

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23FA357

EXAM

8/31/2023

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. EXAM IIC	3
C. SUMMARY	3
D. DETAILS OF THE EXAMINATION.....	4
1.0 ACCIDENT SITE	4
2.0 AIRFRAME EXAMINATION.....	4
2.1 Fuselage.....	4
2.2 Tail Boom and Rotor Assembly.....	4
2.3 Main Rotor Blades.....	5
2.4 Cockpit.....	5
2.5 Fuel/Fuel System.....	5
2.6 Drive... ..	6
3.0 ENGINE EXAMINATION	6
4.0 TAIL ROTOR BLADE/ASSY.....	7
5.0 ADS-B	8
6.0 METEOROLOGICAL INFORMATION	9
7.0 DOCUMENTATION.....	9

A. ACCIDENT

Location: Kingston, New Jersey
Date: August 31, 2023
Time: 1520
1920 (UTC)
Airplane: Robinson R-22 Beta N2356M

B. EXAM

NTSB IIC	Aaron McCarter NTSB Washington DC
Piper	Thom Webster Robinson Torrance, California
Lycoming	Ryan Enders Lycoming Engines Wichita, Kansas

C. SUMMARY

Shortly after departure from Princeton, NJ Airport (39N) while operating at about 1,000 feet mean sea level (800 agl) witnesses reported the helicopter flying erratically; it was climbing, descending, and spinning. During the erratic flying, the helicopter suffered a catastrophic failure; the main rotor blade(s) contacted the tail boom, severing the tail rotor assembly and causing a loss of control and subsequent impact with trees, terrain and water.

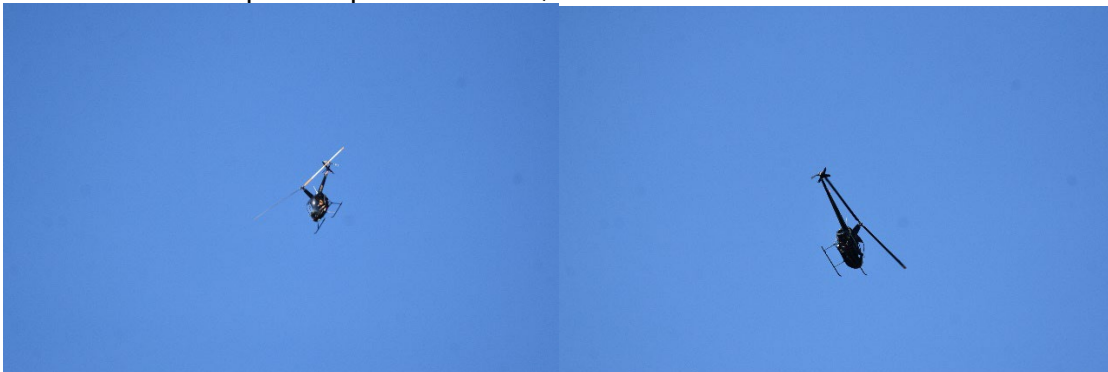


Figure 1 Photographs of helicopter taken by witness preceding crash.

D. DETAILS OF THE EXAMINATION

1.0 Accident Site

Princeton Airport (39N) Princeton/Rocky Hill, New Jersey, USA was about 2 miles west of the accident site. The helicopter came to rest inverted in about 3 feet of water on the shoreline of a tributary; the site contained thick brush, trees and swamp. The main wreckage consisting of the main rotor blades, engine fuselage and about 8 feet of the tail boom came to rest at an elevation of 15 ft. Lat/log 40.372604° / -74.619764° (figure 1)

