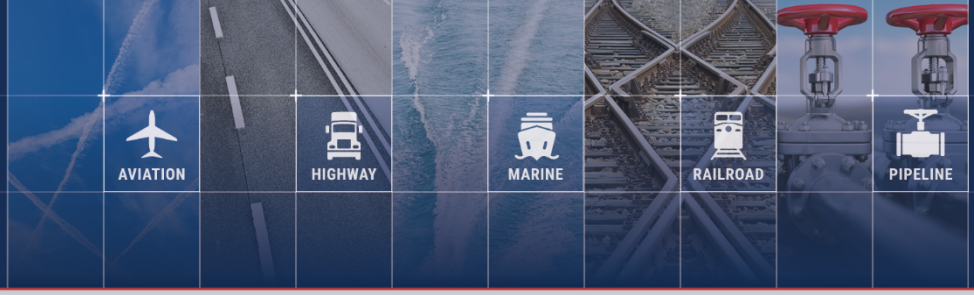

Aviation Investigation Final Report

Location:	Conway, South Carolina	**Accident Number:**	ERA20LA129
Date & Time:	March 17, 2020, 15:50 Local	**Registration:**	N150X
Aircraft:	Cirrus SR22	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was on a cross-country, instrument flight rules flight, and while en route to the destination airport, he diverted to an alternate airport with a higher ceiling. The flight was operating in instrument meteorological conditions and was vectored by the controller to the initial approach fix (IAF) for an instrument landing system approach. The pilot was instructed to cross the IAF at or above 2,000 ft mean sea level (msl); however, with the vertical speed mode of the autopilot off the airplane did not descend much below 3,000 ft pressure altitude as it approached the IAF.

When the flight was less than 2 miles from the IAF, an autopilot course capture with a corresponding heading change to the left occurred. Over the next 25 seconds, with the autopilot altitude bug set at 2,000 ft msl, which was 1,000 ft below the airplane's current altitude, the autopilot vertical speed mode engaged, and the autopilot vertical speed bug set initially to 500 fpm descent and then subsequently to greater than 750 fpm descent, the airplane climbed less than 10 ft over the course of 4 seconds then began slowly descending, with pitch trim-in-motion occurring numerous time over the course of 15 seconds. The slight increase in altitude initially was likely due to environmental conditions since the airplane then began to descend at a rate of about -1,000 feet-per-minute. The delay in descending was likely the result of the increased start up voltage of the pitch servo. As the airplane neared the IAF, a waypoint change from the IAF to the original destination airport occurred. It is likely that this erroneous waypoint change was the result of pilot input. The airplane flew through the localizer course, and as it passed outside of the outer edge of the localizer, the autopilot turned off. The pilot could not recall turning the autopilot off, and the reason for the autopilot turning off could not be determined from the available evidence.

Over the next minute, a series of altitude excursions occurred during which the airplane repeatedly climbed and descended. During this time, the controller advised the pilot that he had flown through the localizer, and the pilot advised the controller that he was aborting the

procedure. The pilot reported that when he added power, he had difficulty maintaining control of the airplane and that it was unstable. Subsequently, the pilot sensed that he was fighting the airplane and in an unusual attitude, with the pitch trim near full nose-down position and the airplane in a corresponding -42° nose-low and 13° left-roll attitude, he deployed the airframe's parachute system. The airplane descended under canopy and touched down in the backyard of a house. The airplane's nose gear collapsed and the rudder partially separated during the landing, resulting in substantial damage to the airframe.

While off course with the autopilot engaged and the vertical speed mode selected, the pilot likely applied and held pitch control input that was sensed by the autopilot auto trim system as an out-of-trim condition. The autopilot auto trim system responded by trimming the airplane, resulting in the corresponding altitude excursions.

Postaccident operational testing of the autopilot components revealed a slight malfunction of the pitch servo that would have resulted in a small delay in the servo reacting to commands from the computer; the delay would have potentially resulted in small pitch oscillations of about 1° to 2°. However, these low magnitude pitch oscillations would likely have presented no flight hazard. No significant discrepancies were noted during testing of the remaining autopilot components. Therefore, it is likely that the pilot manually changed course when near the IAF and then intentionally applied control pressure on the control yoke for longer than 3 seconds with the vertical speed mode engaged. Those actions resulted in a heading change, altitude excursions, and the subsequent departure from controlled flight.

