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----- SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT -----

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## 1 ACCIDENT:

Location: Poughkeepsie, New York  
Date: July 19, 2019  
Time: About 1440 eastern daylight savings time (EDT)  
Aircraft: Piper PA46-310P  
Serial Number: PA46-8508046  
Registration: N811SK

## 2 SYSTEMS GROUP:

Chairman: Michael Bauer  
National Transportation Safety Board  
Washington, D.C.

Member: Tom Jacky  
National Transportation Safety Board  
Washington, D.C.

Member: Jonathon Hirsch  
Piper Aircraft.  
Vero Beach, FL

Member: Philip Grice  
Continental Motors  
Mobile, AL

## 3 SUMMARY:

### 3.1 Event Summary

On July 19, 2019, about 1440 eastern daylight time, a Piper PA46-310P, N811SK, was substantially damaged during a forced landing while on approach to Hudson Valley Regional Airport (POU), Poughkeepsie, New York. The private pilot and two passengers were seriously injured, and one passenger sustained minor injuries. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the flight that originated at Akron-Fulton International Airport (AKR), Akron, Ohio, about 1248. The airplane was owned and operated by the pilot under the provisions of Title 14 Code of Federal Regulations Part 91. The personal flight was originally destined for North Central State Airport (SFZ), Pawtucket, Rhode Island.

### 3.2 Systems Group Summary

The systems group assistance was requested on March 24, 2020 after the initial wreckage examination and engine run were completed. After reviewing available data from the airplane's J.P. Instruments (JPI) Engine Data Monitor (EDM) and an Avidyne Integrated Flight Display (IFD), a second wreckage examination was conducted on August 21, 2020. The systems group chairman was not present for the initial wreckage examination which occurred on August 29, 2019 and the engine run which occurred March 20, 2020, however an NTSB investigator was present and provided oversight for the previously mentioned events. A member of the NTSB systems group was present at the second wreckage examination, since the systems group chairman could not travel due to NTSB COVID-19 protocols in place at the time of the examination.

After the second wreckage examination, the previously disassembled engine driven fuel pump was removed from the box containing the engine for further visual and computed tomography (CT) inspection. Details of CT imaging can be found in the Computed Tomography Specialist's Factual report.

This report contains the factual information related to the group's inspection and documentation of the aircraft's fuel and powerplant systems as noted.

### 3.3 Acronyms

|           |                                      |
|-----------|--------------------------------------|
| 100LL     | 100 Octane Low Lead                  |
| AKR, KAKR | Akron-Fulton International Airport   |
| AL        | Alabama                              |
| COVID-19  | Coronavirus disease 2019             |
| CT        | Computed Tomography                  |
| EDM       | Engine Data Monitor                  |
| EDT       | Eastern Daylight Savings Time        |
| FAA       | Federal Aviation Administration      |
| FL        | Florida                              |
| FWD       | Forward                              |
| Gal       | Gallons                              |
| Gal/Hr    | Gallons per Hour                     |
| Hr        | Hour                                 |
| IFD       | Integrated Flight Display            |
| IIC       | Investigator in Charge               |
| JPI       | J.P. Instruments                     |
| NTSB      | National Transportation Safety Board |
| POU, KPOU | Hudson Valley Regional Airport       |
| RPM       | Revolutions Per Minute               |
| SFZ, KSFZ | North Central State Airport          |
| Sta       | Station                              |
| TCM       | Teledyne Continental Motors          |

## **4 DETAILS OF THE INVESTIGATION:**

### **4.1 Aircraft Information**

Manufacturer/Model Series: Piper PA-46-310P (Malibu)  
Aircraft Registration: N811SK  
Aircraft Serial Number: PA46-8508046  
Manufactured Date: 1985

At the time of the initial wreckage examination, the airplane's hours were noted as follows:

Hobbs Meter: 215.7  
Total Flight Hours: 2,682.8<sup>1</sup>

The airplane's most recent annual inspection was performed on March 12, 2019. At the time of the annual inspection the reported hours were:

Hobbs Meter: 174.2  
Total Flight Hours: 2,641.3

### **4.2 Powerplant Information**

Manufacturer: Continental Motors  
Model Number: TSIO-550-C (1B)  
Serial Number: 802608  
Manufactured Date: November 5, 2001

At the time of the accident, the engine had the following approximate hours.

