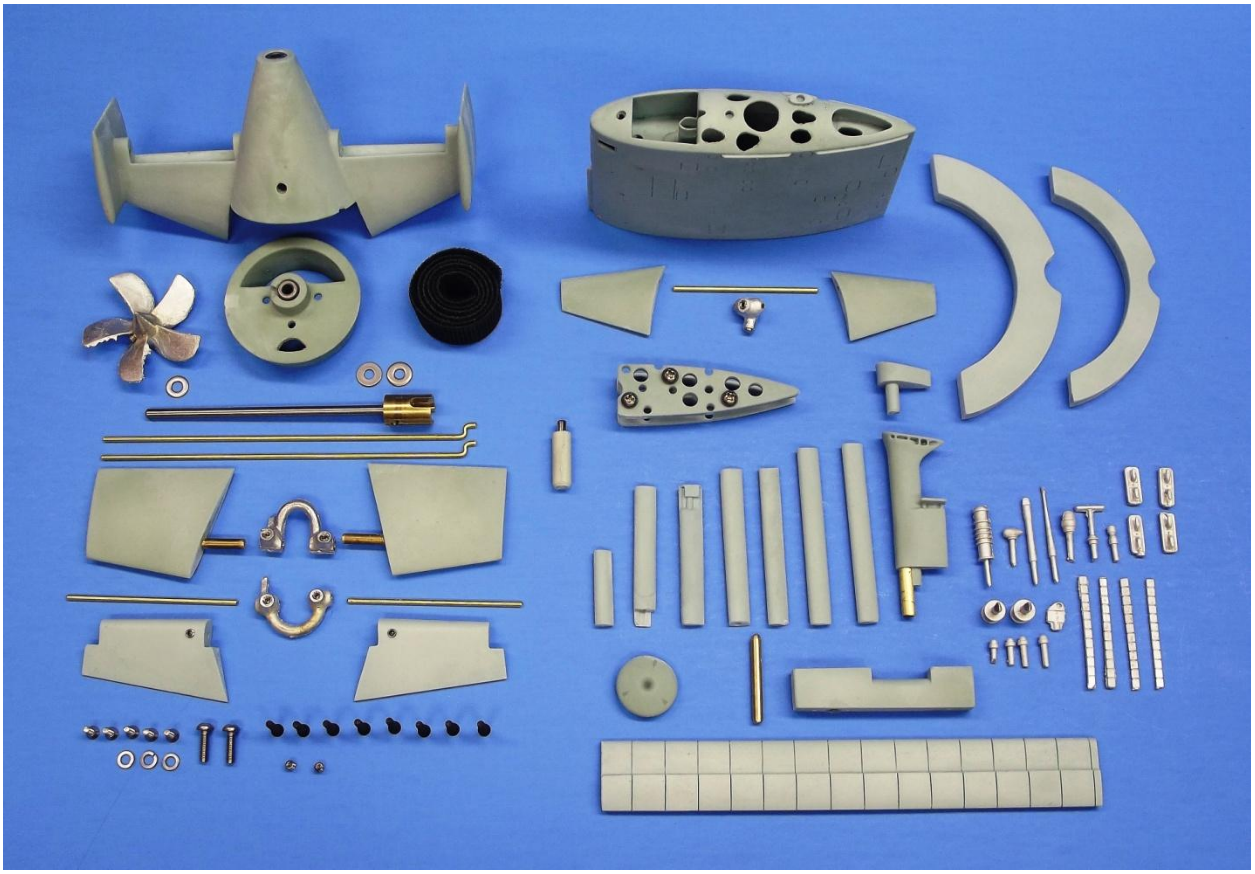
1/96 BLUEBACK KIT INSTRUCTIONS

Congratulations on your purchase of this r/c model submarine kit, representing the USS BLUEBACK, the model to the scale of 1/96. This product originated by David Manley -- a very skilled model builder and kit designer, originally offered through his business, Small World Models.

The instructions, provided here, will guide you through the preparation, assembly, and set-up of this r/c model submarine. Our objective of this manual is to get you from a confusing box of parts to a successfully running r/c submarine.



You will be dealing with three types of substrate: fiberglass (glass reinforced plastic, GRP), metal (Tin-Antimony alloy), and cast resin (polyurethane).

As you dumped the kit parts out on the bench you likely were dismayed at the apparent complexity of the kit. I can assure you that the changes made to this product have enhanced the probability that you -- the kit-assembler -- will be able to complete this project. Where you would have had to devise and manufacture your own linkages, we've done that job for you; where the ugly gap between hull halves was an issue you had to engineer a solution too, we've worked out the fix for you to implement. And, where there were originally only a few detail parts, we've come up with new parts -- parts that contribute to making this, every inch, an attractive scale model of an important class of combat submarine: a model submarine worthy of prominent static display and r/c operation.

David Manley is an exceptional Craftsman! The more work of his I study as his submarine kits are readied for market, the more I come to appreciate his engineering genius and outstanding craftsmanship. He's taught this old dog a new tricks. Example: while leafing through one of his neat little instruction booklets I came across his method of representing clear 'windows' at the upper leading edge of the sail. His technique of using nothing more than some masking tape and 5-minute epoxy glue was brilliant! It was so stupid-simple I just had to drop everything at that moment, and try it out on one of the first test-shots of his revamped kit. Worked like a charm! Just one of the many innovative tricks Dave Manley has brought to this game of ours.

Follow the instructions presented here. They are not *suggestions*.... they are INSTRUCTIONS! Follow them and you'll find this project an instructive, fun, and rewarding experience.

ASK FOR HELP, THE INTERNET IS BUT A FEW CLICKS AWAY And as you go about the many tasks involved in assembly of this kit, know that there are many Internet forums dedicated to the hobby of r/c model submarining -- forums that can be of assistance to you. If you need advice from those knowledgeable in this activity, don't be shy about logging in and asking questions. But, be careful: it is the Internet after all -- a place where you'll find expert and poser alike. Ask your questions, but do challenge your correspondent as to his accomplishments in this field. Most of the guys who visit and contribute to the forums know their stuff and are a real asset. However, the usual useless hacks are out there too; idiots who will waste your time because they have nothing else to do at 3 AM, in their pajamas.

The forum I contribute too can be found here, http://forum.sub-driver.com/forum

I'm one of the Moderator's there. Register, log on, and ask your questions. But, beware! .... you ask a question already addressed in these instructions and I'll hand you your head! (Yes, Virginia, there ARE stupid questions!).

We assume you have a dedicated work-space, tools, consumables, talent, and motivation. If not, then you're in the wrong game! R/c submarining is the most challenging of the r/c vehicle hobby; this is not an entry-level activity. If you come into this game no technical and/or craft experience, make those expensive purchases, then you will fail.

If the above pictures of tools, consumables and work-space are not familiar to you, then I recommend your next move be to cram the kits contents back into the box, log onto EBay, and try to get some of your money back -- you ain't ready for this, pal. And this game is an expensive one; if your house has wheels under it r/c submarining, at this level, is not for you.

To sum it all up: These kits are not for the unprepared, untalented, under-funded, and/or uninterested! Assembling one of these kits is not a casual activity -- it's hard, demanding, sometimes frustrating WORK! However, in spite of all that, I've found the hobby of r/c model submarining to be one of the most enjoyable activities of my life. It's most satisfying watching your model submarines periscope sedately cutting through the water keeping pace with, and only feet behind, a model of a big, low in the water, model Japanese freighter!

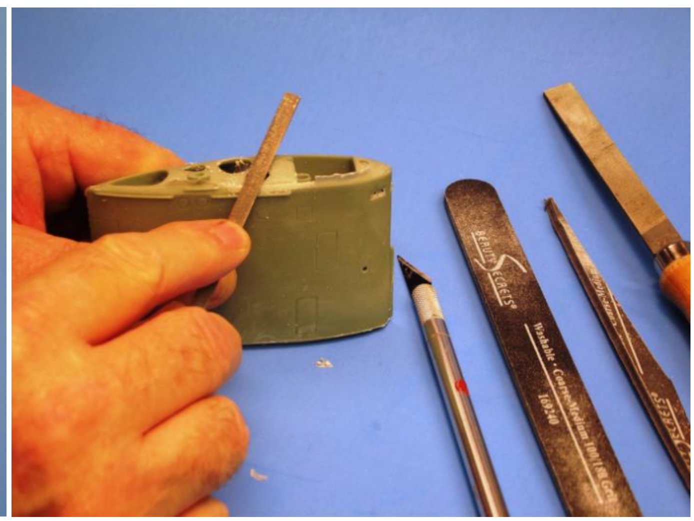
David Douglass Merriman lll

Nautilus Drydocks

PREPARING THE MODEL PARTS FOR PRIMER

SCRUBBING MOLD-RELEASE AGENT OFF THE FIBERGLASS PARTS There are only two GRP pieces with this kit: the upper and lower hull halves. During the glass lay-up process the surface of these parts picked up the poly-vinyl-alcohol (PVA) mold-release barrier. This water soluble film is removed through a good scrubbing with warm soap and water. Take care to push the abrasive pad into every crevasse. Rinse and dry. Don't get cocky -- you've only removed the PVA, you still have to give the parts 'tooth' to make them ready to bond strongly with the primer coats to come.

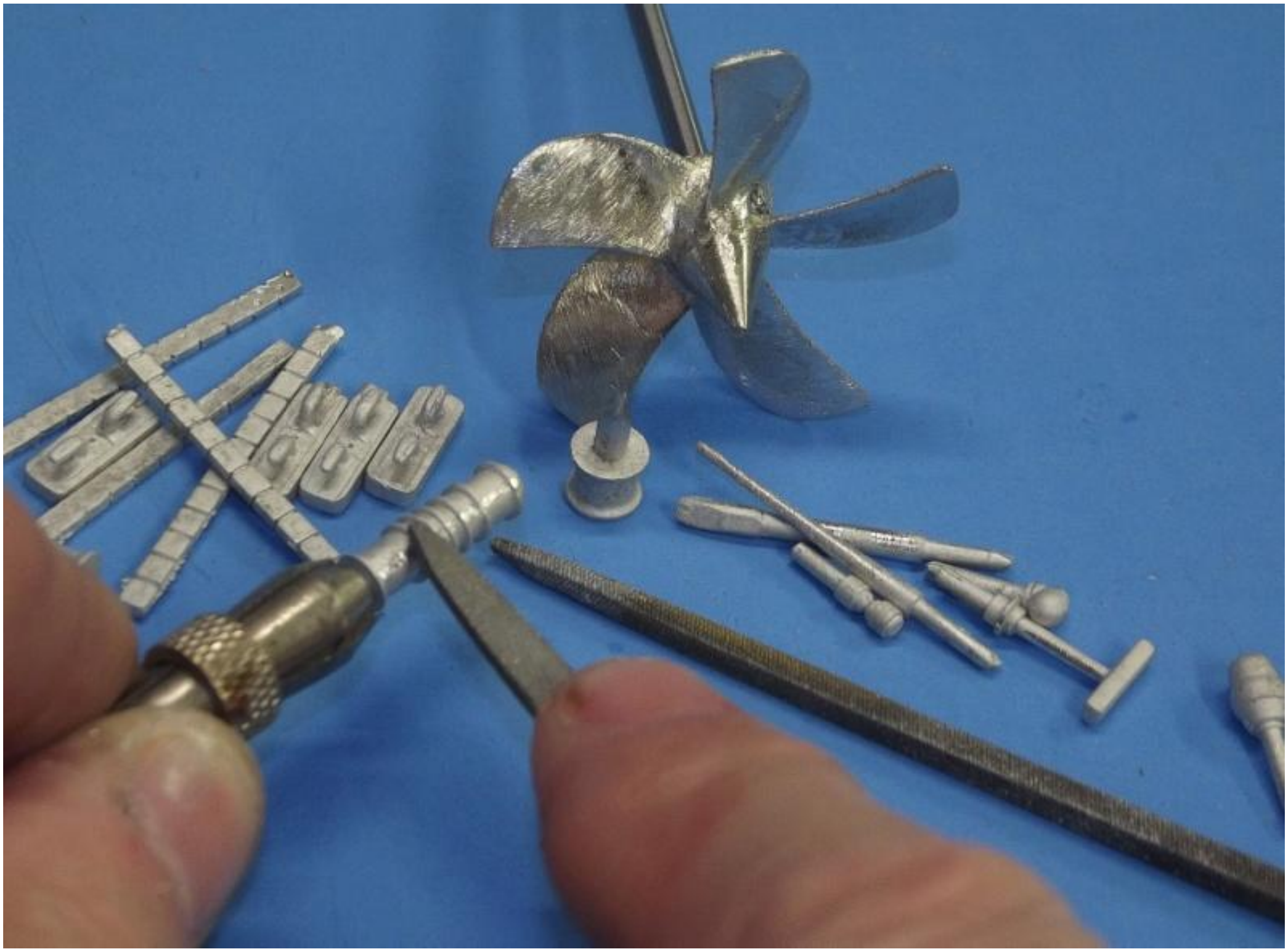


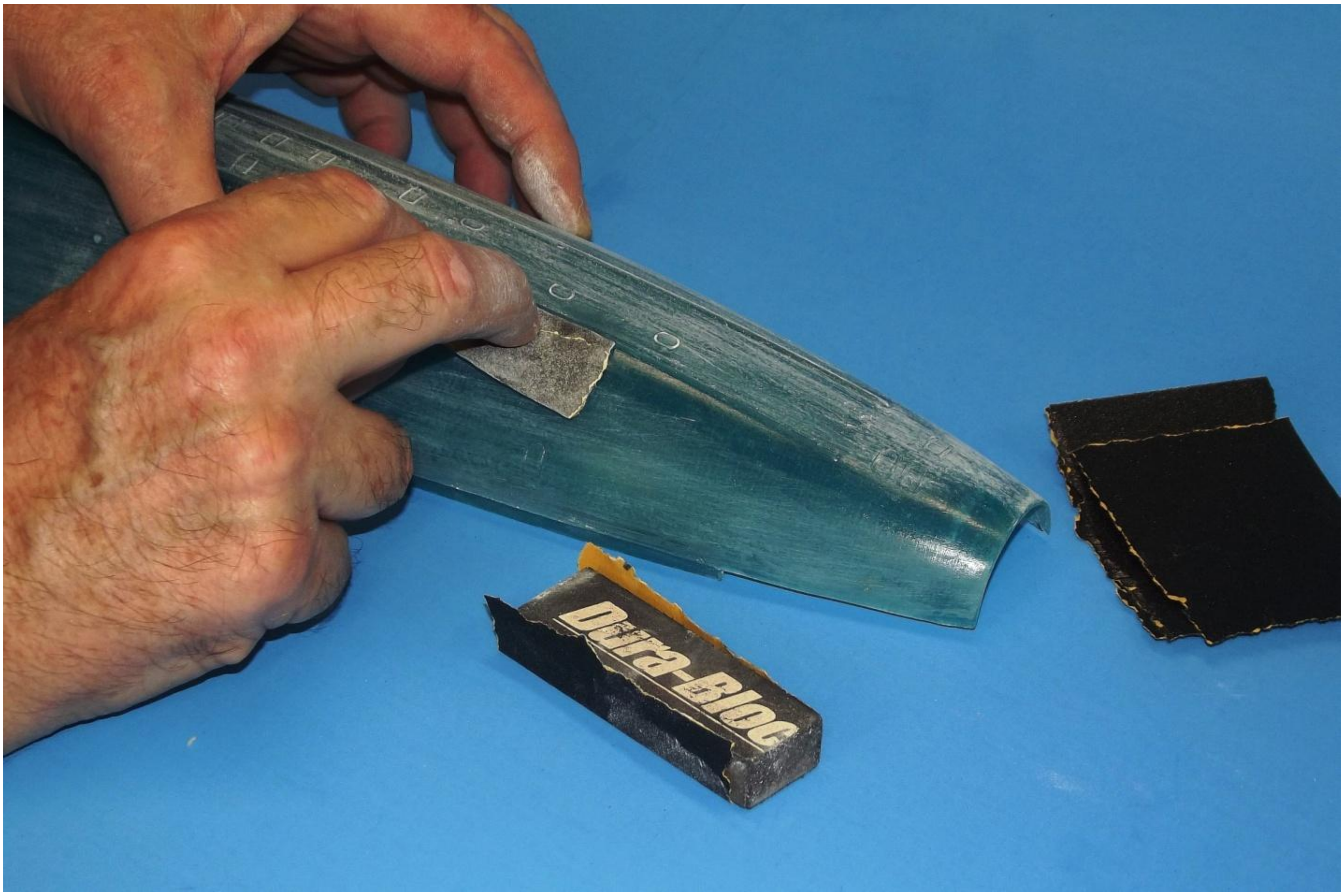
REMOVING FLASH FROM THE PARTS   An unfortunate artifact of the casting and lay-up process is the presence on the GRP, resin, and metal parts of 'flash'. Flash is excess material that gets by the separation plane of the molds during the casting or lay-up process. These flash lines, projecting at a right angle to the part, are removed with knife, file, or sandpaper block -- usually a combination of these tools.

Not flash, but excess material -- you'll have to grind and sand back on the GRP hull halves, as their longitudinal and radial edges are in the rough and need to be trued up with sanding blocks, files, and sanding sticks. The demarcation lines between excess material and proper edge are very apparent on the parts.

The smaller items that need cleaning up are the ones cast in metal. It's recommended that the antennas and scopes be temporarily mounted on their streamlined resin masts. Which, for the time being serve as convenient handles, giving you much better control of the work as you file away the flash with an appropriate jewelers file.

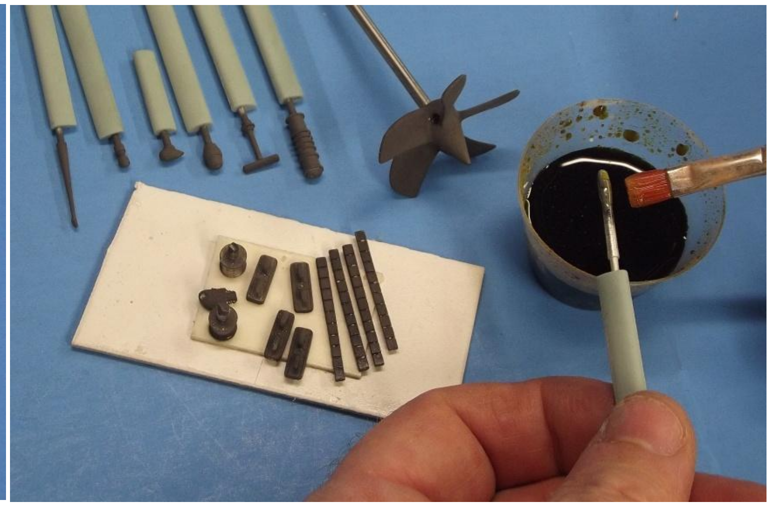


An alternative is to hold these little metal items in either a pin-vise, as illustrated here, or within the soft-jaws of a jewelers hand-vice. It's handy if you secure the propeller to its 1/8" propeller shaft – using the shaft as a handle as you cut, file and sand back the flash from the leading and trailing edges of the propeller blades.



The GRP hull halves are given a thorough sanding with #400 grit sandpaper backed by soft and hard blocks. This to give the surface of these otherwise slick parts the 'tooth' needed to enhance the primers bond to the GRP's surfaces.

DEGREASING THE RESIN PIECES Filing and sanding flash away is only the beginning of the primer preparation work. The resin pieces arrive to you coated with silicon mold-release oil on their surfaces. This has to be removed. All surfaces, inside and out, are soaked in lacquer thinner and while immersed are scrubbed with an abrasive pad or '000' steel-wool. Care has to be taken not to knock down raised details such as the strakes atop and the cut-water at the leading edge of the sail. The resin parts are then wiped off and blown down with air to remove any remaining solvent. All resin parts that will be exposed to view are then wet and/or dry-sanded with #400 sandpaper -- the abraded surface of the resin pieces now have the tooth to better hold onto the primer.

OXIDIZING THE METAL PARTS TO MAKE THEM READY FOR PRIMER white-metal will shrug off all but the most tenacious two-part, self-etching primers. This alloy requires special attention. Specifically, reduction of the Tin-Antimony alloy surface to oxides of the base metals -- to produce a substrate which is more receptive to primer bonding than the pristine alloy.

The white-metal surfaces are chemically etched by exposure to a weak acid (Ferric Chloride or the like) till the surface of the part assumes a dark gray color. Scrubbing the metal parts with a stiff acid filled brush insures all metal surfaces are oxidized. Once of a uniform dark color, the metal part is placed into a solution of water laced with some baking soda -- the high pH of the baking soda working to neutralize the acid. Then, a fresh water rinse followed by a blow-down to dry the part, the pickled metal part now ready for primer.

Note that some of the resin masts are used as handles for some of the small metal part pickling. Other parts were stuck to double-sided tape as one side was pickled, flipped, and the back-side pickled.

APPLYING PRIMER

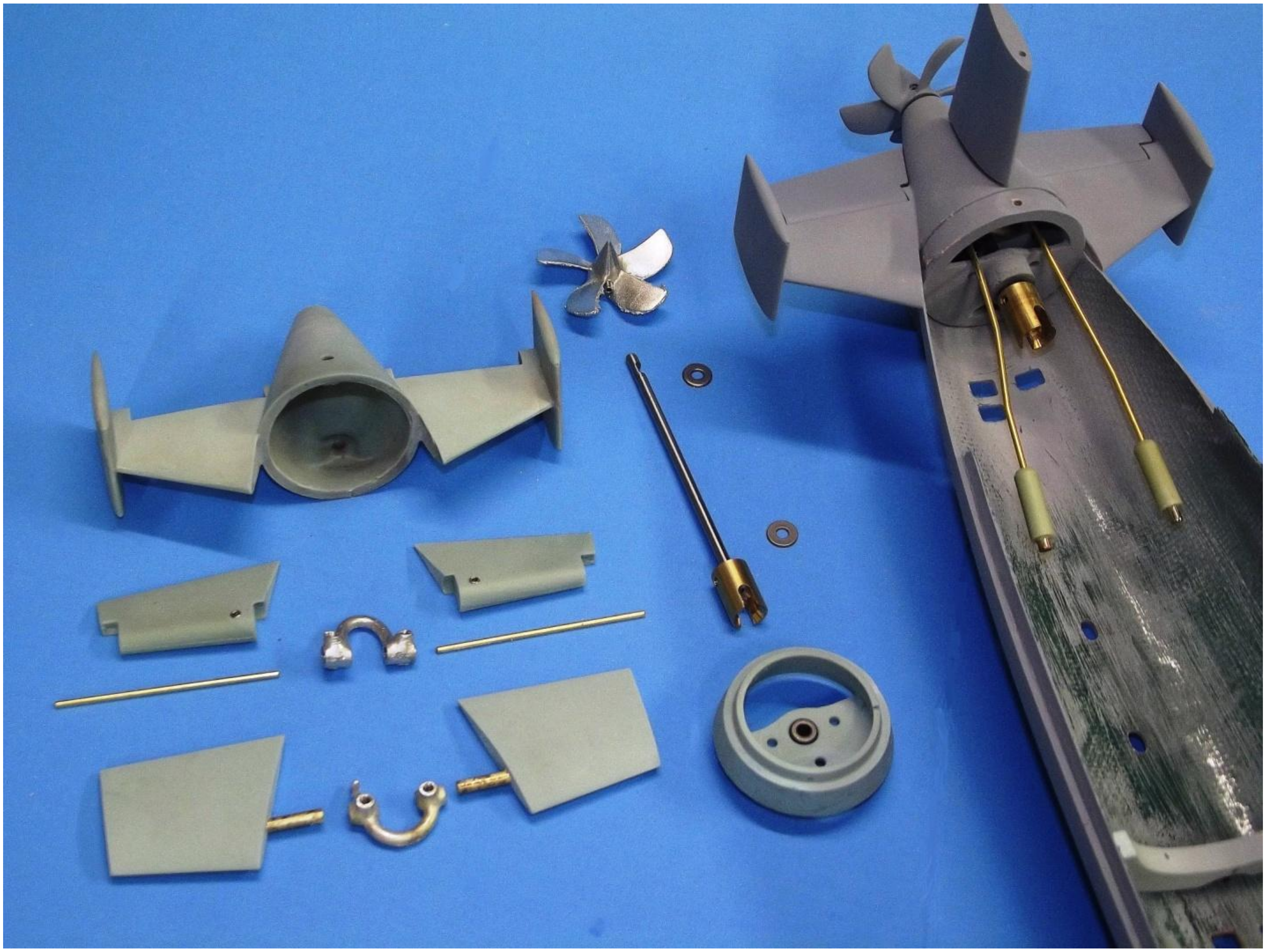
You can more easily see surface flaws on model parts if everything is of a uniform gray color. And that's why most primers are some lighter shade of gray. Primer is formulated to have a significantly high particulate percentage -- this is what gives the dry primer its fill and contouring ability; it's utility as a scratch and flaw filler. Primer is the interface film between model part substrate and the paints, weathering agents, and clear coats that eventually decorate the models surface. Primer turns a mass of many different substrates -- with their attendant effects on top coats -- into a unified surface of consistent 'color' and chemistry. Look on primer as the neutral, friendly barrier between model parts and the eventual paints and clear-coats.

We use professional grade, automotive refinishing primer, paint, and clear-coats. This insures the absolute best adhesion; color density; and toughness against mechanical abrasion, UV, and chemical attack. Your mileage will vary, depending on the brand, chemistry, and quality of the paint system you use.

The better the performance of the primer, the better the paint job. Insure that the primer you select is compatible with the paint and clear-coat chemistry that will go over it. Test primer, paint, and clear coat compatibility on cardboard or an old, unused model hull before committing the system to your model.

Most of you will use a rattle-can primer. It's vital that your primer adheres well to the model parts. Test by laying down some primer on an area of a GRP and resin part. Let it dry. Then place some masking tape (the yellow, high-tack stuff) over the primed area, pushing the tape in to achieve maximum adhesion.

Did any primer pull away from the work when the tape was removed? If primer came away with the tape you either did a poor job de-greasing and/or abrading the surface of the parts. Or, you're primer is crap. Make appropriate adjustment(s). Remember, some of the color work will require masking, and you don't want to find at that advanced point in the job that the bond between model surface and primer is not adequate!

