Aviation Investigation Final Report

Location:	Palos Hills, Illinois	**Accident Number:**	CEN15FA009
Date & Time:	October 12, 2014, 22:40 Local	**Registration:**	N31EW
Aircraft:	RAYTHEON AIRCRAFT COMPANY 58	**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 departed in the multiengine airplane from a controlled airport under night, marginal visual flight rules conditions for a personal flight. Radar data showed the airplane climb to about 2,200 ft mean sea level (msl). At this altitude and when the airplane was about 3 nautical miles (nm) from the airport, it began a descending left turn, followed by a right turn, losing about 700 ft of altitude during this time. The airplane then began a climbing left turn. The left turn continued while its radius decreased until the end of the recorded data. During the final left turn, the airplane initially climbed about 400 ft, descended about 400 ft, and then climbed again about 1,300 ft before reaching its peak altitude of 2,800 ft msl. The final recorded radar point was 0.1 nm from the accident site, and the calculated descent rate between the final two radar points was more than 5,000 ft per minute. Postaccident examinations of the airframe, engines, and propellers, revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation. The airplane's avionics and instruments could not be functionally tested due to the extent of the impact damage.

The recorded weather conditions at the destination airport, located about 6 miles from the accident site, at the time of the accident included a broken ceiling at 1,000 ft above ground level (agl), an overcast ceiling at 1,700 ft agl, and visibility of 6 miles with mist. The radar data indicated that the airplane penetrated the cloud layers during the accident flight. The pilot held the appropriate certificates and ratings for operation of the multiengine airplane in instrument conditions, but no clearance had been issued for operation in instrument meteorological conditions. The weather and light conditions at the time of the accident were conducive to the development of spatial disorientation. Further, the flightpath, which was not consistent with the intended course; the airplane's repeated climbs and descents; and the loss of airplane control and high-speed impact were consistent with the known effects of spatial disorientation. Based on this evidence, it is likely that the pilot experienced spatial disorientation after the airplane entered the clouds at night, which led to his failure to maintain airplane control.

Probable Cause and Findings

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

The pilot's loss of airplane control due to spatial disorientation while operating in night, instrument meteorological conditions.

Findings

Personnel issues	Spatial disorientation - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Not attained/maintained
Environmental issues	(general) - Effect on personnel

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 October 12, 2014, about 2240 central daylight time, a Beechcraft model 58 airplane, N31EW, was destroyed when it impacted trees and terrain in Palos Hills, Illinois. The private rated pilot and two passengers sustained fatal injuries. The airplane was registered to ARC Aviation LLC and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Marginal night visual meteorological conditions prevailed for the flight, which was not on a flight plan. The flight originated about 2235 from the Midway International Airport (MDW), Chicago, Illinois, and was en route to the Lawrence Municipal Airport, Lawrence, Kansas.

Radar track data showed that the airplane departed runway 22L at MDW and began climbing on runway heading (220 degrees). At 2238:01, the airplane had accelerated to a computed groundspeed of about 130 knots and climbed to an altitude of about 2,200 ft above mean sea level (msl). After reaching this altitude, when the airplane was about 3 nautical miles (nm) from MDW, the airplane then began accelerating and descending as it turned about 20 degrees to the left to a heading of 200 degrees, which was followed immediately by a turn to the right. By 2238:38, when the airplane was about 4.8 nm from MDW, the airplane had descended about 700 ft to an altitude of 1,500 ft msl. The airplane then began climbing. As the climb was initiated, a left turn was also initiated. The left turn continued while the radius of the turn decreased until the end of the radar data. During the final left turn, the airplane initially climbed about 400 ft, descended about 400 ft, and then climbed again about 1,300 ft before reaching a peak altitude of 2,800 ft msl at 2239:24. At this time the airplane was about 5.9 nm from MDW and about 0.1 nm from the accident site. The final radar data point was at 2239:29 at a recorded altitude of 2,400 ft. The final radar data point was located within 0.1 miles of the accident site, and about 6 nm southwest of MDW. The calculated rate of descent between the final two radar points exceeded 5,000 ft per minute.

Pilot Information

Certificate:	Private	**Age:**	34,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	January 31, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	February 3, 2014
Flight Time:	417.6 hours (Total, all aircraft), 114.4 hours (Total, this make and model)		

The pilot, age 33, held a private pilot certificate with single-engine land, multiengine land, and instrument airplane ratings. He also held a third class airman medical certificate that was issued on January 31, 2012. The medical certificate listed no limitations.

