

# **TOP NOTCH**

# **Mooney M-18**

## **Mooney Mite**



# **ASSEMBLY MANUAL**

Top Notch Products Company  
PO Box 1051  
Goodlettsville, TN 37072

Made in the USA

## BEFORE YOU BEGIN

### A word about laser cut parts and adhesives.

There are three primary types of adhesives recommended for constructing your model. They are CyanoAcrylate (CA) in all viscosities, Aliphatic Resin Glue (carpenters glue) and Epoxy. CA is the primary adhesive to use however there are times when it is not the best choice. They are:

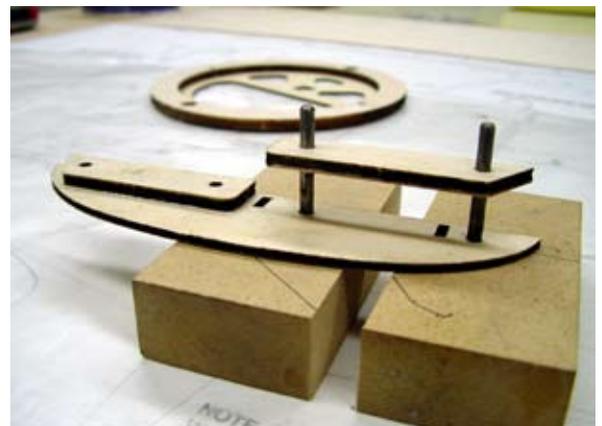
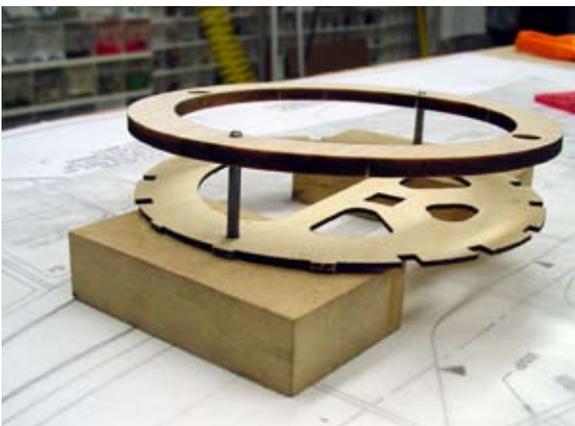
1. When you need more time to carefully position a part than a fast setting adhesive will allow.
2. When attaching plastic such as a windshield (Use Pacer formula 560 here).
3. When gluing laser cut aircraft grade plywoods. The microwave set adhesives used in aircraft grade plywoods ablates at a much higher temperature than the surrounding wood. As a result it burns the wood fibers near by leaving a thin charred edge. Fast setting CA adhesives do not allow time for the adhesive to penetrate this layer of char and bond to the wood fiber underneath. Use a slower setting adhesive such as Aliphatic Resin or for maximum strength use Epoxy on aircraft grade ply parts. Lite Ply's do not use this type of adhesive and do not suffer from this problem.

To apply thin CA I recommend the Dave Brown pipets available at your hobby shop. Be sure to stretch the end (pull it with a pair of pliers) to a thin applicator tip, as they are not supplied in this configuration and some folks don't know that you have to do this. No mention of this is made on the package they come in.

### PIN REGISTRATION

A great shop technique introduced by Top Notch Products is the use of 1/8" piano wire pins to quickly and precisely position laminated parts such as fuselage doublers etc. Many of the parts in Top Notch kits utilize this method and are supplied with pinning holes. Take the time to construct two of these handy tools. Use two small hardwood blocks and two short lengths of 1/8" music wire. Round the ends for easy insertion into the parts.

Below are two examples of this technique as used in the Cessna 195 kit. On the left, two fire wall components are being assembled using the pins. Any time precision placement is required, this method is used. You will find the pinning holes are easily filled after completing the model. This method allows the use of fast setting adhesives such as CA because the parts cannot be out of register. In the photo on the right, landing gear components are being assembled with the pins. Precision placement of these parts is required to assure that the 1/8" landing gear wire will fit snugly into this assembly. In the background is the completed fire wall assembly.



Use a sheet of Wax Paper to protect your plans. When assembling flat sheets such as the stabilizer skins I recommend laying the parts on a sheet of parchment paper. Assemble the parts, apply thin CA and frequently lift the part and wipe up any excess CA from both the part and the paper with a piece of paper towel.

## OK, LETS BUILD A TOPNOTCH MOONEY M-18

*The vertical fin and rudder assembly will employ most of the building techniques used in the rest of the aircraft so we will start with these smaller parts. Note that I will go into detail on this assembly but will only refer to these methods later on for the remaining assemblies. Even if you decide to build the model in a different sequence than arranged here in the assembly manual, It would be wise to build the fin and rudder assembly first if only for this reason.*

## Mooney M-18 Assembly Instructions

The stabilizer, vertical fin and ailerons of the Mooney utilize core sheet construction. If you are not familiar with this method of construction you will be pleased with the speed and ease of construction. In addition, this type of structure is very light and very strong and conforms perfectly to the scale airfoil of the full-scale aircraft. You will be building each structure onto a 1/16" balsa sheet cut with notches for all ribs, leading and trailing edges. It is important to make sure that these assemblies are held perfectly flat during the gluing process. Whatever shape they possess when they are glued is the shape they will retain so keep them flat.

- 1 Locate the vertical fin components VC, V1 through V5, VTE, VLE and VT. Note that the tabs on the ribs are longer at the trailing edge of the ribs than they are at the leading edge. The Mooney has a 29° forward sweep of the trailing edge and that can be confusing while in the building process.
- 2 Install V1 into the appropriate notches in the core sheet VC. Observe the correct size notches, the narrower end is the leading edge. Hold V1 firmly flat against VC when applying glue, thin CA is recommended.
- 3 Proceed to install and glue V2 through V5 in the same manner.
- 4 Note that the trailing edge of VC has notches for the trailing edge section VTE. Be sure that VTE is seated in these notches and then apply thin CA while holding the assembly flat against the building board.
- 5 The leading edge has no tabs and is very thin but it is installed in the same manner. Use the edge of a straight edge to hold VLE firmly against VC while applying glue.
- 6 Install the hinge caps VHC at each hinge location. Note that each hinge cap is a different shape to accommodate that particular location. These caps will provide a pocket for the Robart hinges.
- 7 Flip the assembly over and repeat this process on the opposite side. V1 through V5, VTE, VLE and three hinge caps VHC.
- 8 The Vertical Fin sheeting is supplied in two pieces that must be assembled before sheeting the fin. Locate and assemble VS. Select the best side for the outside and sand smooth while still flat. Note the two notches in VS will engage the two tabs on VTE to precisely position the sheeting.



*Assembly of the vertical fin underway with only one side completed. Note the core sheet splice on the right. The tabs on the trailing edge will position the sheeting when installed. The hinge pin openings have been capped with balsa and the assembly is ready to be turned over and completed.*

- 9 Glue the sheeting (VS) to the fin.
- 10 Glue on VT to the tip on both sides.
- 11 Sand the fin to final shape.
- 12 Use a hinge to mark the trailing edge at the barrel of the hinge. Remove a small amount of material from the trailing edge to allow the hinge to be seated with the pivot point aligned with the trailing edge. Note that when the hinge bottoms in the opening provided your hinge line will be laser straight.



*The vertical fin assembly ready for sheeting. Note that all hinge pin openings have been capped and the leading and trailing edges have been sanded to contour with the ribs. Avoid altering the tabs on the trailing edge when sanding to contour. They will be sanded after the sheeting is attached.*



*After sheeting, VT pieces are added and sanded to contour. Note the hinge pin openings are already provided and will assure a straight hinge line.*



*The vertical fin sheeting is assembled from two laser cut parts and then sanded flat before installing onto the vertical fin assembly.*



*When the hinge pins are bottomed in the hinge pin holes, they are in the correct alignment. A small amount of material must be removed to accommodate the hinge barrel.*



*Assembly of the vertical fin completed and ready for final sanding and shaping of the leading edge. Very little additional shaping is required to form a perfect airfoil. Very light, very strong and very quick to build.*

## RUDDER ASSEMBLY

The rudder is composed of three sections that are glued together. The core sheet or center lamination contains openings for the hinges as well as the rudder torque rod. You will use the pin registration method to assemble these three components.

- 1 Locate and prepare one RC and two RUD parts. Place one RUD on the register pins. I do not recommend CA for this assembly; instead use an adhesive that you can spread a thin layer onto the surface of RC. This can be Aliphatic Resin or spray on contact cement. You will want a thin but firmly glued joint between the three sections when you go to shape the final part. Apply a thin layer of adhesive to the correct side of RC and then slide it down the pins into contact with RUD.



*One RUD part has been placed on the register pins and the core (RC) has been coated with spray adhesive and is about to be pushed down the register pins and into contact with RUD. Note that the rudder core sheet contains the hinge pin openings precisely aligned with those in the vertical fin. Also on the right is a slot for the rudder torque rod. Note the half moon key at the left end that will receive the tip assembly.*

- 2 Apply a thin layer of adhesive to the remaining RUD and slide it down the pins and into contact with the assembly. Remove from the pins and put under pressure until cured.

- 3 The leading edge of the rudder assembly will need to be double beveled to accommodate the swing of the rudder. I prefer to do this on a band saw set to 35° angle. Note that this will only work before shaping the airfoil. Using a razor plane will work as well.



*On the left is the vertical fin assembly with steel pins temporarily replacing the hinge pins and on the right is the rudder assembly. The double bevel on the rudder was cut using a band saw set at 35°. The rudder has been removed from the steel pins after marking the leading edge with the fin trailing edge. The rudder assembly can now be tapered to match the fin. The rudder torque rod is only temporarily installed and will be removed before finishing.*

- 4 Three 1-1/2" pieces of music wire are used in the hinge pockets to hold the rudder and vertical fin in perfect alignment. Then the leading edge of the rudder is marked for shaping.

- 5 First plane the rudder down to the thickness indicated by these lines and then introduce into it the airfoil shape.

- 6 Assemble the two RT pieces and then glue onto the tip of the rudder. Place the assembly back onto the fin using the pins and mark the counter balance (the material that sticks forward of the hinge line) along the fin for a trimming guide. The counter balance should be the same width as the fin. Then trim and sand to contour with the rudder.

- 2 Locate the steering arm in the hardware pack. The locking screw location must be changed 90° so that it can be installed through the side of the fuselage during final assembly. To do this, press the brass barrel out of the nylon horn. Drill a 7/64" hole in the nylon hub parallel to the steering arm. Then press the brass barrel back into the nylon arm aligning the screw hole in the barrel with the new hole in the nylon arm.



This concludes the assembly of the vertical fin and rudder assembly. Final installation of this assembly will be done after installing on the aircraft and finishing.

*A nose wheel steering arm is used on the rudder but it has to be modified as shown above. The brass hub is removed from the Nylon arm and a 7/64" hole is drilled into it in alignment with the arm. The hub is then installed with the locking bolt hole in alignment with it. A #4-40 x 1/4" socket head bolt will replace the regular screw. The steering arm in the background is the stock configuration. This will facilitate installing it through the side of the fuselage during final installation.*

## STABILIZER ASSEMBLY

- 1 Locate the stabilizer core sheet SC. Note that SC is supplied in two sections and must be assembled. Note that there is a small web between the sides of the hinge opening at the root end. Remove this web before proceeding with the assembly.
- 2 Locate and prepare all ribs, S1 through S7. Note that S2 and S3 have different geometry on the bottom for the servo mount screw rails. Be sure to use S2-TOP and S3-TOP on the top side of the stabilizer. Assume you will be assembling the top side first.
- 3 Install and glue all top side rib sections. Use the same technique as you did on the vertical fin section.
- 4 Install and glue the trailing edge STE. Note that it must align with the notches in the core sheet.
- 5 The leading edge SLE is quite thin and must be handled with care. Remove it from the sheet, clean off any nubs left by the retainers and install onto the core sheet. Make sure it is flat against the core sheet before applying glue.
- 6 Install and glue all hinge caps, (six places).
- 7 Flip the assembly over and install all rib sections. Note that ribs S2 and S3 are labeled S2-BOT and S3-BOT.