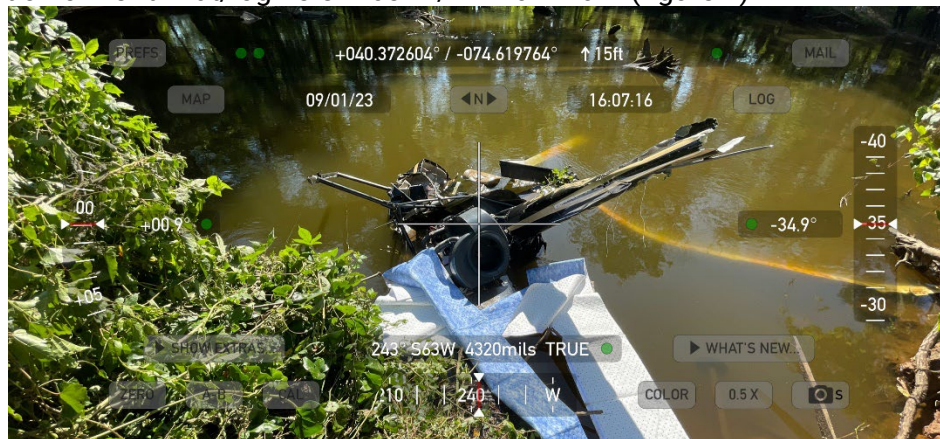


Figure 2 Accident site with location/ direction details

2.0 Airframe Examination

2.1 Fuselage

The forward fuselage was buckled and crumpled. The lower portion where the rudder pedals were located was crushed upwards into the occupiable space in the cockpit indicating that the helicopter struck the terrain nose low. The tail rotor assembly was severed aft of the N numbers. Photographic evidence showed that the tail came off in three separate pieces.

2.2 Tail Boom and Rotor Assembly

All control rods/tubes remained intact although damaged by impact forces. No anomalies or other irregularities were discovered. Tail Rotor pedals and their associated control rods showed no signs of anomalous damage or other irregularity. Continuity was established up through the fuselage to the remaining tail boom.



Figure 3 Tail boom severing showing 3 large pieces including the rotor blades and shaft.

2.3 Main Rotor Blades

Both rotor blades exhibited features consistent with tail strike damage. Scuff marks on the leading edge and gouges. The blades remained attached to the main rotor hub and one of the pitch control links (PCL) was severed and had the appearance of damage due to overload. The remaining PCL remained connected and functioned normally when manually manipulated.

2.4 Cockpit

The clutch switch was in the engaged position. The fuel selector valve selected to the ON position. When manually operated, the selector moved freely, and resistance was felt at each of the detents. The caution and warning lights were checked with one light, the low RPM showing signs of stretching. Each of the instruments were waterlogged but otherwise intact. The altimeter was indicating 10,600 ft and the altimeter setting was set at 30.04. The manifold pressure off indicating less than zero. The airspeed was indicating 105 knots and the engine RPM was indicating 55. The VSI indicated 300 fpm climb. The mag switch was in the "both" detent and was manually moved to each detent to ensure functionality. AMPS, Oil Pressure and Fuel gauges were destroyed by impact forces.

2.5 Fuel/Fuel System

About 4 1/2 gallons of fuel was drained/pumped out of the fuel tank which remained intact. The gascolator fuel screens were removed and contained some debris but was relatively free of obstructions. There was about 5 ounces of blue liquid with the smell and consistency of aviation fuel that was drained out of the gascolator. In the tub where the fuel was drained contained about 2 cups of water.

2.6 Drive

One V-belt remained in the forward grooves of the upper sheave and the aft grooves of the lower sheave. The other V-belt was laying on the clutch shaft forward of the upper sheave.

The overrunning clutch operated properly with no anomalous findings.

The belt tension actuator was extended and fractured at the upper support bearing mount. The upper and lower support bearing was manually rotated by hand and was smooth in action.

The forward flex coupling was bent slightly.

The main rotor was rotated more than 720° with no anomalies confirming continuity.

The main rotor drive shaft was bent at the swashplate.

The intermediate flex coupling was partially fractured on the clutch side and completely separated at the flex plate. The tail rotor driveshaft and tail rotor gearbox were not recovered.

3.0 Engine Examination

Lycoming O-320-B2C #L-17720-39A

~641.4 Hours Since Field O/H

There was no evidence of a post-crash fire.

The carburetor was impact separated and fractured but remained with the engine via the control cables and the air filter housing. The fuel line from the engine driven fuel pump to the carburetor was intact and undamaged. The line was removed, and no fuel was present. The engine drive fuel pump was fractured at the mounting flange and remained with the engine via the connecting fuel lines.

