



Aviation Investigation Final Report

Location:	Livingston, Texas	Accident Number:	CEN22FA086
Date & Time:	December 30, 2021, 11:41 Local	Registration:	N8AU
Aircraft:	Bell 206B	Aircraft Damage:	Substantial
Defining Event:	Loss of tail rotor effectiveness	Injuries:	2 Fatal, 2 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Passengers reported that the helicopter flight was a sightseeing flight won at a local charity auction. The flight began normally with the intention to fly over the front-seat passenger's childhood home but diverted to the passenger's current home due to low clouds along the original route. The rear-seat passengers stated that the helicopter flew down the road where the residence was located and then around the house making a level right turn at low speed. The helicopter then flew over a pond on the property and toward the house. As the helicopter approached the house it was facing a southerly direction and came to a hover above the trees where the accident occurred. The passengers stated that the helicopter was either motionless in the hover or slightly drifting. The helicopter then began to rotate to the right, completing 2 revolutions while descending. The helicopter rotors struck trees and then fell onto a pile of wood that had been stacked due to land clearing activities.

Postaccident examination of the helicopter did not reveal any preimpact anomalies and a passenger reported that the helicopter's engine was still running after the accident.

Video evidence showed that just before the accident the helicopter was operating with about 89% torque and in a hover about 150 ft above the ground, and no engine anomalies were recorded. Aviation weather reports indicated that the helicopter may have been facing into a slight wind of about 3 knots (kts); however, the lack of nearby official weather reporting stations, and the variability of unofficial weather reporting stations, made the wind determination inconclusive.

Loss of tail rotor effectiveness (LTE) can be affected by numerous factors that could not be conclusively eliminated. Based on the lack of evidence of a mechanical failure, passenger witness accounts, and video showing the helicopter's instrument panel after the initiation of

the rotation, the helicopter likely sustained an aerodynamic loss of tail rotor effectiveness that resulted in an exceedance of the yaw capability of the helicopter during a high-power hover maneuver at low altitude, from which the pilot was unable to recover.

Probable Cause and Findings

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

The pilot exceeding the yaw control capability of the helicopter for the flight conditions, resulting in a non-mechanical loss of tail rotor effectiveness.

Findings

Aircraft	Yaw control - Capability exceeded
Personnel issues	Aircraft control - Pilot

Factual Information

History of Flight

Maneuvering-low-alt flying Loss of tail rotor effectiveness (Defining event)

On December 30, 2021, about 1141 central standard time, a Bell 206B helicopter, N8AU, was substantially damaged during an accident near Livingston, Texas. The pilot and one passenger were fatally injured, and two passengers received minor injuries. The flight was operated under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight.

Automatic dependent surveillance - broadcast data for the flight showed that the helicopter departed the Livingston Municipal Airport (00R) about 1107 and headed east-northeast for about 25 nautical miles (nm) before reversing course to a west-southwest direction. The helicopter then turned further south before the end of the data at 1138. The final recorded location was 1.8 nm northeast of the accident site.

