Aviation Investigation Final Report

Location:	Red Hill, Virginia	**Accident Number:**	ERA09FA029
Date & Time:	October 24, 2008, 19:01 Local	**Registration:**	N8820P
Aircraft:	Piper PA-24	**Aircraft Damage:**	Destroyed
Defining Event:	Aircraft structural failure	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The flight was being operated on an instrument flight rules flight plan. About 6 minutes prior to the accident, the flight was cleared to descend from its cruise altitude of 7,000 feet. About 2 minutes after the descent clearance was issued, the owner/pilot requested a diversion to a different airport, due to low visibility at the original destination. The request was approved, a heading change to 360 degrees was issued, and about 4 minutes later, the airplane departed controlled flight, and impacted terrain. A performance study revealed that after the airplane left its cruise altitude, it initially descended at a calibrated airspeed of approximately 178 mph. Once the pilot completed the diversion turn, the airspeed increased to values that ranged between 190 and 196 mph. Examination of the wreckage revealed that the two stabilators had deformed and separated prior to impact, and that one stabilator had been improperly repaired with incorrect fasteners. A review of the certification, service, and maintenance information indicated that the airplane's original maximum structural cruise speed of 180 mph was still applicable; the airplane was not to be operated above this speed except in smooth air. A weather analysis indicated moderate to severe turbulence in the vicinity of the flight track.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain aircraft control due to an improper repair to the stabilator, which resulted in an in-flight failure of the stabilator. Contributing to the accident was the descent in turbulence, at airspeeds above the maximum structural cruise speed.

Findings

Aircraft	Horizontal stabilizer - Incorrect service/maintenance
Aircraft	Horizontal stabilizer - Failure
Personnel issues	Incorrect action performance - Pilot

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Enroute-descent	Turbulence encounter
Approach-IFR initial approach	Aircraft structural failure (Defining event)
Approach-IFR initial approach	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On October 24, 2008, about 1901 eastern daylight time, a Piper PA-24-260, N8820P, was destroyed when it departed controlled flight and impacted trees and terrain near Red Hill, Virginia, while being vectored for an instrument approach to Charlottesville-Albemarle Airport (CHO), Charlottesville, Virginia. The certificated private pilot and the passenger were fatally injured. The personal flight was operated under the provisions of 14 Code of Federal Regulations Part 91. Night visual meteorological conditions prevailed at the destination airport, and the flight operated on an instrument flight rules (IFR) flight plan.

According to Federal Aviation Administration (FAA) and Lockheed Martin Services (LMS) information, about 1633 the pilot telephoned LMS, and filed an IFR flight plan from Asheville Regional Airport (AVL), Asheville, North Carolina to Orange County Airport (OMH), Orange, Virginia. The pilot filed CHO as the alternate airport, which was 25 miles west-southwest of OMH. About 1726, the airplane departed AVL.

Air traffic control (ATC) radar tracking data indicated that the airplane's cruise altitude was 7,000 feet above mean sea level (msl). About 9 minutes prior to the accident, the pilot requested the "GPS-8" instrument approach procedure (IAP) to OMH. About 6 minutes prior to the accident, when the airplane was 45 miles southwest of OMH, ATC cleared it to descend to 4,000 feet. Approximately 2 minutes after the descent clearance was issued, the pilot radioed ATC that the visibility at OMH was "right at the minimums," and requested a diversion to CHO for the instrument landing system (ILS) approach to runway 3. ATC approved the request, and issued a corresponding heading change to "three six zero" degrees. Two minutes after the heading change instruction, ATC cleared the airplane for the approach. Two minutes later, three "mayday" calls, presumed to be from the accident airplane, were broadcast in rapid succession on the frequency. No further transmissions were received from the accident airplane.

PERSONNEL INFORMATION

According to FAA records, the pilot held a private pilot certificate, with airplane single-engine land and instrument airplane ratings. The pilot's logbook indicated that as of October 12, 2008, he had accumulated approximately 1,070 total hours of flight experience, including 180 hours at night, 157 hours in complex airplanes, 82 hours of actual instrument time, and 75 hours of simulated instrument time. His logbook indicated that he had 71 hours in the accident airplane make and model. The pilot's most recent flight review was in January 2008, and his most recent instrument flight proficiency check was in April 2008. His most recent FAA third-class medical certificate was issued in August 2007.