Engine Hours at last 100-hour inspection: 1053.6  
Total Engine Hours: 1095.1 (estimated)

The aircraft was initially delivered in 1985 with a TSIO-520-BE engine installed.

### **4.3 Accident Site Information**

The systems group chairman did not travel to the accident scene. The group chairman was briefed by the investigator-in-charge (IIC) regarding the on-scene findings. The initial examination on scene was performed by an FAA inspector. The aircraft came to rest upright among trees and brush. There was no evidence of fuel, fuel spillage and no odor of fuel at the accident site. Photographs from the accident site showed the airplane's right wing displayed significant impact damage, was separated at its root, and came to rest immediately adjacent to the fuselage. The left wing appeared attached and largely intact.

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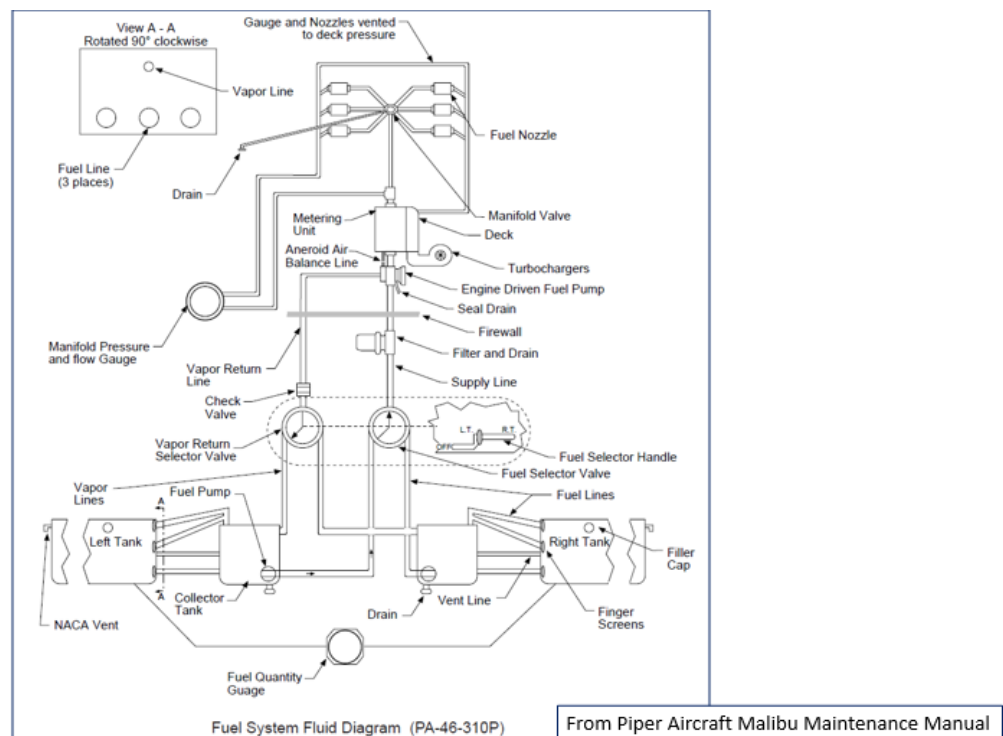
<sup>1</sup> Based on Hobbs meter time and airframe logbook entry for last annual.

## 4.4 Systems Descriptions, Inspections and Testing

The following sections contain descriptions and operation information for the respective systems. The information is based on aircraft flight manual documentation and manufacturer documentation.

### 4.4.1 Fuel System:

The aircraft fuel system main components consist of two main integral wing tanks, two collector/sump tanks, two fuel pumps, a fuel selector valve, a fuel filter and tubing connecting to the engine driven fuel pump. On the powerplant the fuel system consists of an engine driven fuel pump, fuel metering unit, manifold valve and six fuel injector nozzles. Refer to Figure 1 which contains a schematic representation of the fuel system.



**Figure 1 - Fuel system schematic from aircraft maintenance manual**

The main integral wing tanks are located in both the left and right wings, outboard of the mid wing splice and each tank is capable of holding 60 usable gallons with one gallon of unusable fuel. The total capacity of both tanks is 122 gallons. A filler cap for each tank is located on the top of each wing. Each tank is gravity fed through three lines to its respective collector/sump tank which are located at the root of each wing. The collector tank sumps are the lowest points in the fuel system and contain a drain valve to allow draining of the collector and main tanks.

The main tanks vent to the atmosphere by “non-icing vents” located outboard of each wing tank. The collector/sump tanks vent to their respective main tanks. Reverse flow from the collector to the main tanks is prevented by two flapper check valves in each collector tank.