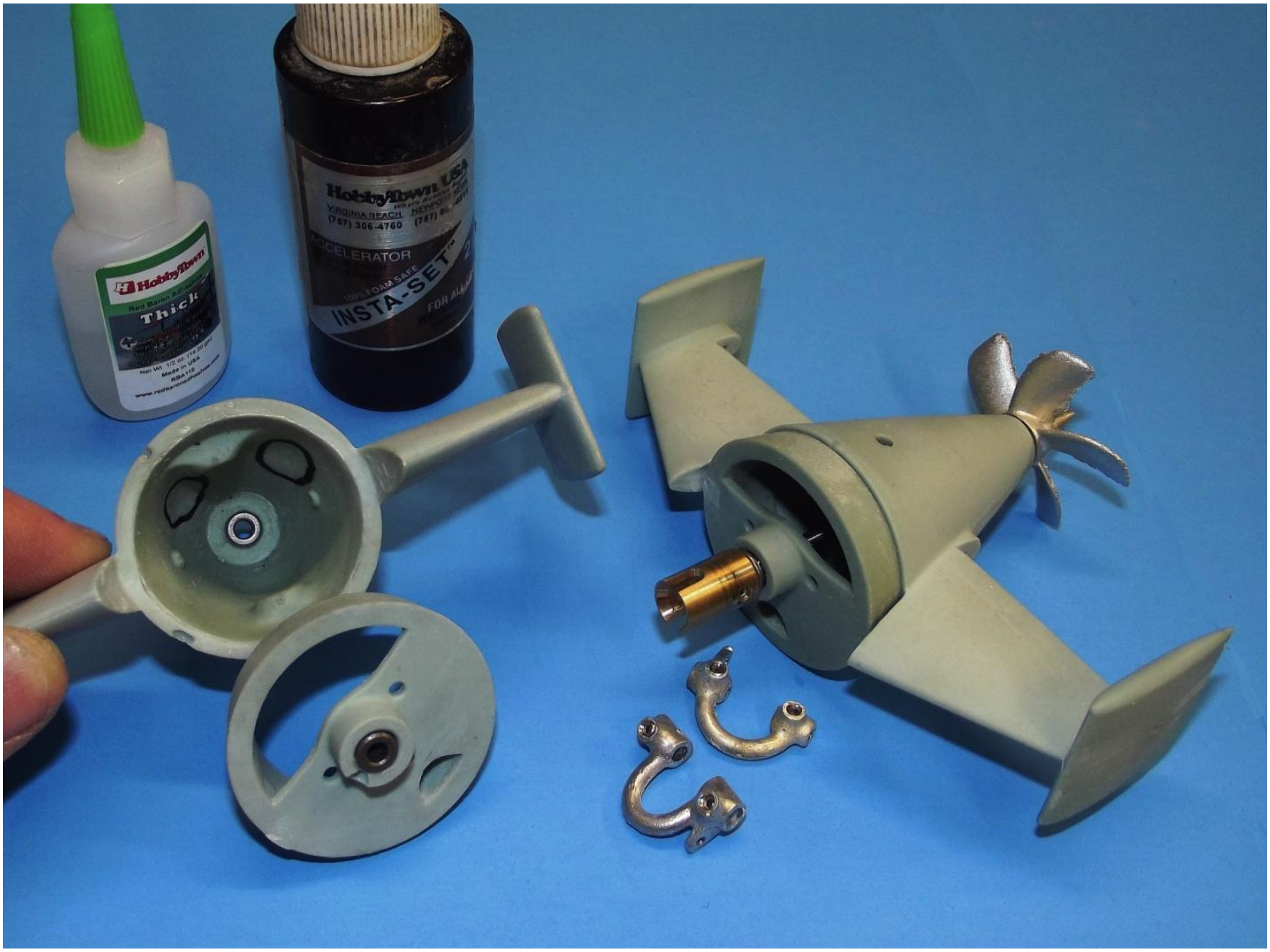


PREPARING THE TAIL-CONE, CONTROL SURFACES AND PROPELLER-SHAFT

The big deal with this kit are the tail-feathers -- getting those control surfaces to work without binding or interferring with the centrally running propeller shaft. And that has always been a big issue with r/c submarines representing single-screw, spindle hull type designs with a centrally running propeller shaft: the tight confines of the tappering cone, coupled with the need to interconnect opposing control surfaces whoes center of rotations pass right through the propeller shaft, that has always been a tough mechanism to fabricate and get to work correctly.

The solution is to provide the two sets of control surfaces (stern planes and rudders) with a 'jumper' link, or more properly, a 'yoke' to make the control surfaces work in unison but to do so without hitting the propeller shaft. Most kit manufacturers put the burden of yoke design and manufacture on the customer. We, however provide you the yokes, control surface operating shafts, pushrods, forward bearing foundation, propeller shaft, bearings, and thrust washers. All ready for use.

However, before you bond the tail-cone to the after end of the lower hull, you must first perform a dry-fit of the control surfaces and linkages, along with the drive-shaft (running gear) -- this to insure non-binding, correct operation of the control surfaces and rotation of the propeller-shaft without interferrence or binding.



THE TAIL-CONE, WHICH WAY IS 'UP' Look within the tail-cone. You can make out concave portions on the inner surface, left and right of the hole through which the rudder operating shaft passes . This denotes the 'top' of the tail cone. Those depresions within allow clearance of the yoke bell-cranks.

Note in the above photo that we've marked those concave sections within the tail-cone with a heavy black marker. It's recommend you do the same on your kits tail-cone.

Atop the tail-cone, where you can see it, write 'top' so you won't accidently invert the tail-cone during the next steps.

STERN PLANES Test fit the stern planes into the tail-cone by holding a stern plane in position against the trailing edge of its horizontal stabilizer (the set-screw of each plane is on the bottom); pushing a 1/16" diameter brass rod stern plane operating shaft through the hole at the outboard face of the vertical stabilizer; through the stern plane; into the stern plane operating shaft yoke (which has been held in place to accept the operating shaft as its pushed through). Tighten the stern plane set-screw, making the operating shaft one with the stern plane; tighten the set screw of the yoke under which the operating shaft ran. Reapeat this operation for the other stern plane. The two stern planes now interconnected through their yoke, working as one.

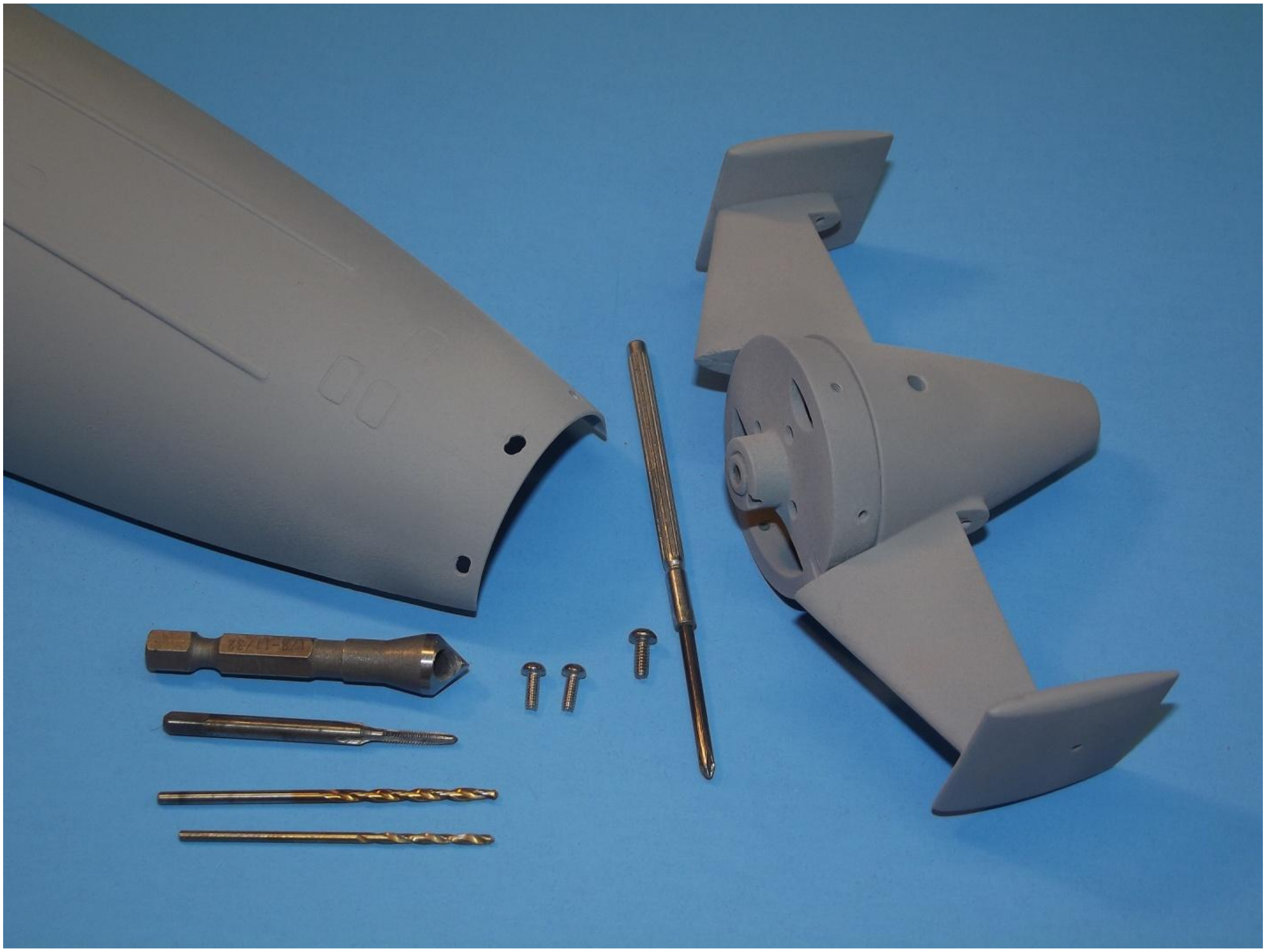
RUDDERS The upper rudder is the one with a hole atop it that later accepts the stern-anchor light. Holding the rudder yoke within the tail-cone, run a rudders operating shaft through its hole in the tail cone and on into the yoke. Tighten the yoke set-screw over the operating shaft to make it fast. Do the same for the opposing rudder.

RUNNING GEAR Running gear is the term that describes all elements pertaining to the rotation of the propeller. This includes the propeller itself, the propeller shaft, the intermediate drive shaft (that interfaces between SD and propeller shaft), Oilite bearings, thrust washers and Dumas style universal coupler elements.

Run two stainless steel thrust washers up against the forward face of the brass coupler attached to the after end of the propeller shaft. Holding the forward bearing foundation against the forward face of the tail-cone, push the after end of the propeller shaft through its bearing, into the tail cone, and out through the tail-cone bearing. Place a single thrust washer onto the after end of the propeller shaft, then slip on the propeller and tighten its set screw onto the machined flat of the propeller shaft -- this sandwiches the forward bearing foundation up tight against the forward face of the tail-cone. What you have now is a proper ***tail-cone assembly***. Check for unbinding and unabstructed movement of the stern planes, rudders, and rotation of the running gear. You are now assured that at a later stage you will be able to make up all stern linkages and running gear without difficulty after the tail-cone assembly has been permanently attached to the lower hull.

At this stage you remove the propeller shaft, forward bearing foundation, and control surfaces and their respective yokes.

Note that the semi-circular opening at the face of the forward bearing foundation is at the top of the tail-cone. Glue this part permanently to the tail-cone. The semi-circular opening atop and the smaller holes in the face of the forward bearing foundation permit installation of the yokes and access to their set-screws.



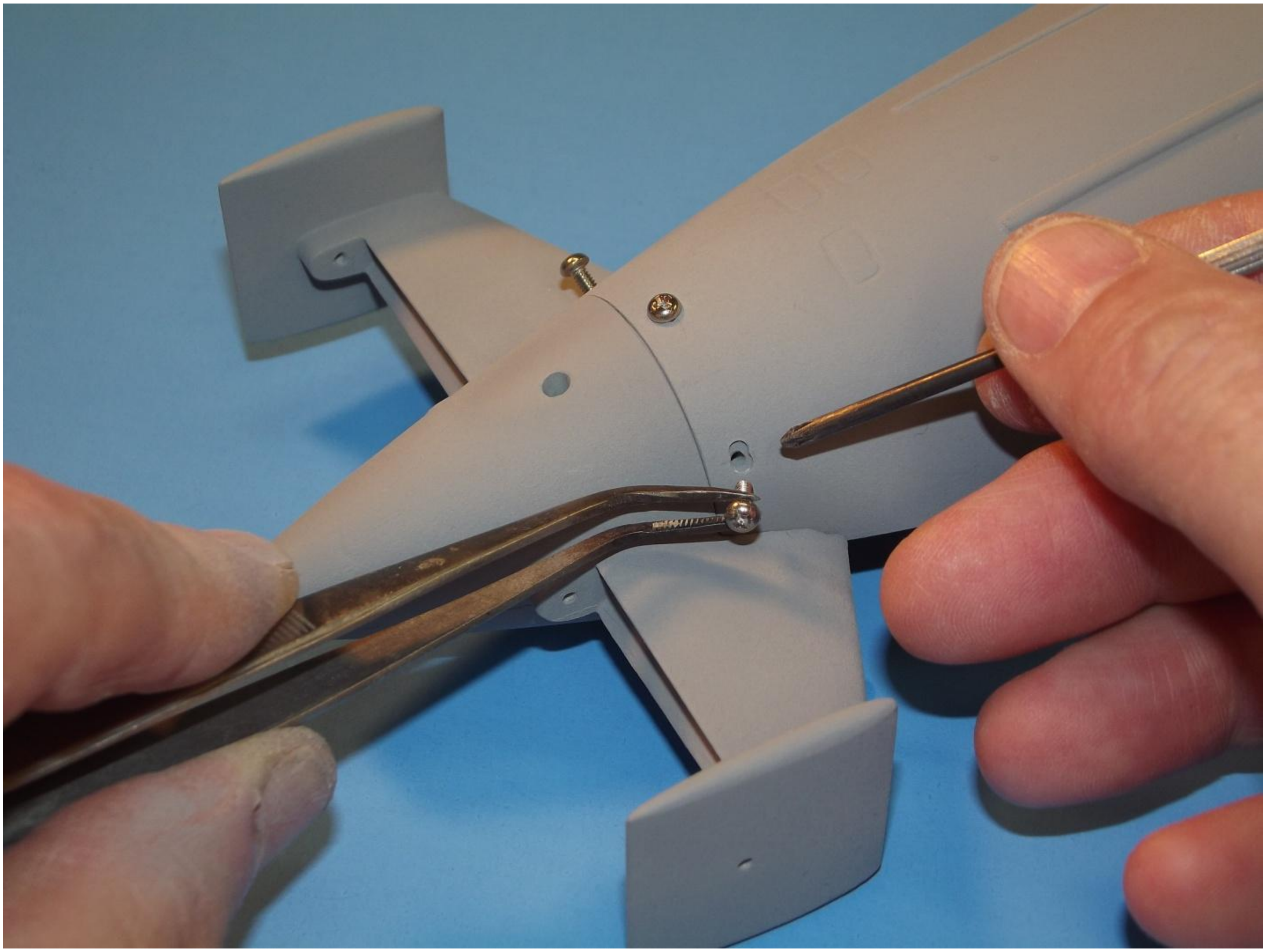
ATTACHING THE TAIL-CONE ASSEMBLY TO THE LOWER HULL

Now, to attach the tail-cone assembly to the after end of the lower hull: This is a big deal! If you glue the tail-cone to the hull with its propeller shaft bore (defined by the two Oilite bearings) out of align with the hulls longitudinal centerline, the skewed thrust line will make the model all but impossible to control at any significant throttle level.

Don't count on the radial flange of the assembled tail-cone meeting the radial edge of the lower hull as assurance that the propeller shaft bore is in alignment with the hulls longitudinal center line.

Three 2-56, 1/4" long, round-head machine screws temporarily secure the tail-cone assembly to the lower hull, giving you the ability to slightly slide and rotate the two assemblies as you ascertain the orientation between tail-cone assembly and hull.

1/4" from the after edge of the lower hull drill three equally spaced 3/32" holes. Examine the above photo.



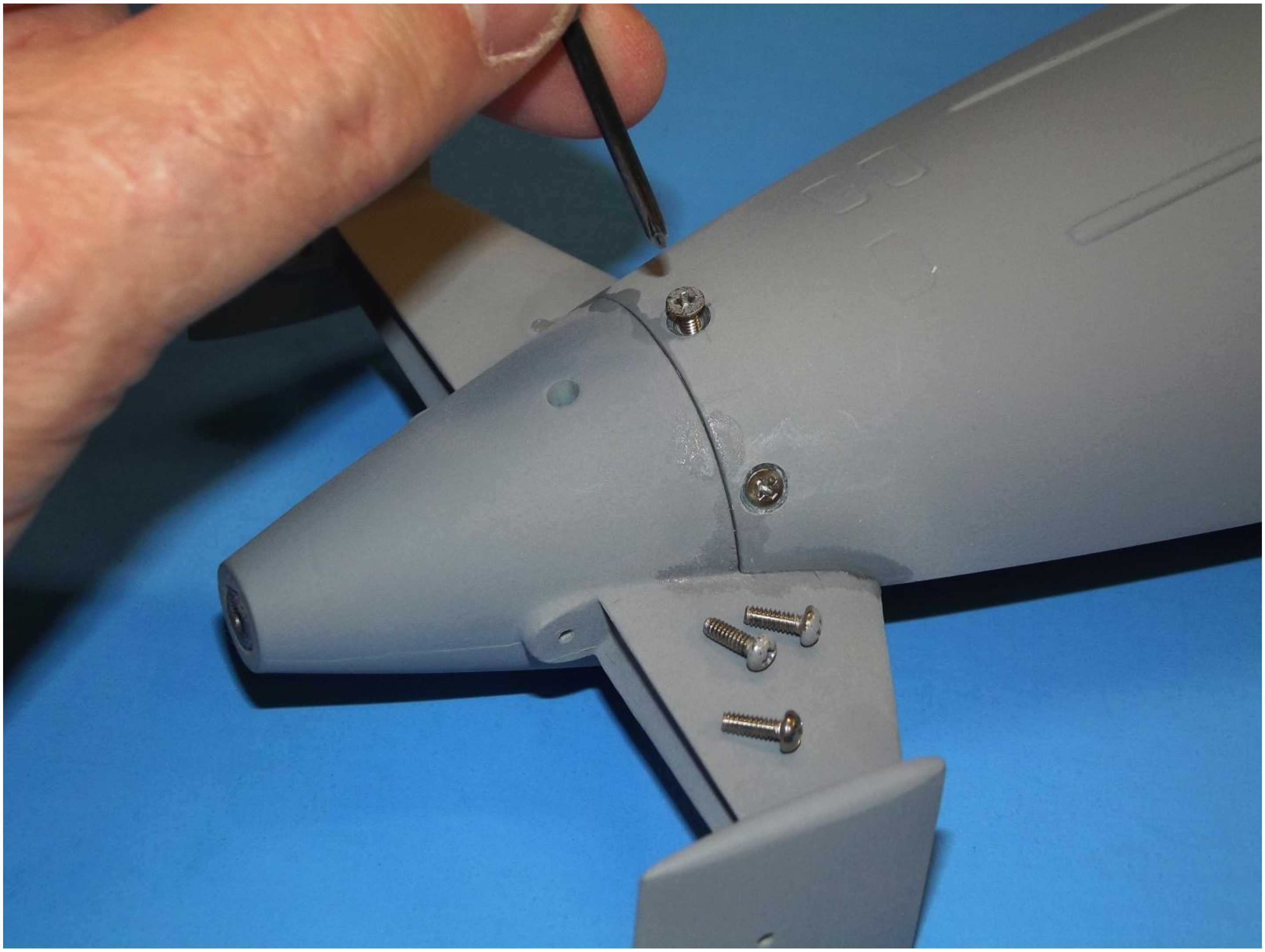
You also have three round-head 2-56, 1/4" long machine screws. First, you'll make use of the round head screws to initially secure the tail-cone in place -- the round-head screws feature a flat bottom to their heads -- permitting easy sliding around of the tail-cone assembly in relation to the hull as you establish tail-cone-hull orientation. Easily done as you loosen and tighten the three retaining screws as you bore-sight the tail-cone assembly to the hulls longitudinal centerline. The process goes like this:

Eye-ball align the tail-cone assembly and tighten the three round-head machine screws holding it to the stern of the lower hull piece. Place a straight-edge atop the hulls longitudinal edges (the longitudinal flanges).

Sight from the stern. Are the horizontal stabilizers parallel to the straight-edge? If not, loosen the three screws a bit and rotate the stern-cone assembly as required and re-tighten the screws. Now, to check the pitch-yaw orientation of the tail-cone to the hulls longitudinal center-line.

Insert a length of 1/8" diameter aluminum tube into the two Oilite bearings of the tail-cone assembly, the majority of this tube projecting into the hull. We suggest aluminum as its light-weight will not work to torque the thrust line (the bore-site formed by the two Oilite bearings) down inadvertently as you make the adjustment between tail-cone assembly and hull. The initial measurement is taken with the three securing screws tight. Is the shaft in line with the hulls longitudinal centerline? If not, loosen the screws a bit and skew the tail-cone around till it is. Tighten the screws and check again to make sure nothing changed.

Only after things are lined up do you use thin formula CA to bond the tail-cone assembly permanently to the lower hull.

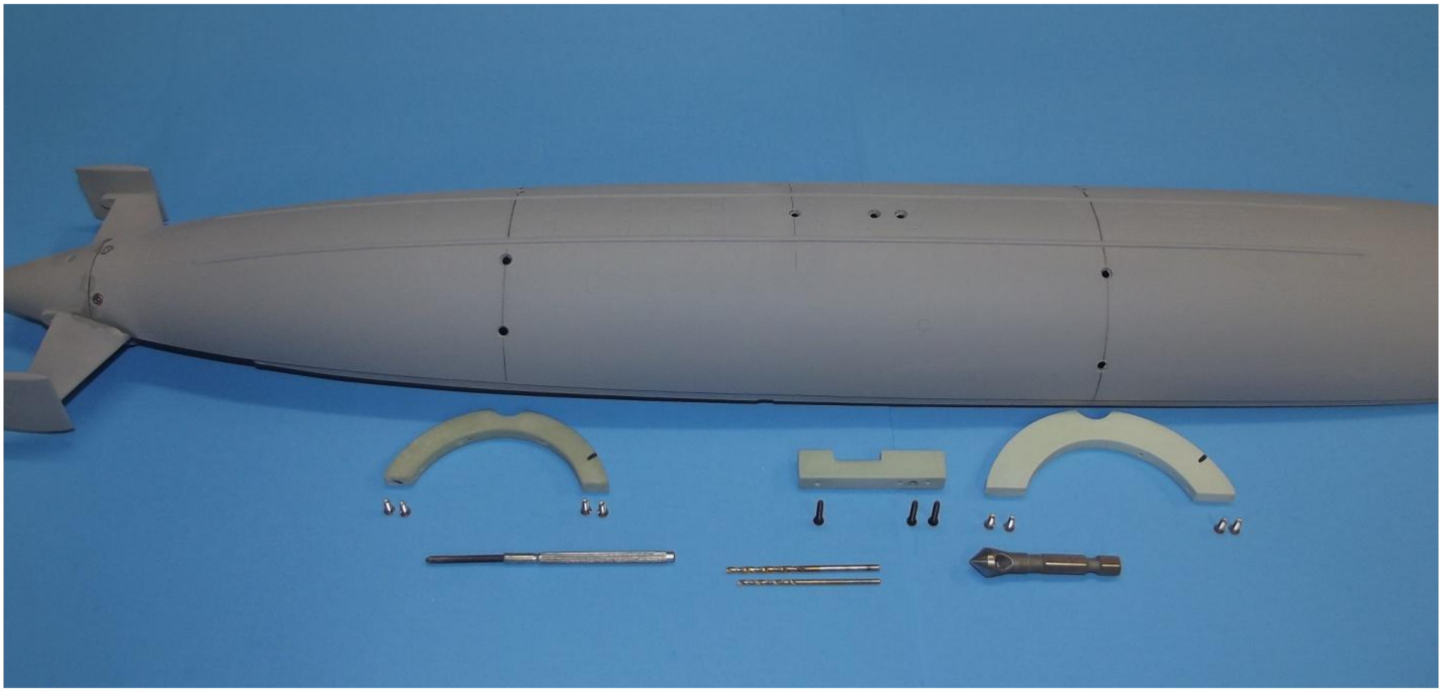


Remove the round-head screws, counter-sink the holes in the hull to accept the permanent flat-head screws, and make the swap. A touch of CA over the flat heads of these screws completes the tail-cone-to-lower-hull assembly.

Additional thin formula CA is placed into the radial gap between hull and tail-cone, and liquid accelerator applied to create a strong, hard filler that is later filed and sanded to contour. Where the roots of the horizontal stabilizers make contact with the lower hull CA is also applied and hit with accelerator.

SD SADDLES AND INDEXING PIN-VELCRO STRAP FOUNDATION

This kit is designed to accept a 2.5" diameter SubDriver (SD). A WTC, if you will -- the system that provides control, propulsion and variable ballasting; a removable, easily maintained enclosure within which all the items that need to kept dry are housed. Two resin saddle pieces support the SD within the lower hull. A resin Velcro strap-indexing pin piece serves to hold the SD down in place and assure its rigidity within the hull through a 1/8" diameter brass indexing pin that extends upward and into a mating hole in the bottom of the SD's ballast tank.



