National Transportation Safety Board
Aviation Accident Final Report

Location:	Tyrone, Pennsylvania	**Accident Number:**	ERA19FA161
Date & Time:	May 1, 2019, 12:51 Local	**Registration:**	N733KZ
Aircraft:	Cessna 172	**Aircraft Damage:**	Substantial
Defining Event:	VFR encounter with IMC	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

This report was modified on [month/date/year]. Please see the public docket for this investigation to view the original report.

The pilot was conducting a personal, cross-country flight with one passenger onboard. The pilot received a formal preflight weather briefing, which warned of instrument and marginal visual meteorological conditions as well as mountain obscuration conditions due to clouds near the departure airport and along the airplane's expected route of flight. Although the pilot had filed an instrument flight rules flight plan for the flight, he advised air traffic control at the departure airport that he would be departing under visual flight rules (VFR). Flight track and weather data showed that, after departure, the airplane proceeded toward mountainous terrain that was likely obscured by clouds. A witness near the accident site reported seeing the airplane flying below the clouds (fog) before losing sight of it behind trees and then hearing the impact.

Postaccident examination of the airframe and engine revealed no evidence of any preaccident mechanical failures or malfunctions that would have precluded normal operation. Based on the damage signatures displayed by the wreckage and trees surrounding the accident site, it is likely that the airplane impacted trees and terrain in a relatively level, slightly right wing down flight attitude and that the engine was producing power at the time of the impact.

Although the pilot held an instrument rating, ~~whether the pilot met~~he did not meet the necessary ~~experience~~ currency requirements to undertake an instrument flight rules flight. ~~could not be determined due to a lack of available pilot records. Additionally, why the pilot chose to depart on the flight under VFR, despite having filed an instrument flight plan, could not be determined.~~ It is likely that, after departing, the pilot encountered deteriorating weather conditions that obscured the mountainous terrain, and resulted in the pilot's controlled flight into terrain.

Probable Cause and Findings

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

The pilot's continued visual flight rules flight into instrument meteorological conditions, resulting in controlled flight into trees and terrain.

Findings

Personnel issues	Decision making/judgment - Pilot
Environmental issues	Low ceiling - Decision related to condition

Factual Information

History of Flight

Enroute-cruise	VFR encounter with IMC (Defining event)
Enroute-cruise	Controlled flight into terr/obj (CFIT)

This report was modified on [month/date/year]. Please see the public docket for this investigation to view the original report.

On May 1, 2019, about 1251 eastern daylight time, a Cessna 172N, N733KZ, was destroyed when it when it was involved in an accident near Tyrone, Pennsylvania. The pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 91 personal flight.

The pilot filed an instrument flight rules (IFR) flight plan through the ForeFlight application for the intended flight from University Park Airport (UNV), State College, Pennsylvania, to Pittsburgh/Butler Regional Airport (BTP), Butler, Pennsylvania. According to audio recordings from the UNV air traffic control tower (ATCT), on initial contact with ground control, the pilot advised the controller that he had obtained automated terminal information service update Papa and requested to taxi to runway 24 for a westbound departure. The controller asked the pilot if he wanted to depart on the filed IFR flight plan or if he was "going VFR [visual flight rules]," and he replied he would depart under VFR. The controller then cleared the pilot for takeoff from runway 24, provided him an updated altimeter setting, and told him to advise when he departed class D airspace. The pilot acknowledged the instruction but ultimately did not advise the controller when he departed the airport's airspace. No further communications were received from the pilot.

According to Federal Aviation Administration radar flight track data, the airplane departed about 1240 and remained on the runway heading for about 4.5 nautical miles (nm) while climbing to 2,500 ft mean sea level (msl). The airplane turned slightly right to a west-southwest heading, descended to about 2,000 ft msl, and remained on that heading and altitude for about 10 nm. The airplane then turned to the same heading initially flown after takeoff, descended slightly, and then climbed back to about 2,000 ft msl over about 3 nm. The airplane entered a right turn before the flight track data were lost at 1251:07. At that time the airplane was at an altitude about 2,050 ft msl. The accident site was located about 700 ft north-northwest of the last radar data target, at an elevation of about 2,100 feet.

A witness located about 2,078 ft east-southeast from the accident site reported that, at the time of the accident, it was very foggy, but it was not raining. She heard a loud sounding airplane, which got her attention. She then saw the airplane flying below the fog, "straight" in a westerly direction then banking but not too steeply. She lost sight of the airplane when it went behind trees, followed by the sound of an explosion.

