

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Washington, D.C. 20594

ENGINE and FUEL SYSTEM

Factual Report

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1. EVENT SUMMARY

Location: Palatka, Florida

Date: March 6, 2018

Aircraft: Experimental Amateur-Built, ESCAPADE (JUST AIRCRAFT)

Registration: N45DC

Operator: Individual

NTSB Number: ERA18LA097

2. DETAILS OF EXAMINATION

The airplane was examined by the NTSB investigator-in-charge (IIC) and a Rotech Flight Safety Investigator on April 5, 2018 in a private hangar at the Palatka, Florida (28J) airport. The airplane was found hangered, with the wings removed and the fuselage and engine strapped on a trailer. The airplane was moved to this location after the accident, and a Federal Aviation Administration (FAA) inspector had previously examined the airplane on behalf of the NTSB IIC. This report details the factual findings pertaining to the engine and fuel system examination, and engine test run.

2.1. Fuel System Examination

Fuel System Description

The airplane was equipped with two standard 9-gallon wing fuel tanks, which were gravity fed to a header tank, and vented from tubes fixed to the fuel caps. The header tank size was about a half-gallon and was located behind the passenger seat in the baggage compartment. From the header tank to the engine, the fuel line was equipped with a dual filter system that had a bypass valve to open the line to either filter. Past the dual filter, was the ON/ OFF fuel shut off valve and the fuel flow transducer. Past the fuel flow transducer, an engine driven fuel pump would provide fuel to the left and right carburetors.

The airplane was also equipped with a red auxiliary 12-gallon fuel tank that was strapped to the baggage compartment floor, directly behind the pilot and passenger seat. The auxiliary fuel tank had a fuel line leading to the header tank. In between the header tank and the auxiliary tank, the line contained a one-way check valve, an electric fuel pump,

and a fuel shutoff valve, which could only shutoff the fuel from the auxiliary tank. Refer to figure 1 for a fuel system schematic, sketched by the investigative team.

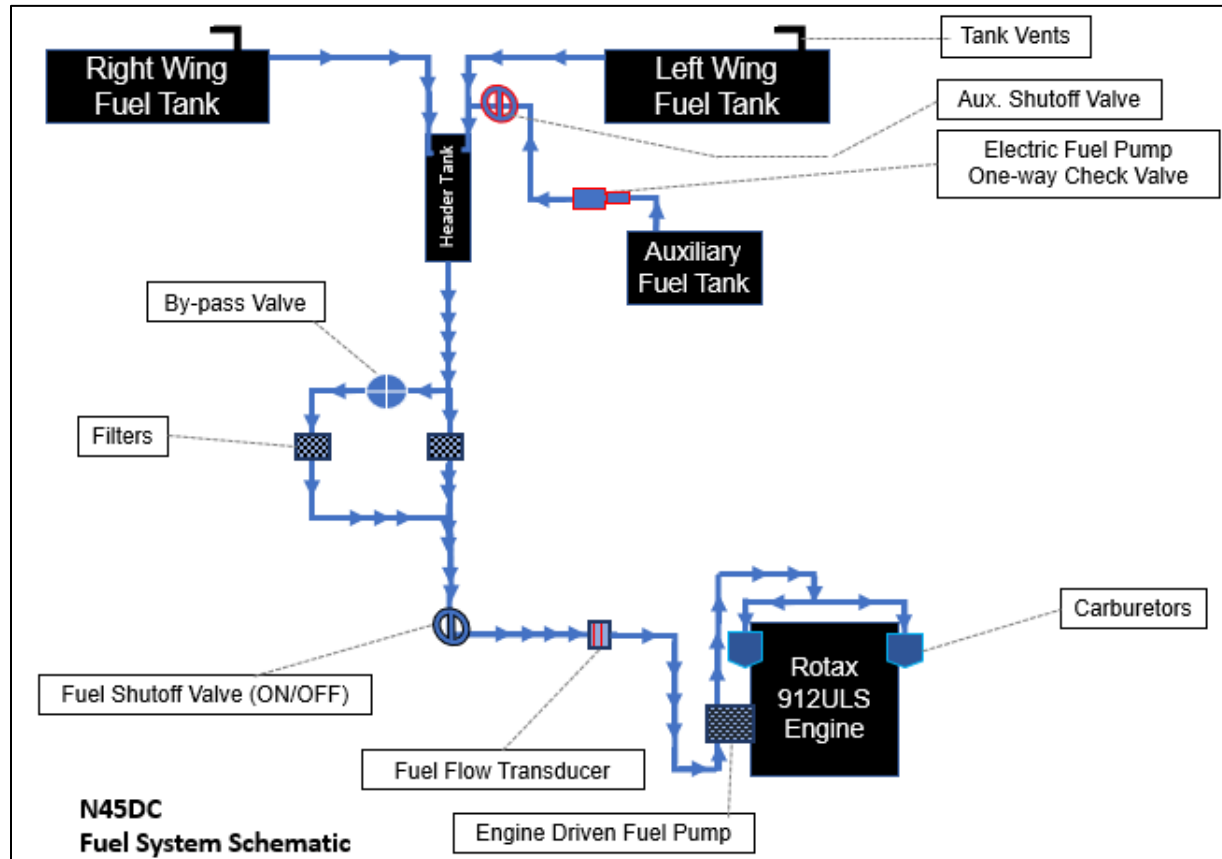


Figure 1: N45DC Fuel System Schematic

Fuel System Examination

The left wing remained attached to the airframe and was folded aft by recovery personnel. The left wing fuel tank vent was blown through by mouth, and air was felt at the opposite end of the line, which lead to the header tank.

