National Transportation Safety Board
Aviation Accident Final Report

Location:	Shreveport, LA	**Accident Number:**	CEN17FA103
Date & Time:	02/15/2017, 0023 CST	**Registration:**	N598PB
Aircraft:	BELL HELICOPTER TEXTRON CANADA 429	**Aircraft Damage:**	Substantial
Defining Event:	Controlled flight into terr/obj (CFIT)	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

While performing a dark night, cross-country flight, the helicopter cruised towards its destination. The helicopter impacted a marshy area of a lake. Impact signatures were consistent with the helicopter colliding with trees and terrain in a nose low attitude. Weather information for the time of the accident showed that the helicopter was operating in an area favorable for instrument flight rules (IFR) conditions due to precipitation and mist, cloud ceilings between 1,000 to 1,600 ft above ground level, and possible moderate turbulence. Due to cloud cover, it is likely that the Moon was not visible. There is no evidence that the pilot obtained a weather briefing prior to takeoff. The pilot's log books were not recovered during the investigation and the pilot's total time, and night experience is not known. While the pilot held a rating for instrument airplane, it is not known how much training the pilot obtained, if any, for an instrument helicopter rating. It is likely that the pilot had no more than 30 hours in make and model.

Data downloaded from onboard avionics found that the flight was uneventful until 4 minutes before the accident when the helicopter made a right turn and began flying to the southwest. As the helicopter tracked southwest, the altitude dropped to about 600 ft msl (500 ft above ground level [agl]). A minute later, the helicopter turned left turn and descended in the turn to about 420 ft agl before it pitched up to 40° nose high, resulting in a 2,500 ft per minute (fpm) climb. The helicopter momentarily stabilized on a 55° heading. At this time, the pilot armed the airspeed hold mode but did not turned on the force trim, so the autopilot would not engage. It is likely that the pilot expected the autopilot to engage, and when the helicopter began a left bank, he turned on the force trim but did not re-engage the autopilot. Shortly thereafter, the helicopter exceeded a 45° left bank and the pitch exceeded 40° nose low. The helicopter rapidly descended and impacted terrain. An examination of the avionics data, airframe, and engine did not identify any preimpact anomalies. While several substances were found in the pilot's toxicology, their use did not appear to contribute to the accident. The circumstances of the accident are consistent with the pilot's inadvertent encounter with instrument meteorological

conditions, which resulted in in spatial disorientation, loss of control, and subsequent impact with terrain.

Probable Cause and Findings

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

The pilot's inadvertent encounter with instrument meteorological conditions resulting in spatial disorientation, loss of control, and subsequent impact with terrain.

Findings

Personnel issues	Spatial disorientation - Pilot (Cause)
Environmental issues	Obscuration - Effect on personnel (Cause)
	Obscuration - Awareness of condition
	Dark - Effect on personnel

Factual Information

History of Flight

Enroute-cruise	Other weather encounter Inflight upset
Maneuvering	Controlled flight into terr/obj (CFIT) (Defining event)

On February 15, 2017, at 0023 central standard time, a Bell 429 helicopter, N598PB, impacted terrain and water at Wallace Lake near Shreveport, Louisiana. The private rated pilot and passenger were both fatally injured. The helicopter was substantially damaged. The helicopter was registered to and operated by a private individual under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Dark night instrument meteorological conditions (IMC) prevailed for the flight, which operated without a flight plan. The flight originated from a field in Bossier City, Louisiana, and was en route to Center Municipal Airport (F17), Center, Texas.

The helicopter was in contact with air traffic control. When the helicopter disappeared from radar unexpectedly and did not respond to radio communications, it was the subject of an alert notice and was located on the afternoon of February 15. The wreckage was located at the southern end of Wallace Lake.