Both magnetos remained attached to the accessory housing. The right-hand magneto was undamaged and sparked at all four leads. The left-hand magneto capacitor was damaged by impact forces, preventing spark from occurring.

The Nos 2 and 3 (Top & Bottom) spark plugs displayed unusual blue coloration with normal electrodes as compared to the Champion Aerospace AV-27 Check-A-Plug chart. Blue thick substance found on spark plug and in the induction system. Sent the induction pipe(s) to the NTSB Materials lab for analysis.



Figure 4 Spark Plugs and blue tint

The oil filter was opened, and the pleats contained no foreign debris or ferrous material. The oil appeared dark brown in color and all lubricated components appeared to be well lubricated.

The engine crankcase was manually rotated 720° rotation. Continuity was confirmed and all pistons, valves springs and pushrods operated as designed. There was adequate suction and compression on each of the four cylinders. Continuity of the crankshaft to the camshaft was confirmed throughout the engine. Several small parts

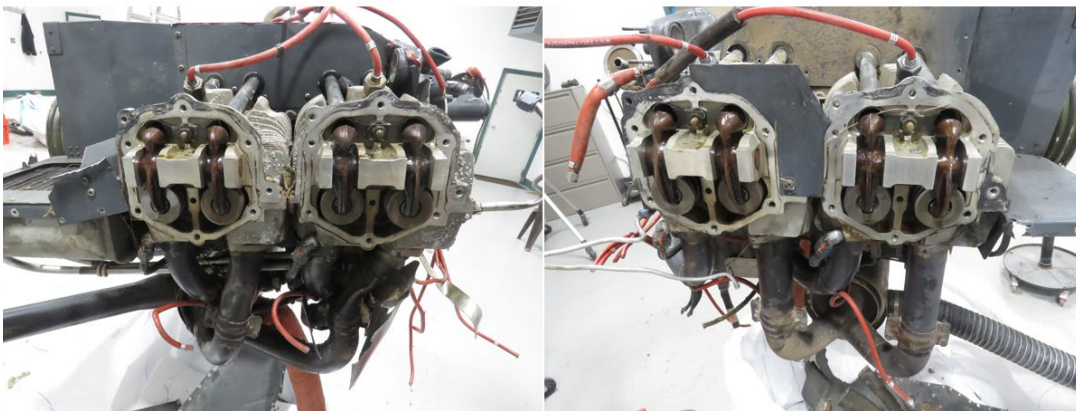


Figure 5 View of left and right side of engine prior to examination.

4.0 Tail Rotor Blade/Assy

The tail rotor drive shaft and the tail rotor blade assembly and gearbox (minus one 2 ft section of blade) and a partial tail boom with the stabilizers were not recovered. Multiple search

attempts were made; The Civil Air Patrol and Fire Rescue personnel were unable to locate the missing wreckage. Multiple search grids were searched including in the river and tributaries.

