WRECKAGE AND IMPACT

HISTORY OF FLIGHT

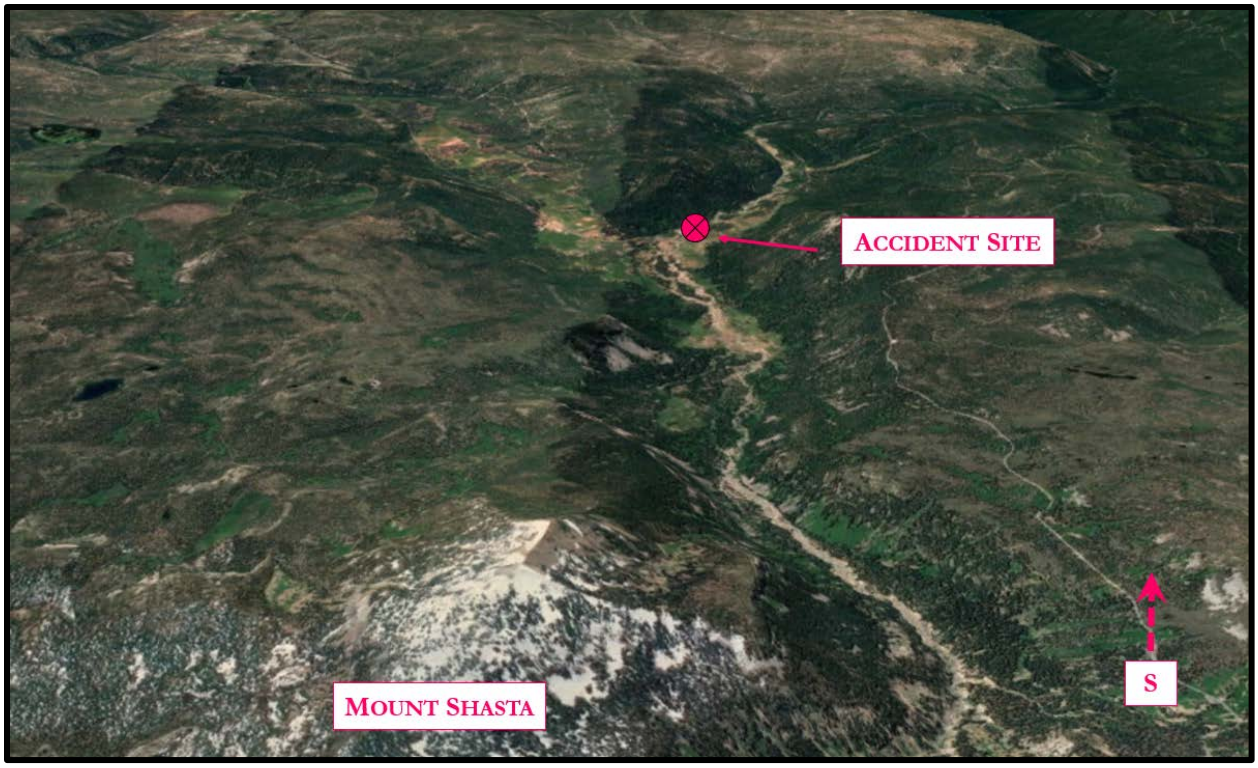
On May 01, 2019, about 1100 Pacific daylight time, a Cessna T182P, N7302S, experienced a loss of power and collided with a powerline while making an emergency landing to grassy marsh in Mill Creek, California. Air Carriage, Inc.,[1] the registered owner, was operating the airplane under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91. The certified flight instructor (CFI) and front-seated passenger sustained serious injuries; the rear-seated pilot-rated passenger sustained fatal injuries. The airplane sustained substantial damage. The personal local flight departed from Chino Airport, Chino, California, about 1010. Visual meteorological conditions prevailed and no flight plan had been filed.

The pilot stated that earlier in the morning he made a short local 20-minute flight in an effort to familiarize himself with the airplane. After he arrived back at the airport, he had the airplane topped off with full fuel and then met the passengers. The purpose of the flight was for the pilot to fly the passengers around Mount Shasta and after landing they intended to go to lunch together.

The pilot stated that following departure, he maneuvered the airplane toward Mount Shasta and climbed to about 11,000-11,500 feet msl. The airplane approached the west side of the mountain and the pilot began to maneuver in a right turn with the intention of making a 360° tour around the it. As soon as the airplane transitioned over to the east side of Mount Shasta, he heard a muffled "boom" from the engine compartment immediately followed by a puff of white vapor and a partial loss of power. Thereafter, black smoke began to enter the cockpit consistent with the smell of burnt oil. The pilot trimmed the airplane for the best glide-speed and the airplane began to descend rapidly at an estimated 1,000 feet per minute. When looking for a suitable place to make an off-airport landing, he observed a snowy field and began a stable approach, extending full flaps with the intention of slipping the airplane to the clearing. The pilot briefly attempted to troubleshoot the engine and noted that when he retarded the throttle there was a slight reduction in power, which gave him an indication that at least one piston that continued to fire. He immediately advanced the throttle fully forward to arrest the dissent as much as possible.

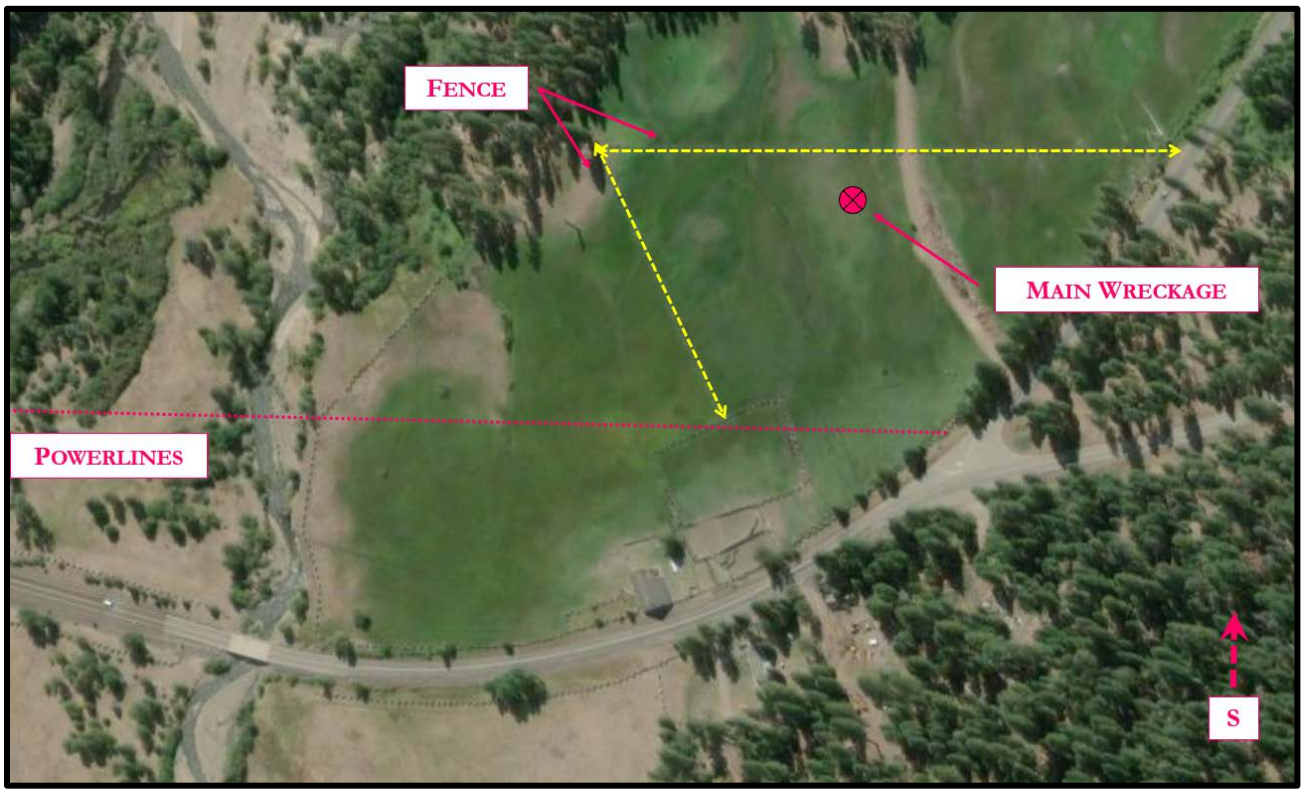
Picture 01: Accident Site in Reference to the Departure Airport

[1] Internet presence: http://www.aircarriageinc.info/index.html ;
https://www.facebook.com/lowell.daun/timeline?lst=620096409%3A1098091315%3A1557437458