AIRCRAFT INFORMATION

According to FAA and Piper information, the accident airplane was manufactured in 1965. In 1981, and again from 1983 to 1985, the airplane was registered in Canada. The accident pilot was approximately the seventh owner of the airplane; he acquired it in March 2007.

The airplane was a four place, low wing model of all metal construction, with electrically actuated, retractable, tricycle-configuration landing gear. Primary flight controls included a stabilator, which functioned as both the horizontal stabilizer and elevator. Secondary flight controls included electrically-actuated flaps, and manually-actuated stabilator pitch trim. The airplane was equipped with an autopilot.

Maintenance records indicate that in 1992, several aftermarket speed modifications were installed on the airplane. The airplane was equipped with a Lycoming IO-540 piston engine, and a McCauley three blade, constant-speed propeller. The engine was overhauled by Teledyne Mattituck Services, and installed on the airplane in October 2000. The logbook entry for the installation of the overhauled engine indicated that the airplane had accumulated a total time in service of 9,270 hours, the tachometer registered 6,656 hours, and the engine had accumulated a total time in service of 3,965 hours, with 0 (zero) hours since major overhaul (SMOH).

The most recent annual inspection was accomplished in October 2007. At that time, the airplane had accumulated a total time in service of 9,460 hours, the tachometer registered 6,866 hours, and the engine had accumulated a total time in service of 4,165 hours, with 200 hours SMOH. The final maintenance entries were dated August 8, 2008, and listed a tachometer time of 6,921.8 hours. The engine tachometer was rendered unreadable by the accident. According to the pilot's logbook, he had flown the airplane approximately 71 hours since the October 2007 annual inspection. The National Transportation Safety Board (NTSB) was unable to determine whether any other persons also flew the airplane during the period between the 2007 annual inspection and the accident.

METEOROLOGICAL INFORMATION

Local sunset occurred at 1823. The 1853 recorded weather observation at CHO included zero

wind, 10 miles visibility, broken ceiling at 1,900 feet, overcast ceiling at 2,600 feet, temperature 11 degrees C, dew point 8 degrees C, and an altimeter setting of 30.24 inches of mercury. The 1900 OMH observation included winds from 010 degrees at 4 knots, 10 miles visibility, broken ceiling at 1,900 feet, overcast ceiling at 2,600 feet, temperature 12 degrees C, dew point 10 degrees C, and an altimeter setting of 30.27 inches of mercury.

AIRMETs for mountain obscuration and IFR conditions, and occasional moderate turbulence below 12,000 feet, were current for the route of flight. No Convective SIGMETs, SIGMETs, or Weather Watches were current for Virginia during the period of the flight.

Winds-aloft information indicated the presence of winds from the south, with velocities that ranged from 30 to 45 knots for the flight altitudes and the geographic regions of the diversion and the accident. Weather radar summary data indicated that a band of echoes associated with rain and rain showers was present at the location where the pilot decided to divert to CHO, and extended to the accident site. The weather radar information also indicated the presence of wind shear values from 12 to 18 knots along the edges of the echo and in the vicinity of the flight track, which were consistent with an encounter with moderate to severe turbulence along the flight track.

The freezing level varied between 9,000 and 12,000 feet msl along the route of flight.

AIRPORT INFORMATION

The straight-in minima for the GPS-8 IAP to OMH were 1,120 feet msl minimum descent altitude and 1 mile visibility, and the circling minima were 1,360 feet msl, and 1 1/4 miles visibility. The straight-in minima for the ILS IAP to CHO runway 3 were 856 feet msl, and 1/2 mile visibility.

WRECKAGE AND IMPACT INFORMATION

The accident site was located in a wooded area, approximately 12 miles south of CHO. The debris field measured approximately 400 feet long and 100 feet wide. The debris path was oriented along a magnetic heading of approximately 195 degrees.

