Aviation Investigation Final Report

Location:	Farmington, Pennsylvania	**Accident Number:**	ERA16FA064
Date & Time:	December 11, 2015, 14:22 Local	**Registration:**	N72054
Aircraft:	Beech A36	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot and two passengers were departing on a cross-country flight. Witness statements and data from an onboard GPS indicated that, after takeoff, the airplane turned left and entered the downwind leg of the airport traffic pattern for the departure runway. The airplane climbed to a maximum altitude about 500 ft above ground level (agl), then entered a gradual descent as it continued downwind and entered a left base leg. Witnesses noted that the landing gear was extended. The final data points from the GPS indicated that the airplane was conducting a tight turn from the base to final legs of the traffic pattern at a low airspeed and an altitude about 200 ft agl. The airplane crashed in a heavily wooded area near a golf course. It is likely that, during the final turn, the airplane exceeded its critical angle of attack and experienced an aerodynamic stall. A passenger, who was severely burned but able to egress the airplane following the accident, advised first responders that the cabin door had opened just after takeoff.

Examination of the wreckage revealed no evidence of any mechanical malfunction of the airplane or engine prior to the accident. The forward cabin door's upper latching mechanism (hook) was not fully extended; the slot in the upper fuselage frame, which the hook engaged when the door was closed, showed no evidence of tear-outs; and the door handle mechanism was not fully in the locked position. These findings are consistent with the cabin door being open at the time of impact.

The airplane's pilot's operating handbook (POH) advised that the forward cabin door could unlatch in flight if not properly secured; this could occur during or just after takeoff. Although the door would open about 3 inches, the flight characteristics of the airplane would not be affected, with the exception of a reduced rate of climb. The POH advised that, if the door opened in flight, the pilot should "return to the field in a normal manner."

Twenty-two years before the accident flight, the airplane manufacturer published a mandatory service bulletin after receiving reports of the lower aft latch pin on the cabin door retracting in flight due to misrigging and/or vibration. When the latch pin retracted, it would force the entire door latching mechanism to reverse, allowing the door to open. This service bulletin, which had not been

accomplished on the accident airplane, would have modified the forward cabin door to reduce the possibility of a cabin door opening in flight.

Toxicological testing on specimens from the pilot identified amphetamine at 0.310 ug/ml and 0.347 ug/ml in blood and 1.828 ug/ml in urine. This is well above any therapeutic range, which is less than 0.20 ug/ml. Generally, levels above 0.20 are the result of misusing amphetamine to maximize its psychoactive effects. In addition, phenylpropanolamine was detected in the pilot's urine, which suggests that he obtained the drug from non-pharmaceutical sources. An autopsy identified thickening of the heart walls and minimal coronary artery disease; however, this was unlikely to have caused acute symptoms. The thickening of the heart walls was likely caused by the increased workload related to repeated episodes of increased heart rate and blood pressure resulting from amphetamine use. It is possible that these two conditions (thickened heart and significant levels of amphetamine) combined to cause a sudden arrhythmia (a specific risk with amphetamine) which could have caused palpitations or fainting, resulting in the pilot's loss of control of the airplane. Such an event would not have left evidence that could be identified on autopsy.

It could not be determined whether the pilot was experiencing the euphoria of early phase response to amphetamine or the dysphoria of coming down from its effects. In either case, the effects are significantly impairing and affect the ability to concentrate, make safe decisions, and perform.

Regardless of the reason the door opened in flight, the airplane should have remained airworthy and controllable. Although the pilot was attempting to return to land as prescribed by the POH following a door opening event, he did not safely manage the airplane's airspeed and angle of attack and lost control of the airplane. The investigation could not determine whether the pilot's impaired judgement or an acute arrhythmia caused by his misuse of amphetamine led to his inability to safely land the airplane; however, in either case, the pilot's misuse of amphetamine contributed to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain control of the airplane after a cabin door came open in flight, which resulted in the airplane exceeding its critical angle of attack and experiencing an aerodynamic stall. Contributing to the accident was the pilot's misuse of amphetamine.

Findings

Aircraft	(general) - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	Illicit drug - Pilot
Aircraft	Passenger/crew doors - Not specified
Personnel issues	Decision making/judgment - Pilot

Factual Information

History of Flight

Prior to flight	Miscellaneous/other
Initial climb	Miscellaneous/other
Approach-VFR pattern base	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

HISTORY OF FLIGHT

On December 11, 2015, about 1422 eastern standard time, a Beech A36, N72054, was destroyed when it impacted trees and terrain shortly after takeoff from Nemacolin Airport (PA88), Farmington, Pennsylvania. The private pilot and two passengers were fatally injured. The airplane was privately owned and operated under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the personal flight, which was destined for Montgomery County Airport (GAI), Gaithersburg, Maryland.

