National Transportation Safety Board
Aviation Accident Final Report

Location:	Greenfield, Indiana	**Accident Number:**	CEN19FA148
Date & Time:	May 22, 2019, 12:45 Local	**Registration:**	N311G
Aircraft:	Cessna S550	**Aircraft Damage:**	Destroyed
Defining Event:	Aerodynamic stall/spin	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was conducting a personal cross-country flight in a turbofan-powered airplane. Shortly after departure, the airplane entered a witness-estimated 90° left bank with the nose parallel to the horizon; as the airplane began to roll out of the turn, the nose remained at or below the horizon before it dropped and the airplane impacted the ground. Flight track data revealed that, shortly after departure, the airplane's ground speed immediately began decreasing from its maximum of 141 knots during takeoff and continued decreasing until the last recorded data point, which showed that the airplane had a ground speed of 100 knots.

The surface wind reported about 10 minutes before the accident was from 170° at 9 knots, gusting to 14 knots, which resulted in a 1- to 2-knot tailwind component. Given this information and the airplane's configuration at the time of the accident, the airplane's indicated airspeed (IAS) would have been between about 86 and 93 knots. The airplane's stall speed was calculated to be 100 knots IAS (KIAS) with a bank angle of 45° and 118 KIAS with a bank angle of 60°. Thus, the pilot failed to maintain airspeed or accelerate after departure, which resulted in an aerodynamic stall

A pilot who had flown with the accident pilot twice before the accident reported that, during these flights, the pilot had flown at reduced power settings and slower-than-normal airspeeds. During the flight 1 year before the accident, he reached over and pushed the power levers forward himself. He also stated that every time he had flown with the pilot, he was "very behind the airplane."

Postaccident examination of the engines revealed no signs of preimpact mechanical failures or malfunctions that would have precluded normal operation, and both engines exhibited circumferential rub marks on all rotating stages, blade tip bending opposite the direction of rotation, and debris ingestion through the gas path, indicating that the engine had power at impact. Further, the right engine full authority digital electronic control (FADEC) nonvolatile memory recorded no faults. (The left engine FADEC could not be downloaded due to damage.)

The Airplane Flight Manual stated that the pilot must, in part, advance the throttle lever to the maximum

takeoff detent for the FADEC's nonvolatile memory to record a logic trend snapshot 2 seconds after takeoff.

The lack of a FADEC logic trend snapshot is consistent with the pilot not fully advancing the throttles during the takeoff and initial climb and is likely why he did not attain or maintain sufficient airspeed.

The flight track data, pilot witness account, and airplane damage are consistent with the pilot failing to fully advance the power levers while maneuvering shortly after takeoff, which led to his failure to maintain sufficient airspeed and resulted in the exceedance of the airplane's critical angle of attack and a subsequent aerodynamic stall.

Probable Cause and Findings

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

The pilot's failure to fully advance the power levers during the takeoff and initial climb, which led to his failure to maintain sufficient airspeed and resulted in the exceedance of the airplane's critical angle of attack and a subsequent aerodynamic stall.

Findings

Personnel issues	Lack of action - Pilot
Personnel issues	Use of equip/system - Pilot
Aircraft	Angle of attack - Capability exceeded
Aircraft	Airspeed - Not attained/maintained

Factual Information

History of Flight

Initial climb	Miscellaneous/other
Initial climb	Aerodynamic stall/spin (Defining event)

On May 22, 2019, about 1245 eastern daylight time, a Cessna Citation S550 airplane, N311G, was destroyed when it was involved in an accident near Greenfield, Indiana. The pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

A witness on the ground at Indianapolis Regional Airport (MQJ), Indianapolis, Indiana, reported seeing the airplane turn shortly after departure from runway 7 in an estimated 90° left bank with the wings vertical and the fuselage parallel to the ground. He then saw the nose lower slightly before it rose again to a level attitude. The wings started to level, then the nose went straight down, and the airplane disappeared behind trees.