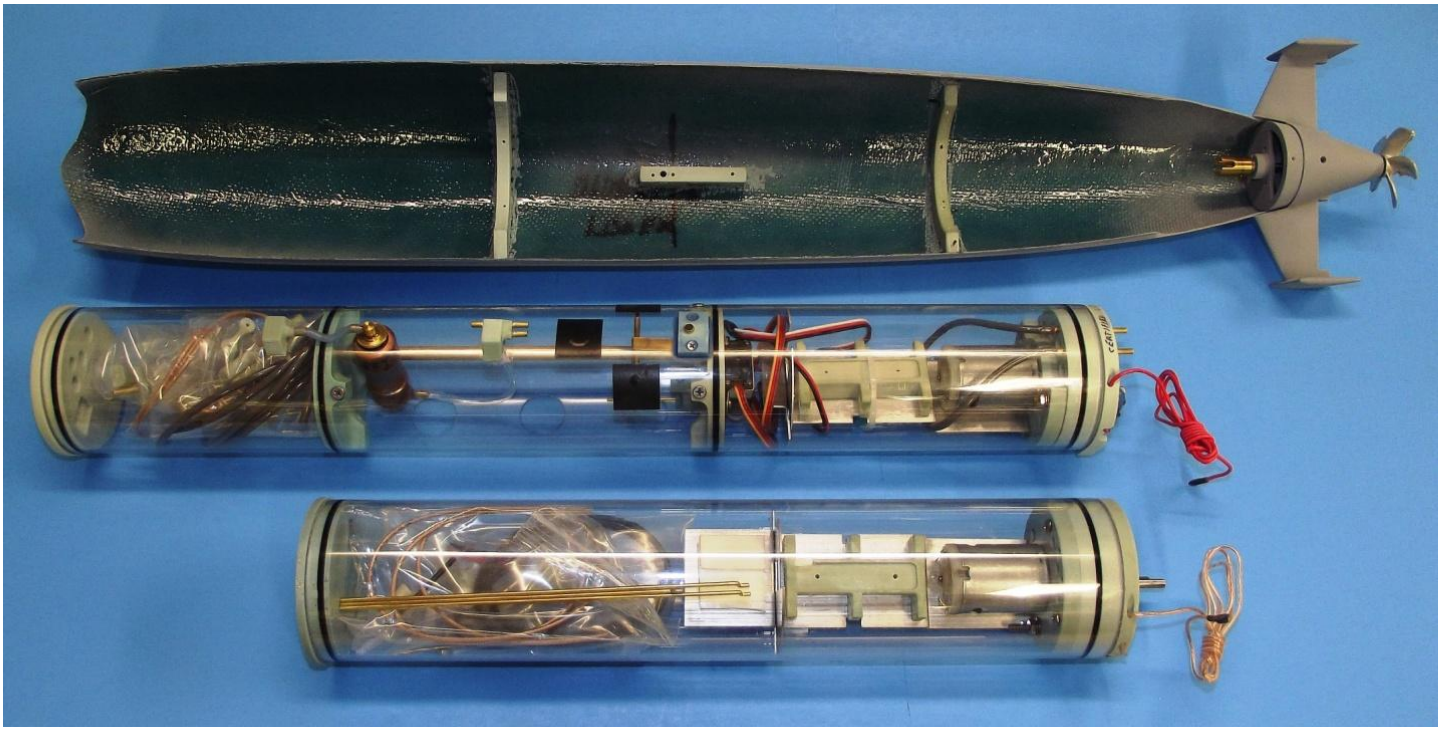
POSITIONING THE SADDLES AND STRAP-PIN FOUNDATION WITHIN THE LOWER HULL Three cast resin pieces are screwed and glued into the lower hull -- two semi-circular SubDriver (SD) saddles, and a combined Velcro strap-indexing pin foundation. You'll use four 2-56 by 1/4" long flat-head screws to secure each saddle to the lower hull -- the two saddles are sized for a specific position within the hull. Three 2-56 by 1/2" long flat-head screws secure the strap-pin foundation in place.

Using the stern radial seam between tail-cone assembly and lower hull as the datum line, measure and mark points along the bottom of the hull at, 6 1/8", 11 3/8", and 14 5/8". Lay down radial lines at the forward and after points. These are ware you will drill four equally spaced 3/32" holes, and counter-sink them from the outside of the hull. Through these holes will pass the screws that eventually hold the saddles in place within the lower hull. Study the above photo.

Onto the outer face of each saddle, held by hand within the hull, mark with a pencil through each hull hole; remove the saddle, drill and tape 2-56 holes. Reinstall the saddle within the hull and make up the screws.

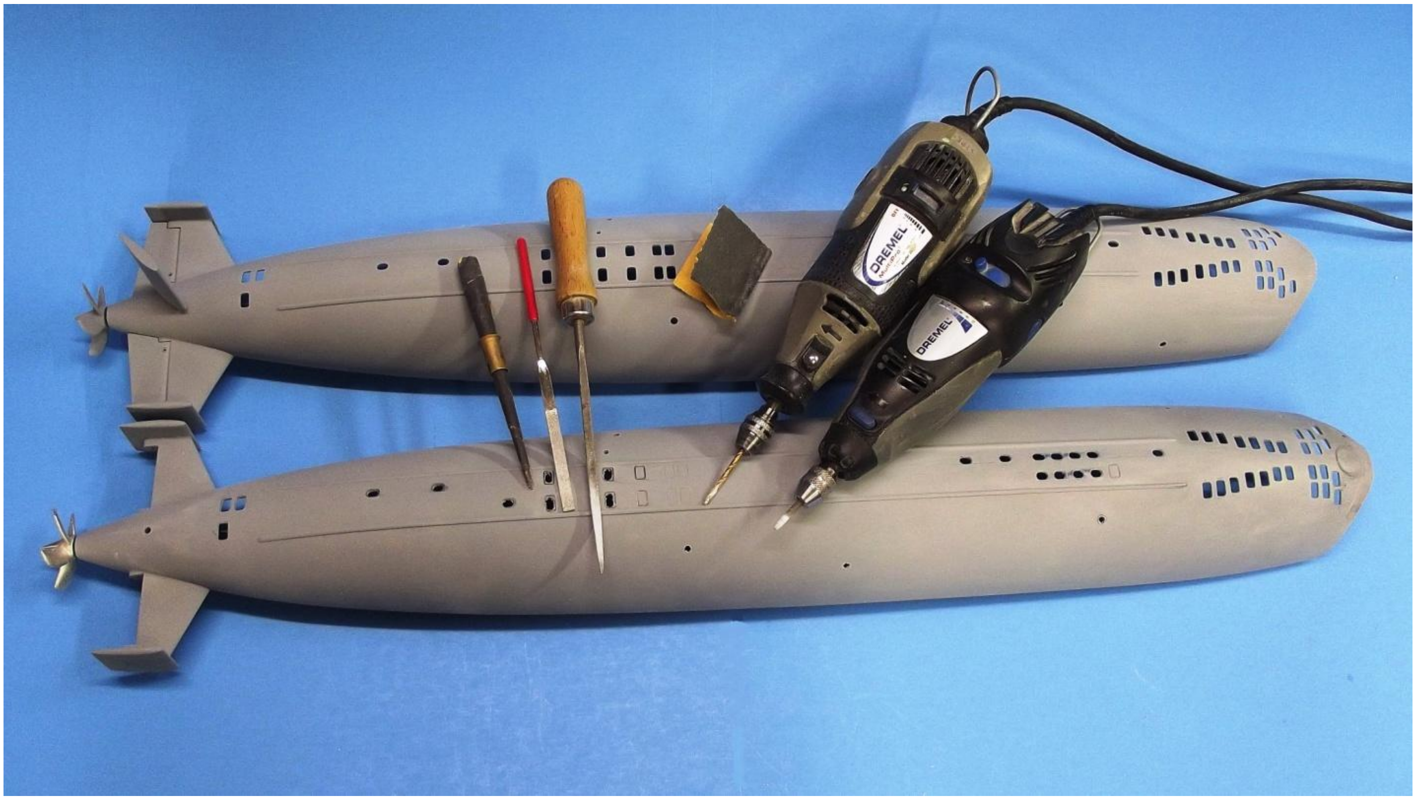
The strap-pin foundation after most screw hole falls along the 11 3/8" point. Use the strap-pin foundation piece itself as a template to mark off where the other two screw holes will be drilled. Drill the three holes, counter-sink them and mount the strap-pin foundation in place, much as you did with the saddles.

Mark off the outlines of the saddles and strap-pin foundation within the hull with a pen. Remove the saddles and strap-pin foundation and sand the inboard side of the hull within the outlines of the removed pieces with #100 grit sandpaper -- this to produce the tooth between the parts and hull to insure a very tight bond. Re-install the three parts, and synch down tight on their screws. Within the hull lay down thick formula CA where the saddles and strap-pin foundation pieces make contact with the hull.



POSITIONING THE SD WITHIN THE LOWER HULL If the SAS (ballast tank equipped) type SD is used, drill a 1/8" hole in the bottom of the ballast tank, the center of that hole 1/2" forward of the wet-side face of the after ballast bulkhead. Insert the provided 1/8" brass pin into the hole within the strap-pin foundation piece that accepts it, and then drop the SD down onto the saddles, the pin registering the SD to the lower hull. Run the Velcro strap around the SD and through the square opening at the bottom of the strap-pin foundation and make the strap up tight. The SD is now secured against rolling or longitudinal motion to the hull.

If you are using the short Easy (no ballast tank) type SD, simply center it between the two saddles, and make up the Velcro strap. You will need to devise two back-stop pieces that are glued to the hull. Each back-stop butting up against an end of the SD -- these to retain the SD against any longitudinal motion. Glue strips of #100 sandpaper, grit side up, to the face of the two saddles. The friction between the abrasive non-skid strips and SD cylinder will secure it against rotation once the Velcro strap is synched down tight.

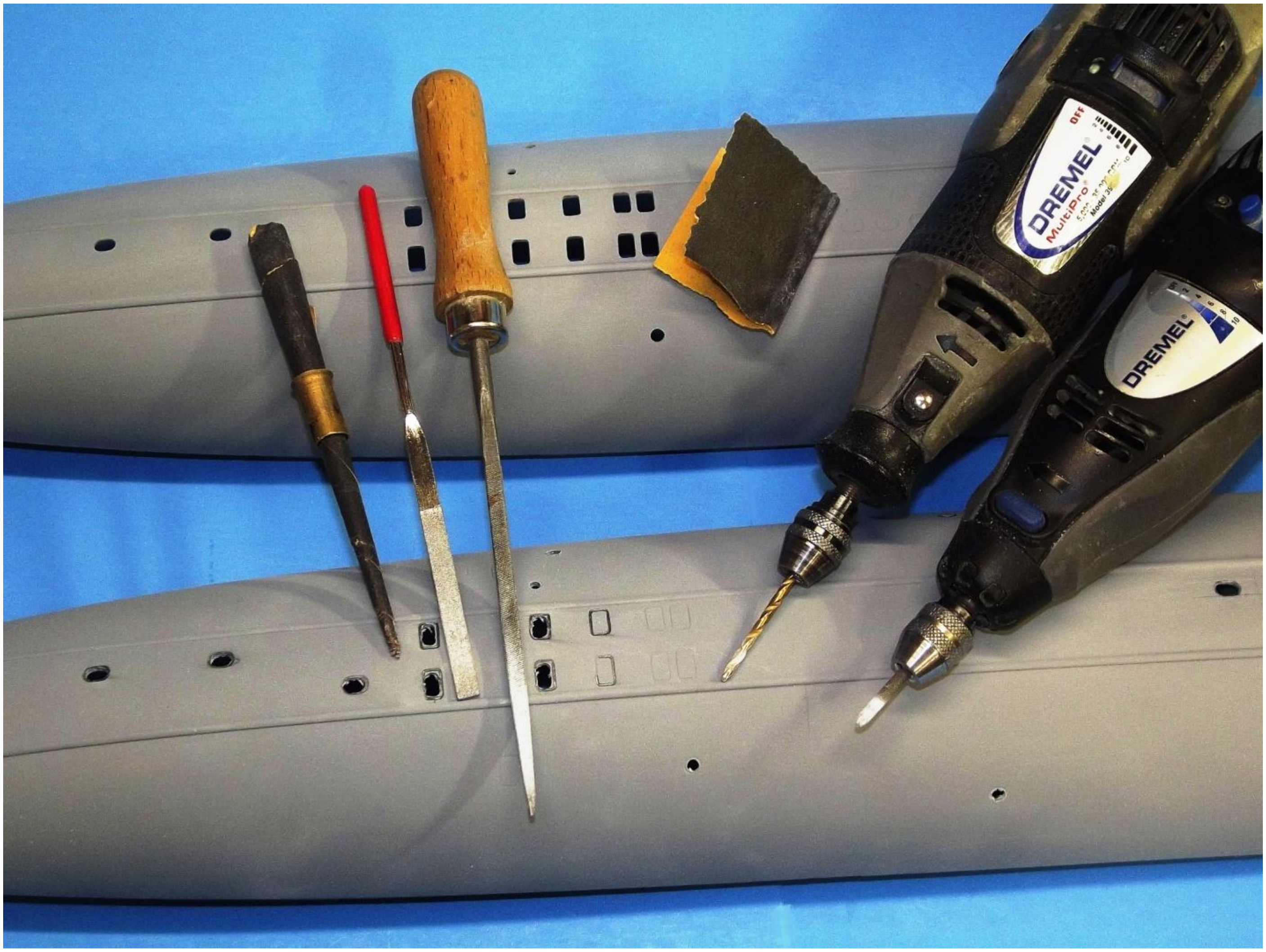


PUNCHING OUT THE HOLES IN THE HULL

You have to open up the square and oval shapped flood-drain holes in the bottom of the hull. Also, there are diesel exhaust, auxillary, main, and a/c sea water suction/discharge holes in the sides of the hull to be punched out. Atop the hull the centers of the two deck hatches are opened up as well as the two main ballast tank vents at the bow -- these and the big openings under the sail permit quick escape of air as the model submarine makes the transition from surfaced to submerged trim. All hole positions are engraved onto the hull.

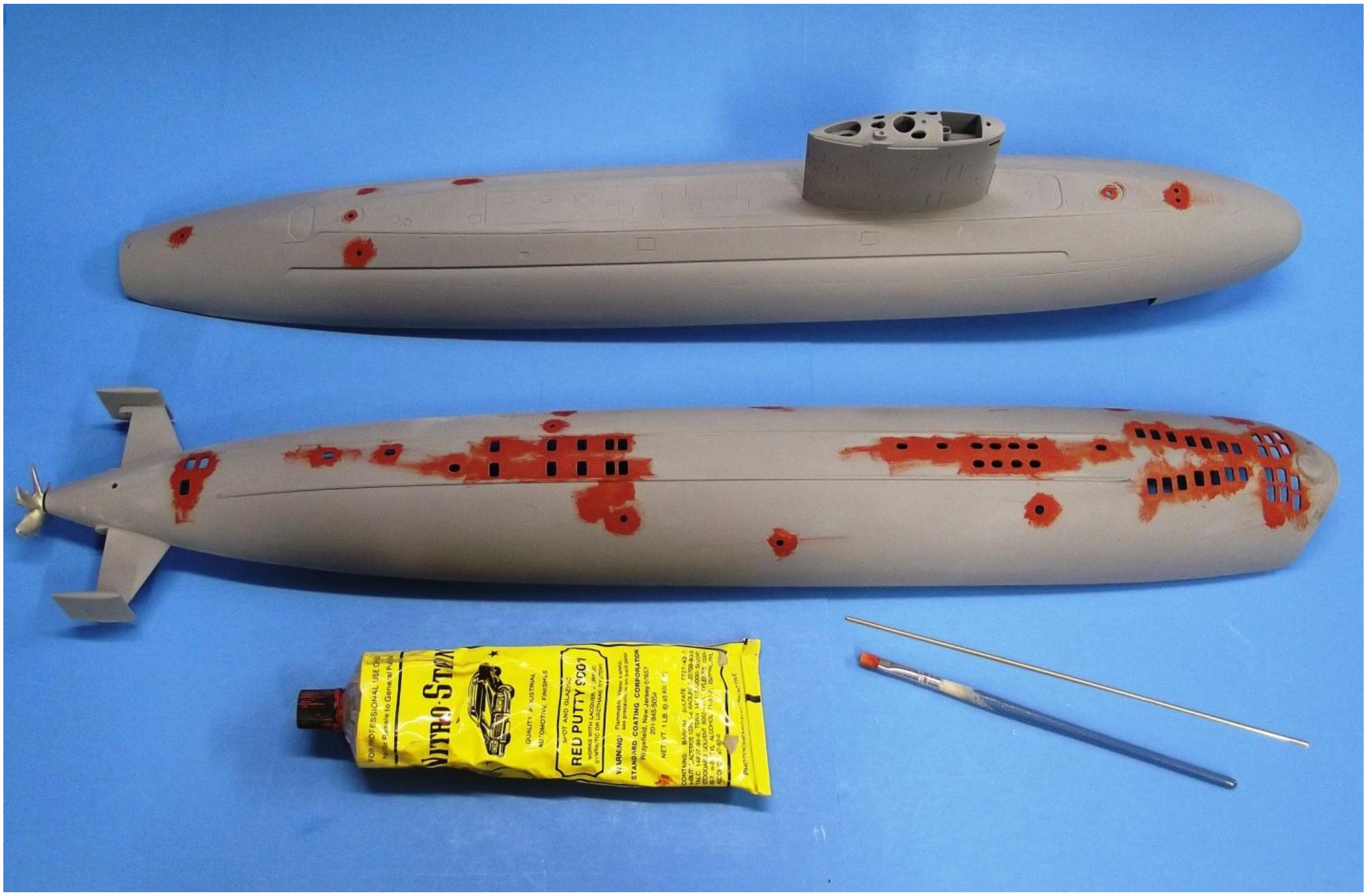
Obviously the round holes are addressed with a standard drill bit -- but make the bit smaller in diameter than the eventual hole you want to open up. Why? Because we're punching through GRP with a gel-coat surface which chips easily. You start with an undersized hole and finish up with a tappered (rat-tail) file affixed to the chuck of a reversable drill motor.

(Once the round-file is chucked up -- and before addressing the hole you started with a drill bit -- set the drill motor to spin in reverse at low speed. Reverse because most round file teeth have a right-hand helical twist along the length of the tool and if you pushed such a self-feeding tool into the work it would jam in tight, stressing the GRP, producing a god-awful mess. So, run the file backwards!)

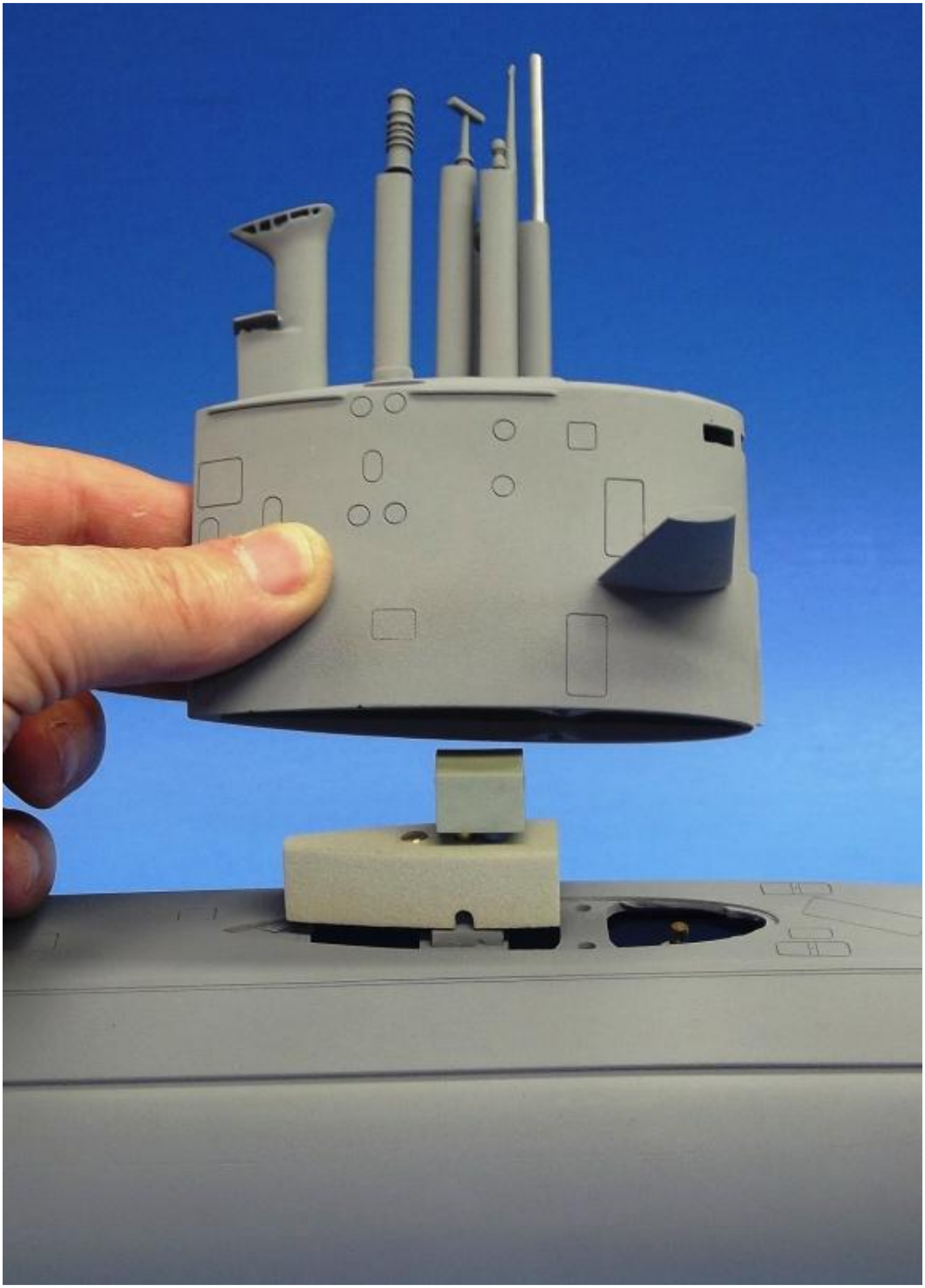


The square and oval holes are done with a small drill bit, maneuvered within a holes outline much as an end-mill, roughing out the shape of the hole. Take care! You finish the holes with appropriately shaped jewelers files and custom cut sanding sticks. GRP is HARD! And it will quickly dull tool-steel, so the best type file here are the ones that employ diamond grit. Note the use of wound sandpaper to do the final work on the oval and round holes.

A very short length of 1/8" diameter round-file is chucked up in the moto-tool and used to work the semi-circle portions of the oval holes.



SOME PUTTY WORK Invariably you will over-strike in some area as you punch out the holes. And some of the gel-coat will chip. These flaws are addressed with an air-dry putty applied with a soft, short brush -- the brush occasionally dipped in fresh lacquer thinner to keep the brush from stiffening. Working small patches at a time brush on the putty, and quickly swirl a 1/16" brass rod within the hole. This both pushes the putty into the edges of the holes filling file-marks, and at the same time produces a 1/32" radius at the corners of the square holes. When dry, the surface of the puttied areas are wet-sanded with #400 sandpaper. Spot primer is applied and the work inspected for pits and unfilled tools marks -- these problem arias addressed with more putty.

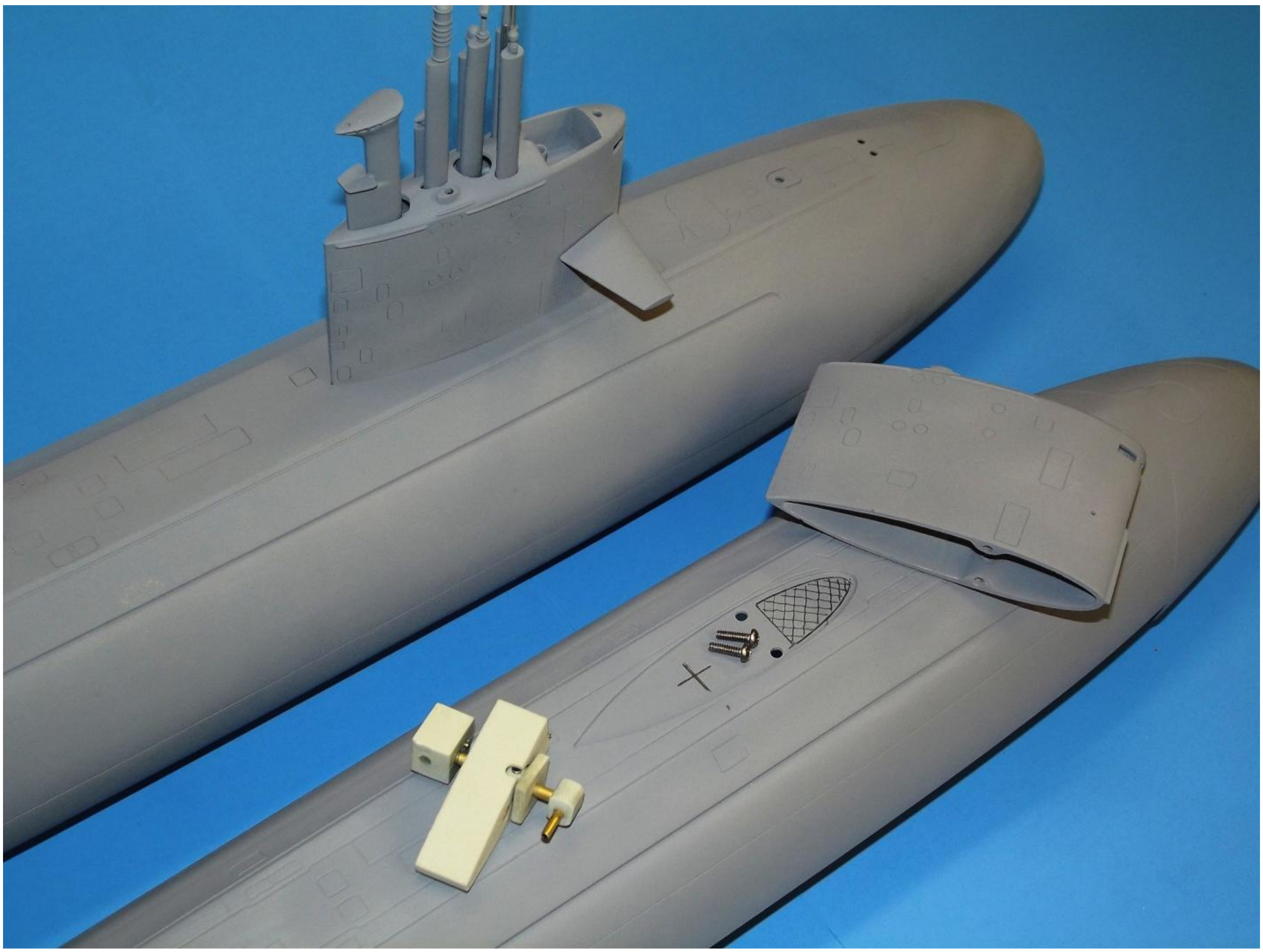


THE SAS SNORKEL ASSEMBLY

If your model is to be equipped with the SAS type SD -- employing a ballast system requiring the use of a sail mounted float actuated snorkel head-valve assembly (an item provided with the SD) -- you will mount the snorkel assembly atop the hull, within the sail.