PA88 was located on the property of the Nemacolin Woodland Resort. A witness who was staying at the resort, who viewed the airplane from his hotel room which was located on the northwest side of the runway reported that, after takeoff from runway 23, the airplane's landing gear retracted, and the airplane appeared to be departing the area; however, the airplane continued to turn as if entering the downwind leg of the traffic pattern. The landing gear extended, and the airplane began to descend. The airplane continued to descend in a turn consistent with a left base for runway 23; the witness then lost sight of the airplane behind terrain. Shortly after, he observed smoke. Another witness who was standing about 2,500 ft southeast of the runway saw the airplane pass overhead with the landing gear down. He stated that the airplane was "pretty low" and that the engine sounded normal. He saw the airplane bank to the left, and then he lost sight of it behind buildings; he then heard an impact and saw flames and smoke.

An onboard GPS recorded data for the accident flight. The recording began at 1415:57 near the airport parking area. The airplane subsequently taxied to the end of runway 23 for takeoff. Recorded GPS altitude at this time was about 1,975 ft. The takeoff roll began at 1420:18. At 1421:00, at a GPS altitude of 2,184 ft and about 2,500 ft from the departure end of the runway, the airplane began a left, climbing turn. The turn continued, and the airplane reached a maximum recorded altitude of 2,457 ft at 1421:36. At this time, its position was consistent with a left downwind for runway 23. The airplane descended as it continued the downwind leg, then began a left turn about 1422. Shortly thereafter, the airplane descended through 2,150 ft at 69 knots groundspeed. The last recorded data point was at 1422:22.

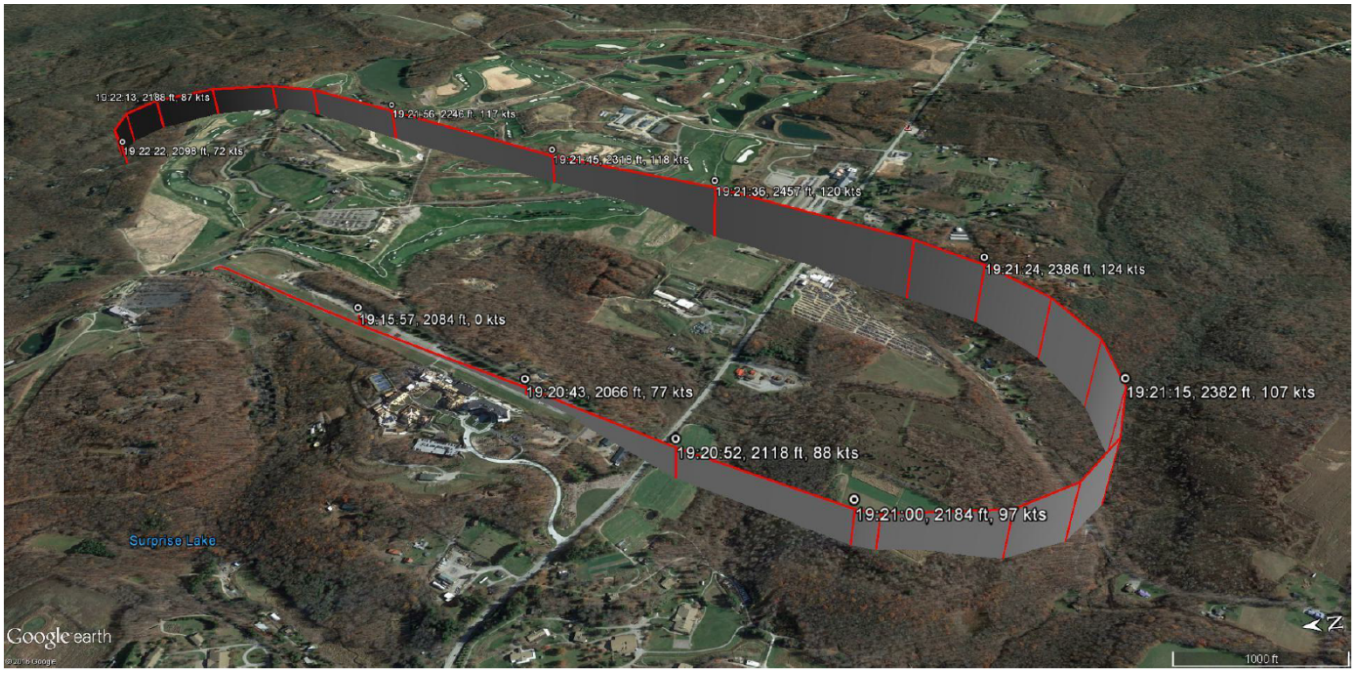

Figure 1. Plotted GPS Data – Complete Accident Flight.

