



# Aviation Investigation Final Report

<b>Location:</b>	Perkinsville, Arizona	<b>Accident Number:</b>	WPR17FA213
<b>Date &amp; Time:</b>	September 22, 2017, 16:35 Local	<b>Registration:</b>	N7070Q
<b>Aircraft:</b>	Cessna 172L	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Turbulence encounter	<b>Injuries:</b>	2 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

## Analysis

The pilot had received his private pilot certificate about 7 months before the accident. He had told family members that he was planning to fly with his friend, the passenger, and stay in the airport traffic pattern performing touch-and-go takeoffs and landings.

Contrary to the pilot's stated plan, radar data indicated that the airplane departed toward a meandering river canyon immediately after takeoff. The radar data ended just before the airplane entered the canyon, likely due to terrain masking along the route of flight as a result of the airplane descending below the canyon walls.

The wreckage was located about 2 miles beyond the entrance to the canyon, at a tight turn of the river. The wreckage was on the steep face of a boulder-strewn cut bank about 500 ft above the river and 200 ft below the canyon rim. Wreckage debris indicated that the airplane impacted the ground in a near-vertical attitude with low-energy impact signatures, consistent with a low-speed collision and likely the early stages of a spin. The majority of the primary airframe structure was consumed by fire, but postaccident examination did not reveal any anomalies with the remaining airframe or engine components that would have precluded normal operation.

Performance calculations indicated that, while it was theoretically possible to negotiate the canyon bend in the airplane, the pilot would have needed to fly with precision and factor for tailwinds along with turbulence and downdrafts that were likely present in the canyon at that time and would have made escape from the canyon difficult.

The pilot had flown through the canyon with his instructor once before in another, slower, airplane but in the opposite direction of flight than that he took on the day of the accident. The wreckage was located in an area the instructor had specifically warned the pilot about due to the tight radius of the river bend and the close canyon walls, and during that flight they had bypassed the area. It is possible that the pilot did not recognize the turn during the accident flight because he was approaching from the opposite direction.

It could not be determined why the pilot chose to fly into the canyon instead of remaining at the airport as he had stated he planned to do. One possibility was that the airplane would soon need refueling, and the exit of the canyon was in the general direction of the airport where the pilot typically purchased fuel. Additionally, although by all accounts the young pilot was a conscientious and conservative aviator, having his friend on board may have influenced his decision to take a more exciting, yet less safe route.

There were no witnesses to the accident, and no one realized that the airplane was missing until the day after the accident. The airplane was ultimately discovered a few hours after the search was initiated. Although the airplane was equipped with an operational emergency locator transmitter (ELT), it failed to provide timely notification of the accident for at least two reasons. First, the ELT transmitted on the frequencies (121.5/243 MHz) that are no longer monitored by the Air Force Rescue Coordination Center; instead, they are only monitored randomly by some overflying aircraft. Second, the ELT signal was severely attenuated by the combination of its antenna location in relation to the final resting attitude of the airplane. However, due to the nature of the injuries incurred by both occupants, a timelier response to the accident site would not likely have increased their chances of survival.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's decision to fly into a canyon during wind conditions conducive to turbulence and downdrafts, and his subsequent loss of aircraft control while maneuvering in the canyon. Contributing to the accident was the pilot's limited canyon flying experience.

### Findings

<b>Personnel issues</b>	Decision making/judgment - Pilot
<b>Personnel issues</b>	Aircraft control - Pilot
<b>Aircraft</b>	(general) - Not attained/maintained
<b>Personnel issues</b>	Total experience - Pilot
<b>Environmental issues</b>	Terrain induced turbulence - Effect on operation
<b>Environmental issues</b>	Downdraft - Effect on operation
<b>Environmental issues</b>	Terrain induced turbulence - Ability to respond/compensate
<b>Environmental issues</b>	Downdraft - Ability to respond/compensate

