



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

November 20, 2018

AIRFRAME & ENGINE EXAMINATION REPORT

WPR17FA171

Big Bear City, California

July 29, 2017

1410 PDT

Cessna 172N; N5381J

Examination Participants

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HISTORY OF FLIGHT

On July 29, 2017, about 1420 Pacific daylight time, a Cessna 172N, N5381J, was substantially damaged after it collided with mountainous terrain. The commercial pilot and passenger was fatally injured. The personal flight was operated under the provisions of *14 Code of Federal Regulations Part 91*. Visual meteorological conditions prevailed and no flight plan was filed for the flight that departed Big Bear City Airport (L35), Big Bear City, California at 1410 and was destined for Apple Valley Airport (APV), Apple Valley, California.

According to witness who was located near the departure end of the active runway, the airplane departed runway 08 and slowly climbed to about 100 feet above ground level in an approximate 10° pitch up nose attitude. The airplane maintained the same altitude and pitch attitude as it turned south to the crosswind leg of the airport traffic pattern. After about 1 nautical mile, the airplane then turned to a westerly heading and began to "sink." As the airplane descended towards the tree tops the wings began to rock back and forth and then the airplane disappeared behind the trees. The witness reported that the engine sounded continuous during the ground roll and climbout.

PERSONNEL INFORMATION

The pilot, age 30, held a commercial pilot certificate with ratings for single-engine land, multi-engine land, and instrument airplane. He also held ratings for rotorcraft-helicopter and instrument helicopter. The pilot's most recent first-class medical certificate was issued on April 12, 2017, which did not include any limitations. At the time of the exam, the pilot reported that he had accumulated 225 total flight hours and no hours in the previous 6 months.

According to his personal logbook records, which were current as of July 10, 2017, the pilot accumulated a total of 225 total flight hours. Most of the pilot's single-engine flight time was accrued in a Diamond DA-40 airplane. His logbook indicated that he had completed a total of three flights in the accident airplane make and model and amassed a total of about 13 flight hours. His logbook showed flights in the accident airplane make and model as local flights from APV.

AIRCRAFT INFORMATION

According to Federal Aviation Administration (FAA) records, the airplane was manufactured in 1980 and registered to Zrelak Patrick and Midfield Aviation on August 1, 2009. The airplane was powered by a Lycoming O-320-H2AD, a direct drive, air cooled, 160 hp engine. A review of the logbooks revealed that the airplane's most recent 100 hour inspection was completed on July 2, 2017 at an accumulated flight time of 14,258.8 total flight hours. The 100 hour airframe and engine inspections were completed simultaneously at 4,252.6 hours and 589.1 hours since the engine's most recent overhaul, which was completed on October 23, 2015. At the time of the accident the airplane had accrued 4,306.4 hours total time in service.

The engine records showed that the engine had been removed and reinstalled in 2016 due to "camlobe and no. 3 cylinder." The logbook entry did not indicate the discrepancies with the camlobe and no. 3 cylinder. During the airplane's most recent 100 hour inspection, the no. 3 cylinder was replaced.

A fuel receipt recovered from Big Bear Air showed that the pilot purchased 5.14 gallons of 100 LL aviation grade gasoline at 1406 on the day of the accident. According to the airport staff, no fuel contamination or engine anomalies were reported by customers who fueled their airplanes on the day of the accident.

METEOROLOGICAL INFORMATION

The 1355 recorded weather observation at L35 included wind from 060° and 3 knots, visibility 10 statute miles, scattered clouds at 10,000 feet, temperature 26° C, dew point 01° C, and an altimeter setting of 30.37 inches of mercury.

An NTSB preliminary weather study showed the density altitude of 9138.9 feet.

WITNESS REPORTS

According to witness who was located near the departure end of the active runway, the airplane departed runway 08 and slowly climbed to about 100 feet above ground level in an approximate 10° pitch up nose attitude. The airplane maintained the same altitude and pitch attitude as it turned south to the crosswind leg of the airport traffic pattern. After about 1 nautical mile, the airplane then turned to a westerly heading and began to “sink.” As the airplane descended towards the tree tops the wings began to rock back and forth and then the airplane disappeared behind the trees.