Figure 2. Plotted GPS Data – End of Accident Flight.

About 1423, landscaping personnel called the resort's security dispatch and reported the accident. Security personnel arrived to find the airplane fully engulfed in flames and one passenger laying outside of the airplane on the golf course.

The passenger, who was severely burned during the accident, had egressed from the airplane by himself and was pulled from the accident site by resort guests. He advised first responders that his father (who was flying the airplane) and his friend were onboard the airplane. He remembered taking off from the

runway, the door opening and feeling wind, and then being surrounded by flames. He was transported to a burn center and succumbed to his injuries about 2 days later.

PERSONNEL INFORMATION

According to Federal Aviation Administration (FAA), and pilot records, the pilot held a private pilot certificate with ratings for airplane single-engine land and instrument airplane, and a commercial pilot certificate with ratings for helicopter and instrument helicopter. His most recent application for an FAA third-class medical certificate was dated February 22, 2014. The pilot had accrued about 3,261 total hours of flight experience, of which 2,663 hours were in the accident airplane make and model.

AIRCRAFT INFORMATION

According to FAA airworthiness records and airplane maintenance records, the airplane was manufactured in 1984. The airplane's most recent annual inspection was completed on November 11, 2015. At the time of the inspection, the airplane had accrued about 4,448.5 total hours of operation, and the engine had accrued about 1,158.8 total hours of operation since major overhaul.

METEOROLOGICAL INFORMATION

The 1435 reported weather at Garrett County Airport (2G4), Oakland, Maryland, located 17 nautical miles southeast of the accident site, included wind from 250° at 11 knots gusting to 19 knots, 10 miles visibility, broken clouds at 1,300 ft, temperature 11°C, dew point 8°C, and an altimeter setting of 29.95 inches of mercury.

AIRPORT INFORMATION

PA88 was located about 1 mile east of Farmington, Pennsylvania. It was classified by the FAA as a privately owned, private-use airport. The airport elevation was 2,010 ft above mean sea level and the asphalt runway was configured in a 5/23 orientation. The runway measured 3,980 ft long by 49 ft wide. The runway 23 threshold was displaced 935 ft due to trees off the approach end of the runway. The runway was equipped with medium intensity runway edge lights, and a precision approach path indicator system which, at the time of the accident, was disabled.

FLIGHT RECORDERS

The accident airplane was equipped with a handheld Garmin GPSMAP 39x/49x series GPS.

The unit had suffered extreme thermal damage, but an internal examination revealed the non-volatile memory chip was intact, and data from the accident flight was extracted.

WRECKAGE AND IMPACT INFORMATIOJN

The airplane came to rest in a heavily wooded area located next to a golf course.

Examination of the accident site revealed that the airplane had broken apart after striking trees in a left-wing-down, nose-low attitude. During the impact sequence, the main cabin portion of the airplane traveled about 152 ft before impacting the forest floor and coming to rest, facing the opposite direction

of travel, with the aft fuselage and empennage lying behind it in an inverted position. The engine, left outboard wing, right wing flap, right main landing gear, and engine cowlings were all separated from their mounting positions and were strewn throughout the accident site. Further examination also revealed the presence of propeller strikes on broken tree branches and tree trunks that littered the ground, along with areas of burned underbrush and fire-damaged trees.

Examination of the wreckage revealed that the landing gear was in the down position, and all major portions of the airplane's structure were present at the accident site. No evidence of any preimpact failure of the airplane structure was discovered.

Examination of the flight control system revealed no evidence of any preimpact failure or malfunction, and flight control continuity was established from the flight control surfaces to the rudder pedals and control wheels through breaks in the system consistent with overstress failure.

Examination of the fuel system revealed that all four fuel caps were closed and locked, and the fuel selector valve was in the left main tank position.

