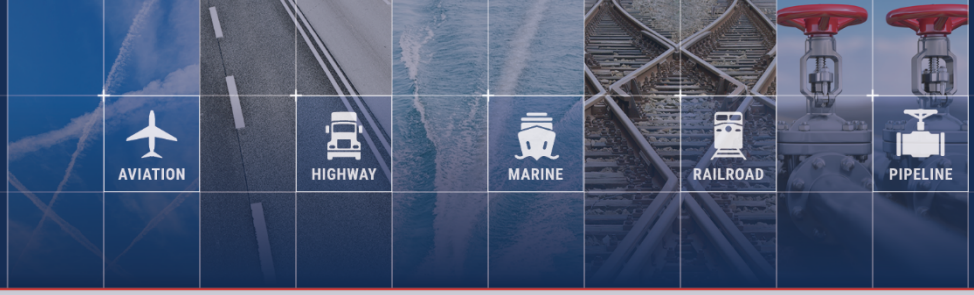

Aviation Investigation Final Report

Location:	Springfield Township, New Jersey	**Accident Number:**	ERA18FA167
Date & Time:	June 13, 2018, 09:07 Local	**Registration:**	N218BL
Aircraft:	RAYTHEON AIRCRAFT COMPANY 58	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The private pilot, who was not instrument current, and a passenger departed on an instrument flight rules flight into instrument meteorological conditions. After takeoff, the pilot did not climb to the clearance altitude of 2,000 ft mean sea level (msl), instead leveled off about 500 ft msl. The pilot then began a second climb to a maximum altitude of 1,400 ft, then leveled off, followed by a steep right descending turn to about the base of the clouds about 400 ft. The airplane then began a climb to 1,700 ft msl while the airspeed decreased. While flying in a right bank near the published wings-level, 1-g stall speed, the airplane likely exceeded its critical angle of attack, stalled, and entered a descent. A witness reported hearing a loud engine sound from the low-flying airplane, and last observed the airplane in a slight left bank, although the airplane impacted the ground in a nose and right-wing low attitude.

Examination of the flight controls, engines, engine systems, and propellers revealed no evidence of preimpact failure or malfunction. While postaccident acceptance testing of autopilot components revealed minor out-of-tolerance conditions, the conditions noted would not have adversely affected proper operation. Although the presence of moisture in the static system could not be ruled out because the static system was destroyed, it is unlikely that was an issue because the ADS-B data for pressure altitude and geometric altitude calculated by the GPS revealed no gross difference.

The restricted visibility, maneuvering during the transition from takeoff to cruise flight, and the pilot's lack of instrument proficiency provided conditions conducive to the development of spatial disorientation. The airplane's altitude and track variations were inconsistent with its takeoff and departure clearance and the high velocity impact are consistent with the known effects of spatial disorientation. Therefore, it is likely that the pilot became spatially disoriented while flying in instrument meteorological conditions and lost control of the airplane. Contributing to the loss of control was the pilot's lack of recent instrument experience.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of control due to spatial disorientation while climbing after departure in instrument meteorological conditions. Contributing to the accident was the pilot's lack of recent instrument experience.

Findings

Personnel issues	Spatial disorientation - Pilot
Aircraft	(general) - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Environmental issues	Low ceiling - Effect on operation
Personnel issues	Recent instrument experience - Pilot

Factual Information

History of Flight

Enroute-climb to cruise	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On June 13, 2018, about 0907 eastern daylight time, a Beech 58, N218BL, was destroyed when it was involved in an accident near Springfield Township, New Jersey. The private pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (*CFR*) Part 91 personal flight.

The purpose of the flight was to pick up a patient and their spouse for a volunteer medical transport flight from Barnstable Municipal Airport-Boardman/Polando Field (HYA), Hyannis, Massachusetts, to Northeast Philadelphia Airport, (PNE), Philadelphia, Pennsylvania.

According to a transcript of communications with the United States Air Force (USAF) McGuire Field (Joint Base McGuire Dix Lakehurst) Airport (WRI) radar approach control, about 0858, an occupant onboard the accident airplane contacted clearance delivery and was issued an amended instrument flight rules (IFR) clearance to HYA, which included the requirement to climb and maintain 2,000 ft after takeoff from South Jersey Regional Airport (VAY), Mount Holly, New Jersey. (It could not be determined if the pilot or the pilot-rated passenger was operating the radios.) At 0859:43, the controller asked if the flight was ready to depart, and an occupant responded that they were. About 0900, a military aircraft about 12 nautical miles east-northeast of VAY reported that the cloud bases were about 300 ft, then about 30 seconds later, reported being on top of the first cloud layer about 2,500 ft mean sea level (msl).

