Aviation Investigation Final Report

Location:	Brunswick, Georgia	**Accident Number:**	ERA14FA168
Date & Time:	March 24, 2014, 17:38 Local	**Registration:**	N923RS
Aircraft:	Piper PA-44-180	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The pilots of the twin-engine airplane were conducting a cross-country instrument flight rules (IFR) flight. Although both pilots were instrument-rated and IFR-current, the right seat pilot had only 8.8 hours of actual instrument experience, and the left seat pilot had only 1.8 hours of actual instrument experience. While en route and likely operating in IFR conditions, radio and radar contact were lost after the airplane entered a descending, 180-degree right turn. Examination of the wreckage at the accident site revealed signatures consistent with an in-flight breakup of the airframe. The horizontal situation indicator (the only vacuum-system-driven flight instrument that was recovered) exhibited signatures showing that it was likely not operational when the airplane impacted the ground. Both of the engine-driven vacuum pumps exhibited fractured rotors. Although physical examination of the vacuum pumps could not determine whether the rotors fractured before or during impact, the inoperative horizontal situation indicator suggests that both pumps had failed before the impact.

The operator reported that the vacuum pump mounted to the airplane's right engine was not operational before the airplane was dispatched on the accident flight and that the pilots had been advised of this deficiency. The operator used the Part 91 minimum equipment limitations for flights, which permitted dispatching the airplane with only one of the two engine-driven vacuum pumps operational. However, the Federal Aviation Administration's master minimum equipment list for the airplane for Part 91 operators, advises operators to limit the airplane to daytime visual flight rules flights when only one of the two vacuum pumps is operational. The operator's decision to dispatch the airplane with a known mechanical deficiency and no operational limitations reduced the safety margin for the flight and directly contributed to the accident.

It is likely that the left vacuum pump failed en route rendering the vacuum-driven flight instruments inoperative. Given the pilots' minimal flight experience operating in IFR conditions combined with the difficulty of detecting and responding to the loss of attitude information provided by the vacuum-driven flight instruments, it is likely that the pilots became spatially disoriented and lost control of the airplane,

resulting in the subsequent inflight breakup. No definitive determination could be made as to which of the two pilots was acting as pilot-in-command of the airplane at the time of the loss of control.

Probable Cause and Findings

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

An inflight failure of the airplane's only operating vacuum pump, which resulted in the loss of attitude information provided by vacuum-driven flight instruments. Also causal was the pilots' failure to maintain control of the airplane while operating in instrument flight rules (IFR) conditions, likely due to spatial disorientation, following the failure of the vacuum pump. Contributing to the accident was the operator's decision to dispatch the airplane with a known inoperative vacuum pump into IFR conditions.

Findings

Personnel issues	Spatial disorientation - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Failure
Organizational issues	Adequacy of policy/proc - Operator
Aircraft	(general) - Damaged/degraded

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Enroute	Flight instrument malf/fail
Enroute	Loss of control in flight (Defining event)
Uncontrolled descent	Aircraft structural failure
Uncontrolled descent	Part(s) separation from AC
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On March 24, 2014, about 1738 Eastern Daylight Time, a Piper PA-44-180, N923RS, was destroyed during an inflight breakup and subsequent impact with terrain near Brunswick, Georgia. The flight departed from the Concord Regional Airport (JQF), Concord, North Carolina, about 1551 and was destined for Jacksonville Executive Airport at Craig (CRG), Jacksonville, Florida. Day visual meteorological conditions prevailed and an instrument flight rules (IFR) flight plan was filed. The two private pilots were fatally injured. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91.

According to Federal Aviation Administration (FAA) records and Lockheed Martin Flight Service records, the pilot seated in the right seat filed and IFR flight plan with an intended departure time of 1530, and had requested an enroute cruise altitude of 8,000 feet above mean sea level (msl).

