



# Aviation Investigation Final Report

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<b>Location:</b>	Bethel, Alaska	<b>Accident Number:</b>	ANC15FA032
<b>Date &amp; Time:</b>	May 30, 2015, 11:30 Local	<b>Registration:</b>	N1653U
<b>Aircraft:</b>	Cessna 207	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Low altitude operation/event	<b>Injuries:</b>	1 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Flight test		

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## Analysis

The pilot departed on a postmaintenance test flight during day visual meteorological conditions. According to the operator, the purpose of the flight was to break in six recently installed engine cylinders, and the flight was expected to last 3.5 hours. Recorded automatic dependent surveillance-broadcast data showed that the airplane was operating at altitudes of less than 500 ft mean sea level for the majority of the flight. The data ended about 3 hours after takeoff with the airplane located about 23 miles from the accident site. There were no witnesses to the accident, which occurred in a remote area. When the airplane did not return, the operator reported to the Federal Aviation Administration that the airplane was overdue. Searchers subsequently discovered the fragmented wreckage submerged in a swift moving river, about 40 miles southeast of the departure/destination airport.

Postmortem toxicology tests identified 21% carboxyhemoglobin (carbon monoxide) in the pilot's blood. The pilot was a nonsmoker, and nonsmokers normally have no more than 3% carboxyhemoglobin. There was no evidence of postimpact fire; therefore, it is likely that the pilot's elevated carboxyhemoglobin level was from acute exposure to carbon monoxide during the 3 hours of flight time before the accident. As the pilot did not notify air traffic control or the operator's home base of any problems during the flight, it is unlikely that he was aware that there was carbon monoxide present. Early symptoms of carbon monoxide exposure may include headache, malaise, nausea, and dizziness. Carboxyhemoglobin levels between 10% and 20% can result in confusion, impaired judgment, and difficulty concentrating. While it is not possible to determine the exact symptoms the pilot experienced, it is likely that the pilot had symptoms that may have been distracting as well as some degree of impairment in his judgment and concentration. Given the low altitudes at which he was operating the airplane, he had little margin for error. Thus, it is likely that the carbon monoxide exposure adversely affected the pilot's performance and contributed to his failure to maintain clearance from the terrain.

According to the operator, the airplane had a "winter heat kit" installed, which modified the airplane's original cabin heat system. The modification incorporated an additional exhaust/heat shroud system designed to provide increased cabin heat during wintertime operations. Review of maintenance records

revealed that the modification had not been installed in accordance with Federal Aviation Administration field approval procedures.

Examination of the recovered wreckage did not reveal evidence of any preexisting mechanical anomalies that would have precluded normal operation of the airplane. Examination of the airplane's right side exhaust/heat exchanger did not reveal any leaks or fractures that would have led to carbon monoxide in the cabin. Because the left side exhaust/heat exchanger was not recovered, it was not possible to determine whether it was the source of the carbon monoxide.

## Probable Cause and Findings

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

The pilot's failure to maintain altitude, which resulted in collision with the terrain. Contributing to the accident was the pilot's impairment from carbon monoxide exposure in flight. The source of the carbon monoxide could not be determined because the wreckage could not be completely recovered.

### Findings

<b>Personnel issues</b>	Aircraft control - Pilot
<b>Aircraft</b>	Altitude - Not attained/maintained
<b>Personnel issues</b>	Carbon monoxide - Pilot

## Factual Information

### History of Flight

<b>Unknown</b>	Low altitude operation/event (Defining event)
<b>Unknown</b>	Collision with terr/obj (non-CFIT)

On May 30, 2015, about 1130 Alaska daylight time, a Cessna 207, N1653U, sustained substantial damage after impacting trees about 40 miles southeast of Bethel, Alaska. The airplane was being operated by Yute Air, Bethel, as a visual flight rules (VFR) post maintenance flight under Title 14 CFR Part 91 when the accident occurred. The commercial pilot, the sole occupant, sustained fatal injuries. Visual meteorological conditions were reported in the area of the accident, and company flight following procedures were in effect. The accident flight originated at the Bethel Airport about 0830, with an expected return time of 1200.

