SNOWATER MANUAL

Introduction

This manual is intended to provide guidance on the SnoWater kit construction and descriptive information on variations and use. In addition to the kit version described herein, a complete turnkey assembly with brushless motor and electronics is available and a "short kit" is also available (user supplies standard carbon fiber tubes, hardware, sheeting, and rudder material available from any good RC hobby shop). See the Appendices for supplemental information and variations.

The **SnoWater** is an airboat that can be adapted for use on packed snow, ice, and water.

Simplicity in design and construction make this the ideal solution to year-round fun in any climatic conditions. The principle design focus was on development of a durable platform that can be user-modified and adapted for multiple uses.

The structural design and use of hobby-grade materials results in a streamlined frame suitable to run on both water and snow/ice surfaces. Wood components are used in all major elements such that the hobbyist may make unique modifications to suit their needs and style.

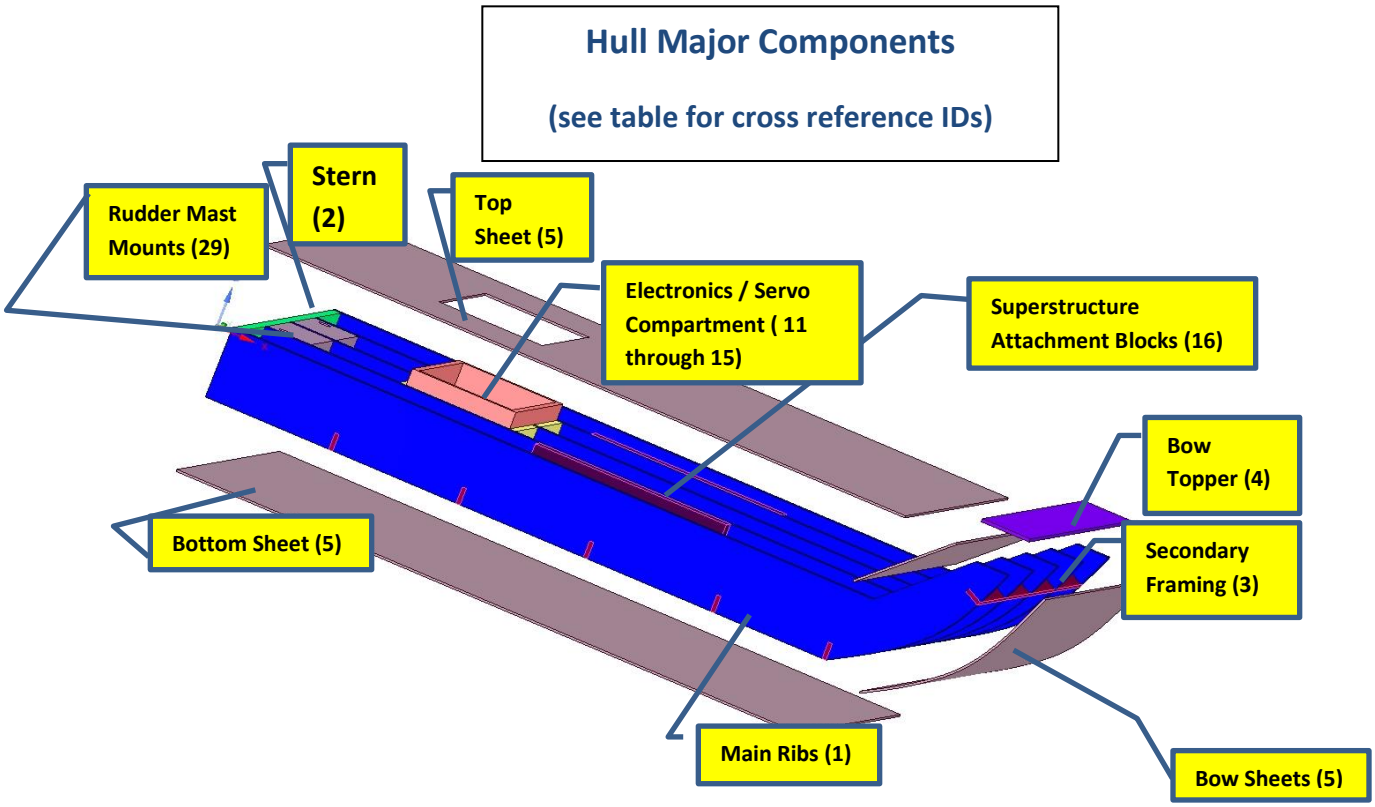
Dual rudder installation is typical, but can be modified with minor changes during construction. Finishing materials can include fiber glassing, epoxy finish coating, or even sheeting with aluminum, plexiglass (polycarbonate sheet), and many other possible choices. The build described herein will use aircraft hobby-grade 1/16" plywood for sheeting – supplied in the standard kit.

Recommended Motors: Although almost any type of motor system can be used, we have chosen to demonstrate construction with a brushless electric build that incorporates built-in electronic speed controls (ESC). Pictured example photos show large Hitec brushless motors with integrated ESCs. This simplifies the wiring and reduces overall weight.

Kit Contents

The SnoWater standard kit includes all the wood components necessary to construct a complete sheeted frame, including motor mount, electronics compartment, battery compartment, and scale seating. Additional materials for rudders and rudder mounting are included. Variations in electronics and user preferences are easily made.

Recommended glues include CA and various cure time epoxies.



Parts List and Cross Reference ID

ID	Description	Size	Qty	Material
1	Main Ribs	Precut / Shaped	5	Model Plywood 1/4"
2	Back / Stern	Precut	1	Model Plywood 1/4"
3	Bottom Slats	Precut	6	Basswood 3/32"
4	Bow Topper	Precut	1	Basswood 3/32"
5	Sheeting	1/16 X 12 X 24"	3	Model Plywood 1/16"
6	Motor Mount Side	Precut / Shaped	2	Birch Plywood 3/8"
7	Motor Mount Plate	Precut / Shaped	1	Birch Plywood 3/8"
8	Motor Mount Base	Precut / Shaped	1	Birch Plywood 3/8"
9	Base Sides - Long	Precut 6-1/8"	2	Basswood 1/4"
10	Base Sides - Short	Precut 3-5/16"	2	Basswood 1/4"
11	Servo Box Long Side	Precut 5-3/8"	2	Basswood Sheet 3/16"
12	Servo Box Short Side	Precut 2-7/8"	2	Basswood Sheet 3/16"
13	Top Sheet Supports	Precut 2-5/8"	4	Basswood 1/8"
14	Servo Mount Block Wide	Precut	1	Birch Plywood 3/8"
15	Servo Mount Block Narrow	Precut	1	Birch Plywood 3/8"
16	Interior Batt Compartment Stiffener	Precut 6"	2	Basswood 1/2 x 1/2"
17	Holdown Strips	Precut 4"X1/2"	2	Model Plywood 1/4"
18	Seat Top Sides	Precut 2-1/2 X 3"	2	Basswood 1/4"
19	Seat Bottom	Precut 7-1/2" X 3"	1	Basswood 3/16"
19a&b	Seat Bottom Framing (Short & Long)	Precut 7” & 1-3/4” X2/Ea	4	Basswood 3/16 x 1/2”
20	Forward Vert of Seat	Precut 7-1/2	1	Basswood 1/4"
21	Rear Vert of Seat	Precut 7-1/2	1	Basswood 1/4"
22	Batt Box Step	Precut 7-1/2 X 2"	1	Basswood 1/8"
23	Seat Box Joiner - Short	Precut 2-1/4" X 1	2	Basswood 1/8"
24	Seat Box Joiner - Long	Precut 6-3/4" X 1	2	Basswood 1/8"
25	Seat Back Slats	Aprox 7" (Cut Later)	2	Basswood 3/32" x 1 x 24”
26	Batt Box Upper Sides	Precut 2-3/8"	2	Basswood 1/4"
27	Batt Box Bottom Long Side	Precut 7-1/2 X 1-1/2"	2	Basswood 1/4"
28	Batt Box Bottom Short Side	Precut 3-7/8 X 1-1/2"	2	Basswood 1/4"
29	Rudder Mast Blocks	Precut 2-5/8 X 1-1/2"	4	Birch Plywood 3/8"
30	Spacer Blocks	Precut	4	Temporary - Use To Align Ribs
31	Hull Sheeting	1/16” 12 X 24”	2	Birch Plywood 1/16”
32	Hull Sheeting	1/16” 12 X 6”	1	Birch Plywood 1/16”
Hardware / Misc - Supplied				
	Battery Box Screws (4)			
	Lexan / Plexiglass - Rudder Material (2 Pieces)			

	Carbon Fiber Rudder Tube (2 Pieces)			
	Nylon Rudder Mount Bracket (4)			
	Aluminum Tube Length 12" (1)			
	Screw Sets For Nylon Brackets (4)			
The following are not supplied due to variations in electronics and user preferences. These may be supplied, upon request, should the user wish to use a similar rudder linkage configuration as pictured in this manual.				
	Linkage Solder Ends			
	Duel Takeoff Coupling/Ball Link			
	Music Wire Length (1)			
	90 Degree Bellcrank & Hardware			
	Control Horn (2)			

Additional Items (based on a typical electric powered build):

1. Motor with integral ESC (Hitec Propel or Black Widow recommended) And /*Or*
2. ESC to Match Power System
3. Prop sized for power system (13” - 15”)
4. Receiver / Transmitter (Radio System)
5. Assorted wiring & connectors (to suite your build)
6. LiPo Battery (if using electric motor)
7. Epoxy (6 minute – 4oz , 30 minute – 9 oz) and / or
8. CA – Thick, Medium & Thin
9. Finishing Epoxy or Polyethylene
10. Optional - Fiberglass Cloth & Resin