PERSONNEL INFORMATION

According to FAA and operator records, the right seat pilot, held a private pilot certificate with ratings for airplane single and multi-engine land, and instrument airplane. He held an FAA first-class medical certificate, issued February 4, 2014, with no limitations. At the time of the medical examination, the pilot reported 73 total hours of flight experience and no flight experience within the 6 months prior to the medical application. The pilot's logbook was located within the wreckage and the last recorded entry was dated March 24, 2014, and indicated a flight from JQF to CRG, in a different PA-44-180. Including that entry, the total recorded flight time was 155.3 flight hours and 8.8 hours of actual instrument flight experience.

According to FAA and operator records, the pilot seated in the left front seat held a private pilot certificate with ratings for airplane single and multi-engine land , and instrument airplane He held a FAA first-class medical/student pilot certificate issued May 20, 2013, with no limitations. At the time of the medical examination the pilot reported no previous flight experience. The pilot's logbook was located within the wreckage and the last recorded entry was dated March 23, 2014, and indicated a flight

from Daytona Beach International Airport (DAB), Daytona Beach, Florida, to JQF. Including that entry, the total recorded flight time was 163.7 flight hours and 1.8 hours of actual instrument flight experience.

AIRCRAFT INFORMATION

According to FAA and airplane maintenance records, the airplane was issued an airworthiness certificate on August 19, 1976, and was originally registered to ATP Aircraft 2, LLC on January 29, 2008. It was powered by a Lycoming O-360-E1A6D and LO-360-E1A6D engines. The airplane was not equipped with an autopilot, nor was it required to be. According to the operator, the last recorded Hobbs meter entry was 2,290.6 flight hours, which correlated to an airframe total time of 6,664.3 hours.

According to maintenance records, the left engine vacuum pump was installed on May 13, 2011, with a recorded Hobbs time of 1,082.8 hours. The right engine vacuum pump was installed on August 31, 2013, with a recorded Hobbs time of 2,118.1 hours; however, the unit's serial number in the maintenance logbook did not coincide with the serial number on the vacuum pump in the accident airplane. According to the operator, the right vacuum pump that was actually installed on the airplane had been installed on January 24, 2014; however, the information submitted to the NTSB did not contain a serial number nor was the information located within the airplane's maintenance logbooks provided by the operator. The Airworthiness Approval Tag, associated with the right vacuum pump, that was at the accident scene, indicated that it had been overhauled on June 18, 2013.

According to maintenance records for the accident airplane, the right engine vacuum pump had accumulated about 65 total hours since overhaul. However, information provided by the operator also revealed that this vacuum pump was noted as inoperative and placarded in accordance with Federal Aviation Regulation (FAR) 91.213(d) and their maintenance procedures prior to the accident flight. The operator further determined to have the airplane flown to the maintenance facility at CRG to repair the inoperative vacuum pump. Additionally, the pilots had been verbally advised of this discrepancy and were provided the opportunity to refuse the airplane, prior to departing on the accident flight. According to a representative of the operator, no flight limitations existed, for their airplane, for an inoperative vacuum pump beyond those prescribed by applicable FARs and the airplane Pilot's Operating Handbook.

METEOROLOGICAL INFORMATION

The 1755 recorded weather observation at Brunswick Golden Isle Airport (BQK), Brunswick, Georgia, located approximately 3.5 miles to the west southwest of the accident location, included wind from 050 degrees at 10 knots with gusts up to 16 knots, visibility 10 miles, overcast clouds at 3,800 feet above ground level (agl), temperature 12 degrees C, dew point 7 degrees C; and barometric altimeter setting of 30.08 inches of mercury.

The regional radar mosaic from the University Center for Atmospheric Research for 1745 indicated an area of very light intensity echoes in the vicinity of Brunswick, Georgia, in the range of 5 to 15 dBZ.

Sounding

The Jacksonville (KJAX), Florida 2000 upper air sounding, located approximately 50 miles south of the accident site indicated the freezing level was at 10,000 feet, and implied no in-flight icing in the vicinity. The lifted condensation level (LCL) or approximate base of the clouds was at 1,580 feet agl, with the

relative humidity greater than 80% from the LCL to approximately 6,300 feet which supported low stratiform clouds. The sounding indicated a defined low-level frontal inversion from 2,500 to 3,800 feet with a marked change in wind direction and a high probability of moderate turbulence at 3,800 feet. The Lifted Index (LI) was 12, and indicated a stable atmosphere. The wind profile indicated light northeasterly winds at the surface with a low-level wind maximum at 2,000 feet from 060 degrees at 26 knots, with wind veering rapidly to the south above the inversion, and then veering to the southwest and west by 10,000 feet. The mean wind was from 270 degrees at 27 knots. A defined jetstream was over the regions with the maximum wind located above the tropopause at 38,000 feet with wind from 270 degrees at 140 knots.

