Aviation Investigation Final Report

Location:	New Market, Virginia	**Accident Number:**	NYC01FA122
Date & Time:	May 12, 2001, 19:45 Local	**Registration:**	N948CG
Aircraft:	Cessna U206E	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane was in cruise flight at 8,000 feet in visual flight rules conditions, when the pilot reported he experienced a total loss of engine power. At that time, the airplane was about 4 miles from an airport with a 2,920-foot long, asphalt runway. The air traffic controller initially cleared the airplane to an airport more than 20 miles from it's position and then directed the airplane to an airport located on the other side of a ridgeline, about 12 miles away. After the pilot reported he could not reach the airport, the controller then directed the airplane to the airport with the 2,920-foot long runway; however the airplane struck the top of a residence and a tree, before it came to rest inverted in a field, approximately 1.5 miles east of the runway. Streaks of oil were present on the bottom of the fuselage and small holes were observed on the top portion of the engine crankcase near the number 5 cylinder. Examination of the engine revealed that the number 5 piston was separated from it's respective connecting rod. The bottom portion of the number 5 piston was broken into several small pieces, which were observed in the engine. Examination of the intact fracture surfaces did not reveal any evidence of fatigue or preexisting cracks; however is was noted that only 75 percent of the number 5 piston boss area, and less then 25 percent of the number 5 piston skirt below the upper oil control ring was recovered. The engine had been operated for about 70 hours since it was rebuilt by it's manufacturer and was installed in the accident airplane, about 11 months prior to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of engine power due to a failure of the number 5 piston for undetermined reasons. A factor in this accident was the inadequate emergency handling provided by the air route traffic controller.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: CRUISE - NORMAL

Findings
1. (C) ENGINE ASSEMBLY,PISTON - UNDETERMINED
2. (F) ARTCC SERVICE - INADEQUATE - ATC PERSONNEL(ARTCC)

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: DESCENT - EMERGENCY

Factual Information

HISTORY OF FLIGHT

On May 12, 2001, about 1945 eastern daylight time, a Cessna U206E, N948CG, was substantially damaged during a forced landing after a loss of engine power near New Market, Virginia. The certificated commercial pilot was seriously injured, and the private pilot was fatally injured. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the flight that departed the Eastern West Virginia Regional Airport (MRB), Martinsburg, West Virginia, destined for the Hickory Regional Airport (HKY), Hickory, North Carolina. The personal flight was conducted under 14 CFR Part 91.

The airplane was owned by the private pilot and based at HKY. According to the owner's wife, earlier in the day, both pilots departed HKY, and flew to Florence, South Carolina, as part of the "Angel Flight America" program. They then departed Florence, flew to MRB, and then departed MRB with the intent of returning to HKY.

Review of air traffic control (ATC) information obtained from the Federal Aviation Administration (FAA), revealed the airplane departed MRB, about 1915, and utilized the call sign "Angel Flight Eight Charlie Golf." The airplane was in cruise flight at 8,000 feet, and in contact with the Washington Air Route Traffic Control Center, when at 1937:04, the pilot reported a total loss of engine power. At that time, recorded radar data indicated the airplane's position was about 3.5 miles southeast of the New Market Airport (8W2), about 10.5 miles southwest of the Luray Caverns Airport (W45), and about 22 miles northeast of the Shenandoah Valley Regional Airport (SHD).

At 1937:51, the pilot stated "I've got an engine failure. I've got to get on the ground." The airplane was then cleared directly to SHD, which the controller stated was "about one o'clock and, uh thirty miles." Recorded radar data indicated the airplane was located about 20.5 miles to the northeast of SHD, and at an altitude of about 7,100 feet. The pilot replied, "I don't know if we'll make it" and the controller then directed the airplane to W45, which he stated was "about eight miles to your left." Recorded radar data indicated the airplane was located about 12 miles to the southwest of W45.

At 1938:24, the controller asked the pilot to confirm that the airplane was a single engine aircraft, and that the engine had "quit." The pilot then replied "Affirmative, We've lost the oil pressure."

At 1939:01, the pilot asked for a direction to W45, and the controller responded, "Uh, roger sir. I show Luray about your, uh, let's make it your nine o'clock and about eight miles, six miles." Recorded radar data indicated the airplane was at 6,000 feet, about 11.7 miles southwest of

W45.

At 1940:41, recorded radar data indicated the airplane was at 4,200 feet, 10 miles southwest of W45. At 1941:49, the pilot reported "...we got a mountain between us and Luray [airport]. We're not gonna make that." The controller replied "alright, sir, I'm showin if you, if you look to be about a three six zero heading at about your eleven o'clock, looks to be about three miles is the New Market Airport." The pilot replied, "three miles to New Market." Recorded radar data indicated that 8W2 was about 2.4 miles on a heading of 325 degrees from the airplane's position.

