



Aviation Investigation Final Report

Location:	Grand Rapids, Minnesota	Accident Number:	CHI08LA154
Date & Time:	June 8, 2008, 20:30 Local	Registration:	N7214Y
Aircraft:	Beech A36	Aircraft Damage:	Substantial
Defining Event:	Part(s) separation from AC	Injuries:	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot stated that about 40 minutes into the flight he heard a loud noise followed by a rapid deceleration of the engine, and then a "distinct bang." The windshield was immediately covered with a film of oil, completely obstructing forward visibility. He established a descent at best glide airspeed and established a course for the nearest suitable airport. During the descent, the engine continued to run rough and smoke entered the cockpit. It became apparent to the pilot that he did not have enough altitude to reach the airport. He attempted to increase engine power in order to slow the descent; however, the engine seized shortly afterward. He set up for a forced landing to a clearing adjacent to a set of power lines. During the forced landing, the airplane impacted trees and a utility pole, which separated the left tip tank and left aileron from the airframe. The airplane slid approximately 50 feet and came to rest upright. A postaccident inspection revealed that the propeller assembly had separated from the engine propeller flange. The propeller flange appeared intact. The propeller assembly was not recovered. Two propeller bolt fragments and one propeller alignment pin fragment were recovered from the engine cowling. Examination of the fracture surfaces revealed features consistent with reverse bending fatigue cracking. In addition, the washer faces of both nuts were worn and polished consistent with relative movement against the crankshaft flange. Maintenance records indicated that the propeller spinner bulkhead was replaced approximately one year prior to the accident in order to comply with a manufacturer's service letter. At the time of the accident, the propeller assembly had accumulated 1,906 hours total time in service, with 235 hours since replacement of the spinner bulkhead. About 531 hours had accumulated since overhaul of the propeller assembly.

Probable Cause and Findings

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

A loss of engine thrust due to the propeller separating from the aircraft as a result of fatigue failure of the propeller attachment bolts caused by the insufficient torque of the bolts during installation.

Findings

Aircraft	Propeller assembly - Fatigue/wear/corrosion
Aircraft	Propeller assembly - Incorrect service/maintenance
Personnel issues	Installation - Not specified

Factual Information

History of Flight

Enroute	Powerplant sys/comp malf/fail
Enroute	Part(s) separation from AC (Defining event)
Landing	Off-field or emergency landing

HISTORY OF FLIGHT

On June 8, 2008, about 2030 central daylight time, a Beech model A36 (Bonanza), N7214Y, was substantially damaged during an in-flight collision with trees, a utility pole and terrain near Grand Rapids, Minnesota. The pilot was executing a forced landing at the time of the accident. The flight was being conducted under 14 CFR Part 91 on an instrument flight rules (IFR) flight plan. Visual meteorological conditions prevailed in the vicinity of the accident site. The pilot and two passengers on-board reported no injuries. The flight departed Falls International Airport (INL), International Falls, Minnesota, about 1945. The intended destination was Flying Cloud Airport (FCM), Eden Prairie, Minnesota.

The pilot stated that about 40 minutes into the flight, he heard a loud noise followed by a rapid deceleration of the engine, and then a "distinct bang." The windshield was immediately covered with a film of oil, completely obstructing forward visibility. He established a descent at best glide airspeed and declared an emergency with air traffic control. The pilot identified Grand Rapids/Itasca County Airport (GPZ), Grand Rapids, Minnesota, as the nearest suitable airport, and altered course accordingly.

The pilot reported that during the descent, the engine continued to run rough and smoke entered the cockpit. It became apparent that they did not have enough altitude to reach the runway. He attempted to increase engine power in order to slow the descent; however, the engine seized shortly afterward. He set up for a forced landing to a clearing adjacent to a set of power lines approximately 2 miles east of GPZ. During the forced landing, the airplane impacted trees and a utility pole, which separated the left tip tank and left aileron from the airframe. The pilot noted that the airplane slid approximately 50 feet after initial impact with the ground.

PERSONNEL INFORMATION

The pilot held a Private Pilot certificate with single and multi-engine airplane ratings, and an instrument airplane rating. He was issued a Third-Class Airman Medical certificate on April 28, 2008, with a limitation for corrective lenses.

The pilot reported a total flight experience of 1,232 hours, with 162 hours in the same make and model as the accident airplane. He noted 209 hours of instrument flight time. His most recent flight review was completed on March 28, 2008.

AIRCRAFT INFORMATION

The accident airplane was a 1984 Beech model A36 (Bonanza), serial number E-2169. It was powered by a 300-horsepower Continental IO-550-B1F reciprocating engine, serial number 296821-R, and a McCauley D3A32C409-C three-blade, controllable pitch propeller assembly, serial number 982568.

Aircraft maintenance records indicated that the most recent annual inspection was completed on March 21, 2008, at 3,164.4 hours total airframe time. The recording hour (Hobbs) meter indicated 855 hours at the time of that inspection. The propeller had accumulated 1,226.8 hours total time and 482.3 hours since overhaul.

