



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

September 14, 2019

FUEL SYSTEM TEST – FIELD NOTES

WPR19LA259

This document contains 1 embedded photo.

A. ACCIDENT

Location: Marana, Arizona
Date: September 13, 2019
Aircraft: Piper PA-28-181, N4403Z, Serial #: 2843726
NTSB IIC: Andrew Swick

B. EXAMINATION PARTICIPANTS:

Andrew Swick
Aviation Accident Investigator
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C. PRELIMINARY REPORT

On September 13, 2019, about 1730 mountain standard time, a Piper PA-28-181, airplane, N4403Z, caught fire during preflight startup at the Marana Regional Airport (AVQ), Marana, Arizona. The flight instructor and two student pilots not injured. The airplane sustained substantial damage to the firewall. The airplane was registered and operated by the CAE Oxford Aviation Academy Phoenix Inc under the provisions of Title 14 *Code of Federal Regulations* Part 91 as an instructional flight. Visual meteorological conditions prevailed for the flight and a flight plan was not filed for the flight.

According to the flight instructor, after landing at AVQ, he and the student pilots exited the airplane, used the airport facilities, and had the airplane refueled. About 30 minutes after the airplane was shut down, the flight instructor completed his preflight and he and the student pilots boarded the airplane. During the preflight, the flight instructor stated he did not see any fuel or liquids during the walk around. After a second failed attempt to start the engine the flight instructor and student pilots smelled smoke. The flight instructor saw smoke coming from the nose wheel well and he and the student pilots stood clear of the airplane and called the local authorities. The airplane continued to smoke for about 15 minutes before the fire department arrived.

During a post-accident examination of the airplane, the cowling was removed which revealed substantial damage to the firewall. The cowling and various lines and accessories sustained thermal damage.

D. DETAILS OF THE INVESTIGATION

1.0 Continued Engine Test Runs

On September 18, 2019, CAE was able to produce a large amount of fuel flowing from the carburetor during a test run and subsequent start attempts on two of their airplanes. A video confirmed that when the engine was operated to a certain oil temperature and then shut down, the accessory section including the carburetor and associated fuel lines were 'heat soaked' after a period of time, that during the subsequent engine start procedure, about 6-8 ounces of fuel 'showered' from the carburetor air intake.



Figure 1-Test Run by CAE

On September 19, 2019, at the hangar facilities at CAE, a sister airplane was prepared for an engine run. The induction box was removed from the carburetor and the electric primer solenoid fuel line was disconnected from the exit port, and a line was added to empty any fuel from the primer solenoid during the test into a bottle. A temperature probe was attached to the primer solenoid housing and the readout was attached to the outside of the airplane.

At 1217, the engine was motored with throttle 'cracked open', and mixture full rich, magnetos in the OFF position, boost pump on, and no fuel was noted from the carburetor. Prior to engine

operation, outside temperature was about 98°F, the primer solenoid housing temperature was at 61°F. The engine was run for approximately 20 minutes before the oil temperature reached 200°F. Here are the temperatures over the next 25 minutes:

Time	Carburetor Temperature (F°)	Primer Solenoid Temperature (F°)
12:30	170	126
12:35	158	129
12:40	157.5	134
12:45	155.5	137
12:50	153	139
12:54	152.5	139

At 1255, about 25 minutes after shutting the engine down, the engine was motored with throttle at idle and slowly increased to 1/4 and 1/2 inch, mixture full rich, magnetos in the OFF position, boost pump to the ON position, and about 2 ounces of fuel was noted from the carburetor. After a few minutes, the engine was motored again with no fuel noted from the carburetor.

The engine was test run again to an oil temperature of 240°F (red line is at 245°F). After shutting down at 13:19, the oil temperature continued to rise to 242°F. After a few minutes, the following temperatures were captured:

Time	Carburetor Temperature (F°)	Primer Solenoid Temperature (F°)
13:19	163	152
13:21	165	154

At 1322, the engine was motored with throttle in the idle position, mixture full rich, boost pump to the ON position, magnetos in the OFF position, and about 10-12 ounces fuel was noted showering from the carburetor. After the motoring of the engine was completed, the carburetor continued to shower fuel and a motoring and whistling sound emanated from the carburetor area. (see video DSCN1746-) The primer line that emptied into the bottle remained dry.