At 1942:25, the pilot asked the controller for a heading to 8W2. The controller replied, "roger sir. It looks to be about, uh, if you're in a left turn, twelve o'clock and two to three miles."

There were no further communications received from the pilot and the airplane's last recorded radar position at 1942:41, was 2 miles southeast of 8W2, at an altitude of 2,000 feet.

The airplane was located in a field, approximately 1.5 miles east of 8W2.

The accident occurred during the hours of daylight and was located approximately 38 degrees, 38 minutes north latitude, and 78 degrees, 40 minutes west longitude.

PERSONNEL INFORMATION

According to the private pilot's wife, both pilot's were good friends and flew together regularly. She added that the private pilot no longer enjoyed flying alone and often was accompanied by the commercial.

The commercial pilot held ratings for airplane single and multi-engine land. He also held ratings for flight instructor, and instrument airplane. Review of the commercial pilot's logbook revealed had had accumulated about 2,840 hours of total flight experience. The commercial pilot began flying the accident airplane in January 1998, and his logbook's last entry was dated May 8, 2001. Since January 1998, he had accumulated about 350 hours of total flight experience, which included about 215 hours in the accident airplane.

The commercial pilot's most recent FAA second class medical certificate was issued on March 28, 2001.

The private pilot held a private pilot certificate with a single engine land rating. He was not instrument rated. Review of his log book revealed he had accumulated about 285 hours of total flight experience. During the time period when he began flying the accident airplane, which was in January 1998, and until the last logbook entry, which was dated January 31, 2001, the pilot logged about 125 hours of total flight experience, which included about 100 hours in the accident airplane.

The private pilot's most recent FAA third class medical certificate was issued on May 17, 2000.

AIRCRAFT INFORMATION

The airplane was equipped with a Teledyne Continental Motors (TCM) IO-520F3B engine. According to manufacturing records, the engine was rebuilt by TCM, Mobile, Alabama, in April of 2000, and installed on the accident airplane in June 2000, at a tachometer time of 4470.1 hours. Additionally, at that time, the airplane had undergone an annual inspection.

At the time of the accident, the engine had been operated for about 70 hours since it was installed.

METEOROLOGICAL INFORMATION

The weather reported at SHD, which was located about 25 miles south-southwest of the accident site, at 1944, was: wind from 350 degrees at 7 knots, gusting to 14 knots, visibility 10 statue miles, clear skies, temperature 22 degrees C, dew point 11 degrees C, altimeter 30.00 in/hg.

The accident site was about 55 miles southwest of MRB, which at 1953, reported clear skies, with 10 statue miles of visibility.

The visibility and sky conditions at area airports with recorded weather observations, were as follows:

Charlottesville-Albemarle Airport (CHO), Charlottesville, Virginia, which was located about 33 miles south-southeast of the accident site: at 1953, clear skies, visibility 10 statue miles.

Orange County Airport (OMH), Orange, Virginia, which was located about 40 miles southeast of the accident site: at 1925, overcast ceiling at 10,000 feet, visibility 10 statue miles

Culpeper Regional Airport (CJR), Culpeper, Virginia, which was located about 40 miles east of the accident site: at 1942, scattered clouds at 10,000 feet, visibility 10 statue miles.

Winchester Regional Airport (OKV), Winchester, Virginia, which was located about 40 miles northeast of the accident site: at 2000, scattered clouds at 6,000 feet, visibility 10 statue miles.

AERODROME INFORMATION

According to an airport facility directory, the New Market Airport contained a single 2,920-foot long, 60-foot wide, asphalt runway, oriented on 060/240 degree heading.

WRECKAGE AND IMPACT INFORMATION

The airplane was examined at the accident site by an FAA inspector. The airplane struck the top of a residence and a tree, before it came to rest inverted on the field. A golf course was located approximately 1/2 miles north of the accident site.

All major components of the airplane were accounted for at the accident site. Streaks of oil were present on the bottom of the fuselage and small holes were observed on the top portion of the engine crankcase near the number 5 cylinder. Additionally, the number 5 cylinder connecting rod was observed separated from its crankshaft journal. The engine was retained for further examination.

Further examination of the engine was conducted at Hagerstown Aircraft Services, Hagerstown, Maryland, on May 16, 2001, under the supervision of a Safety Board investigator.