Each collector/sump tank contains a submerged, electrical, centrifugal fuel pump. The fuel pumps are operated by a switch on the instrument panel and has two speed settings, low and high.

A fuel selector handle is located in the cockpit and allows for the pilot to select between the left and right tanks and an off position. The fuel selector handle is connected to the fuel selector valve via a cable assembly. The fuel selector valve also contains a vapor return circuit which allows fuel vapor to return to the selected collector/sump tank during operations. The fuel selector valve is mounted on the right-hand side of the aircraft, behind the co-pilot's seat in a non-pressurized compartment.

Fuel flows from the selector valve to the fuel filter located below the baggage floor on the right-hand side of the aircraft. The fuel filter contains a drain valve which has a nylon tube that extends through the fuselage skin to allow for fuel samples to be taken. To obtain a fuel sample from the fuel filter, the operator/maintainer simply pushes on the nylon tube to extract the fuel sample. After the sample is taken, releasing the push on the nylon tube closes the drain valve.

Fuel then continues to flow towards the engine driven fuel pump. The engine driven fuel pump is driven through a geared system from the engine crankshaft. Changes in engine speed, measured by revolutions per minute (RPM), affect the total flow from the engine driven pump. The engine driven pump contains a drain which will port fuel overboard in the event of a failure of an internal fuel pump seal. Excess fuel and vapor from the pump travels through the fuel return lines to the selector collector/sump tank.

Fuel from the engine driven pump is then fed to the throttle and fuel metering unit. The throttle and fuel metering unit controls the engine air intake and sets the metered fuel pressure for proper fuel/air mixture for engine operation. The fuel/air mixture then flows to the manifold and is then distributed among the engine's six cylinders. Excess fuel is returned to the engine driven fuel pump.

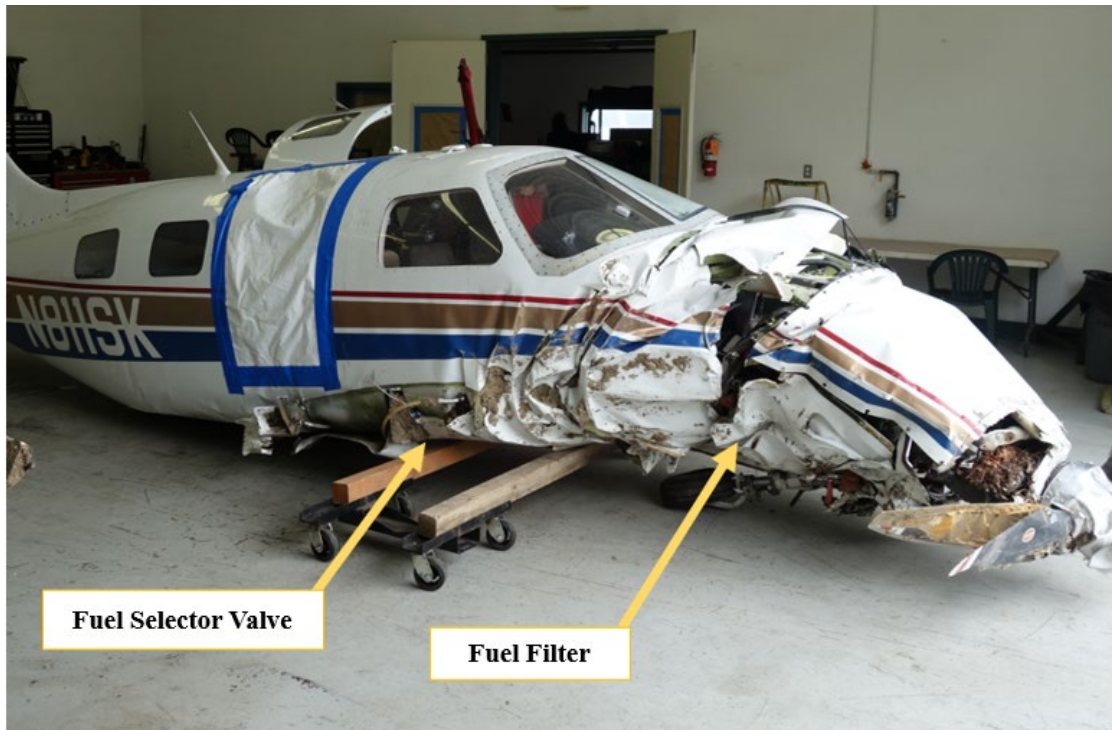
Tank quantities are measured using two sensor sending units in each main tank. Fuel flow and fuel pressure are measured on the engine downstream of the fuel metering unit. The quantities, fuel pressures and flow rates are displayed in the cockpit and recorded by the JPI EDM<sup>2</sup>.

