



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Swanzy, New Hampshire	Accident Number:	NYC02FA178
Date & Time:	September 2, 2002, 11:00 Local	Registration:	N6688D
Aircraft:	Beechcraft 58P	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	7 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The six-passenger airplane arrived at the departure airport with a malfunctioning landing gear system. Due to lack of maintenance personnel, the pilot elected to conduct the accident flight with the landing gear extended. The airplane departed with seven occupants, near the certified gross weight. Witnesses observed the airplane flying about 200-300 feet above the ground, with its engines "sputtering and backfiring." The airplane made a left turn towards the airport, descended, and came to rest in a wooded area about 2 miles southeast of the airport. Examination of the right engine revealed the propeller was not feathered, and the number 5 cylinder head was fractured about 3/4 inch from the bottom of the upper portion of the head. A fatigue fracture initiated in the root radius of the cylinder head thread that engaged with the top thread on the cylinder barrel. Indentations and displaced material on the upper and lower flanks of the cylinder head threads matched with the locations of protruding material observed on the cylinder barrel threads. The protruding material was located on the flank/crown radius of the threads, and was consistent with the folding over of a burr into the thread, originating during the manufacturing process. The number 5 cylinder assembly consisted of a new cylinder head that had been installed on a remanufactured barrel. The right engine was remanufactured in 2001, and had accumulated about 140 total hours of operation since. According to 14 CFR Part 91.7, "No person may operate a civil aircraft unless it is in an airworthy condition. The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when unairworthy mechanical, electrical, or structural conditions occur." According to 14 CFR Part 91.107, "...each person on board a U.S.-registered civil aircraft must occupy an approved seat or berth with a safety belt...during movement on the surface, takeoff, and landing." According to the Airplane Flying Handbook (FAA-H-8083-3), Transition to a Multiengine Airplanes, "When one engine fails on a multiengine airplane, performance is not halved, but is reduced by approximately 80 percent."

Probable Cause and Findings

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

****This report was modified on 2/24/2016. Refer to the public docket for this accident for additional information.****

the pilot's improper preflight planning and his decision to depart with known landing gear system mechanical deficiencies, which resulted in a forced landing during a partial loss of power on one engine. Factors related to the accident were the fatigue failure of an engine cylinder barrel, the inadequate manufacturing process of the cylinder barrel, and the pilot's inability to retract the landing gear.

Findings

Occurrence #1: LOSS OF ENGINE POWER(PARTIAL) - MECH FAILURE/MALF

Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

1. (F) ENGINE ASSEMBLY,CYLINDER - FATIGUE
2. (F) FACILITY INADEQUATE - MANUFACTURER
3. 1 ENGINE

Occurrence #2: FORCED LANDING

Phase of Operation: EMERGENCY DESCENT/LANDING

Findings

4. (C) PREFLIGHT PLANNING/PREPARATION - IMPROPER - PILOT IN COMMAND
5. (C) OPERATION WITH KNOWN DEFICIENCIES IN EQUIPMENT - PERFORMED - PILOT IN COMMAND
6. (F) GEAR RETRACTION - NOT POSSIBLE
7. (F) PROPELLER FEATHERING - NOT PERFORMED - PILOT IN COMMAND
8. AIRCRAFT WEIGHT AND BALANCE

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT

Phase of Operation: EMERGENCY DESCENT/LANDING

Findings

9. OBJECT - TREE(S)

Factual Information

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HISTORY OF FLIGHT

On September 2, 2002, about 1100 eastern daylight time, a Beechcraft 58P, N6688D, was destroyed during a forced landing after experiencing a partial loss of engine power near Swanzey, New Hampshire. The certificated private pilot and six passengers were fatally injured. Visual meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan was filed for the flight that departed from the Dillant Hopkins Airport (EEN), Keen, New Hampshire, destined for the Yeager Airport (CRW), Charleston, West Virginia. The personal flight was conducted under 14 CFR Part 91.