Pilot logbook information recovered during the investigation revealed that the pilot received his multiengine rating on February 2, 2014. The records indicated that the pilot had accumulated 417.6 hours of total flight experience, including 114.4 hours of multiengine experience. Review of the records indicated that the multiengine experience included 11.5 hours of training, 7.9 hours of simulated instrument experience, 21.1 hours of actual instrument experience, and 25 hours of night flight experience.

Aircraft and Owner/Operator Information

Aircraft Make:	RAYTHEON AIRCRAFT COMPANY	**Registration:**	N31EW
Model/Series:	58 UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	2000	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TH-1939
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	May 12, 2014 Annual	**Certified Max Gross Wt.:**	5503 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	1778.2 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550-C
Registered Owner:	On file	**Rated Power:**	300 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The accident airplane was a Beechcraft model 58 airplane, serial number TH-1939. It was a six-seat twin-engine monoplane with a retractable tricycle landing gear configuration. The airplane was powered by two 300 horsepower Continental IO-550-C six cylinder, reciprocating engines.

According to maintenance records, the most recent annual inspection was performed on May 12, 2014 and both engines had been overhauled during the annual inspection. At the time of the annual inspection the airframe had accumulated 1778.2 hours total time in service. The most recent maintenance action was performed on October 8, 2014, and the airplane had accumulated 1869.1 hours total time in service as of that date.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	MDW,620 ft msl	**Distance from Accident Site:**	6 Nautical Miles
Observation Time:	03:38 Local	**Direction from Accident Site:**	40°
Lowest Cloud Condition:		**Visibility**	6 miles
Lowest Ceiling:	Broken / 1000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.88 inches Hg	**Temperature/Dew Point:**	15°C / 13°C
Precipitation and Obscuration:	Moderate - None - Mist		
Departure Point:	Chicago, IL (MDW)	**Type of Flight Plan Filed:**	IFR
Destination:	Lawrence, KS (LWC)	**Type of Clearance:**	VFR
Departure Time:	22:35 Local	**Type of Airspace:**	Class C

Weather conditions recorded by the MDW Automated Surface Observing System (ASOS), located about 6 miles northeast of the accident site, at 2153, were: wind from 160 degrees at 9 knots gusting to 17 knots, visibility 10 miles, overcast clouds at 1,700 ft above ground level (agl), temperature 16 degrees Celsius, dew point 12 degrees Celsius, and altimeter 29.89 inches of mercury.

At 2238, the MDW weather was: wind from 170 degrees at 9 knots, visibility 6 miles with mist, broken clouds at 1,000 ft agl, overcast clouds at 1,700 ft agl, temperature 15 degrees Celsius, dew point 13 degrees Celsius, and altimeter 29.89 inches of mercury.

The Aeronautical Information Manual defines marginal VFR weather conditions as ceilings from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles inclusive.

Airport Information

Airport:	CHICAGO MIDWAY INTL MDW	**Runway Surface Type:**	Asphalt;Concrete
Airport Elevation:	619 ft msl	**Runway Surface Condition:**	
Runway Used:	22L	**IFR Approach:**	None
Runway Length/Width:	6445 ft / 150 ft	**VFR Approach/Landing:**	None

The Midway International Airport, located in Chicago, Illinois, had five runways and an operating control tower. Three of the runways, 31L/13R, 31C/13C, 31R/13L, were oriented in a northwest/southeast direction. The remaining two runways, 4L/22R, 4R/22L, were oriented in a northeast/southwest direction. The accident airplane used runway 22L which was a 6,445 ft long hard surfaced runway.

