

National Transportation Safety Board

Office of Aviation Safety

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WPR24LA139

AIRFRAME AND ENGINE EXAM SUMMARY REPORT

November 20 & 21, 2024

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A. ACCIDENT

Location: Tumwater, Washington
Date: May 3, 2024
Time: 16:00 Pacific daylight time
Aircraft: Robinson R22 BETA, N4082J

B. AIRFRAME AND ENGINE EXAM SUMMARY REPORT

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SUMMARY

Examination of the recovered wreckage was conducted on November 20 & 21, 2024, at the facilities of AvTech Services, Auburn, Washington. No preaccident mechanical anomalies were noted to the airframe or engine.

C. DETAILS OF THE INVESTIGATION

1.0 Airframe examination

Make: Robinson
Model: R22 BETA
Serial Number: 1794

Hourmeter: 381.88
Mixture: Lean
Carb Heat: OFF
Ignition: OFF, key not present

The helicopter was resting upright on its skids. (see figure 1) The toe section of the right skid was separated near the front crossbar, consistent with impact damage.



Figure 1. Front left view (courtesy of Robinson).

The left cabin door remained partially attached to the door frame and displayed breaks in the fiberglass. The right cabin door remained attached to the door frame and appeared undamaged. The left cyclic grip was fracture separated from the cyclic crossbar, consistent with impact damage. Both collective levers were intact and the throttle grips functional. Both seats remained installed, and the support structures were undamaged. All circuit breakers were in, except for the strobe light, which was out.

**The instrument panel's upper console was displaced, with loose hinges. Examination inside the upper panel console revealed that multiple wire bundles, including the main electrical harness, the pitot - static lines, and the MAP line were disconnected. Further review of accident aircraft photos taken by NTSB IIC Kristyn Blocher on 5/21/24, and Arnold & Arnold adjuster, Kody Spencer on 5/23/24, revealed that unauthorized alterations had been made, to the instrument panel and other systems, after NTSB instructed the Operator to leave the wreckage unaltered.

Both fuel tanks displayed denting and crushing, and damage adjacent to the main rotor mast. The auxiliary tank's inboard skin was punctured. Neither bladder was breached. Both filler caps were secure. Fuel samples from each tank revealed 1-2 visible drops of water at the bottom of the sample. About 12 gallons of 100LL aviation

fuel was drained, in total, from the tanks. Both finger screens were clear, and the gascolator screen was clean, and the fuel hoses remained secure, and the vent hoses and lines were clear.

The main rotor assembly remained attached to the mast. The mast fairing was crushed along its lower edge. The vertical and horizontal firewalls were dented and distorted. The main rotor flight controls showed disconnects in the upper rod end of both main rotor pitch links, and a disconnect in the left A121-7 push pull tube, adjacent to the damage associated with the upper edge of the main fuel tank and main rotor mast tube, all consistent with impact damage.

Both sheaves were undamaged. Both V-belts were off their sheaves. The friction surfaces of the V-belts appeared serviceable. The belt tension actuator was extended 1.40" between the scissor mounts. The upper and lower actuator support bearings rotated smoothly.

The main rotor gearbox input shaft rotated smoothly, but did not move the main rotor driveshaft. The sump was fractured, allowing the ring gear to disengage from the input pinion gear. The main rotor was rotated by hand and rotation of the ring gear was confirmed. No damage was noted to the ring gear. The driveshaft remained straight. The gearbox was free of oil and the chip detector was removed and found to be free of debris.

The forward flex coupling was undamaged. The intermediate flex coupling was bent and distorted. The aft flex coupling was undamaged. The tail rotor damper bearing support arm was bent and twisted, and the bearing rotated smoothly.

The tailcone displayed separations between bays 1 and 2, and bays 3 and 4, consistent with impact damage. The tail rotor drive shaft was bent near the forward end and protruded through torn aluminum in bay 1. It was separated near tail cone bays 3 and 4, consistent with impact damage. The tail rotor push pull tube was separated in two places.

The aft portion of the tailcone, with the empennage and tail rotor was separated from the forward sections of the tailcone. The top of bay 6 displayed crush damage and the aft bulkhead was cracked.

The tail rotor assembly remained attached to the tail rotor gearbox. (see figure 2) Tail rotor driveshaft continuity was established, from the driveshaft fracture separation near tail cone bays 3 and 4, to the tail rotor gear box. The tail rotor gearbox chip detector was removed and found to be clear of ferrous debris. Oil was visible in the oil level sight gauge for the tail rotor gearbox. (see figure 3)



Figure 2. View of tail rotor assembly (courtesy of Robinson).



Figure 3. View of tail rotor gearbox oil level sight gage.

2.0 Engine Examination

Engine Manufacturer: Lycoming
Engine Model Number: O-320-B2C
Engine Serial Number: L-12841-39A

The engine was secure and in place with no damage to the mounts. (see figure 4)



Figure 4. View of right side of engine.

