Rigging an 1/8th Scale Nitro Boat by Mike Cathey

I have had heard many new people over the years say about a newly constructed hull, "I've got my boat done"! Well actually you are about half done. Making good equipment installs and finishing take as much time. I know that there are a lot of different techniques and parts choices that experienced builders use that will be different from my own. This article is based on what I know works for me based on rigging over 25 boats for myself and others. For this article I am using is one of Jeff Snell's Hull #8255 medium layup fiberglass boats set up for a CMB 67 and 3rd channel needle valve.

Before starting any work on a fiberglass or carbon fiber hull it needs to get a thorough scrubbing with a little bit of mild detergent dish soap and warm water. I use some of the fine (gray colored) Scotch Brite to assist with getting all the mold release and wax off. Rinse it off and blow it dry with air if you have compressed air. Wait until your wife is not home and give it a rinse in a hot shower.

Installing the Motor and Driveline

This is a critical area that will ultimately determine how well your boat performs. Taking the time in this phase of installation will avoid a lot of problems on race day. It's not really something you can correct at the lake. Getting this right will increase your fun factor in model boat racing. Misalignments in this area will just kill the boats performance, be hard on the motor, take out stuffing boxes and cables. In the end you will have to do it over again and get it right. There's not much margin for error so take your time and if you screw it up start over. I've had my share of do-overs, but it was worth it.

This hull has a belly pan and I like to drop the motor as low as I can and just be able to get the starter belt under the flywheel and behind the drive nut. This has performance value by lowering the CG for better cornering and making the driveline a straighter shot to the strut reducing drag from the cable.

This phase of the build will be installing the motor mounts, the stuffing box and cable and the strut/strut brackets. Here's the parts list.

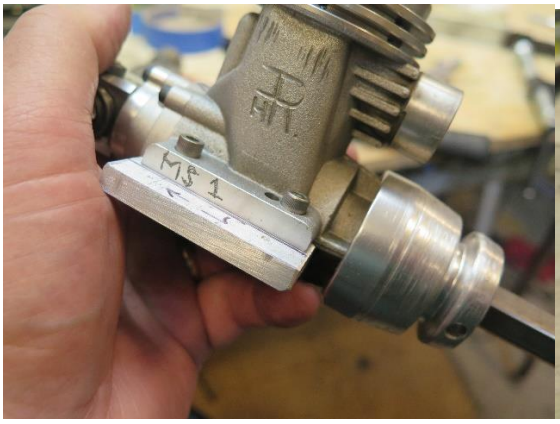
1. **Floor mounted motor mounts for a 67. (I obtained these from Bill Brandt at Rattlesnake RC and bored out and tapped to ¼-20 the 8/32 isolator holes and substituted ¼-20 isolators).**

These mounts must be made out of 7075 because they were a real bugger to tap. If you do what I did use a new high-quality four fluke tap with lots of good tapping fluid like Tap Ease.

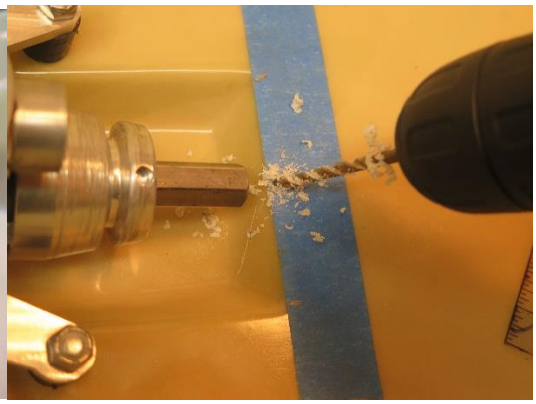
2.) **A selection of ¼" ID Aluminum spacers. These are Speedmaster pieces.**
3.) **Four 1/4-20 X 5/8" X 5/8" rubber isolators (1 male end and 1 female end) and four 1/4-20 stainless steel hex button head screws w/stainless washers. These isolators are 18lb. shear.**
4.) **Gary Jensen strut/strut brackets (also from Rattlesnake RC).**
5.) **Octura ¼" cable, ferrule, drive dog (w/two 8/32 sets screws), two 3/16ths collars and some thrust washer sets, some of Gary Jensen's 3/16ths stub shaft material, DO NOT USE HOBBY SHOP 3/16THS MUSIC WIRE FOR STUB SHAFTS-IT WILL BREAK!**

On this build I will have to drop the motor ½" to get it where I want it. I will do this with what I call transfer blocks and spacers. Remember to use 6061 T6 aluminum for these parts. It is strong yet is easy to machine.

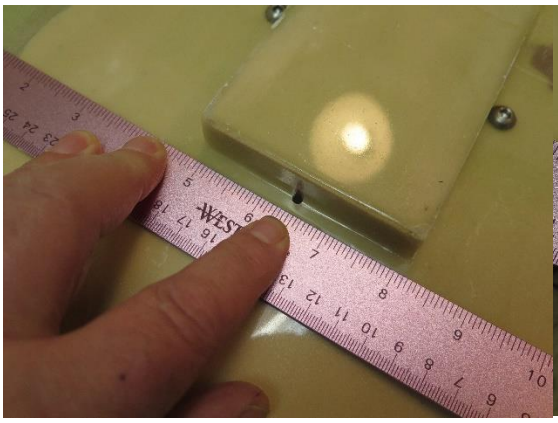
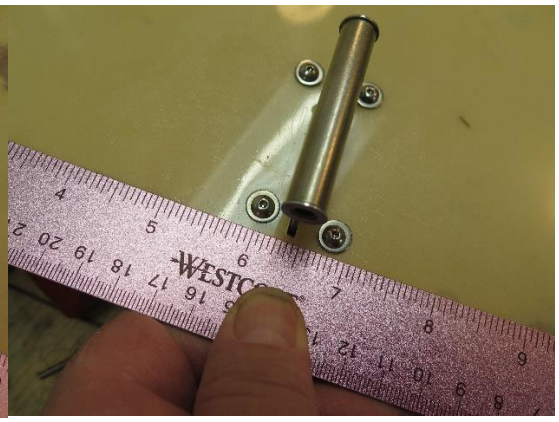
Note labeling to keep your parts straight and aligned. I also cap the isolators with stainless nylock half nuts. Anything that has more than 3 threads exposed gets cut off to save weight.



