



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Johnstown, New York	Accident Number:	ERA13FA253
Date & Time:	May 24, 2013, 17:10 Local	Registration:	N31743
Aircraft:	Piper PA-34-200T	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The volunteer medical transport flight was established on course toward an en route navigational fix. Upon reaching the fix, the flight was expected to continue toward the initial approach fix at the destination airport in preparation for an instrument approach; however, about 5 miles southeast of the en route fix, the airplane began to deviate off course. When asked by an air traffic controller about the reason for the deviation, the pilot stated that the airplane had turned "the wrong way" and indicated that he had incorrectly loaded the instrument approach into the airplane's GPS. The controller provided a vector to the pilot to return the airplane to the previously established course, and the pilot acknowledged. About 1 minute later, radar contact with the airplane was lost.

Radar data indicated that the airplane entered a rapidly-descending left turn in the final moments of the flight during which it reached an estimated 80-degree left bank, lost about 3,700 feet of altitude in 36 seconds, and accelerated to an airspeed of about 240 knots before breaking up. All fracture surfaces exhibited failure characteristics consistent with overload. Examination of the engines revealed no anomalies. Analysis of weather information for the area of the accident site indicated that the airplane was likely operating in instrument meteorological conditions at the time of the accident but that icing conditions likely were not present in the immediate vicinity.

The restricted visibility, turbulence, the airplane's unexpected off-course turn, the pilot's resulting distraction with the operation and configuration of the GPS, and possibly his sudden need to fly the airplane without the aid of the autopilot would have been conducive to the development of spatial disorientation. The resulting ground track, rapid turning descent, and breakup were consistent with a loss of control as a result of spatial disorientation.

Probable Cause and Findings

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

The pilot's loss of control due to spatial disorientation in instrument meteorological conditions, which resulted in an exceedance of the airplane's design stress limitations, and a subsequent in-flight breakup.

Findings

Personnel issues	Spatial disorientation - Pilot
Aircraft	(general) - Not attained/maintained
Environmental issues	Low visibility - Effect on operation
Aircraft	(general) - Capability exceeded

Factual Information

History of Flight

Enroute-cruise	Loss of control in flight (Defining event)
Enroute-cruise	Aircraft structural failure

On May 24, 2013, at 1710 eastern daylight time, a Piper PA34-200T, N31743, operating as Angel Flight 743, was destroyed during an in-flight breakup near Johnstown, New York. The commercial pilot and two passengers were fatally injured. Instrument meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the personal flight, which departed Laurence G. Hanscom Field Airport (BED), Bedford, Massachusetts, and was destined for Griffiss International Airport (RME), Rome, New York. The flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91.

The purpose of the volunteer medical transport flight was to return the patient and his spouse from the Boston, Massachusetts, area to their home in New York. The flight departed BED at 1603, and the pilot contacted air traffic control (ATC). Radar contact was established at 1604, and the flight was incrementally cleared to a cruise altitude of 8,000 feet msl.

At 1630, ATC advised the pilot of an area of moderate to occasionally heavy precipitation along the airplane's route of flight. The pilot indicated that he "[had] the weather upload" and was aware of the precipitation. ATC instructed the pilot to advise if he required a deviation around the weather, and the pilot acknowledged. About 15 minutes later, the pilot requested and was issued a 20-degree left deviation for precipitation.

At 1643, ATC asked the pilot if he was able to turn back on course. The pilot requested to fly to the very high frequency omni-directional range (VOR) at Albany International Airport (ALB), Albany, New York, and then stated that he could resume the planned course. After passing ALB, the pilot was cleared direct to ROOMS intersection. The pilot acknowledged, and established the airplane on an approximate 290-degree track toward the intersection.

At 1703, the pilot was issued a frequency change to the Syracuse, New York approach control facility. The pilot subsequently contacted ATC on the new frequency and advised that he had the current weather information at RME. The controller advised the pilot of areas of light to moderate precipitation along the airplane's route and suggested a deviation to avoid the precipitation; however, the pilot elected to stay on course to ROOMS, then planned to turn left to fly direct to the Utica VOR in Utica, New York, before proceeding to RME.

Around 1708, ATC noted that the airplane had begun a right turn to the north from its established track toward ROOMS. When ATC queried the pilot about the deviation, he replied, "Yeah I turned the wrong way here I'm sorry I thought I loaded the...approach correctly but I didn't it turned me toward the wrong [unintelligible]...." ATC provided the pilot with a heading of 280 degrees to return on course, which the pilot acknowledged by replying, "two eight zero." About this time, the airplane initiated a descending

left turn, and radar contact was lost about one minute later.

