



Aviation Investigation Final Report

Location:	Urbana, Ohio	Accident Number:	CEN21FA376
Date & Time:	August 20, 2021, 14:40 Local	Registration:	N700DT
Aircraft:	Socata TBM 700	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was performing a short cross-country flight, which was his third solo flight in the high-performance single-engine airplane. The airplane departed and climbed to 20,000 ft mean sea level (msl) before beginning to descend. About 8 minutes before the accident, the airplane was southbound, descending to 11,000 ft, and the pilot established communications with air traffic control (ATC). About 4 minutes later, the controller cleared the pilot to descend to 10,000 ft msl and proceed direct to his destination; the pilot acknowledged the clearance.

While descending through 13,000 ft msl, the airplane entered a descending left turn. The controller observed the left turn and asked the pilot if everything was alright; there was no response from the pilot. The controller's further attempts to establish communications were unsuccessful. Following the descending left turn, the airplane entered a high speed, nose-down descent toward terrain. A witness observed the airplane at a high altitude in a steep nose-down descent toward the terrain. The witness noted no signs of distress, such as smoke, fire, or parts coming off the airplane, and he heard the airplane's engine operating at full throttle. The airplane impacted two powerlines, trees, and the terrain in a shallow descent with a slightly left-wing low attitude.

Examination of the accident site revealed a long debris field that was consistent with an impact at a high speed and relatively shallow flightpath angle. All major components of the airplane were located in the debris field at the accident site. Examination of the airframe and engine revealed no preimpact mechanical malfunctions or failures with the airplane that would have precluded normal operation.

A performance study indicated the airplane entered a left roll and dive during which the airplane exceeded the airspeed, load factor, and bank angle limitations published in the Pilot's

Operating Handbook (POH). An important but unknown factor during these maneuvers was the behavior of the pilot and his activity on the flight controls during the initial roll and dive. The pilot responded normally to ATC communications only 98 seconds before the left roll started. It is difficult to reconcile an alert and attentive pilot with the roll and descent that occurred, but there is insufficient information available to determine whether the pilot was incapacitated or distracted during any part of the roll and dive maneuver.

Although all the available toxicological specimens contained ethanol (the alcohol contained in alcoholic drinks such as beer and wine), the levels were very low and below the allowable level for flight (0.04 gm/dl). While it is possible that some of the identified ethanol had been ingested, it is also possible that all or most of the identified ethanol was from sources other than ingestion (such as postmortem production). In either case, the levels were too low to have caused incapacitation. It is therefore unlikely that any effects from ethanol contributed to the circumstances of the accident. There was minimal available autopsy evidence to support any determination of incapacitation. As a result, it could not be determined from the available evidence whether medical incapacitation contributed to the accident.

Probable Cause and Findings

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

The pilot’s failure to arrest the airplane’s left roll and rapid descent for reasons that could not be determined based on the available evidence.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Lateral/bank control - Unknown/Not determined
Aircraft	Descent rate - Unknown/Not determined
Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

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

On August 20, 2021, about 1440 eastern daylight time, a Socata TBM 700A airplane, N700DT, was destroyed when it was involved in an accident near Urbana, Ohio. The pilot sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

ATC information provided by the Federal Aviation Administration (FAA) indicated the airplane was en route from the Erie-Ottawa Airport (PCW), Port Clinton, Ohio, to the Cincinnati Municipal Airport (LUK), Cincinnati, Ohio. At 1412, the airplane departed runway 9 at PCW and climbed to 20,000 ft msl before beginning to descend. At 1432, the airplane was southbound, descending to 11,000 ft msl, and the pilot established communications with the assigned terminal radar approach control controller.

About 1436, the controller cleared the pilot to descend to 10,000 ft msl and proceed direct to LUK. The pilot acknowledged the clearance, and about 98 seconds later, while descending through 13,000 ft msl, the airplane entered a left turn. At 1438, the controller observed the left turn and asked the pilot if everything was alright; there was no response from the pilot. Radar contact was subsequently lost with the airplane, and the controller’s further attempts to establish communications were unsuccessful.