#### **4.4.1.1 Initial Wreckage Examination Findings**

The aircraft was moved from the accident site to a wreckage storage facility. An initial wreckage examination, conducted in August 2019, with a NTSB investigator present noted the following conditions of the aircraft, with regards to the fuel system.

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<sup>2</sup> Further information regarding recovered data from the JPI EDM can be found in Engine Data Monitor (EDM) Specialist's Factual Report in the accident docket.



**Figure 2 - Aircraft fuselage at wreckage facility prior to engine removal (photo courtesy of Piper Aircraft)**

- The fuselage was intact and exhibited crush damage on the forward section with buckling also noted in the airframe, see Figure 2.
- Fuel was noted in the fuel line to the fuel manifold valve.
- The fuel selector handle was in the “Left” position and the fuel selector valve was also in the left tank position.
- The outlet port from the electric boost pump in the left wing was disconnected and compressed air was blown through the selector valve. Air went forward through the selector valve, to the fuel filter.
- Selector handle lever was moved to the right tank position, the fuel selector valve moved, and air was blown from the fuel line at the base of the right-wing strut to the fuel filter bowl without obstruction.
- Both the left and right tanks fuel finger strainers were not obstructed, and no debris was noted.
- Both the left and right tanks were breached.
- Both the left and right fuel tank caps remained seated and in place.

- 6 oz. of fluid was drained from the fuel filter bowl. About 1 oz. was similar in appearance to 100LL aviation fuel.
- The engine was removed for shipping and testing at the engine manufacturer.

#### 4.4.1.2 Second Wreckage Examination Findings

During the second wreckage examination the group inspected the fuel system from the fuel selector valve to the fuel line terminations for evidence of fuel leaks. The fuel return line was checked by inserting compressed air and soapy water into the return line near the engine firewall. Compressed air was then used to force the water mixture through the return lines to check for breaches or leaks in the line.

To provide access to the fuel selector valve and fuel supply/return tubing, a hole was cut in the fuselage skin to allow for a visual inspection, ref Figure 3, Figure 4 and Figure 5. Areas of displacement to the fuel feed and vapor return lines, consistent with impact damage, were visible along various portions of the fuselage. There were no indications of leaked fuel around the fuel selector valve, fuel tubing or surrounding structure.

