# Aviation Investigation Final Report

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| **Location:** | Townsend, Montana | **Accident Number:** | WPR15FA247 |
| **Date & Time:** | August 19, 2015, 22:30 Local | **Registration:** | N62731 |
| **Aircraft:** | Cessna 172P | **Aircraft Damage:** | Substantial |
| **Defining Event:** | Loss of visual reference | **Injuries:** | 2 Fatal |
| **Flight Conducted Under:** | Part 91: General aviation - Personal | | |

## Analysis

The non-instrument-rated pilot notified his wife at 2211 that he would be departing the airport momentarily. The direct route to the destination of the dark night cross-country flight crossed a mountain range with elevations over 7,200 ft. The following morning, an emergency locator transmitter signal was detected, and the wreckage was subsequently located in the mountains at an elevation of about 5,000 ft along the direct route of flight. The wreckage pattern and ground scars indicated that the airplane impacted a rock formation on the face of a mountain during a steep right turn. An examination of the airframe and engine did not reveal any preimpact mechanical malfunctions or anomalies that would have precluded normal operation.

Although the pilot had accumulated some experience crossing the mountain range, he had never completed this flight in nighttime conditions, and he had only 3.8 hours of night flight experience. The pilot's wife reported that she had made the flight several times with the pilot, and he would typically fly over the mountain range unless the clouds were low, in which case he would take a longer route to avoid the mountains. The departure airport was reporting an overcast cloud layer that was about 8,000 ft mean sea level. Further, a witness at the destination airport reported that the sky condition was "pitch black," which was likely the result of a partially illuminated moon blocked by the overcast layer. In addition, mountain obscuration due to smoke and haze was present at the time of the accident, which would have further decreased the pilot's ability to recognize obstructions. As stated in a January 2008 National Transportation Safety Board safety alert, *Controlled Flight Into Terrain in Visual Conditions*, "darkness may render visual avoidance of high terrain nearly impossible," and "the absence of ground lights may result in loss of horizon reference."

It is likely that the airplane collided with terrain because the pilot could not see and avoid the surrounding terrain given the dark night conditions and mountain obscuration. Pilot spatial disorientation may also have occurred due to multiple risk factors including the pilot's lack of night flight proficiency and his absence of mountain flying experience in dark night conditions. Because the

airplane was in a steep turn, it could not be determined whether the pilot was trying to avoid terrain that he saw at the last minute or if he was disoriented and inadvertently banked the airplane.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The non-instrument-rated pilot's decision to conduct a cross-country flight over a mountain range in dark night conditions with limited night flight experience, which resulted in a collision with mountainous terrain.

### Findings

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| **Personnel issues** | Decision making/judgment - Pilot |
| **Personnel issues** | Total experience - Pilot |
| **Environmental issues** | Dark - Effect on personnel |
| **Environmental issues** | Obscuration - Effect on personnel |
| **Personnel issues** | Spatial disorientation - Pilot |
| **Personnel issues** | Geographic disorient (lost) - Pilot |

# Factual Information

## History of Flight

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| **Enroute-cruise** | Other weather encounter |
| **Enroute-cruise** | Loss of visual reference (Defining event) |
| **Enroute-cruise** | Collision with terr/obj (non-CFIT) |

On August 19, 2015, about 2230 mountain daylight time, a Cessna 172P, N62731, was substantially damaged after it collided with mountainous terrain near Townsend, Montana. The private pilot and passenger were fatally injured. The airplane was registered to and operated by the pilot as a personal flight under the provisions of Title 14 Code of Federal Regulations Part 91. Night visual meteorological conditions prevailed about the time of the accident, and a flight plan was not filed for the local flight. The flight originated from Helena Regional Airport (HLN) about 2215, and was destined for White Sulphur Springs Airport (7S6), White Sulphur Springs, Montana.

According to the pilot's wife, her husband departed 76S for HLN about 2000 to pick-up a friend who was scheduled to arrive on a commercial flight at 2100. He landed approximately 45 minutes later, picked up the passenger and then called his wife at 2211 before they departed on the accident flight.

On the following morning, Salt Lake Center recorded an emergency locator transmitter signal near Bozeman, Montana, that was also picked up by a low flying aircraft. The pilot's flight instructor, who was the Chief of Safety for the Montana Department of Aeronautics, subsequently initiated an aerial search, and located the airplane about 0830.