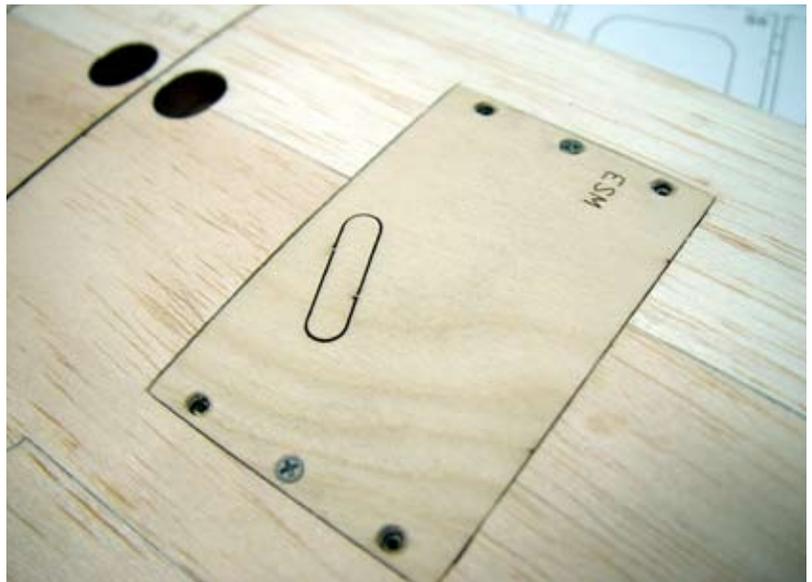
- 8 Locate ESMR and ESM. Use three #1 x 3/16" stainless flat head wood screws to attach ESMR to ESM. Screw one ESMR to each end of ESM. Test fit and then glue this assembly to S2-BOT and S3-BOT in the notches supplied. Take care not to get adhesive on the ply plate ESM. After the adhesive has set, remove the screws and ESM. This method will assure that ESM will fit perfectly after sheeting.



*Partially assembled stabilizer section with only the bottom sheeting remaining to be added. All components are clearly visible here. Note the servo mounting screw rails between S2-BOT and S3-BOT, the hinge point caps, and leading and trailing edges.*

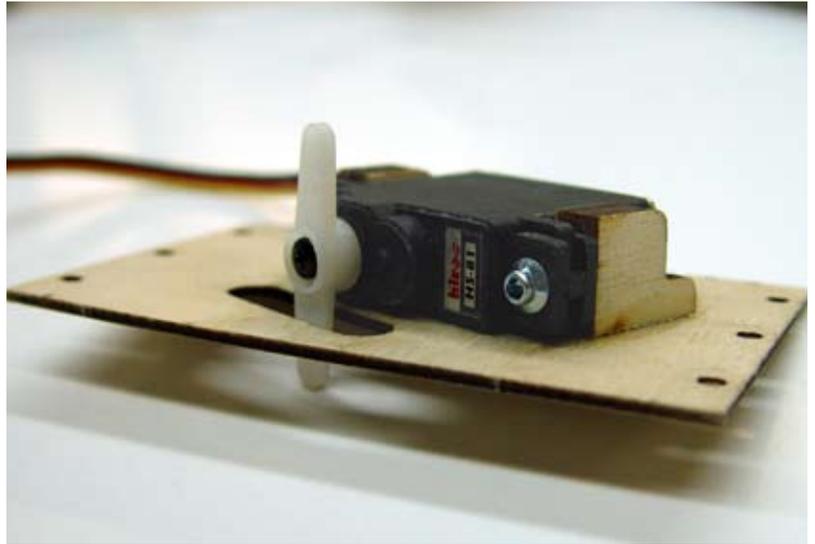
- 9 The stabilizer sheeting is labeled SS with a T or a B for top or bottom. The bottom sheeting has holes cut into it for the servo plates and the servo wire exit holes. Assemble two top and two bottom sheets. They are comprised of three sections each.
- 10 Sand the leading and trailing edge of the stabilizer assembly to contour with the ribs,. This should only require a few passes with sandpaper. Test fit one of the top sheet assemblies. Assure that it lines up with the center rib and the tip rib. Then remove it. Apply a bead of thick CA along the trailing edge and the install the sheeting by inserting the notches in the sheeting into the tabs in STE. Turn the assembly and while holding each rib firmly against the rib, apply thin CA. Do the aft half of each rib first, then turn the assembly around and complete the forward portion of the ribs. Then while holding the leading edge sheeting against SLE, trickle CA down the inside of the assembly to glue the sheeting at the leading edge.
- 11 Repeat this operation for the remaining top sheeting.

- 12 To install the bottom sheeting, use aliphatic resin glue along each rib with the exception of the area around the servo bay opening. We will be trimming this material later and will glue it after trimming. Put a bead of thick CA along the trailing edge STE and then place the sheeting into the tabs on STE. Hold this assembly flat until the trailing edge glue has cured. Pull the sheeting tight and firmly squeeze it at the leading edge while applying thin CA. Work your way along the leading edge until complete. Repeat this method for the remaining bottom sheeting.



*ESM is temporarily installed and used as a guide to cut the exact opening for it. Note the counter sink on ESM so the screw heads will sit flush with the surface.*

- 13 Install one ESM into each servo opening with #1 x 3/16" flat head wood screws and then use a sharp knife along the edges of ESM to cut the sheeting to fit. Then remove ESM and the material that you just trimmed off. Glue the sheeting to the ribs and ESMR. Reinstall ESM, make sure it does not stand proud of the sheeting.
- 14 Glue one STP on to the stabilizer tip on both ends, top and bottom then sand to contour.
- 15 Sand the leading edge to contour.



*A Top Notch Servo Mount is used to retain the HS81 servo to the Elevator Servo Mount (ESM) as shown here. This assembly is then installed into the stabilizer as shown below.*

This concludes the assembly of the stabilizer.

## ELEVATOR ASSEMBLY

- 1 Locate and prepare the elevator core sheet EC. Note that EC is composed of two parts however we will assemble them after shaping, similar to what we did on the vertical fin and rudder. Glue the elevator horn plate (EHP) into the slot in EC, and put the smaller EC aside for now.
- 2 For now assemble the larger EC and ES-B using the pin register method. First a ES-B, then a EC and then another ES-B.
- 3 You can use the band saw method or a razor plane to double bevel the leading edge of the elevators. Once again, use an angle of 35°.
- 4 Once again, use three 1-1/2" music wire pins in the hinge locations to hold the stabilizer and elevator rigidly together. Mark the leading edge of the elevator by running a pencil along the trailing edge of the stabilizer. This will give you the correct taper for shaping the elevators.
- 5 As you did on the rudder, plane the elevator down to the taper indicated by the lines you have just drawn and then proceed to add the airfoil shape.
- 6 Assemble the elevator counter balance tips consisting of the core and two ES-A parts. Install these assemblies on each tip and then sand to shape.
- 7 Once again, final shaping of the elevators is easiest if you mount the elevators to the stabilizer with 1/8" x 1-1/2" steel pins. These will hold the elevators firmly centered while you shape them.



*The finished servo installation. Note that you will need a servo reversing Y-Connector to reverse one of the servos to get proper operation.*

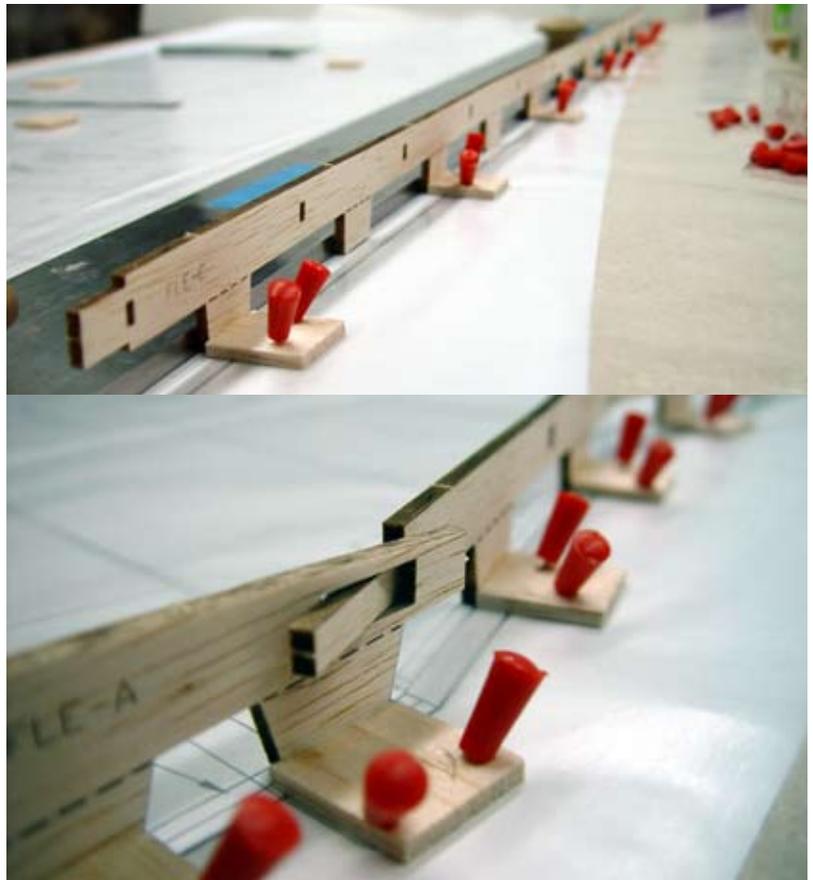
- 8 Locate the elevator servo mounting plates ESM and the servo mounts SMS. Cut three pieces of scrap 1/64" plywood about 3/8" x 1", these will be used as temporary spacers when mounting the servos. Note that this procedure will be used and referred to for all wing servos as well. Place the servo into position on ESM so that the servo arm will be centered in the servo arm opening in ESM. Place a piece of scrap 1/64" ply under it. Place one SMS at each end of the servo with a 1/64" ply scrap spacer between the servo and each SMS. Using thin CA sparingly, tack SMS to ESM. Carefully remove the servo and the 1/64" ply spacers. Now using thin CA, apply a liberal amount to secure ESM and SMS firmly together. After curing, place the servo back into position with the ply spacers in place and drill the screw holes for the servos into SMS. Remove the servo and spacers and saturate SMS with thin CA. After it cures thoroughly, re-drill the screw holes and then install the servo. The assembly is now ready to install into the stabilizer.

This concludes the stabilizer and elevator assembly.

## WING ASSEMBLY

A few notes on the wing construction before you begin. With this type of notch and tab engineering it is necessary to initially assemble many of the components without glue. This is to facilitate adding internal parts before the assembly becomes ridged and inflexible. Please follow gluing instructions and do not glue the assembly until instructed to do so. I cannot over emphasize the importance of having all parts bottomed in their respective notches and tabs before applying glue.

- 1 Locate the false leading edge sections, FLE-A, FLE-B and FLE-C. Use a straight edge over the plans and aligned with the aft edge of FLE-C and pin it in place. Now locate FLE-C and place it against the front edge of the straight edge. Place some pinning tabs at every other FLE-C stand off and using thin CA, glue one to each stand off and pin the tab to the plans. Proceed down FLE-C until the entire length is secured to the plans. Repeat this operation to FLE-B and FLE-A. Note that all sections are designed to overlap.
- 2 Locate SW-B, SW-T and all wing ribs. W1 through W14 including W6-A, W6-B, W7-A, W10-A and W11-A.
- 3 Use pin registration for all of the following rib sub-assemblies. Assemble rib sub-assemblies W6, W6-A and W6-B. Note that W6-A must be on the inboard side of W6. W6-B must be on the outboard side of W6. See the plan.
- 4 Assemble rib sub-assembly W7 and W7-A,. Note that W7-A must be on the inboard side of W7.