(Incidentally, this SAS type SD and its snorkel, as well as the Easy variant are compatible with most other 1/96 scale, single-screwed r/c submarine models).

A single 1/8" hole is drilled through the slightly recessed platform (under which the removable sail sits) on the deck of the upper hull, centered 1 1/2" forward from the trailing edge of the sail. Glue the snorkel induction tube foundation over this hole with the foundations set-screw facing to starboard.

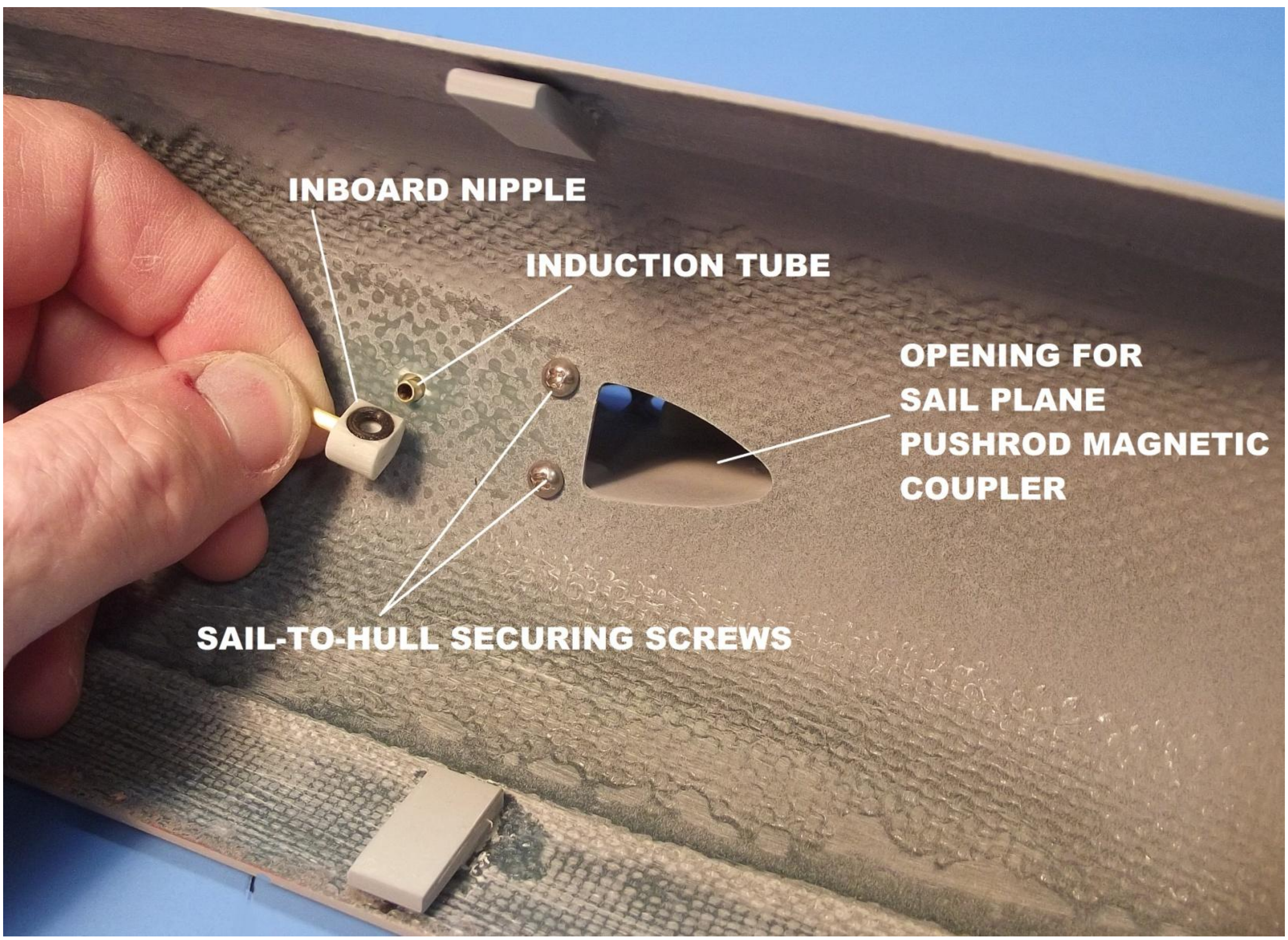


To better vent the hull and to provide an opening through which a portion of the sail plane operating linking will run you need to remove a significant portion of the recessed area under the sail. Provide a 3/32" footing inboard of the perimeter defined by the recessed sail area of hull. Cut an opening back to about 1/4" forward of the two sail securing screw holes.

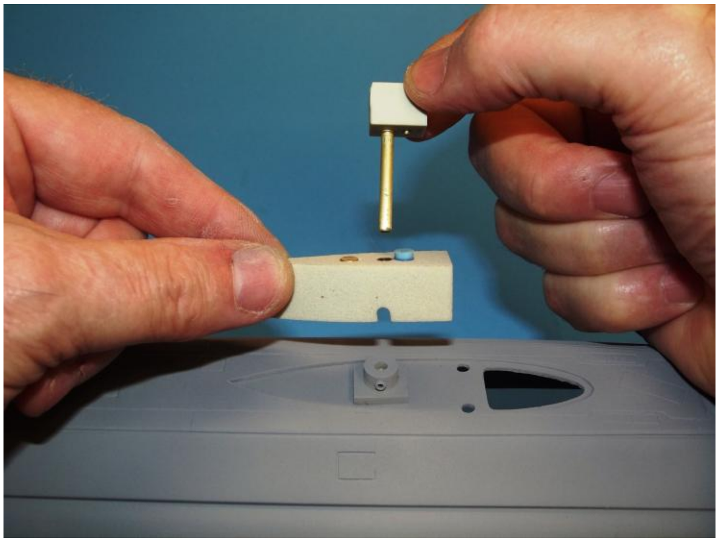
While the drill motor is out, chuck up a 7/64" bit and punch out the two holes in the sail recess that pass the two 4-40, 1/2" round-head screws that secure the sail to the hull. Drill out the two hole at the base of the sail that will accept these screws -- use a 3/32" bit, followed by a 4-40 starting tap to thread those holes.

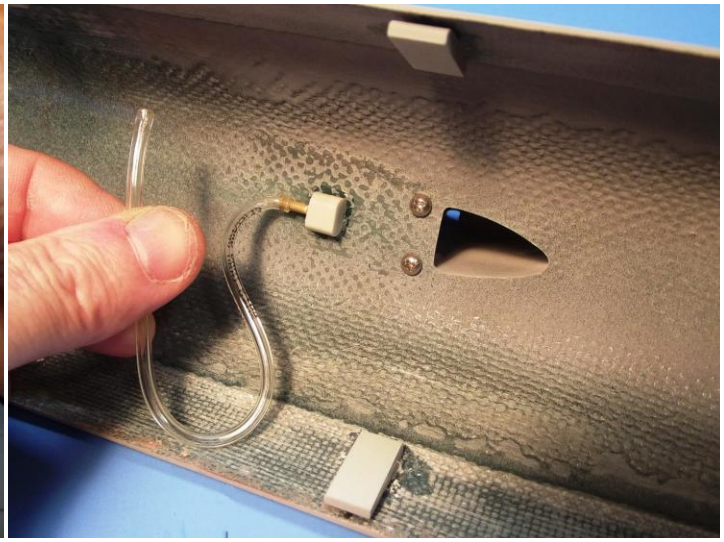
Place the induction tube and snorkel float onto the foundation. With gravity pulling the float down, adjust the height of the induction tube so that a 1/16" gap between the float rubber disc and intake nipple at the bottom of the snorkel head-valve block is achieved. Tighten the foundation set-screw. In this condition the bottom of the induction tube projects into the hull excessively. Mark the induction tube 3/32" proud of the inner surface of the hull. Loosen the foundation set-screw and remove the float and induction tube. Cut off the excess material from the base of the induction tube. Before re-assembly of the snorkel head-valve, bevel and chamfer the bottom of the induction tube and blow down the head-valve block and tube through the head valve induction nipple -- it's vitally important to keep metal chips out of the low pressure blower plumbing.

At this point only 3/32" of induction tube projects into the inboard side of the upper hull when assembled -- enough to place the open end of the induction tube into the center of the inboard nipple piece when it's glued against the hull, its o-ring making a tight gas-tight seal to the induction tube. It's through the nipple that a flexible hose connects the snorkel induction line to the SD's four-point manifold.



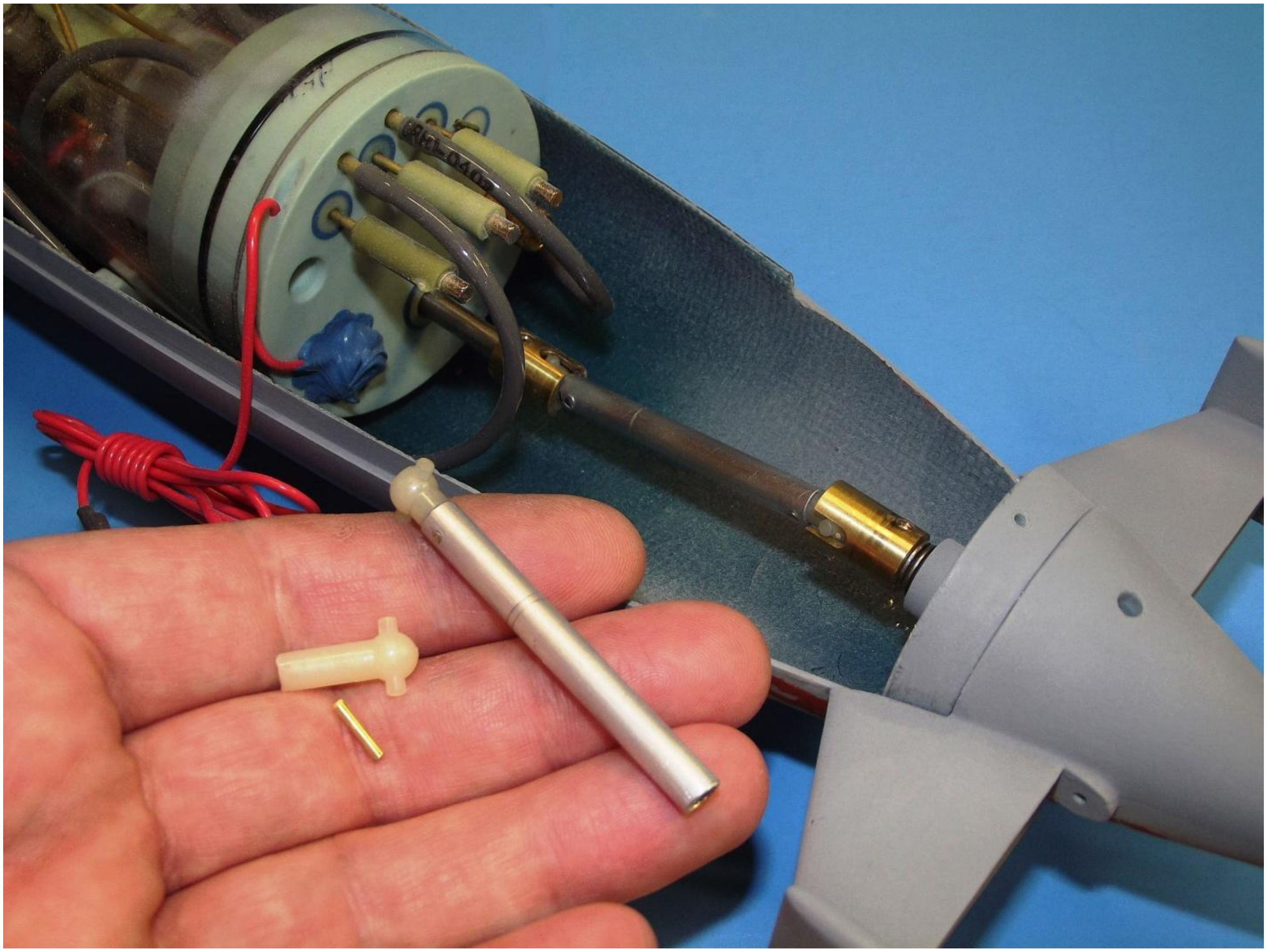
GREASING UP AND GLUING THE NIPPLE BODY TO THE HULL The inboard nipple has an o-ring that makes a watertight seal between it and the induction tube. You're going to glue the face of the inboard nipple to the hull. To prevent any glue from sticking to the o-ring or running onto the surface of the induction tube, coat both the projecting end of tube and within and atop the inboard nipples o-ring with grease -- take care not to get any grease on the resin body of the inboard nipple, as that would inhibit adhesion of the CA used to fix the inboard nipple to the hull.





TESTING THE SNORKEL FOR CORRECT OPERATION The function of the snorkel assembly is to isolate the atmosphere side of the induction line when under water (the other branch of the induction line takes air from the closed dry spaces of the SD). As the float is the mechanism that opens and closes the snorkel air valve you test its operation by installing a flexible hose between your mouth and the inboard nipple. With the upper hull right-side-up and gravity pulling the float down, the valve is open and you should be able to suck air.

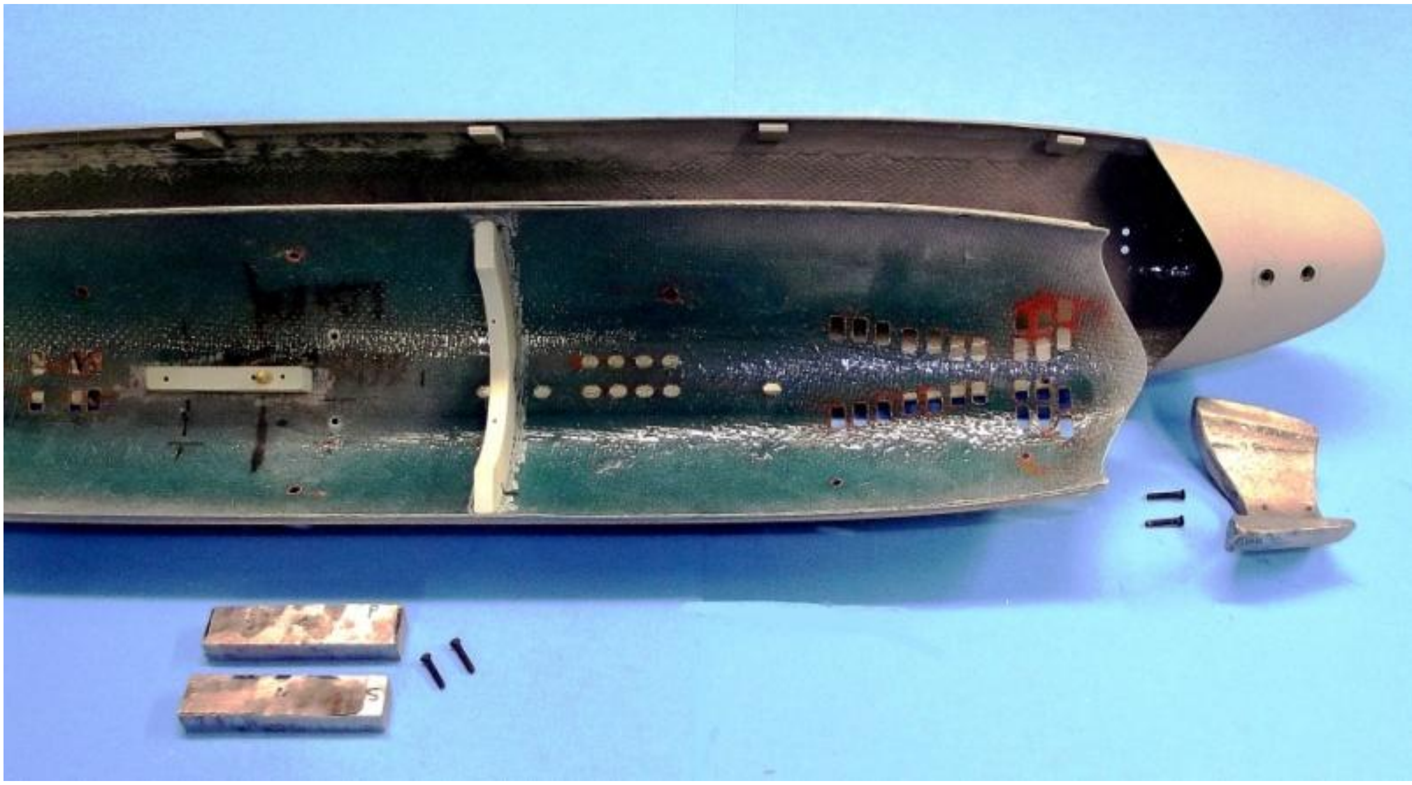
Invert the upper hull, gravity pulls the float 'down', closing the induction valve, and when you suck on the hose no air should flow. If air gets by, dab some grease on the rubber element of the air valve and check for binding between the float and inside surfaces of the sail.



THE INTERMEDIATE DRIVE-SHAFT

Regardless of the type SD you use aboard your 1/96 BLUEBACK model, you need to custom size the length of an intermediate shaft. That shaft fitting between the SD motor output shaft and models propeller shaft. You'll be using Dumas type universal components on this portion of the running gear. A 3/16" bore Dumas coupler at the SD side, and the 1/8" bore Dumas coupler already attached to the provided propeller shaft.

Install the propeller drive shaft into the tail-cone assembly. Mount the SD into the lower hull. You'll need a length of 7/32” diameter, aluminum tube. Take a nylon Dumas 'dog-bone', cut it in half, and insert a half into the aluminum tube to a point where 1/8" of dog-bone shank projects past the end of the tube. That leaves about 3/8" of shank within the aluminum tube. 1/4" from the end of the tube drill a transverse 1/16" hole, that hole passing through both tube and shank of the dog-bone. Drive a 1/16" brass rod through the hole, and snip all but 1/32" of this pin flush to the surface of the aluminum tube. On an anvil carefully peen back the projecting ends of the pin to secure it tightly in place -- this solidly secures the nylon dog-bone half against any motion within the aluminum tube.



INSTALLING THE FIXED BALLAST WEIGHT

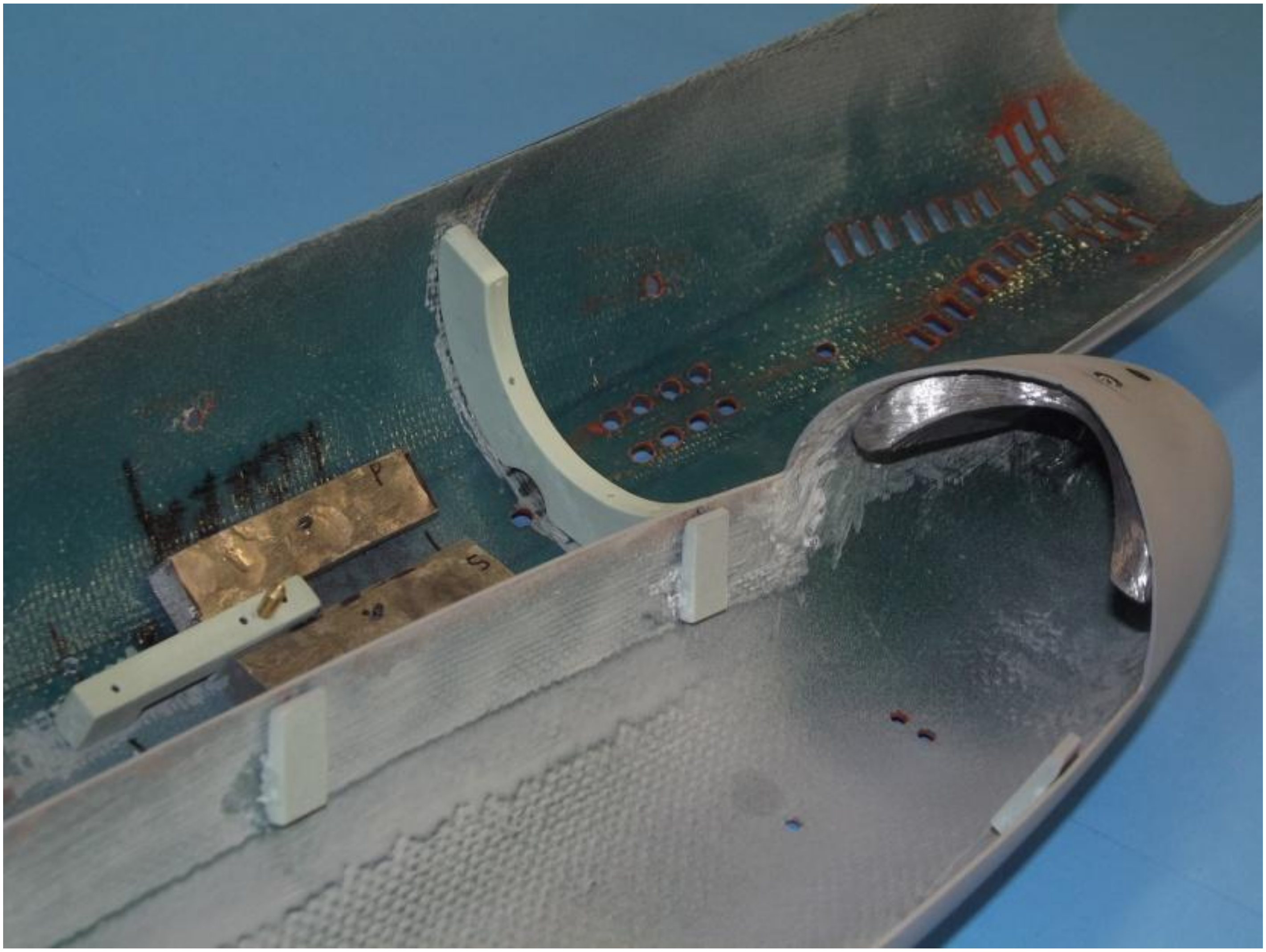
With either the dynamic or static type WTC installed we've found the ideal longitudinal center of gravity to be half way along the models length. This produces the moments at the stern and sail that produce the required yaw, pitch and vertical rates -- contributing to what makes this a very, very maneuverable r/c submarine on and below the surface.

Longitudinal placement of the 10 ounces of ballast weight -- along with installation of a fully outfitted SD, and all other items that go in and on the ready-for-water model -- is driven by the need to balance the model at the mid-hull point. This puts five ounces of fixed ballast weight in the extreme bow, and five ounces of fixed ballast weight just forward of the Velcro securing strap.

As the submarine has no active control surfaces to control roll (bank, if you will), the submarine relies exclusively on its inherent ability to right itself when upset. The submarine must be statically stable about the roll axis.

And that's the other function served by all that weight down low in the hull: it positions the vertical component of the vehicles center of gravity (c.g.) relatively low. The magnitude of an objects static stability when buoyed in a fluid is a function of the vertical distance between its c.g. and center of buoyancy (c.b.); the greater the vertical distance between the c.g. and c.b. the greater the righting force about the objects roll axis. We've found ten-ounces of fixed ballast weight to be the minimum amount required aboard the BLUEBACK model to make it adequately stability about the roll axis.

You may be uncomfortable using lead, as illustrated here. Or you don't have the facilitties to form lead into the required shapes. An alternative is to mix lead shot (little balls of lead), available from stores selling to ammunition reloaders, with a slow-cure epoxy resin. This slurry of epoxy-lead shot poured into clay damns set into the hull. After the potting compound cures hard the clay dams are removed. The epoxy works to bond these weights permanently in place to the hull. With this method no mechanical fasteners are required to fix the ballast weights in place.



USE OF MACHINE SCREWS TO SECURE THE FIXED BALLAST WEIGHTS IN PLACE   You can use just RTV sealant to adhere the weights in place, but if you plan to subject the model to realistic handeling loads (the josteling the model is subject too during transport to and from the lake, for example), it's wise to drill and tap 2-56 holes in the lead weights and pass securing screws through counter-sunk holes punched through the hull. RTV and screws, that's the way to make these heavy masses secure within the hull. No nasty surprises on the road if you take these measures to secure the fixed ballast weights in place.