## Factual Information

### History of Flight

<b>Maneuvering-low-alt flying</b>	Turbulence encounter (Defining event)
<b>Maneuvering-low-alt flying</b>	Loss of control in flight
<b>Uncontrolled descent</b>	Collision with terr/obj (non-CFIT)

On September 22, 2017, about 1635 mountain standard time, a Cessna 172L, N7070Q, collided with mountainous terrain near Perkinsville, Arizona. The private pilot and passenger sustained fatal injuries, and the airplane was destroyed by postimpact fire. The airplane was registered to Peach Flyers LLC and was operated by the pilot as a Title 14 *Code of Federal Regulations (CFR) Part 91* personal flight. Visual meteorological conditions prevailed, and no flight plan was filed for the flight, which departed Ernest A. Love Field Airport (PRC), Prescott, Arizona, at 1621 with an unknown destination.

The pilot told family members that he was planning to fly with his friend, who was the passenger, and stay in the traffic pattern at PRC performing touch-and-go takeoffs and landings.

The Federal Aviation Administration (FAA) provided data from an airport surveillance radar sensor located in Seligman, Arizona (about 57 miles northwest of PRC), and audio recordings from the PRC air traffic control tower. The data revealed that, on the day of the accident, after contacting ground controllers, the pilot switched to the tower frequency and requested a departure to the northeast. The clearance was granted, and after taking off from runway 21R, a radar target with a transponder beacon code of 1200 entered the right downwind leg of the airport traffic pattern and departed to the northeast. Over the next 2 1/2 minutes, the target climbed to a transponder-reported altitude of 7,175 ft mean sea level (msl), about 2,100 ft above field elevation, where it leveled off 2.75 miles northeast of the airport.

For the next 8 minutes, the target began a gradual descent while maintaining the northeast track and a ground speed about 110 knots (See Figure 1). The last target was recorded at 1632:47 traveling at a ground speed of 95 knots just west of the entrance to the Verde River Canyon at an altitude of 4,550 ft msl (750 ft above the river). Beyond the canyon entrance, the Verde River followed a meandering path to the southeast, eventually reaching the town of Cottonwood, Arizona, 15 miles away.

No radar data were available to indicate that the airplane ever emerged from the end of the canyon, nor was there any evidence that the airplane reached Cottonwood.

The following morning, the pilot's family and friends became concerned when they had not heard from him since the previous night. They alerted the local sheriff's department, and at 1108, the FAA issued an Alert Notice. The sheriff's department initiated a helicopter search using radar data and network-based cell phone signal analysis, and the wreckage was discovered about 1300 within the Verde River Canyon, 1.8 miles east-southeast of the last recorded radar target and 19 miles northeast of PRC (see Figure 2).