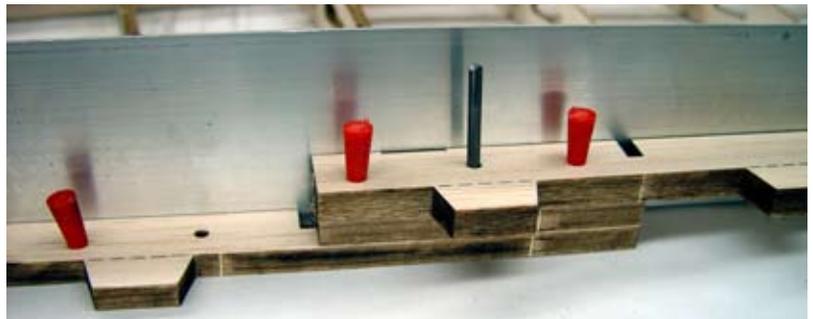


*Wing construction begins by fastening the false leading edge sections firmly to the building board. Where the wing break sections meet, the sections interlace with a simple finger joint. A straight edge is used to align the sections with the plans and assure they are straight and at 90° to the building board.*

- 5 Assemble rib sub-assembly W10 and W10-A. Note that W9-A must be on the outboard side of W9.
- 6 Assemble rib sub-assembly W11 and W11-A. Note that W11-A must be on the inboard side of W11.
- 7 Cut a piece of cable tunnel tubing 10" long.
- 8 Slide ribs W7, W8, W9 and W10 onto this tube through the holes provided and in the proper sequence. NOTE: The inboard section of cable tunnel can be installed after the wing is assembled through the hole provided in W1.
- 9 Locate SW-B and slide ribs W2 through W13 into there appropriate slots.
- 10 Locate SW-T and slide it down into the slots on each rib next to SW-B. Use finesse here, as force will only break parts. When everything is lined up correctly the parts will just fall together.
- 11 Taking care to assure that SW-B and SW-T are perfectly flush, top and bottom, tack glue at both ends. You will now have all ribs except root and tip captive in the shear web assembly.
- 12 Note the holes cut into SW-B and SW-T on opposing sides along the entire length of the assembly. These are glue ports. Starting at the center, squeeze the sheer web assembly from the top and bottom to assure they are perfectly flush with each other and then tack glue through the nearest glue port. Repeat this process moving one bay at a time and then return to the center and finish the other end.
- 13 Locate TE-A, TE-B and TE-C. The trailing edge is comprised of an assembly of these three pieces. See the plan for the stack order. Use a single pin (one of the pins you made for installing the elevators will work) through the hole provided for exact position. Note that TE-C also has hinge pin holes in it so don't confuse one of these for the alignment hole. The alignment hole is on the end of TE-C without a stand off foot.
- 14 Place the trailing edge assembly into position, most ribs will just tip into the slots provided.
- 15 Starting at one end, place the rib leading edge tab into the appropriate slot in the false leading edge. Make sure the rib is aligned correctly and that the parts are bottomed in there appropriate slots and notches. This is very important, as it will affect the fit of subsequent parts. Glue all rib leading edges to FLE.

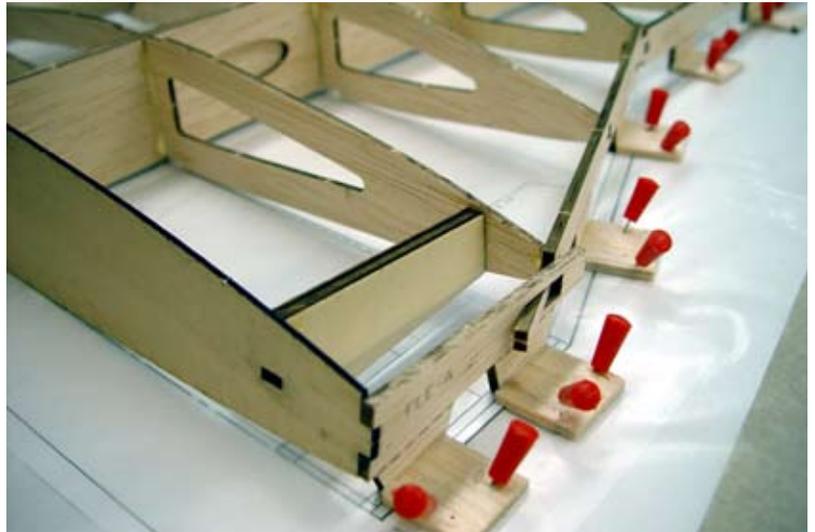


*Above, the wing leading edge is in position and fastened to the bench. All ribs except the root and tip are in there appropriate slots in SW-B and on the left is SW-T which will be installed next. The outboard section of cable tunnel tubing must be installed prior to placing the ribs into the sheer web slots. Once SW-T is installed, the ribs are captive in the sheer web assembly.*

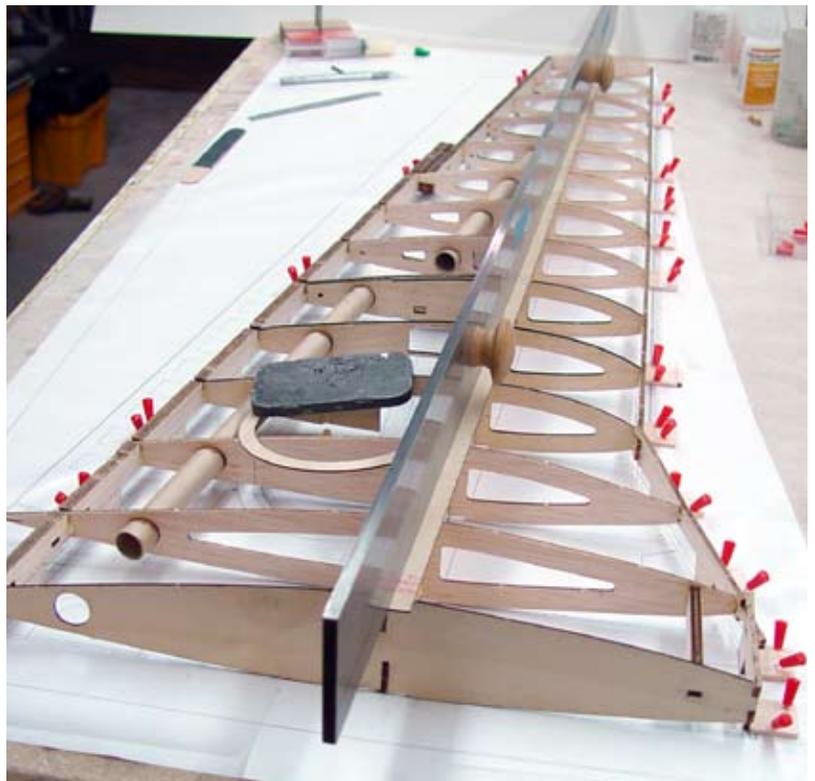


*The trailing edge is assembled from three pieces. The 1/8" pin is used to get the exact placement of the parts and the aluminum angle is used to keep the assembly perfectly straight.*

- 16 Align and then secure to the building board, the trailing edge assembly. Use pinning tabs glued to the stand off feet as you did on the leading edge.
- 17 Starting at the wing tip, glue each rib first to FLE and then to TE. Assure that both FLE and TE are flat on the building board and that the ribs are bottomed in their appropriate notches and slots. Do not glue the ribs to the shear webs at this time. Proceed down the wing until you get to W1. Install W15 between W1 and W2.
- 18 Using a straight edge, check W1 for straightness when all notches and slots are bottomed. Make any adjustments necessary and then glue W1 to FLE, TE, the sheer webs and W15.
- 19 Moving back out to the wing tip, glue each rib to the sheer web assembly.
- 20 Cut a 13" section of the 5/8" cardboard tube and install it through the hole in W1. Glue in place.
- 21 Using a Dremel sanding drum or sharp knife make an opening in the cable tunnel between W4 and W5 large enough for the gear pneumatic lines.
- 22 For maximum strength, revisit all glue joints with a syringe and a small fillet of Aliphatic Resin glue.
- 23 Next you will install the top spar flange. You will notice that the top spar flange also incorporates the gear bay outliner and a small notch that will engage W2 for exact positioning. Before installing the flange, sand out any nubs left from the retainer tabs on the sheer web assembly. The spar flange must be in contact with the sheer web assembly. Apply a liberal bead of Aliphatic Resin glue along the entire length of the sheer webs and on each rib where the flange will come into contact. Place the flange into position and use a weighted straight edge to hold the flange straight and in contact with the shear webs until cured.
- 24 Install and glue WBP between W1 and W2 at the trailing edge. Trim one end of filler piece, WBP to accommodate the angle of W1 and install and glue on top of WBP. Plane and sand WBP to contour with W1 and W2.

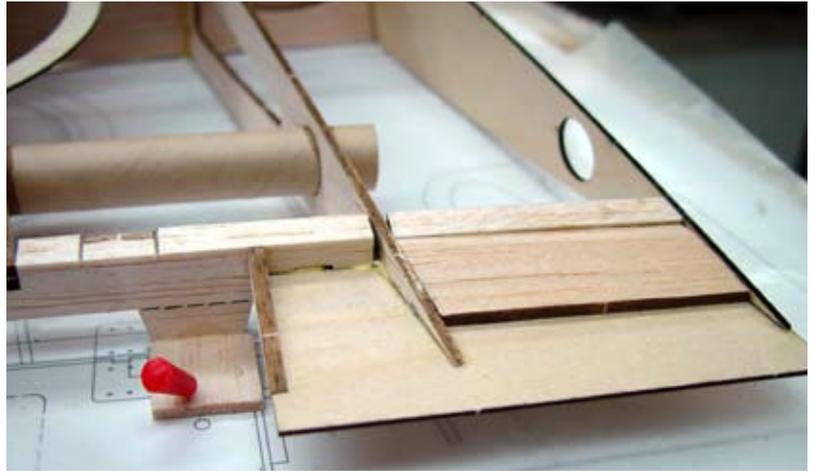


*Ply part W15 will later support the wing dowels along with the ply leading edge. Note that the correct dihedral for W1 is set by the sheer webs. All joints have now been glued and installing the top spar flange is next.*



*The top spar flange has been installed with Aliphatic Resin glue is curing under the weight of a straight edge to keep things laser straight. Note that the wheel well outliner is part of the spar flange and the lead weight is holding that down till cured.*

- 25 Note along the top of the trailing edge the small indentations to locate the flap hinges. When you plane the trailing edge to contour with the ribs in preparation for sheeting you will remove the part that would be visible after sheeting. To mark these locations for visibility after sheeting make a shallow saw cut so that the kerf will be visible after sheeting, then plane the trailing edge to contour with the ribs.



*Here WBP has been installed as well as WPBF and W2-B at the left end of WBP. WBP (wing bolt plate) is filled flush to the ribs by WPBF and will support the wing sheeting when the wing bolts are installed.*

- 26 Install and glue W2-B Top to the out-board end of WBP.
- 27 Glue two HPB (hinge point blocks) at each hinge hole in TE-C, the aileron bay.

- 28 Carefully remove the pins holding the assembly to the building board and turn the assembly over. Do not remove the stand off's and pinning tabs at this time. Were not quite through with them. Prepare the bottom of the sheer web by removing any nubs and then install the bottom spar flange as you did the top one. The exact position is correct when the spar butts against W6 and lays in the notches on the top of the ribs. The top spar flange should be flat on the bench.



*To provide more support for the aileron hinge points, these hinge blocks are added to the trailing edge of the aileron bay.*

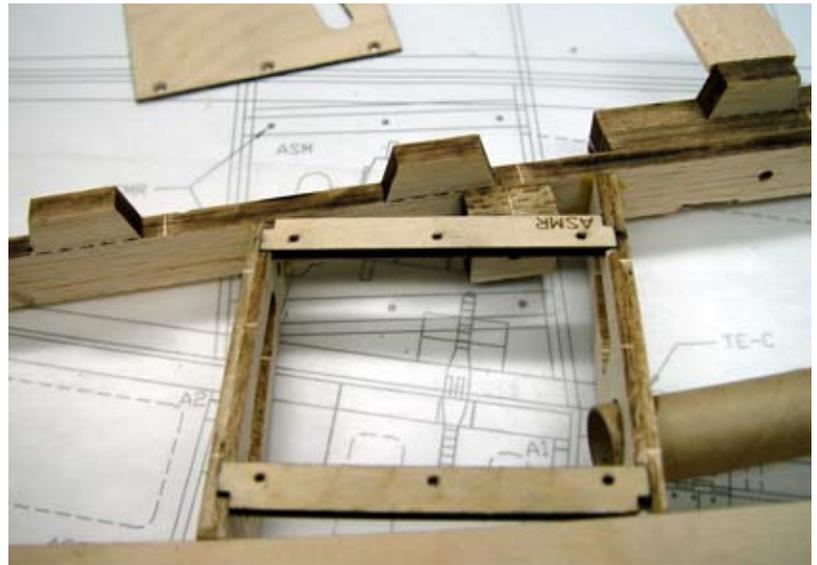
- 39 Install and glue WBPF.
- 30 Install and glue the bottom section of W2-B.