Examination of the propeller and engine also revealed no evidence of any preimpact failure or malfunction that would have precluded normal operation. The propeller remained attached to the propeller flange and exhibited a circumferential fracture just aft of the propeller flange. All three blades exhibited S-bending, twisting, and chordwise scratching. Oil was present in the rocker boxes and oil sump, and the oil filter was absent of debris. Crankshaft and valve train continuity was confirmed, and compression and suction were observed on all six cylinders.

Examination of the interior of the cylinders with a lighted borescope did not reveal evidence of any preimpact damage to the piston domes, cylinder walls, or valves. Both magnetos were functional and produced spark at all towers.

Examination of the remains of the utility doors, which were located on the aft right side of the fuselage, and the forward cabin door, which was located on the forward right side of the fuselage, revealed that most of the door structures had been burned away. Further examination revealed that the locking mechanisms were present and did not show any evidence of malfunction or failure.

Examination of the forward cabin door revealed that the upper latching mechanism (hook) was not fully extended, and the slot in the upper fuselage frame that the hook engaged when the door was closed showed no evidence of tear-outs. Further examination also revealed that the door handle mechanism was not fully in the locked position; the lower aft latch pin, which rode in a guide inside the lower aft portion of the forward cabin door and engaged a receptacle in the lower door sill, was missing.

MEDICAL AND PATHOLOGICAL INFORMATION

According to FAA airman medical records, during his last medical examination, the pilot reported that he had no chronic medical conditions and was on no medications.

According to the report of the autopsy performed by Cyril H. Wecht and Pathology Associates, Inc., Pittsburgh, Pennsylvania, the cause of death was multiple blunt force injuries and the manner of death was accident. The autopsy identified minimal coronary artery disease with about 10-15% stenosis. The heart weight was not provided, but the right ventricular wall was described as 0.4-cm thick, the left

ventricular wall as 1.5-cm thick, and the septum as 1.3-cm thick. Average for these thicknesses is 0.3 cm, 1.23 cm, and 1.23 cm, respectively. The remainder of the examination was unremarkable.

Toxicology testing performed at the request of the medical examiner by NMS Labs identified caffeine and 0.310 ug/ml of amphetamine in the pilot's blood.

Toxicology testing performed by the FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, identified amphetamine at 0.347 ug/ml in blood and 1.828 ug/ml in urine, as well as phenylpropanolamine in urine, but not in blood.

Amphetamine is a Schedule-II controlled substance that stimulates the central nervous system. It is available by prescription for the treatment of attention deficit disorder and narcolepsy. It carries a boxed warning about its potential for abuse and has warnings about an increased risk of sudden death and the potential for mental health and behavioral changes. Commonly marketed names include Adderall, Dexedrine, and Vyvanse. After a single 30 mg oral dose, early blood levels averaged 0.111 ug/ml and average blood levels in adults using the long acting prescription orally for a week were about 0.065 ug/ml. Generally, levels above 0.2 are the result of misusing amphetamine to maximize its psychoactive effects.

Amphetamine is also prepared and used as a street drug, often by snorting, inhaling, or injecting. Street preparations may begin with phenylpropanolamine, which may then contaminate the final product.

In the early phase, amphetamine misusers may experience a combination of euphoria, excitation, exhilaration, rapid flight of ideas, increased libido, rapid speech, motor restlessness, hallucinations, delusions, psychosis, insomnia, reduced fatigue or drowsiness, increased alertness, a heightened sense of well-being, stereotypes behavior, feelings of increased physical strength, and poor impulse control. Heart rate, blood pressure, and respiratory rate increase, and they may have palpitations, dry mouth, abdominal cramps, twitching, dilated pupils, faster reaction times, and increased strength. As the initial effects wear off, users commonly experience dysphoria, restlessness, agitation, and nervousness; they may experience paranoia, violence, aggression, a lack of coordination, delusions, psychosis, and drug craving.

Phenylpropanolamine is a sympathomimetic also in the amphetamine class that was once available in over-the-counter preparations for treating colds. However, it also increases heart rate and blood pressure, and its availability in the United States was discontinued in 2000. It remains available as a veterinary medicine.

ADDITIONAL INFORMATION

Materials Laboratory Examination

On May 4, 2016, the latching mechanism for the door of the airplane was examined in the NTSB Materials Laboratory. Deposits were observed on the external surfaces of the latching mechanism that were consistent with soot and other combustion products. Using a 5x to 50x stereo-zoom microscope, the fracture surfaces were examined. The fracture surface features were consistent with overstress related to incipient melting.