Pilot Information

Certificate:	Commercial	**Age:**	55,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	BasicMed With waivers/limitations	**Last FAA Medical Exam:**	June 20, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 583 hours (Total, all aircraft), 543 hours (Total, this make and model)		

The pilot held a commercial pilot certificate with ratings for airplane single-engine land and instrument airplane. ~~None of the pilot's personal flight logs were available for review.~~ Review of the pilot's application to join the flying club that operated the accident airplane, which was submitted to the flying club in June 2017, revealed that he had accumulated 563 total hours of flight experience, of which 523 were in the accident airplane make and model. He also noted that he had accumulated 79 hours of instrument flight experience. On the application the pilot stated that his most recent flight was in May 2011. The pilot subsequently completed 13 flights in the accident airplane, over the course of 20.7 flight hours, between August 2017 and April 2019.

The pilot's personal logbook recorded simulated instrument flight for a duration of 0.3-hour during a 1.0-hour-long flight for the purposes of a flight review in accordance with 14 *CFR* Part 61.56(a), on August 15, 2017, more than 20 months before the accident. He had logged a total of 13.5 hours and 66.0 hours of actual instrument flight time and simulated instrument flight time, respectively. Between the flight review date and the last logbook entry, dated April 18, 2019, he did not record any actual or simulated instrument flight experience, the completion of an instrument proficiency check, or any instrument approaches.

According to members of the flying club, a flight instructor flew in the accident airplane with the pilot, about 1 month before the accident after it had undergone maintenance for an extended time, and during which two Garmin G5 electronic flight instruments and a Garmin GFC 500 autopilot were installed. The club had advised pilots to fly the airplane with an instructor to refamiliarize themselves with the airplane and for a proficiency check.

The flight instructor who flew with the pilot stated that the proficiency flight covered loss of control, power-on and power-off stalls, steep turns, and emergency procedures. Because the instructor was not an instrument instructor, he did not cover topics that might have been addressed during an instrument proficiency check, but he did have the pilot fly for about 18 minutes using a vision restricting device. The flight instructor described that during that time, the pilot struggled to hold altitude, but he was within +/- 100 ft. The pilot mentioned that the likely reason he struggled to hold altitude was that the display format of the new electronic

flight instruments were more responsive than the previously installed analog instruments. The pilot did not mention anything to him about his instrument flight experience or instrument currency. After the flight, flight instructor did not sign the pilot's logbook, and he suggested he fly a few more times VFR to familiarize himself with the new electronic flight instruments.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N733KZ
Model/Series:	172 N	**Aircraft Category:**	Airplane
Year of Manufacture:	1976	**Amateur Built:**	No
Airworthiness Certificate:	Normal; Utility	**Serial Number:**	17268363
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	March 15, 2019 Annual	**Certified Max Gross Wt.:**	2400 lbs
Time Since Last Inspection:	20 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	7272.2 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-320-D2G
Registered Owner:	On file	**Rated Power:**	160 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Following the airplane's last annual inspection on March 15, 2019, a maintenance facility employee conducted a test flight and deemed it satisfactory during all phases of flight. He reported that he was impressed with the autopilot system. Club personnel estimated that, excluding the accident flight, the airplane had been operated about 20 hours since the annual inspection. The president of the flying club conducted a 1.0-hour flight on April 30, 2019, which was the last flight of the accident airplane before the accident flight. He reported no issues with either the G5 or autopilot. The only discrepancy he noted was a 20-second loss of the GPS signal. There was no record that the airplane was flown after the president of the club flew it and the accident pilot began his flight.

The airplane's altimeter, altitude reporting, and static system tests required by 14 CFR Part 91.411 and the transponder test required by 14 CFR Part 91.413 were last completed on November 14, 2018.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	UNV,1231 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	72°
Lowest Cloud Condition:		**Visibility**	7 miles
Lowest Ceiling:	Overcast / 1200 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.27 inches Hg	**Temperature/Dew Point:**	13°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	State College, PA (UNV)	**Type of Flight Plan Filed:**	IFR
Destination:	Butler, PA (BTP)	**Type of Clearance:**	None
Departure Time:	12:40 Local	**Type of Airspace:**	

A review of ForeFlight records revealed that the pilot obtained preflight weather briefings at 0854 and 1125. The weather briefing package contained all the standard weather information, including valid and active AIRMETs Sierra and Tango, a current surface analysis graphic, METARs, pilot reports, graphical forecasts for aviation (GFA), TAFs, and winds aloft forecasts. He last checked the UNV airport information (which can include METAR and TAF information) about 1235. It could not be determined if the pilot checked or received any additional weather information before or during the flight.

