



National Transportation Safety Board Aviation Accident Final Report

Location:	Wichita, KS	Accident Number:	CEN13FA049
Date & Time:	11/06/2012, 0745 CST	Registration:	N793FE
Aircraft:	CESSNA 208B	Aircraft Damage:	Substantial
Defining Event:	Powerplant sys/comp malf/fail	Injuries:	1 Fatal
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

According to air traffic control records, the pilot reported that the airplane had experienced a total loss of engine power during cruise climb about 4.5 minutes after the cargo flight's departure. After the loss of engine power, the pilot reported that his forward visibility was restricted by engine oil on the airplane's windshield. The pilot completed a forced landing to an open field, but the airplane impacted a hedgerow during the landing roll.

A postaccident engine disassembly revealed a failure of the gas generator due to a compressor turbine blade separation. The fractured compressor turbine blade released into the engine gas flow path and subsequently impacted adjacent compressor turbine blades and downstream components, which caused the loss of engine power. A metallurgical examination established that the blade had failed in high-cycle fatigue that originated from the blade trailing edge. However, the root cause of the fatigue could not be determined due to secondary damage sustained to the fracture surface. All other mechanical damage to the engine was consistent with collateral damage sustained subsequent to the release of the compressor turbine blade. Engine oil was observed on the downstream side of the power turbine disk; any engine oil that entered the gas flow path at that location would have been discharged through the exhaust ducts and into the outside airstream, and this was likely the source of the engine oil observed on the exterior of the airframe. Recovered engine parameter data indicated normal engine operation until the sudden loss of power. Additional data analysis did not reveal any abnormal engine parameter trends.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The total loss of engine power as a result of a fractured compressor turbine blade due to high-cycle fatigue.

Findings

Aircraft

Turbine section - Failure (Cause)

Turbine section - Fatigue/wear/corrosion (Cause)

Factual Information

HISTORY OF FLIGHT

On November 6, 2012, about 0745 central standard time, a Cessna model 208B airplane, N793FE, was substantially damaged when it collided with a hedgerow during a forced landing following a loss of engine power near Wichita, Kansas. The loss of engine power occurred about 4-1/2 minutes after departing Wichita Mid-Continent Airport (ICT), Wichita, Kansas. The commercial pilot, who was the sole occupant, was fatally injured. The airplane was registered to the Federal Express Corporation and operated by Baron Aviation Services Incorporated, under the provisions of 14 Code of Federal Regulations Part 135 while on an instrument flight plan. Day visual meteorological conditions prevailed for the cargo flight that had the intended destination of Garden City Regional Airport (GCK), Garden City, Kansas.

According to air traffic control transmissions, at 0734:35 (hhmm:ss), the pilot requested an instrument flight rules clearance from ICT to GCK. Radar track data indicated that the airplane departed runway 19R approximately 0737:45. At 0738:18, the tower controller told the pilot to change to the departure control frequency. The departure controller then cleared the flight to proceed direct to GCK and to climb to 8,000 ft mean sea level (msl). The airplane continued to climb on a westerly heading until 0742:02, at which time the airplane began a left 180-degree turn back toward the departure airport. According to radar data, the airplane had reached 4,700 ft msl when it began the left turn.

At 0742:13, the pilot transmitted that his airplane had experienced a loss of engine power and that he was attempting to return to the departure airport. At 0742:31, the pilot asked if there were any nearby airports because he was unable to reach ICT. The departure controller provided vectors toward an airstrip that was approximately 2.5 miles southeast of the airplane's position. At 0743:46, the pilot advised that he could not see the airstrip because the airplane's windshield was contaminated with oil. At 0744:57, the pilot's final transmission was that he was landing in a grass field. The airplane was located about 2.2 miles south of ICT at 1,600 feet msl, about 300 feet above ground level (agl) at the time of the last transmission. The radar data continued northeast another 1/2 mile before radar contact was lost at 0745:15.