Satellite imagery

The GOES-13 infrared image at 1745 indicated a layer of low to mid-level stratocumulus to nimbostratus type clouds with a radiative cloud top temperature of 256 Kelvin or -17 C, which indicated cloud tops near 20,000 feet. No defined cumulonimbus clouds were identified in the vicinity of the accident site.

Weather Briefing

The pilot obtained a preflight weather briefing prior to departure from a qualified Direct User Access Terminal System (DUATS) provider at 1516, and filed an IFR flight plan through ForeFlight.com with Lockheed Martin Flight Service. While enroute, he also contacted Flight Watch at 1647:32, obtained the latest weather for the destination, obtained the updated AIRMET (Airman's Meteorological Information) Sierra for IFR conditions over Florida, and issued a pilot report (PIREP). The report indicated that the flight was 11.8 miles southeast of Barnwell Regional Airport (BNL), Barnwell, South Carolina; the PIREP indicated 10 miles visibility, no turbulence, no visible weather, and light haze. The recording ended at 1652:28.

COMMUNICATION

According to recorded air traffic control communications provided by the FAA, the flight contacted Jacksonville Air Route Traffic Control Center (ARTCC) at 1727:23 and reported their altitude as 8,000 feet. The controller then provided the flight with the local altimeter setting. At 1727:32 the flight confirmed the altimeter setting, and no further communications from the flight were received. Several attempts to contact the accident flight were conducted between 1739:27 and 1740:36, all of which were met with no recorded response.

The ARTCC controller solicited assistance from another nearby airplane to fly in the vicinity of the last radar return to see if the accident airplane could be located. The ARTCC controller reported to the other airplane that the accident flight was "…at eight thousand in your vicinity uh I uh saw him go down about three hundred feet and then uh completely lost him on radar I don't know if it was full electrical failure or what but I lost him right over the golden isles airport." At 1743:14 the other airplane stated "I'm gonna need you to descend me to probably two thousand five hundred so I can get out of the clouds." At 1745:07 the ARTCC controller reported to the other airplane "…he was just east of the golden isles airport southbound at eight and then uh I showed him at three hundred feet low and then uh I I lost * (everything didn't even get a) primary on him." All further reported communication revealed that the accident flight was unable to be located and no ELT was audibly observed.

RADAR DATA

Review of radar data provided by the FAA revealed that the flight was cruising at an indicated an altitude of 8,000 feet above mean sea level (msl). The subsequent four recorded radar targets, which occurred over a span of 38 seconds, indicated a recorded altitude of 7,900 feet to 7,200 feet msl. The last recorded radar data, at 1738:10, indicated an altitude of 0 feet and was in the vicinity of the accident location. The last four radar targets, that indicated an altitude above 7,000 feet msl, were consistent with a descending right 180-degree turn.

WRECKAGE AND IMPACT INFORMATION

The wreckage was found in a marsh area, in about 15 feet of water. The main wreckage was located inverted at N 31:16.793, W 081:24.687 at an elevation of 4 feet msl. The debris path was about 2 miles in length and along a linear path. The engines remained attached to the airplane with lines and cables, and were co-located with the main wreckage. The wreckage debris path was oriented on 225 degree magnetic heading from the main wreckage, which was located on a 130 degree magnetic heading and about one-half mile from the last radar return. Both outboard wing sections were located about nine-tenths of a mile from the main wreckage and the vertical stabilizer was located about 2 miles from the main wreckage.

