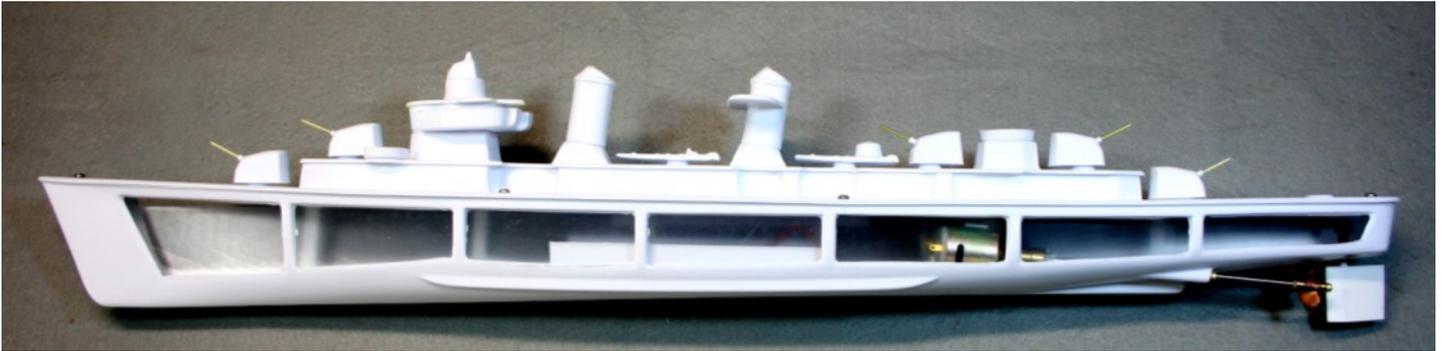


# **Combat Vac-U-Fletcher™**

1:144 Semi-Scale Model RC Warship Combat Fletcher-Class Destroyer Hull Kit  
Manufactured by Vac-U-Boat 1259 Humphries Rd. Conyers, GA 30012 philpace@vac-u-boat.com



Based upon one of the most successful weapons systems deployed in World War II.

While no RC Warship Combat kit is “easy to build or cheap”, this “Beginner-Class” kit will get you started in this fascinating hobby and not only give you an understanding of construction, control and weapon systems, but will make an effective addition to any fleet in battling against your buddies!

**This Combat Vac-U-Fletcher Hull Kit Features:** Tough high-impact polystyrene hull with polyurethane-bonded sub-deck and carbon-fiber-reinforced hull-ribs & sub-deck cross-members. The sub-deck hatch openings and the hull’s pre-formed penetrable area panels can be removed with a hobby knife or box cutter. Clear hatch lids & hatch tape waterproof the hull. The deck supports realistic details and can house a forward-firing 50-round cannon or mounted as a stern gun (not included). The rudder kit includes a 1.8 square-inch rudder cast on a brass shaft with a self-aligning rudder bracket, rudder arm, pushrod, and e-z connector with stainless screw for the servo. A mini servo is included for the rudders. Servo models will vary according to availability. The twin drive kit includes two “365” motors direct-driving counter-rotating precision stainless steel shafts supported by Oilite® bushings in brass stern tubes with brass couplings, injection-molded copper colored polyethylene props, 6-32 threaded drive dogs, and prop nuts.

This Fletcher-Class Destroyer is a 1.0 unit ship under the rules of the International Radio Controlled Warship Combat Club. It can be equipped with a “1/2 bilge pump” and a 25 rounds in its cannon, or a 50 rounds and no bilge pump.

## *Now for the Warnings!*

**Read all of the instructions!** Review and understand each step, and the one after, as you build your boat. Don't rush. Good work takes time.

**This is not a toy!** I know. It LOOKS like a toy, but it isn't. Toys are generally safe for small children. This boat is not safe for small children. Assembling it requires the use of sharp tools that can cut skin, strong adhesives that can bond flesh and injure eyes, spray paints that can be flammable and toxic, as well as batteries that can short causing severe burns or fires. Read all of the instructions and warnings on all of the tools and chemicals you plan to use. Use protective eyewear when recommended. **USE SAFETY GLASSES! If you think you don't have the skills, or are uncomfortable with tools and chemicals, or just changed your mind, then pack up this kit and return it immediately for a full refund including economical standard return shipping. If you need some help, find a local boat club to join, check with the hobby shop where you purchased your radio gear, or contact local RC Warship Combat clubs and organizations for assistance.** Keep your work area away from children. Even if you have no children, when not working on the kit, keep all sharp objects and all chemicals locked away in a safe area. You never know who will come to visit and how well they will supervise the young ones with them.

**This is STILL not a toy!** Once you complete the boat and are running it in a lake, know that the boat can injure life, limb, and property. Never touch the propeller, spinning or not, while there is a battery inside or connected to the boat. Even if it is turned OFF, assume it can glitch and run on its own. Never run the boat if swimmers are in the water. Don't chase wildlife. Be careful with rechargeable batteries. They have the ability to dump large amounts of current in a very brief period of time if shorted, causing burns or fires. Never store the boat with the battery inside it, connected or not. Keep your batteries in a safe place, out of the reach of children. You are responsible for the safe use of this product. You are responsible for choosing wisely, those who you entrust the use of the boat and radio, even for a few minutes at a lake.

### **Never swim after a disabled model boat!**

**All of these warnings are just for the Hull Kit! Add the RC Warship Combat parts and this model is ABSOLUTELY DANGEROUS. Use safety clips in the cannon when not battling to prevent accidental firing of a bb. Know that Lithium batteries are dangerous if mishandled, damaged or if charged improperly. CO<sup>2</sup> powered firing systems contain pressurized gas that can project parts at a high rate of speed during assembly or repair. Everyone wears SAFETY GOGGLES when in combat, or testing on the work bench.**



## **WARNING**



**CHOKING HAZARD** - Small parts. Not for children under 3 years.

**WARNING** - To avoid danger of suffocation, keep plastic bags away from babies and children. Do not use in cribs, beds, carriages or play pens.

**WARNING:** Brass parts in this kit contain lead, a chemical known to the State of California to cause cancer and birth defects and other reproductive harm.

**WARNING: THIS IS NOT A TOY!** Once completed, this model should only to be used with the Safety Rules and guidelines of the International Radio Controlled Warship Combat Club

<http://ircwcc.com/main/home/rules/>

# ***KIT CONTENTS***



**Hull & Sub-Deck** joined with openings reinforced with carbon fiber rod. Top view and bottom view.



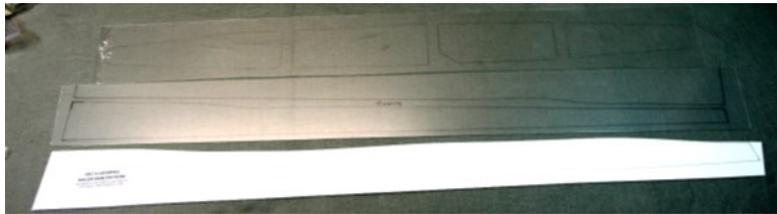
**Pre-Trimmed Deck**



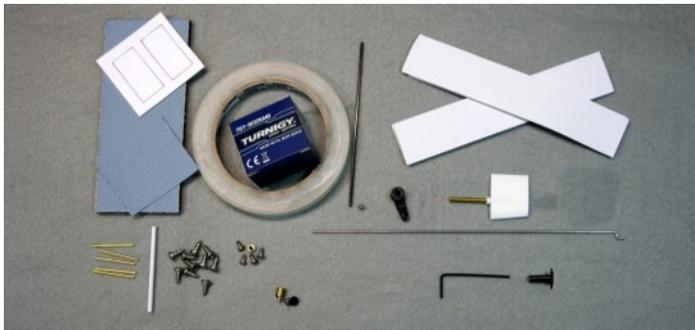
**2nd Deck & Deck Components**



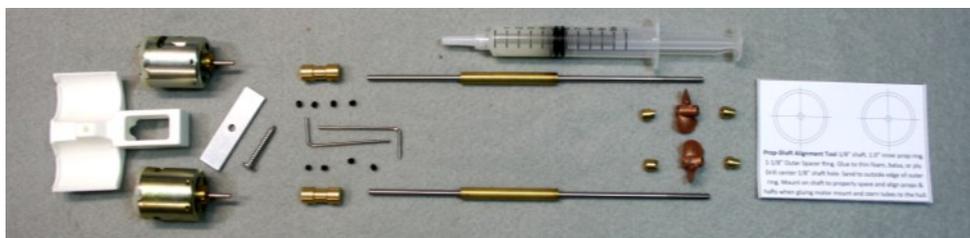
**Boat Stand and Internal Electronics Tray.**



**Internal Armor, Hatch Covers & Balsa Skin Cutting Template.**



**Hull Hardware Kit** with stainless steel deck screws, plastic & brass 5" gun barrels, prop alignment templates, torpedo launcher base, rudder, self-aligning mount, rudder arm, stainless set screws, stainless pushrod, ez-connector, mini servo, sanding block, sandpaper, hook & loop tape and 72 yards of hatch tape.



**Twin Drive Package** with stern tubes, precision stainless shafts, couplings, drive dogs, prop nuts, props, synthetic grease, motors, motor/servo mount, couplings & prop alignment template.

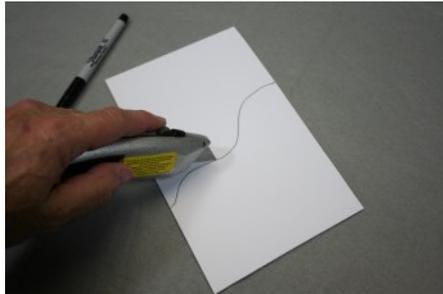
## INSTRUCTIONS

We are ready to get started building this Combat Fletcher hull kit. Follow the photos and captions to assemble your boat. Read through the instructions before building. Assemble the necessary tools and adhesives on a clean workbench or table. Keep paper towels handy to catch spills. Don't forget the safety glasses!