The outboard 3 feet of the right stabilator was the first component in the debris path. A corresponding segment from the left stabilator was the next item in the debris path; this component was located 15 feet southwest of the right stabilator segment. The third item in the debris path was the inboard 3 feet of the left stabilator. This was located approximately 70 feet south-southwest of the outboard left stabilator segment. No impact damage was observed on these components, and the trees in the vicinity of these components were undisturbed.

Witness marks indicated that the airplane first struck trees at a height of approximately 50 feet above ground level (agl), approximately 200 feet beyond the first stabilator segment. Wing, aileron and flap segments were distributed along the debris path subsequent to the tree strikes, and the components exhibited impact damage. All fuel tanks were fragmented. The initial ground impact point was a crater that measured approximately 15 feet long, 8 feet wide, and 2 feet deep. The crater was approximately 250 feet beyond the first stabilator segment. The main wreckage, comprised primarily of cockpit, cabin and inboard wing sections, and the main landing gear, was located 50 feet beyond the initial ground impact point. The engine was the final component in the debris path, and was located 100 feet beyond the main wreckage.

The cockpit/cabin area was essentially upright, with significant crush, disruption and fracture damage. The aft fuselage/tailcone and portions of the empennage also exhibited significant crush damage, and were located east of the initial ground impact point. The inboard section of the right stabilator, and most of the vertical fin, remained attached to the aft fuselage/tailcone.

One propeller blade was found separated from the propeller hub, approximately 60 feet west of the initial ground impact crater. The blade was bent approximately 110 degrees aft at the outboard end, and exhibited trailing edge S-bending, and slight chordwise scratching. The other two blades were found in the crater, with one attached to the hub. The blade attached to the hub was bent 20 degrees forward in an arc starting at the two-thirds span point. The outboard 6 inches of the other blade was bent aft 15 degrees, and the blade had two 1/2 inch radius bends in the trailing edge near the two-thirds span point.

The engine was found inverted approximately 150 feet beyond, and on terrain 30 feet higher than, the impact crater. There was evidence of a small fire in the vegetation surrounding one of the mufflers. The engine was devoid of most accessories, intake and exhaust tubing, and mounting hardware. All cylinders were attached and relatively intact, including their valve covers. The oil sump was impact-separated, and the engine case was cracked in several locations. A hole in the forward bottom of the crankcase measured approximately 10 inches long and 6 inches wide; the crankshaft and piston rods visible through the hole were intact.

Both magnetos sparked at all towers when rotated by hand. All six bottom spark plugs, and two of the top spark plugs were removed from the engine, and all had electrodes of light gray coloration, with normal wear. The other four top spark plugs could not be removed due to impact damage. The fuel injector servo was fragmented, and the fuel screen was missing. The fuel flow divider contained clean fuel, and the diaphragm was intact and clean. Four of the fuel injector nozzles were intact, one was bent, and one was fractured. None passed the "sight test," due to the presence of mud and other debris. The dry-type vacuum pump was impact-separated and fragmented, and no vanes or vane fragments were found. The oil suction screen and oil filter were free of metallic debris. The aft section of the propeller hub remained attached to the crankshaft, and all hub-to-shaft attach hardware were in place and safetied. The crankshaft could not be rotated by hand due to the deformation of the engine case. Examination of the engine and engine accessories did not reveal evidence of any pre-impact anomalies.

All of the instruments and avionics were separated from the instrument panel, and from the cockpit area. Most exhibited significant crush damage and/or fragmenting. The ignition switch was found in the "Both" position, and the fuel selector valve was set to the "Right Main" tank. No other switch or control settings could be determined.

Flight control continuity was established for the ailerons, rudder, stabilator, and stabilator trim. The stabilator trim jackscrew extension indicated a trim setting of full airplane nose up. The flap jackscrew extension indicated a flap setting of approximately 23 degrees. The two main landing gear assemblies were found in their respective wheel wells, and the nose landing gear was found 20 feet south of the main wreckage.

