Composite Fuel Tank Construction

*** FUEL COMPATIBILITY UPDATE (07/10/2000)***

It has now been over two and a half years since I immersed test coupons in three different fuels. They were immersed December 25, 1997. To date there is no sign of disintegration. The three fuels being tested are BP 87 octane, Shell SU2000 93 octane and 100LL aviation gasoline.

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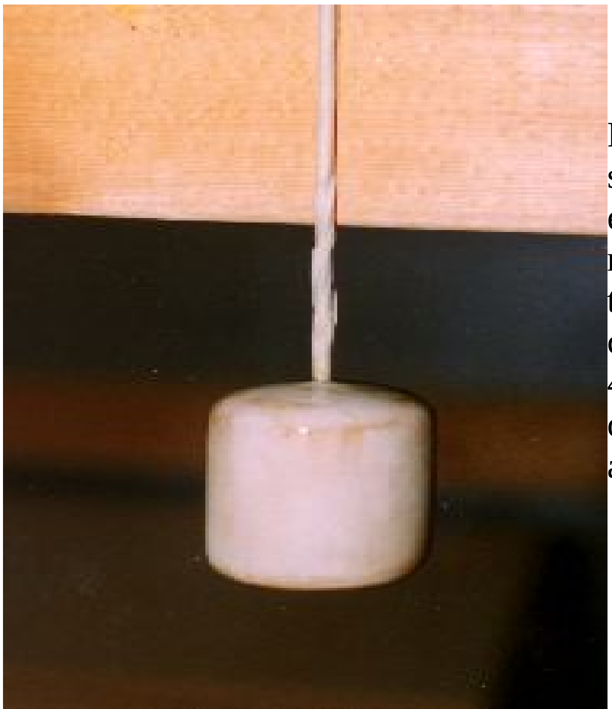
The factory fuel tank for the Horizon 2 holds a little less than 13 gallons and is constructed of welded aluminum sheet. The cost is $300 plus shipping. In the spirit of homebuilding I chose to construct my own tank from foam core, fiberglass and vinyl ester resin. The result is a 19 gallon composite fuel tank that cost about $150 in materials. While I have previous composite fabrication experience, this was very much an educational experience. This was the first time I had worked with vinyl ester resin. All previous work has been in epoxy. This was the first attempt at moldless construction utilizing flat, foam core panels. It was also the first time I'd used peel ply, flox, styrene monomer (thinner for resin) and the very tightly woven #7781 E-glass fabric.

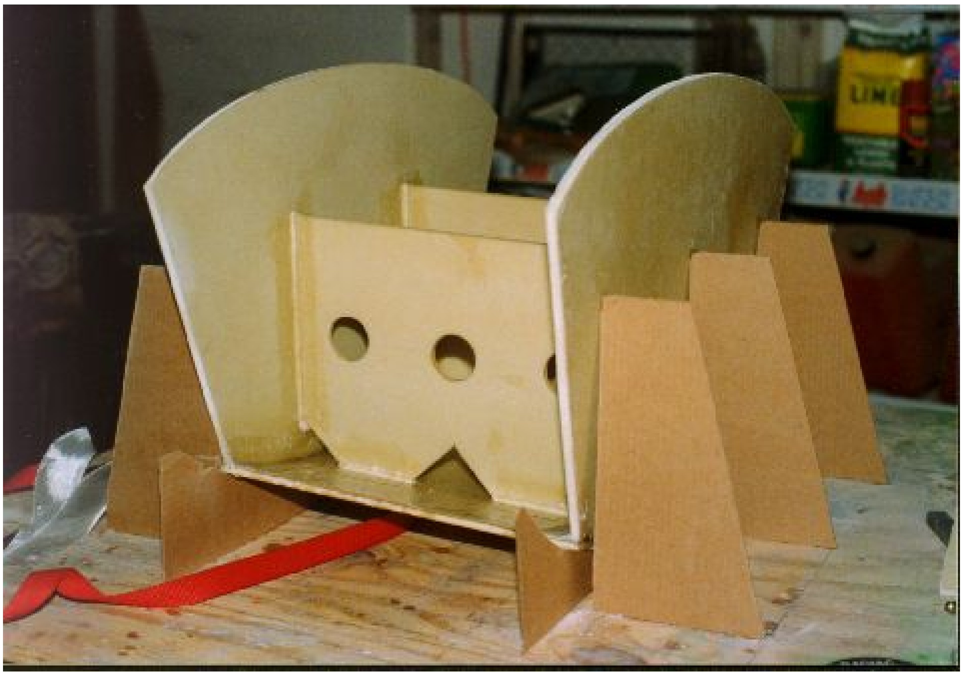
Plastic fuel filler cap features teflon guide tube for float gauge. You can't really glue teflon so the guide has a little groove cut in it to provide a snap fit in the hole in the cap. After snapping the guide in place I filled the recess in the cap around the guide with 5 minute epoxy to help capture it. The hole in the teflon guide is oversize to double as the tank vent. After this picture was taken I realized the guide needed to be on the outside of the tank to provide proper vent function and to prevent fuel siphoning. This also provides room for the float when the tank is full.