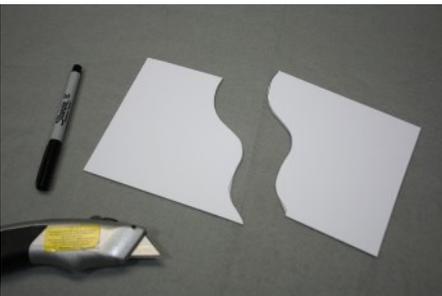
To build this kit you will need: A variable-speed drill. A hobby knife or box cutter, sharp scissors, medium CA glue or Gorilla brand super glue, Devcon 2-Ton Epoxy or hobby epoxy with a 30 minute or greater cure-time. 5 minute, 7 minute, or 15 minute epoxy is not waterproof and has too short of a working time to fold in filler and use with this model. Baby powder (100% Talc), micro-spheres or your preference as filler for epoxy. Drill bits 3/32", 1/8", 5/32" and 3/16". A #2 Phillips screwdriver and a roll of painter's masking tape. A step-drill bit is handy for making large holes safely. Following smaller drills with larger ones will work. A Dremel Rotary hobby grinder will be helpful to cut flats on the shaft ends.

Read ahead for each step. With hobby knives or box cutters, always cut in a direction away from nearby body parts. Practice harder installations, motor/drives for example, without glue first to be comfortable with what steps are needed to ensure a good fit.

When drilling styrene, drill at the **slowest setting**. The material is soft so little pressure is needed to drill into it. All surfaces that will be glued with epoxy or CA-super glue need to be sanded/scuffed with 100 grit sandpaper to help the surfaces have a strong bond.



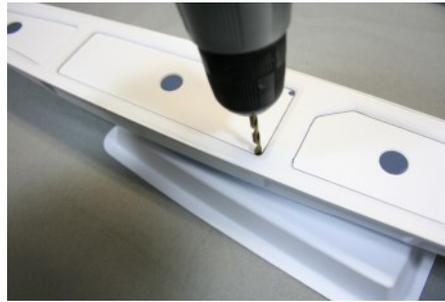
Styrene can be cut by scoring and breaking, or with scissors. The first score should be very light while concentrating on accuracy. The second and third score is made with more pressure and will follow the first.



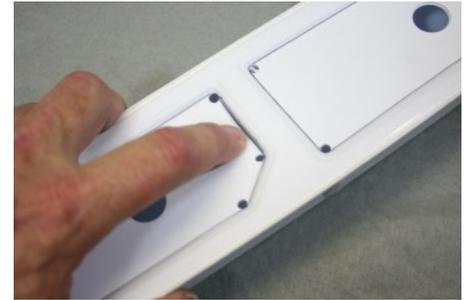
Bending at the score will break the plastic along the scored line. You can cut with scissors if you prefer. Either way, any rough edges can be smoothed out with the included 100 grit sand paper or sanding block.



The stand fits the hull as shown. The right end of the stand lines up with the rear of the bilge keels on either side of the hull. Outline the bottom of the sub-deck openings with a pencil. Use slight outward pressure on the pencil so it will follow the outline of the recess. The mark helps you see where to score the opening. 4



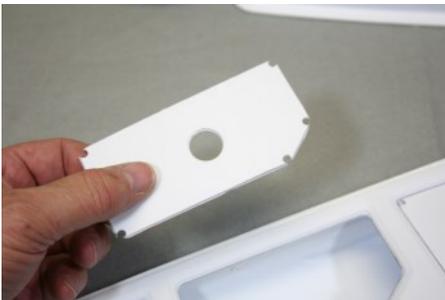
Use a 3/16" drill to round the corners by drilling next to the marked line at each corner. Do this for all 4 openings.



Score along an opening, lightly the first time and with a little more pressure the 2nd or 3rd time. If your knife falls through the slit, tilt it sideways to pull it free. Press on one end flexing the plastic until it separates.



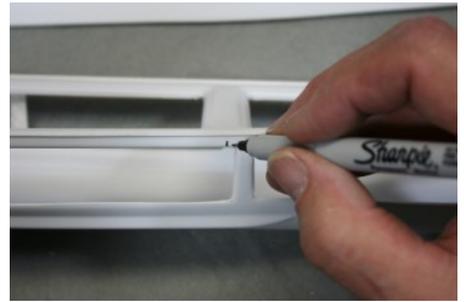
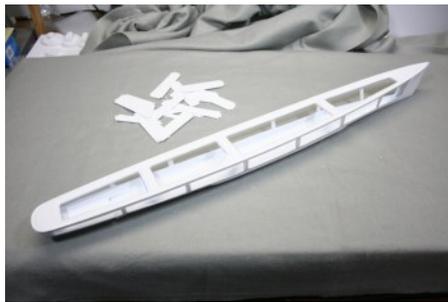
Continue to work the plastic with your finger until it breaks free. If it resists, then score the opening one more time with the knife and try again.



Save the scraps. Repeat for the other three deck openings. The side openings have three sides that are easy to mark. The bottom is located by using the side of a pencil to mark the change in the hull curve.



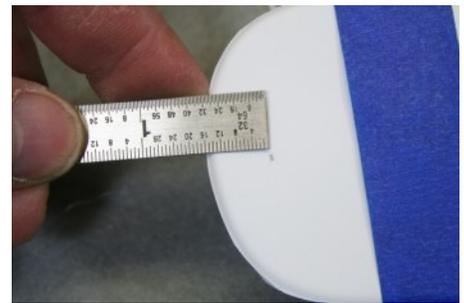
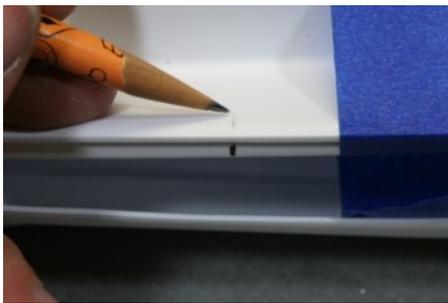
Make the bottom mark about 1/16" ABOVE the pencil line. Drill the four corners of each opening with a 3/16 inch drill. Score the four sides of an opening. It is thicker at the bottom line. Additional scores there.



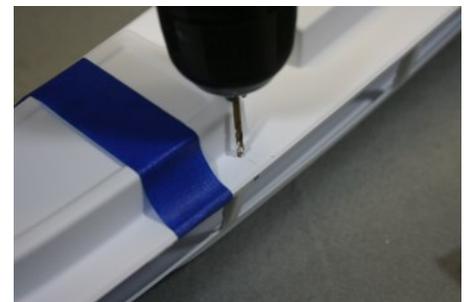
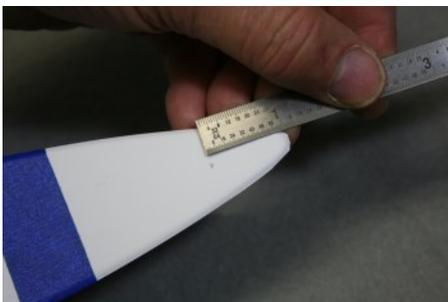
Push the side panel inward causing it to separate at the bottom and remove it. Repeat 13 more times. Mark the upper side of the hull at the center of the front two sub-deck cross-members to help locate the deck screw holes.



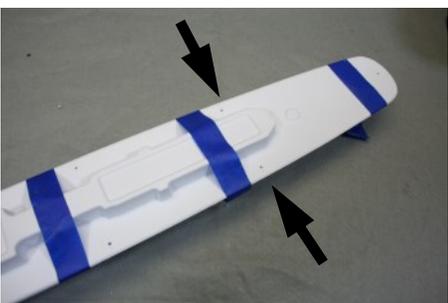
Set the deck on the sub-deck. Turn it upside-down. Look to see that it fits into the deck overhang evenly.



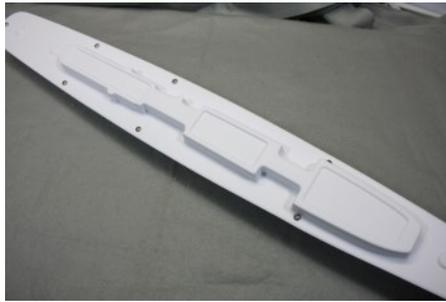
Tape the deck to the sub-deck/hull assembly. Set upright. Make a light line above each side cross-member mark. At the center of the stern (back end) make a dot 1/2 inch from the edge of the deck.



At the bow (front end) make a dot centered one-inch from the tip of the deck. On the sides, mark the dot 3/8 inch from the outer edge. Drill 3/32 holes through the deck & sub-deck at each dot. (Six holes.)\*\*



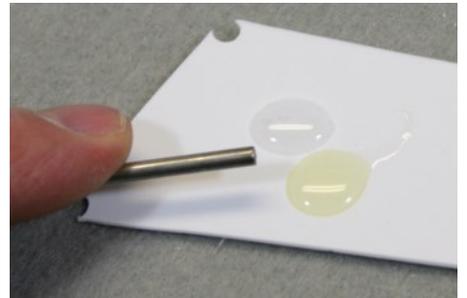
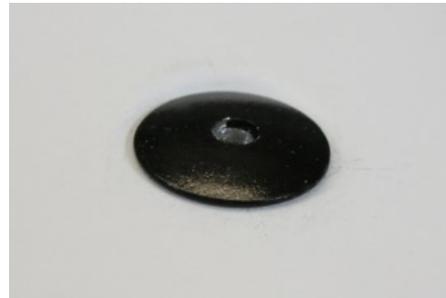
**\*\*You can omit screws at the rear-most crossmember without affecting the appearance of the kit. Remove the deck. Drill through the center of the deck holes with a larger 5/32-inch drill.**



Insert the #6 x 3/8 inch Phillips pan head screws. Keep them straight as they thread into the sub-deck until just snug. Don't over tighten. Next time, start them by hand and tighten with screwdriver. Use a 3/16 inch drill to drill into the center of the rudder inset at the stern of the hull. Wallow out the hole a little so the rudder base will fit.