MEDICAL AND PATHOLOGICAL INFORMATION

The FAA Civil Aero Medical Institute (CAMI) toxicology results for the pilot were negative for screened drugs. Ethanol was detected (12 mg/dL) in muscle tissue, but was not detected in the liver. Putrefaction of the specimens was noted. Tests for carbon monoxide and cyanide were not performed. An autopsy was conducted by the Virginia Department of Health in Richmond, Virginia; the autopsy report listed the cause of death as "blunt force trauma," and did not list any contributing factors.

ADDITIONAL INFORMATION

Airspeed Limitations and Indicator Markings

According to the FAA publication "Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25)," the maximum calibrated airspeed for normal operation (referred to as Vno, or maximum structural cruise speed), was the "speed at which exceeding the limit load factor may cause permanent deformation of the airplane structure." In the same document, the FAA cautioned pilots that they should "not exceed this speed except in smooth air." FAA regulations required that airspeed indicators for airplanes that weighed less than 12,500 pounds, and that were manufactured after 1945, were required to be marked in accordance with a "standard color-coding system." A green arc on the airspeed indicator was required to depict the normal operating speed range of the airplane, and the upper limit of the green arc was defined by Vno. A red line was required to depict the "never exceed speed" (referred to as Vne), and operation of the airplane above this speed was prohibited.

Airworthiness Directives, Service Bulletins, and Service Letters

Starting in 1972, empennage vibration concerns prompted the issuance of PA-24 Service Bulletins and Letters from Piper Aircraft. According to Piper, "Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent to the latest

U.S. registered owners and Piper Service Centers." Service Letters "deal with product improvements and service hints pertaining to the aircraft. They are sent to Piper Service Centers and sometimes directly to owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the service letter information."

In August 1972, Piper issued Service Bulletin (SB) No. 362. The SB stated that "Piper Aircraft Corporation is investigating the effects of improper maintenance and/or unauthorized repair procedures with respect to possible deterioration of the margin of safety when applied to flutter characteristics of the horizontal and vertical tail surfaces. In order to provide additional margin and in the interest of safety, Piper has reduced the never exceed speed" for the PA-24-260. The SB reduced the Vne from 227 mph calibrated air speed (CAS) to 203 mph for the PA-24-260. The SB specified that a placard denoting the revised Vne was to be installed on the airspeed indicator.

In October 1972, Piper issued SB 362A, which supplemented, but did not supersede, SB 362. The subsequent SB (SB 362A) prescribed the installation of Piper Rudder Balance Weight Installation Kit 760-705. According to SB 362A, the revised Vne would remain at 203 mph, but "installing rudder balance weights...will prevent possible adverse airplane vibration effects, thus providing a greater margin of safety at higher speeds."

In late 1972, the FAA issued Airworthiness Directive (AD) 72-22-05, which restricted the PA-24-260 Vno to 167 mph CAS, and the Vne to 188 mph. The AD stated that installation of Piper Rudder Balance Weight Installation Kit 760-705 would allow the Vno and Vne to be increased to 180 and 203 mph CAS, respectively. Maintenance records indicated that the Rudder Balance Weight Kit 760-705 was installed on the accident airplane in December 1972, by Gillis Aviation in Montana.

In June 1974, Piper issued Service Letter 687, which modified the stabilator by installing stabilator tip weights, stabilator hinge reinforcements and stabilator tab hinge reinforcements, in accordance with Piper Service Kit 760-747. This modification, when installed in conjunction with or subsequent to the Rudder Balance Weight Kit 760-705, permitted PA-24-260 airplanes to be returned to the original Vne of 227 mph CAS. The accident airplane maintenance records did not indicate compliance with Piper Service Letter 687.