The accident pilot's wife reported that her husband had flown from 7S6 to HLN twice on the day of the accident. During the first trip, her husband collected some belongings from Helena, and then returned to their home in White Sulphur Springs, Montana. The pilot's wife had driven to HLN to help transport some of the items that would not fit on the airplane. She then returned to White Sulphur Springs at the same time her husband was preparing to leave on his second trip to HLN to pick-up his friend who was returning to White Sulphur Springs after visiting his daughter in Ohio.

## Pilot Information

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| **Certificate:** | Private | **Age:** | 59,Male |
| **Airplane Rating(s):** | Single-engine sea | **Seat Occupied:** | Left |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | 3-point |
| **Instrument Rating(s):** | None | **Second Pilot Present:** | No |
| **Instructor Rating(s):** | None | **Toxicology Performed:** | Yes |
| **Medical Certification:** | Class 3 With waivers/limitations | **Last FAA Medical Exam:** | July 16, 2015 |
| **Occupational Pilot:** | No | **Last Flight Review or Equivalent:** | September 30, 2014 |
| **Flight Time:** | 280.3 hours (Total, all aircraft), 276.8 hours (Total, this make and model), 220.1 hours (Pilot In Command, all aircraft) | | |

## Passenger Information

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| **Certificate:** | | **Age:** | Male |
| **Airplane Rating(s):** | | **Seat Occupied:** | Right |
| **Other Aircraft Rating(s):** | | **Restraint Used:** | 3-point |
| **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:** | | | |

A review of the pilot's logbook revealed that he had amassed a total of 280 flight hours at the time of the accident; about 277 of which were in the accident airplane make and model. The pilot had accrued a total of 3.8 hours of total night flight experience; 3 hours of which were completed with an instructor in October 2013, and 0.8 hours were completed over two separate flights without an instructor. The pilot's first night flight without his instructor took place in December 2014 over 0.4 flight hours. He recorded another night flight about 1 month before the accident, during which time he accumulated 0.4 flight hours. The logbook indicated that both flights consisted of 3-4 landings in the airport traffic pattern. According to the pilot's flight instructor, they completed one instructional cross country night flight from Helena to Bozeman. The second instructional night flight consisted of 12 landings at a local airport and did not include any cross-country flight time. The last entry in the logbook showed that the pilot had flown from 7S6 to HLN on August 19, 2015.

Flight Training

According to the pilot's flight instructor, the pilot began taking flight lessons from him in April 2013 when the instructor was employed by a flight school at HLN. The pilot received instruction in a Cessna 172M model airplane until he purchased the accident airplane later that year. In September 2014, his flight instructor endorsed him to fly solo to commute between 7S6 and HLN. The instructor stated that the pilot's upset recovery abilities and aeronautical decision making were "typical of someone starting in their late 50's."

Private Pilot Examination

Records furnished by the Federal Aviation Administration (FAA) indicated that the pilot was unsuccessful during his initial private pilot check ride. According to the designated pilot examiner who administered the check ride, the pilot did not demonstrate adequate pilotage during the examination. The pilot deviated from his assigned course by approximately 7 nautical miles, and was unable to identify multiple terrain features. The pilot subsequently completed two instructional flights that included navigation practice to prepare for the follow-up examination to his private pilot check ride.

72-Hour History

A follow-up interview with the pilot's wife was used to construct a 72-hour history of the pilot's activities. On Sunday, August 16, 2015, the pilot attended a church service, and completed some activities around the house. During the following 2 days, the pilot attended gatherings at a local café for coffee, and performed some work within the community. The pilot's wife observed no abnormalities in the pilot's behavior or sleep patterns on the day of the accident and the 3 days that preceded it.

The pilot's wife reported that she had flown with him between 7S6 and HLN about four times. During these flights, they would typically fly over the mountain range; however, if the clouds were "too low," they would circumvent the mountain.

## Aircraft and Owner/Operator Information

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| **Aircraft Make:** | Cessna | **Registration:** | N62731 |
| **Model/Series:** | 172P | **Aircraft Category:** | Airplane |
| **Year of Manufacture:** | 1982 | **Amateur Built:** | |
| **Airworthiness Certificate:** | Normal; Utility | **Serial Number:** | 17275330 |
| **Landing Gear Type:** | Tricycle | **Seats:** | 4 |
| **Date/Type of Last Inspection:** | June 25, 2015 Annual | **Certified Max Gross Wt.:** | 2299 lbs |
| **Time Since Last Inspection:** | 45 Hrs | **Engines:** | 1 Reciprocating |
| **Airframe Total Time:** | 9056.6 Hrs as of last inspection | **Engine Manufacturer:** | Lycoming Engines |
| **ELT:** | C91 installed, activated, aided in locating accident | **Engine Model/Series:** | O-320-D2J |
| **Registered Owner:** | On file | **Rated Power:** | 160 Horsepower |
| **Operator:** | On file | **Operating Certificate(s) Held:** | None |

According to FAA records, the airplane was manufactured in 1982, and registered to the pilot and his wife on July 26, 2013.

