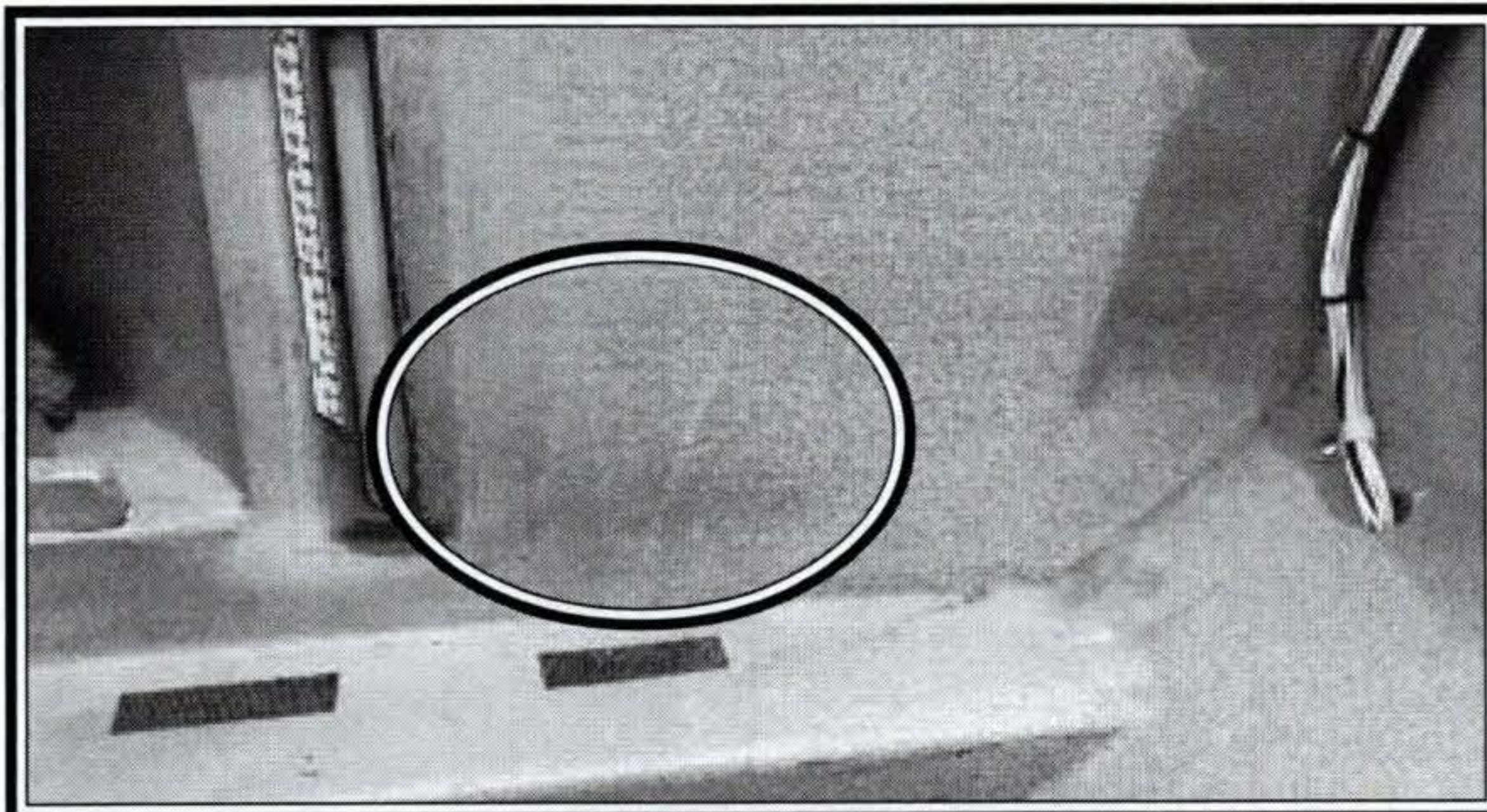


Fuel Leak

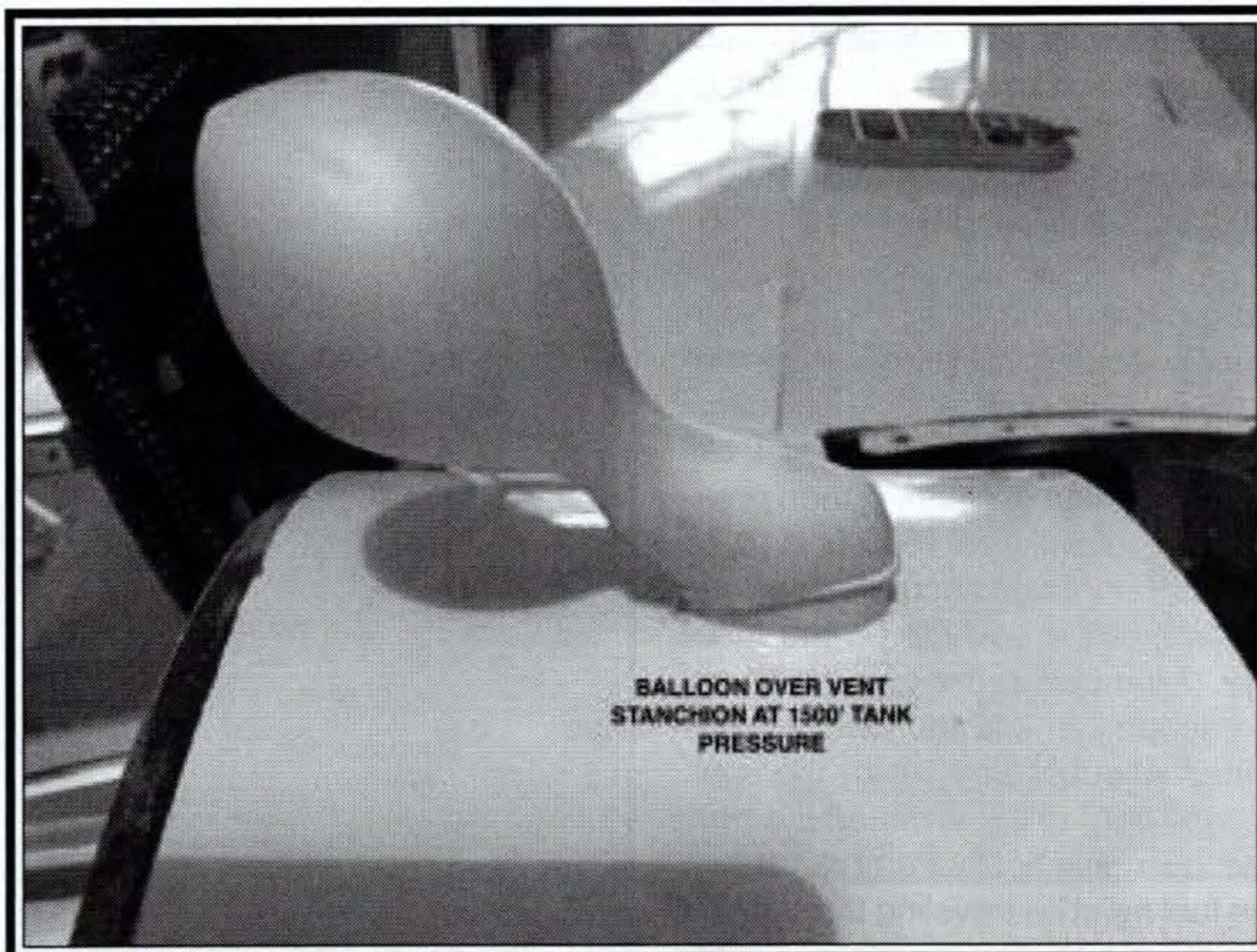
Doug Kouri (MI) - It finally happened after 34 years of flying... FUEL LEAK! It happened last September during a stop-over at Owensboro, KY (KOWB), for some fuel and to wait for the weather to clear at my destination, Rough River, KY. The linesman filled my right fuel tank, contra to my instructions for only 8 gallons. It was raining and I didn't want to stand out there while he went about his business. It wasn't a weight issue, I just didn't need that much fuel to get to 2I3 and make it home to Romeo, MI (D98) on Sunday.

After landing on Thursday at 2I3, and with all the greetings and brewskies being passed around, someone had looked at my cowl and informed me that he had some bad and some good news; "Doug you have a fuel leak, good news though, it shows nice flow and attachment along your new cowl". Dang-it, I went around to take a look and sure enough, blue fuel streaks flowed from the cowl-fuselage junction on the right side of the airplane. I looked around in the cockpit and could not see any signs of fuel, nor smell any fuel. I buttoned up the plane for the night and the next morning I opened the canopy and still could not smell any fuel in the cockpit. I dropped the lower cowl and could see only the fuel stains at the point where the horizontal cowl lip on the fuselage makes the bend vertically down to the NACA duct. Fuel stains in that corner only, but no wet fuel. I buttoned it up and decided to look into it when Michelle and I returned home.