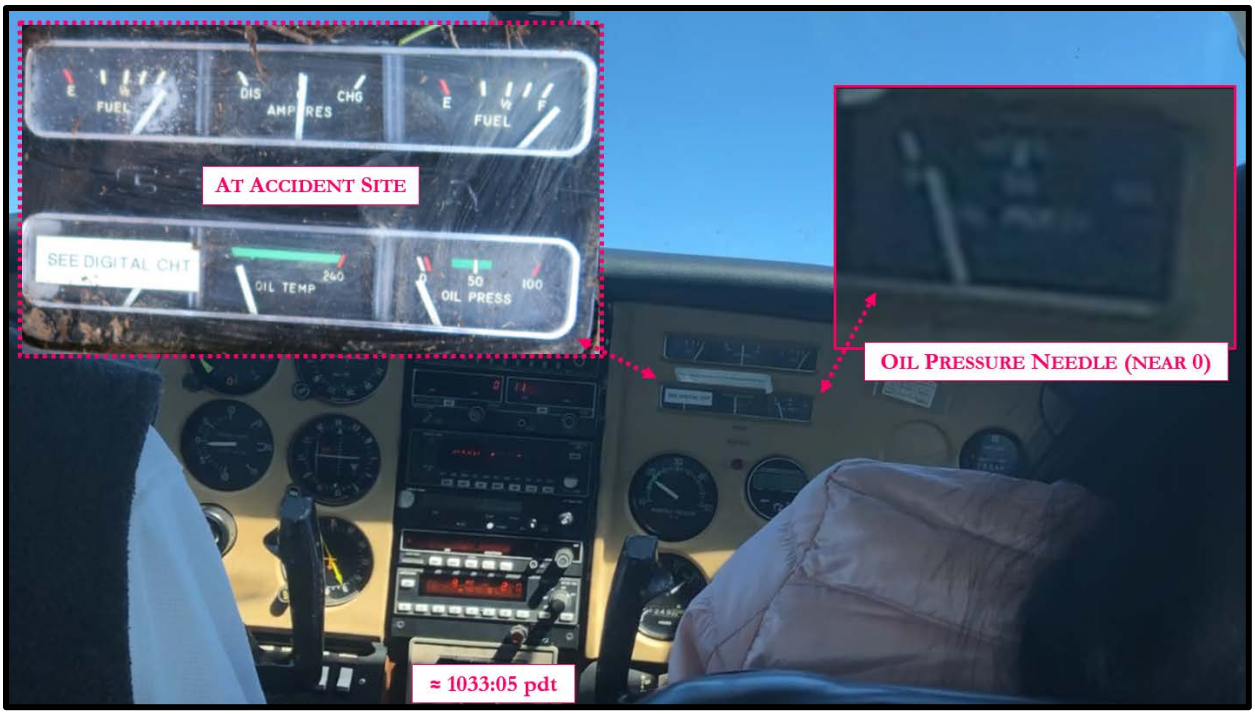
Picture 02: Accident Site in Reference to Mount Shasta

While aligning with the snow patch, the pilot noticed a grassy meadow and decided that would be a better option because there was no snow coverage. He retracted the flaps and made a right turn toward the meadow aiming to have enough altitude to clear the treetops. He planned to flare the airplane immediately after clearing the four-foot fence that stretched northwest-southeast across the field. After the airplane passed over the treetops, he extended the flaps again and continued toward the fence. The pilot suddenly saw powerlines immediately ahead and attempted to maneuver the airplane in a dive underneath them. The airplane contacted the wires and spun from the impact coming to rest inverted.



Picture 03: Main Wreckage in Reference to the Powerlines

The rear-seated passenger's cellular phone[2] contained photographs and a video of the flight. The 24-second video, beginning at 1032:43, captured part of the cockpit. Images revealed that the engine oil pressure gauge was indicating near 0 psi and the tachometer read 4249.7 hours.[3] The engine pumps about 4 gallons of oil per minute. The last photograph on the phone was taken at 1038:16 when the airplane was north of Mount Lassen.

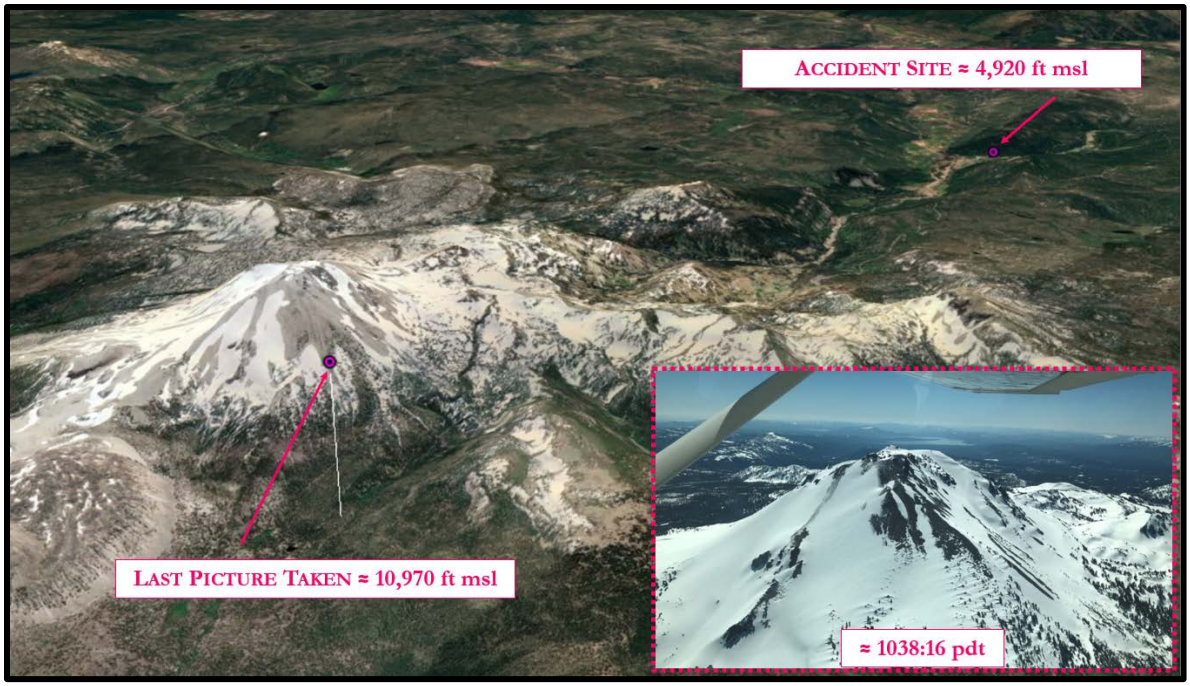


Picture 04: Video Image Showing the Engine Oil Pressure Gauge

Picture 05: Video Image Showing the Tachometer

[2] Apple iPhone X

[3] At the accident site, the tachometer read 4250.1.



Picture 06: Location of Last Photograph Taken in Reference to the Accident Site

A review of the Air Traffic Control recordings from Oakland Center and Chico Tower revealed that there was a transmission on the Chico Tower frequency about 1040:25 that said "mayday, mayday".[4] The rear-seated passenger sent a text at 1041 that read "Smoke in cockpit," followed by another text that said "Stopping."

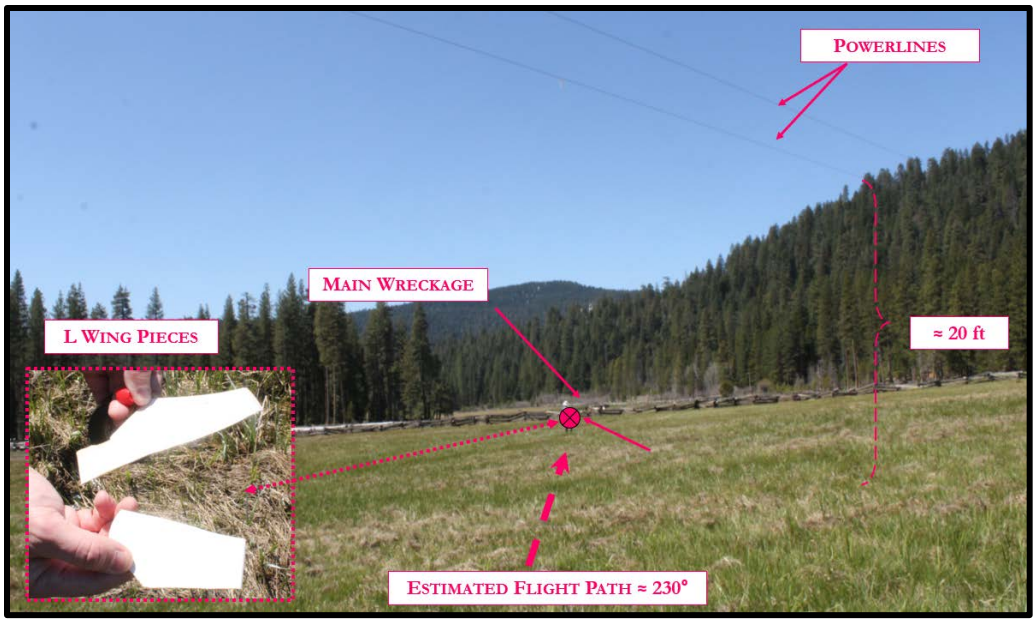
ACCIDENT SITE

The accident site was located in marshy terrain about 37.5 nautical miles from the destination airport at the following coordinates: 40°21'38.10"N / 121°30'39.90"W . In character, the terrain was composed of soft, wet grassy marsh. The wreckage was found distributed over a 565 foot distance on a median magnetic bearing of about 230°. Powerlines, two parallel wires about 20 feet in height and oriented east-west, stretched across the field. There were several fence structures, about 4 feet in height, two of which bordered the debris field; one fence located on the south end of the debris field was oriented east-west and the other oriented northwest-southeast was oriented in between the wires and the main wreckage.

