Aviation Investigation Final Report

Location:	Rhine, Georgia	**Accident Number:**	ERA17FA330
Date & Time:	September 20, 2017, 06:01 Local	**Registration:**	N3875J
Aircraft:	Cessna 150G	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The student pilot departed in dark night, marginal visual flight rules (MVFR) conditions from his private grass runway that was partially lit with solar lights. A witness heard the airplane depart followed by the sound of a crash, and when he arrived at the airstrip, he observed a light layer of fog over the runway. The airplane came to rest in heavily-wooded terrain adjacent to the runway. Examination of the airplane and engine revealed no anomalies that would have precluded normal operation before impact.

Data downloaded from an onboard GPS unit revealed that, after departure, the airplane made a climbing right turn to an altitude of 407 ft. It then descended to 256 ft and reached a maximum airspeed of 95 knots (kts) while continuing the right turn. The airplane then climbed in a right, 30° bank to a maximum altitude of 666 ft while slowing to an airspeed of 32 kts, which was well below the minimum stall speed. The airplane then rolled to the right and entered a rapid descent before the data ended.

Conditions conducive to the development of spatial disorientation were present, including the dark night, MVFR conditions and a noninstrument-rated student pilot. Additionally, the airplane's track data, which reflects spiral-like maneuvering, and a wreckage distribution consistent with a loss-of-control, stall-type vertical descent, are consistent with the known effects of spatial disorientation. Based on this evidence, the student pilot most likely experienced spatial disorientation after takeoff, which led to the airplane exceeding its critical angle of attack and an aerodynamic stall.

Probable Cause and Findings

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

The student pilot's decision to take off from a partially-lit grass runway in dark night, marginal visual flight rules conditions, which resulted in spatial disorientation, an exceedance of the airplane's critical angle of attack, and an aerodynamic stall.

Findings

Personnel issues	Decision making/judgment - Student/instructed pilot
Personnel issues	Aircraft control - Student/instructed pilot
Aircraft	Angle of attack - Capability exceeded
Personnel issues	Spatial disorientation - Student/instructed pilot
Personnel issues	Recent experience - Student/instructed pilot
Environmental issues	Dark - Effect on personnel
Environmental issues	Low visibility - Effect on personnel

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)
Initial climb	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On September 20, 2017, at 0601 eastern daylight time, a Cessna 150G, N3875J, was substantially damaged when it collided with terrain shortly after takeoff from a private airstrip near Rhine, Georgia. The student pilot was fatally injured. The airplane was owned by the pilot who was operating it as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Dark night marginal visual flight rules (MVFR) conditions prevailed in the area and no flight plan was filed for the flight, which was destined for Turner County Airport (75J), Ashburn, Georgia.

On the morning of the accident, the student pilot, who was the owner of the airplane, planned to pick up his flight instructor in Ashburn before flying to St. Simon's, Georgia, where he was scheduled to take his private pilot practical test the following day. The instructor had checked the weather that morning and saw that that there was fog reported in some areas, so he called the student, who did not answer his phone. The instructor then received a text from the student that stated, "I'll see you in a few." The instructor responded, "ok;" this was his last communication he had with the student pilot.

A witness stated that he had just stepped out of his home when he heard an airplane with the engine "full throttle." It was dark outside and the sun was not up. He said that he never saw the airplane, but it sounded like the airplane took off, made a turn, then crashed. The witness then drove 3/4 mile to the airstrip, where the student pilot also had a business. When he arrived, he observed "light" fog over the airstrip. The witness then spoke with the student pilot's employees and told them that he thought the airplane had crashed.

The student pilot's cousin and uncle, who were also both pilots, initiated an air search and located the airplane via the airplane's ELT about 0710.

The airplane was equipped with a hand-held Garmin GPSMAP 396. The device recorded the date, time, latitude, longitude, GPS altitude, and an averaged groundspeed and track. An NTSB airplane performance specialist conducted an airplane performance study based on the data retrieved from the device.

According to the study, the airplane departed about 05:59:47 and entered a climbing right turn, reaching an altitude of 407 ft at 06:00:40. The airplane then descended to 256 ft while continuing the right turn, reaching its maximum airspeed of 95 knots (kts). The airplane then climbed in a tightening right turn to a maximum altitude of 666 ft at which point the lowest airspeed, 32 kts, was recorded at 06:01:11; the

bank angle at that time was 30° right wing down. The airplane then quickly lost altitude and rolled right, losing about 440 ft in 13 seconds. By 06:01:24, the airplane had descended to 226 ft before the last data point was recorded at 06:01:33 at an altitude of 279 ft.

An airspeed of 32 kts at a calculated bank angle of 30° right wing down is below the manufacturer's minimum stall speed for all configurations and bank angles.

PERSONNEL INFORMATION

The student pilot's most recent Federal Aviation Administration (FAA) third-class medical certificate was issued on April 13, 2017. A review of his logbook revealed that he had accrued a total of 236 flight hours, all of which were in the accident airplane. The student pilot had logged 8.3 hours of night time experience; however, none of those flights included taking off or landing at his private airstrip at night.