Examination of the recovered airframe and flight control system components revealed no evidence of preimpact mechanical malfunctions. Examination of the engines revealed both vacuum pump shafts (coupling) were sheared; however, no other evidence of preimpact mechanical malfunctions were noted. The only recovered air-driven gyroscopic flight instrument was the horizontal situation indicator (HSI), which exhibited minimal damage to the housing and no evidence of crush damage. Disassembly of the gyro found no scoring or rotational damage to the pendulous vane housing or rotating assembly. A detailed "Airframe and Engine On-Scene Examination Report" with accompanying pictures is contained in the public docket for this investigation.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the right seat pilot on March 27, 2014, by the Georgia Bureau of Investigation, as requested by the Glynn County Coroner. The autopsy findings included "Multiple Injuries due [to] Aircraft Accident." The report listed the specific injuries.

Forensic toxicology was performed on specimens from the right seat pilot, by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The toxicology report stated no carbon monoxide was detected in blood (cavity), no ethanol was detected in Vitreous, and no drugs were detected in the urine.

An autopsy was performed on the left seat pilot on March 27, 2014, by the Georgia Bureau of Investigation, as requested by the Glynn County Coroner. The autopsy findings included "Multiple Injuries due [to] Aircraft Accident." The report listed the specific injuries.

Forensic toxicology was performed on specimens from the left seat pilot by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The toxicology report stated no carbon monoxide was detected in blood (cavity), no ethanol or drugs were detected in the urine.

TEST AND RESEARCH

Both vacuum pumps were found attached to their respective attachment point on the rear of each engine. Examination of the pumps found both drive shafts sheared and salt deposits were noted throughout the units.

According to maintenance records for the accident airplane, the left engine vacuum pump had accumulated 1,207.8 total hours since overhaul. The pump was disassembled and examined for wear marks indicative of rotor motion in contact with the housing. The rotor was found fractured in multiple locations, and cracks were present on 4 of the 6 slots and a transverse crack was present across the hole on one of the rotor flanges. The forward and aft faces of the rotor were examined for wear marks indicative of rotor motion as it contacted the housing. These rotor faces exhibited dents and wear consistent with non-rotational or stationary contact with adjacent components. However, on the interior of the housing, there was evidence of circumferential wear marks, consistent with contact during rotation.

The pump was disassembled and circumferential score marks were observed on the interior surface of the rotor center hole. The fracture surfaces of the rotor were consistent with brittle overstress fracture and were consistent with multiple crack initiations locations. Horizontal and vertical sliding marks were present on the faces of the vanes and were consistent with sliding of the vanes that occurred during rotational operation of the rotor.

The examination also noted that the widths of the vanes in the left vacuum pump were less than, and inconsistent when compared to, the width of the vanes in the right vacuum pump.

Replacement Aircraft Parts Co. (RAPCO), Inc "Shear Coupling Force Failure Report," dated August 28, 2008, was a report of shear mode characteristics of the shear coupling after a simulated in flight vacuum pump failure. The report listed four independent force shear failures of the coupler. The four tests were conducted with the same testing sequence and the only change being the post failure run time. Post failure run times were 10 seconds, 30 seconds, 1 minute, and 5 minutes. The report revealed in part "each of the samples shows some melting of the base material after failure. As the run times after failure increase with each different sample the melting of the base material becomes more severe. This is due to the increase exposure to heat." The left engine vacuum pump exhibited melting of the base material similar to the melting noted in both the 30 seconds and 1 minute post-failure run time components. However, the investigation could not conclusively determine how long the left engine vacuum pump operated after the coupling was sheared.

ORGANIZATIONAL AND MANAGEMENT INFORMATION

At the time of the accident, the operator of the accident airplane, Airline Transport Professionals, Inc., also known as ATP USA. Inc., conducted flight training with 38 training centers located in 18 states, and operated a fleet of 266 aircraft. The fleet consisted of various airplanes, including 104 Piper PA-44 airplanes. The accident pilots were currently flying out of the Jacksonville, Florida, base. ATP also had six maintenance centers and utilized contract maintenance providers located within the United States, of which, one of those maintenance centers was located in Jacksonville, Florida. The operator's corporate headquarters was also located in Jacksonville, Florida.