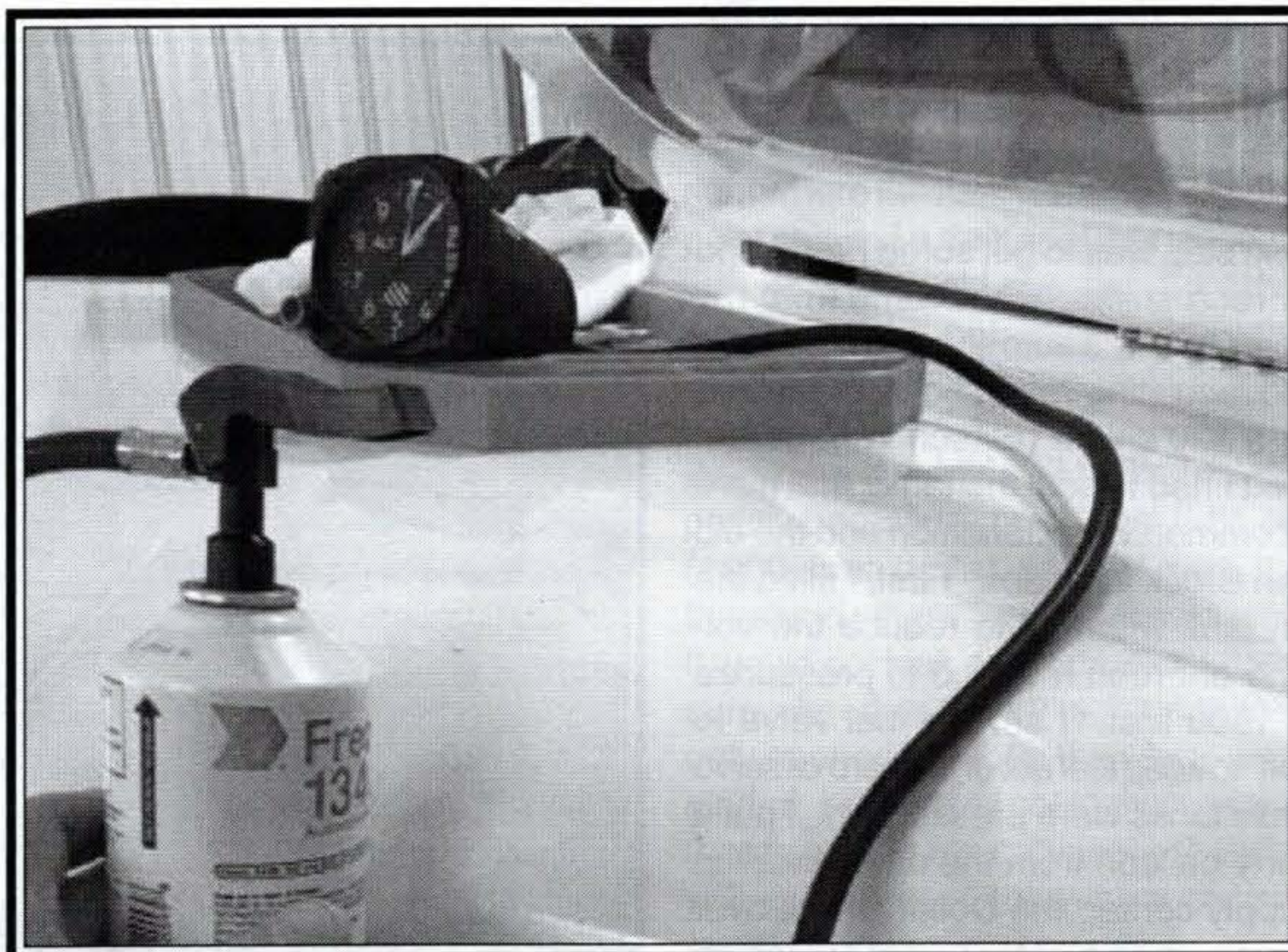
Sunday morning departure from 2I3 and again no fuel smell in the cockpit, but when we gained some airspeed in level flight, we could both smell the odor of fuel. Back at my home airport after Rough River, I put some silicone around the fuel tank vent lines thinking the smell was coming from a leak around the tubing; no change. Fall was in the air and flying was slowing down except for a "pie fly" in late October. Yep, same fuel streaks on the cowl and odor in the cabin on the trip to Grimes (I74). Some folks have their \$100 hamburger but we choose home-