Probable Cause and Findings

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

The pilot's incorrect use of the autopilot while approaching the initial approach fix and his subsequent improper primary pitch control input while a pitch mode of the autopilot was engaged, which resulted in pitch excursions and subsequent departure from controlled flight.

Findings

Aircraft	Autopilot system - Incorrect use/operation
Aircraft	Elevator control system - Incorrect use/operation
Personnel issues	Use of equip/system - Pilot

Factual Information

History of Flight

Approach-IFR initial approach	Course deviation
Approach-IFR initial approach	Altitude deviation
Approach	Loss of control in flight (Defining event)

On March 17, 2020, about 1550 eastern daylight time, a Cirrus SR22, N150X, was substantially damaged when it was involved in an accident near Conway, South Carolina. The private pilot was not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot stated that he had owned the airplane for about 2.5 years and was selling it. On the day of the accident, he was delivering it to the new owner for an acceptance flight, departing from Hammond, Louisiana, about 1215 on an instrument flight rules clearance. He proceeded towards the destination airport, which was Columbus County Municipal Airport (CPC), Whiteville, North Carolina. According to Federal Aviation Administration (FAA) air traffic control information, while en route, the pilot discussed the weather conditions at CPC with the controller and elected to divert to Myrtle Beach International Airport (MYR), Myrtle Beach, South Carolina, which was reporting a higher ceiling than CPC. The controller cleared the flight direct to MYR and instructed the pilot to descend and maintain 3,000 ft mean sea level (msl).

At 1540:39, when the flight was north-northwest of MYR flying on a southeasterly heading at 6,370 ft pressure altitude (PA) and descending about 500 ft-per-minute (fpm), the controller cleared the flight to UXDEP, which was the initial approach fix (IAF) for the instrument landing system (ILS) or localizer runway 18 approach at MYR. The pilot stated that he entered the UXDEP waypoint into the GPS. The airplane turned to a southerly heading towards UXDEP and continued to descend about 500 fpm.

The pilot reported that the airplane was in instrument meteorological conditions and that he flew towards UXDEP with the autopilot possibly in "NAV" mode. (Recorded data downloaded from the airplane's cockpit displays confirmed that the autopilot was in "NAV' mode.) As the flight continued towards UXDEP, the airplane was not descending as fast as the pilot wanted, and the airplane "was not as stable as he wanted [it] to be."

The downloaded data indicated that at 1544:07, autopilot course capture occurred. About 7 seconds later, the airplane was about 4,500 ft PA and 8 nautical miles northwest of UXDEP, when the controller instructed the pilot to cross UXDEP at or above 2,000 ft msl and cleared the flight for the ILS runway 18 approach (see figure 1).

