Aviation Investigation Final Report

Location:	Anchorage, Alaska	**Accident Number:**	ANC16FA065
Date & Time:	September 10, 2016, 16:30 Local	**Registration:**	N62905
Aircraft:	HEFTY Polar Cub	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot departed in his float-equipped, experimental, amateur-built airplane during day visual meteorological conditions. According to a friend of the pilot, the purpose of the flight was to fly over a proposed hunting site and then return.

About 90 minutes later, multiple witnesses saw the airplane complete two, low-level, high-speed, 360° right turns over a residential neighborhood. The witnesses said that the airplane's first 360° turn was accomplished at an altitude between 150 and 200 ft above ground level, but the second turn was much lower. Witnesses near the accident site reported that, as the airplane completed the second, steep, 360° turn, the nose of the airplane pitched down, and the airplane began a rapid nose-down descent. The engine rpm then increased significantly, and the wings rolled level just before the airplane impacted a stand of tall trees adjacent to a home. The airplane subsequently descended onto a neighborhood road and came to rest inverted. A postcrash fire ensued about 30 seconds after impact, which quickly engulfed the entire airplane.

According family members and close friends, this was highly unusual behavior for this pilot.

Postaccident examination of the airplane's exhaust system revealed that the muffler can assembly was cracked around most of its circumference near the inlet portion of the muffler, which would have allowed exhaust gases to enter the cockpit/cabin. Toxicology tests revealed 48% carboxyhemoglobin (carbon monoxide) in the pilot's blood. The pilot was a nonsmoker, and nonsmokers normally have no more than 3% carboxyhemoglobin. The pilot's cause of death was extensive blunt force trauma including lacerations of the aorta, heart, and liver, and there was no soot found in his trachea. Although there was a postimpact fire, given the extensive blunt force injuries the pilot sustained and the lack of soot in his trachea, it is likely that the pilot's elevated carboxyhemoglobin level was from acute exposure to carbon monoxide during the 90-minute flight and not from postimpact fire.

Carboxyhemoglobin levels between 10% and 20% can result in confusion, impaired judgment, and difficulty concentrating, and the pilot's 48% carboxyhemoglobin level likely resulted in severe impairment.

No aircraft maintenance records were located for the airplane, which the pilot had built in 1996, so it is unknown when the muffler was last inspected or maintained. Additionally, due to the extensive postimpact fire, it was not possible to determine if the airplane was equipped with any type of carbon monoxide detection equipment. According to friends of the pilot, he conducted all maintenance on the airplane.

Probable Cause and Findings

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

The pilot's severe impairment from carbon monoxide poisoning in flight, which resulted in a loss of control and a subsequent collision with trees and terrain.

Findings

Personnel issues	Carbon monoxide - Pilot
Aircraft	(general) - Damaged/degraded
Aircraft	Altitude - Not attained/maintained

Factual Information

History of Flight

Maneuvering	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On September 10, 2016, about 1630 Alaska daylight time, a float-equipped, experimental amateur-built, Hefty Polar Cub airplane, N62905, was destroyed following a loss of control and subsequent impact with tree-covered terrain in a residential neighborhood in Anchorage, Alaska. The private pilot, the sole occupant, was fatally injured. The airplane was registered to and operated by the pilot as a personal local flight under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and no flight plan was filed. The flight reportedly originated in southwest Anchorage from Jewell Lake about 1500, but the actual departure time and flight route are unknown.

According to family and friends of the pilot, the purpose of the flight was to fly over a proposed hunting site near Willow, Alaska, and then return to Anchorage. The friend related that the pilot and a group of friends were planning a fly-in hunt later in the week.

During on-scene interviews conducted by the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) on the day of the accident, multiple witnesses consistently reported that they observed the airplane complete two, low-level, high-speed, 360° right turns over a residential neighborhood. The witnesses said that the airplane's first 360° turn was accomplished at an altitude between 150 and 200 ft above ground level, but the second turn was much lower. One homeowner stated that, as the airplane passed over his home, it was about 50 ft above his roofline. The witnesses also reported that the airplane's bank angle increased significantly on the second 360° right turn. One pilot-rated witness estimated that the airplane's bank angle was in excess of 60° during the second 360° turn. Multiple witnesses reported hearing the airplane's engine operating in a manner consistent with high power settings throughout both 360° turns.