- 31 Locate one FSM (flap servo mount) and one ASM (aileron servo mount) and a pair of FSMR (flap servo mount rails) and a pair of ASMR (aileron servo mount rails). The rails will be glued to the ribs and then the servo mounts will be attached to them with #1 x 3/16" flat head wood screws. Determine the correct orientation of ASM and FSM and countersink the screw holes for the flat head screws. They will sit flush to the surface when finished. The easiest way to assure that everything will line up when finished is to temporarily attach



*The flap and aileron mounts and their screw rails are temporarily assembled and then the rails are glued into their respective ribs. The servo mounts are then removed. This method assures perfect alignment of the components. The flat head wood screws are countersunk to fit flush to the surface of the servo mounts. Note the material sticking out beyond the edges of the servo mount. This will provide a small shelf to support the wing sheeting.*

the screw rails (ASMR and FSMR) to the servo mounts with the mounting screws. Then glue the assembly (rails only) to the ribs. Then remove the screws and the servo mounts. Note that the hinge block may interfere slightly with the aft servo mount rail. Remove enough material from the block to allow ASMR to seat into its slot.

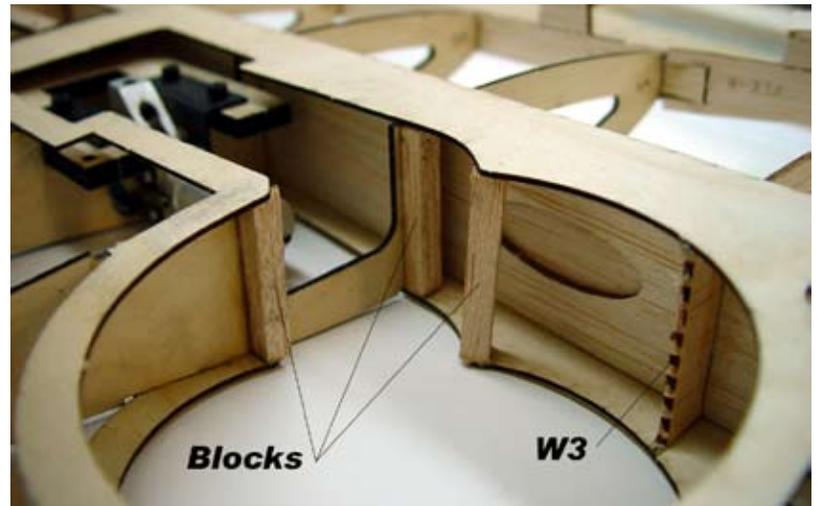


*The aileron servo mount screw rails have been installed and the aileron servo mount removed. The same method is used for the flap servo mounts. Note the flange that protrudes out from under the servo mount will provide a small shelf to support the sheeting when installed.*

- 32 Remove the dash cut material from W3 in the area of the wheel well. The easiest way to do this is to make a cut anywhere in the center of this area and then just tip it out. Install a scrap balsa post at the three locations indicated on the plans and sand to contour with the wheel well opening.

- 33 Locate the 1/64" ply wheel well bay liner (WWL) and install and glue into the wheel well. Trim and sand it flush with the spar flange/wheel well outliner.

- 34 The wing is now ready for sheeting. You can prepare the sheeting to the diagram on the plans for best results. Sand the outside of the sheeting prior to installing onto the wing. Trim the sheeting about 1/2" over size.

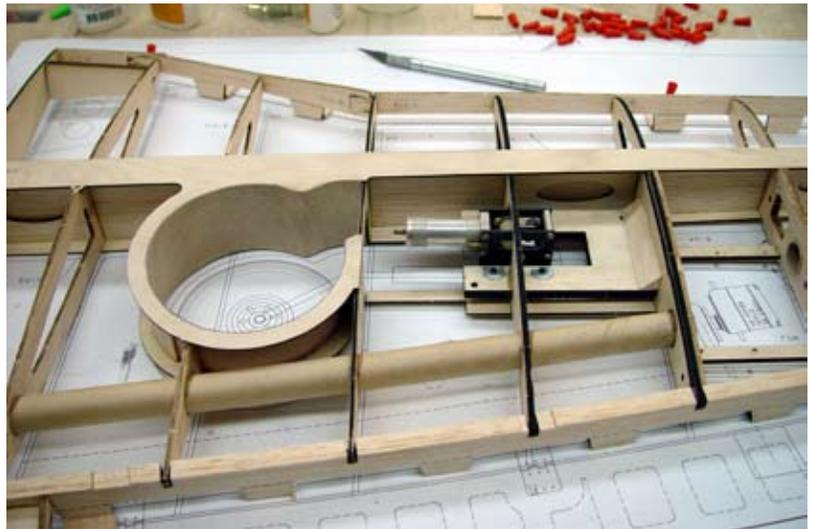


*The dash cut material in W3 has been removed and three scrap balsa post sections have been added to help support the 1/64" plywood gear bay liner that will be installed next.*

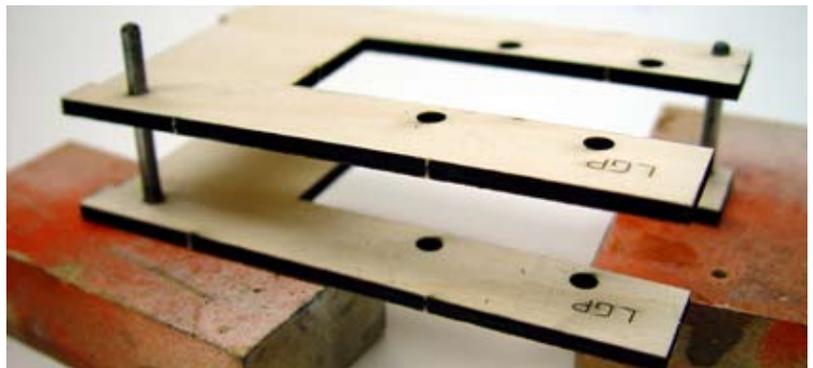
- 35 Plane and sand FLE to contour with the ribs. Plane and sand TE to contour with the ribs. Shave a 1/32" depression in TE to accept the flap hinges. Try not to get glue in these when attaching the wing skins.

- 36 Place the wing assembly back onto the building board and tack into place using the pinning tabs. Once again assure that both the leading edge and trailing edge are flat on the building board. Using Aliphatic Resin glue, run a liberal bead along each rib, the leading and trailing edge. DO NOT glue the sheeting to the spar flange. Place the sheeting into position on the wing and weight the sheeting down. Use pins along the leading and trailing edge, one about every half inch. Use a few clothes pins at the trailing edge root. When cured, trim all balsa sheeting flush with the wing.

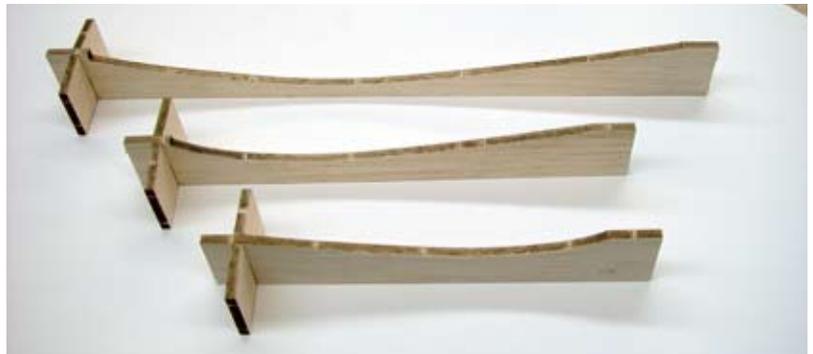
- 37 Revisit all rib and sheetg joints with a bead of Aliphatic Resin glue.
- 38 The bottom sheeting requires a different approach. To hold the wing in the correct position and avoid altering the wash out, three jig pieces are used to support the assembly while the bottom sheeting is installed. Locate and assemble the sheeting jigs from sheet #39. They are designed to support the wing in the correct position when located at W2, W8 and W13. Tack them to the bench to help stabilize the assembly.
- 39 The landing gear mount (LGP) is laminated from two 1/8" aircraft ply sections. Use pin registry and assemble the landing gear plates. Locate the holes for your gear and drill for the blind nuts. Keep your gear leg as short as possible (retract should be as close to wheel well as possible). Use four #6-32 blind nuts in the landing gear plate. Note that they will have to be trimmed so they do not hang over and interfere with the retract. Install the modified blind nuts and then using Epoxy, glue the gear plate assembly into place. Back up all rib/plate intersection on the top side with triangle stock or scrap balsa for additional strength.



*The gear bay liner has been installed and the retract has been temporarily installed to check all clearances. Note the addition of 3/8" triangle stock to the gear mounting plate. Not visible here is the small opening that has been cut into the servo cable tunnel tube between W4 and W5 to accommodate the retract pneumatic line.*

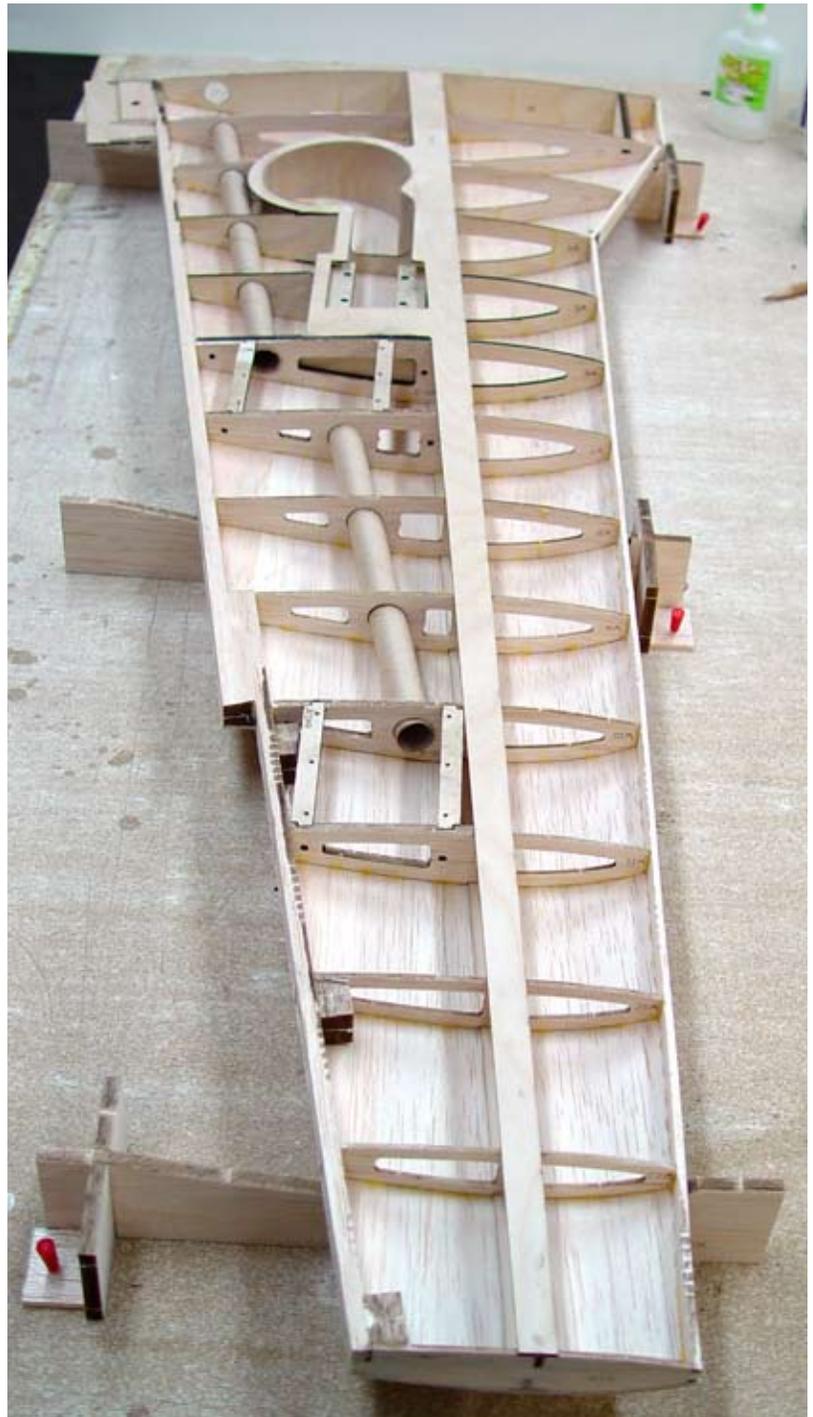


*Top photo shows the landing gear plate (LGP) being assembled on the registry pins. Below, the finished landing gear plate ready to install. Note that the blind nuts have been trimmed so they do not interfere with the retract when installed.*



*RIGHT: The wing jigs for installing the bottom sheeting. They will support the wing assembly and prevent changes in wash out during the sheeting procedures.*

- 40 Place the wing in position on the jig and apply Aliphatic Resin glue to all ribs, leading and trailing edges. Do not apply glue to the areas immediately around the servo hatches or along the bottom spar flange. Do glue around the wheel well opening.
- 41 Place the sheeting in place and weigh it down. Once again use plenty of pins along the leading and trailing edges.
- 42 After curing, trim the sheeting to the edges of the wing. Locate the gear bay and starting in the center, work your way out and trim out this area.
- 43 For the aileron bays, start in the center and work your way out to the inside edges of the bay. Slowly work your way back just far enough to locate the center screw hole on ASMR and FSMR. Now install the servo mounting plates with the flat head screws and use the edges of the mounts to cut the material along the edges. Remove the servo mounts and then the material that you have just cut. After cleaning up any remaining material and after you are satisfied with the fit, glue the inside edges of the sheeting around the servo opening.
- 44 Glue on the outer leading edge, use pins to hold it into position and tape to pull it into contact with the wing. Bevel the end of the inner leading edge section for a tight mortar with the outer leading edge section. Trim the leading edge flush at the wing tip.
- 45 Assemble the wing tip block from three laminations of WT and glue onto the wing tip.
- 46 Plane and sand the leading edge and wing tip to final shape. After shaping, carefully cut the tip flush with the trailing edge. Save the cut off sections for the aileron tips.