The flight was released for departure about 0901, and at 0903:48, VAY security video captured the airplane departing from runway 8. ADS-B data captured the airplane beginning at 0903:56 as the airplane climbed through 150 ft msl. The flight proceeded about runway heading while climbing about 105 knots (best rate of climb), then turned left onto a north-northeasterly heading, climbing to about 500 ft msl. The climb stopped about 0904:24, and the airplane descended and began accelerating. About 0904:32, while flying on a north-northeasterly heading, an occupant advised the controller that the flight was, "…through five hundred for two thousand"; ADS-B data depicted the airplane at 465 ft msl at this time.

The flight continued on the north-northeasterly heading until about 0904:56, then turned to the right and proceeded on a northeasterly heading. Although the early portion of the observed ground track was consistent with the departure instructions, the altitude profile was not. At 0905:10, a second climb was initiated, and according to the transcript, at 0905:21, while flying about 1,100 ft msl, the controller asked the pilot what the ceiling base was, and an occupant asked the controller to repeat the question. The controller immediately repeated "say bases," but the occupants did not reply. At 0905:55, the airplane leveled at 1,400 ft msl, contrary to the departure instructions, and about 5 seconds later, the controller asked the pilot to state flight conditions at departure and the reply was "IFR." The airplane at that time

was in a level climb attitude, about 150 knots, in a 10° right bank. During the next 20 seconds, the airplane began a right descending turn with the bank angle increasing to greater than 80°. At 0906:25, at an altitude below 500 ft msl, the controller broadcast the call sign of the airplane. The transmission from the airplane was not clear, but sounded like "copy." There were no further transmissions from the airplane despite repeated attempts by the controller.

At 0906:27, the airplane entered a steep climb to a maximum altitude of 1,700 ft at 0906:35. Its airspeed decelerated during the climb and approached the published wings-level, 1-g stall speed of 84 knots. At that time, the airplane was in a right bank of 30°; the pitch attitude lowered abruptly and the airplane rolled into a 60° left bank, followed by a right bank. The last unvalidated ADS-B data target was located about 300 ft south-southwest of the accident site. At 0907:14, the controller broadcast that radar contact with the accident airplane had been lost.

A witness who was outside about 800 ft south of the accident site heard the airplane coming toward him from the east. He could not see the airplane but recalled the sound to be very loud. The airplane sound circled behind him, and he stated that the sound decreased for about 12 to 15 seconds and returned from the northwest. He stated that his first visual sighting of the airplane was to the north. He recalled the airplane flying away from him with the left wing a few degrees lower than the right wing. He indicated that the airplane was close to the tops of the trees while the engines were making a very loud constant sound. He heard the airplane impact, describing it as a "thud." He then drove to the accident site to render assistance. He indicated that as the airplane flew overhead, he did not see any smoke.

Another witness who was outside with a co-worker about 1,450 ft south of the accident site reported a low cloud ceiling and gentle breeze around the time of the accident. About 0900, she heard an airplane that was flying "exceptionally low." It sounded as if the airplane made one pass over her location, consistent with turning around. She did not see the first pass but could tell the airplane was directly above their position. She looked at her co-worker and then ran to a nearby fence line. As they were heading to the fence, they could see the airplane make a pass over the site and turn toward the northern fence. The airplane turned, flew over the tree line, and came "…down at an awful angle like it was trying to land, but the angle was too steep." She then heard two "thumps," like the airplane hit trees and then crashed into the ground.

Pilot Information

Certificate:	Private	**Age:**	69,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	August 11, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 7, 2017
Flight Time:	2508.1 hours (Total, all aircraft), 25.2 hours (Last 90 days, all aircraft), 8.6 hours (Last 30 days, all aircraft)		

Pilot-rated passenger Information

Certificate:	Private	**Age:**	71,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Glider	**Restraint Used:**	None
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 None	**Last FAA Medical Exam:**	October 7, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	2111 hours (Total, all aircraft)		

The pilot's most recent flight review and instrument proficiency check (IPC) were performed in the accident airplane on October 7, 2017.