HIDING ALL THE SCREW HEADS

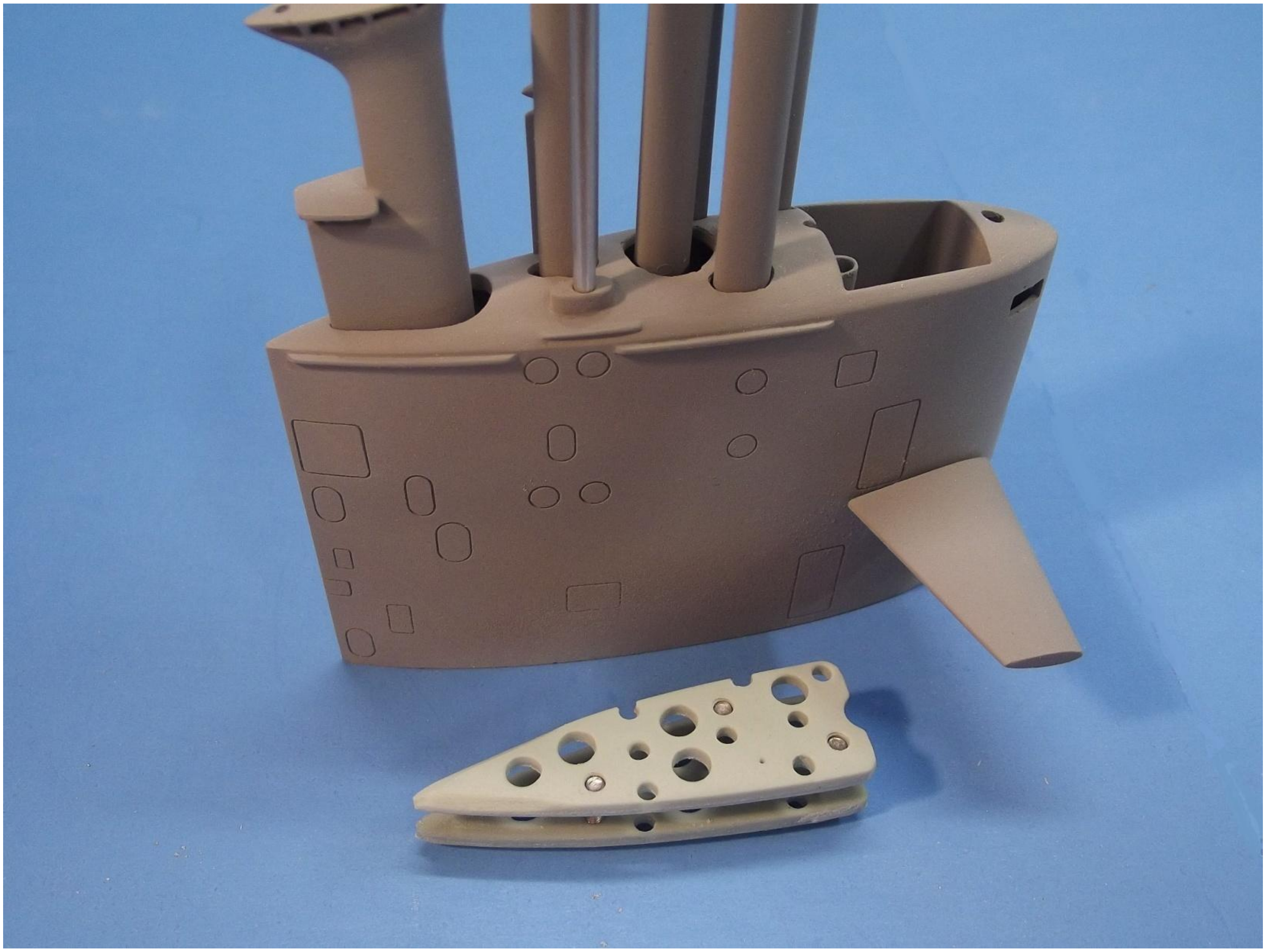
You've used a lot of counter-sunk, flat-head machine screws on this project, all set within the lower hull. Check to see that they all are recessed slightly deeper than the surface of the hull. If not, remove the projecting screw, and hit the hole with the counter-sink bit again to further deepen the tapered hole, and reinsert the screw.

To both secure the screw permanently in place, and produce a filler to fair the surface of the hull over the screw heads, thin formula CA is placed over a screw head, quickly followed by a sprinkling of baking soda. The high pH of the baking soda instantly catalyses the CA to a hard mass. A mass that is filed and block-sanded back down to contour with the hull. But, there are always a few pit-holes and cracks in this 'instant grout', so you'll wipe some air-dry touch-up putty over the work and then wet-sand that to shape.

The absolute best touch-up putty on the face of this planet is Nitro-Stan's 9001 (red) or 9002 (gray) air-dry, lacquer based, touch-up putty.

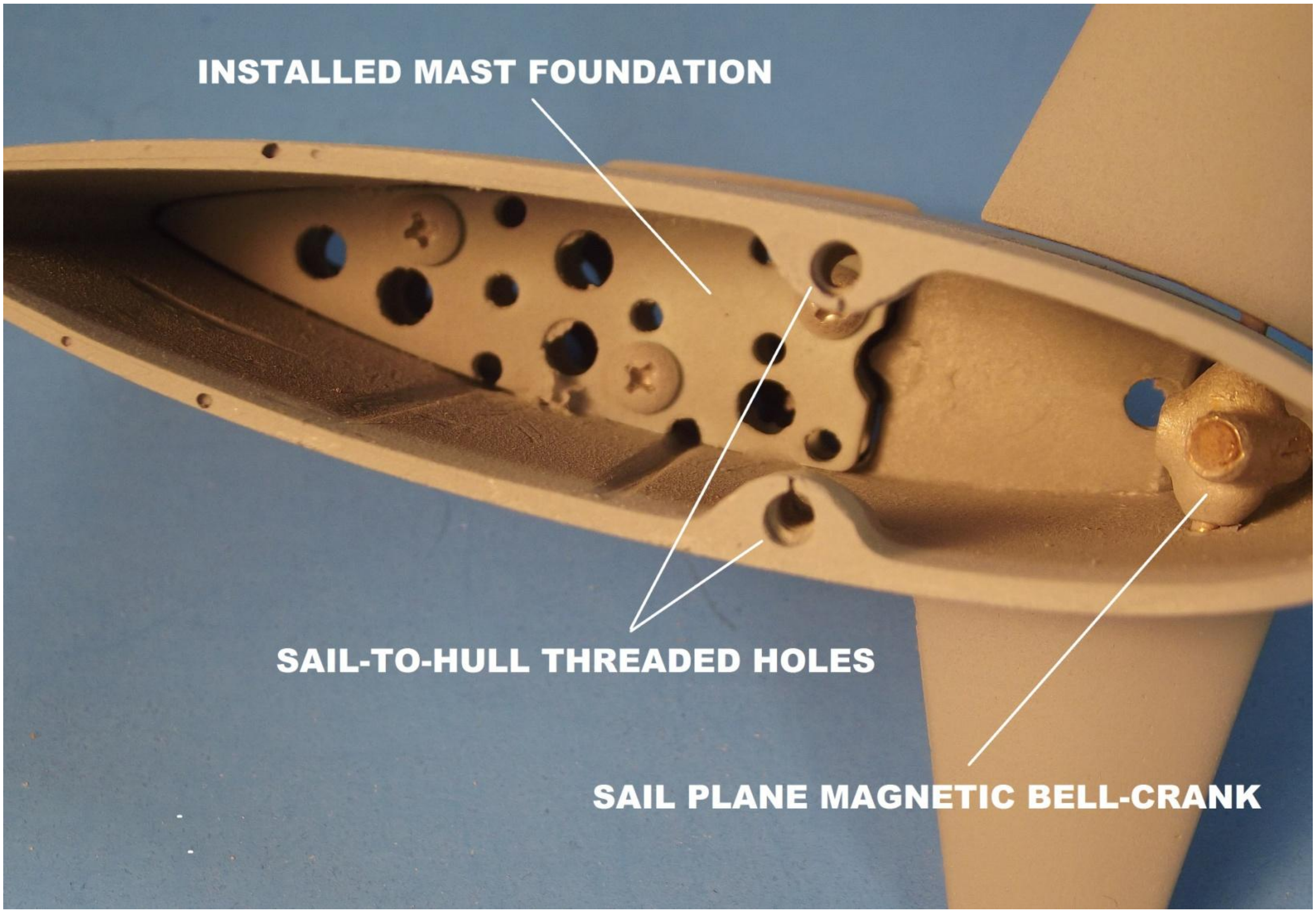
(Don't buy your finishing products at the hobby-shop as they are all crap! retailers want safe, not good -- thank you, litigation lawyers! That's why the 'hobby' putty you get at the general retail level is formulated for banality, not function. You want good fillers, putties, paints and clear-coats that get the job done right? Go to specialty shops that serve the automotive refinishing trade. Sure, their stuff will give you Cancer; change your skin color; your eyes will pop out; change your Party affiliation; shrivel up your balls into raisons; and make you irritable. So what? ... the stuff works!).

Apply some air-dry touch-up putty, come back to it in a few hours, and wet sand the hardened putty to contour with the hull. Some touch-up work with primer and you'd never know the screw heads are under it all.



SAIL, MAST FOUNDATION, AND MASTS

The most distinctive things on a model submarine are the sail, masts atop the sail, the propulsor, and arrangement of the control surfaces. One of the first things the viewers eyes go to is the sail -- looking for the bridge (if open), and masts. This is where a bit of work and skill will turn an otherwise blah looking display into one that not only catches the eye, but is appreciated for its complexity and beauty of function -- and nothing denotes function better than seeing the entire array of mast, antennas and scopes raised atop the sail. That's why David Manley incorporated them in his initial offering of the BLUEBACK kit. And that's why we've made a special effort to make their representation on this kit an easier goal to achieve.

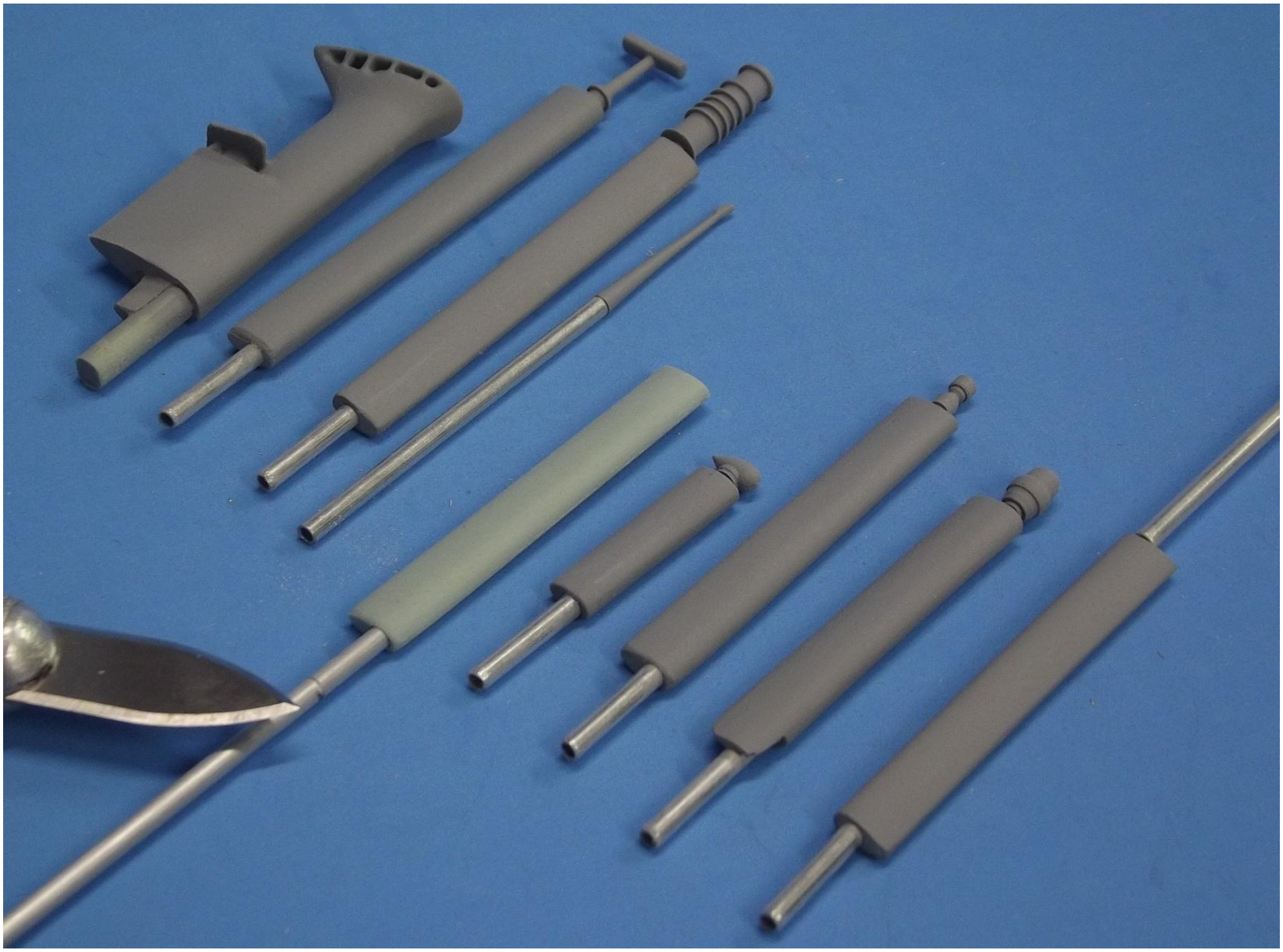


INSTALLING THE MAST FOUNDATION ASSEMBLY The mast foundation assembly came to you assembled. The two platforms of the assembly serve to accept the mounting pins and cylinders of the streamlined resin masts, snorkel part, #2 -scope, and starboard radio antenna.

Note that one of the platforms is rounded off near its after-end -- this goes on top! You've de-greased the assembly as well as the inside of the sail, right? Why Not! .... We told you to!

RTFI!

Before gluing the mast assembly within the sail do a trial fit of all masts -- placing a finger up into the sail to push the assembly in place while you conduct this check might be necessary. Once you are happy with how the masts stand, remove the masts and add a few drops of CA where the lower platform meets the inside of the hull, permanently bonding the mast foundation assembly within the sail.



INSTALLING THE MAST MOUNTING PINS All masts (often called 'fairings'), with the exception of the #1 scope mast, have a 3/32" hole at their base. These holes accept 3/32" aluminum tubes that serve as pins that make an interferrence fit in the holes of the mast foundation assembly.

To ease the following task, if you have a set of incremental drill bits, bore those holes out with a .093" bit which will produce a non-interference fit between pin and the bore of the mast pin hole. If not, just file the tube a bit before applying glue and inserting it into the base of the mast.

OK, this is simple enough: Put a bit of CA adhesive in the mast pin hole; slide the aluminum tube in there and wait a few seconds for the bond to harden. Then, mark off the desired pin length of 1/2" onto the tube, then roll the tube under a knife blade till the soft aluminum parts. File the end of the pin to a bevel. Repeat this procedure to the rest of the masts that make use of a mounting pin.

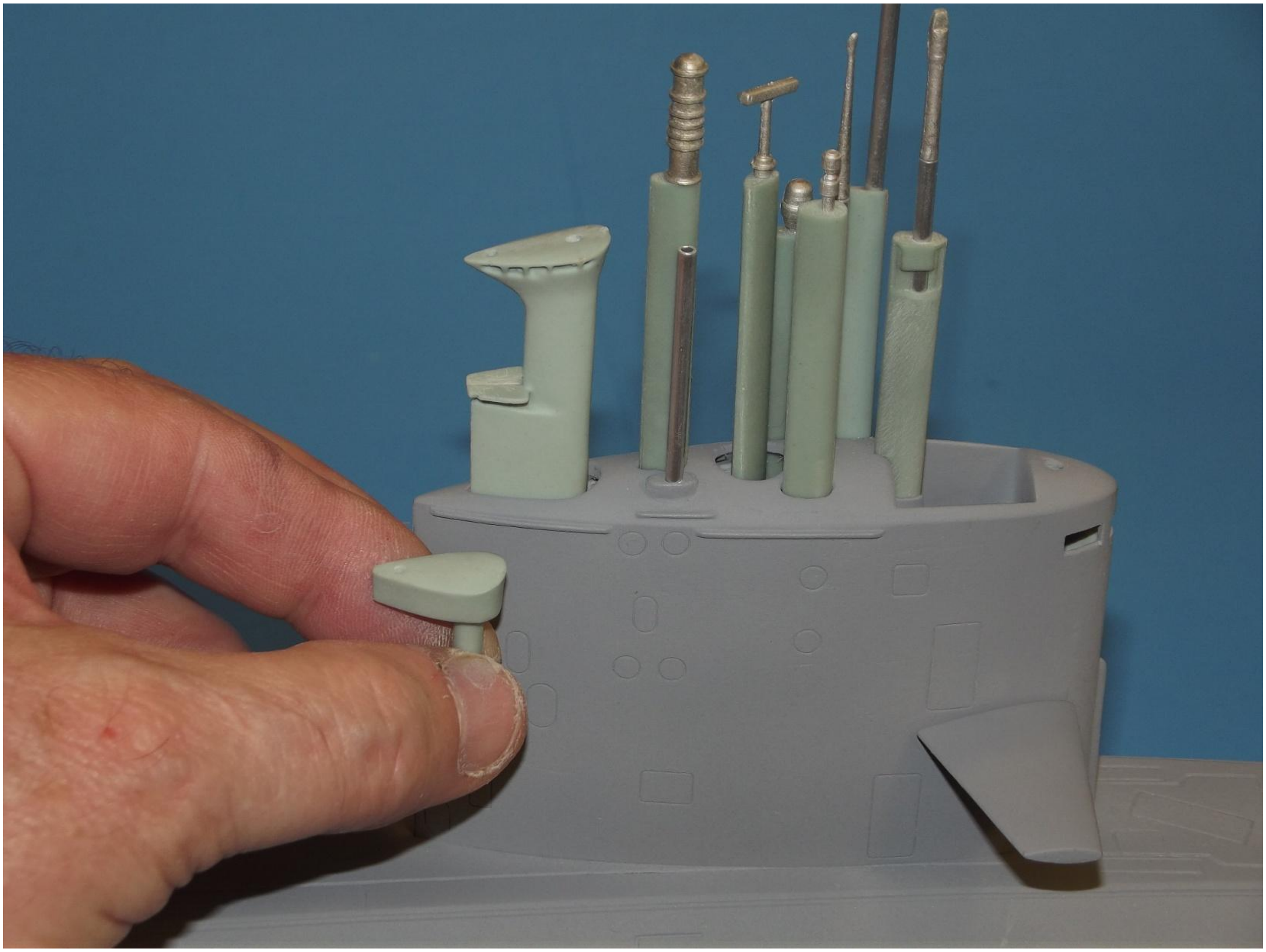
As each mast is test fit atop the sail and checked for alignment with the vertical you'll find that any discrepancy here is dealt with by simply removing the mast, and bending its soft aluminum pin the appropriate direction and amount to get the re-installed mast into proper vertical alignment.

THE #2 -SCOPE AND THE WHIP ANTENNAS No masts in the classic sense here, just lengths of 3/32" diameter aluminum tube. The tube under the attack scope is 2 3/4" long. The starboard whip antenna, the tube that fits in the small fairing atop the sail on the starboard side. is 2 1/2" long. Both of the holes in the sail for these items are enlarged by a .093" bit if you have it. If not, a little work with a jeweler's size rat-tail file will make the holes atop the sail non-interference fits. These tubes extend down through the two platforms of the mast foundation assembly. Eventually the #2- scope head part is glued atop the tube representing that scope.

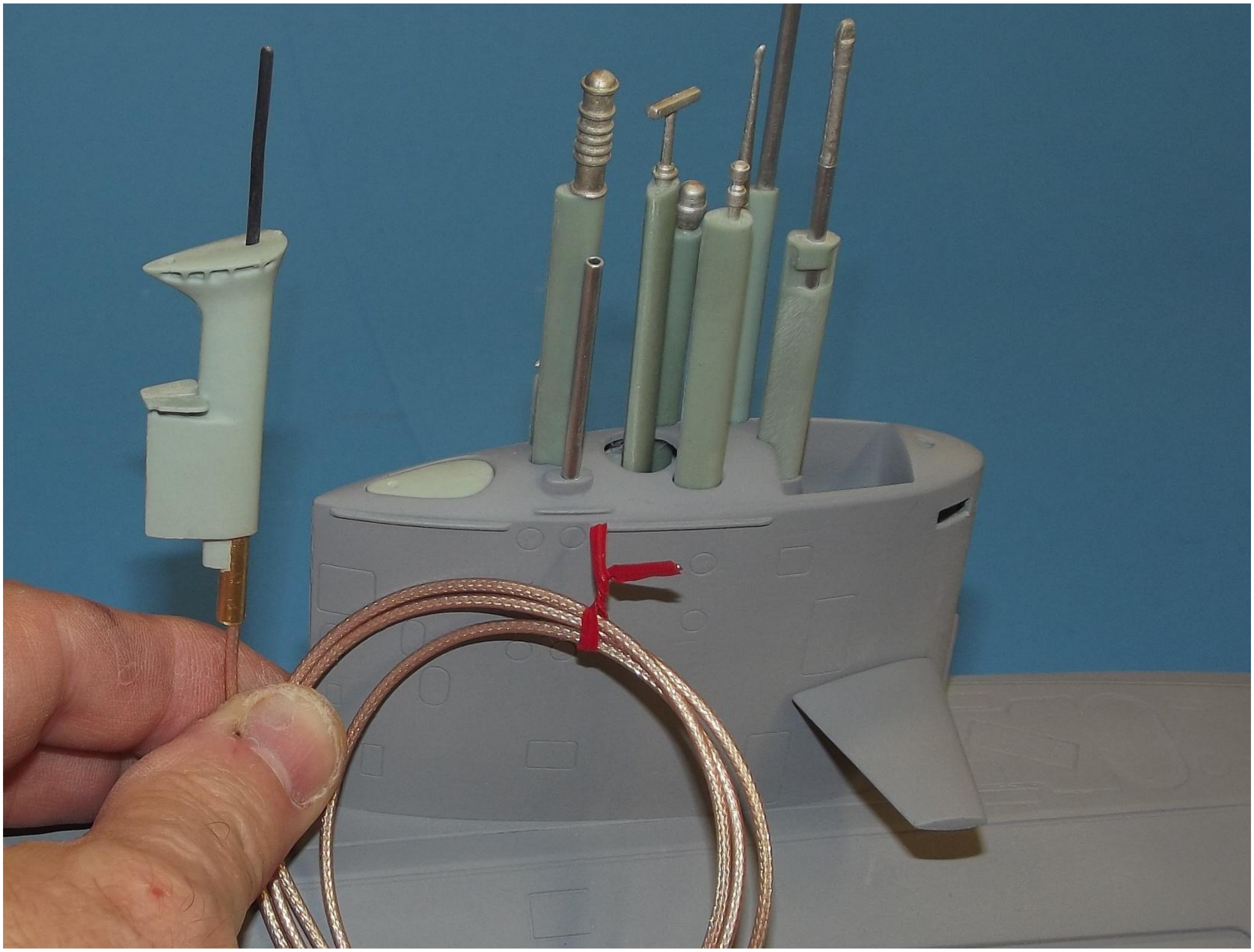
Another length of 3/32" diameter aluminum tube is used to represent the port whip antenna atop its extended mast. The length of the tube is 1 1/2" long. A 1/16" diameter, 1/2" long brass rod is glued half-way set into the base of this tube becoming the mounting pin that integrates the tube with its mast. Bore out a 1/16" deep, 3/32" diameter hole atop the mast to slightly recess the tube when it's inserted into the mast.

Both the port and starboard whip antenna tubes have their openings caped with glue or filler to give them the appearance of being solid.

THE #1- SCOPE This is the only item atop the sail that does not engage the mast foundation assembly. Instead, the base of the #1-scope mast fits within a conformal socket molded into the after portion of the sails open bridge. A length of 3/32" diameter aluminum tube fits between the periscope head and mast -- that tube extending down into the top of the mast where a portion of the tube is exposed through the sides of a wake attenuation fairing atop the mast. The length of the #1-scope tube is 1 1/2" long.



USE OF THE SCALE SNORKEL BLANKING PIECE Most of the time you will elect not to run the r/c submarine with all of the masts installed -- believe me, we doubt there was a moment (other than pre-commissioning acceptance trials, and post overhaul shakedown) when the boat cruised underwater with all masts raised! If you're anything like me you'll leave most of the masts in the field box when you plop the model into the water for an afternoon's play-time. It's enough to simply yank the smaller masts from the sail and leave those openings as is. However, that scale snorkel, when removed, leaves a big ugly hole. We've provided a blanking piece to fit in there, representing the top of the snorkel induction -- just as it would look with the real snorkel retracted into the sail.



USING THE SNORKEL PART AS A 2.4gHz ANTENNA FOUNDATION

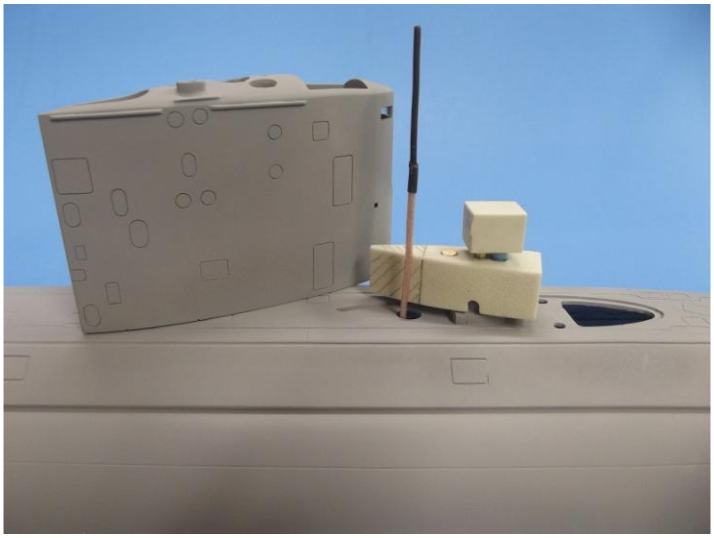
Some of you will be using a 2.4gHz r/c system. Today, that band is the only game in town as you shop for an r/c system. Not only here, but in the rest of the world. R/c systems that operated on the bands of the lower frequencies (which had no problem passing through fresh water) are no longer produced. And it's only a matter of time till governments reassign use of the old bands to other service. Soon, everyone will be compelled to use 2.4gHz r/c systems for control of their hobby vehicle, like it or not.

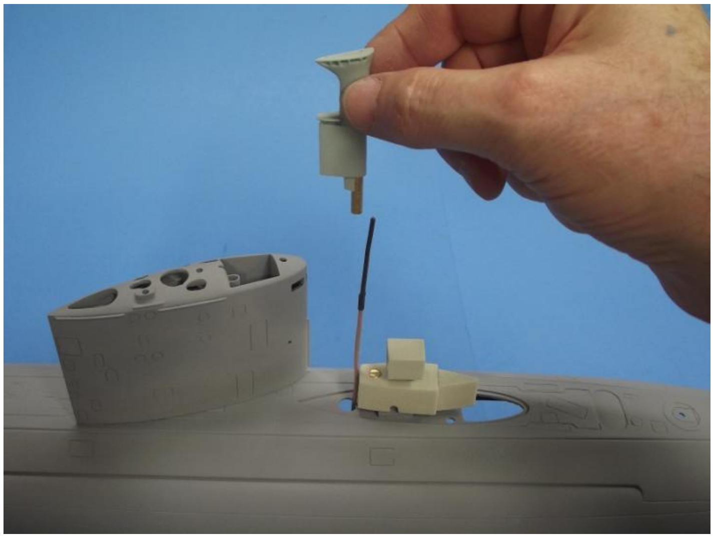
guess what!?.... it just so happens that 2.4gHz is the resonate frequency of water! That makes water completely opaque to this frequency. Ouch! So, if a model submarine is to be controlled using an r/c system on this band, the receiver antenna has to project above the water. That's right, with this r/c system you can no longer control your r/c submarine deeper than periscope depth.