The engine was removed from the airplane and mounted on a "nose-stand" for disassembly. Both magneto's were removed and produced a spark on all towers when rotated by hand. All spark plugs were removed. Their electrodes were intact and dark gray in color. Small pieces of metal flakes were observed inside the oil filter and oil pick-up screen. When the oil sump was removed, two pieces of a connecting rod cap, two broken connecting rod bolts, two connecting rod bearings, three valve lifters, pieces of a piston, and other miscellaneous metal fragments were located in the sump.

All connecting rods, with the exception of the number 5 cylinder connecting rod, moved freely on their respective journals and did not exhibit any evidence of distress. The number 5 cylinder connecting rod and bolts were severely damaged.

The numbers 1, 2, 3, and 4 pistons were removed. Their domes exhibited light deposits, their rings were free to rotate and no scoring was observed on their skirts. The number 5 piston pin had separated from its piston and exhibited impact damage. The bottom portion of the number 5 piston was broken into several small pieces which were observed in the engine. The top portion of the number 5 piston remained lodged in the cylinder. The number 6 piston and attached connecting rod remained inside the cylinder and could not be removed due to damage in the skirt area.

During the disassembly, it was noted that the torque values for the cylinder hold down nuts, through bolts and nose bolts, were with-in limits, except for two cylinder hold down nuts for the number three cylinder. The nuts turned about 1/8 of an inch and less than an 1/8 of an inch, respectively, before reaching the required torque of 41 ft/lbs. Additionally, measured torque values for the engine connecting rod bolts varied between 150 to 450 in/lbs.

According to the engine manufacturer, the required installation torque for the connecting rod bolts was between 690 to 710 in/lbs. A representative of the engine manufacturer also stated that it was not uncommon for connecting rod torque values to vary significantly after an engine experiences a catastrophic failure.

The intact number 1, 2, 3, and 4 pistons and connecting rod assemblies; the fractured number 5 connecting rod assembly; the number 5 cylinder with piston lodged in the barrel, the number 5 piston pin with plugs, and the fractured piston skirt pieces were retained and forwarded to the Safety Board's Material's Laboratory, Washington, DC, for further examination.

MEDICAL AND PATHOLOGICAL INFORMATION

The private pilot was examined on May 14, 2001, by the Office of the Chief Medical Examiner, Richmond, Virginia. An autopsy was not performed.

Toxicological testing was conducted on the private pilot by the FAA Toxicology Accident Research Laboratory, Oklahoma City, Oklahoma.

TESTS AND RESEARCH

The retained portions of the engine were examined by a Safety Board Metallurgist on July 10, 2001. Examination of the number 5 connecting rod assembly revealed that although heavily damaged by post fracture mechanical contact, sufficient fracture surfaces remained to establish that the fractures in the rod and cap were consistent with bending overstress separations. No indications of preexisting cracking, such as fatigue, were found at either fracture location and no heat tinting was noted at the bearing area. Additionally, no fretting was noted on the split line surfaces of the rod and the original machining marks were clearly visible. The number 5 connecting rod bearing was severely bent and folded, but not fractured. The non-bearing outer diameter surfaces had mechanical damage associated with the overall deformations but did not show indications of movement within the rod prior to separation, such as scoring or fretting. Additionally, no heat damage was observed.

The number 5 cylinder piston pin was separated from the rod. The body of the pin was dented, scuffed and marked, but not fractured. However, the aluminum plugs in each end of the pin were severely battered and deformed from their normal cylindrical shape into a shape resembling a truncated cone.

The number 5 piston was extracted from the cylinder. The piston contained multiple fractures through the pin bosses and the skirt below the upper oil control ring. The fractures and underside of the crown also exhibited multiple post fracture mechanical dents and impact marks. Many of the marks were consistent with contact with the end plugs of the piston pin. Several small pieces of the separated skirt and bosses were recovered separately. Many of the small pieces were matched to the crown, but only an estimated 75% of the pin bosses and much less than 25% of the skirt below the upper oil control ring was recovered. Microscopic examination of the fractures surface on the recovered piston pieces were typical of overstress fracturing and no indications of preexisting cracking, such as fatigue were observed.

Examination of the number 5 cylinder revealed that the cylinder bore exhibited a uniformly crosshatched hone pattern with no indications of localized wear, piston scuffing or metal

transfer. Except near the mechanical damage at the base, the barrel surface was smooth and displayed a ring groove. The cylinder head was intact and both valves were in place and appeared undamaged. The combustion chamber contained light tan deposits with no indications of mechanical or thermal damage.

Examination of the numbers 1, 2, 3 and 4 connecting rod assemblies showed that all rods exhibited slight fretting on one of the split line faces. The other faces displayed the as-manufactured machine pattern. The fretting was very light and had not yet completely removed the original machining marks in the area. The rod bolts all appeared intact and undamaged.

