



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Perry, Oklahoma	Accident Number:	CEN22FA053
Date & Time:	November 28, 2021, 16:58 Local	Registration:	N59600
Aircraft:	Bell 206	Aircraft Damage:	Destroyed
Defining Event:	Unknown or undetermined	Injuries:	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Prior to the flight, the pilot, who is not a mechanic, installed the flight controls at the helicopter's left seat position. The pilot and passenger, who was in the right seat and held a student pilot certificate, departed from the pilot's property for a local area flight. The pilot was demonstrating how he performed low-level aerial application maneuvers to the passenger. During a pass to the east, the two occupants both observed a coyote in a large field. The pilot performed a right pedal turn to get a better look at the coyote. The pilot maneuvered the helicopter to an out-of-ground effect hover over the tall grass, facing to the south, about 40 ft agl, and the two occupants were looking at the coyote. The helicopter then immediately began an uncommanded left roll.

The passenger couldn't tell what the cyclic positions were (such as if they both went to the left or if just one went to the left) during the uncommanded left roll. The passenger reported the accident sequence happened "very fast" and that the pilot was on the flight controls for the entire flight. The helicopter did not spin, there were no vibrations emitted from the helicopter, and no alarms or warning lights came on during this period. The helicopter impacted a grass field just prior to a barbed wire fence and a postimpact fire ensued.

Postaccident examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation; however, the helicopter was destroyed by the postimpact fire. Detailed examination of the flight control system, including determining flight control continuity, could not be established due to the impact and thermal damage. Postaccident scanning and examination of the three hydraulic servo actuators did not reveal any mechanical malfunctions or failures that would result in a cyclic hard over sequence.

Based on autopsy findings, the pilot had severe stenosis of two coronary arteries. However, there was no evidence of sudden incapacitation, and the passenger reported that the pilot was acting fine the entire flight. Thus, the pilot’s cardiovascular medical condition was not a factor in this accident. The drug identified on the pilot’s toxicology results was the non-impairing pain reliever acetaminophen, thus the pilot’s medication use was not a factor in this accident.

The passenger had reported no medical conditions that would be a factor in this accident. Toxicology testing detected no psychoactive compounds from cannabis in his blood but detected tetrahydrocannabinol (THC) and its psychoactive metabolite 11-hydroxy-delta-9-THC (11-OH-THC) in his urine. THC’s inactive metabolite, carboxy-delta-9- tetrahydrocannabinol (THC-COOH), was detected in his blood and urine, but this compound can be found long after using cannabis. Thus, it is unlikely that the passenger’s use of cannabis contributed to the accident.

At the time of the loss of lateral control, the pilot and passenger were visually focused outside of the helicopter. With the unexpected and rapid onset of the uncommanded left roll as described by the passenger, there would have been minimal time for the flying pilot to assess and initiate corrective actions.

Based on the available evidence, the reason for the loss of lateral control during a hover could not be determined.

Probable Cause and Findings

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

A loss of lateral control during a hover that resulted in an impact with terrain. Based on the available evidence, the reason for the loss of lateral control could not be determined.

Findings	
Personnel issues	Aircraft control - Pilot
Not determined	(general) - Unknown/Not determined
Aircraft	Lateral/bank control - Not attained/maintained
Aircraft	Lateral/bank control - Unknown/Not determined

Factual Information

History of Flight

Maneuvering-hover	Low altitude operation/event
Maneuvering-hover	Unknown or undetermined (Defining event)
Maneuvering-hover	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

On November 28, 2021, about 1658 central standard time, a Bell 206B helicopter, N59600, was destroyed when it was involved in an accident near Perry, Oklahoma. The commercial pilot sustained fatal injuries and the passenger, who held a student pilot certificate, sustained serious injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 personal flight.

According to the passenger, who is the pilot’s son, the pilot preflighted the helicopter at 1530. The helicopter was kept on the pilot’s property in a barn. Nothing abnormal was noticed during the preflight. During the preflight, the pilot installed the flight controls for the left seat position.

For the flight, both front doors were installed and neither occupant did any filming during the flight. The pilot, in the left seat, had on a surplus US Army (Gentex) SPH-4 helicopter flight helmet, but the flight helmet did not have a tinted visor and he did not have on sunglasses. The passenger, in the right seat, had on a headset, and he did not have on sunglasses.

The helicopter departed from the pilot’s property about 1600 with about 50 gallons of fuel onboard, and when the accident occurred there was about 25 gallons of fuel onboard.

After departing from the property, the helicopter flew to the Perry Municipal Airport (F22), Perry, Oklahoma. The pilot flew three traffic pattern flights. After the three traffic pattern circuits, the helicopter departed the airport and flew to the west of I-35. According to the passenger, everything appeared normal with the helicopter up to this point.