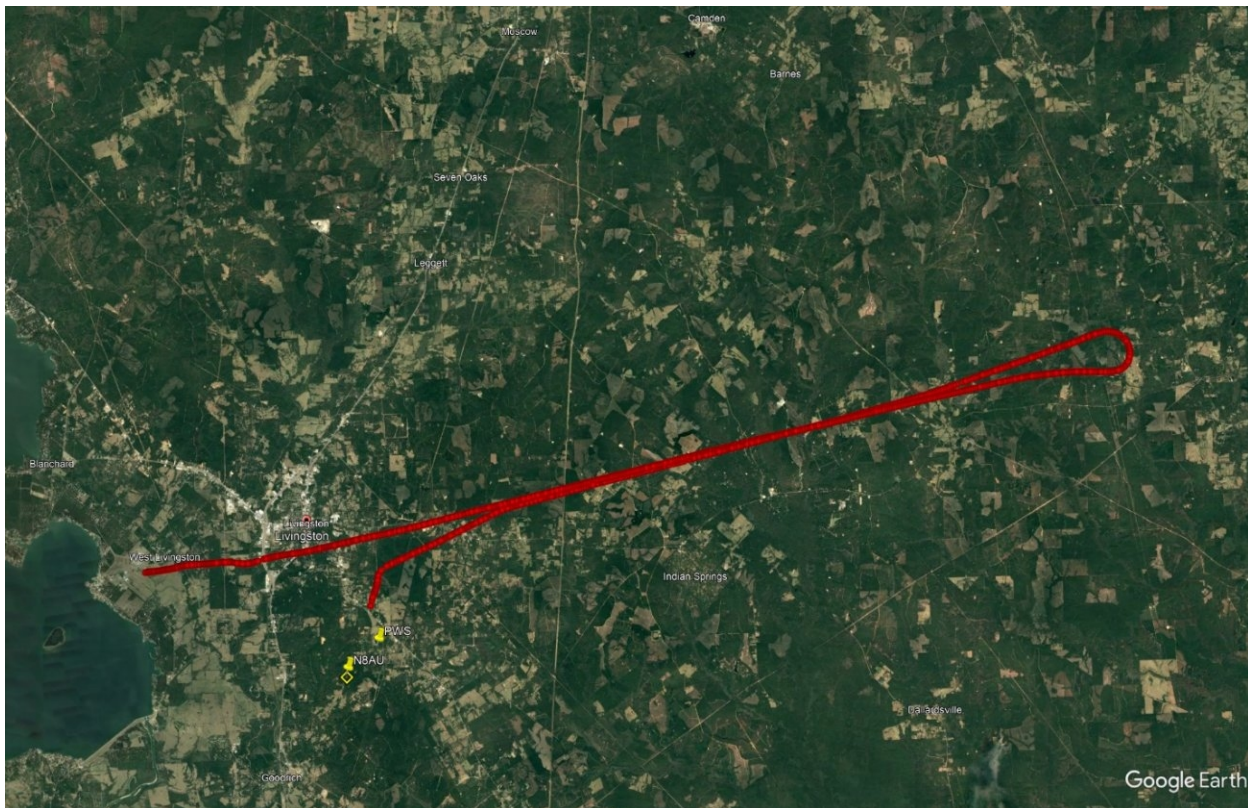


Figure 1. ADS-B Flight Path Depiction

Video from the front left passenger's cellular phone showed that the helicopter flew along the road where the passenger's house was located. The video showed that the helicopter was traveling about 40 kts about 150 ft above ground level before slowing and making a right turn around the house. The helicopter completed about 270° of turn and slowed to a hover before the video ended. The audio portion of the video captured the sounds of the rotors and the engine. No discernable unusual noises were evident in the audio recording. The video and audio ended before the accident occurred.

According to the surviving passengers, the flight was a sightseeing flight that the deceased front-seat passenger had won at a local charity auction. On the day of the accident, the passengers met the pilot at 00R. The original intent was to fly over the deceased passenger's childhood home near Woodville, TX. While on course toward Woodville, it became evident that the flight could not be continued due to low clouds and the helicopter was then maneuvered to the passenger's current residence near Livingston, TX. The rear-seat passengers stated that the helicopter flew down the road where the residence was located and then around the house making a level right turn at low speed. The helicopter then flew over a pond on the property and toward the house. As the helicopter approached the house it was facing a south direction and came to a hover above the trees where the accident occurred. The passengers stated that the helicopter was either motionless in the hover or slightly drifting.



Figure 2. Depiction of the Flight Final Path to the Accident Site

Once in the hover, the helicopter began to rotate to the right, which one passenger initially thought was the pilot intentionally maneuvering the helicopter. The helicopter continued to rotate, and the passenger realized the rotation was not intentional. The helicopter rotated about two full revolutions before striking a tree with the rotor blades and descending to the ground. It came to rest on its left side on top of a wood pile that had been created due to land clearing. One passenger noticed, after attending to the pilot and front-seat passenger, that the helicopter's engine was still running. He started moving any switch he could find to the "off" position until the helicopter's engine stopped.

