



AVIATION



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PIPELINE

Aviation Investigation Final Report

Location:	Marietta, Georgia	Accident Number:	ERA17FA135
Date & Time:	March 24, 2017, 19:24 Local	Registration:	N8DX
Aircraft:	Cessna 500	Aircraft Damage:	Destroyed
Defining Event:	Aerodynamic stall/spin	Injuries:	1 Fatal
Flight Conducted Under:	Part 91: General aviation		

Analysis

The private pilot departed on an instrument flight rules flight plan in his twin-engine turbojet airplane. The flight was uneventful until the air traffic controller amended the flight plan, which required the pilot to manually enter the new routing information into the GPS. A few minutes later, the pilot told the controller that he was having problems with the GPS and asked for a direct route to his destination. The controller authorized the direct route and instructed the pilot to descend from 22,000 ft to 6,000 ft, during which time the sound of the autopilot disconnect was heard on the cockpit voice recorder (CVR).

During the descent, the pilot told the controller that the airplane had a steering problem and was in the clouds. The pilot was instructed to descend the airplane to 4,100 ft, which was the minimum vectoring altitude. The airplane continued to descend, entered visual meteorological conditions, and then descended below the assigned altitude. The controller queried the pilot about the airplane's low altitude and instructed the pilot to maintain 4,100 ft. The pilot responded that he was unsure if he would be able to climb the airplane back to that altitude due to steering issues. The controller issued a low altitude warning and again advised the pilot to climb back to 4,100 ft. The pilot responded that the autopilot was working again and that he was able to climb the airplane to the assigned altitude.

The controller then instructed the pilot to change to another radio frequency, but the pilot responded that he was still having a problem with the GPS. The pilot asked the controller to give him direct routing to the airport. A few minutes later, the pilot told the controller that he was barely able to keep the airplane straight and its wings level. The controller asked the pilot if he had the airport in sight, which he did not. The pilot then declared an emergency and expressed concerns related to identifying the landing runway. Afterward, radio contact between the controller and the pilot was lost. Shortly before the airplane impacted the ground, a witness saw the airplane make a complete 360° roll to the left, enter a steep 90° bank to the left, roll inverted, and enter a vertical nose-down dive. Another witness saw the airplane spiral to the ground. The airplane impacted the front lawn of a private residence, and a postcrash fire ensued.

The pilot held a type rating for the airplane, but the pilot's personal logbooks were not available for review. As a result, his overall currency and total flight experience in the accident airplane could not be determined. The airplane was originally certified for operations with a pilot and copilot. To obtain an exemption to operate the airplane as a single pilot, a pilot must successfully complete an approved single-pilot exemption training course annually. The accident airplane was modified, and the previous owner was issued a single-pilot conformity certificate by the company that performed the modifications. However, there was no record indicating that the accident pilot received training under this exemption. Several facilities that have single-pilot exemption training for the accident airplane series also had no record of the pilot receiving training for single-pilot operations in the accident airplane. Therefore, unlikely that the pilot was properly certificated to act as a single-pilot.

The GPS was installed in the airplane about 3.5 years before the accident. A friend of the pilot trained him on how to use the GPS. The friend said that the pilot generally was confused about how the unit operated and struggled with pulling up pages and correlating data. The friend of the pilot had flown with him several times and indicated that, if an air traffic controller amended a preprogrammed flight plan while en route, the pilot would be confused with the procedure for amending the flight plan. The friend also said the pilot depended heavily on the autopilot, which was integrated with the GPS, and that he would activate the autopilot immediately after takeoff and deactivate it on short final approach to a runway. The pilot would not trim the airplane before turning on the autopilot because he assumed that the autopilot would automatically trim the airplane, which led to the autopilot working against the mis-trimmed airplane. The friend added that the pilot was "constantly complaining" that the airplane was "uncontrollable." A postaccident examination of the airplane and the autopilot system revealed no evidence of any preimpact deficiencies that would have precluded normal operation.