According to the manager of a fixed based operation (FBO) at EEN, the accident airplane arrived on August 30 and was parked for the weekend. On the day of the accident, he observed the airplane being taxied to a self-service fuel pump, where it was fueled with approximately 110 gallons of 100 low-lead aviation gasoline. During the fueling process, the manager also observed a passenger sitting on the fuel pump, "calling off" the gallons to the pilot filling the airplane. After fueling, about 5-6 duffle bags were loaded into the nose section of the airplane, and the occupants entered the passenger cabin. The airplane was taxied to runway 20, where the pilot performed a normal run-up, and the flight departed. The manager additionally stated that the departure appeared normal until the airplane flew away from his sight.

Witnesses, who were located south of the airport, observed the airplane about 200-300 feet above the ground, with its engines "sputtering and backfiring" as it passed overhead. The airplane then began to make a left hand turn, reversing its direction towards the airport, before descending out of the witnesses sight.

The airplane came to rest in a wooded area about 2 miles southeast of EEN.

On the day of the accident, the pilot contacted the Burlington, Vermont; Flight Service Station (FSS), to obtain a weather briefing, and file an IFR flight plan. During his conversation with the FSS specialist, the pilot commented that he would be flying the airplane back to Louisiana with the landing gear in the extended position, and that he "can't get it up." The pilot also added that there would be 7 occupants onboard. The FSS specialist queried the pilot that he "thought a baron only carried uh six people," which the pilot replied, "well we've got some kids with us today."

According to a representative of the pilot's family, the pilot stated that he had experienced a problem with the landing gear after takeoff from CRW. After landing at EEN, no maintenance was performed on the airplane due to the lack of maintenance personnel.

The accident occurred during the hours of daylight, at 42 degrees, 52.00 minutes north longitude, 72 degrees, 14.32 minutes west latitude, at an elevation of 606 feet msl.

PERSONNEL INFORMATION

The pilot held a private pilot certificate for airplane single and multi-engine land, and instrument airplane.

The pilot's most recent application for a Federal Aviation Administration (FAA) third class medical certificate was dated on July 5, 2001.

Review of the pilot's logbook revealed that he had accumulated about 1,284 hours of total flight experience, 469 hours of which were in multiengine airplanes.

AIRCRAFT INFORMATION

According to the Beechcraft Baron 58P Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, the maximum passenger seating configuration was "Five (5) passengers and one (1) pilot."

A review of the airframe and engine records did not reveal any abnormalities with the engines or the airframe.

The airplane's most recent annual inspection was completed on February 4, 2002, at a total aircraft time of 2,699.3 hours. The compression check result for the number 5 cylinder from the right engine, obtained during the inspection, was "78/80."

The right engine's lubricating oil and filter was changed on August 6, 2002. The old oil filter was cut open after removal, and inspected as "OK." The engine was serviced with oil, washed, and a run up check was determined "OK."

The right engine was manufactured on October 4, 1984, and had accumulated 1,836.6 hours of total operation. The engine was then remanufactured on March 13, 2001, and had accumulated about 140 total hours of operation since. During the remanufacture, new Engineering Components, Inc. (ECI) Nickel cylinder assemblies were installed on the engine. The cylinder hold-down nuts were replaced and torqued per "Overhaul Manual Supplement."

The left engine underwent the same remanufacturing process, and had accumulated the same operational times as the right engine.

METEOROLOGICAL INFORMATION

The weather reported at the EEN airport, at 1055, included winds from 020 at 3 knots; 10 statute miles of visibility; broken clouds at 1,900 feet; temperature of 64 degrees Fahrenheit; dew point of 57 degrees Fahrenheit; and an altimeter setting of 30.21 inches of mercury.