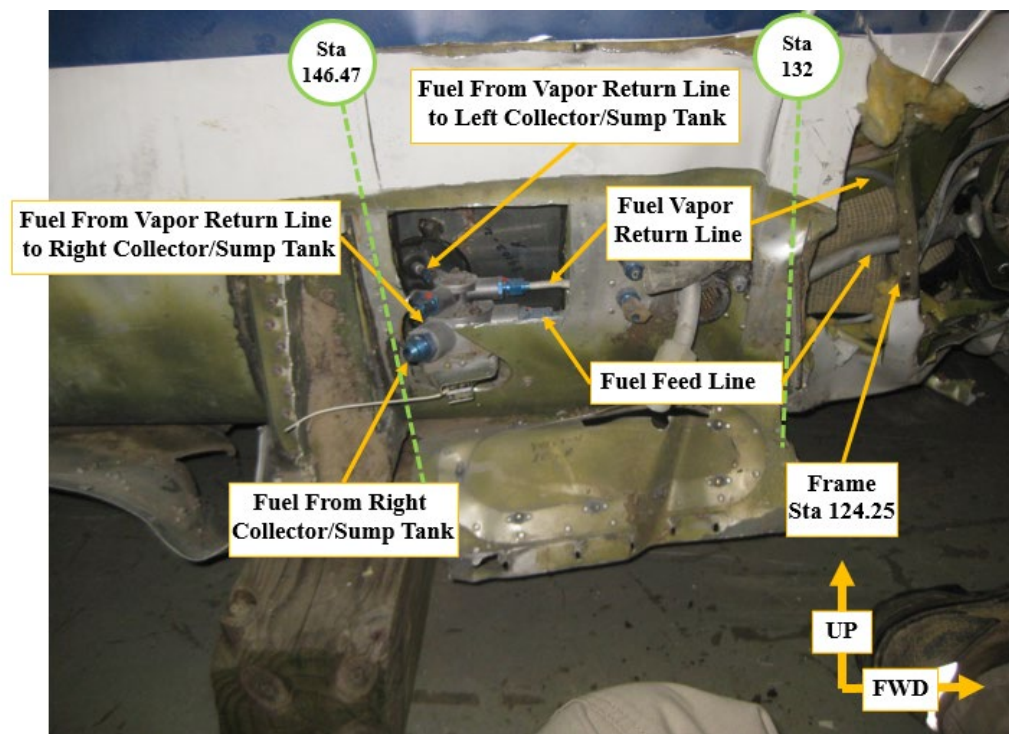


Figure 3 - Fuel selector valve and tubing on right side of aircraft fuselage.

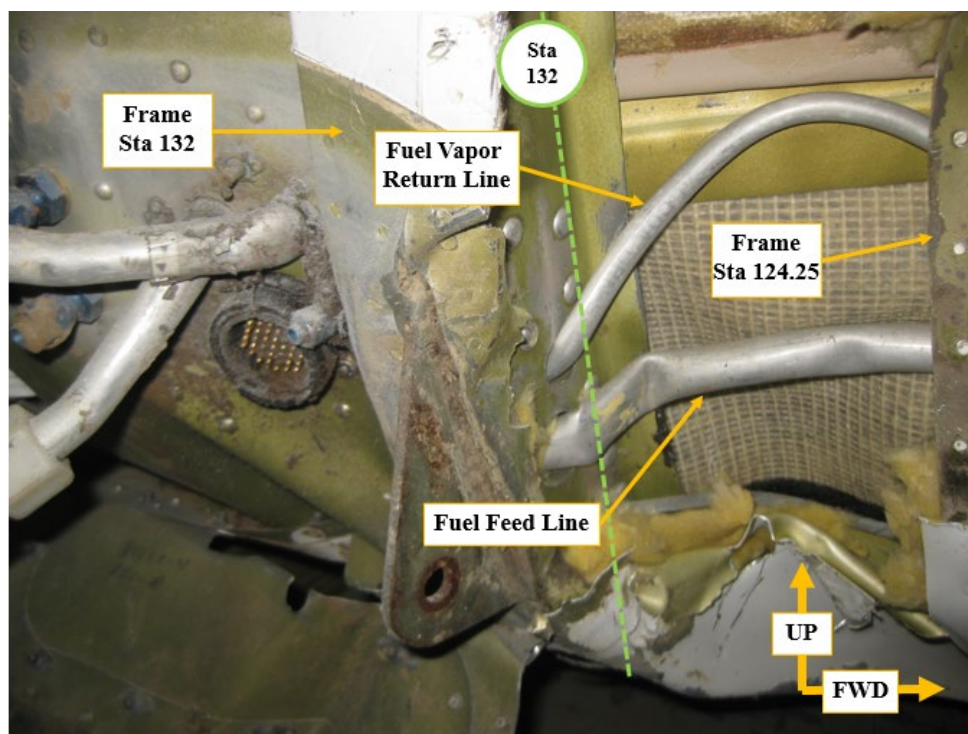


Figure 4 - Fuel lines along right-side fuselage from station 132 to station 124.25

