Beech on a Budget

SAFE • LEGAL • LOW COST

By Mike Caban

The Dreaded Fuel Bladder Leak

One of the things experienced Beechcraft owners tell newcomers when they are shopping for their perfect Bonanza, Debonair, Baron, or Travel Air is to be sure the fuel bladders are in good condition or have been recently replaced. The fuel bladders in our Beechcraft were originally from Goodyear and Uniroyal, who were no strangers to rubber manufacturing and supply the U.S. military with fuel cells for their top jet aircraft. Many owners report decades of service from these original cells. But sadly, all good things must come to an end. When a fuel cell needs replacement it is quite the job to extract the old and install the new (or overhauled).

Figure 1

Shortly after purchasing my B55 Baron in 2004 the left auxiliary cell developed a leak. The labor charge at a repair shop was on the order of $1,000! Add another grand for the fuel cell itself and you can see where this is headed. There goes the equivalent of about 500 gallons of avgas or about 30-something hours of Bonanza fuel, or 20+ hours in a Baron. If that wasn't enough fun for me, in early 2005 the *right* auxiliary fuel cell started leaking. Both cells were original equipment, so after 40 years of service, they didn't owe anyone anything. With the "shock and awe" experience of the left fuel cell replacement under my belt, I solicited the help of my IA for an "owner-assisted" change out. Even with the two of us it was still about a 12-14 hour event. I purchased both auxiliary fuel cells from Floats and Fuel Cells, Inc. (FFC), *http://ffc-fuel-bladders.com* (**Figure 1**).

Fast-forward to October 2013: I arrive to tinker in my hangar a day or so after topping off for an upcoming trip and can't believe there is a puddle of my liquid blue gold under the right wing near the main wheel. I had topped all the tanks to the filler cap rims and it was soon evident that the right auxiliary cell was the leaker. After draining that tank it was easy enough to open the inboard access panels to inspect the two inboard nipples (sump and main feed). With the larger panel opened up you can lift up the cell in the airframe and get your hand and a flashlight in there for a good look.

In the process of lifting the cell, some remaining fuel sloshed into the forward main corner where the main feed nipple is located. I immediately began to see and feel fuel dribbling out of the main feed nipple area. This was quite disappointing given that this cell was just barely 8.5 years old and the failure seemed to be in an area that is relatively rigid and almost always wet with residual avgas. Whatever the cause, the cell had to be removed.

For those of you with the fortitude to tackle a fuel bladder removal and replacement (R&R) with your mechanic please read on. The rest of you may also appreciate what your shop has to go through to accomplish this task so when you get your estimate or invoice, you'll be prepared.

Figure 2

First, the cell must be as empty as possible (run the engine to burn the fuel on the ground or drain it using the sump drain valve). Next, remove the large rectangular access panels under the wing (in the case of auxiliary B55 tanks – Bonanza mains may be similar). This reveals aluminum access plates on the bottom of the cell held on by safety wired bolts and a cork gasket.