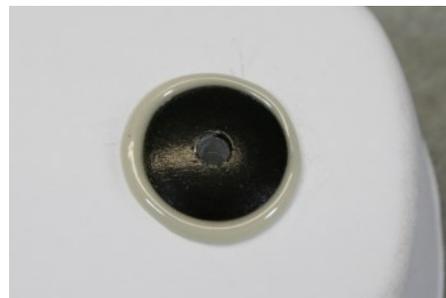
Remove the deck. Test fit the rudder mount. It should drop in and sit flush. If it binds, enlarge the hole a little with the 3/16 inch drill. Sand the underside and stem of the aluminum mount and the inside of the recess.



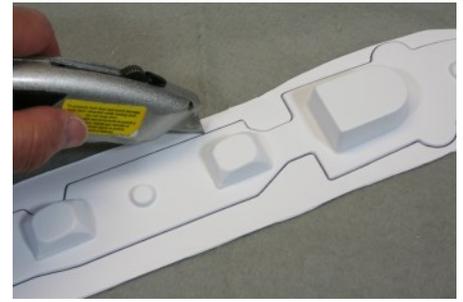
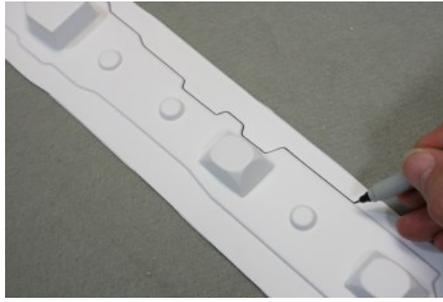
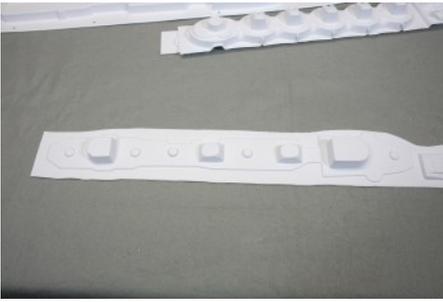
Inside the hull, sand the top of the rudder mount recess. Test fit the rudder mount again. Mix epoxy together.



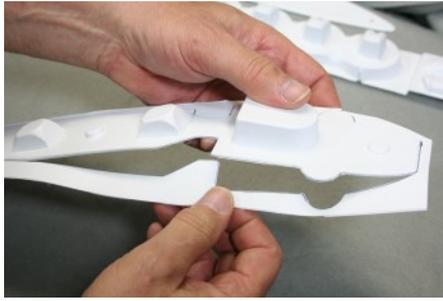
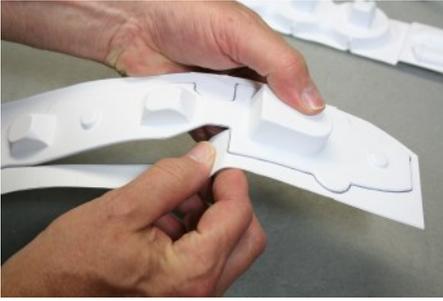
Fold in the same volume of filler until smooth. Rub a little into the sanded area of the rudder recess.



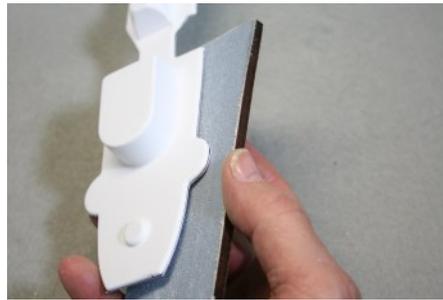
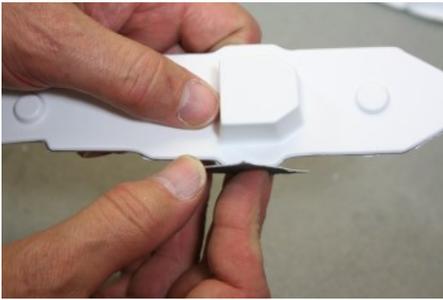
Spread epoxy on the rudder mount. Press into the hull. It should look like this. Less epoxy is OK. Set the hull aside for the epoxy to cure. Lay out the deck and deck accessories as shown.



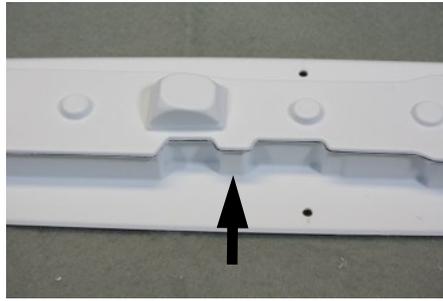
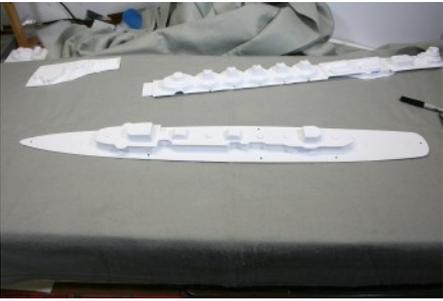
The upper deck sits on top of the deck. It has a raised outline. Mark the bottom of the outline with a pencil and use your knife to lightly score the outline. Repeat scoring until the edges will break away.



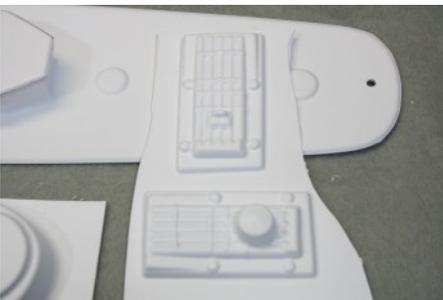
Careful not to tear the upper deck at corners. The rough edges can be trimmed with a hobby knife or scissors.



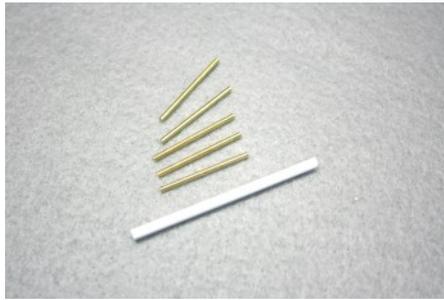
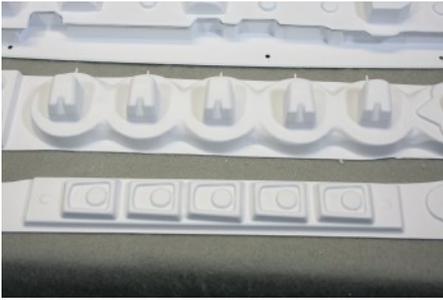
Use sandpaper to smooth the edges. Use the sanding block to sand the underside so the curved overhang of the upper deck is even when viewed from the side.



Center the upper deck on the deck. **The front-to-rear reference point is this side roof over a doorway.** Left-to-right in the photo, center the upper deck to that opening. (arrow) You will use this again on page 22.



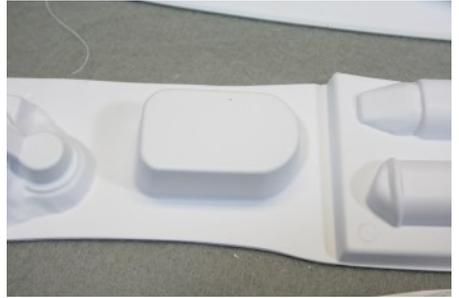
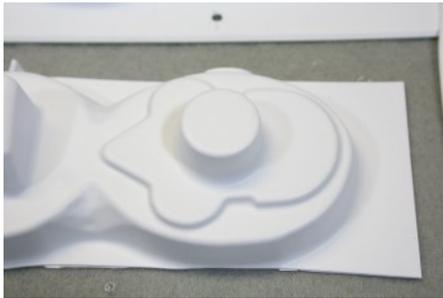
Identify the deck accessories. These are torpedo launchers. The one with the round dome on top goes behind the one without a dome. They are located on either side of the rear Stack.



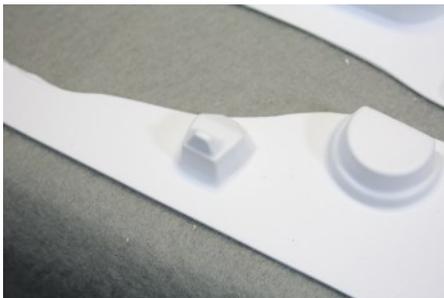
5-Inch guns and their bases go together with the 2-piece barrels to make five guns for the deck.



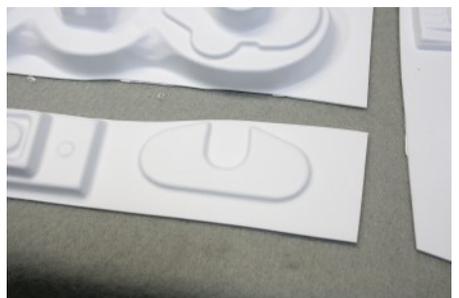
The bridge assembly starts with the bridge, formed upside-down where the pilot house crew can walk outside.



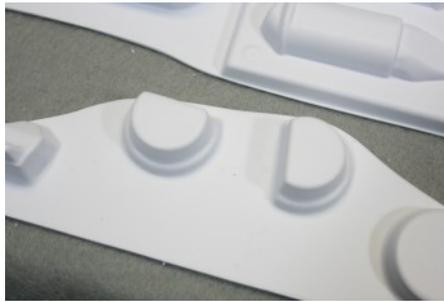
The pilot house roof supports the mast and gun director. The pilot house is also formed upside-down.