A witness located about 2 miles south of the accident location stated that he observed the airplane at a high altitude in a nose-dive descent toward the terrain. He reported the airplane was not turning or spinning; it was headed straight down. The witness observed no signs of distress, such as smoke, fire, or parts coming off the airplane, and he stated the airplane’s engine was at full throttle. The witness lost sight of the airplane as it descended behind some trees.

The accident site was located 1.3 miles northwest of the last radar contact, and on scene evidence indicated the airplane impacted two powerlines, trees, and the terrain in a shallow descent with a slightly left-wing low attitude. (See figures 1 and 2.)

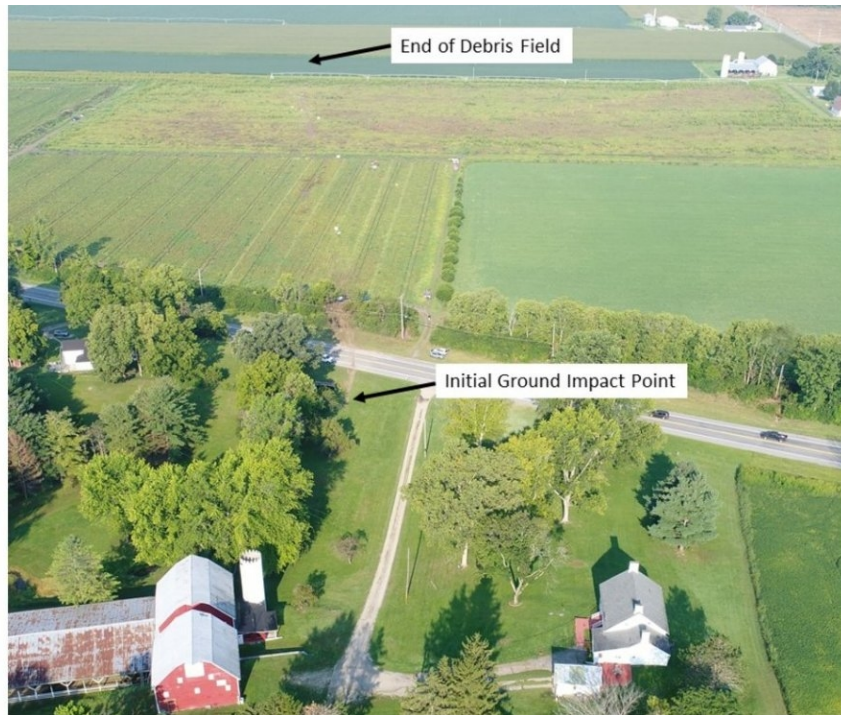


Figure 1. Accident site



Figure 2. Accident site and initial impact point

Pilot Information

Certificate:	Private	Age:	68, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Unknown
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	August 13, 2020
Occupational Pilot:	No	Last Flight Review or Equivalent:	August 14, 2021
Flight Time:	2156 hours (Total, all aircraft), 17.1 hours (Total, this make and model), 38 hours (Last 90 days, all aircraft), 21.1 hours (Last 30 days, all aircraft)		

According to the pilot's associates, he purchased the airplane about 9 days before the accident. Before the purchase, the pilot had owned and piloted Piper PA-46-310P/350P airplanes for about 20 years.

After purchasing the airplane, the pilot and a flight instructor completed several hours of ground school and 15.5 hours of dual instruction in the airplane. The pilot and flight instructor had known each other for about 20 years and previously trained in the pilot's Piper airplanes. The instructor stated the pilot was a "good student, in good health, and comfortable on the airplane's systems." The instructor advised the pilot to fly the airplane for about 10 to 15 hours by himself to get comfortable and not to fly in marginal weather.

The accident flight was the pilot's third solo flight in the airplane, and he had planned to pick up a family member at LUK.