5.0 ADS-B

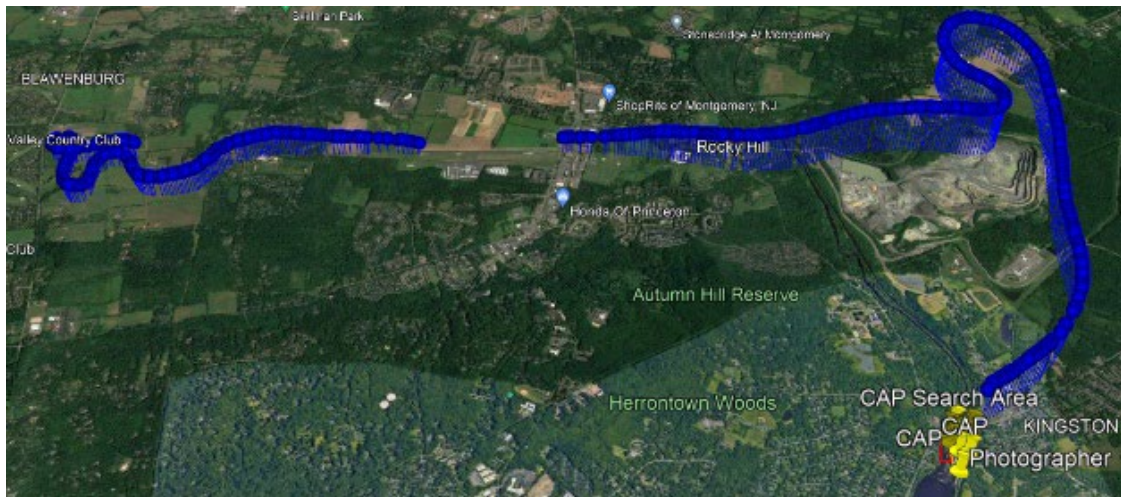


Figure 6 ADS-B Flight track. Instructor stated that he was supposed to do regular airport pattern work. This was unusual and he doesn't know why the pilot deviated from his instruction.

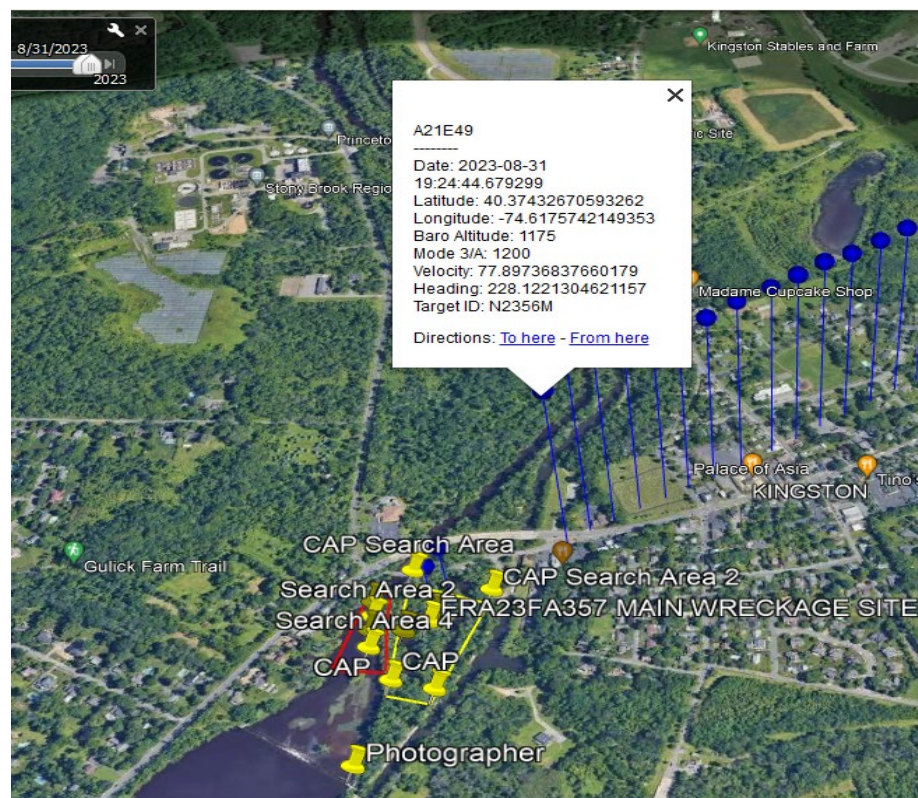


Figure 7 Last flight target prior to loss of control and impact. Note search grids and location of photographer.

6.0 Meteorological Information

Location.....: KTTN

Day of month.....: 31

Time.....: 18:53 UTC

Wind.....: true direction = 350 degrees; speed = 8 knots with gusts of 18.