The pilot flew to the west of I-35 over ranch property to demonstrate how he performed his 14 *CFR* 137 low-level aerial application flights in the helicopter. The passenger reported that the setting sun was in both of their eyes during this timeframe.

The pilot performed several low-level east to west maneuvers and he was demonstrating the use of the Satloc aerial application navigation system to the passenger. During these maneuvers, the helicopter was about 15 ft above ground level (agl) and was traveling about 60 kts airspeed.

During a pass to the east, the two occupants both observed a coyote in a large field. The coyote was in tall grass, just to the south of a barbed wire fence near where the helicopter came to rest. The pilot performed a right pedal turn to get a better look at the coyote.

The pilot maneuvered the helicopter to an out-of-ground effect hover over the tall grass, facing to the south, about 40 ft agl. Both the pilot and passenger were looking at the coyote when the helicopter began an uncommanded left roll.

The passenger couldn't tell what the cyclic positions were (such as if they both went to the left or if just one went to the left) during the uncommanded left roll. The passenger reported the accident sequence happened "very fast," the pilot was on the flight controls for the entire flight, and that the passenger was not operating the flight controls during the accident sequence.

The pilot did not announce anything during this time regarding what he thought was going on with the helicopter. The helicopter did not spin, and the passenger did not recall the main rotor blade striking the ground before the helicopter impacted the terrain. There were no vibrations emitted from the helicopter and no alarms or warning lights came on during this period. The helicopter impacted a grass field just south of a barbed wire fence.

The grass around the helicopter instantly caught on fire after the impact. The passenger was able to extract himself and the deceased pilot away from the wreckage. About 5 minutes later, the wreckage caught on fire and was destroyed. The passenger then contacted first responders from his cellular phone who then arrived shortly after. There were no known witnesses who observed the accident sequence.

Pilot Information

Certificate:	Commercial	Age:	55,Male
Airplane Rating(s):	None	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	4-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	May 5, 2021
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	October 30, 2021
Flight Time:	(Estimated) 6385.6 hours (Total, all aircraft), 2250 hours (Total, this make and model), 6343.4 hours (Pilot In Command, all aircraft)		

Student pilot Information

Certificate:	Student	Age:	24, Male
Airplane Rating(s):	None	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	None	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	February 10, 2021
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	(Estimated) 0 hours (Total, all aircraft), 0 hours (Total, this make and model)		

Pilot

The pilot, who owned the accident helicopter, worked full time as a helicopter air ambulance pilot. The pilot also worked part time as a 14 *CFR* Part 137 aerial application pilot (as the sole pilot in the business he owned) and as a rancher.

The pilot's helicopter air ambulance company records were available for review; however, the pilot's personal logbook was not available for review.

According to Federal Aviation Administration (FAA) records, the pilot did not hold a mechanic certificate.

Passenger/Student Pilot

The passenger was enrolled in a university aviation program and was learning to fly helicopters.

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N59600
Model/Series:	206 B	Aircraft Category:	Helicopter
Year of Manufacture:	1974	Amateur Built:	
Airworthiness Certificate:	Normal; Restricted (Special)	Serial Number:	1420
Landing Gear Type:	None; High skid	Seats:	2
Date/Type of Last Inspection:	Unknown	Certified Max Gross Wt.:	3200 lbs
Time Since Last Inspection:		Engines:	1 Turbo shaft
Airframe Total Time:		Engine Manufacturer:	Rolls-Royce
ELT:		Engine Model/Series:	250-C20B
Registered Owner:	On file	Rated Power:	420 Horsepower
Operator:	On file	Operating Certificate(s) Held:	Agricultural aircraft (137)
Operator Does Business As:	On file	Operator Designator Code:	None

The helicopter was certificated by the FAA in both the standard and restricted airworthiness categories. According to FAA records, the pilot purchased the helicopter in November 2013.

According to the pilot's girlfriend, she flew with the pilot in the helicopter about 1.5 weeks prior to the accident. The pilot took her on an aerial application flight in the local area to spray several crop fields and nothing abnormal was noticed with the helicopter. The girlfriend reported that the pilot was the only one who would install and remove the copilot cyclic control in the helicopter. The pilot would install the copilot cyclic if he was going to fly with his son and then the pilot would later remove it.

The helicopter was modified with a Simplex 4900 aerial application spray system per a FAA-approved supplemental type certificate. At the time of the accident, the helicopter did not have the spray booms installed. Per FAA records, the helicopter was equipped with a Satloc unit (unknown model) and a Shadin Fuel Flow Indicator unit (unknown model); however, the Satloc was destroyed and the Shadin Fuel Flow Indicator unit was not identified in the wreckage. The helicopter was not equipped with a crash-resistant fuel system, nor was it required to be. An emergency locator transmitter was not identified in the wreckage and the passenger reported he was unsure if one was installed in the helicopter.