Picture 07: Debris Field

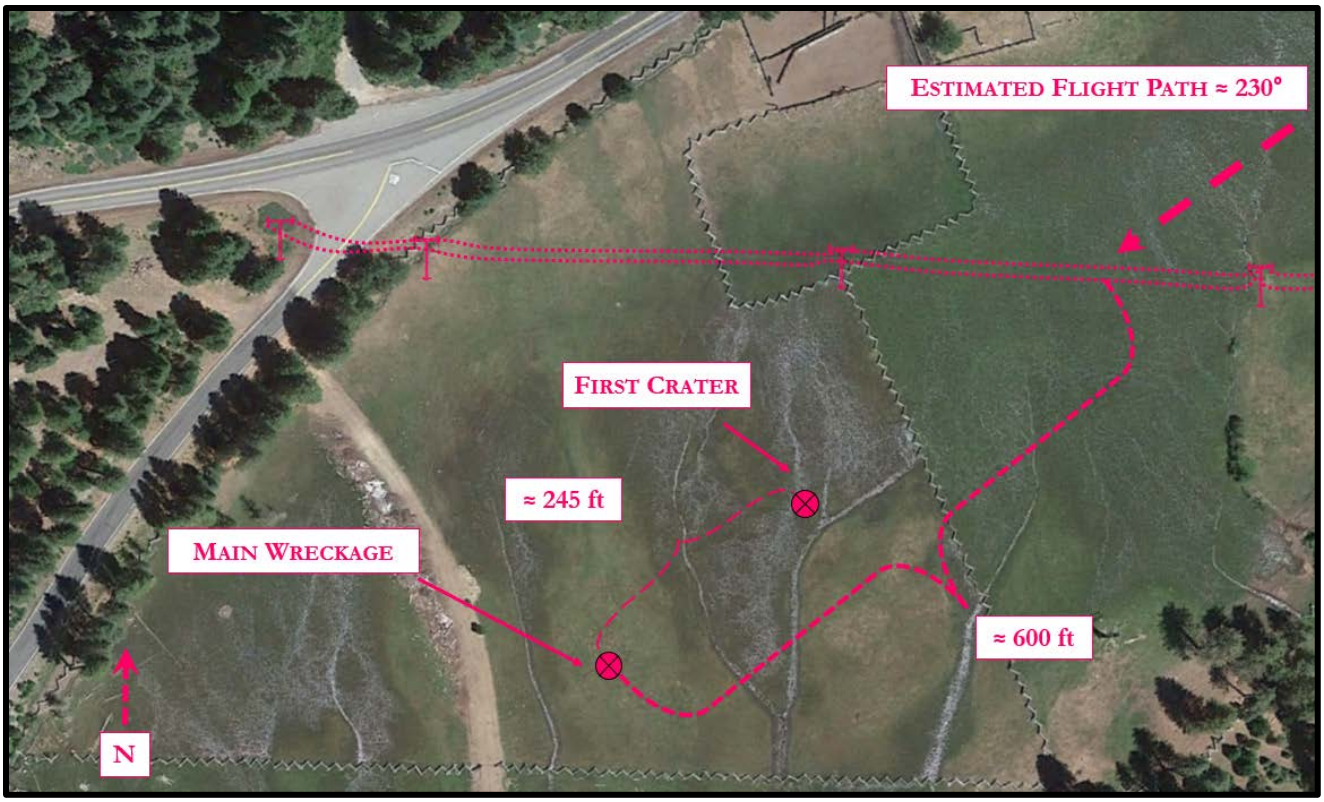
[4] http://archive-server.liveatc.net/kcic/KCIC1-May-01-2019-1730Z.mp3

The first identified pieces of debris were pieces of the fairing from the left-wing strut and located about 40 and 70 feet from the powerlines. The towers supporting the wires were about 375 feet apart.

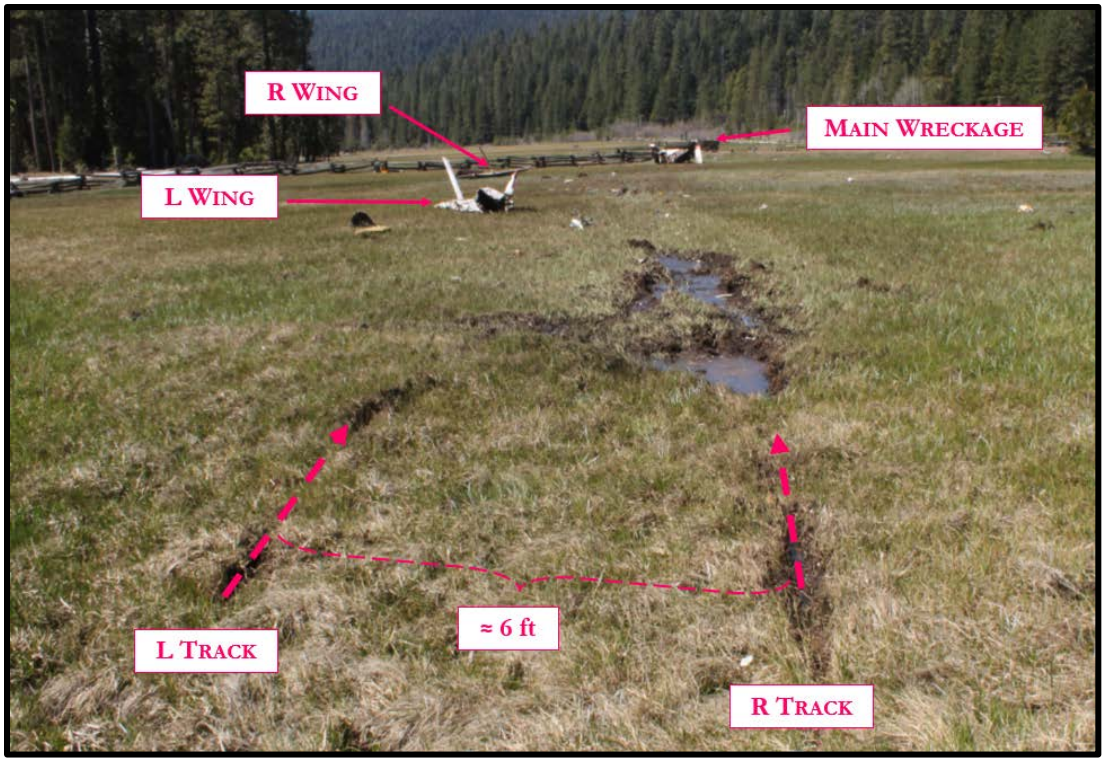


Picture 08: First Identified Debris

The first identified points of contact consisted of disrupted mud and grass in the marsh making up the far northeastern end of the debris field. The markings started as two nearly parallel indentations in the vegetation and dirt spaced about 6 feet apart. There were deep craters after the indentations and disrupted grass that continued southwest toward the main wreckage. The craters were consistent in size and orientation to that of vertical stabilizer and rudder, consistent with the airplane impacting terrain inverted.

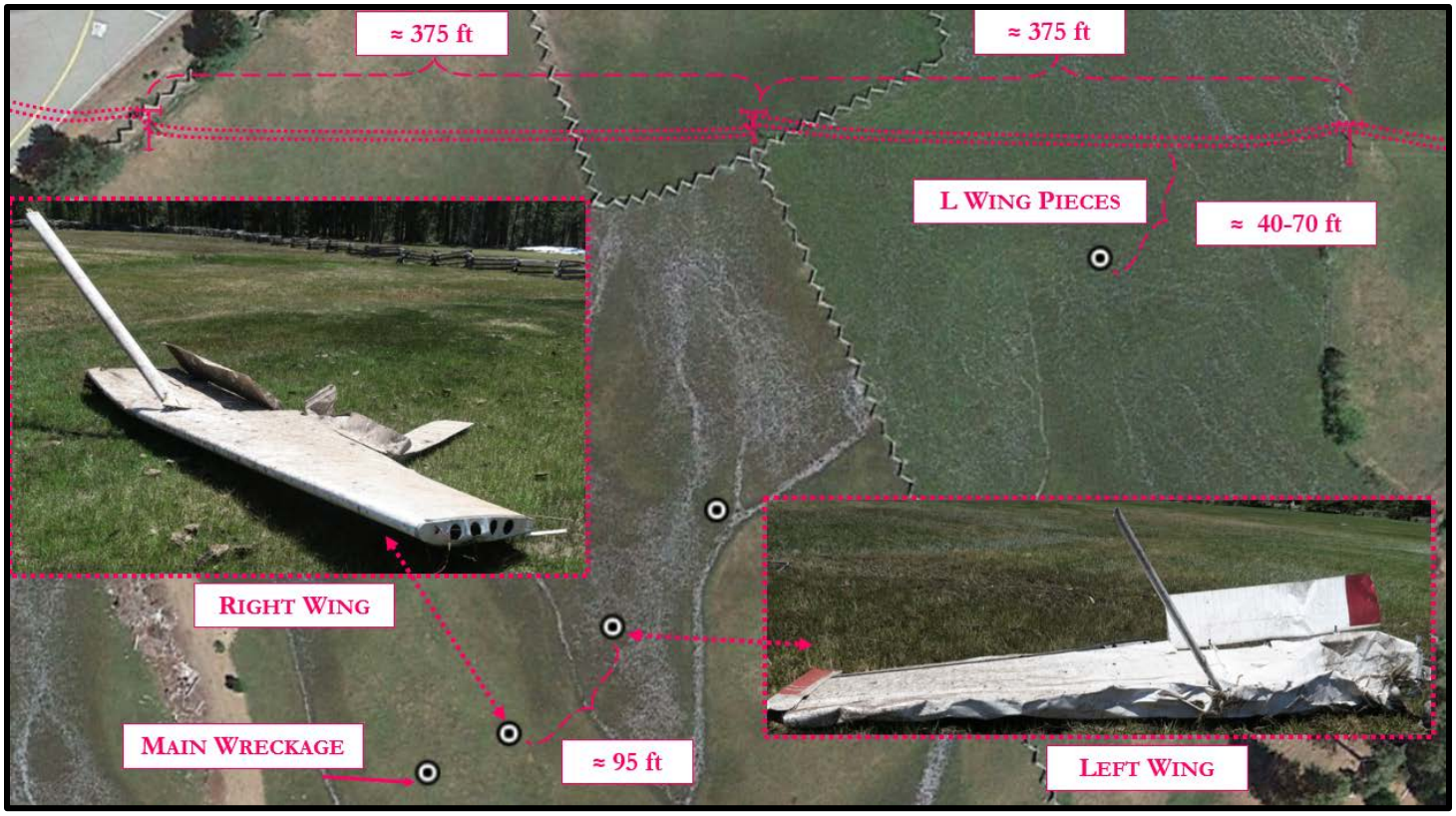


Picture 09: Debris Field in Reference to the Powerlines



Picture 10: Ground Scars in Debris Field

The left wing was about 460 feet from the powerlines and came to rest inverted. The right wing, also inverted, was about 95 feet further along the debris field from the left-wing. Along the debris field were several pieces of the internal engine components consisting of a portion of a connecting rod and fragments of piston. Additionally, in the debris field there were portions of the upper fuselage, window frame, personal items, attitude indicator, outboard left horizontal stabilizer, and wing pieces.