This information suggests that pilot historically had difficulty flying the airplane without the aid of the autopilot. When coupled with his performance flying the airplane during the accident flight without the aid of the autopilot, it further suggests that the pilot was consistently unable to manually fly the airplane. Additionally, given the pilot's previous experience with the GPS installed on the airplane, it is likely that during the accident flight the pilot became confused about how to operate the GPS and ultimately was unable to properly control of the airplane without the autopilot engaged. Based on witness information, it is likely that during the final moments of the flight the pilot lost control of the airplane and it entered an aerodynamic stall. The pilot was then unable to regain control of the airplane as it spun 4,000 ft to the ground.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain adequate airspeed while manually flying the airplane, which resulted in the airplane exceeding its critical angle of attack and experiencing an aerodynamic stall. Contributing to the accident was the pilot's inability control the airplane without the aid of the autopilot.

Findings

Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	Knowledge of equipment - Pilot
Personnel issues	Incorrect action performance - Pilot
Personnel issues	Use of automation - Pilot

Factual Information

History of Flight

Maneuvering	Loss of control in flight
Maneuvering	Aerodynamic stall/spin (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On March 24, 2017, at 1924 eastern daylight time, a Cessna 500, N8DX, collided with terrain in a residential neighborhood near Marietta, Georgia. The private pilot was fatally injured. The airplane was destroyed by impact forces and postcrash fire. The airplane was registered to Shelter Charter Services Inc., which was operating the airplane as a Title 14 *Code of Federal Regulations* Part 91 business flight. Visual meteorological conditions existed near the accident site at the time of the accident. The flight was operated on an instrument flight rules (IFR) flight plan. The flight originated from Cincinnati Airport–Lunken Field (LUK), Cincinnati, Ohio, about 1812, and was destined for Fulton County Airport–Brown Field (FTY), Atlanta, Georgia.

The pilot, who was based in Atlanta, was returning home from a business trip. The airplane was equipped with a cockpit voice recorder (CVR); the recording started about 1853. The air traffic control (ATC) transcript showed that, at 1851:36, when the airplane was level at 23,000 ft, a controller with the Atlanta Air Route Traffic Control Center (ARTCC) advised the pilot of an amendment to his original flight plan. Ten seconds later, the controller provided new routing information. The controller repeated the new routing at 1852:50 and 1855:17, and the pilot correctly read back the information at 1855:25. The airplane was equipped with a Garmin GTN 750 unit that provided navigation, radio tuning, and other capabilities. Aural clicks and the sound of knobs turning were heard on the CVR consistent with the pilot attempting to enter the new routing into the Garmin GTN 750 GPS.

At 1858:57, the controller instructed the pilot to descend the airplane to 22,000 ft, and the pilot acknowledged this instruction. At 1859:04, the pilot told the controller, "I'm having a little trouble with my ah GPS did you give me direct (unintelligible) on that arrival." The controller then asked the pilot to repeat his request, and the pilot said, "I'm having difficulty with my GPS it's not picking up this arrival and I was wondering if you can give me uh direct routing then instead of going to the arrival." At 1859:46, the controller cleared the airplane direct to FTY and, at 1900:10, instructed the pilot to descend the airplane to 11,000 ft; the pilot acknowledged this information. About three minutes later the CVR recorded the pilot saying, "I have no idea what's going on here."

At 1907:42, the controller instructed the pilot to descend the airplane to 6,000 ft, and the pilot acknowledged this instruction. At 1910:26, the CVR recorded a sound similar to the autopilot disconnecting.

At 1911:02, the pilot told the controller that the airplane was descending though 8,000 ft but was experiencing a "steering problem" and that he could not "steer the aircraft very well." The pilot then mentioned that the airplane was "in the clouds." At 1914:29, the controller instructed the pilot to descend the airplane to 4,100 ft, the minimum vectoring altitude. The airplane continued to descend,

during which time the airplane entered visual meteorological conditions. At 1915:44, the controller told the pilot that the airplane had descended to an altitude of 3,600 ft, which was 500 ft below the minimum vectoring altitude, and instructed the pilot to maintain an altitude of 4,100 ft. At 1915:52, the pilot said, "Yeah I understand I'm going back up but an I have no...I have very little steering on here and I have mountains (around me) Atlanta doesn't have mountains." The controller then issued a low altitude warning and advised the pilot again to climb the airplane to 4,100 ft. The pilot responded that he had his "autopilot back...so it gives me stability." At 1917:21, the controller instructed the pilot to change to another Atlanta ARTCC frequency; afterward, the pilot reported that the airplane was at 4,100 ft. At 1917:54, the controller confirmed that the airplane was at 4,100 ft and instructed the pilot to contact Atlanta approach control on a frequency of 121.0 MHz. The pilot reported, at 1918:21 and 1918:26, that "I can't get to one two one point zero" and that, "I'm having a problem with my ah Garmin."