About 1415, flight coordination personnel from Yute Air in Bethel notified the director of operations (DO) that the accident airplane was overdue. About 1435, the DO notified the Federal Aviation Administration (FAA) who issued an alert notice (ALNOT). About 1532, an aerial search was initiated by Yute Air, Alaska State Troopers, Alaska Air National Guard, as well as other air operators and Good Samaritans. On May 31, about 1730, searchers discovered the airplane's submerged and fragmented wreckage in a swift moving river slough.

### Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	47, Male
<b>Airplane Rating(s):</b>	Single-engine land; Single-engine sea; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	3-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 None	<b>Last FAA Medical Exam:</b>	April 14, 2015
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	January 20, 2015
<b>Flight Time:</b>	7175 hours (Total, all aircraft), 6600 hours (Total, this make and model), 6990 hours (Pilot In Command, all aircraft), 362 hours (Last 90 days, all aircraft), 94 hours (Last 30 days, all aircraft), 8 hours (Last 24 hours, all aircraft)		

The pilot, age 47, held a commercial pilot certificate with an airplane single and multi-engine land rating. The most recent second-class airman medical certificate was issued on April 14, 2015, and contained no limitations. According to company records, the pilot had about 7,175 total flight hours; about 6,600 flight hours were accrued in the accident airplane make and model.

In the preceding 90 and 30 days prior to the accident, the company listed the pilot's flight time as 362 and 94 hours, respectively. The pilot was hired on June 9, 2010.

The pilot completed an airman competency/proficiency check flight under Title 14 CFR Part 135.293 (Initial and Recurrent Testing), and 135.299 (Pilot-in-Command Line Check), with the chief pilot for the operator in a Cessna 207 airplane on January 20, 2015. In the remarks section of FAA form number 401-07 (airman competency/proficiency check form), the chief pilot wrote: "IPC (instrument proficiency check) satisfactory."

The accident flight was the pilot's first flight of the day, on the second day of a two-week on-duty rotation.

### Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N1653U
<b>Model/Series:</b>	207	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1974	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	20700253
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	7
<b>Date/Type of Last Inspection:</b>	May 29, 2015 100 hour	<b>Certified Max Gross Wt.:</b>	3803 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	28211.4 Hrs as of last inspection	<b>Engine Manufacturer:</b>	CONT MOTOR
<b>ELT:</b>	C91 installed, not activated	<b>Engine Model/Series:</b>	IO 520 SERIES
<b>Registered Owner:</b>	BETHEL LEASING LLC	<b>Rated Power:</b>	2300 Horsepower
<b>Operator:</b>	BETHEL LEASING LLC	<b>Operating Certificate(s) Held:</b>	Commuter air carrier (135), Other operator of large aircraft
<b>Operator Does Business As:</b>	Yute Air Alaska	<b>Operator Designator Code:</b>	YAAA

The Cessna 207, a seven-seat high-wing, tricycle landing gear-equipped airplane, serial number (S/N) 20700253, was manufactured in 1974. It was powered by a Continental Motors IO-520-F engine, serial number 810024-R, rated at 300 horsepower. The airplane was also equipped with a Hartzell model PHC-C3YF-1RF, controllable pitch propeller. According to maintenance records, the last inspection performed on the airplane was a 100-hour inspection dated May 29, 2015; at that time the airframe had accumulated 28,211.4 total hours. The engine had accrued 6,296.9 hours, 537.8 hours since overhaul.

In addition to the 100-hour inspection, all six of the engines cylinders were replaced just before the accident flight. The purpose of the flight was to break in the new cylinders in accordance with Continental Motors guidelines, which recommends a normal takeoff and a shallow climb to gain airspeed and cooling. Level flight should be at 75% power and richer mixture for the first hour of flight. The second hour power settings should alternate between 65% and 75% power, varying power every 15

to 20 minutes. Descents should be made at low cruise power settings, avoiding long descents with cruise power.

