National Transportation Safety Board
Aviation Accident Final Report

Location:	Thorne Bay, Alaska	**Accident Number:**	ANC13LA068
Date & Time:	July 24, 2013, 11:40 Local	**Registration:**	N4787C
Aircraft:	DEHAVILLAND BEAVER DHC 2	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	3 Serious, 1 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The pilot reported that, while the float-equipped airplane was in cruise flight about 1,200 ft above ground level, the engine made a loud noise and lost partial power, so he maneuvered the airplane to land on a nearby lake. During the approach, the engine lost total power, and the airplane descended into an area of trees before reaching the lake, which resulted in substantial damage to the wings, fuselage, and empennage.

The operator reported that the engine had been overhauled (zero-timed) 31 hours before the accident. A postaccident engine examination revealed metal fragments and heavy gouging damage to the rotating components within the crankcase. The bottom portion (crankshaft end) of the No. 1 linkrod and its respective bushing were missing from the No. 1 linkpin; the oil sump contained metal debris consistent with heavily damaged remnants of these (and other) components. The No. 2 cylinder barrel and linkrod and the No. 3 linkrod showed deformation to the left (in the direction of engine rotation). Based on the damage observed in the engine, it is likely that the event that initiated the engine failure involved either the the No. 1 linkrod bushing or the bottom portion of the No. 1 linkrod; however, the extensive damage to these components precluded determination of the failure mode.

Probable Cause and Findings

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

The failure of the No. 1 linkrod bushing or the bottom portion of the linkrod, which resulted in a total loss of engine power.

Findings

Aircraft	(general) - Failure

Factual Information

On July 24, 2013, about 1140 Alaska daylight time, a float-equipped de Havilland DHC-2, N4787C, collided with trees following a loss of engine power near Lake Galea, about 15 miles northwest of Thorne Bay, Alaska, on Prince of Wales Island. The airline transport pilot and two passengers received serious injuries, one passenger was uninjured, and the airplane sustained substantial damage. The on-demand air taxi flight was operated by Promech Air, LLC, under the provisions of 14 Code of Federal Regulations (CFR) Part 135 with a company visual flight rules flight plan filed. Visual meteorological conditions prevailed. The flight departed Ketchikan Harbor Seaplane Base (5KE), Ketchikan, Alaska, at 1100 and was destined for Shipley Bay, Alaska.

According to the pilot, the airplane was in cruise flight at an altitude of about 1,500 feet above mean sea level (msl), which he estimated was about 1,200 feet above ground level (agl) in the area over which he was flying, when he heard a loud "boom" and a series of loud and continuous "pop-pop-pop" noises. The pilot said that he reported to the company via the radio that he had lost an engine cylinder and was going to land. The pilot said that everything was shaking and that he did an immediate 180-degree turn to land on the lake that he had just overflown. The pilot stated that, as he turned the airplane on a base leg for the lake, he put in two pumps of flaps, and, about that time, the engine lost power completely. The pilot estimated that the amount of time that elapsed from when he first heard the loud "boom" to the time that the engine lost power completely was less than 1 minute. The pilot stated that, once the engine lost power completely, the airplane was soon colliding with trees. According to the operator, the airplane came to rest in a wooded area about 300 yards from the lake, sustaining substantial damage to the wing, fuselage, and empennage.

The pilot stated that he and two passengers were able to exit the airplane but the passenger in the right seat was unable to exit the airplane until more help arrived. The pilot located the airplane's 406-MHz emergency locator transmitter and flipped the switch to the "on" position to be sure that it was transmitting. According to the operator, the Rescue Coordination Center (RCC) telephoned the operator and provided coordinates for the downed airplane. The pilot also located the airplane's survival kit, and he and a passenger positioned a piece of wing wreckage in a marsh area to try to make the accident site visible to overflying aircraft. The pilot established cellular telephone contact with the operator, which had dispatched another company airplane to assist. The pilot said that he heard the other company airplane approaching and used a flare from the survival kit to signal his location. The other company airplane landed on Lake Galea, and company personnel hiked to the accident site to assist the pilot and passengers. A U.S. Coast Guard (USCG) helicopter from Air Station Sitka soon arrived. The USCG transported the pilot and all three passengers from the scene two at a time.

Aircraft recovery personnel who retrieved the wreckage and Federal Aviation Administration (FAA) inspectors who observed reported that engine cylinder damage was visible. According to the operator, the Pratt & Whitney R-985-AN-14B engine had accumulated 31 hours since major overhaul.

