



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region
June 28, 2016

FUEL SYSTEM EXAM REPORT

WPR16FA091

This document contains 20 embedded photos.

A. ACCIDENT

Location: Fallbrook, CA

Date: April 2, 2016

Aircraft: Nokes Matthew Lancair IV P, Registration Number: N438Y, Serial #: LIV-298

NTSB IIC: Howard Plagens

B. EXAMINATION PARTICIPANTS:

Howard Plagens
Senior Air Safety Investigator
National Transportation Safety Board
Federal Way, WA

C. Summary

Examination of the fuel system was conducted on June 28, 2016, at the facilities of Air Transport, Phoenix, Arizona.

DETAILS OF THE INVESTIGATION

1.0 Fuel System

The airplane was equipped with an external belly tank. The belly drain was scraped, ground down, and breached.



Photo 1 Belly Tank

The pilot/owner explained that each wing held 52 gallons, and the belly tank held 33 gallons. He would add fuel to the left wing tank; when the fuel gauge began to indicate, this meant that the centerline belly tank was full. The 75 gallons meant that when it and the belly tank were full, there were 10 gallons in reserve.

Each wing had an 8-foot long capacitance type fuel sensor.

The markings on the left wing indicated a quantity of 75 gallons; the right wing indicated 52 gallons.



Photo 2 Left Wing Tank Markings



Photo 3 Right Wing Fuel Tank Filler

The fuel quantity gauge had two indicators.