The airframe and engine maintenance records for the helicopter were not available for review.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KSWO, 984 ft msl	Distance from Accident Site:	18 Nautical Miles
Observation Time:	16:53 Local	Direction from Accident Site:	137°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	None / None
Wind Direction:		Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.21 inches Hg	Temperature/Dew Point:	14°C / -1°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Perry, OK (PVT)	Type of Flight Plan Filed:	None
Destination:	Perry, OK (PVT)	Type of Clearance:	None
Departure Time:	16:00 Local	Type of Airspace:	Class G

The passenger reported the local weather conditions for the flight were no wind, no turbulence, and clear visibility.

A review of meteorological data indicated a light southerly wind below 2,000 ft agl, no indication of turbulence or low-level wind shear, or any other outflows or wind shifts. A pilot report indicated flight visibility of 10 miles. There were no inflight weather advisories over the region during the flight. Astronomical conditions indicated the accident occurred before sunset with a low sun elevation present.

A review of the meteorological data surrounding the time and location of the accident did not reveal any meteorological areas of concern.

The estimated density altitude for the accident site was 931 ft above msl.

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 1 Serious	Latitude, Longitude:	36.380203,-97.344568(est)

The accident site, at an elevation of 1,056 ft above msl, consisted of private property that is used as a cattle pasture. The barbed wire fence that the helicopter came to rest just prior to, was found intact with no sign of impact. The barbed wire fence was later cut by the investigative team to facilitate access to the wreckage. All major structural parts of the helicopter were accounted for at the accident site.

Most of the forward and intermediate fuselage was consumed in the fire. The tailboom detached from the intermediate fuselage and was found near the main wreckage.

The main rotor hub and blade assembly remained attached to the mast which fractured just below the hub. Both main rotor blades suffered various degrees of fracturing and bending. All remnants of the main rotor blades were accounted for. The transmission case was partially consumed in the post-crash fire. Due to the thermal and impact damage, main rotor drive continuity could not be established. The tail rotor drive system was continuous within the tail boom section found adjacent to the wreckage.

During the impact sequence, the tail rotor gearbox separated from the tail boom. The complete tail rotor assembly separated from the tail rotor gearbox output shaft. The tail rotor gearbox was able to be rotated by hand in both directions with no binding or abnormal sounds coming from the tail rotor gearbox.

The components of the fuel system, including the fuel bladder, two electric boost pumps, lower and upper tank indicating units, fuel/vent lines, fuel shutoff valve, airframe fuel filter, and an electric sump drain valve were destroyed by the fire.

The components of the hydraulic system, including the hydraulic pump and regulator assembly, three servo actuators, solenoid valve, tube assemblies, hose assemblies, and hydraulic filter were destroyed by the fire. The hydraulic servo actuator support suffered significant thermal damage. However, the left/right (cyclic) and collective (center) servo actuators were located and retained for further examination.

The components of the flight controls, including collective pitch controls, cyclic controls, and tail rotor controls were destroyed by the fire. One collective stick was present in the wreckage along with one pedal assembly. However, the cyclic control were not located in the wreckage.

Due to the extensive damage to the flight controls from the fire, flight control continuity could not be established.

The hopper was destroyed and there was no evidence of chemical being carried in the helicopter at the time of the accident.

The cockpit structure, dash panel, and two cockpit seats and restraints were destroyed. All the cockpit gauges were destroyed by the impact sequence and postimpact fire and no readings were obtained.

Fuel samples from the airframe and engine were not available.

The turboshaft engine was found securely mounted to the remnants of the airframe. The engine sections (intake, compression, combustion, and exhaust) all sustained fire damage. Damaged sustained to the cockpit and fuselage prevented engine control continuity checks to the fuel control unit and the power turbine governor. The power turbine support was removed from the exhaust collector to inspect the remainder of the turbine stages. The second, third, and fourth stage turbine wheels were undamaged with no missing blades or nozzle airfoils. The turbine to compressor coupling (N1 shaft) was intact and dark in appearance. A silver powder-like substance was observed on the first stage nozzle shield, third stage nozzle, and third stage turbine wheel. This substance is consistent with the compressor front diffuser coating and was likely liberated during the impact sequence, supporting engine operation at impact.

Postaccident Fourier Transform Infrared Spectroscopy and mass spectroscopy analysis of fluid samples extracted from the servo actuators revealed that the fluid did not match either MIL-H-5606 or MIL-H-6803 hydraulic oils that were listed in the engineering drawing. The actual identity of the fluid could not be determined, but the results of the analysis indicated that it was a mixture of a petroleum based and synthetic based hydraulic fluid, combined with a third unknown component. The passenger reported he did not know if any hydraulic fluid was added before the accident flight.

Postaccident scanning and examination of the three servo actuators did not reveal any mechanical malfunctions or failures that could result in a cyclic hard over sequence.

