# Aviation Investigation Final Report

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| **Location:** | South Bend, Indiana | **Accident Number:** | CEN13FA196 |
| **Date & Time:** | March 17, 2013, 16:23 Local | **Registration:** | N26DK |
| **Aircraft:** | HAWKER BEECHCRAFT CORPORATION 390 | **Aircraft Damage:** | Destroyed |
| **Defining Event:** | Loss of engine power (total) | **Injuries:** | 2 Fatal, 3 Serious |
| **Flight Conducted Under:** | Part 91: General aviation | | |

## Analysis

According to the cockpit voice recorder (CVR), during cruise flight, the unqualified pilot-rated passenger was manipulating the aircraft controls, including the engine controls, under the supervision and direction of the private pilot. After receiving a descent clearance to 3,000 feet mean sea level (msl), the pilot told the pilot-rated passenger to reduce engine power to maintain a target airspeed. The cockpit area microphone subsequently recorded the sound of both engines spooling down. The pilot recognized that the pilot-rated passenger had shutdown both engines after he retarded the engine throttles past the flight idle stops into the fuel cutoff position. Specifically, the pilot stated "you went back behind the stops and we lost power." According to air traffic control (ATC) radar track data, at the time of the dual engine shutdown, the airplane was located about 18 miles southwest of the destination airport and was descending through 6,700 feet msl. The pilot reported to the controller that the airplane had experienced a dual loss of engine power, declared an emergency, and requested radar vectors to the destination airport. As the flight approached the destination airport, the cockpit area microphone recorded a sound similar to an engine starter spooling up; however, engine power was not restored during the attempted restart. A review of the remaining CVR audio did not reveal any evidence of another attempt to restart an engine. The CVR stopped recording while the airplane was still airborne, with both engines still inoperative, while on an extended base leg to the runway. Subsequently, the controller told the pilot to go-around because the main landing gear was not extended. The accident airplane was then observed to climb and enter a right traffic pattern to make another landing approach. Witness accounts indicated that only the nose landing gear was extended during the second landing approach. The witnesses observed the airplane bounce several times on the runway before it ultimately entered a climbing right turn. The airplane was then observed to enter a nose low, rolling descent into a nearby residential community. The postaccident examinations and testing did not reveal any anomalies or failures that would have precluded normal operation of the airplane.

Although the CVR did not record a successful engine restart, the pilot was able to initiate a go-around during the initial landing attempt, which implies that he was able to restart at least one engine during the initial approach. The investigation subsequently determined that only the left engine was operating at

impact. Following an engine start, procedures require that the respective generator be reset to reestablish electrical power to the Essential Bus. If the Essential Bus had been restored, all aircraft systems would have operated normally. However, the battery toggle switch was observed in the Standby position at the accident site, which would have prevented the Essential Bus from receiving power regardless of whether the generator had been reset. As such, the airplane was likely operating on the Standby Bus, which would preclude the normal extension of the landing gear. However, the investigation determined that the landing gear alternate extension handle was partially extended. The observed position of the handle would have precluded the main landing gear from extending (only the nose landing gear would extend). The investigation determined that it is likely the pilot did not fully extend the handle to obtain a full landing gear deployment. Had he fully extended the landing gear, a successful single-engine landing could have been accomplished.

In conclusion, the private pilot's decision to allow the unqualified pilot-rated passenger to manipulate the airplane controls directly resulted in the inadvertent dual engine shutdown during cruise descent. Additionally, the pilot's inadequate response to the emergency, including his failure to adhere to procedures, resulted in his inability to fully restore airplane systems and ultimately resulted in a loss of airplane control.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The private pilot's inadequate response to the dual engine shutdown during cruise descent, including his failure to adhere to procedures, which ultimately resulted in his failure to maintain airplane control during a single-engine go-around. An additional cause was the pilot's decision to allow the unqualified pilot-rated passenger to manipulate the airplane controls, which directly resulted in the inadvertent dual engine shutdown.

### Findings

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| **Personnel issues** | Decision making/judgment - Pilot |
| **Personnel issues** | (general) - Pilot |
| **Aircraft** | Gear extension and retract sys - Incorrect use/operation |
| **Personnel issues** | Aircraft control - Pilot |
| **Personnel issues** | Incorrect action selection - Passenger |
| **Aircraft** | Power lever - Incorrect use/operation |
| **Personnel issues** | Total experience w/ equipment - Passenger |
| **Personnel issues** | Use of policy/procedure - Pilot |

# Factual Information

## History of Flight

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| **Enroute-descent** | Engine shutdown |
| **Enroute-descent** | Loss of engine power (total) (Defining event) |
| **Landing-flare/touchdown** | Abnormal runway contact |
| **Landing-aborted after touchdown** | Miscellaneous/other |
| **Initial climb** | Loss of control in flight |
| **Uncontrolled descent** | Collision with terr/obj (non-CFIT) |

On March 17, 2013, at 1623 eastern daylight time, a Hawker Beechcraft model 390 (Premier IA) business jet, N26DK, serial number RB-226, collided with three residential structures following an aborted landing attempt on runway 9R located at the South Bend Airport (SBN), South Bend, Indiana. The private pilot and pilot-rated-passenger, who were occupying the cockpit seats, were fatally injured. An additional two passengers, who were seated in the cabin area, and one individual on the ground sustained serious injuries. The airplane was registered to 7700 Enterprises of Montana, LLC, and operated by Digicut Systems of Tulsa, Oklahoma, under the provisions of 14 Code of Federal Regulations Part 91 while on an instrument flight rules flight plan. Day visual meteorological conditions prevailed for the business flight that departed the Richard Lloyd Jones Jr. Airport (RVS), Tulsa, Oklahoma, at 1356 central daylight time.