dark spot is fuel leak hint



Freon under 1500 ft of pressure

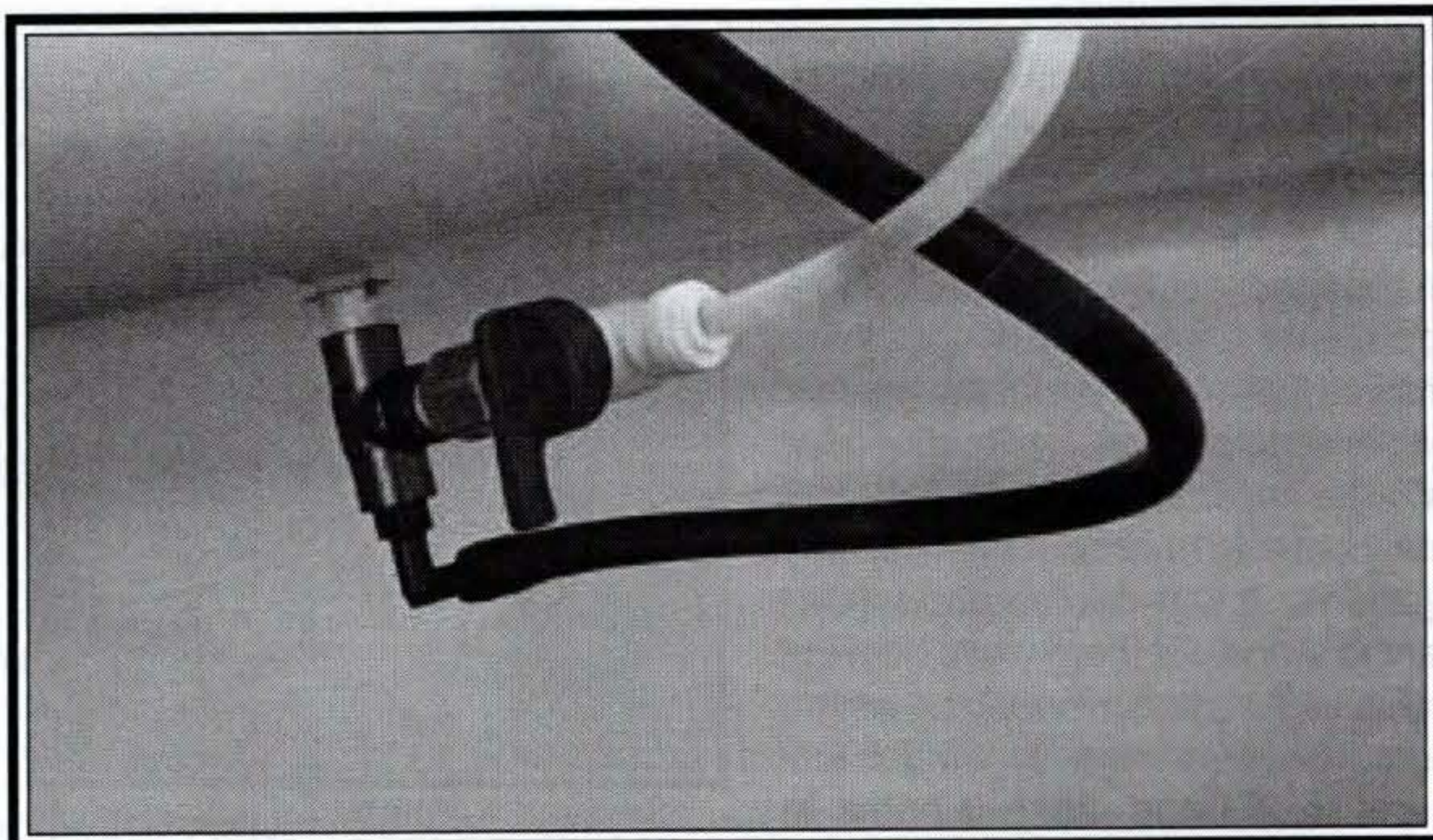


made pie in the Midwest. I don't think our beloved editor ever misses a pie fly. It wasn't until mid-March, 2019, when I flew again with 3 gallons in the right tank and about 16 gallons in the left. I flew on the left tank only and when I landed, the fuel streaks reappeared on the right side of the cowl.