Flight recorders

The helicopter was not equipped with a crashworthy flight data recorder or a cockpit voice recorder, nor was it required to be.

Medical and Pathological Information

Pilot

At his most recent FAA medical examination, he reported no medications or medical conditions. According to the autopsy report from the Office of the Medical Examiner, Oklahoma City, Oklahoma, the cause of death of the pilot was multiple blunt force injuries and the manner of death was accident. The medical examiner reported the pilot had 90% stenosis of his left anterior descending and right coronary arteries.

Toxicological testing performed by the FAA's Forensic Sciences Laboratory identified the non-sedating pain reliever acetaminophen (commonly marketed as Tylenol) in the pilot's femoral blood and urine.

Passenger

At his most recent FAA medical examination, he reported no medications or medical conditions. Toxicology testing performed by the FAA Forensic Sciences laboratory detected the primary psychoactive compound of cannabis, THC, in the passenger's urine at 1.7 nanograms per milliliter (ng/mL); THC was not detected in his blood. THC's psychoactive metabolite 11-OH-THC was detected but not quantified in his urine but was not detected in his blood. THC's inactive metabolite THC-COOH was detected in the passenger's hospital admission blood at 23.4 ng/mL and in his urine at 84.1 ng/mL.

Additional Information

Flight Controls

The task instructions to install and remove the copilot's flight controls is in the Bell 206 series FAA-approved maintenance manual.

Bell released Operations Safety Notice 206-84-12 for the Bell 206 and the TH-57 series helicopters on July 17, 1984. This document discusses the dual control-quick disconnect kit and states in part:

Investigation of a recent model 206 helicopter accident, which resulted in a fatality, revealed that lateral cyclic control was lost as a result of an improperly installed copilot's quick-disconnect cyclic stick.

Flight crews are cautioned to assure quick removal flight controls are properly installed prior to operating the helicopter.

The Bell Operations Safety Notice was released shortly after an accident (NTSB accident number DEN84FA207) that occurred on July 2, 1984. The accident report, involving a Bell 206B helicopter, stated in part:

Witnesses stated the helicopter entered a "hard left turn" in a near inverted position before "it went down hard and fast." Inspection disclosed the metal connection for the left cyclic stick was broken in half. The pilot was flying from the left seat. Examination of the cyclic stick quick disconnect locking nut revealed it was held in place on the connector by one thread. Properly installed, the locking nut tightens down over six threads on the connector. When backed out to one thread, movement of the cyclic will not produce a corresponding change in the lateral control hydraulic servos.

Bell subsequently released Alert Service Bulletin (ASB) 206-85-27 for the Bell 206 and the TH-57 series helicopters on March 15, 1985. This document discusses design changes made to the dual control-quick disconnect kit to help ensure proper installation.

Compliance with manufacturer service bulletins for aircraft operated under 14 *CFR* Part 91 and 14 *CFR* Part 137 is not mandated by the FAA. Since the airframe maintenance records for the helicopter were not available for review, it was undetermined if ASB 206-85-27 was complied with.

At the time of the accident, there was no clear guidance published about the topic of flight control installation and removal (such as who is allowed to perform the task, inspection requirements, weight and balance documentation requirements, and maintenance record entry requirements) for owners, operators, pilots, and maintenance personnel operating helicopters under 14 *CFR* Part 91 and 14 *CFR* Part 137. Bell was asked by the NTSB investigator-in-charge (IIC) if they would publish guidance on this task for operations in the United States (as the type certificate for the helicopter is held in Canada and is managed by Transport Canada) and Bell declined.

Rotorcraft Flight Manual

A review of the FAA-approved Bell 206B rotorcraft flight manual found no guidance for pilots listed if a flight control malfunction occurs. This includes a failure of components with the flight control system transmitted through feedback, binding, resistance, or sloppiness and not

mistaking these conditions for a failure of hydraulic power. Bell was asked by the NTSB IIC if they would publish guidance for pilots on this emergency procedure topic and Bell declined.

Startle Response

The FAA has published a Fly Safe Fact Sheet that defines what startle response is and states in part:

Humans are subject to a “startle response” when they are faced with unexpected emergency situations and may delay or initiate inappropriate action in response to the emergency. Training and preparation can reduce startle response time and promote more effective and timely responses to emergencies.

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	Jason Jaworsky; FAA Will Rogers FSDO; Oklahoma City, OK Jon-Adam Michael; Rolls-Royce; Indianapolis, IN Dane Immel; Woodward; Valencia, CA John Roberts; Transportation Safety Institute; Oklahoma City, OK Nora Vallee (Accredited Representative); Transportation Safety Board of Canada; Quebec, OF Ian Sturgeon (Technical Advisor); Transport Canada; Ottawa, OF Gary Howe (Technical Advisor); Bell; Fort Worth, TX
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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).