According to air traffic control (ATC) information, after departing RVS, the accident flight proceeded toward the intended destination while receiving normal ATC services. The flight was eventually cleared to a final cruise altitude of 41,000 feet (FL410). The cockpit voice recorder (CVR) contained about 31 minutes of cockpit conversation/audio and radio communications. At 1545:31, the beginning of the CVR recording, the pilot was discussing the airplane's fuel status and how much fuel would be required for the return flight. The pilot continued to explain and demonstrate various flight management system functions to the pilot-rated-passenger. At 1546:08, the pilot-rated-passenger remarked "a lot of stuff to learn." The pilot continued to explain and demonstrate the features of the flight management system, the use of his mobile tablet as an electronic flight bag, and the airplane's various weight limitations.

At 1552:17, the pilot established contact with Chicago Air Route Traffic Control Center and reported being level at FL410. The controller subsequently cleared the flight to descend to 24,000 feet (FL240). After receiving the descent clearance, the pilot and pilot-rated-passenger discussed how to initiate a descent using the autopilot's vertical speed mode. The pilot explained how to use airplane pitch and engine power and to maintain a desired airspeed during the descent. At 1555:22, the pilot stated "we're up more speed, so we got to get our power back. gettin' ready to start beeping at us. got to bring it back." At 1555:27, the CVR recorded a sound similar to the airspeed overspeed warning for 13.5 seconds. At 1555:31, the pilot-rated-passenger asked the pilot, "just pull it way back?" The pilot replied, "well, just get it out of the line. and we got to get it so, that it trends -- there you go -- there you go -- now give it -- it ends, there you go." The pilot continued to explain how to maintain a desired airspeed. At 1555:55,

the pilot-rated-passenger remarked, "I just hate chasin' the darn thing." The pilot replied, "huh, how many hours you got flying this jet?" The pilot-rated-passenger stated, "well, I know, but I'm just saying it's just, you know, uncomfortable. Creates alarm in the back -- throttle up, throttle down."

The pilot then explained how to setup a descent while maintaining a specified airspeed. At 1557:29, the pilot-rated passenger stated, "so, pull back?" The pilot replied, "little bit. little bit. keep working it back 'cause that tells you where you're gonna be in six seconds. so, right now, you're going to be at the line in six seconds, so you want to continue to trend back. so yeah. so, just take two seventy or something like that." At 1557:53, the pilot told the pilot-rated-passenger to "just keep us out the red."

At 1558:08, the controller cleared the flight direct to South Bend. After acknowledging the direct clearance, the pilot told the pilot-rated-passenger how to program the flight management system to proceed direct to the destination airport. The pilot then discussed the airplane's indicated airspeed, ground speed, and how to cross-check the airplane's flight attitude with the backup cockpit instrumentation. At 1559:24, the Automatic Terminal Information Service (ATIS) recording is audible over the radio channel. At 1559:42, the pilot-rated-passenger asked the pilot if they needed to engage engine heat. The pilot replied that they would wait until they get an ice indication light. At 1600:34, the pilot-rated-passenger asked the pilot "okay. pull back on the power?"

At 1601:35, the controller cleared the flight to descend and maintain 20,000 feet (FL200). At 1602:13, the pilot discussed the current weather conditions that he had obtained from the ATIS recording, the expected wind correction during the approach and landing, the minimum descent altitude during the instrument approach, and the landing reference speed. At 1603:22, the controller asked the pilot to expedite a descent to 17,000 feet mean sea level (msl). At 1603:51, the pilot told the pilot-rated-passenger "watch your speed" and "very good, very good. great speed management."

At 1605:08, a sound similar to the altitude alert was heard, the pilot announced "thousand away" and told the pilot-rated-passenger "okay, now we can come nose back up." At 1605:29, the pilot stated "let's go to the stop... to the click (detent)... MCT (maximum continuous thrust)." At 1606:14, the CVR recorded a sound similar to the airspeed overspeed warning that lasted for 11.4 seconds. At 1606:20, the pilot stated "that's what a check pilot will do, is he'll give you three things to do... when he knows you're trending in the wrong direction." At 1606:32, the pilot said "your throttles."

At 1606:49, the controller cleared the flight to expedite a descent to maintain 11,000 feet msl. After acknowledging the descent clearance, the pilot and pilot-rated passenger continued to discuss how to maintain airspeed during a cruise descent. At 1607:23, the controller asked the pilot for a ride report. The pilot replied that the weather conditions had been "smooth all the way." At 1607:52, the pilot told the pilot-rated-passenger to maintain 290 knots. The pilot-rated-passenger replied "okay, where is it?" The pilot responded "two ninety would be more power." At 1608:44, the controller issued a heading change for traffic sequencing. The pilot then explained how to promote a waypoint using the flight management system and how to plan for a descent to the selected waypoint. At 1610:11, the controller cleared the flight direct the destination airport and to contact South Bend Approach Control.

At 1610:32, the pilot established communications with South Bend Approach Control and reported being level at 11,000 feet msl. The approach controller cleared the flight direct to KNUTE, the outer marker for the instrument landing system (ILS) runway 9R instrument approach, but to expect a visual

approach to the airport. The pilot then explained how to promote KNUTE as the next active waypoint within the flight management system, and how to plan for the descent to the waypoint. At 1611:45, the approach controller cleared the flight to descend and maintain 10,000 feet msl. At 1613:07, the approach controller cleared the flight to descend and maintain 3,000 feet msl.