On September 23, 2013, a "Winter Heat Kit" was installed on the accident airplane. The modification included the installation of an additional air induction box on the right side of the engine, additional ducting and scat tubing, as well as a heat shroud on the right muffler, and a Y duct to join the airflow from the left and right heat shrouds to increase cabin heat. According to the operator's director of maintenance (DOM), the air induction box was fabricated onsite, the Y duct was a specialized order to accommodate the modification, and the right exhaust pipe was shortened to fit the larger muffler and heat shroud.

Examination of the exhaust system and records revealed that it was not in compliance with either the engine or the airframe manufacturer's specifications. This type of modification requires an FAA 337 Major Repair and Alteration per CFR 43, Appendix A. After a submitting a Form 337 describing the alteration, the Flight Standards District Office determines what data is needed to approve the alteration as a field approval or a supplemental type certificate (STC). Once the alteration is approved the 337 is signed by an FAA inspector and the airplane is considered airworthy.

Modifications for the accident airplane were not in compliance with the manufacturers, or any known STC, nor was there an accompanying FAA 337 Major Repair and Alteration documentation.

During an inspection of Yute Air maintenance operations in May 2013, a Cessna 207 with the exhaust modification was in the hangar and there was discussion between the PMI and DOM. Based on that discussion, the PMIs understanding of the modification was that it was a "work in progress" and the final product and required paperwork would be submitted for inspection and approval. The DOM believed that a verbal agreement had been made and that a logbook entry of the modification would meet the requirement.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	PABE,128 ft msl	<b>Distance from Accident Site:</b>	40 Nautical Miles
<b>Observation Time:</b>	18:53 Local	<b>Direction from Accident Site:</b>	
<b>Lowest Cloud Condition:</b>	Few / 12000 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	10 knots /	<b>Turbulence Type Forecast/Actual:</b>	/ None
<b>Wind Direction:</b>	210°	<b>Turbulence Severity Forecast/Actual:</b>	/ N/A
<b>Altimeter Setting:</b>	30.12 inches Hg	<b>Temperature/Dew Point:</b>	16°C / 9°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Bethel, AK (PABE)	<b>Type of Flight Plan Filed:</b>	Company VFR
<b>Destination:</b>	Bethel, AK	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>		<b>Type of Airspace:</b>	Class G

The closest weather reporting facility was Bethel, about 40 miles northwest of the accident site. At 1053, an aviation routine weather report (METAR) reported, in part: Wind 210 degrees at 10 knots; visibility 10 statute miles; clouds and sky condition few at 12,000 feet, scattered at 2,000 feet; temperature 16 degrees C; dew point 9 degrees C; altimeter 30.12 inHg.

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Fatal	<b>Latitude, Longitude:</b>	60.3325,-161.054443

The main wreckage was submerged in the Kwethluk River, at 244 feet mean sea level (msl), and at latitude N60.20.123 and longitude W161.03.256. An area believed to be the initial impact point was marked by a broken treetop, atop an estimated 30-foot-tall birch tree. A portion of the right wing tip was found on the ground beneath the tree. The fuselage came to rest inverted on its left side, along the opposite side of the river, submerged in fast flowing water, about 270 feet from the initial impact point, on a magnetic heading of 010 degrees. The engine separated from the airplane; the engine and propeller were located submerged upstream and in the main river channel.

On August 5, 2015, under the supervision of the NTSB investigator-in-charge (IIC), the wreckage was examined at a private hangar in Bethel. Flight control system cable continuity was established from each control surface to the point of impact-related damage.

The throttle, propeller, and mixture controls were in the full forward position. The cowl flaps were in an intermediate position. The fuel selector was selected to the left tank, the fuel valve was also indicating the left fuel tank. The fuel pump was in the off position. Both the left and right fuel tanks were bladder tanks. The vent system was unobstructed; the vented fuel caps were on and secure.

On August 19, the NTSB IIC, and the parties noted in this report, completed an engine teardown and inspection after it was retrieved from the river and transported to Palmer, Alaska.

The engine was submerged in a river for 2 months and showed signs of water corrosion. The engine was placed on a stand for examination. The exam revealed impact damage to the oil sump, and a portion left exhaust system was missing. The right side exhaust system was removed and retained for leak testing. Only the risers remained of the left side exhaust system.