Visibility.....: 10 Statute Miles

no clouds and no restrictions on vertical visibility

Temperature.....: 25 degrees Celsius

Dewpoint.....: 11 degrees Celsius

QNH.....: 29.94 inHg

Sea Level Pressure...: 1013.3 Mb

Temperature.....: 25 degrees Celsius

Dew Point.....: 10.6 degrees Celsius

7.0 Documentation

Log Book Entry
Hobbs 641.4 Date: 8/23/2023

Make of Aircraft	Aircraft Registration	Aircraft Serial	Aircraft Total Time	Engine Serial	Engine Total Time
Robinson R22	N2356M	2262	7233.5	L-17720-39A	5031.2

Complied with the following maintenance items:

- 1) Performed 100hr inspection IAW Robinson Maintenance Manuals.
- 2) Performed 50 & 100hr inspection IAW Lycoming O-320 operators manual.
- 3) Changed Engine oil and filter with new p/n: AA48108-2 and serviced with 5qts of Philips 20W50 oil.
- 4) Complied with engine compression check IAW Lycoming O-320 operators manual. #1 - 78, #2 - 78, #3 - 78, #4 - 78
- 5) Checked and adjusted magneto timing to engine IAW Lycoming O-320 Operators manual.
- 6) Installed new B771-1 air filter.
- 7) Performed aircraft and engine ground run and leak check.

Complied with the following Technical Bulletins:

- 1) Complied with 50Hr / 4 Month Lycoming SB 480 Oil & Filter Change and Inspection
- 2) Complied with 50Hr Lycoming SB 366 Carburetor Throttle Body screw inspection.
- 3) Complied with 50 / 100Hr Lycoming SI 1080 maintenance items for special attention.
- 4) Complied with 100Hr Lycoming SI 1191 Cylinder Compression
- 5) Complied with 100Hr Lycoming SI 1129 Alternator Belt Tension

All work was accomplished in accordance with approved, currently revised manufacturer's Robinson R22 and Lycoming O-320 Maintenance / Operators Manuals and AC 43.13-18

THE AIRCRAFT AND ENGINE WAS REPAIRED AND INSPECTED IN ACCORDANCE WITH THE CURRENT REGULATIONS OF THE FEDERAL AVIATION ADMINISTRATION AND IS APPROVED FOR RETURN TO SERVICE.

AUTHORIZED SIGNATURE [Redacted]
Jason M Smith A&P / [Redacted]

Log Book Entry
Hobbs 641.4 Date: 8/23/2023

Make of Aircraft	Aircraft Registration	Aircraft Serial	Aircraft Total Time	Engine Serial	Engine Total Time
[Redacted]	N2356M	2262	7233.5	L-17720-39A	5031.2

Complied with the following maintenance items:

- 1) Performed 100hr inspection IAW Robinson Maintenance Manuals.
- 2) Performed 50 & 100hr inspection IAW Lycoming O-320 operators manual.
- 3) Changed Engine oil and filter with new p/n: AA48108-2 and serviced with 5qts of Philips 20W50 oil.
- 4) Complied with engine compression check IAW Lycoming O-320 operators manual. #1 - 78, #2 - 78, #3 - 78, #4 - 78
- 5) Checked and adjusted magneto timing to engine IAW Lycoming O-320 Operators manual.
- 6) Installed new B771-1 air filter.
- 7) Performed aircraft and engine ground run and leak check.

Complied with the following Technical Bulletins:

- 1) Complied with 50Hr / 4 Month Lycoming SB 480 Oil & Filter Change and Inspection
- 2) Complied with 50Hr Lycoming SB 366 Carburetor Throttle Body screw inspection.
- 3) Complied with 50 / 100Hr Lycoming SI 1080 maintenance items for special attention.
- 4) Complied with 100Hr Lycoming SI 1191 Cylinder Compression
- 5) Complied with 100Hr Lycoming SI 1129 Alternator Belt Tension

All work was accomplished in accordance with approved, currently revised manufacturer's Robinson R22 and Lycoming O-320 Maintenance / Operators Manuals and AC 43.13-18

THE AIRCRAFT AND ENGINE WAS REPAIRED AND INSPECTED IN ACCORDANCE WITH THE CURRENT REGULATIONS OF THE FEDERAL AVIATION ADMINISTRATION AND IS APPROVED FOR RETURN TO SERVICE.

AUTHORIZED SIGNATURE [Redacted]
Jason M Smith A&P / [Redacted]

Figure 8 Last mx record for airframe and engine.

Submitted by:

McCarter, Lawrence Aaron
Aviation Accident Investigator IIC