After receiving the descent clearance to 3,000 feet msl, the pilot told the pilot-rated-passenger "let's power back. let's bring it back to uh -- let's trend toward uh two twenty, two ten." The pilot-rated-passenger acknowledged and the pilot replied "and we'll have to come way out of it to do that." At 1613:30, the cockpit area microphone recorded a sound consistent with a decrease in engine speed. The pilot then verbalized a descent checklist and turned on the seatbelt cabin chime. At 1614:14, the pilot told the pilot-rated-passenger "we gotta get -- just pull -- just pull the power out." At 1614:18, the pilot-rated-passenger asked, "just pull it on down?" The pilot replied, "yeah, let's -- let's get back to two hundred (knots)." At 1614:21, the cockpit area microphone recorded another sound consistent with a decrease in engine speed. At 1614:26, the cockpit area microphone recorded the sound of two clicks. At 1614:27, there was a brief interruption in electrical power, an autopilot disconnect chime, and two unidentified tones. According to ATC radar track data, at 1614:28, the final radar return with an accompanying mode-C altitude return was recorded at 6,700 feet msl. At that time, the flight was located about 18 miles southwest of the destination airport. At 1614:29, the pilot said "uh-oh" and the pilot-rated-passenger replied "what?" At 1614:33, the sound similar to the landing gear warning horn was heard for 3.5 seconds. At 1614:35, the pilot told the pilot-rated-passenger "you went back behind the stops and we lost power." (The airplane throttle quadrant had a mechanical stop at the flight idle power position, which required lifting finger levers, or pull-up locks, to further retard the throttles into the fuel cut-off position.)

At 1614:43, the pilot said "okay let's see here... boost pumps are on... okay we are dead stick." At 1614:56, the sound similar to the landing gear warning horn was heard for 10.9 seconds. At 1615:01, the approach controller told the pilot to turn five degrees left for runway 9R and to report when he had the airport in sight. At 1615:02, the cockpit area microphone recorded a sound similar to an engine starter/generator spooling up; however, according to a sound spectrum study, engine power was not restored during the attempted restart. At 1615:08, the pilot told the approach controller, "uh... South Bend, we have an emergency, two six delta kilo. dead engines, dead stick, no power." The controller asked if he needed assistance and the pilot replied "affirm." Between 1615:19 and 1615:27, there was a sustained electrical power interruption to the CVR. At 1615:30, the controller asked for the pilot's intentions and the pilot replied "uh, we've lost all power and we have no hydraulics." At 1615:32, there was the sound similar to an altitude alert.

At 1615:38, the controller stated that the airport would have emergency equipment standing-by and asked if the airplane was controllable. At 1615:42, the pilot replied "ah, barely controllable." The controller told the pilot that all of the runways were available for landing and issued the current wind condition. At 1615:53, the pilot told the controller "uh, we have no navigation. if you could give us a vector please... we have no heading either. which -- you're gonna have to tell us which way to fly." The controller replied that the airplane was about 9 miles from the airport, which was at the 12-o'clock position. At 1616:09, the pilot-rated-passenger stated "there's the airport" and the pilot responded "Where? -- Okay." At 1616:12, the sound similar to the landing gear warning horn was audible until the end of the CVR recording. At 1616:13, the approach controller told the pilot to turn left 10 degrees. At 1616:16, the pilot replied "two six delta, turning left." At 1616:32, the CVR stopped recording while the

airplane was still airborne with both engines still inoperative.

No additional voice communications were received from the accident airplane. The approach controller continued to transmit radar vectors toward runway 9R without any response from the accident pilot. At 1618:59, the approach controller told the accident airplane to go-around because the main landing gear was not extended. (The tower controller had informed the approach controller that only the nose landing gear was extended) The accident airplane was then observed to climb and enter a right traffic pattern for runway 9R. The airplane made another landing approach to the runway with only the nose landing gear extended. Several witnesses observed the airplane bounce several times on the runway before it ultimately entered a climbing right turn. The airplane was then observed to enter a nose low, rolling descent into a nearby residential community.

## Pilot Information

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| **Certificate:** | Private | **Age:** | 58 |
| **Airplane Rating(s):** | Single-engine land; Multi-engine land | **Seat Occupied:** | Left |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | Unknown |
| **Instrument Rating(s):** | Airplane | **Second Pilot Present:** | Yes |
| **Instructor Rating(s):** | None | **Toxicology Performed:** | Yes |
| **Medical Certification:** | Class 3 With waivers/limitations | **Last FAA Medical Exam:** | January 22, 2013 |
| **Occupational Pilot:** | No | **Last Flight Review or Equivalent:** | May 4, 2012 |
| **Flight Time:** | (Estimated) 613.7 hours (Total, all aircraft), 171.5 hours (Total, this make and model) | | |

## Pilot-rated passenger Information

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| **Certificate:** | Private | **Age:** | 60 |
| **Airplane Rating(s):** | Single-engine land; Multi-engine land | **Seat Occupied:** | Right |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | Unknown |
| **Instrument Rating(s):** | Airplane | **Second Pilot Present:** | Yes |
| **Instructor Rating(s):** | None | **Toxicology Performed:** | Yes |
| **Medical Certification:** | Class 3 None | **Last FAA Medical Exam:** | August 3, 2005 |
| **Occupational Pilot:** | No | **Last Flight Review or Equivalent:** | September 19, 2006 |
| **Flight Time:** | 1877.1 hours (Total, all aircraft), 0 hours (Total, this make and model), 1705.3 hours (Pilot In Command, all aircraft) | | |

--- Pilot ---

According to Federal Aviation Administration (FAA) records, the pilot, age 58, held a private pilot certificate with single and multi-engine land airplane and instrument airplane ratings. He was type-rated for the Hawker Beechcraft model 390 (Premier IA) business jet. His last aviation medical examination

was completed on January 22, 2013, when he was issued a third-class medical certificate. The medical certificate had a limitation that it was not valid for any certificate classification after January 31, 2014. A search of FAA records showed no previous accidents, incidents, or enforcement proceedings.

The pilot's flight history was reconstructed using a partially completed pilot logbook, a spreadsheet flight log, several applications for his FAA pilot certificates and ratings, and a spreadsheet history of the flights that had been completed in the accident airplane. The pilot began his primary flight instruction on January 21, 2011. On April 29, 2011, when he applied for his private pilot certificate, he reported having 71 hours total time. On February 5, 2012, when he applied for his instrument rating, the pilot reported having 314 hours total time. On February 26, 2012, when he applied for his multi-engine rating, the pilot reported having 330 hours total time. On May 4, 2012, when he applied for his type-rating in the Hawker Beechcraft model 390, the pilot reported having 450 hours total time. According to additional flight documentation, after he had received his type-rating, the pilot accumulated an additional 163.7 hours in the accident airplane. The pilot's total flight experience was estimated to be about 613.7 hours, of which at least 171.5 hours were completed in the same make/model as the accident airplane.