The airplane was powered by a Lycoming O-320-D2J, a normally-aspirated, direct drive, air cooled, 160 hp engine. A maintenance history was constructed from a collection of work orders that were provided by the pilot's maintenance facility as the aircraft logbooks were not recovered. The work orders indicated that the airplane's most recent annual inspection was completed on June 25, 2015; at that time, the recorded tachometer reading was 9,056.6 flight hours. Although the tachometer was found a few feet from the main wreckage, the tachometer time at the time of the accident could not be verified due to the condition of the unit.

Refueling records provided by the 76S airport manager showed that the pilot purchased 13.6 gallons of 100 low lead aviation grade gasoline on August 13, 2015, at a self-service fuel pump. The pilot noted "fuel" under some entries in his personal logbook, but did not include the total fuel quantity; therefore, a fuel quantity for the accident flight could not be computed.

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Night/dark |
| **Observation Facility, Elevation:** | HLN,3877 ft msl | **Distance from Accident Site:** | 18 Nautical Miles |
| **Observation Time:** | 22:53 Local | **Direction from Accident Site:** | 80° |
| **Lowest Cloud Condition:** | | **Visibility** | 5 miles |
| **Lowest Ceiling:** | Overcast / 4100 ft AGL | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 7 knots / | **Turbulence Type Forecast/Actual:** | / None |
| **Wind Direction:** | 250° | **Turbulence Severity Forecast/Actual:** | / N/A |
| **Altimeter Setting:** | 29.86 inches Hg | **Temperature/Dew Point:** | 22°C / 5°C |
| **Precipitation and Obscuration:** | Moderate - None - Haze | | |
| **Departure Point:** | Helena, MT (HLN ) | **Type of Flight Plan Filed:** | None |
| **Destination:** | WHT SPHR SPGS, MT (7S6 ) | **Type of Clearance:** | None |
| **Departure Time:** | 22:15 Local | **Type of Airspace:** | Class E |

According to an NTSB Meteorological study, the 2253 recorded weather observation at HLN included winds from 250 degrees at 7 knots, visibility 4 statute miles, haze, an overcast cloud layer at 4,100 feet above ground level (agl), temperature 22 degrees C, dew point 5 degrees C, and an altimeter setting of 29.86 inches of mercury.

A Terminal Aerodrome Forecast was issued for HLN at 1908. The field weather forecast for the accident time included visibility of 4 statute miles, haze, and scattered clouds at 4,000 feet agl. An Area Forecast was issued at 2045 by the Aviation Weather Center in Kansas City, Missouri. The narrative forecasted a broken smoke layer at 8,000 feet and occasionally visibility between 3-5 statute miles in smoke and haze.

The National Oceanic and Atmospheric Administration publishes a Smoke Text Product, which is a narrative used to describe significant areas of smoke associated with active fires. A Smoke Text Product was issued on the day of the accident that reported heavy smoke over parts of Oregon, Washington,

Idaho, and Montana, forecast for that evening. The report described moderate density smoke farther east into Central Montana.

An Airmen's Meteorological Information (AIRMET) advisory was issued as 2045 for mountain obscuration due to smoke and haze at the time of the accident in a region inclusive of the accident site.

The United States Naval Observatory, Astronomical Applications Department for Townsend recorded the moon phase as a waxing crescent Moon with 22% of the Moon's visible disk illuminated. The recorded Moonset for Townsend was 2243.

A witness reported the visibility at 76S on the night of the accident was approximately 2 statute miles, and the sky was "pitch black."

According to Lockheed Martin Flight Services, the pilot did not file a flight plan or request a weather briefing through them or DUATS.

## Wreckage and Impact Information

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| **Crew Injuries:** | 1 Fatal | **Aircraft Damage:** | Substantial |
| **Passenger Injuries:** | 1 Fatal | **Aircraft Fire:** | None |
| **Ground Injuries:** | N/A | **Aircraft Explosion:** | None |
| **Total Injuries:** | 2 Fatal | **Latitude, Longitude:** | 46.655277,-111.558609 |

The airplane impacted an area of mountainous terrain that was located on the rising face of a ridge at a terrain elevation of 5,046 feet. All four corners of the airplane were accounted for at the accident site. A debris path that measured about 100 feet long by 80 feet wide was oriented on a 351-degree magnetic heading. The initial impact point (IIP) was identified by a broken green aircraft position light and silver colored signatures that were vertically oriented, and spanned approximately 13 feet in length on a rock face. The airplane main wreckage, comprised of the cockpit, fuselage, and empennage, was located about 70 feet beyond the IIP. A local sheriff detected an odor at the accident site that resembled fuel.