Between November 17, 2012, and the last logged flight on June 1, 2018, he recorded about 4.0 hours simulated instrument experience. He recorded three instrument approaches and 1.0 hour of actual instrument flight time in the 6 months before the accident.

Further review of the pilot's logbooks revealed that, prior to his last recorded actual instrument flight on June 1, his previous logged actual instrument flight occurred on November 27, 2017. He logged 1.0 hour in actual instrument conditions in the accident airplane, but he did not log any instrument approaches. His next previous instrument experience occurred the same day as the IPC. He logged 1.0 hour actual instrument flight in the accident airplane, but no instrument approaches.

According to the flight instructor who performed the pilot's last flight review and IPC, the flight duration for the flight review was about 1.8 hours, and the flight duration for the IPC was about 1.7 hours. Both flights, and about 8.0 hours of ground instruction, were conducted through Bonanza/Baron Pilot Training Inc. The instructor also stated that the pilot executed eight instrument approaches and holding procedures, but did not perform "partial panel," or procedures for the loss of primary flight instruments, contrary to IPC guidance published by the Federal Aviation Administration (FAA). The instructor described the pilot as competent.

The pilot's relatives reported that he was in excellent health and exercised daily. They also reported that he was a "by the book" pilot.

According to documents provided by Angel Flight East, since November 19, 2013, the pilot had been assigned 18 flights, of which one was cancelled due to a mechanical reason, and one was canceled due to weather.

Aircraft and Owner/Operator Information

Aircraft Make:	RAYTHEON AIRCRAFT COMPANY	**Registration:**	N218BL
Model/Series:	58 UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	1996	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TH-1780
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	February 3, 2018 Annual	**Certified Max Gross Wt.:**	5500 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	2044.1 Hrs as of last inspection	**Engine Manufacturer:**	Continental Motors, Inc.
ELT:	C91A installed	**Engine Model/Series:**	IO-550-C
Registered Owner:		**Rated Power:**	300 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane was equipped with a Bendix/King KFC-200 three-axis autopilot flight control system. The autopilot system installation included an autopilot annunciator panel. Following the accident, the annunciator panel was sent to the NTSB Materials Laboratory for examination, which revealed that only the bulb filament for HDG (heading) was stretched.

The airplane's static system provided static air for the rate-of-climb indicator, altimeter, and airspeed indicator. Static air was taken from two static ports, one located on each side of the aft fuselage. The installed emergency static air valve was designed to provide a source of emergency static air from the cockpit, and also to drain the static air plumbing, which was required to be drained as part of the preflight inspection. Review of the maintenance records revealed that a transponder test and the altimeter, pitot-static and altitude system reporting system checks were last performed on August 16, 2016.

Further review of the maintenance records revealed that the airplane's most recent annual inspection was completed on February 3, 2018, at an airplane total time of 2,044.1 hours. The engines and propellers were inspected on that same date in accordance with a 100-hour inspection. On that date, both engines and propellers had accrued 392.1 hours and 731.7 hours, respectively, since major overhaul. The last entry in the aircraft maintenance records dated June 1, 2018, reflected the hour meter reading was 2,059.0.

The airplane was equipped with a Garmin GNS-530W GPS unit, which was sent to the NTSB Vehicle Recorder's Laboratory to obtain non-volatile memory. A portion of the unit would not power up; therefore, no data were recovered.

The airplane was fueled on June 12, 2018, at VAY, with 36.0 gallons of 100 low lead fuel. According to the person who fueled the airplane, he filled the fuel tanks to the tabs; this would have resulted in 166 gallons of usable fuel.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	VAY,53 ft msl	**Distance from Accident Site:**	6 Nautical Miles
Observation Time:	09:01 Local	**Direction from Accident Site:**	220°
Lowest Cloud Condition:		**Visibility**	
Lowest Ceiling:	Overcast / 400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/ Unknown
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/ Unknown
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	19°C / 19°C
Precipitation and Obscuration:	Moderate - None - Mist		
Departure Point:	Mount Holly, NJ (VAY)	**Type of Flight Plan Filed:**	IFR
Destination:	Hyannis, MA (HYA)	**Type of Clearance:**	IFR
Departure Time:	09:04 Local	**Type of Airspace:**	

The pilot obtained an Outlook Briefing from ForeFlight.com at 1745 the night before the accident and filed an IFR flight plan at that time. The briefing indicated that no adverse weather advisories were current at the time and that clear skies and visual meteorological conditions (VMC) prevailed from New Jersey through the Hyannis, Massachusetts, area. The Terminal Aerodrome Forecast (TAF) for PNE included in that briefing expected marginal visual flight rules (MVFR) conditions with an overcast cloud ceiling at 1,200 ft above ground level (agl) during the morning. There were no other records of the pilot receiving any updated weather information from ForeFlight before departing on the accident flight.