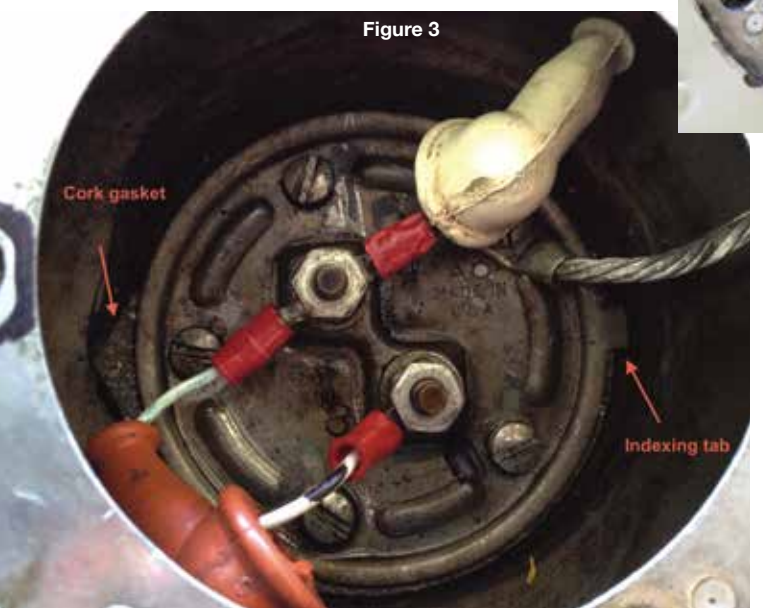

Figure 3

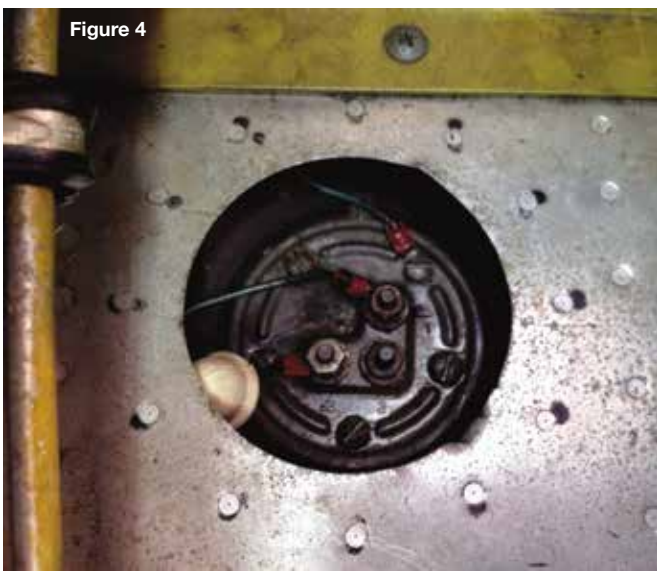

Figure 4

I removed these plates and then began to work up on top of the wing, removing the filler neck bolts (**Figure 2**) and the fuel level transmitters (**Figure 3** outboard and **Figure 4** inboard) in the engine nacelle. **Figure 5** shows the extraction of one of the fuel level transmitters.

Before removing the fuel filler neck from the cell, I made a FWD clocking mark to put the filler neck back onto the cell properly (**Figure 2**), since I liked the fuel cap clocking position. If you don't like your fuel cap clocking, now is the time to change it. I also photographed and marked the fuel level transmitter connections prior to removing them to ensure that all would be as it was prior to the fuel cell replacement.

Figure 5

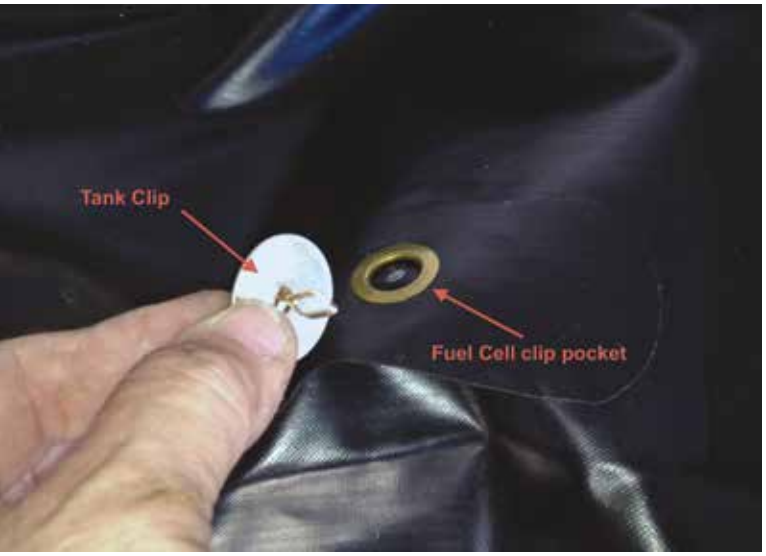

Figure 6

With the fuel level transmitters and the fuel filler neck unscrewed from the top of the wing, everything up top is able to collapse into the cell cavity. From the bottom of the wing access panels I worked my hand to the top of the cell to unsnap the clips that are used to suspend the tank from the top of the box cavity liner. **Figure 6** shows the clips and the fuel cell pocket that is designed to hold clip and allow it to suspend the cell from the top of the liner.

In my case, there are four nipple ports in the aux tank: Feed to selector valve (**Figure 7**), sump drain line (**Figure 8**), fuel return, and tank vent (**Figure 9**). The feed and sump nipples are inboard and the fuel return and vent nipples are outboard.

The entire 31-gallon fuel cell lives in a rectangular box cavity in the wing. **Figure 10** shows the outboard end of the

