall were destroyed during the postimpact fire. The throttle linkages on the engine-side of the firewall remained intact and connected to the fuel servo. Mixture control cable continuity was established from the cockpit control knob to the fuel servo mixture control arm.

The starter ring gear had dislodged from the flywheel. The starter ring gear left a significant gouge on the oil cooler body consistent with engine operation at impact, as shown in figure 16.

The fuel flow divider on the top of the engine was deformed from prolonged exposure to the postimpact fire and the internal diaphragm was destroyed. All B-nut fuel injector lines were tight between the fuel flow divider and their respective fuel injectors. All six fuel injectors were removed and were clear of debris. The fuel servo

butterfly rotated freely when the throttle arm was moved by hand. The fuel servo inlet screen was removed and exhibited no debris.

All six valve covers remained intact. The valve pushrods did not exhibit significant damage. Internal engine and valve train continuity, along with compression and suction on all cylinders, were confirmed as the crankshaft was rotated by hand. All valve rocker shafts moved normally during engine crankshaft rotation. Borescope inspection of each cylinder revealed no anomalies with the piston domes, cylinder walls, intake and exhaust valves, and lower sparkplugs.

The engine was equipped with two magnetos that exhibited significant thermal damage from the postimpact fire and could not be tested, as shown in figure 17. The upper spark plugs were removed and exhibited features consistent with normal engine operation. The ignition harness exhibited significant thermal damage from the postimpact fire.

The engine mechanical fuel pump was removed from the accessory section and a functional check revealed no anomalies when the lever was cycled by hand.

The oil pickup screen was removed and there was no evidence of debris.

Postaccident examination of the engine revealed no evidence of a mechanical malfunction that would prevent normal operation.



Figure 13. Left side of engine (as installed on helicopter)



Figure 14. Right side of engine (as installed on helicopter)



Figure 15. Engine accessory section



Figure 16. Starter ring gear gouge on the oil cooler body



Figure 17. Magnetos