A search of the FAA contract Automated Flight Service Station (AFSS) provider Leidos indicated no contact from the pilot for any weather briefing data.

The National Weather Service (NWS) northeast section of the Surface Analysis Chart for 0800 on the day of the accident depicted a low-pressure system over Canada associated with an occluded frontal system, with a warm front extending east-southeast from the system across New York into northern New Jersey. The accident site was located south of the warm front and in the warm air sector of the front. The weather depiction chart station models immediately surrounding the accident site depicted IFR conditions due to low ceilings and visibility restricted in fog or mist.

The station models surrounding the accident site depicted light southerly winds of about 5 knots, obscured to overcast clouds with visibility restricted in fog or mist, temperatures in the mid-60°F with dew point temperature spreads of 2°F or less. Multiple stations to the west and northwest of the accident site reported light to moderate rain.

A weather observation from VAY at 0854, about 4 minutes before the airplane contacted clearance delivery, reported calm wind, visibility 2 1/2 miles in mist, overcast ceiling at 500 ft agl, temperature and dew point each 19°C, altimeter 30.00 inches of mercury.

The bases of the clouds were at 378 ft agl, with saturated conditions (100% relative humidity) to 6,000 feet and clouds above 10,000 ft. The precipitable water content was 1.89 inches. A sounding indicated a stable atmosphere that was supportive of nimbostratus type clouds capable of producing drizzle or light rain and fog.

The TAF for WRI issued at 0600 on the accident date, valid until 1200 UTC on June 14th, forecast wind from 200° at 9 knots, with visibility about 5 miles in light rain showers, overcast clouds at 1,500 ft agl, with an altimeter setting of 30.00 inches of mercury.

The only advisory applicable for the accident site at the time of the accident was AIRMET Sierra for IFR conditions AIRMET Sierra update 2, issued 0741, expected ceilings below 1,000 ft and visibility less than 3 statute miles with mist, conditions ending between 0800 and 1100.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	40.026111,-74.755554

The initial impact occurred in a field about 6.5 nautical miles and 040° from the approximate center point of runway 08/26 at VAY. Ground scars and wreckage debris was noted on both sides of an adjacent road.

The initial impact point was identified as a depression with a green-colored glass lens embedded in the ground. A ground scar oriented on a magnetic heading of 055° was continuous from the wingtip for 70 ft. Aerial imagery of the accident site revealed that the estimated right bank angle at impact was about 30°. Based on the known distance between the wingtip and the right engine (13 ft), and the measured distance between the wingtip and right engine ground scar locations (33 ft), the estimated descent angle was calculated to be about 20°.

The outboard portion of the right stabilizer was noted in the ground along the scar. Pieces of battery box and VHF antenna were located along the ground scar. The left propeller, with two attached propeller blades, was partially buried in the ground. Also located along the ground scar were the pitot tube, pieces of carpeting, cabin roof, and pieces of fuel bladder tank with access panel.

The right propeller, with all three blades attached, was located past the end of the ground scar, and a single propeller blade from the left propeller was noted near the three-bladed propeller location. Airplane debris was strewn across the road. Examination of the road following recovery and clean-up revealed no evidence of scrape marks from the airplane.

Fuel blight was noted in the field adjacent to the ground scar and among the leaves of the trees.

The cockpit, cabin, and wings were heavily fragmented; the wing spars of both wings were fractured at each wing root. There was no evidence of preimpact failure or malfunction of any of the structural components. Both engines were separated and both propellers separated from each engine. There was no evidence of pre- or postimpact fire on any of the observed components. All primary flight control surfaces and secondary flight control surfaces for pitch and yaw, and a portion (hinge) for roll remained attached or were recovered. The elevator and aileron primary flight control cables for the cockpit section were not located among the wreckage. Examination of the remaining flight control cables revealed no evidence of preimpact failure or malfunction. Although both flap actuators were separated from their respective flaps, they remained attached to their drive cables. The left and right flap actuators were each in the flaps-retracted position; the landing gear gearbox also depicted the landing gear in the retracted position.