Control rod continuity was established between the throttle grip and the carburetor. Control cable continuity was established between the cabin mounted mixture control knob and the mixture control arm on the carburetor. Control cable continuity was established between the cabin mounted carburetor heat control knob and the slider valve.

5 quarts of oil were observed on the dipstick measurement. The air filter appeared clean and unobstructed. The intake duct was clear.

The aft face of the upper sheave had a short scuff mark adjacent to the centering strut and the centering strut had a corresponding scuff mark.

The lower spark plugs were removed and inspected. Each appeared serviceable and normal, when referencing the Champion Aviation Check-A-Plug chart. Spark plugs 1

AIRFRAME AND ENGINE EXAM SUMMARY REPORT

and 3 were oil coated, consistent with the engine coming to rest on its left side during the accident sequence. Drive train continuity was established by manually rotating the engine cooling fan. No anomalies were noted. Thumb compression and suction was confirmed on all four cylinders. The lower spark plugs were reinstalled.

**Unauthorized postaccident alterations to the upper instrument console were discovered on November 20, 2024, at the wreckage examination. These alterations resulted in being unable to start the engine using the standard ignition system components, installed in the cabin. The console wire harness and pressure lines (pitot, static, and MAP) were not connected to the main wire harness and pressure lines. Prior to the accident, the main electrical harness in this aircraft had been modified, to accommodate a later version of the upper console (which is what had been installed and in operation at the time of the accident.) At the time of the postaccident examination, the console was found to be the earlier version, which prevented the ability to connect the current (altered postaccident) console harness to the main harness. (see figures 5 and 6)



Figure 5. View of N4082J upper console at OLM prior to wreckage recovery, 5/21/24



Figure 6. View of N4082J upper console at wreckage exam, 11/20/24

A portion of the wire harnesses did connect successfully, allowing activation of the Engine Tachometer, Oil Pressure gauge, Oil Temperature gauge, Cylinder Head Temperature gauge and main fuel level gauge. The Ignition/magneto key switch and the main Battery switch were not functional.

To determine the state of the engine, an alternate method of starting and running the engine was performed. The following steps were taken, to perform engine start and function test engine operation:

- The V-belts were cut and removed to disconnect the drive system.
- All nonessential circuit breakers were pulled.
- The fuel valve was opened.

- The P-leads from both magnetos were disconnected and individual jumper wires were attached to the P-lead terminals and grounded to the frame.
- A remote starter button was attached to the positive battery post and the solenoid terminal on the starter.
- A jumper wire was attached to the "switch" terminal on the battery relay and grounded to the ground strap providing power to the aircraft.
- The battery presently installed did not have enough energy to rotate the engine and an external power source was added.
- After a few unsuccessful attempts at engine start, it was discovered that the power terminal on the starter motor was loose and preventing sufficient contact. The wires were resecured on the terminal.
- The P-lead jumpers were disconnected from the frame.
- The fuel mixture knob was set to full rich, engine was primed with the primer pump, the throttle set to idle and using the remote starter button, the engine was started.
- Initially, gray smoke was emitted from the exhaust pipe and the engine struggled to run smoothly. After several seconds, the smoke cleared, and the engine idled smoothly.
- Oil pressure indicator was observed in the green range.
- The engine was run at 65-70% RPM until a rise was observed in the oil temp gauge (approximately 3 minutes).
- The throttle was increased to read 100% RPM on the engine tachometer. The engine ran smoothly at that RPM with no anomalies, for 2 minutes.
- The oil pressure remained in the green arc along with the oil and cylinder head temperatures.
- The throttle was reduced to read 75% RPM.
- To test each magneto individually, the right magneto P-lead was grounded to the frame resulting in a 8% drop in RPM. That P-lead was ungrounded, and the RPM returned to 75%. The left magneto P-lead was grounded to the frame resulting in a 12% drop in RPM. That P-lead was ungrounded, and the RPM returned to 75%.
- The throttle was reduced to idle, the fuel mixture knob was pulled to fuel cutoff, and the engine shut down.

3.0 Main Rotor Blades and Tail Rotor Blades Examination

Both main rotor blades exhibited multiple areas of bending, buckling and gouging along the leading edges. One main rotor blade was bowed upward with chordwise creases along the span, and bowed opposite the direction of rotation, near its tip. The other main rotor blade was bent upward 90° and bowed opposite the direction of rotation, near its tip; the droop stop tusk for this blade was fractured, consistent

with impact damage. Both blades displayed scuff marks near their tips, running chordwise. (see figure 7)

One tail rotor blade appeared undamaged; the other tail rotor blade was bent inward near the blade root and displayed scuff marks on the outboard surface.



Figure 7. View of both main rotor blades.

Submitted by:

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Air Safety Investigator