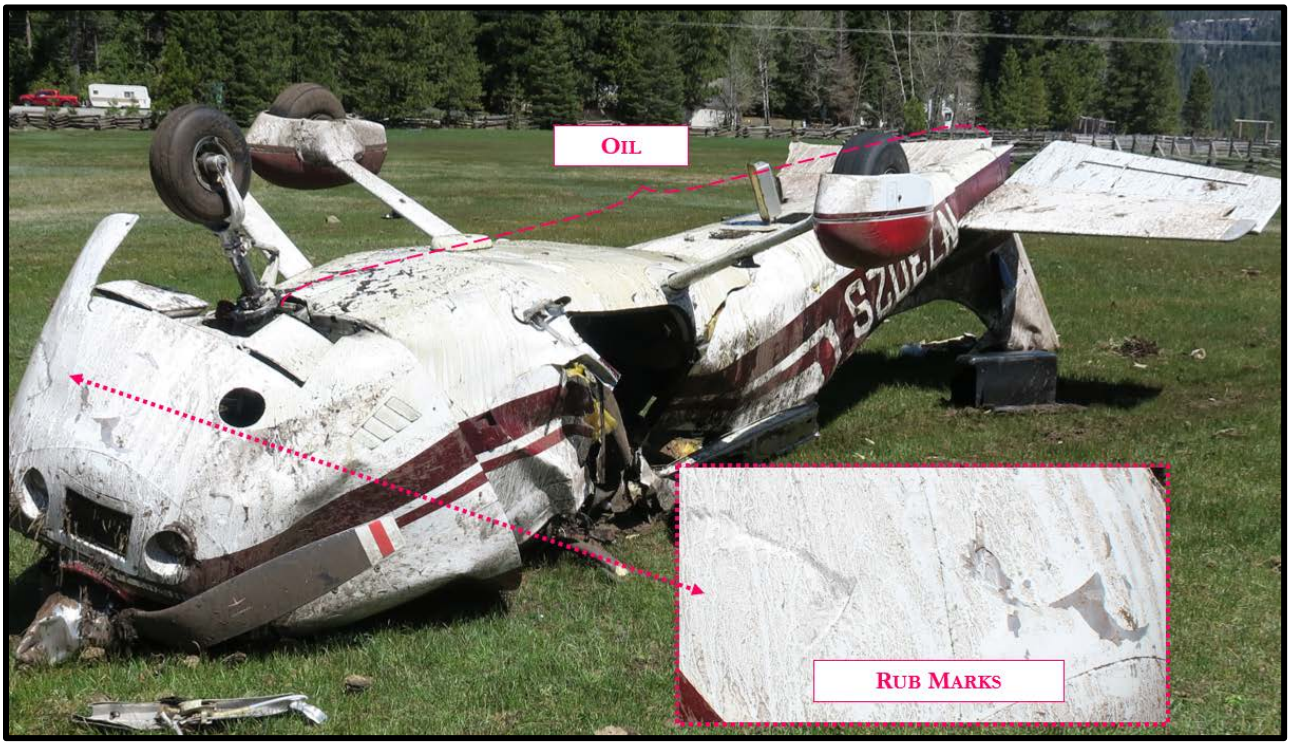


Picture 11: Main Wreckage Referencing Wings

AIRFRAME

The fuselage came to rest inverted. A 2.5-foot portion of the left-wing strut remained attached to the fuselage and the fracture surface was consistent with the fracture surface on the portion attached to the left wing. The doors had been removed by first responders. There was an oil sheen on the entire belly of the fuselage and lower surface of the horizontal stabilizer and elevator control surfaces. The lower left cowling contained a rub mark consistent with contact with a wire.