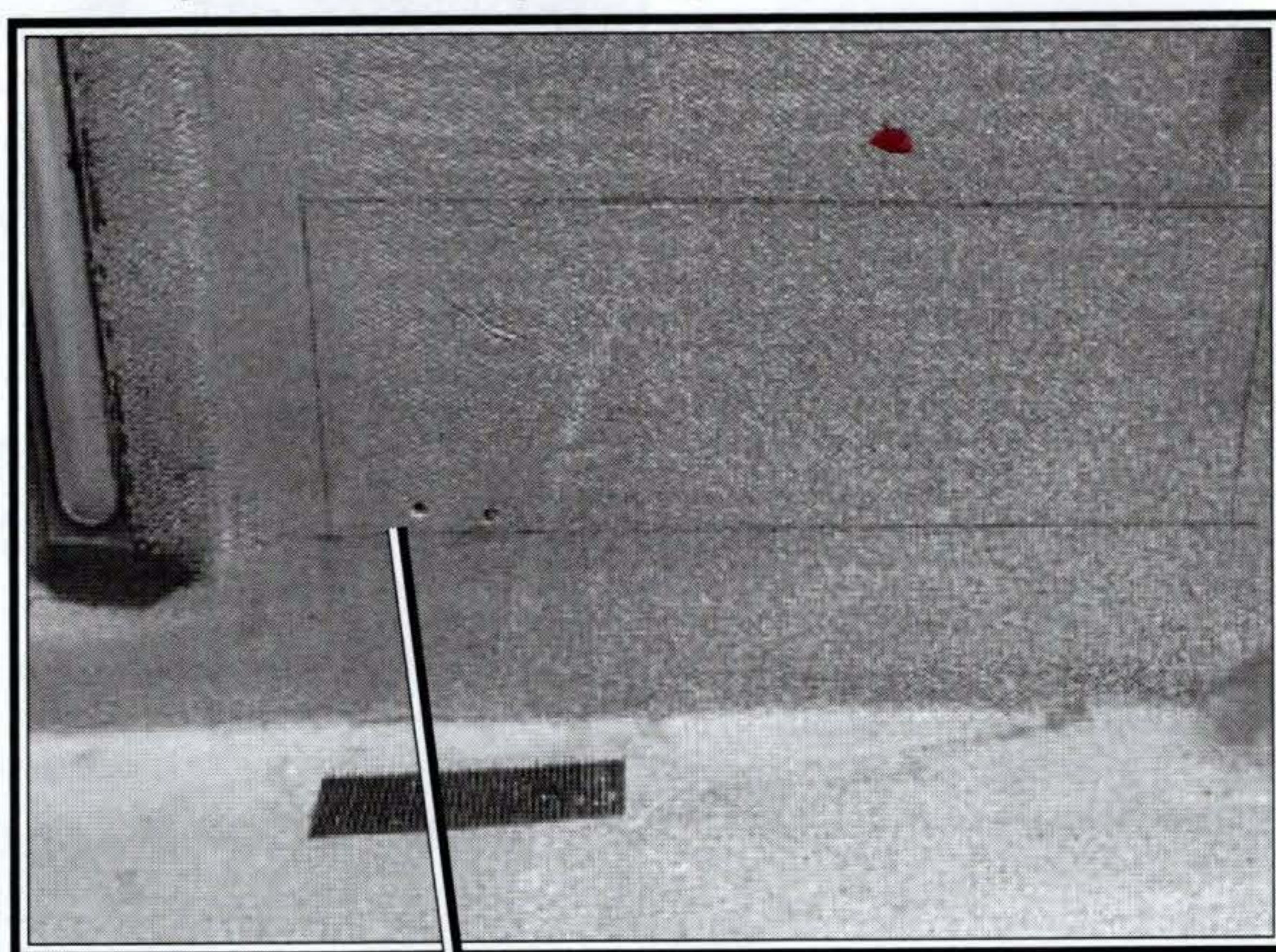
It was time to ground the plane until this was resolved. I poured over the build plans and pulled out every issue of the CSA Newsletter and Canard Pusher that mentioned fuel leaks. I learned a bit about the methods others used for tackling the problem but none of the published articles seemed to have a similar leak situation. I went to my barn and roasted 150 grams of Ethiopian Yirgacheffe and came up with a plan. Caffeine always helps, ask Harry Manvel (N2HM).

I jacked the plane up at about 10 degrees positive AOA, put 13 gallons of fuel in the right tank, and let it sit overnight. The next morning, as I expected, no sign of a leak. I then pressurized the tanks to 1500 feet (0.78 PSI) and within 60 seconds, fuel was weeping at the cowl lip on the fuselage. I jumped in the plane with my borescope camera and took pictures of the fuel outlet tube, inside the spar, the wall behind the armrest, the hell-hole, but could not find any wet spots. The fuel must be traveling through the blue foam between the glass layups. I drained the tank, let it air out for a day, and then stuck my camera in the tank just to see if there was anything obvious. I have a load of photos, but no revealing evidence of the leak.

