

THE APOGEE
A 100-INCH AMA DURATION SAILPLANE FROM DYNAFLITE

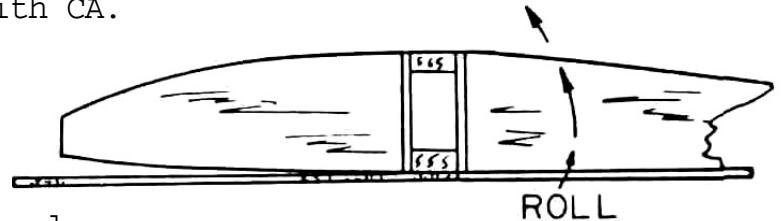
Apogee is the intermediate sailplane designed to be competitive in AMA duration contests. Effective spoilers, rudder and full flying stabilizer give it the first-class controllability needed in contests. Also, thanks to Apogee's SHULMAN wing plan form, eplier airfoil and overall sleek design it produces excellent penetration even with an empty ballast box. With the ballast box loaded, it will fly through wind that slows down or stops other sailplanes. Overall, Apogee's top end L/D, excellent penetration, controllability and ease of flying, make it your best choice among 100-inch sailplanes.

Apogee's construction is relatively simple. However, because its instructions assume a fair working knowledge of modeling, Apogee can not be recommended for first-time builders. If you don't have prior modeling experience, try a Wanderer kit. Friendly to the new modeler, the Wanderer will help you develop building and basic flying skills. Then you can enjoy building and flying an Apogee.

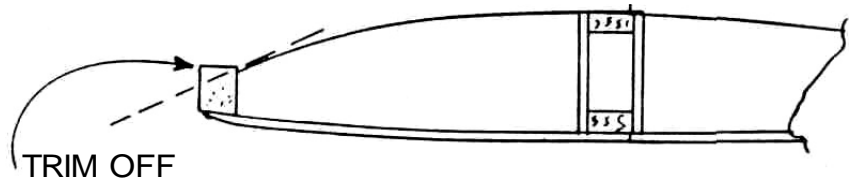
WING

- 1 Start by laying the 1/16 bottom L.E. sheet over the drawing. Use 1/16 x 3 x 24 balsa in the center and 1/16 x 3 x 30 balsa for the tips which go from the rear of the spar out past the L.E.
- 2 Glue the 1/8 x 5/16 hardwood lower spar to the sheeting. The 1/8 x 5/16 hardwood is used only in the center. Use CA.
- 3 Glue the 1/8 x 1/4 hardwood lower tip spars into place. Use CA.
- 4 Pin the lower 1/16 x 1 7/16 balsa trailing edges into place. NOTE: use two pieces 24 inches long with only one break in the sheeting where the dihedral will be installed <Mark: is this clear?>.
- 5 Sheet the lower center section, bays 1 and 2 between the spar and the T.E.. Use 1/16 balsa and CA.
- 6 Cut, then fit the lower cap strips between the spar and the T.E. out to the tip rib (W-9). Use CA. Omit the cap strip between bays 8 and 9 (dihedral will be installed there).
- 7 Install ribs W-1 through W-9. Do not install W-1 where the spars change size at bays 8 & 9. You will install this rib after the dihedral is in place. Use CA. Do not glue the lower L.E. sheet yet.
- 8 Fit the upper spars into place. Cut the spar notches in the ribs if necessary. Use CA.
- 9 Using 1-1/16 x 3 x 24 balsa, cut and install the vertical-grain shear webs. Section C-C shows this. The balsa webs are in bays 3, 4, 5, 6, 7, 10 & 11 on the rear of the spar and on the front side in bays 3, 4, 5 & 6.
- 10 Use epoxy to install the two forward 1/16 ply shear webs in bays 1 & 2. Only install the forward webs, because you must install the fiberglass wing rod tubes.
- 11 Use epoxy to install the outermost dihedral brace. This extends from W-4 to W-6 and bends around the curve in bays 12 & 13. You will need to cut W-5 so the brace fits. (1)

- 12 Install the two 5/16 o.d. x 6-inch fiberglass tubes as shown in section C-C. Sharpen one end of the tube and use it as a tool to cut holes in the ribs. Use scrap wood to fill in the areas above and below the tube.
- 13 Use lots of epoxy to coat the entire area and install the rear 1/16 ply shear webs. Clothes pins work well as clamps.
- 14 Remove the wing from the building board. You should have a center panel and the tip panel. These will be joined later.
- 15 Install the top T.E. Sand the lower T.E. as shown in section A-A until the top T.E. blends in with the ribs. Using a slow CA or white glue will give you time to work.
- 16 Cut holes in the ribs and install the spoiler plastic tube, using the route shown on wing drawings in section A-A as guides. Leave the tube long on the root end. You will trim it later.
- 17 Glue the bottom L.E. sheeting to the ribs. HINT: set the panel on the table and roll it forward. Glue with CA.