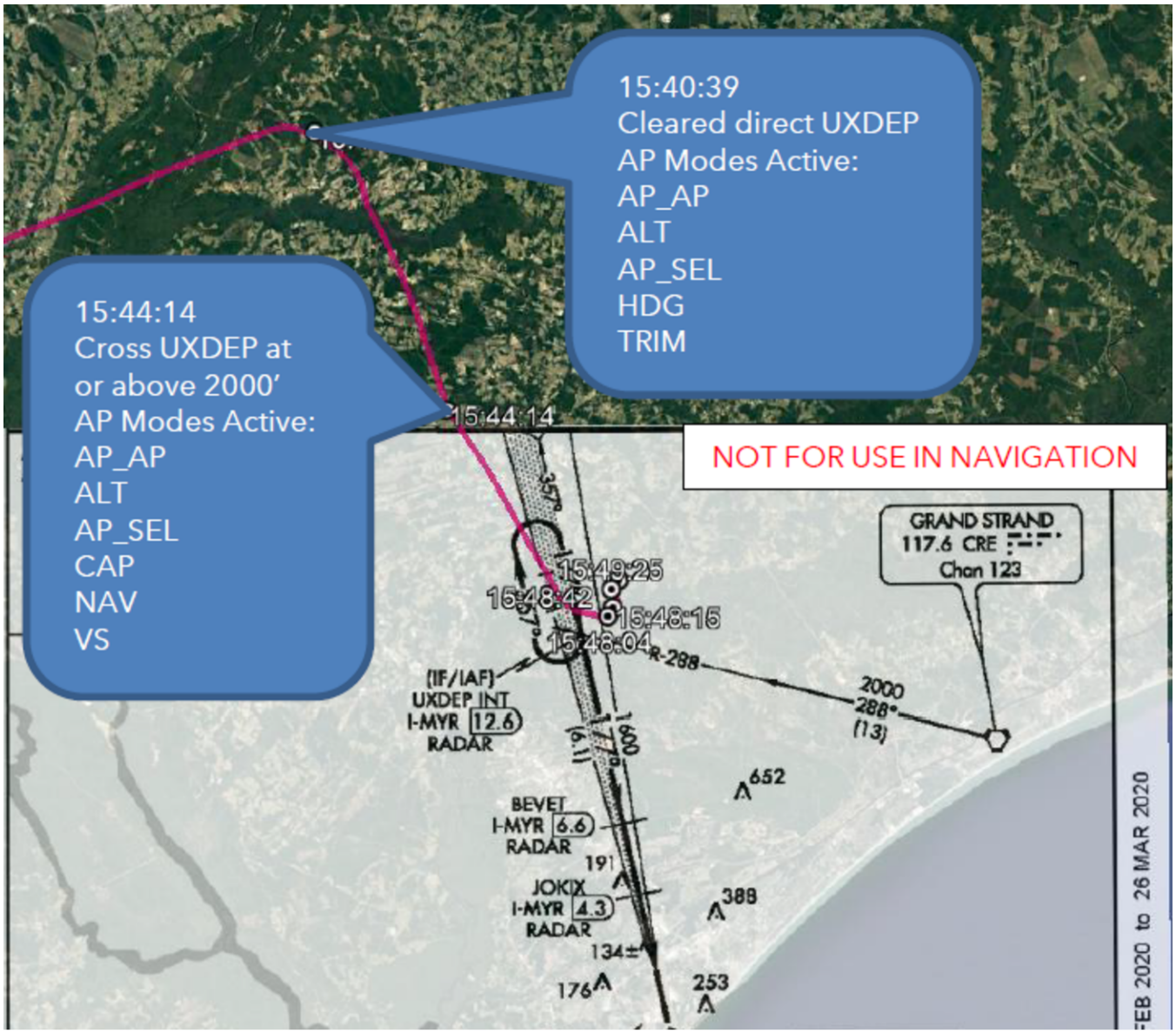

Figure 1 – Flight track plot (purple) with selected moments overlaid on the MYR runway 18 ILS instrument approach procedure.

The flight continued towards UXDEP and continued to descend until about 1546 when it leveled off about 3,000 ft PA. At 1547:15, when the flight was about 1.4 nautical miles north-northwest of UXDEP on a south-southeasterly heading at about 3,000 ft PA, autopilot course captured occurred again, followed 1 second later by a turn to the left. It could not be determined from the available evidence what autopilot course was selected; the recorded data showed that the approach mode of the autopilot was never engaged and that autopilot failure did not occur.

At 1547:20, with the autopilot altitude bug set at 2,000 ft msl, the autopilot vertical speed mode engaged, and the autopilot vertical speed bug set to 500 fpm descent, the airplane climbed less than 10 ft over the course of 4 seconds then began slowly descending with the altitude rate decreasing to -1,000 feet-per-minute, and pitch trim-in-motion occurring several times until 1547:45. About this time, the flight was near UXDEP and crossed the center of the

localizer course heading in an east-southeasterly direction, and the waypoint changed from UXDEP to KCPC.

Between 1547:45 and 1547:59, with the autopilot vertical speed mode engaged, multiple short duration pitch trim-in-motion engagements occurred resulting in the airplane climbing. At 1547:59, as the flight passed outside of the outer edge of the localizer, the autopilot turned off (see figure 2). The pilot could not recall turning the autopilot off, and the reason for the autopilot turning off could not be determined from the available evidence.