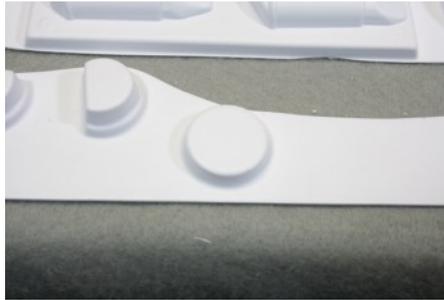
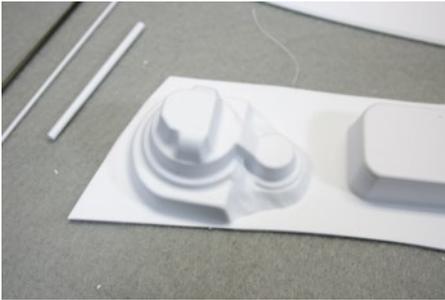
These parts stack together on top of the upper deck. This small bump is the gun director that sits on top of the pilot house roof. There are more tiny details that aren't included in this kit. Add more bits after you are done.



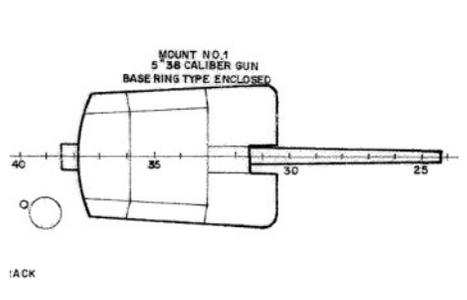
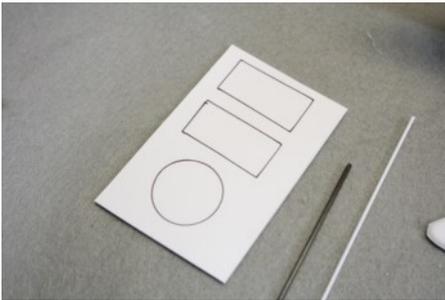
The stacks are formed in halves. They glue together and sit on the angled bases on the 2nd deck. The rear-most stack has a wing that mounts searchlights.



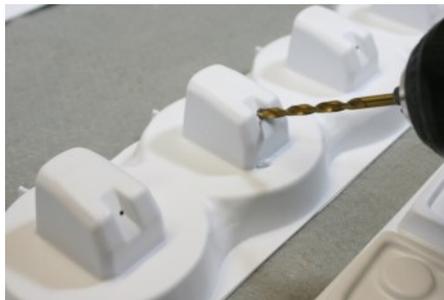
These half-round items are anti-aircraft gun placements near the Bow.



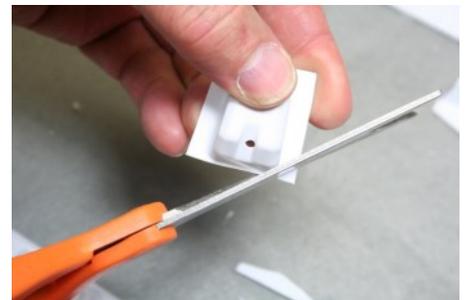
Early Fletchers had an AA gun nount with a rangefinder mount next to it. Later versions had just the gun mount.



The circle forms the floor of the early AA gun mount. The rectangles are bases for mounting the torpedo launchers. The slot in the 5-Inch guns is off-center with the barrel mounted centered on the right of the slot.



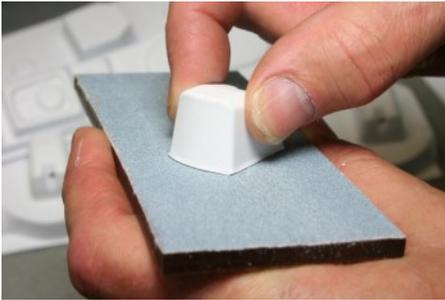
Before separating the 5-inch gun tops, choose the angle of your gun barrels. Put a dot on each cannon where you plan to drill. Hold the drill at the same angle for each cannon. Slowly drill a 1/8-inch hole in each cannon.



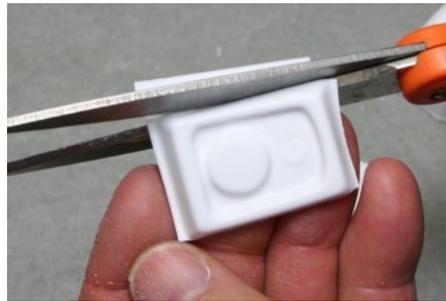
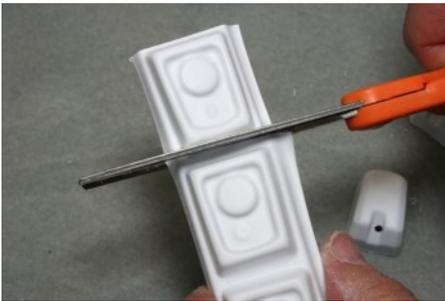
Gradually trim the plastic closer to the sides of a cannon. For your final cuts, **lay the top blade of the scissors flat against the side you are trimming**. Don't forget the 45 degree corner cuts on the front.



Laying the upper blade flat against the side of the cannon, trim each side until it looks like this.



Sand on the sanding block. **Rotate it frequently to keep the base of the gun square and even on all sides.** Sand just until the rounded bottom is gone as shown on the right photo, “after” on left and “before” on right.



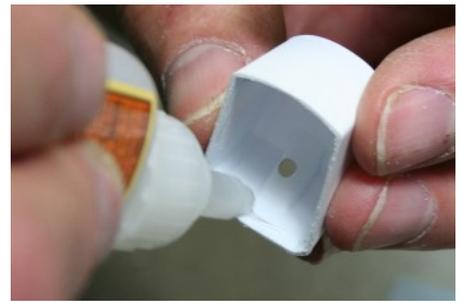
Cut a gun base from the strip. Trim it a little at a time to remove edge scrap. **Turn it over** and trim as shown.



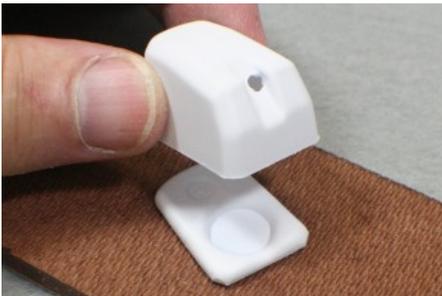
Now trimmed just outside of the raised rounded area, mark the outer edge of that raised area with a pencil. Trim to the mark with scissors.



Cut the tiny 45 degree front angles and carefully trim the rounded back area. Sand the sides to make them even with the bottom of the round edge. Here are two halves of a gun ready to be glued together.



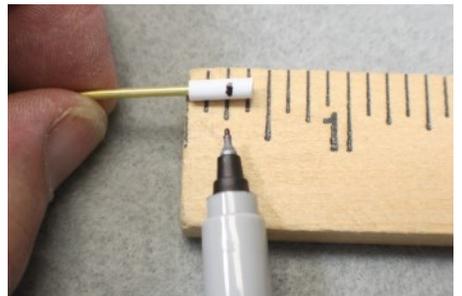
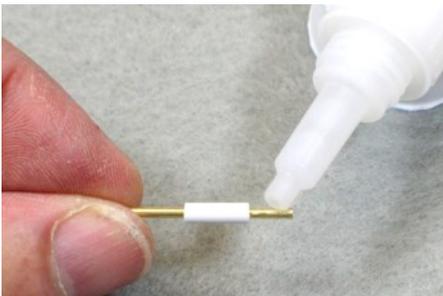
Lightly sand inside the bottom of the gun shell. Apply super glue around inside the shell and spread evenly.



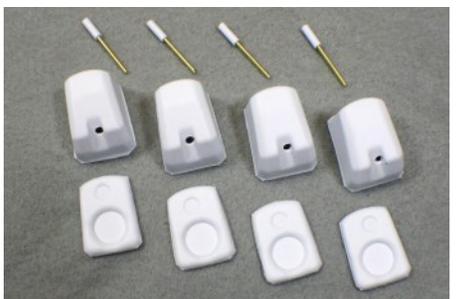
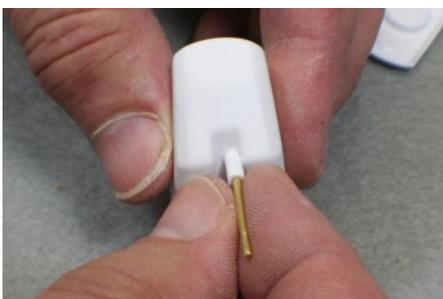
Set the base on a flat scrap surface. Align the gun and press down to engage the base and hold for 10 seconds.



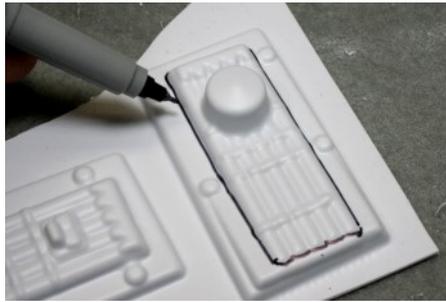
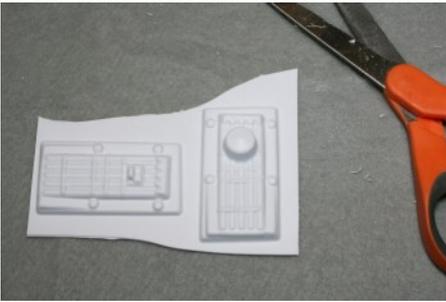
It should look like this. Cut a 3/8-inch piece of 1/8-inch plastic tubing. Scuff 1/4" of the end of a brass barrel.