Pilot Information

Certificate:	Private	**Age:**	54, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With Waivers/Limitations	**Last FAA Medical Exam:**	05/26/2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 900 hours (Total, all aircraft), 30 hours (Total, this make and model)		

The pilot held a private pilot certificate with ratings for helicopter, airplane single-engine land, multi-engine land, and instrument airplane. His log books were not recovered during the investigation and the pilot's total time, and night experience is not known. While the pilot held a rating for instrument airplane, it is not known how much training the pilot obtained, if any, for an instrument helicopter rating.

On May 26, 2015, the pilot was issued a third-class medical certificate with the limitation that he "must wear correct lenses for near and distant vision." He reported no medication use.

The pilot attended the Bell Training Academy at the end of October 2016. During his training, he logged 9.2 hours of flight instruction of the Bell 429 to include operation of the auto pilot. In addition, he logged 5.2 hours of flight instruction in a flight training device which included Auto Pilot Operation, use of the on-board flight planning devices, and inadvertent flight into IMC. All maneuvers performed were evaluated to the Federal Aviation Administration (FAA) Practical Test Standards Test tolerances.

Aircraft and Owner/Operator Information

Aircraft Make:	BELL HELICOPTER TEXTRON CANADA	**Registration:**	N598PB
Model/Series:	429 NO SERIES	**Aircraft Category:**	Helicopter
Year of Manufacture:	2014	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	57249
Landing Gear Type:	Skid	**Seats:**	5
Date/Type of Last Inspection:	10/27/2016, Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	18 Hours	**Engines:**	2 Turbo Shaft
Airframe Total Time:	30 Hours at time of accident	**Engine Manufacturer:**	P&W CANADA
ELT:	C126 installed, not activated	**Engine Model/Series:**	PW207D1
Registered Owner:	BAILEY TERRY	**Rated Power:**	710 hp
Operator:	On file	**Operating Certificate(s) Held:**	None

The Bell 429 intermediate helicopter is an eight-seat twin engine, Category A, single pilot IFR certified rotorcraft. It is equipped with autopilot and force trim systems. The force trim system uses a spring force to hold the flight controls to a detent position. The detent position can be moved anywhere in the control range by either releasing the fight control from the spring mechanism and re-engaging it in a different position, or by driving it to a new position using a motorized actuator. The pilot can also fly the controls without releasing the force trim, but in this case the pilot must work against the spring force to make control inputs. Force trim is required for the autopilot to couple to the flight director.

Complete maintenance logbooks were not recovered. Of the records located, a listing of scheduled maintenance inspections completed on October 31, 2016, reported the helicopter had accrued 12.1 total hours. The last annual inspection was performed on October 27, 2016, at a total time of 10.0 hours.

The pilot purchased the helicopter on July 1, 2016. The helicopter had accrued approximately 30 hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	**Condition of Light:**	Night/Dark
Observation Facility, Elevation:	KSHV, 259 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	1249 CST	**Direction from Accident Site:**	324°
Lowest Cloud Condition:	Thin Broken / 1000 ft agl	**Visibility**	7 Miles
Lowest Ceiling:	Broken / 1000 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	320°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	8°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Bossier City, LA	**Type of Flight Plan Filed:**	None
Destination:	Center, TX (F17)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	

A weather study was conducted by a National Transportation Safety Board (NTSB) Meteorologist. At 2356, an automated weather reporting station located at Shreveport Municipal Airport (KSHV), Shreveport, Louisiana, 10 nautical miles north of the accident site, reported wind from 320° at 11 knots, visibility 4 statute miles with light drizzle and mist, a broken ceiling at 700 ft, overcast at 1,300 ft, temperature 45° F, dew point 45° F, and a barometric pressure of 29.93 inches. There was a remark that drizzle began at 2251, and the ceiling varied between 500 ft and 900 ft.

At 0049, the same station reported a wind from 320° at 9 knots, visibility 7 miles, a broken ceiling at 1,000 ft, overcast at 1,400 ft. There was a remark that drizzle ended at 0047.

