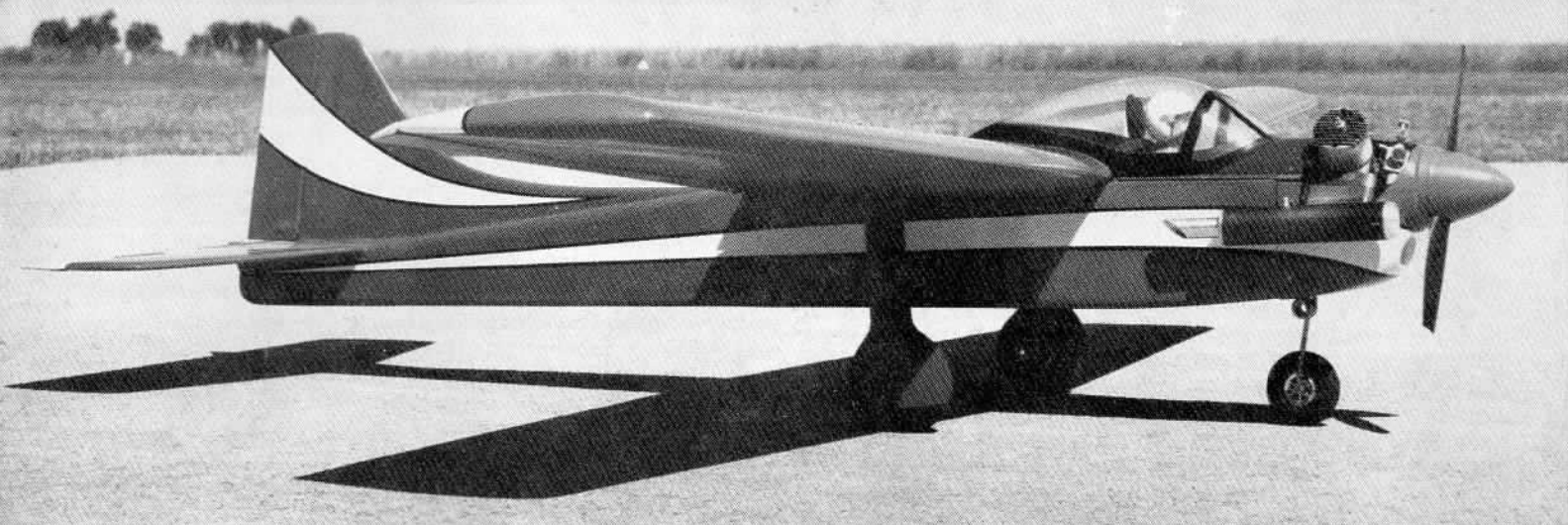


# KOMANDER

*MARK II*



**BUILDING AND FLYING INSTRUCTIONS**



**SIG**<sup>®</sup>  
CRAFTSMAN'S KIT

# KOMANDER

MARK II



Although the Komander is a fine sport model, it was designed especially for use as a 4-channel aileron trainer. Novice fliers are advised to take their basic training with a flat-bottomed wing, high stability model such as the Sig Kadet. These flights will give experience and confidence plus a start on the very necessary automatic reactions for correct control application. The Komander is a faster model than the Kadet and while it has a certain amount of hands-off stability, it is more maneuverable. Built-in washout (a decrease in wing incidence at the tip as compared to the wing root) helps prevent tip stalls and improves slow speed flight characteristics and landings.

The first of the three prototype Komanders was flown with a .40 cu. inch engine and this size provides good all-round performance, though the model should be kept light when using this displacement. Remember that a muffler will reduce engine power and allowance should be made for this effect. If you live at a high altitude, engines will not develop power equivalent to that delivered at sea level and a higher displacement must be used to give the same results. A .45 was used in test Komander No. 2. The extra power gave livelier takeoffs from grass runways and snappier maneuvers in the air. No. 3 used a .50 for higher speed and expert-style pattern maneuvers when flying at full throttle. Beginners using larger size engines may want to throttle down a bit during their first practice flights. Any engine larger than a .50 is not really necessary and is not recommended. If a .60 is used, it would be advisable to strengthen the wing by inseting a spar into the foam core of the wing before it is sheeted.

While it is mainly intended for aileron control with 4-channel equipment, the Komander will fly with 3-channel equipment and rudder control, although this is not particularly recommended. More stable hands-off flight with rudder control can be obtained with a slight increase in dihedral if desired, about 1" additional on each tip.

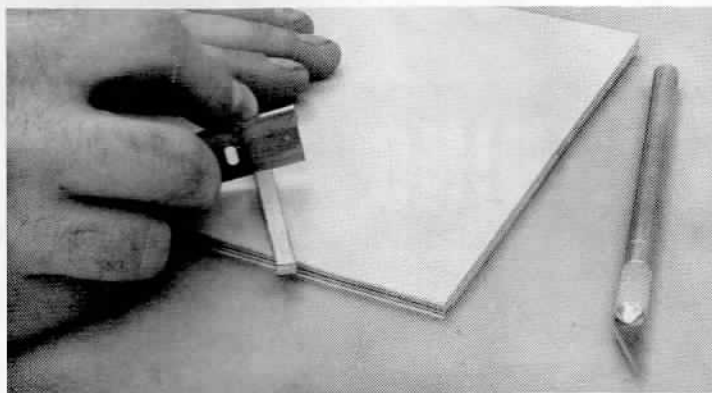
The construction steps for the Sig Komander are planned so that complete full size plans are not necessary. This saves on the kit price since large full size plans are expensive to print and store. For example, in the case of the Komander, a full size wing plan would serve no purpose because the core is already cut out and the sheeting is done on a table without reference to a plan. The fuselage side view is printed on the balsa sheets. Tail parts go together by reference to keying marks printed on them. A full size plan is included for the top view for assembly of the sides and for several other areas where one is useful. Occasionally a kit buyer will say he feels insecure without complete full size plans, but we find that after following the pictorial directions, most will say that the lack of full size plans for some parts was not noticed at all.

## ABOUT THE BUILDING SEQUENCE

The quickest and most efficient way to complete a model is to work on several pieces at the same time. While the glue is drying on one section you can start on or proceed with another part. Work can even go forward on several sections of the same assembly at the same time, such as the front and rear of the fuselage. We occasionally get suggestions that our instruction books should be in exact step-by-step building sequence. But this would result in many sentences starting, "While the glue is drying on the fuselage, move to the wing . . . etc." and a lot of jumping back and

“ . . . . . read the book completely and study the full size plan before beginning to work.”

forth between assemblies with no constant pictorial progression. Also, a pre-selected building sequence by our choice might not suit your workshop space and time allotments. Therefore, we feel the present system of covering main assemblies in a unit works out best for the majority of kit builders. So keep in mind that the numbering sequence used in this book was chosen as the best way of explaining the building of each major assembly and is not intended to be followed in exact one-two-three fashion. Start on the wing at No. 1 and after performing a step or two flip over to the next main heading of "FUSELAGE CONSTRUCTION" and do a step or two there, then over to "TAIL ASSEMBLY" and so forth. You will, of course, arrive at points where you can go no farther until another component is available. For example, you need a completed and mounted wing before the front of the fuselage on top can be completed. The way to understand these relationships is to read the book completely and study the full size plan before beginning to work. Any reference to right or left refers to right or left as if seated in the cockpit.



## SOME BUILDING SUGGESTIONS

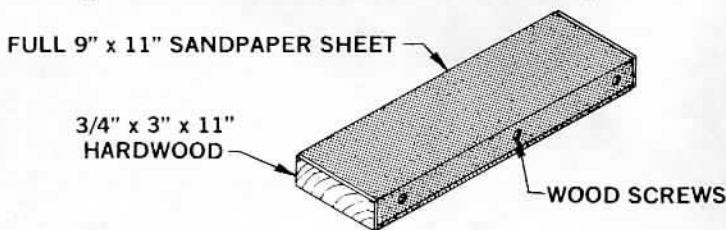
Cut all long pieces of balsa first, followed by medium lengths before cutting up any full-length strips into short pieces.

A piece of Celotex-type wallboard makes a handy building board, into which pins can easily be pushed. Lay the building board on a table with a flat and untwisted top. Pins can be pushed through all pieces in the kit without any lasting damage. Don't be afraid to use plenty of pins when planing. The holes will fill up during sanding and doping. Use Sig-Bond glue for general construction except where the book calls for epoxy.

**IMPORTANT NOTE:** Use only Sig Core Bond, Sig Epoxy Glue or Sig-Bond glue on the foam wing cores. Model cement, Sig-Ment, dope and fiberglass resin will all attack and destroy foam. If you use any other product other than those listed, test them on a scrap of foam before use on the wing. Where Sig Epoxy Glue is specified, Sig Kwik-Set Epoxy may be used instead if the builder prefers.

## YOU CAN'T GET ALONG WITHOUT A GOOD SANDING BLOCK

An indispensable tool for proper construction is a large sanding block, sized to take a full sheet of sandpaper. Use several wood screws along one edge to hold the sheet in place. Use the block to bring all parts and

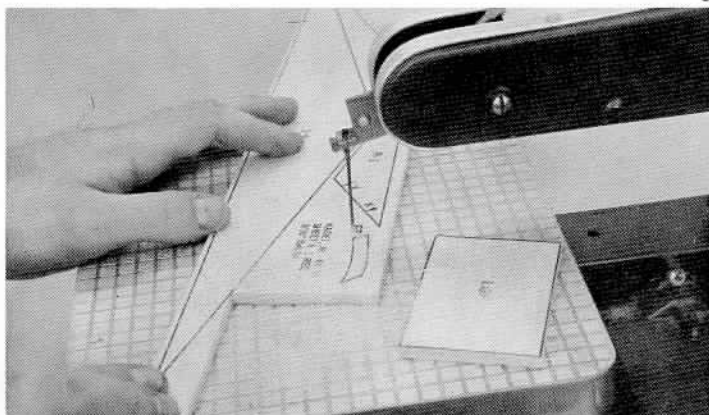


sticks to final, exact fit. I recommend 80 grit garnet paper for use on block during general construction. You can switch to 100 grit, followed by 220 silicone paper for final finish just before covering.