At 1918:33, the pilot asked the controller to "take me in"; the controller agreed. About 1 minute later, the pilot told the controller that he was "just barely able" to keep the airplane straight and its wings level. The pilot also indicated that he was unsure if he would be able to make a right turn into the airport. At 1921:17, the controller told the pilot that the airport was 2 to 3 miles on a heading of 177°, and the pilot responded that he thought that he had a heading of 177° but did not have the airport in sight. At 1922:09, the controller asked the pilot if he wanted to declare an emergency, and the pilot said, "I'm not sure and I think I oughta declare an emergency just in case." The pilot then asked the controller to have the FTY control tower "turn up" the runway's landing lights, and the controller acknowledged this request.

At 1923:09, the pilot asked the controller, "what runway am I running into...is the runway going sideways." The controller responded that runway 8 was the active runway. At 1923:44, the pilot said, "well I've got my landing gear down but I don't know." This statement was the last communication from the pilot to the Atlanta ARTCC controller.

At 1923:55, the CVR recorded the pilot straining. At 1924:00, the pilot is heard on the CVR saying, "...it's going down, it's going down" followed by the sound of the autopilot disconnect tone. At 1924:07, the Terrain Awareness and Warning System (TAWS) announced "sink rate, sink rate" followed by "pull up, pull up." The CVR recording ended at 1924:19.

Data recovered from the TAWS unit, which is part of the onboard enhanced ground proximity warning system (EGPWS), recorded the two warnings heard on the CVR. The first warning, a Mode 1 Sinkrate warning, occurred when the airplane was at an altitude of 4,000 ft and on a heading of 160°. The airplane's descent rate increased from approximately 0 ft per minute (fpm) to approximately 8,500 fpm. About three seconds later, as the descent rate increased, and a Mode 1 Pull Up warning was triggered at an altitude of 2,900 ft. The data ended approximately 7 seconds later with a recorded descent rate of almost 12,000 fpm.

Several witnesses observed the airplane before the accident. A witness, who was a professional pilot, stated that he observed the airplane flying level on a southerly heading about 1,000 ft below the cloud layer. The witness said that there was nothing unusual about the airplane until it made "a complete 360 degree roll" to the left before entering a steep 90° bank to the left. He described the turn as similar to a "military high key turn." The witness also said that the airplane then rolled inverted and entered a sudden vertical nose-down dive. He further said, "the plane entered a slow counterclockwise spiral...as it started its dive" that continued until the airplane disappeared behind a building. Another witness stated

that she observed the airplane make a "barrel roll" with the nose of the airplane "slightly elevated." She then observed a second roll and stated that the airplane slowed before its nose began to point down and the airplane spiraled downward counterclockwise.

Pilot Information

Certificate:	Private	Age:	78, Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	5-point
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:	September 27, 2016
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	6000 hours (Total, all aircraft)		

The pilot, age 78, held a private pilot certificate with ratings for airplane single-engine land, single-engine sea, multiengine land, and instrument airplane. He purchased the airplane in May 2001 and received a Cessna 500 type rating in 2002. The pilot's last Federal Aviation Administration (FAA) third-class medical certificate was issued on September 27, 2016, with the limitation that he possesses glasses for near/intermediate vision. At that time, he did not report his total flight time; his previous medical application (dated September 18, 2013) indicated a total flight experience of 6,000 hours and 50 flight hours in the previous 6 months. The pilot's logbooks were not available for review. As a result, the pilot's overall currency and total flight experience in the accident airplane could not be verified.

The Cessna 500 was originally certified to be operated with a pilot and copilot. The FAA can delegate an exemption to an authorized training facility to approve pilots to operate several aircraft, including the Cessna 500, with a single pilot. To qualify for single-pilot operations, a pilot must successfully complete an FAA-approved single-pilot authorization training course annually.

The previous owner of the accident airplane had been issued a single-pilot conformity certificate by Sierra Industries, Ltd, of Uvalde, Texas, which had performed earlier modifications to the airplane. However, no record indicated that the accident pilot received training under Sierra Industries' exemption. Several training facilities that have the single-pilot exemption training for the Cessna 500 were contacted to see if they had provided such training to the pilot, but none of those facilities had any record showing that the pilot had been trained for and granted single-pilot authority.