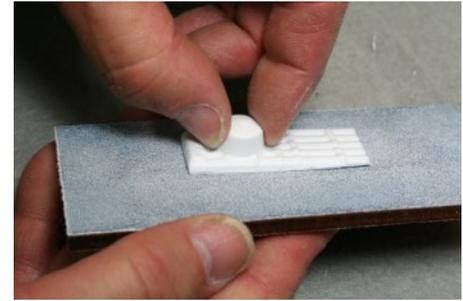
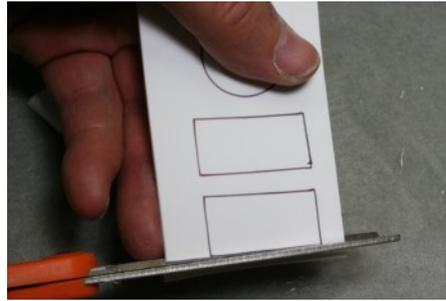
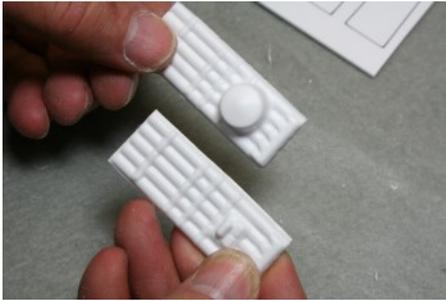
Insert the sanded end of the rod through the tube. Apply a little CA (super glue) around the end, then push the tube down over the CA covered rod against a flat surface. Mark the tube end of the barrel 1/8-inch from the end.



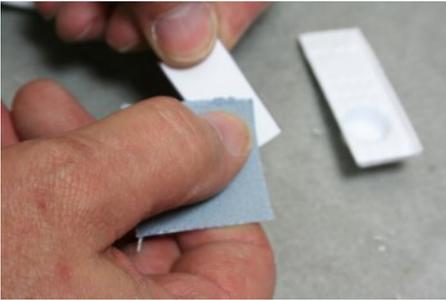
Put a little CA around the 1/8-inch area and insert into the hole of the gun. Repeat for the other 4 guns. Don't attach them to your ship yet. One is a spare as your BB Cannon may be in the #2 or #4 Gun location. If the rudder mount epoxy has cured, you can add more epoxy inside the hull around the stems to reinforce them. 12



Locate the torpedo launchers. Outline the launcher with a pencil. Cut out the launcher along the line.



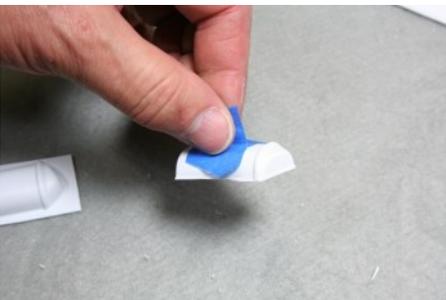
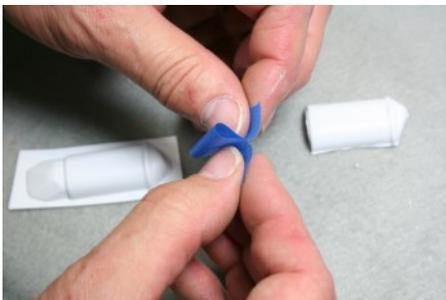
Sand the edges straight. Cut out the two plastic rectangles. Sand smooth the bottom of the trimmed edges.



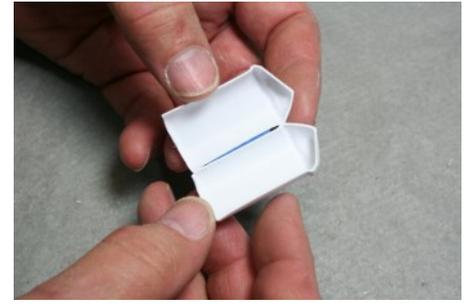
Sand one side of a rectangle. Sand the underside of the launcher. Apply CA to the raised areas under the launcher.



Press the sanded side of the rectangle to the underside of the launcher. This forms a flat base for mounting it.  
Locate the 4 Stack halves and the searchlight wing. Trim the edges of two stack halves as shown.



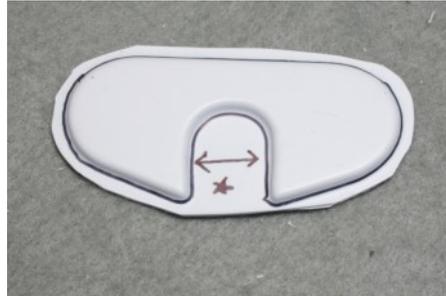
Make a handle from a piece of masking tape. Lightly sand the stack half against the sanding board to remove the slight curve along the cut line, just like you did with the cannon tops. Rotate it while sanding to be even.



Sanded pair of stack halves “before” & “after”. Once done, hold together and tape one edge to make a hinge.



Apply a thin layer of CA around the edge of one of the halves. Fold together and align. The CA will let you reposition the halves until you have them aligned. Hold for 10 seconds. Secure with a 2nd piece of tape.



Put a piece of foam for flotation inside the stack. Add filled epoxy to hold the foam and strengthen the inside of the seams. Mark the outline of the searchlight mounting wing and trim the outside with scissors. Don't fully trim the inside area (double arrow). Leave room to sand and fit to the width of your finished stack.

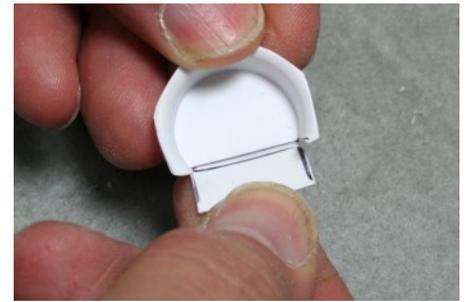


Score the inside **narrower than the marked lines**. Break out the inside piece and sand the edges of the wing smooth. **Don't sand the inside slot yet**. Sand the bottom of the wing smooth and level with the sanding block.

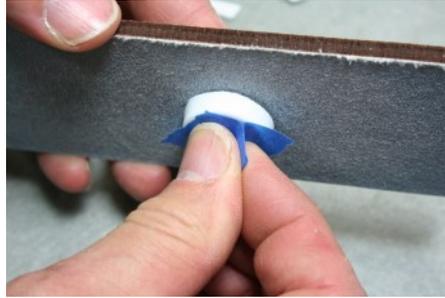


The width of a stack will vary according to how much you sanded away. The slot in the wing should not be too large at this point. Install it on the stack **LATER**. Locate the anti-aircraft gun placements for the bow.

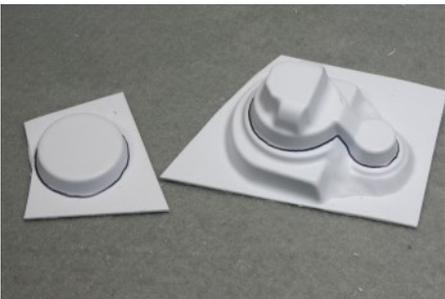
Mark them as shown for trimming.



Trim the outside with scissors. Use a knife to score the inside opening. Break open along the score lines.



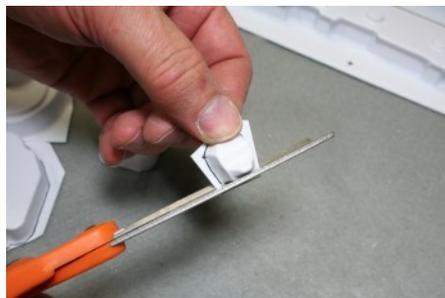
Cut around the outside along the line. Make a "tape handle" and sand the top and side opening smooth and straight. Scuff the bottom of the gun placements and the corresponding round areas of the upper deck and glue with CA.



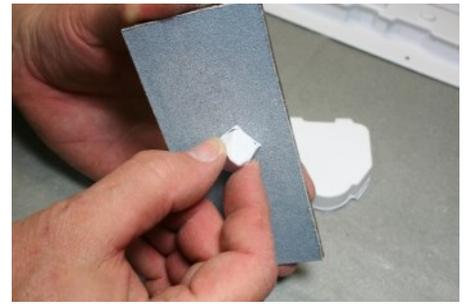
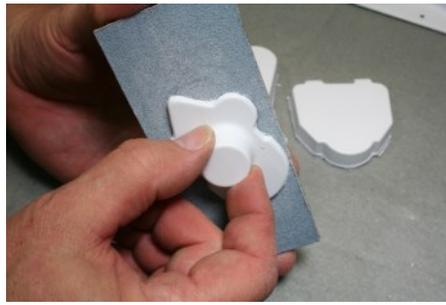
Choose the later version on left or the earlier version on the right and trim the rear anti-aircraft gun placement. Attach a "tape handle" and sand the top smooth and even.



Use your hobby knife or box cutter to remove any plastic bits around the inside of the placement. After scuffing the surfaces, glue to the top of the rear-most structure of the upper deck. Gather the bridge pieces as shown.



Mark them for trimming. This bridge piece is marked on the inside, to remove the round area. Cut away the edges with scissors. A knife is best to score the roof of the bridge.



Even the edges. Sand the bottom of the bridge roof. Sand the gun director. Rotate it frequently to sand evenly.



Sand just until the rounded edge is gone. Same for the pilot house and the Bridge.



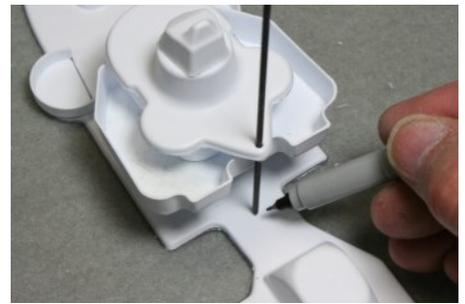
Lightly dragging the blade sideways will remove rough edges left from sanding. Score the inside marks at the bridge. The finished parts should look like this. **LOOK CLOSE** at the cutout detail of the Bridge to match it. **IMPORTANT - IF INSTALLING A BOW CANNON, DO NOT GLUE ON THE PILOT ROOF YET.**



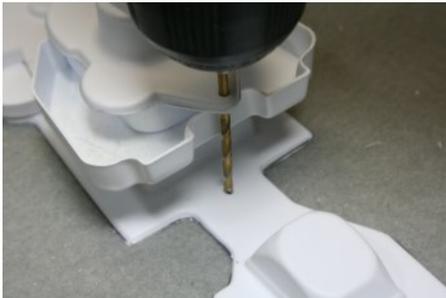
Set the pilot house into the bridge as shown. Center, scuff mating surfaces and glue in place. Sand around the underside of the pilot roof. Apply CA to the top edge of the pilot house. Center, press & hold the roof for 12 seconds. Center the triangular part between the rectangular vent extensions.



