



Aviation Investigation Final Report

Location:	Fort Rice, North Dakota	Accident Number:	CEN18FA277
Date & Time:	July 17, 2018, 14:23 Local	Registration:	N24515
Aircraft:	Cessna 152	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The pilot was conducting his second low-level aerial photography flight that day; the pilot would take the photographs through the left window of the airplane. A review of surveillance data showed the airplane depart from the airport and fly to the target areas for aerial photographs. After the pilot completed the photography work over the target areas, the airplane traveled over a river. The airplane then made several low-level turns over the river, most of which were to the left. The last recorded data point showed that the airplane at 1,700 ft. msl and a groundspeed of 49 knots. The airplane wreckage was found partially submerged in the river. The photographs from the pilot's camera were extracted, and the last several images showed a fish in the river. It was undetermined why the pilot was taking photos of the fish.

Postaccident examination of the airplane and engine revealed no anomalies that would have precluded normal operation of the airplane.

Given the temperature and dew point at the time of the accident, the airplane was susceptible to serious carburetor icing at glide power settings. The airplane was equipped with a carburetor temperature system that was installed on the right side of the cockpit. The system had an "ice zone" warning light that illuminated before carburetor ice could form. It is likely that, during the low-level turns to the left over the river, the pilot was focusing on taking photographs through the airplane's left window and did not see that the ice zone light had illuminated. After illumination of this light, a pilot was expected to apply carburetor heat. However, the airplane's carburetor heat was found in the off position. Thus, given the ambient conditions at the time of the accident, it is likely that carburetor ice formed and resulted in a loss of engine power. Because the pilot's attention was diverted while taking photos of a fish in the river, he likely did not notice the loss of airspeed, which resulted in the airplane exceeding its critical angle of attack, and a subsequent low-level aerodynamic stall.

Before the accident flight, a mechanic who assisted the pilot with refueling the airplane observed that

the pilot kept rubbing his eyes. The mechanic surmised the pilot was fatigued. The mechanic suggested that the pilot take a nap before continuing flight operations and the pilot replied that he can't make any money if he isn't flying, and subsequently departed for the accident flight. Evidence does not suggest that the pilot had a reduced sleep opportunity or circadian disruption during the days preceding the accident. However, at the time of the accident the pilot had completed one photo flight in the morning and was about 57 minutes into a second photo flight when the accident occurred. Although the pilot's total flight time that day was not extreme, the single-pilot aerial photography flight required low level maneuvering and divided attention which could have been fatigue inducing from a workload and time-on-task perspective. However, there was insufficient information from which to determine whether fatigue played a role in the sequence of events.

Probable Cause and Findings

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

The pilot's failure to use carburetor heat in conditions that were conducive to serious carburetor icing, which resulted in a loss of engine power, an exceedance of the airplane's critical angle of attack, and an aerodynamic stall. Contributing to the accident was the pilot's diverted attention during the low-level aerial observation flight.

Findings	
Personnel issues	Lack of action - Pilot
Personnel issues	Aircraft control - Pilot
Personnel issues	Use of equip/system - Pilot
Personnel issues	Monitoring equip/instruments - Pilot
Aircraft	Engine anti-icing system - Not used/operated
Environmental issues	Conducive to carburetor icing - Effect on equipment
Personnel issues	Attention - Pilot
Personnel issues	Monitoring equip/instruments - Pilot

Factual Information

History of Flight

Maneuvering-low-alt flying	Miscellaneous/other
Maneuvering-low-alt flying	Other weather encounter
Maneuvering-low-alt flying	Loss of engine power (total) (Defining event)
Maneuvering-low-alt flying	Loss of control in flight
Maneuvering-low-alt flying	Aerodynamic stall/spin
Maneuvering-low-alt flying	Off-field or emergency landing
Maneuvering-low-alt flying	Collision with terr/obj (non-CFIT)

On July 17, 2018, about 1423 central daylight time, a Cessna 152 II, N24515, sustained substantial damage when it was involved in an accident near Fort Rice, North Dakota. The commercial pilot sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 aerial photography flight.

The purpose of the flight was to take photographs of farms and ranches in Morton County, North Dakota. The pilot used a handheld digital camera and took photographs with the left window of the airplane opened. The pilot also used a kneeboard with a county map to locate the target areas. To photograph the targets, the pilot would set engine power between 1,800 and 2,200 rpm and fly at a 45° approach angle toward the target, positioning the camera forward of the wing strut to not get the strut or the airplane's propeller in the photograph.