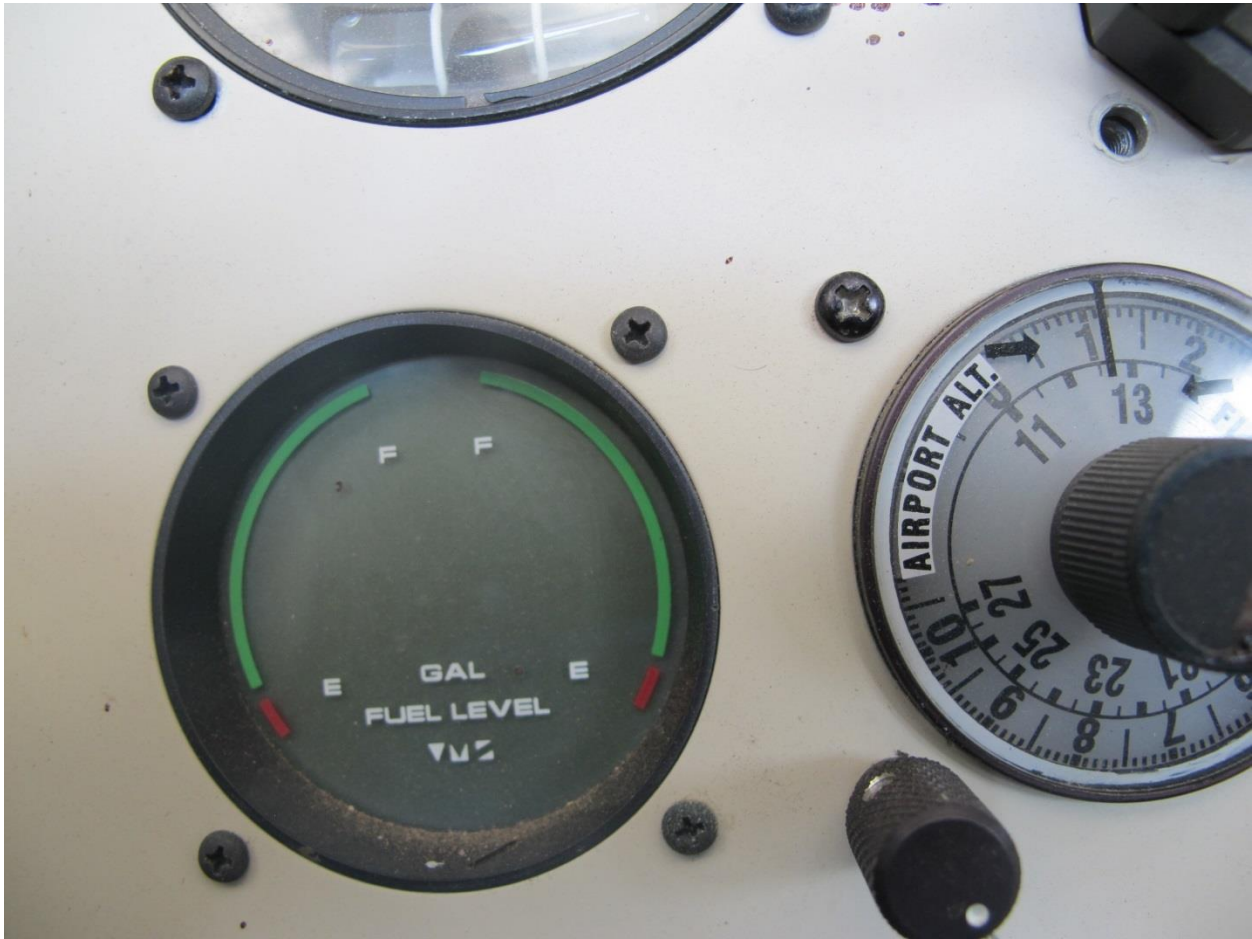


Photo 4 Fuel Quantity Gauge

An annunciator panel above the radio stack had the following lights.

LFE	F PRES	Oil P
RFE	Vac	Oil T
Fuel Tot	Volts	Alt Air
CHT	Amps	TIT

The fuel selector valve (FSV) was labeled L, R, and OFF/OFF. The fuel line from the left wing fuel tank was connected to the belly tank, which in turn was connected by a separate line to the FSV. The right wing tank fuel line connected directly to the FSV. The return line from the engine was connected directly to the FSV, which had a separate line going directly to each (left and right) wing fuel tank.