The student pilot's instructor stated that he knew "for a fact" that the student pilot had departed at least "30-40" times from his private airstrip at night. He had advised the pilot not to do so on several occasions because it was not safe. The strip was in poor condition and not properly lighted. The instructor also learned after the accident that the student pilot had given airplane rides to several family members and friends. He described the student pilot as a "good pilot" but "very head strong." He had "no fear – saw no danger."

The instructor said that the student pilot always checked the weather before a flight but that he "didn't know weather" like a more experienced pilot would.

AIRCRAFT INFORMATION

The Cessna 150G is a two-seat, high-wing airplane equipped with a Continental O-200A engine.

A review of the airframe maintenance logbook revealed that the most recent annual inspection was performed on March 2, 2017, at a total tachometer time of 5,534.8 hours. The most recent 100-hour inspection was performed on July 11, 2017, at a total tachometer time of 5,588.83 hours.

METEOROLOGICAL INFORMATION

A review of weather observations from Fitzgerald Airport, (FZG), Fitzgerald, Georgia, about 13 miles southwest of the accident site, revealed that MVFR conditions prevailed at the time of the accident with visibility restricted by mist.

At 0555, the weather at FZG included calm wind, 4 miles visibility, mist, clear skies below 12,000 ft, temperature 22°C, dew point 22°C, and an altimeter setting of 30.01 inches of mercury.

At 0615, FZG reported calm wind, 3 miles visibility, mist, clear skies, temperature 22°C, dew point 22°C, and an altimeter setting of 30.01 inches of mercury.

GOES-13 infrared images taken at 0615 depicted clear skies over the accident site with a mid-level band of clouds near 14,000 ft to the northeast and east. The image could not discriminate between any low mist or fog and the surface temperatures at the time of the image.

According to the U.S. Naval Observatory, civil twilight in Rhine, Georgia, began at 0656 and sunrise was at 0720. The moon phase was "new" at 0130.

AIRPORT INFORMATION

The student pilot co-owned the private airstrip from which he departed. According to family, the grass runway was about 4,200 ft long, oriented southwest/northeast, and partially lighted with solar lights placed every 200 ft. The pilot was known to taxi to the end of the runway and depart to the south. After departure, he always made a 360° turn over the airport and confirmed that the airplane was performing normally before departing for his destination.

WRECKAGE EXAMINATION

The airplane came to rest in wooded terrain adjacent to the private airstrip. The initial impact point was an approximate 80-ft-tall pine tree. The airplane came to rest about 70 ft from the initial impact point. Several tree branches were strewn along the wreckage path. Several of these tree limbs were fractured and exhibited 45° angular cuts. These cuts were flat and exhibited black paint transfer marks consistent with propeller contact. There was no postimpact fire.

The main wreckage came to rest upright with the tail section bent over the top of the airplane. Both wings sustained extensive leading edge impact damage. The center section of wing was partially separated from the airframe. The engine and propeller remained attached to the airplane. A small section of the outboard wing, along with the tip, separated and was found adjacent to the right wing. The left wing tip separated and was found several feet away from the main wreckage. The tip portion of the vertical stabilizer was also damaged.

Flight control cable continuity was established for all flight controls to the cockpit, and the wing flaps were fully retracted. The main right wing aileron cable was found separated. The fractured ends were frayed consistent with overload stress. The elevator trim tab was found 5° tab down (nose up).

The right and left wing fuel caps were secure, but the right wing fuel tank was breached. Fuel was noted draining from both wings during recovery of the airplane. A fuel receipt found in the airplane revealed that the pilot had purchased 20 gallons of 100LL aviation fuel the day before the accident. The fuel selector was in the "on" position. The gascolator remained attached to the firewall. The bowl contained some fuel and the screen was absent of debris. The carburetor was removed from the engine and the bowl was absent of fuel.

The vacuum pump was secure to the engine. It was removed and rotated freely by hand.

The attitude indicator was not impact damaged. The face of the instrument was black with a black background. The unit was disassembled and no damage was noted to the internal components. The rotor drum was removed from its housing. No rotational scoring was noted on the interior of the drum.

The throttle, mixture, and carburetor heat controls were all full forward.

The engine remained attached to the airframe. The two-bladed propeller remained attached to the engine. One blade was bent aft and exhibited distortion at the blade tip. The other blade was bent aft.

The engine caught on the starter gears when it was rotated by hand at the propeller. The starter was installed with several spacers and there was contact between the crankshaft gears and the starter gears. The crankshaft gear teeth were also slightly worn, as were the starter gear teeth. A family member reported that the pilot was having issues starting the engine before the accident. The rocker covers and top spark plugs were removed. The engine was rotated, and compression and valve train continuity were established for each cylinder. Spark was also produced to each ignition lead. No mechanical deficiencies were found that would have precluded normal operation of the engine at the time of the accident.