Figure 7

Figure 8

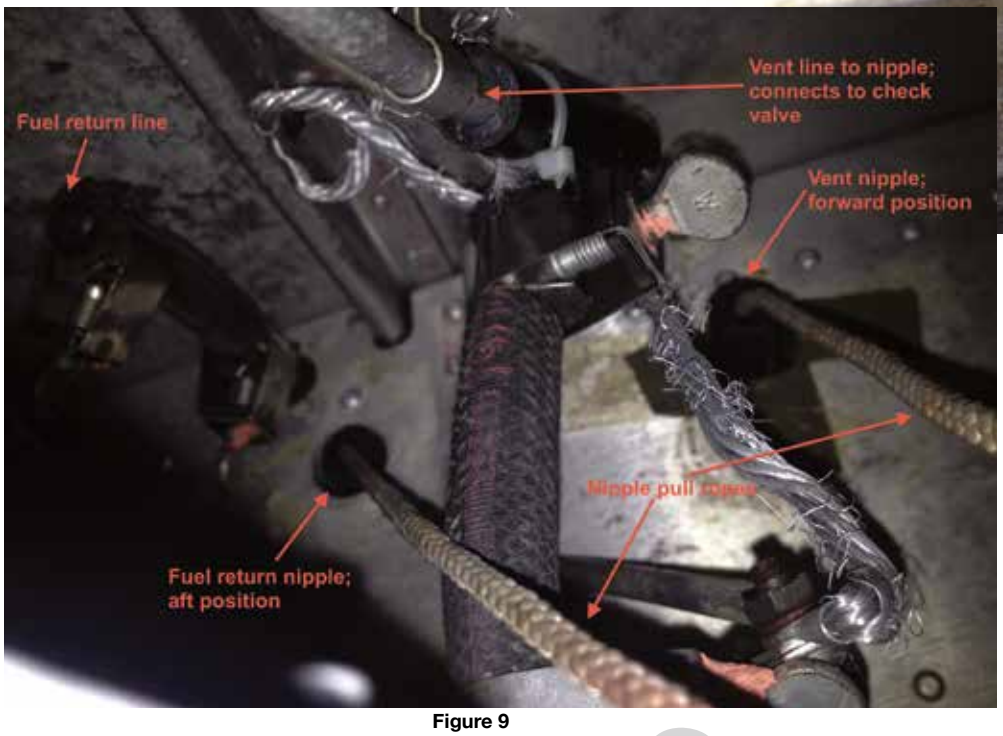

Figure 9

cavity as well as the tank clip holders in the top of the box liner. You can see the importance of taping the rivet lines and corners of the liner, which prevents decades of flight operations from abrading a hole in the tank.

After unsnapping all the clips from the top of the cell, the last step for removal is to extract the nipples from their

