

Construction Manual
for the
2013 RCCD Club Project Plane

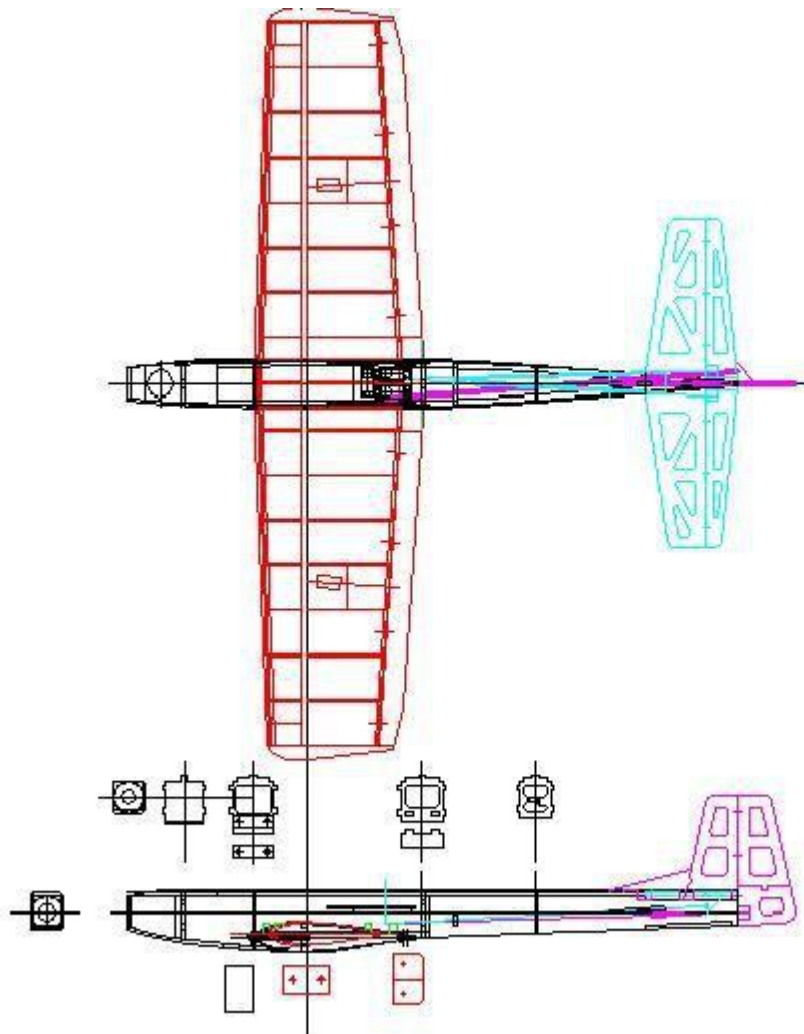


It is recommended that the project plane be constructed in the sequence as described in this manual. An experience builder may deviate by using his/her method of construction, and adding features for their individual needs. For example, access panels, cowling features, canopy, wheel pant, etc. may be added.

Note: If the plane is to be entered in the club 40 racing events, be careful as to what is changed and/or added to the original design. There are racing rules that will govern the amount of changes that will be accepted for racing.

Prototype 1

*CAD development file
(shown)*



Project Plane Kit

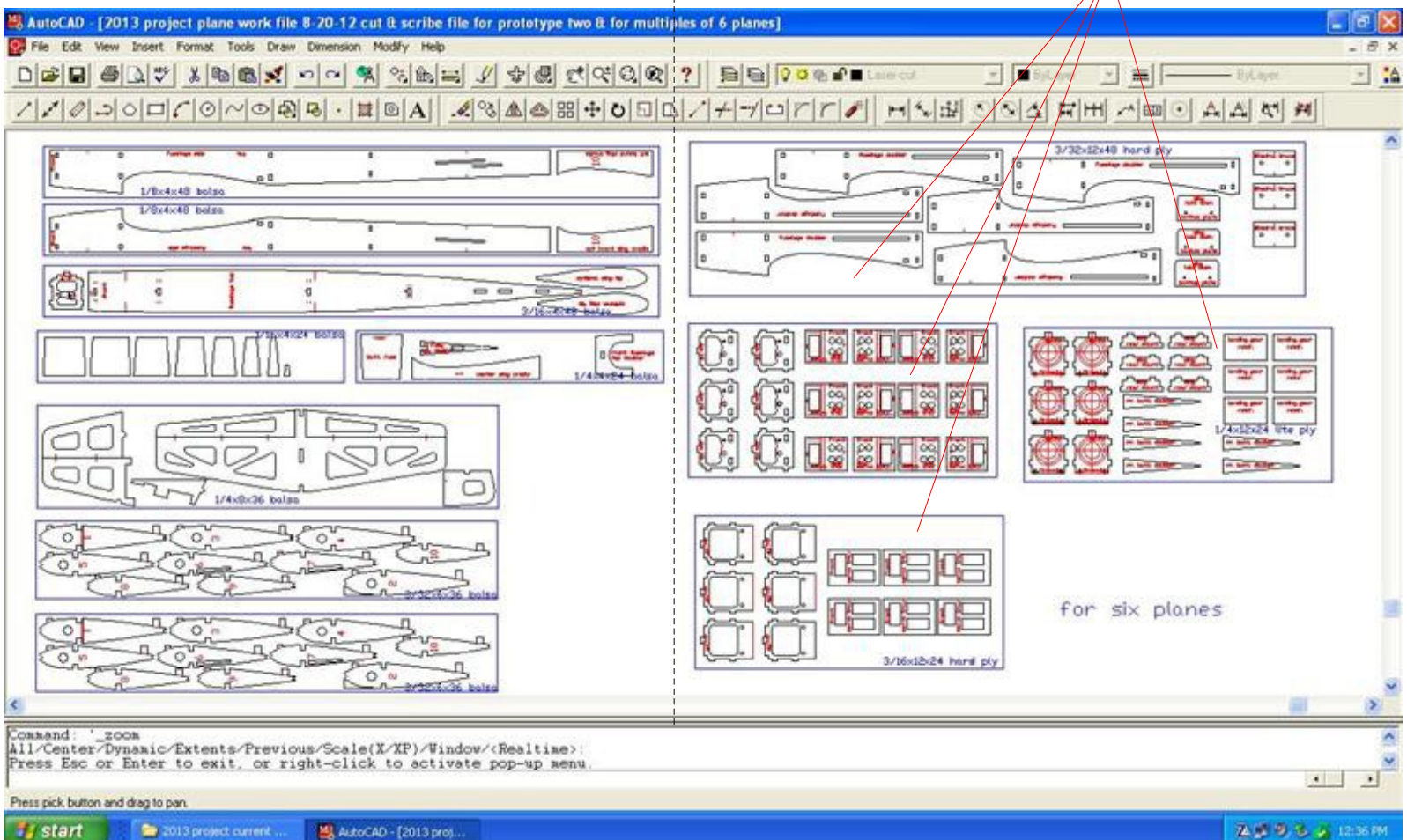
Wood Supplied in the Short Kit

WOOD		SIZE	PART DISCRPTION	AMOUNT REQUIRED
balsa	1545	1/8x4x48	fuse sides & #10 cradles	2 sheets contains parts laser cut
balsa	1547	3/16x4x48	fuse top & #5 former & flat wing tips	1 sheet contains parts laser cut
balsa	1541	1/16x4x48	fuse bott rear	1 sheet contains parts laser cut
balsa	1548	1/4x4x48	fuse bott front, cent cradle, frt & rr fuse top doub,	1 sheet contains parts laser cut
balsa	special order	1/4x8x36	empennage	1 sheet contains parts laser cut
balsa	1163	3/32x6x36	main wing ribs	2 sheets contains parts laser cut
balsa	1077	1/4x1/2x36	fuse and main wing	4 pieces
balsa	1925	1/2x1/2x36 triangle	fuse	1 piece
balsa	1823	1x2x18	wing tips	1 piece
balsa	1086	3/8x3/8x36	leading edge	2 pieces
balsa	1075	1/4x1/4x36	trailing edge	2 pieces
balsa	1122	3/32x2x36	sheeting trailing edge	4 pieces
balsa	1143	3/32x4x36	sheeting leading edge	4 pieces
balsa	1162	3/32x6x48	sheeting center area	1 piece
balsa	1025	3/32x1/4x36	rib cap strips	5 pieces
balsa	1917	3/8x2x36	ailerons	2 pieces
lite ply	6181	1/4x12x24	l/g reinf, firewall, bott rr reinf, wing rr mtg.	parts laser cut
lite ply	6181	1/4x12x24	#4 former, wing servo trays	parts laser cut
plywood	6273	3/16x12x24	#3 formers, fuse servo tray	parts laser cut
plywood	6243	3/32x12x48	fuse side dblr, dihedral brace, wing mtg	parts laser cut
spruce	5577	3/8x3/8x36	main spars	4 pieces
maple	5405	1/4 diax36 (6" long)	wing pins	2 pieces per plane 6" long

Laser Cut & Scribe File

Balsa wood parts are left within the sheet stock.

Plywood & lite ply parts are supplied as separate laser cut parts removed from the sheet Stock that is optimized for multiples planes.



Material & Hardware Supplied in the Short Kit

- *Preformed Plastic Cowl, one supplied*
- *Project Plane Logo N/C Cut Vinyl Decal, one set supplied*
- *Plans for the Contoured Main Wing Tips, two copies supplied*
- *Servo wire tubes supplied*

Material & Hardware Not Supplied

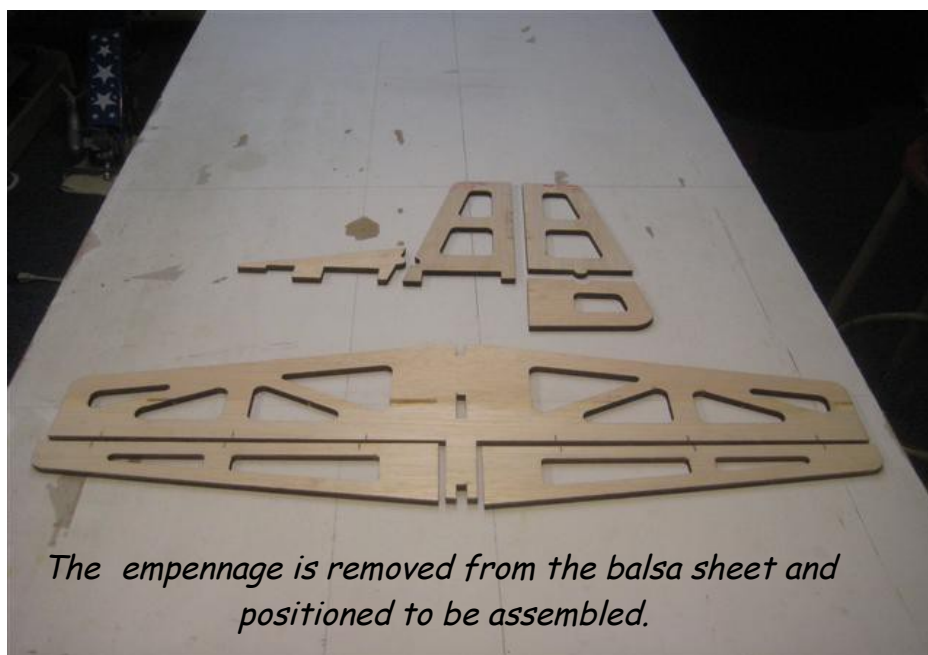
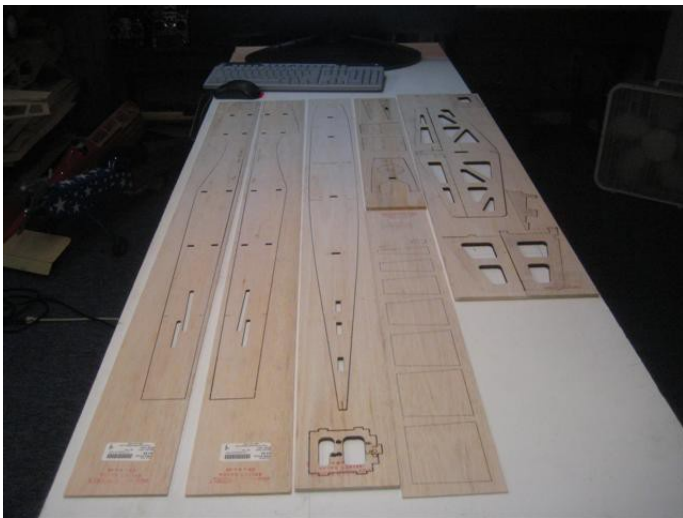
- *.40-.49 size two cycle, fuel, engine recommended/required for club racing*
- *2-1/4" dia spinner for engine prop.*
- *8 oz fuel tank*
- * fuel tubing (approx. 2 ft.)*
- * fuel filler tap (optional)*
- * motor mount*
- * bolts & 'T' nuts for mounting motor mount to firewall*
- * main landing gear*
- * bolts, washers, lock washers, to mount main gear to fuse*
- * axles for main gearwheels collars*
- * tail wheel assembly*
- * wheels (two main 2-1/4" dia. & one tail wheel 3/4" dia.)*
- * 1/4-20 nylon bolts for wing hold down 2pcs*
- * medium control horns 5 pcs*
- * 2-56 metal push rods 12" (cut to size) 2 pcs aileron*
- * 2-56 metal push rods 30" (cut to size) 3 pcs rudder & elevators*
- * 2-56 throttle flex cable type push rod 24" (cut to size) 1 pc*
- * quick connectors for 2-56 metal push rods 5 pcs*
- * CA hinges*
- * servos 5 required*
- *servo wire extensions*
- * C A glue -Thin & gap filling, 1 large bottle each*
- * covering*
- *Optional: canopy, wheel pants, etc.*

The build sequence is as follows:

EMPENNAGE (TAIL FEATHERS) CONSTRUCTION

The empennage or tail feathers (Vertical Fin & Rudder), (Horizontal Stabilizer & Elevator) are built using the 1/4" thick balsa laser cut parts supplied.

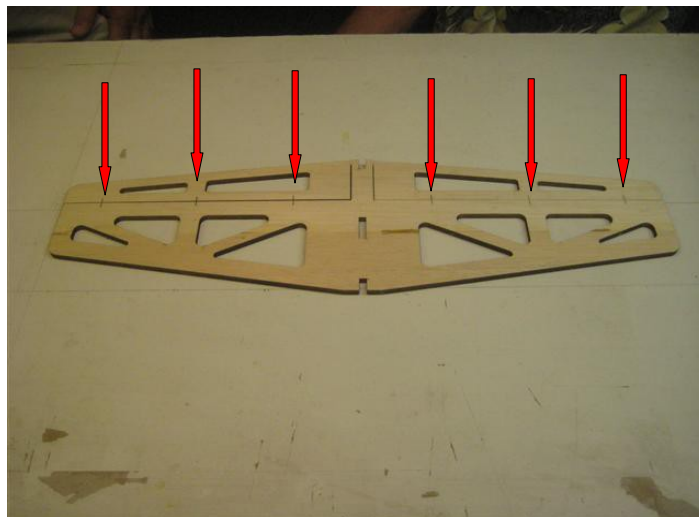
Start the empennage construction by first segregating all the component parts of the empennage then familiarize yourself with the parts and the build sequence by using the instructions and photos as posted below.



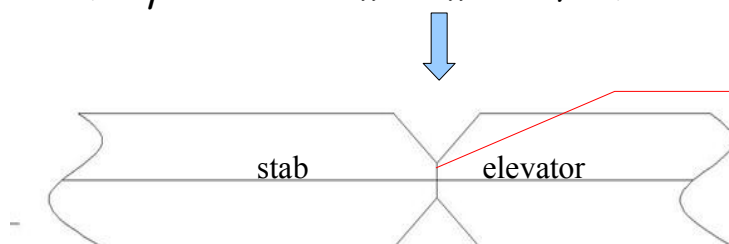
HORIZONTAL STABILIZER and ELEVATOR CONSTRUCTION:

The horizontal stabilizer and elevators are fully laser cut to size including locating slots to aid in the assembling of the stabilizer to the fuselage. The center lines of the CA hinge locations are also laser scribed. The laser cut parts should not be altered unless specified in the instructions.

The first step is to cut in the CA hinge slots in the stabilizer and elevators at the laser scribed hinge center lines (a total of six hinges are used).



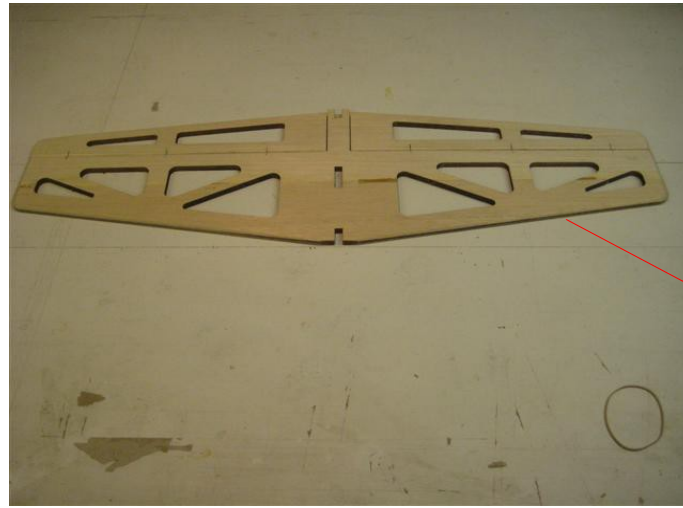
The rear edge of the stabilizer and the front edge of the elevators should be beveled to create clearances for the up and down movement of the elevators.



The width of this surface should be held to a minimum to allow for the movement of the elevators.

The CA hinges are inserted in place (dry) and the total edge or periphery of the combined stabilizer and elevator should be rounded and both top and bottom surfaces of the assembled stabilizer and elevator sanded smooth.





Round over the complete periphery of the stab & elev.

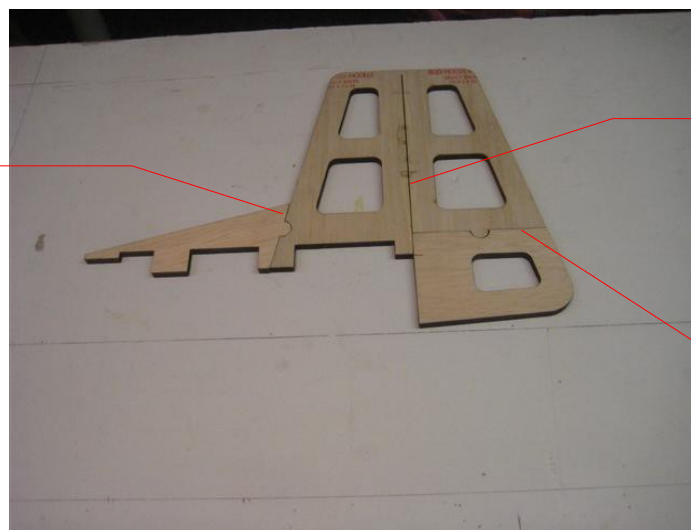
The assembled stabilizer and elevator are now set aside and are ready to assemble to the fuselage.

VERTICAL FIN and RUDDER CONSTRUCTION:

The vertical fin and the rudder are fully laser cut to size including locating slots and tabs to aid in the sub assembling the vertical fin components and the rudder components. There are also tabs that are laser cut to locate the vertical fin/rudder assembly to the horizontal stabilizer and onto the fuselage. The center lines of the CA hinge locations are also laser scribed.

The loose forward portion (dorsal) of the vertical fin and the main portion of the vertical fin should be placed flat on a build surface that is covered with wax paper. The two parts are lined up using the locating slot and tab. Apply glue to the joint making sure the two parts are laying flat on the build surface.

The top and bottom parts of the rudder should be placed flat on a build surface that is covered with wax paper. The two parts are lined up using the locating slot and tab. Apply glue to the joint.

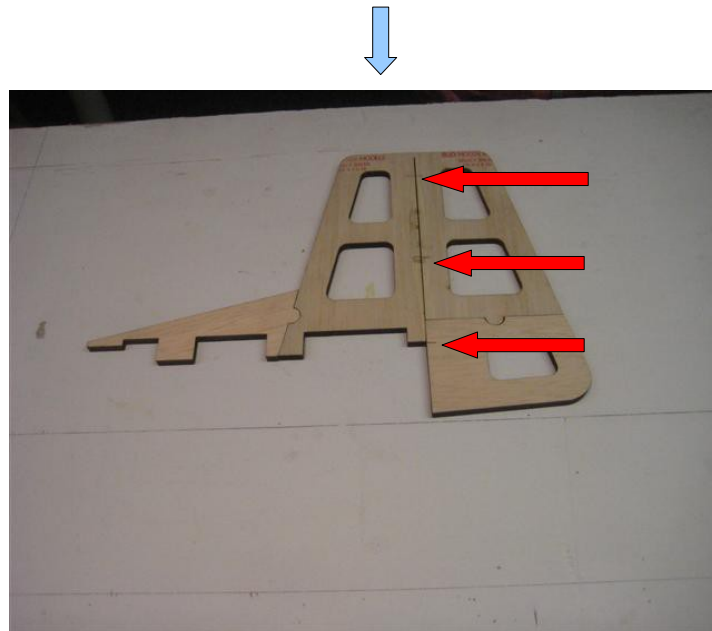


Apply glue to joint

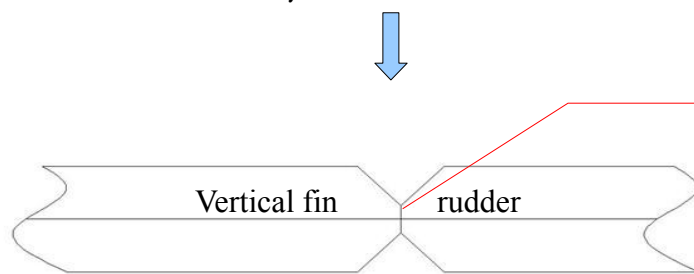
Keep the fin and the rudder separated during the gluing operation to eliminate any wicking of the CA into the hinge joint.

Apply glue to joint

The CA hinge slots in both the rear edge of the vertical fin and the leading edge of the rudder should be cut in at the laser scribed locations (a total of three hinges are used).

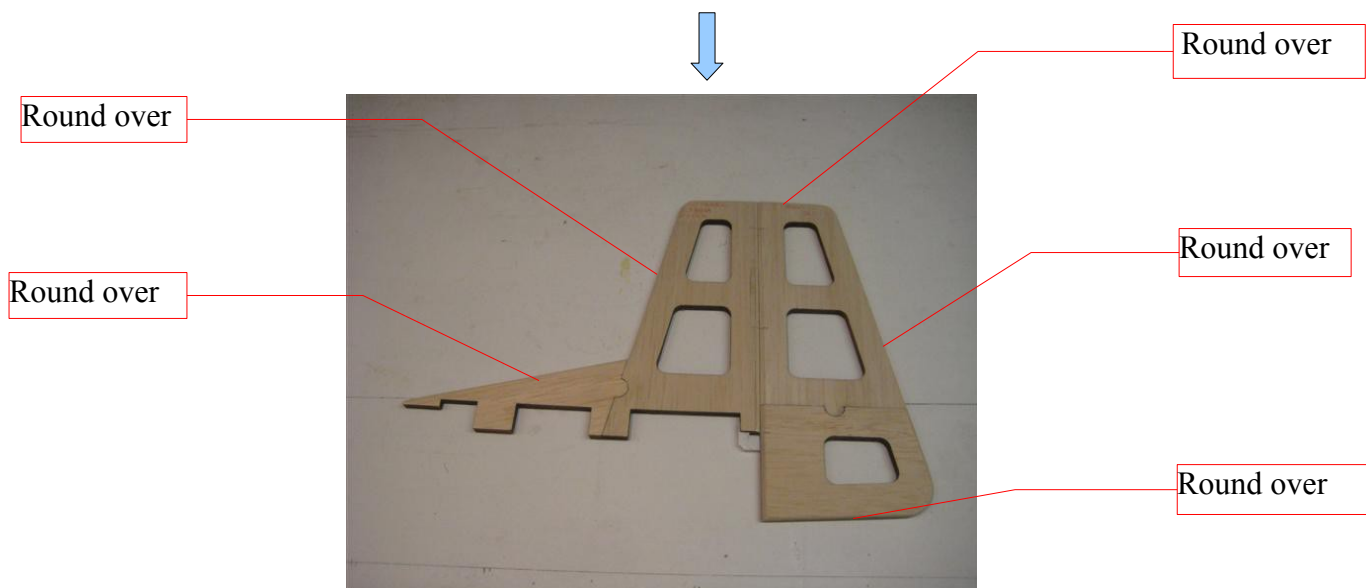


The rear edge of the vertical fin and the front edge of the rudder should be beveled to create clearances for the side way movement of the rudder.

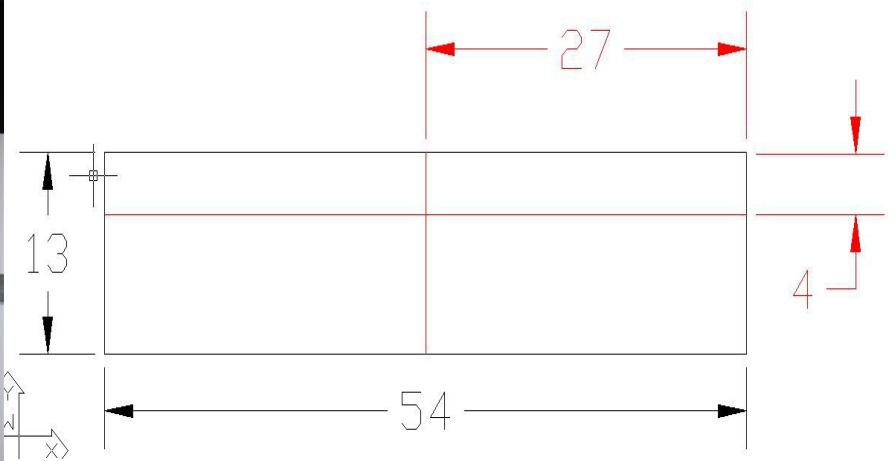
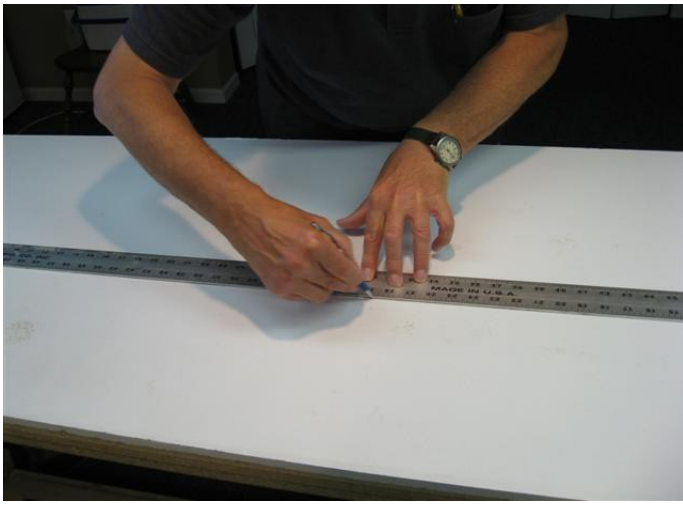


The width of this surface should be held to a minimum to allow for the movement of the rudder.