After boring and tapping the transfer block for the motor pattern and attaching it to my set-up motor I clamp the motor mount to the transfer block and using a transfer punch locate where the transfer block will be screwed to the motor mount. A set of transfer punches are invaluable for doing this kind of fabrication work.

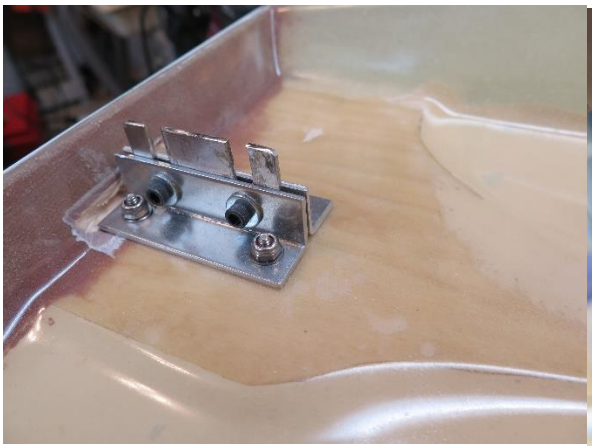
After stacking spacers to get the angle correct and the back of the drive nut centered in the belly pan mark, bore and fasten the motor to the boat. There is just enough space to slide the starter belt under the flywheel and behind the drive nut. Be careful in your fore and aft alignment as well as the side to side. Then bore an 1/8th inch hole to data mark the center of the cable location.

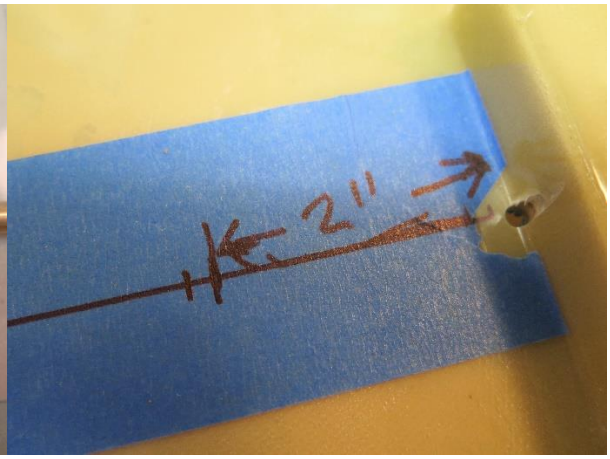
From the data point I measured from the edge of the tunnel to the center of the hole and repeated it to find the center of the strut. If you are doing one of these boats do not go by the indicated measurements because I just butted this scale up against the edge of the tunnel and took the measurement and the scale had about a ½" space before the zero mark.

I got into the project and forgot to take photos of cutting the slot for the strut. Assemble whatever strut you are using with the stub shaft, thrust bearings and drive dog. This is a Jensen strut, brackets and stub shaft. This needs to be done because the clubs I race in here in the northwest because the drive dog cannot extend past the transom. Once the placement is centered by squaring with the transom I cut a slot just so the strut will easily move up and down. Remember to add an 1/8" to the ends of the slot to allow the strut angle to be adjusted. The next step is to slip the strut up from the bottom into the strut brackets and fasten it to with the two pinch screws. To eliminate any misalignment when drilling the holes for the strut brackets bore a single hole and install a fastener (I am using 6/32 stainless button head hex with nylock half nuts) and washers . Repeat the process one screw at a time and everything will be exactly in alignment. A good starting point on these hulls is 1" level from the bottom of the boat to the bottom of the strut. For other scales I have built I would start at 1 ¼".

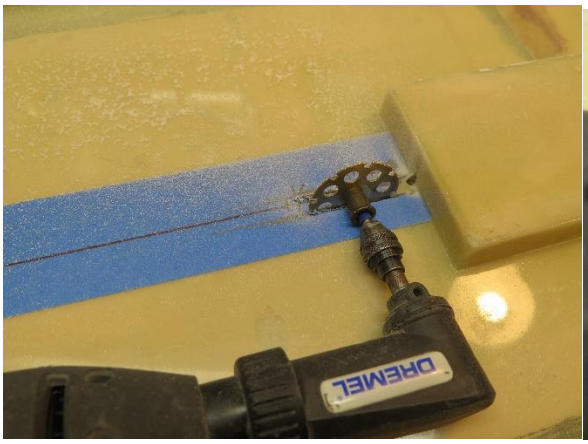
If a hull is new to you it is beneficial to ask someone who has one so that when you put the bend in the 5/16ths cable tube so it's close to the proper angle and avoid making multiple bends and buggering up the tubing. One gentle bend equals horsepower!



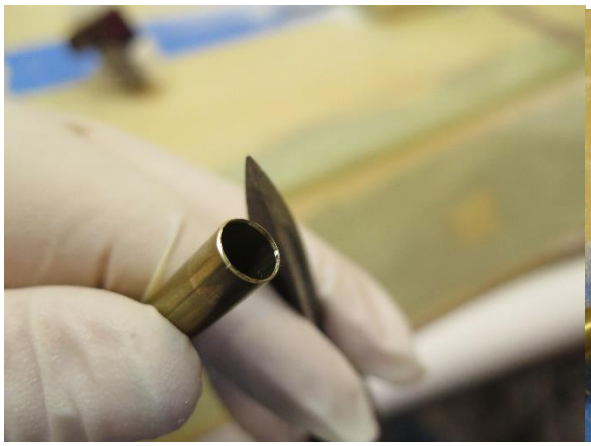
I had to hog out the transom a little bit to clear the strut brackets. After the installs were done and I stripped the boat for paint I floated in some West Systems mixed with West 405 filler and tilted the boat up at an angle to get the epoxy lay in there.