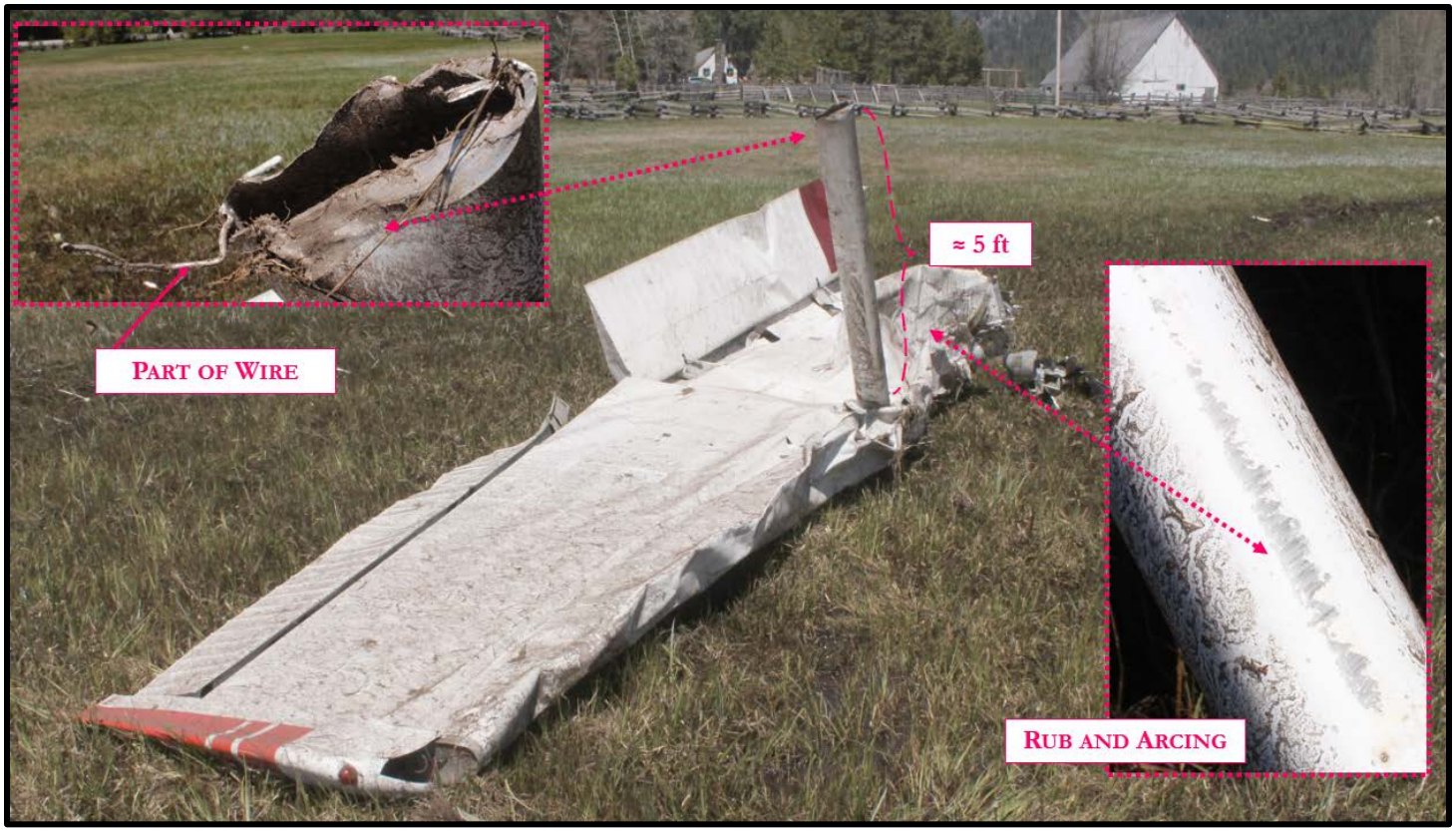
Picture 12: Main Wreckage



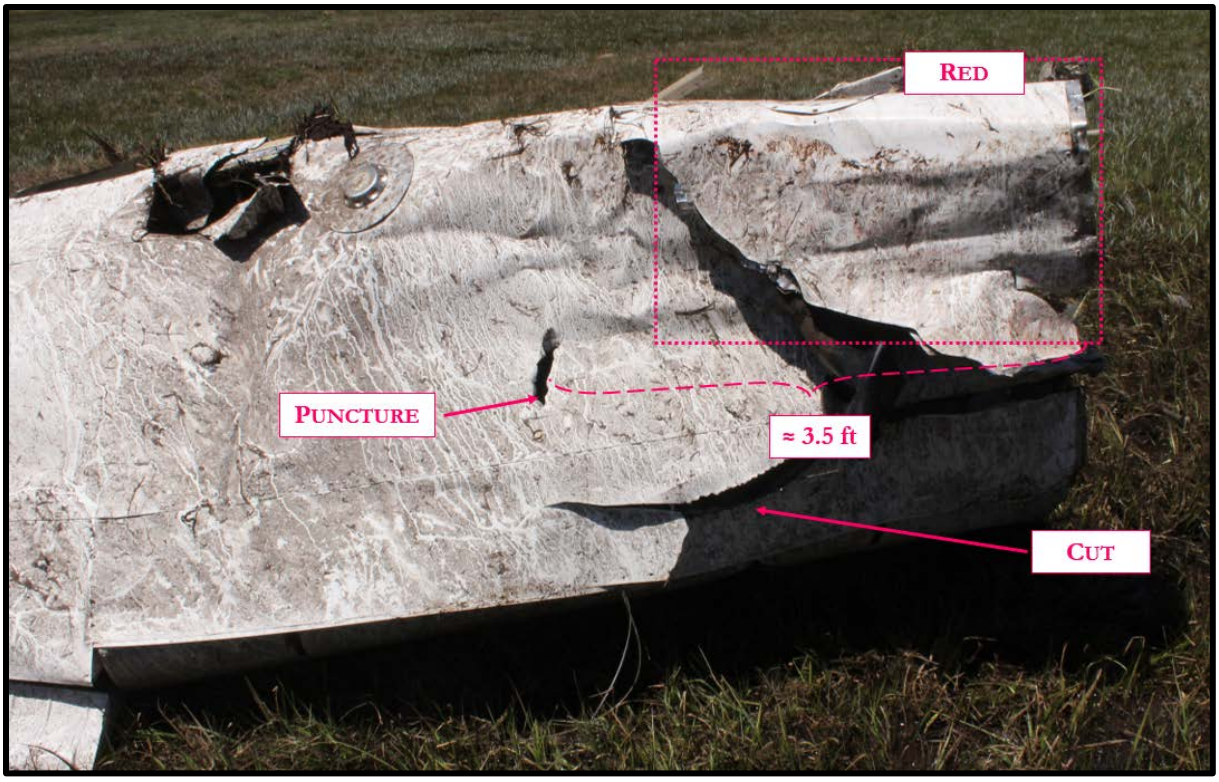
Picture 13: Main Wreckage Referencing Oil and Rub marks

The left wing had the aileron and flap control surfaces attached at their respective attached points. The leading edge exhibited crush damage along the entire length with the inboard section significantly crushed more aft. The upper 5 feet of wing strut remained attached to the wing. On the leading edge of the wing strut were numerous rub marks and small holes consistent with arcing. The area where the separation of the strut occurred contained a small metal wire in the fracture surface was consistent with having been sliced apart. The fuel cap remained engaged in the wing. The crush damage to the inboard of the wing had damaged the bladder of the fuel tank. On the top of the wing

there was a red color inboard and a puncture about 3.5 inches inboard consistent in size and placement to the wing making contact with the antenna on the upper cabin. The was cut parallel to the leading edge, consistent with the aileron cable being attached at impact.



Picture 14: Lower Left Wing



Picture 15: Upper Left Wing

The right wing had the flap control surface attached at its respective hinges. The aileron had folded on itself and only remained attached to the inboard attached points. The wing contained a liquid consistent in odor and appearance with Avgas. According to the Cessna representative, the flap actuator indicated there was 20° the flaps extended.

The rudder control surface remained affixed to the vertical fin structure. The horizontal stabilizer and elevator remained attached to the empennage. The Cessna representative confirmed control continuity from the cockpit controls to the control surfaces. The 121.5 Emergency Locator Transmitter (ELT) was activated during the accident.

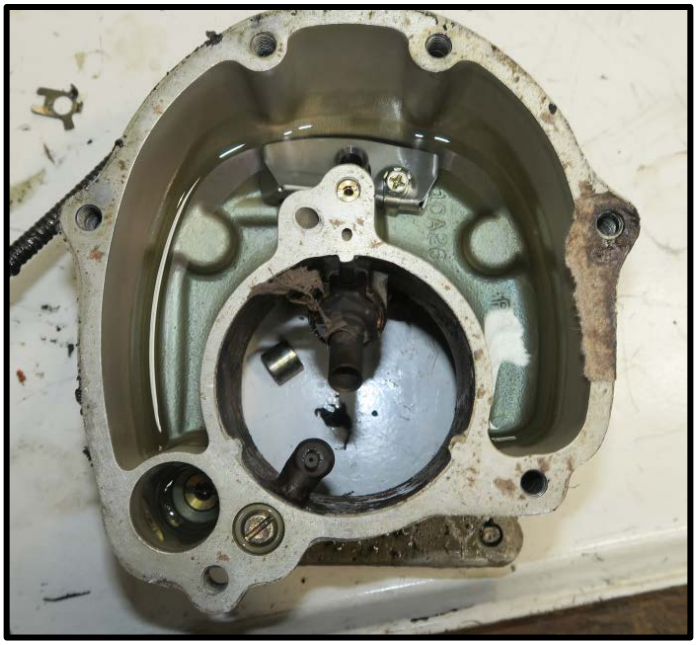
Picture 16: Right Wing

Picture 17: ELT

FUEL

Fuel system continuity could not be established due to impact. Liquid consistent in odor to that of 100LL Avgas was present in the right wing tank, in the fuel strainer and in the carburetor. The fuel selector valve was found in the "RIGHT" position. There was no evidence of debris in the strainer. The fuel screens in the wing tanks were clean of debris.

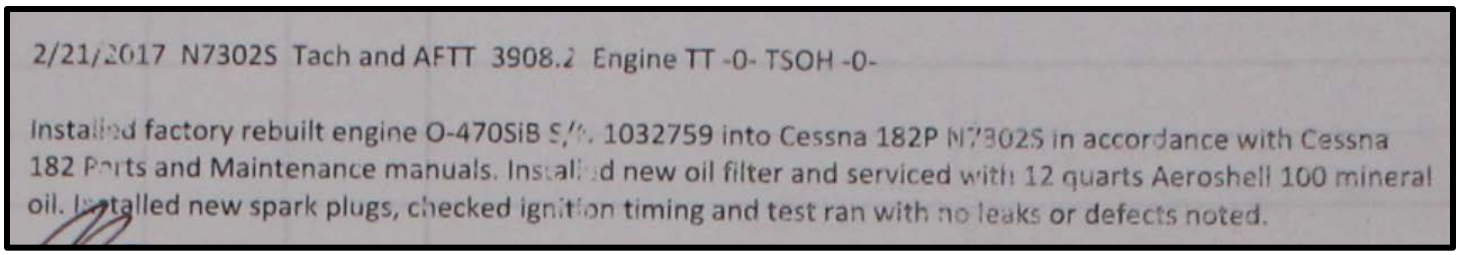
Picture 18: Strainer With Fuel



Picture 19: Carburetor Bowl with Fuel

ENGINE

The Continental Motors O-470- S, serial number 1032759, was a factory remanufactured engine installed on February 21, 2017 at an airplane total time of 3908.2 hours. Continuity was established from the throttle, mixture, and propeller controls in the cockpit to their respective arms in the engine compartment.


2/21/2017 N7302S Tach and AFTT 3908.2 Engine TT -0- TSOH -0-

Installed factory rebuilt engine O-470SiB S/N. 1032759 into Cessna 182P N7302S in accordance with Cessna 182 Parts and Maintenance manuals. Installed new oil filter and serviced with 12 quarts Aeroshell 100 mineral oil. Installed new spark plugs, checked ignition timing and test ran with no leaks or defects noted.

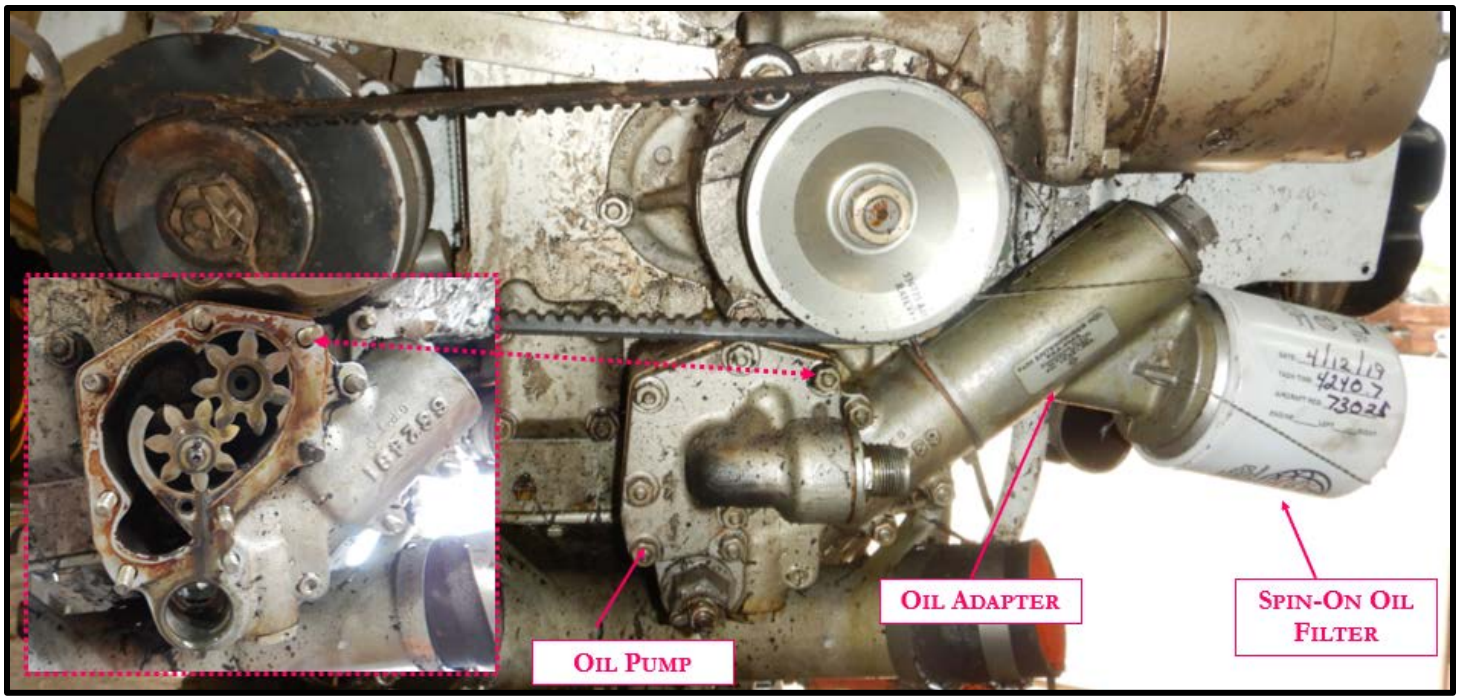
Picture 20: Logbook Entry for Engine Change