Flight track data for this report was obtained from L3/Harris OpsVue, a commercially available web base product that that aggregates and georeference's FAA data sources including data from FAA ASDE-X and ASSC systems, FAA Terminal and En Route Radars, the FAA certified ADS-B Network and Flight Plan data from the En Route Automation Modernization (ERAM) system. A review of the data revealed that, after the airplane climbed through 1,025 ft mean sea level (msl) (163 ft above ground level), its ground speed began decreasing from its maximum of 141 knots during takeoff. As the airplane continued to climb and turned north, the ground speed continued to decrease until the last recorded data point, which showed the airplane about 1,125 ft msl and heading 346° at a ground speed of 100 knots. The airplane impacted a field about 1/2-mile northeast of MQJ. The surface wind reported about 10 minutes prior to the accident was from 170° at 9 knots gusting to 14 knots, which when applied to the 100 knot ground speed and 346° heading equates to an airspeed of between 86 knots and 93 knots.

Pilot Information

Certificate:	Airline transport	**Age:**	75,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Glider	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	November 19, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	3530 hours (Total, all aircraft)		

The pilot held type ratings for Cessna CE-500 and CE-525-S and Beechcraft RA-390-S airplanes. A review of the pilot's training records provided by Vue, Inc., showed that, on February 16, 2019, he accomplished recurrent training and training in accordance with a Federal Aviation Administration-approved training program that was required for a single-pilot exemption for the CE-550, which was originally certificated for two pilots.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N311G
Model/Series:	S550	**Aircraft Category:**	Airplane
Year of Manufacture:	1985	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0041
Landing Gear Type:	Retractable -	**Seats:**	8
Date/Type of Last Inspection:	May 20, 2019 Continuous airworthiness	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Turbo fan
Airframe Total Time:		**Engine Manufacturer:**	Williams International
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	FJ44-3A
Registered Owner:		**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane, a Cessna S550, was originally certificated for two pilots. However, the Federal Aviation Administration (FAA) allowed an exemption (9917) for single- pilot operations if that pilot accomplished training in accordance with an FAA- approved training program.

Each engine was controlled by a full authority digital engine control (FADEC). The FADEC nonvolatile memory (NVM) will record a logic trend snapshot when the following criteria are met:

EngineMode = Run
TLA (Throttle Lever Angle) => TLA_MaxTakeOff…
Altitude value is > -1,000 and < 10,000…
Mach value is > 0 and < 0.3
Then when WOW (weight on wheels) transitions from True to False and after 2 sec[onds], a snapshot of data is then stored and written to NVM.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	862 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	16:35 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Scattered / 600 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 4000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots / 14 knots	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:		**Temperature/Dew Point:**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Greenfield, IN (MQJ)	**Type of Flight Plan Filed:**	IFR
Destination:	Minden, NV (MEV)	**Type of Clearance:**	IFR
Departure Time:	12:43 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	INDIANAPOLIS RGNL MQJ	**Runway Surface Type:**	Asphalt
Airport Elevation:	862 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	07	**IFR Approach:**	None
Runway Length/Width:	6005 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	Unknown
Total Injuries:	2 Fatal	**Latitude, Longitude:**	39.851387,-85.883613

The airplane impacted a flooded cornfield. The wreckage field was about 270 ft long and 103 ft wide and the airplane was significantly fragmented. Both engines had separated from the airplane and were found about 197 ft from the point of initial impact roughly aligned with the ground scar. A postimpact fire consumed about 80% of the airplane.

Postaccident examination of the engines revealed no signs of preimpact mechanical malfunctions or failures that would have precluded normal operation. Both engines displayed circumferential rub marks on all rotating stages, blade tip bending opposite the direction of rotation, and debris ingestion throughout the gas path.

Both the left and right engine FADECs were recovered from the wreckage. The left engine FADEC sustained impact and fire damage, and the nonvolatile memory (NVM) data could not be downloaded from it. The right engine FADEC was intact with minor case impact damage, and the NVM data were successfully downloaded. The FADEC recorded no logic trend snapshots or faults.