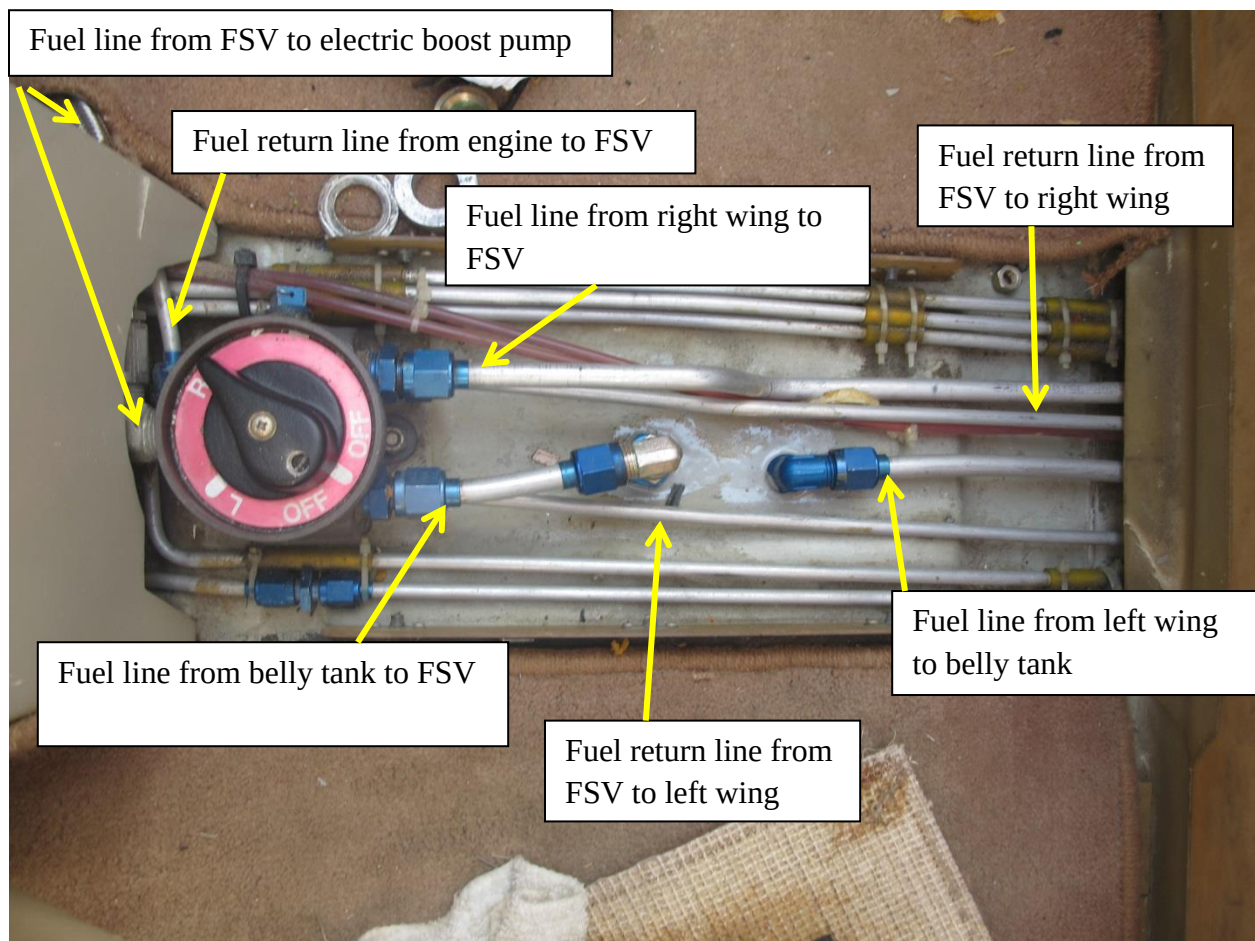


Photo 5 Fuel Lines

The outlet from the FSV connected to an electric fuel pump located on the right side wall of the cabin. A line went through the firewall to connect the electric fuel pump to the gascolator.