Pilot Information

Certificate:	Airline transport	Age:	73, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	
Instrument Rating(s):	Airplane; Helicopter	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	
Medical Certification:	BasicMed Without waivers/limitations	Last FAA Medical Exam:	July 15, 2016
Occupational Pilot:	UNK	Last Flight Review or Equivalent:	
Flight Time:	1679 hours (Total, all aircraft), 71.7 hours (Total, this make and model)		

The pilot held an airline transport pilot certificate with multi-engine land airplane and rotorcraft-helicopter certificates. He also had private pilot privileges for single-engine land airplanes. He reported civil flight experience that included 1679 total and 72 hours in last six months as of his most recent medical exam dated July 15, 2016. He was issued a Second-Class Medical Certificate without limitation on that date. The medical certificate expired for all classes in 2018, but he had applied for BasicMed. The pilot had most recently completed the BasicMed Course on June 7, 2020, and the most recent submission of the required Comprehensive Medical Examination Checklist (CMEC) was on June 13, 2018.

Review of pilot flight records indicated that he had about 200.9 hours of flight experience in helicopters, which included about 71.7 hours in the accident make and model.

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N8AU
Model/Series:	206B	Aircraft Category:	Helicopter
Year of Manufacture:	1990	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	4089
Landing Gear Type:	High skid; Skid	Seats:	5
Date/Type of Last Inspection:	May 20, 2021 Annual	Certified Max Gross Wt.:	3200 lbs
Time Since Last Inspection:		Engines:	1 Turbo shaft
Airframe Total Time:	2296.3 Hrs as of last inspection	Engine Manufacturer:	Rolls Royce
ELT:	Installed, activated, did not aid in locating accident	Engine Model/Series:	M250-C20J
Registered Owner:	206B LLC	Rated Power:	420 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

The helicopter maintenance records were not available during the investigation; however, the maintenance facility that completed the most recent maintenance provided a copy of the inspections performed. The records provided indicated that the helicopter had received 12-month and 24-month inspections per the manufacturer's maintenance manual on May 20, 2021.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	K6R3,245 ft msl	Distance from Accident Site:	31 Nautical Miles
Observation Time:	11:53 Local	Direction from Accident Site:	236°
Lowest Cloud Condition:	Clear	Visibility	7 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	3 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	160°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.94 inches Hg	Temperature/Dew Point:	24°C / 23°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Livingston, TX (00R)	Type of Flight Plan Filed:	None
Destination:	Livingston, TX (00R)	Type of Clearance:	None
Departure Time:	11:07 Local	Type of Airspace:	Class G

Unofficial weather stations located between 5 and 12 miles from the accident site recorded winds from 357° to 196° with magnitudes varying from 1 to 4 kts. The quality of the data from the unofficial sites could not be determined.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal, 2 Minor	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	2 Fatal, 2 Minor	Latitude, Longitude:	30.648176,-94.91511



Figure 3. Helicopter as viewed during on-scene examination (NTSB Photo)

The helicopter impacted terrain and rolled over onto its left side coming to rest on a pile of logs. The forward fuselage and left side fuselage and tail boom sustained substantial damage. The main and tail rotors were separated. The elevation at the accident site was about 250 ft above mean sea level.

Postaccident examination of the helicopter did not reveal any preimpact failures or malfunctions with the airframe, rotor systems, engine, or flight controls that would have precluded normal operations.

Injuries to Persons

The passenger seated in the front left seat of the helicopter was fatally injured in the accident. The pilot, seated in the front right seat, initially survived and was transported to a hospital but succumbed to his injuries 13 days after the accident. The death certificate listed complications following multiple blunt force injuries as the cause of death.

Flight recorders

The helicopter was not equipped with on-board flight or data recording equipment; however, the front-seat passenger recorded the flight on his personal cellular telephone. Three recordings were obtained from the family and examined by a National Transportation Safety Board recorder specialist. The recordings were short, with durations of 11, 21, and 46 seconds respectively.