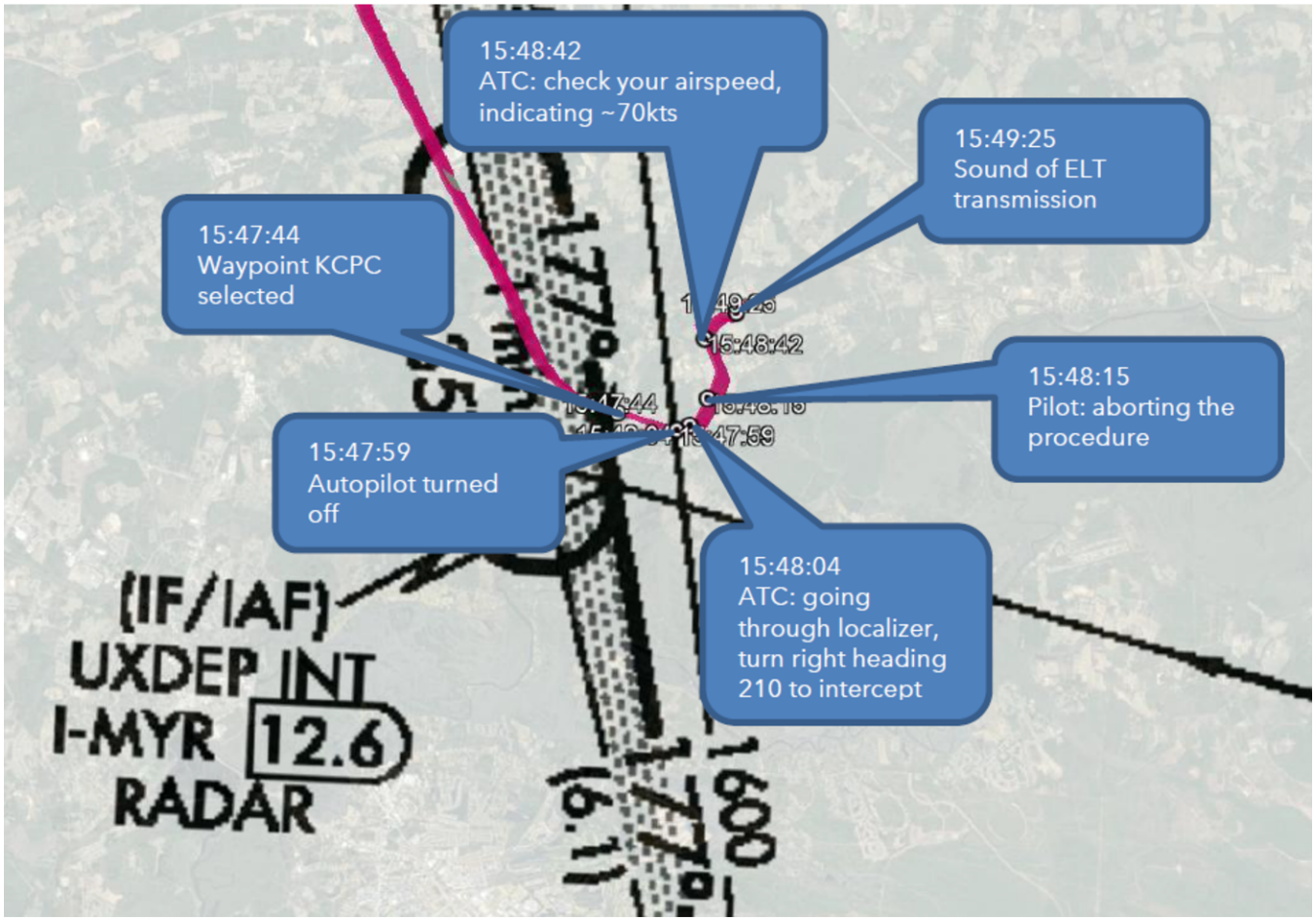

Figure 2 - Flight track plot with selected events annotated.

Beginning at 1548:00 and lasting about 1 minute, a series of altitude excursions occurred during which the airplane repeatedly climbed and descended. At 1548:04, the controller advised the pilot that he was going through the localizer, and 11 seconds later, the pilot advised the controller that he was aborting the procedure and would "climb out."

The pilot reported that he added power to maintain altitude or climb and intended to "re-shoot the approach." When he added power, it felt "like it was harder and harder to keep the instruments centered," "like it was less stable than more," and "like he was fighting it." He saw the chevrons, which display on the primary flight display (PFD) when the pitch value is greater than +50° or less than -30°, and decided to deploy the Cirrus Airframe Parachute System (CAPS).