A review of data from the closest National Weather Service Surveillance Radar-1988, Doppler, located at KSHV, found that near the accident site at the accident time, conditions were conducive for IMC and drizzle. There were no lightning strikes around the accident site at the accident time.

Two Airmen's Meteorological Information (AIRMET) were issued at 2045 CST on February 14, for forecasted instrument flight rules (IFR) conditions due to precipitation and mist, and possible moderate turbulence below 8,000 ft. Both AIRMETs were valid until 0900 on February 15.

The phase of the Moon was waning gibbous with 78% of the Moon's visible disk illuminated. With the extensive cloud cover above the accident site at the accident time, the Moon would not have been visible.

A search of official weather briefings sources did not locate a pilot's request for weather prior to the accident flight.

The complete weather study report is located in the docket of this report.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	32.311389, -93.705556

Damage to several trees and a large crater were consistent with the helicopter's impact with terrain. The debris field fanned out about 20° either side of a 320° magnetic heading for about 80 yards in a marshy area of Wallace Lake. There was evidence of a post-impact fire in the debris field. The helicopter was fragmented in multiple location and scattered throughout the debris field. The main wreckage consisted of the fuselage and main rotor hub which came to rest near the end of the debris field.

The helicopter was removed from the marsh and transported to the shore for documentation and examination. The examination did not reveal any preimpact anomalies with the helicopter. The helicopter's display unit (DU) retains non-volatile memory and was sent to Bell Helicopter, Fort Worth, Texas, for download.

Display Unit Download

Under the auspices of the NTSB and Federal Aviation Administration (FAA), the DU was downloaded and the information plotted. A review of the information revealed that the helicopter lifted off and departed a field near the Horseshoe Casino, Bossier City, Louisiana, at 0015. The helicopter departed to the southwest and then flew near the Red River, as it headed to the southeast, and maintained an altitude between 800 to 1,000 ft mean sea level (msl). At 0019, the helicopter made a right turn and flew to the southwest. As the helicopter tracked southwest on a 230° heading, the altitude dropped to about 600 ft msl or 500 ft above ground level (agl). At 0022, the helicopter turned 30° bank left turn. The helicopter descended in the turn to about 420 ft agl, before it pitched up to 40° nose high, resulting in 2,500 ft per minute (fpm) climb to 1,470 msl (1,386 agl). The helicopter momentarily stabilized on a 055° heading. At 0023:00 then exceeded a 45° left bank and the pitch exceeded 40° nose low. The time of the last capture was 0023:13, with the helicopter traveling 167 knots and descending more than

8,800 fpm. Control inputs were performed by the pilot up to and including the last capture.

During the flight, no problems with airframe or engine control inputs were detected. Data captured revealed that the pilot flew a majority of the accident with the Force Trim off. He also did not select any flight director modes. At 0022:46 (27 seconds prior to impact), the pilot armed the airspeed hold mode. The pilot's action would have presented him flight director commands, but due to the Force Trim being off, the autopilot could not engage to hold this mode. At 0022:56 (18 seconds prior to impact), the pilot turned on the Force Trim. However, the pilot did not reselect an attitude mode for the autopilot to engage to a mode. The manufacturer recommends turning on Force Trim shortly after takeoff.

Communications

About 0017, an air traffic controller from KSHV contacted the pilot since the helicopter had entered Class C airspace. The controller informed the pilot of the Class C airspace and the pilot proceeded on course to F17. No radar services were provided, and no distress call was recorded.

Medical And Pathological Information

Due to the condition of the remains, the De Soto Parish Coroner's Office, Mansfield, Louisiana, was not able to perform an autopsy.

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicology testing on samples from the pilot. Testing was negative for ethanol. Testing detected amphetamine, dihydrododeine, nordiazepam, oxazepam, and temazepam.

