National Transportation Safety Board
Office of Aviation Safety
Central Region

Accident Site and Wreckage Examination Summary

NTSB Accident No:	CEN20FA001
Accident Date/Time:	Thursday, 3 October 2019, at 0858 EDT
Accident Location:	Lansing, Michigan 42°46'48.6"N 84°36'22.32"W 846 ft mean sea level
Aircraft Make/Model:	Socata TBM 700 C2
Aircraft Registration:	N700AQ
Aircraft Serial No:	252
Engine Make/Model:	Pratt & Whitney PT6A-64
Engine Serial No:	PCE-PM-0140
Propeller Make/Model:	Hartzell HC-E4N-3/E9083SK
Propeller Serial No:	HH1456
Airworthiness Date:	12 May 2003
Airplane Time:	3,550.6 hours since new
Engine Time:	3,550.6 hours since new
Propeller Time:	3,550.6 hours since new
Airplane Operator:	N700AQ LLC 965 Airport Access Dr Greenwood, Indiana, 46143
Airplane Owner:	N700AQ LLC 965 Airport Access Dr Greenwood, Indiana, 46143
Examination Dates/Locations:	October 4-5, 2019 (Lansing, MI, Accident Site)
Participants:	Andrew T. Fox – National Transportation Safety Board Matthew Livingstone – Federal Aviation Administration Michael Matthews – Federal Aviation Administration Philippe Santoro – Daher Marc Gratton – Pratt & Whitney Canada Les Doud – Hartzell Propeller

SUMMARY

An onsite examination of the airplane and its engine was completed by a National Transportation Safety Board (NTSB) investigator who was assisted by representatives from the Federal Aviation Administration, Daher, Pratt & Whitney Canada, and Hartzell Propeller. The postaccident examination did not reveal any anomalies that would have precluded normal operation of the airplane before it collided with terrain.

AIRPLANE CONFIGURATION AND MAINTENANCE

The airplane, a Socata TBM 700 C2, serial number 252, was manufactured in 2003. The low-wing airplane was of conventional aluminum construction and was equipped with a retractable tricycle landing gear and a pressurized cabin that was configured to seat six individuals. The airplane was powered by a 700 shaft-horsepower Pratt & Whitney Canada PT6A-64 turbo-propeller engine, serial number PCE-PM-0140, through a 4-blade, constant speed, full-feathering, Hartzell HC-E4N-3/E9083SK propeller assembly, serial number HH1456. The airplane was approved for operations in instrument meteorological conditions and in known icing conditions. The airplane had a maximum allowable takeoff weight of 7,394 lbs. On May 12, 2003, the airplane was issued a standard airworthiness certificate and a registration number when it was imported into the United States after manufacture in France. The current airplane owner purchased the airplane on July 31, 2018.

According to maintenance records, the airplane had been maintained under the provisions of an approved manufacturer inspection program. The most recent annual inspection was completed on June 1, 2019, at 3,512.3 hours total airframe time. At the time of the accident, the airframe, engine, and propeller had accumulated 3,550.6 hours since new. The engine had accumulated 1,184.8 hours since its last hot section inspection. The propeller had accumulated 1,089.4 hours since its last overhaul. The static system, altimeter system, automatic pressure altitude reporting system, and transponder were last tested on April 10, 2018. A postaccident review of the available maintenance records found no history of unresolved airworthiness issues.

The airplane had two fuel tanks, one located in each wing, and a total fuel capacity of 290.6 gallons (281.6 gallons usable). The airplane had been fueled with 100 gallons of fuel before the flight, and according to available fueling documentation and airplane use logs, the airplane had about 202 gallons of fuel (1,374 lbs) onboard before the flight.

According to the Socata TBM 700 C2 Pilot Operating Handbook (POH), Supplement No. 41, the aerodynamic stall speed at maximum takeoff weight with the landing gear and flaps extended for landing is 65 knots. The aerodynamic stall speed at maximum takeoff weight with the landing gear and flaps extended for takeoff is 77 knots. The aerodynamic stall speed at maximum takeoff weight with the landing gear and flaps retracted is 83 knots. The approach speed with flaps in the landing position is 85 knots.

ACCIDENT SITE

The accident site was in an open grass field located about 0.3 miles west-northwest of the runway 10R threshold. The initial impact point was in a large, depressed grass area that preceded a 135 ft long ground scar oriented on a 060° bearing. The initial impact area measured 42 ft wide, consistent with the wingspan of the airplane (Figure 1). The lower VHF antenna, the left main landing gear door, and several flap track fairings were located along the wreckage debris path.

MAIN WRECKAGE

The main wreckage consisted of the entire airplane (Figure 2). Both wings and the empennage remained attached to the fuselage. All flight control surfaces remained attached to their respective hinges. Flight control continuity for the elevator, rudder, and right aileron were confirmed from each flight control surface to the forward cabin. Flight control continuity to the left aileron could not be established due to impact damage; however, the observed cable separations near the left wing root were consistent with overstress. Both spoilers were retracted and remained connected to their respective ailerons. Both the rudder and elevator trim surfaces were found in a neutral position.

