



# National Transportation Safety Board Aviation Accident Final Report

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|--------------------------------|--------------------------------------|-------------------------|------------|
| <b>Location:</b>               | Dawsonville, GA                      | <b>Accident Number:</b> | ERA14FA058 |
| <b>Date &amp; Time:</b>        | 12/02/2013, 1919 EST                 | <b>Registration:</b>    | N87NF      |
| <b>Aircraft:</b>               | PIPER PA-46-310P                     | <b>Aircraft Damage:</b> | Destroyed  |
| <b>Defining Event:</b>         | Loss of control in flight            | <b>Injuries:</b>        | 1 Fatal    |
| <b>Flight Conducted Under:</b> | Part 91: General Aviation - Personal |                         |            |

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## Analysis

The pilot filed an instrument flight rules flight plan for the flight and was communicating with an air route traffic control center controller en route. The controller verified that the pilot had the local weather information for the intended destination and then he queried the pilot about the airplane's heading (which was north of the direct heading), and the pilot reported that he was having trouble with the autopilot. He then asked the pilot if he was able to hold the assigned altitude of 8,000 ft mean sea level (msl), and the pilot responded that he could; however, the airplane descended below 8,000 ft msl, and the controller then issued an altitude of 7,000 ft msl and a heading of 200 degrees. There was no response from the pilot, and radar contact was lost. Shortly after, the airplane wreckage was found.

According to air traffic control radar data, the airplane turned left and then right before entering a descending left turn. A trajectory and performance study determined that, during the flight's final 18 seconds, the airplane descended from about 8,000 to 2,200 ft msl, accelerated to about 300 knots indicated airspeed, and then broke up. According to the Pilot's Operating Handbook, the airplane's maximum operating limit speed was 172 knots.

Examinations of the airframe, engines, and autopilot revealed no preimpact mechanical malfunctions that would have precluded normal operations, and there was no evidence of medical impairment that would have affected the pilot's performance. The pilot held an instrument rating; however, investigators were unable to determine the extent of the pilot's recent night or instrument flight experience.

Although postaccident testing did not reveal any anomalies with the autopilot system, the pilot should have been able to disable the autopilot if it was experiencing a problem and then continue to fly the airplane. However, given the available data and his conversation with the controller, it is likely that the pilot became focused on the autopilot system and diagnosing the reported problem. Dark (moonless) night conditions prevailed for the flight, and, about the time of the accident, instrument meteorological conditions with restricted visibility due to rain prevailed. Given the pilot's distraction, the weather conditions encountered during the flight, and the sustained descending left turn, it is likely that the pilot experienced spatial

disorientation and then lost control of the airplane.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's in-flight loss of airplane control due to spatial disorientation while operating in dark night instrument meteorological conditions, which resulted in the exceedance of the airplane's design stress limitations and a subsequent in-flight breakup. Contributing to the accident was the pilot's distraction by the reported malfunction of the autopilot system.

### Findings

|                             |   |
|-----------------------------|---|
| <b>Aircraft</b>             | Autopilot system - Not specified (Factor)<br>Performance/control parameters - Not attained/maintained (Cause)               |
| <b>Personnel issues</b>     | Aircraft control - Pilot (Cause)<br>Spatial disorientation - Pilot (Cause)<br>Attention/perception/monitor - Pilot (Factor) |
| <b>Environmental issues</b> | Dark - Effect on operation (Cause)<br>Low ceiling - Effect on equipment (Cause)   |

## Factual Information

### HISTORY OF FLIGHT

On December 2, 2013, at 1919 eastern standard time (EST), a Piper PA-46-310P, N87NF, was destroyed following an inflight break up, and impact with terrain in a heavily wooded area near Dawsonville, Georgia. Night instrument meteorological conditions prevailed and an instrument flight rules flight plan was filed for the flight. The private pilot was fatally injured. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91. The flight departed Morristown Municipal Airport (MMU), Morristown, New Jersey, around 1635 with the intended destination of Dekalb-Peachtree Airport (PDK), Atlanta, Georgia.