The first recording began with an inward view showing the individual who was holding the phone and then panned to the rear where the two rear-seat passengers could be seen. The engine sounds indicated that the helicopter was powered on and no abnormal sounds were heard.

The second recording was an outward forward-facing view and captured the helicopter taking off and climbing. The helicopter was adjacent to the left side of a runway. About 10 seconds into the video, the helicopter turned to the left and climbed over trees before flying over a field. No abnormal engine noises were heard.

The third video also captured a predominately outward forward-facing view but panned a few times during the recording. At 2 seconds after the start of the recording, the camera was pointed out of the left side of the helicopter and showed the ground and a parking area with some utility vehicles. At 5 seconds, the camera panned forward and showed the helicopter flying at a low altitude over a tree line. At 15 seconds, the camera panned to the right and captured the instrument panel. The helicopter's airspeed was 40-45 kts, the altitude read 400 ft, heading was 230°, and the attitude indicator showed a slight left roll. A status bar displayed "GPS" in green, and "MSG" in orange. The annunciator panel was not illuminated with any warnings or cautions. At 22 seconds, the helicopter began a right turn, and the camera captured the turbine power between 97-100% and the rotor rpm between 90-100%. The helicopter's airspeed was just below 40 kts and the altitude was 400 ft. At 26 seconds, the helicopter continued the right turn. Torque was about 60% and airspeed had slowed to about 35 kts. At 31 seconds, the helicopter had circled the house and began to hover. A left drift occurred as the helicopter yawed to face the backside of the house. At 38 seconds, as the helicopter was behind the house, the torque indicator read about 82% and the airspeed was at

0 kts. At 39 seconds, the torque indicator read about 89% and airspeed read 0 kts. At 46 seconds, the recording ended. At no time during the recording were any abnormal engine noises heard. The passengers reported that the third video ended seconds before the accident occurred.

Tests and Research

The Federal Aviation Administration's Helicopter Flying Handbook describes Loss of Tail Rotor Effectiveness (LTE) as a condition that occurs "when the flow of air through a tail rotor is altered in some way, either by altering the angle or speed at which the air passes through the rotating blades of the tail rotor system." This can result in the required thrust from the tail rotor exceeding the thrust available. The Helicopter Flying Handbook further stated regarding LTE:

This alteration of tail rotor thrust can be affected by numerous external factors. The main factors contributing to LTE are:

- 1. Airflow and downdraft generated by the main rotor blades interfering with the airflow entering the tail rotor assembly.*
- 2. Main blade vortices developed at the main blade tips entering the tail rotor.*
- 3. Turbulence and other natural phenomena affecting the airflow surrounding the tail rotor.*
- 4. A high power setting, hence large main rotor pitch angle, induces considerable main rotor blade downwash and hence more turbulence than when the helicopter is in a low power condition.*
- 5. A slow forward airspeed, typically at speeds where translational lift and translational thrust are in the process of change and airflow around the tail rotor will vary in direction and speed.*
- 6. The airflow relative to the helicopter;*
 - a. Worst case—relative wind within $\pm 15^\circ$ of the 10 o'clock position, generating vortices that can blow directly into the tail rotor. This is dictated by the characteristics of the helicopters [sic] aerodynamics of tailboom position, tailrotor size and position relative to the main rotor and vertical stabilizer, size and shape.*
 - b. Weathercock stability—tailwinds from 120° to 240° , such as left crosswinds, causing high pilot workload.*

c. Tail Rotor Vortex Ring State (210° to 330°). Winds within this region will result in the development of the vortex ring state of the tail rotor.

7. Combinations (a, b, c) of these factors in a particular situation can easily require more anti-torque than the helicopter can generate and in a particular environment LTE can be the result.

Administrative Information

Investigator In Charge (IIC):	Brannen, John
Additional Participating Persons:	Peter B Brandon; FAA - Houston FSDO; Houston, TX Mark Stuntzner; Bell Helicopter; Fort Worth, TX Dave Riser; Rolls-Royce; Indianapolis, IN
Original Publish Date:	April 18, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=104459

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