MEDICAL AND PATHOLOGICAL INFORMATION

The Georgia Bureau of Investigation's Division of Forensic Sciences, Decatur, Georgia, performed the autopsy on the pilot. The autopsy report indicated that the pilot died as a result of "multiple blunt impact injuries."

The laboratory at FAA Forensic Sciences, Oklahoma City, Oklahoma, performed toxicological testing of the pilot. Fluid and tissue specimens from the pilot tested negative for carbon monoxide, ethanol, and other drugs.

ADDITIONAL INFORMATION

According to the FAA's Pilot Handbook of Aeronautical Knowledge, Chapter 17, spatial disorientation specifically refers to the lack of orientation with regard to the position, attitude, or movement of the airplane in space. It states:

The body uses three integrated systems that work together to ascertain orientation and movement in space:

• Vestibular system—organs found in the inner ear that sense position by the way we are balanced

• Somatosensory system—nerves in the skin, muscles, and joints that, along with hearing, sense position based on gravity, feeling, and sound

• Visual system—eyes, which sense position based on what is seen.

All this information comes together in the brain and, most of the time, the three streams of information agree, giving a clear idea of where and how the body is moving. Flying can sometimes cause these systems to supply conflicting information to the brain, which can lead to disorientation.

During flight in visual meteorological conditions (VMC), the eyes are the major orientation source and usually prevail over false sensations from other sensory systems. When these visual cues are removed, as they are in instrument meteorological conditions (IMC), false sensations can cause a pilot to quickly become disoriented. The vestibular system in the inner ear allows the pilot to sense movement and determine orientation in the surrounding environment. In both the left and right inner ear, three semicircular canals are positioned at approximate right angles to each other. Each canal is filled with fluid and has a section full of fine hairs. Acceleration of the inner ear in any direction causes the tiny hairs to deflect, which in turn stimulates nerve impulses, sending messages to the brain. The vestibular nerve transmits the impulses from the utricle, saccule, and semicircular canals to the brain to interpret motion. The somatosensory system sends signals from the skin, joints, and muscles to the brain that are

interpreted in relation to the Earth's gravitational pull. These signals determine posture. Inputs from each movement update the body's position to the brain on a constant basis. "Seat of the pants" flying is largely dependent upon these signals. Used in conjunction with visual and vestibular clues, these sensations can be fairly reliable. However, the body cannot distinguish between acceleration forces due to gravity and those resulting from maneuvering the aircraft, which can lead to sensory illusions and false impressions of an aircraft's orientation and movement. 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 combinations of normal motions and forces create convincing illusions that are difficult to overcome. Prevention is usually the best remedy for spatial disorientation. 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.

Pilot Information

Certificate:	Student	**Age:**	44,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	April 13, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	236 hours (Total, all aircraft), 236 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N3875J
Model/Series:	150G UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	1966	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	15065175
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	July 11, 2017 100 hour	**Certified Max Gross Wt.:**	1499 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	5588.83 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91 installed, activated, aided in locating accident	**Engine Model/Series:**	O-200 SERIES
Registered Owner:		**Rated Power:**	100 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	FZG,364 ft msl	**Distance from Accident Site:**	16 Nautical Miles
Observation Time:	06:35 Local	**Direction from Accident Site:**	195°
Lowest Cloud Condition:	Clear	**Visibility**	3 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.02 inches Hg	**Temperature/Dew Point:**	22°C / 22°C
Precipitation and Obscuration:			
Departure Point:	Rhine, GA	**Type of Flight Plan Filed:**	None
Destination:	Ashburn, GA (75J)	**Type of Clearance:**	None
Departure Time:	06:10 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	31.52,-83.800003(est)

Preventing Similar Accidents

Reduced Visual References Require Vigilance

About two-thirds of general aviation accidents that occur in reduced visibility weather conditions are fatal. The accidents can involve pilot spatial disorientation or controlled flight into terrain. Even in visual weather conditions, flights at night over areas with limited ground lighting (which provides few visual ground references) can be challenging.

Preflight weather briefings are critical to safe flight. In-flight, weather information can also help pilots make decisions, as can in-cockpit weather equipment that can supplement official information. In-cockpit equipment requires an understanding of the features and limitations.

We often see pilots who decide to turn back after they have already encountered weather; that is too late. Pilot's shouldn't allow a situation to become dangerous before deciding to act. Additionally, air traffic controllers are there to help; be honest with them about your situation and ask for help.

Even when flying at night, visual weather conditions can also be challenging. Remote areas with limited ground lighting provide limited visual reference cues for pilots, which can be disorienting or render rising terrain visually imperceptible. Topographic references can help pilots become more familiar with the terrain. The use of instruments, if pilots are proficient, can also help pilots navigate these challenging areas.

See http://www.ntsb.gov/safety/safety-alerts/documents/SA_020.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Read, Leah
Additional Participating Persons:	Daniel Moen; FAA/FSDO; Atlanta, GA Michael Council; Continental Motors Inc; Lucedale, MS Ricardo Arsensio; Textron Aviation; Wichita, KS
Original Publish Date:	July 8, 2019
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=96044