The airport had multiple radio frequencies in use at the time of the accident. During the final portion of the flight, the MDW tower was in communication with the accident airplane. The airport elevation was 620 ft msl.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	2 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	41.707221,-87.83361

The airplane impacted trees and terrain in a residential area 6 nm southwest of MDW. Several tree branches exhibited clean cuts consistent with propeller impact and engine power production. Some of the cut branches were about 4 inches in diameter. The initial impact point was about 20 ft north of a house on the neighboring lot. The house and a sport utility vehicle parked in the driveway sustained damage from flying debris. The entire airplane was crushed and fragmented. All of the major airframe pieces were contained within the wreckage distribution path that extended to the southeast, across the street and into the front yards of the houses on the opposite side of the street. Most of the wreckage was located at the initial impact point with smaller pieces of debris scattered along the wreckage path. The proximity of the initial impact point with the surrounding trees was consistent with a near vertical impact. The entire fuselage was crushed and almost unrecognizable. The right engine propeller was about 1 ft below ground level and the engine crankshaft had fractured at the propeller hub. The engine was lying on the ground. The left engine was buried in the ground and the propeller was about 2 to 2-1/2 ft below ground level. The propeller was still attached to the engine. A cage for an air operated gyroscopic instrument was found among the wreckage debris. The circular bore of the cage contained rotational scoring that was consistent with operation at the time of impact. The wreckage was recovered and relocated to a storage facility for further examination.

A partial layout of the main airframe pieces was accomplished. All of the major airframe parts and flight

controls were confirmed to be present during the layout. The main landing gear was retracted in the wheel wells. The vertical stabilizer remained attached to the aft fuselage. The rudder had separated with the mid and upper hinges and the rudder trim tab remained attached to the rudder. The rudder balance weight had separated. The right horizontal stabilizer remained attached to aft fuselage with the right elevator still attached. The right elevator trim tab remained attached and the right elevator balance weight remained partially attached. The right elevator torque arm remained attached with the control rod still attached. The left horizontal stabilizer remained partially attached to the aft fuselage. The outboard horizontal stabilizer had separated. The left elevator had separated and was torn into two main pieces. The left elevator trim tab remained attached and the left elevator balance weight had separated. The left elevator torque arm remained attached with the aft portion of the control rod still attached. The right wing had fragmented in multiple locations and the right flap had separated into two main pieces which remained attached. The right aileron had fragmented and a portion remained attached to the wing. The right wing tip had separated and was impact damaged with the fuel cap still attached. The left wing was impact damaged with the left outer wing and tip separated at mid aileron. The left inboard aileron remained attached with the aileron trim tab still attached. The cockpit exhibited substantial crushing damage.

The airplane's flight control cable system was examined and control cable continuity was verified from all control surfaces to the cabin area of the airplane. Due to the amount of damage to the cockpit, verification of yoke and rudder pedal continuity was not possible. All of the identified breaks in the airplane control system were consistent with impact damage or recovery efforts.

The left engine was impact damaged with one magneto separated. The propeller hub remained attached and all three propeller blades had separated near the blade roots. One blade tip had separated. The right engine was impact damaged and the right propeller had separated with the propeller flange. One propeller blade separated and was not observed. The on-scene engine examination consisted of removal of cowling and airframe components to enable shipping for further examination at the manufacturer's facility, and a borescope examination of the cylinders. The borescope examination did not reveal any anomalies.

Functional testing of the airplane's flight instruments, avionics, and autopilot system was not possible due to the extent of the damage incurred during the impact.

During a subsequent examination, the left propeller was disassembled and no evidence of preimpact malfunction or failure was detected. It was not possible to determine the impact blade angle from impact witness marks. The right propeller was not disassembled. The propeller assembly contained a large high compression spring and the mechanism for safe removal of the spring was damaged, preventing safe disassembly. No external evidence of preimpact malfunction or failure was detected.

A teardown examination of both engines was conducted at the manufacturer's facility under the direct supervision of the National Transportation Safety Board Investigator-In-Charge.

The right engine was heavily damaged from impact forces. The engine crankcase was fractured and the propeller flange was separated from the front of the crankshaft. The internal examination of the engine revealed no abnormal operational signatures. The magnetos, fuel system components, vacuum pump, oil cooler, oil pump were examined and exhibited impact damage. No abnormal operating signatures were noted. No preimpact anomalies were detected that would have prevented normal engine operation.

The left engine exhibited impact damage concentrated on the front lower half of the crankcase. The crankcase was fractured in the nose section. The crankshaft flange was impact damaged and remained attached to the crankshaft. The forward cylinders, Nos. 5 and 6, were impact damaged. The remaining cylinders exhibited varying degrees of impact damage and exhibited normal operating signatures. The internal examination of the engine revealed no abnormal operational signatures. The magnetos, fuel system components, vacuum pump, oil cooler, oil pump were examined and exhibited impact damage. No abnormal operating signatures were noted. No preimpact anomalies were detected that would have prevented normal engine operation.