According to training records, from April 29, 2012, through May 4, 2012, the pilot attended initial type-rating training for the Hawker Beechcraft model 390 airplane at The Jetstream Group, located in Chino, California. The course consisted of 41 hours of ground training, 8 hours of flight briefing/debriefing, and 7.8 hours of flight training in the Hawker Beechcraft model 390 airplane. On May 4, 2012, the pilot obtained his type-rating following a 2.1-hour oral examination and a 2.0 hour checkride with a FAA designated pilot examiner.

--- Pilot-Rated-Passenger ---

According to FAA records, the pilot-rated-passenger, age 60, held a private pilot certificate with single and multi-engine land airplane and instrument airplane ratings. His last aviation medical examination was completed on August 3, 2005, when he was issued a third-class medical certificate with the limitation for corrective lenses. A search of FAA records showed no previous accidents, incidents, or enforcement proceedings.

A review of available logbook information indicated that the last recorded flight was completed on September 28, 2008. At that time, the pilot-rated-passenger had accumulated 1,877.2 hours total flight experience, of which 1,705.3 hours were listed as pilot-in-command. He had accumulated 1,576.2 hours in multi-engine airplanes and 301 hours in single-engine airplanes. He had accumulated 92.4 hours in actual instrument conditions and 517.6 hours at night. His last recorded flight review and instrument proficiency check was completed on September 19, 2006, in a Beech model 60 twin-engine airplane. A review of available information did not reveal any logged flight experience in turbine-powered business jets.

According to an affidavit provided by the pilot's son following the accident, the pilot-rated-passenger was not an employee of the operator, nor was he employed as a pilot for the accident flight. He was reportedly a friend of the pilot who shared a common interest in aviation. He reportedly did not have an official role on the accident flight, and as such, was considered a pilot-rated-passenger.

## Aircraft and Owner/Operator Information

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| **Aircraft Make:** | HAWKER BEECHCRAFT CORPORATION | **Registration:** | N26DK |
| **Model/Series:** | 390 | **Aircraft Category:** | Airplane |
| **Year of Manufacture:** | 2008 | **Amateur Built:** | |
| **Airworthiness Certificate:** | Normal | **Serial Number:** | RB-226 |
| **Landing Gear Type:** | Retractable - Tricycle | **Seats:** | 8 |
| **Date/Type of Last Inspection:** | November 4, 2012 AAIP | **Certified Max Gross Wt.:** | 12500 lbs |
| **Time Since Last Inspection:** | 38 Hrs | **Engines:** | 2 Turbo fan |
| **Airframe Total Time:** | 457.5 Hrs at time of accident | **Engine Manufacturer:** | Williams International |
| **ELT:** | C126 installed, activated, did not aid in locating accident | **Engine Model/Series:** | FJ44-2A |
| **Registered Owner:** | 7700 Enterprises of Montana, LLC | **Rated Power:** | 2300 Lbs thrust |
| **Operator:** | Digicut Systems | **Operating Certificate(s) Held:** | None |

The accident airplane was a 2008 Hawker Beechcraft model 390 (Premier IA) business jet, serial number RB-226. Two Williams International model FJ44-2A turbofan engines, each capable of producing 2,300 pounds of thrust at takeoff, powered the airplane. The airplane had a maximum takeoff weight of 12,500 pounds. The airplane was equipped for operation under instrument flight rules and in known icing conditions.

The accident airplane was issued a standard airworthiness certificate on March 13, 2008. According to FAA documentation, 7700 Enterprises of Montana, LLC, purchased the airplane on April 18, 2012. The current FAA registration certificate was issued on May 1, 2012. The airplane was maintained under the provisions of a FAA-approved manufacturer inspection program. The last inspection of the airplane was completed on November 4, 2012, at 419 hours total airframe time. As of the last inspection, both engines also had accumulated 419 hours since new. The static system, altimeter system, automatic pressure altitude reporting system, and transponder were last tested on July 7, 2011. A postaccident review of the maintenance records found no history of unresolved airworthiness issues. The airplane hour meter indicated 457.5 hours at the accident site.

The primary flight control systems, except the spoilers, were manually operated through control cables, push/pull tubes, and mechanical linkages. The spoilers were electronically controlled and hydraulically actuated. The pitch trim system, roll trim system, and yaw trim system were electrically operated. The speed brake was controlled electrically and operated hydraulically. The flaps were electronically controlled and electrically actuated.

Pitch attitude of the airplane was controlled by the elevators and the variable incidence horizontal stabilizer. The elevator control system was operated manually by movement of the cockpit control columns. Roll attitude was controlled through the ailerons, spoilers and roll trim. The aileron control

system was operated manually by movement of the cockpit control wheels. The spoiler control system was electrically controlled by movement of the cockpit control wheels and hydraulically actuated. Yaw control was accomplished by the rudder and rudder trim tab. The rudder control system was operated manually by moving the cockpit rudder pedals.

The cockpit engine thrust levers were connected to control cables that extended aft through the fuselage to the power control arm located on the bottom of each hydromechanical fuel control unit (HMU). In addition to the mechanical throttle linkages to the HMUs, each engine had an electronic control unit (ECU) that interfaced with its respective HMU to provide automatic fuel control throughout the normal engine operating envelope. The ECUs were part of the Standby Bus electrical system. Finger levers, or pull-up locks, were installed to prevent the inadvertent movement of the thrust levers from flight idle into the fuel cutoff position. To access the fuel cutoff position, the pull-up locks are lifted as the thrust levers are moved aft into the fuel cutoff position. During normal flight, with the engines operating, placing the thrust levers into the fuel cutoff position will shut off fuel flow to the engine and cause the engines to shut down.