Inner and outer tubes. If you are using a Teflon liner you will have to use different sized tubing. Once the boat is painted and the outer tube reinstalled I will bore an 1/8th hole through the inner stuffing tube block and both tubes so I can grease it between runs. Always rough up any tubing in the portions that epoxy will fasten to with 180 grit emery cloth and clean with lacquer thinner.

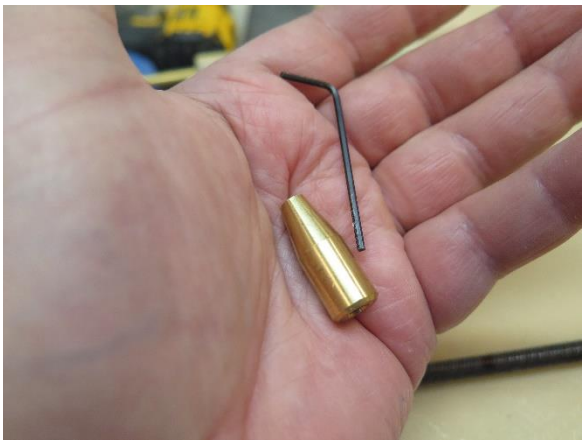


The 90 degree Dremel, tungsten wheels and Robart carbide bits are the bomb for this type of cutting.



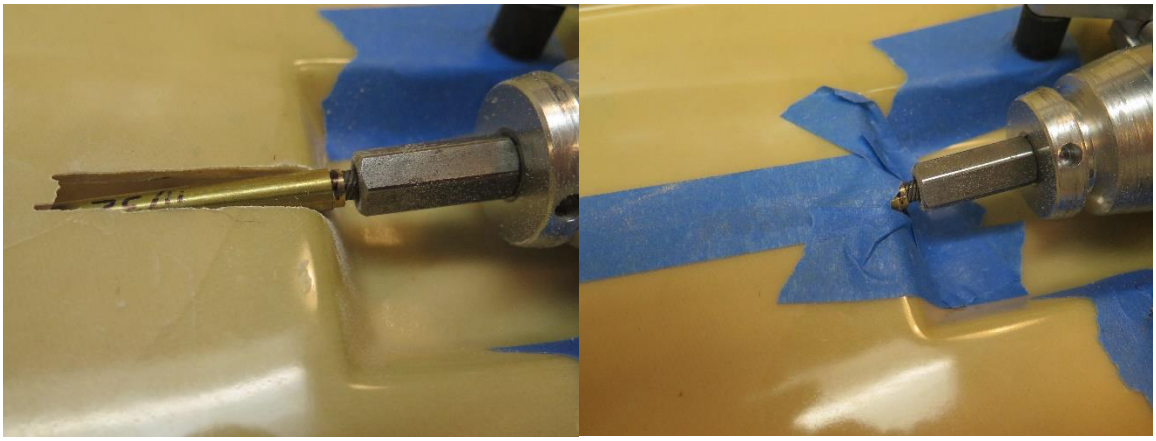

Using a bearing scraper is an easy and fast way remove flash and make the tubing slide easily in and out. If you use a tubing cutter go slow so the tubing is not deformed and reduced in diameter. This part of the process you need to sneak up on and remove as little hull material as possible.

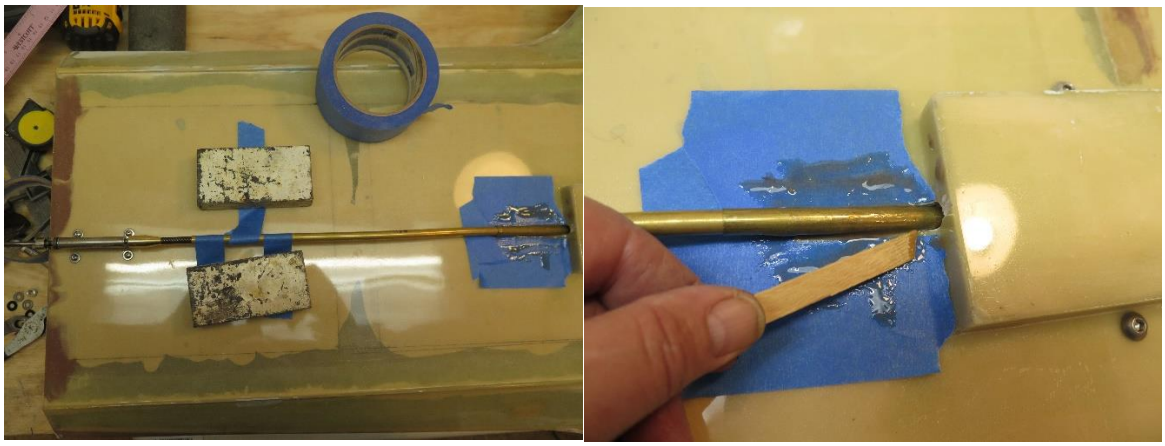

The next step is to set up the stubs haft and cut the cable to length. I use the square drive nut so I leave an 1/8″ for the cable to float fore and aft as it expands from RPM. Note the collar on the front side of the stub shaft. I haven't lost a stub shaft or an expensive prop since I started doing this 15 years ago. First place the inner tube in the slot and insert the cable fully into the back of the drive nut. MAKE SURE the cable is seated ALL the way in or you will be headed for a do-over. Run the cable to the front of the ferrule and mark.