Aircraft and Owner/Operator Information

Aircraft Make:	Socata	Registration:	N700DT
Model/Series:	TBM 700 A	Aircraft Category:	Airplane
Year of Manufacture:	1998	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	134
Landing Gear Type:	Retractable - Tricycle	Seats:	6
Date/Type of Last Inspection:	August 6, 2021 Continuous airworthiness	Certified Max Gross Wt.:	7394 lbs
Time Since Last Inspection:		Engines:	1 Turbo prop
Airframe Total Time:	2624 Hrs as of last inspection	Engine Manufacturer:	Pratt & Whitney Canada
ELT:	Installed	Engine Model/Series:	PT6A-64
Registered Owner:		Rated Power:	700 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

On August 6, 2021, maintenance personnel completed an "A+ inspection" and an annual inspection on the airframe, engine, and propeller in accordance with the manufacturer's maintenance program. On August 19, 2021, at the request of the pilot, the pilot's local maintenance company contracted with an FAA certified engine repair station to complete a borescope inspection of the engine's turbine section. No defects were noted during the borescope inspection.

According to flight tracking data and an associate, the pilot last refueled the airplane in Cleveland, Ohio, on August 14, 2021. After the refueling and before the accident flight, the pilot conducted two flights totaling about 1.5 hours. The amount of fuel remaining in each fuel tank after these flights was unknown.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KI74,1067 ft msl	Distance from Accident Site:	2.5 Nautical Miles
Observation Time:	14:55 Local	Direction from Accident Site:	360°
Lowest Cloud Condition:	Scattered / 4000 ft AGL	Visibility	10 miles
Lowest Ceiling:		Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	None / Unknown
Wind Direction:		Turbulence Severity Forecast/Actual:	N/A / Unknown
Altimeter Setting:	30.01 inches Hg	Temperature/Dew Point:	28°C / 20°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Port Clinton, OH (PCW)	Type of Flight Plan Filed:	IFR
Destination:	Cincinnati, OH (LUK)	Type of Clearance:	IFR
Departure Time:	14:12 Local	Type of Airspace:	Class E

No significant meteorological information, precipitation, or other forecast issues were reported in the area about the time of the accident. The reported weather included scattered cloud top levels were between 7,000 ft and 9,000 ft msl.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	40.066464,-83.774502(est)

The initial ground scar, located in a residential yard, contained separated components of the left wing. From the initial ground scar, a debris path continued across a highway, through trees and a ditch, and then continued into mature potato and soybean fields. The airplane wreckage, which was highly fragmented, was scattered over a distance of about 2,050 ft along a measured magnetic heading of 275°. An odor of Jet A aviation fuel was noted at the accident site by first responders.

The cockpit and fuselage were fragmented by impact forces. Flight control cable continuity could not be established due to the fragmentation of the airplane. All sections of the cables and push-pull tubes located in the wreckage exhibited tensile overload fractures. The primary and secondary flight control surfaces were fragmented and located in the debris field. The forward lower left fuselage skin displayed scrape marks consistent with contacting the highway road surface. The cabin and emergency doors were separated from the fuselage structure. The main cabin door locking pins were extended, and the door handle was in the closed position. The right main landing gear actuator was found locked in the UP position.

The National Transportation Safety Board (NTSB) Materials Laboratory examined the light bulbs in the cockpit annunciator panel. The panel contained 30 individual annunciators, each of which contained 2 bulbs. One annunciator was missing from the panel. The individual annunciator lights were removed from the panel and x-rayed to determine the status of the filaments. None of the bulb filaments exhibited hot filament stretch.

The left wing was separated at the wing root and fragmented. The left flap and aileron were separated from the wing. The forward and rear spars of the left wing were bent aft from their original positions. The right wing was separated near the wing root and was fragmented into two sections. The right flap and aileron were separated from the wing. The flap jackscrew was found in the flaps UP position. The left and right horizontal stabilizers were separated, and the vertical stabilizer remained partially attached to the aft fuselage structure. The left elevator was separated; the right elevator remained partially attached; and the rudder remained attached to the vertical stabilizer. The rudder trim was found in a neutral position, and the elevator trim was about in the full nose up position.