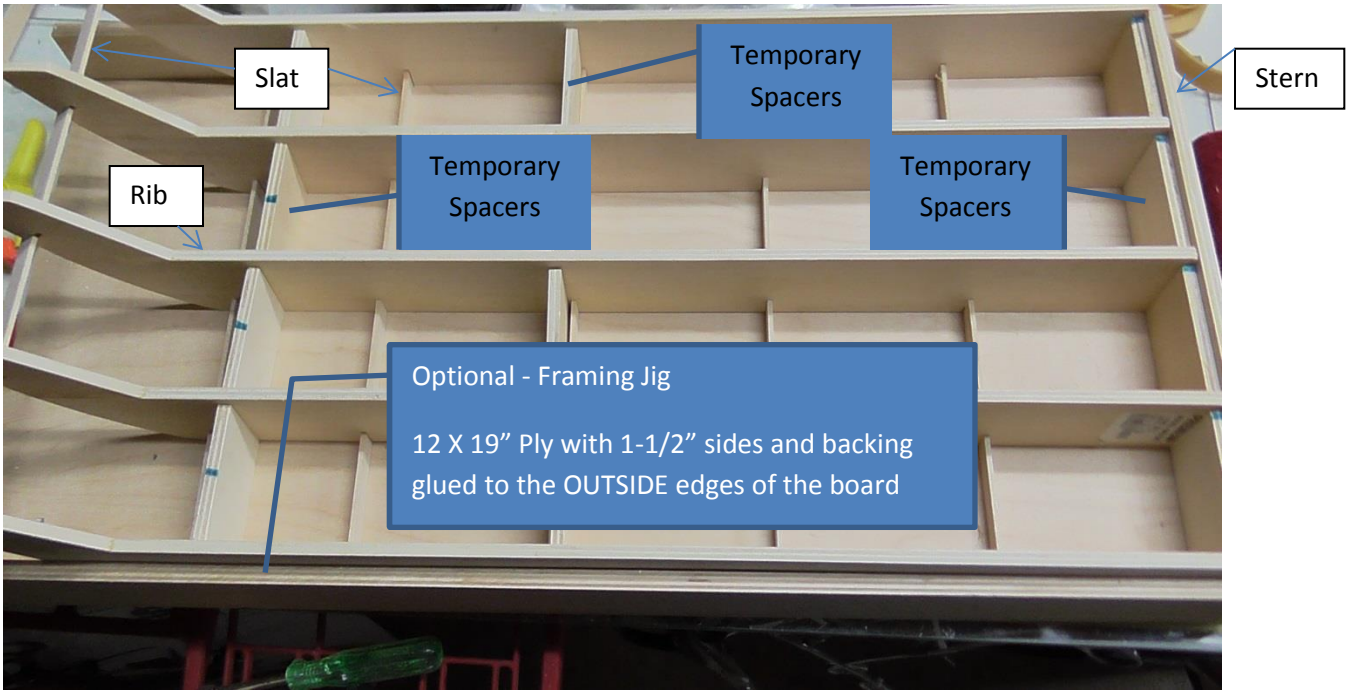
Nice to Have:

1. Construction Jig (made from plywood) to align ribs and frame (see photos & Diagrams & Appendix 1 –Photo Hints)
2. Basic hobby tools (sanding blocks, Hobby Knife, clamps, etc)

Assembly (see accompanying photos and diagrams)

Assembly is performed by simple gluing of major components and use of common hobby hand tools. The choice of glue is based on builder preferences. We recommend using epoxy for all large surfaces to be joined and medium CA should a "quick set" be desired. Hobby clamps and rubber bands will be required to assure tight fitting joints. Most wood parts are precut and ready to assemble. Due to minor variations in factory supplied materials, machine cutting, and intentional oversizing of certain parts, it is recommended prior to gluing that all parts be dry-fit and sanded, if necessary, to get a tight joint. Certain subassemblies should be assembled first and sanded after the glue has dried. These include the battery box, motor mount, and seat assemblies. Refer to the pictures and diagrams that follow. Numbers enclosed in brackets ( ) correspond to the parts ID in the table on page 3. Most supplied parts will also be marked or otherwise easily identifiable to correspond with the table numbering and descriptions.

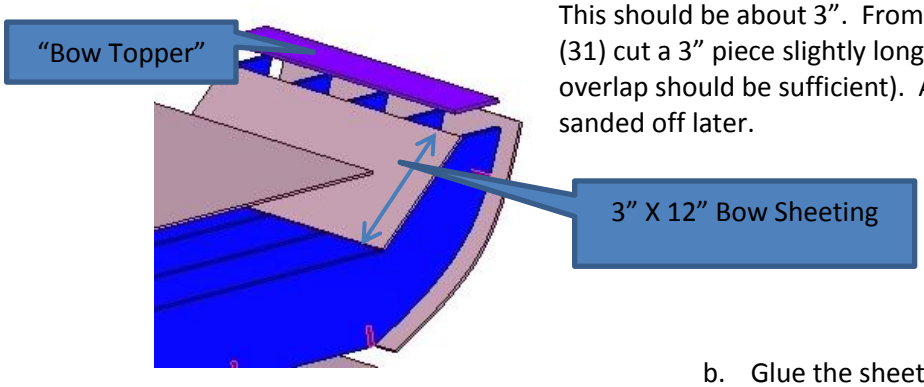
1. Align ribs (1) with the six slats (3) inserted in rib slots. The two slightly longer ribs are the outer side ribs. Use four supplied spacers (30) to align ribs both vertically and parallel with each other. You may wish to make additional spacers as shown in the following photo. Use a square or Framing Jig (see ***Appendix 1 – Photo Hints)*** to assure alignment. Side-to-side distance must be no wider than your sheeting material width (typically about 11-7/8" if using 1/16" 12X24" ply sheeting supplied with standard kit). Glue slats to ribs. HINT: If using the Framing Jig, line the bottom with wax paper to prevent gluing the frame to the jig.



2. Glue stern/back piece (2) to the five ribs.

3. Forward Top Bow Sheeting:
   This piece should have a good perpendicular cut to assure a proper fit. Cut a 3 X 12" (+/-) section of sheeting sheet as follows:

   a. Measure the distance from the start of the base of the bow to the top of the bow flat. This should be about 3". From one 12 X 24" sheet (31) cut a 3" piece slightly longer than required (1/4" overlap should be sufficient). Any excess will be sanded off later.

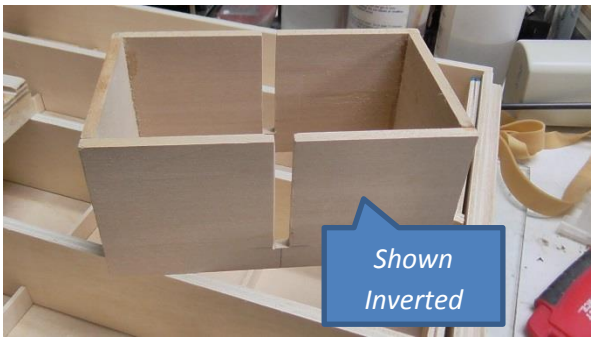


   b. Glue the sheeting in place with the excess protruding at the bow end. When dry, sand the excess off and flat with the top flat of the bow where it will mate with the Bow Topper (4). The intent is to fit the two pieces with minimal spacing or gaps.

4. Center and glue the Bow Topper (4) to the ribs and to the edge of the ply sheeting. There should be excess both forward and aft which will be sanded off after all sheeting is complete.

5. Servo Box Assembly:

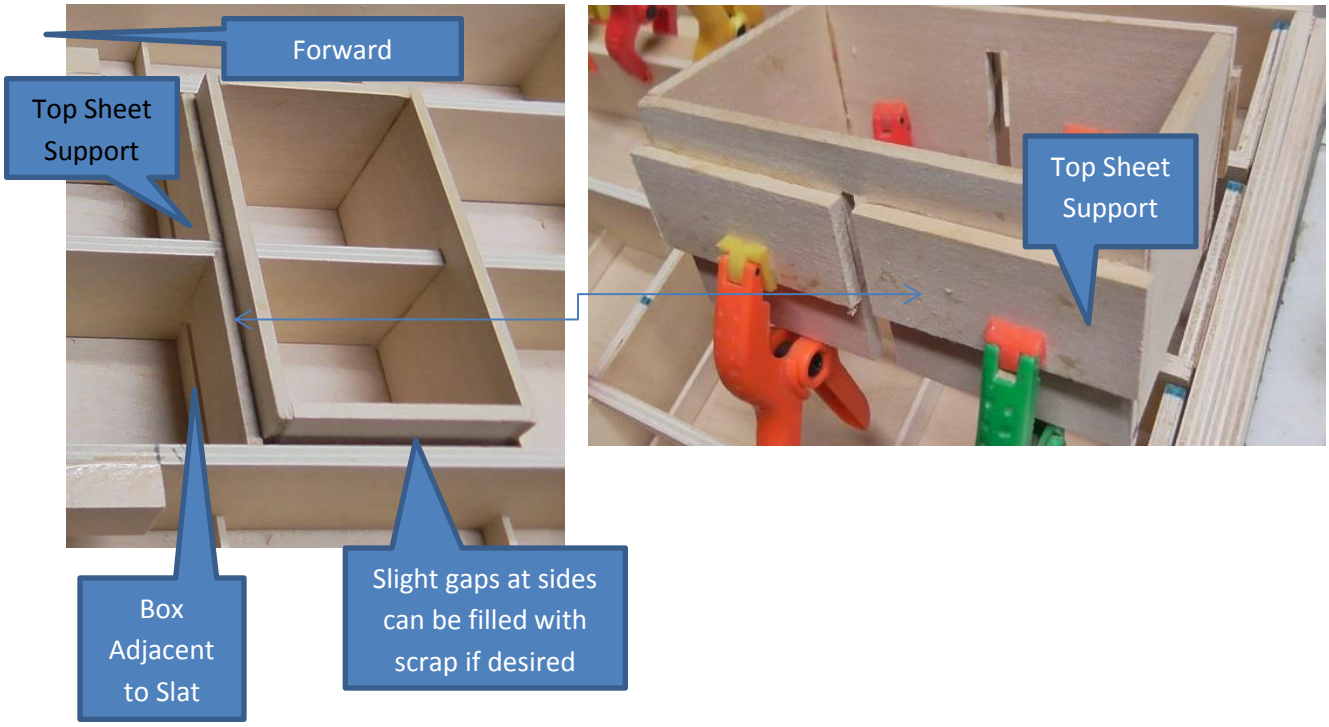
   a. Assemble the servo box (For a moderate fee, the slotted box section can be supplied assembled through step "c" below):



   b. Glue the sides with the short pieces (12) sandwiched between the two longer pieces (11). Assure the box is squared prior to the glue setting.

   c. If not already slotted, cut slots 2-3/16" X ¼" through the middle of the assembled box. These slots should be sized to fit snugly over the center rib so that the top will protrude about ½" above the rib when pressed all the way down. The slots can be easily cut with a couple of passes on a table saw set to 2-3/16" height (same height as the rib) or may be hand cut using a miter box / hand saw.

   d. Set the box into the rib framing with the forward bottom side butting directly against the second from rear slat. Assure that the box sits flat at the bottom of the framing. When satisfied with the fit, dry fit the four Top Sheet Supports (13) to the box so that the top is flush with the top of the ribs. The supports will extend slightly beyond the side edges of the box when aligned with the edges of the slots. Mark their position. Remove the box and glue the supports to the box as shown.



e. Apply glue to all edges / surfaces that will contact the framing when reinserted back into the frame and butting up against the slat as before. After glue is applied at all interfaces, place the assembly back into the frame and butting against the slat.