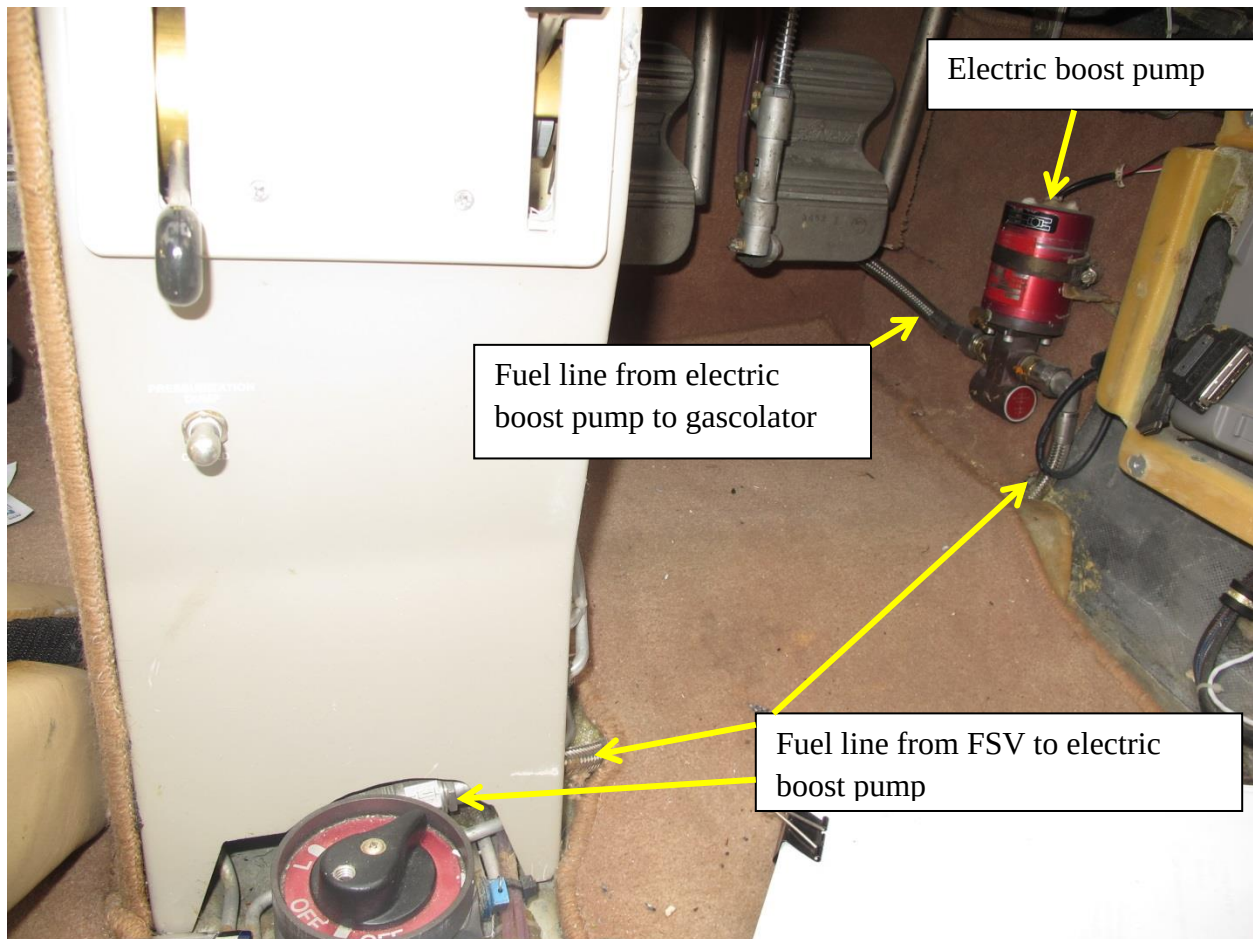


Photo 6 Electric Boost Pump

A return line from the engine connected directly to the FSV.

