



Aviation Investigation Final Report

Location:	Rowlett, Texas	Accident Number:	CEN22FA151
Date & Time:	March 25, 2022, 11:27 Local	Registration:	N514CD
Aircraft:	ROBINSON HELICOPTER R44	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

This report was modified on April 29, 2024. Please see the docket for the original report.

According to the operator, the lesson syllabus for the instructional helicopter flight included emergency procedures, equipment malfunctions, and vortex ring state (VRS) recognition and recovery. Flight track data, video, and a witness statement indicated that the helicopter was maneuvering at slow speeds about 2,000 ft mean sea level in the minute before the accident and shortly before a 4-ft section of the tailboom separated and the helicopter entered a spiraling descent to the ground. The witness stated that the helicopter appeared to hover when the tail boom separated.

The 4-ft section of the tailboom which included the tail rotor came to rest on the roof of a commercial building about 300 ft from the main wreckage. Examination of the helicopter revealed that the main rotor elastomeric teeter stops were severely damaged, and the brackets were bent. The main rotor drive shaft displayed scuff marks where the teeter stops were damaged, consistent with extreme teetering of the main rotor. Main rotor blade contact marks and dents were consistent with the main rotor blades contacting the tailboom in flight, resulting in its separation. Examination of the helicopter and engine did not reveal any preaccident anomalies with the helicopter that would have precluded normal operation.

The syllabus for the accident flight included an introduction to VRS and given the flight track information and witness statement, it is possible that the flight instructor was demonstrating, or the pilot receiving instruction was performing, a VRS entry/recovery when the accident occurred. However, since detailed information regarding the helicopter's flight control and engine parameters was not available, the exact maneuver being conducted at

the time of the tail boom separation could not be determined. The main rotor's contact with the tailboom is consistent with improper flight control inputs or low rotor RPM.

Toxicology testing of the flight instructor revealed the presence of bupropion, an antidepressant medication. Based on the available information, it could not be determined whether effects of the flight instructor's bupropion use or an associated condition contributed to the accident. Toxicological testing of the pilot receiving instruction revealed the presence of cetirizine, an antihistamine. It is unlikely that the effects of this medication contributed to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

A loss of helicopter control while maneuvering, which resulted in main rotor blade contact with the tailboom in flight, tail boom separation, and an uncontrolled descent.

Findings

Personnel issues	Aircraft control - Instructor/check pilot
Aircraft	(general) - Not attained/maintained

Factual Information

History of Flight

Maneuvering	Loss of control in flight (Defining event)
Maneuvering	Part(s) separation from AC

On March 25, 2022, about 1127 central daylight time, a Robinson R44 helicopter was destroyed when it was involved in an accident near Rowlett, Texas. The flight instructor and pilot receiving instruction sustained fatal injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

According to the operator, the accident flight was the second flight of the day for the flight instructor and the pilot receiving instruction. The first flight, which was lesson 10 of the training syllabus, was completed successfully. The accident flight was lesson 11, which included pre-solo maneuvers, introduction/simulation of emergency procedures, equipment malfunctions, and vortex ring state (VRS) recognition and recovery.

Video provided to the National Transportation Safety Board (NTSB) showed the helicopter and its separated tailboom and tail rotor section falling. The video did not show the actual in-flight separation of the tail section. About the last minute of the automatic dependent surveillance – broadcast (ADS-B) data for the flight showed that the helicopter was maneuvering at various slow airspeeds and altitudes. At 1126:07, the helicopter was about 1,975 ft mean sea level (msl) and flying at 7 knots ground speed. (See figure 1.)