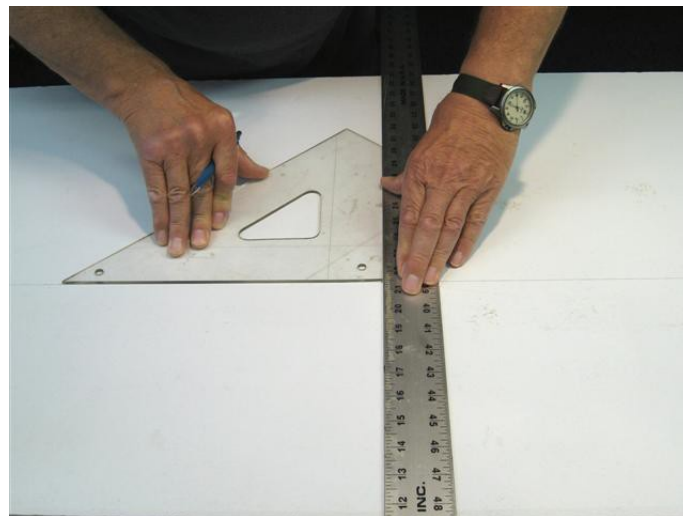
The CA hinges are inserted in place (dry) and the exposed edges of the combined vertical fin and rudder should be rounded and both right and left surfaces of the assembled vertical fin and rudder sanded smooth.



The assembled vertical fin and rudder are now set aside and are ready to assemble to the fuselage.



Draw a straight center line 90° to the work line at the center line of your work surface and across the full width of the work surface.

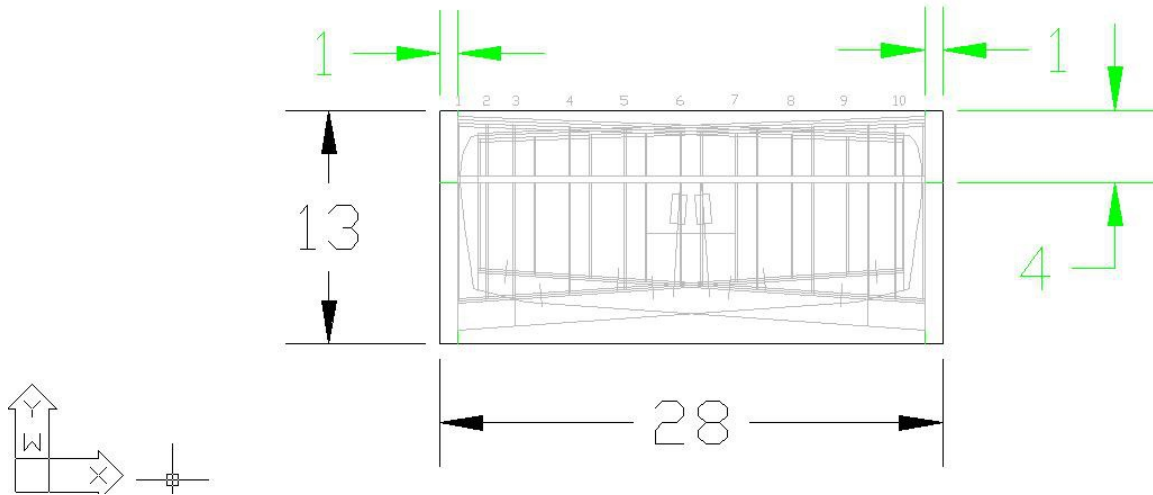


Cover your work surface with wax paper or equivalent to protect the wing from sticking to the work surface as the wing is built.

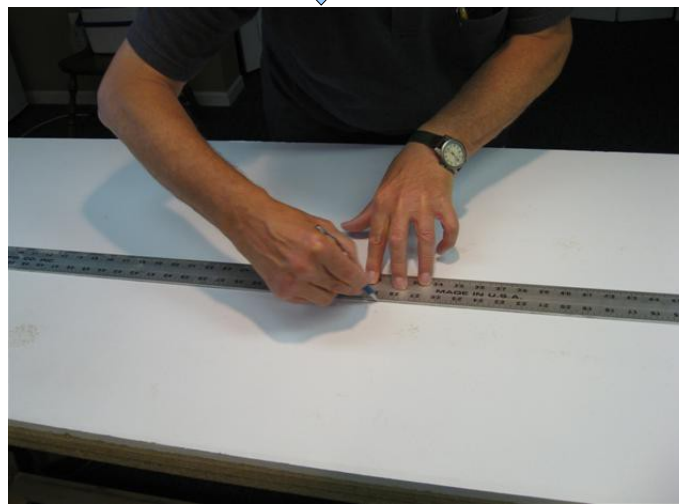


OR

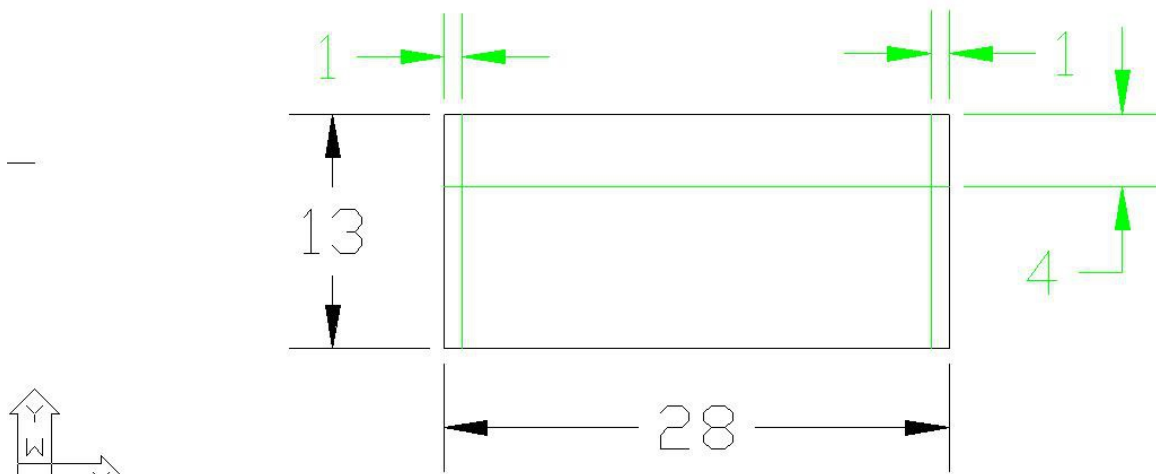
If the wing is built in two pieces, prepare your build surface as follows (the dimensions are minimum sizes) :

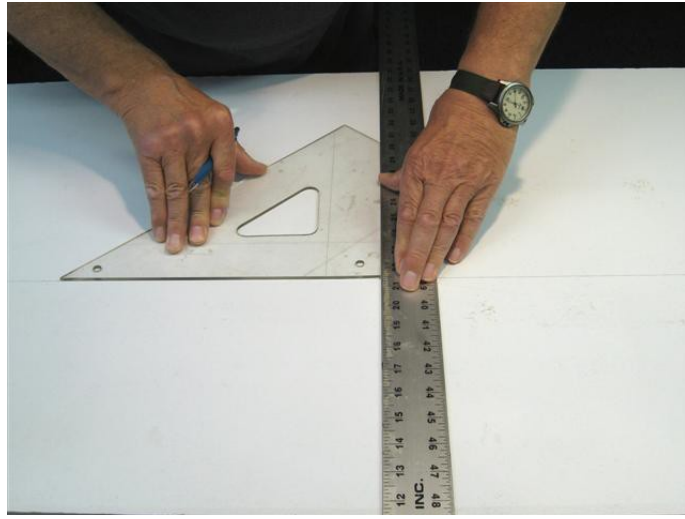


Drawing a straight work line the length of your work surface, and approx. 4" parallel to one edge of the work surface.



Draw two straight center lines 90° to the work line and approx. 1" parallel to each end of the work surface and across the full width of the work surface. See sketch below.





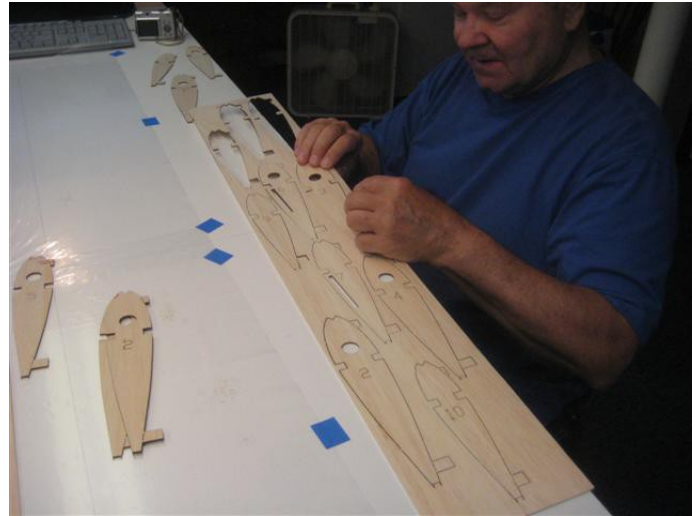
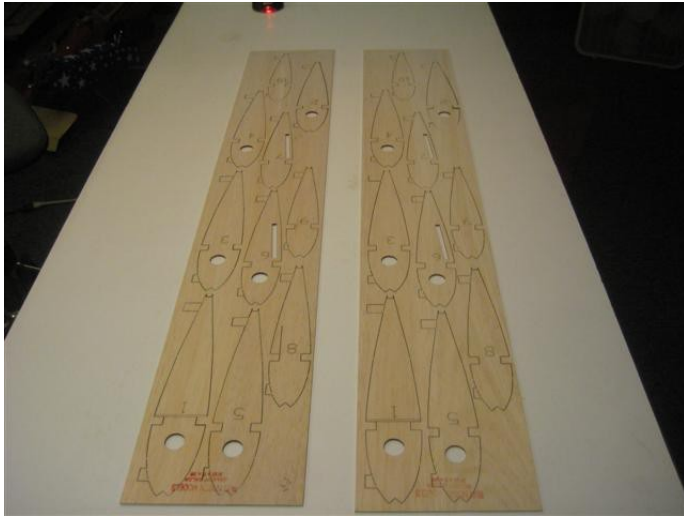
Cover your work surface with wax paper or equivalent to protect the wing from sticking to the work surface as the wing is built.



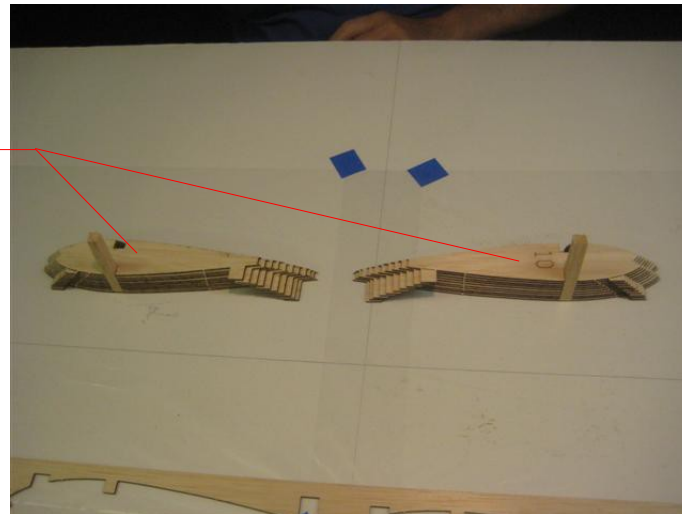
Once your build surface is prepared, You will be able to build your main wing following the instructions and pictures to follow.

MAIN WING CONSTRUCTION:

Start the main wing construction by first segregating all the component parts of the main wing. There are two laser cut (un-labeled) triangular shaped parts to be later used as the sides of the fuselage extension that will be attached to the main wing. Familiarize yourself with the parts and the build sequence by using the instructions and photos as posted below.



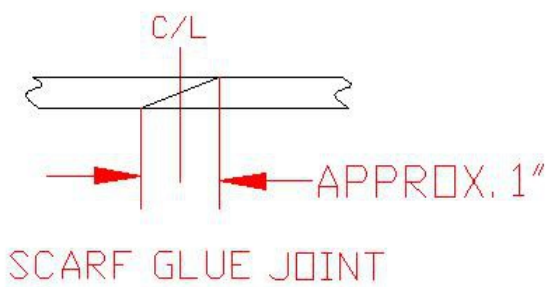
The ribs are stacked in sequence showing the wing taper. This photo is used only as a visual aid and not part of the construction sequence.



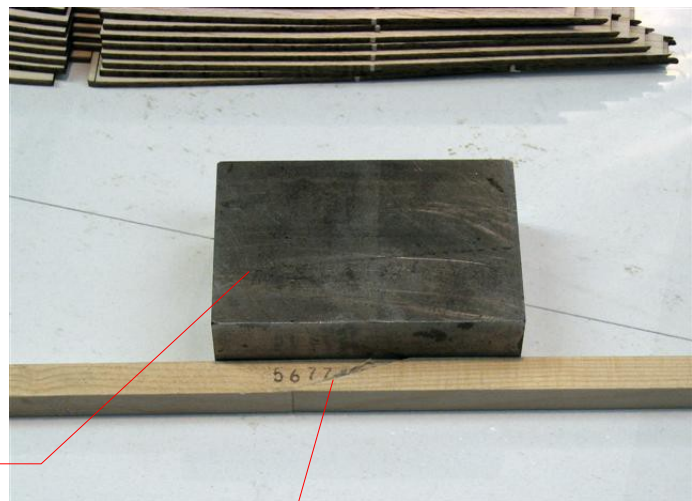
You will find that all the instructions posted will be for the one piece wing construction. For the two piece wing construction follow the sequence for the one piece wing construction and personally make the necessary construction adjustments for the two piece wing build.

NOTE: The main wing is constructed with its top surface built facing the build surface or simply stated (top side down). Position the top main spar and all the break away tabs of all the ribs down on the build surface. This will produce a true and straight wing. The built in dihedral and wing taper will automatically be in place.

The top main spar is prepared by scarf joining two 3/8x3/8x48" spruce sticks together. Rough trim each side of the main spar to a length of 25-1/4" on each side of the center line. The finish length or span will be trimmed at a later time.



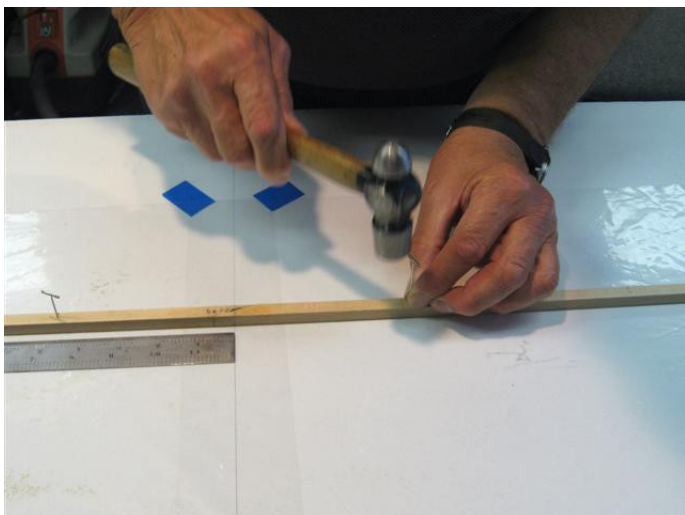
Block used to hold the main spar scarf joint in line during the gluing of the joint.



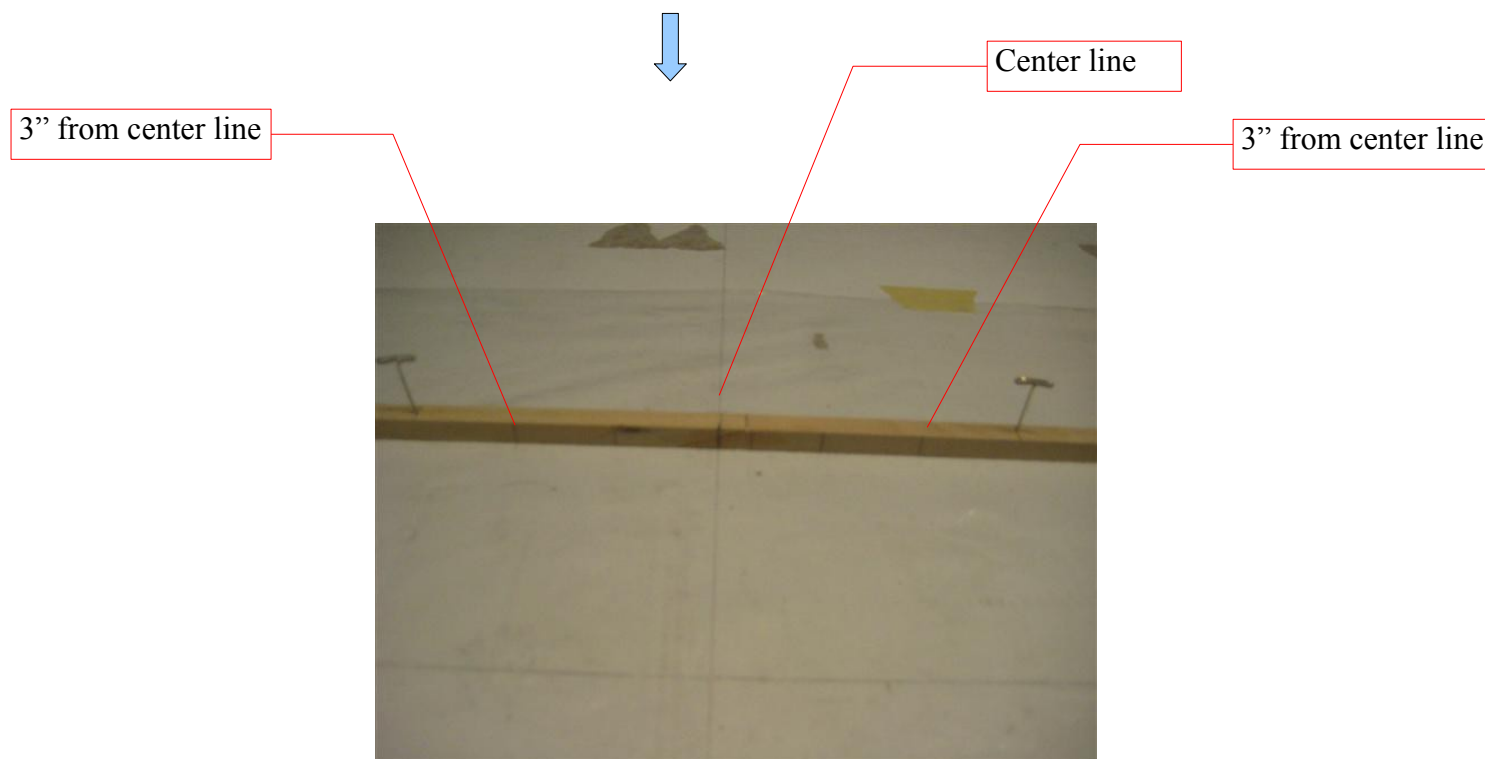
Glue scarf joint

Note, To aid in the top main spar alignment and fastening to the build surface, pre-drill small holes through the spruce spar starting at 4-1/2" from the center line of the spar, followed by additional holes at 6" spacings. These holes should be sized per your straight or "T" pin diameter.

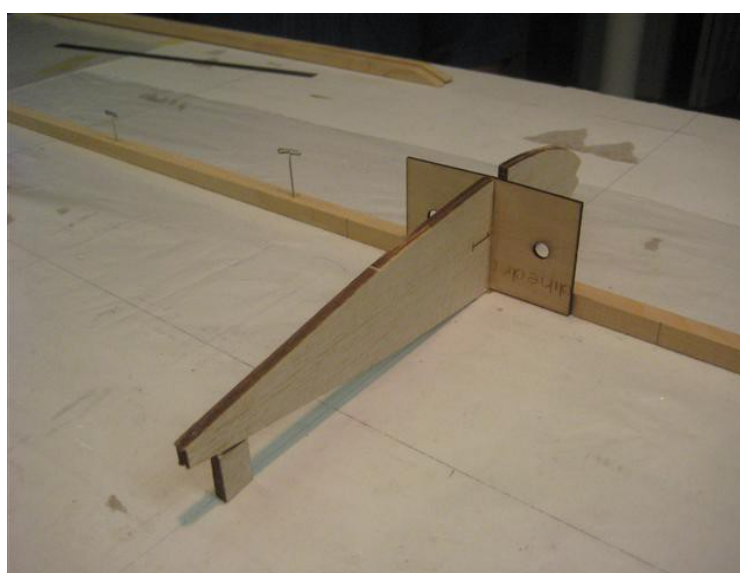
Position the top main spar flat on the build surface. Line up the rear corner of the spar to the front of the work line drawn on the work surface and line up the center of the scarf joint of the main spar to the drawn center line on the work surface. Pin the top main spar in location to the work surface using the pre-drilled holes for location.



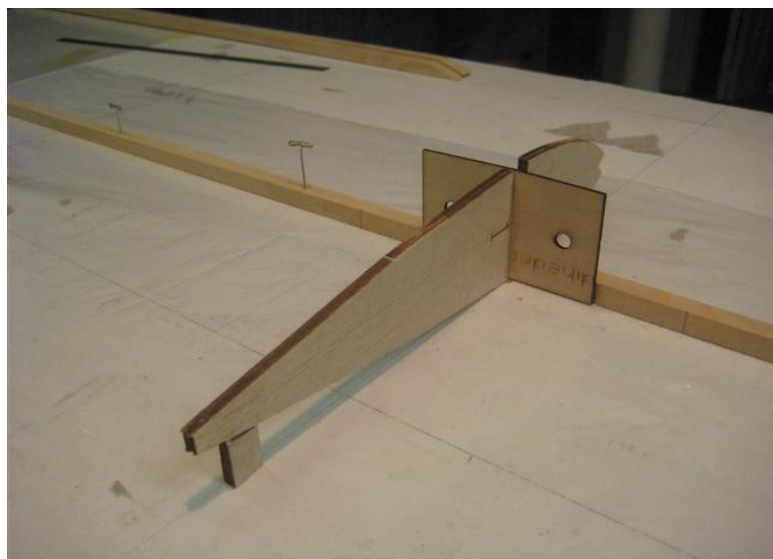
Measure out board from the center line of the wing 3" on both sides of the wing. This will be used to line up the inboard side of the third rib.



Position the dihedral brace against the rear face of the top main spar with the top edge of the dihedral brace flat on the work surface. Line up the center line of the dihedral brace to the center line on the work surface and glue in place.
Note: The photo below was taken out of sequence but shown here to help clarify the above directions.

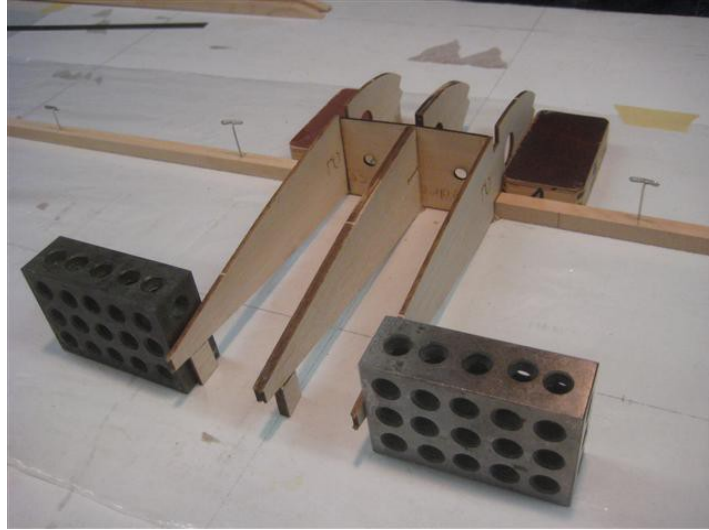


Prepare the #1 ribs by gluing both #1 ribs together (for the one piece wing). Cut away the stock between both laser scribed lines just at and to the rear of the notches for the main spars. Install the front portion of the #1 ribs with its breakaway tabs flat on the work surface and the notch in the ribs placed over the top main spar and lining up the center of the two #1 ribs on the center line of the wing. Place the front trimmed edge of the rear portion of the #1 ribs against the dihedral brace, lining up the center of the two #1 ribs on the center line of the wing and with it's breakaway tabs flat on the work surface. Make sure the ribs are held 90° to the work surface and glue in place.

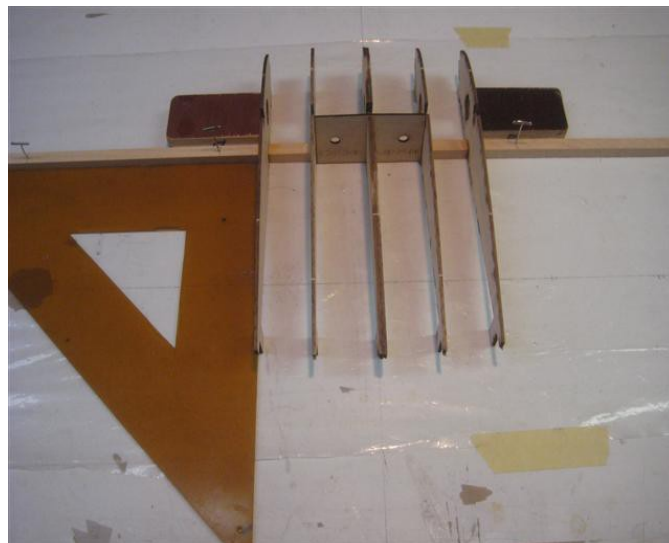


Install the #2 rib with its breakaway tabs flat on the work surface and the notch in the rib placed over the main spar and lining up the inside surface of the rib against the edge of the dihedral brace. Make sure the rib is 90° to the main spar, Glue in place to the main spar and the dihedral brace. Do this installation on both sides of the center line of the wing.





Place the #3 rib with its breakaway tabs flat on the work surface and the notch in the rib placed over the main spar while spacing the inside surface of the #3 rib 3" from the #1 rib, as previously marked. Make sure the rib is 90° to the main spar, Glue in place to the main spar. Do this installation on both sides of the center line of the wing.

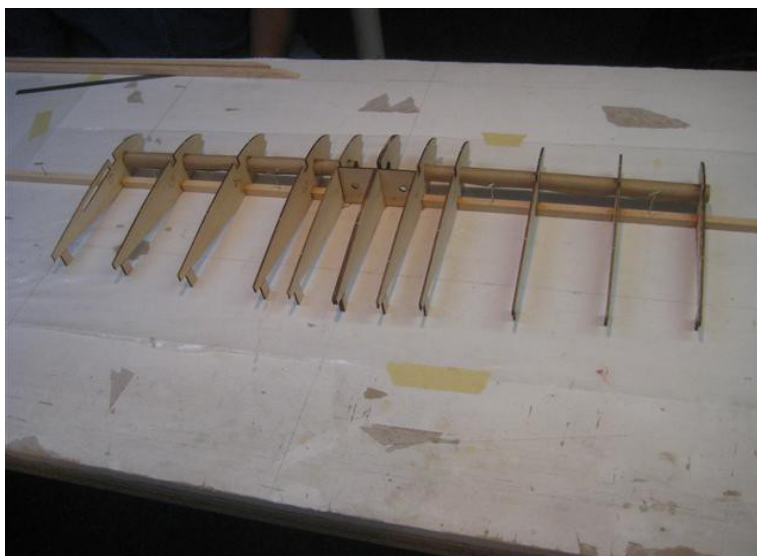


Place the #4, #5, #6 ribs with their breakaway tabs flat on the work surface and the notch in the rib placed over the main spar and all spaced 3" apart from each other. As an aid, use a temporary 3" spacer block placed between the ribs. Make sure the ribs are 90° to the main spar, Glue in place to the main spar. Do this installation one rib at a time and in numerical sequence on both sides of the center line of the wing.