Accident Airplane Stabilator Maintenance History

A maintenance records entry dated October 23, 2006 indicated that the airplane was inspected in accordance with an annual inspection, and found to be in an airworthy condition. This entry documented a tachometer time of 6,787.27 hours, and a total time in service of 9,381.27 hours. This entry also documented the removal of the left and right stabilators, and their replacement with two "serviceable units." The right stabilator was removed due to leading edge damage. The left stabilator was removed due to the fact that it was a stabilator for a PA-30, and was therefore not eligible for installation on the PA-24. The ineligible PA-30 stabilator was

initially installed on the accident airplane on August 28, 1990, at a recorded tachometer time of 5,178.17 hours.

The 2006 annual inspection and stabilator replacements were accomplished by Jet Services Incorporated (JSI), located in Manassas, Virginia. According to maintenance documentation, the two replacement stabilators were provided to JSI by Webco Aircraft, of Newton, Kansas. Discussions with the installing mechanic and the owner of JSI, and a review of JSI and Webco documentation, indicated that Webco conducted at least the preparation and painting of the two stabilators prior to shipment to JSI for installation. Serial number comparisons indicated that these stabilators were on the airplane at the time of the accident.

As of date of this report, the NTSB was unable to locate the two stabilators that were removed from the airplane in October 2006, and sent to Webco by JSI. The right stabilator was part number (p/n) 20193-35, serial number (s/n) 24-4119, and the left stabilator was p/n 22523, s/n 30-973.

Accident Airplane Stabilator Configuration and Damage

Two segments of the left stabilator, one segment of the right stabilator, and the aft part of the fuselage/tailcone containing the remaining portions of the left and right stabilators and other pitch control components, were examined by the NTSB Materials Laboratory in Washington, D.C.

Neither the two segments of the left stabilator, nor the outboard segment of the right stabilator, exhibited any impact damage. Each stabilator segment retained its corresponding spanwise portion of the stabilator trim tab.

Left Stabilator

Examination of the fracture between the two stabilator segments showed that the main spar was fractured just outboard of the butt line (BL) 36 rib. Evidence of compression buckling deformation was found on both the upper and lower portions of the spar, and the compression damage extended into the adjacent skin.

Examination of the fracture between the inboard stabilator segment and the fuselage showed that the stabilator was creased and folded downward on an approximate 45-degree angle from the main and stub spar fractures near the BL 12 rib to the rear spar fracture between the BL 24 and 36 ribs. Most of the damage associated with the folding was on the inboard portion of the stabilator, but the damage extended onto the trim tab on the outboard portion of the stabilator, across the fracture at the BL 36 rib.

Both segments of the left stabilator exhibited similar damage patterns, where the leading edge or "nose" sections (approximately 10 inches chordwise) of each segment forward of the main spar was crippled and bent downward approximately 30 degrees, but remained attached to the

forward spar. The ribs forward of the forward spar ("nose ribs") were deformed, and had separated from their lower attach points to the nose skins. The leading edge of the nose skins exhibited "star" or "X" fractures. Such fractures are associated with repetitive cyclic bending of structures such as stabilators.

Contrary to the Piper design, which specified MS20470 solid rivets, a series of blind rivets was used to attach the nose ribs to the lower nose skin. The investigation was unable to locate any documentation that substantiated or approved the deviation from the design configuration. The shafts of most of these blind rivets were of a constant diameter, with no "bulbed" or expanded sections. The appearance of these blind rivets was similar to rivets that were either minimally drawn, or not drawn at all.

Examination of the left stabilator nose skin in areas with missing paint showed a bare aluminum surface without evidence of a primer or a chromate conversion coating, which were required by the Piper finish specification. Areas with missing paint on the stabilator skin between the spars had some regions where a chromate conversion coating was visible. Pre-accident scuffing of the aluminum surface, similar to that resulting from coarse sanding, was observed in a few areas between the spars where paint was missing. Areas of the skin between the spars contained what appeared to be a gray primer directly adjacent to the skin, with a layer of zinc chromate primer on top of the gray primer. No areas of the gray primer were observed on the nose skin. All interior surfaces were covered with zinc chromate. The two spacers at the outboard closure rib were non-weighted phenolic blocks.