Airframe

The outboard section of the right wing was located in the debris path about 30 feet below the initial impact point. A piece of the inboard section of the right wing was identified by the right wing strut, and was located about 15 feet from the main wreckage. The leading edge of the wing was compressed into alternating ridges and grooves that resembled corrugated metal. The right wing fuel tank was breached, and void of fuel. Both the flap bell crank and jackscrew had separated from the right wing, and were found in the energy path about 30 feet from the main wreckage. The flap jackscrew measured 2.9", consistent with a 10-degree flap deployment.

The left wing came to rest a few feet from the main wreckage, and was co-located with the engine.

Several portions of skin were pulled back away from the wing, which revealed a breached left wing fuel tank that was void of fuel.

The rudder, elevator trim, and elevator cables were traced from the cockpit to each control surface. Both aileron cables had separated at the wing roots; however, the fracture surfaces exhibited signatures consistent with tensile overload.

The empennage was co-located with the main wreckage, and remained attached to the tail cone by a piece of airframe skin. The vertical stabilizer and rudder assembly were connected, but damaged by the impact. Both elevators remained attached to the horizontal stabilizers; however, the right and left elevator torque tubes had separated in tensile overload. The elevator trim tab measured 1.15", indicative of a 5-degree tab down position.

The fuel selector handle had separated and exposed the selector pin, which rotated successfully to each detent. Air was directed through the unit as the selector was moved, which confirmed continuity through the left, right, and both positions of the selector. The fuel strainer bowl was found in the debris field, but the fuel strainer screen was not observed.

The attitude indicator was recovered from the debris field. An examination of the unit revealed that the gyro spun normally when turned by hand. The gyroscope surface displayed a significant amount of scoring along its circumference, which indicated that it was rotating at impact.

Engine Examination

Both propeller blades were recovered from the debris path along with the propeller hub, which had separated from the crankshaft at the engine flange. Propeller blade one displayed chordwise scratches, gouges, s-bending, and tip curling, but remained attached to the hub. Propeller blade two had separated at the blade tip and the blade root, which was attached to the propeller hub. The propeller blades exhibited both chordwise scratches and gouges at the leading and trailing edges.

A hole was observed in the crankcase between cylinders three and four that measured approximately 8 inches in diameter. The crankshaft had seized, which precluded a successful rotation of the powertrain; however, drive-train continuity was confirmed through a visual inspection. The cylinders displayed normal operating signatures, and all valves appeared to be seated properly when examined with a borescope.

Both magnetos were removed from the engine accessory section and tested. The right magneto produced spark on all leads when rotated by hand. The left magneto was destroyed, and could not be tested.

The top and bottom spark plug were removed, and placed in a spark plug inspection tray. The spark plugs to cylinders one and three were dark in color, but exhibited normal wear. Examination of the top and bottom spark plugs from cylinders two and four did not reveal any anomalies.

The carburetor was destroyed, which precluded an examination of the floats and needle valve. The carburetor fuel inlet screen was not recovered.

The vacuum pump had separated from the accessory housing, and was found in the energy path of the accident airplane. Disassembly of the pump revealed that the rotor had broken into sections; however, the vanes displayed even wear without any signs of binding.

## Communications

According to an NTSB Air Traffic Control Specialist, there was no available audio for the pilot's departure on the night of the accident as HLN tower had closed at 2000.

A review of Enhanced Radar Intelligent Tool data from the Salt Lake City Air Route Traffic Control Center did not show the accident airplane or its route of flight.

## Medical and Pathological Information

An autopsy was performed on the pilot by the Montana Department of Justice, Forensic Science Division. The autopsy report listed the pilot/owner's cause of death as "multiple blunt force injuries."

Forensic toxicology testing was performed on specimens of the pilot by the FAA Bioaeronautical Science Research Laboratory (CAMI), Oklahoma City, Oklahoma, which did not detect any ethanol in the pilot's muscle or drugs in the pilot's urine.

## Additional Information

According to an NTSB Safety Alert that was published January 2008,

"Terrain familiarization is critical to safe visual operations at night. Use sectional charts or other topographic references to ensure that your altitude will safely clear terrain and obstructions all along your route."