Subsequent disassembly examination of the engine under the authority of the NTSB revealed that the No. 1 cylinder head showed both vertical and horizontal cracks, and the top of the No. 1 piston was visible through the cracks. The No. 1 piston was positioned abnormally high within the cylinder barrel. The vertical crack in the No. 1 cylinder head extended over the top of and bisected the cylinder head,

and a horizontal crack extended around the circumference, such that the bisected halves of the cylinder head could be lifted off by hand, exposing the piston top.

Internal damage to the engine precluded the removal of any cylinders using typical engine disassembly techniques. The No. 1 cylinder barrel and the No. 1 piston could not be removed. Removal of the Nos. 2, 3, 6, 7, 8, and 9 cylinders (accomplished by prying the cylinder barrels and applying force) and removal of their respective pistons allowed for a view inside the crankcase. The top (piston end) of the No. 1 linkrod was attached to the piston pin (established by feel), but the bottom portion (crankshaft end) of the linkrod and its respective bushing were missing. The linkpin for the No. 1 linkrod was attached to the crankshaft assembly.

The remaining visible linkrods (Nos. 2, 3, 6, 7, 8, and 9) all exhibited gouging damage. The No. 2 linkrod and No. 2 cylinder barrel showed pronounced deformation to the left (in the direction of engine rotation). The No. 3 linkrod also showed deformation to the left. The underside of the removed pistons (Nos. 2, 3, 6, 7, 8, and 9) all showed heavy gouging damage, and the No. 2 piston also was cracked on the bosses for the piston pin. A piece of a separated crankshaft counterbalance weight was found inside the crankcase with fragments of its attachment bolts present in the separated piece. The separated counterbalance weight piece showed heavy gouging damage. Metal fragments and heavy gouging damage were visible inside the crankcase. The oil sump contained metal debris, including fragments that appeared visually consistent with the color of bushing material, fragments that appeared visually consistent with the shape of piston ring pieces, and other metal debris.

A maintenance record for the airplane dated July 16, 2013, recorded the installation of engine SN JP206275 at an engine time since overhaul of 0.0 hours, an engine total time of 6,029.5 hours, and an airframe total time of 33,326.1 hours. The engine's authorized release certificate and airworthiness approval tag from the FAA-certificated repair station that performed the overhaul was dated June 6, 2013. A record dated May 28, 2013, documented that the engine's ground test run was 5 hours. A repair station record dated May 15, 2013, (which documented the engine's "inspection, reconditioning, and assembly in accordance with Pratt & Whitney Manual No. 123440") noted that the engine's linkrods were serviceable, and the linkpin bushings were replaced. A record dated January 23, 2013, documented the magnetic inspection of the linkrods. During a telephone interview, a representative from the facility that had performed the engine overhaul stated that the facility had experienced no changes in its linkpin bushing supplier and no differences in its techniques or procedures for performing engine overhauls with regard to the overhaul of the accident engine compared to others.

History of Flight

Enroute-cruise	Loss of engine power (partial) (Defining event)
Emergency descent	Loss of engine power (total)
Emergency descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline transport	**Age:**	65
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
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:**	April 16, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 31, 2013
Flight Time:	(Estimated) 19500 hours (Total, all aircraft), 600 hours (Total, this make and model), 19400 hours (Pilot In Command, all aircraft), 189 hours (Last 90 days, all aircraft), 117 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Passenger Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	Center
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	Center
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	DEHAVILLAND	**Registration:**	N4787C
Model/Series:	BEAVER DHC 2	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1330
Landing Gear Type:	N/A; Float	**Seats:**	9
Date/Type of Last Inspection:	July 10, 2013 AAIP	**Certified Max Gross Wt.:**	5110 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	33326 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney
ELT:	C126 installed, activated, aided in locating accident	**Engine Model/Series:**	R-985AN-14B
Registered Owner:		**Rated Power:**	450 Horsepower
Operator:		**Operating Certificate(s) Held:**	Commuter air carrier (135), On-demand air taxi (135)
Operator Does Business As:	Promech Air	**Operator Designator Code:**	Z3

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KCC,0 ft msl	**Distance from Accident Site:**	12 Nautical Miles
Observation Time:		**Direction from Accident Site:**	176°
Lowest Cloud Condition:	1800 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 2500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	16°C / 13°C
Precipitation and Obscuration:			
Departure Point:	Ketchikan, AK (5KE)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Shipley Bay, AK	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 Serious, 1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Serious, 1 None	**Latitude, Longitude:**	55.825,-132.884994(est)

Administrative Information

Investigator In Charge (IIC):	Gagne, Catherine
Additional Participating Persons:	David Fredrick; Juneau FAA Flight Standards District Office; Juneau, AK Gary Stears; Juneau FAA Flight Standards District Office; Juneau, AK
Original Publish Date:	March 17, 2015
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=87564

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.