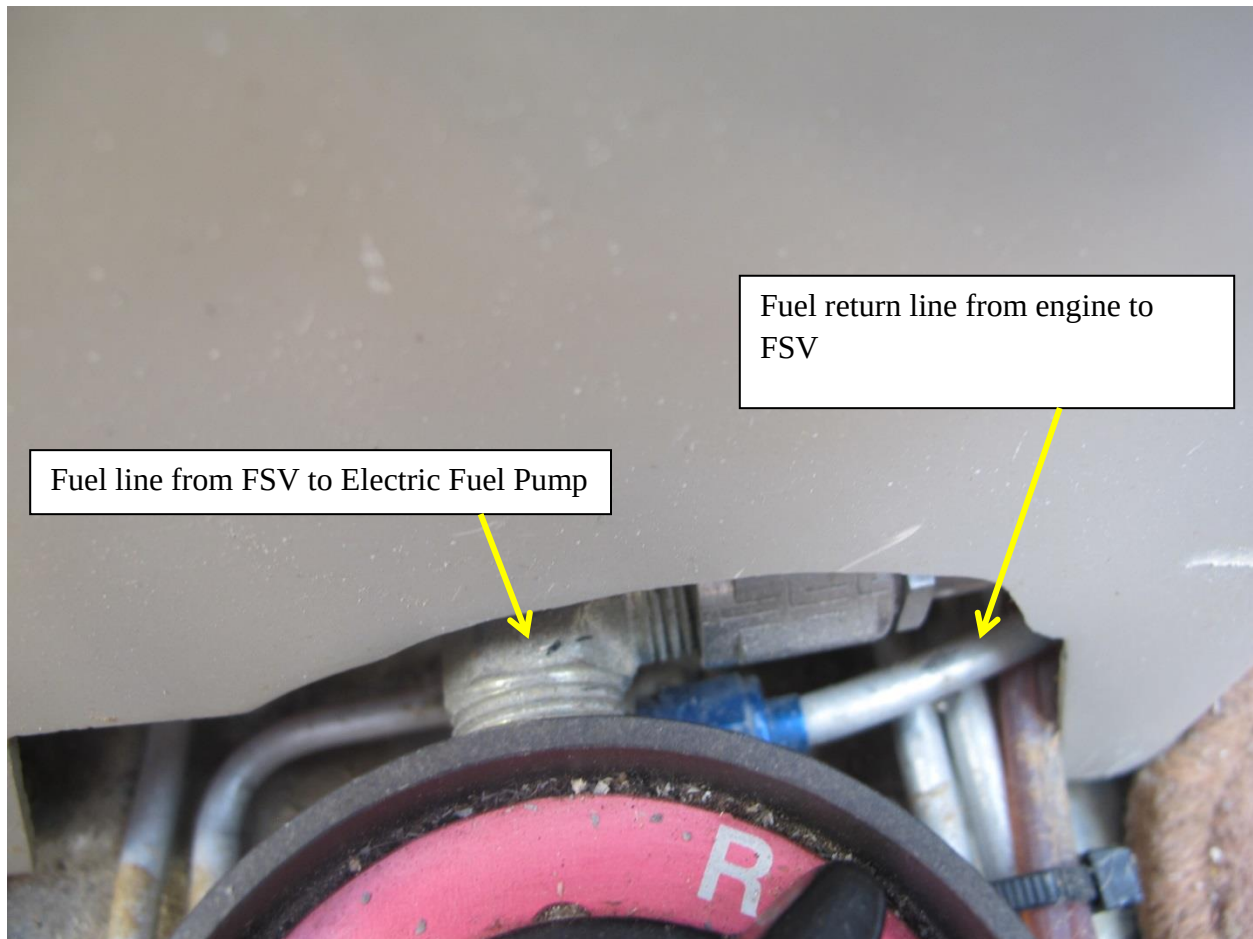


Photo 7 Fuel Lines on FSV

The belly tank was scraped and breached during the accident sequence.



Photo 8 Bottom of Belly Tank

The IIC attempted to determine the fuel quantity for the belly tank by having recovery personnel seal the scraped parts of the auxiliary tank with silicone.



Photo 9 Scraped Belly Tank

The FSV was placed in the OFF position, and the line from the belly tank to the FSV was removed so that when the tank was full, it would allow fluid to flow out the top of the tank. The line from the left wing to the FSV was removed, and a line was plumbed in from a plastic jug that contained 5 gallons of water. A valve was opened to allow water into the tank, and it leaked at numerous locations.



Photo 10 Fuel Lines Plumbed to Attempt Fuel Measurement

In an attempt to seal the tank, several holes were drilled into the tank.



Photo 11 Belly Tank Opened

It was determined that the extent of the damage was too great to effectively seal the system.

The belly tank was about 7 feet long; the widest point at the front was about 35 inches wide, and it tapered to several inches at the rear. There were numerous compartments in the belly tank. The deepest point at the front was about 5 inches and about 3.5 inches in the aft compartment. All compartments had multiple slots at the top and bottom to allow fuel transfer between the compartments.