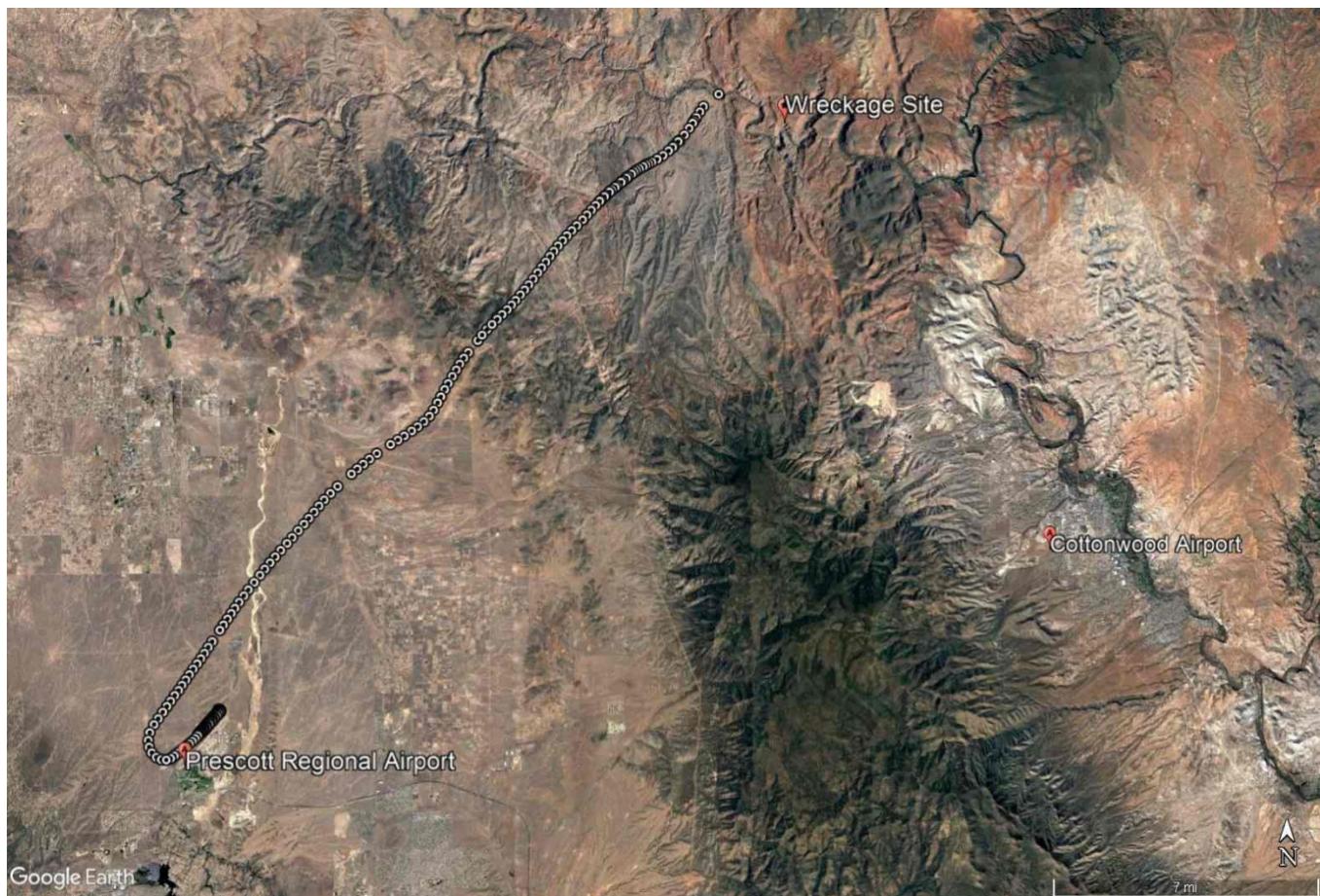


Figure 1 - Radar track and accident site

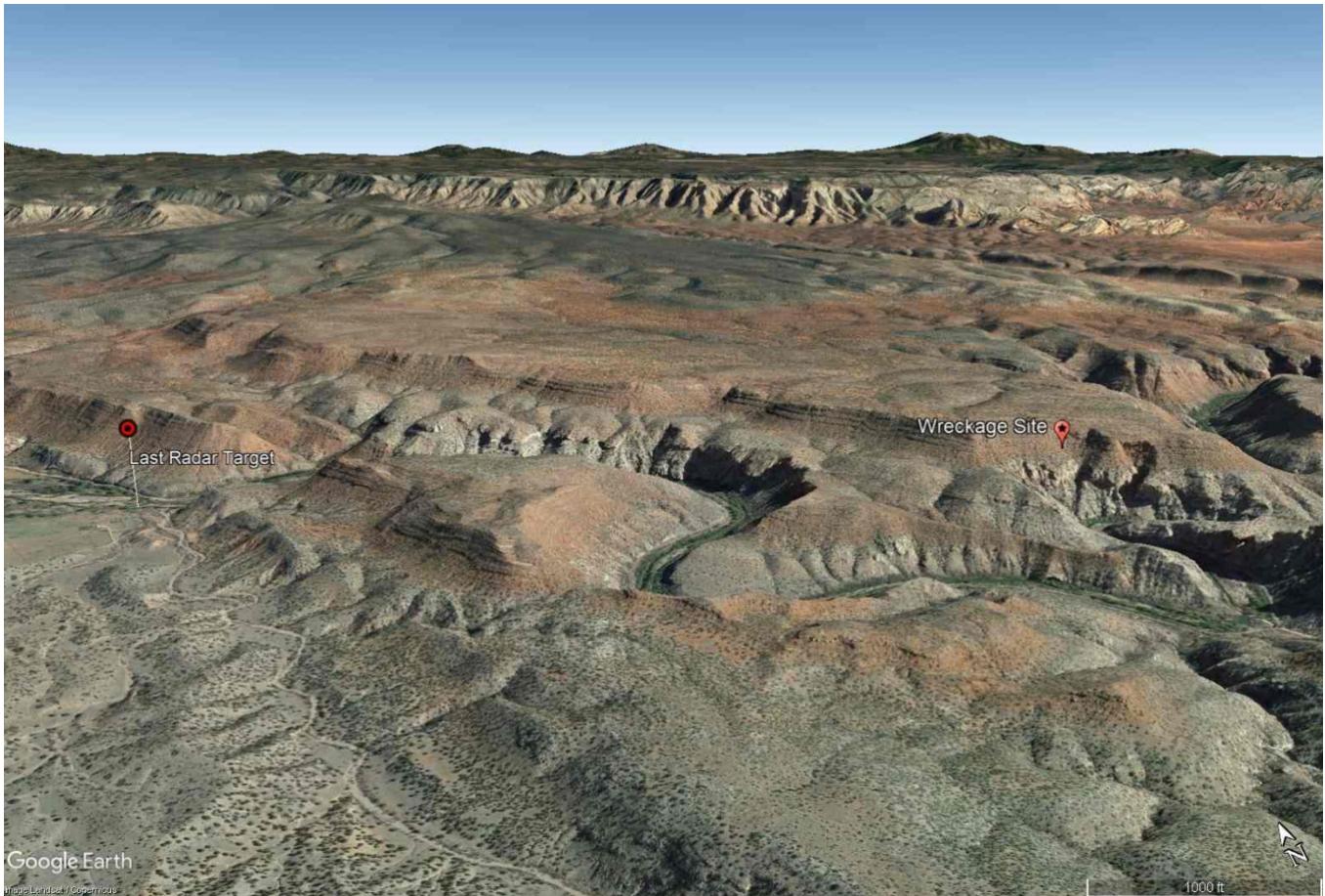


Figure 2 – Last radar target and wreckage site

## Pilot Information

Certificate:	Private	Age:	19, Male
Airplane Rating(s):	Single-engine land	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 2 Without waivers/limitations	Last FAA Medical Exam:	April 14, 2014
Occupational Pilot:	No	Last Flight Review or Equivalent:	February 25, 2017
Flight Time:	(Estimated) 120 hours (Total, all aircraft), 100 hours (Total, this make and model)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N7070Q
<b>Model/Series:</b>	172L	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1972	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal; Utility	<b>Serial Number:</b>	17260370
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	June 27, 2017 Annual	<b>Certified Max Gross Wt.:</b>	2400 lbs
<b>Time Since Last Inspection:</b>	30 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	4064.7 Hrs as of last inspection	<b>Engine Manufacturer:</b>	LYCOMING
<b>ELT:</b>	C91A installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	O-360-A4M
<b>Registered Owner:</b>		<b>Rated Power:</b>	180 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The airplane was manufactured in 1972 and was originally equipped with a 150-horsepower Lycoming O-320 engine. It was upgraded to a 180-horsepower Lycoming O-360 engine in 2005 in accordance with supplemental type certificate (STC) SA4428SW. The upgrade provided for an increase in maximum gross weight from 2,300 to 2,500 lbs, along with associated changes in flight performance and fuel consumption.