At 1325, the engine was setup to motor again, and while the boost pump was on, and as the mixture lever was positioned to the full rich position, a vapor was seen exiting the carburetor and a whistling sound was heard. About 4 seconds later, fuel showered from the carburetor; about 10-12 ounces before stopping. The whistling continued until the fuel stopped. Note: the engine was not rotated during this setup. (See video DSCN1747-)

AT 1330, the engine was motored with the throttle in the idle position, mixture full rich, boost pump to the ON position, magnetos in the OFF position, and about 10-12 ounces fuel was noted showering from the carburetor. During the showering of fuel from the carburetor and shortly after the motoring of the engine was completed, a blowout of fuel and air was seen exiting the carburetor. The motoring and whistling sound continued emanated from the carburetor area. (see video DSCN1749-) The primer line that emptied into the bottle remained dry.

At 1530, three Piper Archer TX's (two 2013 and one 2019 models) were run simultaneously to near their oil temperature red lines. During shutdown, with the mixture lever was brought back to

the cutoff position, all three airplanes continued to run at low and varying rpms for about 15-20 seconds. After the magnetos were disconnected, the engines continued to run at low and varying rpms for a few seconds before shutting down. The engines were setup to motor again, and while the boost pump was on, and as the mixture lever was positioned to the full rich position During motoring, fuel was noted dripping and pouring from the lower cowlings. A Piper Seminole was setup in the same fashion and about 1/2 an ounce of fuel was noted from the left engine carburetor and about 5 drops were noted from the right engine carburetor.

On September 20, 2019, at 0926, at the facilities of Falcon Executive Aviation at FFZ, a 1976 Piper Archer belonging to Falcon Executive Aviation, was test run to near the engine oil temperature's red line, about 230°F. The engine was setup to motor, magnetos enabled, and while the boost pump was on, and as the mixture lever was positioned to the full rich position, a few drops of fuel was noted dripping from the carburetor. The airplane was installed with the following:

- larger (-6) fuel lines, larger (-12) fire sleeves
- boost pump outlet line teed' into outlet line from the mechanical fuel pump
- boost pump and gascolator are isolated from the accessory section, and their own ram air cooling inlet
- exhaust location setup on the forward left side
- lower cowling louvers
- engine driven mechanical pump has a shroud scat tubing providing ram air cooling

The engine was run again to increase temperatures, and no fuel was noted during the motoring of the engine.

2.0 Progress Meeting

On September 20, 2019, party members from Piper Aircraft, Lycoming (phone-in), Avstar Fuel Systems, Precision Airmotive, and representatives from CAE were available for the conference call. The accident airplane photos and subsequent engine test run videos were shared. Plans of research and testing will be planned within the next couple of weeks. Short-term and long-term mediation will be planned.

At 1550, another CAE airplane was setup for a test run. The induction box was removed, and a pressure gage was attached to the inlet line to the carburetor. During the startup and run, the fuel pressure gage read 3.5 to 5 psi. The engine was operated until reaching an oil temperature of 235°F. At shutdown, the carburetor read 167°F and fuel line pressure had increased to 6 psi. During the motoring of the engine the fuel pressure decreased then climbed to 9psi and continued to climb to 11.6 psi, 24 minutes after shutdown. Fuel was noted showering from the carburetor during the motoring of the engine. Fuel pressure decreased during the motoring and then continued to climb to 7.5 psi.

3.0 AeroGuard Engine Test Run

On September 23, 2019, an airplane from AeroGuard Flight Training Center, at the Phoenix Deer Valley Airport (DVT), Phoenix, Arizona, was available for a test run. The induction box

remained installed and outside ambient temperatures were in the 80's with monsoonal weather in the area. The oil temperature was increased to 200°F during the run. After shutdown the carburetor was at 159°F and fuel pressure was at 5 psi. During the motoring of the engine, no fuel was noted from the induction box. The airplanes at AeroGuard have been modified with the "Slick Start" electronic start-assist STC. This modification has a significant effect in starting the engine quicker with less hesitation during the start up.

Submitted by: Andrew Swick