Radar data showed the airplane established on a track of about 290 degrees toward ROOMS intersection at an altitude of 8,300 feet. About 1707, approximately five miles southeast of ROOMS, the airplane began a gradual right turn to the north. At 1708, the airplane turned north-northeast and continued on that track for about one minute before beginning a descending left turn. The last three recorded radar targets, between 21:09:01 and 21:09:19, showed the airplane at altitudes of 8,200 feet, 7,800 feet, and 6,700 feet respectively. The last recorded radar return placed the airplane about 1,500 feet west of the main wreckage.

A witness near the accident site reported that she observed the airplane in a steep bank at an altitude "around 1,000 feet" as it flew southwest in the direction of the Garoga Reservoir, located about 7 miles west-northwest of Johnstown, New York. She reported that the left wing was missing from the airplane. As it disappeared from her view behind a row of trees, she heard an "explosion," then ran across the road to render assistance to any victims.

Another witness, who was canoeing with a friend on the reservoir at the time of the accident, stated that he heard a "loud whining noise like an engine at full throttle." As he watched the airplane descend and grow closer, he heard a "loud bang" and subsequently observed it break apart. He stated that he saw an engine falling, and that it impacted land. "Bolts and other small parts" fell around the canoe, and the men rowed away to avoid being hit. The witness saw the fuselage descending, and heard it impact the water, but could not see where it impacted.

A third witness near the accident site described hearing the airplane circle the area "from the south to the east to the north and then to the west." He stated that the engines sounded as though they were "revving" up and down. He then heard the sound of an explosion, and observed parts of the airplane falling to the ground.

Pilot Information

Certificate:	Commercial; Private	Age:	70
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	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:	May 16, 2013
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	(Estimated) 1746 hours (Total, all aircraft), 1000 hours (Total, this make and model), 1650 hours (Pilot In Command, all aircraft), 24 hours (Last 90 days, all aircraft), 9 hours (Last 30 days, all aircraft)		

The pilot, age 70, held a commercial pilot certificate with ratings for airplane multiengine land and instrument airplane, and a private pilot certificate with ratings for airplane single engine land and sea.

His most recent Federal Aviation Administration third class medical certificate was issued on May 16, 2013.

Review of the pilot's personal flight logs indicated that he had completed a 1.2-hour combined flight review and instrument proficiency check in November 2012. In the six months preceding the accident flight, the pilot logged about 53 total hours of flight time, of which about 9 hours were in actual instrument meteorological conditions (IMC). All of the flight time in actual IMC was logged in the 30 days prior to the accident flight. At the time of the accident, the pilot had logged about 1,746 total hours of flight time, of which over 1,000 hours were in the accident airplane make and model.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	Registration:	N31743
Model/Series:	PA-34-200T	Aircraft Category:	Airplane
Year of Manufacture:	1978	Amateur Built:	
Airworthiness Certificate:	Restricted (Special)	Serial Number:	34-7870264
Landing Gear Type:	Retractable - Tricycle	Seats:	6
Date/Type of Last Inspection:	March 8, 2013 Annual	Certified Max Gross Wt.:	4750 lbs
Time Since Last Inspection:	45 Hrs	Engines:	2 Reciprocating
Airframe Total Time:	3550.6 Hrs at time of accident	Engine Manufacturer:	CONT MOTOR
ELT:	C91 installed, activated, aided in locating accident	Engine Model/Series:	TSIO-360 SER
Registered Owner:	CAMPBELL ASSOCIATES AT CURTISS AERO INC	Rated Power:	225 Horsepower
Operator:	CAMPBELL ASSOCIATES AT CURTISS AERO INC	Operating Certificate(s) Held:	None

The airplane was manufactured in 1978 and registered to the pilot in 1998. It was equipped with two Continental TSIO-360 turbocharged, reciprocating engines, each of which produced 200 horsepower. Review of maintenance logs indicated that the most recent annual inspection was completed on March 3, 2013 at a total aircraft time of 3,505.4 hours. At the time of the accident, the airplane had accumulated a total time of 3550.6 hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	Condition of Light:	Day
Observation Facility, Elevation:	KSCH, 378 ft msl	Distance from Accident Site:	27 Nautical Miles
Observation Time:	16:45 Local	Direction from Accident Site:	114°
Lowest Cloud Condition:		Visibility	7 miles
Lowest Ceiling:	Overcast / 2600 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	8 knots / None	Turbulence Type Forecast/Actual:	/ Unknown
Wind Direction:	330°	Turbulence Severity Forecast/Actual:	/ Moderate
Altimeter Setting:	29.95 inches Hg	Temperature/Dew Point:	8°C / 7°C
Precipitation and Obscuration:	Light - None - Rain		
Departure Point:	Bedford, MA (BED)	Type of Flight Plan Filed:	IFR
Destination:	Rome, NY (RME)	Type of Clearance:	IFR
Departure Time:	16:04 Local	Type of Airspace:	