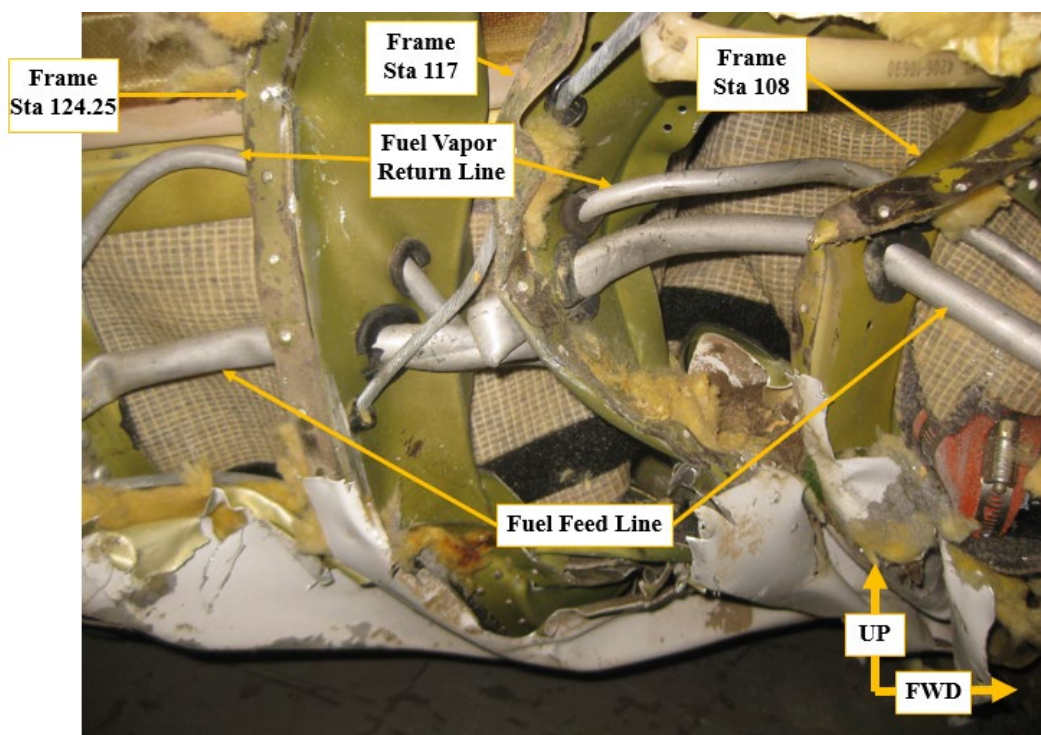
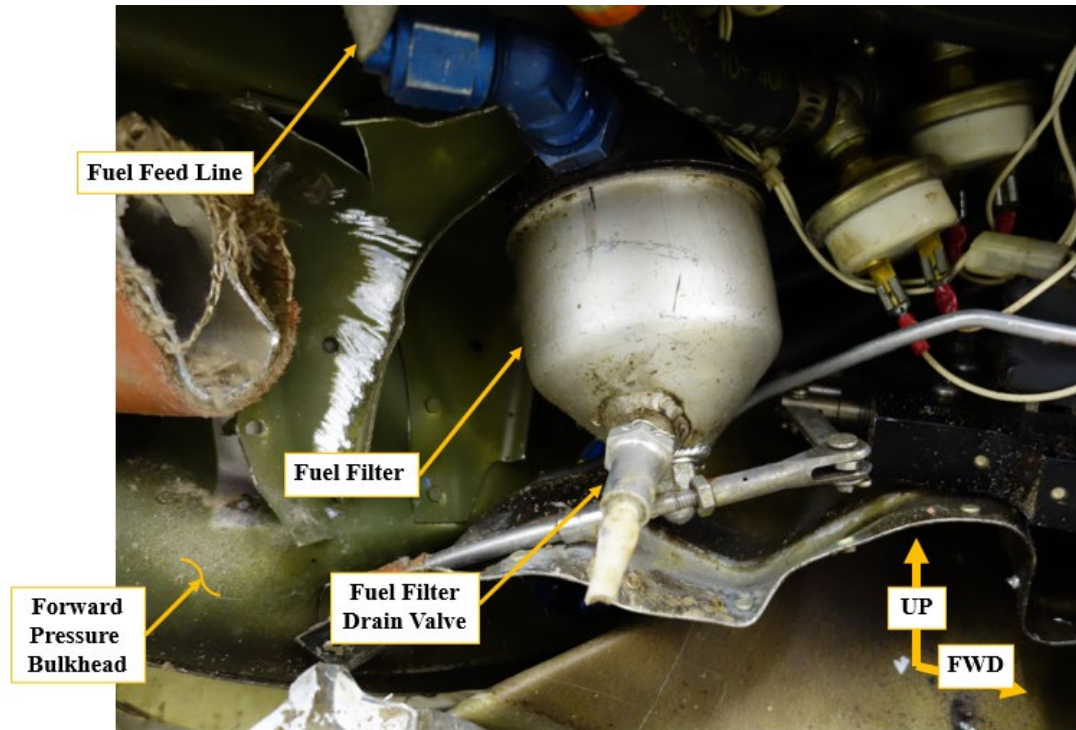


Figure 5 - Fuel lines along right-side fuselage from station 124.25 to station 108

The area in the forward pressure bulkhead where the fuel filter was installed showed damage consistent with impact. The fuel filter mounting brackets were displaced but the fuel filter was intact, Figure 6. There were no indications of leaked fuel around the fuel filter, fuel tubing or surrounding structure.