Postaccident examinations of the airframe, control system, engines, and propellers did not reveal any anomalies consistent with a preimpact failure or malfunction.

Communications

At 2228, the pilot contacted MDW controllers to obtain an instrument flight rules (IFR) clearance. The controller was not able to access the flight plan information and requested that the pilot provide him the information by radio transmission. The pilot queried the controller asking if it would be easier to take off under visual flight rules (VFR). The controller informed the pilot that if departing under VFR, he would only need the aircraft type information and the desired direction of flight. The pilot elected to provide the information and received a VFR clearance to depart MDW. Controllers then issued taxi instructions to the pilot.

At 2234:35, the pilot contacted the MDW control tower and stated that he was holding short of runway 22L and requested a VFR departure. At 2234:44, the tower controller issued the current wind condition and cleared the airplane for takeoff. Over the next 4 minutes there were several routine communications between the accident pilot and the MDW tower controller. During these communications, the pilot did not inform the controller of any airplane difficulties. At 2240:21, the tower controller attempted to call the accident airplane due to a loss of radar contact but there was no response. Several more attempts were made but no further communications were received from the accident airplane.

During communications between the pilot and controllers, no clearance for flight in instrument conditions was authorized.

Medical and Pathological Information

An autopsy of the pilot was performed by the Cook County Coroner's Office, Chicago, Illinois, on October 14, 2014. The pilot's death was attributed to injuries received in the accident.

Toxicology testing was performed by the FAA Civil Aerospace Medical Institute. Testing results indicated 17 (mg/dL, mg/hg) Ethanol detected in Kidney. All remaining tests were negative for substances in the screening profile.

Tests and Research

Fueling records indicated that the accident airplane had been serviced with 20 gallons of 100LL aviation gasoline. A sample of fuel from the truck used to service the airplane was obtained and laboratory testing was performed. The results of the testing confirmed that the water content, particulate content and existent gum content were within acceptable limits for 100LL fuel. The boiling range of the fuel indicated that the sample was moderately weathered but not sufficiently to suggest significant contamination.

The airplane was equipped with a Honeywell Enhanced Ground Proximity Warning System (EGPWS) that was capable of recording several flight parameters. The unit was recovered from the wreckage and sent to the NTSB Recorders Laboratory for evaluation. Upon evaluation of the unit it was discovered that the electronic chip that was used to store recorded data had received impact damage and no data could be retrieved.

Preventing Similar Accidents

Reduced Visual References Require Vigilance (SA-020)

The Problem

About two-thirds of general aviation accidents that occur in reduced visibility weather conditions are fatal. The accidents can involve pilot spatial disorientation or controlled flight into terrain. Even in visual weather conditions, flights at night over areas with limited ground lighting (which provides few visual ground references) can be challenging.

What can you do?

- Obtain an official preflight weather briefing, and use all appropriate sources of weather information to make timely in-flight decisions. Other weather sources and in-cockpit weather equipment can supplement official information.
- Refuse to allow external pressures, such as the desire to save time or money or the fear of disappointing passengers, to influence you to attempt or continue a flight in conditions in which you are not comfortable.
- Be honest with yourself about your skill limitations. Plan ahead with cancellation or diversion alternatives. Brief passengers about the alternatives before the flight.
- Seek training to ensure that you are proficient and fully understand the features and limitations of the equipment in your aircraft, particularly how to use all features of the avionics, autopilot systems, and weather information resources.
- Don't allow a situation to become dangerous before deciding to act. Be honest with air traffic controllers about your situation, and explain it to them if you need help.
- Remember that, when flying at night, even visual weather conditions can be challenging. Remote areas with limited ground lighting provide limited visual references cues for pilots, which can be disorienting or render rising terrain visually imperceptible. When planning a night VFR flight, use topographic references to familiarize yourself with surrounding terrain. Consider following instrument procedures if you are instrument rated or avoiding areas with limited ground lighting (such as remote or mountainous areas) if you are not.
- Manage distractions: Many accidents result when a pilot is distracted momentarily from the primary task of flying.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-020.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Brannen, John
Additional Participating Persons:	Mike Machnik; FAA - West Chicago FSDO; West Chicago, IL Mike Gibbons; Textron Aviation; Wichita, KS Chris Lang; Continental Motors; Mobile, AL
Original Publish Date:	May 2, 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=90252