Pilot's Operating Handbook - Forward Cabin Door

The airplane's pilot's operating handbook (POH) stated that, when closed, the spring-loaded outside cabin door handle would fit into a recess to create a flat, aerodynamically clean surface. It could be locked from the outside with a key to secure the airplane.

The door could be opened from the outside by lifting the handle out of the recess and pulling until the door opened.

When closing the door from the inside of the airplane, the door handle was moved to the open position. In this position, the latch handle would be free to move about 1 inch in either direction before engagement of the locking mechanism. The door could then be grasped and firmly pulled closed, and the handle could then be fully rotated counterclockwise into the locked position. When the door was properly locked, the door latch handle would be free to move about 1 inch in either direction.

The POH noted that, when checking the door latch handle, "do not move it far enough to engage the doorlatch release mechanism." The POH also advised to press firmly at the top rear corner of the door and that, if any movement of the door was detected, to completely open the door, and close it again by following the instructions.

When exiting the airplane, the door could be opened from the inside by depressing the lock button, and rotating the handle clockwise.

The "BEFORE TAKEOFF" checklist contained in the POH included the item, "Doors and Windows – SECURE."

According to the POH, if the cabin door was not properly latched, it could unlatch in flight. This could occur during or just after takeoff. The door would trail open approximately 3 inches and result in a reduced rate of climb, but the flight characteristics of the airplane would otherwise not be affected. The procedure for an unlatched door in flight was to "Return to the field in a normal manner."

Beechcraft Mandatory Service Bulletin

In 1993, Beechcraft had received reports of the third latch pin (lower aft latch pin) on the cabin door retracting in flight due to misrigging and/or vibration. When the latch pin retracted, it would force the entire door latching mechanism to reverse, allowing the cabin door to open.

As a result, in September 1993, Beechcraft released Mandatory Service Bulletin No. 2457, which required that Kit 36-4007 be installed to modify the cabin door by adding a third latch pin overcenter mechanism, modify the bellcrank assembly for the third latch pin, and replace the original third latch pin guide assembly with a redesigned one to reduce the possibility of a cabin door opening in flight.

Comparison of the accident airplane's internal door locking mechanism to an exemplar internal door locking mechanism revealed that the door had not been modified in accordance with the mandatory service bulletin. Review of the airplane maintenance records also did not indicate that the mandatory service bulletin had been accomplished.

The pilot's spouse advised that they had the "door light" come on a few times before the accident, and that the door was hard to latch.

Review of the POH indicated that the annunciator panel in the airplane contained three annunciators placarded "LOW BUS VOLTS", "START", and "AFT DOOR." No indication of an annunciator being mounted in the panel for the forward cabin door was discovered.

Air Speed Information

Review of the GPS data showed that the airplane's groundspeed dropped to 69 knots prior to its rapid descent. Calculations using the wind vector solutions function of an E6-B flight computer indicated that the true airspeed of the airplane at that point, would have been about 79 knots, which was below the published stall speed in the Beechcraft Bonanza Pilot's Operating Handbook (POH) for banked turns in excess of about 45°.

Pilot Information

Certificate:	Commercial; Private	**Age:**	68,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	February 22, 2014
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 1, 2014
Flight Time:	3261 hours (Total, all aircraft), 2663 hours (Total, this make and model)		

Passenger Information

Certificate:		**Age:**	Male
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:		**Age:**	Male
Airplane Rating(s):		**Seat Occupied:**	Rear
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N72054
Model/Series:	A36 UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	1984	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	E-2181
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	November 11, 2015 Annual	**Certified Max Gross Wt.:**	3651 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	4448.5 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	C91 installed, not activated	**Engine Model/Series:**	IO-550-B78
Registered Owner:	On file	**Rated Power:**	300 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	2G4,2933 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	14:25 Local	**Direction from Accident Site:**	135°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 1300 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots / 19 knots	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	11°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Farmington, PA (PA88)	**Type of Flight Plan Filed:**	IFR
Destination:	GAITHERSBURG, MD (GAI)	**Type of Clearance:**	
Departure Time:	14:20 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Nemacolin Airport PA88	**Runway Surface Type:**	Asphalt
Airport Elevation:	2010 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	23	**IFR Approach:**	None
Runway Length/Width:	3980 ft / 49 ft	**VFR Approach/Landing:**	Precautionary landing;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	2 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	39.813888,-79.535278

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	James Olsen; FAA/FSDO; Pittsburgh, PA Brian Weber; Textron Aviation; Wichita , KS Nicole Charnon; Continental Motors; Mobile, AL
Original Publish Date:	January 9, 2018
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=92429