Amphetamine is a Schedule II controlled substance available by prescription that stimulates the central
nervous system available by prescription for the treatment of attention deficit disorder (ADD) and narcolepsy. Dihydrocodeine is an active metabolite of hydrocodone, a Schedule II opioid medication.

According to records obtained from the pilot's primary care physician, he had a longstanding diagnosis of attention deficit disorder and had been treated with Vyvanse since before April 2015, (the first available visit record). He also had a history of joint pain for which he intermittently used hydrocodone. In 2015, he had an obstructing kidney stone and had been given a prescription for diazepam. His last visit was on January 24, 2017, for a review of his attention deficit disorder and mildly elevated blood pressure. No comment was made in the physician's record regarding any symptoms from the ADD or the effectiveness of the medication.

Additional Information

Spatial Disorientation

The FAA Pilot's Handbook of Aeronautical Knowledge, chapter 16, "Aeromedical Factors," stated, "Under normal flight conditions, when there is a visual reference to the horizon and ground, the sensory system in the inner ear helps to identify the pitch, roll, and yaw movements of the aircraft. When visual contact with the horizon is lost, the vestibular system becomes unreliable. Without visual references outside the aircraft, there are many situations in which normal motions and forces create convincing illusions that are difficult to overcome...Unless a pilot has many hours of training in instrument flight, flight should be avoided in reduced visibility or at night when the horizon is not visible. A pilot can reduce susceptibility to disorienting illusions through training and awareness and learning to rely totally on flight instruments."

At the time of this report's creation, the FAA's Helicopter Flying Handbook, FAA-H-8083-21A, dated 2017, does not contain a section on spatial disorientation.

Inadvertent Entry into IMC

The FAA's Helicopter Flying Handbook, FAA-H-8083-21A, dated 2017, chapter 12, page 4, states, "Deteriorating weather is even harder to detect at night...". In addition, 5 basic steps "that every pilot should be ultimately familiar with and should be executed immediately after inadvertently entering IMC.

1. Attitude—level the wings on the attitude indicator, both pitch and bank.
2. Heading—pick a heading that is known to be free of obstacles and maintain it. This may be 180° from your current heading.
3. Power—adjust to a climb power setting.
4. Airspeed—adjust to a climb airspeed.
5. Trim—maintain coordinated flight so that an unusual attitude will not develop.

Workload Management

The FAA's Helicopter Flying Handbook, FAA-H-8083-21A, dated 2017, chapter 14, "Effective Aeronautical Decision-Making," states, "Another important part of managing workload is recognizing a work overload situation. The first effect of high workload is that a pilot begins to work faster. As workload increases, attention cannot be devoted to several tasks at one time, and a pilot may begin to focus on one item. When a pilot becomes task saturated, there is no awareness of additional inputs from various sources, so decisions may be made on incomplete information, and the possibility of error increases. A very good example of this is inadvertent IMC. Once entering into bad weather, work overload becomes immediate. Mentally, the pilot must transition from flying outside of the aircraft to flying inside the aircraft. Losing all visual references can cause sensory overload and the ability to think rationally is gone. Instead of trusting the aircrafts instruments, pilots try to hang on to the little visual references that they have and forget all about the other factors surrounding them. Instead of slowing the helicopter

down they increase airspeed. Because they are looking down for visual references they forget about the hazards in front of them and finally, because they are not looking at the flight instruments, the aircraft is not level. All of this can be avoided by proper training and proper planning. If going inadvertent IMC is your only course of action, pilots must commit to it and fly the helicopter using only the flight instruments and not trying to follow what little visual references they have."

Administrative Information

Investigator In Charge (IIC):	Jason T Aguilera	**Adopted Date:**	11/05/2018
Additional Participating Persons:	Dean Johnson; FAA; Baton Rouge, LA Matthew Rigsby; FAA AVP-100; Washington, DC Scott Tyrell; FAA Rotorcraft Directorate; Dallas, TX		
Publish Date:	11/05/2018		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=94717		