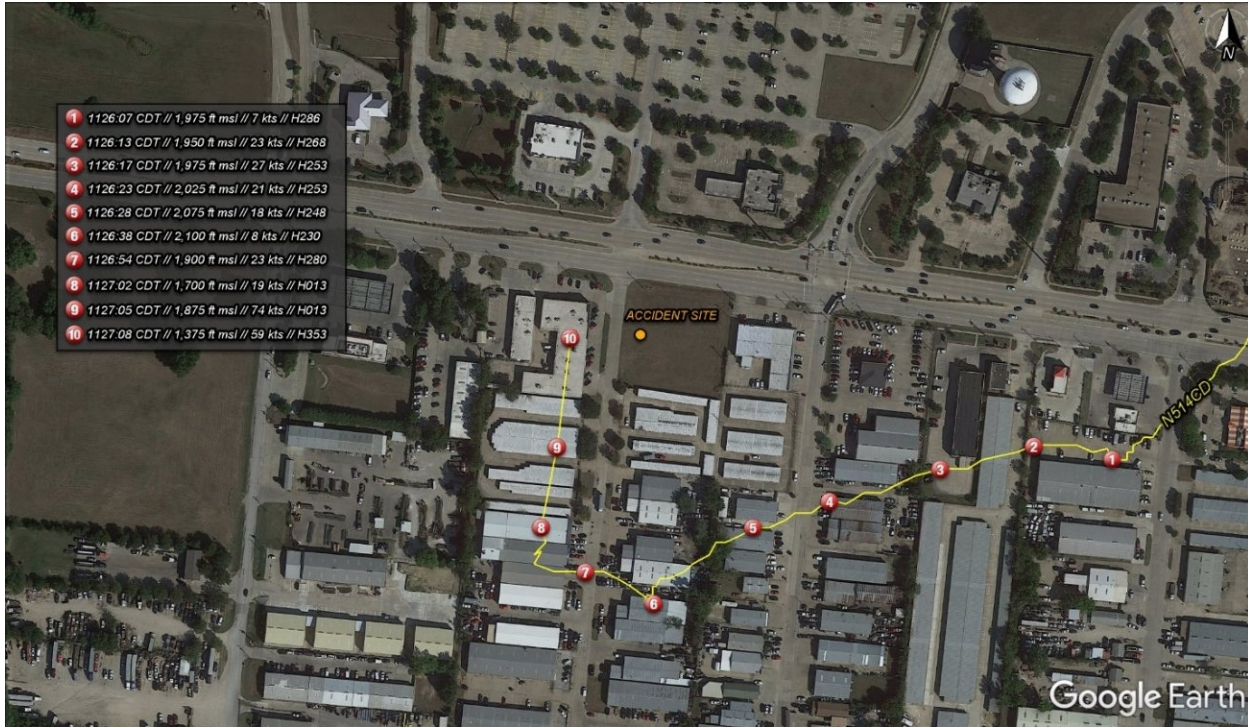


Figure 1. Final Minute of Flight Track from ADS-B Data

The ADS-B data points were consistent with a witness report. The witness heard the helicopter and did not think much of it until after a minute, when he noticed that the helicopter was not moving. He then looked up and saw the helicopter hovering in one place and assumed that it was taking photos of the area. Continuing to observe the helicopter, the witness saw it move about 100 ft and hovered in one place again. After about 10 seconds, the helicopter moved about another 100 ft and hovered. The witness then observed something separate from the helicopter. He saw the helicopter start to go backwards and the tail section fell toward the west. He then saw the helicopter spiraling and falling for about 100 ft. The helicopter stopped falling and spinning for a couple of seconds. Then the helicopter started to spin again and nose-dived to the ground.

There were no radio or distress calls heard from the helicopter.

Flight instructor Information

Certificate:	Commercial; Flight instructor	Age:	31,Female
Airplane Rating(s):	None	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	3-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	Helicopter	Toxicology Performed:	Yes
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	June 8, 2021
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	March 15, 2022
Flight Time:	525 hours (Total, all aircraft), 330 hours (Total, this make and model), 455 hours (Pilot In Command, all aircraft), 39 hours (Last 90 days, all aircraft), 30 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Student pilot Information

Certificate:	Commercial; Private	Age:	42,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	3-point
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	February 7, 2018
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	486 hours (Total, all aircraft), 16 hours (Total, this make and model)		

The pilot was receiving instruction to add a helicopter rating to his pilot certificate. Seven of his previous lessons were flown with a different instructor.

According to training records provided by the operator, the accident instructor flew with the pilot for three lessons before the accident flight. The flight instructor was qualified as an instructor in the R-22 and R-44 helicopters and had completed the Robinson Helicopter Pilot Safety Training Course on May 5, 2021.

Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER	Registration:	N514CD
Model/Series:	R44	Aircraft Category:	Helicopter
Year of Manufacture:	2016	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	30007
Landing Gear Type:	Skid	Seats:	4
Date/Type of Last Inspection:	February 14, 2022 Annual	Certified Max Gross Wt.:	2200 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	920 Hrs at time of accident	Engine Manufacturer:	Lycoming
ELT:	Not installed	Engine Model/Series:	O-540-F1B5
Registered Owner:	SKY HELICOPTERS INC	Rated Power:	185 Horsepower
Operator:	SKY HELICOPTERS INC	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KF46,575 ft msl	Distance from Accident Site:	8 Nautical Miles
Observation Time:	11:15 Local	Direction from Accident Site:	79°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	230°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.16 inches Hg	Temperature/Dew Point:	19°C / -2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Garland, TX (T57)	Type of Flight Plan Filed:	Company VFR
Destination:	Rockwall, TX (F46)	Type of Clearance:	None
Departure Time:	10:20 Local	Type of Airspace:	Class E

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	On-ground
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	32.907879,-96.582196

The main section of the helicopter was found in a vacant lot between a commercial strip mall and a municipal roadway. The main wreckage was mostly consumed by a post-impact fire. A 4-ft section of the tail boom, with the tail rotor assembly attached, impacted the top of a one-story commercial building about 300 ft from the main wreckage. Main rotor blade impact marks on the separated section of the tail boom were consistent with main rotor blade contact of the tail boom in flight. The elastomeric teeter stops were severely damaged, and the brackets bent. The main rotor drive shaft displayed scuff marks where the teeter stops were damaged.