Cut the supplied servo wire tube to a length of 11-1/4". Insert the trimmed tube through the holes in ribs #6 through #2 and glue in place.

Make sure you install the servo wire tube before installing the remaining ribs.





Place the #7, #8, #9, #10 ribs with their breakaway tabs flat on the work surface and the notch in the ribs placed over the main spar and all spaced 3" apart from each other. As an aid, use a temporary 3" spacer block placed between the ribs. Make sure the ribs are 90° to the main spar, Glue in place to the main spar. Do this installation one rib at a time and in numerical sequence on both sides of the center line of the wing.

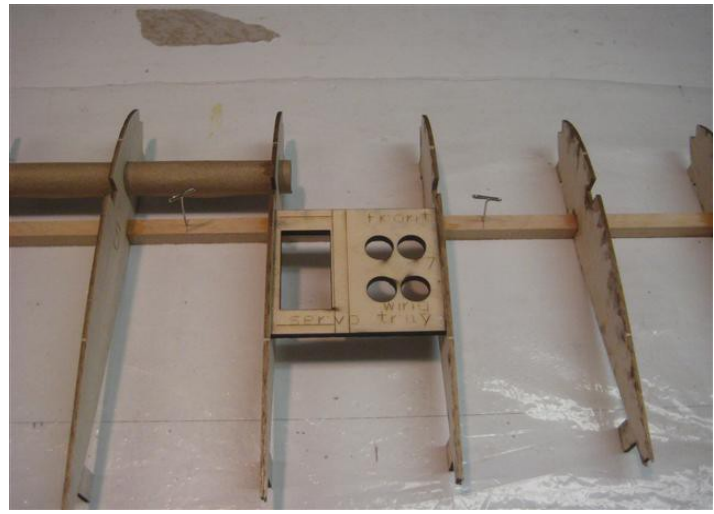
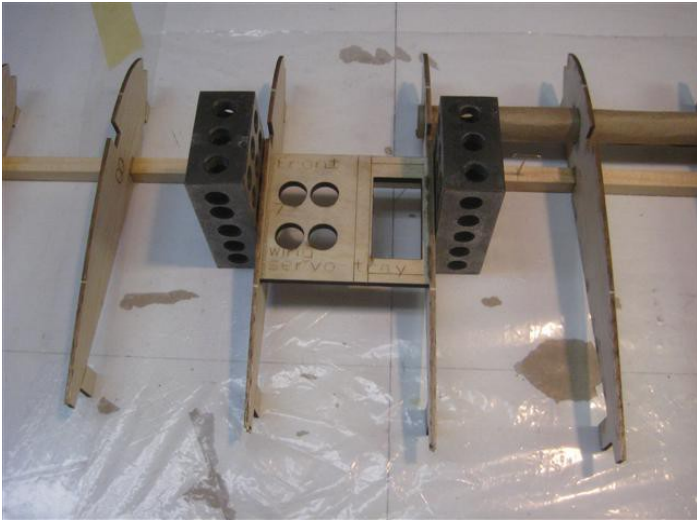
Note: The total span at this point from the outside of #10 rib right side to outside of #10 rib left side is approx. 49-3/4" to 49-7/8".



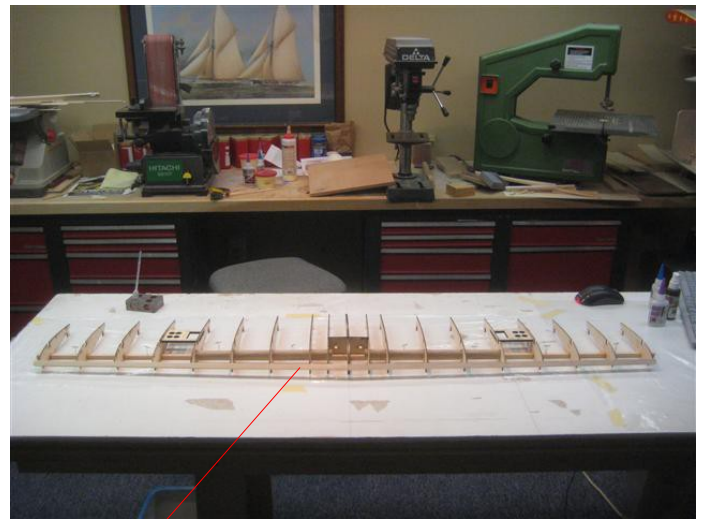
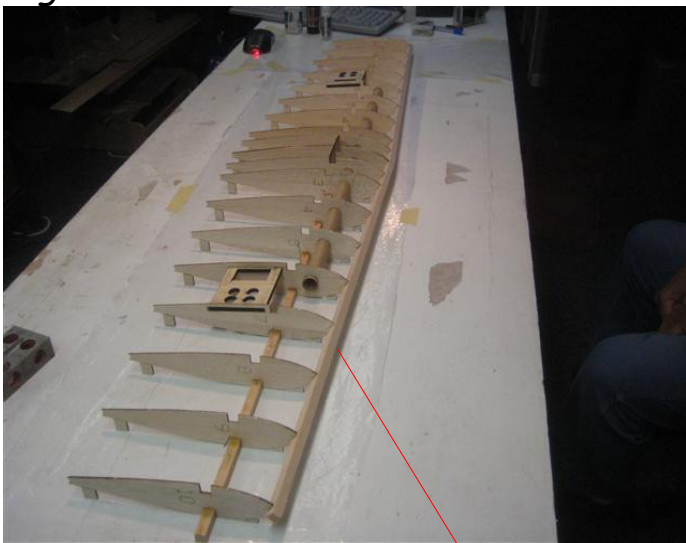
Note: you may notice in some photos and in some sketches the wing servo trays may appear different than those shown in the following photos. The wing servo trays with the circular lightening holes reflect the latest build changes. The wing servos have been repositioned since the prototype build to simplify the installation of the servos and the covering of the wing.

Carefully insert the main wing servo trays through the slots in the #6 and #7 ribs and line up the trays as labeled on the trays. Glue in place. Do this installation on both sides of the center line of the wing.





Place the leading edge (3/8 "x3/8" square balsa sticks) in the notches in the front end of all the ribs and glue in place. Do this installation on both sides of the center line of the wing.

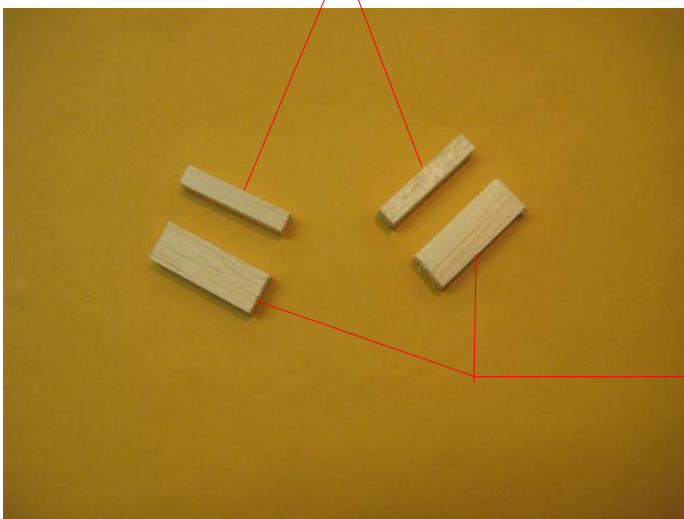


Leading edge

Fabricate two leading edge reinforcements that fit between the #1 rib and the #2 rib and behind the leading edge. Use lengths of 1/4x1/2" and 1/4x1/4" balsa sticks and glue them together to form the reinforcements. Cut and fit the assembled balsa sticks to fit between the ribs, then glue in place. Do this on both sides of the wing center line. This reinforcement is used to strengthen the leading edge when it is drilled for the wing locating and mounting dowels.

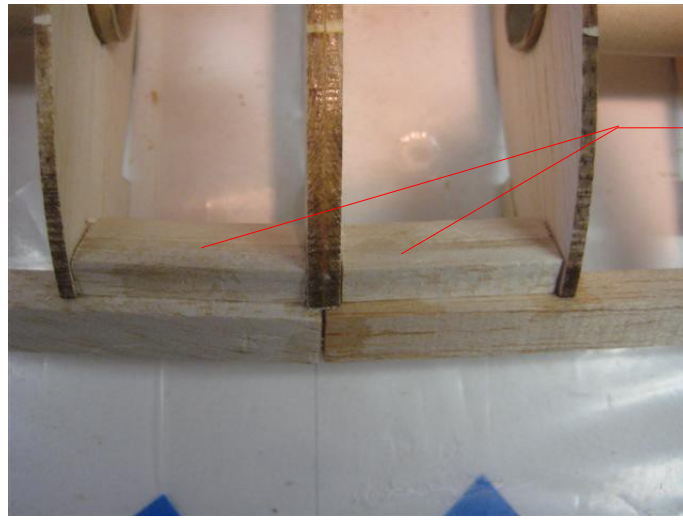


1/4x1/4" balsa sticks



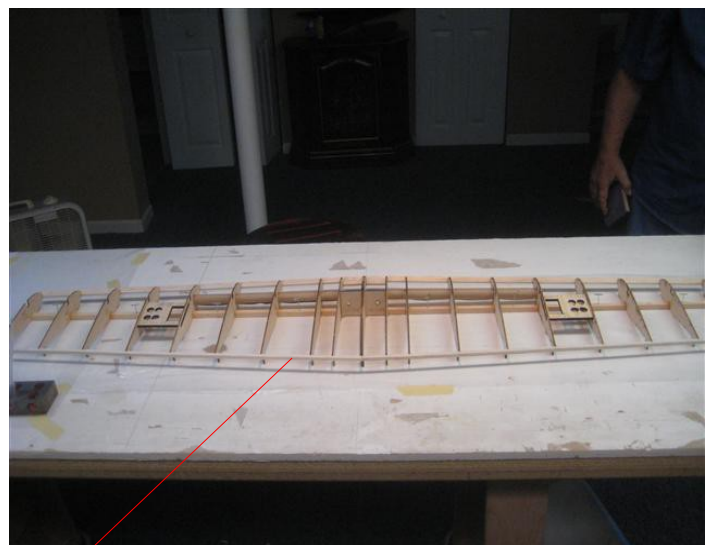
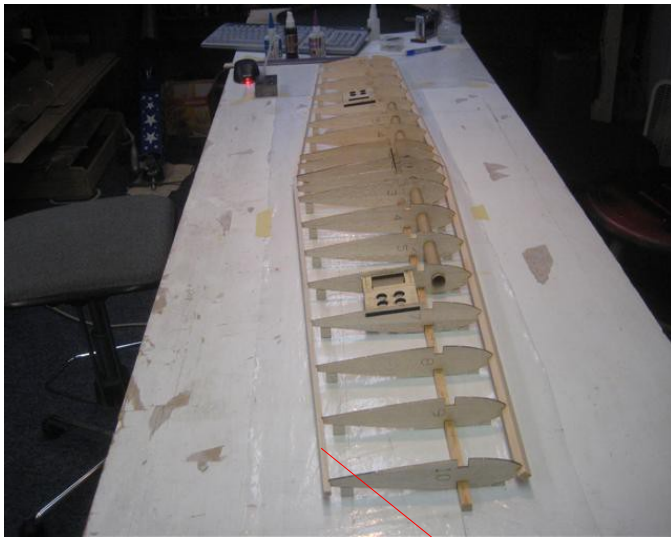
1/4x1/2 " Balsa sticks





Leading edge reinforcement

Place the trailing edge (1/4"x1/4" square balsa sticks) centered on the rear end of all the ribs and making sure the ribs are spaced properly and glue in place. Do this installation on both sides of the center line of the wing.



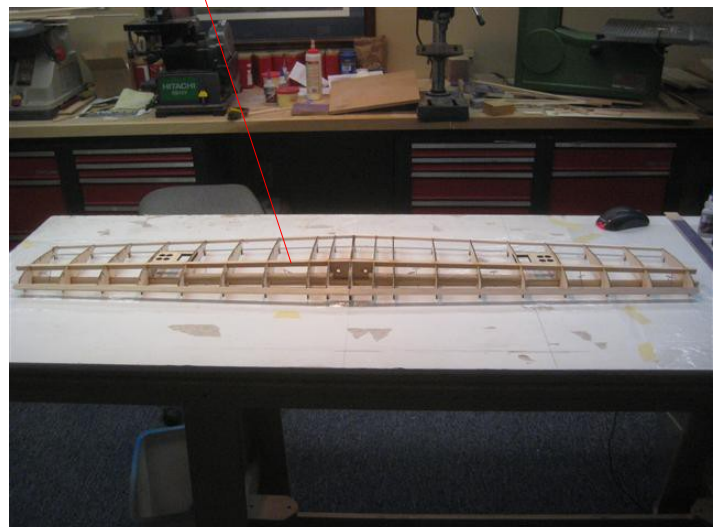
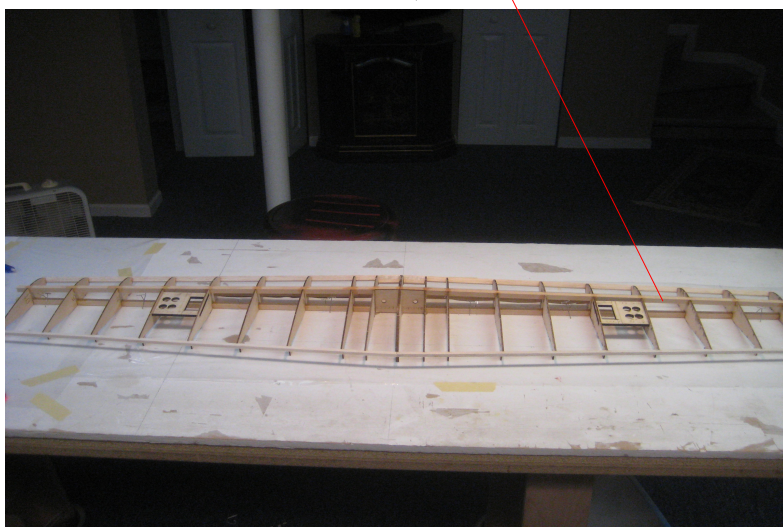
Trailing edge

Note, prior to installing the lower main spar, remove straight or "T" pins from the top spar, and relocate them in a criss-cross fashion, trapping the main top spar to the building surface. Do this in the out board open bays to keep the wing in it's original build position.

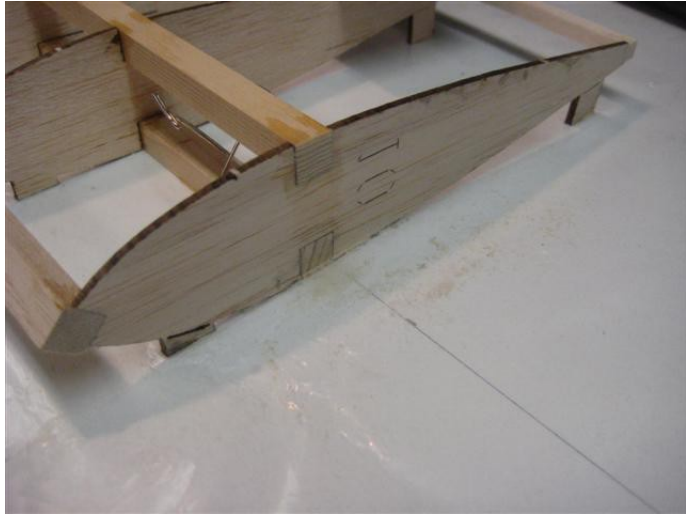
Trim one end of each of the "lower main spars" on a 1° angle for a tight fit, when installing them in place in the rib notches. Note: These "bottom main spars" are actually the spars on top of the ribs and away from the build surface during the building of the main wing, keeping in mind the main wing is being built with the top of the main wing facing down on the build surface.



Lower main spars

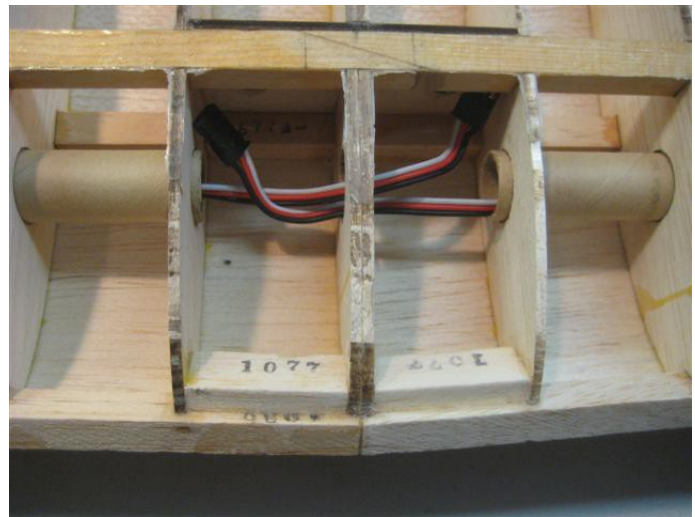


Trim the top and bottom main spars, the leading edge, and the trailing edge flush with the outside surface of the #10 ribs. Do this trimming on both ends of the wing.



The skeleton of the wing is roughly and basically complete. Install the servo wire extensions in the wire extension tubes or fish a string through the tube and tape off the ends of either, out of the way during the rest of the wing build.

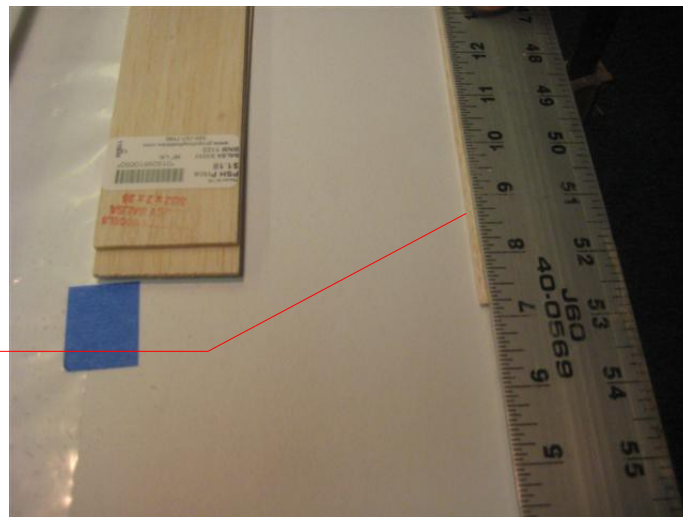
Note: The photos below were taken out of sequence but shown here to help clarify the above directions.



A. *Prepare the rear sheeting (3/32" x2" balsa sheets, 4 pieces) by trimming one edge of the sheet "straight" by removing a minimum amount of stock off that edge on each of the sheets. Make sure the trimmed edge is "straight". Two sheets are used at this time. The remaining two trimmed sheets will later be used for the top side of the wing.*



Trim edge of sheeting straight

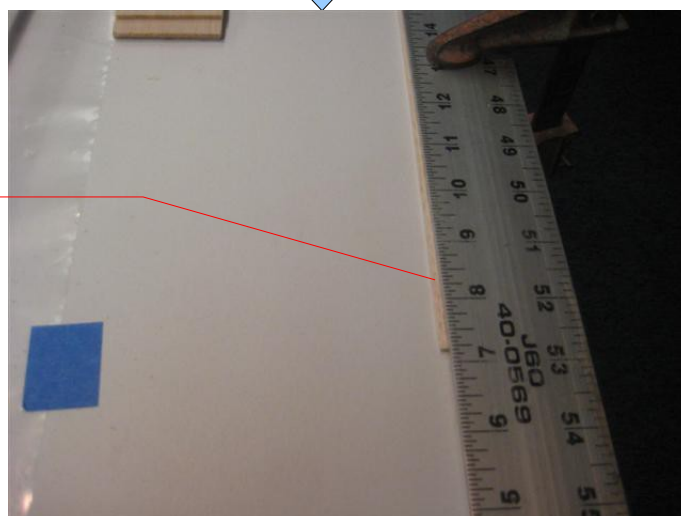


B. Place the straight edge of the trimmed $3/32$ " sheeting along the rear edge of the trailing edge of the wing. Make sure the center edge of the sheets follows the center line of the wing. Cut and sand the center edge as required. Mark the length of the outboard edge of the sheeting to length by using the outboard surface of the # 10 ribs as a guide. Rough trim the outboard edge of the sheeting. Reposition the sheeting in place and glue. Do this installation on both ends of the wing. ↓

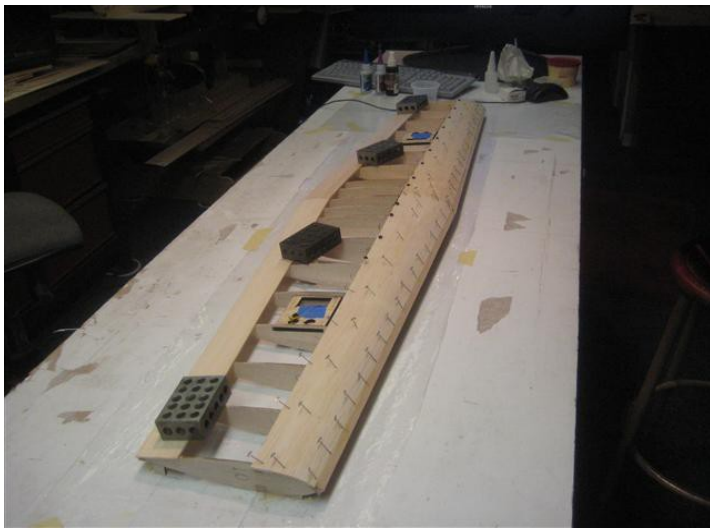


C. Prepare the front sheeting ($3/32 \times 4$ " balsa sheets, 4 pieces) by trimming one edge of the sheet "straight" by removing a minimum amount of stock off that edge on each of the sheets. Make sure the trimmed edge is "straight". Two sheets are used at this time. The remaining two trimmed sheets will later be used for the top side of the wing. ↓

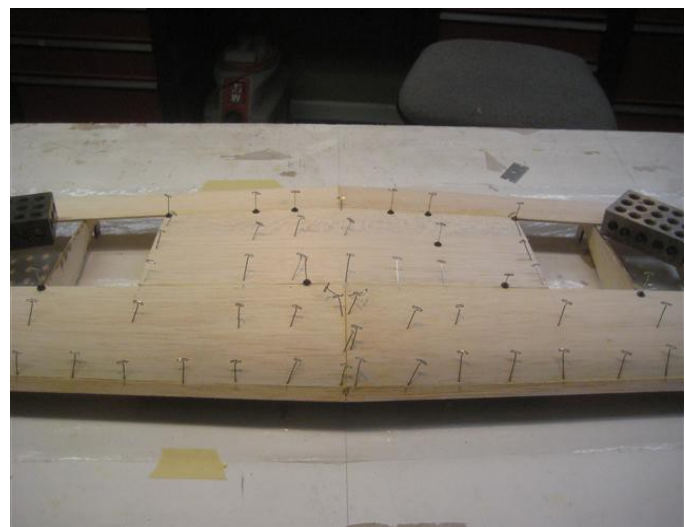
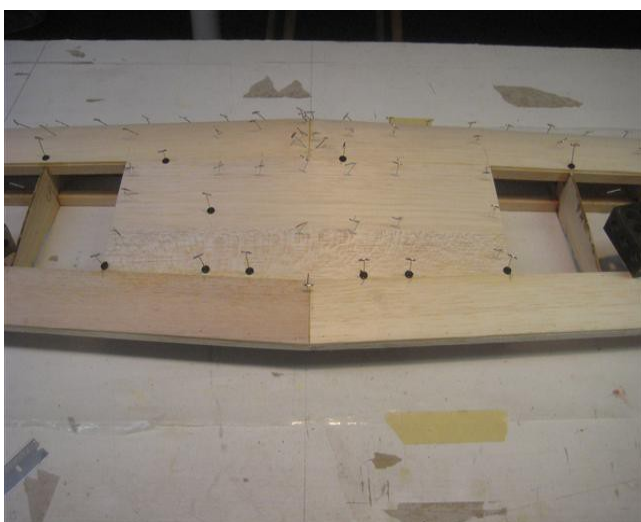
Trim edge of sheeting straight



D. Place the straight edge of the trimmed $3/32 \times 4$ " sheeting along the rear edge of the leading edge of the wing. Make sure the center edge of the sheet follows the center line of the wing. Adjust as needed. Tape the straight front edge of the sheeting against the leading edge and bend the sheeting to the contour of the ribs. Mark the outboard edge of the sheeting to length by using the outboard surface of the # 10 ribs as a guide. Rough trim the outboard edge of the sheeting. Reposition the sheeting in place and mark a line along the rear edge of the bottom main spar. Remove the marked sheeting and trim the rear edge of the sheeting $1/8$ " forward of the marked line. The exposed $1/8$ " of the spar will help align the rib caps later. Moistening the sheeting will aid in the bending. Reposition and glue the sheeting in place. Do this installation on both sides of the center line of the wing. Double check that the wing skeleton is still laying flat on the build surface. You may have to weigh down the wing skeleton, so all the construction tabs on the ribs are still flat to the build surface during the sheeting operation.



E. Make a filler sheeting from $3/32 \times 6$ " balsa sheet trimmed to fit: between the right hand outboard surface of the #4 rib and the left hand outboard surface of the # 4 rib; and between the rear edge of the front sheeting and the front edge of the rear sheeting. You can first make a paper template of that area by laying the paper on the wing and tracing the shape on the paper, then transfer the shape to the balsa sheet and cut and fit the balsa sheet to size. When satisfied with the fit, glue the sheeting in place.

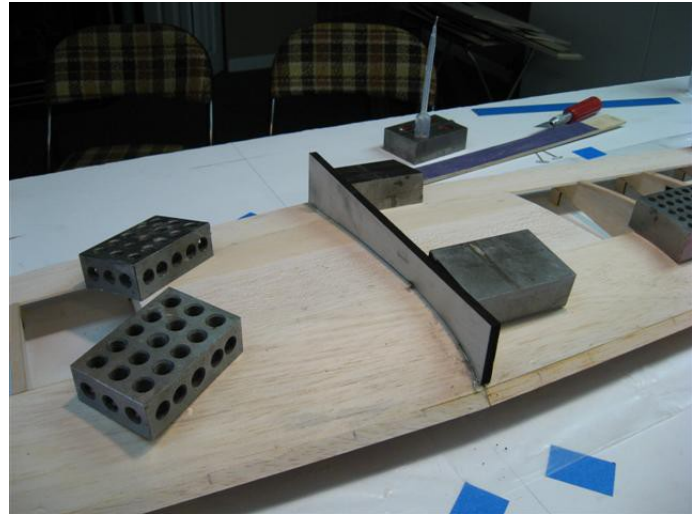


F. Sand all the ends of the sheeting flush with the outside surface of the #10 ribs.

G. Cut, fit and glue in place 3/32x1/4" cap strips between the leading edge sheeting and the trailing edge sheeting and centered on all the exposed rib edges. Note, the cap strip on the #10 rib is applied flush to the outside surface of the #10 rib.