**Figure 6 - Fuel filter prior to removal from aircraft, during initial examination (photo courtesy of Piper Aircraft)**

During the initial wreckage examination, the fuel filter bowl and filter media was inspected. As stated in 4.5.1.1, fluid was drained from the filter bowl. Figure 7 shows the contents of the fuel filter after the filter bowl and filter media was removed. No additional testing of the fuel filter was performed.

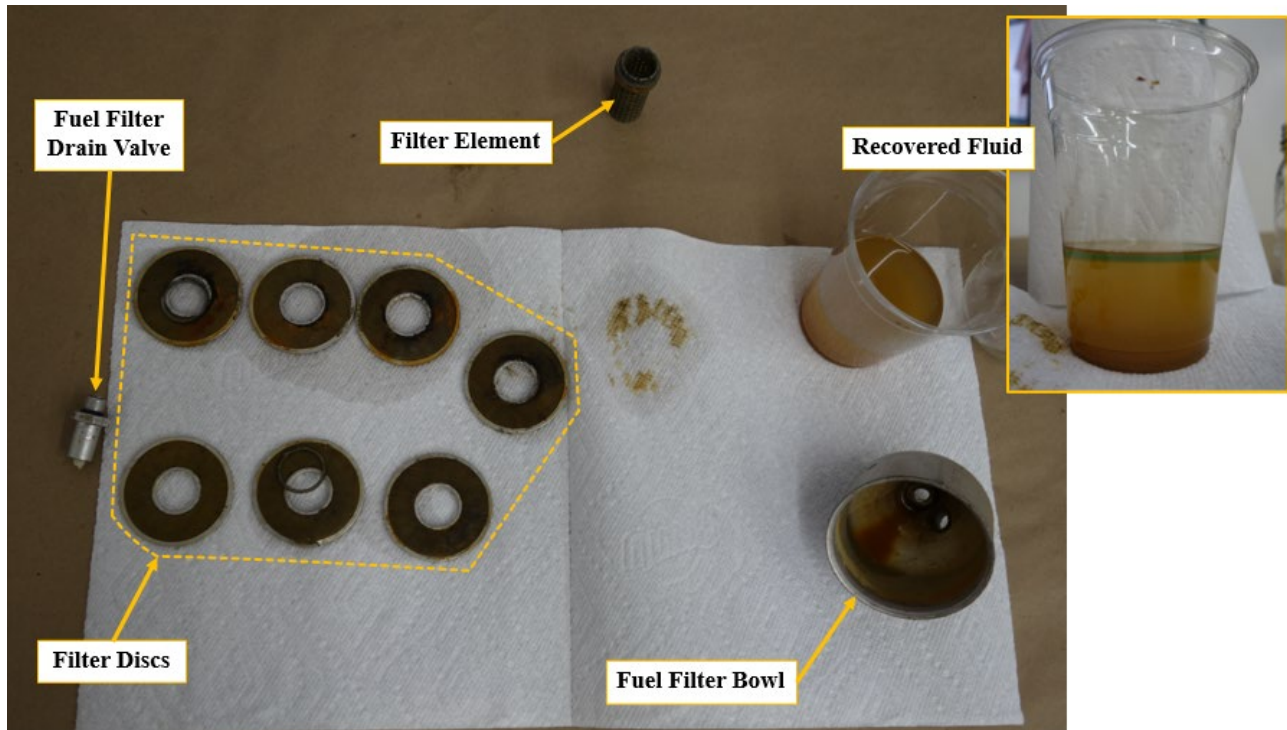


Figure 7 - Disassembled fuel filter and fluid found in filter. (Courtesy of Piper Aircraft)

#### 4.4.1.3 Engine Driven Fuel Pump

##### 4.4.1.3.1 Data Plate and Service History

Based on the unit's data plate:

|                |             |
|----------------|-------------|
| Part Number:   | 649368-20A2 |
| Serial Number: | B01JA159    |

##### 4.4.1.3.2 Visual Inspection

The engine was removed from the wreckage during the initial wreckage exam and shipped to TCM for an inspection and testing. The engine driven fuel pump remained attached to the engine and the fuel lines and other interfaces were cut to aid in removal and packaging. Sections of the fuel supply and vapor return lines remained with the engine until installation in the test rig.