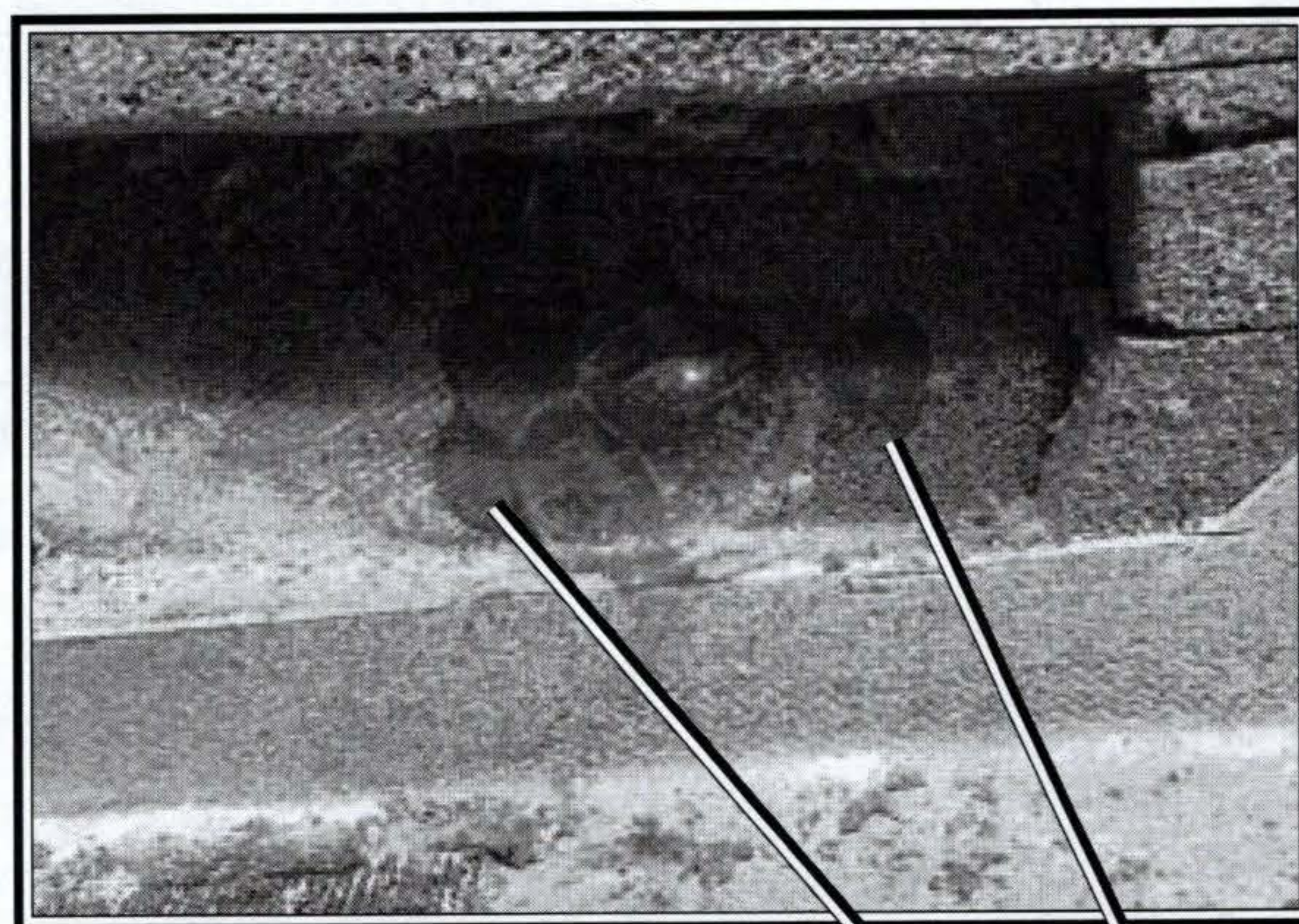
Next step was to get some Freon and a Freon sniffer. That came from my local O'Reilly's auto shop for the Freon and regulating valve and then Amazon for a \$20 sniffer (Elitech WJL-6000). Next I had to seal the tanks that have a common vent stanchion and the old Ken Brock fuel caps. First, I filled the left tank with fuel to reduce the volume of Freon required to pressurize to 1500 feet. I set the fuel valve to "Off" to keep fuel out of the carb or servo while tanks were pressurized. I put a party balloon from the other aviation supply center, the Dollar Store, over the common fuel tank vent stanchion