WRECKAGE DESCRIPTION

Examination of the accident site revealed terrain, which consisted of evergreen and hardwood trees reaching a height of about 80 feet. The hardwood trees, which predominantly surrounded the accident site, had branches of varying diameters that were cut at 45-degree angles and displayed black paint transfer. The cut branches were located on the ground and suspended in other trees, along the wreckage path. The wreckage path was oriented on a 360-degree heading, with the main fuselage coming to rest on a 005-degree heading. Surrounding the accident site, were large patches of wilted foliage and charred fallen leaves. A post-crash fire consumed the main fuselage.

The first tree strike area was located about 300 feet prior to the main fuselage. A 32-inch section of the outer left wing was located about 125 feet from the first tree strike. About 15 feet from the outer left wing, a 30-inch section of the inboard right wing was located, suspended in a tree. A large section of a 9-inch diameter hardwood tree was found lying on the ground about 6 feet past the inboard right wing section. About 15 feet in front of the fallen tree was a 54-inch section of the left horizontal stabilizer. Also in this area was the left elevator, right wing aileron, a 60-inch section of the right wing containing the main fuel tank, and a 32-inch section of the outer right wing. About 50 feet further was the nose landing gear assembly. About 50 feet beyond the nose gear was the left engine propeller assembly. About 20 feet beyond the left engine propeller assembly was the main wreckage. The inboard section of the left wing, vertical stabilizer, rudder, and a 40-inch section of the right horizontal stabilizer remained attached to the fuselage. All flight control surfaces were accounted for at the accident site.

When the main wreckage was examined, the left horizontal stabilizer had a 12-inch deep "u"-shaped dent on the leading edge, about 19 inches from the outboard edge. Tree bark was observed in the dent compression marks.

The left and right engines were found separated from their respective wing attachments, and sustained extensive fire damage.

The left engine's turbocharger did not rotate when examined. The top spark plugs on all six cylinders were removed; their electrodes were intact and light gray in color. The left and right magnetos were separated from the engine, and sustained impact and heat damage. The engine was rotated 1/2 turn, and rotation was observed through the accessory drive section. No fuel was observed in the fuel manifold or fuel lines.

The right engine's number 5 cylinder head was fractured about 3/4 inch from the bottom of the upper portion of the head. About 1/2 inch of the barrel was observed inside the fracture. The throttle plate was observed in the closed position. The left and right magnetos were separated from the engine, and sustained impact and heat damage. The engine rotated freely until damage to the number six cylinder push rod prevented any further rotation of the crankshaft. During the rotation of the engine, movement through the accessory drive section was observed. The top spark plugs on all six cylinders were removed; their electrodes were intact and light gray in color. No fuel was observed in the fuel manifold or fuel lines. The turbocharger did not rotate when examined.

The left engine propeller assembly exhibited chordwise scratching to all three blades. Two propeller blades were bent rearward, and the other blade was bent forward at the tip. The propeller spinner remained attached to the assembly, and was crushed upward and inward.

The right engine propeller remained attached to the engine. One blade was melted about 14 inches from the hub, curling the blade backwards. The second blade displayed fire damage, but was not bent. The third blade was bent rearward. Slight chordwise scratching was observed on all of the three blades. The propeller spinner cap remained attached to the assembly, and was crushed upward and inward.

The pilot's airspeed indicator was recovered, but had sustained impact and heat damage. The airspeed indicator displayed a reading of 60 knots. No other intact flight instruments or navigational radios were located. Impact forces and fire damage destroyed all engine instruments.

Control cable continuity for the rudder, elevator, and trim surfaces located on the tail section of the airplane, were confirmed to the cockpit area. All cable ends to the left and right wings were separated. No corrosion was observed at the separation points.

The landing gear was determined to be extended by noting the fracture locations on the strut assemblies. The flap position was determined to be 15 degrees, by the position of the left and right flaps and the cockpit flap selector. The rudder trim control surface was determined to be about 4 degrees nose left trim. The mechanical rudder trim indicator in the cockpit was aligned with the 10 degrees nose left position.