The airplane's fuel capacity was 42 gallons, and its fuel consumption varied between 6.1 and 10.3 gallons per hour depending on the airplane's weight, engine power setting, and environmental conditions. The airplane's weight and balance information was not located; however, the airplane owner's manual (AOM) indicated a typical basic empty weight of 1,364 lbs.

The airplane was owned by a limited liability corporation of which the pilot had been a member for about 1 year. The pilot was the predominant operator of the airplane during that period. The airplane was kept in a hangar.

The last fueling records located indicated that the airplane was serviced to capacity with the addition of 25 gallons of 100 low-lead aviation gasoline at Cottonwood Airport (P52) on September 8, 2017. The pilot who flew the airplane and serviced it with fuel stated that the airplane flew well that day and that there were no maintenance discrepancies. He further stated that fuel was typically purchased in Cottonwood, where the fuel prices were lower, before returning to PRC.

The accident pilot was the only pilot to fly the airplane since fueling, during the 1.5-hour instrument training flight that took place on September 20.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KPRC, 5052 ft msl	<b>Distance from Accident Site:</b>	20 Nautical Miles
<b>Observation Time:</b>	23:53 Local	<b>Direction from Accident Site:</b>	223°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	15 knots / 22 knots	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	200°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	29.86 inches Hg	<b>Temperature/Dew Point:</b>	19°C / -9°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	PRESCOTT, AZ (PRC )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>		<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	16:21 Local	<b>Type of Airspace:</b>	Class G

### Surface Observations

PRC (elevation 5,045 ft msl) was equipped with an Automated Surface Observation System (ASOS) augmented by the local tower controllers. The observation issued at 1653 indicated wind from 200° at 15 knots gusting to 22 knots, 10 miles visibility, clear sky below 12,000 ft, temperature 19°C, dew point -9° C, altimeter setting of 29.86 inches of mercury (Hg). Gusting wind conditions existed throughout the hottest parts of the afternoon, generally from 180° to 200°, sustained at 12 to 17 knots with gusts to 27 knots.

Similar conditions existed at Sedona Airport (SEZ), 18 miles east of the accident site at an elevation of 4,830 ft msl. The automated weather observation at 1635 indicated wind from 210° at 16 knots gusting to 24 knots, 10 miles visibility or greater, clear skies below 12,000 ft, temperature 21°C, dew point 3°C, altimeter 29.84 inches of Hg.

### Sounding

A High-Resolution Rapid Refresh (HRRR) numerical model was obtained from archived data from the National Oceanic and Atmospheric Administration Air Resource Laboratory database for the approximate location of the accident at 1700.

The HRRR model depicted a surface temperature of 23.2°C, a dew point of -3.9°C, relative humidity 16%, density altitude of 6,255 ft, and a surface wind from 210° at 11 knots. The sounding supported strong thermals from the surface to 9,000 ft.

The wind profile indicated south-southwesterly winds from 10 to 20 knots through 10,000 ft. Calculated conditions at the airplane's last radar-observed altitude of 4,550 ft included wind from 210° at 14 knots, a temperature of 21°C, and density altitude near 6,343 ft.

The National Weather Service Flagstaff 1700 sounding, which was launched 28 miles northeast of the accident location, showed similar temperature structures, but with a temperature inversion at 6,240 ft above ground level (agl) and strong thermals from the surface to this level. The wind profile showed wind at the surface from 190° at 10 knots gusting to 26 knots, with wind speeds through to 1,000 ft increasing to 24 knots. The observed sounding indicated a moderate potential for low-level wind shear and a moderate and greater potential for turbulence below 1,000 ft agl.

#### Pilot Reports and Local Observations

There were no significant pilot reports (PIREPs) of turbulence below 8,000 ft surrounding the period of the accident.