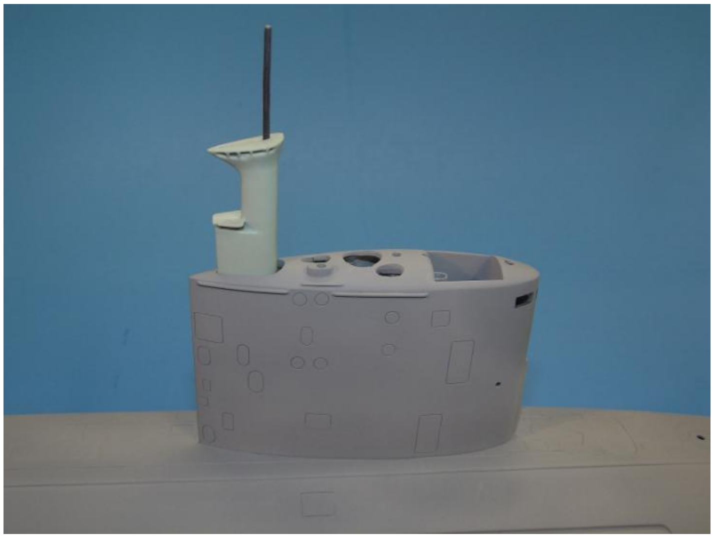
Acknowledging this situation, and providing you the ability to adapt your submarine for 2.4gHz operation, the kits snorkel piece has been outfitted with a brass tube mounting pin that can be bored out and used to extend the 1 1/4" long, full-wave, 2.4gHz antenna up and through a hole at the top of the snorkel piece.

(To facilitate use of the 'new' 2.4gHz r/c systems, our complete line of SD's now come with a 2.4gHz antenna adaptor kit -- a length of coaxial cable to run between the receiver and antenna, a packing gland to pass the .070" diameter coaxial cable, and a complete set of illustrated instructions describing how to move the receiver antenna and get it out of the SD and up atop the models sail).

For this model, all you need do it drill a 3/32" hole up through the snorkel piece pin, stopping 1/8" from the top of the piece. Finish the hole with a 1/16" bit, producing a hole atop the snorkel piece that permits the 2.4gHz antenna to project up vertically. The result is a practical antenna the sits a bit above the level of the two scale periscope heads. You can run the model submerged, but no deeper than periscope depth.





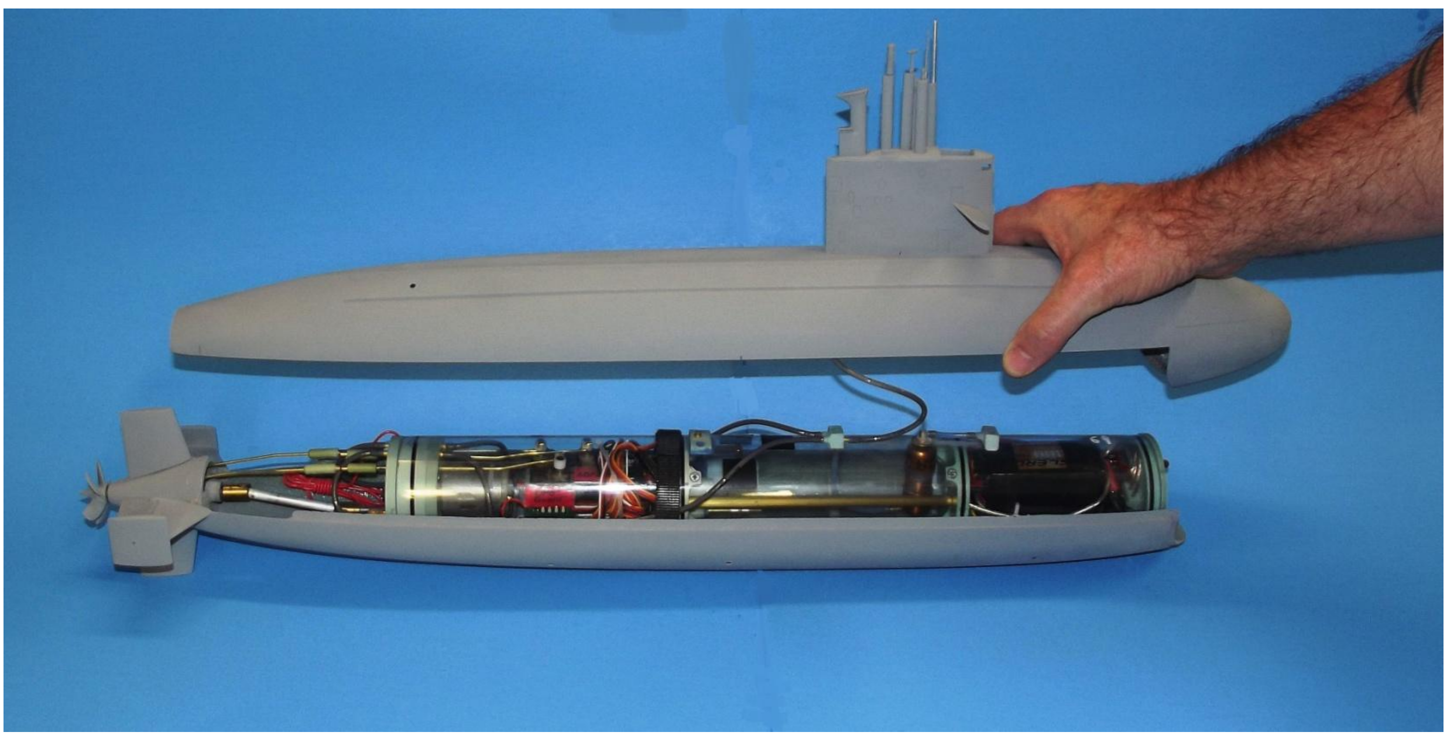


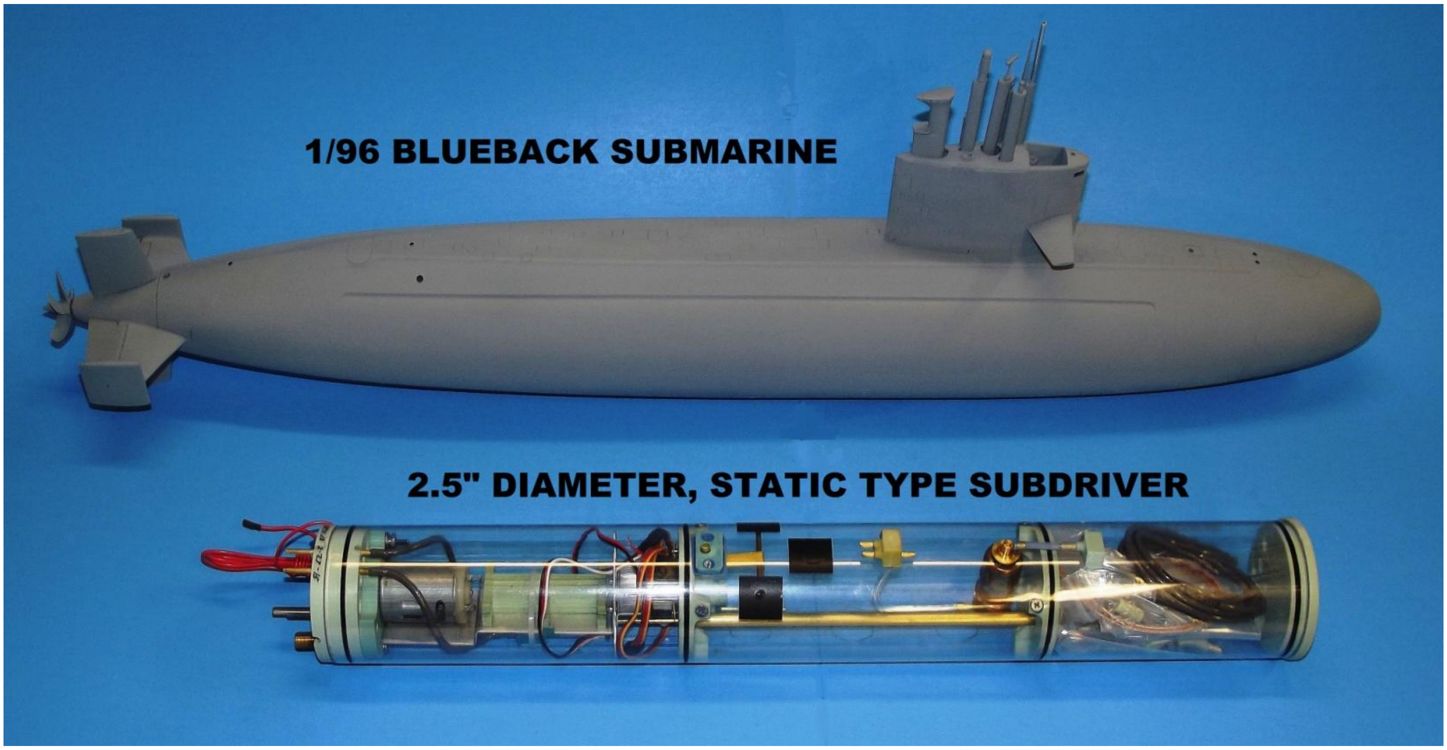
MODIFYING THE SAS INDUCTION SNORKEL FLOAT TO PASS THE 2.4gHz ANTENNA The 2.4gHz antenna, atop the coaxial cable that shields the conductor that extends from the SD housed receiver, passes up through the after end of the sail.

First, a 1/4" hole is punched into the recessed portion of deck under the sail. The center of that hole, 3/4" from the trailing-edge of the sail. This hole is directly under the snorkel piece mounting pin atop the sail. It is through this hole the 2.4gHz coaxial cable passes. A piece of SAS float has to be removed to clear the coaxial cable. You reattach that piece to the front face of the float with CA.

In practice, as you prepare the model for operation, you run the antenna through the bottom of the sail, up through the holes atop the sail, and pull it over the top of the sail. Insert the antenna into the snorkel piece. The snorkel piece, with the antenna now projecting through the small hole atop it, is pushed in place onto the sail. The 1 1/4" 2.4gHz antenna projecting above the snorkel. And that's that.

Though the 2.4gHz system won't permit you to dive deeper than the antenna, it does, inadvertently, provide a fail-safe function: when the model does dive deep enough to wet the antenna, the signal is lost and the electronic speed controller (ESC) immediately stops the propulsion motor. If the boat has been trimmed properly, the slight positive buoyancy of the boat in submerged trim will gradually raise the boat as its speed bleeds away, where the antenna -- once again above the water -- brings things back to life, and the ESC resumes running the motor as commanded by your transmitter.





THE WATER TIGHT CYLINDER -- CHOICES!

The 1/96 BLUEBACK model is designed to accept a 2.5" diameter water tight cylinder (WTC). The WTC is a system, comprising as many as three sub-systems:

The ***contro***l sub-system which encompasses the servos, receiver, antenna, angle-keeper circuit, fail-safe circuit, and battery eliminator circuit.

The ***propulsion*** sub-system with its propulsion battery (which also provides power to the control devices), electronic speed controller (ESC), main mission switch, power cabling, motor, and gear-train.

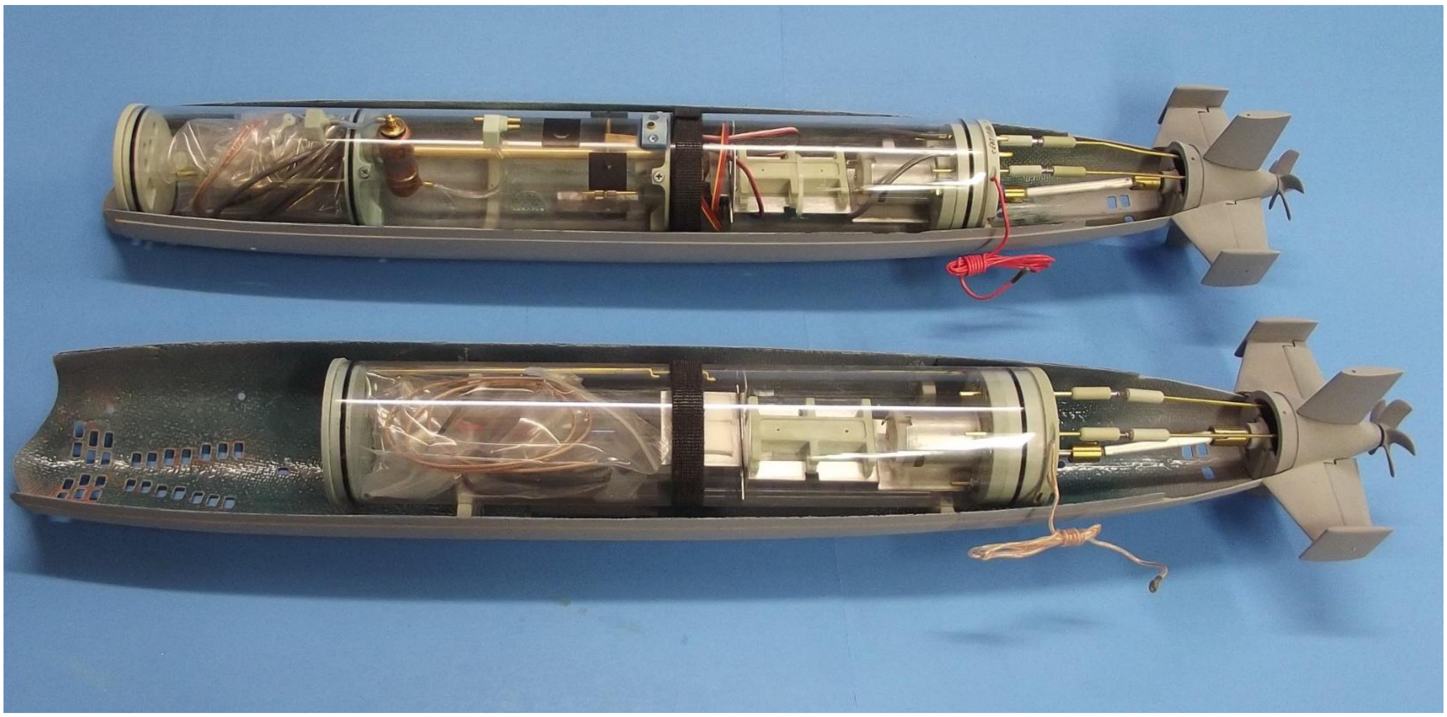
The ***variable ballast*** sub-system which handles the intake and discharge of water to change the weight of the submarine so it can make the change from surfaced to submerged trim and back again. The items needed to achieve the change in weight comprising a servo, pump/gas bottle, vent valve, and the space required to house the ballast water.

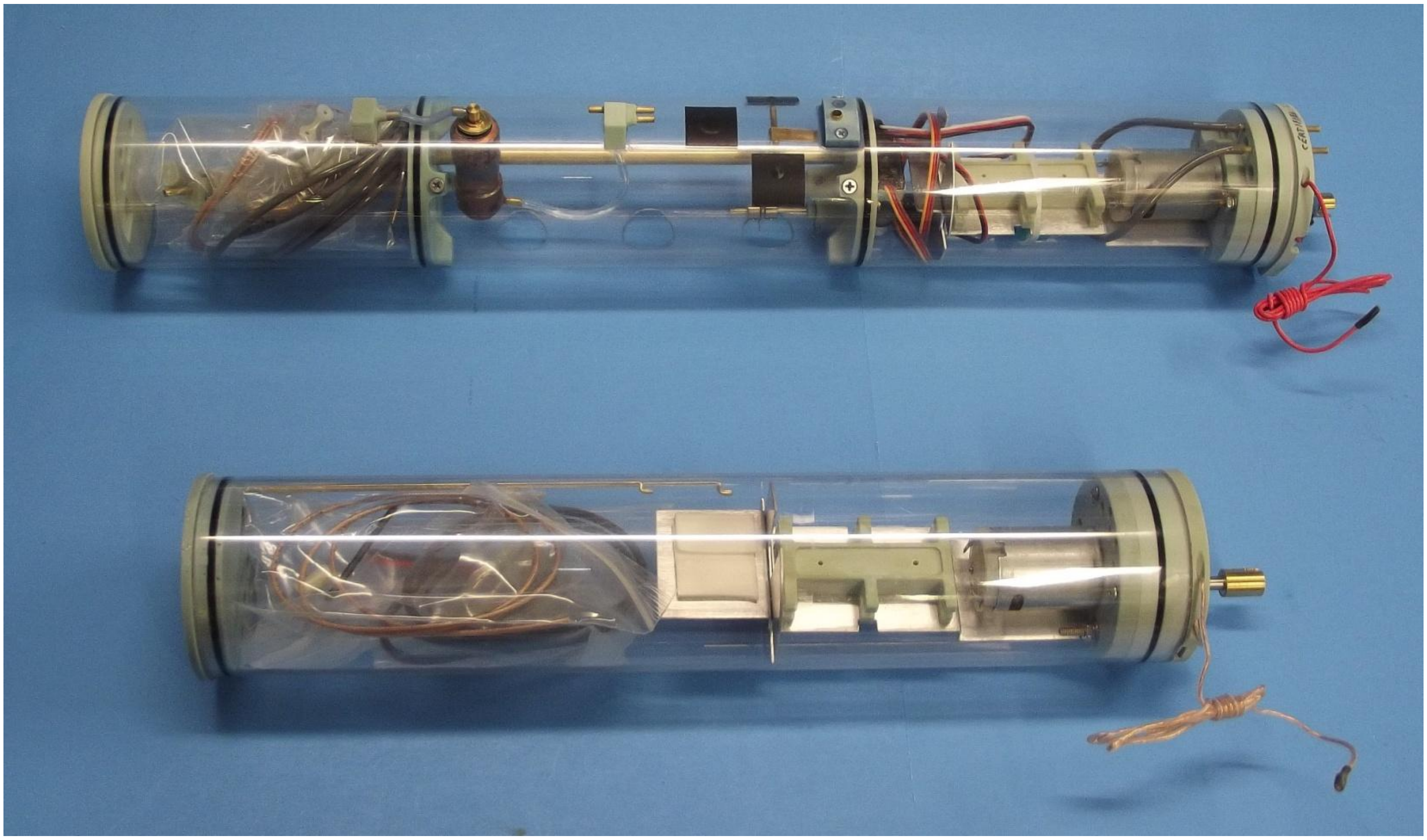
A simplified WTC, without the variable ballast sub-system, can be employed. In that arrangement the boat can only operate in a semi submerged state at slow speed or dead in the water. The model submarine must advance quickly in the water to achieve the force required on down-turned horizontal control surfaces to force the buoyant submarine beneath the surface. An easy to fabricate WTC system, but one that does not give you the opportunity to operate the model in a scale-like manner. How low the submarine sits in the water without way on is the preference of the operator, of course. The lower it sits, the less force (less speed) required to pull it underwater and the more realistic its submerged operation. For the dynamic diving type submarine I prefer to trim it so that half of the sail projects above the water with no way on.

And this brings us to the two modes of submerged operation: Stati***c*** or Dynamic diving.

Dynamic diving r/c submarines have no ballast tank. This system relies on forward motion and horizontal control surface position to drive the model underwater. As the submerged submarine has an unequal balance between vehicle weight and buoyant force, the totally immersed boat will always rise unless the dynamic forces produced by the planes and hull generate a downward force equal to the difference between vehicle weight and vehicle buoyancy. A simple, cheap, and easy to maintain mechanism -- but one that makes your model submarine look like a wild, racing toy when operating under the surface.

Static diving r/c submarines have a ballast sub-system that physically changes the displacement of the boat by taking on water weight into its ballast tank -- a weight close to equal the weight of water displaced by the above waterline structures. This mode of operation permits the well trimmed submerged submarine to maintain desired depth with very little way on. However, this sub-system takes up room, adds considerable complexity to the system, and demands pre and post mission maintenance. But, there's a payoff for this expense and trouble: there's nothing slicker looking than a well controlled model submarine sneaking around under the water at a leisurely speed.

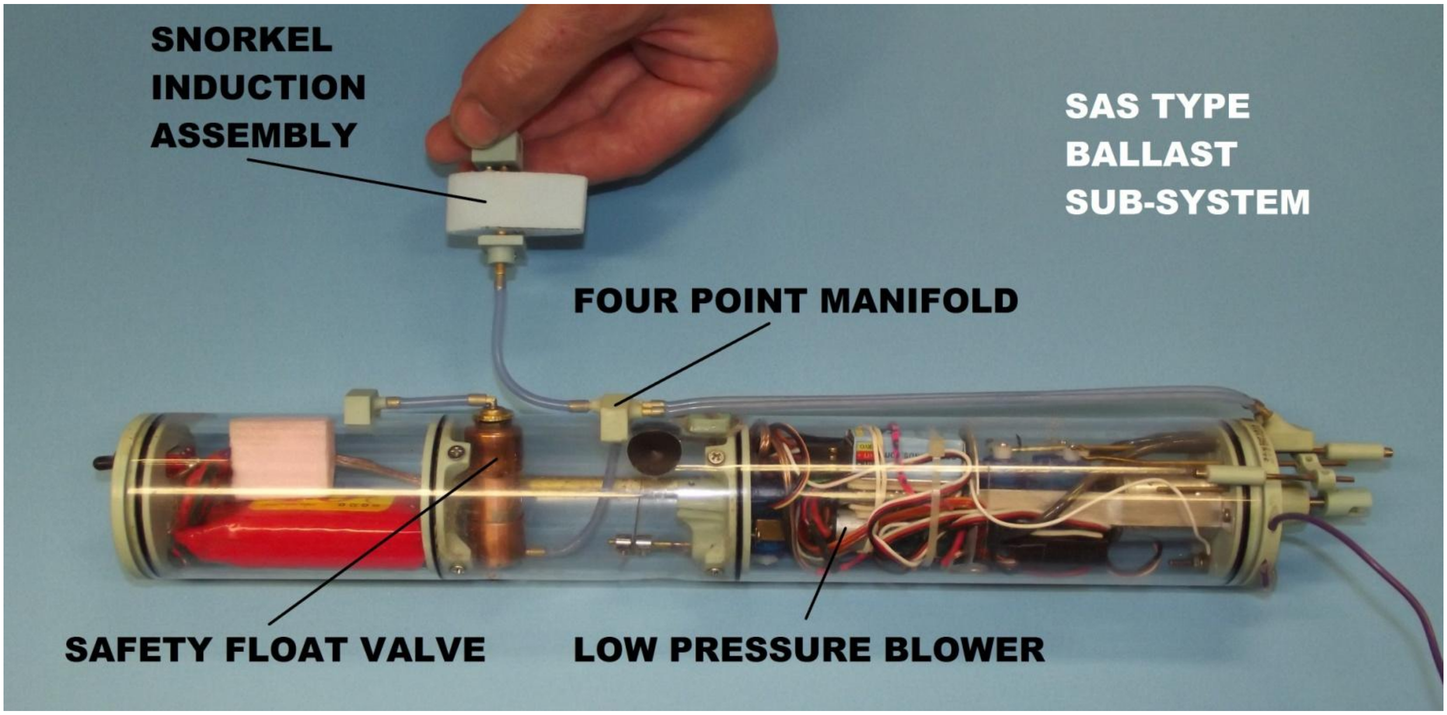




STATIC OR DYNAMIC SUBDRIVER'S AVAILABLE FOR THIS MODEL We offer two commercially available WTC's -- we call them SubDriver's, SD for short. One features our Semi-ASpirated (SAS) ballast sub-system and permits the model submarine to operate in the static diving mode. Our Easy type SD is a simplified version of our SD and dispenses with the ballast sub-system and operates the model submarine in the dynamic diving mode.

The above photos illustrates the difference in length and internal complexity between the static and dynamic diving mode SD's. The price difference between the two is also quite apparent, I can assure you. Other than a difference in the location and amount of buoyant foam placed within the hull -- required to achieve the desired fixed trim -- the two versions of our SD are interchangeable in the hull.

This illustrates what you get with the static type, SAS equipped SD recommended for the 1/96 BLUEBACK model. Contents include a specialized snorkel induction valve assembly, 2.4gHz antenna retrofit kit, and all hardware and plumbing required. The installed SAS low pressure blower, motor pump controller, vent valve, and safety float-valve have been tested as individual units and as an integrated sub-system. The ballast sub-system can quickly be retro-fitted with an additional gas ballast blow device if so desired (recommend for deep water operations).



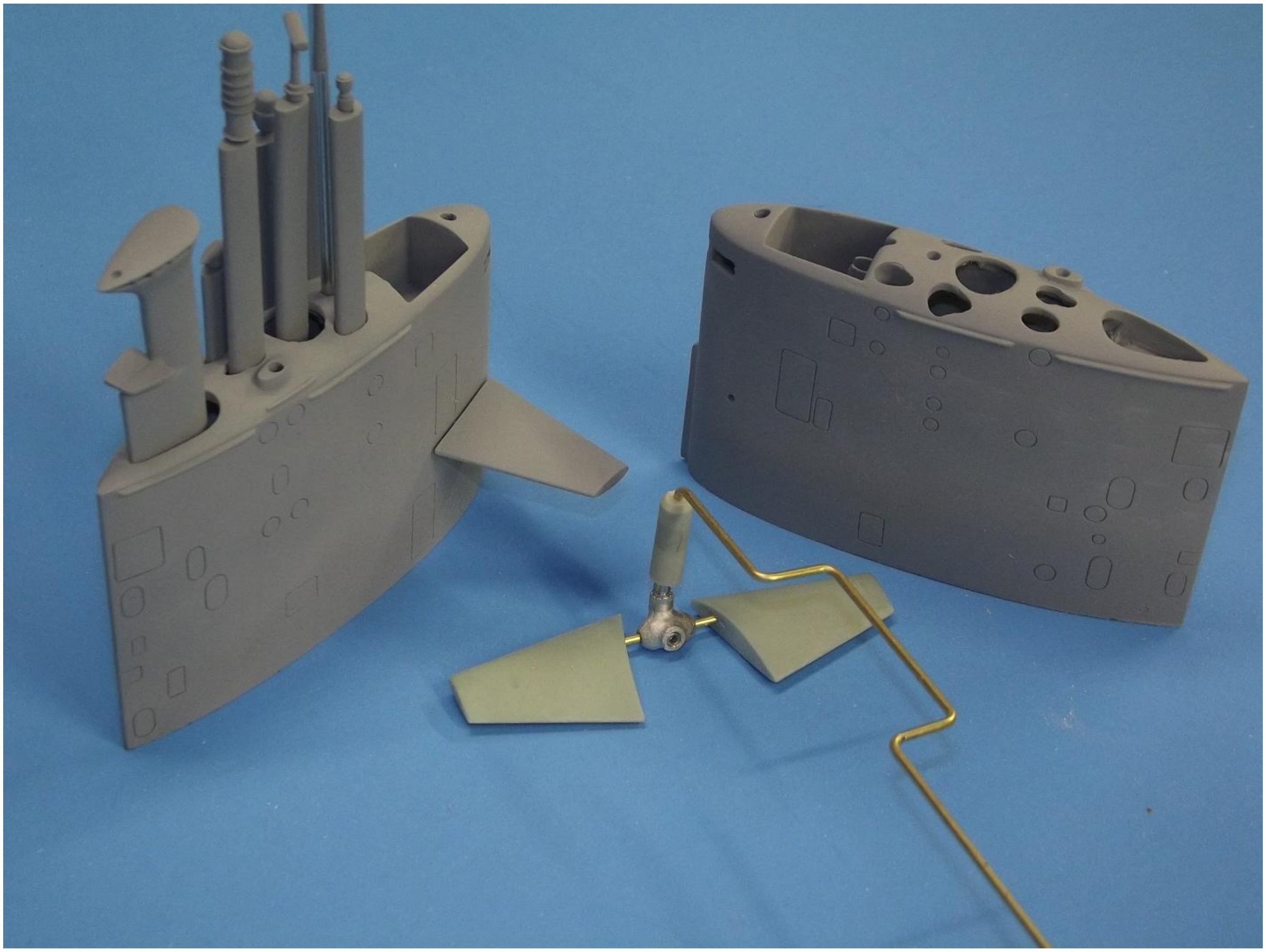
The SAS type SD is divided into three spaces by two internal watertight bulkheads.