Witnesses near the accident site reported that, as the airplane completed the second, steep, 360° right turn, the nose of the airplane pitched down, and it began a rapid nose-down descent. The engine rpm then increased significantly, and the wings rolled level just before the airplane impacted a stand of tall trees adjacent to a home. During the collision sequence, the airplane's floats were severed, and the airplane subsequently descended onto a neighborhood road, coming to rest inverted. A postimpact fire ensued about 30 seconds after impact, which quickly engulfed the entire airplane.

During a brief on scene interview with the NTSB IIC, a family member, along with a friend of the pilot, both reported that it was highly unusual and uncharacteristic behavior for the pilot to be flying as witnesses described.

Pilot Information

Certificate:	Private	**Age:**	75,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	None None	**Last FAA Medical Exam:**	May 23, 2007
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	2200 hours (Total, all aircraft), 1 hours (Total, this make and model)		

The pilot, age 75, held a private pilot certificate with an airplane single-engine land rating; he did not hold a single-engine sea rating. In addition, he held a Federal Aviation Administration (FAA) repairman certificate specifically for the accident airplane. The pilot's most recent third-class, special issuance medical certificate, was issued on May 23, 2007, and contained the limitation: "Not valid for any class after May 31, 2008."

On the pilot's application for medical certificate, dated May 23, 2007, he indicated that his total aeronautical experience was about 2,200 flight hours. No personal flight records were located for the pilot.

Aircraft and Owner/Operator Information

Aircraft Make:	HEFTY	**Registration:**	N62905
Model/Series:	Polar Cub	**Aircraft Category:**	Airplane
Year of Manufacture:	1996	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	0001
Landing Gear Type:	Tailwheel; Float	**Seats:**	2
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	1300 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Lycoming
ELT:	C91 installed, not activated	**Engine Model/Series:**	O-320-A2A
Registered Owner:	On file	**Rated Power:**	150 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane, which bears a resemblance to a Piper PA-11, had a rectangular, welded steel-tube structure that was covered with fabric. The wings, rudder, and horizontal stabilizer were all fabric covered. At the time of the accident, the airplane was equipped with a set of EDO 2000-series floats.

According to archived documents on file with the FAA certification office located in Oklahoma City, the airplane was built by the pilot from a set of purchased plans and was issued an FAA experimental airworthiness certificate with operating limitations on May 22, 1996. At the time the airworthiness certificate was issued, the airplane was equipped with a Continental Motors C-90-12-F engine.

At the time of the accident, the airplane was equipped with a Lycoming O-320-A2A engine, serial number L-9126-27, and a Catto composite propeller. No installation documentation for either the engine or propeller was located.

No aircraft maintenance records were located for the accident airplane. According to family members of the pilot, the airframe and engine logbooks were likely on board the airplane at the time of the accident. According to a family friend, the accident pilot performed all of the maintenance on the accident airplane.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ANC	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:		**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Few / 2500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.13 inches Hg	**Temperature/Dew Point:**	17°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Anchorage, AK	**Type of Flight Plan Filed:**	None
Destination:	Anchorage, AK	**Type of Clearance:**	None
Departure Time:	15:00 Local	**Type of Airspace:**	

The closest official weather observation station to the accident site was located at the Ted Stevens Anchorage International Airport, about 10 miles to the east. On September 10, 2016, at 1553, the station was reporting, in part: wind 230° at 4 knots; visibility 10 statute miles; ceiling and clouds, few at 2,500 ft; temperature 63° F; dew point 43° F; altimeter 30.14 inches of mercury.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	61.125278,-149.748886

Responding fire department and police personnel reported that, upon arrival, they discovered the inverted and burning wreckage on a neighborhood road, which was surrounded by tall trees. All of the airplane's major components were found at the main wreckage site. The airplane's longitudinal axis was oriented on a heading of 035° magnetic. Flight control continuity was established from the respective flight controls to the cabin area.

The airplane's first impact point was a stand of tall spruce trees about 120 ft from the wreckage point of rest. Broken tree branches and small portions of aircraft fabric that remained in the treetops marked the area.

The next impact point was a second stand of tall trees about 100 ft from the wreckage point of rest. The airplane's two EDO 2000-series floats were found entangled and suspended in the stand of tall trees.

The right wing was displaced slightly aft of its normal orientation to the fuselage, and the fabric on the underside of the wing was burned away. The aileron and flap remained attached to the wing, and the right flap appeared to be up. The leading edge of the right wing was slightly crushed and flattened in an aft direction, from about midspan to the wingtip. The inboard end of the wing and the right fuel tank were fire damaged.