pressurized tank plumbing attaches at fuel drain



investigation area

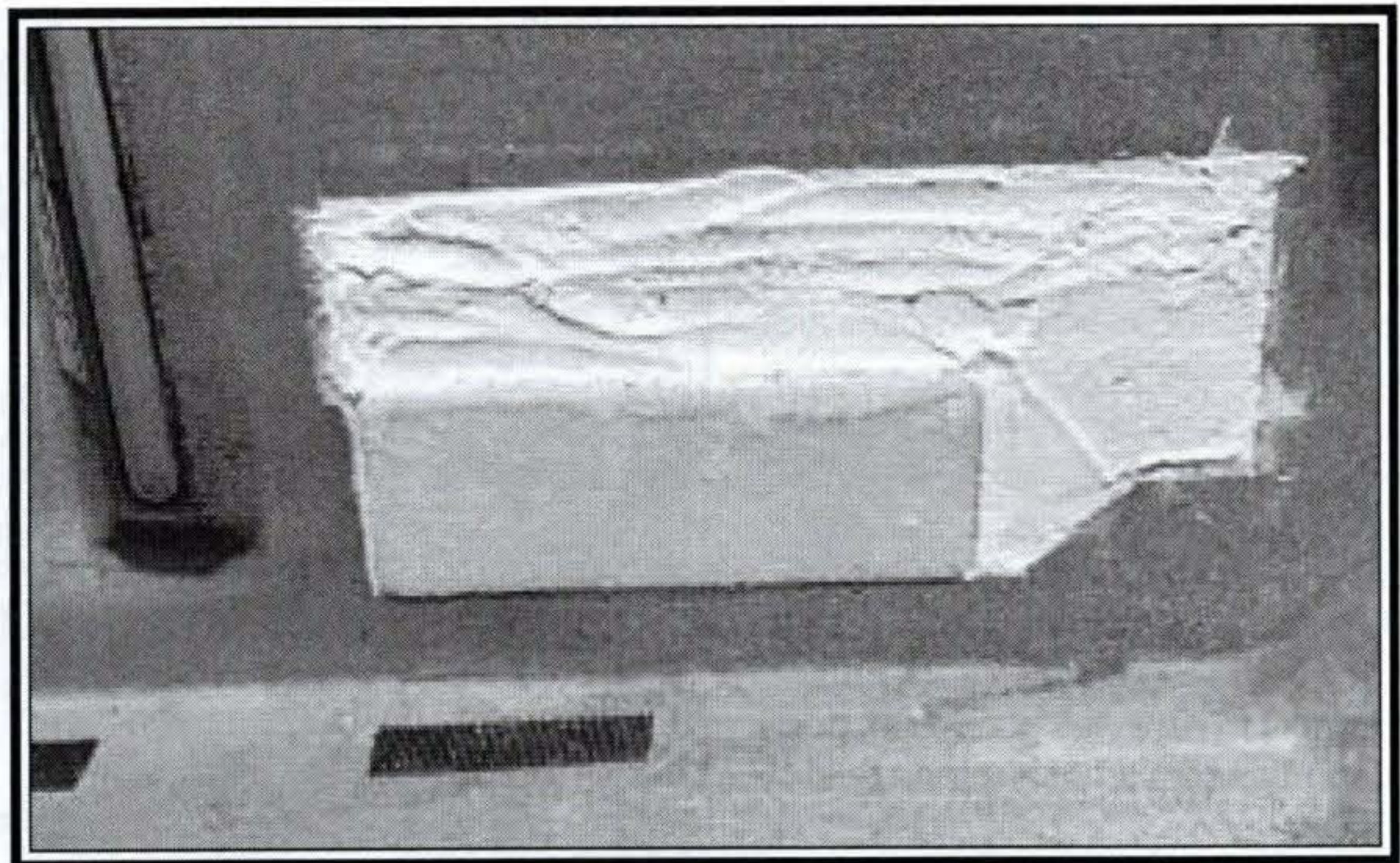


bubbles indicate leak

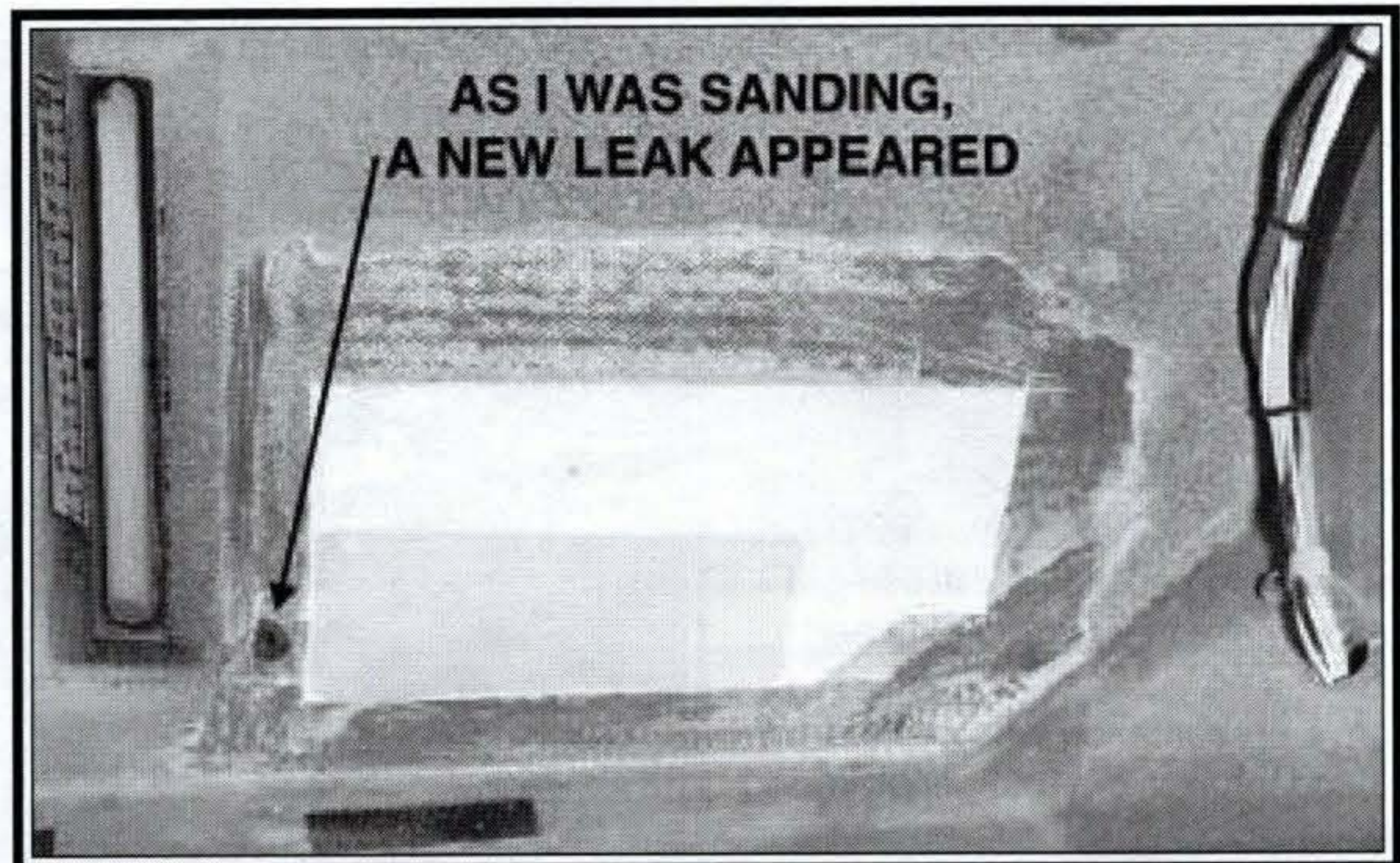
on the turtle deck and it acted like a nice condom and kept my Freon from leaking. I used the fuel drain valve fitting to insert a tee so that I could attach my altimeter on one branch of the tee and a SharkBite ball valve on the other tee branch. I could attach the Freon hose to the ball valve or just blow with my lungs. About 4 deep lungs full will get you to 1500 feet if one tank is full of fuel. I taped the fuel caps with blue painter tape. Do not use duct tape, the fuel vapors soften the adhesive and it leaks (experience).