According to recorded Federal Aviation Administration (FAA) Air Traffic Control (ATC) data, the airplane checked in on the Atlanta Air Route Traffic Control Center. The controller verified that the pilot had the local weather information for the intended destination of PDK. Then, the controller queried the pilot about the airplane heading and asked if he was able to hold the assigned airplane altitude. The pilot responded affirmative and that he was having trouble with his autopilot. The controller then issued the airplane a heading of 200 degrees and an altitude of 8,000 feet mean sea level (msl). The aircraft had descended below 8,000 feet msl and the controller issued a revised altitude of 7,000 feet msl. There was no response from the flight and radar contact was lost, with the last recorded radar data occurring at 1918. Search and Rescue was initiated immediately and local law enforcement received emergency calls reporting an aircraft crash soon after.

According to a witness, he heard the airplane fly over his house and heard the engine "sputter" a bit. In addition, the airplane sounded like it was in an "extremely deep dive" and it seemed like the pilot "tried to do full throttle out of the dive."

### PERSONNEL INFORMATION

According to Federal Aviation Administration (FAA) records, the pilot held a private pilot certificate with ratings for airplane single-engine land, multiengine land, and instrument airplane. The most recent third-class medical certificate was issued on March 1, 2013, and had a restriction of "must wear lenses for distant – possess glasses for near vision." This pilot reported his flight experience on the most recent medical application, which included 3,500 total hours and 50 hours in previous six months.

### AIRPLANE INFORMATION

According to FAA records, the six-seat, low-wing, retractable gear airplane was issued an airworthiness certificate in 1987 and was registered to Culbair LLC in 2007. It was powered by a Pratt and Whitney PT-6A-34 750-shaft horsepower engine. It was also driven by a 4-bladed Hartzell controllable pitch propeller. According to the airplane maintenance logbooks, the most recent annual inspection was performed on January 29, 2013, and at that time, it had accumulated 5904.4 hours of total time. In addition, at the time of the annual inspection the recorded hobbs time was 1516 hours.

### METEOROLOGICAL INFORMATION

The Lee Gimer Memorial Airport (GVL), Gainesville, Georgia, which was located approximately 12 miles southeast of the accident location, at an elevation of 1,276 feet, had an

automated weather observation that recorded the weather at 1853 EST was calm wind, visibility 4 miles in mist, ceiling overcast at 500 feet above ground level (agl), temperature 10 degrees C, dew point 9 degrees C, and an altimeter 29.86 inches of mercury (Hg).

The Atlanta composite reflectivity image at 1917 EST indicated that the last radar target was on the leading edge of a large area of light to moderate radar echoes on the range of 15 to 35 dBZ. A review of total lightning activity from 1800 through 1930 EST detected no lightning activity in the area, supporting light to moderate rain showers and no thunderstorms associated with the area of echoes.

The GOES-13 infrared imagery for 1915 EST with the most recent radar target data and the frontal position indicated an extensive area of overcast nimbostratus type clouds over the region, with a radiative cloud top temperature of negative 13.15 degrees C, which corresponded to cloud tops near 16,600 feet.

According to the Astronomical Applications Department at the United States Naval Observatory, the official sunset occurred at 1726, end of civil twilight at 1754, with the moonset occurring at 1727. At the time of the accident both the Sun and the Moon were more than 15 degrees below the horizon.

#### WRECKAGE AND IMPACT INFORMATION

The airplane impacted trees approximately 30 feet agl and then impacted the ground inverted. The wreckage path from the initial component found on the ground to the main wreckage was about 2,000 feet long on a 220 degree heading. An odor similar to Jet A fuel was noted in the field where several components of the airplane were located and at the site of the main wreckage.

#### Nose Section

The engine cowling remained attached. The nose gear was in the retracted position. Three of the propeller blades remained attached to the propeller flange. The spinner remained attached to the propeller but was impact damaged. The fourth propeller blade was located in dirt underneath the propeller flange and it exhibited S-bending. An undeterminable amount of fluid that smelled similar to Jet A fuel was drained from the header tank just aft of the firewall.