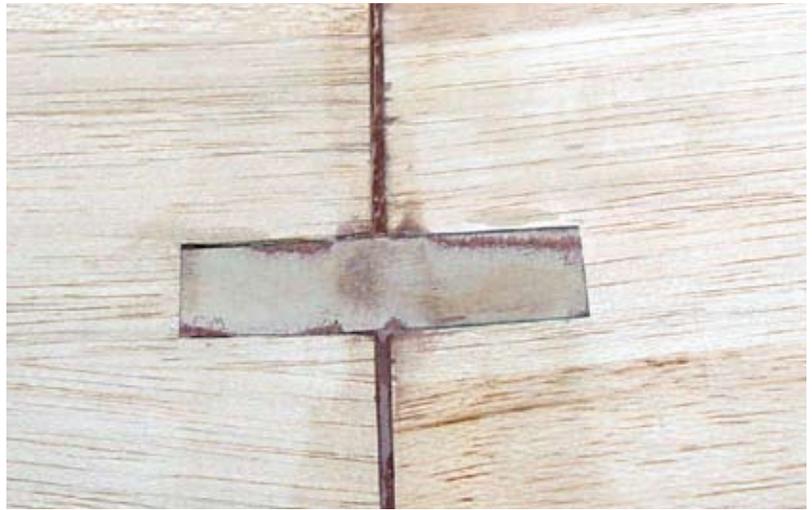


*The left wing panel assembly nearing completion. The top sheeting has been installed and the assembly is placed in the bottom sheeting jigs. These jigs will support the wing and prevent any distortion of the wash out during the sheeting process. For all of it's complexity, at this stage it appears to be a relatively simple structure.*

This concludes the main wing panel, build the remaining panel in the same manner.

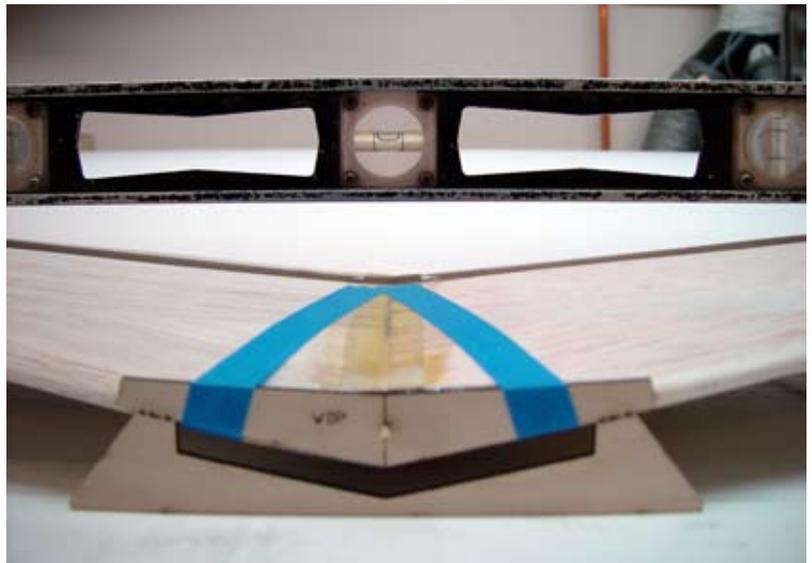
## WING WING PANEL ASSEMBLY

- 1 Sand the root ends of the wing panels as flat as possible. Cut two  $\frac{1}{4}$ " x  $\frac{1}{2}$ " dowels and glue them into one of the wing panel root ribs where indicated on the plans. These will serve to align the two root ribs and assure that both wing panels are at the same incidence without any guesswork. Cut a piece of scrap balsa 9-1/2" long to prop up one panel. Place one panel flat on the bench with waxed paper under the root end and weight it down. Place the remaining wing panel into position and prop up the tip with the scrap prop stick. If everything looks good, mix up a batch of microballons and Epoxy. Apply a liberal application of the mixture around the perimeter of the root rib and then join the two panels. Use rubber bands at the trailing edge and long strips of masking tape at the leading edge to pull the two panels together.



*The wing joiner consists of three layers of  $\frac{1}{64}$ " ply at the junction of the spar flanges. The wing halves are glued with a slurry of micro ballons and Epoxy to fill any gap in the center section. This method yields a very strong true I-beam spar that is contiguous from tip to tip.*

- 2 When cured, locate the ply wing joiner pieces (WJ). The wing joiners consist of three layers of  $\frac{1}{64}$ " plywood that join the top and bottom spar flanges. When installed, the wing spar will be one contiguous I-beam from tip to tip. Remove the  $\frac{1}{16}$ " balsa sheeting at the root. Use WJ as a template. Apply Epoxy to the top spar flange and then press into place one WJ. Add another layer of Epoxy and another WJ, repeat this process one more time to complete the top wing joiner.



*The self leveling wing dowel plate is attached with Epoxy after leveling the wings. The trailing edge is shimmed up 1". After curing the stand portion of WDP is removed and then the  $\frac{5}{16}$ " holes are drilled through W15 using WDP as a guide. This assures perfect alignment with the dowel holes in former F2. The  $\frac{1}{8}$ " positioning dowel through W1 and WDP assures the correct location of the wing dowels.*

- 3 Install the bottom wing joiner in the same manner.

- 4 Use thin CA to tack one end of the 1" wide fiberglass tape to the trailing edge at the center section. Pull the tape tight and CA at the leading edge. Repeat this on the bottom of the wing and then Brush in finishing resin to glass the center section.

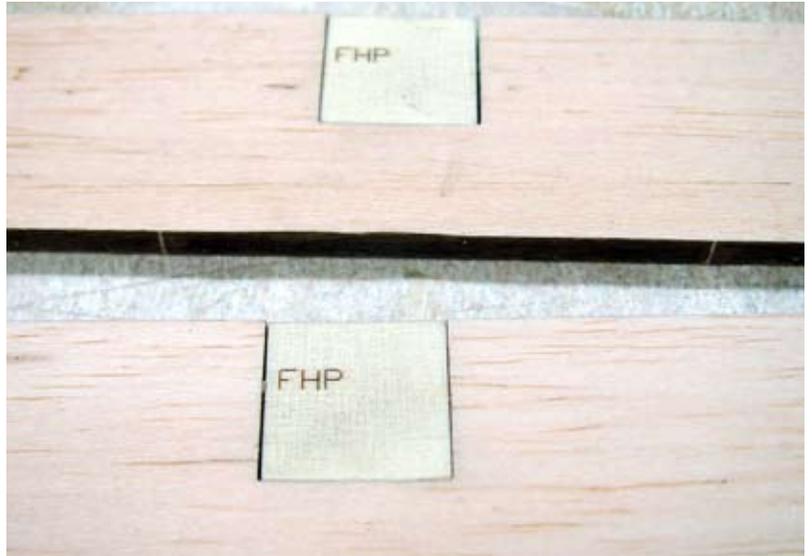
- 5 The wing dowel plate (WDP) will be installed next. Note the WDP has a bracket at the bottom that will hold it level when placed on the bench. Place the wing on the bench with the trailing edge blocked up 1". Use a  $\frac{1}{8}$ " dowel in the opening provided in W1. This will engage the hole in WDP for exact position of the wing dowels. Use Epoxy to attach WDP, level the wings and check WDP for square to the bench.

- 6 Drill the 5/16” holes for the wing dowels using WDP as a guide. Install two wing dowels. Leave about 1/4” protruding.

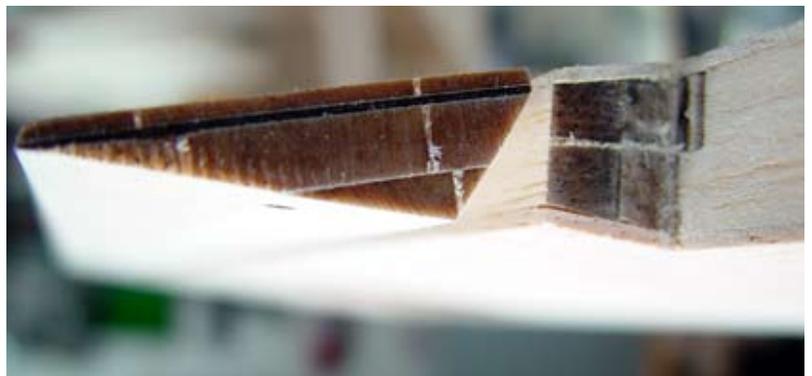
This concludes the wing assembly

## FLAP ASSEMBLY

- 1 Locate the flap components, FL-1, FL-2, FL-3, FL-4 and FHP. Install and glue FHP into FL-3.
- 2 Use the register pins and assemble the flap starting with FL-4. Note that you must assemble a left and a right flap. This is determined by the orientation of FL-3. Make sure that when you install FH-2 that the hinge openings are on the same side as FHP in FL-3. Use spray contact adhesive and place the assembly under pressure until totally cured.
- 3 If you have a band saw, that is the easiest way to shape the flaps. See the plans for the correct angles to set the saw. If not, use your plane and sandpaper to shape the flaps. Remove a small amount of material from FL-1 and FL-3 at the hinge locations to allow the hinge to set into the flap slightly to reduce the hinge gap.
- 4 Tests fit the flaps to the wings with hinges and install the flap horn temporarily. The flap should allow at least 35° of deflection.



*The flap hinge blocks are glued into FL-3 in preparation for laminating the flap assembly. Note that you must assemble a left and a right flap, they are different.*



*The flap assembly shown temporarily mounted to the wing. Cutting the shape on a band saw is quick and easy but must be done accurately.*

This concludes the flap assembly

## AILERON ASSEMBLY

- 1 Locate and prepare the aileron components, ACS, A1 through A5, ALE and AHP.

- 2 Glue the aileron horn plate (AHP) into the slot provided in ACS.
- 3 Note that you must build a right and a left aileron. Best to lay out both ACS sheets, one with the tip at the left and one with the tip at the right. Mark TOP on each one to prevent building two of the same side. Install and glue A1-TOP through A5-TOP.
- 4 Install ALE-TOP. Once again assure that the leading edge and core sheet are held flat against the bench while applying CA.
- 5 Install and glue all hinge caps AHC-1, AHC-2 and AHC-3.
- 6 Install and glue AHPF.
- 7 Turn the assembly over and install A1-BOT through A5-BOT.
- 8 Install ALE-BOT.
- 9 Install the hinge caps on the bottom.
- 10 Install and glue AHPF on the bottom over the aileron horn plate. This will act as filler between the sheeting and the horn plate.
- 11 Plane the leading edge and AHPF to contour with the ribs in preparation for sheeting on both sides.
- 12 Glue on the top aileron sheeting but do not glue it to the ACS at the trailing edge.
- 13 Glue on the bottom aileron sheeting but do not glue it to ACS at the trailing edge.
- 14 Not gluing to ACS was to prevent building a in a reflex at the trailing edge. Turn the aileron assembly so that the trailing edge is facing up and run a bead of thin CA along the trailing edge. Place the trailing edge under pressure so it will bond to the last 3/8" of the core sheet. This will make a hardened trailing edge that can be tapered to accommodate the airfoil shape.
- 15 Locate and glue on the wing tip sections you removed when making the wing.
- 16 Plane and sand the trailing edge to contour.