Although most of the helicopter was consumed by a post-impact fire, detailed examinations of the airframe, drive system, annunciator light panel, flight controls, main rotor, tail rotor, drive systems, powerplant controls, and fuel system did not reveal any preaccident mechanical failures or malfunctions with the helicopter systems that would have precluded normal operation.

All fractures in the flight control tubes were consistent with overload or thermal damage. All control tube attachments were accounted for and secure. The main rotor swashplate moved freely by hand. Both main rotor blade pitch links were fractured at the upper rod end in overload. All three hydraulic servos sustained thermal damage and could not be moved by hand. The tail rotor pitch change slider moved freely by hand.

A detailed examination of the engine was completed on-scene. No preaccident mechanical failures or anomalies were observed that would have precluded normal operation.

Medical and Pathological Information

Autopsies on the flight instructor and pilot receiving instruction were conducted at the Southwestern Institute of Forensic Sciences at the Dallas Office of the Medical Examiner, Dallas, Texas. The cause of death for both was blunt force injuries.

Toxicological testing of the flight instructor and pilot receiving instruction were performed at the Federal Aviation Administration Forensic Sciences Laboratory. Tests were also performed at the Southwestern Institute of Forensic Sciences at the Dallas Office of the Medical Examiner, Dallas, Texas. 68 ng/g of the antidepressant medication bupropion was detected in specimens from the flight instructor.

258 ng/ml, ng/g of the antihistamine medication cetirizine was detected in the specimens from the pilot receiving instruction.

Additional Information

Vortex Ring State Information from Robinson Flight Training Guide, dated March 2019:

The vortex ring state is most dangerous when it happens at relatively low altitudes. The most common condition is during a steep approach with a tailwind. It should be demonstrated at an altitude of at least 1000 feet AGL.

To enter a maneuver, adjust the power to approximately 13–15 inches manifold pressure. Hold altitude with aft cyclic until the airspeed approaches 20 KTS. Allow the sink rate to increase to 300 FPM or more as the attitude is adjusted to obtain airspeed of less than 10 KTS. The aircraft will begin to shudder. Application of additional up collective will increase the vibration and sink rate while the cyclic and pedal effectiveness is reduced. Once the condition is well developed, rate of sink in excess of 2000 FPM can result. Recovery should be initiated at the first sign. The maneuver can also be entered from an OGE hover. There are two recovery techniques:

- 1. The traditional technique is to apply forward cyclic to increase airspeed and simultaneously reduce the collective. When the airspeed indicates 20-30 KTS and the trim strings have become effective raise the collective to takeoff power and adjust the cyclic to a maximum performance climb attitude. The recovery is completed when the VSI reads 0.*
- 2. A more efficient recovery technique is called the Vuichard Recovery. Initiate the recovery by raising the collective to takeoff power (MCP at lower gross weights), simultaneously*

applying left pedal to maintain heading and right cyclic (10°–20° bank) to get lateral movement. Once the right side of the rotor disc reaches the upwind part of the vortex the recovery is completed. Average loss of altitude during the recovery is 20–50 feet.

In January 2024, Robinson amended paragraph 2 in its Flight Training Guide to read:

To enter a maneuver, adjust the power to approximately 13-15 inches of manifold pressure. Hold altitude with aft cyclic until the airspeed approaches 20 KTS. Allow the sink rate to increase to 300 FPM or more as the attitude is adjusted to obtain airspeed of less than 10 KTS. The aircraft will begin to shudder. Application of additional up collective will increase the vibration and sink rate while the cyclic and pedal effectiveness is reduced. If this condition becomes well developed, rate of sink in excess of 2000 FPM can result. Do not allow the condition to develop beyond the initial indications and avoid large control inputs. Recovery should be initiated at the first sign. The maneuver can also be entered from an OGE hover.

Administrative Information

Investigator In Charge (IIC):	Lemishko, Alexander
Additional Participating Persons:	Gavin Hill; FAA North Texas FSDO; Irvine, TX Thom Webster; Robinson Helicopters; Torrence, CA David Harsanyi; Lycoming Engines; Williamsport, PA
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Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=104828

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