During normal operation, the Standby Bus is powered by the Essential Bus. The Essential Bus receives electrical power from the main battery and generators (when online). During engine prestart and engine start, the ECUs are powered by the main battery until a generator is brought online. The generators are used as starter motors during normal engine starts and starter-assisted air starts. As such, following an engine start, a generator is reset by selecting the associated toggle switch that is located on the electrical control sub-panel. The momentary reset toggle switch position reestablishes electrical power from the generator to the Essential Bus system. During normal engine operation, the ECUs are powered by the generators through the Essential Bus; however, the ECUs could also be powered by the standby battery, through the Standby Bus, if the standby battery is selected following the depletion of the main battery.

The airplane's main battery was a 24-volt direct current (DC), maintenance free lead-acid battery with a minimum performance capacity of 42 ampere-hours. The battery provides power for self-contained engine starts and is a backup power source for the Essential Bus components.

The standby battery was a 5 ampere-hour, lead-acid battery. The standby battery was used to supply 24-volts DC to the Standby Bus and 5 volts DC for lighting of selected components during abnormal power conditions. The standby bus supplies electrical power to dedicated airplane components to sustain safe operation of the airplane when no other source of power is available. According to the airframe manufacturer, the standby battery was designed to supply 150 watts of power for a minimum of 30 minutes or until the cutoff voltage of 20 volts DC is reached.

In abnormal power situations, the main battery is used to provide airplane power until a generator is reset and brought back online. Furthermore, if a starter/generator is inoperative due to a loss of engine power, the main battery is designed to power the starter/generator to reignite the affected engine. In the event the battery switch is selected to Standby, regardless if the generators have been reset, electrical power would not be available to the essential bus (only the Standby bus would be powered). Additional information concerning the airplane electrical system, including a list of components found on the Essential and Standby Buses, is included with the docket materials associated with this investigation.

In the event of a loss of engine power during flight, an engine can be restarted in the air by one of two

methods: either a windmilling start or a starter-assisted air start. A windmilling start uses residual engine speed, air movement against the fan blades, and engine igniters to restart the engine and regain power. A starter-assisted air start uses electrical power, routed through the generator/starter motor, to increase the N2 shaft to a speed where the igniters can restart the engine. Generally, the flight envelope to accomplish an engine air start is between 130 and 300 knots indicated airspeed and from sea level to 25,000 feet. At lower airspeeds, a starter-assisted air start is recommended and uses the normal engine start switch. At higher airspeeds a windmilling start is recommended and does not use the normal engine start switch. In contrast to the normal ground start procedure, the air start procedure requires that the igniter switches be switched to the "ON" position before attempting any engine air start.

The airplane was equipped with an electrically controlled, hydraulically actuated, retractable landing gear. If hydraulic or electric power is unavailable, an alternate procedure is used to extend the landing gear. When the alternate landing gear extension handle, located at the base of the left-side control column, is pulled outward from the stowed position, the landing gear and door up-lock hooks are released, which allows the landing gear to free-fall into the down-and-locked position. The use of the alternate landing gear handle also opens a mechanically actuated recirculation valve that connects the main landing gear retraction and extension hydraulic lines to allow a more positive free-fall of the gear. The landing gear release is sequenced so that the nose gear is released first, followed by the main landing gear inboard doors, and finally the main landing gear. According to the airframe manufacturer, the nose landing gear is released from the up-locks when the alternate extension handle is extended to 2-1/4 inches (+/- 0.25 inch). The main landing gear inboard doors are released when the alternate extension handle is extended to 2-3/4 inches (+/- 0.25 inch). Finally, the main landing gear are released from their respective up-locks when the alternate extension handle is pulled to 3-1/4 inches (+/- 0.25 inch). The full stroke length of the alternate extension handle, following a full deployment of the landing gear, is specified to be a minimum of 4 inches.

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | SBN,799 ft msl | **Distance from Accident Site:** | 1 Nautical Miles |
| **Observation Time:** | 16:20 Local | **Direction from Accident Site:** | 305° |
| **Lowest Cloud Condition:** | Clear | **Visibility** | 10 miles |
| **Lowest Ceiling:** | None | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 13 knots / 17 knots | **Turbulence Type Forecast/Actual:** | / None |
| **Wind Direction:** | 120° | **Turbulence Severity Forecast/Actual:** | / N/A |
| **Altimeter Setting:** | 30.13 inches Hg | **Temperature/Dew Point:** | 2°C / -8°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | Tulsa, OK (RVS ) | **Type of Flight Plan Filed:** | IFR |
| **Destination:** | South Bend, IN (SBN ) | **Type of Clearance:** | IFR |
| **Departure Time:** | 13:56 Local | **Type of Airspace:** | Class C |

At 1620, the SBN automated surface observing system reported: wind 120 degrees at 13 knots, gusting 17 knots; a clear sky; 10 mile surface visibility; temperature 2 degrees Celsius;

dew point -8 degrees Celsius; and an altimeter setting of 30.14 inches of mercury.

## Airport Information

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| **Airport:** | South Bend Airport SBN | **Runway Surface Type:** | Asphalt |
| **Airport Elevation:** | 799 ft msl | **Runway Surface Condition:** | Dry |
| **Runway Used:** | 09R | **IFR Approach:** | Visual |
| **Runway Length/Width:** | 8414 ft / 150 ft | **VFR Approach/Landing:** | Traffic pattern |

The South Bend Airport (SBN), a public airport located approximately 3 miles northwest of South Bend, Indiana, was owned and operated by the St. Joseph County Airport Authority. The airport was a certificated airport under 14 CFR Part 139 and had on-airport fire and rescue services. The airport field elevation was 799 feet msl. The airport had three runways: runway 9R/27L (8,414 feet by 150 feet, asphalt/grooved); runway 18/36 (7,100 feet by 150 feet, asphalt/grooved); and runway 9L/27R (4,300 feet by 75 feet, asphalt).