Lightly sand the surface of all the sheeting and rib caps making sure all of the surface is smooth and continuous.

Place the three laser cut wing cradles in position on the surface of the bottom of the wing. The rear ends of the cradles should line up with the trailing edge and the front end of the cradles should line up with the joint of the leading edge and the front wing sheeting. The #1 cradle is lined up on the center line of the wing. The #10 cradles should be lined up flush with the outboard surface of the # 10 ribs. Hold the cradles in place by using a minimum spot gluing or using hot glue.



Carefully remove the wing from the work surface and turn the wing over, so that the bottom of the wing is now facing the work surface and the three cradles are setting flat on the work surface. Remove the breakaway tabs from the ribs and lightly clean up and sand the top side of the main wing.

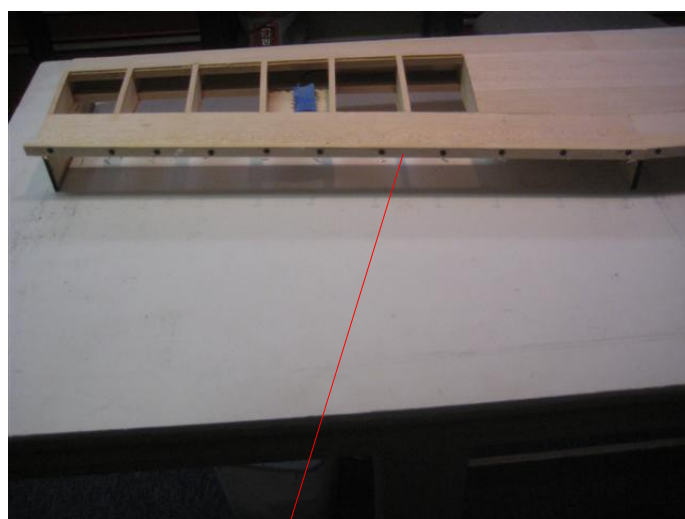


The top surface of the wing is ready for the top sheeting. The sheeting on the top surface of the wing will be completed in a similar sequence as the bottom sheeting. (see steps **A.** through **G.** shown above.)



After the top sheeting is applied, lightly sand the rear edge of the wing which includes the trailing edge stock, the top and bottom sheeting, so all three pieces are straight and flush to each other.

Rough cut to length $1/4 \times 1/2 \times 25-1/2$ " balsa sticks and glue the sticks to the rear edge of the wing, both sides of the center line of the wing.



1/4x1/2" balsa sticks

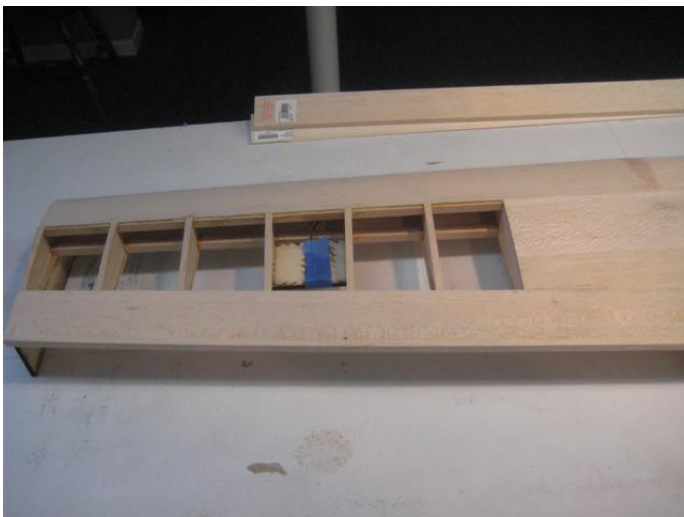


1/4x1/2" balsa sticks

When the glue dries, block plane or sand the top and bottom of the balsa sticks flush with the surface of the wing.



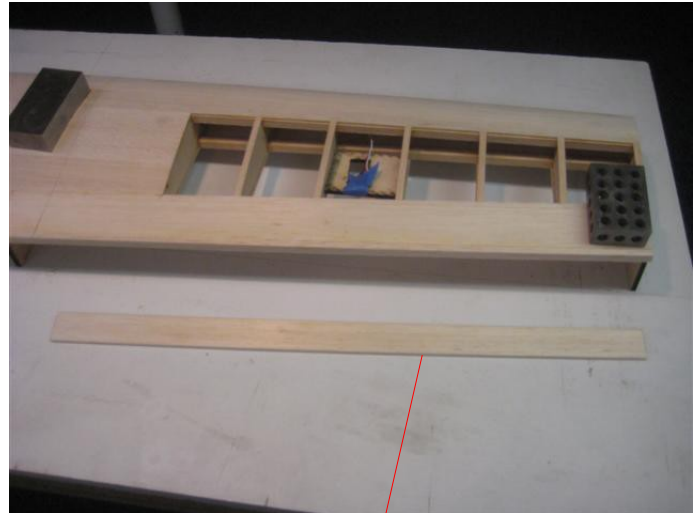
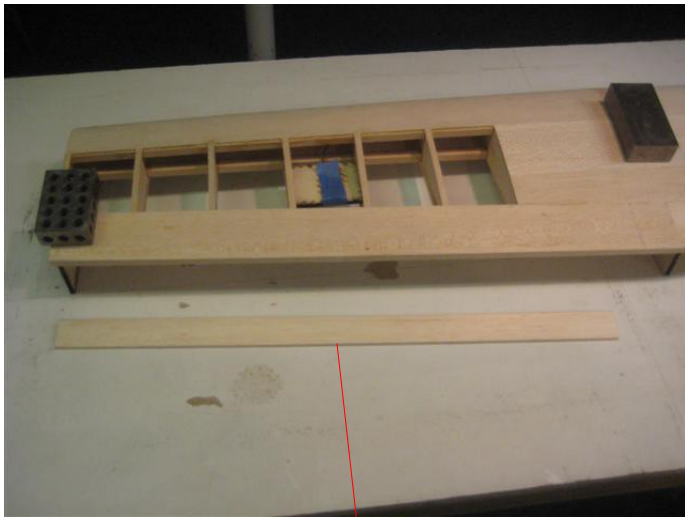
Lightly sand the top surface of all the sheeting and rib caps making sure all of the surface is smooth and continuous. The wing is now ready for the ailerons, the center wing extension blocks and the wing tips.



Note: At this point, you must decide on which wing tip option you will build. There are two options included in the short kit; contoured wing tips that each builder must cut and sand from a supplied balsa block to the final shape using paper plans also supplied, or flat end caps that are laser cut to shape. The choice of the end treatment also affects the build of the ailerons.

Use the following instructions to build the main wing with the "contoured wing tip option":

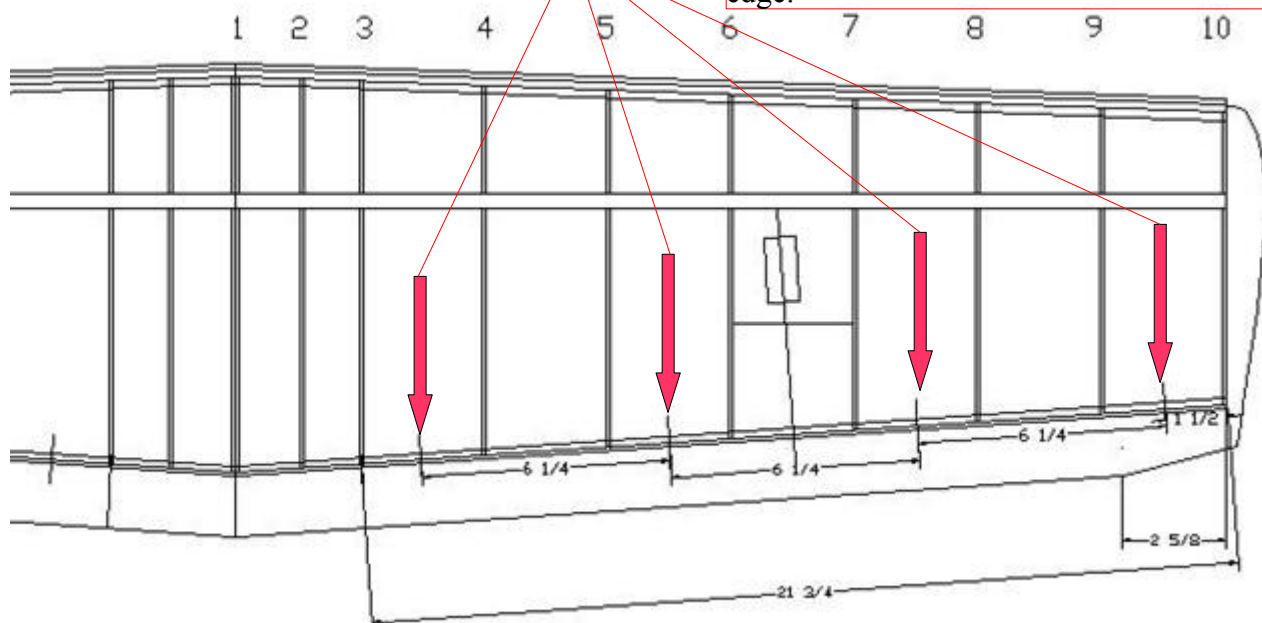
Prepare the ailerons by making them 1-1/4" parallel in width. Hold the front or hinge edge and cut the trailing edge to the 1-1/4" width. Cut the ends of the ailerons square to the front edge of the aileron and to a rough length of 22".

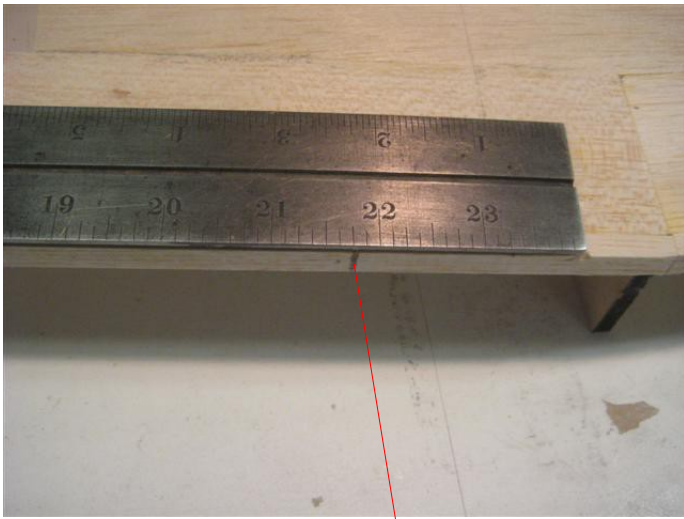


Cut two lengths of supplied aileron stock to 1-1/4" in width and 22" in length.

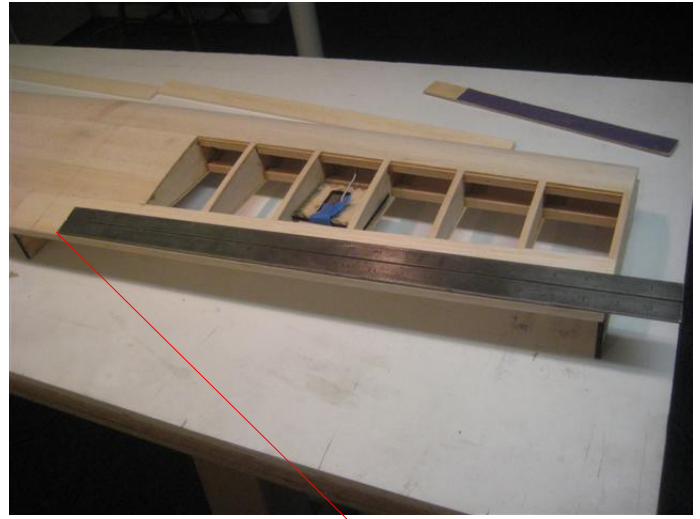
At this point, layout the following lines on the main wing and ailerons. First draw a line 21-3/4" from the rear outboard corner of the wing. Temporarily position the inboard corner of the aileron to that line and hold the aileron in place along the trailing edge of the wing with masking tape. Draw a straight line flush with the out board side of rib # 10. Draw a short line 2-5/8" from that line on the rear edge of the aileron for the tapered wing tip. The actual tapering will be done when working on the wing tips. Draw the hinge center line locations on both the wing and the aileron. Refer to the sketch below. Do all of this on both right and left side of the wing.

Cut hinge slots (4 places) in the leading edge of both ailerons and (8 places) in the wing trailing edge.

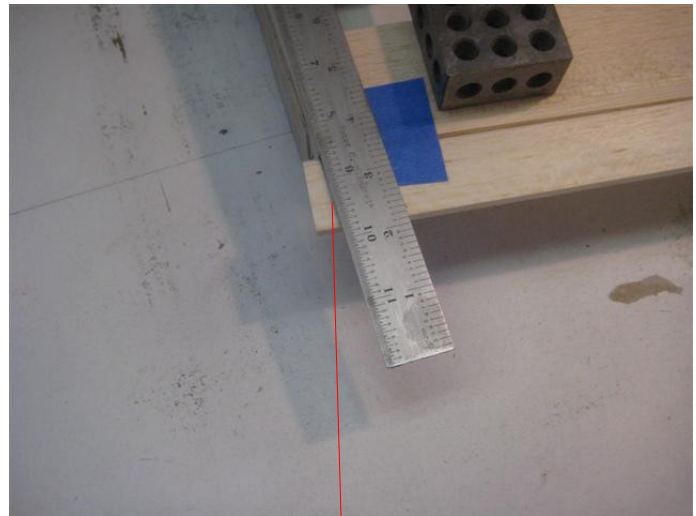




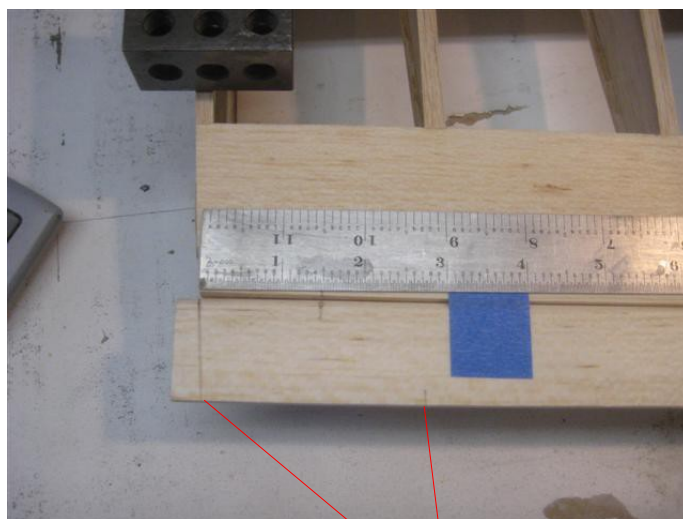
Draw a line 21-3/4" from outside surface of rib # 10



Position both aileron to their 21-3/4" line



Draw a straight line flush to the outside surface of rib # 10 on both ailerons

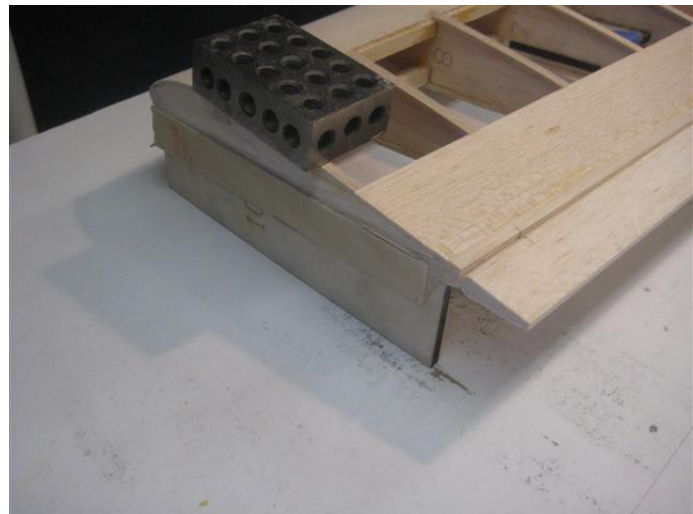
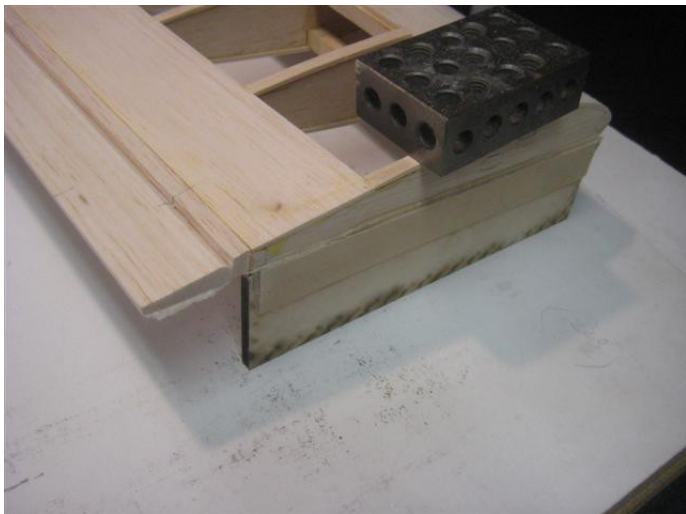


Draw a line 2-5/8" from the line drawn even with the outside surface of rib # 10

Remove the ailerons, and cut in the hinge slots in the wing and ailerons at all the marked hinge locations.

Insert the hinges (dry) in the ailerons and position the ailerons back on the wing holding them again temporarily in position with masking tape.

Sand off the ends of the aileron flush to the outboard surface of the last rib.

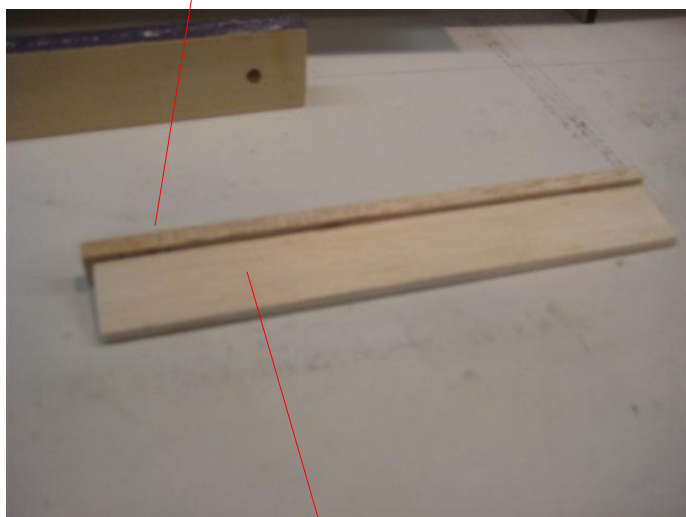


Make two balsa wood wing extension blocks using altered remnants of the aileron stock. The leading edge of the aileron stock is cut back 1/4" to remove the radii and a piece of 1/4"x1/2" balsa is glued on. The surface of the added balsa stock is planed flush to the surface of the aileron stock. These blocks are joined at the center line of the wing and fit against the trailing edge of the wing and between the ailerons. Use the top surface of the wing to line up the wing extension. Trim the trailing edge of the wing extension in line with the trailing edge of the ailerons that are temporarily held in place. Glue the wing extension to the trailing edge of the wing.

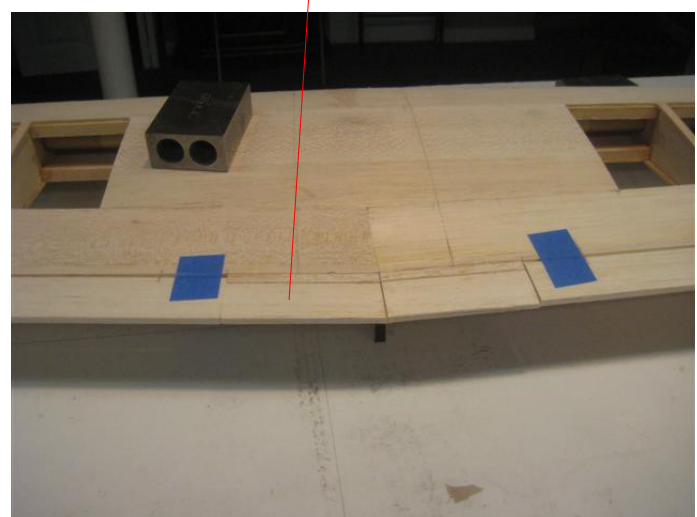
1/4x1/2" balsa glued on to the aileron stock after removing the front radii.



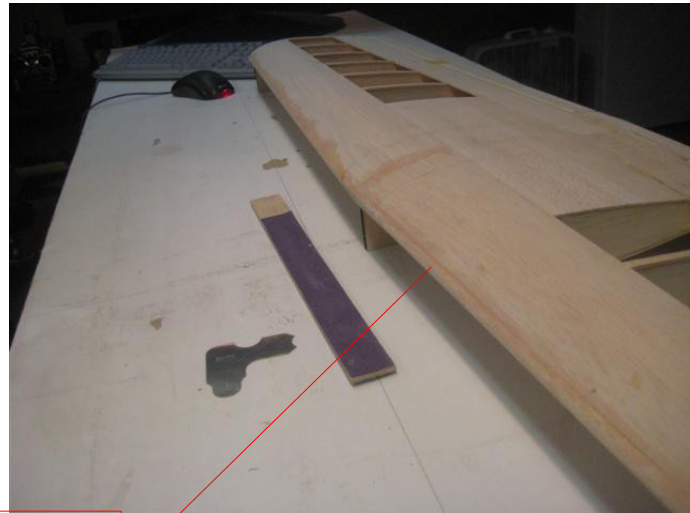
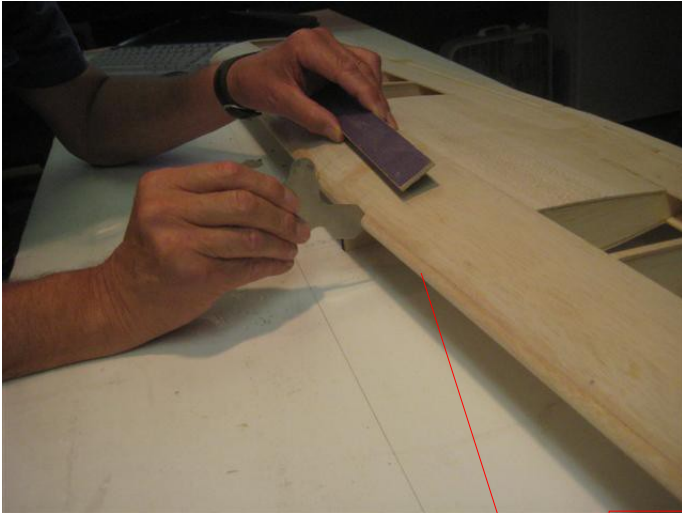
Wing extension held flush with the top surface of the wing and glued in place.



Aileron stock



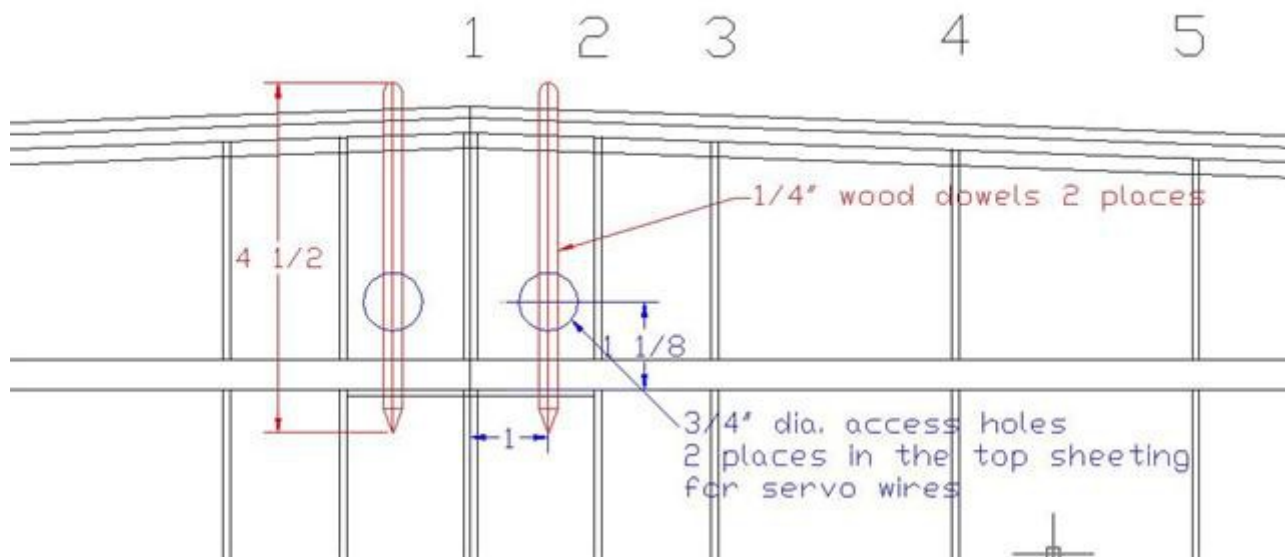
The leading edge of the main wing should be block sanded round or rounded off using a 3/8" radius along it's full length.

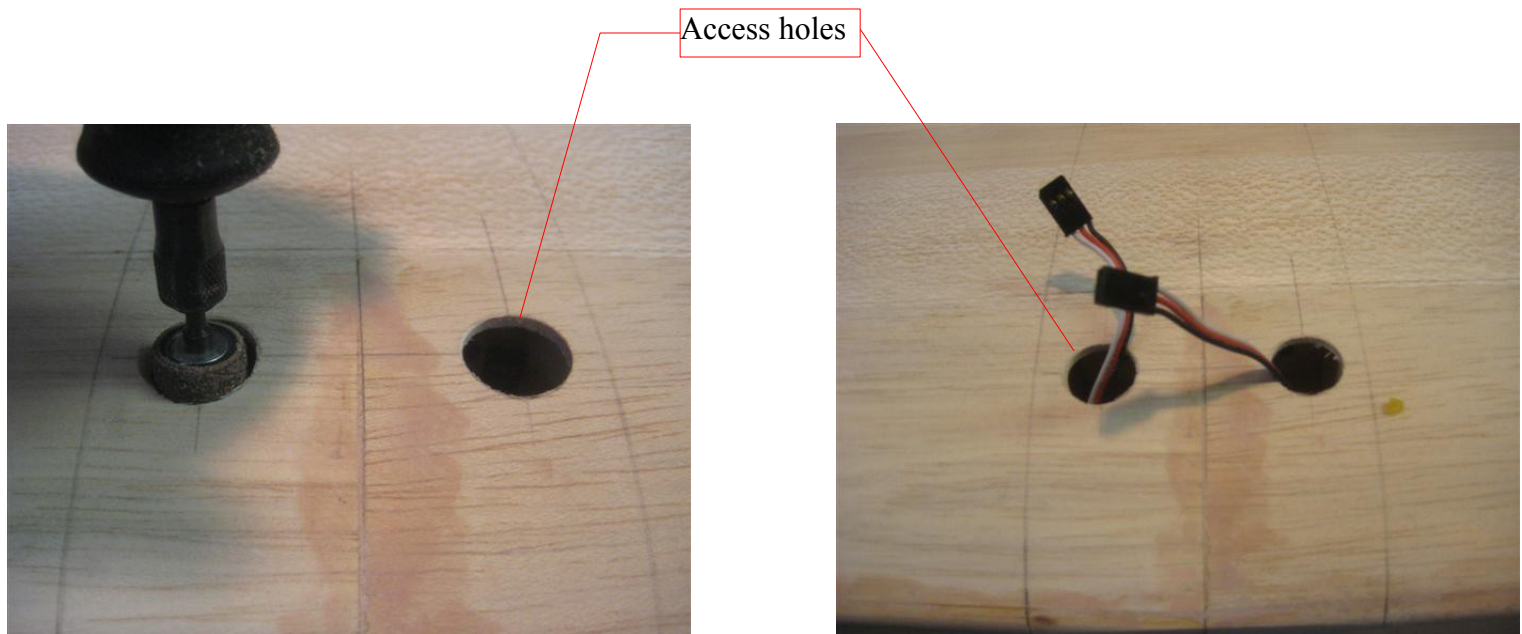


Round off the leading edge using a 3/8" radii.