The engine accessory gearbox and forward propeller shaft were separated from the engine and located in the debris field. Multiple parts of the power turbine section and the compressor section exhibited rotational scoring. Multiple compressor impeller blades were bent opposite the direction of travel.

The propeller hub was separated from the engine propeller shaft. All five blades were separated from the hub, and a portion of each blade was found in the wreckage.

Additional Information

Airplane Performance Study

An Aircraft Performance and Simulation Study was completed by the NTSB's Office of Research and Engineering. The study was based on ATC data, Garmin GTN 750 GPS device data, wreckage location and debris field evidence, weather information, airplane performance information from the POH, and output from aircraft performance analysis programs and

simulations. The airplane was not equipped (and was not required to be equipped) with a flight data recorder or cockpit voice recorder. No measures of the flight control inputs or engine power during the flight were available. However, the Garmin GTN 750 recorded many performance parameters, including altitude, position, ground speed and airspeed, Euler angles (heading, pitch, and roll), and vertical and lateral load factors. This information was used to define the trajectory of the airplane during its descent from 20,000 ft msl and sudden left turn and dive as it descended through 13,000 ft msl.

The airplane began its descent about 1433:00, while flying at 183 knots calibrated airspeed (KCAS) about 25 nautical miles (nm) north and 7 nm east of the accident site. The descent rate was relatively constant, about -1,600 ft/minute (ft/min), varying between -1,500 and -1,700 ft/min with oscillations between -1,150 and -1,850 ft/min during turns. During the descent, the airspeed increased to 200 KCAS at 1435:00, and then at 1435:40 increased further, reaching 235 KCAS at 1438:20 and 13,000 ft msl, just before the start of the left roll and final dive. Turns during the descent were consistent with the autopilot roll authority limits of 25° roll angle and 5°/second roll rate.

The position data recorded by the GTN 750 was consistent with recorded automatic dependent surveillance-broadcast (ADS-B) and radar data. For unexplained reasons, there were periodic 14 to 16 second gaps in the ADS-B data every 4 to 5 minutes during the flight, and the ADS-B data stopped entirely at 1437:28, about 83 seconds before the end of the GTN 750 data, as the airplane was descending through 14,100 ft msl, about 4.9 nm north of the accident site. The reason for the lapses in the ADS-B data is unknown.

At 1436:42, 98 seconds before the start of the final roll and dive, as the airplane was descending through 15,300 ft msl about 8 nm north of the accident site, the pilot made a final radio transmission to ATC. The content of the communication was appropriate and unremarkable.

At 1438:20.5, the airplane started rolling left about 7°/second (faster than the autopilot authority). The airplane continued rolling left at this rate until the roll angle reached about 110° left wing down, when the roll rate momentarily dropped back to zero. The roll angle then started to return towards wings-level, reaching 62° left wing down at 1438:49.7, and then remained relatively constant until the end of the GTN 750 data at 1438:51.7. During the roll maneuver, the pitch angle decreased from about 4.5° nose down at 14:38:20 to 31.5° nose down at 14:38:37, and it continued to decrease even as the roll angle lessened, reaching 53° nose down as the roll angle was returning through 80° left wing down. Thereafter the pitch angle started to increase, reaching 45° nose down at the end of the data.

The GTN 750 data ends at an altitude of about 4,200 ft msl, or 3,200 ft above the terrain elevation of about 1,000 ft msl. At the end of the data, the descent rate was about 30,000 ft/min but was apparently decreasing. The airplane was about 1 nm away from the impact location when the data ended, and simulations indicated that it would have taken about another 11 seconds to cover that distance. According to the NTSB GPS devices specialist, it is

very common for the data recorded in avionics devices to end before impact because of the buffering process used in writing the data to storage media; the data loss can range from a few seconds up to a minute.