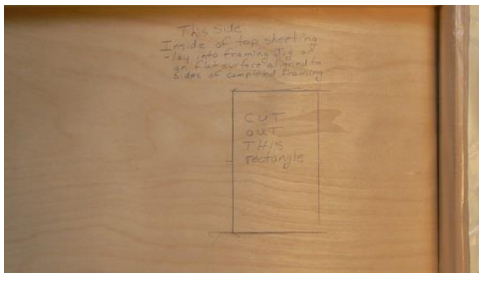
f. Optional: There will be a slight gap between the short sides of the box and the adjacent ribs. Glue scrap filler between the short box sides and adjacent ribs if desired.

6. This step can be done at any time prior to gluing the bottom sheeting in place. Glue the two Interior Battery Compartment Stiffeners (16) on the outside of the 2nd and 4th main ribs. They should be flush with the top of the ribs and placed about 1" forward of the servo box. They will later align with the battery box hold down strips (17) that will be on the upper side of the top sheeting. These are intended to provide the "meat" for the battery box fixing screws.

7. Top Sheeting Preparation:

   a. Measure the distance from the start of the base of the bow to the back of the stern. This should be about 19-1/2". Cut this piece of sheeting from the remaining sheet (31) used to cut the 3" piece from Step 3 above. This piece should be slightly longer than required (1/4" overlap should be sufficient). Any excess at the stern will be sanded off later.
   b. The following steps will assure that an accurate rectangular hole is made for the servo box fitment to the top sheeting. First, sand the forward/underside edge of the top sheeting at an angle so it will lie against the bow sheeting without a gap. Lay the top sheeting with the inside face against the servo box. Align the forward edge of the sheeting above where it will meet the bow sheeting. Center the sheeting above the outer ribs at the same time.
   c. Holding the sheet in place, and with pencil ready, invert the entire assembly. Mark the outer outline of the servo box onto the bottom of the sheeting.

   d. Carefully cut out the marked box rectangle. When in doubt, cut the hole slightly smaller than needed – it can be trimmed during the dry-fit described below. Hint: Use a straightedge and sharp hobby knife to score the outline. Multiple passes will be necessary to completely cut through the ply and remove the cutout section.

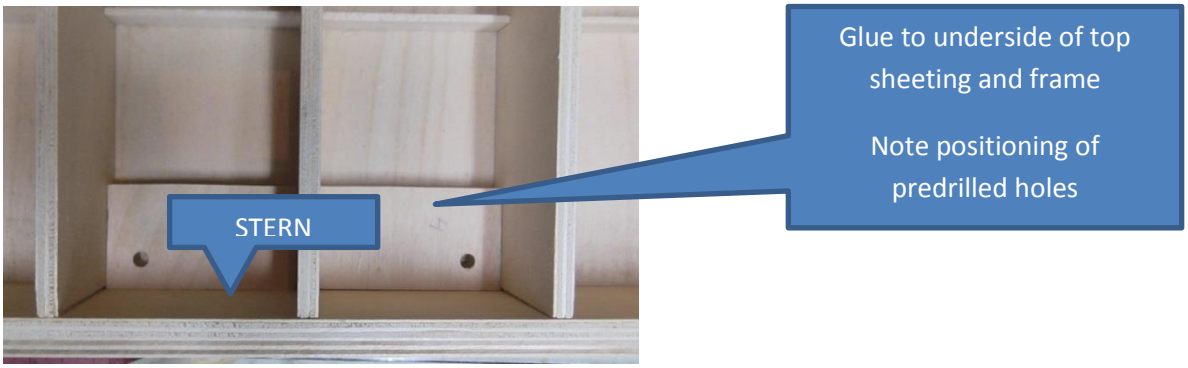


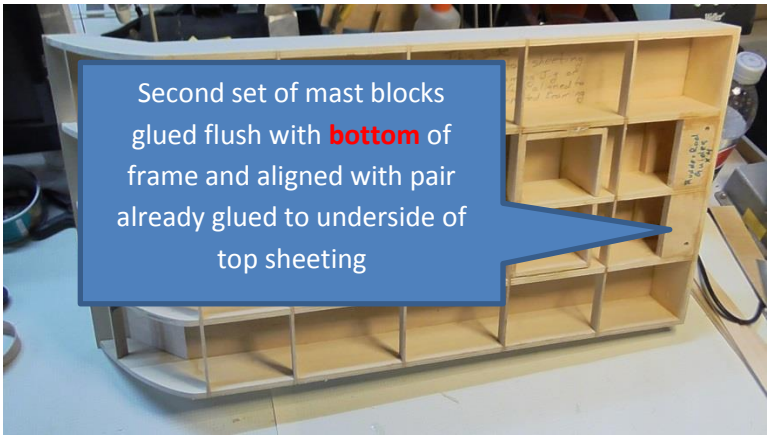
e. Dry-fit the top sheeting to the frame with the servo box protruding through the surface and the sheeting resting tight to the framing and servo box top sheet supports. If necessary, trim the sheeting so that it fits around the box and the outer edges of the sheeting align with the outer edges of the ribs and also with the forward interface of the bow sheeting. There should be a slight overhang beyond the stern.

8. Using a slow-cure thick CA or 30 minute epoxy, glue the top sheeting in place at each rib interface, at the stern, at the top sheet supports, and where the top sheeting meets the bow sheeting. Use plenty of clamps or large rubber bands and blocking to assure tight joints.
9. Prior to the glue setting, invert the assembly and inspect the joint seam at the top sheeting tapered edge and bow sheeting. If necessary, from the underside, glue thin strips of scrap wood or other suitable material (excess sheeting material cut in thin strips will work well) over the joint seam interface with enough glue to completely seal any gaps and provide support at the joint.

10. Rudder Mast Block Installation - If installing the supplied carbon fiber rudder tubes these blocks should be installed as described. For any other custom installation or modification, these steps may not be required or may be modified to suite your needs:

    a. There are four blocks (29) with predrilled holes that fit the carbon fiber rods. The blocks are a matched set. The blocks should fit snugly against the ribs, stern, and sheeting. If there is any interference from previously applied glue, carefully scrape or sand it away to assure a snug fit. With the assembly inverted, glue two rudder mast blocks (29) to the interior underside of the top sheeting. The holes must face outward and to the rear of the frame (See the following photos). Try not to get glue inside of the holes. Similarly, glue the remaining two blocks to the stern and ribs assuring that it is also fitted well and that the respective predrilled holes line up vertically. These two blocks should be glued such that the bottom sheeting will rest flush to them. HINT: During alignment it may be helpful to insert the carbon fiber rods through the holes from the bottom (protruding out the bottom at this time) and checked for vertical alignment using a square. They should be perpendicular to the surface of the frame. Adjust the blocks as necessary prior to allowing the glue to set. The carbon fiber rods may be left in if you are sure that the glue is not contacting the rods. Set aside to cure completely. Remove the rods when fully set.





    b. From the bottom, using a long thin drill bit inserted through the bottom hole and through the hole of the top sheeting blocks, drill a small pilot hole through the top

sheeting. This allows for accurate location of the mast holes in the top sheeting once the bottom sheeting is applied.

c. At this time or any time prior to installing the mast rods, the top sheeting pilot holes can be opened from the top to the same diameter as the mast rods. A round file is recommended to open the holes. Care should be exercised so as not to bore out the predrilled block holes causing a loosely fitted rod. It should also be noted at this time that the bottom sheeting will be covering the bottom block hole and acts as the lower resting point of each rod – it should not be drilled through.

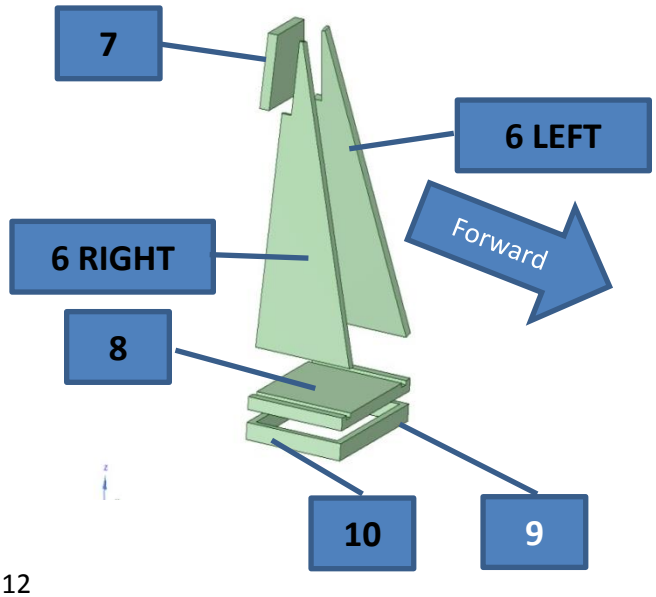
11. Install the remaining sheeting:
    a. Bow Underside Sheeting:
        i. At the bow, measure from the underside of the bow topper rearward to the flat bottom on the ribs – where the slat at the base is located (should be about 6“). When the larger bottom sheeting is installed, it will butt up against the protrusion of the lower bow sheeting.
        ii. Glue the 6 X 12” bow sheeting (32) in place assuring adequate glue applied to the ribs, bow topper interface, and at the slat at the base of the bow. This 6” piece is intentionally oversized so that there will be excess on the underside flat bottom. The excess will be trimmed / sanded after the flat bottom sheet is installed below.

    b. Flat Bottom Sheeting:
        i. Install the remaining flat bottom sheeting by first sanding a taper on the bottom / forward edge to fit snugly ***under*** the bow sheeting excess installed above and so that is resting slightly on the slat at the base of the bow. Measure and cut the bottom sheeting about ¼” longer so it will extend slightly beyond the stern. The excess at the stern and the overlap of bow sheeting will be sanded off after the glue has thoroughly dried. Apply glue to all framing and interfaces with other parts of the assembly. Don’t forget to apply glue to the bottom mast blocks (don’t get glue in the holes) and at the interface with the bow sheeting. Glue and clamp the sheeting until the glue is set. Use plenty of clamps, large rubber bands, and blocking to assure tight joints.
        ii. Optional Keel / Runners:
            1. You may wish to install runners to the bottom of the hull to help “guide” the boat when used solely on water. For use on soft snow surfaces, runners will make it difficult to steer the boat left or right. With runners installed, the boat will respond to steering on packed snow or ice with minimal impact.
            2. Symmetrically orient multiple runners from left to right across the bottom of the hull. Just a single runner may also be installed along the bottom centerline. Shape / sand the leading edge to blend into the bottom of the sheeting so there will be minimal resistance. Runners can be made with any hardwood strips. Lengths of ¼ x ½” basswood strips work well. The wider ½” side lays flat on the hull.
        iii. When the glue has dried, trim and sand all excess overlapping sheeting and the excess overlaps of the bow topper. Your hull is now assembled!

