



National Transportation Safety Board Aviation Accident Final Report

Location:	Fargo, North Dakota	Accident Number:	CEN17FA045
Date & Time:	December 1, 2016, 16:29 Local	Registration:	N123KK
Aircraft:	Cessna 340	Aircraft Damage:	Destroyed
Defining Event:	Fire/smoke (non-impact)	Injuries:	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Other work use		

Analysis

The airplane was equipped with an air sampling system used to collect air samples at various altitudes. The accident occurred when the pilot was returning to the airport after taking air samples at various altitudes over oil fields. As he was being vectored for an instrument approach, the airplane overshot the runway's extended centerline. The pilot then reported that he had a fire on board. The airplane lost altitude rapidly, and radar contact was lost. Examination of the accident site indicated that the airplane struck the ground at high velocity and a low impact angle.

One piece of the airplane's shattered Plexiglas windshield exhibited soot streaking on its exterior surface. This soot streaking did not extend onto the piece's fracture surface, indicative of the smoke source being upstream of the windshield and the smoke exposure occurring before windshield breakup at impact.

Both nose baggage compartment doors were found about 2 miles south of the main wreckage, which indicative that they came off at nearly the same time and most likely before the pilot's distress call. Although there was no soot deposits, thermal damage, or deformation to the doors consistent with a "high energy explosion," the separation of the luggage compartment doors could have occurred due to an overpressure caused by the ignition of a fuel air mixture within the nose portion of the airplane. The ignition of fuel air mixtures can create overpressure events when they occur in confinement. An overpressure in the nose baggage compartment may have stretched the airframe enough to allow the doors to push open without deforming the latches. If it was a lean fuel air mixture, it would likely leave no soot residue.

Post-accident examination revealed no evidence that the air sampling system, which was strapped to the seat tracks behind the copilot's seat, was the cause of the fire. The combustion heater, which was mounted in the right front section of the nose baggage compartment, bore no evidence of fuel leakage, but a fuel fitting was found loose.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The loose fuel fitting on the combustion heater that leaked a lean fuel-air mixture into the nose baggage compartment. The mixture was most likely ignited by the combustion heater, blowing off the nose baggage compartment doors and starting an in-flight fire.

Findings

Aircraft	Heating system - Damaged/degraded
Aircraft	Fuel - Not specified
Aircraft	Flight compartment windows - Damaged/degraded
Aircraft	Cargo/baggage doors - Capability exceeded

Factual Information

History of Flight

Approach	Fire/smoke (non-impact) (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On December 1, 2016, at 1629 central standard time, a Cessna 340, N123KK, impacted terrain about 10 miles south of Hector International Airport (FAR), Fargo, North Dakota, after the pilot reported an in-flight fire. The pilot was fatally injured, and the airplane was destroyed. The airplane was registered to and operated by Weather Modification, LLC, of Fargo, under the provisions of Title 14 Code of Federal Regulations Part 91 as an "other work use" flight. Visual meteorological conditions prevailed at the time of the accident, and an instrument flight rules (IFR) flight plan had been filed. The local flight originated from FAR about 1430.

Under contract with the National Oceanic and Atmospheric Administration (NOAA), the pilot had taken air samples at various altitudes over oil fields near Carrington, North Dakota, and was returning to FAR. According to radar data and voice communications transcripts, the pilot was being vectored towards, but overshot, the FAR runway 36 localizer. Shortly thereafter, when the airplane was at 1,700 feet mean sea level (msl), he reported an onboard fire. The airplane then lost altitude and radar contact was lost shortly thereafter.

Pilot Information

Certificate:	Commercial	Age:	55, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Lap only
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	Toxicology Performed:	Yes
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	May 5, 2016
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	March 1, 2016
Flight Time:	7898 hours (Total, all aircraft), 7771 hours (Pilot In Command, all aircraft), 11 hours (Last 30 days, all aircraft)		

The 55-year-old pilot held a commercial pilot certificate with airplane single- and multi-engine land ratings, and a Beech 300 type rating. He also held a flight instructor certificate with airplane single-engine, multi-engine, and instrument ratings. In addition, he held a mechanic's certificate with airframe and powerplant ratings. His most recent first-class airman medical certificate, dated May 5, 2016, contained the restriction: "Must possess glasses for near and intermediate vision."