This concludes the aileron assembly



*Above, the ailerons are being assembled over a piece of parchment paper. One aileron has been completed on one side and will now be turned over and completed. Note the 1/16" ply horn plate installed into the core sheet at the top of the photo.*



*One aileron assembly completed and another ready for sheeting. The hinge caps and aileron horn plate filler have been installed and the all surfaces have been shaped to contour in preparation for sheeting.*



*End view if completed aileron assembly showing the core sheet, leading edge, A-1 rib and sheeting. Very light and very strong.*

## FUSELAGE ASSEMBLY

- 1 The fuselage sides are assembled from three sections. Locate the sections and remove any nubs along the splice line. Do not remove the servo opening in the aft section of the left side; this will be removed after assembly. Lay the two parts flat and glue together. Glue on FSC over the joint. Note that you will need to make a left and a right side and the FSC will be on the inside.
- 2 Glue on SSD, the stabilizer saddle doubler along the stabilizer saddle.
- 3 Use the register pins to install the 1/64" ply fuselage doublers. Apply a bead of thick CA around the perimeter and along the former lines and then slide the doubler down the pins and into contact with the fuselage side. After this has cured, apply thin CA along all of the lightening hole edges.
- 4 Determine your power, electric or glow and locate the appropriate firewall sections. The firewall is laminated from two 1/8" ply sections, lite ply for the electric version and aircraft ply for the glow version. Use pin registry and glue the two-firewall layers together. If you are assembling the glow firewall I recommend using Epoxy. For the electric you can use thick CA.
- 5 If your using a glow set up, now is the best time to locate your motor mount bolts. Use the centerlines or the offset centerline indicated on the firewall to locate, drill and install the #8-32 Blind Nuts.
- 6 To simplify and speed construction, there several subassemblies to construct before beginning assembly of the fuselage sides. The first being F2, F2-A, F8, two F10 and the completed firewall.



*CENTER: The fuselage sides are assembled from three sections of 1/8" balsa. The 1/16" balsa scab covers the joint at the tail section.*

*BOTTOM: The stabilizer saddle doublers are attached. Note the rudder servo opening. This will be that left side.*

*TOP: The 1/64" ply fuselage doublers are installed using CA and the pin register method.*

- 7 Assemble F2 and F2-A using the register pins.
- 8 Place the F2 assembly on the bench with the F2-A side up. Install and glue two F10 and the F8 battery/tank shelf. Use Epoxy for this assembly.
- 9 Glue the firewall assembly to the front of the F2 assembly.
- 10 Locate the two-nose gear mounting plates (NGP) and laminate them using the pins and install four #6-32 blind nuts.
- 11 Locate and glue the three NGPB sections, align them carefully with the center one being the one with the tab at the back.
- 12 Install NGP and the brace NGPB with Epoxy to the front of the firewall. You may have to sand a small amount of material off of the tabs on NGP to get a flush fit with the firewall. Note that the blind nuts must be facing up.
- 13 The fuselage sides are first joined with the F2 assembly, F3 and the cabin floor F9. Use Epoxy and clamp each former at all four corners to assure that the sides conform to the formers shape. Do not attempt to glue the sides to the firewall at this time.
- 14 After curing, use Epoxy to form the sides to the firewall. Glue in the balsa gussets (FG) as necessary above and below F9. Saturate these with thin CA for additional strength.
- 15 Locate the tail alignment wedge (FTB). Sand a slight angle into the stabilizer saddle doubler (SSD) to accommodate pulling the sides together at the tail. Install and glue FTB checking that both sides are exactly parallel. Use some scrap 3/32" balsa cross grain to sheet the tail section from the stabilizer platform to the flat area on the bottom.
- 16 Locate WNP and install two #1/4 x 20 blind nuts.
- 17 Install WNP to former F4. Use the braces WNPB to set the correct angle for WNP.
- 18 Use Epoxy and glue the F4 assembly into the fuselage assembly. Note that the wing bolt plate (WBP) must face aft in the fuselage.

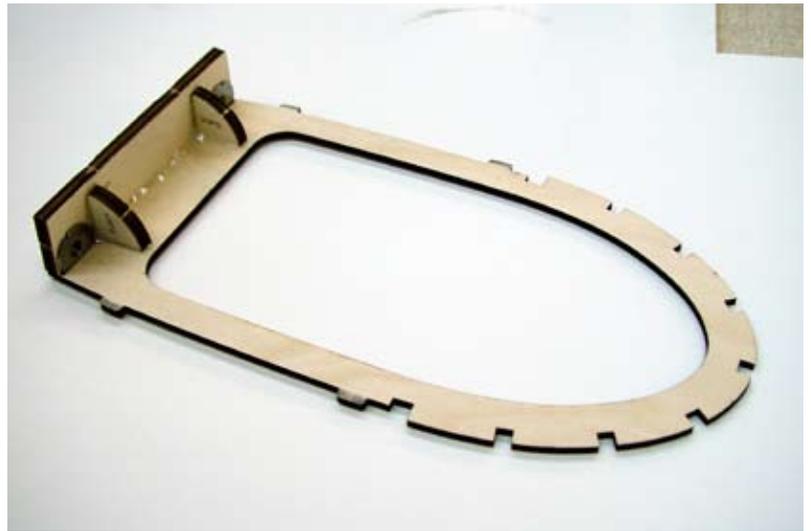


*The firewall is being assembled from two 1/8" plywood sections. Epoxy and pin registration are used. Note that this is the glow firewall and is cut from aircraft ply while the electric firewall is cut from two sections of lite ply.*



*This forward fuselage sub-assembly speeds the assembly. It consists of the firewall, F2, F2-A, F10, F8 and the nose gear mounting assembly.*

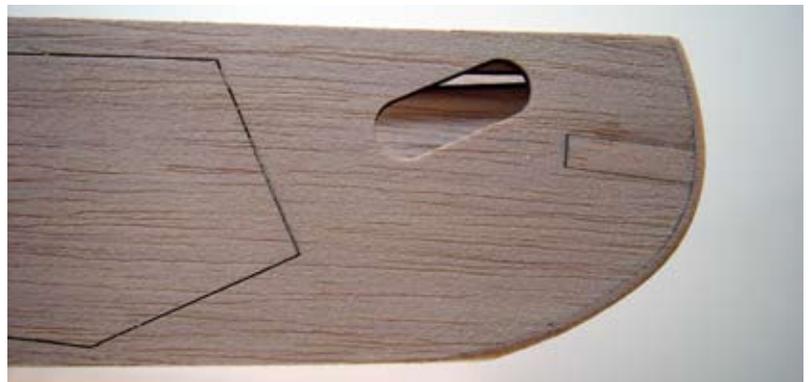
- 19 Install and glue formers F5, F6 and F7.
- 20 Locate three 1/4" x 1/4" x 36" balsa sticks. Angle splice 4" onto two of them and then install and glue them into the notches provided on both sides of the fuselage.
- 21 Locate the part labeled (NOSE GEAR SERVO) on sheet #1. Glue this to the outside of the F10 on the left side of the nose gear bay. This will mount the steering servo and the servo must be recessed into F10. The rectangular opening corners will match up with the irregular hole in F10.
- 22 Mount one HS85MG servo into this mount. You will be able to access this later but it is a lot easier to service it now while you have more access.
- 23 Locate four FST-B pieces. Note that one has material removed from the inner portion. This is to clear the steering servo. The two FST-B's that fit against the fuselage sides will have to be angled to accommodate the sheeting installed later. Glue all four of these into their respective notches in F2 and the firewall.
- 24 Locate the two-fuselage bottom sheeting parts (FSB). These will have to be soaked before wrapping around the lower nose section. Spray the outside of one FSB. (I use Windex) and place it inside a zip lock bag to soak. Allow about ten minutes and then apply another spray of Windex and return it to the bag for about ten minutes. Install both FSB sections to close in the fuselage bottom forward section. The nose gear bay will remain open.
- 25 The rudder servo is mounted in the tail. The mount for it is assembled from RSM-A, RSM-B and RSM-C. When RSM-A and RSM-B are assembled they will form a spacer with a flange that can be glued into the servo opening in the side of the fuselage. Locate SM-A and RSM-B. Use some small T-pins to pin them down in register with RSM-B



*F3 sub assembly with the wing bolt plate and bracing attached and ready to be installed.*



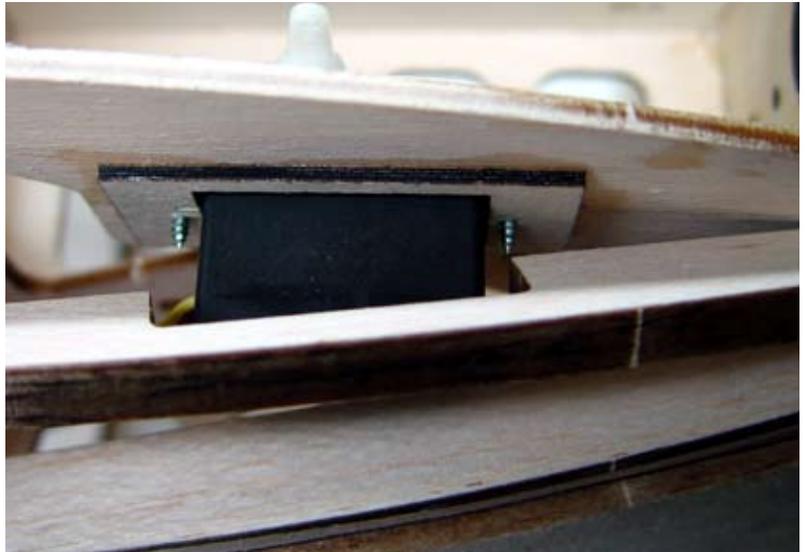
*Bracing for the firewall is supplied by gussets both above and below F8.*



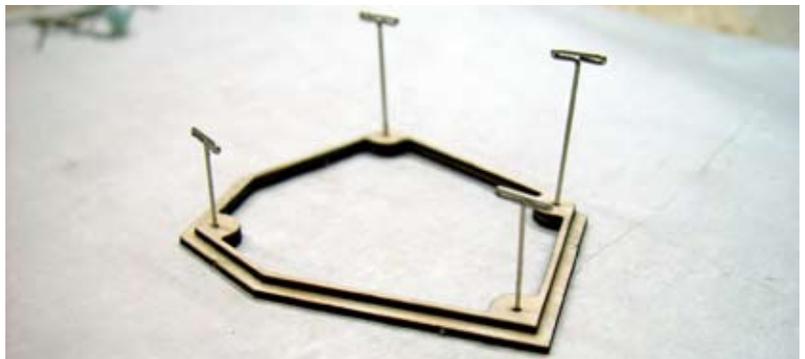
*The tail section is pulled together and keyed with FTB and then the tail section is sheeted with 3/32" scrap balsa.*

on top. Note, they must be in the same orientation as the opening in the side of the fuselage. Glue them together in this order. Remove the pins, open up the servo opening in the fuselage side and install this assembly into the servo opening from the inside. Glue with thin CA. This will provide a recessed mount for the servo that will be flush with the fuselage side.

- 26 The instrument panel is installed  $\frac{1}{2}$ " behind F2. Use a scrap piece of  $\frac{1}{2}$ " balsa at the top to attach it to F2.
- 27 Install and glue three  $\frac{1}{4}$ " x  $\frac{1}{4}$ " balsa stringers between the firewall and the instrument panel.
- 28 Install and glue FFT, the fuselage forward top sheeting. Once again you will want to soak these parts prior to bending them around the firewall and F2.
- 29 Install seven  $\frac{3}{16}$ " x  $\frac{3}{16}$ " square balsa stringers into the notches provided in F3 through F7.
- 30 Locate the  $\frac{1}{64}$ " ply turtle deck sheeting. Test fit this material and trim as necessary to butt fit at the side. Let the top overlap for now. Apply a liberal bead of thick CA along the  $\frac{1}{4}$ " stringer and the edge of the fuselage side and install the ply sheeting. Use several pieces of masking tape to hold it into position and keep pressure on the joint until it cures.
- 31 Roll the sheet over F3 and mark the sheet at the exact center of the top stringer. Mark the sheet at the other end where it is exactly half way across the stringer. Use a straight edge to trim the edge to a straight line between the two marks. Apply thick CA to all formers and then wrap a long piece of masking tape from one side over the top to the other side.