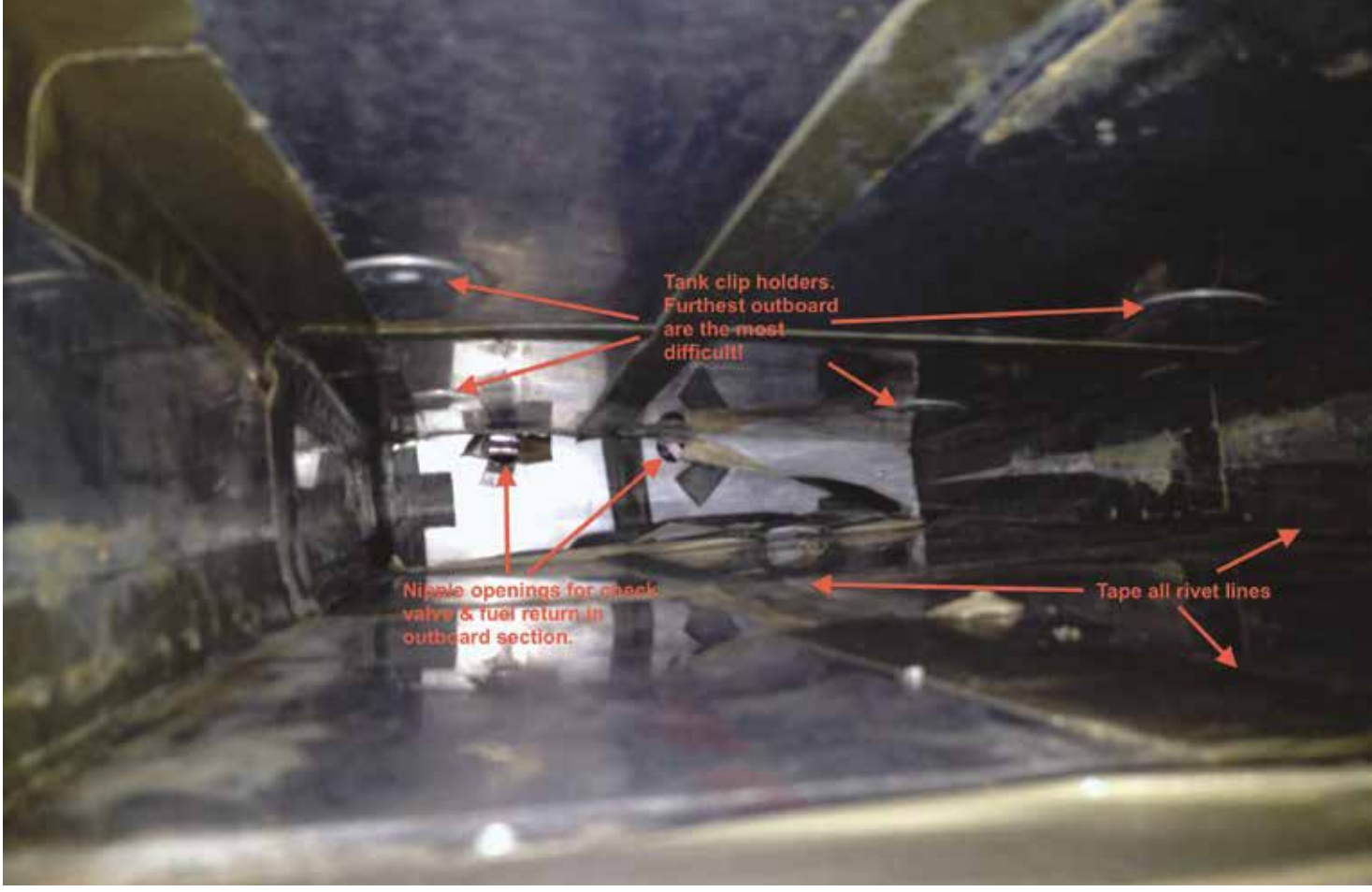

Figure 10

Figure 11

Figure 12

openings in the box cavity. Wiggling and gentle tugging on the cell can preserve the nipple joints during extraction in case the cell is serviceable. In my case the culprit associated with my leak is shown in **Figure 11**, the main fuel outlet nipple.

After getting the cell to FFC for evaluation, they indicated that the other nipples had impending doom in their future as well. Given the time necessary to make the repair, FFC was kind enough to offer me a completely refurbished cell and an installation kit (clips, gaskets clamps, and tape) for the cost of the repair. Given that they had a 2010 vintage overhauled cell on the shelf to send me (**Figure 12**), I gladly accepted the deal. Upon receipt of the cell I immediately inspected the nipple joints and could see a dramatic difference in the reinforcing used in this overhauled unit (**Figure 13**). This is what FFC's Director of Sales and Marketing called "continuous improvement."

Figure 13

I am fortunate to live in a southern climate because the rubber compound used in our cells is so much easier to work with and get it in and out of the small openings in warm temperatures. October in Texas is still 80-90 degrees so I was in good shape.

With the old cell removed, it's a good time to replace any aged or missing tape along the rivet lines. Some areas of the cavity are much more accessible than others, and this is quite a tedious task without long skinny arms. Reinstallation involves:

1. Bolting and safety wiring the fuel filler neck to the top of the cell and clocking it correctly with a mark you made during removal.
2. Inserting the new fuel cell back into the cavity.
3. Pushing the nipples through their respective holes in the box cavity.
4. Snapping the clips into the top of the box liner.

5. Reinstalling the fuel transmitters and bolting the fuel filler neck to the top of the wing.
6. Bolting and safety wiring the bottom plates and gaskets to the cell.
7. Attaching hoses and plumbing to the four nipples.

Item #1 and #2 are a little tedious but went well for me. Items #3 and #4 presented a whole new level of head scratching since I am not configured with long skinny arms. The outboard nipples and clips presented the greatest challenge to the whole project.

After several attempts and contortions my IA and I were able to get the outboard clips secured. Getting the outboard nipples pushed out their respective holes in the outboard section of the box cavity when neither of our arms would reach the end of the box required a bit of innovative ingenuity.

Figure 14 shows the innovative solution we came up with to *pull* the outboard nipples through the holes in the airframe. We threaded rope through the two nipples and tied it to a length of 2" × 2" wooden block, and tied a retrieval rope to the block to allow for extraction. Once the nipple ropes are attached to the block, the pulling can begin at the outboard access opening. This allows the block to exert a flat force against the two nipples and pops them through the holes. The retrieval rope pulls the block and two nipple ropes out of the cell.

Figure 14

The clamping and plumbing of the outboard nipples presents another "ship in a bottle" challenge given the limited access opening to work with.

No sealant was used on any of the cork gaskets and a few gallons of 100LL were sacrificed to flush the tank out through an open sump drain.

As you can see, this is not a project for the faint of mechanical heart. You can also see why it's such a pricey deal from your shop. It's also why Beechcraft shoppers should be sure they are getting tanks with some expectation of service life remaining, lest they be facing this pricey project on their ownership watch.

Happy Skies and Happy Holidays!