

# Voyager's Fuel Tank

December, 2005

## Goals:

- At least 50 *useable* gallons, about the same as now with the two tanks.
- Minimal unusable fuel
- A low sump for these reasons:
  - Minimize fuel made unusable by rolling-induced sloshing
  - A collection point for *all* water and most crud
  - A built-in, always easily available, pump-out of the sump using small diameter (1/4") hose. Every time we fill the tank we'll draw off any water and crud. The hose is a small diameter so there's little good fuel pumped out. Also used to get fuel for filling filters, etc.
- No low spots (except at sump); all fuel drains naturally to the sump despite imperfect tank construction, heeling and pitching.
- Good fuel gauge with a rolling-resistant sender
- Cleanout hatch with reasonable access to the entire tank
- Fill pipe that goes to (nearly) the bottom of the tank to reduce foaming
- 2" deck fill for those fast pumps

## Current tank dimensions

- 9" x 30"w x 36" long
- But there's 2" clearance at top
- Removing 2x4 supports lets me lengthen it by 3.5"
- There's a good 3" or so available forward of the tank
- I think the biggest width to get down the hatch is 29" so make it 28" to be safe.

## Notes on new tank

- Tanks walls are 0.25"
- Baffles:
  - Tabbed in place. Where they intersect they're tabbed together.
  - 0.25" thick
  - Two additional small transverse baffles (not shown on drawing) stiffen the tank. These are 0.25" thick and run from the bottom of the tank just up to the bottom of the rectangular section. There's one of these on each side of the full-height baffle.
  - Holes are provided in main transverse baffle where it meets longitudinal one for the two pickup lines from the sump.
  - Fuel lines are tabbed to the longitudinal baffle.
- Hatch:
  - Hatch is round, 12 inches in diameter. That size may change when I build a prototype and run some experiments.
  - Secured by threaded inserts (McMaster-Carr p/n 92398A114) that are inserted and glassed over. One insert every one inch.

- The hatch gasket is cut from one 12x12 piece of neoprene – McMaster p/n 9455K122.
- Fill pipe is heavily tabbed to the tank's top and is only supported in that manner.
- Access to prop shaft coupling has been improved: The tank is 11" tall which, since there's no 1" thick shelf, essentially lifts it by an inch. It's 28" wide giving essentially another inch of athwartship access.
- Tank support: This is a fully self-supporting tank with no shelf. The 0.25" thick FRP will be so strong (I hope) that no other support is needed. On the port and starboard sides there's a 4" wide 40" long piece of wood 5200'd to the tank. (That gives 32,000 pounds of load-carrying ability). The current plywood that's glassed to the cockpit sides to support the tank will be cut down to hang just 6" below the cockpit. 20 screws staggered on 2" centers connect the tank to the plywood (so, each screw supports about 12 pounds with a full tank). But rolling will put large loads on the FRP-to-ply sections, so the tank has stainless angle pieces fore and aft at the top (5200's on) to deal with these sheer loads. These are bolted to the cockpit floor. The aft angle is glued on the top of the tank and bolts to the aft cockpit bulkhead.
- The fuel and return lines will run forward over the port mounting ear, so that ear doesn't stretch all the way to the top of the tank; it starts about 2" down.
- The three lines go through the top via copper pipes soldered onto a piece of 0.125" copper plate, that's attached to the tank with 5200. The two ¼ lines are each in two parts and are joined by hose clamps and fuel line. The junction is right under the hatch.
- Pump-out arrangement:
  - A manual fuel pump pulls from the clean-out line. The input to this pump has a shut-off valve; the output has a 90 degree bend to discharge downwards. It's mounted vertically in the port cockpit locker.
  - We pump into a 500ml graduated cylinder stored (somehow) conveniently. We look at the fuel to check for water and crud on each tank fill.
  - A 1 gallon jerry jug lives in that locker to collect waste fuel from this and filter changes.
- Layup schedule: 6 layers of mat. That's 0.258 to 0.288" thick. 60" wide, so lay up fore and aft (42" direction).
- Male mold: built to be 0.25" smaller than the tank in all dimensions, to account for the laminate thickness.

#### Tank size & notes

- The fuel pickup is mounted 2.75" above the bottom of the sump
- Total capacity: 59.9 gallons (includes allowances for baffles, wall thickness, etc)
- Unusable fuel with no heel: 0.29 gallons (this is the unusable part of the sump)
- 15 degree heel unusable capacity: 0.45 gallons (entire sump and nothing else)
- No heel, number of gallons to put 1" of fuel over the sump (note there's 0.16 usable gallons available in the sump as well): 0.3 gallon
- If the tank doesn't get completely filled for some reason (heels, foam, etc) amount lost if there's 1" of empty space at top: 4.9 gallons

- Amount of fuel in pump-out line wasted when checking for water: 0.01 gallon