An external examination of the engine revealed oil staining on the firewall. There was a hole in the bottom of the case where the No. 3 cylinder and the push rods were loose. There was additionally a hole in the upper case near the No. 4 cylinder. The internal case was examined by using a lighted borescope through the hole in the crankcase near No. 4 cylinder. The oil sump contained about a cup of visible oil and numerous pieces of the internal components were at the bottom. There were numerous gauges and shinny grooves on the back of the No. 4 piston and the No. 3 piston had rotated and there was no piston pin present.

Picture 21: Engine Showing Hole in Case

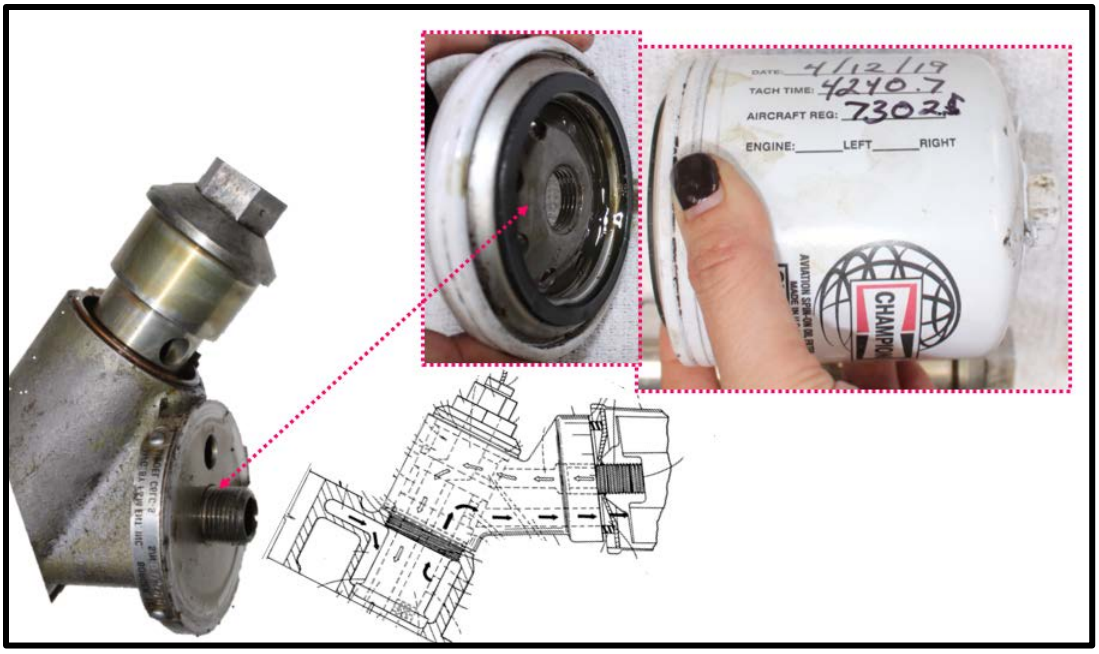
Investigators removed the upper spark plugs of all cylinders; they were light gray in color with the No. 3 plug face being slightly darker gray. According to the Champion Aviation Check-A-Plug AV-27 Chart, these spark plug signatures correspond to normal engine operation. A lighted borescope was used through the spark plug holes to examine the combustion chambers. All the cylinders, aside from the No. 4 cylinder, revealed no foreign object damage, no evidence of detonation, and no indication of excessive oil consumption. The No. 4 cylinder could not be internally examined due to the piston being frozen in a position partially covering the borescope hole. The carburetor was dissembled, revealing intact plastic floats and liquid resembling Avgas in the bowl.

The engine was equipped with an F&M Enterprises Inc. engine oil filter adapter, model C6LC-S (s/n 60399). The purpose of the adapter was to enable the engine to use a conventional spin-on oil filter. As manufactured, the oil pump has a brass oil screen mounted to the casing and the filter adapter uses the oil screen bore to attach to the engine. According to the patent[5] the adapter included a tee casting (housing) and a hub (shaft) which was threaded to screw into the oil screen hole on the oil pump casting. The tee casting had a sleeve with a through bore and a mounting base with an end for receiving a spin-on oil filter. When installed, the hub was journaled into the bore of the sleeve and screwed into the oil screen hole, which had two oil passage openings. A crown (1-inch bolt head) at the outer end of hub secures the tee casting against the oil pump casing. Oil inlet and oil outlet passages are provided through the hub and the tee casting to circulate oil from the oil screen hole into the spin-on filter, and back into the oil screen hole from the spin-on filter.



Picture 22: Accessory Gear Case Showing Location of Oil Filter Adapter

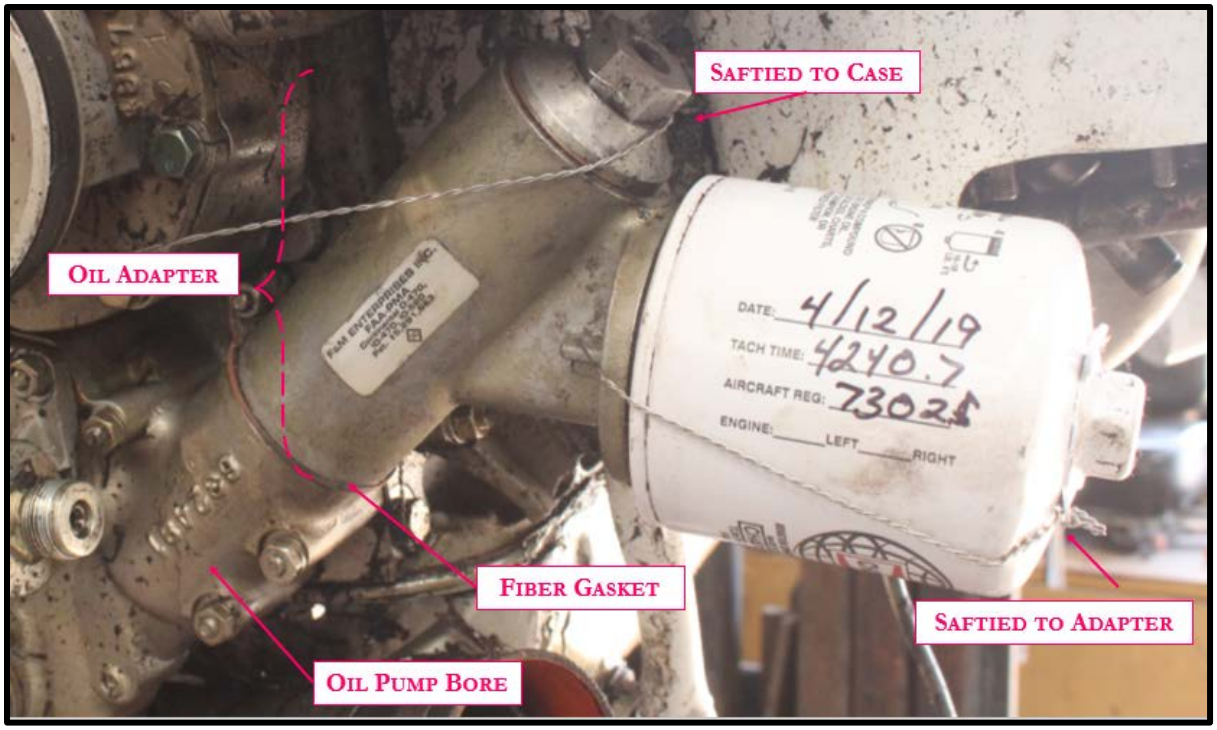
[5] See Attachment 05: Oil Filter Adapter Patent



Picture 23: Oil Filter Adapter Mounting Pad

EXAMINATION

An external examination of the engine at the accident site, revealed that the filter adapter was loose, and the adapter housing could be rotated about the shaft.[6] The crown head of the shaft and the oil filter screen bolt head both remained saftied. There was a concentration of oil in the area of the adapter and adjacent firewall.