*TOP: The nose gear steering servo is mounted on the inside of F10, which side will depend on your gear steering arrangement. Note that the servo is recessed into F10. BOTTOM: The nose gear steering servo from the back. Note the plywood mount attached to F10. The FST-B sections have been installed and the one with the cut out in it is for the servo clearance.*



*ABOVE: RSM-A and RSM-B are pinned to the board and then glued with thin CA.*

*RIGHT: The assembly is then installed and glued into the opening in the side of the fuselage. RSM-C which will contain the servo will mount to this assembly.*



- 32 Use a short straight edge to force the sheeting into contact with the top stringer between F7 and F6 and then glue with thin CA and accelerator. Move up to the section between F6 and F5 and repeat these processes till complete. Do not attempt to force the ply sheeting to adhere to the stringers as it may cause deformities in the sheeting.
- 33 Repeat this procedure for the remaining side.
- 34 Flip the fuselage over and apply a liberal bead of glue to both sides along the top stringer.
- 35 Install a piece of 1/8" scrap fill along the 1/4" side stringers in the cockpit area to bring this area out flush with the sides.
- 36 Install and glue F4-B.
- 37 If you haven't already done so, sand the sheeting you applied to the tail section when you pinched it together flush with the bottom of the fuselage sides. You will install the bottom sheeting next and it should lay flush on top of this sheeting.
- 38 Install the fuselage aft bottom sheeting (FAB). It should start flush with F4-B and be centered.
- 39 Plane and sand the aft fuselage bottom corners to a 45° angle. Install one aft bottom corner (ABC) to each side. Secure with masking tape until cured. After curing, plane and sand the aft fuselage section to shape.
- 40 Place the wing onto the fuselage and check for fit. Trim the saddle area for a good fit. The ABC sections will have to be planed to contour with the wing saddle. There will be a small gap at the trailing edge of the wing. This can be filled with a piece of 1/2" wide scrap. Miter the ends for a good fit with the ABC and the plane to contour with the fuselage sides.



*Fuselage forward bottom sheeting has been wet formed around the firewall and F2. The area between the sheets on F2 and the firewall are filled with 1/8" scrap.*



*A piece of 1/2" scrap balsa is used to space the instrument panel 1/2" away from F2.*



*The forward top sheet has been formed over the firewall at the front and F2 and the instrument panel in the cockpit area.*

- 41 Locate and drill the wing boltholes. I use a couple of 1/4"-20 bolts with the heads cut off and the end sharpened to a blunt point. I screw these into the blind nuts and adjust until they are slightly proud of the fuselage sides. Then after making any adjustments to square the wing, the wing is pushed down onto these bolts to dimple the wing. Then drill the wing boltholes. Remember the holes should be drilled to be perpendicular to the bottom of the wing so the bolt heads will seat flat against the bottom of the wing when installed.



*A piece of scrap balsa is used to fill in any remaining gap between the wing trailing edge and the fuselage wing opening.*

## INSTALLING THE STABILIZER

By now you should have determined how you are going to finish your Mooney M-18. If you are going to use an iron on covering, it may be easier to cover the vertical fin and stabilizer before attaching to the fuselage. If you are going to glass and paint your Mooney it is definitely easier to glass these components before they are installed onto the fuselage. Either way, now is the time to make that decision.

A leveling jig has been supplied to remove any guesswork regarding the position of the fuselage. When the leveling stand is installed into the wing dowel holes in F2 and a 3-3/4" block is placed under F7, the fuselage is level. This can be helpful in checking the incidences of the wings and stabilizer

- 1 Locate the ply leveling stand, install two 5/16" X 1/2" dowels.
- 2 Place the leveling stand into the wing dowel holes and stand the fuselage on a level surface.
- 3 Block up the tail to 3-3/4" directly under F7.
- 4 Place the stabilizer assembly on the stabilizer saddle and check for fit.
- 5 Check for square by measuring from the top center of F3 to the trailing edge of the stabilizer at the tip. It should be the same on both sides. Then use Epoxy to glue the stabilizer on. Adjust so that each stabilizer tip is the same height off the bench.
- 6 Assemble six FF sections to produce the filler block at the leading edge of the stab. Carve and sand this to shape before gluing to the fuselage.
- 7 Install and glue two TF blocks to the tail section aft of the stabilizer, plane and sand to contour. The top should continue the contour of the top of the stabilizer.



*Above left, six FF sections have been glued together to form the filler block at the leading edge of the stabilizer. Right: After carving and sanding to shape, the block is installed onto the fuselage.*

## INSTALLING THE VERTICAL FIN

- 1 Place the vertical fin into position on top of the stabilizer. The leading edge should align with the leading edge of the stabilizer. Mark the top of the stabilizer at the aft edge of the fin. You will have to cut an angled hole through the stabilizer to allow the rudder torque rod to pass through. Mark the location of this hole and then cut it. Test fit for movement with the rudder installed onto the fin.
- 2 Use Epoxy to install the vertical fin, measure from each stabilizer tip to the tip of the fin to assure it is at 90° to the stabilizer..
- 3 Glue the two VF dorsal fin parts together to form the dorsal fin. It is easiest to shape this part before installing it onto the fuselage. Back cut a notch into the side that will slide over the leading edge of the vertical fin. This will significantly reduce the amount of filler required to get a smooth transition with the fin.
- 4 Glue the dorsal fin assembly onto the vertical fin and fuselage.



*Installation of the vertical fin and dorsal fin. The dorsal fin is back sanded to form around the leading edge of the vertical fin.*

Much of the strength of the attachment of the stabilizer and vertical fin will come from the Epoxy and microballons fillet. Apply this fillet to the underside of the stabilizer and along the top of the stabilizer and vertical fin joint. Mix up a fairly dry mix of Epoxy and balloons and form it by dipping your finger in denatured alcohol. This will prevent the Epoxy from sticking to your finger and also fair it in thinly with the balsa.

This concludes the installation of the vertical fin.

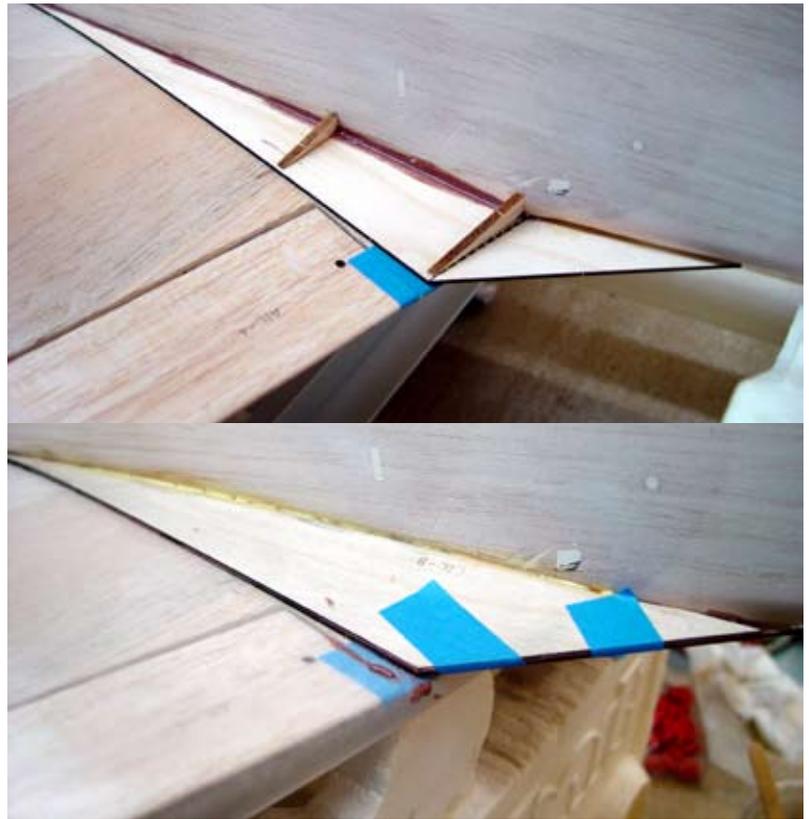
## INSTALLING THE WING FILLET

- 1 Locate FIL-A, FIL-B, FIL-C and FIL-D. Temporarily mount the wing onto the fuselage. Lay FIL-A on the wing with the dash cut lined up with the trailing edge of the wing. Mark the side of the fuselage at the front of FIL-A.
- 2 Remove the wing and then trim 1/16" of material off of the wing saddle area from your mark to the trailing edge to accommodate the 1/16" plywood fillet.



*Above, FIL-A has been attached with a slurry of Epoxy and micro balloons. The lead weight and clamp assure that the fillet will conform closely to the wing.*

- 3 Use a mixture of Epoxy and balloons to glue the fillet onto the wing saddle to fill any voids.
- 4 Install FIL-C and FIL-D and trim these to fit.
- 5 Test fig FIL-B. It should lay onto FIL-C and FIL-D and be even with the outer edges of FIL-A. Trim to fit and the glue with Epoxy.
- 6 Place waxed paper over the wing where it comes into contact with the wing saddle. Mix up a medium dry mix of Epoxy and Balloons. Apply a liberal bead of the mixture to the fuselage wing saddles and then install the wing. If there are any voids, fill with the mixture. Pull the wing bolts snug and let cure. After curing, remove the wing and sand the saddle to contour with the fuselage



This completes the assembly of the fuselage structure.

*TOP, FIL-A has been glued to the wing saddle with a slurry of Epoxy and balloons and FIL-C and FIL-D have been glued to FIL-A.  
BELOW, FIL-B has been glued to FIL-A with a slurry of Epoxy and Balloons. An Epoxy and balloons fillet will now be added to the entire wing saddle area.*

## COWL ATTACHMENT

- 1 Place the cowl on the bench and using a Sharpie, draw a line 3/16" above the bench top all the way around the cowl. Trim the edge of the cowl at this line. Temporarily place the cowl ring just inside the edge of the cowl. Some sanding may be required but do not sand too much, you want a snug fit. Using a full sheet of 150-grit sandpaper laying flat on the bench. Sand the edge of the cowl perfectly straight. Use Epoxy to attach the cowl ring to the cowl. The cowl ring should be exactly flush with the edge of the cowl.
- 2 Install four shoulder head wood screws into the holes provided in the firewall. Initially, run them in until the shoulder is about 1/8" above the firewall. Place the cowl onto the firewall and then adjust the screws for a snug fit to the firewall. You want the cowl to fit snugly to the firewall but also be easily removed.
- 3 Locate the 1/4" magnets and using Epoxy, install one into each of the two holes provided in the firewall.
- 4 Place the two remaining magnets over the two in the firewall. Mark the side facing forward with a Sharpie pen. Now glue the magnets into appropriate holes provided in the cowl ring.
- 5 Removing the cowl will require upward pressure to overcome the magnets and then slide it forward off of the screws.

This concludes the basic cowl installation. The Mooney M-18 had several iterations primarily with different engine installations. The original Mooney M-18 utilized a converted water-cooled auto engine, for this model there were no protruding engine cylinders but you will need to construct a radiator scoop. Some of the flat four aircraft engine installations utilized a scoop intake at the bottom forward section of the cowl for carburetor air. These also had the engine cylinders protruding out of the side of the cowl. To facilitate either of these configurations, the cowl is provided in the basic form and you can modify it as you desire.



*The cowl assembly ready to be customized for your model. The keyhole openings will engage shoulder head screws in the firewall to firmly retain the cowl. The 1/4" holes will contain magnets that along with the magnets installed into the firewall will prevent the cowl from detaching. To remove the cowl it must first be lifted and then pulled forward.*

*This mounting method not only allows for quick tool free detachment but allows for an almost invisible clean install with no screw or bolt heads protruding.*

## AIRCRAFT SET UP

When setting up your model always remember to do a lateral balance as well as the CG balance. This is especially important if you have side mounted a glow motor. The lateral balance should be done by supporting the model by the motor shaft and a point at the tail that will not inhibit the model from rolling one way or the other. Some models will want to roll upside down and that is OK just make sure that they settle in a level position. If not add or remove weight till they do. Due to many variables in construction and equipment installation your model will weigh more or less then the nominal weight suggested. This is normal and a wing loading chart has been supplied to indicate what your wing loading will be at increments of 4 oz. From 9 lb. To 12 lb. Remember the higher the wing loading the higher all flight speeds will be maintain a safe flight envelope.

Initial controle surface throws.