#### Engine

The engine remained attached to the firewall through wires and all engine mounts. Several power turbine blades were discovered on the ground underneath the engine. The exhaust area of the engine exhibited impact damage. The compressor turbine and power turbine blades exhibited rotational scoring. In addition the compressor turbine was rotated by hand and mechanical continuity was confirmed between the compressor and the accessory gear box. Also, rotational scoring was noted on the downstream side of the power turbine vanes. The oil and fuel filter were removed and no debris was noted. In addition oil was discovered in the oil filter housing and fuel was noted in the fuel filter housing. The magnetic chip detector was removed with no material noted on the magnetic poles. The compressor bleed valve was manually operated with no anomalies noted. The fuel pump was turned by hand with no anomalies noted. The fuel control housing was impact damaged but remained attached to the engine.

#### Right Wing

The outboard 10 foot section of the right wing was located along the debris path about 700 feet from the main wreckage in the field. The wing spar was bent in the negative direction. The inboard approximate 7 feet remained attached to the fuselage and exhibited crush damage about one foot from the fuselage. In addition, the inboard section of the flap remained attached to the wing. The outboard section of the flap separated from the wing but was co-located in the field where the outboard section of the right wing was located. The outboard section of the right aileron was separated from the wing and found in the field located 700 feet north of the main wreckage. The inboard section of the right aileron was separated from the wing and located 2,000 feet east northeast from the main wreckage, across the pond. The flap was in the retracted position. The outboard section of the wing contained an undeterminable amount of fuel. In addition, the fuel lines located in the inboard section of the right wing contained fuel. The right wing main fuel tank fuel cap remained attached, seated correctly, and locked in position. The right main landing gear remained attached to the right wing in the retracted position.

### Tail Section

The aft section of the fuselage was separated at the aft pressure bulkhead. The left and right horizontal stabilizer were separated from the empennage and found in the field 700 feet from the main wreckage. The left and right elevator counterweights were separated from the elevator and found in the field. The left and right inboard sections of the elevator remained attached to each other and were found in the field. The left and right midsection of the elevator were separated and found along the debris path, on a road approximately 900 feet from the main wreckage. The rudder was found in the field located 700 feet from the main wreckage. The vertical stabilizer was located next to the road approximately 850 feet from the main wreckage. Cable continuity was confirmed from the base of the rudder pedals to the rudders through several cable fractures. All separations exhibited tensile overload. The pitch trim drum showed nine threads of upper shaft extension, which was consistent with a neutral trim setting. The leading edges of the left and right horizontal stabilizer were splayed open and exhibited impact damage. The tail cone was located near the aft portion of the main wreckage and was impact damaged. The two static ports located of the aft right side of the fuselage were free and clear of debris.

### Left Wing

The outboard approximate 15 foot section of the left wing was found separated from the fuselage and located in a field about 700 feet from the main wreckage. The wing spar was bent in the negative direction. The inboard section of the left aileron remained attached to the outboard section of the wing. The outboard section of the aileron was separated from the wing and found in the field. The inboard approximate 4 foot section of the left wing remained attached to the fuselage and exhibited slight crush and impact damage. The outboard section of the left wing contained an undeterminable amount of fuel and the fuel caps remained secured and seated. The left flap was separated from the wing. The flap was discovered in the retracted position. Flap control continuity was confirmed for the flaps even though the control rod separated from the flap motor assembly in tensile overload. The aileron was separated and cable continuity was confirmed from the base of the control column to the associated fracture points out to the aileron. The aileron cable exhibited tensile overload at all fracture points. The left aileron cable was noted outside the pulley retaining pin beneath the aft facing left seat. A flap setting could not be determined from the flap actuator because it was impact damaged.

The left main landing gear remained in the up and locked position. The left main gear door was separated from the wing.

#### Cockpit

The cockpit exhibited extensive vertical crush damage. The engine controls were intact. The power lever and propeller lever were in the full forward position. The condition lever was in the midrange position. A hobbs meter in the airplane indicated 1602.2 hours. Both yokes remained attached to the control column. The top left section of the right front seat was deformed down and aft. The top right section of the front left seat was deformed slightly aft and down. The lap belts and shoulder harnesses of the front seats did not exhibit web stretching or deformation. In addition, all seat belts remained attached to their respective attach points. A pair of eye glasses was discovered in the forward section of the cabin. Flight control continuity was confirmed from the cockpit to all flight control surfaces through tensile overload breaks.