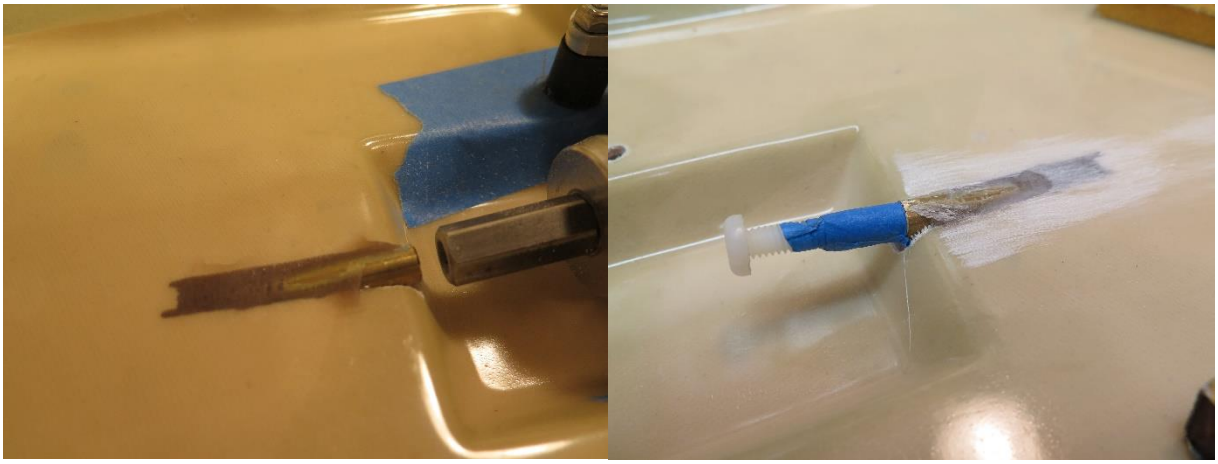
Take the ferrule or another just like it and slide a small hex wrench down the inside edge until you feel it touch the shoulder and transfer that additional distance to the cable and cut the cable and slightly trim the edges where you made the cut.

Insert the inner tube into the outer tube and place in the slot and the cable into the drive nut. Gradually make the bend so it matches the way the cable naturally wants to go and cut off the inner tube leaving a little extra to adjust later. Make sure that the pieces are aligned inside the boat and put masking tape on the inside to prevent epoxy from dripping through. Then adjust the cable/tube alignment and tape the inner tube in place with the cable centered at both ends. I use tape and some weights to influence how I wanted the cable/tube to lay.

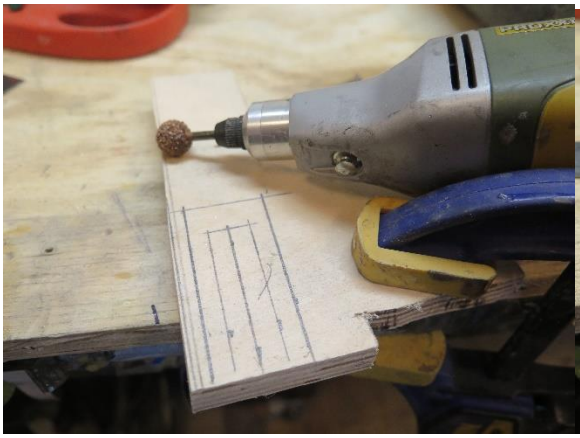


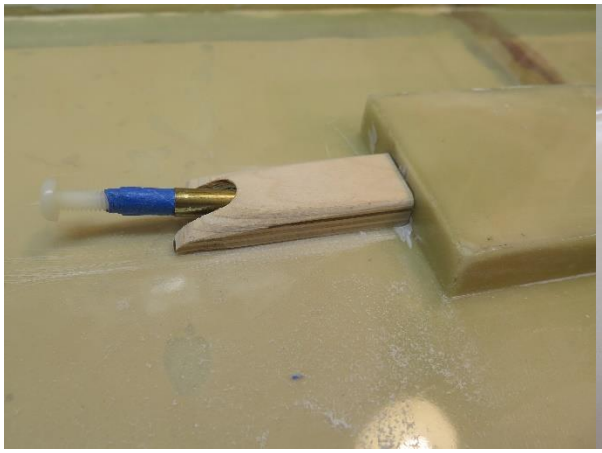
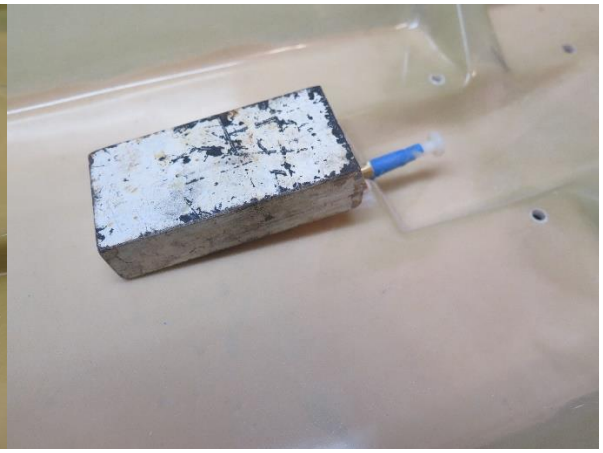


Lay in some West Systems with 405 filler. Wiping up excess epoxy with paper toweling is way easier than sanding it off later and saves a lot of time.



Remove tape and sand flush any epoxy that came through and around where the inner block will go. Pull the motor and mounts and seal off the end of the inner tube with tape and a ¼" screw.



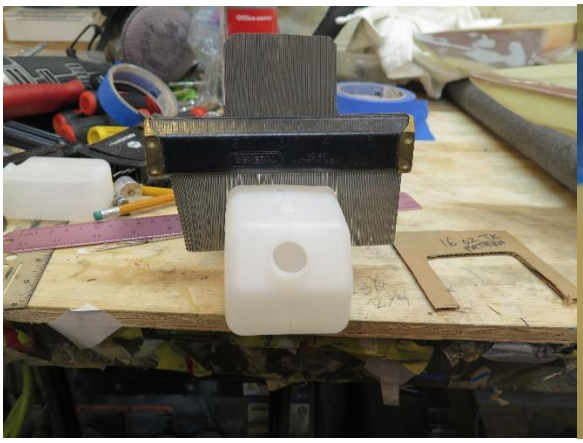



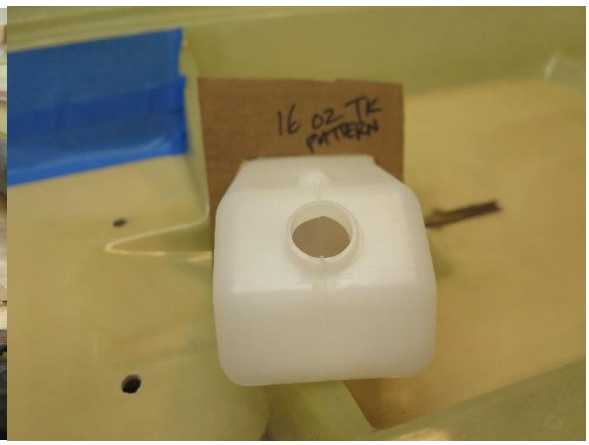
I like to make my blocks out of good plywood rather than hardwood as it has less tendency to crack. Cut the inner groove and then the block. I shape the bottom block so it has no edges which will resist getting damaged in any kind of collision. Keep removing material from the inside groove and shaping the blocks until they fit flush on all sides. Epoxy in place. Tape off everywhere except the tube and the space around it. Set the boat on the transom and start floating in some West mixed with 410 filler.