- 18 Do the same as above to the tip panels.
- 19 Install the 1/4-inch square leading edges in place at the leading edge.
- 20 Glue the 3/16 forward alignment dowel in place.
- 21 Carve the L.E. to the shape of the ribs in preparation for the L.E. sheeting.



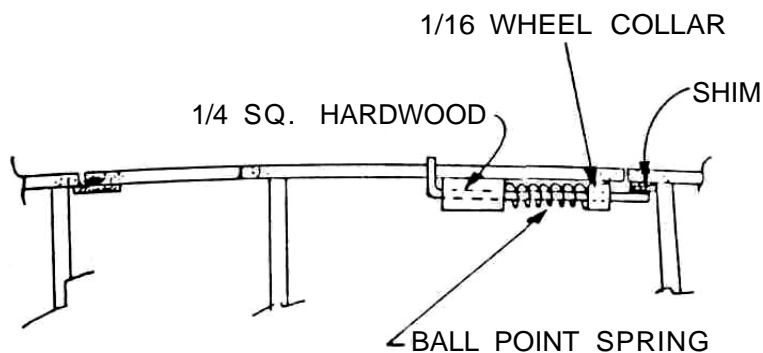
- 22 Install the dihedral brace in bays 8 & 9. Lay the center panel on your table. Raise the tip five inches. Sand the parts so the joint is tight. Epoxy the 1/16 ply dihedral brace in place.
- 23 Cut and fit the 1/16 x 1/4 lower cap strip at bays 8 & 9.
- 24 Glue the rib into place at bays 8 & 9.
- 25 Sheet the leading edges. HINT: use white glue, pins and long sticks of wood to hold the assembly together while the glue dries.
- 26 Install two pieces of scrap ply on the inside of the root rib to hold the hook you will later screw in this location. Glue the top center section sheeting into place.
- 27 Notch the four ribs in the spoiler area for the 1/8 x 1/4 stiffener. See top view in section A-A.
- 28 Cap strip the wing and the area around the spoiler with the 1/16 x 1/4 stock.
- 29 Cut and fit the spoiler so it fits the area provided by the cap strips. Try to make a snug fit. (2)

- 30 Spot glue the spoiler into place. This is so you can sand it to blend into the airfoil- DO NOT USE TOO MUCH GLUE.
- 31 Sand the tip flat to receive the tip block. This is made of 1/2 x 2 x 5 wood. Trim it to a 100-inch wing span.
- 32 Sand the wing using section A-A as a guide.
- 33 Trim off the plastic tube flush with W-1. Do not install the 1/16 ply root ribs yet-- you will first have to align the wings with the fuselage.

FUSELAGE

- 1 Glue the fuselage front to the rear. Use the drawing as a guide to aligning the parts.
- 2 Glue the 1/4 sq. longerons onto the fuselage sides. The top is one piece; the bottom two pieces. Note the location on the drawing. Be sure to make both a right and a left!
- 3 Drill a 5/16 hole in the punch mark of the doubler. Glue the 1/8 ply doublers to the inside of the fuselage between the 1.4 sq longerons. See section drawing .F-4 for clarity. Be sure to make both a right and left side!
- 4 On the fuselage drawing is a dashed line identified as elevator cable route. On the right side, glue the outer cable housing along this line. Leave cable loose at the rear so it can be installed into the fin. On the left side, glue the rudder cable along the same route but exit the fuselage back. See drawing. Micro balloons and CA work well.
- 5 Punch out the bulkheads and sand the edges.
- 6 Mark on the fuselage sides the location of the bulkheads and crutch. See reference marks on plans.
- 7 Examine the top view of the fuselage and sand the rear longeron as shown. Fuselage sides should be approximately 1/8 inch apart. This leaves space for the fin post.
- 8 Set the fuselage over the top view on drawing and tack glue the rear longerons together.
- 9 Drill a 3/32 hole in F-4 and notch the bottom of F-3 for the tow hook. Section F-4 shows the location of this hole. Put the die cut part behind the drawing and mark the location of the hole. Notch the F-3 bulkhead.
- 10 Install bulkheads F-3, F-4 and F-5.
- 11 Install bulkhead F-6 in place.
- 12 Glue F-1 and the ply deck into place. Use masking tape to hold assembly while you glue it.
- 13 Install bulkhead F-2.
- 14 Sand the top of the fuselage with a sanding block.
- 15 Sheet the top of the fuselage with 3/32 balsa cross grain. You will cut the hatch out later.