A witness to the accident reported that he was outside his residence when he observed the accident airplane overfly his position. He recalled that the airplane's propeller was not rotating and that he did not hear the sound of the engine operating. He stated that the airplane landed in a nearby agricultural field on a northeast heading. He reported that during the landing rollout the airplane impacted a hedgerow located at the northern edge of the field. The witness indicated that the pilot was unresponsive when he arrived at the accident site and that there was a small grass fire located 8 to 10 feet in front of the main wreckage.

PERSONNEL INFORMATION

According to Federal Aviation Administration (FAA) records, the pilot, age 52, held a commercial pilot certificate with single and multi-engine land airplane and instrument airplane ratings. He also held a flight instructor certificate with single and multi-engine land airplane and instrument airplane ratings. His last aviation medical examination was completed on April 2, 2012, when he was issued a second-class medical certificate with a limitation for corrective lenses.

The pilot's flight history was reconstructed using information provided by the operator. The

pilot had been employed by the operator, Baron Aviation Services Incorporated, since September 2005. On April 11, 2012, the pilot reported having over 15,000 hours total flight experience, of which about 3,900 hours were accumulated in single engine airplanes and 11,000 hours in multi-engine airplanes. Company flight records indicated that he had flown 361.3 hours during the past year, 198.8 hours during the prior 6 months, 117.3 hours in the previous 3 months, and 30.8 hours in the last 30 days. The pilot had not flown during the 24 hour period before the accident.

According to training records, from August 20, 2012, through August 22, 2012, the pilot attended recurrent training for the Cessna model 208 airplane at FlightSafety International, located in Wichita, Kansas. The recurrent training consisted of 15 hours of ground instruction, 4 hours of simulator training, and 2 hours of flight briefing/debriefing. The pilot's most recent FAA Part 135 Proficiency/Qualification Check for the Cessna model 208B airplane was satisfactorily completed on August 22, 2012, following the recurrent training.

AIRCRAFT INFORMATION

The accident airplane was a 1991 Cessna model 208B airplane, serial number (s/n) 208B0291. The cargo airplane had a maximum takeoff weight of 8,750 pounds and was equipped for operation under instrument flight rules and in known icing conditions.

The accident airplane was issued a standard airworthiness certificate on November 27, 1991. The current FAA registration certificate was issued on January 8, 1992. The airplane was maintained under the provisions of a FAA-approved manufacturer inspection program. The last phase inspection was completed on September 28, 2012, at 10,790.6 hours total airframe time. A postaccident review of the maintenance records found no history of unresolved airworthiness issues. The airplane hour meter indicated 10,852.2 hours at the accident site.

The airplane was powered by one Pratt & Whitney model PT6A-114A, s/n PCE-17282, 675 shaft horsepower engine with a three bladed constant-speed McCauley propeller. The gas generator featured a three-stage axial, single-stage centrifugal compressor, a reverse annular-type combustion chamber, and a single stage compressor turbine. A single-stage power turbine drives a reduction gear assembly and power output drive flange.

Maintenance service records established that the engine had accumulated 13,466.6 hours since new (TSN) and 12,499 cycles since new (CSN). The last overhaul was completed by the Pratt & Whitney service facility located in Bridgeport, West Virginia, on April 12, 2001. The engine had accumulated 5,516.1 hours and 4,793 cycles since the last overhaul. The compressor turbine disk and blades were inspected by Pratt & Whitney Engine Services on April 13, 2006, at 4,999 TSN and 5,747 CSN. The last borescope inspection was completed on September 28, 2012, with no defects observed. At the time of the accident, the compressor turbine blades had accumulated 7,880 hours and 8,473 cycles since new.

METEOROLOGICAL INFORMATION

The closest weather observing station was located at the departure airport, about 2 miles north of the accident site. At 0753, the ICT automated surface observing system reported the following: wind 200 degrees magnetic at 5 knots, visibility 7 miles, few clouds at 6,500 feet above ground level (agl) and scattered clouds at 11,000 and 20,000 feet agl, temperature 4 degrees Celsius, dew point 2 degrees Celsius, and an altimeter setting of 30.08 inches of mercury.