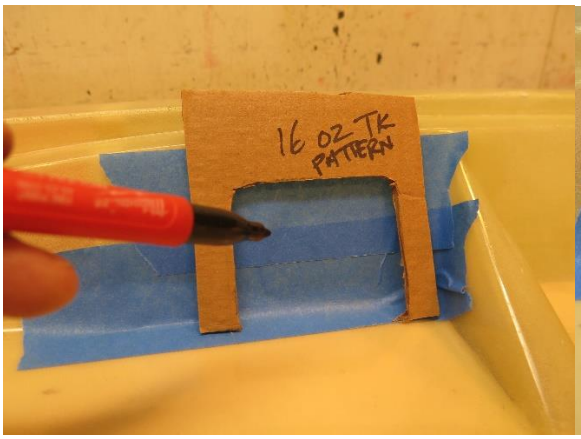
Running a wire down in there will help get air bubbles out. Note flat spot cut in the inner block. You can see where the inside block has a flat spot to drill a hole to grease the cable. Make the flat spot at an angle so you can snake a grease gun into the hole between the pipe and side of the boat.

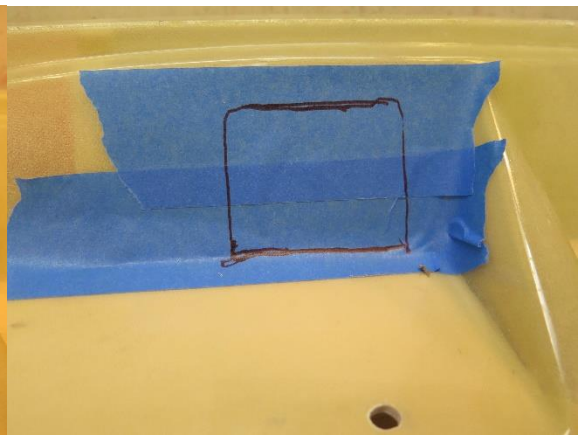
Fuel System

The fuel system is another area that must be done correctly to avoid a lot of headaches at the lake. I prefer to use a 2-tank system whenever I can to lessen the amount of plumbing to leak. While there is no doubt having the weight on the left side would counteract prop torque I like to have the tanks to the right of the motor so that fuel is being thrown towards the carburetor in the turns. I will give up a little weight to have uninterrupted fuel flow for better acceleration off the turns. The fuel pickups inside the tank should also be built to pick up fuel as far as possible towards the centerline and aft. For the current crop of 67 sized motors a combination of 20 oz. capacity is the minimum. This is a Sullivan 16 oz. hard slant tank.









A contour gauge is very helpful in making patterns. Another area where you want undersize the pattern a little bit so that you can gradually remove the least amount of material from the hull. I used the same rotary bits as on the stuffing box.

When I reassemble the boat after painting I use RTV silicone and a small piece of carbon fiber angle to hold the tank in place. On these hulls the tank sits just forward of the sponson transom so be careful not to use too long of screws to fasten the turn fin bracket that might pierce the tank.

Most experienced builders will tell you an old fuel tank is better than a new one. Here's why. This is the crap that was inside the 16 oz. tank. Before plumbing I inspect the tanks for defects and remove all the flash around the tank necks. Blow them out with air and then slosh around a little denatured alcohol and blow out again. Marking where you want your lines is helpful.

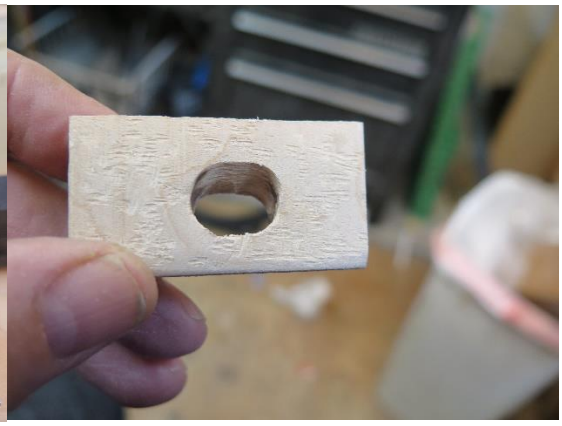
Here is the selection of tools I use to make the stoppers and fuel lines. I like the Sullivan aluminum stopper kits because you can cinch down tighter without worrying about stripping out a screw. Currently these kits are being sold with rubber material that is supposed to be good for gas or nitro. When I used these, they degraded and fell apart inside the tank. You can save yourself some grief by using the white stoppers that came with the fuel tank. A minimum size tubing for a 67 is 5/32". In order to use these aluminum stoppers you must bore an additional 3/16ths hole to accommodate the 5/32nds tubing. Pay attention to the orientation when boring. Deburr all the stopper pieces.

A powerful flashlight helps in determining where the lines are lying inside the tank. I don't think I have ever done this process without ruining some tubing by trying to bend it too tight and kinking it so get extra tubing. If you use the Dremel to cut off tubing always deburr inside and out and blow out with air. On suction lines make sure that the end inside the tank doesn't butt up against the side of the tank impeding fuel suction. I always cut mine at an angle so that can't happen and leave the ends a ¼"-3/8" from the tank wall. You also must take care that the vent line has some room between it and the top of the tank. Oh yeah, spit is good lube 😊.