Note: Fiber glass tape 2" wide" should be applied over the center joint of the two piece built wing on both the top and bottom surface.

Two 3/4" dia access holes are cut in the front top surface of the wing sheeting for the servo wires. Reach though the holes and retrieve the servo wires with tweezers. See the sketch below for the hole locations.





At this point in the wing construction, set the wing aside and go forward to the fuselage construction instructions.

Note: Within the fuselage construction instructions, the main wing will be prepared for it's mounting to the fuselage. The completion of the main wing will continue and be completed during the fuselage construction.

FUSELAGE CONSTRUCTION

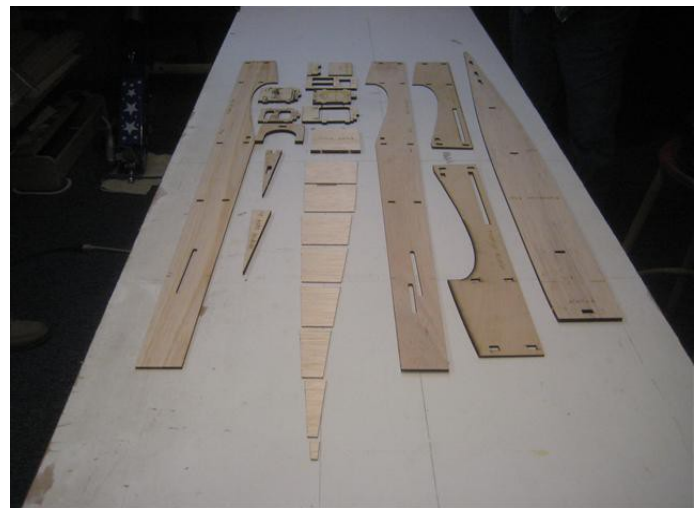
The major components are fully laser cut to size including locating slots and tabs to aid in the assembling of the fuselage. There are laser scribe lines indicating areas to be hand worked or used to aid in locating components.

The laser cut parts should not be altered unless specified in the instructions. The fuselage is built with the top of the fuselage facing the build surface.

Start the fuselage construction by first segregating all the component parts of the fuselage then familiarize yourself with the parts and the build sequence by using the instructions and photos as posted below. Keep all the remnants of the sheet stock after the parts are removed for future use.

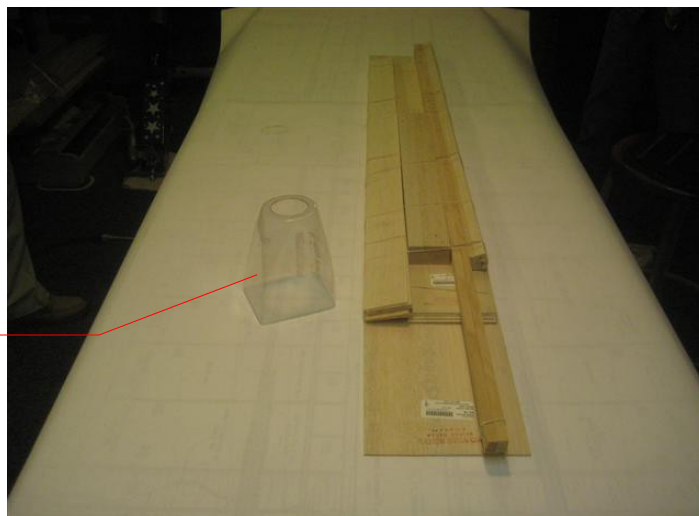


The balsa laser cut parts are still within the sheet stock.



Carefully separated the laser cut parts and organize them for assembly.

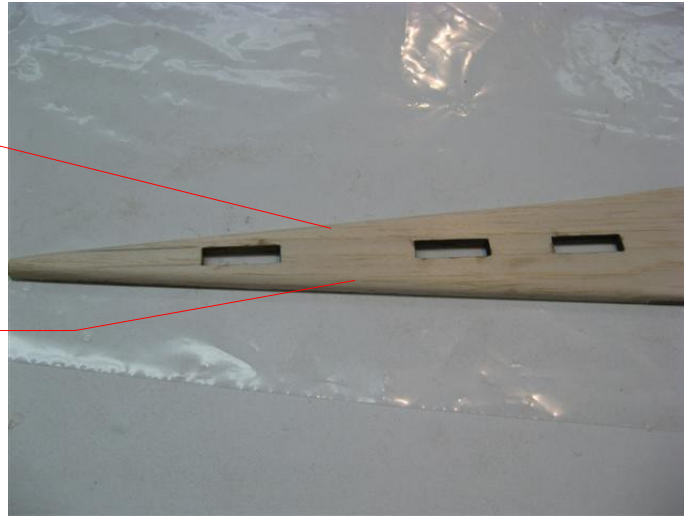
A preformed plastic cowl with scribed finish trim lines is supplied.



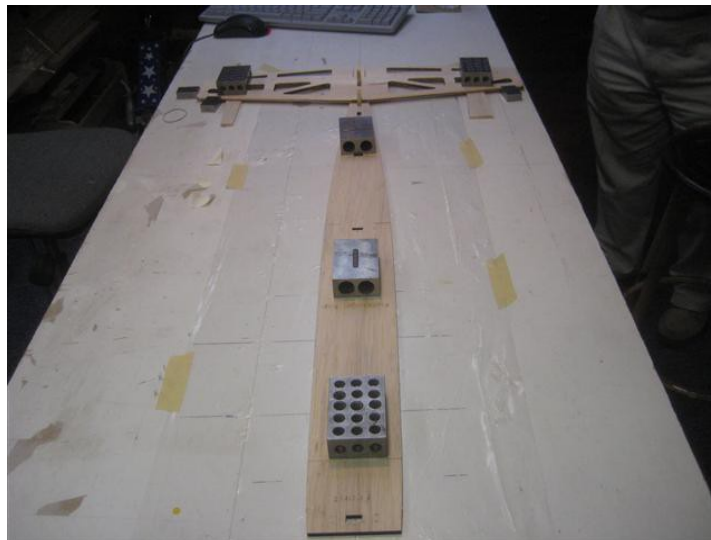
Start with preparing the 3/16" thick balsa laser cut "fuselage top" by applying a 1/8" radius at the rear top side of the fuselage top (it's the side opposite of the laser scribed lines and identification) for a length of 8-1/2".



Apply a 1/8" radii



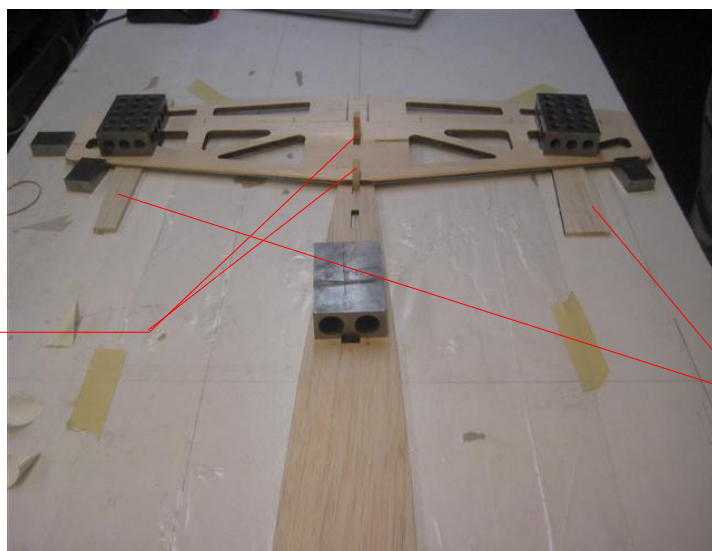
The 3/16" thick balsa laser cut "fuselage top" is laid flat and pinned or weighted down on a flat work surface that is covered with wax paper. Position the "fuselage top" with the laser scribed side facing up.



The previously prepared "horizontal stabilizer" is placed on the rear end of the "fuselage top". Place 3/16" thick shims (made from scrap pieces) on the work surface and under the outboard ends of the "horizontal stabilizer". This shimming will line up the horizontal stabilizer to be parallel with the "fuselage top". Insert short 1/4"x1/2" removable balsa sticks through the slots in the "fuselage top" and the "horizontal stabilizer". These sticks will line up the "horizontal stabilizer" to the "fuselage top".

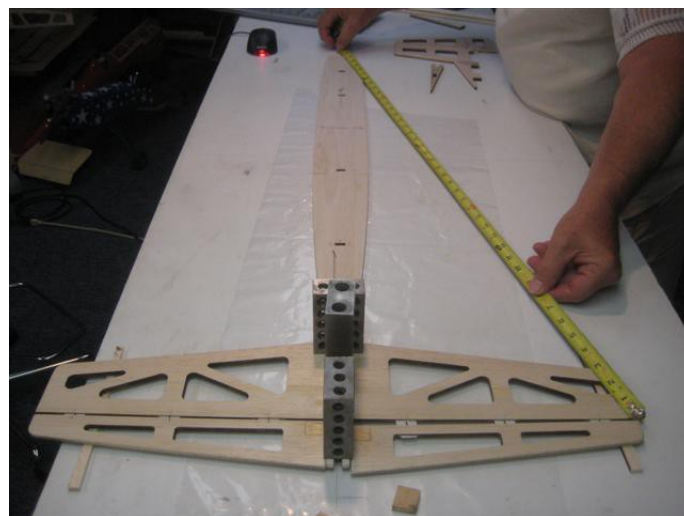
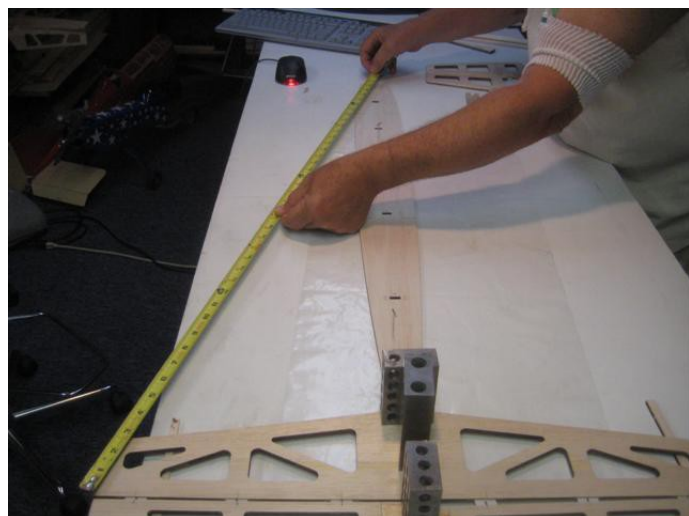


1/4x1/2" removable balsa sticks used as locators



3/16" shim made from remnants of the sheet stock

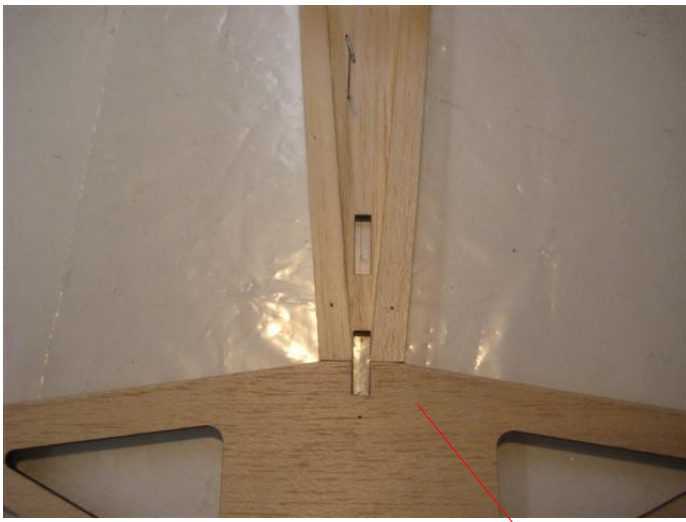
Verify the alignment by measuring from the outboard corners of the "horizontal stabilizer" to the center line laser scribed on the front edge of the "fuselage top". The distances measured must be equal on both sides for a perfect alignment. Adjust if needed, by slightly moving the "horizontal stabilizer" as needed to equalize the distances. Glue when the alignment is correct. Make sure the 1/4"x1/2" removable balsa sticks are not glued in the slots.



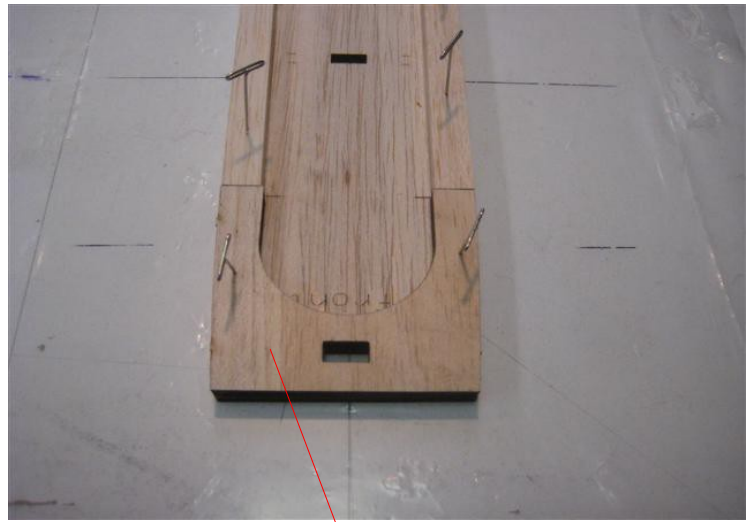
Cut to length and fit two 1/4x1/2" balsa sticks (one on each side of the "fuselage top"). The balsa sticks' rear end should be trimmed to fit against the front edge of the "horizontal stabilizer" (already glued in place) when the sticks are bent to fit flush with the periphery of the "fuselage top". The front end of the balsa sticks should be trimmed to the scribed line between former #2 and former #3. Glue in place while holding the outside edge of the 1/4x1/2" balsa stick lined up with the periphery of the "fuselage top".

Place the laser cut 1/4" thick "front fuselage top doubler" on the front of the "fuselage top" by lining up the periphery of both parts, the 1/4x1/2" locating slot, and butting up the rear edge of the doubler to the 1/4x1/2" balsa sticks and glue in place.



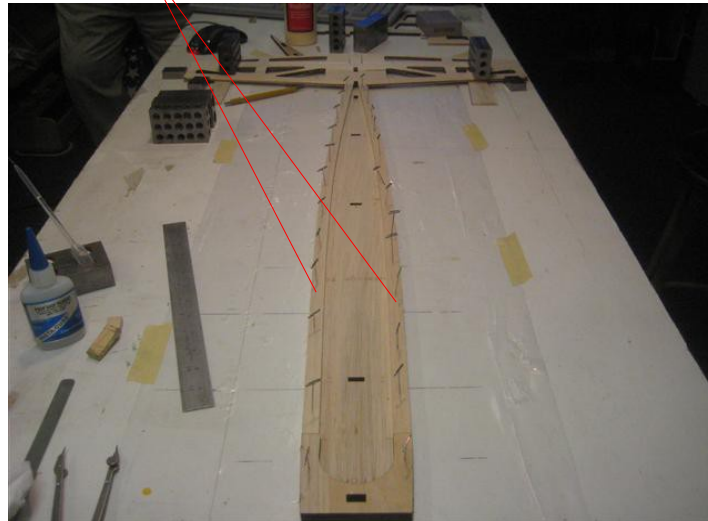


1/4x1/2" balsa stick bent to fit the edge of the fuselage top

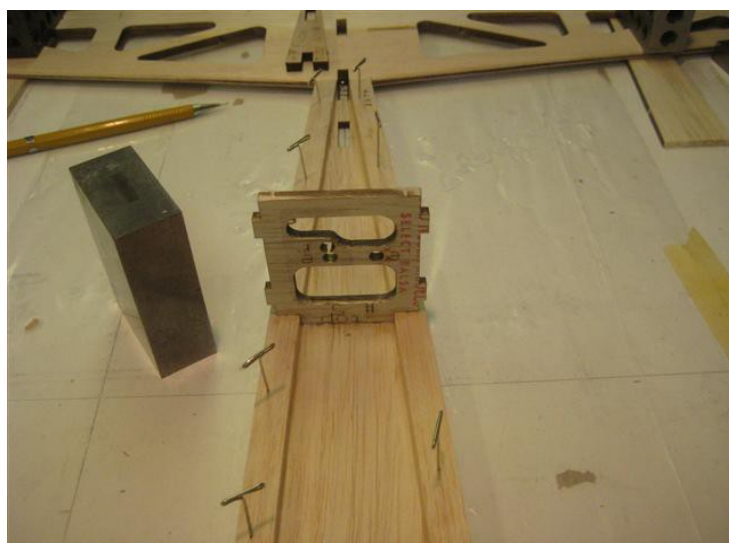


Horizontal Stab

Front fuselage top doubler



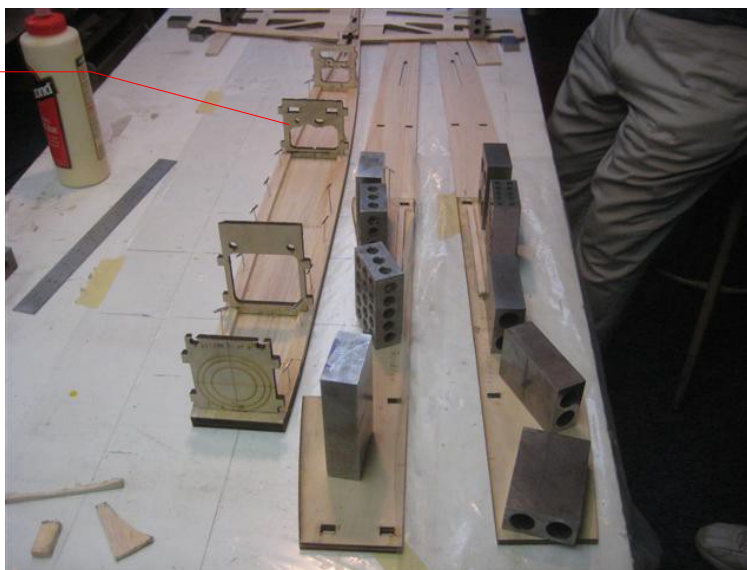
Place the laser cut 3/16 thick balsa "former # 5" on the "fuselage top" with the former's top tab in the fuselage's slot and with the number 5 of both parts facing each other. Hold the former 90° to the fuselage top with a square.



Place the laser cut 1/4" thick lite ply "former # 4" on the "fuselage top" with the former's top tab in the fuselage's slot and with the number 4 of both parts facing each other. Hold the former 90° to the fuselage top with a square.



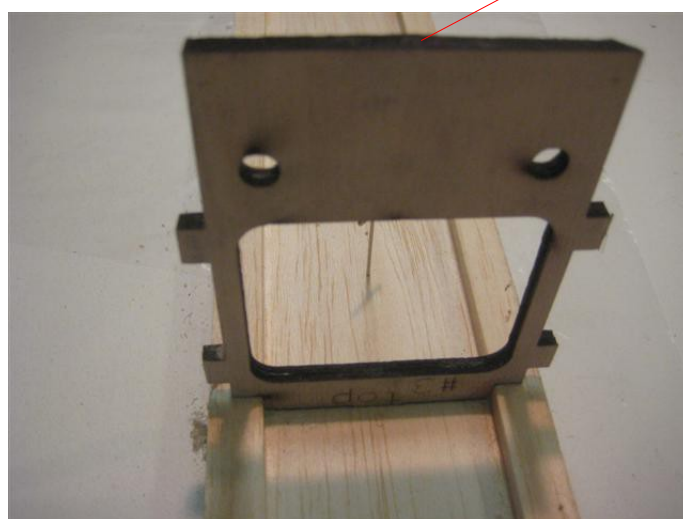
Former #4



Prepare the laser cut 3/16 thick plywood "former # 3" by beveling the bottom edge of the former. The bevel is sanded from the laser cut bottom rear edge to the laser scribed line near the bottom edge on the front side of the former. Place the laser cut 3/16 thick plywood "former # 3" on the "fuselage top" with the former's top tab in the fuselage's slot and with the number 3 of both parts facing each other. Hold the former 90° to the fuselage top with a square.



Bevel the bottom edge



When formers #5, #4, and #3 are in place and between the 1/4x1/2" balsa sticks that are lined up to the periphery of the fuselage top, apply glue to all the joints.

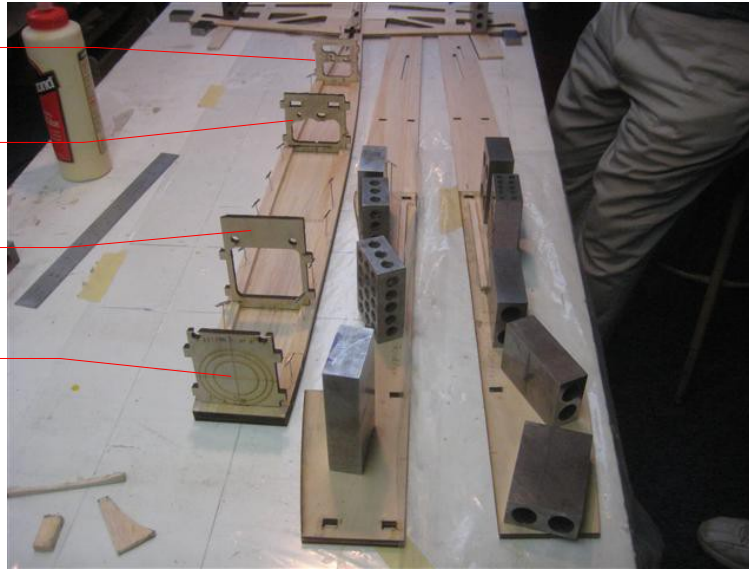


Former #5

Former # 4

Former #3

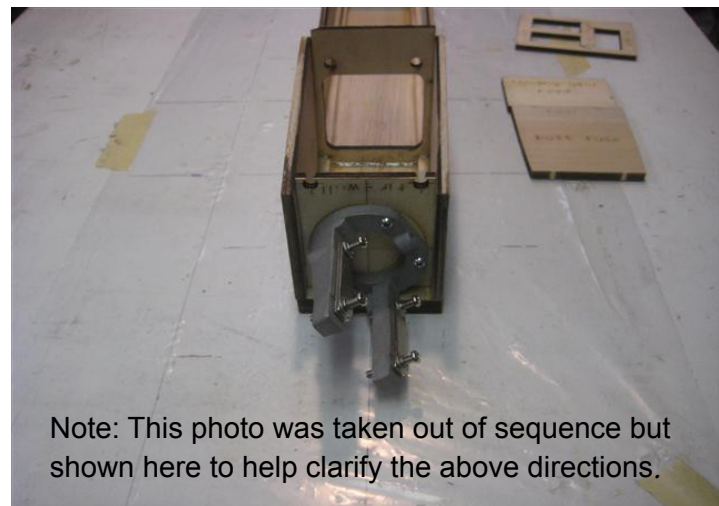
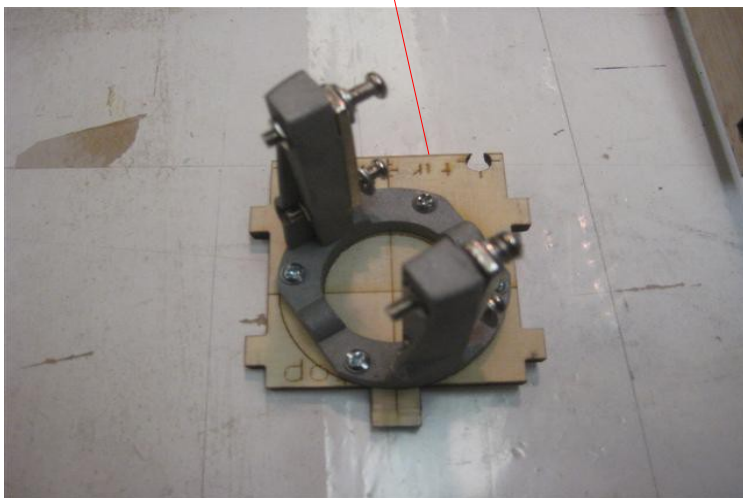
Former #2
firewall



Prepare the laser cut 1/4" thick lite ply "firewall (former # 2)" by beveling the bottom edge of the former. The bevel is sanded from the laser cut bottom rear edge to the laser scribed line near the bottom edge on the front side of the former. Decide on the engine attitude, that is, whether the engine is mounted in a vertical position or rotated about the center lines scribed on the firewall. Position the engine mount of your choice in relationship to the laser scribed center lines on the face of the firewall. Use the manufacturer's mounting instruction and temporarily fasten the engine mount to the firewall. Place the laser cut firewall ("former # 2") on the "front fuselage top doubler" with the former's top tab running through the "front fuselage top doubler" and through the slot in the "fuselage top" and with the number 2 of both parts facing each other. Hold the former 90° to the fuselage top with a square and glue in place. Note: There is no engine thrust off set in the alignment of the firewall. Clearances may have to be added due to engine and/or engine mount interferences with the stock laser cut parts. It's the builders responsibility for these modifications.