The left wing was displaced aft about 45° from its normal orientation to the fuselage, and most of the fabric had burned away. The aileron and flap remained attached to the wing, and the left flap appeared to be up. The leading edge at the outboard end of the wing was flattened and crushed aft, with downward curling of the wingtip. The inboard end of the wing was extensively fire damaged, and the left fuel tank was incinerated.

The entire cockpit, baggage area, and fuselage extending to the vertical stabilizer were consumed by fire. Both wing lift struts remained attached to their respective wing and fuselage attach points.

The propeller hub assembly remained connected to the engine crankshaft, but the composite propeller blades were obliterated due to impact damage. The engine had impact and fire damage to the underside and front portion. Continuity of the drive train was established at the tachometer drive fitting on the accessory case when the propeller hub was moved by hand. The engine's four sparks plugs were examined and were dry with no unusual combustion signatures. The carburetor received impact damage. The engine control cables were either attached, or broken, at their respective carburetor control arms.

Medical and Pathological Information

A postmortem examination of the pilot was conducted under the authority of the Alaska State Medical Examiner, Anchorage, Alaska. The cause of death for the pilot was attributed to blunt force injuries. The autopsy also identified extensive lacerations of the aorta, heart, and liver. There was no soot identified in the tracheobronchial tree.

The FAA Bioaeronautical Sciences Research Laboratory performed toxicological examinations, which revealed 48% carboxyhemoglobin (carbon monoxide) in the pilot's blood. Additionally, amlodipine,

metoprolol, naproxen, and rosuvastatin were detected in the pilot's blood and urine.

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. 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.

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

Amlodipine is a prescription blood pressure medication also called Norvasc. Metoprolol is a beta blocking prescription medication, often called Lopressor or Toprol, that is used to treat high blood pressure and to prevent heart attacks in patients with coronary artery disease. Naproxen in an anti-inflammatory analgesic available over the counter with a variety of names, including Aleve. Rosuvastatin is a prescription medication to treat high cholesterol and is commonly marketed with the name Crestor. None of these medications adversely affect performance.

According to the NTSB chief medical officer's review of the pilot's autopsy and medical records obtained from the Veteran's Administration Hospital, Joint Base Elmendorf-Richardson, Anchorage, he had a history of hypertension, high cholesterol, coronary artery disease, and bladder neck obstruction. A copy of the NTSB' chief medical officer's factual report is available in the public docket for this accident.

Tests and Research

On December 2, 2016, after being notified by the FAA's Bioaeronautical Sciences Research Laboratory of the elevated level of carboxyhemoglobin in the pilot's blood, the NTSB IIC recovered the accident airplane's exhaust system for a detailed examination. The airplane's exhaust system consisted of a muffler covered by an exterior shroud assembly that provided ducted heat to the airplane's cockpit, cabin, and engine carburetor heat system. During the exhaust system examination, the NTSB IIC peeled open the shroud assembly, which revealed a severely degraded and damaged muffler can assembly. The muffler can was cracked around most of its circumference near the inlet portion of the muffler. The entire muffler assembly was then sent to the NTSB's Materials Laboratory for further examination.

Accident Muffler Can Assembly

The examination revealed that portions of the muffler can material were missing and that areas adjacent to the missing material had white, oxidized exhaust deposits. Cracks and corrosion on the interior surface of the exterior shroud in an area under a riveted doubler were also seen. A copy of the NTSB's Materials Laboratory Factual Report is included in the public docket for this accident.

Additional Information

FAA Advisory Circular (AC) 91-59A, "Inspection and Care of General Aviation Aircraft Exhaust Systems," emphasizes the safety hazards of poorly maintained aircraft exhaust systems and highlights points at which exhaust system failures occur. In addition, the AC stresses the importance of having carbon monoxide detection equipment installed. Due to the extensive postcrash fire damage to the airplane, the NTSB was unable to determine if the accident airplane was equipped with any type of

carbon monoxide detection equipment.

Administrative Information

Investigator In Charge (IIC):	Johnson, Clinton
Additional Participating Persons:	Todd Boren; Federal Aviation Administration - CMO; Anchorage, AK John Harrington; Federal Aviation Administration - CMO; Anchorage, AK
Original Publish Date:	May 11, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=93993

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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.