ADDITIONAL INFORMATION

RAPCO Service Letter

According to the manufacturer of the vacuum pumps, all overhauled units do not contain an inspection port cavity and the most recent overhaul inspection record revealed that the left vacuum pump was overhauled at the manufacturer's facility on February 8, 2008, and the right vacuum pump was overhauled at the manufacturer's facility on June 18, 2013.

Service Letter RASL-005, with a revision date of October 6, 2010, contained guidance to clarify the recommended replacement intervals of new and overhauled pneumatic vacuum pumps. The Service Letter noted that the left and right vacuum pumps had a time in service life limit of 500 flight hours, or 6 years from the date of installation. Upon reaching the service life limit, the manufacturer specified that the pump should be replaced.

Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25)

The FAA's Pilot's Handbook of Aeronautical Knowledge contained guidance which stated that "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 airplane. When visual contact with the horizon is lost, the vestibular system becomes unreliable. Without visual references outside the airplane, there are many situations where combinations of normal motions and forces can create convincing illusions that are difficult to overcome."

The Handbook also advised, "unless a pilot has many hours of training in instrument flight, flight in reduced visibility or at night when the horizon is not visible should be avoided."

The Handbook further stated that "it is important to monitor vacuum pressure during flight, because the attitude and heading indicators may not provide reliable information when suction pressure is low. The vacuum, or suction, gauge generally is marked to indicate the normal range. Some airplanes are equipped with a warning light that illuminates when the vacuum pressure drops below the acceptable level."

Spatial Disorientation

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."

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."

Piper PA-44 Maintenance Manual

Section 3 "Scheduled Maintenance" prescribes a checklist to be utilized for inspections every 50 and/or 100 hours. Subsection B.36 states "Inspect and operationally test vacuum pumps and lines." It further requires that the vacuum pump installed on each engine was to be inspected every 100 hours. Note 7 further stated "Replace or overhaul, as required, or at engine overhaul."

Piper PA-44 Pilot Operating Handbook

Section 7.19 "Vacuum System" stated in part "The vacuum system operates the air-driven gyro instruments. The vacuum system consists of a vacuum pump on each engine, plus plumbing and regulating equipment…A shear drive protects the engine from damage. If the drive shears, the gyros will become inoperative. The vacuum gauge mounted on the right instrument panel to the right of the radios, provides valuable information to the pilot about the operation of the vacuum system… (a low vacuum indicator light is provided in the annunciator panel)…In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system…A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.2 inches of mercury…"

According to Section 3 "Emergency Procedures" has a section with "Gyro Suction Failures" which stated:
"Suction below 4.5 in. Hg
RPM Increase to 2700
Altitude descend to maintain 4.5 in. Hg [Suction]
Use electric turn indicator to monitor Directional Indicator and Attitude Indicator performance"

Review of the POH revealed no Equipment List for the pilot to reference in regards to inoperative equipment, nor was one required.

Piper PA-44 Master Minimum Equipment List (MMEL) "FOR PART 91 OPERATIONS ONLY!"

According to the FAA Piper PA-44 MMEL Revision 6, dated January 23, 2003, "The MMEL includes all items of installed equipment that are permitted to be inoperative. Equipment required by the FAR, and optional equipment in excess of FAR requirements, included with appropriate conditions and limitations…it is incumbent on the operator to endeavor to determine if O [Operations] and/or M [Maintenance] procedures for that equipment must be developed…the MMEL is intended to permit operations with inoperative items of equipment for the minimum period of time necessary until repairs can be accomplished. It is important that repairs be accomplished at the earliest opportunity in order to

return the aircraft to its design level of safety and reliability…Operators are responsible for exercising the necessary operational control to ensure that an acceptable level of safety is maintained."

According to Section 37 "VACUUM/PRESSURE," sequence title "1. Vacuum Pump" that two vacuum pumps are installed and one is required for dispatch. It further provided, under the "REMARKS OR EXCEPTIONS," that "(M) One may be inoperative for day VFR flights."