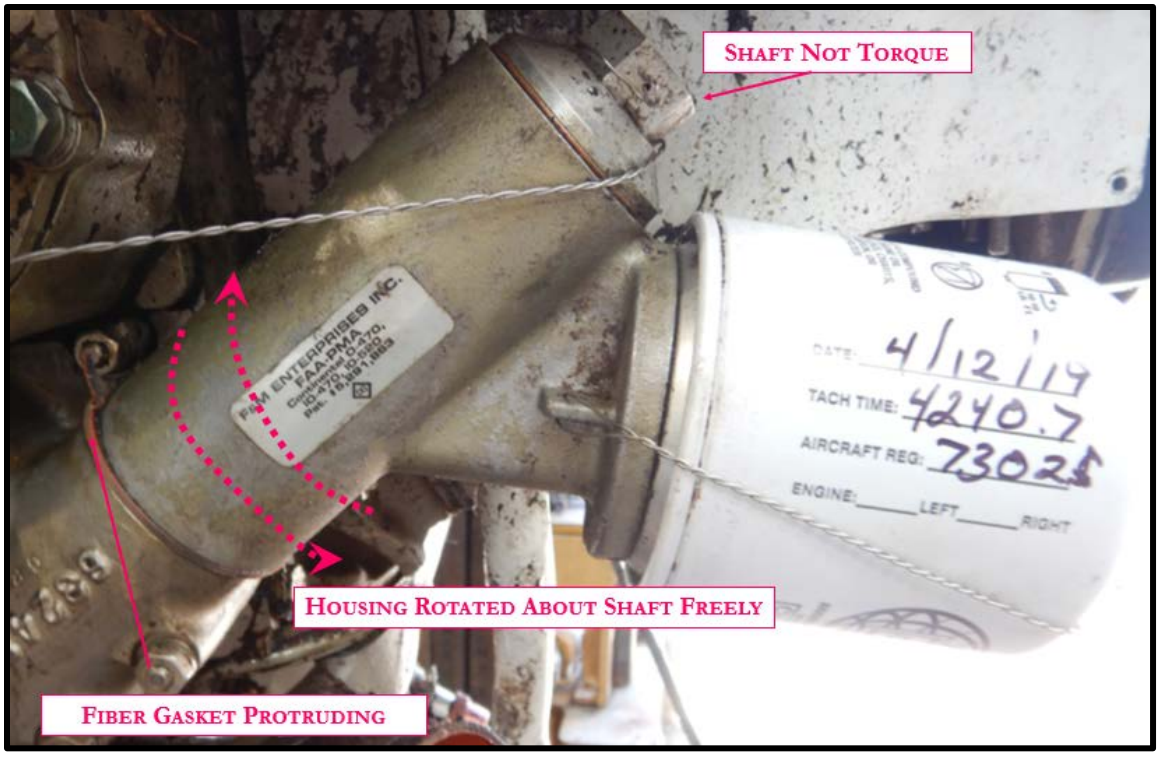


Picture 24: Oil Filter Adapter as Installed on Oil Pump Bore

Following recovery, a closer examination revealed that the fiber gasket, located between the oil pump casting and the adapter was protruding with the outside edge extending beyond the castings. Additionally, a tear could be seen in the gasket where the adapter housing abutted the engine case. Investigators removed the safety wire and

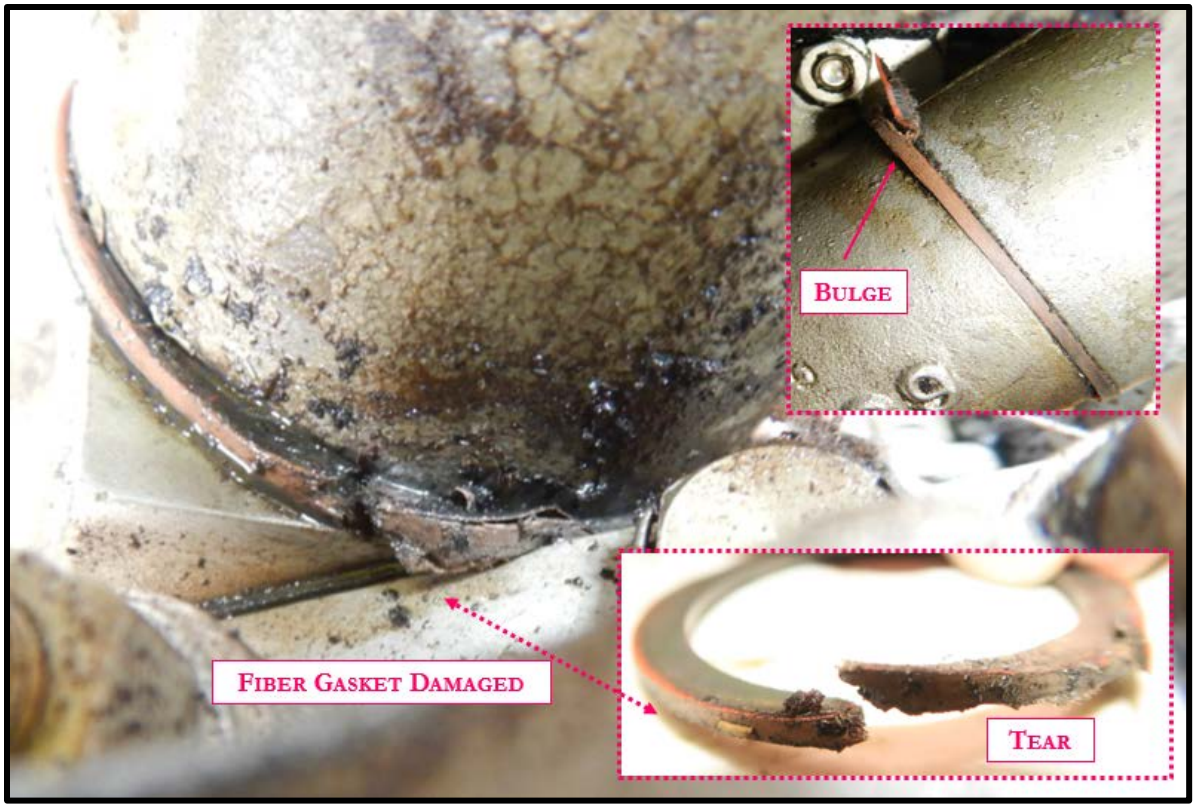
[6] See https://www.flickr.com/photos/136005688@N02/28283176785/in/set-72157668173219294/ for example

attempted to assess the breakaway torque of the adapter. The torque was less than 20 foot-pounds, which was the force set on the torque wrench.