Rotational continuity was established throughout the engine and valve train. The crankcase, crankshaft, and camshaft did not show any signs of operational distress, and the bearings showed normal wear.

An Aviation Supplies & Academics, Inc., (ASA) carbon monoxide detector was mounted on the instrument panel, the date opened was recorded as 09/2013. This type of detector is a spot detector, which turns dark in the presence of carbon monoxide. Instructions on the back of the detector include "Write date opened on front and replace every 90 days."

The examination of the airframe and engine revealed no evidence of mechanical malfunction or failures that would have precluded normal operation.

## **Medical and Pathological Information**

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A postmortem examination was conducted under the authority of the Alaska State Medical Examiner, Anchorage, Alaska, on June 8, 2015. The cause of death for the pilot was attributed to blunt force, traumatic injuries.

The FAA's Civil Aeromedical Institute performed toxicological examinations for the pilot on August 10, 2015, which was negative for ethanol. The toxicological examination revealed 21 percent carboxyhemoglobin (carbon monoxide) in the pilot's blood.

Carbon monoxide is an odorless, tasteless, colorless, nonirritating gas formed by hydrocarbon combustion. Carbon monoxide binds to hemoglobin with much greater affinity than oxygen, forming carboxyhemoglobin; elevated levels result in impaired oxygen transport and utilization.

Nonsmokers may normally have up to 3 percent carboxyhemoglobin in their blood; heavy smokers may have levels of 10 to 15 percent. Family members and friends reported that the pilot was a nonsmoker.

The NTSB's chief medical officer reviewed the pilot's autopsy, toxicology report, personal medical records, the FAA blue ribbon medical file, and the NTSB IIC's reports.



A copy of the NTSB's medical officer's factual report is available in the public docket for this accident.

## SEARCH & RESCUE

When the airplane failed to arrive in Bethel, company personnel initiated a telephone and satellite phone search to see if the airplane had diverted to another village. Unable to locate the airplane, company management personnel contacted the Air Force Rescue Coordination Center, Anchorage to report the missing airplane.

The airplane was not equipped with, nor required to be equipped with, a digital, 406 MHz ELT that instantly transmits a distress signal to search and rescue satellites, thereby alerting rescue personnel within minutes of the location of the crash. As of February 1, 2009, analog, 121.5 MHz ELT's stopped being monitored by search and rescue satellites, and the installation of the 406 MHz has been voluntary.

The fragmented and submerged wreckage was spotted in a river on May 31, about 1730, by former Yute Air pilots who had volunteered to participate in the search and rescue efforts.

## Tests and Research

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Portions of the right exhaust system were retained for further examination and testing. A pressure test was done on the right muffler/heat exchanger, which revealed no leaks or fractures. As previously noted, the accident airplane had been retrofitted with an additional muffler/heat exchanger, but a search at the accident site failed to find the additional muffler/heat exchanger, and it remains missing.

## Additional Information

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The accident airplane was equipped with automatic dependent surveillance-broadcast (ADS-B) technology. In typical applications, the ADS-B capable aircraft uses an ordinary Global Positioning System (GPS) receiver to derive its precise position from the Global Navigation Satellite System (GNSS) constellation, and then combines that position with any number of aircraft parameters, such as speed, heading, altitude, and aircraft registration number. This information is then simultaneously broadcast to other ADS-B capable aircraft, and to ADS-B ground, or satellite communications transceivers, which then relay the aircraft's position and additional information to Air Traffic Control (ATC) centers in real time.

The data retrieved from the accident airplane's ADS-B information shows the airplane was operating at less than 500 feet msl for the majority of the approximate 3-hour flight. The last return signal from the accident airplane was when it was 23 miles southeast of the accident site, at an altitude of 1,075 feet msl.



A flight track map overlay is included in the public docket for this accident.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Hill, Millicent
<b>Additional Participating Persons:</b>	James Howery; FAA; Anchorage, AK
<b>Original Publish Date:</b>	November 29, 2016
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=91274">https://data.nts.gov/Docket?ProjectID=91274</a>

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](#).