CFR Part 91.205

According to CFR 91.205 (d) "Instrument flight rules" states in part "For IFR flight, the following instruments and equipment are required:
(1) Instruments and equipment specified in paragraph (b) of this section, and for night flight instruments and equipment specified in paragraph (c) of this section
(2) Two-way radio communication and navigation equipment suitable for the route to be flown.
(3) Gyroscopic rate-of-turn indicator, except on the following aircraft…[the exceptions were not applicable to the accident airplane]
(4) Slip-skid indicator
(5) Sensitive altimeter adjustable for barometric pressure
(6) A clock displaying hours, minutes, and seconds with a sweep-second pointer or digital presentation
(7) Generator or alternator of adequate capacity
(8) Gyroscopic pitch and bank indicator (artificial horizon).
(9) Gyroscopic direction indicator (directional gyro or equivalent)"

At the time of the accident, the operator utilized CFR Part 91.205 to determine ability to dispatch airplanes with inoperative equipment.

Advisory Circular (AC) 91-75

According to Advisory Circular AC 91-75, a Safer Skies initiative recommendation authored by the FAA and industry highlighted vacuum system failures as a significant cause or contributor to fatal accidents in instrument meteorological conditions (IMC).

The FAA and the Aircraft Owners and Pilots Association (AOPA) conducted research to further analyze the potential hazards of partial panel operations in IMC. As part of the study, the FAA's Civil Aeromedical Institute conducted simulations studying pilot responses to vacuum system failures, while AOPA's Air Safety Foundation conducted parallel flight studies in a Piper Archer and a Beech Bonanza. These studies included pilots with varying experience levels in both high and low performance aircraft.

The studies showed that a vacuum system or gyro failure is insidious because the gyro fails slowly, making the failure difficult to recognize. Data indicated that pilots might not have the proficiency to safely recover and land the airplane, particularly in high-performance airplanes, even though instrument-rated pilots receive partial panel training.

It also identified that, because the attitude indicator is centrally located in the pilot's primary field of view, it provides easily interpreted pitch and bank information in one instrument. For this reason, most pilots tend to rely heavily on the attitude indicator in IMC to maintain aircraft control.

Additionally, since most small general aviation airplanes typically have an attitude and heading indicator powered by a single vacuum source, these airplanes normally do not have redundant vacuum systems or a second attitude indicator. Therefore, to recognize that a failure condition exists and isolate which instrument has failed, the pilot must cross-check other instruments that indicate pitch or bank information.

Pilot Information

Certificate:	Private	**Age:**	31
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	February 3, 2014
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	155.3 hours (Total, all aircraft), 55.2 hours (Total, this make and model), 95.9 hours (Pilot In Command, all aircraft)		

Pilot-rated passenger Information

Certificate:	Private	**Age:**	28
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	May 20, 2013
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	163.6 hours (Total, all aircraft), 38.9 hours (Total, this make and model), 97.4 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N923RS
Model/Series:	PA-44-180	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	44-7995196
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	March 13, 2014 100 hour	**Certified Max Gross Wt.:**	4400 lbs
Time Since Last Inspection:	19 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	6645.6 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	C91A installed, not activated	**Engine Model/Series:**	O-360-E1A6D
Registered Owner:	ATP AIRCRAFT 2 LLC	**Rated Power:**	180 Horsepower
Operator:	ATP USA, Inc.	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BQK,26 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	17:55 Local	**Direction from Accident Site:**	250°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 3800 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots / 6 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	50°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.07 inches Hg	**Temperature/Dew Point:**	12°C / 7°C
Precipitation and Obscuration:			
Departure Point:	Concord, NC (JQF)	**Type of Flight Plan Filed:**	IFR
Destination:	Jacksonville, FL (CRG)	**Type of Clearance:**	IFR
Departure Time:	15:51 Local	**Type of Airspace:**	Class C

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	31.28,-81.411392

Administrative Information

Investigator In Charge (IIC):	Etcher, Shawn
Additional Participating Persons:	James Payne; FAA/FSDO; Atlanta, GA Mike McClure; Piper Aircraft; Vero Beach, FL John Butler; Lycoming Engines; Williamsport, PA Philip K Cooper; Airline Transport Professionals; Jacksonville, FL Robert Taylor; Airline Transport Professionals; Jacksonville, FL
Original Publish Date:	October 28, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=88964