## Wreckage and Impact Information

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| **Crew Injuries:** | 1 Fatal | **Aircraft Damage:** | Destroyed |
| **Passenger Injuries:** | 1 Fatal, 2 Serious | **Aircraft Fire:** | None |
| **Ground Injuries:** | 1 Serious | **Aircraft Explosion:** | None |
| **Total Injuries:** | 2 Fatal, 3 Serious | **Latitude, Longitude:** | 41.695835,-86.296112 |

The airplane collided with three residential structures during the final impact sequence. A majority of the wreckage was found within one of the structures. There was a noticeable odor of Jet-A fuel at the accident site and the South Bend Fire Department reported that fuel had pooled in the basement of the house. The airplane wreckage was recovered from the house and transported to the South Bend Airport to facilitate a more detailed examination. A postaccident examination of the runway 9R revealed areas of abrasion damage to the grooved asphalt surface. The observed damage was consistent with the accident airplane coming in contact with the runway surface during the accident flight.

--- Fuselage ---

The radome had separated from the radome bulkhead, which had separated from the fuselage. The nose baggage and avionics sections had separated forward of the forward pressure bulkhead and the nose wheel well structure had buckled. The cabin area exhibited impact damage; however, portions remained intact from the forward pressure bulkhead to the aft pressure bulkhead. A section of the right cabin sidewall, from the emergency escape hatch opening forward to approximately the right side galley area,

had been cut open by first responders to extract the occupants. The aft fuselage had separated from the cabin portion at the aft pressure bulkhead, but remained attached by flight control cables and other conduits. Both engines remained attached to the aft fuselage. The main entry door remained attached at both hinge locations and was found open with the latches in the closed position. The main entry door latching mechanism was actuated and operated as designed. Examination of the fuselage revealed no evidence of an in-flight or post-impact fire. The VHF communications No. 1 antenna had separated from the lower fuselage, and exhibited gouges and scoring of the lower leading edge that were consistent with contact with the runway surface. The VHF communications No. 1 antenna was recovered from the runway by airport personnel following the accident.

--- Wings ---

The wing assembly had separated from the airframe at all mounting points. The left wing exhibited deformation consistent with impact forces, but remained intact with all flight control surfaces attached. The right wing exhibited deformation consistent with impact forces and had separated in several locations. The inboard portion of the right wing exhibited minor damage when compared to the outboard wing. The outboard portion of the right wing, outboard of the inboard flap, exhibited impact damage, deformation, and had separated into several pieces. The outboard portion of the right wing, from the aileron outboard, had separated as one piece, with the exception of the composite wing tip assembly. The composite wing tip assembly had separated from the outboard end of the wing and was found amongst the main wreckage. The lower skin of the outboard portion of right wing and the lower skin of the composite wing tip exhibited gouging/scoring that was consistent with contact with the runway surface. The marks made by the gouging/scoring were approximately parallel with the chord of the wing and were aligned with the longitudinal axis of the fuselage. Additional abrasion damage was observed on the lower aft portion of all right wing flap tracks and the aft portion of the wing center keel structure. The trailing edge of the right aileron also exhibited abrasion damage. The wing flaps were observed in the retracted position and the measurement of the individual flap actuators corresponded with fully retracted flap positions. The aileron flight control system displayed multiple separations throughout the circuit; however, all observed separations exhibited features consistent with an overstress failure. The roll trim actuators remained attached to their respective aileron and were observed to be extended 1.3 inches. The roll trim tabs were visually aligned (faired) with the aileron trailing edge, consistent with a neutral position.

--- Stabilizers ---

The horizontal stabilizer remained attached to the rear fuselage and revealed limited impact damage. The pitch trim actuator remained attached to its mounting location in the vertical stabilizer and was attached to the leading edge of the horizontal stabilizer. The pitch trim actuator extension was observed to be extended 17-5/8 inches. The elevators remained attached to the horizontal stabilizer at all hinges. The outboard portion of the right elevator, including the balance weight, had separated from the remaining right elevator. The right and left elevator trim tab surfaces remained attached to their respective elevators at their hinges. Both elevator trim tab surfaces were visually aligned (faired) with the trailing edge of the respective elevator. The rudder remained attached to the vertical stabilizer and the hinges exhibited no apparent damage. The rudder trim tab remained attached to the rudder at the hinges and did not appear to be damaged. The rudder trim tab surface was visually aligned (faired) with the trailing edge of the rudder. Flight control continuity for the elevator and rudder displayed multiple

separations; however, all observed separations exhibited features consistent with an overstress failure or had been cut to facilitate wreckage recovery.

--- Landing Gear ---

The nose landing gear had separated from the airframe trunnion. The nose landing gear drag brace had separated from the nose landing gear assembly and the airframe supporting structure. The down lock actuator and down lock "pawl" assembly had separated from the drag brace assembly. The nose wheel and tire remained attached to the nose landing gear assembly. The nose wheel exhibited signs of impact damage to a portion of the bead area. The nose landing gear doors had separated from the airframe and were found amongst the main wreckage. The nose landing gear actuator had separated from the airframe in two pieces. The piston portion of the actuator remained attached to the nose landing gear assembly.

The left main landing gear assembly remained intact and attached to the left wing trunnion. The gear was found in the wheel well; however, the uplock was not engaged to the main landing gear uplock roller. The left main landing gear actuator remained attached to the main landing gear assembly and to the wing supporting structure. The actuator was found in the retracted position; however, multiple separations of hydraulic lines and impact damage prevented a determination of the landing gear position by the measurement of the landing gear actuator. The left outboard gear door remained attached to the wing structure and the left main landing gear assembly. The left inboard gear door had separated from the wing and was found in several pieces amongst the main wreckage. The left inboard gear door actuator remained attached to the wing. About 90-percent of the inboard gear door was recovered and reconstructed. The paint on the exterior portions of the door appeared to be eroded, consistent with contact with the runway surface while in the closed position.