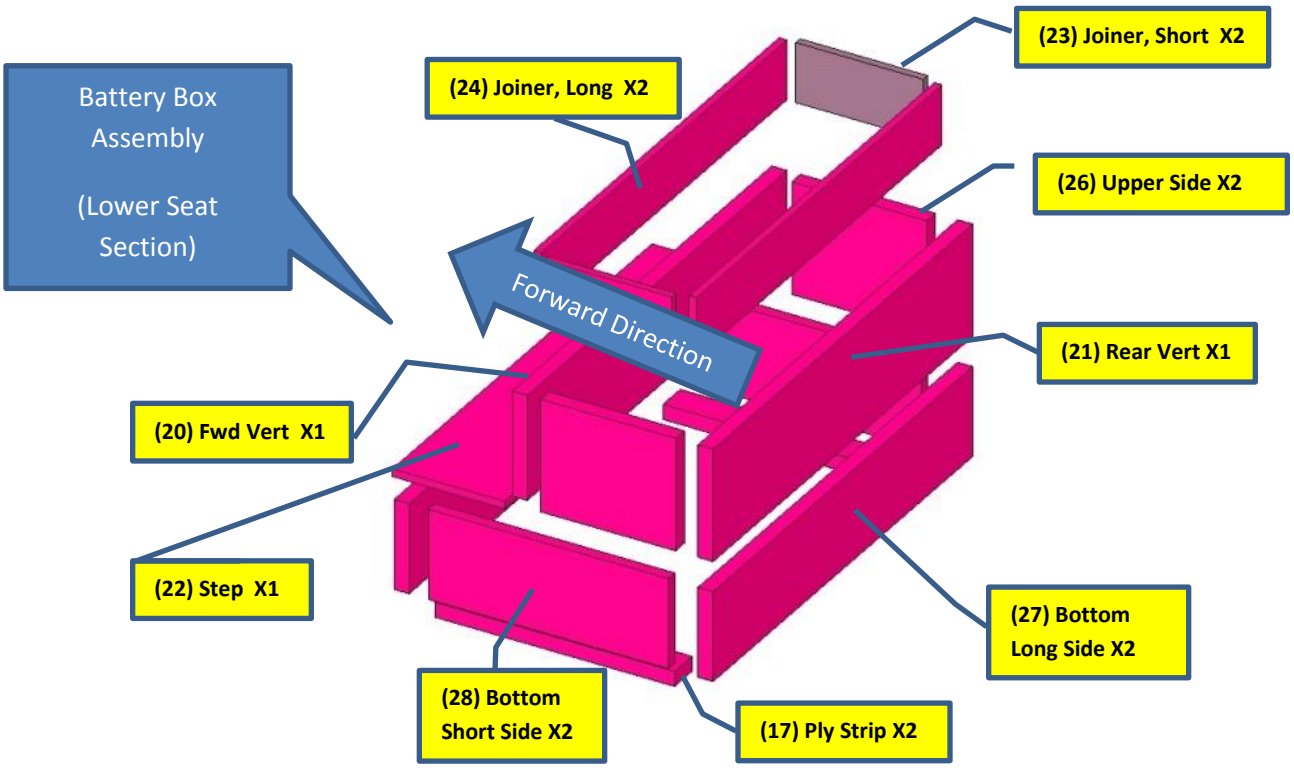
iv. At this time it is recommended that you waterproof the interior of the servo box. This is easily done by "painting" the inside with a "thin mix" of epoxy. Mix a sufficient amount of epoxy and thin it into a paintable consistency with small amount of isopropyl alcohol (rubbing alcohol). Coat the interior surfaces. Set aside to dry.

12. Assemble The Motor Mount: (For a moderate fee, this Assembly can be supplied fully assembled and ready to sand / finish):

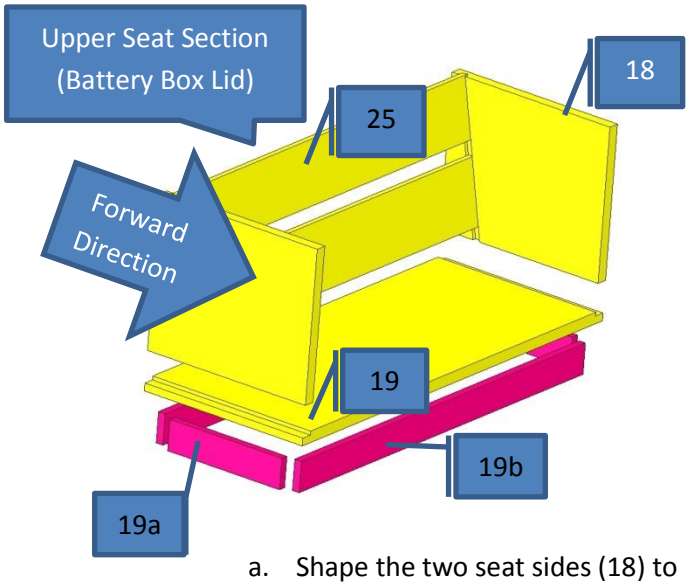
    a. If not already done, assemble the motor mount base bottom perimeter frame by gluing the four frame pieces (9 & 10) to the base bottom (8). Make sure the frame is squared off and pieces are parallel to the base sides. When complete, the frame will sit firmly around the servo box front and rear sides and there will be a gap on the port and starboard sides. Allow glue to set prior to continuing to the next step.
    b. Temporarily place the two triangular sides (6 Left & 6 Right), leaning toward each other, into the base grooves and with the Motor Mount Plate (7) placed in the precut recesses at the top. Note that the plate should fit flat at the bottom of the recesses. If not, swap the two sides – 50% chance of getting it right the first time …. Note that the recesses are made so that the plate will rest flat at the bottom of the recess when the sides are correctly placed (ie, the sides are mirror images of each other). Align the plate (7) so its sides are parallel with the side (6) edges. There will be some slight excess plate at the sides that will be sanded off after assembly. Note the placement and orientation of all parts. Separate the dry fitted pieces in preparation for gluing.
    c. Prepare a flat surface with wax paper or other non-stick material to set the assembly on in the following step.
    d. Apply sufficient glue in the base grooves to fill the gaps when assembling. Place the motor mount sides into the grooves at the angle while at the same time gluing the plate at the top recesses. Prior to allowing the glue to set, place the assembly (motor base down) on a flat surface to dry. All pieces should be contacting the flat surface while firmly clamped or banded while drying. You may need to press down on the sides and base to assure that they are lying flat and flush with each other.

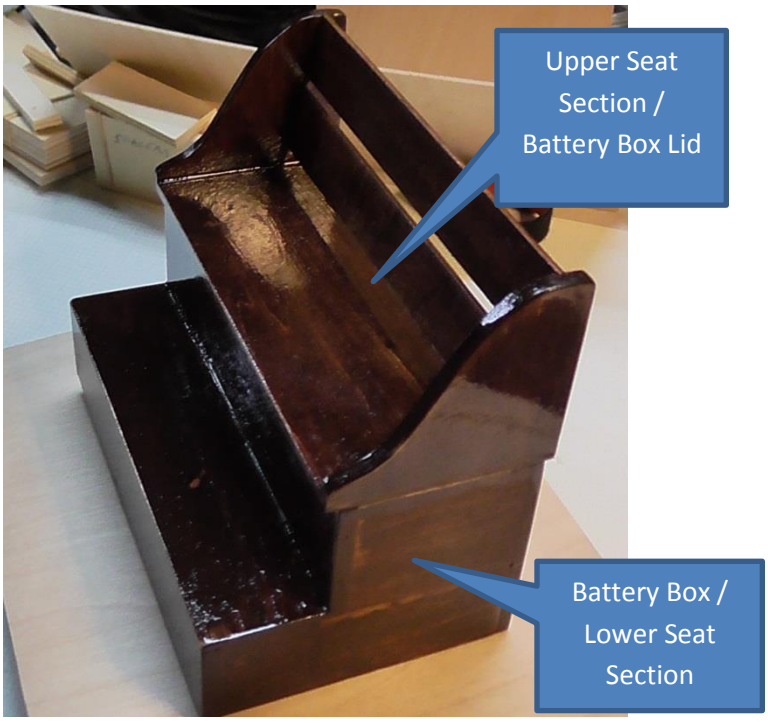


13. Assemble the Battery Box (Lower Section of Seat):
    a. Refer to the following list of parts and the following page "parts explosion" for the battery box / seat box bottom assembly. Read through this entire section and fully understand the positioning of parts prior to assembly.
        1. (20) Forward Vertical, Precut 7-1/2 X 1-3/4 X ¼", 1 piece basswood [**NOTE:** Part 20 is 1/8" narrower than Part 21 so it will match up with the height of the top when assembled. It fits on top of the 1/8" thick "step", Part 22]
        2. (21) Rear Vertical, Precut 7-1/2 X 1-7/8 X ¼", 1 piece basswood
        3. (22) Batt Box Step, Precut 7-1/2 X 2", 1 piece basswood
        4. (23) Seat Box Joiner – Short, Precut 2-1/4 X 1", 2 pieces basswood
        5. (24) Seat Box Joiner – Long, Precut 6-3/4 X 1", 2 pieces basswood
        6. (26) Battery Box Upper Sides, Precut 2-3/8", 2 pieces basswood
        7. (27) Battery Box Bottom Long Side, Precut 7-1/2 X 1-1/2", 2 pieces basswood
        8. (28) Battery Box Bottom Short Side, Precut 3-7/8 X 1-1/2", 2 pieces basswood
        9. (17) Holdown Strips, Precut 4"X1/2", 2 pieces, 1/4" ***plywood***
    b. Glue parts (27 X 2) and (28 X 2) squarely making a 7-1/2" long rectangle, (27's) fitting between (28's).
    c. Glue the plywood pieces (17 X 2) at the inner bottom of the rectangle at both ends.
    d. The joiners (23) and (24) are used to join the two sections of the battery box/seat elevations When completed, it will form an "inner box frame" helping to join and reinforce the upper and lower sections:
        i. Glue one joiner (24) to the inside / rear, bottom long side (27) so it will overlap ½" inside and ½" out at the top.
        ii. Glue the rear vertical of the upper section (21) to the ½" overlap section made in step (i) above so that parts (27) and (21) make one continuous single 7-1/2 X 3-3/8" back section. Make sure to also apply glue to the edges of pieces being joined.
        iii. Similarly, glue the two short joiners (23) to the inside rear of the two bottom short sides (28) . Again, overlap ½" upward so the two upper sides (26) can be glued to the overlap. Now glue the upper sides (26) to the rear of the bottom short sides (28). Again, make sure to also apply glue to the joiners and edges of pieces being joined.
        iv. Glue the step (22) to the lower box section so that it is flush with the upper sides (26).
        v. Glue the forward vertical of the top section (20) on the top edge of the step installed above. Again, make sure to also apply glue to the edges of all pieces being joined.
        vi. Line up and glue the second long joiner (24) over the interior seam formed between the step (22) and forward vertical (20). It may need minor sanding to fit at the ends where it meets at the short joiners. If desired, you may also trim this joiner prior to gluing so it does not extend below the step bottom. The excess is inconsequential.
        vii. Sand flat both the top and bottom of the completed assembly. Sand off any excess at the corners.