"In remote areas, especially in overcast or moonless conditions, be aware that darkness may render visual avoidance of high terrain nearly impossible and that the absence of ground lights may result in loss of horizon reference."

"When planning a nighttime Visual Flight Rules (VFR) flight, follow Instrument Flight Rules (IFR)

practices, such as climbing on a known safe course until well above surrounding terrain. Choose a cruising altitude that provides terrain separation similar to IFR flights (2,000 feet above ground level in mountainous areas and 1,000 feet above the ground in other areas)."

According to the FAA Aeronautical Information Manual, Chapter 7-5-6, "Mountain Flying,"

"Understand Mountain Obscuration. The term Mountain Obscuration (MTOS) is used to describe a visibility condition that is distinguished from IFR because ceilings, by definition, are described as "above ground level" (AGL). In mountainous terrain clouds can form at altitudes significantly higher than the weather reporting station and at the same time nearby mountaintops may be obscured by low visibility. In these areas the ground level can also vary greatly over a small area. Beware if operating VFR–on–top. You could be operating closer to the terrain than you think because the tops of mountains are hidden in a cloud deck below. MTOS areas are identified daily on the Aviation Weather Center located at: http://www.aviationweather.gov."

"Some canyons run into a dead end. Don't fly so far up a canyon that you get trapped. ALWAYS BE ABLE TO MAKE A 180 DEGREE TURN!"

"VFR flight operations may be conducted at night in mountainous terrain with the application of sound judgment and common sense. Proper pre-flight planning, giving ample consideration to winds and weather, knowledge of the terrain and pilot experience in mountain flying are prerequisites for safety of flight. Continuous visual contact with the surface and obstructions is a major concern and flight operations under an overcast or in the vicinity of clouds should be approached with extreme caution."

## Preventing Similar Accidents

Controlled Flight Into Terrain in Nighttime Visual Conditions (SA-013)

**The Problem**

Controlled flight into terrain (CFIT) by both instrument flight rules (IFR)-rated and visual flight rules (VFR) pilots operating under visual flight conditions at night in remote areas have occurred, in many of these cases, when the pilots were in contact with air traffic controllers at the time of the accident and receiving radar service. The pilots and controllers involved all appear to have been unaware that the aircraft were in danger. Increased altitude awareness and better preflight planning would likely prevent these types of accidents.

**What can you do?**

- CFIT accidents are best avoided through proper preflight planning.

- Terrain familiarization is critical to safe visual operations at night. Use sectional charts or other topographic references to ensure that your altitude will safely clear terrain and obstructions all along your route.
- In remote areas, especially in overcast or moonless conditions, be aware that darkness may render visual avoidance of high terrain nearly impossible and that the absence of ground lights may result in loss of horizon reference.
- When planning a nighttime VFR flight, follow IFR practices such as climbing on a known safe course until well above surrounding terrain. Choose a cruising altitude that provides terrain separation similar to IFR flights (2,000 feet above ground level in mountainous areas and 1,000 feet above the ground in other areas.)
- When receiving radar services, do not depend on air traffic controllers to warn you of terrain hazards. Although controllers will try to warn pilots if they notice a hazardous situation, they may not always be able to recognize that a particular VFR aircraft is dangerously close to terrain.
- When issued a heading along with an instruction to “maintain VFR,” be aware that the heading may not provide adequate terrain clearance. If you have any doubt about your ability to visually avoid terrain and obstacles, advise ATC immediately and take action to reach a safe altitude if necessary.
- ATC radar software can provide limited prediction and warning of terrain hazards, but the warning system is configured to protect IFR flights and is normally suppressed for VFR aircraft. Controllers can activate the warning system for VFR flights upon pilot request, but it may produce numerous false alarms for aircraft operating below the minimum instrument altitude—especially in en route center airspace.
- For improved night vision, the FAA recommends the use of supplemental oxygen for flights above 5,000 feet.
- If you fly at night, especially in remote or unlit areas, consider whether a global positioning system-based terrain awareness unit would improve your safety of flight.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-013.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

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| **Investigator In Charge (IIC):** | Stein, Stephen |
| **Additional Participating Persons:** | Jeff Simmons; Federal Aviation Administration; Helena, MT<br>Peter Basile; Textron Aviation - Cessna; Wichita, KS<br>Troy Helgeson; Lycoming Engines; Williamsport, PA |
| **Original Publish Date:** | January 18, 2017 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | The NTSB traveled to the scene of this accident. |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=91830 |