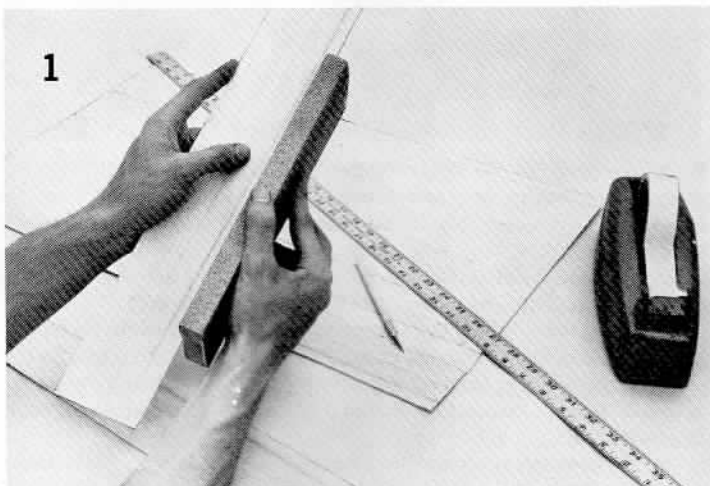
In addition to the large block, there are places where a smaller one is handy. (See pictures farther along in the book.) Also, a sandpaper "file" can be made by gluing sandpaper to a flat spruce stick for working in tight places. I have an especially handy extra long sanding block made for a 40 inch piece of aluminum channel with sandpaper glued to it that is particularly useful for jobs like truing up the leading edge and trailing edge of the wing core.

### CUTTING OUT PRINTED PARTS

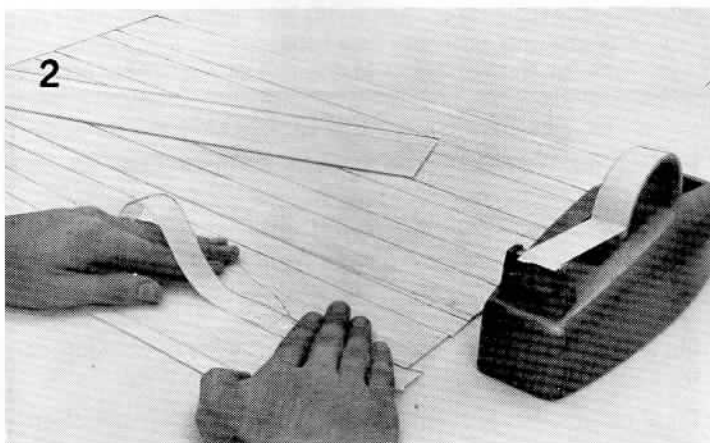
A jig saw is best for this job. Cut just outside the lines, leaving all of the black line on the part. When fitting the part into place in the model, use the sanding block to bring the edges to an exact fit. If a modeling knife is used to cut out the parts, don't cut too close to the lines — leave some extra wood outside the line. True up and finish the edge with the sanding block.



## WING CONSTRUCTION

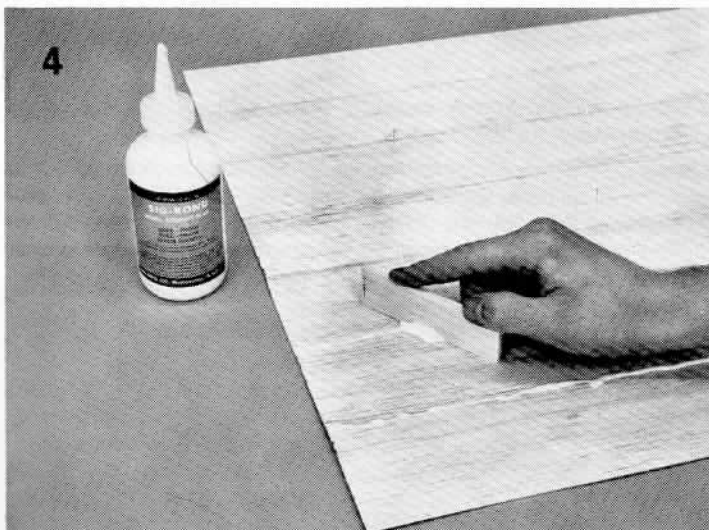
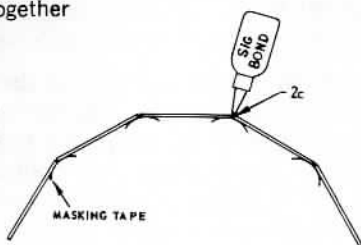


1. True up the edges of the fourteen 1/16" x 3" x 36" sheets of wing planking wood by trimming where necessary using a metal straightedge as a guide. Use the large sanding block for final touch up of the edges.

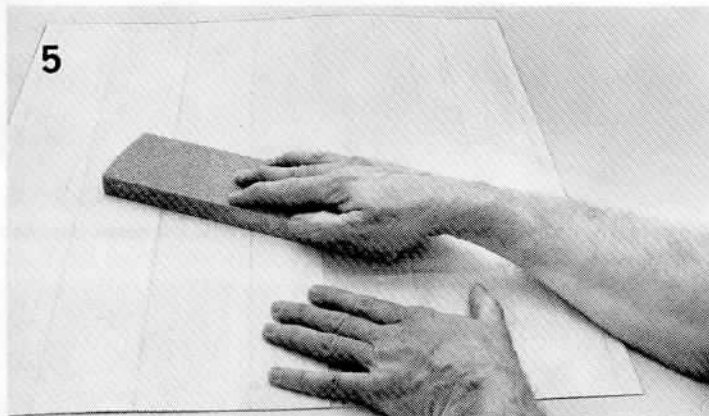


2. Tape seven sheets tightly together with strips of masking tape.

3. Turn over and open up the joints with the masking tape serving as a hinge. Put a bead of Sig Bond in each of the seams and close the joint.



4. Lay the sheets flat. Scrape off the excess glue with a squeegee made from a balsa scrap. Finish glue cleanup with a damp rag. Weight down the sheets on a flat surface and allow to dry thoroughly.



5. Sand the wing skins smooth with the sanding block.

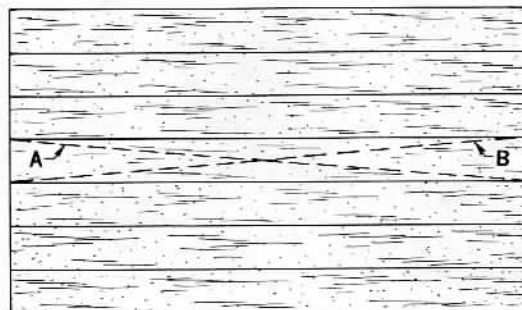
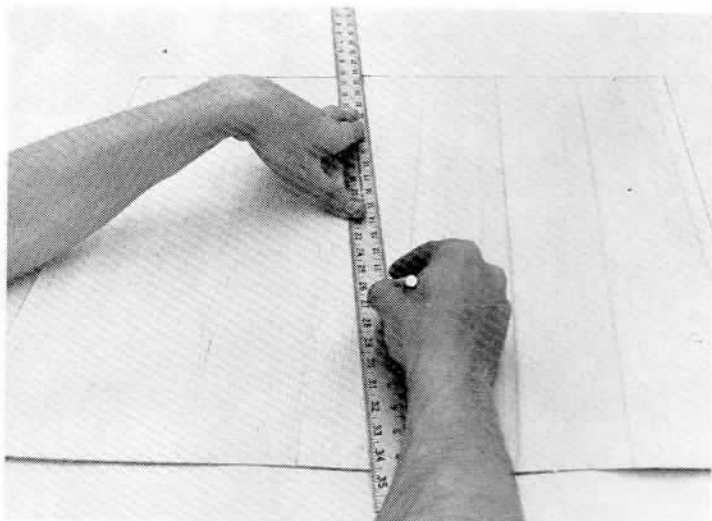
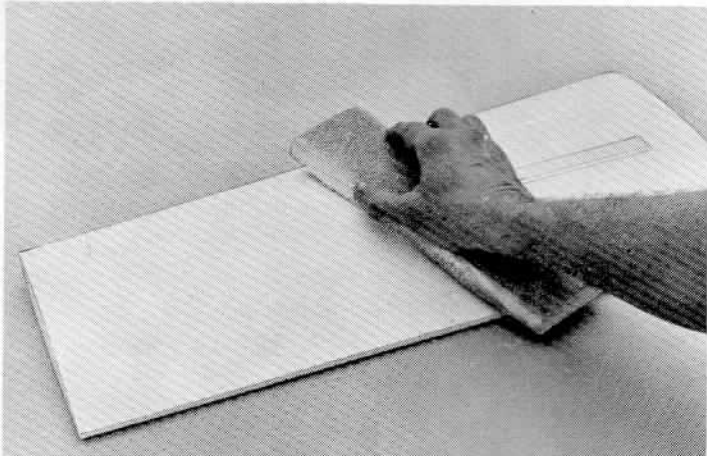


ILLUSTRATION FOR PARAGRAPH 6.

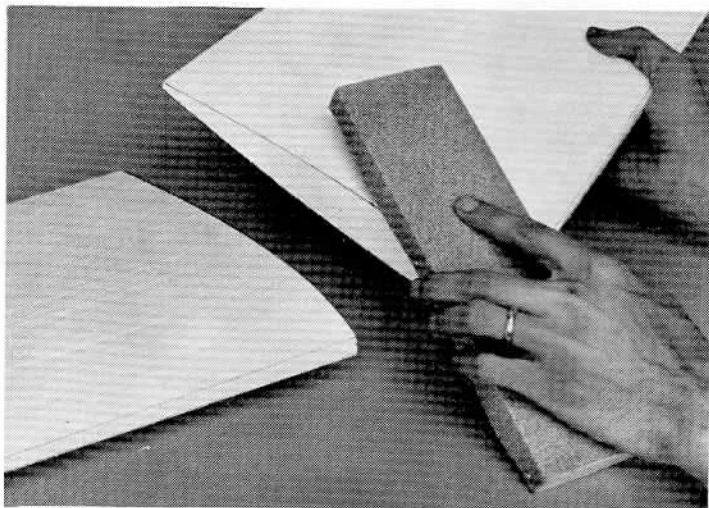


6. Cut one 7-sheet piece diagonally in two, with untaped side up, as shown by the dotted line marked "A".

Cut the other 7-piece diagonally in two, with the untaped side up, in the opposite direction as shown by the dotted line marked "B". This provides 4 wing skins with the untaped, rougher glue seam on the outside surface of the wing. The smoother, taped side should be used against the foam wing for best adhesion of the skin to the foam. The rougher, outer glue seams can be sanded down partially with a sanding block before application of the skins and completed during final sanding of the skin on the wing.



7. Sand any irregularities or cutting wire marks from the cores with the large sanding block.



8. Hold the cores together at the center joint. If there is any mismatch in the airfoil shape, sand as required to make the halves fit smoothly together. Done this way, little matching will be required after planking.

### WARNING!

CAUTION: Use only Sig Core Bond, Sig Kwik-Set, Sig Epoxy Glue or Sig-Bond Glue on the foam wing cores. Model cement such as Sig-Ment, dope and fiberglass resin will attack and destroy foam. If you use any product other than those listed, test them on a scrap of foam before use on the wing.