MEDICAL AND PATHOLOGICAL INFORMATION

The State of New Hampshire Office of the Chief Medical Examiner, Concord, New Hampshire, performed an autopsy on the pilot, on September 3, 2002.

The FAA Toxicology and Accident Research Laboratory, Oklahoma City, Oklahoma conducted toxicological testing on the pilot.

TEST AND RESEARCH

The number 5 cylinder and piston assembly from the right engine was forwarded to the Safety Board Metallurgy Laboratory on September 17, 2002, for further examination.

According to the Metallurgy Laboratory's factual report, the cylinder assembly consisted of a fractured new ECI cylinder head that had been installed on an ECI remanufactured barrel, which was originally manufactured by Teledyne Continental Motors, Inc.

The examination revealed a fatigue fracture that initiated in the root radius of the cylinder head thread that engaged with the top thread on the cylinder barrel. Indentations and displaced material on the upper and lower flanks of the cylinder head threads matched with the locations of protruding material observed on the cylinder barrel threads. The protruding material was located on the flank/crown radius of the threads, and was consistent with the folding over of a machining burr into the thread. Such a feature was consistent as being defined as a lap.

The fractured cylinder head displayed no evidence of material defects, which may have contributed to initiation of the fatigue fracturing. Chemical analysis and hardness testing of the cylinder head material was consistent with manufacturing specifications. There was no discernable difference between the microstructure of samples taken from a relatively hot location, adjacent to the combustion chamber, or a relatively cold location, adjacent to the valve rockers.

Examination of the number 5 cylinder piston assembly revealed surface deposits on the piston head consistent with a slightly rich mixture setting.

The right engine, minus the number 5 cylinder, was forwarded to the Teledyne Continental Motors, Inc., Mobile, Alabama, for further examination. The examination, supervised by FAA personnel, was conducted on October 29, 2002, and did not reveal any abnormalities with the engine.

Subsequently, the number 6 cylinder piston assembly was also forwarded to the Safety Board Metallurgy Laboratory for examination and comparison to the number 5 cylinder piston assembly. The examination revealed no abnormalities, and the observations were similar to the number 5 cylinder piston assembly.

ADDITIONAL INFORMATION

Single Engine Inoperative Performance

According to the Beechcraft Baron 58P Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, the maximum takeoff weight to achieve positive single-engine rate of climb at liftoff, with the landing gear extended and the inoperative propeller feathered, was about 6,240 pounds.

The expected rate of climb with the landing gear retracted and the inoperative propeller feathered, at a weight of 6,240 pounds, was about 230 feet per minute.

There were no charts available in the Operating Handbook, or the FAA Approved Airplane Flight Manual, to calculate performance with the landing gear extended and the inoperative propeller windmilling.

According to the Airplane Flying Handbook (FAA-H-8083-3), Transition to a Multiengine Airplanes,

"When one engine fails on a multiengine airplane, performance is not halved, but is reduced by approximately 80 percent.

When one engine fails, however, it not only loses power, but the drag increases considerably because of asymmetric thrust, and the operating engine then carries the full burden alone. This leaves very little excess power for climb performance.

Since the failed engine is no longer delivering power to the propeller to produce thrust, but instead is absorbing energy to overcome friction and compression of the engine, the drag of the windmilling propeller is significant and causes the airplane to yaw toward the failed engine."

Weight and Balance

The maximum certified ramp weight for the airplane was 6,240 pounds.

The most recent calculated aircraft empty weight record, accomplished on March 13, 2001, was 4,406.83 pounds.

Two weight and balance calculations for the accident flight were calculated during the investigation.

The first calculation included the following known data and assumptions:

- 1) The fuel loading was calculated with the fuel purchased on the day of the accident. The investigation was unable to determine the exact amount of fuel on board prior to the fueling.
- 2) The calculation utilized the weights of the occupants obtained from autopsy reports.
- 3) Five duffle type bags weighing an approximate total of 100 lbs, placed in the nose baggage compartment.
- 4) Passenger 1 (170 lbs), and passenger 2 (104 lbs), were placed in two different seats for the purpose of the calculations because it was unclear if passenger 1 was in the center seat of the cabin or the aft seat.