At 1549:01, the airplane was in about a -42° nose-down and 13° left-roll attitude, which the pilot described as an unusual attitude, when the CAPS was deployed. The pilot informed the controller of the CAPS deployment, and while descending under canopy, he cracked open both doors, secured the engine, and prepared for the touchdown, which occurred on all three landing gear. During the landing the airplane's nose landing gear collapsed, and the rudder partially separated.

Pilot Information

Certificate:	Private	**Age:**	62,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	January 16, 2019
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	February 27, 2019
Flight Time:	350 hours (Total, all aircraft), 269 hours (Total, this make and model), 274 hours (Pilot In Command, all aircraft), 17 hours (Last 90 days, all aircraft), 9 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cirrus	**Registration:**	N150X
Model/Series:	SR22 Undesignat	**Aircraft Category:**	Airplane
Year of Manufacture:	2004	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0813
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	December 20, 2019 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	12 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1912.6 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-550N
Registered Owner:	On file	**Rated Power:**	310 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane was equipped with a Genesys-Aerosystems (formerly S-TEC) Fifty Five X autopilot system, an Avidyne PFD, and an Avidyne multi-function display (MFD). According to the autopilot Pilot's Operating Handbook (POH), when the remote autopilot on switch has been selected and both a roll mode and a pitch mode engaged, the autopilot will provide an annunciation whenever it is automatically trimming the airplane. The POH also indicated that should the pitch servo loading exceed a preset threshold for a period of 3 seconds (such as a pilot input), the autopilot will annunciate "TRIM" followed by an up or down symbol as an advisement that it is automatically trimming the aircraft in the indicated direction. If the autopilot is still in the process of automatically trimming the aircraft after 4 more seconds, the annunciation will flash. Once the aircraft has been sufficiently trimmed, the annunciation with extinguish. The handbook also included a check of the autotrim system as part of the preflight check.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMYR,25 ft msl	**Distance from Accident Site:**	13 Nautical Miles
Observation Time:	16:56 Local	**Direction from Accident Site:**	175°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Overcast / 1600 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	Unknown / None
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	Unknown / N/A
Altimeter Setting:	30.2 inches Hg	**Temperature/Dew Point:**	17°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Hammond, LA (HDC)	**Type of Flight Plan Filed:**	IFR
Destination:	Myrtle Beach, SC (MYR)	**Type of Clearance:**	IFR
Departure Time:	12:15 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	33.897777,-78.950836(est)

A picture of the cockpit taken by a first responder depicted the roll trim indicator in a right roll condition, and a picture of the pitch trim actuator taken by the recovery crew depicted the pitch trim in a near full nose down condition. The PFD and the memory card from the MFD were sent to the manufacturer's facility for read-out. The data was provided to the National Transportation Safety Board's Vehicle Recorder Division and was the source for the Cockpit Displays – Recorded Flight Data report (contained in the public docket for this investigation).

The wing was removed from the airframe, and the airplane was shipped to the manufacturer's facility for a repair estimate. Genesys-AeroSystems autopilot components consisting of the turn coordinator, pitch servo, autopilot processor/computer, and altitude transducer were removed and shipped to the manufacturer's facility for testing and examination by NTSB. Additionally, the Globe Motors autopilot roll servo motor was removed and shipped to the manufacturer's facility for testing and examination by NTSB.

The Genesys-AeroSystems turn coordinator passed the acceptance test procedure (ATP) for all tests except test point 2.6(a), which was a test checking across the gyro signal and gyro reference signal or checking the gyro when level for centering. To allow for ATP testing of the Genesys-AeroSystems pitch servo, the electrical wires that were cut to remove it from the airplane were spliced. Following splicing of the wires, at initial startup, the motor voltage was 4 volts, which was greater than the cutoff value of 2 volts. A representative of the manufacturer reported that the startup voltage being higher than their cutoff value would result in a small delay in the servo reacting to commands from the computer and that this delay would potentially cause small pitch oscillations of about 1° to 2°. The technician also reported that these low magnitude pitch oscillations would present no flight hazard. The pitch servo passed all subsequent test points. The Genesys-AeroSystems autopilot processor/computer and altitude transducer passed all ATP tests, and it was noted that the back lighting of the autopilot processor was dim. Examination of the Globe Motors autopilot roll servo motor at the manufacturer's facility revealed it passed the ATP tests.

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Todd Clamp; FAA/FSDO; West Columbia, SC
Original Publish Date:	November 4, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101082