- 16 Turn the fuselage over and sand the bottom. Bend the tow hook, as shown on the plan, and install the hook using epoxy.
- 17 Sheet the front with 1/8 x 3 balsa cross-grain back five pieces approximately 15 inches <huh?>.
- 18 Sheet from the 1/8 to the tail with 3/32 cross grain.
- 19 Glue the nose faring block into position.
- 20 Sand the front flat at F-1 and glue on the nose block.
- 21 Trim off excess sheeting.
- 22 Tack glue the canopy base into position.
- 23 Glue the front and rear canopy formers into place.
- 24 Drill a 1/16-inch hole where the 1/16 canopy latch is shown. The 1/16 wire slides inside a piece of 1/8 o.d. plastic tube (not shown in drawing). Later, you will drill out F-2 and F-3 for the tube.
- 25 Cut out the hatch. The hatch can be seen in the top and side views. It is about 1-1/16 wide by 4-1/14 long. Making multiple light cuts instead of one deep cut gives better results.
- 26 Glue the 1/8 x 1/4 hatch catch strips in place. The strips are glued to the 1/4 square and under the 3/32 sheeting, not to the hatch.
- 27 The front of the hatch is held in place with a piece of scrap 1/16 ply as shown on the side view.
- 28 The rear is held in place with the catch as shown.



- 29 The fuselage can now be rough sanded. Use section F-4 to see how much you can round the corners.

STABILIZER

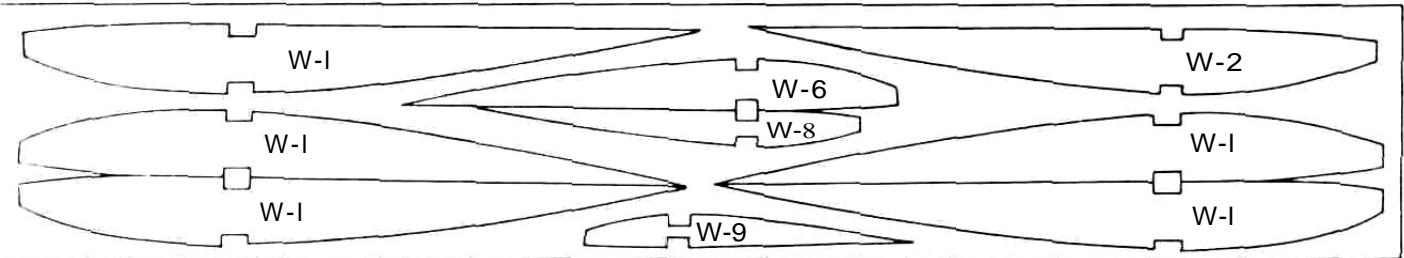
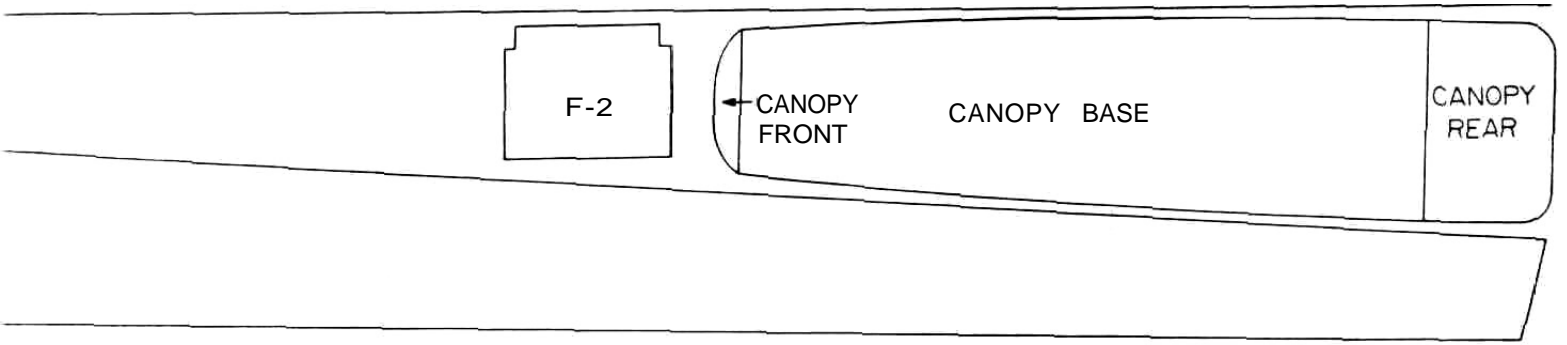
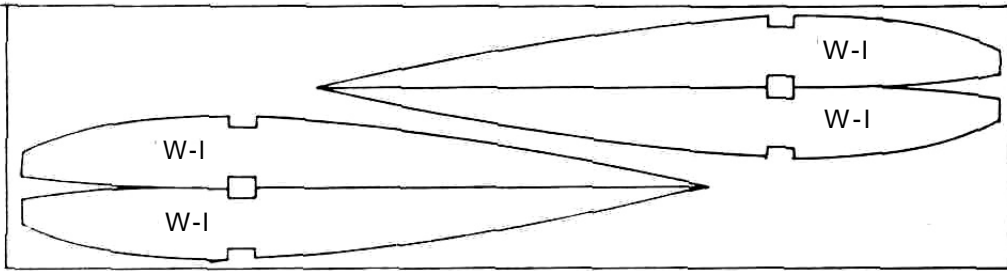
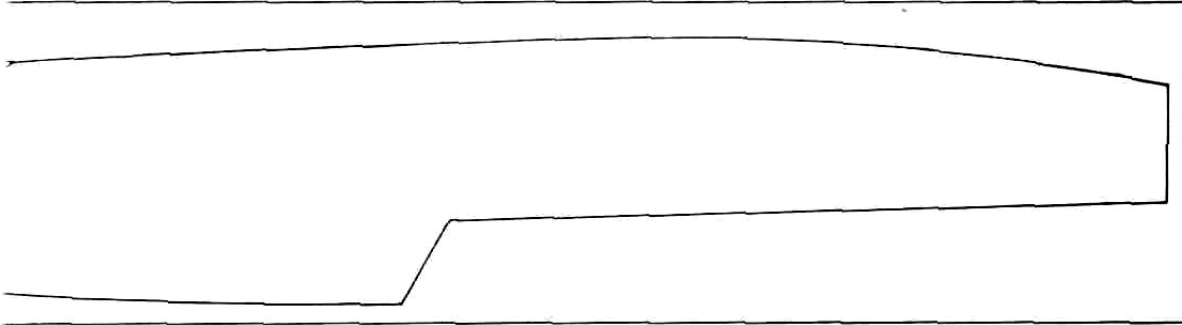
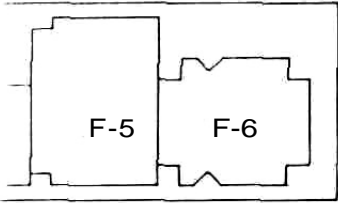
- 1 Put wax paper or plastic wrap over the stabilizer drawing.
- 2 Cut 1/8 x 1/4 balsa for the leading trailing edges. Pin these in place using 1/16 balsa shims to hold the L.E. and T.E. off the building board

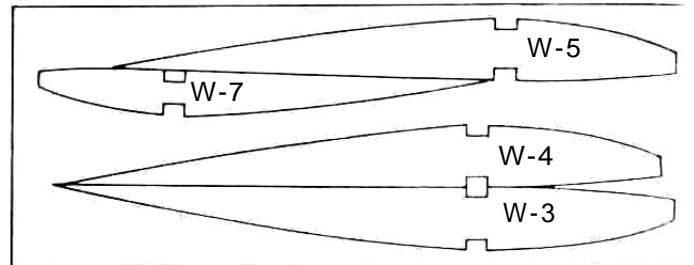
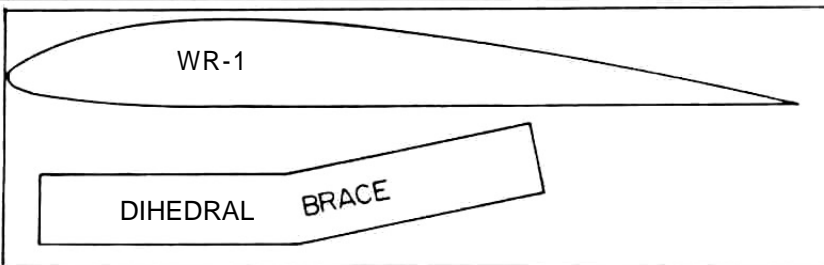
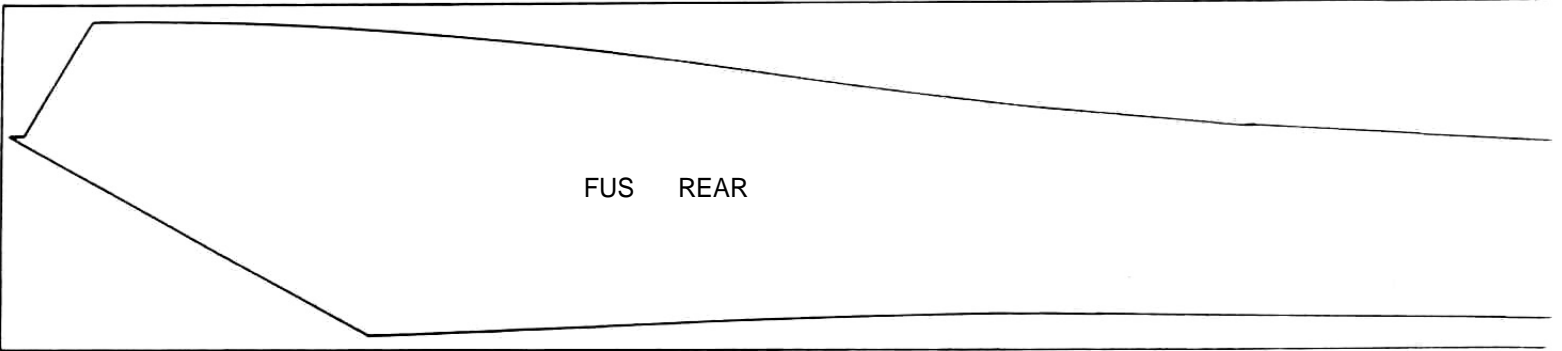
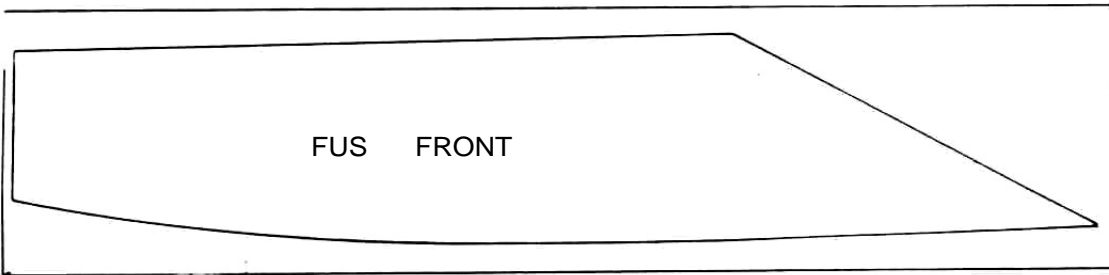
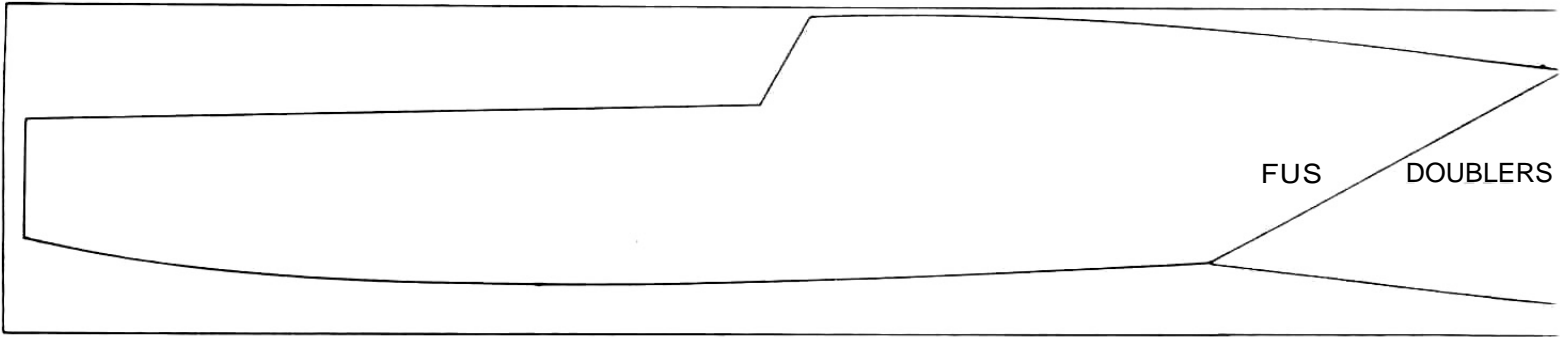
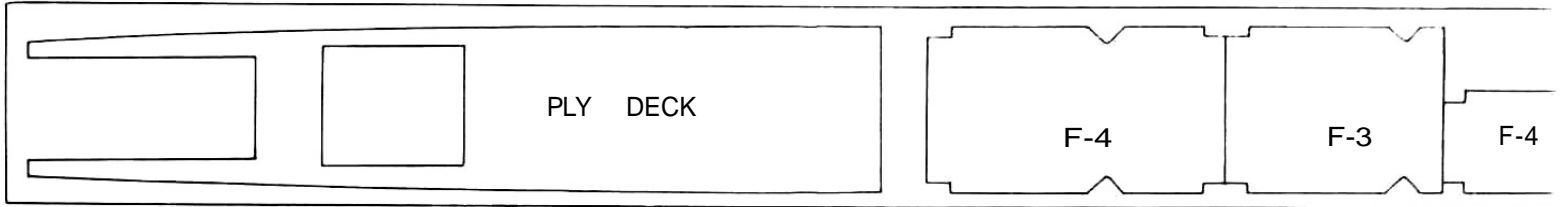
- 3 Use 1/16 x 1/4 balsa. Cut and fit the lower cap strips into place.
- 4 Use 1/8 x 1/4 hardwood and cut stab spars to length.
- 5 Attach the 3/32 I.D. tube to the left spar as shown on the drawing. Use thread and CA.
- 6 Attach the 3/32 wire to the right spar. Use thread and CA.
- 7 Slide the 3/32 wire into the 1/8 tube. Pin and glue this assembly over the drawing. This will bend the cap strips which are the start of the airfoil. See section D-D.
- 8 Cut and fit the upper 1/16 x 1/4 cap strips into place.
- 9 Remove this assembly and sand to the shape shown in section D-D.
- 10 Install the forward 1/16 wire and 3/32 tube. Epoxy into place.
- 11 Install the stab tips and root caps.
- 12 Sand the stab and set aside.

FIN AND RUDDER

- 1 Put wax paper or plastic wrap over the drawing.
- 2 Build the 1/8 x 1/4 fin frame according to shape shown in plans. Be sure rear fin post extends into the fuselage. -
- 3 Sheet one side of the fin with 1/16 inch balsa. It is made up of two pieces of 1/16 x 3 balsa <huh?>.
- 4 Drill the 1/4-inch ply mount for the 1/8 pivot tube.
- 5 Cut a square hole in the 1/16 balsa where the 1/4-inch ply pivot support is installed. Use the pivot support as a template.
- 6 Glue in the 1/4-ply pivot. It flushes out on the 1/16 balsa faces. Install the 1/8 pivot tube but don't glue into place. It will stick out about 1/16 inch past the balsa faces.
- 7 Glue the rear only 1/16 balsa to the fin frame, leaving the front open for installation of the pushrod.
- 8 Notch the lower 1/8 x 1/4 frame so the elevator control cable will fit into the fin. Use drawing as a guide.
- 9 Mount the fin on the fuselage. Leave the front 1/16 balsa still uncovered. Be sure it is straight.
- 10 Cut the front slot for the front stab wire in one side of the fin. Use the stab as a tool to locate slot.
- 11 Install the elevator control cable. Find the second piece of 1/8 O.D. x 7/16 tube. Flatten and drill as shown below.



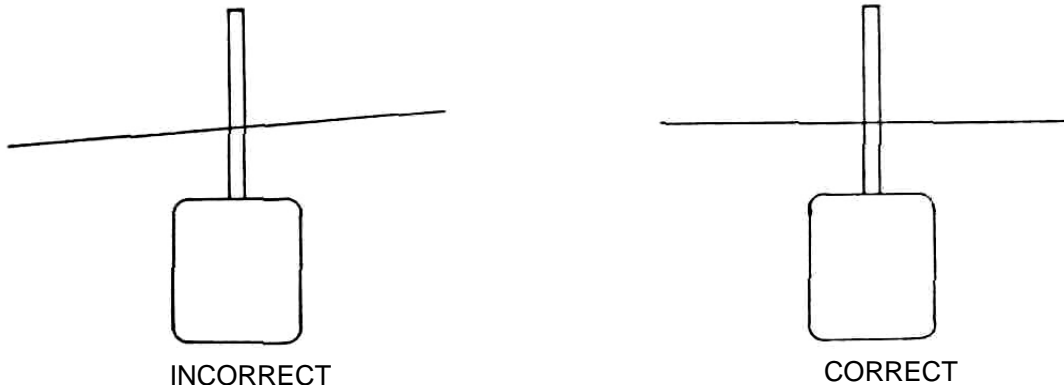




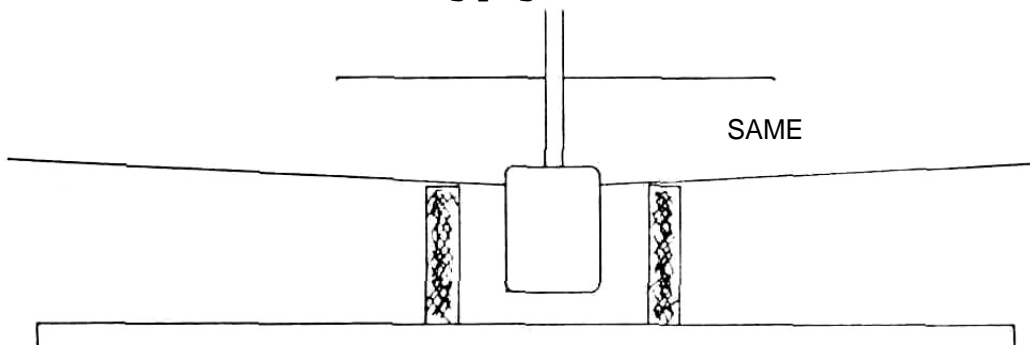
- 12 Now crimp or solder this to one end of the 1/16 stranded control wire.
- 13 Slide the cable into the elevator push-rod housing. Slide the stab into position with the 1/16 forward stab wire through the flattened tube on the end of the cable <clarify>. You should now be able to move the cable without the stab hanging up.
- 14 Sheet the forward fin with 1/16 balsa.
- 15 Install the dorsal from scrap balsa.
- 16 Pin down the 1/4 square rudder post and the leading edge.
- 17 Pin down the 1/8 x 1/4⁴ trailing edge.
- 18 Glue the rudder bottom and top into place.
- 19 Install the 1/8 x 1/4 balsa ribs.
- 20 Remove rudder and sand to the shape shown in section B-B.
- 21 Make hinge slots and install the hinges. See plans for locations.

FINAL ASSEMBLY

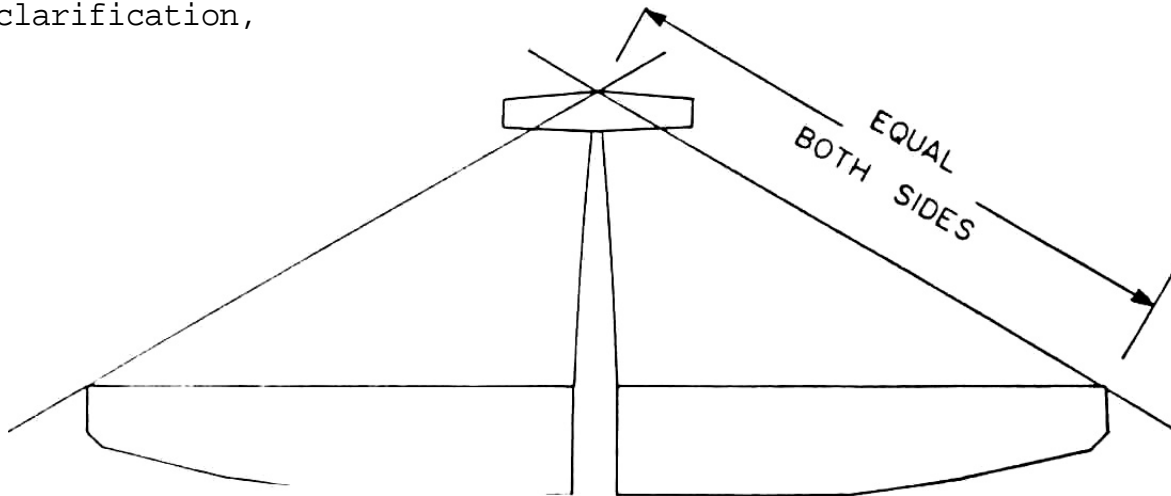
- 1 Mount the stabilizer in the fin, making sure it's 90 degrees to the fin. If it's crooked, remove the pivot tube and redrill until it's straight. Then epoxy the pivot tube into place.



- 2 Align the wings with the fuselage and tail group. HINT: Install the 5/16 fiberglass tube into the fuselage. Do not glue it. Mount the wings to the fuselage with the 1/4 rod. Set this up on two of the same size blocks. (continued on following page)



This will align the wings with each other. You can then twist the fuselage to align the stab as shown above. Look at it from the top to be sure the wings are straight. See the following picture for clarification,



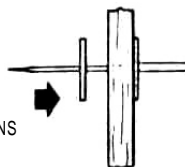
When you are satisfied with the alignment, epoxy the fiberglass tube into the fuselage.