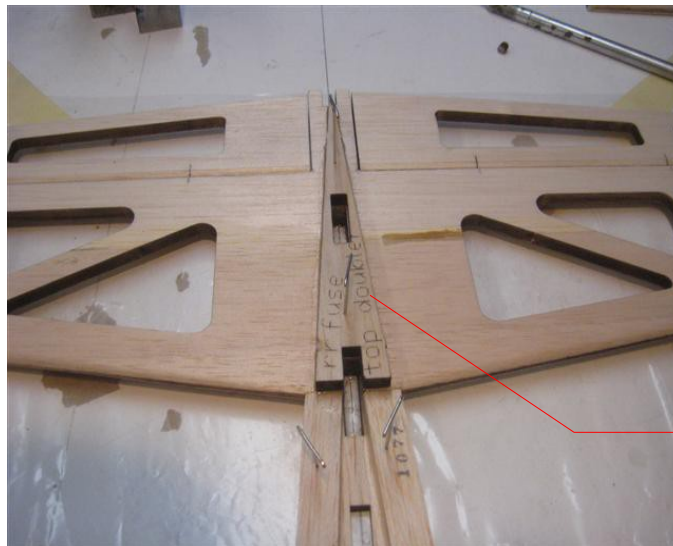


Bevel the bottom edge



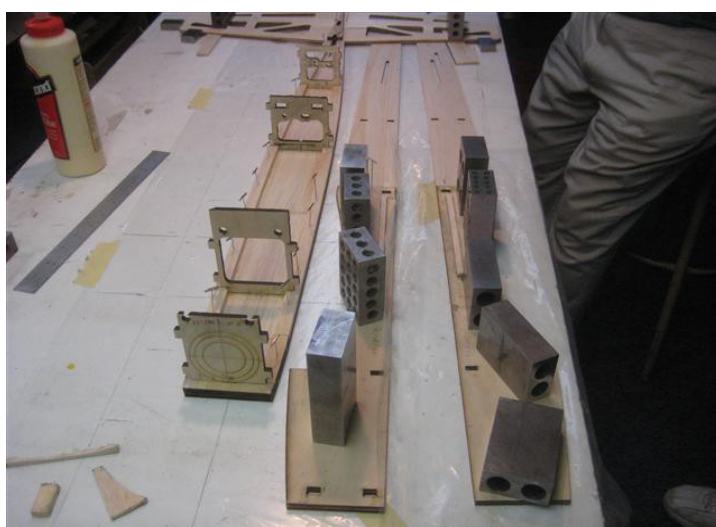
Note: This photo was taken out of sequence but shown here to help clarify the above directions.

Position the 1/4" thick laser cut balsa "rear top doubler" by lining up the doubler using the laser cut slots and using the rear center notch in the horizontal stabilizer. Glue in place.



Rear top doubler

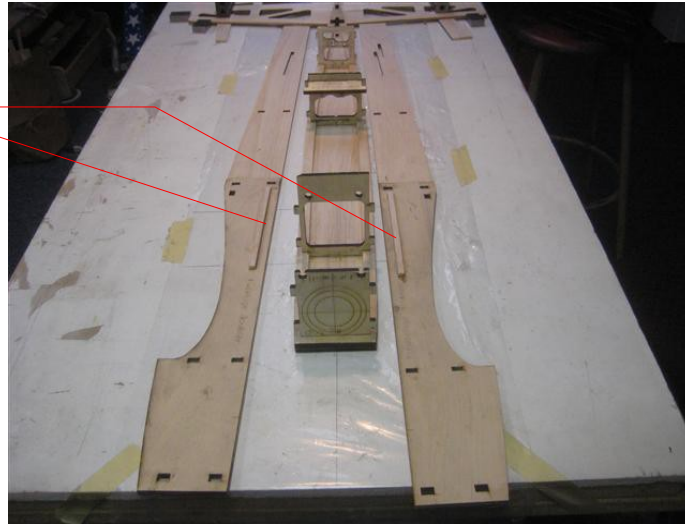
Prepare the 1/8" thick balsa laser cut "fuselage sides" (right and left sides) for sub-assembling the "fuselage doublers" to them. Make sure you lay the "fuselage sides" positioned as a right side and a left side with the laser scribed marks facing up and laying flat, pinned or weighted down on a flat work surface that is covered with wax paper. The periphery of both parts in the doubled up areas should match each other, along with aligning the slots with removable balsa sticks. When satisfied with the locations, disassemble, apply glue, realign parts and weight them down flat to the building surface. Make sure you do not glue the removable balsa sticks in the slots.



Cut two 1/4x1/4x6" balsa stick pieces. These balsa sticks will eventually support the servo tray. Insert and glue these balsa stick pieces into the slots in the laser cut "fuselage doublers" after the doublers are sub-assembled to the "fuselage sides" The sub-assemblies are now ready to assemble to the fuselage.



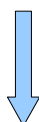
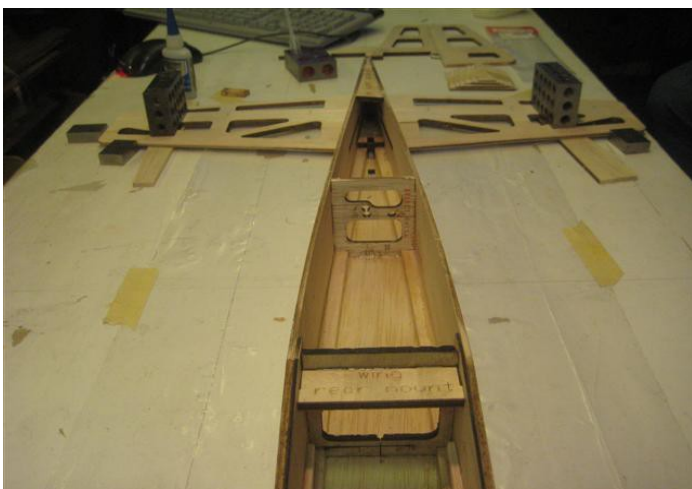
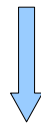
1/4x1/4" balsa sticks



Place both right and left hand "fuselage side" and "fuselage doubler" sub-assemblies in position on the 1/4x1/2" balsa sticks already glued on the fuselage top, using the tabs in former #3 and former # 4 as locators. Place the wing rear mount tabs in the slots in former # 4 and in the slots in the fuselage sides and spot glue all in place to the side walls on former #3 and former #4 and the wing rear mount at this time.

When the glue dries, bend the fuselage sides together at the rear ends of the fuselage sides while making sure the tabs in former # 5 are in the slots of the fuselage side slots. The rear edge of the fuselage sides must line up to the center line of the "horizontal stabilizer". If the alignment is correct, glue the rear area of the "fuselage sides" to the "horizontal stabilizer". Position the lite ply rear fuselage bottom doubler and glue in place. Bend the fuselage sides against the side walls of the firewall with the firewall tabs lined up and inserted in the fuselage sides. Glue in place.

At this time final glue all the joints of the assembled fuselage and it's components.

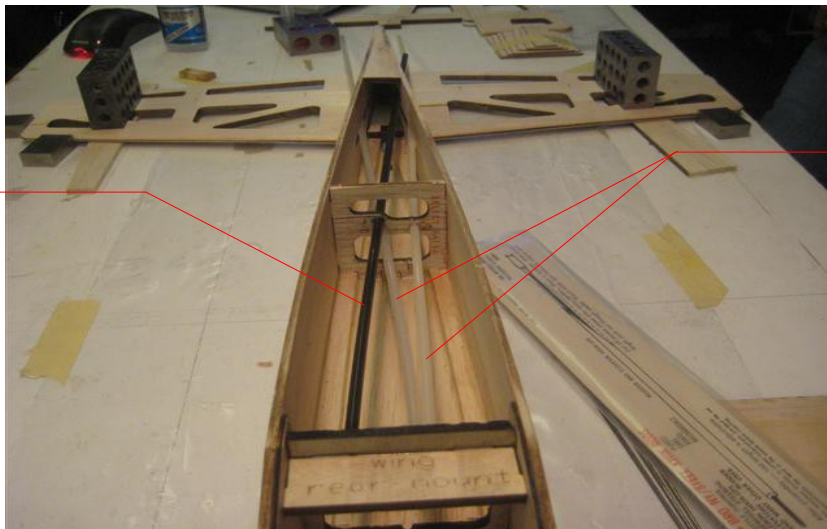




Install the push rod housings. One housing for the rudder and two for the elevators. Make sure the housings are placed through the fuselage sides and through the proper holes that are labeled in the fuselage formers.

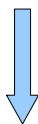


Rudder push rod housing.



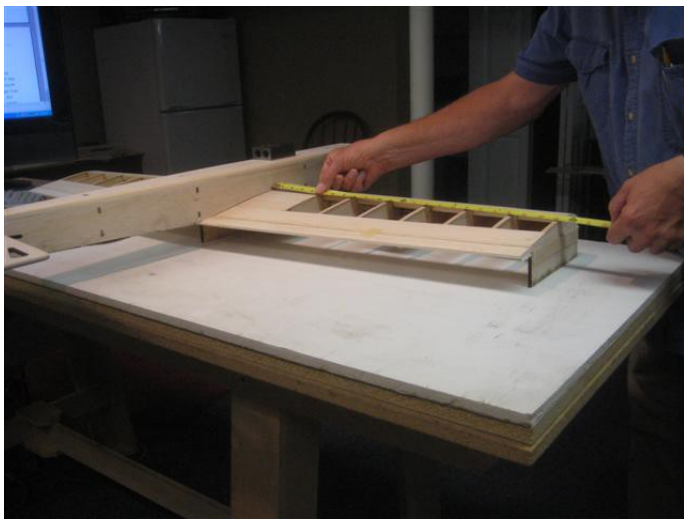
Elevator push rod housings.

Install and glue in place the laser cut 1/16" balsa cross grain bottom sheeting.



At this point in the fuselage construction, the main wing should be prepared for mounting to the fuselage.

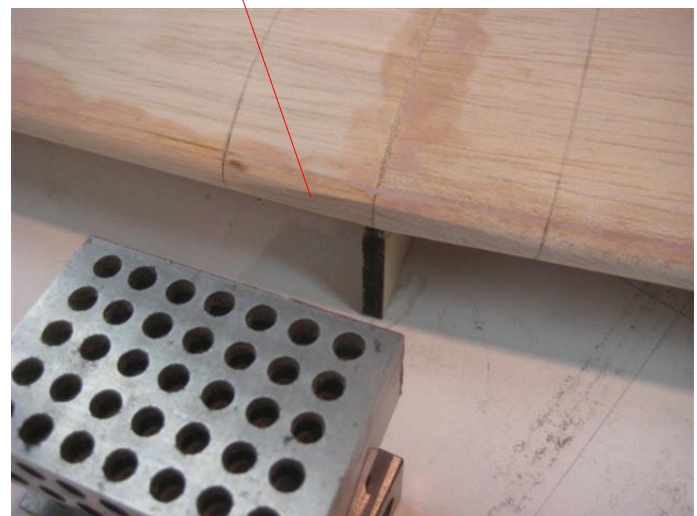
Position the main wing on it's cradles on the work surface. Place the saddle area of the fuselage on the wing. Center the fuselage by measuring from the outboard surface of the last wing rib # 10 to the side surface of the fuselage sides. Move the fuselage until both measurements are the same on both sides of the wing halves. Measure from the hinge line outboard corner of the horizontal stabilizer to the rear corner of the #10 wing rib. Do this on both sides of the wing and adjust until both of these measurements are the same. When you are satisfied with the location of the fuselage on the main wing, draw a pencil lines on the top wing surface along the fuselage sides.



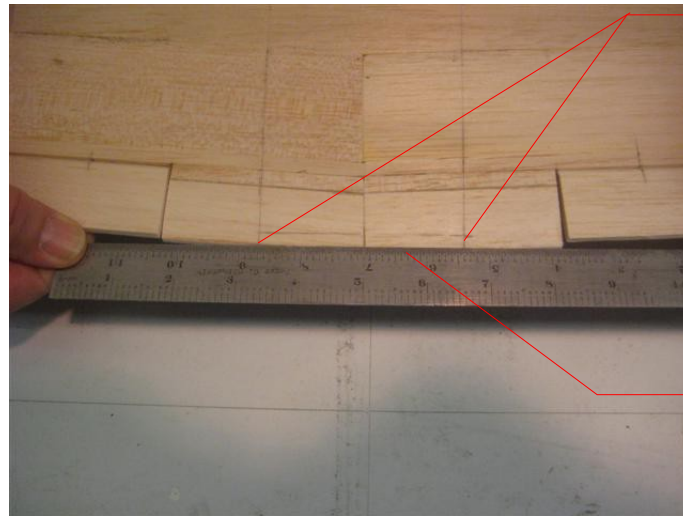
You should notice that the leading edge of the wing, teeters or rocks against the fuselage former #3. You will have to sand off or remove the apex of the angled leading edge so that there is a flat surface between the pencil lines marked on the wing's leading edge. This allows the wing to move forward against the total surface of the fuselage former #3 and the wing is now in it's proper location.



Sand off the point or apex of the leading edge to create a flat on the wing that will rest against the rear of the #3 former.



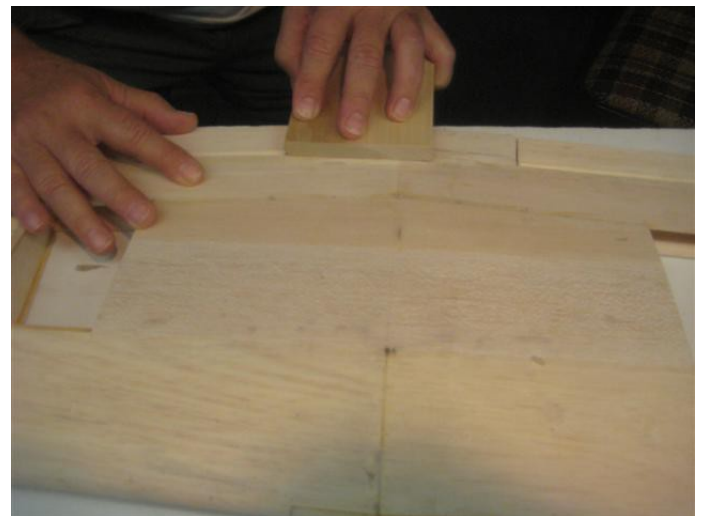
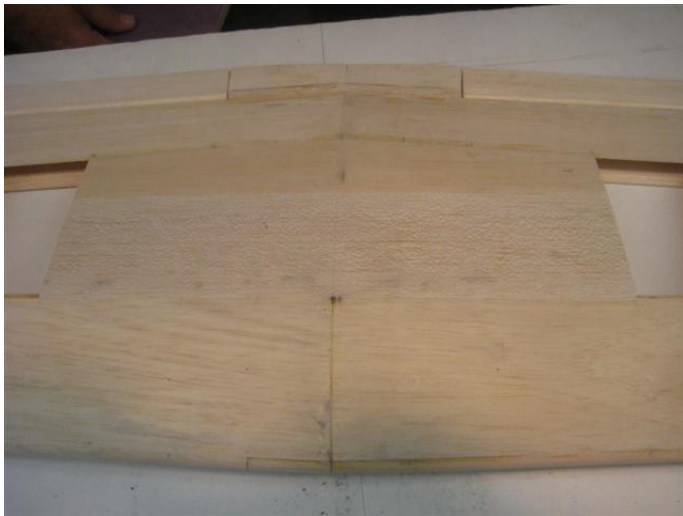
The rear trailing edge of the main wing extension also needs to have the apex sanded flat between the two penciled lines representing the fuselage sides.



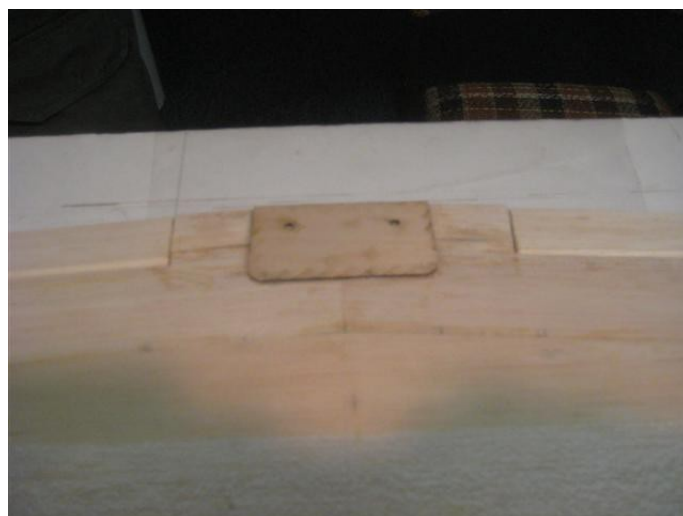
Flatten the trailing edge between the lines representing the fuselage sides

Straight edge

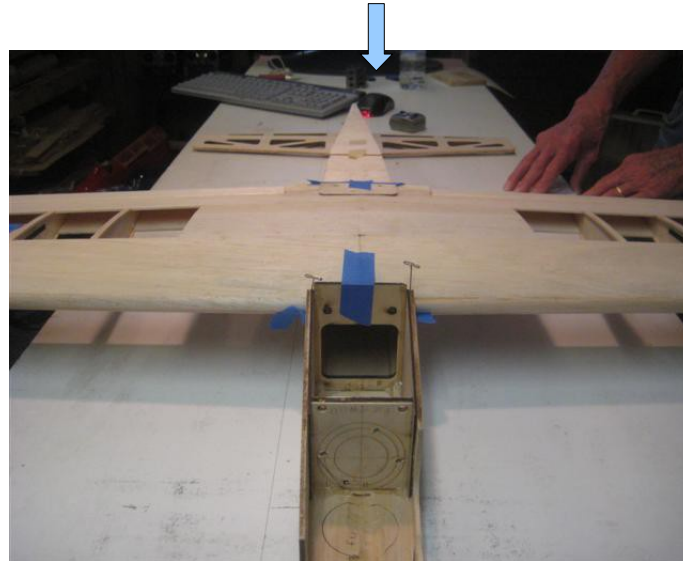
Place the main wing with it's top surface facing the build surface, and carefully remove the center line cradle from the bottom of the wing. Fair the surface along the rear trailing edge and flatten the area below the "wing hold down center bottom plate".



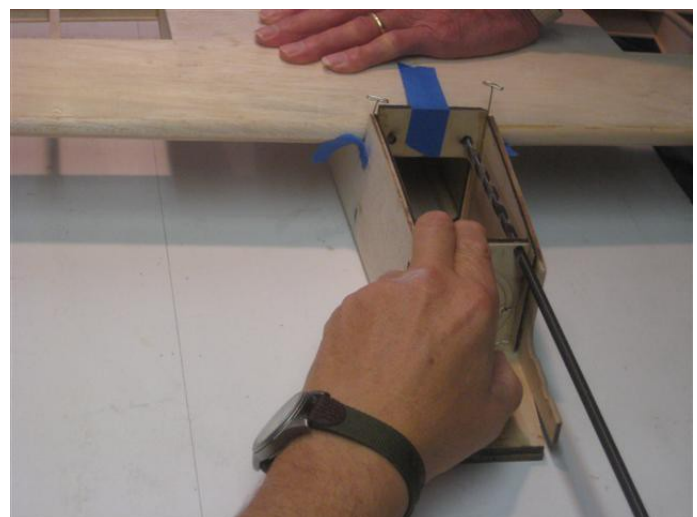
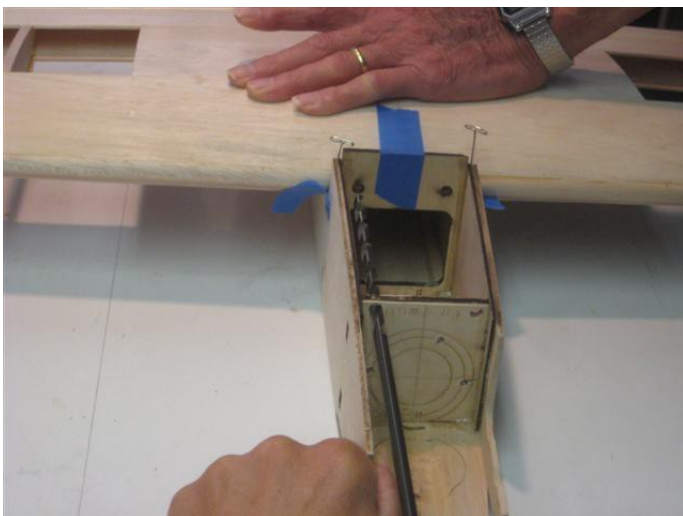
Glue the "wing hold down center bottom plate" in place with thickened epoxy.



Remount the main wing on the fuselage and double check the alignment to the fuselage as previously described. Now is the time to make sure the alignment of the main wing to the horizontal stab is correct looking from the rear of the plane. If necessary, adjust the alignment by slightly sanding the wing saddle or the main wing surface. Temporarily pin in place.

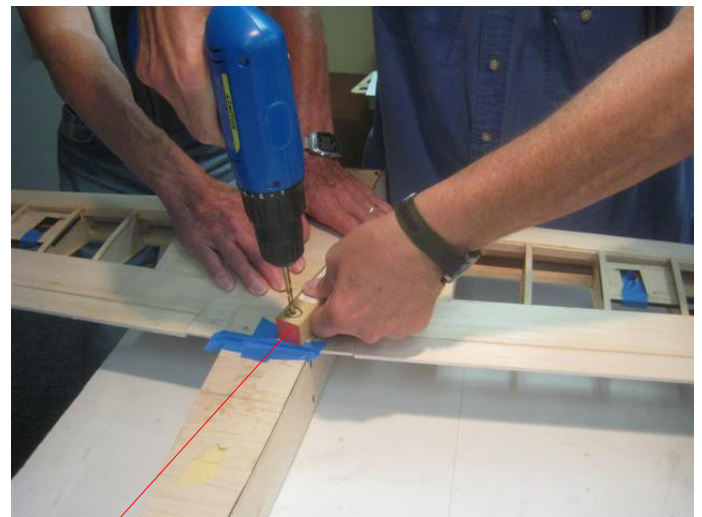
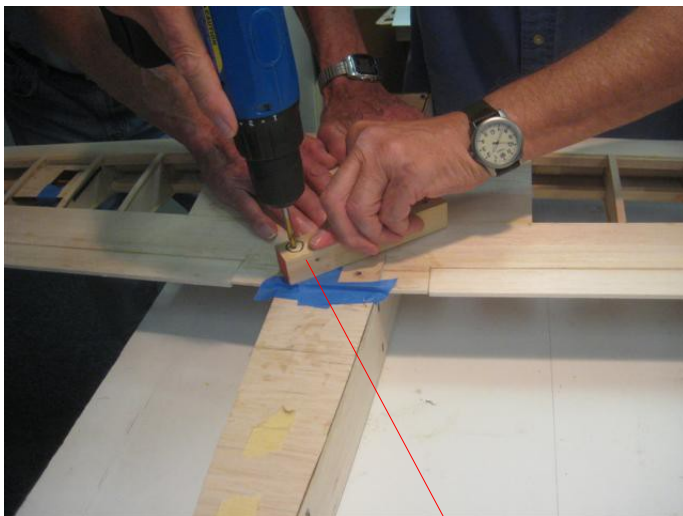


When satisfied with the alignment, drill two 1/4" dia holes through the leading edge of the wing. Use the 1/4" dia holes laser cut in formers # 2 and #3 as a guide for an extended length jobber drill.



After drilling the holes, temporarily insert 1/4" dia wood dowels into the holes to help maintain wing location.

Without removing the main wing from it's location, drill two holes (#7 tap drill for the 1/4"-20 wing bolts) through the holes in the wing hold down center bottom plate, through the wing and through the "wing rear mount" located in the fuselage. As an aid, fabricate a drill guide by drilling a #7 hole 90 degrees to the surface of a block of wood. Hand drill through this block while holding the block steady to the surface of the wing hold down center bottom plate

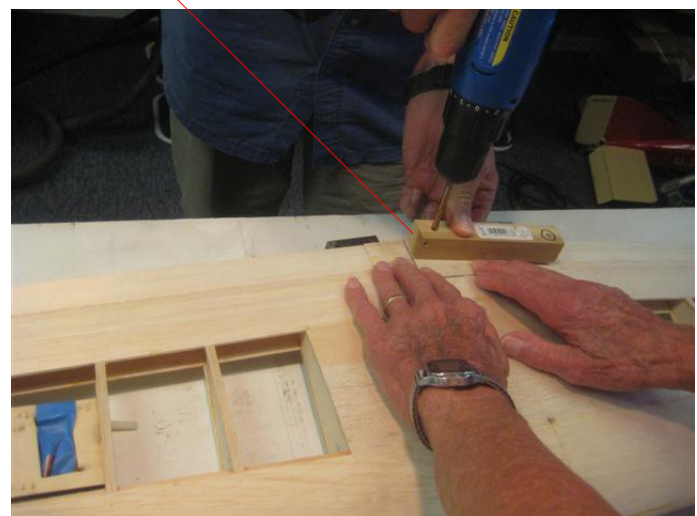


Drill guide with a #7 dia hole.

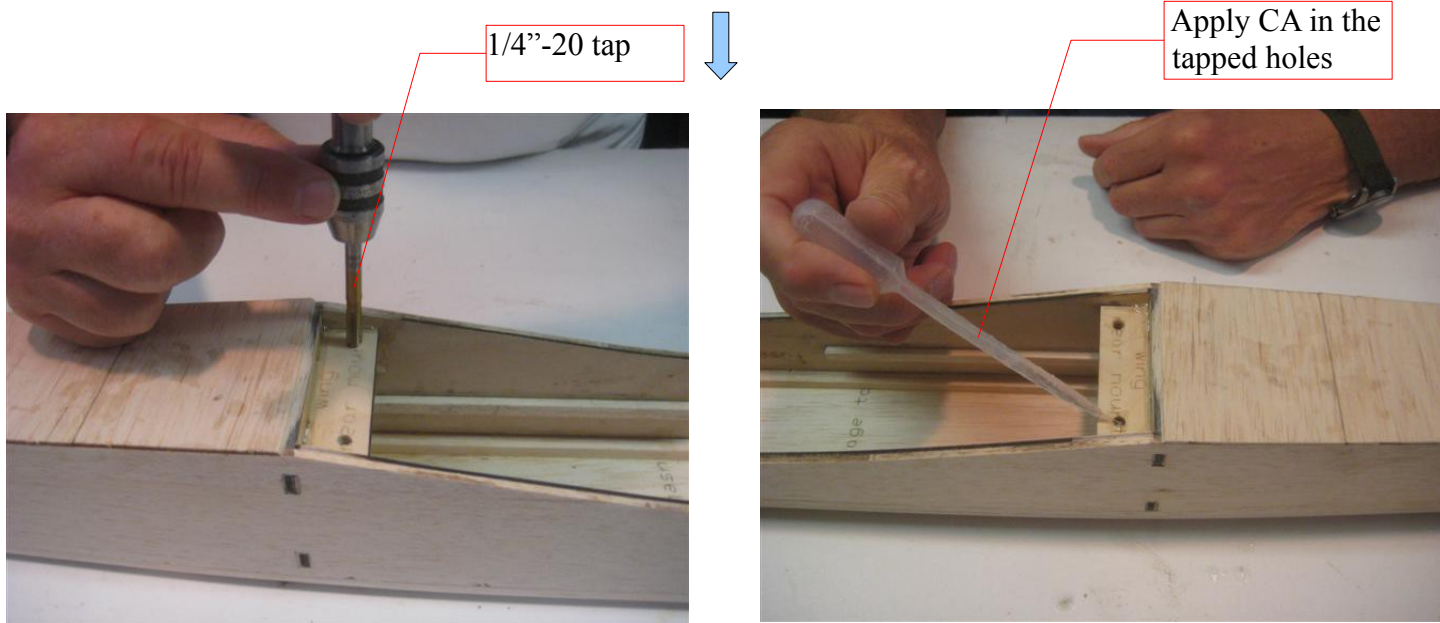
Remove the main wing from the fuselage and re-drill through the #7 tap holes only in the main wing using a 9/32" dia clearance hole for the 1/4"-20 wing bolt.