The left static port located at fuselage station (FS) 178 and water level (WL) 100 was clear and the Poly-flo tube remained attached by a clamp at the port. The Poly-flo tube was continuous and clamped to a "T" fitting located at FS 188 and WL 122. All clamps at the left static port, "T" fitting, and on the right pneumatic line were tight. The fuselage in the area of the right static port was deformed. Examination of the right static port located at FS 178 and WL 100 revealed dirt in 1 of the 3 holes. The Poly-flo tube was separated from the port, but the tube still had a clamp around it. The Poly-flo tube was continuous and clamped to a "T" fitting located at FS 188 and WL 122. The "T" fitting located at FS 188 and WL 122 had all three tubes connected by clamps. The single Poly-flo tube going forward was cut about FS 170. No identifiable Poly-flo tube forward of FS 170 was located. The emergency airspeed static source panel and placard were located, but the valve was not located among the recovered debris. Examination of the shroud revealed no obvious impact mark or impression to determine the valve handle position at impact.

The throttle quadrant was separated from the airplane. The left and right throttle levers were loose. The left throttle was full aft and the right throttle was 1/4 forward from the full aft position. The left and right propeller controls were tight and were full forward. The left mixture control was mid-travel and was loose, while the right mixture control was full forward and tight. The elevator trim was 13 units airplane nose-up.

Examination of the secondary flight control actuators revealed the following:

Left Elevator – Extended 1.2 inches; 10° trailing edge tab down (airplane nose up)
Right Elevator – Extended 1.2 inches; 10° trailing edge tab down (airplane nose up)
Rudder – Extended 4.1 inches; about 5° trailing edge tab left (airplane nose right)
Aileron – Extended 1.2 inches; 7° trailing edge tab up (right roll)

The autopilot computer was recovered from the nose compartment. The yaw, pitch, and pitch trim servos all remained secured to structure, and the bridle cables of all were around the capstans, which turned freely. The roll servo capstan was impact damaged. The electrical connections were secured. The components were retained for examination at the manufacturer's facility with FAA oversight.

None of the observed/recovered pieces of windscreen displayed evidence of bird remains.

Examination of the rotor and rotor housing from the pilot's attitude indicator revealed that the rotor

housing was in place and free to move. The rotor housing cap exhibited a 270° circumferential scoring from its adjacent bushing. Very slight scoring was noted on the rotor, while a single score line of complete circumference (consistent with manufacturing) was noted on the interior of the rotor housing. There were no obvious impact impressions on the plate. The rotor bearings rotated freely with no drag noted.

Examination of a separated rotor and rotor housing from an attitude indicator revealed no obvious scoring of the rotor, but slight scoring of the rotor housing.

Examination of both engines revealed no evidence of preimpact failure or malfunction to the power section, lubrication, exhaust, air induction, fuel injection, or ignition systems. The engine-driven vacuum pump of the left engine was separated and was not recovered. The engine-driven vacuum pump for the right engine displayed no evidence of preimpact failure or malfunction.
The left propeller blades were marked A-C. Propeller blade A remained attached to the hub and was twisted toward low pitch at the tip. Propeller blade B also remained attached to hub and displayed leading edge gouging and twisting toward low pitch. Propeller blade C was separated from the hub and its counterweight was separated. The blade exhibited leading edge twisting toward low pitch and displayed deep gouges.

All three blades remained attached to the right propeller hub. The blades were marked 1-3 as identified by their stamped position. Blade 1 was bent aft near the root, twisted toward low pitch, and displayed deep gouges in the leading edge. Blade 2 was bent forward, the counterweight was separated, and the blade was twisted toward low pitch. Blade 3 was also twisted toward low pitch.

Autopilot System Components

Examination and/or operational testing of the autopilot system components was performed at the manufacturer's facility with FAA oversight. According to the report from the manufacturer with a concurring statement from the FAA inspector, impact damage to the flight computer precluded testing as a unit; however, the lateral, pitch, and altitude boards were inserted into an exemplar unit for testing. Although complete testing could not be performed because the automated tester was inoperative, numerous acceptance tests were manually performed and there were no out-of-tolerance conditions detected. The accident adapter board was then installed in an exemplar autopilot computer, which was installed in an engineering harness for functional testing along with the accident servos. All components were functionally tested with minor out-of-tolerance conditions noted for some components.