COMMUNICATIONS

The accident flight was on an activated instrument flight rules (IFR) flight plan. A review of available ATC information indicated that the accident flight had received normal air traffic control services and handling. A transcript of the voice communications recorded between the accident flight and air traffic control are included with the docket materials associated with the investigation.

WRECKAGE AND IMPACT INFORMATION

An on-scene investigation was completed by representatives with the National Transportation Safety Board (NTSB), Federal Aviation Administration (FAA), Cessna Aircraft Company, Pratt & Whitney Canada, and the operator Baron Aviation Services Incorporated. The airplane landed in a recently planted field of winter wheat. The dry agricultural field contained depressions consistent with the spacing of the airplane landing gear. These tire tracks began about 518 feet from the hedgerow located on the northern border of the field. The airplane was found entangled with a large tree that was part of the hedgerow. The right side of the forward fuselage, including the right side of the cockpit, had collided with the trunk of the tree. Both wings were found partially separated from the fuselage. There was engine oil observed on the airframe, including the cockpit windshield, from the nose bowl aft to the empennage surfaces. The observed oil contamination was primarily located on the left side of the airframe. The pilot-side storm window was found open. The wing flaps were fully extended according to a measurement of the flap actuator jackscrew. Flight control cable continuity could not be established for the aileron cable circuit due to damage; however, all observed cable separations were consistent with overstress or were cut to facilitate wreckage recovery. Flight control cable continuity was confirmed to the rudder and elevator cable circuits. The emergency engine power lever was found stowed, the propeller lever was in the feathered position, and the both fuel control valves were in the OFF position. The propeller was found separated from the engine and all three blades were in a feathered position.

The engine remained attached to the airplane by one mount, cabling, and tubing. The engine did not exhibit any signatures of an in-flight fire or uncontained engine failure. Engine control continuity could not be established due to damage; however, all observed separations were consistent with overstress. The propeller governor control linkage was in the feathered position. The engine was retained for a teardown examination.

MEDICAL AND PATHOLOGICAL INFORMATION

On November 6, 2012, an autopsy was performed on the pilot at the Sedgwick County Regional Forensic Science Center, located in Wichita, Kansas. The cause of death was attributed to multiple blunt-force injuries to the head and torso. The autopsy did not reveal any shoulder or chest abrasions that could be attributed to the pilot wearing shoulder restraints during the accident. The FAA's Civil Aerospace Medical Institute (CAMI) located in Oklahoma City, Oklahoma, performed toxicology tests on samples obtained during the autopsy. The toxicological test results were negative for carbon monoxide, cyanide, ethanol, and all drugs and medications.

SURVIVAL ASPECTS

The postaccident examination revealed that the cabin volume, on the pilot's side of the cockpit, was not reduced and that there was limited structural displacement. The right side of the cabin had been reduced about 5-inches from the firewall aft to the rear door post and right wing root.

The cockpit seats were equipped with four-point restraints. The pilot was located in the left cockpit seat and was found secured by the lap belt only (the available shoulder restraints did not appear to have been used during the accident). The lap belt had been cut by first responders.

TESTS AND RESEARCH

A disassembly of the engine revealed a failure of the gas generator due to a compressor turbine blade separation. The remaining compressor turbine blades exhibited features that were consistent with secondary damage following the initial blade separation. The power turbine exhibited significant asymmetrical damage with scoring noted on the No. 3 bearing air seal. The power turbine shaft housing was fractured adjacent to the reduction gearbox mating flange. Engine oil was observed on the downstream side of the power turbine disk. As such, any engine oil that entered the gas flow path at that location would have been discharged through the exhaust ducts. The airframe manufacturer was unable to determine another source for the engine oil that was observed on the exterior of the airframe.