A friend of the pilot, who was a flight instructor and an airplane mechanic and had flown with the pilot several times, stated that he repeatedly told the pilot that he needed to fly with a copilot. The pilot said that he preferred to fly alone. The pilot also told his friend that he did not need a single-pilot exemption because the airplane had been given a single-pilot exemption with the Sierra Industries modification.

The friend of the pilot said that he had conducted postmaintenance test flights on the accident airplane

and instructed the pilot on operating the Garmin GTN 750, which had been installed in the airplane about 3.5 years before the accident. The Garmin GTN 750 was a more advanced upgrade from the KLN-90 GPS that the pilot had previously been using "for years." The friend said that the pilot was "very confused" with the Garmin GTN 750 unit's operation and would struggle "pulling up pages" and "correlating all the data." If ATC amended a preprogrammed flight plan while en route, the pilot would get confused and not know how to amend the flight plan.

The friend said that the pilot was "very dependent on the autopilot" and would activate it immediately after takeoff and then deactivate it on short final approach to land. The friend also said that the pilot "never" trimmed the airplane before turning on the autopilot, which resulted in the airplane "fighting" the autopilot. As a result, the pilot was "constantly complaining" that the airplane was "uncontrollable." The friend further stated that the pilot "always assumed" that the autopilot would automatically trim the airplane. In addition, the friend said that he flew to Savannah, Georgia, once to "fix" the airplane because the pilot insisted that it was uncontrollable. When the friend arrived and flew the airplane, he quickly realized that the airplane was not trimmed properly and that there was nothing wrong with the autopilot.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N8DX
Model/Series:	500 Citation	Aircraft Category:	Airplane
Year of Manufacture:	1976	Amateur Built:	
Airworthiness Certificate:	Transport	Serial Number:	500-0303
Landing Gear Type:	Retractable - Tricycle	Seats:	8
Date/Type of Last Inspection:	March 2, 2017 Continuous airworthiness	Certified Max Gross Wt.:	
Time Since Last Inspection:		Engines:	2 Turbo fan
Airframe Total Time:	9299.8 Hrs as of last inspection	Engine Manufacturer:	PWC
ELT:	Installed, not activated	Engine Model/Series:	JT15-1A
Registered Owner:	On file	Rated Power:	2200 Lbs thrust
Operator:	On file	Operating Certificate(s) Held:	None

The accident airplane was an eight-seat business jet powered by two Pratt & Whitney Canada JT15-1A turbofan engines. The airplane had a Sierra Industries' Eagle wing modification and wing extension.

The airplane had been retrofitted with JetTech LLC Supplemental Type Certificate (STC) No. ST02427LA on August 28, 2013. The STC replaced and upgraded the flight panel instruments to a Garmin GTN 750 display that supported navigation/mapping, radio tuning, weather display, and terrain/traffic awareness. The unit's navigation capabilities allowed waypoints to be entered that could be used to build and store flight plans for future use. In addition to the touchscreen features, the unit had concentric knobs for data input and radio tuning. Communication and navigation radio information was

shown on the top portion of the display. For radio tuning, the unit had electronic touchscreen "tabs" that provided recent, nearby, and saved radio frequencies. The radio frequency could also be adjusted using the large and small knobs on the lower right corner of the display. When information was entered using the Garmin GTN 750 touchscreen, an aural "click" sound was annunciated.

The JetTech LLC STC integrated the Garmin GTN 750 display with a Sperry (now Honeywell) SPZ-500C autopilot/flight director instrument system. When engaged, the autopilot, with the use of the integrated flight director, coupled to the selected modes and flew the airplane automatically while the pilot monitored the autopilot performance on flight instruments. The autopilot/flight director instrument system provided automatic flight control in the pitch, roll, and yaw axes with manual, automatic, and semiautomatic flight maneuvering options available to the pilot.

According to Honeywell, the autopilot would automatically disconnect in flight if there were a loss of the vertical or directional gyros, a loss of valid 28-volt power to the autopilot or gyros, or a failure of the autopilot torque-limiter. Honeywell also stated that a pilot could disconnect the autopilot in flight using one of the following seven actions:

- Press the AP TRIM DISC button
- Press the vertical gyro FAST ERECT button
- Press the compass LH-RH switch
- Press the AP TEST button
- Select AP Go-Around mode
- Pull the autopilot AC or DC circuit breaker
- Use manual electric elevator trim

The airplane was also equipped with a Bendix/King (now Honeywell) KGP560 GA EGPWS.