Three different simulation scenarios were evaluated in the performance study, titled Controls, Imbalance, and Recovery. The Controls and Imbalance scenarios simulated the initial roll and dive up to the end of the GTN 750 data (from 1438:06 to 1438:52). The Recovery scenario continued the simulation past the end of the data and attempted to determine the flight control inputs that would result in the airplane arriving at the initial impact point in an attitude consistent with the accident site evidence.

The Controls scenario was performed using a symmetrical airplane loading (center of gravity on the airplane centerline). Based on the results, which showed very little yoke and wheel force required during the initial roll and dive, the Imbalance and Recovery scenarios were performed assuming a 420-pound (lb) fuel imbalance (left wing heavier). This imbalance resulted in a match of the initial roll when zero-wheel force was applied and simulated a situation in which the autopilot was holding wheel force against the fuel imbalance until 1438:20.5, but then disconnected for some reason. Assuming that the pilot did not intervene, the wheel force after the autopilot disconnect remained zero.

The Recovery scenario provided an estimate of performance parameters beyond the end of the GTN 750 data that were consistent with the final recorded data points and with the airplane heading, bank angle, and flight path angle evidenced by the impact point and long debris path. The scenario indicated that substantial wheel and column forces were required to maneuver the airplane from the state indicated by the end of the GTN 750 data to the impact point.

The Recovery scenario also indicated that the initial part of the maneuver could be approximately duplicated with zero control forces applied, together with either an aerodynamic or loading asymmetry and a disengaged autopilot. The low control forces required and irregularity of the maneuver itself suggested that the pilot might have been momentarily incapacitated or distracted between 1438:21 and 1438:37. However, the simulations also indicated that the pilot would have had to apply substantial wheel and column forces after 1438:37 to maneuver the airplane to the accident site.

A turbulence encounter that produced a normal load factor of more than 1.6 Gs could have disengaged the autopilot. The GTN 750 data indicated that such an encounter might have occurred before the start of the left roll at 1438:20.5. If the autopilot was holding wheel force against a 420 pound fuel imbalance at the time it disconnected, a roll rate matching that recorded in the data would develop, unless the pilot intervened by applying force on the control wheel. A 420 pound fuel imbalance could result from burning fuel from only one tank for about 1.1 hours in cruise flight.

In the accident, an important but unknown factor was the behavior of the pilot and his activity (or lack thereof) on the flight controls during the initial roll and dive. Notably, the pilot

responded normally to an ATC communication at 1436:42, only 98 seconds before the roll rate started to increase at 1438:20.5. However, it is difficult to reconcile an alert and attentive pilot with the roll and descent that followed. There was insufficient information available to determine whether a fuel asymmetry was present or whether the pilot was incapacitated or distracted for at least part of the roll and dive maneuver.

Medical and Pathological Information

According to the autopsy report issued by the Coroner of Montgomery County, Ohio, the pilot's cause of death was multiple blunt force injuries. The examination was significantly limited by the extent of injury; the brain and heart were not available for examination.

Toxicology testing performed by the FAA's Forensic Sciences Laboratory identified ethanol at 0.018 gm/dl in cavity blood; 0.010 mg/hg in liver; and 0.020 mg/hg in lung. No other tested for substances were detected.

Ethanol is a social drug commonly consumed by drinking beer, wine, or liquor. It acts as a central nervous system depressant; it impairs judgement, psychomotor functioning, and vigilance. Ethanol is water soluble, and after absorption it quickly and uniformly distributes throughout the body's tissues and fluids. The distribution pattern parallels water content and blood supply of the tissue. Ethanol may be produced by body tissues after death by microbial activity (postmortem production). Extensive trauma increases the spread of bacteria and raises the risk of ethanol production after death.

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron		
Additional Participating Persons:	Dennis Garcia; FAA; Columbus, OH		
Original Publish Date:	March 22, 2023	Investigation Class:	3
Note:			
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=103733		

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