A metallurgical examination of the separated compressor turbine blade revealed fracture features that were consistent with a fatigue failure. The fatigue initiated from the blade trailing edge and progressed along the blade chord-line to approximately mid-chord. The remainder of the blade fracture was consistent with tensile overload. Scanning electron microscope (SEM) examination revealed oxidation of the fracture surface from exposure to hot gases. Additionally, the fracture surface exhibited striations that further established that the fatigue initiated from the blade trailing edge. The observed damage to the blade trailing edge was consistent with secondary impact damage and was similar to damage observed on several other compressor turbine blades. A 0.060-inch section of the blade trailing edge, which included the fatigue initiation point, was missing due to the secondary impact damage. As such, the root cause of the fatigue initiation could not be determined. However, additional analysis established that the fracture was the result of high-cycle fatigue. Metallographic examination of the trailing edge revealed no material anomalies or defects. There was no evidence of hot corrosion on the compressor turbine blades or disk serrations. Energy dispersive spectrometry (EDS) analysis confirmed that the chemical composition of the separated blade met the manufacturer's design specifications. Additionally, the airfoil thickness, measured at the beginning of the fracture surface, was within the manufacturer's drawing requirements. An examination of the compressor turbine disk revealed no evidence of damage that would have contributed to a fatigue fracture of the blade.

The accident airplane was equipped with a Pratt & Whitney Aircraft Data Acquisition System Plus (ADAS+) engine monitoring system. The engine monitor, model number EMU-A-010-3, serial number 1766, was shipped to the manufacturer for a non-volatile memory download. The recovered engine parameter data indicated normal engine operation until the sudden loss of power. Additional data analysis did not reveal any abnormal engine parameter trends.

History of Flight

Enroute-climb to cruise	Powerplant sys/comp malf/fail (Defining event) Loss of engine power (total)
Landing	Off-field or emergency landing
Landing-landing roll	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Flight Instructor; Commercial	Age:	52
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	Toxicology Performed:	Yes
Medical Certification:	Class 2 With Waivers/Limitations	Last FAA Medical Exam:	04/02/2012
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	08/22/2012
Flight Time:	(Estimated) 15200 hours (Total, all aircraft), 117 hours (Last 90 days, all aircraft), 31 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	Registration:	N793FE
Model/Series:	208B	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	208B0291
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	09/28/2012, AAIP	Certified Max Gross Wt.:	8750 lbs
Time Since Last Inspection:	62 Hours	Engines:	1 Turbo Prop
Airframe Total Time:	10852.2 Hours at time of accident	Engine Manufacturer:	Pratt & Whitney
ELT:	C126 installed, activated, did not aid in locating accident	Engine Model/Series:	PT6A-114A
Registered Owner:	Federal Express Corporation	Rated Power:	675 hp
Operator:	Baron Aviation Services, Incorporated	Operating Certificate(s) Held:	On-demand Air Taxi (135)
Operator Does Business As:		Operator Designator Code:	DEMA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	ICT, 1333 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	0753 CST	Direction from Accident Site:	360°
Lowest Cloud Condition:	Few / 6500 ft agl	Visibility	7 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	200°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	30.08 inches Hg	Temperature/Dew Point:	4° C / 2° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Wichita, KS (ICT)	Type of Flight Plan Filed:	IFR
Destination:	Garden City, KS (GCK)	Type of Clearance:	IFR
Departure Time:	0737 CST	Type of Airspace:	Class C

Airport Information

Airport:	Wichita Mid-Continent Airport (ICT)	Runway Surface Type:	N/A
Airport Elevation:	1333 ft	Runway Surface Condition:	Dry
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced Landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	37.614722, -97.447778

Administrative Information

Investigator In Charge (IIC):	Andrew T Fox	Report Date:	06/01/2015
Additional Participating Persons:	Tony F James; Federal Aviation Administration; Washington, DC Steven M Miller; Cessna Aircraft Company; Wichita, KS Jeff Davis; Pratt & Whitney Canada; Bridgeport, WV Danny Ball; McCauley Propeller; Wichita, KS John F Downey; Baron Aviation Services, Inc.; Vichy, MO David McNair; Transportation Safety Board of Canada; Quebec,		
Publish Date:	06/01/2015		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=85522		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).