Another witness was in the crosswind flight path to runway 08 when he observed an airplane with white and light brown stripes fly low towards the south over him. The airplane began a turn to the right and then disappeared over the backside of an adjacent hill. Both witnesses remarked that the engine sounded continuous during their respective observations of the accident airplane.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest in a wooded area approximately 0.5 nautical miles south of L35. The initial impact point (IIP) was identified by a tree scar near top of a 45 foot tall tree and the left wingtip, which was co-located with the tree. An additional scar was found on a separate tree about 20 feet forward of the initial tree strike signature. The right elevator remained attached to its horizontal stabilizer and was located 20 feet forward of the second tree. The main wreckage, which was oriented on a 085° heading and marked by multiple broken tree branches, was positioned in a 40° nose down angle and comprised of the engine, fuselage, wings, and empennage, approximately 40 feet forward of the IIP. A wreckage path heading of 227° was recorded from the IIP to the main wreckage. An odor of fuel was detected near each wing fuel tank, which were both breached.

The right wing had advanced forward a few degrees relative to the fuselage and displayed a concaved depression at the leading edge adjacent to the wing root. A cluster of dents were observed near the outboard leading edge. The left aileron exhibited buckling and compression and the flap displayed some compression wrinkles. Tree mark signatures were located throughout the right wing. Multiple dents and compression wrinkles were found on the upper and lower skin of the right wing.

The left wing separated from the wing root and exhibited an approximate 10 inch concaved depression at the outboard leading edge. Aft bending was observed at the outboard portion of the wing’s leading edge and aft compression was found inboard leading edge portion of the wing. The right aileron exhibited some compression along the trailing edge and the flap was extended with some trailing edge compression. Gouges and dents were found along the upper and lower inboard skin.

The fuselage came to rest in an approximate 40° pitch down attitude, but was intact with the exception of the engine, which had separated from the firewall. The nose landing gear collapsed and the forward fuselage was crushed aft into the instrument panel, which was distorted. Both

main landing gear were in their original fixed positions. Soot was observed along the belly of the airplane.

The vertical stabilizer, rudder, and left horizontal stabilizer were secured to the empennage, which remained attached to the aft fuselage. The right horizontal stabilizer separated at the stabilizer root and came to rest in the wreckage path and displayed a concaved depression below the leading edge. Both the vertical stabilizer and rudder were canted to the right. The trim tab was extended in a nose down trip position.

COCKPIT/CABIN OBSERVATIONS

Both the pilot and passenger's lap and shoulder belts were secured at their mounts. The passenger's lap and shoulder belts were not clasped and the pilot's belts had been cut by recovery personnel.

The following table reflects the occupant and baggage weights from property found at the accident site that were presumed to have been onboard the airplane.

Item/Occupant	Location	Weight
Pilot	Coroner's Office	199 lbs
Passenger	Coroner's Office	177 lbs
Baggage weight by coroner	Coroner's Office	66 lbs
	TOTAL	442 lbs

Instrument Indications at the Accident Site

Airspeed: 0
Attitude Indicator: OFF
Altimeter: 560 feet
VOR No. 1: 060°
VOR No. 2: 030°
Vertical Speed Indicator: 15 fpm
Heading Indicator: 007°
Turn Coordinator: Slight left wing low
Ball Deflection: Full Left
R and L Fuel Tank Quantities: 0
Control Lock: Disengaged
Oil Pressure: ~30 PSI
Oil Temp: 0°
Master Switch: ON
Avionics: ON
Magnetos: Left
Carburetor Heat: Knob fully advanced
Circuit Breakers: All in
Throttle lever: Broken
Mixture: Full rich
Flap indicator: 10°

Flap handle: 10°
Primer: Locked
Transponder: 1200 – ON
Trim wheel: Broken
Tachometer: 0 rpm 4,306.4 hours
Hour meter: 2,758.6 hours

AIRFRAME

Airframe Examination

Wings

All flight controls remained attached to the airframe. Left aileron control continuity was traced from the control yoke pulleys to the left bell crank; however, the push/pull tubes that connect the aileron to the bell crank had separated. Both cables were cut by recovery personnel at the left wing root. Right wing aileron control continuity was confirmed from the aileron to the control yoke pulleys and to the balance cable that connects both ailerons. The cables were severed by recovery personnel at the right wing root. The right flap cables were continuous from the bell crank to the wing root where they had been severed by the recovery team. The flap interconnect cables were traced through the cabin. Left wing flap continuity was traced from the wing root to the flap bell crank. The flap jackscrew did not display any threads, consistent with a flaps retracted position. An examination of the stall warning system revealed that the air tubes had been damaged. The stall warning reed did not exhibit any sound when air was sucked from the unit.

Rudder

The rudder cables were traced from the rudder pedals to the aft fuselage, where the cables had been cut by recovery personnel. The severed cable ends were further traced to the rudder bell crank through the turnbuckle.

Elevator

Both elevator cables were traced to the cockpit from the elevator bell crank through a cable separation in the aft fuselage, which was facilitated by the recovery team. The elevator trim jackscrew was extended about 1 1/8 inches, consistent with a 5° flap down deflection.

Fuel System

The fuel selector valve was intact and found in the RIGHT tank detent. The unit rotated normally to the LEFT, RIGHT and OFF positions. Residual fuel was observed in the forward port fuel line to the left wing and air was directed through the right forward port fuel line to the engine feed line through the fuel selector valve. The fuel selector rotated normally through each detent.

Gascolator

The gascolator bowl was removed, which displayed some debris, but no residual fuel.

ENGINE

Engine Examination

The engine was an O-320-H2AD, serial number L-1996-76T. The crankshaft was rotated by hand at the propeller and mechanical continuity was established throughout the engine and valvetrain. Thumb compression was observed for each cylinder as the propeller was rotated. The top spark plugs were gray in appearance, consistent with normal wear and the bottom spark plugs were dark in color, but were otherwise unremarkable. A borescope inspection of each cylinder did not show any deterioration on the intake and exhaust valves and seats. The oil sump contained approximately 3 quarts of oil and the suction screen was free of debris. The impulse coupling of the dual magneto rotated normally by hand, but did not seat during each turn. Spark was observed on each of the eight ignition harness leads. The vacuum pump rotated normally by hand and directed air through the outflow port. The unit was subsequently disassembled; the vanes and rotor were unremarkable.

The carburetor throttle linkage remained attached to the throttle arm and the mixture linkage was attached to the butterfly valve. Trace amounts of fuel was observed in the plunger within the float valve chamber. The needle valve did not exhibit any abnormal wear and the carburetor floats were normal in appearance.

A subsequent engine examination took place at the recovery facility on May 29, 2018 by the NTSB investigator-in-charge.

The rocker covers were removed and the engine was rotated by hand at the propeller flange. Each of the rocker arms exhibited normal and similar movement, consistent normal operation.

The oil filter was disassembled and did not display any metallic particles and the oil sump was free of debris.

All four cylinders were removed from the engine case along with their respective pistons. The cylinder walls display indications of normal wear including cylinder no. 3, which had been installed one month prior to the accident. Both the intake and exhaust valves to each cylinder displayed signatures consistent with normal wear. The valves were then removed from each cylinder and the valve stems were measured at the bottom (near the valve face), midshaft and top. The measurements are shown in the table below.

	Cylinder No. 1		Cylinder No. 2		Cylinder No. 3		Cylinder No. 4	
	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust
Top (mm)	12.55	10.22	12.55	10.19	12.53	10.18	12.52	10.17

Midshaft (mm)	12.52	10.22	12.54	10.21	12.47	10.21	12.50	10.21
Bottom (mm)	12.52	10.18	12.59	10.19	12.51	10.23	12.52	10.18

Table 1: Valve Stem Measurements

The engine case was separated and photographed. The camshaft lobes and each of the 8 camshaft lifters showed normal wear.

EMERGENCY LOCATOR TRANSMITTER (ELT)

The ELT was a Dorne and Morgolin, TSO 91.