Additional Information

Instrument Experience

14 *CFR* Part 61.57(c) states that a pilot may not act as pilot-in-command under instrument flight rules or weather conditions less than the minimums prescribed for visual flight rules unless within the 6 calendar months preceding the month of the flight, that person performed and logged at least 6 instrument approaches, holding procedures and tasks, and intercepting and tracking courses through the use of navigational electronic systems. The regulation further indicates that a person who has failed to meet the instrument experience requirements of this section for more than 6 calendar months may reestablish

instrument currency only by completing an instrument proficiency check.

Mission

According to paperwork provided by Angel Flight East, the patient appointment was scheduled for the afternoon of June 14, and comments from the patient entered into the system by the mission coordinator indicated that the flight could take place, "After 12 noon on 6/13 or can fly morning of 6/14."

Static System Errors

According to the FAA Instrument Flying Handbook (FAA-H-8083-15B), a blockage of the static system can affect, in part, the altimeter. Trapped static pressure causes the altimeter to "freeze" at the altitude where the blockage occurred.

ADS-B Information

According to FAA's frequently asked questions about ADS-B, it reports two types of altitudes: barometric and geometric. Barometric, or pressure altitude, is the altitude displayed on the aircraft's altimeter, while geometric altitude is calculated by GPS satellites as the height of the aircraft above the earth ellipsoid. The two altitudes are not the same, but having both allows for applications that require one or the other as an altitude source and provides a means of verifying correct pressure altitude reporting from aircraft.

Review of recorded ADS-B data associated with the accident flight (167 targets), revealed that with the exception of 2 targets at 0906:46.188 and 0906:47.141, the average calculated geometric altitude was about 46 ft less than the reported pressure altitude, with the calculated geometric altitude being no greater than 150 ft less than the reported pressure altitude. According to the NTSB's Aerial Imagery Report, the 2 targets identified above were deemed invalid, and were noted immediately before impact. Further review of the data associated with pressure altitude and geometric altitude revealed changes in the reported values for pressure altitude corresponded to changes in calculated geometric altitude.

Spatial Disorientation

According to the FAA's General Aviation Safety Enhancement Fact Sheet on Spatial Disorientation, pilots flying under both instrument and visual flight rules are subject to spatial disorientation and optical illusions that may cause a loss of aircraft control. Sight, supported by other senses, allows a pilot to maintain orientation while flying. However, when visibility is restricted (i.e., no visual reference to the horizon or surface detected) the body's supporting senses can conflict with what is seen. When this spatial disorientation occurs, sensory conflicts and optical illusions often make it difficult for a pilot to tell which way is up.

Contributing to these phenomena are the various types of sensory stimuli: visual, vestibular (organs of equilibrium located in the inner ear), and proprioceptive (receptors located in the skin, muscles, tendons and joints). Changes in linear acceleration, angular acceleration, and gravity are detected by the vestibular system and the proprioceptive receptors, and then compared in the brain with visual information. In a flight environment, these stimuli can vary in magnitude, direction, and frequency,

resulting in a sensory mismatch that can produce illusions and lead to spatial disorientation.

Medical and Pathological Information

Postmortem examination of the pilot was performed by the Burlington County Medical Examiner's Office, Westampton, New Jersey. The cause of death reported as "multiple injuries."

Forensic toxicology of specimens of the pilot was performed by the FAA Forensic Sciences Laboratory and also by NMS Labs, located in Willow Grove, Pennsylvania.

According to FAA's toxicology report, cyanide testing was not performed, and the results were negative for carbon monoxide, volatiles, and tested drugs. According to the report by NMS Labs, there were no positive findings reported for any drugs tested.

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Stephan A Koza; FAA/FSDO; Philadelphia, PA Henry J Soderlund; Textron Aviation; Wichita, KS Nicole L Charnon; Continental Motors, Inc.; Mobile, AL Bill Gill; Honeywell; Olathe, KS Arno Boyle; FAA/FSDO; Kansas City, MO
Original Publish Date:	May 19, 2020
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97465

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.