On the day of the accident, the pilot conducted the preflight of the airplane at Mandan Municipal Airport (Y19), Mandan, North Dakota, and reported to a mechanic that he would return to the airport about lunchtime. The airplane departed from the airport about 0845 and returned at some point before 1330, after which the mechanic refueled the airplane. During the payment process for the fuel, the mechanic observed that the pilot "kept rubbing his eyes like he was tired." The mechanic suggested that the pilot take a nap before continuing flight operations, to which the pilot replied that he could not make any money if he did not fly.

The accident flight departed about 1337. Federal Aviation Administration (FAA) surveillance data showed that the airplane followed the Missouri River on a southeast path toward Huff, North Dakota. Once established south of Huff, the airplane performed multiple turns throughout the area at an average altitude of 2,500 ft mean sea level (msl) before traveling east toward Fort Rice. The last segment of data showed that the airplane made several low-level turns over the Missouri River, as shown in figure 1. Most of the turns were to the left. The last recorded data point showed that the airplane at 1,700 ft msl and a groundspeed of 49 knots. About 1442, the Morton County Sheriff's Office received notification that a witness observed the airplane located in the Missouri River.



Figure 1. Last segment of flight over the Missouri River. The image is oriented to the north. The times and locations of the last several aerial images captured by the pilot are shown.

Pilot Information

Certificate:	Commercial	Age:	35, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	3-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	November 1, 2017
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	May 14, 2018
Flight Time:	(Estimated) 746.5 hours (Total, all aircraft), 695.7 hours (Pilot In Command, all aircraft)		

The owner of the aerial photography company for which the pilot worked reported that the accident flight occurred during the pilot's second season (May/early June to October) with the

company. The pilot's wife noted no concerns about the pilot's sleep schedule and activities during the 72 hours before the accident.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N24515
Model/Series:	152 II	Aircraft Category:	Airplane
Year of Manufacture:	1977	Amateur Built:	
Airworthiness Certificate:	Normal; Utility	Serial Number:	15280303
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	December 13, 2017 Annual	Certified Max Gross Wt.:	1670 lbs
Time Since Last Inspection:	240 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	5104.21 Hrs as of last inspection	Engine Manufacturer:	Lycoming
ELT:	C91 installed, activated, did not aid in locating accident	Engine Model/Series:	O-235-L2C
Registered Owner:	On file	Rated Power:	115 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

The airplane's tachometer time on the day of the accident indicated a total of about 4.5 hours of flight that day. Examination of the airplane's maintenance records revealed no evidence of uncorrected mechanical discrepancies.

The airplane was equipped with an Electronics International carburetor temperature system on the right side of the cockpit, located to the right of the yoke on that side. The manufacturer's operating instructions states in part the following:

When Carb. Temp. is selected on the Electronics International Carb. Temp. instrument, the carburetor temperature is continuously monitored and the "Ice Zone" warning light over the display is activated for that channel. The "Ice Zone" warning light is only active for the channel selected. At 39°F (before ice can form in the venturi of the carburetor) the "Ice Zone" warning light will light up. When this happens, apply carburetor heat, making small adjustments to bring the carburetor temperature above 39°F, thereby avoiding any possible carburetor icing condition.... If the carburetor temperature is below 10°F the "Ice Zone" warning light will go off. Below 10°F there is not enough moisture in the air to form ice in the carburetor.

The "Ice Zone" warning light has the advantage of catching your attention without having to continuously monitor the unit.

The carburetor temperature system provides a visual alert system and does not have aural alerts.

Per the Pilot's Operating Handbook, the flaps up stall speed for the airplane at 45° bank is 43 kts.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KBIS, 1660 ft msl	Distance from Accident Site:	17 Nautical Miles
Observation Time:	19:52 Local	Direction from Accident Site:	333°
Lowest Cloud Condition:	Few / 4900 ft AGL	Visibility	10 miles
Lowest Ceiling:		Visibility (RVR):	
Wind Speed/Gusts:	4 knots / None	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	20°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.07 inches Hg	Temperature/Dew Point:	30°C / 17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Mandan, ND (Y19)	Type of Flight Plan Filed:	None
Destination:	Mandan, ND (Y19)	Type of Clearance:	None
Departure Time:	13:37 Local	Type of Airspace:	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	46.528331,-100.567222(est)

The airplane was discovered nose down with its empennage elevated, in about 5 ft of water, and about 75 ft west of a sandbar in the middle of the Missouri River, as shown in figure 2. The front of the airplane was oriented about 190°.