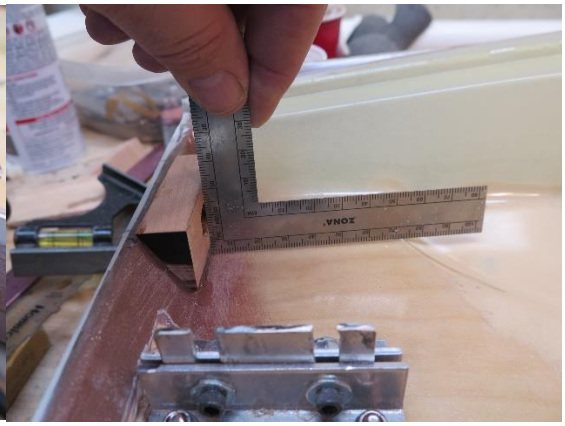
Hanging the Rudder

I will be using a Speedmaster 60 size with a 1 5/8th set back. I like using a wedge type rudder because it helps the boat to track straight as they are self-centering. Today's high torque metal gear servos, pushrods and pushrod connectors are so good that this is perhaps less important now as you can build steering set ups with very little slop. I want my set ups rock-solid. If I take out a servo now and then that's the cost of doing business. Am I giving up a little speed due to drag from the wedge, probably.

Having a boat that tracks straight is the paramount racing characteristic I want. I need to be able to take my eyes off the boat to look up the course and know where the boats going to be when I look back.

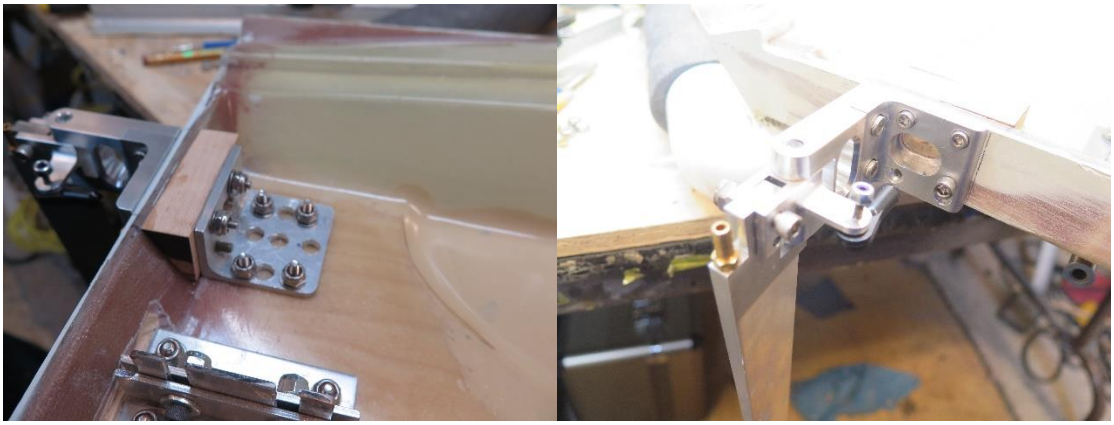
These hulls don't have a ninety-degree transom so I had to make a filler piece out of some really tight grain Maple. I bored out the block to match the hole in the rudder bracket. Note that I roughed up gluing surface with a Dremel wheel.

I clamped the rudder into place and cut out the transom where the pushrod runs. Pay attention that the pushrod will clear everything to where the radio box will be installed. Checking that the block will lay at a ninety-degree angle to the bottom. Match up the holes and epoxy in place.

Note that the Jensen strut has had the slots lengthened (towards the bottom of the boat) and the top cut off to clear the cowling. Use cobalt or titanium drill bits for the bottom holes in the strut slots at low speed with lots of cutting fluid.

Test fitting a 6061 T6 support bracket. There was a small gap at the top so a little whack with a ballpeen opened up the angle so it sat flush on both contact surfaces. <u>When doing fitment, you never, ever want to build stress into a piece by depending fasteners to pull things in place</u>. Note that a little material has been removed from 90 degree outside edge to accommodate the little epoxy bead at the bottom of the Maple block.

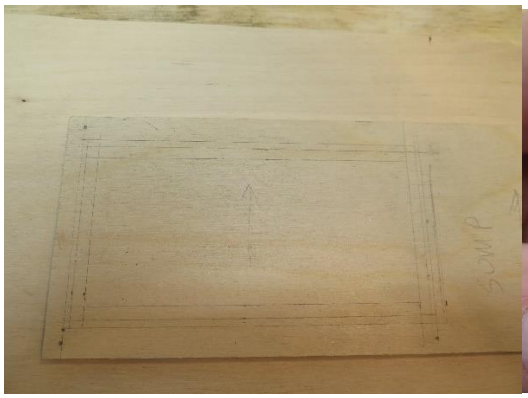


Finished install. Install the rudder to the block. Just like the strut brackets bore one hole at a time, put a fastener in and move to the next one. I bored holes to lighten the piece up. This hull has a low profile so all four of the stock 6/32 mounting holes in the rudder bracket were not able to be used. To compensate I used an 8/32 on the right side and fastened by tapping threads into the inside support. I had to slightly angle the hole upward so that it pieced the inside bracket on the vertical portion. When the boat goes back together all the screws will have some red lock-Tite on it. I tapped the 6/32 holes for the upper mounting screws and they are topped off with nylock half-nuts. The tiller arm has been tapped for a black steel 4/40 screw for the Dubro 4/40 Monster link.

Note the ninety-degree reference line to mount the rudder. I learned the hard way to always use pencil making lines like this on anything that will be painted. I had bleed through from a felt pen that blemished a nice paint job. I make sure to sand off any pencil marks as well.