FORWARD DRY SPACE This space houses the battery. The forward removable bulkhead gives access to the battery and also mounts the systems main mission switch.

BALLAST TANK The center section is of the 'soft' type ballast tank, within which is the conduit between the forward and after dry spaces, through which air and the power cable communicates between forward and after dry space; blanked off hole to fit the on-board bottle of the gas ballast blow device (optional); safety float-valve (back-up to the sail mounted snorkel induction valve) which keeps any water that gets into the induction line from entering the dry spaces; vent valve; SAS four-point manifold, where the induction and discharge flexible hoses intersect; and foundation under the blow-vent linkage which would receive the gas ballast blow valve (if installed).

The forward ballast bulkhead isolates the ballast tank from the forward dry space. The after ballast bulkhead -- which mounts the ballast sub-system servo, and ballast linkage, isolates the ballast tank from the after dry space.

AFTER DRY SPACE This space contains the majority of the propulsion and control elements. The r/c system receiver with through-bulkhead antenna; propulsion motor and 3:1 gear train; device mounting tray and bulkhead; servo foundation; LPB with attached and tested motor pump-controller (MPC); and installed and leak tested pushrod and motor shaft watertight seals. Servicing is easy in that all devices other than the ballast servo and power cable are attached to the motor bulkhead and come out as an entire unit for build-up, testing, adjusting, and servicing.

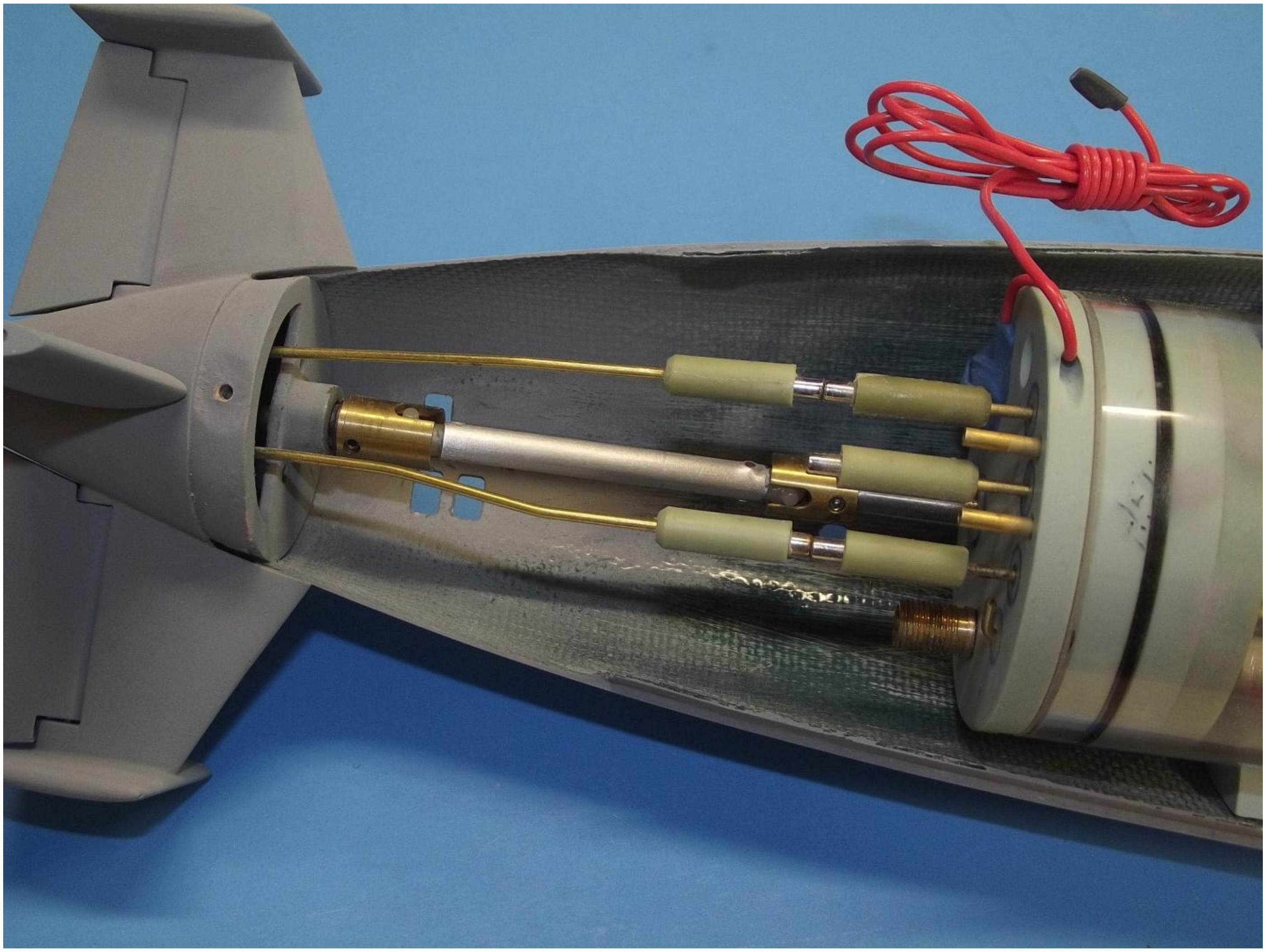


RUDDER, STERN PLANES, AND SAIL PLANE LINKAGES

The arrangement and function of the stern plane and rudder linkages has already been explained. Once again install and get operational those tail-feathers, this time with Z-bent pushrods introduced into the bell-crank portions of the yokes. Once the stern control surfaces are interfaced with the SD, you'll move on to produce the linkage that operates the sail planes -- if you chose to employ them.

PRACTICAL SAIL PLANES, DO YOU REALLY NEED THEM? Now, it's not mandatory to make the sail planes practical -- many like sized r/c model submarines run quite well without active control of their bow or sail planes, all pitch and depth control functions served by the stern planes alone (Mr. Holland would approve). However -- and this is particularly true for static diving type systems -- use of practical sail (or bow) planes does give that added bit of accuracy when it comes to fine-tuning the depth of the model, i.e. the model works in a more scale-like manner.

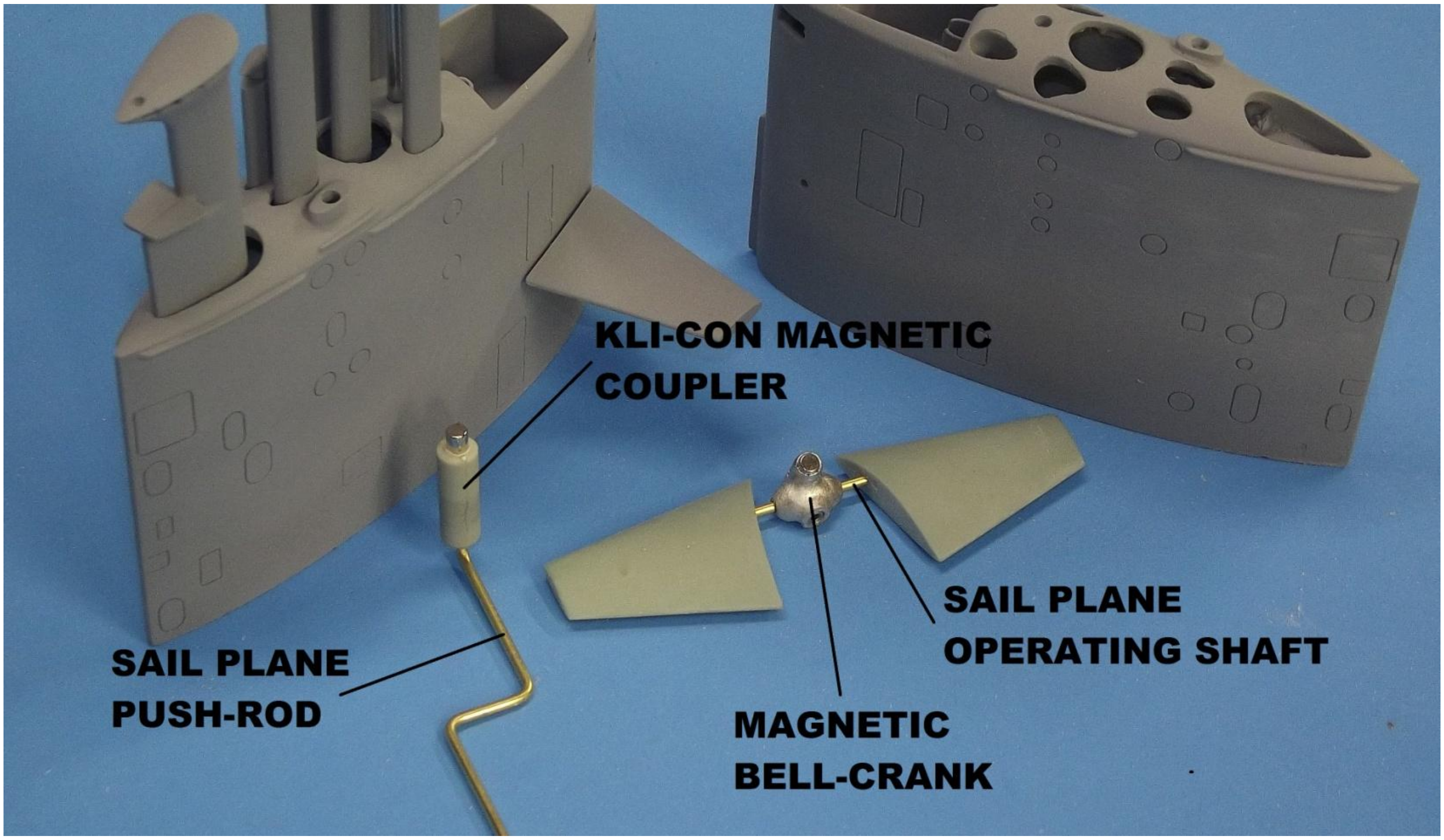
So, if you are going with a dynamic diving type system, we recommend fixing the sail planes in place and dispense with the associated servo and linkages -- doing so eliminates an r/c system channel, making it possible to use the less expensive three-channel gear.



INTERFACING THE CONTROL SURFACE PUSHRODS TO THE SD PUSHRODS Your SD comes with three sets of magnetic couplers, their function is self-evident. The stern plane and rudder pushrods extending forward from the tail-cone assembly. The length of each pushrod adjusted so that when its magnetic coupler makes contact with the SD's magnetic coupler the control surface is at zero deflection and the SD's servo arm is at neutral. All is revealed in the above photo.

The magnetic couplers and intermediate drive shaft allow immediate running gear and control surface linkage make/break whenever the SD is installed or removed. No more tools required to get the SD in and out of the lower hull!

You'll note that there is an apparently unused center SD pushrod with attached magnetic coupler. This coupler makes up to a pushrod, attached to the sail planes.

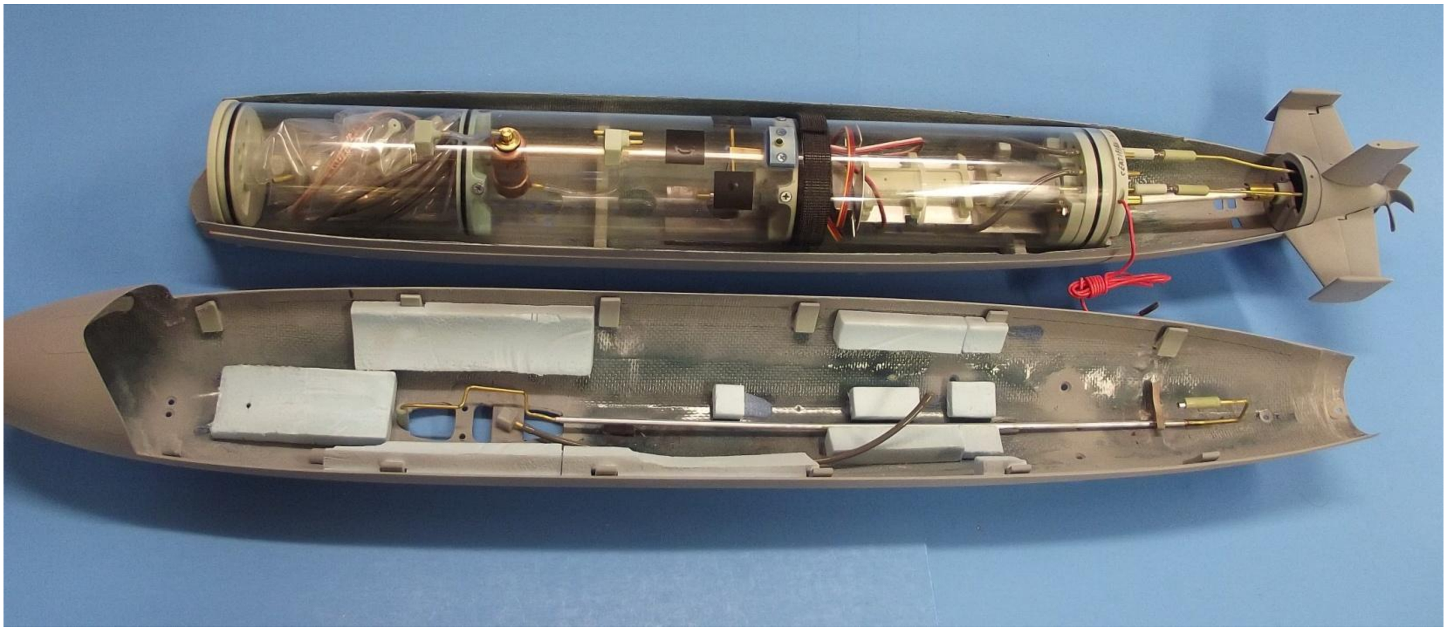


THE SAIL PLANE LINKAGE If you elect to make the sail planes practical then you will make use of the provided sail plane magnetically coupled bell-crank. This cast metal item has within it a magnet that will make up to the Kli-Con magnetic coupler also provided in this kit -- that coupler made up to a length of 1/16" diameter brass rod, bent as illustrated.

Take the provided 1/16" brass rod sail plane operating shaft and CA it in place in one of the two sail planes, you then slide the operating shaft through the sail, the two holes near its lower leading-edge. You may have to work these holes open a bit with a drill bit to make a non-interference fit between the operating shaft and the holes. Slide on the second sail plane from the other side of the sail. If the operating shaft is too long and won't permit the root of the planes to nestle up tight against the sides of the sail, mark off the excess material of the operating shaft, remove it from the sail, and snip off the excess. Make sure to deburr the end so it won't scratch the bore of the plane.

Remove the sail plane and operating shaft from the sail, position the magnetic bell-crank within the sail (a set of tweezers is useful in the confined space here) and slide the operating shaft through one side of the sail, sliding it through the bore of the magnetic bell-crank, and on through the other side of the sail. Place a tiny drop of thin formula CA within the bore of the free sail plane and let it cure hard (accelerator applied will speed up the cure) -- this to make a tight interference fit between this plane and the operating shaft. Jam the sail plane onto the sail plane operating shaft till there remains a 1/32" gap between each sail planes root and the surface of the sail. These gaps will keep the root of the sail planes from scratching the sides of the sail during operation.

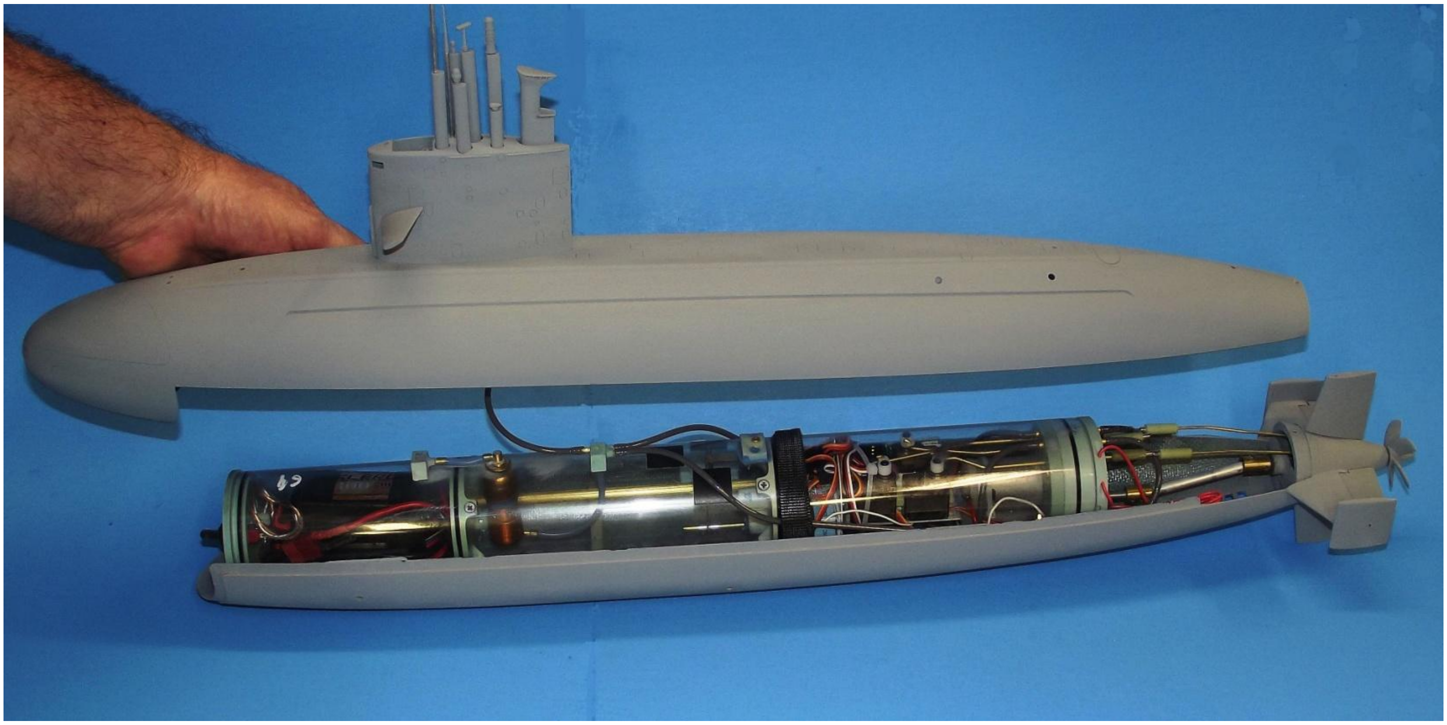
Make up an Allen wrench to the magnetic bell-crank set-screw and torque it down to set the bell-crank on the sail plane operating shaft to the position you see in the above picture; orienting the magnet at a right-angle to the cord of the sail planes, effectively making the tip of the magnet the clevis union between the sail planes and pushrod.



The brass rod from the bow plane end of the sail plane pushrod is given a wide U-shaped bend to provide clearance of the installed SAS inboard nipple glued to the inside of the upper hull. The after end of this short brass rod glued into a long length of 3/32" diameter aluminum tube. The larger diameter aluminum tube both stiffens the pushrod and is of a much lighter weight than if a straight length of heavy brass rod. The after end of this pushrod terminates in another short length of more 1/16" brass rod. That rod bent through two 90-degree angles which puts its Kli-Con magnetic coupler, when the upper hull is placed atop the lower hull, into contact with the SD's sail plane pushrod magnetic coupler. The make-break between sail plane linkage elements is done magnetically.

The union between magnetic couplers presents zero back-lash; this is a linkage with very little slop to it, which in turn leads to better, assured control of the stern planes, rudders, and sail planes.

Linkage rigidity (use of aluminum tube on long push-rod runs) also reduces the possibility of a control induced regenerative oscillation about the pitch or yaw axis. Not all pitch oscillation is a consequence of incorrect angle-keeper circuit sensitivity setting!



HULL CLOSURE, TIGHTENING THE GAPS BETWEEN UPPER AND LOWER HULL

Yes, the initial fit between the upper and lower hull reveals nasty gaps between the hull halves. Nothing like what you see illustrated here. Welcome to the wonderful world of GRP hull integration, pal!

Your job is to tighten the remaining longitudinal and radial gaps. This will be done by adding material to the longitudinal edges of the upper hull and radial edges and flanges of the lower hull. The longitudinal edges will be build-up with baking soda saturated with CA adhesive. The flanges and their edges will be built up with a two-part automotive filler.

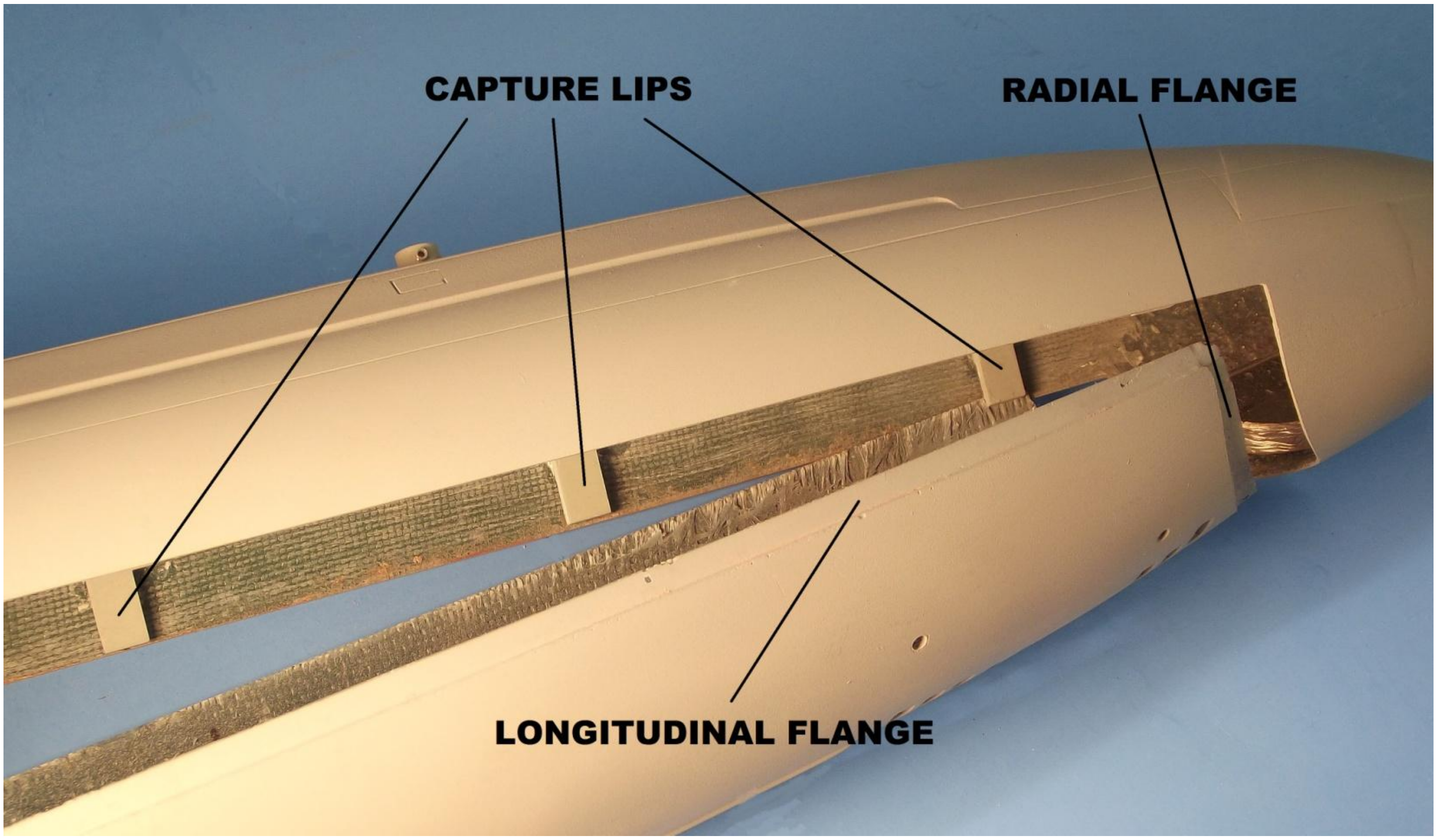
If you carefully followed the flash marks on the upper and lower hull, then you've removed all the GRP needed -- the misalignment now presented is a consequence of an out-of-round condition of the two hull pieces. They warped. Yes, the lower hull has an indexing flange running nearly the entire length of that part. However, it's inset will only prevent the upper hull from bowing inboard, not outboard.

THE CAPTURE LIPS The capture lips, when properly installed, greatly minimize the ‘over-bite’ between the hull halves along the longitudinal edges.