The airplane's maintenance was being managed by CESCO, which is a division of CAMP Systems, the exclusive factory-endorsed maintenance program for Cessna aircraft. This is a continuous airworthiness maintenance program, which is a combined program of maintenance and inspections. The airplane's maintenance logbooks were not located.

The mechanic who had been maintaining the airplane for about 1 year before the accident stated that he would perform maintenance as needed per the CESCO maintenance program. The last Phase 5 Inspection was done in 2016, and the post-maintenance flight test found no items related to the circumstances of the accident. The mechanic stated that he had never seen the airplane's maintenance logbooks and that he would prepare maintenance entries in the CESCO system. He further stated that he would either give the physical entries for the logbooks directly to the pilot or leave them in the airplane.

The mechanic said that he last spoke with the pilot about 2 weeks before the accident. The mechanic reported that, at that time, the pilot told him that "the airplane was flying better than ever." The mechanic indicated that the pilot had not mentioned any maintenance issues regarding the autopilot, gyro instruments, the Garmin GTN 750, or the flight controls. The mechanic further indicated that the only time that the pilot had mentioned the Garmin GTN 750 was when he had asked the mechanic to help find a pilot in the Atlanta area that could help him become more comfortable using the unit.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	RYY,1040 ft msl	Distance from Accident Site:	3 Nautical Miles
Observation Time:	19:47 Local	Direction from Accident Site:	257°
Lowest Cloud Condition:		Visibility	10 miles
Lowest Ceiling:	Overcast / 5500 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	8 knots / None	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	160°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.28 inches Hg	Temperature/Dew Point:	21°C / 9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	CINCINNATI, OH (LUK)	Type of Flight Plan Filed:	IFR
Destination:	ATLANTA, GA (FTY)	Type of Clearance:	IFR
Departure Time:	18:12 Local	Type of Airspace:	Class D

The weather conditions reported at Cobb County International Airport—McCullum Field, located about 3 miles west of the accident site, at 1947 (23 minutes after the accident) were as follows: wind from 160° at 8 knots, visibility 10 statute miles, overcast ceiling at 5,500 ft, temperature 21°C, dew point 9°C, and altimeter setting 30.28 inches of mercury.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	On-ground
Total Injuries:	1 Fatal	Latitude, Longitude:	34.099998,-84.319999

An on-scene examination of the airplane revealed that it impacted the front yard of a home in a residential neighborhood about 15 miles north of the destination airport. The airplane came to rest in an

upright position, and all major components of the airplane were accounted for at the scene. The wreckage was indicative of the airplane impacting the ground in an approximate nose-level/wings-level attitude with little to no forward momentum. A ground scar just forward of the left wing indicated that the airplane bounced back about 3 ft after it impacted the ground. The wires and trees that were near the impact point showed no indication that they had been struck by the airplane.

A postimpact fire consumed most of the cockpit, fuselage, left wing, and the inboard portion of the right wing. The Garmin GTN 750 unit sustained severe heat and fire damage and could not be examined. The major components of the autopilot system (vertical gyros, directional gyros, autopilot servos, flight director computers, and the autopilot computer), were identified and examined. The components sustained postcrash fire and impact damage, and there was no evidence of an autopilot failure. The autopilot components were then removed from the airplane and examined further. No preimpact anomalies were noted on any of the components.

The empennage separated from the airplane at the aft pressure bulkhead. The horizontal and vertical stabilizers remained attached to each other but separated from the fuselage and were found across the street from the main wreckage site. The left elevator and a portion of the right elevator separated from the horizontal stabilizer, and the rudder separated from the vertical stabilizer.

Flight control continuity was established from each primary flight control system to the cockpit. The cable runs were continuous except in areas with structure breaks or severe fire damage. The flaps were in the intermediate flap position, and the flap handle was in the second (takeoff and approach) position. The speedbrake on the left wing was consumed by fire, and the speedbrake on the right wing was in the down and faired position. The elevator trim actuator measured 2.1 inches, which correlated to a 10° tab up position; the rudder trim actuator measured 1.7 inches, which correlated to a 5° tab trailing edge right position; and the left aileron trim tab actuator measured 1.6 inches, which correlated to a tab down position between 0° and 5°. The elevator trim indicator in the cockpit was between neutral and nose down.