Figure 2. Aerial view of the airplane at the accident site. (Courtesy of the Morton County Sheriff's Office.)

The airplane sustained substantial damage to the fuselage and aft crushing to the leading edges of both wings. The propeller spinner was crushed aft and showed no evidence of rotation. One of the two propeller blades was bent slightly aft. The carburetor heat was found in the off position (at both the cockpit and engine locations). The carburetor temperature system was found to be installed correctly from the cockpit to the carburetor. The switch for the carburetor temperature system was found in the "Carb Temp" position.

No preimpact mechanical malfunctions or failures with the airframe and engine were found.

Medical and Pathological Information

The North Dakota Department of Health, State Forensic Examiner, Bismarck, North Dakota,

conducted an autopsy of the pilot. His cause of the death was blunt chest injuries.

Toxicology testing performed at the FAA Forensic Sciences Laboratory was negative for carbon monoxide, ethanol, and tested-for drugs.

Tests and Research

The images from the pilot's digital camera were extracted. Most of the images were of farms and farm equipment taken at a low angle. Between 1421:57 and 1423:12, seven images of the river were captured at a high angle and an almost-straight-down orientation. The metadata associated with all of the recovered images did not contain any GPS data.

Additional Information

The carburetor icing probability chart from the FAA's Special Airworthiness Information Bulletin CE-09-35, Carburetor Icing Prevention, indicated a probability of serious icing at glide power at the temperature (86°F) and dew point (63°F) reported at the time of the accident.

The Aircraft Owners and Pilots Association's Air Safety Foundation published a safety document titled "Maneuvering Flight: Hazardous to Your Health?" This document states that aerial work, including photography, "require a significant division-of-attention at low altitudes. Pilots performing aerial work are generally highly qualified and use excellent judgment. But, if something goes wrong, there is little time to recover."

Preventing Similar Accidents

Preventing Carburetor Icing (SA-029)

The Problem

According to NTSB aircraft accident data, from 2000 to 2011, carburetor icing was a cause or factor in about 250 accidents. On average, carburetor icing causes or contributes to two fatal accidents per year. Accident evidence shows that some pilots do not recognize weather conditions favorable to carburetor icing and inaccurately believe that carburetor icing is only a cold- or wet-weather problem. Pilots may also have not used the carburetor heat according to the aircraft's approved procedures to prevent carburetor ice formation. In addition, some pilots may not recognize and promptly act upon the signs of carburetor icing.

What can you do?

- Check the temperature and dew point for your flight to determine whether the conditions are favorable for carburetor icing. Remember, serious carburetor icing can occur in ambient temperatures as high as 90° F or in relative humidity conditions as low as 35 percent at glide power.
- Refer to your approved aircraft flight manual or operating handbook to ensure that you are using carburetor heat according to the approved procedures and properly perform the following actions:
 - Check the functionality of the carburetor heat before your flight.
 - Use carburetor heat to prevent the formation of carburetor ice when operating in conditions and at power settings in which carburetor icing is probable. Remember, ground idling or taxiing time can allow carburetor ice to accumulate before takeoff.
 - Immediately apply carburetor heat at the first sign of carburetor icing, which typically includes a drop in rpm or manifold pressure (depending upon how your airplane is equipped). Engine roughness may follow.
- Consider installing a carburetor temperature gauge, if available.
- Remember that aircraft engines that run on automotive gas may be more susceptible to carburetor icing than engines that run on Avgas.

See <https://www.nts.gov/Advocacy/safety-alerts/Documents/SA-029.pdf> for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	Dustin Jostad; FAA Fargo FSDO; Fargo, ND Henry Soderlund; Textron Aviation ; Wichita, KS Troy Helgeson; Lycoming Engines ; Williamsport, PA Tom Arbach ; Arbach Enterprises ; Watertown , SD
Original Publish Date:	July 13, 2020
Last Revision Date:	
Investigation Class:	Class 2
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=97813

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