I charged the tanks with Freon to 1500 feet and started my new \$20 sniffer sniffing. Both tanks get pressurized through the common vent stanchion. I tested the fuel caps, fuel valve in the cockpit, vent stanchion balloon, and the wall aft of the fuel sight gauge on the right tank. Damn, no leaks. Using my best guess and having gone over the build plans several times, I drilled two 1/8" holes about 2" aft of the fuel sight gauge and just above the bottom of the strake fuel tank. Bingo, the sniffer started chirping. I surmised the leak was close to that area, so I cut a 4"x7" section of the interior crew compartment fiberglass away, and then started digging out the blue foam to the wall of the fuel tank. Another "sniff" and I zeroed in on the leak. I confirmed the leak with soap bubbles and my stethoscope, which was a piece of 1/4" rubber tube stuck in my ear. I cleared more blue foam away and did the leak tests again. It seemed there was only one small pinhole leak.

I removed about 2.5"x 5" of the blue foam making a nice square opening around the leak. I sanded and cleaned the fuel tank wall, and put a wet 2-ply BID patch and some peel-ply over the pinhole. I rechecked the leak area again after the BID patch cured and no Freon was detected. I cut a piece of foam to fit the opening, slurried it in with some micro, and leveled everything in the 4"x7" opening with micro. As I was sanding the perimeter around the 4"x7" opening for interior skin layup, fuel started leaking as I sanded through the Zolotone interior paint. WTF? The tank had been empty for a week. It seemed a small cell of fuel was trapped in the foam just below the



repaired leak area ready for skin & finish



skin and manifested itself. I figured that was the cause, but to confirm, I drilled two more holes above and below the leak and they were dry. I then laid up a 2-ply skin over the whole cut-out. After some painting with the Rustoleum brand Zolotone substitute and it just looks like another mod to the 34 year-old plane. I chose this route of cutting into the sidewall rather than trying to inject epoxy with a negative pressure drawn on the tank and hoping the epoxy would flow into the leak. I needed a confirmed kill. This was a quick and easy repair compared to other leaks I have read about.

Some info and data points:

- O'Reilly's Freon and adaptor - \$22 (cheaper at Menard's)
- Elitech WJL-6000 Freon sniffer from Amazon - \$20

- SharkBite 1/4"NPT x 1/4" Tube Ball Valve - \$8 HD or ACE
- 1/8" NPT tee and nipples... You should all have those in your hangar.

- Not in my knowledge database, but right where the leak was, the Zolotone paint showed a dark spot that I thought was grease or old age dirt. I cut that piece of glass out and a week later the dark spot was gone.

- Learning that MY fuel tanks run at a positive pressure of at least 0.51 psi (1000 feet delta) as that was the threshold where the tank would leak. It would not leak at atmospheric pressure. Another theory is that the leak only opened up when the wings were loaded. I suppose I could discuss that theory over some caffeine with those willing to do so. Otherwise a brewski would do.