Ailerons      1-1/4" UP 1-1/4" DOWN  
 Elevators     1-1/4" UP 1-1/4" DOWN  
 Rudder       1-3/8" RIGHT & LEFT  
 Flaps          Set to 15° and 30° Stops

Aircraft Weight		Wing Loading
Lbs.	Oz.	Oz. Per Sq. Ft.
9	0	22.99
9	4	23.63
9	8	24.27
9	12	24.90
10	0	25.54
10	4	26.18
10	8	26.82
10	12	27.46
11	4	28.74
11	8	29.37
11	12	30.01

PART #	SHEET #	MATERIAL	SIZE	PART #	SHEET #	MATERIAL	SIZE
A1-BOT X2	5	LPLY	1/8 X 12 X 26	F4	8	AC PLY	1/8 X 12 X 35
A1-TOP X2	5	LPLY	1/8 X 12 X 26	F4-B	38	BALSA	1/4 X 3 X 36
A2-BOT	31	BALSA	3/32 X 4 X 36	F5	5	LPLY	1/8 X 12 X 26
A2-BOT	31	BALSA	3/32 X 4 X 36	F6	5	LPLY	1/8 X 12 X 26
A2-TOP	31	BALSA	3/32 X 4 X 36	F7	5	LPLY	1/8 X 12 X 26
A2-TOP	31	BALSA	3/32 X 4 X 36	F8	5	LPLY	1/8 X 12 X 26
A3-BOT	31	BALSA	3/32 X 4 X 36	F9	5	LPLY	1/8 X 12 X 26
A3-BOT	31	BALSA	3/32 X 4 X 36	FAB	22	BALSA	1/8 X 4 X 36
A3-TOP	31	BALSA	3/32 X 4 X 36	FABC X2	35	BALSA	1/4 X 4 X 36
A3-TOP	31	BALSA	3/32 X 4 X 36	FD X2	28	AC PLY	1/64 X 6 X 24
A4-BOT	31	BALSA	3/32 X 4 X 36	FF X6	42	BALSA	5/16 X 4 X 36
A4-BOT	31	BALSA	3/32 X 4 X 36	FFT	27	BALSA	3/32 X 3 X 36
A4-TOP	31	BALSA	3/32 X 4 X 36	FFT	27	BALSA	3/32 X 3 X 36
A4-TOP	31	BALSA	3/32 X 4 X 36	FG X14	33	BALSA	1/4 X 3 X 36
A5-BOT X2	5	LPLY	1/8 X 12 X 26	FHP X2	2	LPLY	1/4 X 6 X 12
A5-TOP X2	5	LPLY	1/8 X 12 X 26	FIL-A X2	4	AC PLY	1/16 X 12 X 48
AHPF X4	35	BALSA	1/4 X 4 X 36	FIL-B X2	3	AC PLY	1/32 X 4 X 36
AHC-1 X4	29	BALSA	3/32 X 3 X 36	FIL-C X2	23	BALSA	1/8 X 4 X 36
AHC-2 BOT X4	29	BALSA	3/32 X 3 X 36	FIL-D	23	BALSA	1/8 X 4 X 36
AHC-B X4	31	BALSA	3/32 X 4 X 36	FL-1	14	BALSA	1/16 X 3 X 36
AHP X2	4	AC PLY	1/16 X 12 X 48	FL-2 X2	3	AC PLY	1/32 X 4 X 36
AIL-4	43	BALSA	3/16 X 3 X 36	FL-3	36	BALSA	1/4 X 4 X 36
AIL-4	44	BALSA	3/16 X 3 X 36	FL-3	37	BALSA	1/4 X 4 X 36
ALE-BOT X2	40	BALSA	1/4 X 3 X 36	FL-A	15	BALSA	1/16 X 3 X 36
ALE-TOP X2	40	BALSA	1/4 X 3 X 36	FLE-A X2	25	BALSA	1/8 X 3 X 36
AS X2	16	BALSA	1/16 X 3 X 36	FLE-B X2	23	BALSA	1/8 X 4 X 36
ASC X2	18	BALSA	1/16 X 4 X 36	FLE-C X2	25	BALSA	1/8 X 3 X 36
ASM X2	4	AC PLY	1/16 X 12 X 48	FRD	5	LPLY	1/8 X 12 X 26
ASMR X4	8	AC PLY	1/8 X 12 X 35	FRDA X2	2	LPLY	1/4 X 6 X 12
CM	5	LPLY	1/8 X 12 X 26	FRD-B	2	LPLY	1/4 X 6 X 12
CR	1	AC PLY	3/32 X 6 X 35	FS-A	20	BALSA	1/8 X 3 X 36
EC X2	23	BALSA	1/8 X 4 X 36	FS-A	45	BALSA	1/8 X 3 X 36
EHP X2	8	AC PLY	1/8 X 12 X 35	FS-B	18	BALSA	1/8 X 3 X 36
EMM-A	8	AC PLY	1/8 X 12 X 35	FS-B	24	BALSA	1/8 X 3 X 36
EMM-B	8	AC PLY	1/8 X 12 X 35	FSB X2	23	BALSA	1/8 X 4 X 36
ES-A X4	34	BALSA	1/4 X 4 X 36	FS-B X2	21	BALSA	1/8 X 6 X 36
ES-B X4	34	BALSA	1/4 X 4 X 36	FSC X2	17	BALSA	1/16 X 3 X 36
ESM X2	4	AC PLY	1/16 X 12 X 48	FSC X2	22	BALSA	1/8 X 4 X 36
ESMR X4	1	AC PLY	3/32 X 6 X 35	FSM X2	4	AC PLY	1/16 X 12 X 48
F10	5	LPLY	1/8 X 12 X 26	FSMR X4	8	AC PLY	1/8 X 12 X 35
F10 X2	5	LPLY	1/8 X 12 X 26	FST-B	33	BALSA	1/4 X 3 X 36
F2	8	AC PLY	1/8 X 12 X 35	FST-B X4	38	BALSA	1/4 X 3 X 36
F2-A	8	AC PLY	1/8 X 12 X 35	FTB	38	BALSA	1/4 X 3 X 36
F3	8	AC PLY	1/8 X 12 X 35	FW-A	5	LPLY	1/8 X 12 X 26

PART #	SHEET #	MATERIAL	SIZE	PART #	SHEET #	MATERIAL	SIZE
FW-A GLOW	8	AC PLY	1/8 X 12 X 35	ST X4	34	BALSA	1/4 X 4 X 36
FW-B	5	LPLY	1/8 X 12 X 26	STE X4	33	BALSA	1/4 X 3 X 36
FW-B GLOW	8	AC PLY	1/8 X 12 X 35	SV	18	BALSA	1/16 X 4 X 36
HPB X12	39	BALSA	1/4 X 4 X 36	SV X3	12	BALSA	1/16 X 4 X 36
ID	7	AC PLY	1/64 X 6 X 24	SW-B	26	BALSA	3/32 X 3 X 36
IP	21	BALSA	1/8 X 6 X 36	SW-B	27	BALSA	3/32 X 3 X 36
LEVEL STAND	2	LPLY	1/4 X 6 X 12	SW-T	26	BALSA	3/32 X 3 X 36
MM-HORZONTAL	8	AC PLY	1/8 X 12 X 35	SW-T	27	BALSA	3/32 X 3 X 36
MM-VERT	8	AC PLY	1/8 X 12 X 35	TDS X2	7	AC PLY	1/64 X 6 X 24
NG. SERVO	1	AC PLY	3/32 X 6 X 35	TE-A X2	42	BALSA	5/16 X 4 X 36
NGBP X3	2	LPLY	1/4 X 6 X 12	TE-B X2	40	BALSA	1/4 X 3 X 36
NGP	8	AC PLY	1/8 X 12 X 35	TE-C X2	40	BALSA	1/4 X 3 X 36
RHC X2	32	BALSA	3/32 X 3 X 36	TF X2	42	BALSA	5/16 X 4 X 36
RHC X4	29	BALSA	3/32 X 3 X 36	V1 X2	29	BALSA	3/32 X 3 X 36
RSM-A	4	AC PLY	1/16 X 12 X 48	V2 X2	29	BALSA	3/32 X 3 X 36
RSM-B	4	AC PLY	1/16 X 12 X 48	V3 X2	29	BALSA	3/32 X 3 X 36
RSM-C	4	AC PLY	1/16 X 12 X 48	V4 X2	29	BALSA	3/32 X 3 X 36
RT X2	42	BALSA	5/16 X 4 X 36	V5 X2	29	BALSA	3/32 X 3 X 36
RUD X2	38	BALSA	1/4 X 3 X 36	VC X2	9	BALSA	1/16 X 6 X 36
S1 X2	21	BALSA	1/8 X 6 X 36	VF X2	37	BALSA	1/4 X 4 X 36
S2 X2	29	BALSA	3/32 X 3 X 36	VFT X2	34	BALSA	1/4 X 4 X 36
S2-BOT X2	29	BALSA	3/32 X 3 X 36	VLE X2	33	BALSA	1/4 X 3 X 36
S3	32	BALSA	3/32 X 3 X 36	VTE X2	33	BALSA	1/4 X 3 X 36
S3 X2	29	BALSA	3/32 X 3 X 36	W1 X2	1	AC PLY	3/32 X 6 X 35
S3-B	32	BALSA	3/32 X 3 X 36	W10 X2	32	BALSA	3/32 X 3 X 36
S3-B X2	29	BALSA	3/32 X 3 X 36	W10-A	31	BALSA	3/32 X 4 X 36
S4 X4	29	BALSA	3/32 X 3 X 36	W10-A	31	BALSA	3/32 X 4 X 36
S5 X4	29	BALSA	3/32 X 3 X 36	W11 X2	32	BALSA	3/32 X 3 X 36
S6 X4	29	BALSA	3/32 X 3 X 36	W11-A	31	BALSA	3/32 X 4 X 36
S7 X4	29	BALSA	3/32 X 3 X 36	W11-A	31	BALSA	3/32 X 4 X 36
SC	9	BALSA	1/16 X 6 X 36	W12	31	BALSA	3/32 X 4 X 36
SC	10	BALSA	1/16 X 4 X 36	W12	31	BALSA	3/32 X 4 X 36
SFB X2	4	AC PLY	1/16 X 12 X 48	W13 X2	32	BALSA	3/32 X 3 X 36
SFT X2	4	AC PLY	1/16 X 12 X 48	W14	32	BALSA	3/32 X 3 X 36
SHC X12	29	BALSA	3/32 X 3 X 36	W14 X2	32	BALSA	3/32 X 3 X 36
SLE X2	33	BALSA	1/4 X 3 X 36	W15 X2	2	LPLY	1/4 X 6 X 12
SMM X6	2	LPLY	1/4 X 6 X 12	W2	31	BALSA	3/32 X 4 X 36
SS-B X2	10	BALSA	1/16 X 4 X 36	W2	31	BALSA	3/32 X 4 X 36
SS-B X4	13	BALSA	1/16 X 3 X 36	W2-B BOT X2	23	BALSA	1/8 X 4 X 36
SSD X2	21	BALSA	1/8 X 6 X 36	W2-B TOP X2	23	BALSA	1/8 X 4 X 36
SS-T	12	BALSA	1/16 X 4 X 36	W3	31	BALSA	3/32 X 4 X 36
SS-T	10	BALSA	1/16 X 4 X 36	W3	31	BALSA	3/32 X 4 X 36
SS-T X4	11	BALSA	1/16 X 4 X 36	W4 X2	1	AC PLY	3/32 X 6 X 35
				W5 X2	8	AC PLY	1/8 X 12 X 35

PART #	SHEET #	MATERIAL	SIZE
W6 X2	8	AC PLY	1/8 X 12 X 35
W6-A	1	AC PLY	3/32 X 6 X 35
W6-B	31	BALSA	3/32 X 4 X 36
W6-B	31	BALSA	3/32 X 4 X 36
W7	31	BALSA	3/32 X 4 X 36
W7	31	BALSA	3/32 X 4 X 36
W7-A	31	BALSA	3/32 X 4 X 36
W7-A	31	BALSA	3/32 X 4 X 36
W8	31	BALSA	3/32 X 4 X 36
W8	31	BALSA	3/32 X 4 X 36
W9 X2	32	BALSA	3/32 X 3 X 36
WBP X2	4	AC PLY	1/16 X 12 X 48
WBPF X2	40	BALSA	1/4 X 3 X 36
WBPF X2	41	BALSA	1/4 X 3 X 36
WCO	7	AC PLY	1/64 X 6 X 24
WDP	8	AC PLY	1/8 X 12 X 35
WJ X6	39	BALSA	1/4 X 4 X 36
WJ X6	7	AC PLY	1/64 X 6 X 24
WLE X4	41	BALSA	1/4 X 3 X 36
WNBP X2	2	LPLY	1/4 X 6 X 12
WNP	2	LPLY	1/4 X 6 X 12
WT X6	42	BALSA	5/16 X 4 X 36
WWL X2	7	AC PLY	1/64 X 6 X 24

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