To prevent bowing of the upper hull longitudinal edges outboard (and thus away from the longitudinal flanges of the lower hull) we've provided ***capture lips***. These items work to pull the longitudinal edges together when assembling the upper and lower hull halves.

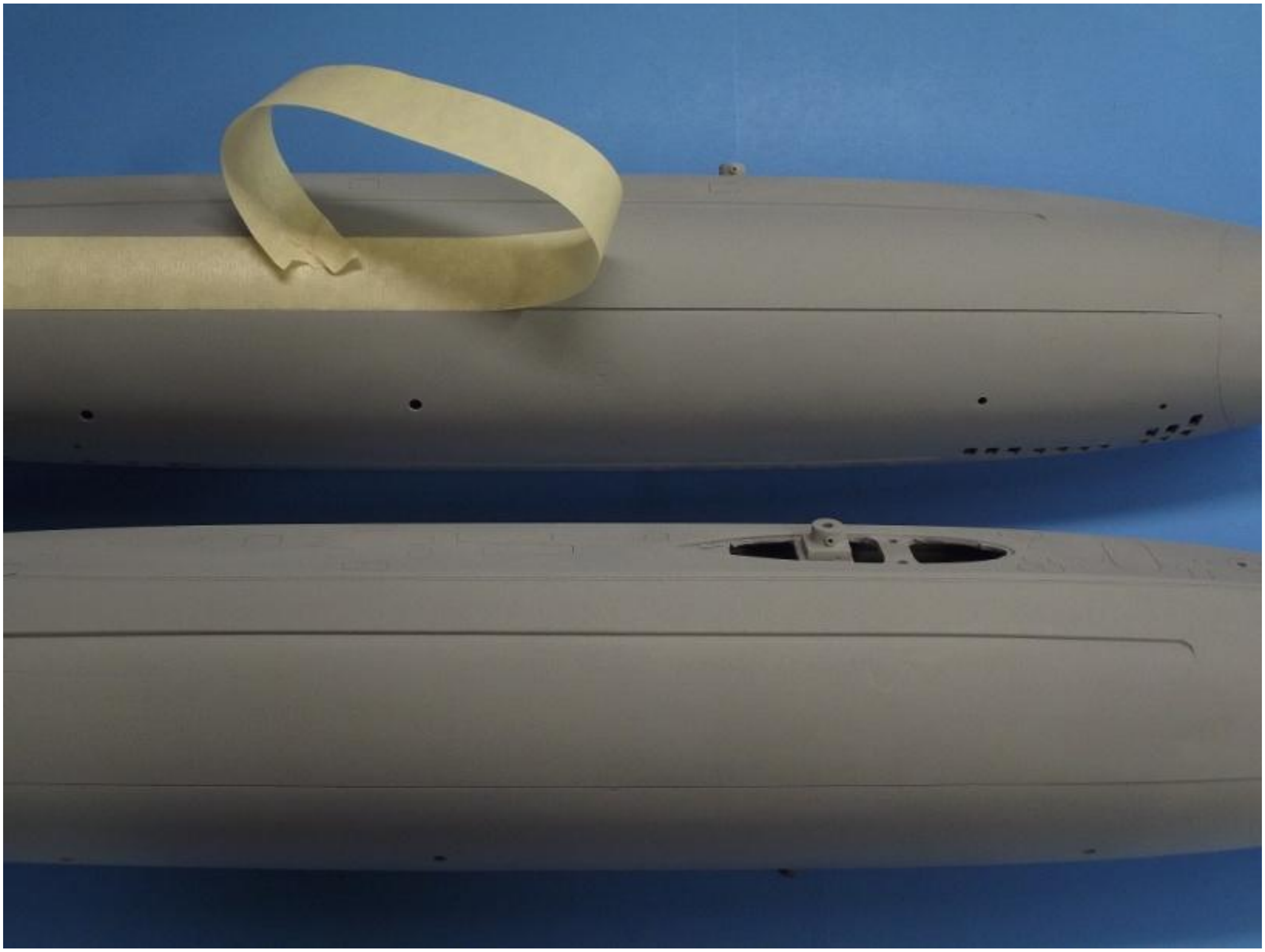
The base of a capture lip is CA'ed within the upper hull, its lip edge sharing the same plane as the longitudinal edge of the upper hull. When the two hull halves are pushed together, the capture lips slide onto the inner face of the lower hulls longitudinal flange, and in so doing pushes the outboard face of that flange up tight against the inboard face of the upper hull, This joining force applied just above the longitudinal edges of the two hull halves. Additionally, the force applied by the capture lips also works to stress the bowed condition of the two hull halves back to the desired circular section they should be.

HOW TO INSTALL A CAPTURE LIP TO THE UPPER HULL As you position a capture lip in place within the upper hull, you sandwich between the lip and the inside of the hull a ***stand-off gauge***. This gauge -- made from a piece of plastic, metal or cardboard -- shares the thickness of the lower hulls longitudinal flange. Take care not to run any CA onto the gauge as you apply the glue to the base of the capture lip where it is bonded to the hull. It's a good idea to coat the stand-off gauge with mold-release wax before use.



In this shot you get some insight into how the capture lips work to pull the upper hull tight over the lower hulls molded-in-place longitudinal flange. Typically you need twelve of these capture lips to do the job (six on each side). However, no two hull sets are the same so we provided extra capture lips if your hull union turns out to be particularly difficult.

Note also how the recessed radial flange of the lower hull will engage within the radial edge of the upper hull piece. That radial flange running up and translating into the longitudinal flange.

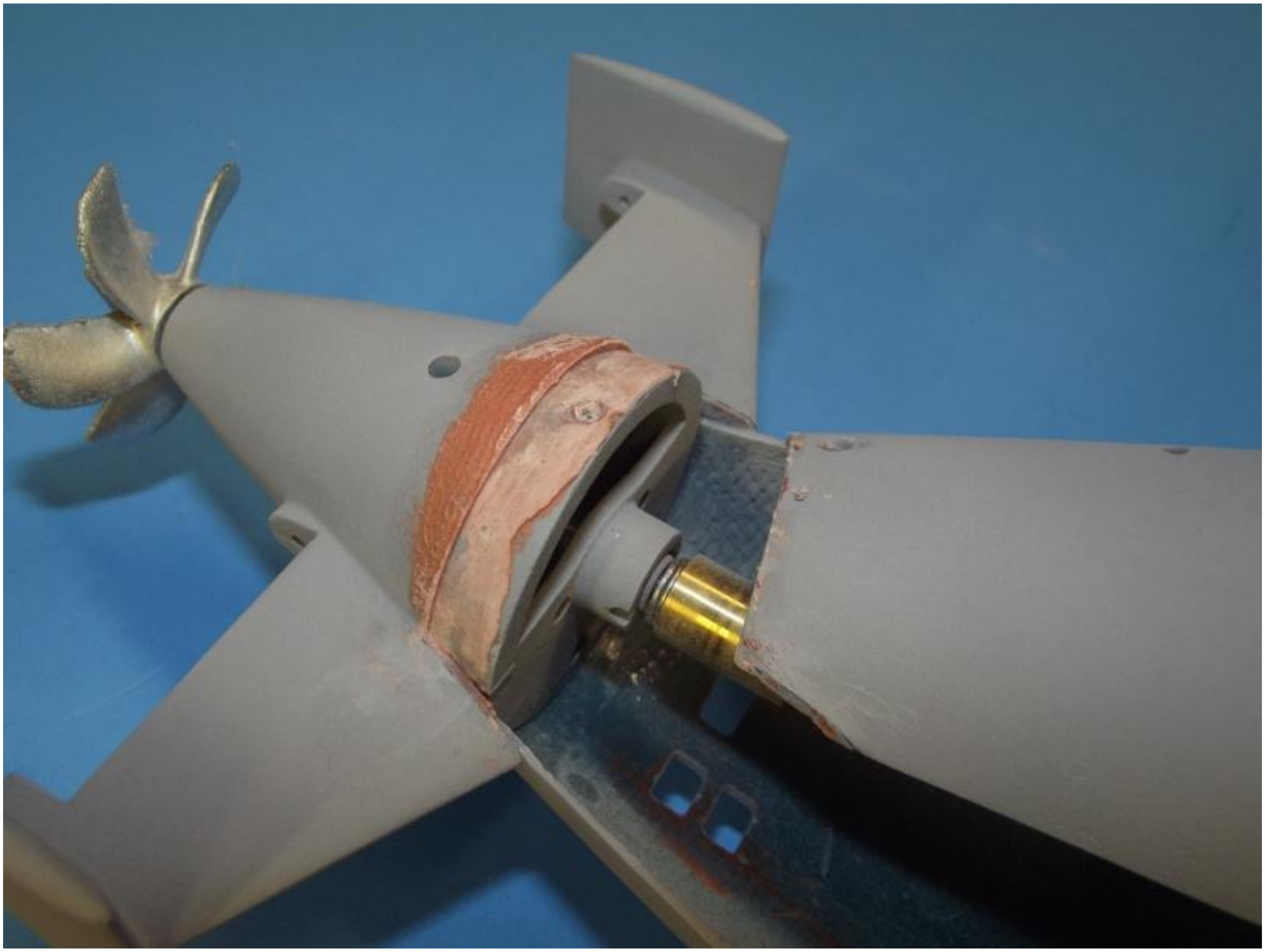


TIGHTENING THE GAP BETWEEN UPPER AND LOWER HULL HALVES Once the capture lips are in and you are able to push the two hull halves together you'll likely find that there still remains an unacceptably wide gap along the longitudinal edges, such is the case with the upper assembled hull pieces -- a bad fit. The lower assembled hull has had its upper hulls longitudinal edges built up to tighten the fit of the assembled hull -- a good fit.

The upper assembled hull is about to receive a build-up along its upper hull longitudinal edge. The bottom edge of the masking tap over the upper hull defins the width and length of the edge build-up required. This tape, once the two halves are separted becomes one-half of a damn made of tape that will contain the build-up material.

Once you've laid down the masking tape on the outside of the upper hull, you pop that half of the hull away from the lower hull. Then lay down more masking tape, this time on the inside -- it's 'top' edge parallel with the tape on the outside of the hull. This forms a 'dam' in which you sprinkle baking soda. This forms a grout when thin CA is dripped onto it. This grout is very hard and attaches to the GRP edge with incredible tenacity. Once the new longitudinal edge has been established, the tape is removed and the edge block-sanded lightly with #240 grit sandpaper.

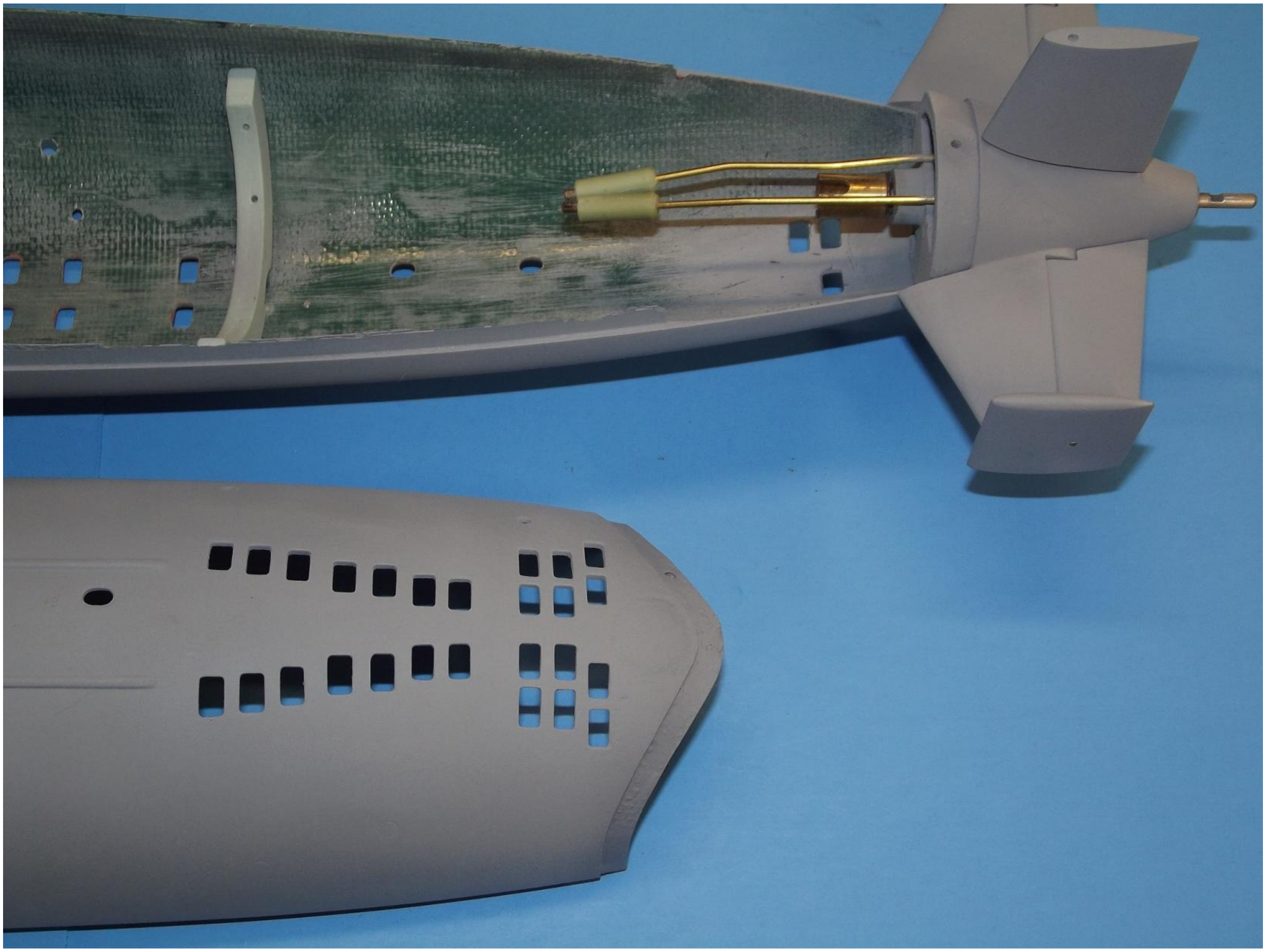
TIGHTENING UP THE BOW AND STERN RADIAL GAPS WITH A TWO-PART FILLER The forward radial gap is formed where the lower hull radial flange edge and the radial edge of the upper hull meet. The after radial gap is formed by the upper hull's radial edge and the tail-cones radial flange edge. As you can see in the photo above, the after radial gap is much, much too apparent and has to be reduced to a barely visible seam.



The gap between the two radial edges is tightened up by a buildup of automotive filler over the forward and after radial flanges. This is done by first applying mold-release wax to the hull underside surface and edge that sits upon a radial flange. The wax keeps the curing filler from adhering to it.

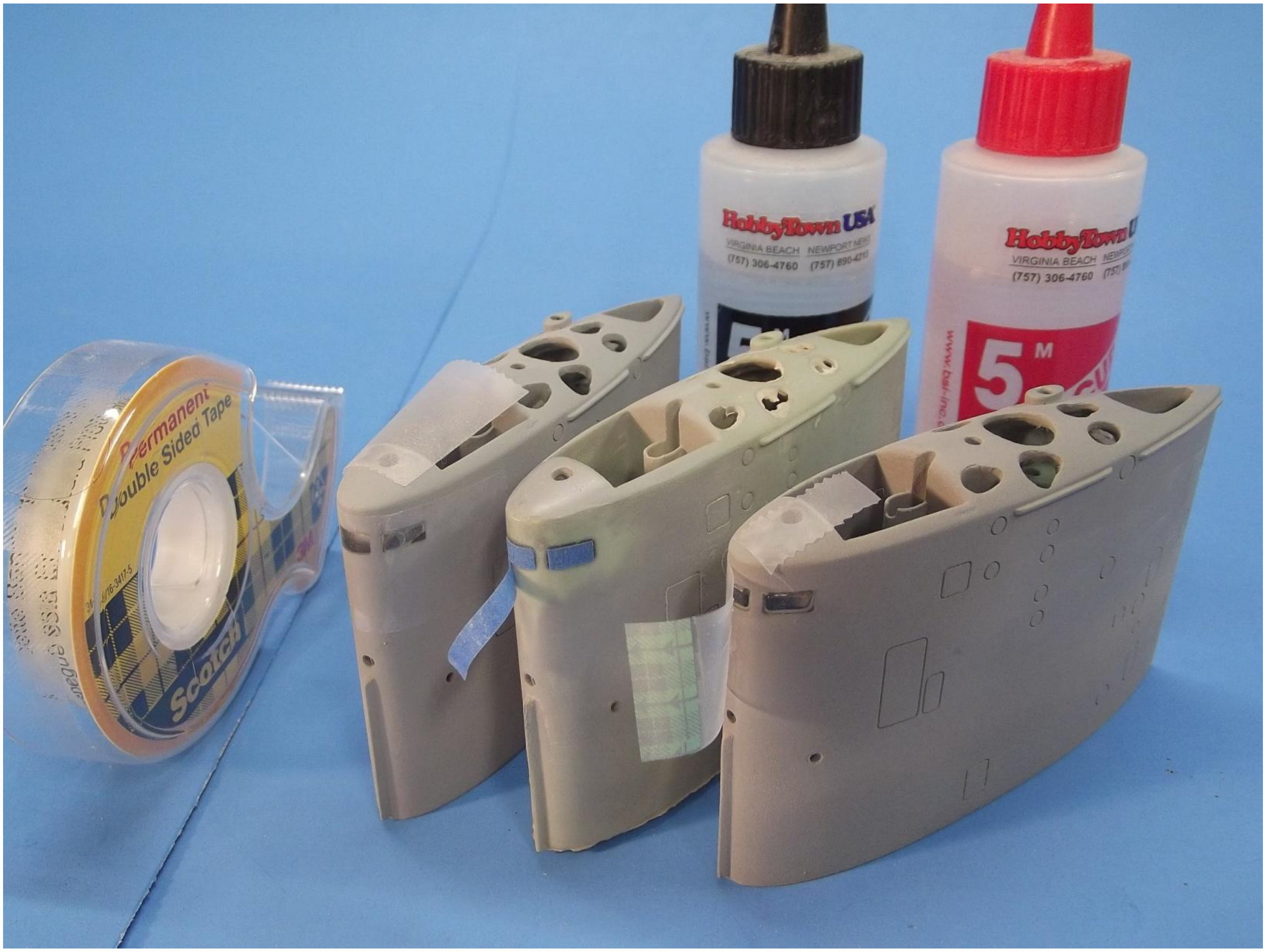
In this example, a small abount of two-part filler is mixed and slathered over the radial flange, up against its edge. The upper hull is slipped in place quickly and held in place till the filler cures hard (about three-minutes).

Ten- minutes later the filer has hardened and the surface of the hull over the filler is filed and sanded back to contour. This process results in a very tight radial seam between the two hull halves. The upper hull is removed and thin formula CA is applied over all filler areas. The CA saturates the weak and pourus filler, greatly strengthening it. The hull halves are again joined and the CA'ed area wet sanded with a #400 sanding block, and the worked area spot primered.



What remains are very tight fitting radial gaps fore and aft, as illustrated here. The lower hull halve is pictured at the bottom of this shot. Note the weird shape -- not the straight radial line you would expect. David Manley, the originator of this kit, incorporated the after portions of sonar window outline into the lower gap between hull halves. Where there has to be a gap, he hid it as a portion of a scale features of the models bow. Now, that's very good model kit engineering in my book!

And, not just that: he originated a very clever idea by placing the after break between upper and lower hull along a significant portion of the horizontal stabilizers leading edge -- the stabilizers acting as outboard hull alignment tabs, pushing the after edge of the upper hull inboard, up tight against the tail-cone assemblies radial flange. Neat!



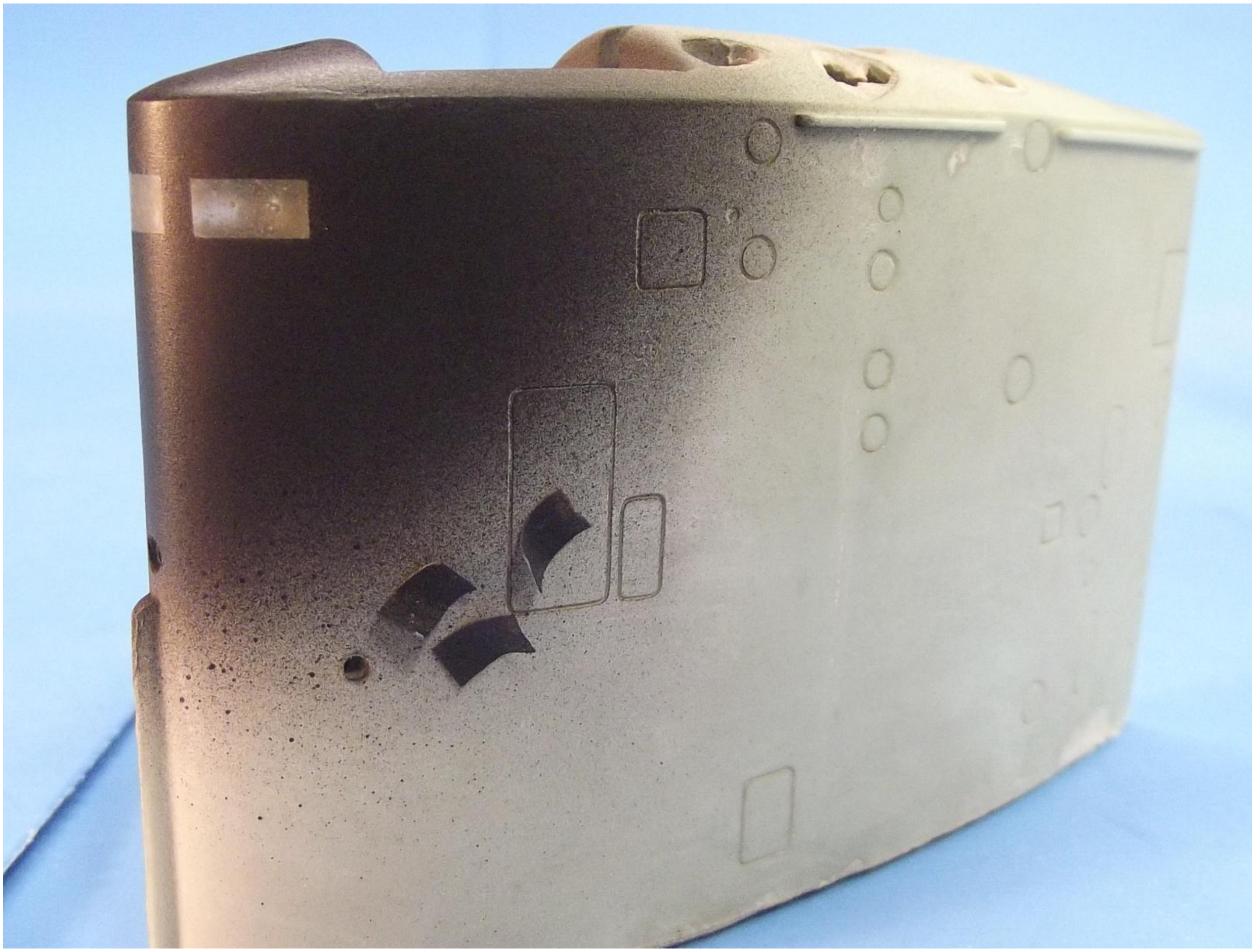
REPRESENTING CLEAR DEADLIGHTS (WINDOWS) FROM 5-MINUTE EPOXY GLUE

What started on the resin sail piece as three square openings at the upper leading edge, are turned into three conforming almost optically clear deadlights, by simply wrapping tape around the outside of the square holes, mixing up and slathering a mass of 5-minute epoxy on the inside of the sail, filling those holes. After ten-minutes the tape was removed, revealing three solid, clear windows.

(These deadlights, to use the proper nautical nomenclature, permitted the bridge crew to duck for cover when those big green-water waves came crashing over the open cockpit of the bridge. Oh, yeah!

On and around the epoxy deadlights you initially wet sand with #400 sandpaper, followed by finer grits till you're at #1200 sandpaper. At that point a water-based polishing compound is used to remove any remaining sanding scratches on the clear deadlights. In no time at all you have three clear deadlights ready to me masked off and the sail painted black.

The three BLUEBACK sails above demonstrate the deadlight process: The sail to the left has the backing tape around the leading edge, over the open square holes where the deadlights go. The sail on the right has had the 5-minute epoxy laid in and the masking tape peeled back a bit. The center sail has had its epoxy deadlights sanded and polished and the individual deadlights masked off in preparation of black paint.



Three deadlight masks are cut out from low tack masking tape and applied over the center of each clear deadlight. Little bubbles in the epoxy clear parts mixed in with some dust particles kind of spoiled the effect, but when viewed from a reasonable distance, the back-lit deadlights capture the essence of the 'real thing'. Be assured, on the real boats equipped with deadlights like this, in no time flat the acrylic material cracked, blushed, was subjected to poor masking as adjacent areas of sail were painted, etc. In short, the optical clarity of the deadlights on operational boats quickly assumed the optical quality of a glass of milk! So, on the model, the results here are reasonable.

So, in conclusion ...

You have a rather comprehensive set of instructions here. Follow them and you likely will have a good looking, well running r/c model submarine. Or, ignore these good words and flop around like a fish about to be gutted. It's up to you. We've taken you through assembly of the model kit. The outfitting of your WTC, trimming, painting, markings, weathering and clear coats are up to you. Rotsa Ruck!

Useful Organizations, Products, and Forums you'll find on the Net

r/c systems explained	https://en.wikipedia.org/wiki/Radio-controlled_model
	https://en.wikipedia.org/wiki/Radio-controlled_submarine
markings	http://woodlandscenics.woodlandscenics.com/show/Item/MG747/page/1
small tube and rods	http://www.ksmetals.com/products.html
	http://www.rc-airplane-world.com/radio-control-gear.html
	http://www.rc-airplane-world.com/radio-control-functions.html
finishing products	http://www.caswellplating.com/
	http://www.autorefinishsupply.com/category-s/383.htm
	http://www.tptools.com/Nitro-Stan-Red-Glazing-Putty,1809.html
r/c submarine products	https://sub-driver.com/
r/c submarine forums	http://forum.sub-driver.com/forum