The 1653 weather observation at RME, located about 40 miles northwest of the accident site, included winds from 330 degrees magnetic at 8 knots, 10 statute miles visibility in light rain, broken cloud layers at 2,300 and 2,800 feet, overcast clouds at 3,700 feet, temperature 7 degrees C, dew point 4 degrees C, and an altimeter setting of 30.06 inches of mercury.

Schenectady County Airport (SCH), Schenectady, New York, was located about 27 miles to the east-southeast of the accident site. A human-augmented report issued at 1645 included wind from 320 degrees at 8 knots gusting to 16 knots, 7 statute miles visibility, overcast clouds at 2,600 feet, temperature 8 degrees C, dew point 7 degrees C, and an altimeter setting of 29.96 inches of mercury.

ALB was located approximately 36 miles to the east-southeast of the accident site. The 1651 observation included wind from 310 degrees at 9 knots, 1.5 statute miles visibility, runway 1 visual range variable between 5,000 and 6,000 feet, rain, mist, and overcast clouds at 800 feet, variable between 500 and 1,100 feet.

An upper air sounding retrieved from a rawinsode launch at 2000 in Albany, New York indicated that the majority of the troposphere was stable or conditionally unstable. A temperature inversion was noted between 5,700 and 7,400 feet. The freezing level was approximately 4,300 feet, with the potential for moderate icing near 10,000 and 14,000 feet. A wind profile indicated a generally northerly wind from 1,000 feet to 7,500 feet, with magnitudes between 12 and 24 knots, and a potential for significant turbulence near 7,500 feet.

Weather radar imagery from Albany, New York, about the time of the accident, depicted light values of reflectivity over much of the area surrounding the accident site with moderate values immediately to the west and southwest of the accident site. Imagery identified the presence of "big drops" of rain in the vicinity of the accident site, with wet snow and snow pellets to the west of the accident site, indicative of melting snow in the area.

Airmen's Meteorological Information (AIRMET) advisories, issued at 1645 for IMC and mountain obscuration, moderate turbulence below 8,000 feet, and moderate icing between the freezing level and 22,000 feet, were valid for the region surrounding the accident site.