Examination of the numbers 1, 2 3, and 4 pistons revealed various amounts of tan deposits on the crown with no indications of detonation damage. The piston skirts displayed the original area of dry lube coating with little or no wear or scuffing. Further examination of the pistons, conducted at Teledyne Continental Motors, Mobile, Alabama, included hardness and dimensional checks of the pistons, piston pins and piston rings. The testing revealed the components met their applicable drawing requirements.

ADDITIONAL INFORMATION

Air Traffic Controller Interview

The controller who directed the accident flight was interviewed by a Safety Board ATC Specialist. During the interview, the controller stated he initially directed the airplane to SHD because the airplane's heading "looked to be taking him right over the top [of the airport]." He also stated that SHD was serviced by an approach control, standard instrument approaches, emergency equipments, and SHD was "the first thing" that came to his mind. When asked why he chose W45, the controller stated because "it was off the left wing" of the airplane, had a published approach, and he had worked approaches into W45 on previous occasions.

The controller said he did not asked the accident pilot about sky conditions or weather. He also did not solicit any pilot reports from other airplanes at lower altitude. The controller stated that the weather was visual flight rules (VFR), and he knew it was VFR because it was a "nice day" outside.

When specifically questioned about the performance characterizes of the Cessna 206, the controller stated "I know he's slow, doesn't climb fast, that's all I know." He said that he did not know prior to this emergency that a Cessna 206 was a single engine airplane.

With regards to providing "clock position directions," the controller stated, "I don't know what [the accident pilot] knows. I thought the clock position heading was the easiest thing to do."

FAA Order 7110.65, "Air Traffic Control," paragraph 10-2-14, "Guidance to Emergency Airport," stated:

"When necessary, use any of the following for guidance to the airport:

1. Radar.
2. DF.
3. Following another aircraft.
4. NAVAID's.
5. Pilotage by landmarks.
6. Compass headings."

Angel Flight America

According the Angel Flight America (AFA) internet site, AFA was "a non-profit charitable air medical transportation organization serving needy people and their families...."

With regard to use of private aviation resources, the internet site stated in part:

"The Angel Flight America Network includes a nationwide integrated regional network of six professionally operated, non-profit Angel Flight Volunteer Pilot Organizations (AFVPOs). All work together to provide "seamless" and fully coordinated medical air travel for qualified patients and family members normally up to 900 or 1,000 miles distance. No-cost transportation is provided by volunteer pilots flying their own aircraft just the same as when they fly trips with their own families or business associates...."

Glide Performance

The elevation in the accident site area was about 1,000 feet msl. According to a chart in the airplane operating handbook, at an altitude of 8,000 feet above ground level, the airplane's maximum ground distance in a glide was about 12 statue miles. The distance was predicted on the following conditions: an indicated airspeed of 85 miles per hour; a wind milling propeller; flaps in a retracted position; and zero wind.

Refueling

The airplane was refueled at MRB, with 45 gallons of aviation gasoline.

Wreckage Release

The airplane wreckage was released to a representative of the owner's insurance company.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	66,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 28, 2001
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 15, 2000
Flight Time:	2840 hours (Total, all aircraft), 210 hours (Total, this make and model), 15 hours (Last 90 days, all aircraft), 5 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Private	**Age:**	57,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	May 17, 2000
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	February 9, 1999
Flight Time:	285 hours (Total, all aircraft), 100 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N948CG
Model/Series:	U206E	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	U20601689
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	June 15, 2000 Annual	**Certified Max Gross Wt.:**	2600 lbs
Time Since Last Inspection:	70 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	4540 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, aided in locating accident	**Engine Model/Series:**	IO-520-F
Registered Owner:	Harry L. King	**Rated Power:**	285 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SHD,1201 ft msl	**Distance from Accident Site:**	25 Nautical Miles
Observation Time:	19:44 Local	**Direction from Accident Site:**	210°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots / 14 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	22°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	MARTINSBURG, WV (MRB)	**Type of Flight Plan Filed:**	IFR
Destination:	HICKORY, NC (HKY)	**Type of Clearance:**	IFR
Departure Time:	19:15 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	NEW MARKET 8W2	**Runway Surface Type:**	
Airport Elevation:	975 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	38.634998,-78.678886

Administrative Information

Investigator In Charge (IIC):	Schiada, Luke
Additional Participating Persons:	Mary P Baxter; FAA Washington FSDO; Dulles, VA Joseph A Hutterer; Cessna Aircraft Company; Wichita, KS Scott Boyle; Teledyne Continental Motors; Arvada, CO Christopher Sutherland; National Air Traffic Controller's Association; Leesburg, VA
Original Publish Date:	June 3, 2002
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=52245