#### Cabin

The right aft facing seat bottom cushion was separated from the seat. In addition, the right forward facing seat bottom cushion was separated. All other seat cushions remained attached to their respective seat pans. All seats remained attached to their respective cabin area structure.

#### Fuselage

The fuselage came to rest beneath the initial tree impact point. It came to rest inverted and the top portion of the fuselage exhibited vertical crush damage. The main cabin door remained attached to the fuselage and the lower section was in the locked position. In addition, the aft utility door remained attached; however, it was found open.

There were several strikes in the tree that the airplane impacted that exhibited a few areas cut around a 45 degree angle. In addition, the areas of cut wood had a paint transfer similar to a black color.

#### MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot on December 4, 2013, by the Georgia Bureau of Investigation, Division of Forensic Sciences. The autopsy findings included the cause of death as "multiple blunt impact injuries."

Forensic toxicology was performed on specimens from the pilot by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The toxicology report stated no ethanol or drugs were detected in the blood.

#### TESTS AND RESEARCH

##### Autopilot System

The airplane was equipped with a KFC 150 Flight Control System, which consisted of a three-axis autopilot system with a flight computer. According to the Bendix King KFC 150 operating manual, "the flight director system [was] was computer which calculate[d] the appropriate pitch and roll attitudes required to intercept and maintain headings, courses, approach paths, pitch attitudes, and altitudes. Once computed the commands [were] displayed to the pilot." The autopilot system consisted of a flight computer, flight command indicator, pictorial navigation indicator, slaved directional gyroscope, yaw rate gyroscope, yaw computer, yaw

servo, roll servo, pitch servo, pitch trim servo, and autopilot disconnect.

The General Emergency Procedures section of the autopilot operating handbook indicated:

1. Disengage Autopilot/Yaw Damp
  - a. Simultaneously regain control of aircraft and hold down Autopilot Disconnect Trim Interrupt button.
  - b. Pull Autopilot circuit breaker.
  - c. Release autopilot disconnect/trim interrupt button.

The autopilot system from the airplane was sent to the manufacturer for further examination and testing under FAA supervision. The examination revealed that the yaw servo, pitch servo, and roll servo tested without any anomalies noted. Both the roll and pitch servo mount slip clutches measured below the tolerance limits for the testing procedures. The yaw servo mount slip clutch was tested without any anomalies noted. The directional gyro had a resistor that was dislodged from the board due to impact forces. A replacement resistor was installed and the unit was functionally tested with no anomalies noted.

For more information concerning the examination and testing of the autopilot system, the examination report can be found in the public docket for this case.

#### Electronic Devices

A Garmin GPSMAP 696 handheld global positioning (GPS), a Garmin 496 handheld GPS, an Avidyne EX500, and an engine monitor were located, removed, and sent to the NTSB Recorder Laboratory for data download.

The Garmin GPSMAP 696 contained data that was recorded at the time of the accident flight. The data began at 1610 and continued until 1919. The last recorded data points indicated that the airplane was on a direct course to PDK, made a slight left turn, and then a right turn approximately 180 degrees away from the track toward PDK at 1916. Then, it made a turn back to the left approximately 360 degrees and continued the bank and began a descent until the data points ended.

Data was unable to be extracted from neither the Avidyne EX500 nor the Shadin Engine Trend Monitor due to impact damage.

#### Trajectory and Performance Studies

A trajectory study and a performance study were performed using GPS data and ATC data in order to determine the altitude of the inflight breakup of the airplane. An airplane performance history was developed using airplane characteristics, atmospheric data, and record radar and GPS data. The airplane had descended to about 8,000 feet msl and had a ground speed of about 175 knots when it started the slight turn to the left. The study determined that in the final maneuver, the airplane descended from about 8,000 feet msl to approximately 2,200 feet, accelerated to about 300 knots of indicated airspeed, and broke up in 18 seconds.