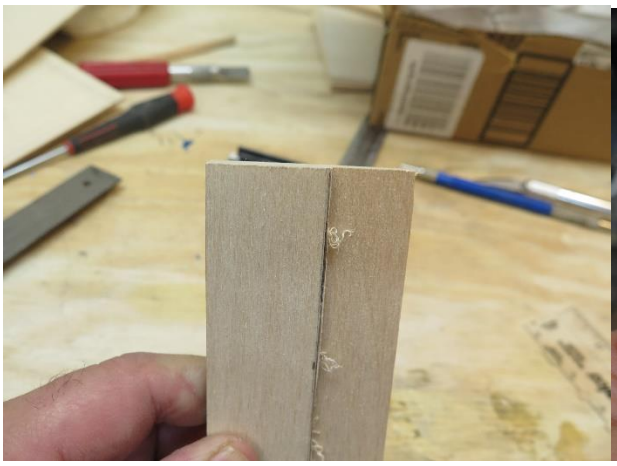
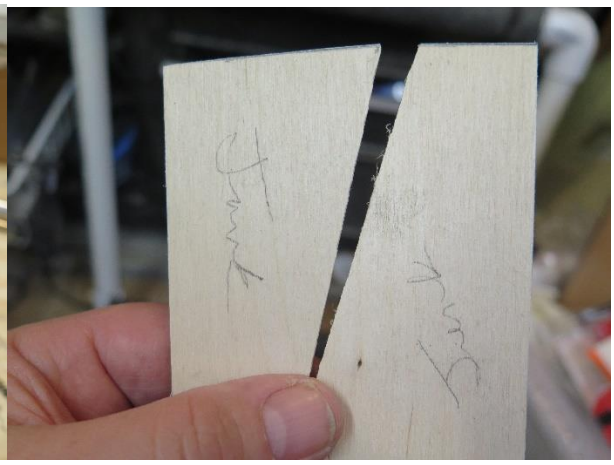
Building the Radio Box and Linkages


One of the reasons I prefer this style of open design hull is that I can have a roomy radio box. I start by making it as large as I can and then start by reinstalling the motor and adding all the components. One of the most important things to be certain of is that the rudder pushrod can make to the rudder tiller arm without any interference. The throttle pushrod lines up with the carb arm (with pushrod connector) and the 3rd channel the arm on the needle. For the steering arm I think it is best to use a good quality aluminum servo arm and a heavy pushrod connector like a Dubro 4/40 Monster Link. For the pushrod itself I will be using one of Central Hobbies Carbon Fiber pushrods (the biggest diameter they offer) with the titanium rod ends. I will be using the Enforcer Boats boots because they have a large diameter, so binding is less of an issue.

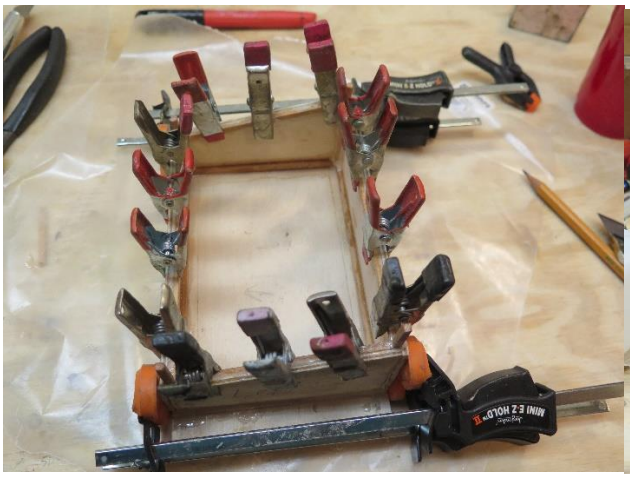
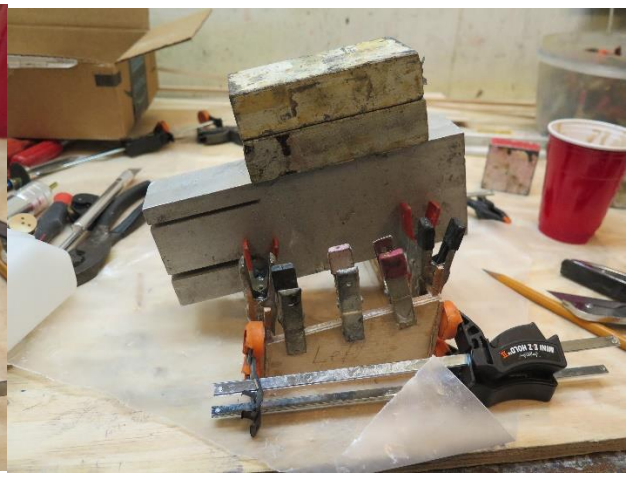



Laying out the dimensions for the 1/8th" spruce glue strips, 1/8th" sides of the box and leaving enough room for the screws to fasten the box to the hull. While there was plenty of room for width I was going to have to lay the rudder servo over so there would be no interference with the cowling. By running a ¼" of spruce that was cut to the same width as the cowling and sliding it over the radio box on the ledge the cowling sits on this was easy to determine if there was enough room.

Easy way of installing sleeves into the grommets in servos.

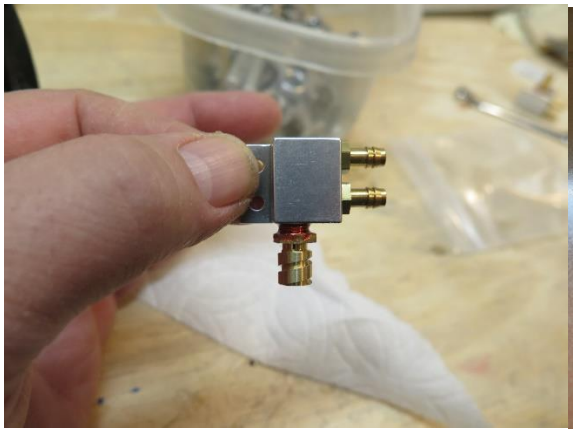



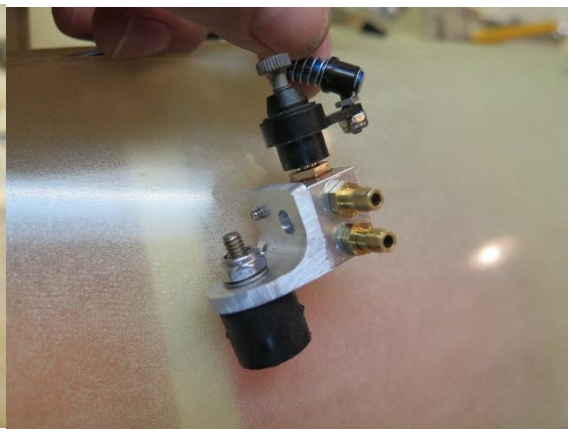
Cutting all the sides out and test fitting them by using weights to hold them in place. The first time I cut out the sides I screwed up two pieces. I always mark my screwups "Junk" and get them off the work bench to avoid compounding the error. I next cut and glued 1/8th inch spruce strips to the sides.