Weather Modification, LLC, personnel made available the pilot's logbooks. The most recent logbook

(logbook 4) contained flight time entries from February 20, 2002, to November 16, 2016. According to this logbook, the pilot had accumulated the following flight hours:

Total time, 7,897.6
Multiengine, 6,920.0
Turbine, 1,998.8
Actual instruments, 1,637.7
Simulated (hood) instruments, 108.3
Flight simulator, 79.0

The pilot's last flight review was conducted on March 1, 2016, in the airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N123KK
Model/Series:	340	Aircraft Category:	Airplane
Year of Manufacture:	1973	Amateur Built:	
Airworthiness Certificate:	Normal; Restricted (Special)	Serial Number:	340-0251
Landing Gear Type:	Retractable - Tricycle	Seats:	3
Date/Type of Last Inspection:		Certified Max Gross Wt.:	5975 lbs
Time Since Last Inspection:		Engines:	2 Reciprocating
Airframe Total Time:		Engine Manufacturer:	Continental
ELT:	Installed, not activated	Engine Model/Series:	TSIO-520-JB
Registered Owner:		Rated Power:	0 Horsepower
Operator:	On file	Operating Certificate(s) Held:	On-demand air taxi (135), Pilot school (141)
Operator Does Business As:		Operator Designator Code:	CTUA

The airplane, serial number 340-0251, was manufactured in 1973 by the Cessna Aircraft Company, Wichita Kansas. It was powered by two Continental TSIO-520-JB engines (serial numbers 275386-R, left; 183304R, right), driving two Hartzell 3-blade, all-metal, constant speed propellers (model number 3AF32C87-N; serial number 767923, left; 786086, right). Both engines had a 1,400-hour time-between-overhaul limitation.

The last annual inspection of the airplane occurred on July 27, 2016, at a total time of 7,012.6 hours. The last 100-hour inspections of both engines and propellers were also on July 27, 2016. At that time, the left and right engines had accrued 6,676.4 hours and 7,134.6 hours total time, respectively. The left engine had been overhauled on March 25, 2014, and the right engine had been overhauled on September 25, 2012.

The airplane was last certified for flight in instrument meteorological conditions on August 2, 2016.

The airplane was equipped with a Stewart Warner combustion heater, sometimes referred to as a Janitrol

heater, that was used to provide cabin heat. The heater was mounted in the right front section of the nose baggage compartment.

The airplane carried a NOAA air sampling system manufactured by High Precision Devices, which was stored in two plastic boxes. One box was filled with glass jars for holding air samples. The remains of this box were found melted to the top forward fuselage. The second box contained the compressor package, which consisted of a rechargeable battery pack, two compressors, circuit boards wiring, and air tubing. The boxes were strapped to the seat tracks behind the copilot's seat.

NOAA representatives reported that the system had been in use for 12 years at 14 different locations. They said that there had never been any reports of fire with the air sampling system. They pointed out that the system does not operate all the time, only when the pilot pushes a button on the remote control attached to the glare shield. A typical mission would be for the airplane to climb to 25,000 feet and the pilot would then activate the system. The system would operate for 2 to 2.5 minutes taking air samples, and then shut off automatically when the sample collection was complete. The pilot would descend to the next sampling altitude and repeat the process.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KFAR, 901 ft msl	Distance from Accident Site:	10 Nautical Miles
Observation Time:	16:46 Local	Direction from Accident Site:	360°
Lowest Cloud Condition:		Visibility	9 miles
Lowest Ceiling:	Overcast / 1500 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	12 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	340°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.98 inches Hg	Temperature/Dew Point:	0°C / -2°C
Precipitation and Obscuration:			
Departure Point:	Fargo, ND (KFAR)	Type of Flight Plan Filed:	IFR
Destination:	Fargo, ND (KFAR)	Type of Clearance:	IFR
Departure Time:	14:30 Local	Type of Airspace:	Class C

Weather recorded at FAR at 1646, about 16 minutes after the accident, indicated that the wind was from 340°; at 12 knots, visibility was 9 miles, the ceiling was 1,500 feet overcast, the temperature and dew point were 0°C. and -2°C., respectively, and the altimeter setting was 29.99 inches of mercury.

Airport Information

Airport:	Hector International KFAR	Runway Surface Type:	Concrete
Airport Elevation:	901 ft msl	Runway Surface Condition:	Dry
Runway Used:	36	IFR Approach:	None
Runway Length/Width:	9001 ft / 150 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	Both in-flight and on-ground
Ground Injuries:	N/A	Aircraft Explosion:	On-ground
Total Injuries:	1 Fatal	Latitude, Longitude:	46.920555,-96.815834(est)

The accident site was in an open field about 10 miles south of FAR at an estimated elevation of 900 feet msl. It was bordered by trees and a ravine to the east. The location of the accident site was 46°43.727' north latitude, and 96°49.686' west longitude. All components of the airplane were identified at the accident site except for the nose baggage compartment doors, which were found about 2 miles south of the main wreckage.

The wreckage path at the accident site was on a magnetic heading of 197° degrees. Ground scars and impact damage were consistent with the airplane striking the ground at high velocity with a low angle of impact and in a left-wing-slightly-low and nose-up attitude. The first evidence of ground contact was multiple propeller slash marks consistent with the left propeller contacting the ground, which was followed by ground scars consistent with the fuselage contacting the ground. Continuing along the wreckage path, there were multiple slash marks consistent with the right propeller contacting the ground. Both upper engine cowlings, the propellers, and the upper nose skin separated from the airplane. Ground scars were consistent with the airplane becoming airborne for a short distance before sliding down an embankment and impacting trees in a wooded area along a creek bed to the east. The right wing, from the engine nacelle outboard, and the empennage separated as the airplane travelled forward. No soot or molten metal was observed on the separated empennage. The fuselage came to rest inverted about 550 feet from the initial point of impact.