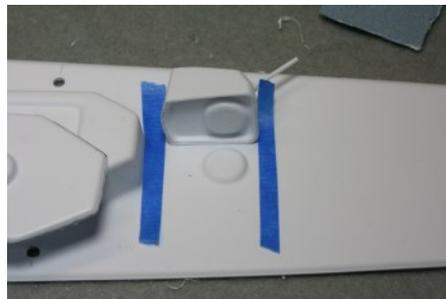
From the side, the bridge railing looks a little high. I should have sanded it a little more. Scuff, center and CA glue the gun director as shown. The bridge is now ready to glue to the upper deck. **16**



The bridge mounts to this upper deck structure with the rounded fronts even and the rear square to the corners of the upper deck below it. Scuff, apply CA to one surface, press and hold. A mast can be installed for flags or a float to mark where the ship sunk. **Do not install one if you are planning on using a bow cannon.**



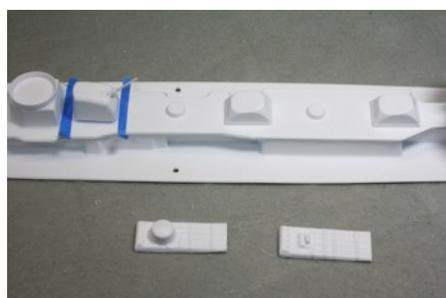
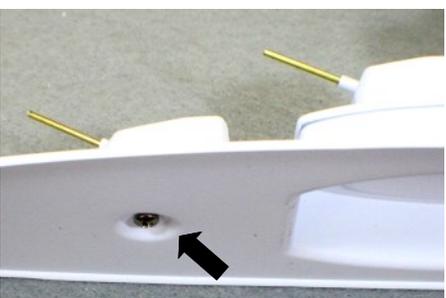
Drill through the roof hole to the upper deck. Tape over underside of hole. Insert the mast. Apply CA to the mast bottom and where it passes through the roof & seat the mast to cure. While you are waiting, grab the sub-deck/hull assembly and put some epoxy with filler around the rudder bracket as shown. Use a paper clip to reach around it.



#1 Cannon. Use tape strips to mark alignment of the round mounting surfaces. Line up gun with cabin behind it.



Scuff. Apply CA to gun. Press & hold 12 seconds. **IMPORTANT - IF INSTALLING A BOW CANNON OR A STERN CANNON, DO NOT ATTACH THE #2 OR #5 GUNS YET.**



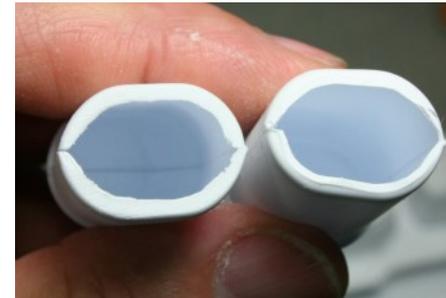
After CA cures, drill 5/64" hole through deck into gun base. Insert #4 x 1/4" screw to help hold gun in place when hit by enemy bb's to avoid embarrassing gun loss in battle. Locate the torpedo launchers. Oriented like this, the bow is on the right. Center the front launcher between the stack bases, centered left and right. 17



Turn over the launcher. Sand the round mount point plus the bottom of the launcher that will contact it. Apply CA to the round mount. Center & press the first torpedo launcher 20 seconds. Repeat for the 2nd Torpedo Launcher.



Get the cured stacks and the searchlight mount. Sand off the rounded edges of the bottom of the Stacks.



Lightly sand, rotating the stack often so it will remain square. Sanded “after” & “before”. **Don't forget to insert a piece of foam into each stack before gluing to help them float when shot off of your ship.** Install the stacks, Scuff the base, apply CA to the stack, center, press & hold. **Note the top angle.** Orient them as shown.



The searchlight mount will attach on the rear-most stack parallel to the deck as shown. Use sandpaper to round and widen the inside of the mount until it fits snug and even without being spread/warped by the stack.



Install it about 1/2 way between the top and bottom of the straight portion of the stack. The upper deck is substantially complete. Whether or not you glue on the 2nd deck now depends on the cannon you plan to install. **18**

**The included servo may be factory water resistant. If not, before installing the Servo, it can be made water-resistant:** Clean off any oil or dirt on the servo case. Scuff the servo case with sandpaper. Paint over the case seams and case screws with two coats of a conformal coating, dope or some nail polish. Put a dab of filled epoxy where the wire comes out of the servo. After the motor installation, squirt some stern tube grease around the output shaft under the servo arm. The Motor/Servo Mount will accommodate the Traxxas 2065 waterproof mini servo.



Once water gets into most servos, they will die. If yours starts to show symptoms or erratic behavior, unplug it immediately and plan to open it up and dry the interior at the end of the day. You may be able to salvage it.



Prop templates can help you align the prop shafts to the hull and rudders in a scratch-built drive system. Glue to flat plastic scrap. Drill 1/8 hole at center & sand to the outer ring. Mount at the center of the threaded part of the shafts temporarily while gluing the motors and stern tubes in place. The inner ring is the prop's 1-inch diameter.

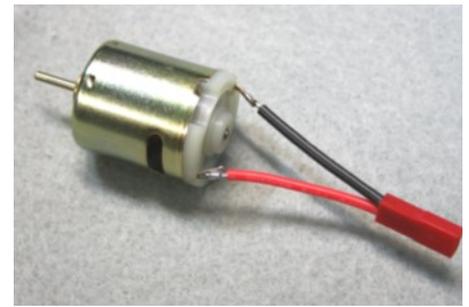
The space between the rings is the clearance you want between the prop and the hull.

With this kit, the motor/servo mount will align the prop shafts pretty well without using templates. You can just install the two props and use them to make sure you have things aligned and proper spacing between the props and the hull. Set the motors on the motor mount as shown.

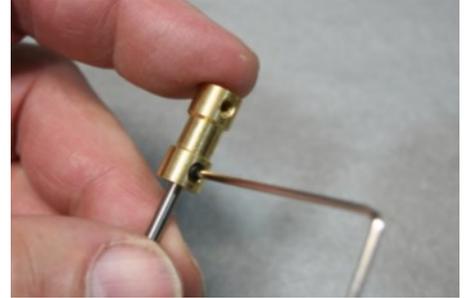
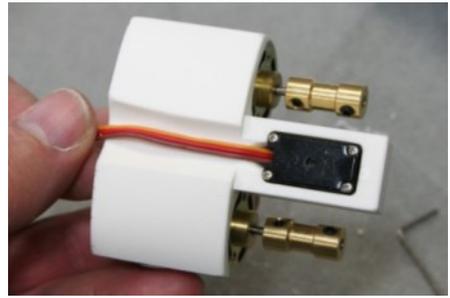
This is one of the smallest classes of ships. The motors only draw an amp or two in normal use. Heavy wires and 100 amp speed controls are not necessary. Weight is a serious factor to properly ballasting the ship. Consider small inexpensive 10 amp Electronic Speed Controls that use red JST connectors. 20AWG wire is better. 22AWG wire is OK. Less breakage with thicker wire. Buy only JST connector pairs that have silicone insulation and you will have less breakage near solder joints. Wire both motors the same, red to + and black to -. The ship has counter-rotating props. One of the motors will run reversed. Make reverse "Y" connector at your ESC where the polarity of one motor connector is normal and the other is reversed. This way you only need one wired spare motor to serve either side of the drive because the ESC's plugs determine which one is running in reverse.



Now is a good time to solder a wiring harness to your motors while they are out of the hull. Next to each brass tab, there is an embossed + and - to indicate the positive pole and negative pole of the motor. Shorten the female JST connector to about 2-1/2 inches. Strip the insulation at the ends. "Tin" the wires by applying solder to them, even if they are "Pre-tinned" silver.



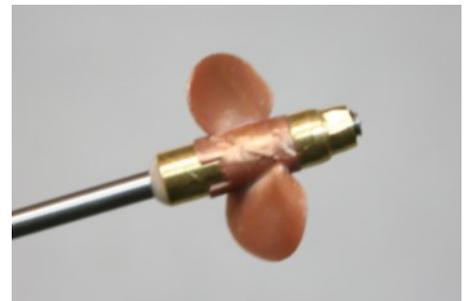
Tin the motor tabs. Connect them by holding the tinned wire to the tinned tab and apply heat to melt them together.



Install the motor clamp and screw. Tighten only until snug. Install the servo with the wire running toward the stern of the ship as shown. Drill 1/16" holes at the dimples in the mount and attach with the two screws included with the servo. Insert shafts fully into motor coupling & **lightly** tighten one set screw.



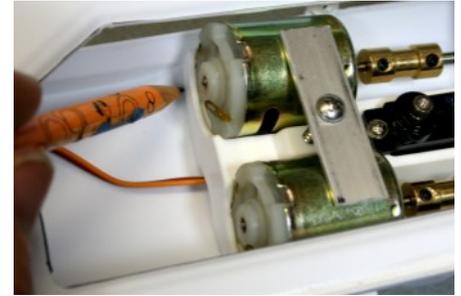
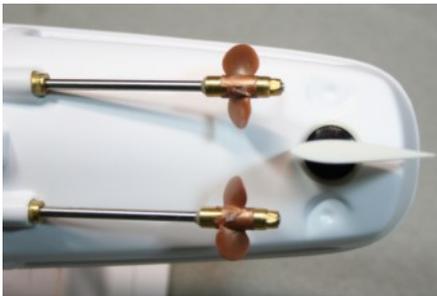
Push the couplings onto the motor shaft. Install and tighten the motor-side set screws. Remove the shaft set screws. Mark the coupling holes on the shaft with a fine tip felt pen to locate where you will grind flats on the shafts. Flats prevent the set screws damaging the shafts which would make them harder to remove for maintenance or repair. Use a Dremel hobby grinder tool to grind 2 flats on each shaft where the shaft was marked. Scrape off any burrs along the edge of the ground area with a hobby knife to prevent binding in the coupling. Do not attach shafts to the coupling yet.