The resulting takeoff weight was calculated as 6,028.9 pounds, and the airplane was within center of gravity limits.

The second calculation included the following known data and assumptions:

- 1) The fuel loading was calculated with an estimated 30 gallons of fuel remaining in the fuel tanks from the airplane's previous flight, and the fuel purchased on the day of the accident.
- 2) The calculation utilized the weights of the occupants obtained from autopsy reports, +10 percent.
- 3) Five duffle type bags weighing an approximate total of 100 lbs, placed in the nose baggage compartment, and 20 pounds for pilot charts and airplane gear, placed in the cargo area.
- 4) Passenger 1 (170 lbs), and passenger 2 (104 lbs), were placed in two different seats for the purpose of the calculations because it was unclear if passenger 1 was in the center seat of the cabin or the aft seat.

The resulting takeoff weight was calculated as 6,320.1 pounds, and the airplane was beyond the forward center of gravity limits.

Review of the pilot's records related to the airplane revealed a document detailing weight and balance calculations. The calculations included passenger weights for seven occupants.

According to 14 CFR Part 91.7,

"No person may operate a civil aircraft unless it is in an airworthy condition. The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when unairworthy mechanical, electrical, or structural conditions occur."

According to 14 CFR Part 91.107,

"...each person on board a U.S.-registered civil aircraft must occupy an approved seat or berth with a safety belt and, if installed, shoulder harness, properly secured about him or her during movement on the surface, takeoff, and landing."

Wreckage Release

The wreckage was released to a representative of the airplane owner's insurance company on September 4, 2002.

Pilot Information

Certificate:	Private	Age:	45, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	Last FAA Medical Exam:	July 5, 2001
Occupational Pilot:	No	Last Flight Review or Equivalent:	October 8, 2001
Flight Time:	1284 hours (Total, all aircraft), 1066 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beechcraft	Registration:	N6688D
Model/Series:	58P	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	TJ-242
Landing Gear Type:	Retractable - Tricycle	Seats:	6
Date/Type of Last Inspection:	February 4, 2002 Annual	Certified Max Gross Wt.:	6240 lbs
Time Since Last Inspection:		Engines:	2 Reciprocating
Airframe Total Time:	2699 Hrs as of last inspection	Engine Manufacturer:	Teledyne Continental
ELT:	Installed, not activated	Engine Model/Series:	TSIO-520
Registered Owner:	6688Delta, Inc.	Rated Power:	325 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:	EEN, 488 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	10:55 Local	Direction from Accident Site:	320°
Lowest Cloud Condition:		Visibility	10 miles
Lowest Ceiling:	Broken / 1900 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	3 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:	20°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.2 inches Hg	Temperature/Dew Point:	18°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(EEN)	Type of Flight Plan Filed:	IFR
Destination:	Charleston, WV (CRW)	Type of Clearance:	IFR
Departure Time:	10:58 Local	Type of Airspace:	Class E

Airport Information

Airport:	Dillant Hopkins Airport EEN	Runway Surface Type:	
Airport Elevation:	488 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	Aircraft Damage:	Destroyed
Passenger Injuries:	6 Fatal	Aircraft Fire:	In-flight
Ground Injuries:	N/A	Aircraft Explosion:	On-ground
Total Injuries:	7 Fatal	Latitude, Longitude:	42.866664,-72.242225

Administrative Information

Investigator In Charge (IIC):	Demko, Steve
Additional Participating Persons:	Sandy Taylor; FAA; Portland, ME Timothy D Rainey; Raytheon Aircraft; Wichita, KS Robert S Boyle; Teledyne Continental Motors; Mobile, AL
Original Publish Date:	June 2, 2004
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=55598

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

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).