Aviation Investigation Final Report

Location:	Ludington, Michigan	**Accident Number:**	CEN24FA046
Date & Time:	November 26, 2023, 10:00 Local	**Registration:**	N850JH
Aircraft:	Socata TBM 700	**Aircraft Damage:**	Destroyed
Defining Event:	Structural icing	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane was removed from an unheated hangar during a period of moderate snowfall. About 15 minutes later, the instrument-rated pilot taxied the airplane to the runway for departure, with visible snow accumulation on the ground and on the airplane wings, and horizontal stabilizer. The airplane was equipped with wing surface deice boots; however, deice boots are used to dislodge ice that may accumulate while in flight.

According to the airplane's pilot operating handbook, all snow, frost, and ice must be removed from all wing and control surfaces during the preflight inspection. On icy or snow-covered runways, anti-icing fluid must be sprayed on the wings, control surfaces and in landing gear wells, shortly before take-off. The risks of snow and ice accumulation on control surfaces were further outlined in a 2018 service letter (SL) from the airplane manufacturer, which stated that takeoffs with snow or ice adhering to the wings should not be attempted because this could drastically affect performance due to the reduced aerodynamic lift and increased drag resulting from disturbed airflow. The SL further provided the appropriate recommendations to assist the operator in checking proper implementation of on ground de-icing or anti-icing procedures. The departure airport did not offer de-icing or anti-icing services.

The airport manager, who watched the airplane take off, said the departure appeared to be normal until the left wing dropped shortly after rotation. Another witness said that the airplane was loud and low. She said the airplane was in a left-wing-low attitude before it cleared a line of trees and then impacted the ground. The airplane was destroyed by impact forces and a postimpact fire.

The impact and fire damage precluded functional testing of the flight controls, and related systems. Signatures on the engine and propeller were consistent with power and rotation at

the time of the accident. Examination of the wreckage did not reveal preimpact anomalies that would have precluded normal operations.

The left wing dropping during the climb was likely the result of snow accumulation on the airplane surfaces; the reduced aerodynamic lift and increased drag resulted in an aerodynamic stall and loss of control during the attempted climb after takeoff.

Probable Cause and Findings

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

The pilot's decision to take off with ice/snow contamination on the airplane's wings, which resulted in an aerodynamic stall and impact with terrain.

Findings

Personnel issues	Preflight inspection - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	Airspeed - Not attained/maintained
Personnel issues	Decision making/judgment - Pilot
Environmental issues	Snow - Decision related to condition

Factual Information

History of Flight

Standing	Structural icing (Defining event)
Takeoff	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On November 26, 2023, at 1000 eastern standard time, a Socata TBM 700, N850JH, was destroyed when it was involved in an accident near Ludington, Michigan. The pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

An instrument flight rules flight plan was filed before the flight from Mason County Airport (LDM) in Ludington, Michigan, to Tri-State Steuben County Airport (ANQ) in Angola, Indiana. The pilot also obtained an electronic weather briefing on the morning of the accident.

According to the airport manager, he assisted the pilot and passenger in removing the airplane from an unheated hangar at the airport about 945. The airport manager stated that about 15 minutes after they pulled the airplane from the hangar the pilot taxied the airplane onto runway 8 and began the takeoff roll. The airport manager said that the takeoff appeared to be unremarkable except that the left wing dipped after rotation and the airplane continued to climb in a left bank. He watched the airplane until it disappeared into the clouds. The airport manager reported that it was snowing before and after departure. He took a photograph of the airplane taxiing to the runway and in the photograph, snow accumulation is visible on the ground and on the airplane wings, and horizontal stabilizer.

A witness walking her dog about ½ mile north of the departure end of runway 8 said that the airplane sounded loud and low. She said the airplane came over the tree line in a left-wing-low attitude and then disappeared behind the tree line before she heard a loud bang.

The airplane impacted a snow-covered field about ¼ mile north of the airport. A post-impact fire ensued.