The right main landing gear assembly remained intact and attached to the wing structure. The right wing had separated between the main landing gear trunnion fitting and the main landing gear actuator wing attach fitting. The main landing gear actuator remained attached to the main landing gear assembly and the wing attach fitting. The right main landing gear actuator was partially extended; the actuator was in neither the fully retracted nor the down-and-locked position. Multiple separations of hydraulic lines and impact damage prevented a determination of the landing gear position by measurement of the landing gear actuator. The right main landing gear outboard door had separated from the wing and was not recovered during the investigation. About 60-percent of the right inboard gear door was recovered and reconstructed. The reconstructed portion of the door exhibited exterior paint abrasion that was consistent with door in the closed position. The inboard gear door actuator remained attached the wing.

--- Cockpit Switch and Lever Positions ---

Both engine power levers were in the normal takeoff position. Both levers were bent right and forward approximately 45-degrees. The power levers moved smoothly from the normal takeoff position to the flight idle detent. There was a positive indication at the normal takeoff and flight idle stops. The finger levers, which allow the power levers to be moved aft of the flight idle detent into fuel cut-off, could not be activated/pulled because of damage to both the power levers and the finger levers.

The flap handle was in the 20-degree detent position. Although the flap handle was bent, it could be moved between each flap position detent. A positive detent was noted at each flap position.

The lift dump switch was in the "Unlock" position. The lift dump handle was in the retracted position.

The speed brake was in the "RETRACT" position.

The landing gear position handle located in the cockpit was observed in the "UP" position. The cockpit landing gear circuit breaker was in the closed (not pulled) position. The landing gear alternate extension handle was found partially extended about 1-1/2 inches and was bent toward the instrument panel.

The battery toggle switch was in the "Standby" position.
Both generator toggle switches were in the "ON" position.
Both avionics switches were in the "ON" position.

The left fuel boost switch was in the "ON" position.
The position of the right fuel boost switch could not be determined due to impact damage.
The fuel transfer switch was in the "OFF" position.

Both engine ECU switches were in the "ON" position.
Both engine ignition switches were in the "ARM" position.
Engine synchronization was in the "OFF" position.

Additional cockpit switch positions are included in the docket materials associated with this investigation.

--- Engines ---

A postaccident examination of the left engine, serial number 105363, revealed evidence of leading edge foreign object damage to the N1 (Spool) Fan, consistent with the ingestion of debris during the impact sequence. Although damaged, the N1 Fan could still be rotated by hand. Thrust lever cable continuity from the center pedestal to the engine could not be verified due to the severity of the airframe damage. However, on the engine, the power control cables were continuous from the engine pylon to the power control arm located at the base of the HMU. The fuel control throttle lever was observed in the maximum power position. The Low Pressure (LP) Trip Lever cable exhibited no visible damage, and the fuel cutoff mechanism had not been activated. All three engine magnetic chip collectors were inspected and were free of metallic chips and/or debris. The powerplant examination revealed evidence that the left engine was operating at the time of impact.

A postaccident examination of the right engine, serial number 105364, revealed evidence of attic insulation, pieces of home roofing shingles, pieces of wood, and other unidentified debris within the engine cowling and bypass duct. However, the N1 fan did not reveal visible evidence of leading edge foreign object damage that would be expected from the ingestion of debris in conjunction with engine operation. Thrust lever cable continuity from the center pedestal to the engine could not be verified due to the severity of the airframe damage. However, on the engine, the power control cables were continuous from the engine pylon to the power control arm at the base of the HMU. The fuel control throttle lever was observed in the maximum power position. The LP Trip Lever cable was found bent and damaged, and the LP Trip Lever fuel cutoff mechanism had been activated. (The LP Shaft Trip

Sensor is activated when the LP turbine is forced in the aft direction against the trip lever. Typical scenarios of when a trip sensor would be activated include a LP Shaft separation or when the engine is exposed to significant impact loading.) All three engine magnetic chip collectors were inspected and were free of metallic chips and/or debris. The powerplant examination did not reveal any evidence that the right engine was operating at the time of impact.

## Communications

The accident flight was on an activated instrument flight rules (IFR) flight plan. A review of available ATC information indicated that the accident flight had received normal air traffic control services and handling. A transcript of the voice communications recorded between the accident flight and South Bend Approach Control are included with the docket materials associated with the investigation.

## Flight recorders

Although not required, the airplane was equipped with an L-3/Fairchild model FA2100-1010 CVR, serial number 446023. The CVR recording contained about 31 minutes of digital audio, which was stored in solid-state memory modules. The CVR was not damaged during the accident and the audio information was extracted from the recorder normally. The recording consisted of four channels of audio information, ranging from good to excellent quality. The recording began at 1545:31 with the airplane established in cruise flight at 41,000 feet (FL410), and the recording stopped about 1616:32 while the airplane was maneuvering toward the destination airport with both engines inoperative. A transcript of the CVR audio information is included with the docket materials associated with the investigation. The airplane was not equipped with a flight data recorder, nor was it required to be so equipped.

## Medical and Pathological Information

On March 18, 2013, autopsies were performed on the pilot and pilot-rated-passenger at the St. Joseph Regional Medical Center, located in Mishawka, Indiana. The cause of death for both individuals was attributed to blunt-force injuries sustained during the accident. The FAA's Civil Aerospace Medical

Institute (CAMI) located in Oklahoma City, Oklahoma, performed toxicology tests on samples obtained during each autopsy.

The pilot's toxicological test results were negative for carbon monoxide and ethanol. Losartan, an FAA-accepted high blood pressure medication, was detected in urine and blood samples. The pilot had reported the use of this medication on his most recent FAA medical certificate application.

The pilot-rated-passenger's toxicological test results were negative for carbon monoxide, ethanol, and all drugs and medications.