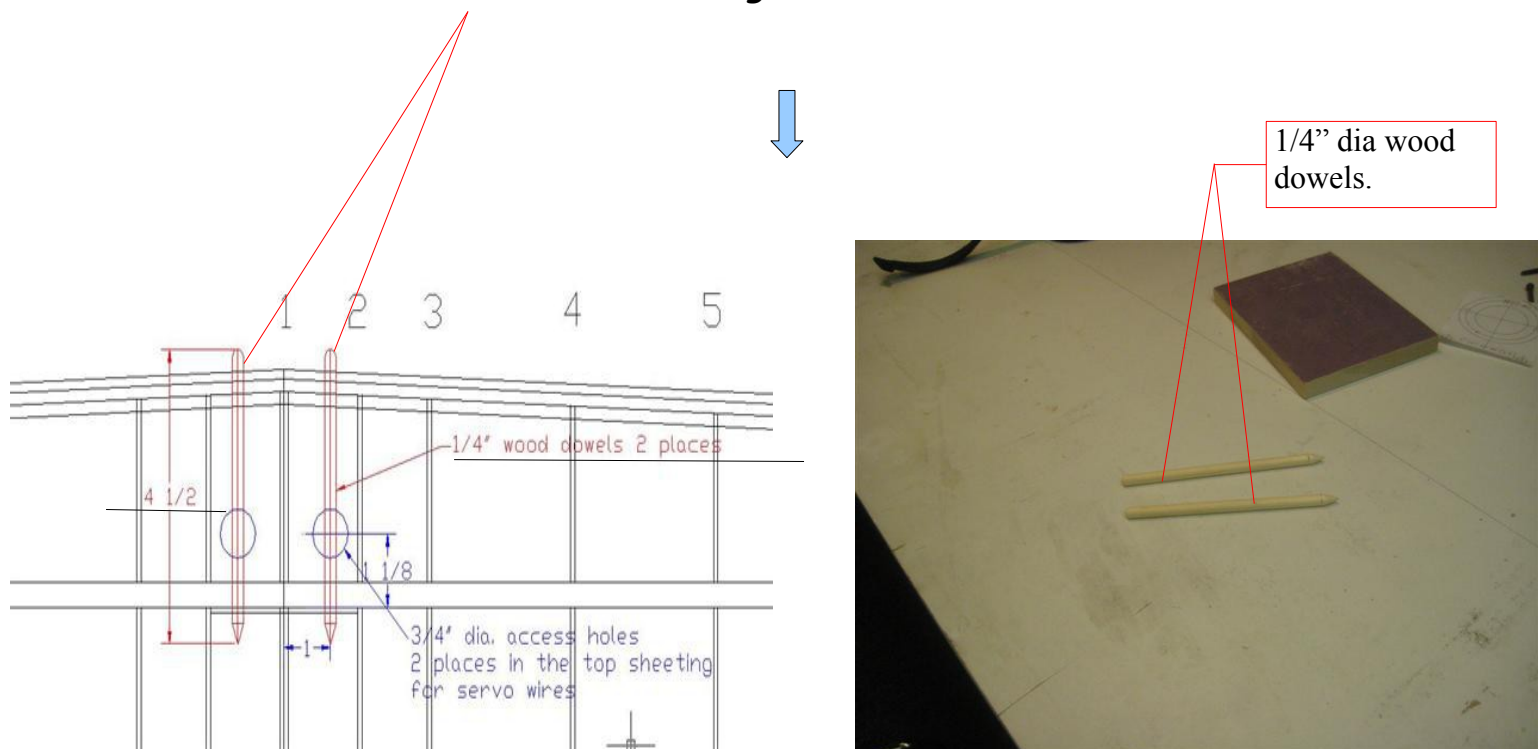
Drill guide with a 9/32" dia hole.



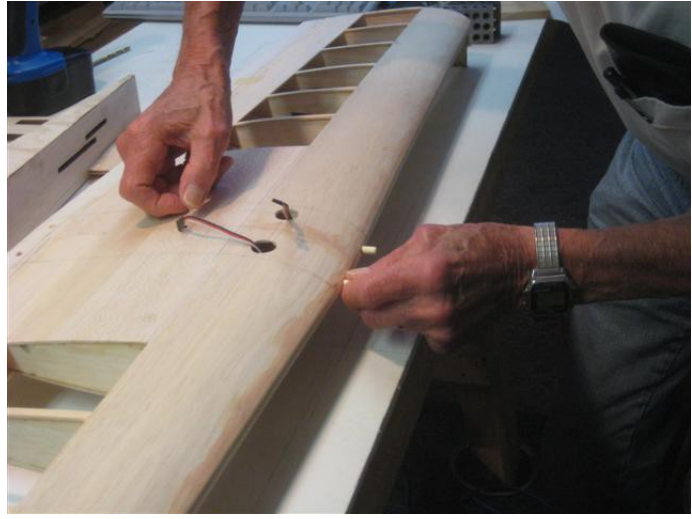
Tap the two #7 holes in the "wing rear mount" using a 1/4"-20 tap . Apply CA to reinforce the tapped threads, then run the tap through again to clear the threads when the CA is dry.



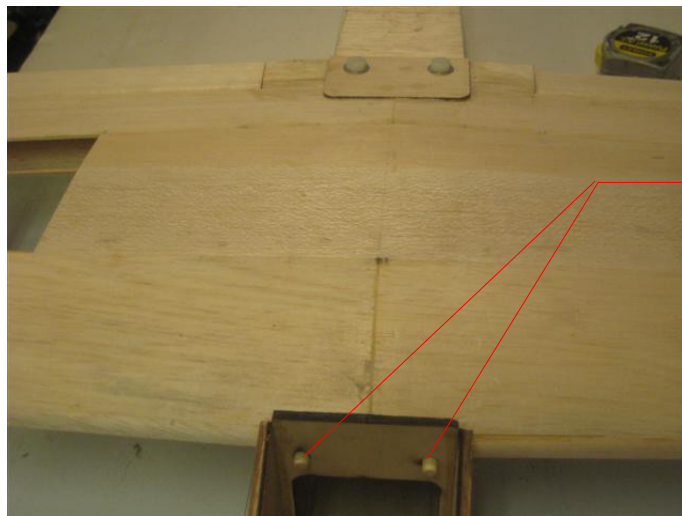
Make two 4-1/2"x1/4" dia wood dowels using the sketch below.



Permanently mount the two 4-1/2"x1/4" dia wood dowels in the main wing by passing the sharpened end of the dowels through the leading edge and through the laser cut holes in the dihedral brace. Leave approx. 3/8" of the forward end of the dowels exposed in front of the leading edge of the wing. Use the two 3/4" dia servo lead holes as a visual aid and access holes to apply glue to the dowels as they pass through the holes in the dihedral brace.

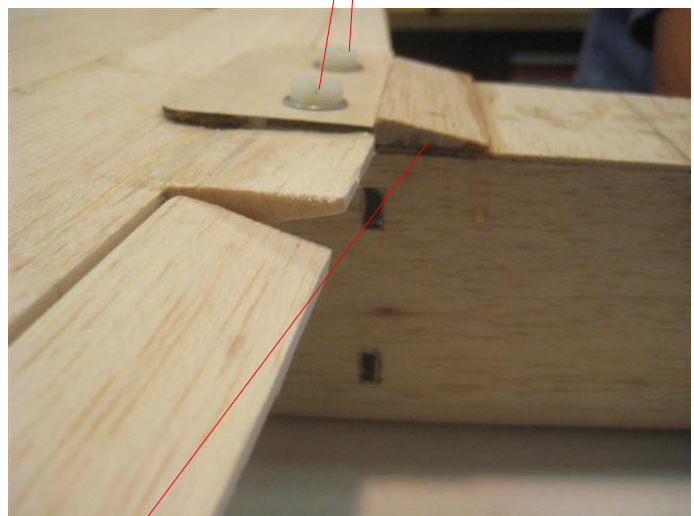


Remount the main wing on the fuselage and fasten it in place using 1/4"-20 nylon bolts. Recheck the alignment. When satisfied with the location, make and glue in place a balsa rear wing stop using a modified remnant of the aileron stock.



1/4" dia locating dowel
glued in the main wing.

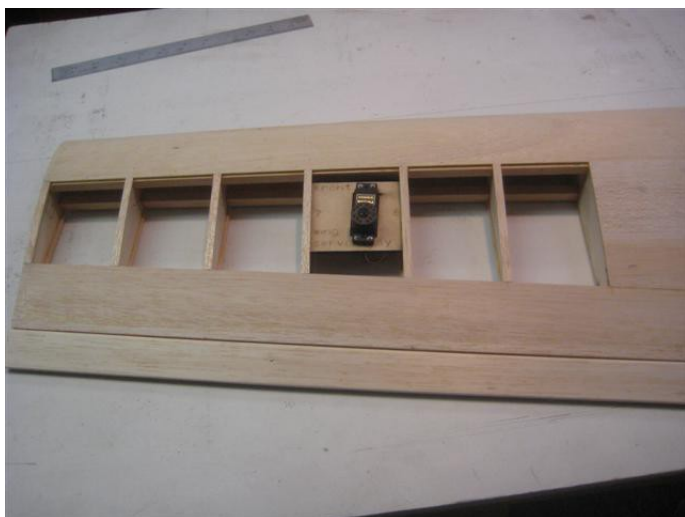
1/4"-20 nylon screws



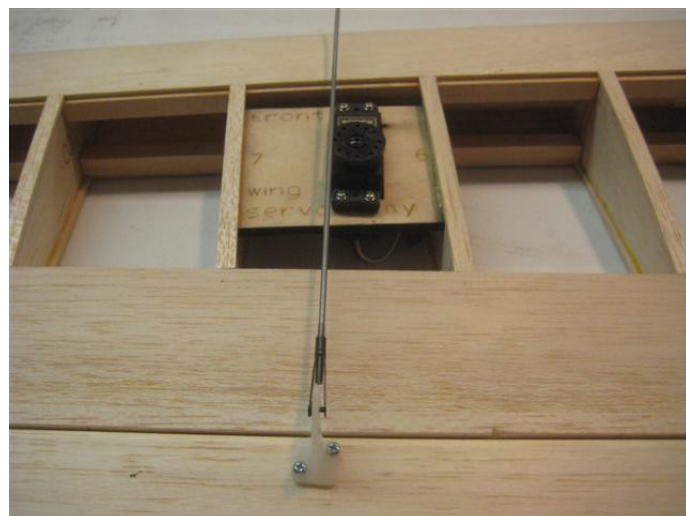
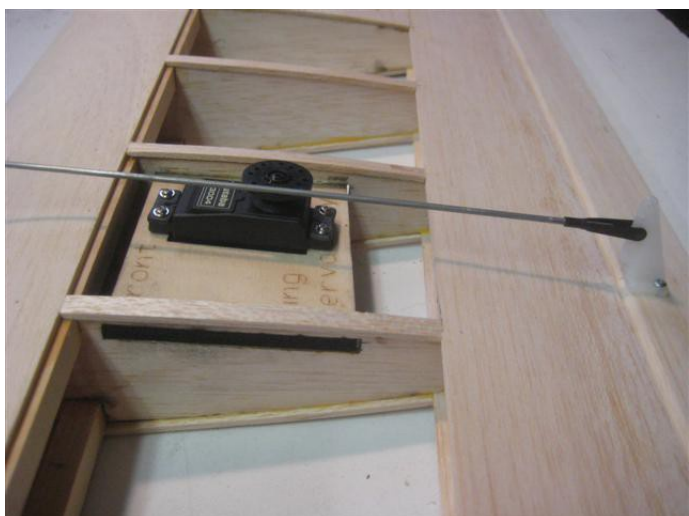
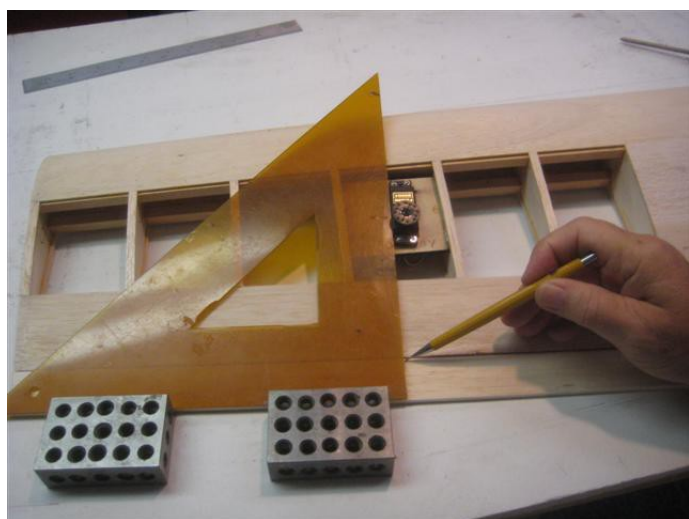
Rear wing stop

After completing the main wing to the fuselage assembly, remove the main wing from the fuselage and continue with the main wing construction as follows.

Position and fasten the wing servos in the wing servo trays. You will notice that the photos show the old wing servo trays. Note, in the new servo tray, the servos are put in parallel to the ribs, but the servo arm should be installed on the servo parallel to the trailing edge of the wing when the servo is in it's neutral positioned. Use the same method of installing the servos push rod as shown.



Using the holes in the servo arms for position, draw lines out to the ailerons, mark and drill for the aileron control horn locations.



New servos trays with the latest servo location.



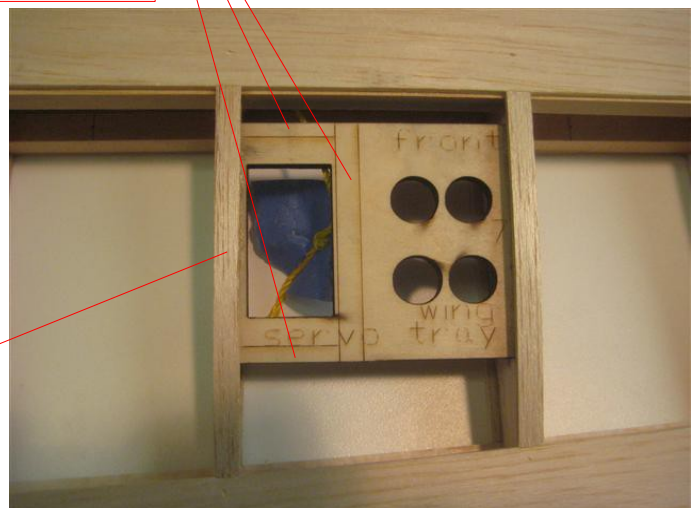
Build three walls from the remnants of the 1/4" balsa wood sheet. Place the walls on the lines that are laser scribed on the bottom side of the servo trays. These walls will surround the installed servo on the front, the out board side and the rear of the servo. The fourth side is the # 6 rib's cap strip. The top edge of the walls should be finished flush with the bottom surface of the wing. Do this on both sides of the center line of the wing. The finish covering (Monocote or equivalent) will be attached to the top of these walls and the cap strip of the # 6 rib.



Build three walls from 1/4" balsa remnants. Glue in place on the bottom side of the servo trays using the laser scribed lines for location. Finish the edge of the wall flush with the bottom surface of the wing.



6 rib cap strip



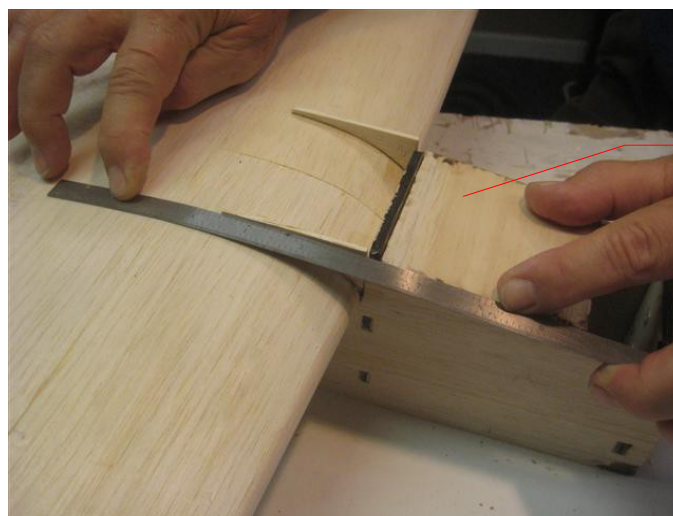
*Build the fuselage extension on bottom of the main wing.
Start by re-installing the main wing in place on the fuselage. Draw two lines on the bottom surface of the main wing by using a straight edge to extend the side walls of the fuselage.*



Place the two triangular shaped un-labeled parts that were included with the wing ribs in the sheet stock, in line with marked lines on the bottom of the main wing. The front of the those parts should fit against the rear face of former #3 (sand to fit). Glue in place only to the wing when satisfied with the fit. This becomes the side wall of the fuselage extension sides.



Temporarily position the fuselage bottom front on the bottom edges of the fuselage side and against the front of former # 3.



Fuselage bottom front.

Cut and fit a remnant of the 3/32" balsa stock between the fuselage extension sides and against the back of the former #3. This becomes the fuselage extension front. Glue in place to the bottom of the wing and between the two fuselage extensions sides. Next cut and fit a remnant of the 3/32" balsa stock between the fuselage extensions side and on the bottom of the wing and on the top of the previously made fuselage extensions front. Glue in place. Sand all the pieces to form the finished fuselage extension.

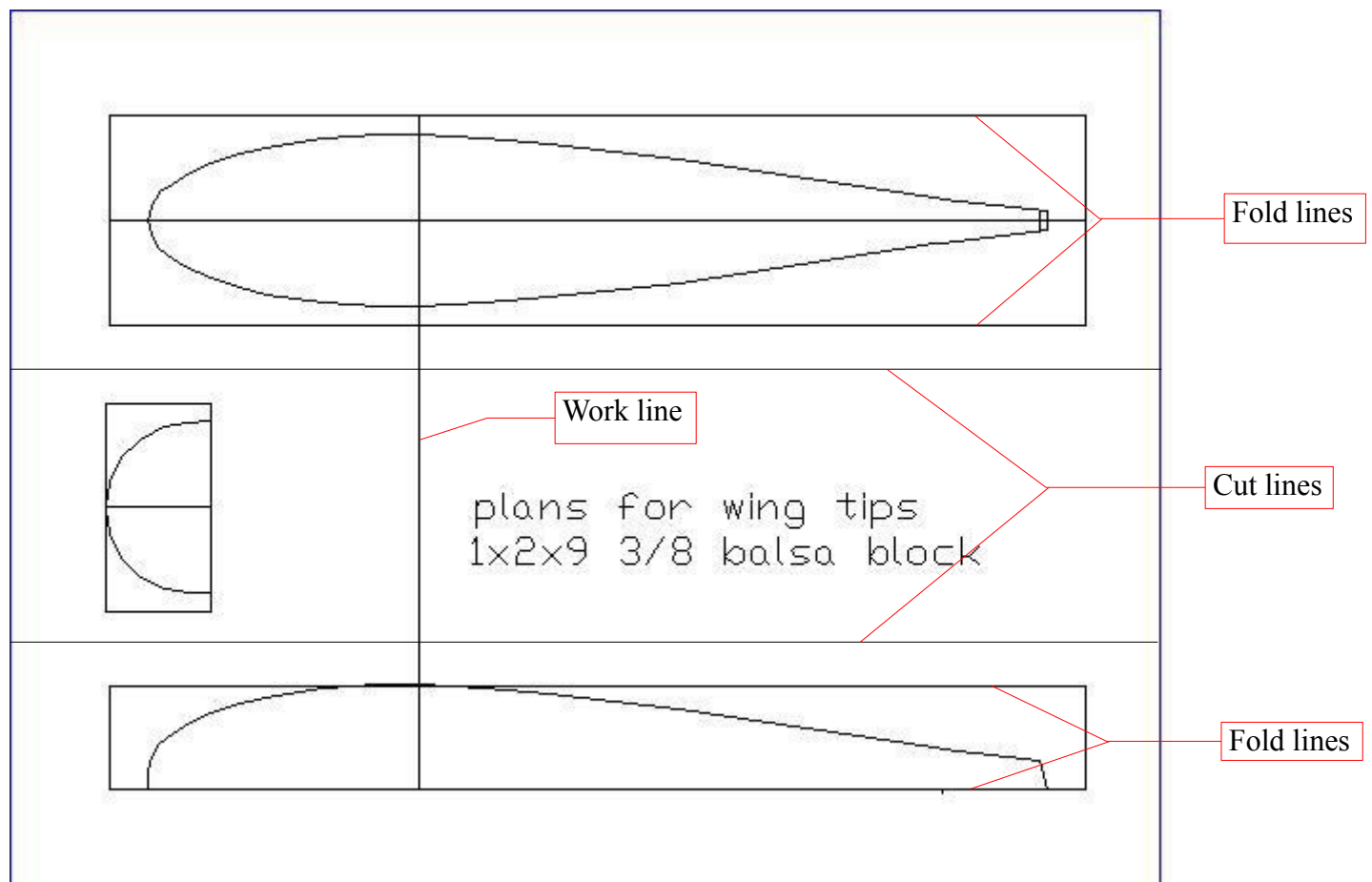
USE EXTREME CARE WHEN GLUING THESE PARTS TOGETHER. Do not glue to the former # 3 or it will be extremely difficult to remove the main wing from the fuselage.



The making of the wing tips is the next step in the wing build.

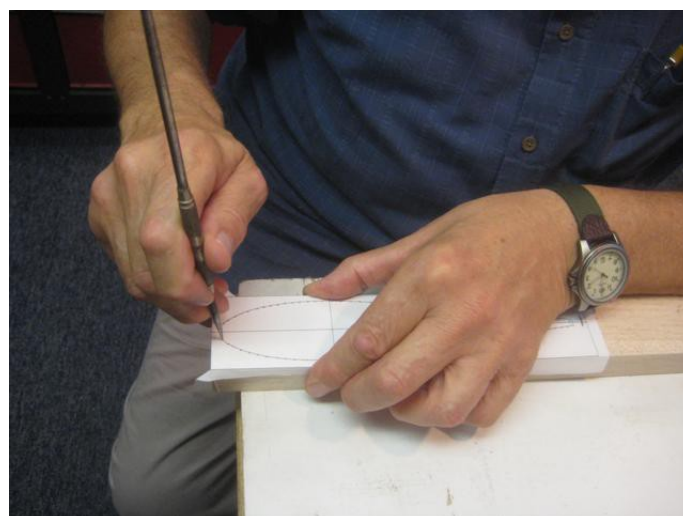
Wing tip Preparation:

Use the inclosed two identical plans of wing tips and the supplied 1"x2"x18" balsa block to build both wing tips. Since the airfoil on the wing is fully symmetrical, both blocks will be made identical to each other. Both plans will be cut and both will be expendable.



Start by cutting the length of the supplied (1x2x18") balsa block in half.

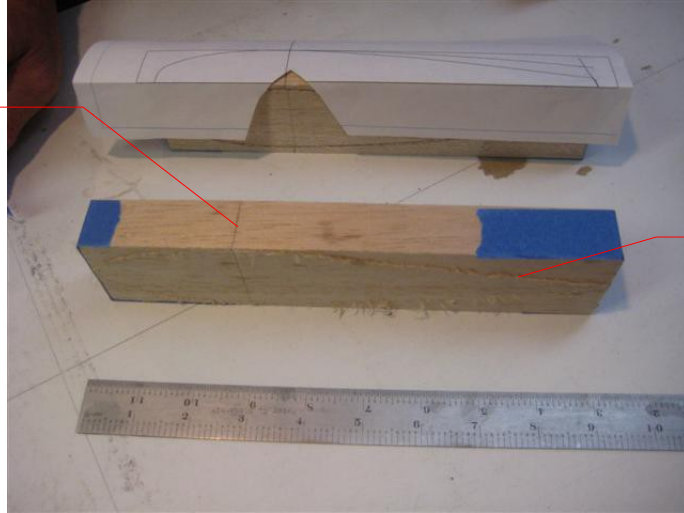
Draw the cut lines on the supplied plans at the approx. locations show on the drawing above. Cut out the overall shape of the side view of the wing tip from the supplied plans along the cut lines. Fold the cut out plans along the fold lines and position the cut out side view of the wing tip on the 2" wide surface of the balsa block using the folded edges of the plans as a guide. Temporarily glue the plans to the block using spray adhesive or equivalent. Draw the work line on the balsa block by extending the line from the positioned plans onto the balsa block.



Using a scroll or band saw, carefully cut the balsa blocks just outside of the overall shape line of the side view. Save the balsa remnants from the cut. Position the remnants back on the balsa blocks on the same sides that they were cut from. Wrap masking tape around the blocks to hold the remnants back in position to the main part of the blocks.



Work line drawn on block by extending the work line from the side view plans.



Band saw cut. Remnants positioned back in location and taped in place.

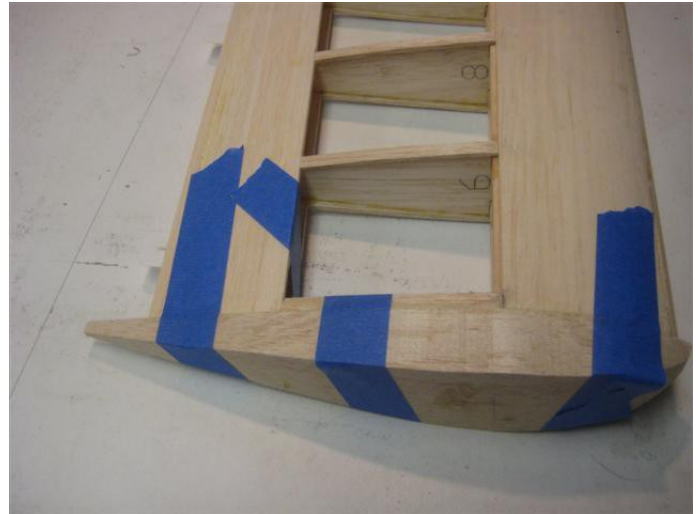


*After reassembling the remnants on the main part of the blocks
Cut out the wide line shape of the of the top view of the wing tip from the supplied plans and position the top view of the wing tip on the 1" wide surface of the balsa block by holding the fold line on the plans along the edge of the blocks and line up the work line as shown above. Temporarily glue the plans to the block using spray adhesive or equivalent.*

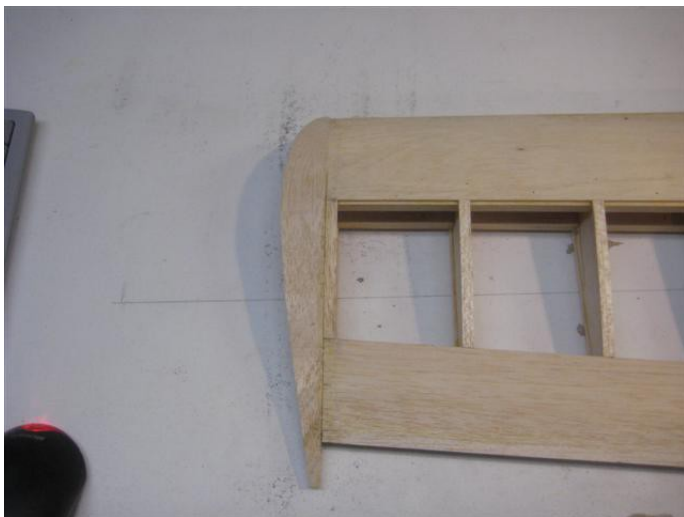
Using a scroll or band saw, carefully cut the balsa blocks just outside of the overall shape line and then final sand to shape. Repeat this on both balsa blocks for the right and left wing tip.