AIRMET Sierra warned of instrument meteorological conditions and mountain obscuration due to clouds and mist, and AIRMET Tango warned of moderate turbulence between 2,000 ft msl and flight level 180. The GFA cloud forecast products indicated a broken-to-overcast cloud ceiling between 2,100 and 2,500 ft msl with cloud tops at 5,000 ft msl. The UNV TAF, which was issued at 1125, forecast an overcast ceiling at 1,000 feet above ground level (or about 2,400 ft msl) around the time of the departure.

The 1300 High-Resolution Rapid Refresh (HRRR) sounding for the accident site indicated alternating layers of stable and conditionally unstable environments from the surface through 8,000 ft msl. The HRRR sounding also indicated that the cloud base was near 2,000 ft msl within about 1.6 nm of the accident site. The Rawinsonde Observation (RAOB) identified the possibility of clouds from between about 2,000 and 6,000 ft msl and indicated that a frontal inversion existed above the accident site at 4,348 ft msl with clouds below the inversion layer and no possibility of icing conditions below 14,000 ft msl. The RAOB indicated the possibility of light, low-level wind shear from the surface to about 3,500 ft msl and light-to-moderate clear-air turbulence (CAT) in several layers between the surface and 14,000 ft msl with moderate CAT between 3,000 and 5,000 ft msl.

At 0658, the Cleveland Air Route Traffic Control Center issued a Center Weather Service Unit Meteorological Impact Statement, which warned of patchy instrument meteorological conditions and isolated marginal visual flight rules conditions at the accident site and BTP with conditions valid through 1500.

At 0825, the National Weather Service Office, State College, Pennsylvania, issued an Area Forecast Discussion, and its aviation section reported widespread instrument meteorological conditions due to low cloud ceilings across the area with clouds remaining across the area through the morning with conditions improving from west to east in the afternoon.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	40.764446,-78.211112

The airplane impacted heavily wooded terrain on a ridgeline with a maximum elevation in that area of about 2,275 ft msl. During examination of the accident site, pieces of the airframe were found in trees and on the ground. The cockpit and cabin exhibited extensive impact and fire damage. Wreckage pieces not found near the cockpit and cabin did not exhibit fire damage. The first identified tree contact was about 20 ft agl at an elevation of 2,122 ft msl. The outer portion of the right wing was found along the energy path about 63 ft past the tree, and the first identified ground contact location, which is where the rudder counterweight was found, was about 80 ft from the right wing's outer section.

The farthest identified wreckage, which comprised the engine assembly and the attached propeller, one side of the horizontal stabilizer with attached elevator, the cockpit, and a section of wing were found at an elevation of 2,181 ft msl. All primary and secondary flight controls and primary structure were accounted for at the accident site.

Examination of the airframe revealed that the fuselage was consumed by postcrash fire from the cockpit to about fuselage station 166. The left horizontal/elevator remained attached to the fuselage with the counterweight attached. The pitch trim actuator was extended about 1.25 inches, which equated to 0° or neutral. Both elevator and rudder control cables remained connected at their respective bellcranks. The elevator bridle cable was attached to the primary control cable and was wrapped around the autopilot trim capstan, which rotated freely. The outboard portion of the left elevator was partially consumed by fire.

The vertical stabilizer's main spar was attached, but it was fractured about 12 inches up from the attachment point. The right horizontal stabilizer had separated and exhibited a

semicircular indentation about 37 inches outboard of the attachment point. The impact angle correlated to about a 18° right bank.

The elevator counterweight was separated. The full span of the elevator trim tab remained connected to the elevator. The pushrod remained connected to the trim tab and elevator trim actuator but was fractured, and the actuator had separated. The rudder counterweight had separated. The elevator trim cable was separated from the chain; both cables were fractured in tension overload.

Examination of the flight control cables for roll, pitch, and yaw revealed that, except for a section of the right aileron primary control cable near the control yoke, which was not found; cables that were cut for recovery; or cables that exhibited tension overload, revealed no evidence of any preaccident failures or malfunctions that would have precluded normal operations. No threads were extended at the flap actuator consistent with flaps retracted.

Both wings were fragmented in multiple pieces and exhibited semicircular indentations on their leading edges consistent with tree contacts. The pitot tube opening was free of obstructions, and electrical wires were noted going to the pitot tube.

Initial examination of the engine revealed that it remained attached to its respective engine mount, which remained attached to the firewall. The engine was covered in yellow fire-retardant residue and exhibited postimpact fire damage. The starter ring gear was fractured. One magneto remained attached to the engine, but the other was detached from the accessory section. The carburetor exhibited impact damage and was not attached to the engine, but it was held into its location via the throttle control cable.