The right wing was separated from the fuselage and its fuel cap was missing the fuel vent, but a piece of the vent base could be observed in its attach point. Air was blown through the top of the fuel cap at the vent hole, and air was felt at the opposite end on the bottom side of the fuel cap. Air was blown into the inlet side of the header tank fuel line, and air was felt from the outlet side of the header tank fuel line.

The dual filter system was blown through, and the bypass was moved in both directions during the test. Air was felt at the outlet side of the fuel line when the bypass valve was moved in either direction. It was not possible to shutoff the fuel at this point. No debris was noted in the filter, and a small amount of fuel remained in the filter housing.

The auxiliary fuel line was blown through from the inlet side, and air was felt on the outlet side leading to the header tank. The airplanes electrical system was turned on, and when

the electric fuel pump switch activated, the fuel pump turned on and residual fuel in the line pumped out.

The fuel shutoff valve was moved to the off and on position, while air was blown through the fuel line. The valve functioned properly, allowing air to pass, and then stopping air from passing through, when the valve was moved to the off position.

There were no blockages found in the fuel system.

2.2. Engine Examination and Test Run

Engine Condition

The engine, a Rotax 912ULS, S/N: 564-6532, was impact damaged but remained attached to the airframe. An FAA inspector had previously examined the engine, airframe, and fuel system, and when the engine was found for this exam, multiple fuel lines were found cut.

An air filter was displaced from the carburetor. The fuel lines were found cut leading to the transducer and from the transducer to the fuel pump. The fuel lines were disconnected at the carburetors. The 3-bladed warp drive propeller was removed by recovery personnel. The blades remained relatively straight, one propeller blade tip was damaged. The engine was not equipped with a fuel return line. The fuel pump was identified as a BCD Corona 893-110, S/N 13.16.19.

The cross over tube from the intake manifolds were modified and were welded to the manifolds. A flowscan fuel flow transducer was installed. Fire sleeves were installed on the fuel lines from the fuel pump to the carburetors. The carburetor vent lines were routed correctly, the fuel pump vent was open, and no line was attached. A tempest oil filter was installed (non-Rotax), and a coolant system modification was installed for cabin heat. The coolant radiator was impact damaged.

Spark Plugs and Spark Plug Caps

The spark plugs were in good physical condition no damage was observed. Thermal damage was observed to all bottom spark plug caps due to their close proximity to the exhaust. The spark plugs were found as NGK DCPR8E – 0.75mm gap, on all plugs. All of the plugs had similar burn patterns. The electrodes and insulators appeared to be in good condition (not worn) and the isolator was white in color. The No. 2 bottom spark plug connection probe was impact damaged.

Ignition System

The ignition system was inspected, and no anomalies were observed.

Carburetors

One of the carburetor float bowls was previously removed by an FAA inspector. The 2/4 float bowl was removed and fuel was contained within. The 155-main jet had no obstructions. The floats were not weighed. The 1/3 float bowl was removed. The smells and look was observed of auto fuel. The floats were in good physical condition. The 155-main jet had no obstructions. The floats were not weighed. A small amount of contamination was observed. Both float bowls were re-installed with their respective carburetors. The fuel was tested for water contamination using water finding paste and no water was detected.

Continuity and compression check

The engine rotated by its electric starter and continuity and compression was felt on all cylinders. The engine rotated smoothly with no unusual noises were heard.

Preparation for Engine Test Run

The following actions were performed so that an engine test run could be attempted:

- Dynon FlightDEK-D180 Electronic Flight Instrument System was reinstalled
- Rotated engine with starter (ignition leads off) to verify starter would turn engine over
- Connected ignition leads to spark plugs
- Reconnected fuel lines
- Checked oil and coolant level – Added half a liter of oil to tank. Bypassed the coolant radiator due to it being damaged by impact
- Added a fuel feed line to the inlet of the transducer to feed engine with fuel. The fuel used was from what was recovered from the accident airplane, found in a portable gas tank

Engine Test Run

The engine started with its own ignition system and with a choke. The throttle was controlled by hand at the engine. The engine ran for about a total of 2-3 minutes at different power settings with no issue. During the engine run, after the engine ran for about 30 seconds, the fuel source was removed. The engine ran for about two minutes without the fuel source connected, and then stopped due to fuel exhaustion.

Dynon FlightDEK-D180 Data

The Dynon FlightDEK-D180 display was monitored and videoed during the test. Once the engine started, the fuel flow gallon per hour (gph) reading stabilized around 4.5-5.5 gph with the fuel source still connected, with rpm ranging from 2800-3200 rpm. Once the fuel source was removed, the engine continued to run for about 1 minute and 30 seconds, at 3000-4000 rpm. When monitoring the fuel flow gph meter after the fuel source was removed, the following indications were observed:

- The gph decreased initially to 2-3 gph for about 20 seconds
- Then, gph decreased to 0.0 for one or two seconds.
- Then, gph rapidly rose to 15-20 gph, and then 50 gph in about 30-40 seconds
- Then, engine RPM was increased to 4000 rpm, and almost instantaneously, gph rose to 99.9 gph. With 3500-4000 rpm, the fuel flow gph read 99.9 for about 30 seconds, until the engine stopped.
- After the engine stopped, the gph meter continued to display 99.9 gph for about 5 seconds, and then decreased back to 0.0 gph.