According to the manufacturer's flight manual, the airplane's maximum operating limit speed (V<sub>mo</sub>) was 172 knots, and its design maneuvering speed (V<sub>a</sub>) was 137 knots at maximum gross weight.

For more information concerning the trajectory and performance studies, the full reports can

be found in the public docket for this case.

## ADDITIONAL INFORMATION

### Spatial Disorientation

According to the FAA Airplane Flying Handbook (FAA-H-8083-3), "Night flying is very different from day flying and demands more attention of the pilot. The most noticeable difference is the limited availability of outside visual references. Therefore, flight instruments should be used to a greater degree.... Generally, at night it is difficult to see clouds and restrictions to visibility, particularly on dark nights or under overcast. The pilot flying under VFR must exercise caution to avoid flying into clouds or a layer of fog." The handbook described some hazards associated with flying in airplanes under VFR when visual references, such as the ground or horizon, are obscured. "The vestibular sense (motion sensing by the inner ear) in particular tends to confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in the attitude of the airplane, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, false sensations are often generated; leading the pilot to believe the attitude of the airplane has changed when in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation."

According to the FAA Instrument Flying Handbook (FAA-H-8083-15), a rapid acceleration "...stimulates the otolith organs in the same way as tilting the head backwards. This action creates the somatogravic illusion of being in a nose-up attitude, especially in situations without good visual references. The disoriented pilot may push the aircraft into a nose-low or dive attitude."

The FAA publication Medical Facts for Pilots (AM-400-03/1), described several vestibular illusions associated with the operation of aircraft in low visibility conditions. Somatogyral illusions, those involving the semicircular canals of the vestibular system, were generally placed into one of four categories, one of which was the "graveyard spiral." According to the text, the graveyard spiral, "...is associated with a return to level flight following an intentional or unintentional prolonged bank turn. For example, a pilot who enters a banking turn to the left will initially have a sensation of a turn in the same direction. If the left turn continues (~20 seconds or more), the pilot will experience the sensation that the airplane is no longer turning to the left. At this point, if the pilot attempts to level the wings this action will produce a sensation that the airplane is turning and banking in the opposite direction (to the right). If the pilot believes the illusion of a right turn (which can be very compelling), he/she will reenter the original left turn in an attempt to counteract the sensation of a right turn. Unfortunately, while this is happening, the airplane is still turning to the left and losing latitude.

Pulling the control yoke/stick and applying power while turning would not be a good idea—because it would only make the left turn tighter. If the pilot fails to recognize the illusion and does not level the wings, the airplane will continue turning left and losing altitude until it impacts the ground."

According to the FAA Instrument Flying Handbook (FAA-H-8083-15A), Chapter 11 "Emergency Operations," stated "Factors that reduce [situational awareness] include: distractions, unusual or unexpected events, complacency, high workload, unfamiliar situations, and inoperative equipment. In some situations, a loss of [situational awareness] may be beyond a pilot's control. For example, a pneumatic system failure and associated loss of the

attitude and heading indicators could cause a pilot to find his or her aircraft in an unusual attitude."

## History of Flight

|                             |   |
|-----------------------------|---|
| <b>Enroute</b>              | Unknown or undetermined<br>Loss of control in flight (Defining event) |
| <b>Uncontrolled descent</b> | Collision with terr/obj (non-CFIT)                                    |

## Pilot Information

|                                  |  |  |            |
|----------------------------------|--|--|------------|
| <b>Certificate:</b>              | Private                                      | <b>Age:</b>                              | 62         |
| <b>Airplane Rating(s):</b>       | Multi-engine Land; Single-engine Land        | <b>Seat Occupied:</b>                    | Left       |
| <b>Other Aircraft Rating(s):</b> | None   | <b>Restraint Used:</b>                   |            |
| <b>Instrument Rating(s):</b>     | Airplane                                     | <b>Second Pilot Present:</b>             | No         |
| <b>Instructor Rating(s):</b>     | None   | <b>Toxicology Performed:</b>             | Yes        |
| <b>Medical Certification:</b>    | Class 3 With Waivers/Limitations             | <b>Last Medical Exam:</b>                | 03/01/2013 |
| <b>Occupational Pilot:</b>       | No   | <b>Last Flight Review or Equivalent:</b> |            |
| <b>Flight Time:</b>              | (Estimated) 3500 hours (Total, all aircraft) |  |            |