The maintenance records noted that the propeller spinner bulkhead was replaced on May 23, 2007, in accordance with McCauley Service Letter 2000-5A. McCauley Service Bulletin 227B, Alert Service Bulletin 248, and Service Letter 1991-11A were also complied with at that time. The propeller had accumulated 1,671.4 hours total time, and 296.5 hours since overhaul. The airplane recording hour meter indicated 669.2 hours, according to the records.

The propeller assembly was overhauled on December 1, 2005, and subsequently re-installed on the accident airplane on December 12, 2005.

METEOROLOGICAL INFORMATION

At 2035, the GPZ Automated Weather Observing System (AWOS) recorded weather conditions as: Calm winds; 10 miles visibility; overcast clouds at 6,500 feet above ground level (agl); temperature 15 degrees Celsius; dew point 12 degrees Celsius; altimeter 29.75 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest upright near the edge of a tree line running along a set of power lines. The left wing tip fuel tank and left aileron had separated from the airframe when it impacted one of the power line support poles during the landing. Impact marks on the utility pole were about 6 feet above ground level. The components were recovered from the debris path. The remaining flight controls remained attached to the airframe. The landing gear was in the retracted (up) position. The flaps were extended. The recording hour (Hobbs) meter indicated 904.1 when observed at the accident site.

A post accident inspection revealed that the propeller assembly had separated from the engine propeller flange. The propeller flange appeared intact. The propeller assembly was not recovered. Two propeller bolt fragments and one propeller alignment pin fragment were recovered from the engine cowling. The mating portions of the fragments were not recovered.

A teardown inspection of the engine revealed damage consistent with oil starvation. The crankshaft bearings and bearing journals were discolored and extruded. The oil sump contained remnants of a connecting rod bolt, and metal fragments consistent with bearing

material. The spark plugs exhibited normal burn signatures. The magnetos produced spark across all leads when tested.

TESTS AND RESEARCH

The recovered propeller bolt fragments were forwarded to the National Transportation Safety Board Materials Laboratory for examination.

Both bolts were fractured through near the center of the bolt at the first or second full thread common to the propeller hub. The nylon insert self-locking nuts were attached to both bolts. The washer faces of both nuts were worn and polished consistent with relative movement against the crankshaft flange. The threads common to the nuts were flattened and damaged consistent with contact to the crankshaft flange holes.

The fracture surfaces exhibited ratchet markings on opposing sides of the bolt stud, indicative of multiple initiation sites. In addition, opposing sets of crack arrest markings was consistent with reverse bending fatigue cracking. The arrest markings were coarsely spaced with some intervening ductile features consistent with high-stress propagation. Fatigue propagation was approximately 80-percent on one bolt and about 20-percent on the second bolt. The remaining portion of the bolt stud cross-sections exhibited features consistent with overstress separation.

The propeller hub alignment pin was fractured near the mid-point at a circumferential groove in the part. The fracture surface exhibited beach marks adjacent to the groove. After the initial radial propagation toward the center of the pin, the beach marks had a coarse appearance consistent with high-stress propagation. The fatigue area comprised approximately 50-percent of the pin cross-section.

The material and plating properties met the manufacturer's drawing specifications.

Pilot Information

Certificate:	Private	Age:	48, 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:	No
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	April 28, 2008
Occupational Pilot:	No	Last Flight Review or Equivalent:	March 28, 2008
Flight Time:	1232 hours (Total, all aircraft), 162 hours (Total, this make and model), 1119 hours (Pilot In Command, all aircraft), 28 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	Registration:	N7214Y
Model/Series:	A36	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	E-2169
Landing Gear Type:	Retractable - Tricycle	Seats:	6
Date/Type of Last Inspection:	March 21, 2008 Annual	Certified Max Gross Wt.:	4000 lbs
Time Since Last Inspection:	49 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	3214 Hrs at time of accident	Engine Manufacturer:	Continental
ELT:	Installed	Engine Model/Series:	IO-550-B1F
Registered Owner:	On file	Rated Power:	300 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	GPZ,1355 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	20:35 Local	Direction from Accident Site:	270°
Lowest Cloud Condition:		Visibility	10 miles
Lowest Ceiling:	Overcast / 6500 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	/ None	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.75 inches Hg	Temperature/Dew Point:	15°C / 12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	International F, MN (INL)	Type of Flight Plan Filed:	IFR
Destination:	Minneapolis, MN (FCM)	Type of Clearance:	IFR
Departure Time:	19:45 Local	Type of Airspace:	

Airport Information

Airport:	Grand Rapids/Itasca County GPZ	Runway Surface Type:	
Airport Elevation:	1355 ft msl	Runway Surface Condition:	
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	2 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 None	Latitude, Longitude:	47.211112,-93.509719(est)

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	Scott Krueger; FAA-Minneapolis FSDO; Minneapolis, MN
Original Publish Date:	March 23, 2009
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=68324

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