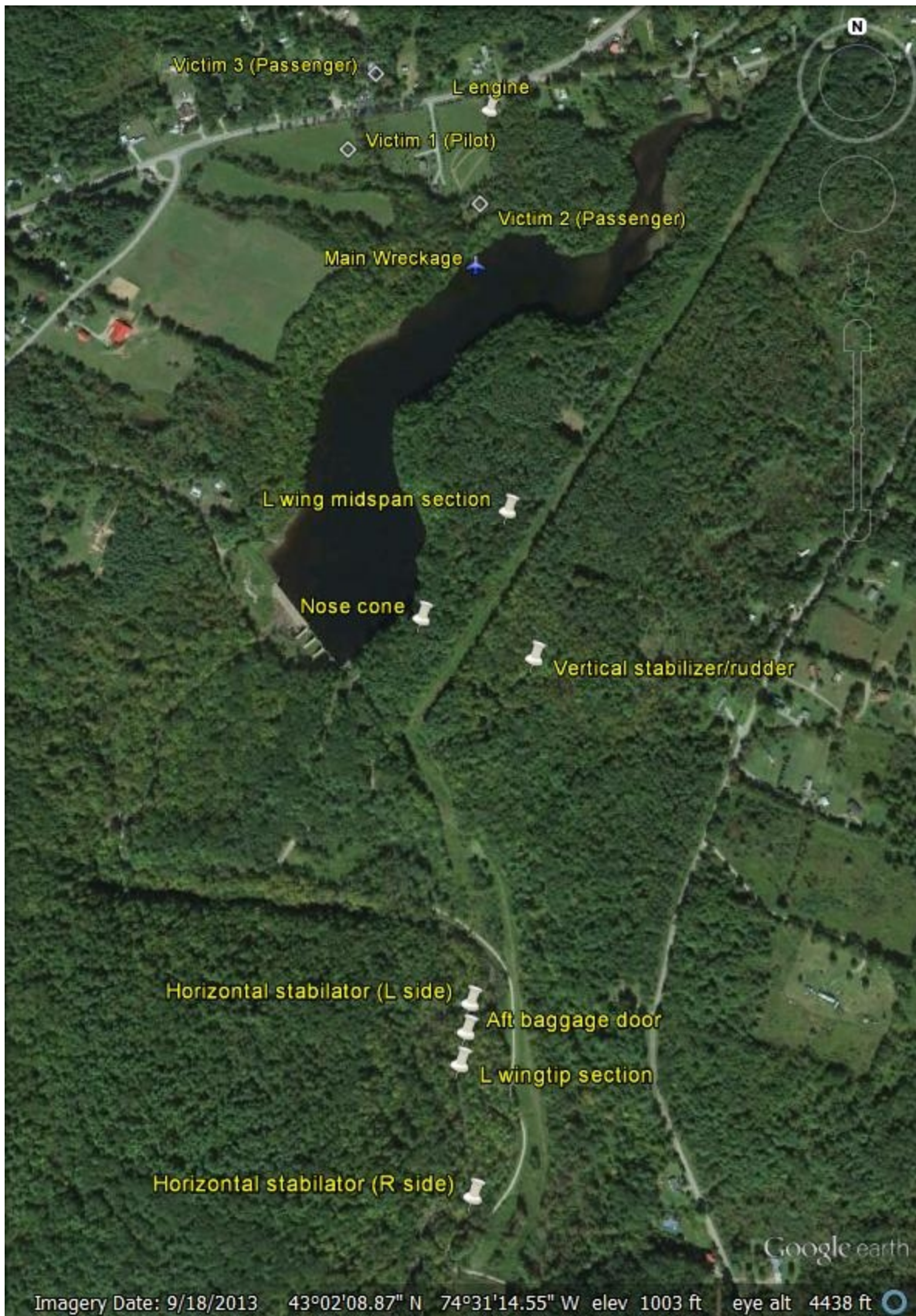
The Area Forecast for northeastern New York issued at 1331 and valid for the accident time predicted overcast cloud ceilings at 1,000 to 2,000 feet with cloud tops to 18,000 feet, surface visibility 3-5 miles, light rain, and mist.

There were no records of the pilot obtaining a weather briefing from Lockheed Martin Flight Services, DTC DUAT, or CSC DUATs weather information services. Review of data provided by a third-party internet flight planning and weather briefing service showed that the pilot filed the flight plan for the accident flight about 1020 the morning of the accident. The pilot also accessed a weather radar summary map for the route of the accident flight at this time.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	2 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 Fatal	Latitude, Longitude:	43.040279,-74.517219(est)

The debris field measured approximately one mile in length, beginning on the southeast side of Garoga Reservoir, continuing to the north side of the reservoir, and was oriented on a heading of approximately 360 degrees magnetic. Portions of the empennage, sections of the left wing, and portions of the fuselage skin were located south of the reservoir. The main wreckage came to rest in the reservoir. The left engine was found on the north side of the reservoir. (See figure 1.)



Wreckage Diagram

Figure 1 - Wreckage Diagram

The main wreckage consisted of the majority of the fuselage, the right wing, and right engine. The aft fuselage sides and roof section were separated from the main wreckage, and the forward roof section was also separated, but was recovered with the main wreckage. The forward baggage door was in place and found in the latched position.

The right wing remained attached at its root, and displayed significant impact damage along its entire span. The aileron remained attached, and control continuity was confirmed to the cockpit. The wing flap remained attached and was observed in the retracted position. The right engine was partially separated from the wing. The vacuum pump remained attached to the accessory section and was removed and disassembled for inspection; the shear shaft and all vanes were intact and undamaged. The three-bladed propeller remained attached at its hub, and two of the blades exhibited aft bending.

The left wing was separated into three sections. The inboard section, from the outboard side of the landing gear to the wing root, remained attached to the fuselage and main wreckage. Aileron control continuity was established from the cockpit to the wing root. The midspan section was separated from the engine nacelle to about two feet inboard of the wingtip, and the inboard half of the aileron remained attached to this section. The outboard section was comprised of the outboard two feet of wing and the wingtip fairing. The outboard half of the aileron and the entirety of the flap were located along the debris path.

The vertical stabilizer and rudder were separated from the airplane, but remained attached to each other at their hinge points. Several inches of rudder control cable remained attached, including the aft turnbuckle. Cable separations displayed signatures consistent with overload failure.