9. a. Sig Core Bond is recommended for applying the wing skins. This is a special adhesive, light and strong, that is ideal for use with foam. As experienced modelers have found, many foam wing glues contain very volatile solvents. When using these glues, if the wing skin is put on before the glue is absolutely dry, the still evaporating solvents are trapped in the assembly and quickly attack and destroy part of the foam core, ruining the wing. Sig Core Bond is much less likely to do this type of damage and is more forgiving of errors in assembly technique. So it's ideal for beginners at foam wing sheeting in addition to being a superior adhesive. If directions on the can and this book are followed, it will result in a perfect wing sheeting job.

b. Shorten the bristles of an ordinary 2" house paint brush to about 1-1/2" in length. This stiffens the brush and makes it easier to spread the glue evenly.

c. Apply a thin, even, full coverage coat of Core Bond to both sides of the foam cores. Avoid heavy spots. Stand the cores on end to dry. (The cores should be coated first because they take slightly longer to dry)

d. Coat the wing skins with Core Bond.

e. Allow the cores and skins to dry. This generally takes about 30

### THE SECRET OF A PERFECT FOAM WING

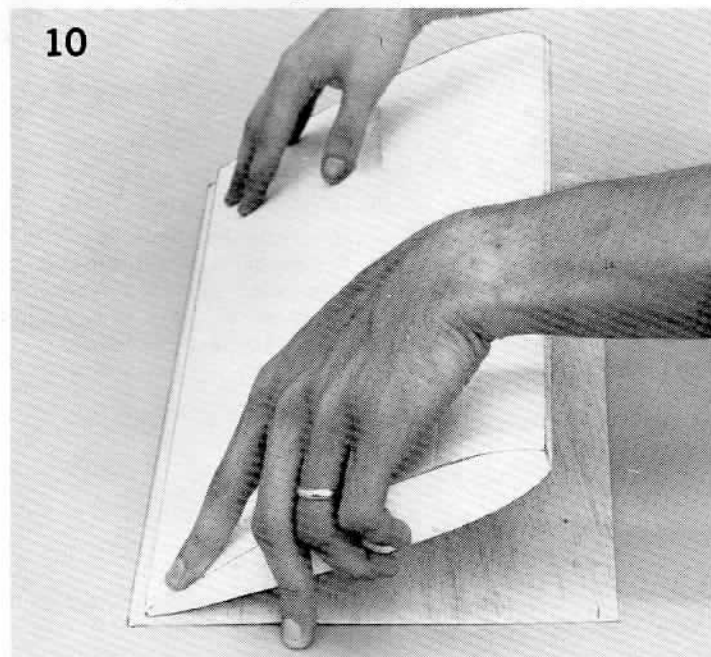
It's a simple matter of a FLAT table. Most tables are not flat, as can be seen by checking them with a good straight-edge. If a foam core is covered on a bowed or twisted surface, then the wing will be bowed or twisted. And a table that checks out true but is flexible and will yield as you press on it will also spoil a wing. The ideal working surface is a sheet of plate glass. Or, it is possible to find a thick piece of plywood that is perfectly true.

Like balsa blocks, foam blocks sometimes have built-in internal stresses and the core bows slightly when cut out of the block. Skinning on a flat surface, in the sequence shown in the pictures, will correct minor bows.

Incidentally, the washout in the Kougar wing is cut right into the foam core. The tip section is 1/8" higher at the trailing edge as compared to the center section trailing edge. The washout will take care of itself. No blocking up or other steps are required of the builder. Proceed with wing construction as if it were a standard wing.

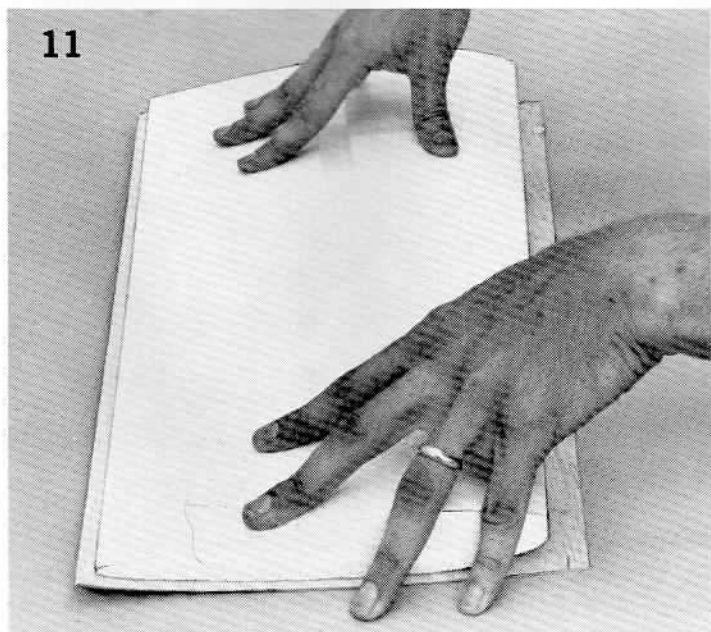
minutes to about one hour. In conditions of high humidity it may take somewhat longer. It is best to join the parts as soon as they are dry, since if they are allowed to lay around, they will not stick together as well. Sig Core Bond will not damage the core if a small spot or two is not completely dry when the skinning is done.

The following series of photos show a Kougar wing being sheeted. The Komander wing is done in the same manner with one exception. Instead of having the grain of the wing skin wood running parallel to the trailing edge, for the Komander have it run parallel to the leading edge. See the isometric drawing of the wing assembly to check on this point.

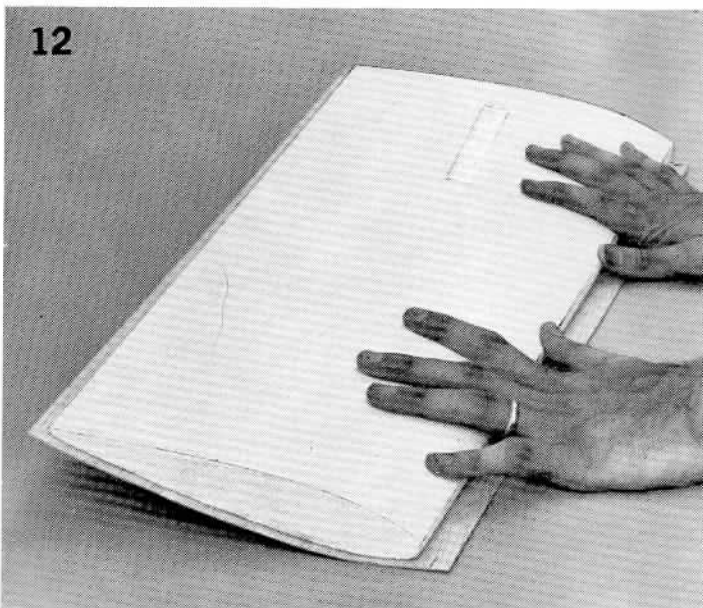


**10.** Hold the trailing edge of the foam core in position just above the wing skin and lower the edge only onto the skin. Make sure it is properly aligned before contact is made because it cannot be removed and repositioned after contact is made. Press down along the trailing edge to make sure it is making good contact and is flat against the table.

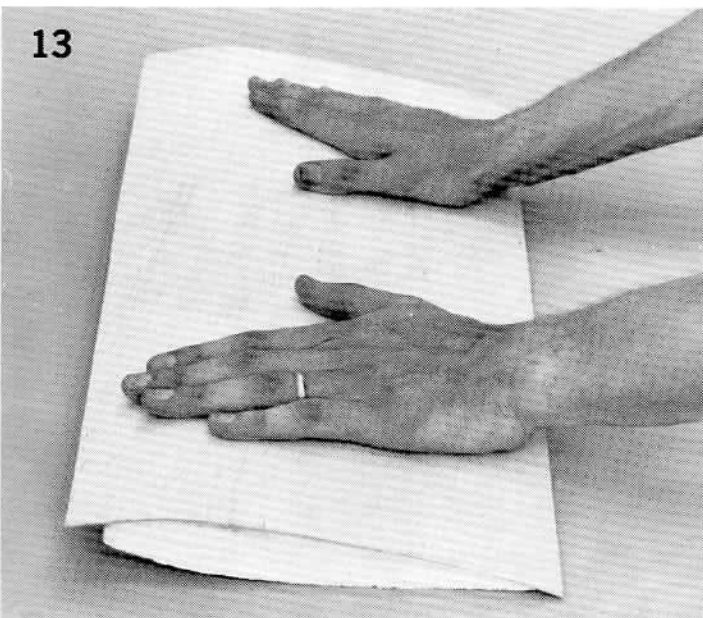
**NOTE:** A kit builder has suggested to us that he prefers to stand on the trailing edge side of the wing, rather than on the leading edge side as we are showing in this picture sequence. He feels that he has a better view of placing the trailing edge and making sure it is true from that side. (Or, it would be helpful to get someone to assist on the opposite side to steer it properly in place.) The main thing, regardless of where you stand, is not to twist or warp the core as it is rolled onto the balsa sheet.



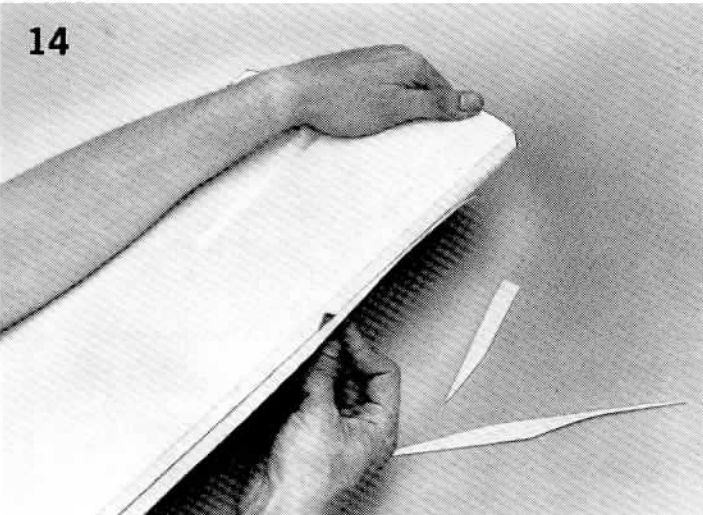
**11.** Roll the core down onto the sheet with a rocking motion.



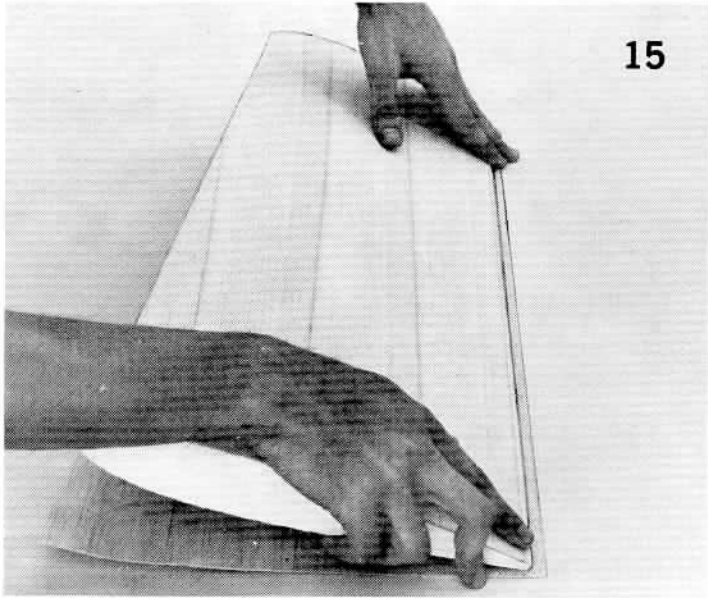
**12.** Continue rolling the core onto the sheet until the leading edge is attached.