The flap selector was found in the up-and-locked position. The wing flap actuator jack screws were found about halfway between the takeoff and landing positions. The landing gear selector switch was found in the gear-up position. The left main landing gear and nose gear were fully retracted and on their respective actuator uplocks. The right main landing gear was retracted into its wheel well; however, the right gear was not secured by its respective actuator uplock.

The throttle was found in the flight idle position, the propeller lever was full forward, and the condition lever was full forward. The fuel manual override was closed and gated. The inertial separator switch was in the ON position. The engine starter switch was OFF. The ignition switch was in the AUTO position. The fuel system switch was found on AUTO and the engine was using fuel from the left fuel tank at impact. Both fuel tanks ruptured during impact and there was a strong odor of Jet-A aviation fuel at the accident site.

Figure 1. Overview Photo of the Initial Impact Point and Ground Scar

Figure 2. Overview Photo of Main Wreckage at Accident Site

The engine remained attached to its respective engine mounts. There was a complete fracture of the propeller shaft and reduction gearbox housing forward of the 2nd stage reduction gears. There was evidence that engine oil was discharged out of the engine after impact; engine oil was found on the outside of the engine cowling, windscreen, and extending 20 ft in front of the engine (Figure 3). There was compressive impact damage to the exhaust case at the 6 o'clock position. Engine control continuity was established from the cockpit to the fuel control unit. The propeller speed setting lever and reset cables were found separated from the propeller governor; however, these cables moved freely when the associated cockpit levers were moved by hand. The compressor rotor turned freely with no anomalies and had continuity with the accessory gearbox. Fuel discharged from hoses when the fuel pump was rotated. The fuel filter bowl was about half full, and the fuel appeared clear with no significant debris or phase separation. Both magnetic chip detectors were free of any metallic particles. There was some minor foreign object debris found on the leading edge of several 1st stage compressor blades and vegetation debris in the inlet screen. The compressor turbine (CT) and power turbine (PT) were intact with all blades present. There were rotational contact signatures observed on the CT blades downstream platforms from contact with the inner shroud of the upstream side of the 1st stage PT vane ring. The 1st stage PT blade tips displayed rubbing, with corresponding rubbing observed on the shroud at the 6 and 12

o'clock positions. Some of the upstream blade platforms displayed rubbing with the inner shroud of the downstream side of the 1st stage PT vane ring.

Figure 3. Overview Photo of the Engine and Propeller at Accident Site

The propeller assembly remained attached to the engine propeller shaft that fractured from the engine reduction gear box during impact (Figure 4). One propeller blade was bent in the forward/thrust direction. The remaining three propeller blades were bent in the aft direction. All four propeller blades exhibited chordwise/rotational scoring on the camber side with paint discoloration from the tip to the outboard end of the deice boot. Three blades exhibited chordwise/rotational scoring on the face side. The spinner dome was dented adjacent to one propeller blade with a counterweight impression area with the center/average angle of about 44°. The pitch change rod was in the feathered position. Three propeller blades could be rotated by hand force due to fractured pitch change mechanisms. One propeller blade had been forcefully rotated beyond the reverse stop position, two blades were in an approximate low pitch position, and one blade was in an approximate feathered position. The beta ring appeared intact and undamaged with the carbon block and beta arm in position. The beta arm and valve moved freely.

Figure 4. Overview Photo of Propeller Before Disassembly

DATA DOWNLOAD

The airplane was equipped with a Shadin Avionics Engine Trend Monitor (ETM) and associated data recorder (p/n 943200-11 s/n 0089). Additionally, a USB memory stick was found the airplane with previously downloaded engine parameter data. The data downloaded from the data recorder was decoded by Daher. The engine trend monitor does not continuously record data; the device only records exceedances and occasional engine parameters during a flight (engine start, takeoff, power check reports, landing). The engine module contained data for multiple flights flown between September 18, 2019 and October 3, 2019.

The recorded data parameters included outside air temperature (°C), pressure altitude (ft), density altitude (ft), indicated airspeed (knots), shaft horsepower (hp), fuel flow (gallons per hour), fuel used (gallons), propeller speed (rpm), engine torque (%), gas generator speed (%), and interstage turbine temperature (°C). The recorded times for the accident flight status messages were offset about 8 minutes from true universal coordinated time (UTC). For the accident flight, the last message was a Power Check Report recorded at 12:15:59 (~12:23:59 UTC / 08:23:59 EDT):

OAT: 0°C, Pressure Altitude: 18,970 ft, Indicated Airspeed: 194 knots, Propeller Speed: 1,989 rpm, Engine Torque: 100.5%, Fuel Flow: 63 gallons per hour, Interstage Turbine Temperature: 762°C, Gas Generator Speed: 95.7%