The horizontal stabilator was separated into two sections, each of which were found along the debris path. The left side portion included the stabilator hinge point, a section of the aft bulkhead, the trim tab drum assembly, and the full span of the stabilator trim tab. The entire section exhibited a downward bend. The right section of the stabilator also displayed diagonal wrinkles and down-bending of the spar. The stabilator pitch trim drum inner shaft extension position corresponded to a slightly nose-down trim setting.

The left engine, propeller, and firewall were separated from the wing and came to rest inverted in a field north of the reservoir. The propeller remained attached at its hub. The vacuum pump remained attached. The rotor vanes were damaged, and the drive shaft was not recovered.

The wreckage was recovered and later examined in its entirety at a secure storage facility. Examination of the airplane revealed that all fracture surfaces exhibited failure characteristics consistent with

overload. The left and right wing fracture surfaces and compression damage were consistent with upward loading on the wings. Compression damage of the upper right wing skin and upper portion of the fuselage was consistent with impact with water.

Left and right horizontal stabilator bending, fracture, and compression damage were consistent with both upward and downward loading.

The top spark plugs were removed from each engine. The spark plugs from the right engine were wet and exhibited significant corrosion. The left engine spark plugs were gray in color and exhibited normal wear. The engine crankshafts were rotated by hand at their respective propellers, and thumb compression was obtained on all cylinders. Both engines displayed continuity to their accessory drives, and rotation of the input shafts of all four magnetos produced spark at each of their respective terminal leads.

The airplane was equipped with deicing boots on the horizontal stabilator, but a placard in the cockpit indicated "surface de-ice boots inop." Review of maintenance logs revealed that the airplane was previously equipped with deicing boots on the wings, which were removed in January 2010. The pitot heat switch was found in the "off" position.

The airplane was equipped with an electronic primary flight display (PFD) unit that interfaced with a panel-mounted global positioning system (GPS) unit and autopilot system. The GPS unit was capable of displaying NEXRAD satellite-delivered weather radar data, along with other textual weather synopsis and forecast products. The airplane was equipped with a two-axis autopilot system that was capable of being coupled to the GPS for course guidance.

The pilot's Google Nexus tablet computer was recovered from the main wreckage and sent to the NTSB recorders laboratory for download. Due to water damage, no data could be recovered from the unit.

An Insight Avionics GEM-1200 graphic engine monitor unit was also recovered and sent to the NTSB recorders laboratory for download. Seven recording sessions were retrieved, including five sessions dated 5/24/2013; however, certain configuration and time setting information could not be retrieved, and the data could not be positively correlated to the accident flight and time.

Medical and Pathological Information

An autopsy was performed on the pilot on May 27, 2013 at the Albany Medical Center in Albany, NY. The cause of death was listed as "massive traumatic blunt force injuries."

Toxicological testing was performed on the pilot by the FAA Bioaeronautical Sciences Research Laboratory in Oklahoma City, Oklahoma. Testing was negative for carbon monoxide and ethanol. Losartan, an FAA-accepted high blood pressure medication, was detected in muscle and liver samples. The pilot reported use of this medication on his most recent FAA medical certificate application.

Additional Information

Performance Studies

Performance and trajectory studies were conducted to determine the accident airplane's altitude, speed, and rate of descent about the time of the breakup.

Correlation of radar data indicated that during the last minute of the flight, the airplane was established on a northerly track at an altitude of 8,300 feet msl and airspeed of about 130 knots. The airplane descended in a left spiraling turn, lost about 3,700 feet of altitude in 36 seconds, and accelerated to an airspeed of about 240 knots prior to the breakup.

A trajectory model utilizing the distribution of the wreckage, the approximate airspeed obtained from the radar performance study, and the wind conditions present at the time of the accident, produced results consistent with a breakup at an altitude near 4,600 feet msl, about 3,600 feet agl.

According to the manufacturer's pilot operating handbook, the airplane's never exceed speed (V_{ne}) was 195 knots, and its design maneuvering speed (V_a) was 138 knots at maximum gross weight.

Spatial Disorientation

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 altitude. 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."

The Airplane Flying Handbook (FAA-H-8083-3A) described some hazards associated with flying when 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."

Administrative Information

Investigator In Charge (IIC):	Diaz, Allison
Additional Participating Persons:	Ronald Borrell; FAA/FSDO; Albany, NY Michael Baringer; FAA/FSDO; Albany, NY John Machemer ; FAA/FSDO; Albany, NY Michael McClure; Piper Aircraft Company; Vero Beach, FL Nicole Charnon; Continental Motors Inc. ; Mobile, AL
Original Publish Date:	January 27, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=86993

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

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](#).