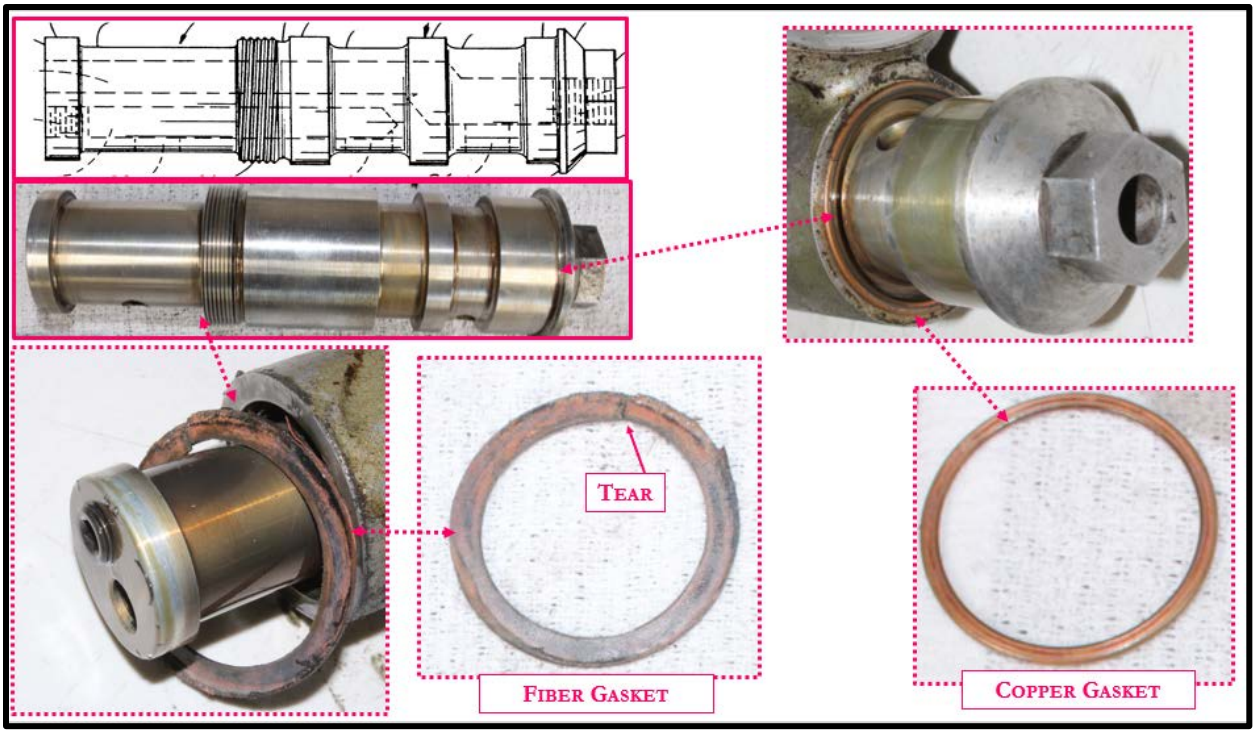


Picture 25: Oil Filter Adapter Could be Rotated Freely

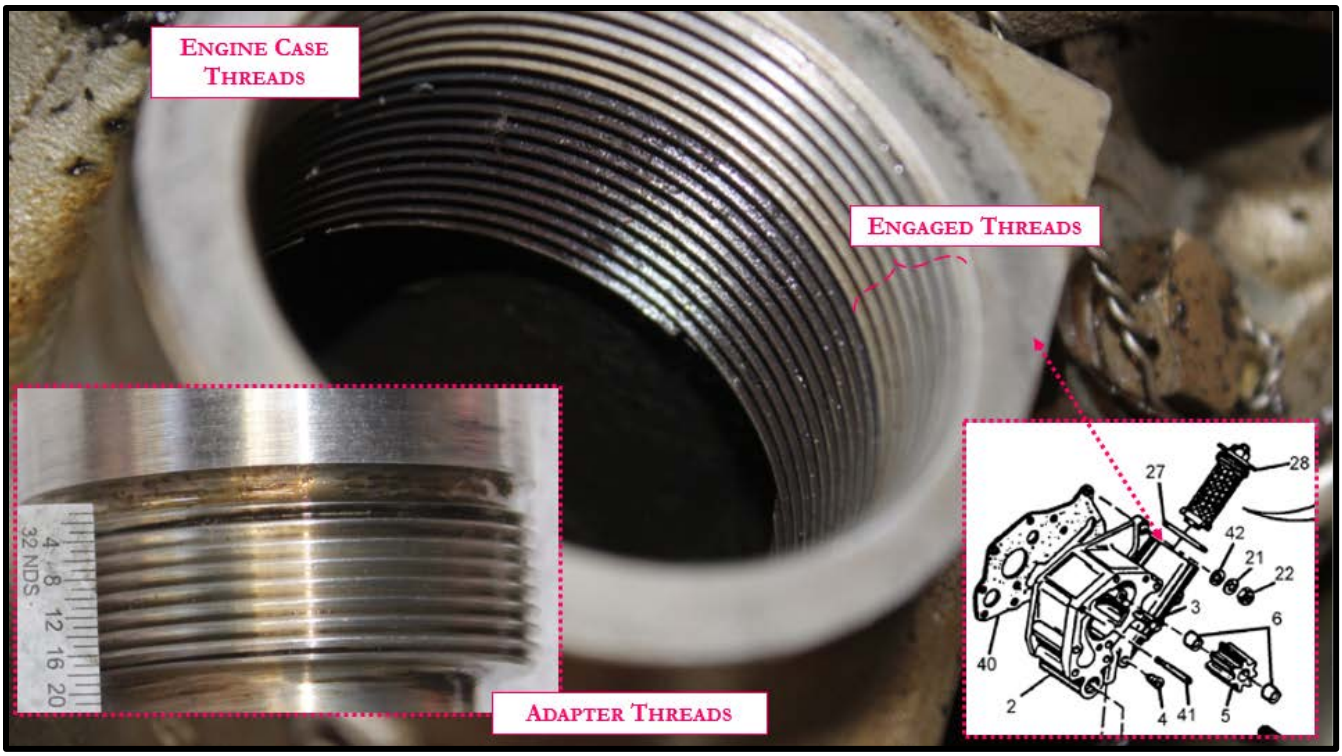
Removal of the adapter revealed that the fiber gasket was completely split The copper crush gasket was intact. The oil filter was removed and cut open; there were several small metal flakes, but otherwise the pleats were clean from debris.



Picture 26: Fiber Gasket



Picture 27: Shaft Showing Gaskets



Picture 28: Threads of Oil Pump and Adapter

MAINTENANCE

The filter adapter was installed on the engine under FAA Supplemental Type Certificate (STC) SE09356SC. According to the owner, he installed the oil filter adapter upon receipt of the engine in February 2017. There were no documents regarding the installation of the adapter, but in an interview with the owner, he stated that he removed the adapter off the prior engine. The FAA records indicated that engine that was removed, O-470-S (s/n 464449) had the STC installed June 16, 2006. The owner stated that the adapter was off an engine for about one month and could not recall the procedures he used to install the adapter, but thought he would have looked at the manufacturer's instructions and


INSTALLED OIL FILTER ADAPTER AS PER STC SE09356SC AND INSTALLATION INSTRUCTIONS FOR CONTINUED AIRWORTHINESS INSPECT FOR SECURITY AND LEAKAGE AT EACH OIL AND FILTER CHANGE AN AT EACH SCHEDULED INSPECTION .

Picture 29: STC Entry in FAA Airworthiness Records

The maintenance records indicate that the oil filter was changed on seven occasions all of which were performed by the owner:

Date	TSMOH	Tach	Performed By
4/18/2017	20.4	3928.6	Owner
6/24/2017	55.6	3963.8	Owner
9/20/2017	103.2	3963.8	Owner
3/24/2018	167.7	4075.9	Owner
7/7/2018	218.1	4126.3	Owner
8/31/2018	267.5	4175.7	Owner
4/26/2019	332.5	4240.7	Owner

Picture 30: Summary of Oil Changes

MANUFACTURER GUIDANCE

The oil filter adapter required one fiber gasket, p/n FM-07, and one copper crush gasket, p/n AN900-28 to be used in the installation. In addition, manufacturing guidance indicated that at each annual inspection or 100-hour inspection, the mechanic was to inspect the oil filter adapter for oil seepage, the safety wire, the security of the adapter, and record the results of the inspections in the logbook. Maintenance guidance for the oil filter adapter included instructions for replacing the gaskets anytime the oil filter adapter was removed from the engine and reinstalled, and at 300 hours or 3 years, whichever occurred first.

On October 08, 2013 F&M Enterprises released a continued airworthiness instruction document, FM2007-01,[7] that sated that gaskets were to be removed at 300 hours or three years, whichever occurs first.

CAUTION.....New gaskets are to be installed anytime the oil filter adapter assembly is removed from the engine and re-installed. Replace gaskets at 300 hours or 3 years whichever occurs first. Refer to the respective F&M Installation Instructions for gasket part numbers.

The C6LC-S Installation Manual[8], released April 06, 2017 contained a note that "The oil filter adapter transfer cylinder must be re-tightened to 65 foot pounds of torque between 8 and 12 hours of operation after installation or any time the adapter is removed and reinstalled." There was another note that stated that the mechanic must include the following statement in the Form 337 (in pertinent part): "If the oil filter adapter is loosened, or removed from the engine for any reason, it must be re-installed using new gaskets, tightened in accordance with these installation instructions and properly safety-wired."

[7] See Attachment 08: Instructions for Continued Airworthiness 2017

[8] See Attachment 06: Installation Manual

On April 06, 2017 Stratus Tool Technologies, LLC (part of Tempest who purchased the STC), issued instructions for continued airworthiness.[9] The document gave instructions that at each oil change and each 100-hour or annual inspection, the mechanic should "inspect the oil filter adapter for oil seepage," and "if oil seepage is detected, replace the fiber and copper gaskets on the transfer cylinder with new gaskets." It stated that the "use of a torque wrench is mandatory when installing or reinstalling the filter adapter," and to "safety-wire the transfer cylinder to an appropriate safety-wire location on the engine accessory case." Following that maintenance the mechanic should "run the engine and check for oil leaks."

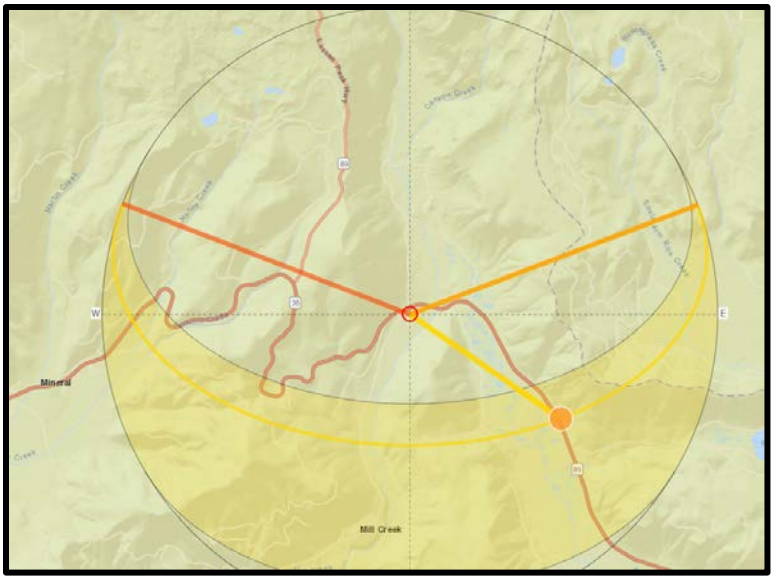
An additional instruction states that a mechanic should "Check and verify that the body does not move (rotate around the transfer cylinder) when 10 to 20 pounds of force is applied to the body in a manner that would tend to rotate it around the transfer cylinder," and "if the body rotates around the transfer cylinder, remove the safety-wire and tighten the adapter." The instructions further stated to "always install new fiber and copper (where used) gaskets each time the filter adapter is removed and reinstalled on the engine."

PROPELLER

The two propeller blades remained in the hub and were bent aft.

Picture 31: Propeller Blades

WEATHER INFORMATION



Dawn:	05:36:03
Sunrise:	06:05:11
Culmination:	13:03:08
Sunset:	20:01:45
Dusk:	20:31:00
Daylight duration:	13h56m34s
Distance [km]:	150.731.005
Altitude:	53.40°
Azimuth:	124.67°
Shadow length [m]:	0.74

Picture 32: Sun Information at the Time of the Accident

[9] See Attachment 07: Instructions for Continued Airworthiness 2017