The primary flight control cables were connected to their associated flight control surfaces and cockpit controls. All the cables exhibited either tension overload separations or had been cut by first responders. The mid-fuselage aileron bellcrank and the flap motor were consumed by fire. The flap sprockets were engaged in the right flap chain, and the chain was in a non-standard position. The left flap chain had separated from the flap drive motor. Both fuel selector handles were consumed by fire. The left fuel selector valve was in an undetermined position. The right fuel selector valve was in the "OFF" position.

No smoke streaking or heat damage was noted at the heater connection in the nose baggage compartment.

The combustion heater was found on the ground next to the cabin area. The heater was intact, impact-damaged, sooted, and showed no signs of explosion. All flight instruments and switches were either damaged or consumed by the post-impact fire. The main circuit breaker bus bars did not exhibit evidence of hot spots. The engine fuel and oil pressure lines did not exhibit evidence of pre-impact fire.

Additional Information

According to Weather Modification, LLC, the airplane was equipped with two hand-held fire extinguishers mounted in the cabin: one was halon, the other was halotron. Both extinguishers held about 5.4 pounds of agent. One had been discharged, the other showed signs consistent with exploding. It is not known which extinguisher had been discharged and which one had exploded. According to Textron Aviation, the Cessna 340 has a pressurized volume of 250 cubic feet plus or minus 50 cubic feet.

According to FAA's Bioaeronautical Sciences Research Laboratory, "Halon does not displace oxygen in its use like [carbon dioxide] does. Low concentrations of halon (less than 8% concentration by volume) are required for any given fire. The result is plenty of air for pilots and passengers to breathe, even during a fire incident . . . very high concentrations . . . could affect the pilot."

According to FAA's William J. Hughes Technical Center's Fire Safety Group, "The inhalation of halon 1211 and/or halotron may have affected [the pilot], depending on how much of each agent was released prior to the crash. All halons and halon replacements are cardiotoxic (have the potential to induce a heart attack) at high concentrations. Halon 1211 and many halon replacements also have narcotic effects at even higher concentrations. The cardiotoxic concentration threshold is lower than the incapacitation concentration threshold. A total release of 5.4 pounds of agent significantly exceeds the recommended agent weight for [the] stated volume of 250 cubic feet plus or minus 50 feet."

Medical and Pathological Information

The University of North Dakota's School of Medicine and Health Sciences, Department of Pathology, Forensic and Autopsy Service, Grand Forks, North Dakota, performed an autopsy on the pilot. According to their report, death was attributed to "multiple injuries." Their toxicological analysis of blood obtained at autopsy was negative for ethanol, drugs, and cyanide. A small amount of carbon monoxide (6% saturation) was detected in blood.

The Federal Aviation Administration's (FAA) Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, also performed a toxicological analysis. According to their report, no carbon monoxide, cyanide, ethanol, or drugs were detected in heart blood. No tests were conducted for the presence of halon or halotron.

Tests and Research

The wreckage was transported to a Weather Modification hangar in FAR, where it was laid out and re-examined.

On December 13, 2017, the compressor package from the airplane's NOAA air sampling system was examined at the National Transportation Safety Board's (NTSB) Materials Laboratory in Washington, DC. The examination determined that all smoke and heat damage had originated externally. There was no evidence to indicate the air sampling system was the cause of the inflight fire.

The Stewart Warner (Janitrol) combustion heater was also examined by NTSB's Materials Laboratory. The body of the heater exhibited thermal discoloration and soot staining, consistent with exposure to a fire environment. There was no evidence of fuel leaks in the combustion heater body or the air blower assembly. One fuel fitting on the combustion heater body was found to be loose.

Plexiglas windshield pieces and the nose baggage compartment doors were also examined. One piece of Plexiglas exhibited soot streak stains on the outside of the windshield that did not extend into the fracture surface, indicative of the smoke source being upstream of the windshield and occurring prior to the windshield breakup. The other Plexiglas pieces had no significant accumulation of soot or thermal damage and had about the same amount of particulate buildup, consistent with no prolonged exposure to a smoke-filled cockpit condition.

The nose baggage compartment doors did not exhibit any soot deposits, thermal damage, or deformation consistent with a "high energy explosion." The latches on one of the doors were not deformed.

Administrative Information

Investigator In Charge (IIC): Scott, Arnold

Additional Participating Persons: Jeffrey R Vigdal; FAA Flight Standards District Office; Fargo, ND
Joanna Spiekermeier; FAA Flight Standards District Office; Fargo, ND
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Note: The NTSB traveled to the scene of this accident.

Investigation Docket: <https://data.nts.gov/Docket?ProjectID=94453>

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.

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