Aviation Investigation Final Report

Location:	BETHEL, Alaska	**Accident Number:**	ANC95LA058
Date & Time:	May 25, 1995, 10:00 Local	**Registration:**	N19BR
Aircraft:	CESSNA 206	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

THE COMMERCIAL PILOT DEPARTED ON AN AIR TAXI CARGO FLIGHT TO A REMOTE DESTINATION. ABOUT 20 MINUTES AFTER TAKEOFF, THE ENGINE SUDDENLY QUIT, AND THE PILOT PERFORMED AN EMERGENCY LANDING ON ROUGH TERRAIN IN A STREAM BED. AFTER RECOVERY OF THE AIRPLANE 5 MONTHS LATER, AN EXAMINATION OF THE ENGINE REVEALED THAT THE #2 MAIN BEARING HAD FAILED AND THE CRANKSHAFT HAD FRACTURED THROUGH THE CRANK CHEEK BETWEEN THE #2 ROD AND #2 MAIN BEARING JOURNALS. THE #2 MAIN BEARING WAS SEVERELY FRAGMENTED AND DEFORMED, AND THE NUMBER 2 MAIN BEARING SADDLE WAS SEVERELY DEFORMED. A METALLURGICAL EXAMINATION OF THE CRANKSHAFT INDICATED THAT IT HAD FAILED FROM FATIGUE. THE EXAMINATION ALSO DISCLOSED THAT THE CRANKSHAFT CONFORMED TO THE MANUFACTURER'S MATERIAL SPECIFICATIONS FOR HARDNESS AND NITRIDING. RECORDS SHOWED THE ENGINE HAD BEEN REBUILT BY THE MANUFACTURER ON 7/23/92 AND INSTALLED IN THE AIRPLANE ON 9/3/92. AFTER BEING REBUILT, IT HAD ACCUMULATED 1154 HOURS OF FLIGHT TIME. AT 1004 HOURS, THE OIL PUMP HAD BEEN SERVICED DUE TO LOW OIL PRESSURE. DURING A 100 HOUR INSPECTION AT 1140 HOURS, METAL WAS FOUND IN THE OIL FILTER AND THE #4 CYLINDER WAS CHANGED.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A FAILURE OF THE #2 MAIN ENGINE BEARING AND SUBSEQUENT FATIGUE FAILURE OF THE ENGINE CRANKSHAFT. A FACTOR RELATING TO THE ACCIDENT WAS: THE LACK OF SUITABLE TERRAIN FOR AN EMERGENCY LANDING.

Findings

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

Findings
1. (C) ENGINE ASSEMBLY,BEARING - FAILURE,TOTAL
2. (C) ENGINE ASSEMBLY,CRANKSHAFT - FATIGUE

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

Occurrence #3: ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
3. (F) TERRAIN CONDITION - NONE SUITABLE

Factual Information

On May 25, 1995, about 1000 Alaska daylight time, a wheel equipped Cessna 206, N19BR, crashed during an emergency forced landing, about 49 miles west of Bethel, Alaska. The airplane was being operated as flight number 40, a visual flight rules (VFR) cross-country cargo flight to Chevak, Alaska, under Title 14 CFR Part 135 when the accident occurred. The airplane, registered to and operated by Arctic Circle Air, Fairbanks, Alaska, received substantial damage. The certificated commercial pilot, the sole occupant, was not injured. Visual meteorological conditions prevailed. Company VFR flight following procedures were in effect. The flight originated at the Bethel airport about 0940.

The operator reported that the pilot was in cruise flight about 600 feet above the ground when the engine suddenly quit. The pilot performed an emergency landing in a stream bed. The airplane received damage to the nose gear, firewall, right wing, and left main gear. Maintenance personnel from the operator responded to the scene and reported that the engine accessories normally driven by the crankshaft, did not rotate when the propeller was turned by hand.

Examination of the maintenance records indicated that the engine, an IO-520-F, serial number 286286-R, had accrued 1,154 hours since it was rebuilt by the manufacturer on July 23, 1992. The engine was installed in the accident airplane on September 3, 1992. During an annual inspection on October 11, 1993, the piston rings were replaced on the number 2,4, and 6 cylinders after the engine had accrued 507.7 hours since being rebuilt. On December 7, 1994, the number 6 cylinder was replaced at 915.1 hours of operation. At 1004.0 hours of operation on January 16, 1995, the engine's oil pump was serviced due to low oil pressure and the engine oil galleries were cleaned by blowing them out with compressed air.