Right Stabilator

The main and rear spars of the right stabilator were fractured between the BL 36 and 48 ribs. Deformation patterns associated with these fractures were consistent with upward loading. Most of the trim tab remained attached to the stabilator, and the tab was fractured inboard of the spar fractures. The tab was bent upward at the approximate spanwise location of the spar fractures.

All of the rivets that attached the skin to the main spar were solid aluminum rivets, as required by the manufacturer's design drawing. The rivets that attached the nose skin to the ribs and to the main spar appeared to be of a type consistent with the rivets specified by the manufacturer's design drawings. Significant material had been removed (ground away or sanded off) from the heads of several rivets on at least one nose rib, and from the heads of rivets on the upper cap of the main spar. In areas around the rivets that were missing paint, the skin showed signs of sanding or severe scuffing. All visible interior surfaces of the right stabilator were covered with zinc chromate primer. The two spacers at the outboard closure rib were non-weighted phenolic blocks.

Aft Fuselage Section

The inboard half of the right stabilator, a small section of the inboard portion of the left

stabilator, the torque tube between the two stabilators, the stabilator horn tube and stabilator balance weight assembly, the stabilator trim tab actuation control drum with cable, the trim tab control rod, and pieces of the rudder lower attachment tabs all remained attached to the aft section of the fuselage. These components exhibited substantial impact and crush damage.

Examination of the left stabilator portion showed that the main spar was fractured just outboard of the outboard end of the torque tube. The fractures showed significant deformation consistent with the outboard portion of the stabilator moving aft and down relative to the inboard portion. The nose skin on this portion was folded down, and twisted. Deformation patterns on the left stabilator segment that remained attached to the fuselage were similar to the deformation patterns on the separated segments of the left stabilator.

Examination of the right stabilator portion showed that the nose skin was deformed downward, into and under the front spar, and that the nose skin and front spar were fractured at the outboard end of the torque tube. No evidence of loose rivets was found on the inboard segment of the right stabilator. The entire inboard portion of the stabilator exhibited severe crushing and deformation, with the rear spar pushed forward of the main spar at the BL 36 rib. The deformation and damage on the inboard portion of the right stabilator was much more severe than the damage on the outboard segment of the stabilator.

The right stabilator main spar was fractured at the BL 36 rib, and the direction of loading associated with this fracture was not clear, although the vertical leg of the upper cap of the spar had compression buckling damage.

The stabilator horn tube was intact and secure within the stabilator torque horn assembly on the torque tube. The stabilator balance weight assembly was displaced approximately 4 inches aft of its normal position on the tube. The two bolts that attached the balance weight to the tube were sheared at the outer circumference of the tube, and the shafts of the bolts remained in their holes in the tube.

The balance weight assembly was removed from the stabilator horn tube, and the components were weighed. The total weight of the components was 79.75 ounces. Piper Service Letter 687 specified the modification of the balance weight assembly, to reduce its weight to between 56 and 63 ounces. The Service Letter specified the drilling four 1/2 inch diameter holes through the bottom half of the center balance weight. The holes were not present in the center balance weight of the accident airplane. These observations, combined with the lack of stabilator tip weights, indicated that the Service Letter 687 was not accomplished on the accident airplane, and that the stabilator weight configuration was congruent with the configuration indicated by the maintenance records.

The trim tab jackscrew, cable drum, and cables were in place on the trim mechanism. The bellcrank bracket for the right trim tab was still attached to the right trim tab and to the control rod. The bellcrank bracket for the left trim tab had separated from the left trim tab but was attached to the control rod. One end of the bolt at the right outboard end of the stabilator

torque tube was sheared, and the stabilator torque collar attached by this bolt was fractured. The right inboard, left inboard, and left outboard stabilator torque collars were intact, as were the attachment bolts for these collars. The stabilator stop bolts showed no evidence of severe or repeated impact.