## Tests and Research

--- Sound Spectrum Study ---

A study was performed to evaluate the sound spectrum of audio recorded by the cockpit area microphone after the loss of engine power at 1614:27. The CVR audio was compared with audio recorded during ground testing of an exemplar Hawker Beechcraft model 390 (Premier IA). The sound spectrum study indicated that, at 1615:02, the pilot engaged a starter motor in attempt to restart one of the engines. The study further established that the electrical noise from the engine igniters was not present at any point during the CVR recording, including the attempted engine air start. (The air start procedure required that the igniter switches be switched to the "ON" position before attempting any engine air start) A review of the remaining CVR audio did not reveal any evidence of another attempt to restart an engine.

--- Surveillance Video Study ---

There were several surveillance videos of the accident airplane during the two landing attempts, and the final descent and impact. A study of airport surveillance footage was completed to determine an average ground speed of the airplane during the second landing attempt. The study determined that the airplane's average ground speed was 127 knots (+/- 4 knots) during the 3.75 seconds of camera footage of the second landing attempt. Additional information concerning the surveillance videos can be found with the docket materials associated with this investigation.

--- Mobile Device Examinations ---

Several mobile devices were recovered from the wreckage and sent to the National Transportation Safety Board (NTSB) Vehicle Recorder Laboratory for examination.

The pilot's tablet mobile device contained several aviation related applications; however, none of the applications contained flight track data for the accident flight. One application, ForeFlight, depicted the planned route-of-flight for the accident flight. Additionally, the ForeFlight application also contained 160 file-and-brief entries for previous flights. Another application, LogTen Pro, contained a partial flight history log.

The pilot's mobile phone was reviewed and no information pertinent to the investigation was recovered.

The pilot-rated-passenger's mobile phone contained a text message, dated March 13, 2013, concerning a previous flight that he had in the accident airplane with the pilot. No additional information was recovered that was pertinent to the investigation.

Another passenger's mobile phone contained multiple out-going text messages with timestamps between 13:45 and 13:53 central daylight time. These text messages noted that the accident flight was about to takeoff and provided the expected time en route to South Bend. At 1505 eastern daylight time, a multi-media text message was sent with a photograph from inside the airplane cabin looking toward the cockpit. At 1612, another photo was taken from inside the cabin looking outside through a cabin window. No additional information was recovered that was pertinent to the investigation.

--- Starter-Generator Examinations ---

An initial visual examination of both starter-generators determined that their drive shafts were intact and the armatures rotated. The brush covers were removed and the brushes were observed to be in a good condition. The starter-generators were examined and tested at the manufacturer and no failures or anomalies were noted that would have prevented normal operation.

--- Generator Control Unit Examinations ---

Visual examination revealed the outer dust sleeve for the left generator control unit (GCU) was dented; however, further disassembly revealed no internal damage. The right GCU appeared to be undamaged. Both devices were examined and tested at the manufacturer and no failures or anomalies were noted that would have prevented normal operation.

--- Battery Examinations ---

During the on-site investigation, the no-load voltage of the main battery was 25 volts. Additional examination, at the manufacturer, confirmed that the battery was electrically intact and exceeded the acceptance test standards for a new battery. The standby battery was visually inspected at the accident site and no additional testing was completed.

--- Throttle Quadrant Assembly Examinations ---

The throttle quadrant assembly was removed from the airplane and examined at the manufacturer. A visual inspection revealed that both throttle levers were bent to the right and the fuel cutoff pull-up locks were jammed. There was foreign object debris, mostly loose attic insulation, found within the throttle quadrant assembly. To facilitate additional testing, the throttle arms were straightened to a vertical position. A partial Acceptance Test Procedure was completed because of existing damage to the throttle quadrant assembly. An electrical continuity check confirmed proper function of the throttle quadrant at each switch location.

--- Engine Electronic Control Unit Examinations ---

Both engine electronic control units (ECU) were examined and tested at the manufacturer on a Williams FJ44-2A engineering test cell. After a successful bit check at power-up, the contents of the ECU's non-volatile memory were downloaded. The examination of the recorded fault codes from each ECU determined no faults were recorded during the last flight in memory. Additionally, neither device contained any information regarding the engine operation during the last recorded flight.

Additional component examination summaries are included with the docket materials associated with the investigation.

## Additional Information

One of the surviving passengers was interviewed by two NTSB Human Performance and Survival Factors investigators. The passenger reported that he loaded his luggage and computer gear on the airplane between 1330 and 1345 central daylight time. After loading, he and the other passenger boarded the airplane and waited for the pilots. Around 1350, the pilot and pilot-rated-passenger boarded the airplane. The passengers were not provided a safety briefing. He stated that the takeoff and cruise portion of the flight appeared to be normal; however, while the airplane was on approach to the runway he noticed instrument panel was not illuminated like it had been earlier in the flight. Specifically, he recalled that the cockpit instrument panel appeared to be unpowered. He saw that the pilot was manually flying the airplane. The pilot-rated-passenger turned around and announced that they should prepare for landing. The passenger stated that he became concerned when the airplane flew past the terminal and control tower and had not touched down. He noted that he felt like the airplane was "coming in hot." The airplane then banked right and climbed away from the runway. The passenger heard the pilot tell the pilot-rated-passenger that they were "down to one engine." The airplane continued in the traffic pattern back to the runway. The passenger stated that the cockpit instrument panel still appeared to be unpowered during the second landing attempt; however, he did recall seeing flashing red and yellow cockpit lights. The passenger believed that during the second landing attempt the airplane had a slower groundspeed when compared to the first landing attempt. He noted that the airplane bounced off the runway several times before it entered a nose-high attitude and rolled to the right. He remembered seeing rooftops of homes before he blacked-out. His next memory was after the accident, as first responders attempted to gain access to the cabin.

## Administrative Information

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|---|---|
| **Investigator In Charge (IIC):** | Fox, Andrew |
| **Additional Participating Persons:** | Robert Hendrickson; Federal Aviation Administration; Washington, DC<br>Brian Weber; Textron Aviation (Hawker Beechcraft); Wichita, KS<br>Chris Greene; Williams International; Commerce Township, MI |
| **Original Publish Date:** | April 14, 2016 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | The NTSB traveled to the scene of this accident. |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=86442 |

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.