Gluing the box and upper glue strips for the top. Weights help push everything onto the floor.

Servo mounts. The mount for the rudder has 4/40 blind nuts into a piece of 1/8" ply. The screws are to keep epoxy out of the 6/32 threads. I laid multiple coats of West with white pigment in it to seal the box and make it easier to spot any dropped parts. I use 1/16" Lexan for my radio box lids so I use two pieces of 1/16" to make the top. I generally oversize the edges of the lid and will trim them later. Remember to keep your cut out for a pattern for the radio box lid. Complete the linkage hookups before gluing on the top. Note the 1/8" vertical strips in the corners.





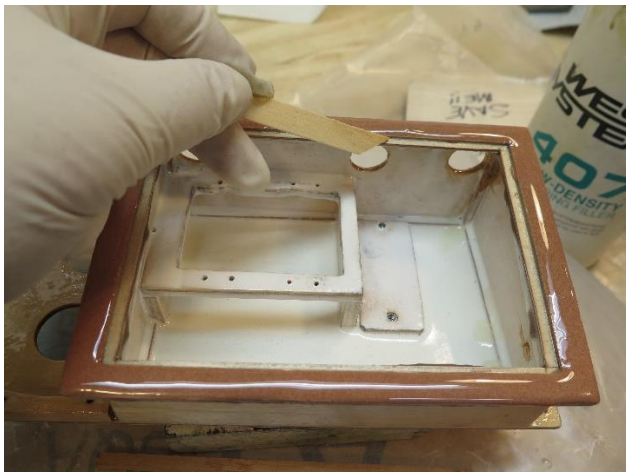
Assembling the OS inflight needle with the Don Ferrette base. I apply red Lock-Tite and invert the base so that Lock-Tite cannot get into the orifice in the bottom of the base when screwing it in. I then turn it back over and let it dry with a little bead of Lock-Tite around the edges to help prevent air leaks. I fashioned a mount out of 6061 T6 and used one of the left over 8/32 isolators that came with the motor mounts. This mounting method may seem a little wobbly until the linkage and fuel lines go on. Remember to route the fuel from the sump tank and fuel filter to the bottom nipple of the base. I like to use the Sullivan quick disconnects on the 3rd channel and throttle arm.

Gluing and clamping the top with West and some 405 filler. You can never have enough clamps!

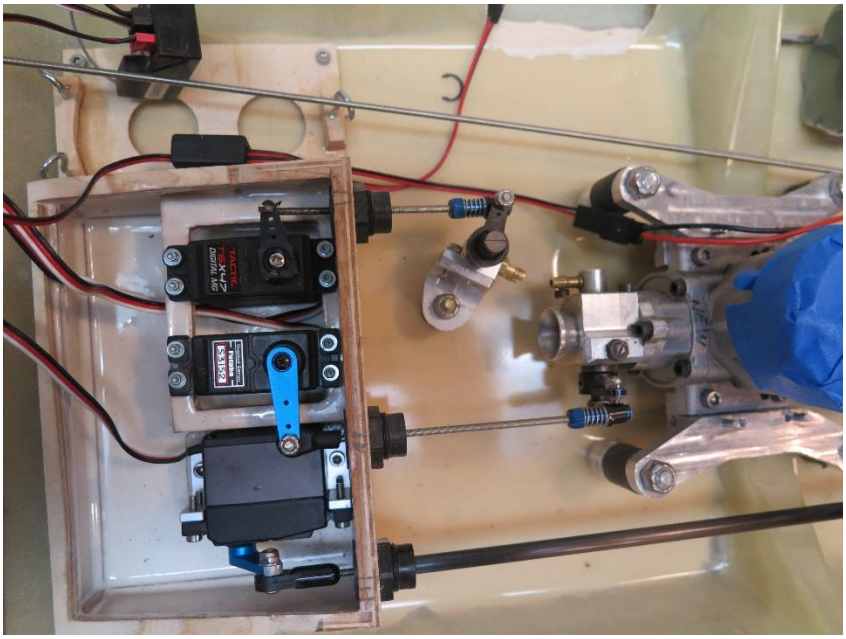
Locating the needle as close as I can to the carb. This way any adjustments take effect almost immediately.

Trimming the radio box top with a Coping saw. Everything gets sanded and multiple coats of West Systems. For a really nice finish sand with 220 grit and wipe down with alcohol between coats of West.

Note the lightening holes where the sump tank sits. Forstner drill bits do a nice job when making holes. Don't try to be too aggressive with the pressure and the cuts will be really clean. Too much pressure also will build a lot of heat and ruin the cheapo ones I use. You can get a complete set from Harbor Freight for about $35. The plywood blocks will have eyescrews (opened slightly to become hooks) installed on final assembly to rubber band the sump tank in place.



Floating on West with 407 filler. Removing excess that dripped into the radio box lid seat. At this stage I hit the West slightly with a heat gun to put a skin on it and keep it from sagging into places I don't want it to go. This will get a really light block sanding starting with 220 grit and finishing with 1500 grit so the tape sticks really well.



Servo linkages and waterproof boot mounts completed. Make sure there is NEVER any binding in the linkages. It will drain a battery faster than anything and cause a lot of heat that can take down electronic components. The final tasks were to mount the switch and antenna exit.

I hope somebody has found this useful. The next part of the project will be painting and adding the scale details. I will continue this series with a final assembly/initial set up phase and then document actual testing at the pond.