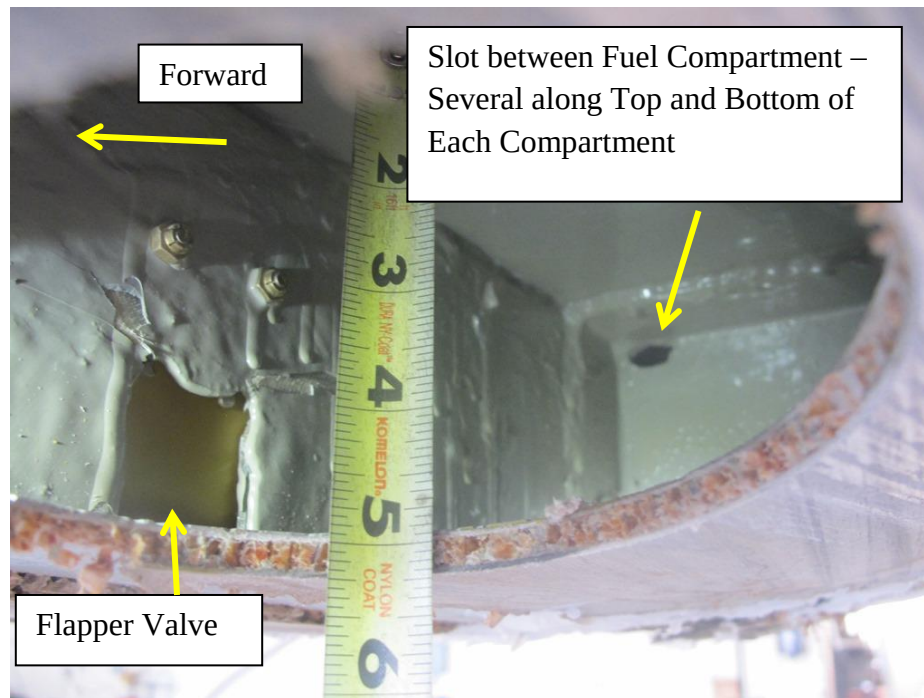


Photo 12 Forward Left Side Compartment

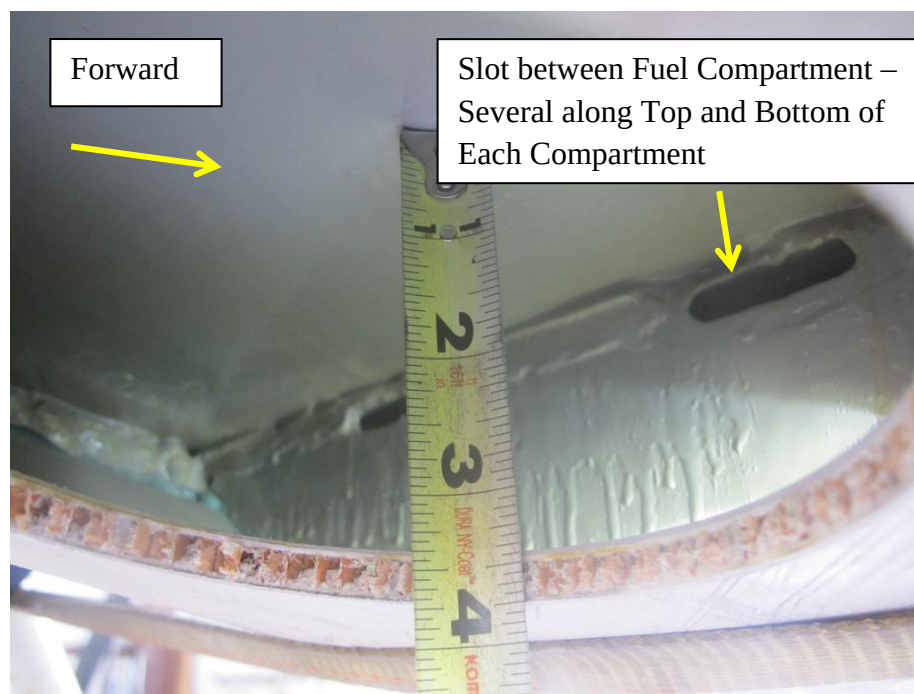


Photo 13 Aft Compartment

The front center compartment contained the feed tube from the left wing and the pickup tube that went to the FSV. This center compartment had fore and aft bulkheads on each side with cutouts covered by flapper valves, presumably to prevent fuel from sloshing away from the pickup tube. The front center compartment also housed the belly fuel drain.