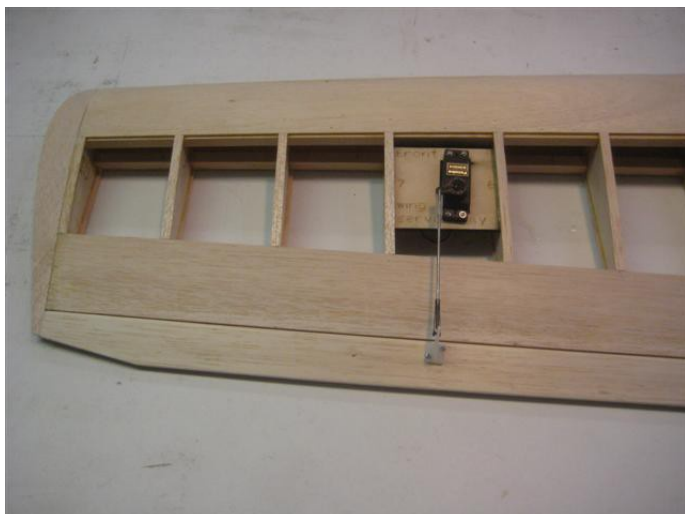
When the wing tip surfaces are sanded into shape, position them onto the end of the wing lining up the surfaces of the blocks to the surface of the wing, then glue them in place.



When the glue dries, final shape the tips and blend them to the surface of the wing.



Re-install the ailerons on the main wing. Install the aileron push rods. Dub the ends of the ailerons to the wing tips. Final sand the wing.



If the flat wing tip option is chosen, the laser cut wing tip is simply lined up to the outside of the # 10 wing rib periphery and glued in place. The edge of the wing tip and the surface of the wing is simply sanded to form a fair surface.

The end of the aileron is cut off flush to the outside surface of the flat wing tip. The end of the aileron is then dub to the wing tip using the same dimensions as for the preceding contoured wing tip directions.

Note: Continue with the fuselage construction.

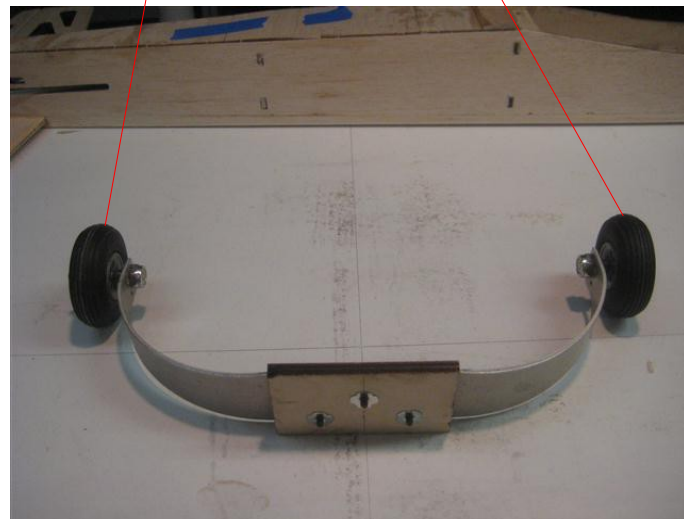
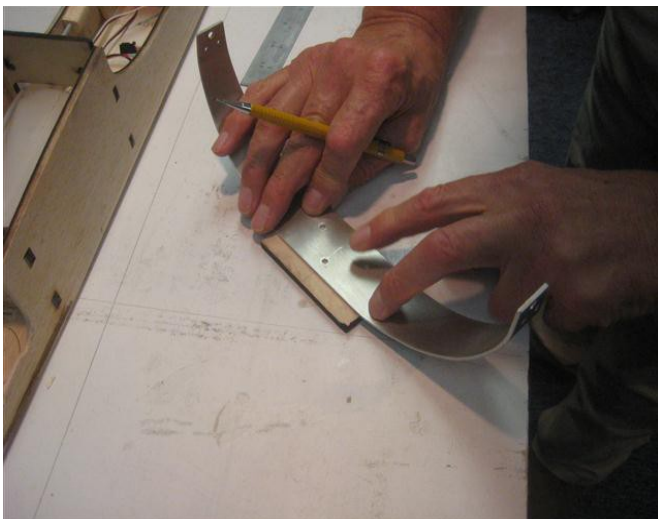
Finish preparing the firewall for the engine installation by drilling a clearance hole for the fuel system tubes and the flexible throttle housing. Make sure there is clearances for the engine or engine mount and the fuel tank. Trial fit the fuel tank and any blocking provisions needed to hold the fuel tank in position. The fuel tank can be installed (and removed) through the main wing saddle opening and slid in place into its compartment area, through the opening in former #3 .



Temporarily mount the main landing gear to the laser cut plywood landing gear reinforcement using the landing gear manufacturer's directions.



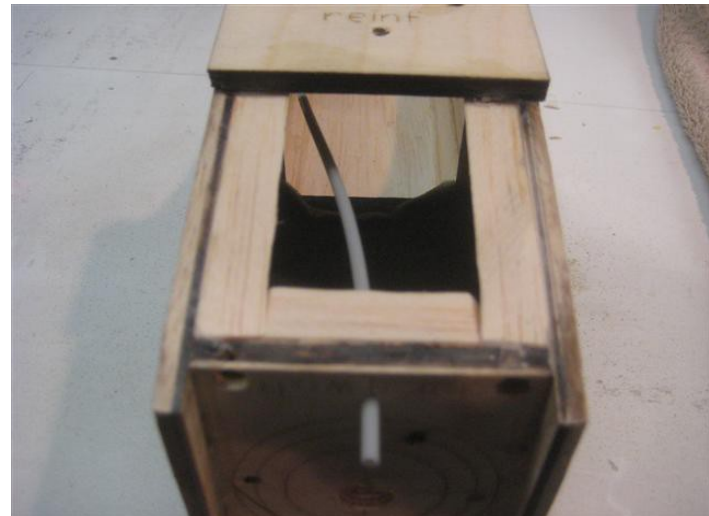
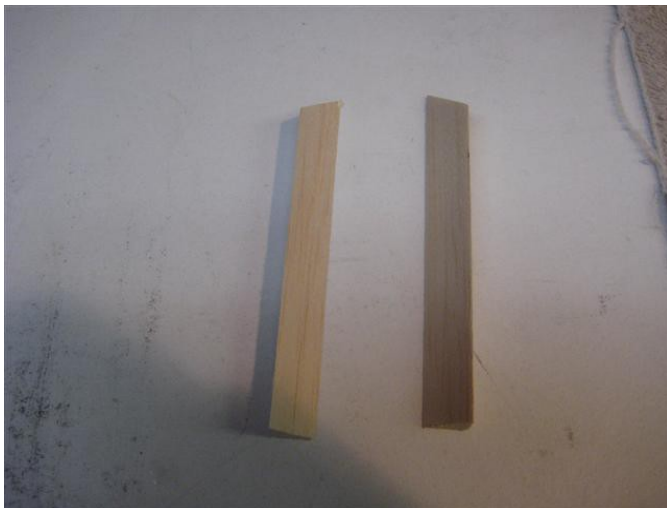
2-1/4" dia wheels



Position the landing gear reinforcement on the bottom of the fuselage sides and against the former #3 and glue in position with epoxy.



Cut and fit the fuel tank compartment triangle corner reinforcement pieces to size and glue in place.

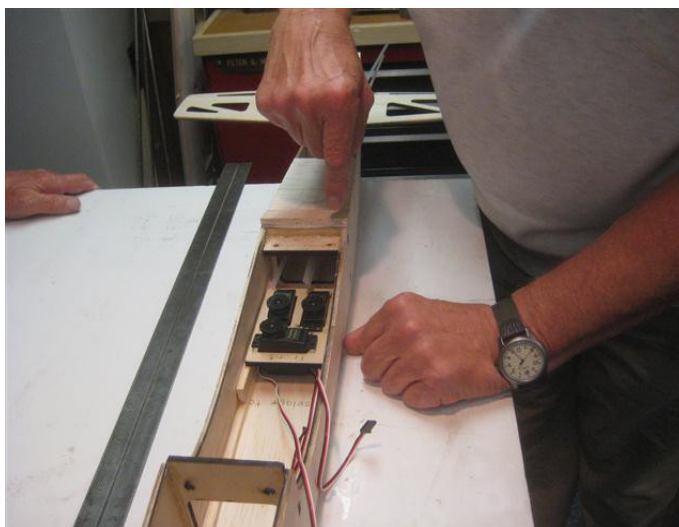
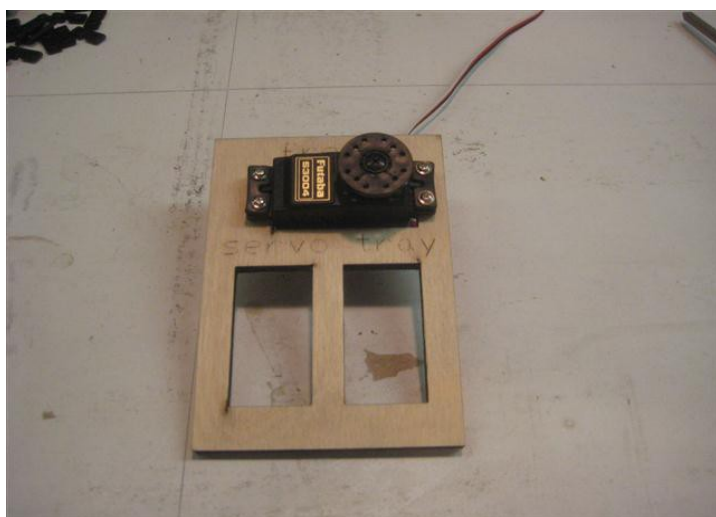


Glue the laser cut balsa bottom fuselage front in place.





Mount three servos in the fuselage servo tray. Position the tray on the 1/4x1/4" side rails previously glued in the fuselage sides and slide the tray rearward and still have the servos mounting screws accessible. Glue the tray to the rails.



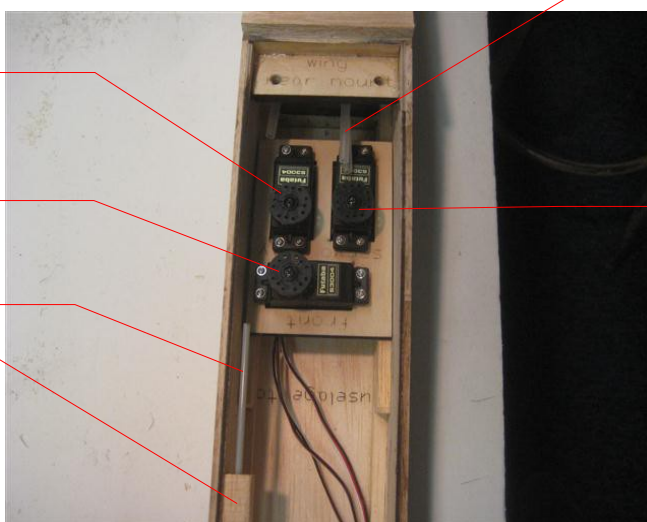
Position the push rod housings in place and trim them to length.



Rudder servo.

Throttle servo.

Throttle push rod.
Note blocking.

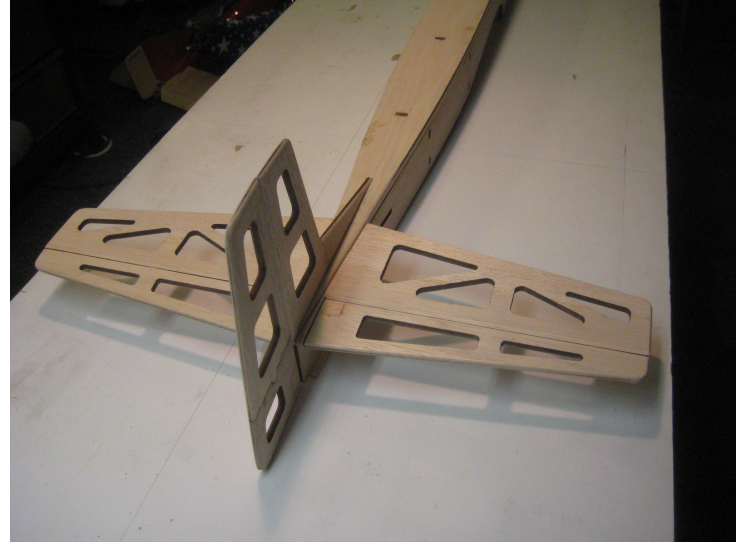


Trim push rod housings rearward to allow for the fastening together of the two elevator push rods.

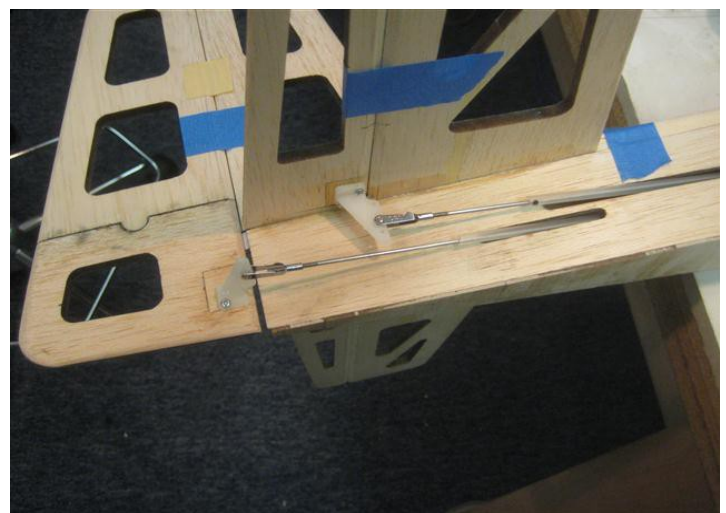
Elevator servo.

Position the vertical fin and rudder assembly in place making sure the vertical fin's tabs are located in the slots in the fuselage top. You will have to cut in a slot between the upper part of the fuselage sides for the exposed C A hinge that is protruding from the rudder. Check the vertical fin to the stabilizer for being square to each other. Glue in place.

Install the tail wheel assembly of your choice. Follow the manufacturer's instructions for the installation.



Slide the push rod into the push rod housings from the rear. Using the push rods for location, drill and mount the control horns in place.



Install E Z connectors on the servo arms of the three servos in the servo tray. Mark the length of the push rods allowing for adjustments, then remove the clevises from the control horn and slide the push rods rearward and out of the housing. Cut the rudder push rod to length as marked and return it in it's housing and through it's E Z connector on it's servo. Cut only one elevator push rod to length as marked. The second elevator push rod should be cut approx. 1" shorter than the first. Return both elevator push rods in their respective housings. Slide both push rods forward till they just clear the front end of their housings, then slide two 5/32" I D wheel collar over both elevator push rods. Continue to slide the longer trimmed push rod forward and through the E Z connector attached to the elevator servo. Attach all the push rods to their control horns. Adjust the rudder and the rudder servos to the neutral position and tighten the E Z connector set screw on the push rod.

Adjust the surface of the elevator that is attached to the longer push rod even with the surface of the horizontal stabilizer and adjust the elevator servo to it's neutral position and tighten the E Z connector set screw on the push rod.

Adjust the surface of the elevator that is attached to the shorter push rod even with the surface of the horizontal stabilizer, then tighten both of the set screws of the wheel collars, thus combining both elevator push rod to work in unison when the elevator servo is activated. The combined push rods may have to be adjusted by making a slight bend in one rod to eliminate any binding that may occur when the push rods travel through the housings.

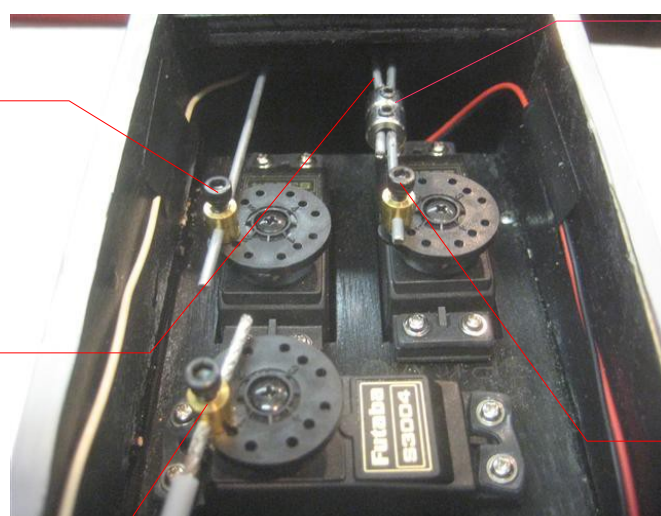
Attach the throttle push rod through the E Z connector of the forward throttle servo and adjust the push rod to actuate the engine throttle.



Rudder E Z connector with the rudder push rod locked in position.

Slight bend in elevator push rod to eliminate any binding when push rods travel through their housing.

Throttle E Z connector with flex cable push rod locked in position.

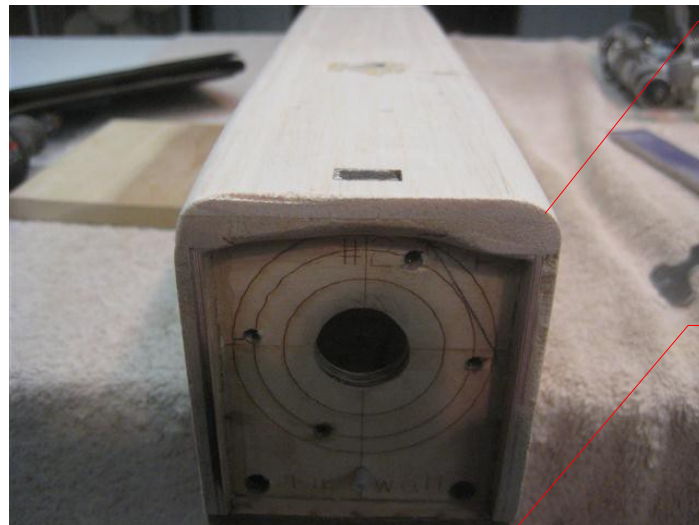


Two wheel collars tightened around both elevator push rods combining both push rods to work in unison.

Elevator E Z connector with the longer elevator push rod locked in position.

Apply a 3/8" radius along the front top edge on both sides of the fuselage. The radius runs constant from the front of the fuselage to a point approx. above the trailing edge of the main wing, then tapers to a 1/8" radius that was previously applied to the rear 8-1/2" of the fuselage.

Apply a 1/8" radius on the bottom front sides of the fuselage for distance of 1" rearward, then tapers to a 1/16" radius at the plywood landing gear reinforcement.

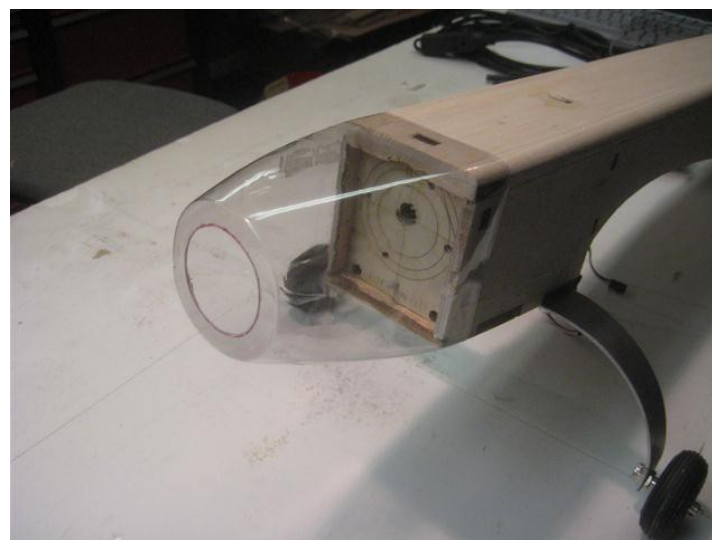


3/8" radii
blending back to
a 1/8" radii at
the horizontal
stab.

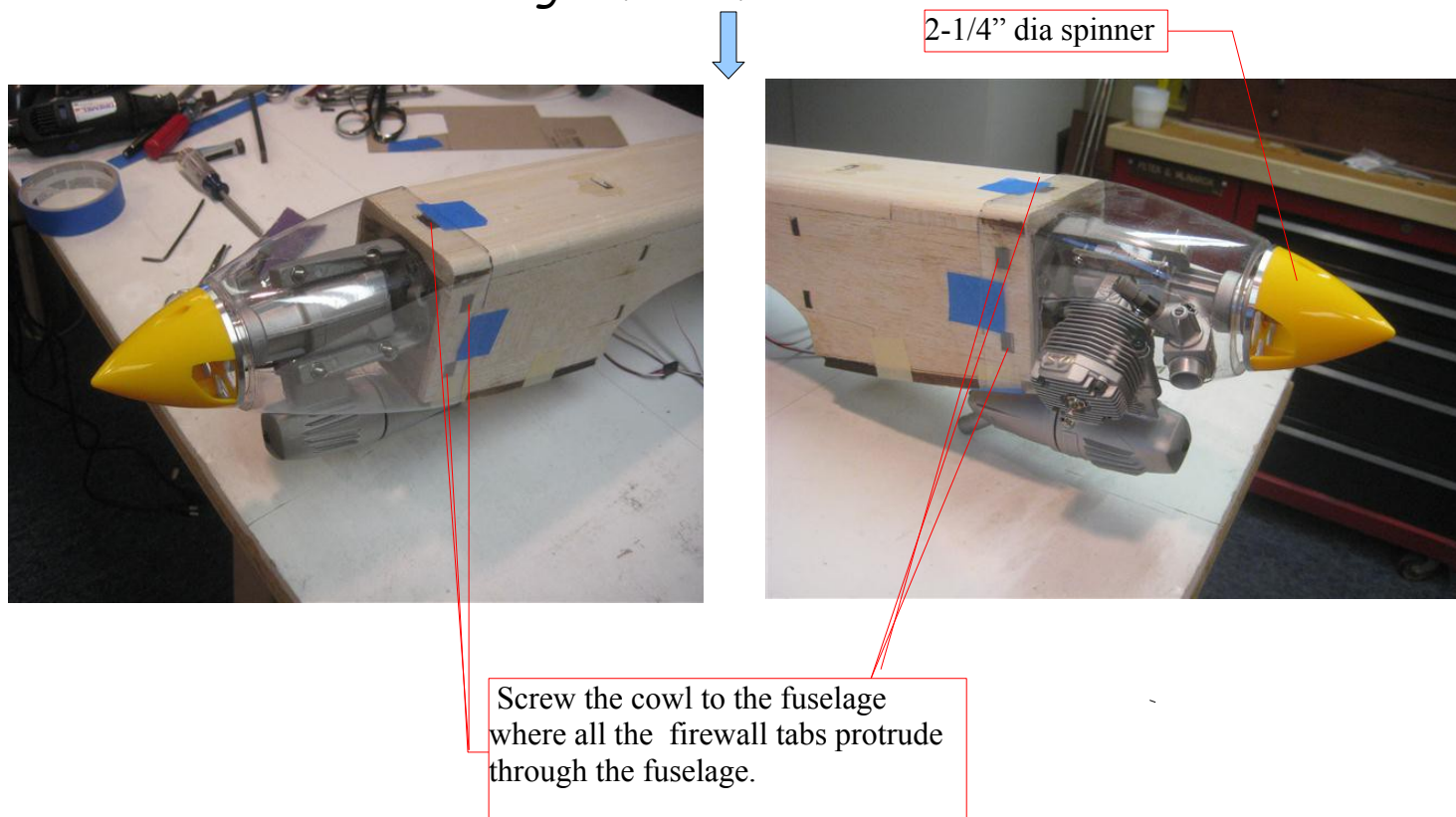
1/8" radii
blending back
to a 1/16" radii.

Final trim the supplied plastic cowl to the scribed line at the rear edge of the cowl. Final trim to the scribed circular opening for the engine case at the propeller shaft.

Trial fit the supplied plastic cowl for fit over the front of the fuselage.



Remount the engine and carefully cut away the plastic cowl clear of the engine. Make sure there is approx. 1/8" clearance around the cowl opening and the engine. Make provisions in the cowl to access the high and low needle valves. Mount the spinner and prop to the engine. Leave a space of approx. 1/8" between the back plate of the 2-1/4" dia spinner and the front of the cowl and position the cowl to match the diameter of the spinner. The cowl is fastened to the fuselage using small pan head screws. The screws are located in line with the edge of the firewall.



The construction of the airframe and the hardware are basically complete.

The engine and all the hardware should be removed and the plane given a final sanding. Clean up the sanding dust from the airframe in preparation for the covering of your choice. After covering the plane and the separate control surfaces, reinstall the control surfaces (ailerons, elevators and rudder) and CA the hinges in place. Reinstall the engine and all the hardware. Add the trim and accessories of your choice (canopy, wheel pants, etc.). If you intend to race in the club racing events, be careful on what you add or leave off the plane. See the racing rule restrictions.

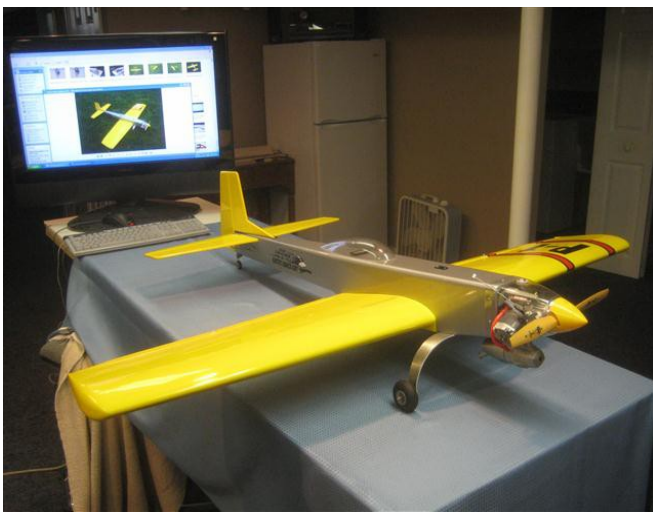
The plane should be CG balanced (dry) between a point that is at the rear edge of the main spar to a point 1/2" rearward of the main spar. The plane should also be balanced laterally along the center line of the engine prop shaft and the vertical fin.

The preliminary control surface movement should be set as follows:

<i>control surface</i>	<i>high rate</i>	<i>low rate</i>
<i>aileron</i> s	<i>3/8"</i>	<i>1/4"</i>
<i>elevator</i> s	<i>5/8"</i>	<i>3/8"</i>
<i>rudder</i>	<i>1"</i>	<i>1/2"</i>

*The above dimensions are the same in both directions of movement.
Either up or down..... Either left or right.*

Prototype 1



The build of the  is complete!

*Now go out, fly safely
and have a great time.
Hope to see you at the club races!*