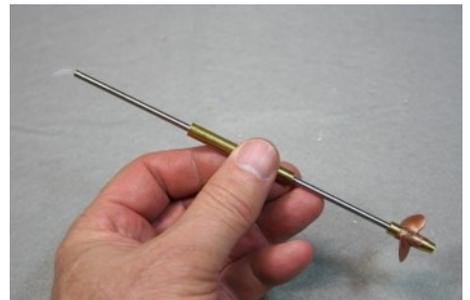
As viewed from the stern, the right prop turns clockwise and the left prop turns counter-clockwise. With threaded drive dogs and prop nuts, they can unscrew when a shaft is turning clockwise. To prevent this, add some thread locker or some epoxy to the front 1/4-inch of threads as you screw on the drive dog. Do not put thread locker on the prop or prop nut. If the drive dog can't rotate, then the prop won't rotate either. Screw on the drive dog to the end of the threads. Push or screw on the prop until it contacts the drive dog with the slots lined up with the tabs on the drive dog. Screw on the prop nuts. They will seat the props into the drive dogs. Tighten until snug. **20**



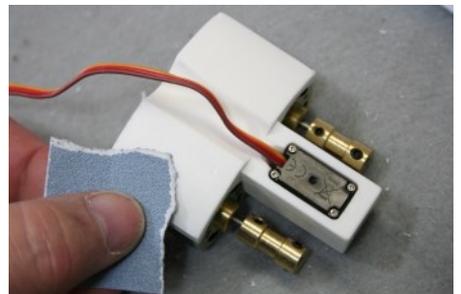
To avoid binding or excessive friction in the drive shaft, the brass stern tubes should fit fully into their hull journals (angled depressions in the hull). The hull is pre-drilled for the stern tubes, but the openings will need some adjustment if the stern tubes are up on the end when inserted like this. Once the top of the hull opening is trimmed, the stern tube will lay down into the journal.



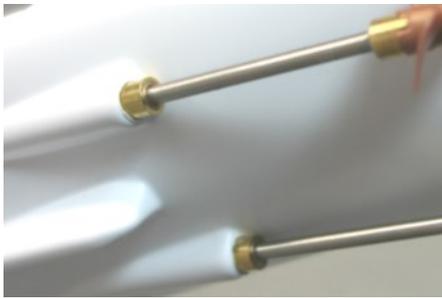
You want the shaft ends approximately equal to the front of the rudders leading edges. Set the hull on the stand. Insert the motor assembly. Connect the shafts to the couplings but don't fully tighten the set screws yet. While holding the motor assembly in place, align the end of the prop shafts to the leading edge of the rudder and check for clearance between the blades and the hull. Inside the hull, mark the position of the motor mount on the hull with a pencil at the front and rear of the mount. This marks the area you need to sand and once epoxy is applied, returning the mount to these marks will assure that the props are in the same correct position.



Scuff the outside of the stern tubes to help them bond to epoxy. Inject grease into both stern tubes. With the sanded stern tube end pointed toward the propeller, insert a shaft into each to the shaft center. Clean off any excess grease.



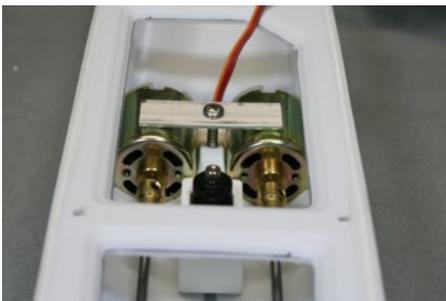
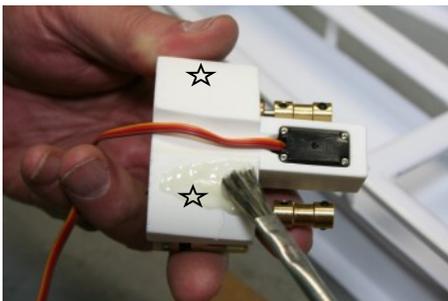
Sand the slots for the stern tubes and re-install the shafts & tubes. Sand the underside of the motor mount. Do not sand the servo or the servo area of the mount.



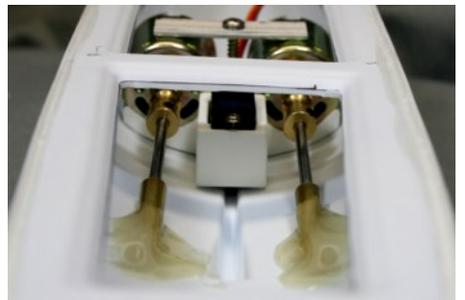
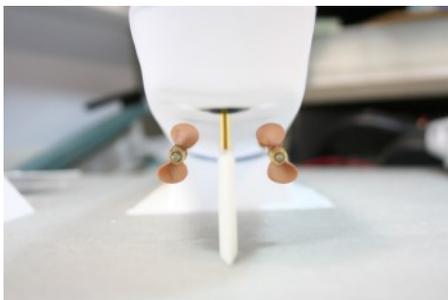
The final location for the stern tubes is with only about 1/8-inch or less protruding from the hull journals. Keep the epoxy off of the shafts. Mix two 1-1/4" puddles of epoxy and add filler.



While holding up the inside shaft end, use a rod or narrow brush to force epoxy under the stern tube into the hull shaft journal. Rotate the tube to distribute the epoxy. Clean any grease off of your fingers to avoid contamination.



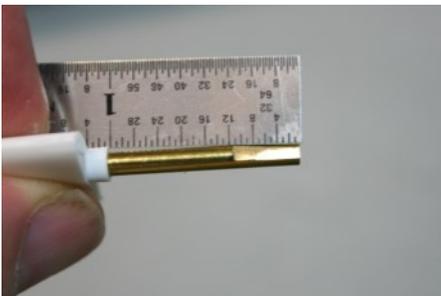
Brush filled epoxy on the underside of the motor mount. **None near the wire tunnel to avoid blocking.** None on servo. Set the motor assembly into the hull at the hull marks. Hold in place. Attach shafts aligning the flats with the coupling set screw holes. With the boat on the stand, insert the rudder in the rudder mount for reference.



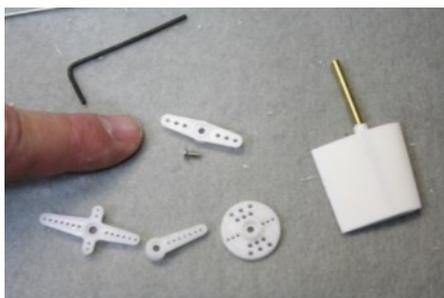
With the rudder shaft lined up with the keel (hull ridge between the two shaft journals), visually center the two props. Slide the motor assembly left or right to center them. Check the prop blade clearance to the hull. Check the position of the stern tubes. Check the appearance of the motor assembly. Note the servo is centered to the keel groove in the floor.



This is the electronics tray. It fits into the 2nd bay from the bow. You may not need all of it. It helps you lay out your electronics. Best to attach it later to the ballast or hull with pieces of hook & loop for easy removal for drying or working on the electronics once you have designed the layout and location of the internal parts. It holds the receiver, switches, ESC, firing boards or other components. Get the remaining parts from the rudder package and servo packet including the stainless steel pushrod.



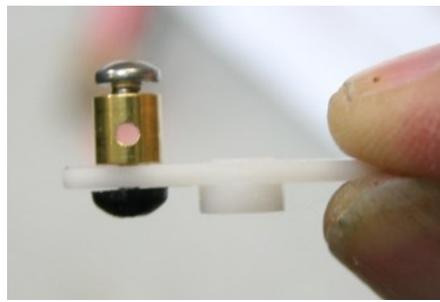
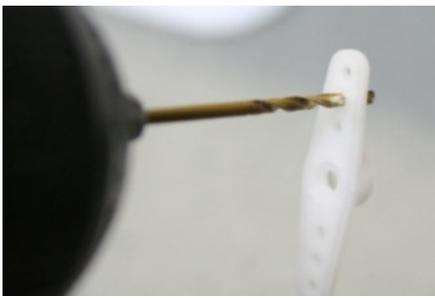
Grind a 3/8-inch flat on the leading edge of the rudder shaft facing forward. Sanding off the sharp corners of the end of the shaft will make it easier to insert into the rudder arm. Put a little grease on the shaft near the rudder blade.