14. Assemble the Battery Box / Seat:





a. Shape the two seat sides (18) to your liking. See the pictured example finished seat sides. Note that the sides are mirror imaged with angled grooves precut to accept the two seat back slats (25).

b. Dry fit the sides into the dados of the seat bottom (19). Measure the required length to cut two seat back slats from the supplied material (25). Each will be about 7" +/-. The slats should fit in the slotting such that sides will be perpendicular to the seat bottom when the seat bottom is resting in its final position. With the slats inserted (not yet glued), glue the seat sides into the precut dados of the seat bottom. Rubber band the assembly and verify sides are properly aligned. Set aside to dry.
c. Shape the seat back slats to your preference. The above picture uses plain slats without any decorative shaping. Glue the slats into the seat side slots.
d. Place the completed seat section squarely on top of the completed battery box section.
e. From the underside of the battery box, scribe or mark the location of the inner perimeter of the battery box onto the underside of the seat bottom.
f. Glue four lengths of Seat Bottom Framing (19a and 19b) to fit INSIDE the scribed box just made. Trim if necessary. You should have two pieces about 7" and two about 1-7/8" long. When glued to the underside of the seat they will align and fit the seat as a lid on top of the lower battery box section.
g. Verify a good fit to the battery box top. Sand if necessary to fit properly. DO NOT GLUE THE SEAT SECTION TO THE LOWER BATTERY BOX SECTION!

15. Finishing:
    a. Sand the completed assemblies smooth if not already done. Remove all oversized edges, imperfections, and if necessary, fill any gaps or spaces with wood filler. If leaving a natural or stained surface, start with 220 grit or finer sandpaper on the sheeting material. Work up to 400 grit to get a finished surface. Coat and finish the hull to create a watertight structure.
    b. Align and center, from side-to-side, the battery box assembly. When properly centered, the inside two ply joiners of the assembly will be resting directly above the two hidden basswood stiffeners previously glued 1" forward of the servo box. The battery box base can be located anywhere from 1" to 4" forward of the receiver box.
    c. Once satisfied that you are happy with the final location of the assembly, drill a hole from the receiver box interior to the battery box:
        i. First select the section of the servo box that you will install your steering servo.
        ii. In the opposite section drill a hole in the forward servo box bulkhead at about ½ to 1" BELOW the top sheeting. The hole should be widened sufficiently to route your motor leads or motor lead extensions through the hull and up to a hole under the battery box assembly (step iii below).
        iii. While noting where your battery box assembly will be mounted, drill a similarly sized hole in the top hull sheeting parallel to and lined up with the hole made in the servo box. This hole is best made directly under the step section of the battery box so your battery leads will not interfere with battery placement. HINT: Make both holes large enough to accept all necessary wiring that will run from the servo box to the battery box – including any accessory wiring for lighting, battery monitoring device, other accessory servos, etc.

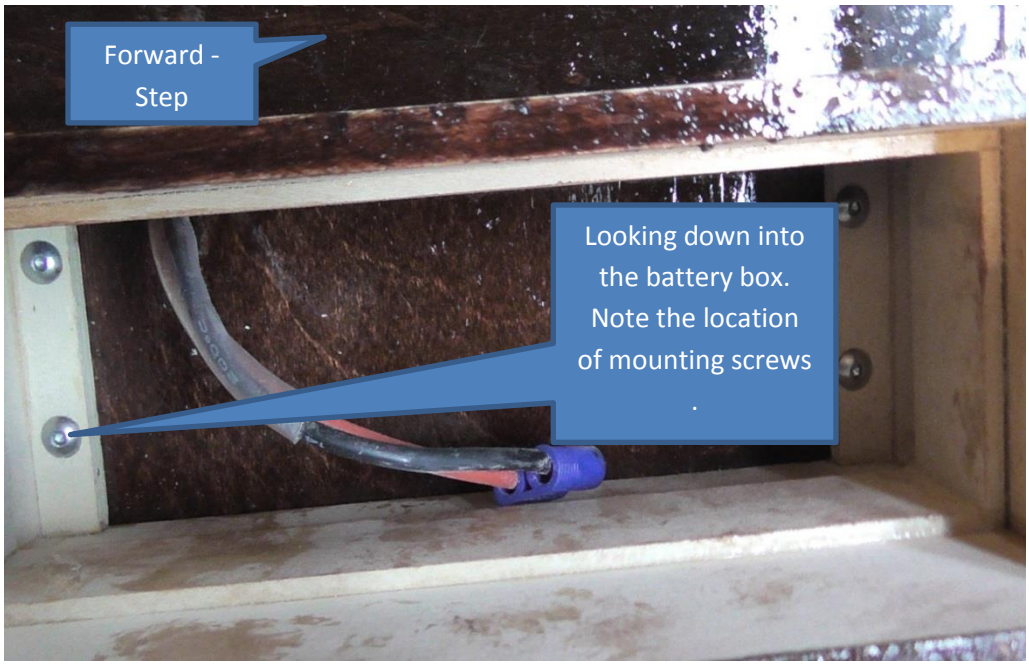
iv. "Fish" a string through both holes and tape the ends to a surface – one inside the servo box and one onto the hull sheeting inside the battery box perimeter. This will later be used to pull any wiring between the two enclosures.

d. Battery Box Assembly Mounting:

i. From the underside of the ply joiners drill four holes slightly larger than the mounting screw shank diameter, two on each side about 1-1/2" apart from each other. They should be placed so that when screws are inserted from the top they can be easily reached with a long shank screwdriver.

ii. Place the assembly on the sheeting, and again center it from side-to-side as before. When satisfied with its final position, mark the location of the holes onto the sheeting using a pencil or thin felt tip marker. Using a drill bit sized for the threads, drill through the sheeting and into the inner basswood stiffeners at least ½" but no more than 1".

iii. Screw the battery box to the hull. HINT: You may want to place some thin "door seal" foam under the box edges to help waterproof the bottom interface.



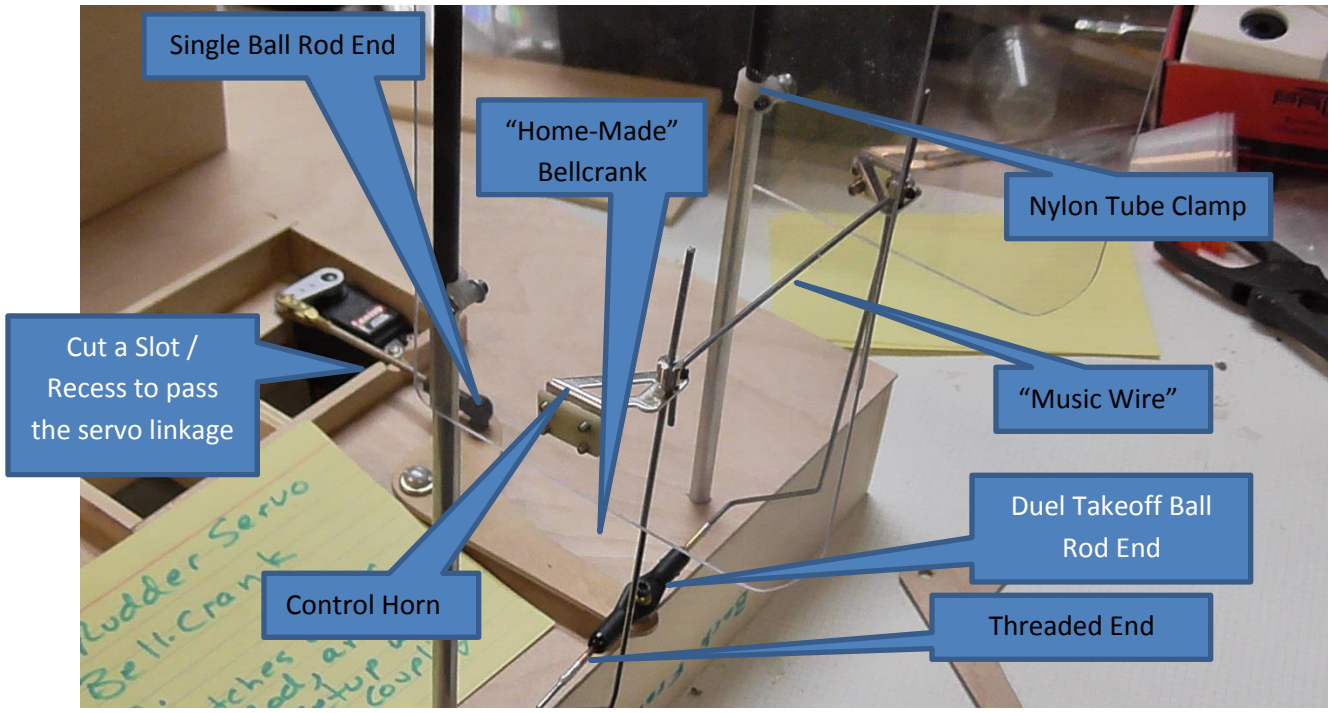
16. Installing Electronics:

a. Glue the two servo mounting blocks (14) and (15) to the interior of the servo box side selected earlier (opposite side from wire routing hole). The blocks should be mounted low enough to prevent interference with the bottom of the motor mount base, yet high enough so the servo linkage to the rudder bellcrank will clear the top sheeting after a slot is cut in the servo box upper perimeter. (Note: A matching overlapping slot will need to be cut into the motor mount base perimeter to clear the servo linkage rod once you have determined the servo linkage position.) Note that the servo blocks are slightly different widths. When installed, the gap between them will allow for the installation of

a “standard size” servo. See the appendix photos for details of example installations (picture is worth a thousand more words). Mount the servos.

b. Mount the motor, facing the rear, to the motor plate.
c. Install your receiver either in the battery box under the step, or in the servo box (opposite side as the servo). Route all wiring and connections between the motor and battery, motor signal wires and receiver, etc. Note that you will need to pass the motor wires through a hole made in the motor mount base. Seal all holes that enter the hull with silicone sealant. This includes antenna tube penetrations, lighting wire penetrations, etc. Do not seal the slot made to pass the bellcrank / servo linkage since the linkage must be free to move. HINT: The interior of the servo box should be inspected after daily use to assure that any splashback has not entered the compartment interior. If so, remove any moisture and air-dry the compartment.