A flight instructor operating in the immediate vicinity of the accident at the time of the accident provided a statement of the conditions that he encountered. He reported south-southwesterly winds near 25 knots, with light turbulence through 9,000 ft. He stated that he did not encounter any significant weather, and indicated that it was an ordinary windy day for the area.

#### Weather Research and Forecasting Model Simulation

A Weather Research and Forecasting (WRF) numerical model was run to simulate the weather conditions during the period from 1600 through 1700 with regard to wind, vertical motion, and the Richardson number (Ri) for turbulence determination surrounding the time of the accident.

The results of the model supported moderate turbulence over the area, with wind speeds of 18 to 20 knots at the accident site about 1630, with vertical velocities ranging between 300 fpm down to 500 fpm up.

#### Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>	1 Fatal	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	2 Fatal	<b>Latitude, Longitude:</b>	34.884166,-112.156387

The airplane came to rest at an elevation of 4,290 ft msl on 45° sloping walls at a river turn on the north cut bank of the canyon (See Figures 3, 4). The airplane was located about 200 ft below the canyon rim and 500 ft above the river. The area was strewn with sandstone slabs, rocks, and boulders up to 8 ft in size.



Figure 3 – View of the wreckage site (circled) toward the northwest



Figure 4 – Wreckage site

The airplane cabin and wings came to rest inverted on a heading of about 030° true. The aft fuselage and empennage had rotated 90° to the airplane's right, and the outboard right wing had folded underneath itself about midspan. Fire had consumed the main cabin and most of the right wing inboard of the aileron. The empennage and the left wing outboard of the pitot tube remained largely undamaged. The engine and firewall came to rest wedged between a set of boulders on the upsloping side of the wreckage (See Figure 5).



Figure 5 – Wreckage site viewed downhill toward turn in river

The wreckage was tightly contained within the immediate vicinity of the accident site, there was no damage to any of the surrounding terrain, and all control surfaces were accounted for. An examination of the engine and airframe was performed following recovery from the accident site. A complete report is contained in the public docket; the following is a summary of findings.

#### Fuselage

The fuselage from the firewall to the baggage door frame was consumed by fire. Remnants included the main landing gear, which was still attached to the lower box assembly. The left door had detached from the airframe and the right door was consumed by fire with only the window frame remaining.

The forward seats, with the exception of the steel seat adjustment components, were consumed by fire. Both the left and right front seat lap buckles were found in the latched configuration and the belts were

consumed by fire.

#### Tail

The empennage remained attached to the aft fuselage. The left side of the aft fuselage was largely undamaged, and the right side sustained thermal damage along its entire length. The elevator remained attached to the horizontal stabilizer by its hinges; the elevator trim tab was in place and its control rod had extended 1.25 inches out of the actuator, consistent with a 5° trim tab-down (elevator up) position.

#### Left Wing

The left wing was intact except for thermal damage to the inboard leading edge at the fuel tank. The flap remained attached at its rails and the aileron remained attached by its hinges. The stall warning horn at the wing root was consumed by fire.

#### Right Wing

The inboard section of the wing was consumed by fire, with only remnants of the fuel tank, flap actuator assembly, outboard flap and rail, and wing spar remaining. The wing sustained accordion-like crush damage to the underside, outboard of the lift strut attach point. The flap actuator jack screw exhibited an extension of about 1/8 inch, consistent with fully-retracted flaps.

#### Engine

The engine remained attached to its mount, which was still attached to the crushed firewall. The engine sustained thermal damage, consuming the right magneto, the spark plug harness, oil sump, alternator, and the right side of the accessory case. The carburetor sustained extensive thermal damage, melting the float and destroying all gaskets. The fuel inlet line fitting was in place, and the inlet screen was free of obstructions.

Visual inspection of the combustion chambers was accomplished through the spark plug bores utilizing a borescope; there was no evidence of foreign object ingestion or valve damage and all combustion surfaces were coated in grey deposits.