Pilot Information

Certificate:	Private	**Age:**	60,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	December 1, 2022
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	April 20, 2023
Flight Time:	4700 hours (Total, all aircraft), 320 hours (Total, this make and model)		

Co-pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	43,Female
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	September 1, 2023
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	3750 hours (Total, all aircraft), 0 hours (Total, this make and model)		

According to flight training records, the pilot had a flight review and instrument proficiency check about 7 months before the accident. The flight review was conducted in the accident airplane and included training in winter weather conditions such as snow and ice. Insurance paperwork filed in March 2023 indicated the pilot had about 4,700 hours total time and 320 hours in the accident make and model airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	Socata	**Registration:**	N850JH
Model/Series:	TBM 700	**Aircraft Category:**	Airplane
Year of Manufacture:	2008	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	448
Landing Gear Type:	Retractable - Tricycle	**Seats:**	7
Date/Type of Last Inspection:	September 7, 2023 Annual	**Certified Max Gross Wt.:**	6579 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo prop
Airframe Total Time:	1660 Hrs as of last inspection	**Engine Manufacturer:**	Pratt and Whitney
ELT:	Installed, activated, aided in locating accident	**Engine Model/Series:**	PT6A-66D
Registered Owner:	BGD LLC	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

According to the airplane manufacturer's pilot operating handbook (POH), during the preflight inspection, all snow, frost, and ice must be removed from all wing and control surfaces; the POH also states that on snow covered or icy runways the airplane must be sprayed with anti-icing fluid. Additionally, in March 2018, the manufacturer published SL-70-053, *Deicing and Anti-icing Procedures on the Ground for TBM 700 aircraft*. The SL stated that takeoffs with snow or ice adhering to the wings should not be attempted because this could drastically affect performance due to reduced aerodynamic lift and increased drag resulting from disturbed airflow. The SL further stated that anti-icing and de-icing procedures should be used when ground operations are being performed in snow or icing conditions. The SL recommends de-icing the airplane with de-icing fluids before departure to prevent the buildup of ice or snow. The airplane was equipped with wing surface deice boots.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KLDM,646 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	09:55 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:		**Visibility**	0 miles
Lowest Ceiling:	Overcast / 400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.82 inches Hg	**Temperature/Dew Point:**	-1°C / -1°C
Precipitation and Obscuration:	Moderate - Showers - Snow		
Departure Point:	Ludington, MI (LDM)	**Type of Flight Plan Filed:**	IFR
Destination:	Angola, IN (ANQ)	**Type of Clearance:**	IFR
Departure Time:	10:00 Local	**Type of Airspace:**	Class G

WSR-88D Level-II base reflectivity weather radar imagery from the Grand Rapids, Michigan, site (KGRR) is presented the figure below. KGRR was located about 75 miles south-southeast of the accident location with an antenna elevation of 875 feet. The reflectivity images depict light reflectivity across the accident region.