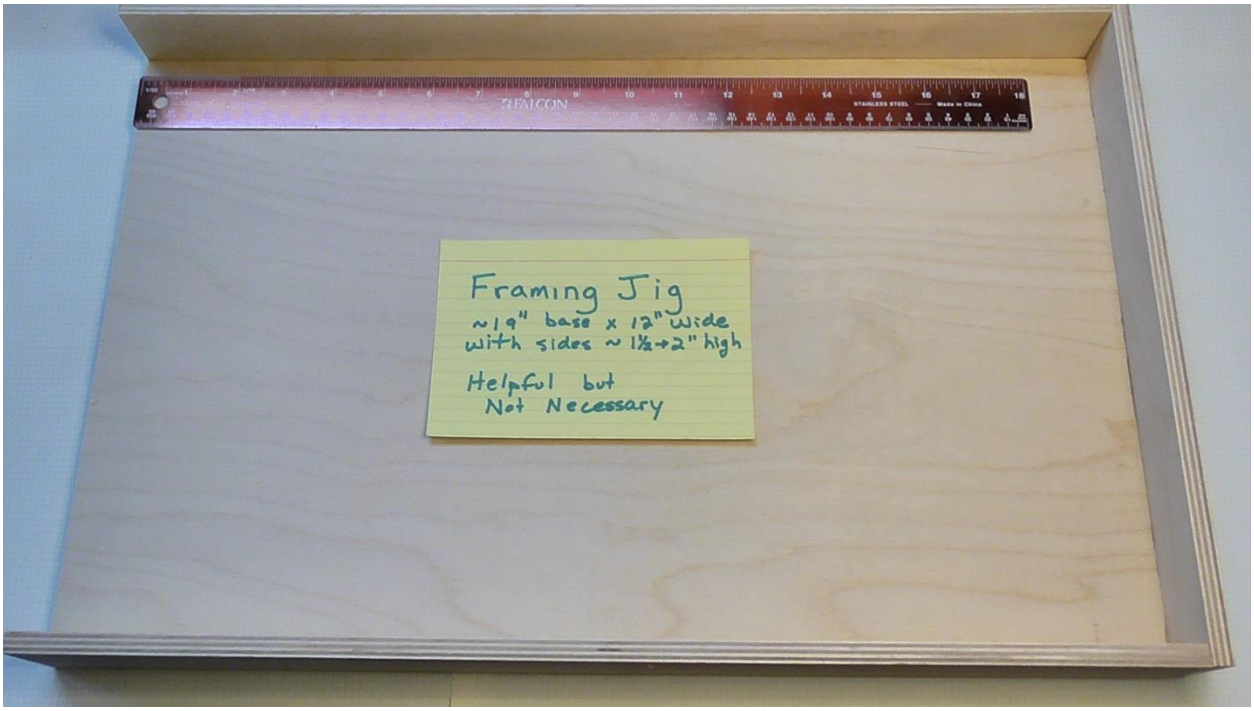
17. Assembly of Rudders and Linkages: This section assumes you will be installing a duel rudder system using a 90 degree bellcrank mounted aft of the servo box.
    a. Cut the plexi rudders to your desired shape. The forward edge should be strait and about 9” long and the width about 4”. Be creative with the shape but leave the forward edge strait!
    b. Install the two carbon fiber rods into the hull. Slip the 5-12” aluminum tube over each rod. The tube acts as a bottom stop/spacer to keep the rudder in place.
    c. Install the supplied nylon tube brackets using the supplied hardware about 1” from the top and bottom edges. Carefully drill the mounting holes to prevent cracking or splitting the plexiglass. The brackets are the “hinge point” for the rudders.
    d. Install the two control horns to the rudders. They should mirror image each other and face inward toward each other. Space them so the horn wire holes will be about 2” forward of the rudder rods and are about 1” above the bottom of the rudders.
    e. Slip the rudders onto the rods. They should swing freely.
    f. Cut a length of music wire about 6“ long. Measure the distance between the innermost holes of the control horns with the rudders parallel to each other. Bend a 90 degree at each end of the wire so the strait part between the bends is the same as measured between the innermost holes. Insert the bent ends into the holes and verify that the rudders remain parallel to each other as they swing back and forth.
    g. Duplicate the music wire configuration shown in the photos from the bellcrank to the control horns. The duel takeoff unit and the additional sections of music wire makes a “U” shaped control setup that fits into the second set of holes in the control horns. All wire can be fixed in place at the control horns with “wheel collars” if desired. The setup pictured uses one duel takeoff ball joint unit at the “U” bent wire and one single ball joint from the bellcrank to the servo horn.
    h. When complete the rudders should have sufficient swing with a properly adjusted rudder servo.

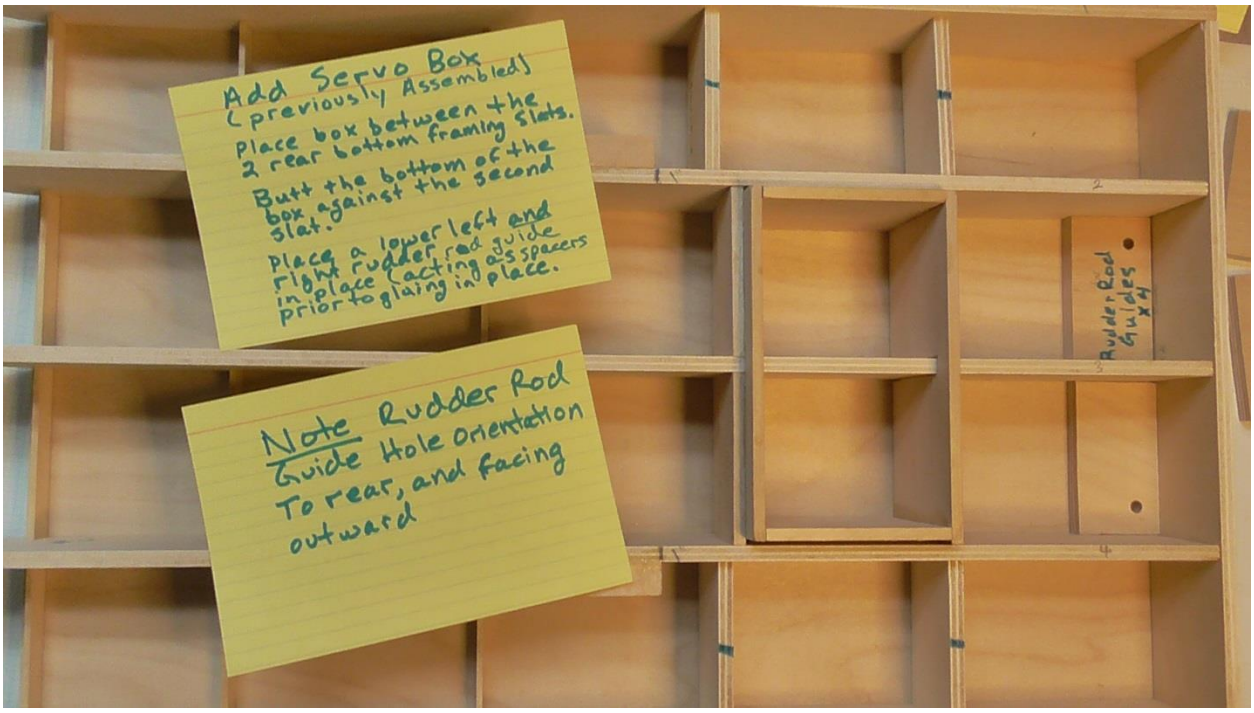


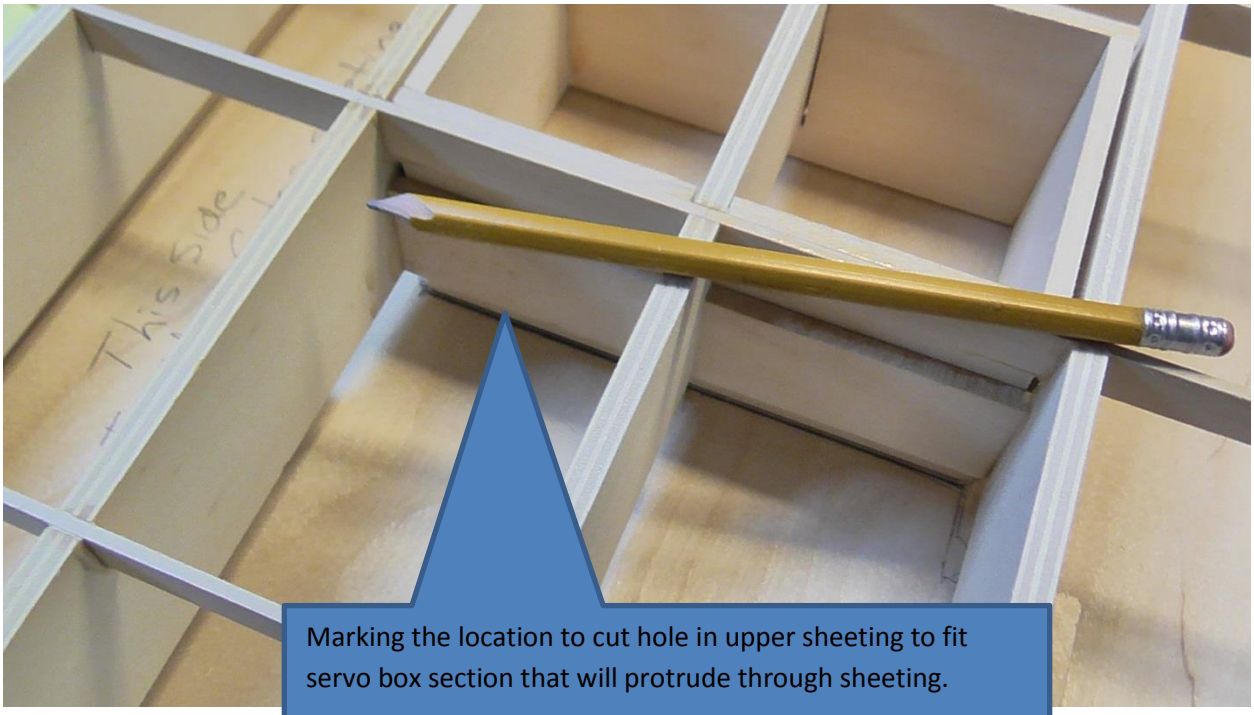
18. The final step is to fix the motor mount to the hull and the battery box seat cover to its base:
    a. There are many ways to secure the motor mount base to the hull. Since you will seldom need access except to check for moisture intrusion at the end of the day, or to "rebind" your receiver on occasion, it can be fixed with one wood screw through the rear of the base and into the servo box. Since the fit between the rear and front of the base is tight to the servo box top, the single screw will suffice at this location since the motor thrust and torque on the base will tend to lift only the rear. Remove the motor mount from the hull. Drill the rear base side with a hole sufficient for the screw shank to fit easily. The hole should be located such that when the screw is installed it will enter the servo box about mid-way up the protruding servo box top. Center the base on the servo box sides prior to drilling the matching pilot hole into the servo box side. Drill this hole in the servo box side smaller to appropriately thread the fixing screws.
    b. Any fastener mounted on the front side of the motor mount base will have limited access for a screwdriver due to interference with the battery box. Alternate methods to secure the motor base include (materials readily available at any good hobby shop):
        i. Install "T" nuts and machine screws. You will need to install "T" nut platforms in the interior of the servo box, and drill matched holes into the top of the base for the matching machine screws.
        ii. Threaded rod running side to side or front to back with nuts on the outside.
    c. The seat cover on the battery box will be accessed each time you power the craft and when you complete a run.
        i. The cover can be secured using "neo" magnets, a hinge and latch, or two latches mounted on opposite sides. Personal preference will dictate here.