Pick this arm. Don't forget the screw that secures it. Center the servo with your transmitter & receiver. If the arm isn't square, flip it around and it may fit better because the post it sets on has an odd number of teeth. See below:



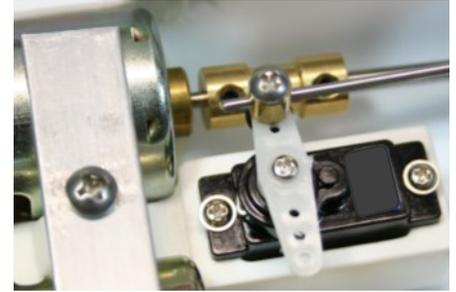
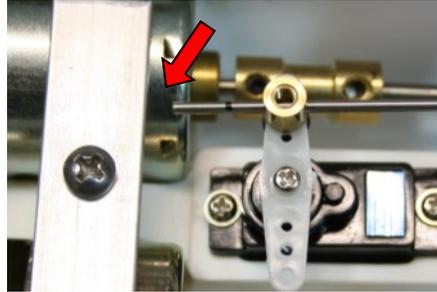
Before attaching the servo arm to the servo, we need to "Center" the servo. This can be done with a servo tester or by connecting it to your radio system and powering it up. Connect the servo lead to the #1 channel of your receiver. Turn on your transmitter. If you are using an ESC with "Battery Eliminator Circuitry" (BEC), the ESC supplies power to the receiver when you attach the battery to the ESC. (No need for a separate battery for the receiver.) Connect the ESC to the receiver and battery. Turn on the Transmitter, then turn on the receiver. (You may need to consult your radio system's manual or ask for help from your fellow captains.) With the system on and working, center the radio's steering stick and center any adjustment wheels or switches to center. This centers the servo. Attach the arm. If it is a little angled, then turn it around and it may fit straighter. Press in place and install the small screw from the servo accessory packet to the center hole of the servo arm.



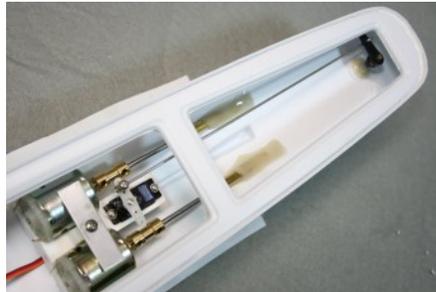
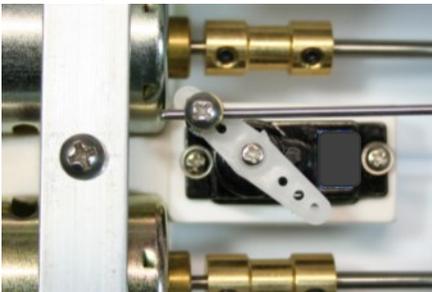
Insert from under middle hole.



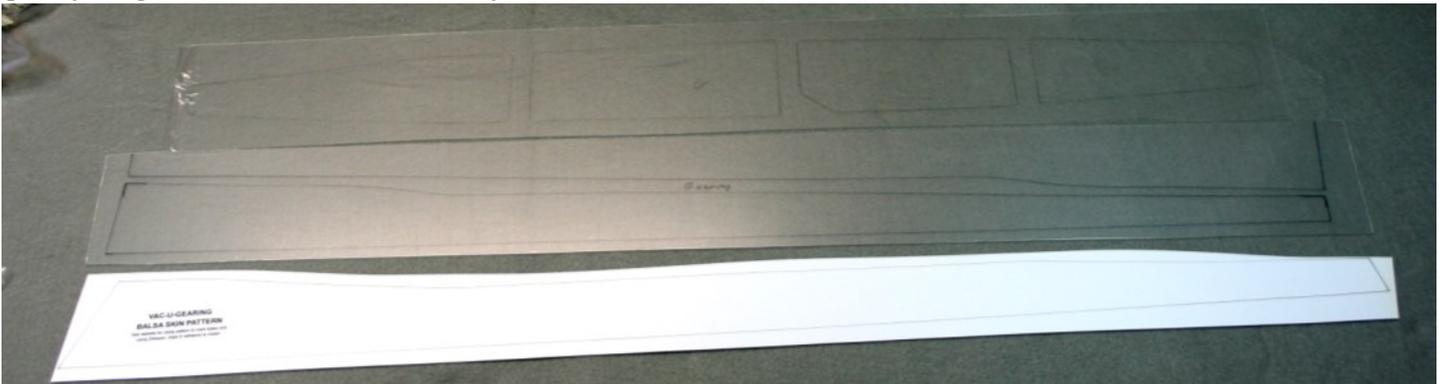
Drill the middle holes on each end of the arm with a 1/16-inch drill. Insert an ez-connector into the hole. If it is a tight fit, then remove the ez-connector and drill again to enlarge the hole a little. With the plastic keeper snapped in place, they should rotate easily, but not be loose. Insert the pushrod and set screw into the rudder arm as shown.



Insert the rudder shaft through the mount and rudder arm. Leave a little up and down play in the rudder to prevent binding. Tighten the rudder arm screw against the flat of the rudder shaft until snug. With the servo centered, insert the rudder pushrod into the servo arm ez-connector as shown. Hold rudder straight and check the end of the pushrod. You may need to shorten the pushrod to prevent it striking the motor clamp. This one is marked for cutting.



Connect your radio gear and turn on your transmitter and receiver. Turn your rudder left and right. Make sure the pushrod does not contact the motor clamp at extreme left or right rudder. The pushrod is a hard material. Cut with quality diagonal cutters or with a hobby tool cut-off wheel. You are almost finished with the Vac-U-Fletcher kit!



Cut out the white balsa skin pattern. Use it to mark your 4-inch x 36-inch piece of balsa to make the two penetrable hull skins. Cut out the four hatch covers then peel off the protective plastic from both sides. It is applied using the 1/2-inch clear tape. They may not be symmetrical so flip them over if they do not fit well. Cut out the two pieces of armor but do not peel off the protective plastic. The protective plastic may help the armor resist bb impacts. Round off the corners of the narrow end to help their installation. Once all of your hardware and electronics are installed, insert the narrow end from the bow with the straight edge facing up, along outside of the electronics tray and motor mount to the stern of the ship until it extends to the side of the rudder arms.

Curl the large end into an S shape to fit through the front hatch and into the bow. Secure with tape if necessary<sup>24</sup>

**It is time to make decisions about your electrical components.** Will you use large waterproofed ESCs with their big wires and plugs, or smaller ones used in small toys like 1:18 scale cars? Will you use high-amperage connectors or smaller ones rated for what this model uses? Or, will you just solder everything together, eliminating the plugs with their weight, but making it harder to service the boat in the field during a battle. You have to think SMALL. What good is a 50 amp ESC to a boat with motors that draw only 1 amp? Wiring the bilge pump and each motor with their own wire-leads & plugs will make servicing/replacing them between battles much easier and is probably a good idea. Removing bulky plastic cases can save space. Velcro will hold receivers, ESCs, and switches in place for easy removal. Small, inexpensive ESCs made for brushed motors can be waterproofed. They should be Forward-Reverse ESCs. Avoid any that advertise “With Brake” as they require extra stick action to engage reverse that you don’t want. You will have to use 12g or 16g CO2 cartridges to fire your cannons. Our lightweight cannon design has tested at a solid 120 shots at 150psi on a single 16g cartridge using a beverage-industry CO2 regulator. This means 2 battles per cartridge! As the first of these hulls are built, we will post examples of equipment setups and sources to help get you started.

In RC Warship Combat, a Destroyer is normally an “**Advanced Build**”. This is because the ship is small and does not displace as much water as the larger ships. This limits the amount of stuff you can put into the hull and still have it float properly. Many components made for general RC Warship builds just won’t fit into a destroyer’s hull. You must think about the weight of everything you put in this ship, and where to put it that the ship remains relatively-balanced. You want heavy things in the bottom to help ballast the ship to hold it upright. You want everything to weigh less than what it takes to have the ship sit at its normal water-line. The best outcome is that you have to add ballast weight to finish the build. The bottom of the ship must be heavier than the top so it will stay upright and run well. The vacuum-formed parts make this easier to accomplish. Recent product advances by suppliers of RC Warship Combat parts has helped. If you are new to this, then seek the experience and advice of groups and clubs experienced with RC Warship construction. If you are a seasoned veteran of RC Warship construction, know that you have to bend some established rules of construction to accommodate the size and weight limitations of this “Tin Can”.

**Painting Tips:** It will take 2 to 3 coats of most hobby paints to give a good even color. Never try to get full coverage with the first coat. It will run every time! You should be able to see through the first coat. **The best tip about any kind of spray paint is to let the paint “flash” between coats.** A coat of paint has “flashed” when it is dry to the touch. Don’t touch the boat. Touch the masking paper or somewhere where a fingerprint won’t show in case you touched it too soon. Hobby enamel or Krylon Fusion paint will take 5 to 15 minutes to flash depending on the temperature. Different colors can take different times to flash. A coat that has flashed properly will support the next coat and prevent it from dripping. The second coat will take longer to flash than the first. Be patient! Practice on a scrap wood on it’s end. Your goal is to get coverage without runs. Avoid spraying enamel on very humid days. Humidity can cause the paint to “blush” leaving a cloudy appearance to dark colors. “Non-toxic” model paints are safest to brush on, for the painter and the boat. “Primer” colors like grey or red can make good hull paints.

**Painting The Hull:** Styrene is best painted with Acrylics, Hobby Enamels, Krylon “Short Cuts”, or Krylon “Fusion” paint or Rust-Oleum 2X paint that is safe for plastic. Sanding is not necessary as these paints chemically bond with the hull plastic. They will not peel from the surface, even when scraped by rocks or other sharp objects. Lacquers and regular enamels, like regular “Krylon” paints will melt or weaken the styrene in thin areas or when applied wet-on-wet. Use them at your own risk! Test your paints on the leftover hull scraps. Remember that all surfaces have 5 sides to paint. Paint each side separately. See “Painting Tips” on the website.

**MAINTENANCE: After a day of battling,** remove all hatch covers. Drain all water from the hull. Rinse with clean water if necessary. Remove everything except the glued-in ballast, armor, cannon, drive system and rudders. Unplug all connectors. Use compressed air (best) or canned air to blow water out of cannon & hoses, drive motors, the bilge pump, the electronics, and out of all plugs, male and female. Don’t blow the top of the servos where waterproofing grease is located. Lay-in the top of the armor at the bow and middle to help air get to the balsa skin. Set the ship and all of the pieces in front of a fan for several hours. Lube motor and shaft bearings with a tiny droplet of oil. Wipe off any excess as oil which can damage plastic. The stern tube grease will only need to be changed if water leaks in along the shafts. It should last for years without changing.