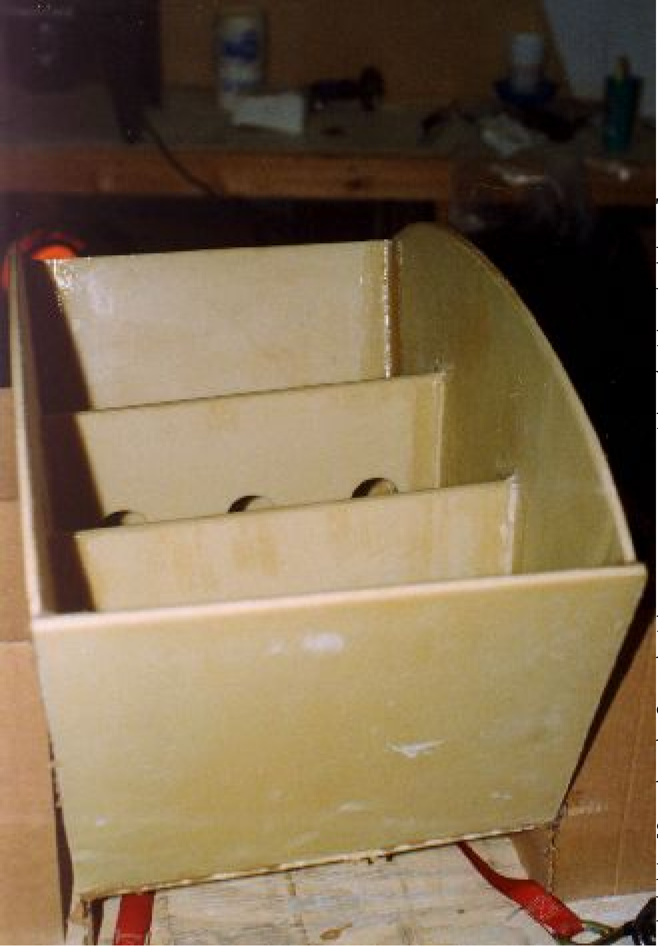
Float. Wire is 1/8" diameter stainless steel embedded in the eurothane foam core. Six 1/2" thick rectangles of foam were epoxied together then contoured by hand to create the float shape. One layer of a 4 oz. fiberglass cloth was applied over the foam followed by a couple applications of microballons in vinyl ester resin. I finished off with a final coat or two of straight vinyl ester resin.

This is the bottom of the tank with two layers of the #7781 cloth and vinyl ester resin applied and cured. Note cardboard form which set the curve in the panel when I was laying it up and now doubles as a jig to hold the panel while I assemble the tank.

Here's a shot of the bottom panel now with the end panels in place. Also shown are the two baffle panels (the ones with the holes in them) and the top of the tank with aluminum fuel filler neck visible in the right of the picture. The baffle panels are sitting upside down. Note the notches cut in these panels. This is to allow fuel to flow to the bottom fitting even when aircraft is banking or pitching.



Here the baffles are installed. All seams are sealed with two plies of 2" wide fiberglass tape with flox (ground cotton in resin) used to radius all corners.



Tapes are wetted out and peel plied. I should mention here the importance of peel ply. It is used on all panel surfaces and tapes to insure the fibers are properly wetted out and laying flat which prevents fuel from wicking along the fibers and finding a path out of the tank.

Side panels floxed in place. They still need fiberglass tapes on all seams. Following that all that remains is to install the top panel. Flox is applied all along the edge of the panels and the tank top dropped in place. You have to balance the amount of flox applied to avoid gaps but not so much flox that it oozes and drops all over the inside of the tank. I used ratchet type straps to hold the panel in place until cured. With the tank closed up tapes can only be applied on the exterior of this panel.

This is what all the work was for. Here's a shot of the completed tank from overhead. The fuel cap and float are at the bottom of the picture. The tank is sporting about $20 worth of the new water based "Smooth Prime" from PolyFiber. I bought a quart from Wicks for $25 to try. Smooth Prime is a WATER based primer designed specifically to help fill pinholes in composite parts. I didn't have to prime the tank. I only did so because it was a handy composite part to try out the new product on and therefore did not include this in my table of costs below.

Fuel Tank Materials, Components, Sources & Costs

Components	Source	Cost
5 yards part #7781 8.9 oz. E-glass cloth	Wicks Aircraft Supply	$24.25
3 yards part #RPB-1 release ply	Wicks Aircraft Supply	$10.98
Fiberglass Tape 2” part#2x50-FGT (used only a portion of $16.88 roll)	Wicks Aircraft Supply	$5.00
4 sheets part #F400-005 Last-A-Foam (used about 3 of the $8.60 sheets)	Wick's Aircraft Supply	$25.80
Fuel filler neck & cap part #FC100-001	Wicks Aircraft Supply	$4.93
Aluminum welding Flange part #AN867-3	Wicks Aircraft Supply	$6.81
System Three 5 minute epoxy part #T-5-PT (used only a faction of the $12.75 bottle)	Wicks Aircraft Supply	$0.75
1.25 gallons vinyl ester resin part #1110 & MEKP Catalyst	FibreGlast Developments	$62.44
2 feet 1/8” diameter stainless wire for float	local machine shop	free
Teflon guide tube for fuel cap	local machine shop	free
Cyanoacrylate based “Insta-Cure+” by Bob Smith Industries (used 1/2 of $6.00 2 oz. bottle)	local hobby shop	$3.00
Misc. brushes, squeege, MEK solvent, stirring sticks, barrier creme, etc.		$10.00
TOTAL COST		**$153.96**