The crankcase did not exhibit any breaches indicative of internal catastrophic failure. Drive train continuity was established and the camshaft and magneto drive idler gears were intact. The camshaft lobes and corresponding tappet contact areas appeared undamaged.

The propeller remained attached at the crankshaft flange. The tip of one blade had melted away about 24 inches from the root; the remaining section of the blade exhibited one-inch-deep leading-edge gouges midspan. The second blade was bent about 15° aft midspan, and its tip separated about 28 inches from the root.

### **Additional Information**

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The airplane was equipped with an ACK Technologies emergency locator transmitter (ELT), model E-

01. It was manufactured in accordance with Technical Standard Order (TSO) C91a and transmitted on the 121.5 MHz and 243.0 MHz frequencies. Maintenance records revealed that the ELT was checked at the last annual inspection in accordance with 14 CFR 91.207d, and a label on the ELT indicated a battery expiration date of December 2022.

The Air Force Rescue Coordination Center (AFRCC), which is responsible for coordinating inland search and rescue activities, receives ELT distress alerts via the Cospas-Sarsat program. The Cospas-Sarsat satellite system ceased processing signals from 121.5 MHz and 243.0 MHz ELTs in February 2009 and now only processes signals from 406 MHz ELTs built in accordance with TSO-C126a.

The ELT was found at the accident site in the "armed" mode. It remained attached to its mount in the tail and was still connected to the antenna, which was undamaged and remained mounted on the top of the aft fuselage. Because the fuselage was inverted, the antenna was resting upside-down against the ground, with its view of the sky obscured.

The pilot from the sheriff's department who located the airplane stated that, although he was performing grid searches just southwest of the accident site, the ELT signal did not aid in the discovery of the airplane, as he did not hear the signal until he was almost directly over the wreckage.

## **Medical and Pathological Information**

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According to the autopsy performed by the Yavapai County Office of the Medical Examiner, Prescott Valley, Arizona, the cause of death for both the pilot and passenger was thermal injury with smoke and soot inhalation, along with multiple blunt force trauma.

Toxicology testing of both occupants was performed by the FAA Forensic Sciences Laboratory. Testing was negative for carbon monoxide and all screened drug substances and ingested alcohol. Refer to the toxicology report included in the public docket for specific test parameters and results.

## **Tests and Research**

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### Airplane Performance

The approximate radius of the bend in the river at the base of the canyon was 300 ft. The radius of the river canyon at the elevation of the wreckage was about 1,050 ft, and the radius at the canyon rim was 1,400 ft.

Airplane turning performance from Aerodynamics for Naval Aviators (NAVWEPS 00-80T-80), Figure 2.29, General Turning Performance (Constant Altitude, Steady Turn) indicated that an airplane with a true airspeed of 79 mph would have to bank 61° in order to fly a turn with a radius of 300 ft. At the same airspeed, an airplane would have to bank 27° in order to fly a turn with a radius of 1,050 ft.

The supplemental flight manual provided with the upgraded engine STC indicated that, at a gross weight of 2,500 lbs, with flaps up, the stall speed was 59 mph (calibrated airspeed). At bank angles of 20°, 40°, and 60°, the stall speed increased to 62, 68, and 84 mph, respectively.

The AOM provided maximum rate-of-climb data indicating that, with the airplane at a gross weight of 2,000 lbs, zero flaps, full throttle, and an indicated airspeed of 79 mph, the rate of climb at 5,000 ft and 20°C would be about 570 ft per minute.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Simpson, Elliott
<b>Additional Participating Persons:</b>	Leon L Kelley; Federal Aviation FSDO; Scottsdale, AZ Mark Platt; Lycoming Engines; Williamsport, PA Peter Basile; Textron Aviation; Wichita , KS
<b>Original Publish Date:</b>	September 10, 2019
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.ntsb.gov/Docket?ProjectID=96061">https://data.ntsb.gov/Docket?ProjectID=96061</a>

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

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