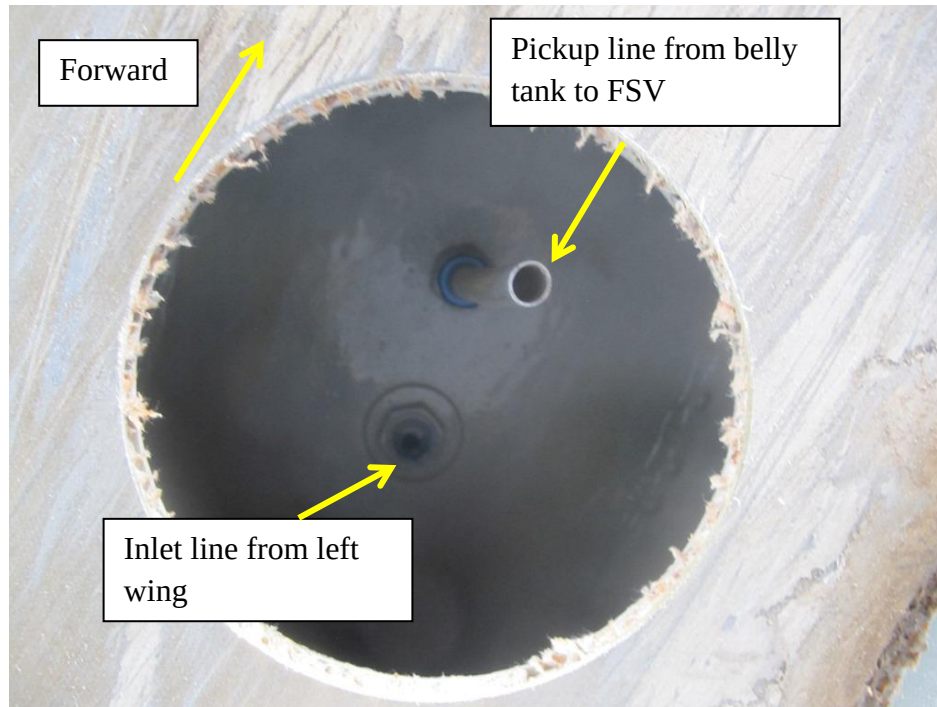


Photo 14 Lines in Center Compartment - Left Wing In FSV Out



Photo 15 Belly Drain in Front Center Compartment



Photo 16 Flapper Valve Closed Position



Photo 17 Flapper Valve Open Position

The aft tank had a vent line going to a solenoid valve, which in turn was connected to a line exiting the belly skin of the airplane aft of the belly tank. The vent line had an outer diameter of 1/4 inch and an inner diameter of 1/8 inch. Blowing into the vent with electrical power off, air could be heard going into the belly tank.



Photo 18 Vent System



Photo 19 Vent Connection to Belly Tank

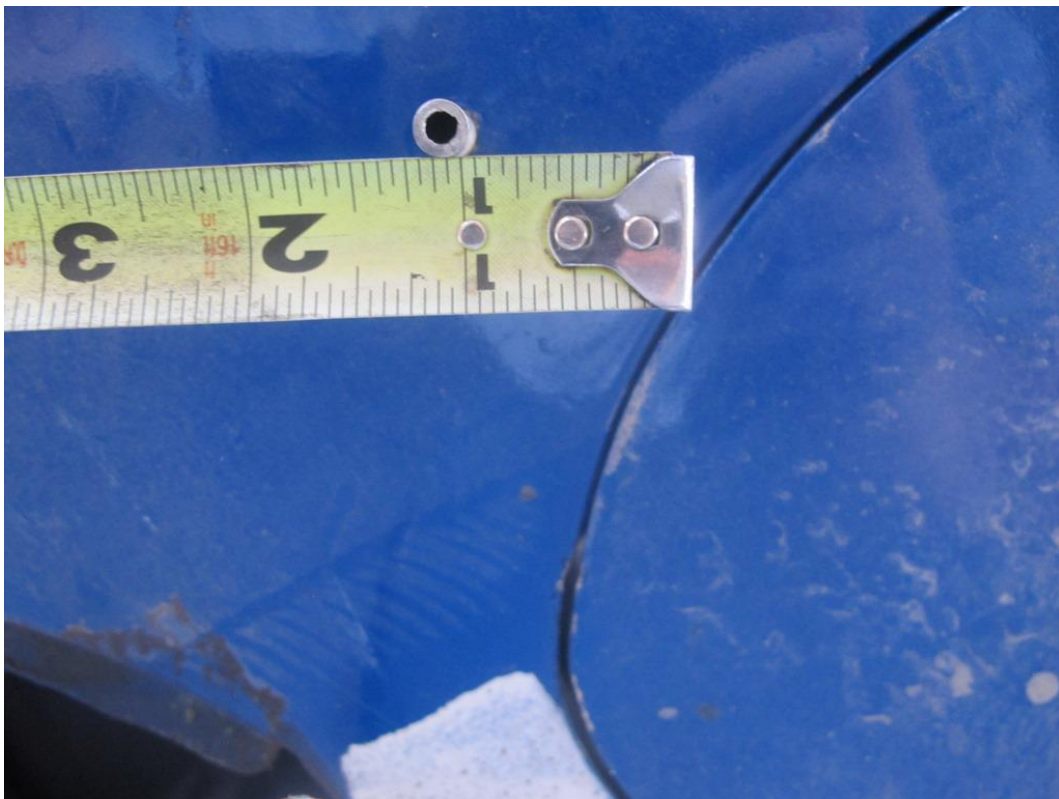


Photo 20 Vent Line