FAA Unapproved Parts Notification

Webco Aircraft Company, which supplied the replacement stabilators for the accident airplane, was the subject of an FAA Unapproved Parts Notification (UPN) 2008-S20070083021, issued on March 27, 2008. This UPN concerned "aircraft parts sold, repaired, or overhauled by Robert A. Weber and/or Johnathan F. Regier, d.b.a. Webco Aircraft Company." The UPN affected all models of Piper Comanche and Twin Comanche airplanes, and specifically cited a variety of components, including pumps, valves, transmissions and generators. The UPN did not cite stabilators or other flight controls. The UPN stated that Webco "maintained and altered" numerous components "contrary to the regulations." The UPN recommended that "aircraft owners, operators, manufacturers, maintenance organizations, parts suppliers, and parts distributors to inspect their aircraft, aircraft records and/or aircraft parts inventory for the referenced parts" and to take "appropriate action" to ensure that those components were airworthy.

Ground-based Radar Tracking Results

ATC ground radar tracking data indicated that during the 6 minute period between the ATC descent clearance and the accident, the airplane generally descended at a rate of approximately 600 feet per minute (fpm). However, the data showed that approximately 3 minutes into the descent, when the pilot made the diversion turn to CHO, there was a 40 second period which included a 2,600 fpm descent, followed by a 650 fpm climb.

The last four radar returns, which spanned a period of 13.8 seconds, indicated that the airplane entered a steep descent. The corrected barometric altitudes for the last four returns, each 4.6 seconds apart, were 3,700, 3,300, 2,600 and 0 feet MSL, respectively. Instantaneous descent rates derived from these altitude values ranged from approximately 5,200 to 33,200 fpm. The final four radar returns also depicted a rapid course reversal from north to south, which consisted of an approximately 180 degree turn to the right, with an approximate turn diameter of 1/2 mile.

Airspeed Calculations

A review of FAA data, manufacturer's service information, airplane maintenance records, and the physical wreckage indicated that the airplane's original, as-manufactured Vno of 180 mph CAS was still valid, but that the Vne should have been restricted to 203 mph CAS, instead of the original value of 227 mph. Damage to the airspeed indicator prevented determination of whether the airspeed indicator was marked with the proper Vno and Vne values.

A performance study that utilized ground-based radar tracking data and atmospheric winds was conducted in order to derive airspeed values for the last minutes of the flight. The study revealed that after the airplane left its cruise altitude of approximately 7,000 feet, it initially descended at a calibrated airspeed of approximately 178 mph, with a descent rate of 560 fpm. Once the pilot completed the diversion turn to CHO, the descent rate increased to approximately 720 fpm, and the airspeed ranged between 190 and 196 mph. About 90 seconds before the accident, the descent flattened slightly to a rate of 510 fpm, and the airspeed decreased to approximately 186 mph.

Pilot Information

Certificate:	Private	**Age:**	47,Male
Airplane Rating(s):	Single-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 Without waivers/limitations	**Last FAA Medical Exam:**	August 1, 2007
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	January 1, 2008
Flight Time:	1070 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N8820P
Model/Series:	PA-24 260	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	24-4276
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 19, 2007 Annual	**Certified Max Gross Wt.:**	2900 lbs
Time Since Last Inspection:	71 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	9460 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C91A installed, not activated	**Engine Model/Series:**	IO-540
Registered Owner:	On file	**Rated Power:**	260 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:	CHO,639 ft msl	**Distance from Accident Site:**	12 Nautical Miles
Observation Time:	18:53 Local	**Direction from Accident Site:**	30°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 1900 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.23 inches Hg	**Temperature/Dew Point:**	11°C / 8°C
Precipitation and Obscuration:			
Departure Point:	Asheville, NC (AVL)	**Type of Flight Plan Filed:**	IFR
Destination:	Albermarle, VA (CHO)	**Type of Clearance:**	IFR
Departure Time:	17:26 Local	**Type of Airspace:**	

Airport Information

Airport:	Charlottesville Albemarle CHO	**Runway Surface Type:**	
Airport Elevation:	639 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	37.940277,-78.548614

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	George Hollingsworth; Piper Aircraft; Vero Beach, FL James M Childers; Lycoming Textron; Williamsport, PA Maurice Dacey; FAA/FSDO; Richmond, VA
Original Publish Date:	October 21, 2010
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=69354