## Aircraft and Owner/Operator Information

|                                      |   |   |                   |
|--------------------------------------|---|---|-------------------|
| <b>Aircraft Manufacturer:</b>        | PIPER   | <b>Registration:</b>                      | N87NF             |
| <b>Model/Series:</b>                 | PA-46-310P  | <b>Aircraft Category:</b>                 | Airplane          |
| <b>Year of Manufacture:</b>          |   | <b>Amateur Built:</b>                     | No                |
| <b>Airworthiness Certificate:</b>    | Normal  | <b>Serial Number:</b>                     | 4608099           |
| <b>Landing Gear Type:</b>            | Retractable - Tricycle                                      | <b>Seats:</b>                             | 6                 |
| <b>Date/Type of Last Inspection:</b> | 01/29/2013, Annual  | <b>Certified Max Gross Wt.:</b>           | 4101 lbs          |
| <b>Time Since Last Inspection:</b>   |   | <b>Engines:</b>                           | 1 Turbo Prop      |
| <b>Airframe Total Time:</b>          | 5904.4 Hours  | <b>Engine Manufacturer:</b>               | Pratt and Whitney |
| <b>ELT:</b>                          | C126 installed, activated, did not aid in locating accident | <b>Engine Model/Series:</b>               | PT6A-34           |
| <b>Registered Owner:</b>             | CULBAIR LLC   | <b>Rated Power:</b>                       | 750 hp            |
| <b>Operator:</b>                     | CULBAIR LLC   | <b>Air Carrier Operating Certificate:</b> | None              |

## Meteorological Information and Flight Plan

|                                  |                       |                              |                       |
|----------------------------------|-----------------------|------------------------------|-----------------------|
| Observation Facility, Elevation: | GVL, 1276 ft msl      | Observation Time:            | 1853 EST              |
| Distance from Accident Site:     | 12 Nautical Miles     | Condition of Light:          | Night/Dark            |
| Direction from Accident Site:    | 135°                  | Conditions at Accident Site: | Instrument Conditions |
| Lowest Cloud Condition:          |                       | Temperature/Dew Point:       | 10° C / 9° C          |
| Lowest Ceiling:                  | Overcast / 500 ft agl | Visibility                   | 4 Miles               |
| Wind Speed/Gusts, Direction:     | Calm                  | Visibility (RVR):            |                       |
| Altimeter Setting:               | 29.86 inches Hg       | Visibility (RVV):            |                       |
| Precipitation and Obscuration:   | Mist                  |                              |                       |
| Departure Point:                 | Morristown, NJ (MMU)  | Type of Flight Plan Filed:   | IFR                   |
| Destination:                     | Atlanta, GA (PDK)     | Type of Clearance:           | IFR                   |
| Departure Time:                  | 1635 EST              | Type of Airspace:            |                       |

## Wreckage and Impact Information

|                     |         |                     |           |
|---------------------|---------|---------------------|-----------|
| Crew Injuries:      | 1 Fatal | Aircraft Damage:    | Destroyed |
| Passenger Injuries: | N/A     | Aircraft Fire:      | None      |
| Ground Injuries:    | N/A     | Aircraft Explosion: | None      |
| Total Injuries:     | 1 Fatal |                     |           |

## Administrative Information

|                                   |  |               |            |
|-----------------------------------|--|---------------|------------|
| Investigator In Charge (IIC):     | Heidi Moats  | Adopted Date: | 05/13/2015 |
| Additional Participating Persons: | Mark Ricker; FAA/FSDO; Atlanta, GA<br>Ron Maynard; Piper Aircraft; Vero Beach, FL<br>Daniel Boggs; Hartzell Propeller; Piqua, OH<br>Bill Gill; Honeywell; Olathe, KS |               |            |
| Publish Date:                     | 05/13/2015   |               |            |
| Investigation Docket:             | <a href="http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=88501">http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=88501</a>                                      |               |            |

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