CHAPTER NINE

The RCM Advanced Trainer

NOTES ABOUT THE ADVANCED TRAINER

The RCM Advanced Trainer, designed by Don Dewey and Joe Bridi, can be built either from the kit from Bridi Hobby Enterprises, 23625 Pineforest Lane, Harbor City, California 90710, or can be built from the construction notes in this chapter along with the full size plans available from R/C Modeler Magazine Plan Service, P.O. Box 487, Sierra Madre, California 91024. The price of the kit is $44.95 and the price of the plans are $3.00. The Advanced Trainer is designed for the novice who has gained the necessary training experience on the Basic Trainer, or for the beginner who has an experienced instructor who will stick with him during the training phase.

The RCM Advanced Trainer has 672 square inches of wing area with an all-up flying weight of from 5½ lbs. to 6¼ lbs. Although designed for a .40 to .61 cubic inch displacement engine, we strongly recommend the use of a K & B .40 or O.S. Max .40 RC engine for your training flights. Later, you will find that this aircraft will be capable of all the maneuvers in the AMA and FAI pattern when a .61 engine is installed. The photographs accompanying this article were taken by the RCM Staff building the Trainer from the highly prefabricated kit from Bridi Hobby Enterprises. The total assembly time, less covering and installation of radio, engine, and hardware is 0-10 hours. Following the instructions and photographs for building the Advanced Trainer from the kit, a reduced set of plans and instructions will be provided for those who wish to build from the plans available from R/C Modeler Magazine.

BUILDING THE RCM ADVANCED TRAINER FROM THE KIT

Rudder:

A. Glue the pine control horn insert to the notch provided in the rudder, use epoxy glue. (This part is in the "hardwood bag," be sure to use the thinner of the two pine blocks).
B. The balance of the rudder, fin and dorsal, will be assembled later.

Elevator:

A. Edge glue the sheeting together, use masking tape to hold the two 1/16 sheets together while drying.
B. Lay one completed sheet on building board, glue trailing edge spar, tips, leading edge spars and center fillers in place on sheet. Glue the ribs in place starting at the tip and working in to the center filler.
C. Glue top sheet in place and sand stab to shape.
D. Glue the pine control horn insert to the notch provided in the elevator; use epoxy glue. (This part is in the "hardwood bag". Be sure to use the thicker of the two pine blocks.
E. Hinge the stabilizer and elevator together using a minimum of four hinges. Epoxy glue should be used and all hinges should be pinned using a wood toothpick or small dowel.

NOTE

Coat the hinge center line with any type of mold release prior to using the epoxy to prevent gluing the hinge action.

Wing:

A. We recommend that the wing be built on the RCM Magazine wing jig. All ribs have the ¼" dia. hole required for the jig. (See Chapter 6.)
B. If the wing jig is used the following steps are recommended.
   1. Place all ribs, except the center rib, on the ¼" rods. The center angled rib is added later.
   2. Add the notched top and bottom main spars.
   3. Add the notched leading edge. Be sure that the 3/32" leading edge sheet does not protrude over the top of the leading edge.
   4. Add the notched trailing edge.
   5. Glue and let dry. Do not remove from the jig.
   6. Add the leading and trailing edge sheeting.
   7. Dampen leading to ensure easier bending.
   8. Add the cap strips for outer five ribs.
   9. Remove the wing half from the jig and repeat steps 1 through 9 for the other half.
   10. Join the wing halves as follows:
      a. Cut the spars, leading edge and sheeting at the center rib notch and sand the center flat.
      b. Glue the two small ¼" dowels, in the "hardwood bag," into the center angled rib. Be sure an equal amount of dowel protrudes from each side of the rib.
      c. Coat the center angled rib


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with epoxy then slide the two completed wing panels on the dowel; this will insure a true wing. Block up the tips the necessary amount to insure a good butt joint at the center and allow the wing to dry.

d. Add the center section 3/32" sheet top and bottom.
e. Add the trailing edge pine center section. Be sure to epoxy the aileron linkage into the pine trailing edge. There is a left and a right aileron linkage; they are correct when the servo connection end is on the bottom of the wing.
f. Sand the center section then resin the entire center section using at least 2" wide glass cloth. Coat the aileron linkage with mold release before coating with resin to insure that they will remain free.
g. Add the ailerons using a minimum of 3 hinges per aileron. Again pin the hinges as specified in the elevator instructions.
h. Add the 3/16" sheet wing tips and filler blocks; it is necessary to cut the filler block stock into eight equal parts.
i. Sand the completed wing as necessary.

C. If the wing jig is not used, the following will insure a straight wing.
1. Pin the rear bottom sheeting down over the plans and glue the notched trailing edge to the sheeting.
2. Raise the bottom spar ¼" up off the plans with spacer or scrap.
3. Add all the ribs except the center angled rib.
4. Add the top spar.
5. Add the notched leading edge and glue all parts.
6. Add the leading and trailing edge sheeting.
7. Add the outer cap strips.
8. After all glue has dried, remove the wing from the working surface and add the bottom leading edge sheet and the cap strips.
9. Repeat steps C1 thru C8 for the other half, then continue the instruction at step 10a through 10i.

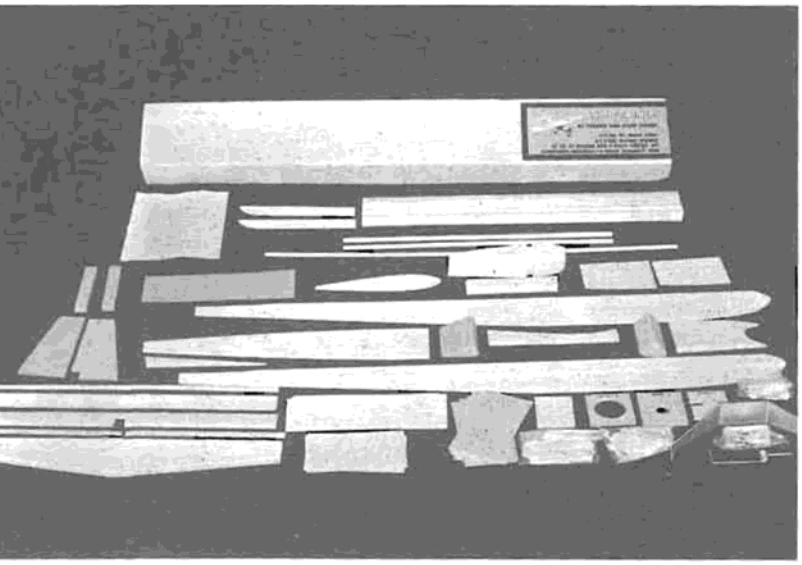
Fuselage:

A. