

On February 13, 2015, about 2330 central standard time, a Piper PA-28R-180 airplane, N3918T, impacted terrain during a forced landing following an in-flight loss of engine power near Haviland, Kansas. The private pilot and passenger were uninjured. The airplane sustained substantial wing damage. The airplane was purchased by and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Night visual flight rules (VFR) conditions prevailed for the flight, which did not operate on a flight plan. The flight originated about 2118 from the East Kansas City Airport (3GV), near Grain Valley, Missouri, and was destined for the Dalhart Municipal Airport (DHT), near Dalhart, Texas.

The pilot indicated in his accident report that he had a mechanic perform a pre-purchase inspection of the airplane. During the pre-purchase inspection, the mechanic asked if a cylinder was changed recently and was told that it had been changed. The airplane owner flew the accident pilot on a local flight to test the function of the landing gear. Airplane logbooks were reviewed.

The pilot and the mechanic departed in the airplane and subsequently contacted Kansas City Approach Control. The pilot requested flight following services to DHT. The airplane was flown at 8,500 feet above mean sea level during cruise flight. About 2.2 hours into the flight, the pilot heard a "pop" and felt a "severe vibration" for about five seconds. The engine "rapidly" lost power. An "explosion" was heard and the airplane subsequently decelerated and pitched down. The emergency locator transmitter activated following the explosion. The airplane was descending between 2,500 and 3,000 feet per minute. The pilot attempted to restart the engine. It did not restart and the pilot saw white lights in a straight line, which he identified as a road. He elected to perform a forced landing to the west on the road. The landing gear selector was placed in the down position and only the main landing gear lights subsequently illuminated. The emergency landing gear extension procedures did not extend the nose landing gear. The pilot lined the airplane up with the road's shoulder so the left wing would not collide with oncoming traffic. The airplane touched down about 75 mph and the pilot held the nose gear up while attempting to avoid oncoming traffic. The airplane impacted a highway sign pole and the airplane subsequently turned 90 degrees to the right. The airplane then impacted a culvert, traveled over a ditch, and came to rest about 50 feet from the road.

At 2335, the recorded weather at the Pratt Regional Airport, near Pratt, Kansas, was: Wind 230 degrees at 6 knots; visibility 10 statute miles; sky condition clear; temperature 1 degree C; dew point -2 degrees C; altimeter 30.21 inches of mercury.

The pilot reported that he held a Federal Aviation Administration (FAA) private pilot certificate with an airplane single-engine rating. He held a third class medical certificate without any limitations. The pilot indicated that he had accumulated 183 hours of total flight time and 2 hours of flight time in the same make and model airplane as the accident airplane.

N3918T was a 1967 model Piper PA-28R-180 four-seat, low-wing, retractable tricycle-gear, single engine airplane with serial number 28R-30255. It was powered by a 180-horsepower, four-cylinder Lycoming IO-360-B1E engine, with serial number S/N: L-4412-51A, which drove a constant-speed propeller. The pilot reported that the airplane had its most recent annual inspection completed on October 21, 2014, and that it accumulated 3,156 hour of total time.

According to the mechanic who replaced the number four cylinder, the cylinder assembly was replaced instead of being repaired due to a time constraint. He indicated that the cylinder was removed as outlined in the Lycoming Operators Manual for the O-360 and Associated Models Manual, P/N: 60297-

12, Revision Number 60297-12-5, dated October 2005 and subsequent Revision dated December 2009. Section 5: Maintenance Procedures, Item 4: Cylinders, Items: A thru C. The piston pin was test fit in the connecting rod and the play felt. The piston pin was within new tolerance. The connecting rod was taken to a fixed base operator for bushing replacement where it was rebushed and checked for straightness.

The rod bolts and rod nuts were replaced and the connecting rod was reinstalled as per Overhaul Manual – Lycoming Aircraft Engines Direct Drive, P/N: 60294-7, Revision Number 60294-7-14, Current Revision July 2011, Section 7: Crankcase, Crankshaft and Reciprocating Parts, Item 7-67. Rod Nuts were torqued as per Section 10: "Table of Limits" of the above overhaul manual, SSP-1776-B current Revision January 2011, Part 1: Direct Drive Engines, Section "V": Special Torque Requirements, Reference (new) 900, Page 1-34. This engine is a Chart "S" code as listed on page "ii" of the Table of Limits. Rod nuts were torqued to 480 in-lbs. / 40 ft-lbs.

A replacement cylinder assembly was received and all its items were visually inspected and deemed serviceable. Cylinder and piston installation was performed as per Lycoming Operators Manual, P/N: 60297-12, Revision December 2009, Section 5: Maintenance Procedures, Item 4: Cylinders, Items: D and E. Cylinder base nuts 1/2" diameter were torqued as per the above Manual procedures with a final torque of 600 in-lbs. / 50 ft-lbs. and 3/8" diameter nuts were torqued to 300 in-lbs. / 25 ft-lbs. These torque numbers are also listed in the "Table of Limits" of the Overhaul Manual Section 10, Part 1, Section "V", Reference (new) 929, Page 1-35. The torque wrench used during this maintenance procedure was reported to have a current calibration.

The mechanic reported that cylinder break-in procedures were performed as per Lycoming Service Instructions 1427C and all functions were normal during all procedures. He was subsequently asked to confirm the break-in flight time as indicated in the logbook endorsement. He, in part, indicated:

I had forgotten that the plane had flown previously until I spoke with the owner. There was approximately 2.5 hours flown prior to the flight with the owner and buyer. Although it didn't fly for two hours continuously, there was two flights lasting approximately 30 minutes each, and then another flight for approximately 1.5 hours. The owner and I had discussed the break-in procedures and it was performed IAW Lycoming SI 1427C with the exception of the two hour single flight.

The cylinder write-up was signed off while the previous and new owner were standing out by the aircraft, I didn't sign it off in the physical presence of the new owner as I had taken the logbook into my hanger and entered the write-up.

No abnormalities were reported to the owner or mechanic by the pilot of the flights that occurred before the airplane departed on the accident flight.

~~The airplane was subsequently flown to a nearby airport for other certification and returned to 3GV. No abnormalities were reported to the owner or mechanic by the pilot of that flight.~~

The airplane wreckage was examined by an FAA inspector who observed that its number four engine cylinder had separated from its crankcase. Its piston was found separated from its connecting pin and the piston remained within the cylinder's bore.

The inspector removed that cylinder and shipped it to Varian Medical Systems, Inc., near Lincolnshire, Illinois. The internal configuration of an engine cylinder head was documented using radiographic images that were collected on March 31, 2015, under National Transportation Safety Board (NTSB) supervision. A total of 985 computed tomography (CT) slice images were examined, processed, and analyzed by an NTSB lead aerospace engineer. The engineer produced a radiographic factual study using the CT images and the study, in part, indicated that there were no indications of any damage to the valves, rocker arm, spark plug (only one was present) or piston rings and that there were indications of three cracked areas within the remaining portion of the piston head. The cylinder was subsequently shipped to Danbury Aerospace near San Antonio, Texas for further examination. The Computed Tomography Specialist's Factual Report is appended to the docket material associated with this investigation.

The engine from the accident airplane was removed and it was also shipped to Danbury Aerospace. The engine was disassembled under the supervision of the NTSB investigator-in-charge. The magnetos were mounted to and run on a test bench where they were found to be operational. The engine driven fuel pump pumped a liquid when its lever was manipulated by hand. The fuel servo, fuel divider, and fuel injectors were operational when tested. The oil pump was bound. The oil pump was opened and debris was found within the pump. The oil screen contained debris.

A safety representative from Danbury Aerospace produced a teardown report, which is appended to the docket material associated with this investigation. The report, in part, indicated that a large hole in the crankcase was observed between the number 4 and number 3 cylinders. The camshaft exhibited a separation in the proximity of the number 3 and number 4 intake lobes. The number 4 connecting rod was severely bent with the piston pin still in the connecting rod small end. The camshaft exhibited damage with its aft section displaced toward the number 4 cylinder. The damage to the number 4 connecting rod and the camshaft was consistent with the connecting rod and its piston pin flailing in the engine and the connecting rod and piston pin contacting the camshaft as the crankshaft rotated the crankpin toward the number 4 cylinder. The top right anchor through bolt exhibited stretching and part of the fracture surface was separated in a flat pattern perpendicular to the length of the through bolt. Some of the cylinder studs were missing. The separation surface of one half-inch stud from the number 4 cylinder exhibited a granular appearance and was broken perpendicular to the length of the stud as shown. The upper sections of the number 4 cylinder deck exhibited fretting along with another section at the upper right anchor through bolt. The body fit hole at the parting line on the separated section of the crankcase above the number 4 cylinder was deformed. The number 4 piston exhibited a fractured around the skirt and through the pin bosses. The remaining skirt portions exhibited a burnished appearance consistent with contact against the bore. A nut on the number 4 connecting rod was not tight. There was no discoloration of the bearing and crankshaft journal. Cylinders number 1 through number 3 all showed exhibited a bore glaze. The number 3 cylinder bore exhibited score marks that were in line with the piston pin plugs. The piston pin plugs were damaged. The number 3 piston was separated below its oil ring and sections of the piston were found in the oil sump along with sections from the number 4 piston. There were loose studs and nuts found on the other cylinders.