- 3 Align the wings for angle of attack. Note the angle of the wing in relation to the fuselage. Be sure these angles are the same, then push in on the wings so the 3/16 dowel will dent the wood of the fuselage.
- 4 Drill the marks with a 3/16 drill. Install the wings and recheck the alignment. If the wings are crooked, enlarge the 3/16 hole until the alignment is correct. Then fill the void around the dowel with wood or epoxy. But, DO NOT GLUE IN THE DOWEL.
- 5 Sand root rib W-1 so it fits flush with the fuselage. Then, drill three holes in W-1 for the wing rod, alignment pin and spoiler tube. Glue the wing root in place.
- 6 Final sand the model and prepare to cover.
- 7 Remove the spoilers from the wing. Sand off 1/32 of an inch from the end and back, so the spoiler will open and close freely after being covered. You will mount the spoiler later.
- 8 Cover the model as desired.
- 9 Attach the canopy to the canopy base.
- 10 Install the servos as shown on the drawing.

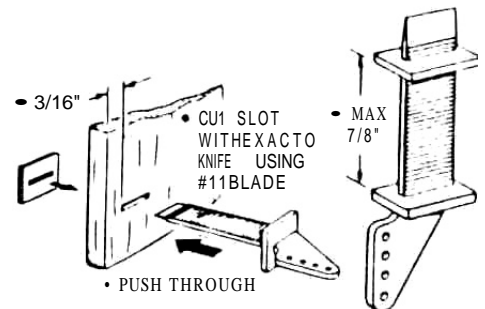
11 Rehinge the rudder with epoxy.

12 Mount the rudder horn.

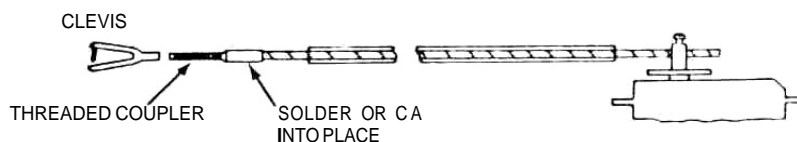
• RATCHET TOP UNTIL TIGHT CUTOFF, (LEAVE 2 SERRATIONS EXPOSED)



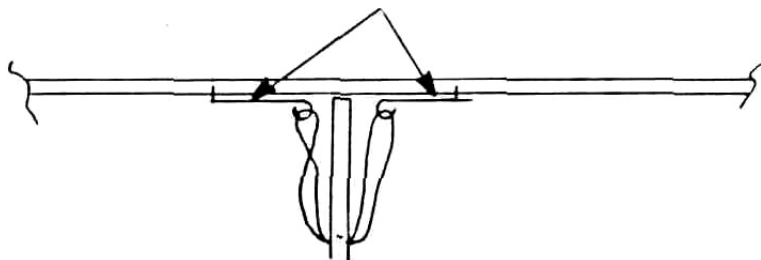
• RUDDER
• ELEVATOR
• AILERON
• FLAPS



13 Crimp or solder a threaded coupler on one end of a stranded cable and screw on a clevis.



- 14 Slide this cable in from the rear to run the rudder. Mount an E-Z connector on the servos and hook up both the rudder and elevator.
- 15 With the canopy removed, drill out the 1/16 canopy-latch wire hole to fit the plastic tubing. Reinstall the 1/16 wire. Slide a piece of plastic tube over the 1/16 wire so it fits flush with F-2 and F-3. Glue in place. This completes the fuselage and tail group.
- 16 To complete the spoilers, start cutting a slot in the spoiler and install a zip horn, cut off the zip horn and glue it into the spoiler next to rib W-1 and in bay 4. It should be close to where the string exits the end of the plastic tube. SEE SECTION A-A.
- 17 Look at the top view of the spoiler on the main wing plan. You will see two lines. These represent hooks for the rubber band return.



BAND FROM HOOK TO HOOK
THROUGH HOLE IN RIB.

- 18 To hinge the spoiler, use a small strip of covering and form the hinge at the front edge. SEE SECTION A-A.
- 19 Put the string through the plastic tube and one end to the control horn
- 20 Use fishing snap swivels to attach the other end to the servo.
- 21 Install the hook into the W-1 root rib. This is used to hook a rubber band between the wings to hold them tight to the fuselage.

YOU ARE NOW READY TO FLY YOUR APOGEE, BUT BEFORE YOU DO:

- * Double check your C.G.
- * Range check your radio
- * Be sure all controls move in the correct direction
- * Complete your pre-flight check list
- * Test glide over tall grass