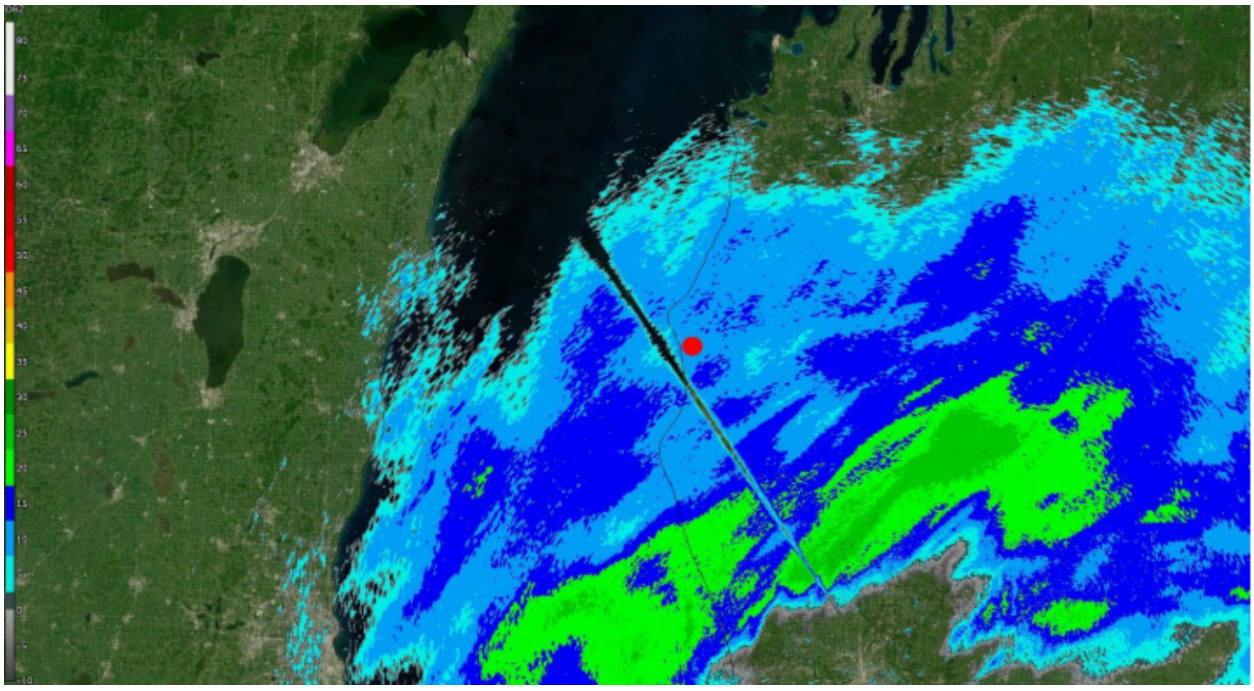

Figure – KGRR 0.483° Level-II base reflectivity product from a sweep initiated at 1000:40. The accident location is identified by the red circle.

The pilot received a weather briefing on the morning of the accident. The briefing included information regarding current and forecasted conditions for snow and ice along the route of travel including current and forecasted conditions at the departure airport.

Airport Information

Airport:	Mason County Airport LDM	**Runway Surface Type:**	Asphalt;Snow
Airport Elevation:	646 ft msl	**Runway Surface Condition:**	Snow
Runway Used:	08	**IFR Approach:**	None
Runway Length/Width:	5003 ft / 75 ft	**VFR Approach/Landing:**	None

The departure airport did not have de-icing or anti-icing fluid or services available.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	43.96801,-86.40243

The debris field, which was about 75 ft long and 40 ft wide, was situated on an east to west heading and consisted of pieces of the left fuel tank, fragmented pieces of the left flap, left fuel tank sensing unit, left wing root, one propeller blade, and left wing tip. Much of the left wing was at the end of the debris field just before the main wreckage. The main wreckage came to rest on its side on a heading of about 120°.

The fuselage was separated into two pieces aft of the firewall. The instrument panel and both yokes were visible; however, they were burned and melted. There were no reliable readings discernible from the instrument panel and the instruments could not be functionally tested.

The elevator trim was positioned 1 cm down from the elevator main trailing edge. The rudder trim was deflected to a near-neutral trim with a .2 cm deflection to the right. Rudder control push/pull tube continuity was confirmed. The rudder pivoted freely to the left and right to the maximum deflection. Continuity of the elevator control push/pull tube was confirmed.

The aileron trim on the left aileron was in the neutral position. The flap track on both the left and right flaps indicated the flaps were in the up position. The left and right aileron flight controls could not be functionally tested due to post-impact fire damage.

The G1000 flight deck and other avionics were consumed by post-impact fire. The secure digital (SD) card slots were located; however, the SD cards were not found.

The mixture, throttle, and propeller controls were not found. The fuel tanks on both wings were compromised and could not be functionally tested. The fuel selector valve was not located.

The engine was still attached to the engine mount at all four locations, and the engine mount was attached to the firewall. The engine exhibited heavy thermal damage. The case was intact, and no holes were noted. No fan liberation was noted. Two witnesses to the accident stated the engine was loud and making power just before impact.

All five composite propeller blades were impact-separated at the hub. The hub was still attached to the gear box. Only one propeller blade was found in the debris field. The pieces of the propeller that were still attached at the hub were ragged with a broom straw appearance cut at a 45° angle and packed with mud.

The nose landing gear and the right main gear were separated from the airplane, but the left main gear was in the wheel well.

Medical and Pathological Information

An autopsy of the pilot was performed on November 27, 2023, by the Western Michigan University School of Medicine, Department of the Medical Examiner and Forensic Services. The cause of death was listed as the result of multiple injuries.

The FAA Forensic Science Laboratory performed toxicological testing. Ibuprofen was detected.

Administrative Information

Investigator In Charge (IIC):	Abraham, Laura
Additional Participating Persons:	Michael Matthews; FAA Grand Rapids FSDO; Grand Rapids, MI Phil Santoro; Daher; Miami, FL Erell Verleyen; Bureau d'Enquêtes et d'Analyses; Le Bourget Leslie Ederer; Pratt and Whitney; Quebec Helen Tsai; TSB
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