Additional Information

Witness Information

A pilot who had flown in the accident airplane with the accident pilot the day before the accident stated that the airplane operated correctly but that he had concerns about the pilot's abilities as captain. During takeoff and once airborne, when the airplane was between about 105 and 110 knots, the accident pilot began reducing power when the airplane was "not very high off the ground"; lowered and trimmed the nose low; and continued to fly at slower speeds, between about 140 and 150 knots. He said that the pilot told him that the jet "flew like a 172." He said the accident pilot flew an instrument approach to the runway and broke off to circle another runway due to wind. The pilot flew the airplane low and slow with the pattern "less than desirable." He provided numbers to the pilot to persuade him to increase the airspeed and prevent the airplane from sinking too fast. On landing, the airplane touched down left of centerline. The accident pilot corrected and continued to decelerate.

The pilot added that, about 1 year before the accident, he also flew with the accident pilot in the accident airplane. He said that the pilot was climbing out at "just barely 95 knots" and "pulling the power back," so he reached over and pushed the power levers forward himself. The pilot asked the accident pilot why he was climbing at a low speed and pulling the power back, and he stated that "it flew like a 172." He told the accident pilot that he did not feel comfortable. He said that every time he had flown with the accident pilot, he was "very behind the airplane" and that the pilot wanted to start doing other things like "pressing buttons" without safely maintaining airspeed and altitude.

Medical and Pathological Information

An autopsy of the pilot was performed by the Hancock County Coroner's Office, Greenfield, Indiana. His cause of death was multiple blunt force injuries.

The FAA Forensic Sciences Laboratory performed toxicology testing on specimens from the pilot. The results were negative for ethanol, carbon monoxide and all tested-for substances.

The airplane's performance and stall speeds were calculated based on the empty weight, the pilot's and passenger's weights, full fuel, 20° flaps, and an outside temperature of 17°C. Under these conditions, the airplane's calculated rotation speed would have been 95 knots indicated airspeed (KIAS), and its best climb-rate speed would have been 195 KIAS. The engine manufacturer-recommended cruise-climb speed was 224 KIAS. Under these same conditions, with a bank angle of 45°, the stall speed was calculated to be 100 KIAS, and with a bank angle of 60°, it was calculated to be 118 KIAS.

Preventing Similar Accidents

Prevent Aerodynamic Stalls at Low Altitude

While maneuvering an airplane at low altitude in visual meteorological conditions, many pilots fail to avoid conditions that lead to an aerodynamic stall, recognize the warning signs of a stall onset, and apply appropriate recovery techniques. Many stall accidents result when a pilot is momentarily distracted from the primary task of flying, such as while maneuvering in the airport traffic pattern, during an emergency, or when fixating on ground objects.

An aerodynamic stall can happen at any airspeed, at any altitude, and with any engine power setting. Pilots need to be honest with themselves about their knowledge of stalls and preparedness to recognize and handle a stall situation. Training can help pilots fully understand the stall phenomenon, including angle-of-attack concepts and how weight, center of gravity, turbulence, maneuvering loads and other factors can affect an airplane's stall characteristics. The stall characteristics may be different in each type of plane, so learn them before you fly.

The stall airspeeds marked on the airspeed indicator (for example, the bottom of the green arc and the bottom of the white arc) typically represent steady flight speeds at 1G at the airplane's maximum gross weight in the specified configuration. Maneuvering loads and other factors can increase the airspeed at which the airplane will stall. For example, increasing bank angle can increase stall speed exponentially.

Reducing angle of attack by lowering the airplane's nose at the first indication of a stall is the most important immediate response for stall avoidance and stall recovery. This may seem counterintuitive at low altitudes, but is a necessary first step.

See http://www.ntsb.gov/safety/safety-alerts/documents/SA_019.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):	Williams, David
Additional Participating Persons:	Dale Hoff; FAA; Indianapolis, IN Andrew Hall; Textron Aviation; Wichita, KS Mayhar Heshmat; Williams International; San Antonio, TX
Original Publish Date:	December 3, 2020 **Investigation Class:** 2
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99464