Appendix 1 – Some Photo Hints

Pictures Shown Larger in this Appendix to provide better resolution

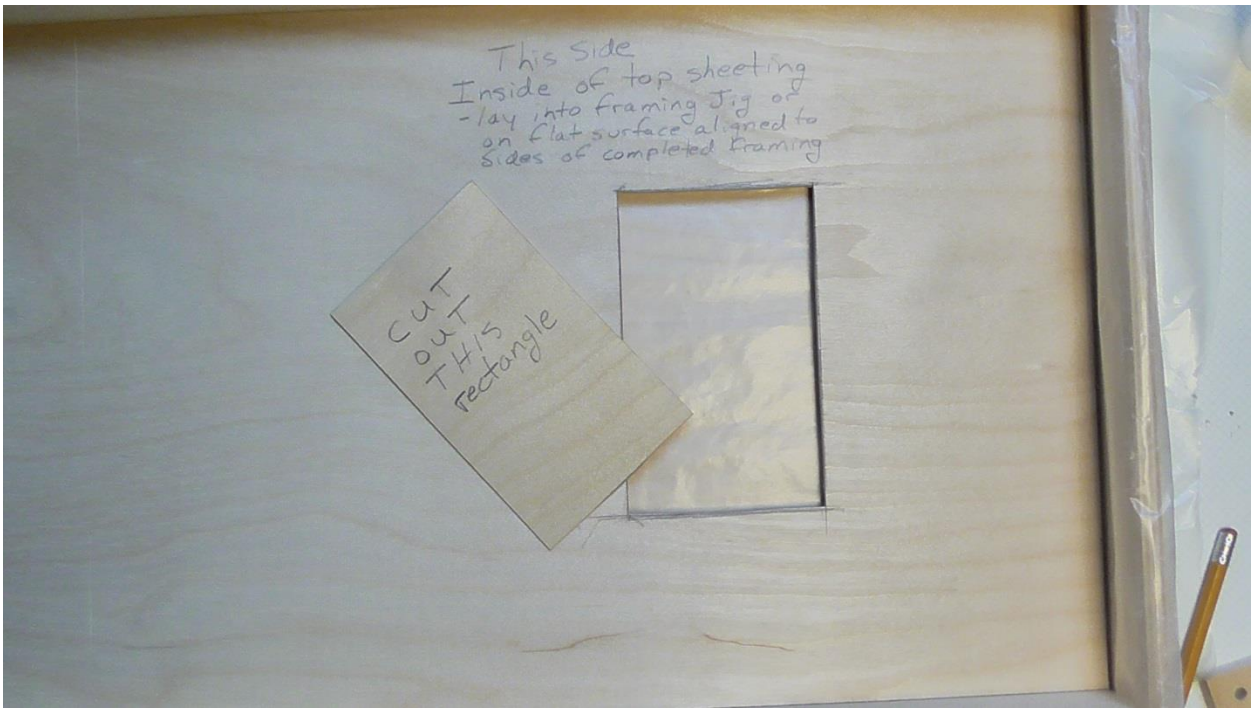


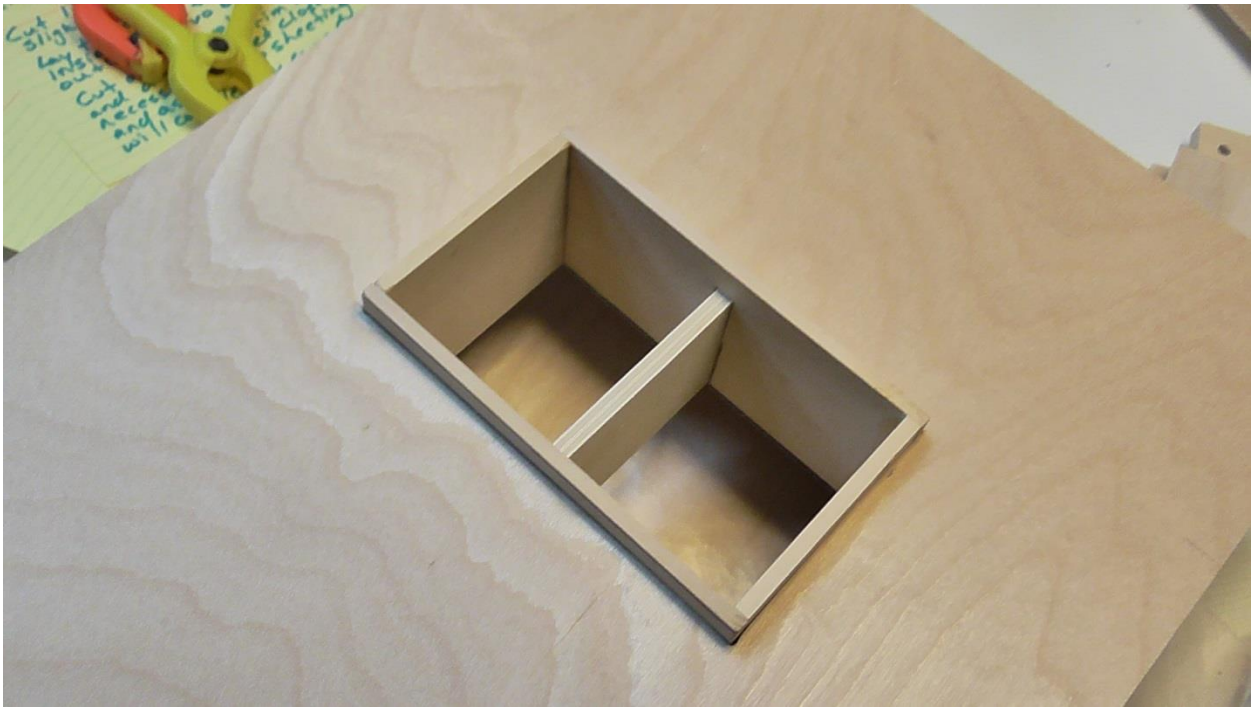


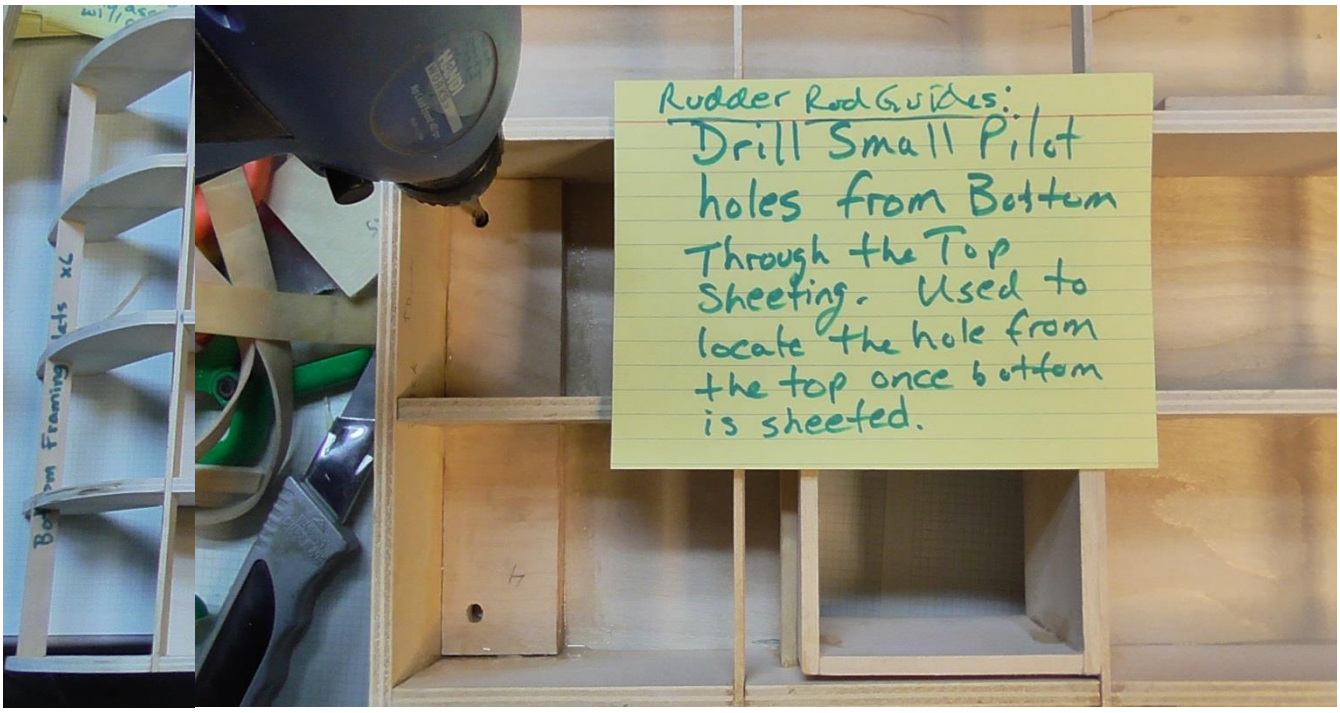


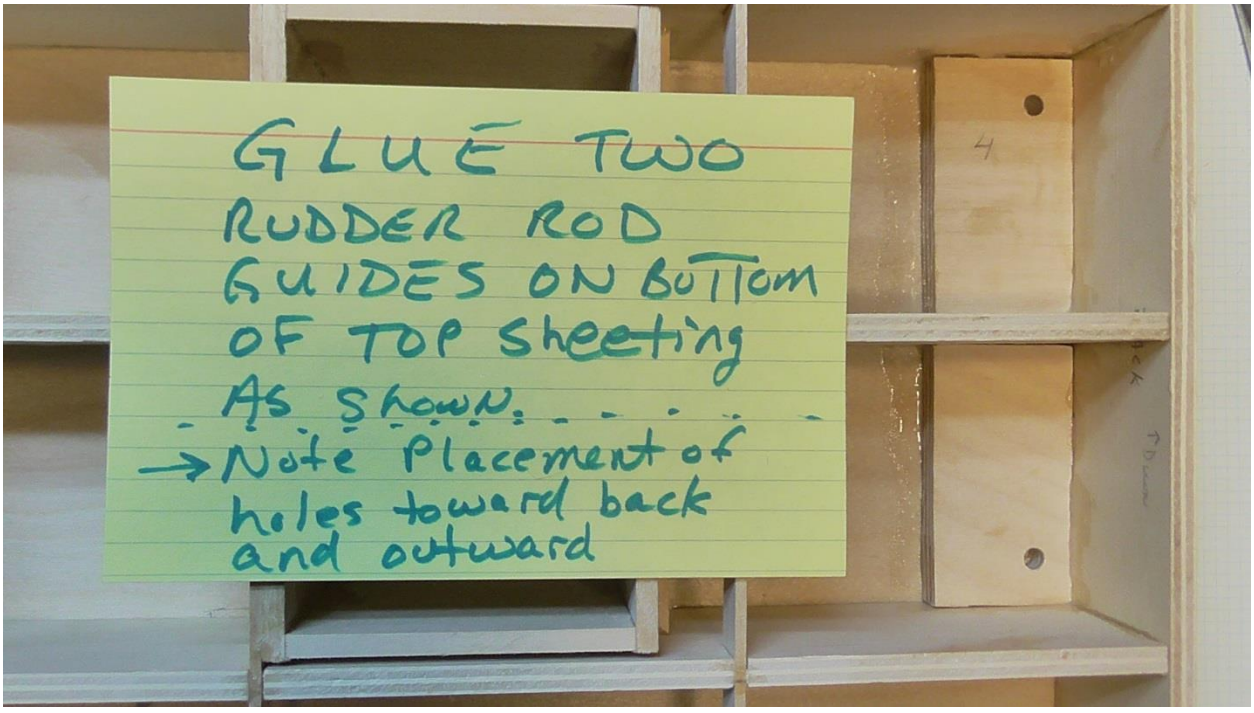
Marking the location to cut hole in upper sheeting to fit servo box section that will protrude through sheeting.

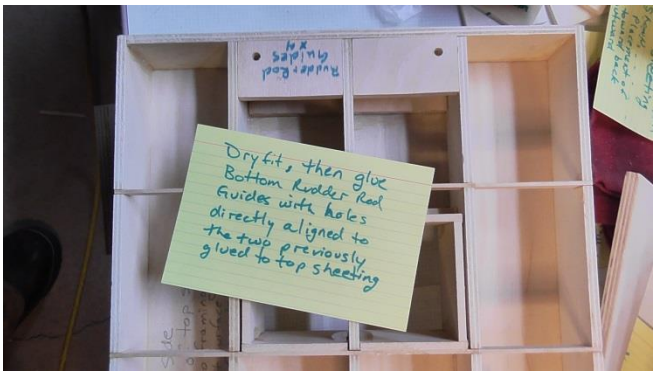
Pencil mark adjacent to Servo Box perimeter as it Touches the inside of the upper sheeting.

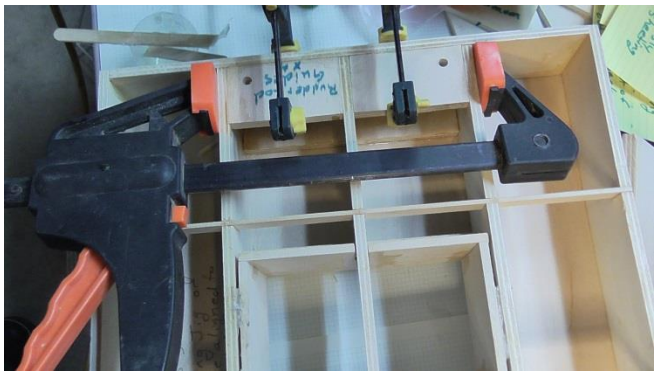

This Side
Inside of top sheeting
-lay into framing Jig or