Further examination of the engine revealed impact damage to the rocker box covers on the Nos. 1 and 3 cylinders and bent and smashed pushrods on the exhaust side of the No. 1 cylinder. Both pushrods on the No. 4 cylinder were bent and smashed. The engine crankshaft was rotated about 60° through the vacuum pump accessory drive, but it could not be fully rotated. Inspection of the cylinders with a borescope revealed that some of the cylinders exhibited corrosion and debris, but all the valves were found intact. Examination of the crankshaft revealed that the propeller flange was bent rearward between about 30° and 40°. The top and lower spark plugs exhibited normal coloration and were in normal-to-worn condition. No electrode damage was noted on any of the spark plugs.

Both magnetos failed to produce spark when rotated using a cordless drill. Further examination of the left magneto revealed that the impulse coupling assembly was “locked” and heavily corroded. The flyweights of the impulse coupling assembly were free to move, although, after removal, the impulse coupling assembly was still seized. During a bench test, the magneto was operated to 1,000 rpm, and it did not produce spark. Safety concerns prevented higher rpm operation. The magneto was disassembled, which revealed heat damage to the distributor block, support bar, insulation of the electrical wire from the capacitor to the contact points, the electrical wire from the primary side of the coil to the contact points, and the ground wire from the coil. The ground side of the electrical wire was removed, and the resistance of the primary side coil was 0.7 to 0.8 ohm (specification is 0.5 to 1.2 ohm), and the secondary side of the coil resistance readings showed an open circuit, likely due to the damage to the coil. The contact

points opened and closed through 360° of rotation. No discrepancies were noted with the rotor gear, distributor block, or distributor gear. The capacitor and the electrical wire insulation exhibited heat damage. Operational testing of the capacitor revealed that the leakage and series resistance tests were satisfactory, but the capacity test was .115 microfarad too high. The impulse coupling assembly, which was soaked for more than 1 hour, was mechanically moved, and spring tension was observed, and the spring was intact, and the flyweights worked satisfactorily.

Examination of the right magneto revealed heat damage to the ignition harness cover, and the ignition leads insulation was melted. The hex of the capacitor of the P-Lead attachment exhibited heat damage. During a bench test, the magneto produced spark at 400 rpm, but it misfired at 1,000 and 1,200 magneto rpm. The magneto produced spark at 2,000 magneto rpm with no discrepancies noted. Disassembly of the magneto revealed a flat spot to the insulation of the electrical wire from the capacitor to the contact points near the capacitor, which was likely due to heat and not abrasion. Examination of the rotor gear, support bar, copper electrode of the distributor gear, carbon brush, and distributor block revealed no evidence of preaccident failures or malfunctions. The coil primary and secondary resistance values, e-gap, and the capacitor were within specifications.

Examination of the lubrication and fuel metering systems revealed no evidence of preaccident failures or malfunctions that would have precluded normal operation. Examination of the propeller, which remained attached to the engine, revealed that both blades exhibited “S” type bending and gouging on the leading edge. Three tree branches, which were about .75 inch to 1.5 inches in diameter, were found at the accident site, and they exhibited cut marks consistent with propeller impact.

Additional Information

Narrative additional information place holder

Injuries to Persons

Narrative injuries to persons place holder

Damage to Aircraft

Narrative damage to aircraft place holder

Other Damage

Narrative other damage place holder

Communications

Narrative communications place holder

Flight recorders

Narrative flight recorders place holder

Medical and Pathological Information

Narrative medical and pathological information place holder

Fire

Narrative fire place holder

Survival Aspects

Narrative survival aspects place holder

Tests and Research

Narrative tests and research place holder

Organizational and Management Information

The president, maintenance officer, and treasurer of the flying club that operated the airplane all reported that the pilot-in-command was responsible for dispatching a flight, decision-making, and risk assessment. The club did not have any bylaws or standard operating procedures that stipulated minimum weather conditions or qualifications for intended flights in either visual or instrument meteorological conditions nor did it have a risk assessment program in place. Part II of the club's "Flying and Safety Rules" specified that "Club members shall operate Club aircraft in accordance with Federal Aviation Regulations, state, airport and Club Flying and Safety Rules at all times…." and failure to comply shall result in disciplinary action by the club.

Useful or Effective Investigation Techniques

Narrative useful or effective investigation techniques place holder

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy		
Additional Participating Persons:	David Reaves; FAA/FSDO; New Cumberland, PA Ricardo J Asensio; Textron Aviation; Wichita, KS David Harsanyi; Lycoming Engines; Williamsport, PA		
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Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99350		