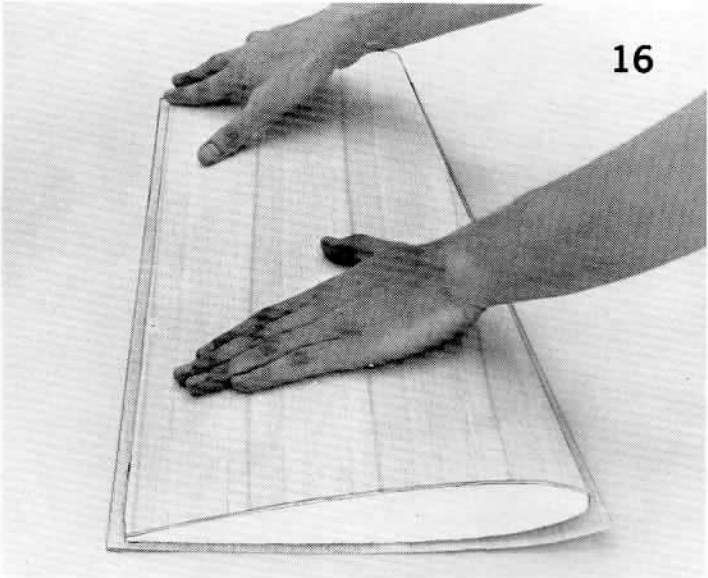
**13.** Turn the core over and firmly rub down the wing skin sheeting with the flat of your hands to insure that the balsa skin is firmly attached to the core.



6  
14. Remove the waste wood around the edges by rough trimming. Do not cut into the foam core. Save fine trim for later.

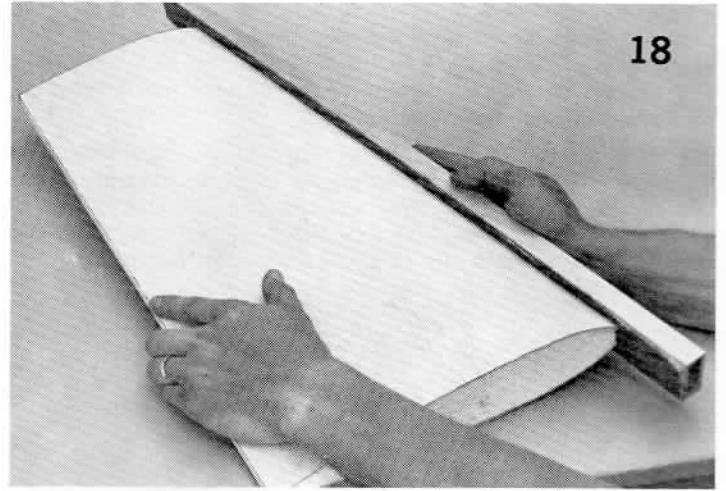
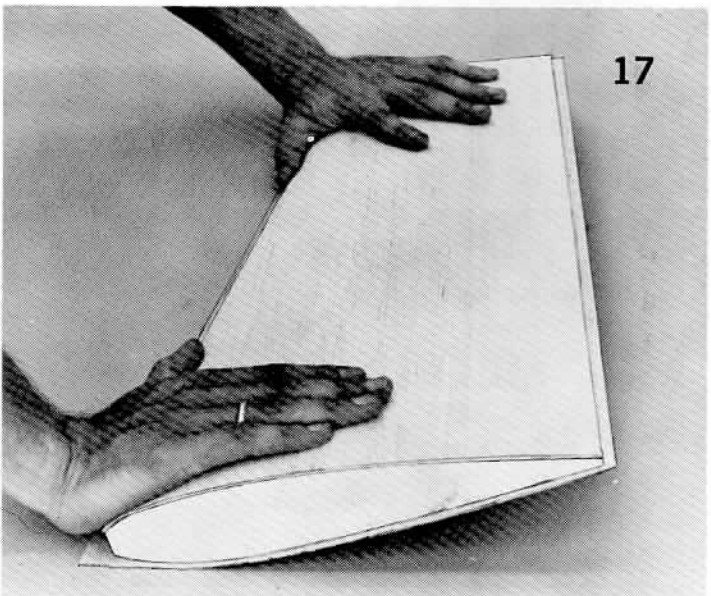


15. Repeat Step 10 on the opposite side of the cores.

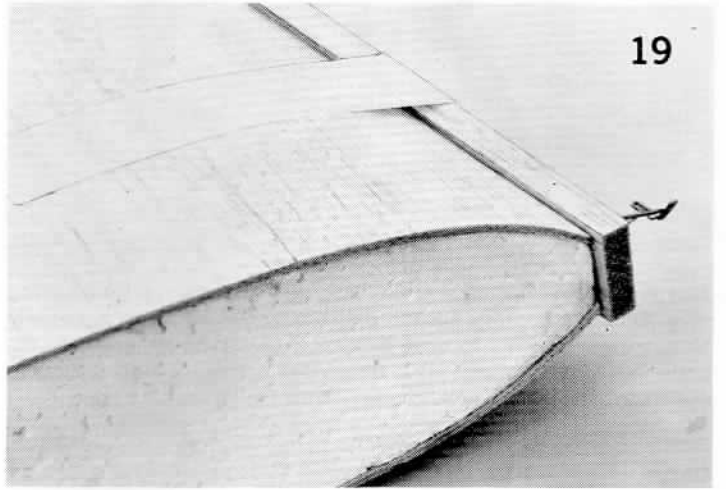


16. Repeat Step 11.

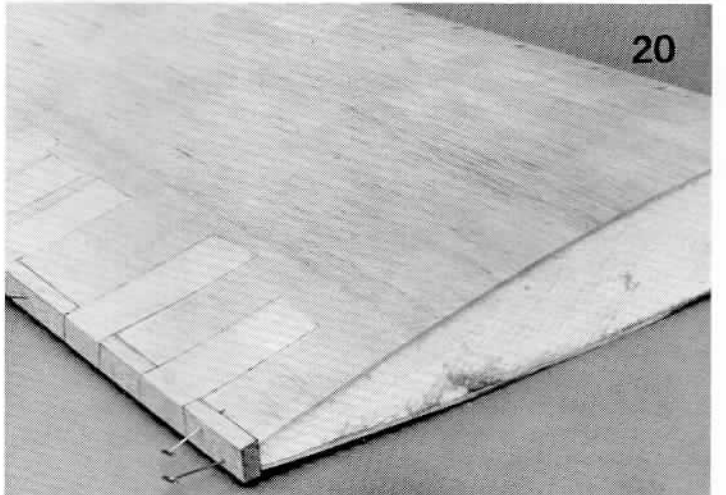
17. Repeat Steps 12 and 13.



18. Trim and sand the edges of the sheeted foam cores. While the regular sanding block can be used, note how useful an extra long block is for this purpose. (The one shown is made from a section of aluminum channel extrusion — with sandpaper glued on using sanding disc adhesive. This handy specialized glue is available at hardware stores and lumber yards.

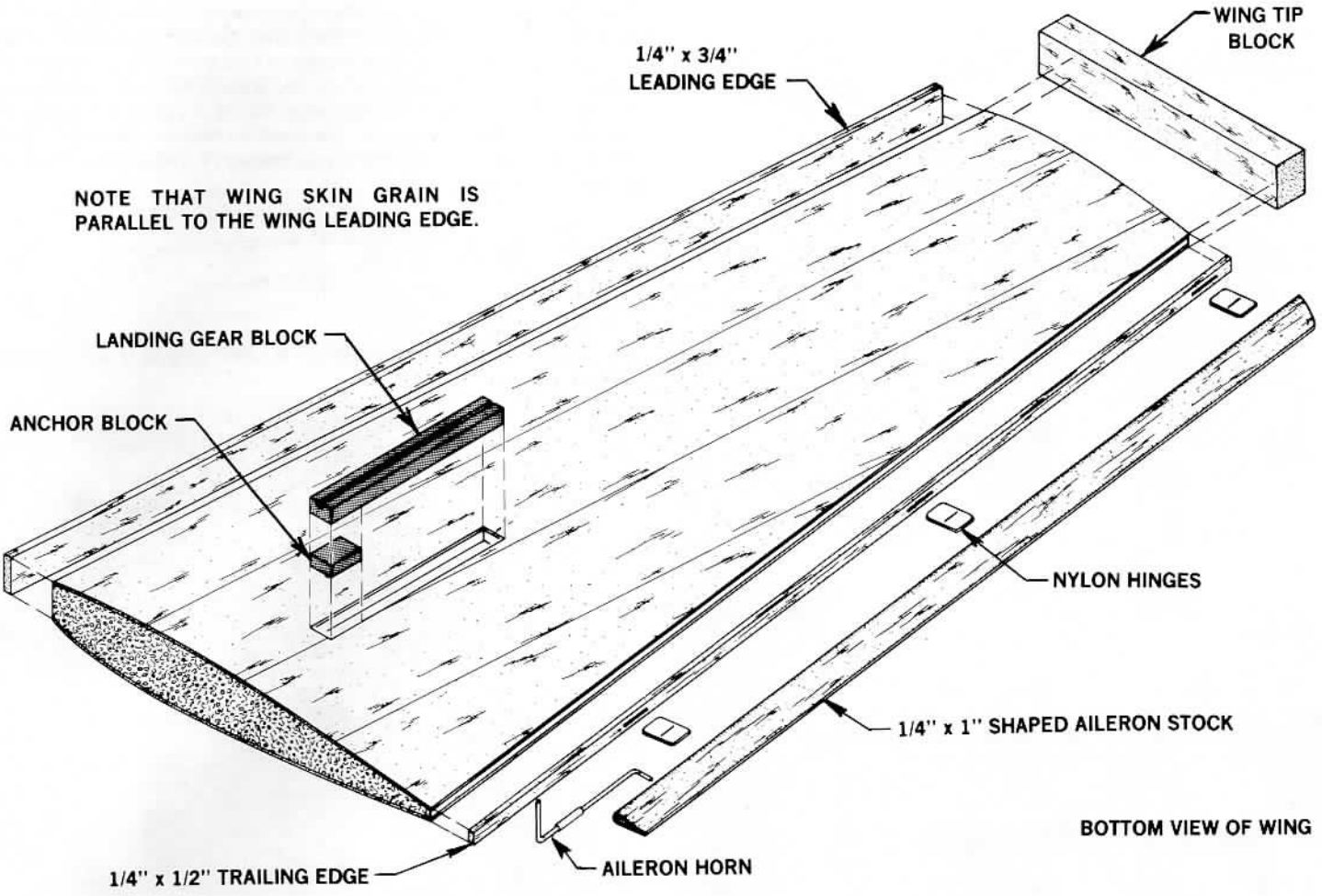


19. Glue on the 1/4" x 3/4" leading edge, holding it in place with pins and strips of masking tape. Sig Bond glue is recommended.