on flat surface aligned to
sides of completed framing
CUT
OUT
THIS
rectangle

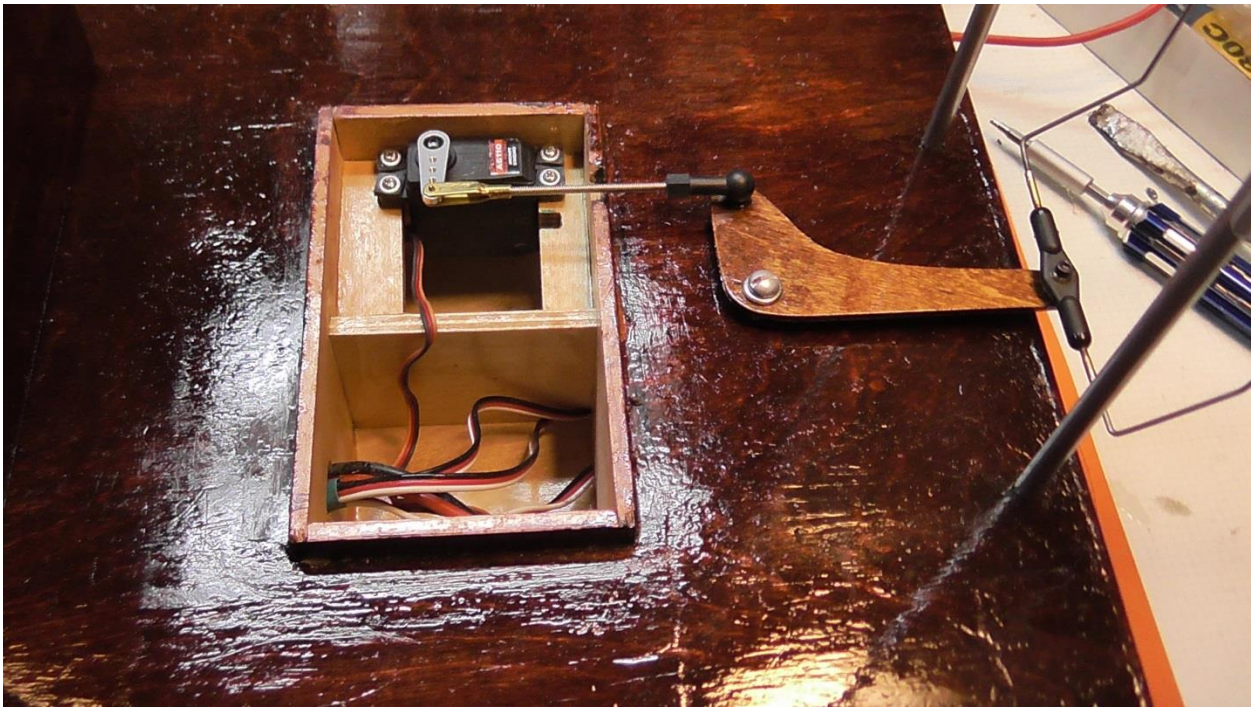


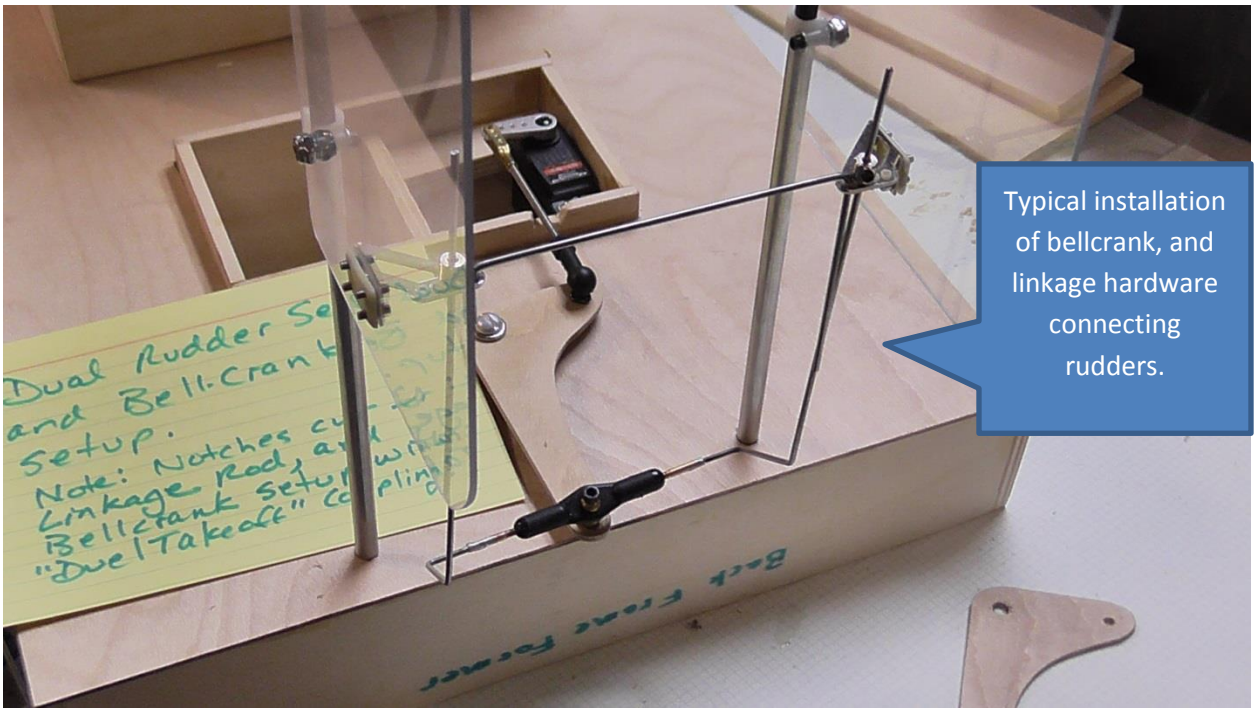

Rudder Rod Guides:
Drill Small Pilot holes from Bottom Through the Top Sheeting. Used to locate the hole from the top once bottom is sheeted.


GLUE TWO RUDDER ROD GUIDES ON BOTTOM OF TOP Sheeting AS SHOWN. . . . . → Note Placement of holes toward back and outward


Dry fit, then glue
Bottom Rudder Rod
Guides with holes
directly aligned to
the two previously
glued to top sheeting







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