Based on information from the engine run report, during the engine run:

“The engine experienced a normal start on the first attempt but would not continuing running without the use of the test cell boost pump. The engine driven fuel pump was removed, and the drive coupling was damaged.”<sup>3</sup>

<sup>3</sup> Further information regarding the engine can be found in Engine Run Report in the accident docket.

At the engine examination, the engine driven fuel pump was disassembled and was noted to contain debris and corrosion throughout the pump which precluded the pump from rotating normally. The pump coupling was damaged.

After the second wreckage examination, the engine driven pump assembly was returned to TCM for additional inspection and testing. Prior to testing the body assembly containing the shaft seal was subject to computed tomography inspection to check the condition of the internal shaft seal components.<sup>4</sup>

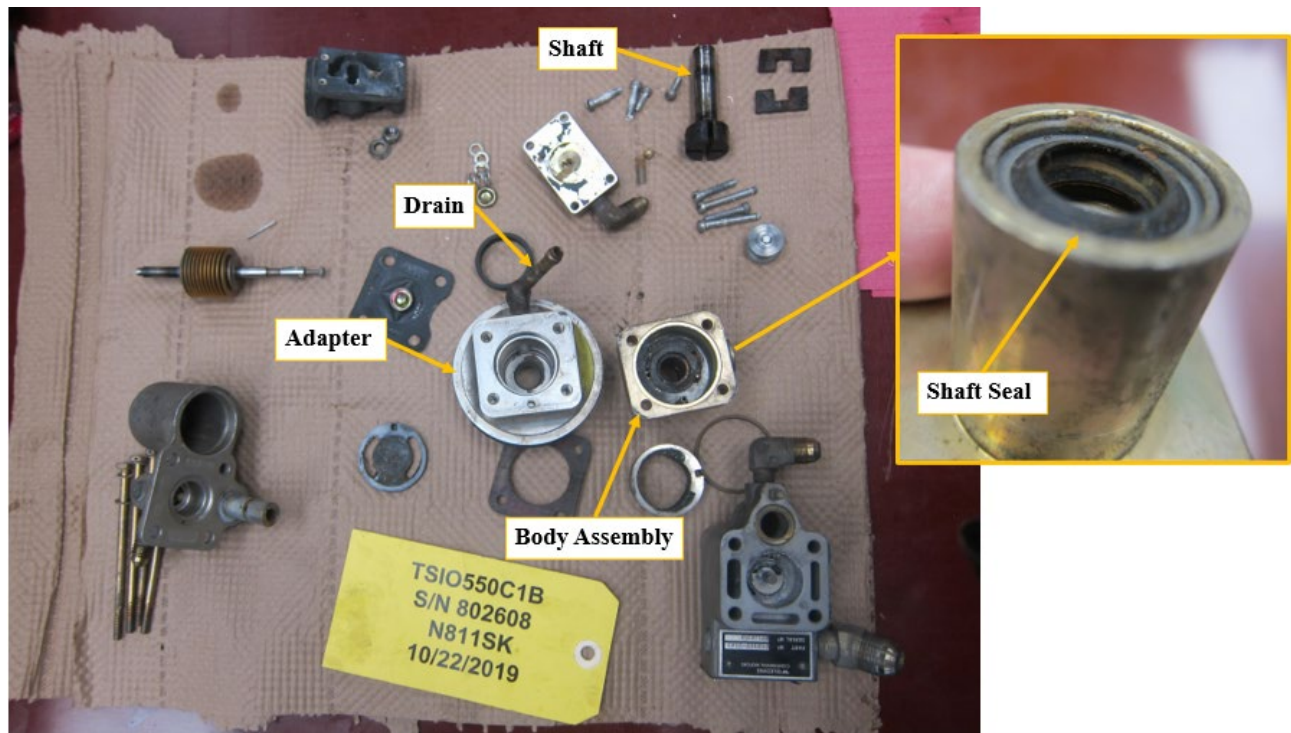


Figure 8 - Disassembled fuel pump and close-up view of shaft seal (Courtesy of TCM)

#### 4.4.1.3.3 Additional Testing

After the CT scanning, the unit was reassembled using the original components except for a gasket located on the aneroid rod housing and pump body. The pump was tested on a TCM test bench and there was no visible leakage from the drain port on the pump during the test run.

Michael Bauer  
Aerospace Engineer

<sup>4</sup> Further information regarding the results from the CT scanning are documented in the “Computed Tomography Specialist’s Factual Report” in the accident docket.