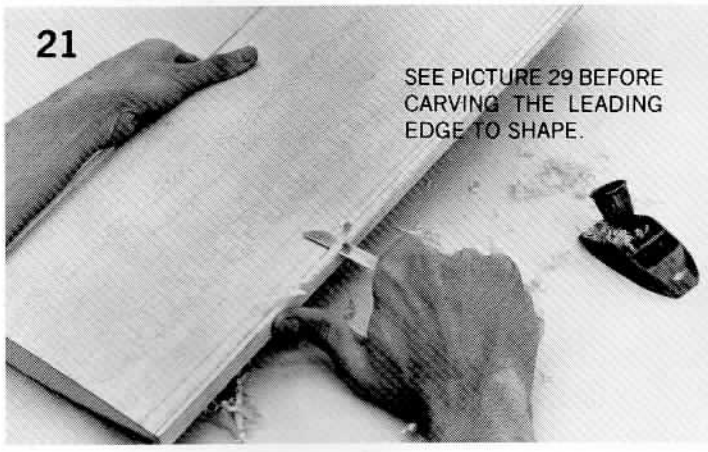
20. a. Glue on the 1/4" x 1/2" trailing edge in the same manner as the leading edge.

21. Carve the leading and trailing edge roughly to contour. Leave 4" in the center of the trailing edge (2" on each side) flat and unshaped for later installation of WF in Paragraph 28.



NOTE THAT WING SKIN GRAIN IS PARALLEL TO THE WING LEADING EDGE.

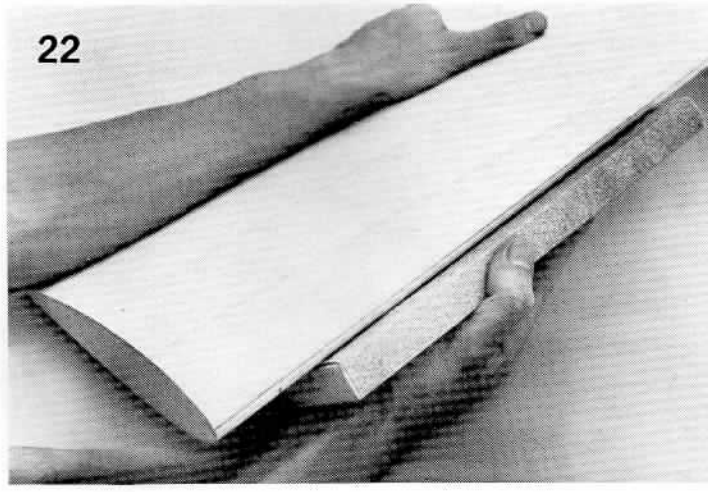
BOTTOM VIEW OF WING



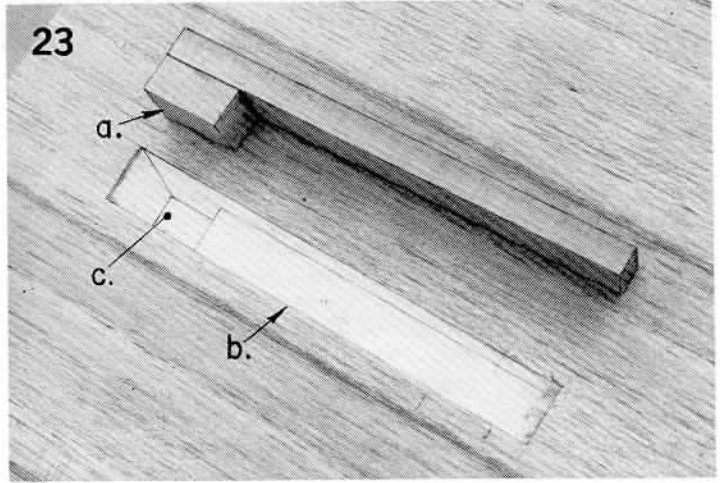
21

SEE PICTURE 29 BEFORE CARVING THE LEADING EDGE TO SHAPE.

22. Sand to exact shape with the sanding block. A pencil line drawn down the center of the leading edge from root to tip will help get the shape true all along the wing.



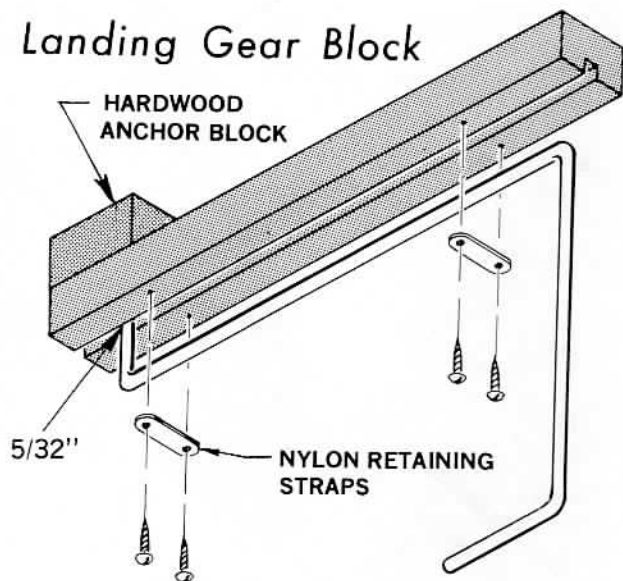
22



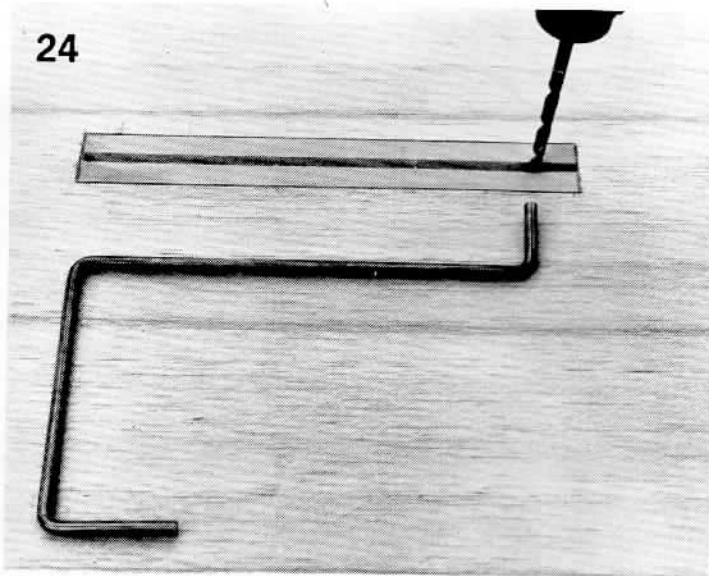
23

- a. Epoxy glue the anchor block to the grooved block.
- b. Cut out the balsa sheeting above the landing gear block slots in the foam core. The slots may be located by pressing on the sheeting or by use of the waste block from the foam core. Cut the holes in the sheeting out undersize at first so that the opening can be trimmed down carefully for an exact fit around the landing gear blocks.
- c. Excavate the foam out of the pre-cut cavity to accommodate the anchor block. The best way to cut foam is with a brand new, sharp modeling knife whittling blade. Or you can heat an old blade in a flame and hot cut the hole.
- d. Epoxy glue the landing gear blocks into the wing. Should there be any areas in the cavities which do not fit snugly against the blocks, fill these voids with a mixture of epoxy glue and scrap foam which has been crumbled into bits.

## Landing Gear Block



24

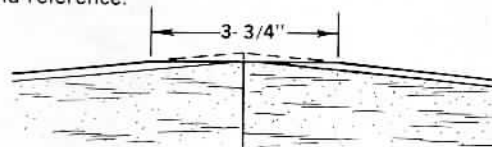


24. Position the landing gear and drill a 5/32" diameter hole into the gear block and anchor block. CAREFUL! It is easy to slip and go clear through the wing. Trim the edge of the hole so that the radius of the wire at the bend will fit down into it. The gear should fit into the block snugly, but not so tightly that it will jam in the block. You may want to remove it later for straightening after a hard landing. Place a nylon landing gear strap held on by No. 2 screws across the gear at each end to retain the gear in the groove.

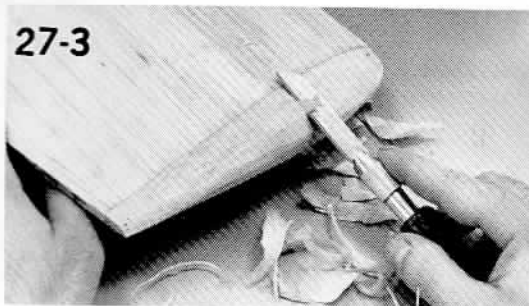
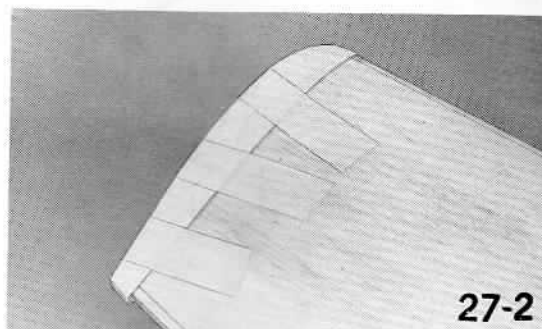
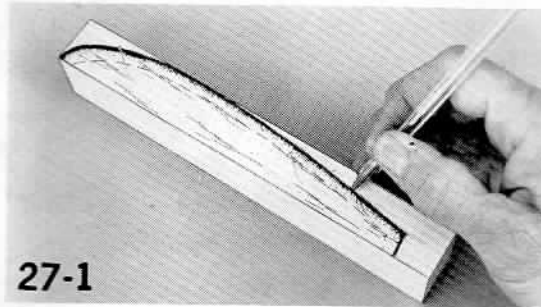
25. The angle already cut into the ends of the foam wing halves sets an approximately correct dihedral angle. To check it, set up the wing halves as shown in the drawing below, with each wing tip blocked up. Sand the wing ends (Photo 25) as required to make the center joint fit correctly together. Glue the halves together with Sig Epoxy Glue or Sig Kwik-Set



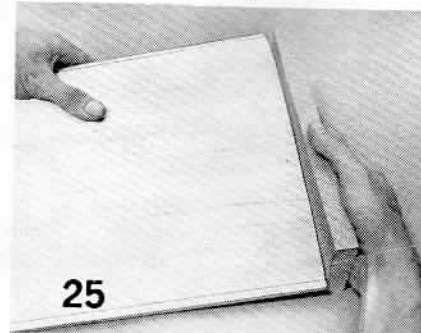
Glue. Use plenty of glue where the balsa sheeting meets so that the joint between the two halves is completely filled. Be certain that the leading and trailing edges are lined up exactly so that no twist between the two halves is built into the wing. Mark center lines on the ends of each panel before joining and match the lines when joining. If you have the wing sitting on a true, flat surface, a further check on twist can be made by putting center marks on the tips also and measuring from them to the table as a second reference.



26. Sand a flat spot on the front of the joined wing as shown in the accompanying drawing.

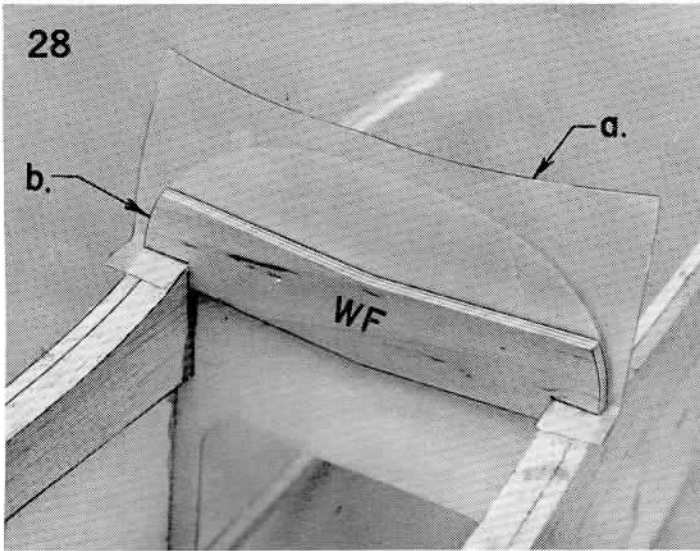


27. Cut out the wing tip blocks, using the pattern for the top view and the end of the sheeted wing for the side view. Glue the tip block on with Sig Bond, holding it in place with masking tape and/or pins. Carve and sand to shape. (If you wish to save weight by hollowing the tip, only tack glue it in place so that it can be removed for hollowing after it has been shaped. Use an X-acto "Y" router blade for hollowing.

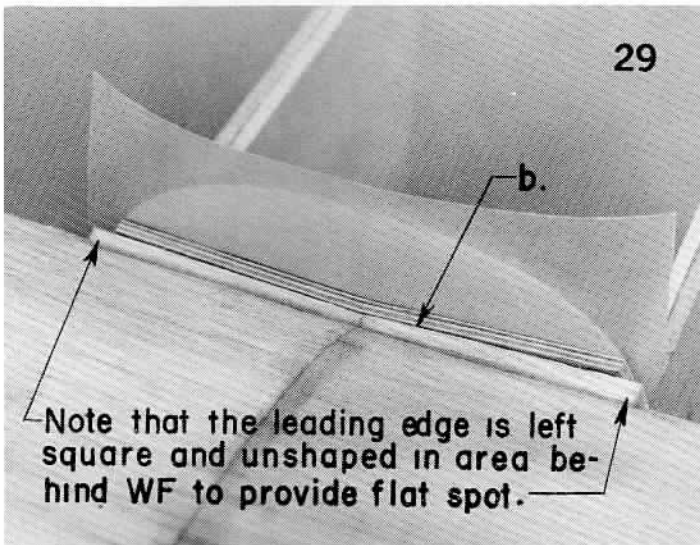




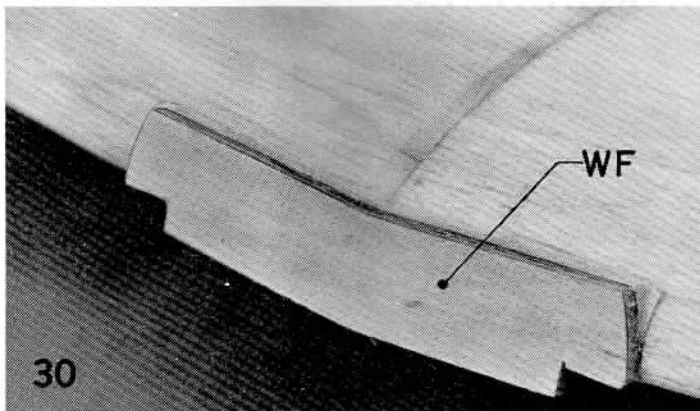
**NOTE:** At this point in construction you will need the fuselage finished up to and including paragraph and picture 85.



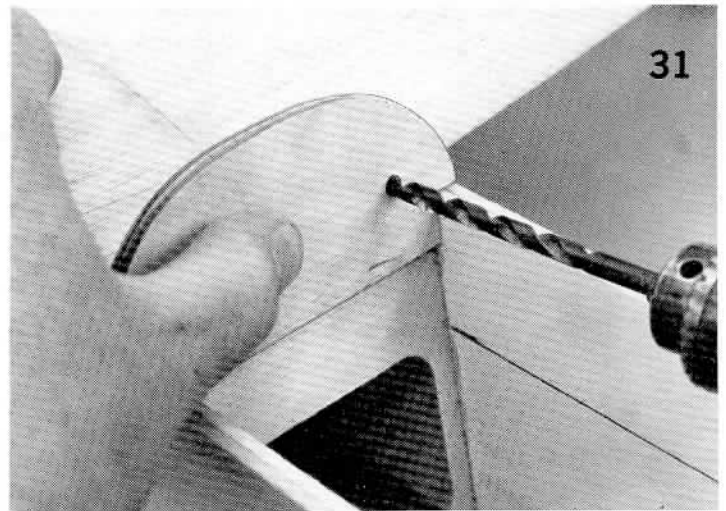
28. a. Put a piece of wax paper up against the back of Former F-2.  
b. Sit plywood part WF on the wing opening of the fuselage and resting up against the back of F-2.



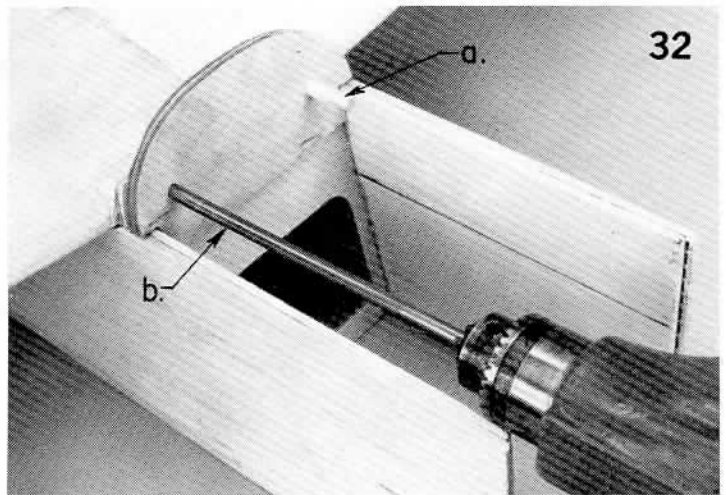
29. a. Sit the wing in place against WF and check how accurately it seats down on the wing opening in the top of the fuselage. Sand the fuselage as required so that the wing seats solidly in place.  
b. Put glue on the flat front of the leading edge and push it up against WF. Hold the wing in place with tape until the glue is dry.



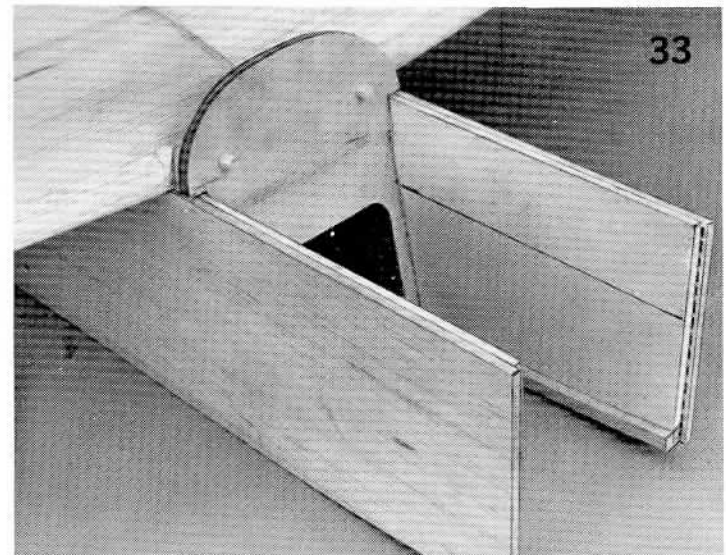
30. This photo shows WF glued in place on the front of the wing center section, as it will be when you remove the wing after Step 29.



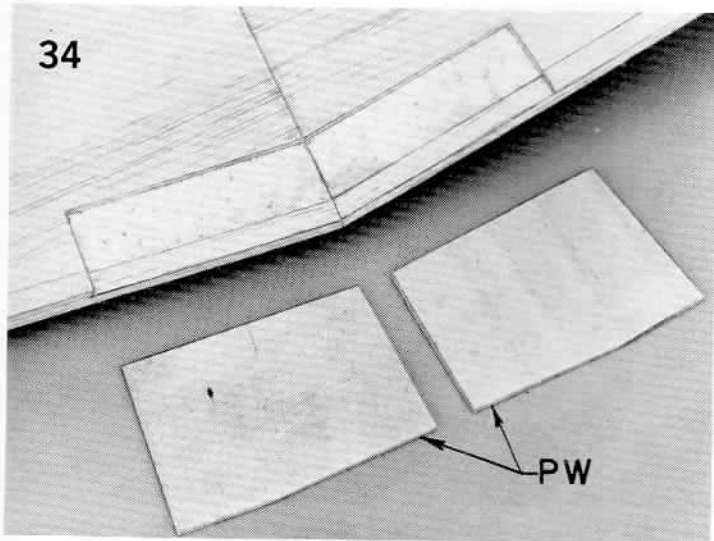
31. Put the wing back in place and drill through the dowel holes previously put in F-2, on through WF and the wing leading edge.



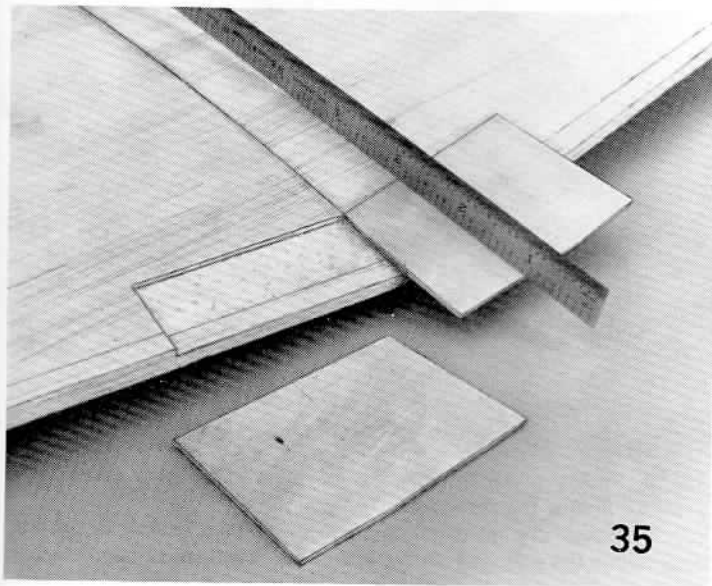
32. a. Push a dowel through the first hole to hold the assembly in place for drilling the second hole.  
b. If your drill bit is not long enough to allow drilling as deep as desired into the wing, use a piece of 3/16" wire with a point and notch in the end.



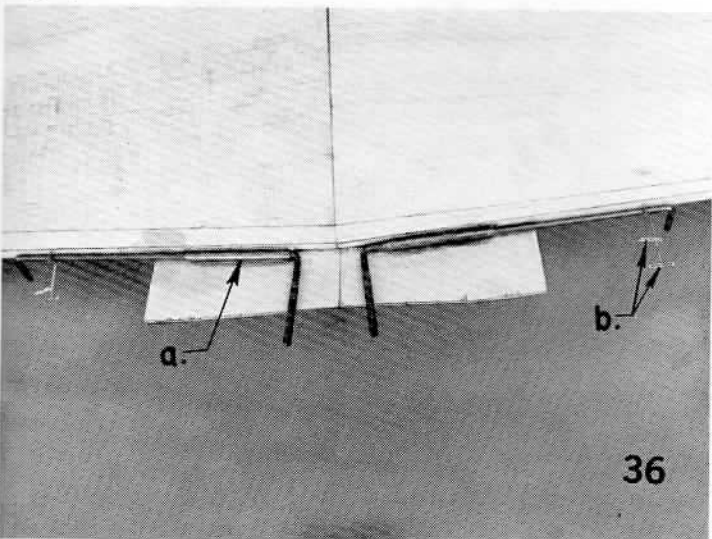
33. Glue the dowels into the holes in the wing. Note that they must protrude through F-2A about 1/8" so as to secure the removable hatch in place. Careful! Don't get glue on F-2. I make the holes slightly oversize, put glue only in the bottom of the hole, then after the glue sets, remove the wing and fill in the gap with more glue.



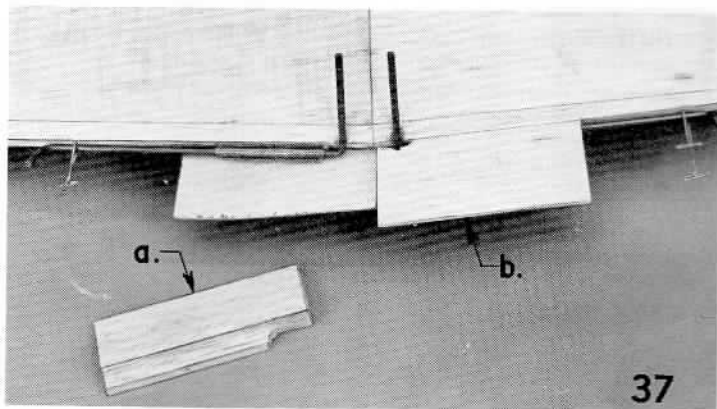
34. Cut out the inset holes in the wing sheeting for the plywood tabs called PW.



35. Epoxy the PW tabs in place, using a ruler to line them up with the wing top surface.

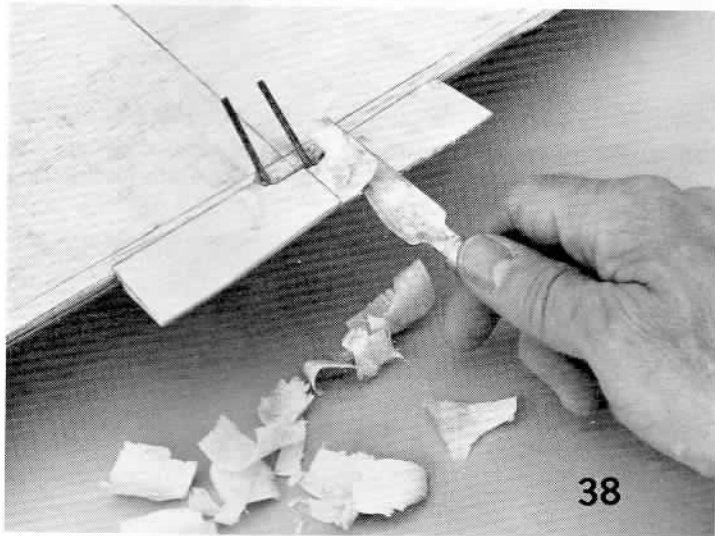


36. a. Epoxy glue the brass bearing tubes into the corner formed by the back of the wing and the PW plywood parts.  
b. Use pins as guides to line up the wire control horns with the center of the trailing edge of the wing.

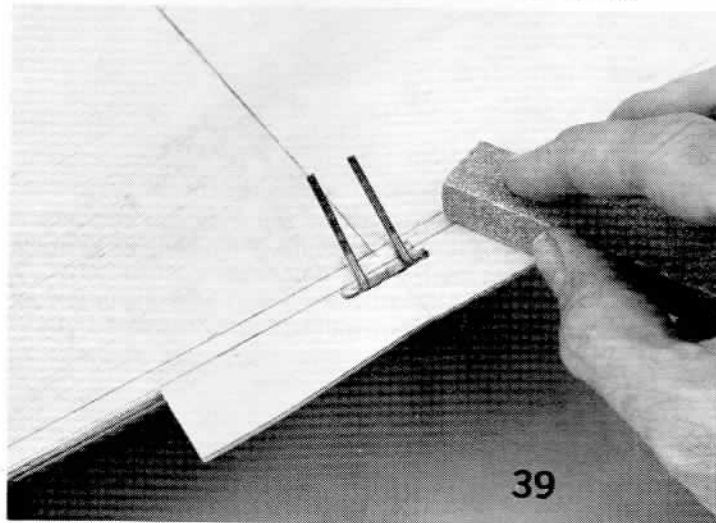


37. a. Cut pieces of shaped aileron stock to fit on PW. Carve out the front so they will fit over the bearing and wire horn.

b. Carefully glue the pieces in place on PW. Don't squeeze glue on to the ends of the bearing or the wire horn.



38. Carve down the pieces flush with the bottom of the wing.

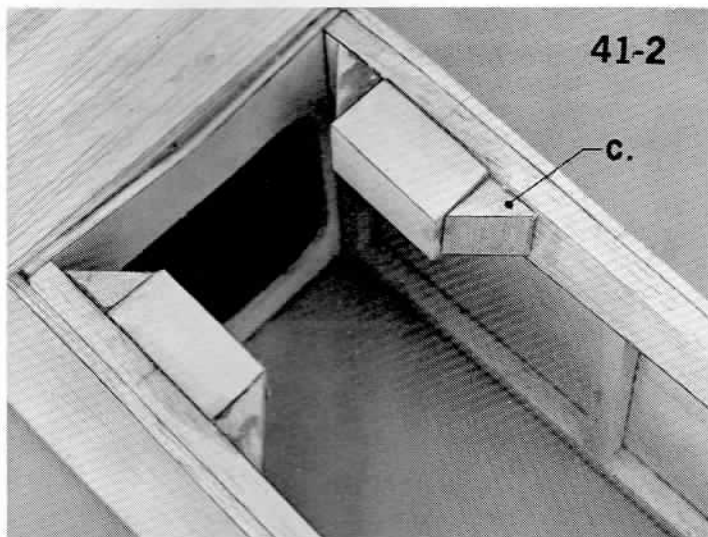
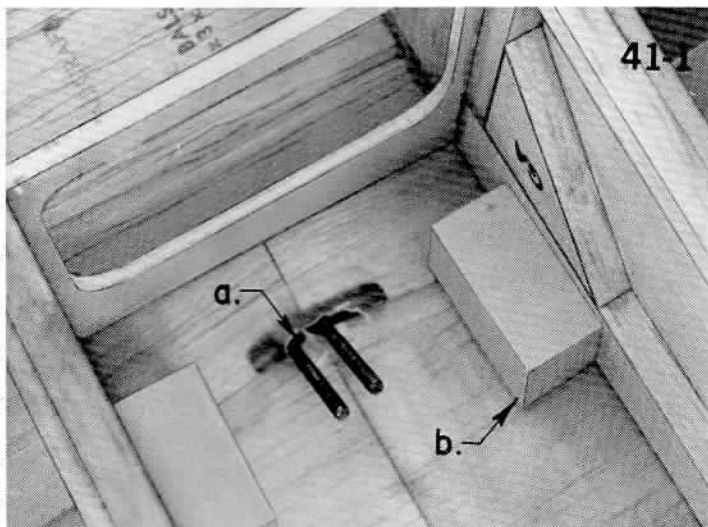


39. Sand smooth.

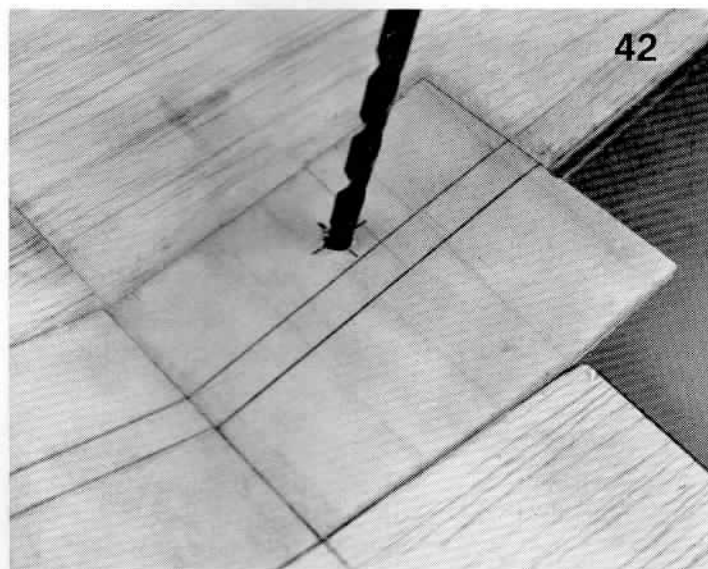
40. Mount the wing on the fuselage with a piece of wax paper between the wing and the fuselage at the back. (See next picture.) Tape the wing in place.

41. a. Cut a hole in the wax paper to pass the horns.  
b. Glue the hardwood wing anchor blocks to the fuselage sides with epoxy glue. The wax paper will keep the glue from sticking the wing to the blocks or to the fuselage.

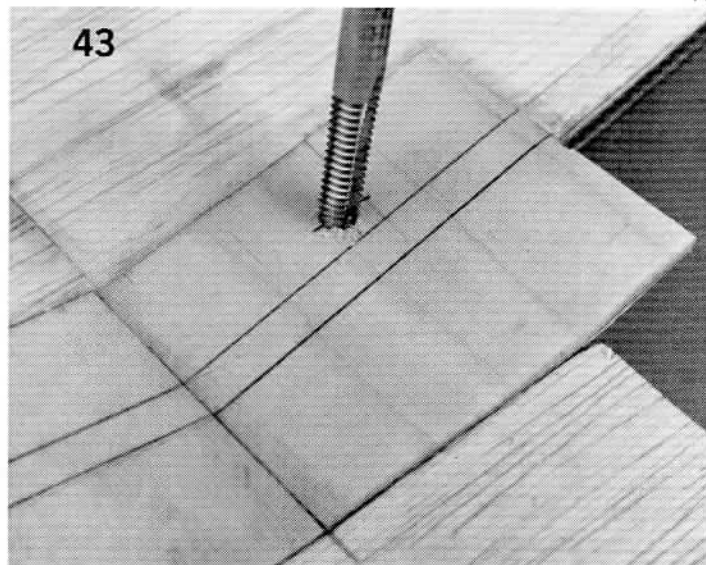
(NOTE: The anchor blocks will have to be shaped slightly so as to seat solidly against both the wing surface and the fuselage side.)



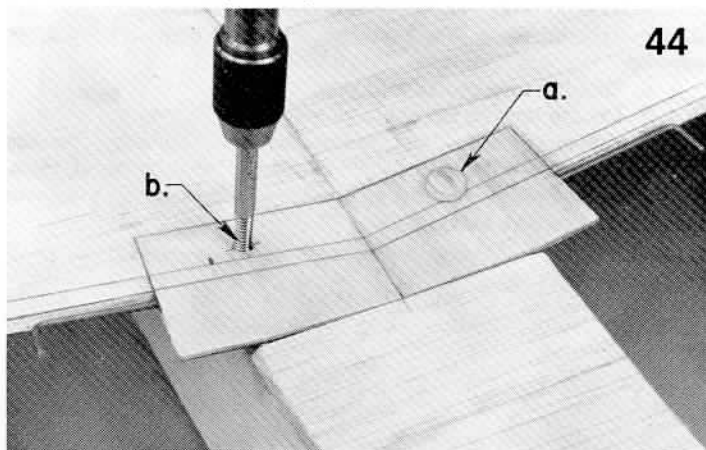
c. Brace the anchor blocks with pieces of 1/2" triangular balsa stock.



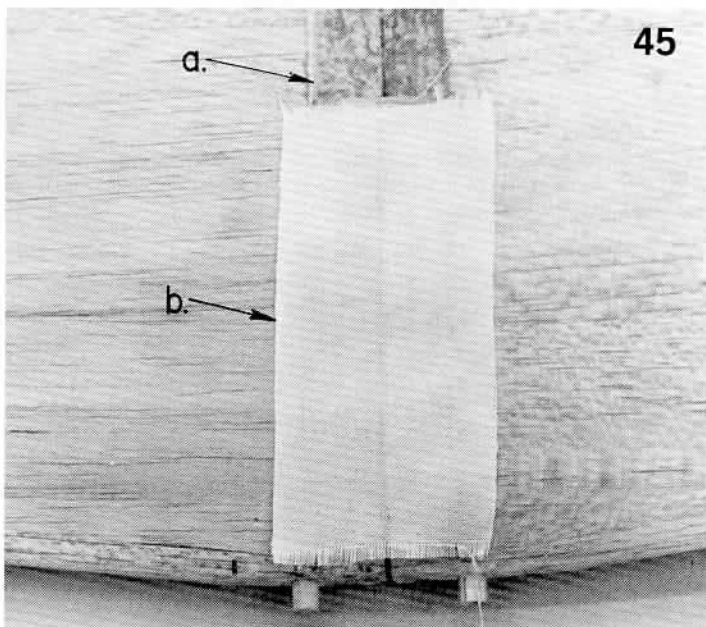
42. Mark the nylon wing bolt positions on the top of the wing and drill through one of them with a No. 7 drill (or if not available, use 13/64", the nearest inch equivalent bit). Hold the drill at 90 degrees to the top surface of the wing. Drill on through the hardwood anchor blocks that were just installed.



43. Run a 1/4-20 tap through the hole.

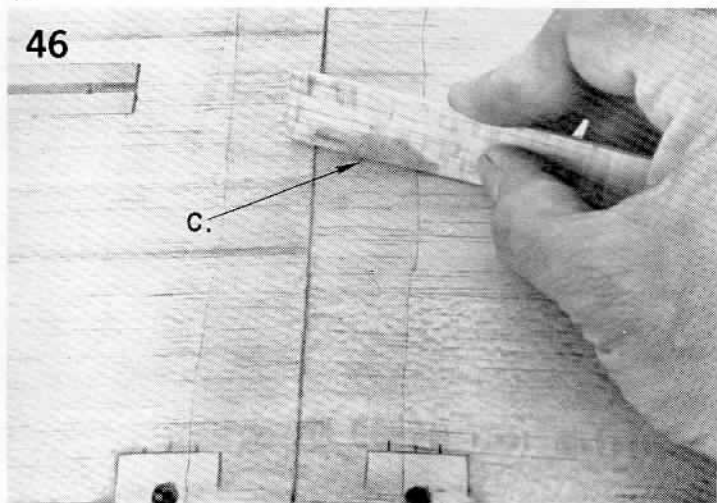


44. a. Bolt the wing on with a nylon wing bolt in the first hole.  
b. Repeat the drilling and tapping process on the other side.



45. a. Cut a cavity in the wing for the servo. Size will depend on the servo and/or mount. Look ahead in the book for further ideas on the requirements for this hole.  
b. Cut strips of 2" fiberglass tape for both sides of the wing center joint.

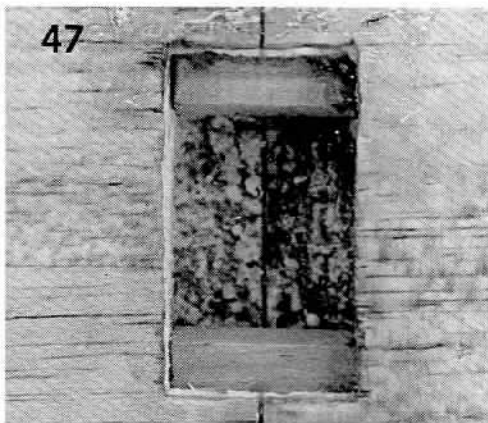
46



46. I use regular Sig Epoxy Glue (not Kwik-Set Glue) for applying the fiberglass tape, since it is thinner and easier to spread out smoothly. It will be even easier to spread if you warm the mixing container by setting it in hot water for a few minutes to raise the temperature of the glue. But work quickly, for the glue will set up much faster than normally when warmed.

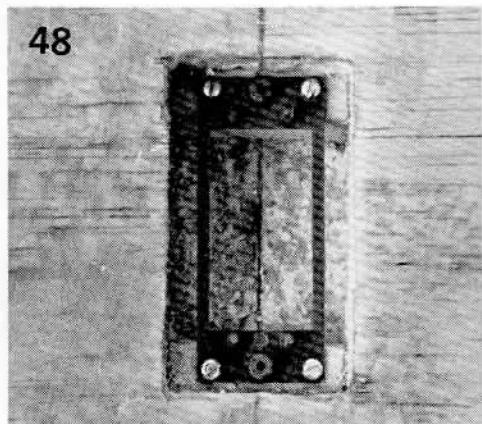
- a. Coat the wing center with glue.
- b. Lay the tape on top of the glue.
- c. Holding one end of the tape so it won't slip, "squeegee" the glue through the tape, with a small paddle made from a scrap of balsa. Scrape over the tape several times with the squeegee paddle to smooth the tape and remove excess glue.

47



47. Glue hardwood mounts (not supplied) for the servo into the cavity. Coat the entire inside of the cavity with epoxy glue to prevent the foam from being damaged by fuel or dope.

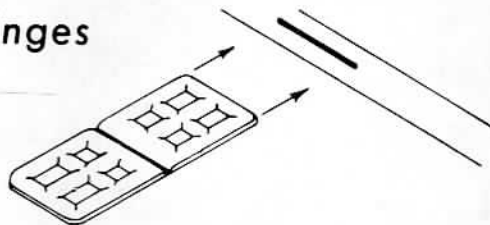
48



48. The plastic servo mount in the photo is for a Logictrol servo. Use No. 2 screws to fasten it to the hardwood mounts.

For more radio equipment installation instructions look ahead in the book.

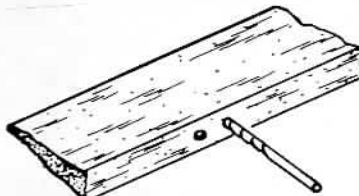
## Hinges



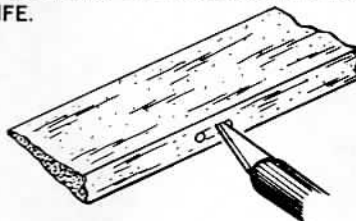
Cut slots in the control surface to receive the hinges.

### MAKING A HINGE SLOT

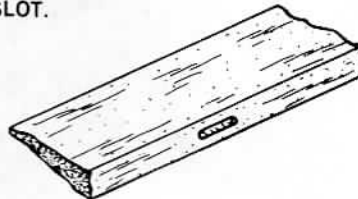
- 1.) DRILL TWO 1/16" DIA. HOLES INTO THE WOOD.



- 2.) CUT BETWEEN THE HOLES WITH A MODELING KNIFE.



- 3.) USE EPOXY GLUE TO FASTEN THE HINGE IN THE SLOT.



NOTE: AN X-ACTO KEYHOLE SAW BLADE NO. 15 IS ALSO HANDY FOR CUTTING HINGE SLOTS.

Here are some pointers for a good hinge installation.

- 1.) Pre-flex the hinges by bending them back and forth to extreme angles several times before using.
- 2.) The hinges have a flat and un-flat side. Have the same side down on all the hinges.
- 3.) The extra-wide slot provided by the 1/16" hole method is intentional. It allows the last half of the hinge to take a non-binding position as the glue sets up if the hinge didn't happen to be perfectly aligned when the first half was glued in place.
- 4.) Use plenty of Sig Kwik-Set epoxy glue in the slot. A pin hole into the bottom of the slot prevents air lock. Be sure glue gets into the holes in the hinge by putting some there before inserting it in the slot.
- 5.) Leave the thin, bendable portion in the center of the hinge completely out of the slot. The gap between the surfaces should be as small as possible without restricting the movement of the controls.
- 6.) Let the glue set up for several minutes. During the time from about 7 to 15 minutes after mixing, the excess glue that has squeezed from the slot can be peeled off easily. Don't leave glue covering the thin, bendable portion in the center.