On May 9, 1995, during a 100 hour inspection, metal was found in the engine oil filter and the number 4 cylinder was replaced. The engine had accrued 1,140.2 hours since the rebuild.

On October 25, 1995, a teardown examination of the engine revealed that the crankshaft was fractured at the number 3 short cheek, between the number 2 rod bearing and the number 2 main bearing. The engine contained numerous fragments from the number 2 main bearing. The number 2 bearing saddle was severely worn and deformed. The remaining bearing saddles appeared undamaged. The crankshaft, serial number B174, was the same crankshaft number that was entered on the manufacturer's quality assurance inspection record sheet when the engine was assembled.

On September 29, 1992, the manufacturer issued a mandatory service bulletin number M92-16. The bulletin indicated that the manufacturer began utilizing vacuum arc remelt (VAR) steel in the forging of crankshafts in 1978. This material was one that produced a forging with the

smallest amount of impurities in the finished product. The bulletin required the replacement of airmelt (non-VAR) crankshafts at the next overhaul or whenever the crankshaft was removed or made accessible for any reason. Non VAR crankshafts were not to be re-used in any other application. Crankshafts made from VAR steel were identified with the raised letters VAR forged into the crankshaft on the number 3,7, or 9 cheek. The service bulletin indicated that rebuilt IO-520-F engines with serial number 286230-R and higher, had been manufactured with a VAR crankshaft and were not affected by the bulletin, unless the engine's crankshaft had been replaced.

The crankshaft was examined by the National Transportation Safety Boards's Materials Laboratory on December 8, 1995. The examination revealed that the raised VAR forging was not present on the crankshaft. A heat code of "H94" was stamped on the number 9 crankshaft cheek. According to the manufacturer, the heat code and lack of a VAR stamp indicated that the crankshaft was an airmelt shaft. The manufacturer also indicated that the use of VAR crankshafts was initiated to address subsurface failures.

The metallurgical examination revealed markings indicating that a fatigue crack emanated from multiple origins at the forward radius of the number 2 rod journal. The initial fatigue origin area contained mechanical smearing damage that obliterated the original fracture features. The surface of the crankshaft's number 2 main bearing journal contained severe circumferential gouge damage. The surface of the remaining crankshaft rod and main journals contained light scoring without evidence of heat damage. Fragments of the number 2 main bearing exhibited severe wear and deformation damage. Etching of the crankshaft revealed a layer of nitrided surface about 0.04 inches deep that was within the manufacturer's specified range for the nitride case depth. A microhardness test of the crankshaft produced an average hardness above the minimum specified hardness for the shaft.

Pilot Information

Certificate:	Commercial	**Age:**	28,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 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	February 1, 1995
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	1425 hours (Total, all aircraft), 48 hours (Total, this make and model), 1299 hours (Pilot In Command, all aircraft), 147 hours (Last 90 days, all aircraft), 103 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	**Registration:**	N19BR
Model/Series:	206 206	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	U206002992
Landing Gear Type:	Tricycle	**Seats:**	1
Date/Type of Last Inspection:	May 9, 1995 100 hour	**Certified Max Gross Wt.:**	3600 lbs
Time Since Last Inspection:	14 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6615 Hrs	**Engine Manufacturer:**	CONTINENTAL
ELT:	Installed, not activated	**Engine Model/Series:**	IO-520-F
Registered Owner:	ARCTIC AIR GROUP	**Rated Power:**	300 Horsepower
Operator:	ARCTIC CIRCLE AIR SERVICE INC.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	ACSA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Unknown	**Visibility**	5 miles
Lowest Ceiling:	Overcast / 700 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	12 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	, AK (BET)	**Type of Flight Plan Filed:**	Company VFR
Destination:	CHEVAK , AK (VAK)	**Type of Clearance:**	VFR
Departure Time:	09:40 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	60.809337,-161.849914(est)

Administrative Information

Investigator In Charge (IIC):	Erickson, Scott
Additional Participating Persons:	DAVE CAMPBELL; ANCHORAGE , AK MIKE GRIMES; MOBILE , AL STEVE ANDERSON; ANCHORAGE , AK
Original Publish Date:	February 8, 1996
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=2651