The airplane's fuel tanks (one in each wing) were breached from impact. Two fuel cross-feed valves were found in the wreckage in the open position.

The nose landing gear was found folded aft and underneath the fuselage. The left and right landing gear were folded underneath their respective wings. The damage was consistent with the landing gear being extended at the time of the accident.

The left engine had separated from the aft fuselage and came to rest on the right engine. In the cockpit, the left throttle was found out of the power quadrant pedestal, and the right engine throttle was at idle. Both engines sustained heat and impact damage and exhibited damage consistent with the engines operating at the time of impact.

No preimpact anomalies were noted that would have precluded normal airplane or engine operation.

Flight recorders

The airplane was equipped with a Fairchild GA-100 CVR that recorded 30 minutes of analog audio on a continuous-loop tape in a four-channel format: one channel for each flight crew position, one channel for a cockpit observer or the public address system, and one channel for the cockpit area microphone. The CVR exterior sustained some impact damage, but the interior crash-protected case did not sustain damage. Audio data were extracted normally, and a full transcript was prepared for the entire recording. The recording began at 1853:46 while the airplane was in cruise flight, captured the accident sequence, and ended at 1924:20.

The airplane was not equipped with a flight data recorder and was not required to be so equipped.

Medical and Pathological Information

An autopsy of the pilot was performed by the Cobb County Medical Examiner's Office, Marietta, Georgia. The cause of death was blunt force injuries.

Toxicological testing performed at the FAA Forensics Sciences Laboratory identified ethanol and propanol in the pilot's blood and ethanol in the pilot's heart. These findings were consistent with postmortem alcohol production. No medications or other substances were detected.

Tests and Research

Testing was conducted on the autopilot computer's roll servo circuit card assembly (CCA) A1T1 transformer, which is part of the roll CCA feedback loop, because of a previous accident involving another Cessna 500 airplane that experienced an uncommanded roll (CEN13FA101). During that accident, an intermittent failure occurred with the A1T1 isolation transformer. Honeywell indicated that a failure (open circuit) of the A1T1 transformer could cause the autopilot to roll the airplane when the autopilot was engaged.

Before the accident transformer was tested, Duncan Aviation notified the National Transportation Safety Board of a failed transformer from the pitch (A2) CCA board of an ancillary Sperry SPZ-200 autopilot computer that had been submitted for repair. The A2T1 transformer (which is similar in design to accident transformer) was removed from the pitch CCA board and examined alongside the accident airplane's roll CCA board and A1T1 transformer.

Honeywell's Circuit Card Assembly Test Plan was used to conduct the examinations. The test plan included photographs, x-rays, and electrical continuity (integrity) tests in hot and cold environments. In addition, the accident airplane's A1 board underwent computed tomography (CT) scanning before testing. At Honeywell, the A1 board was tested with the transformer installed, and then the transformer was removed and tested individually; the ancillary A2T1 transformer was tested individually as well. The tests and CT scans revealed no preimpact anomalies with the roll CCA board/A1T1 transformer from the accident airplane. For the pitch CCA A2T1 transformer from the ancillary Sperry SPZ-200

autopilot computer, however, the tests determined that the transformer's electrical circuit could be opened by pushing on pin 6 of the transformer's pins.

Once this testing was completed, the transformers underwent additional CT scanning. The CT images did not reveal any suspect areas in the accident A1T1 transformer. The scans of the accident A1T1 transformer showed multiple voids and particles within the transformer, but there appeared to be a continuous electrical path from the pin to the coil. No open circuits were identified. For the ancillary A2T1 transformer, the additional CT scanning confirmed anomalous areas of the pin 6 coil wire.

No preimpact deficiencies were noted with the airplane's autopilot system that would have precluded normal operation.

Administrative Information

Investigator In Charge (IIC):	Read, Leah
Additional Participating Persons:	David Detscher; FAA/FSDO; Atlanta, GA Henry Soderlund; Textron Aviation; Wichita, KS Jay Eller; Honeywell Aerospace; Pheonix, AZ
Original Publish Date:	September 10, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=94910

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).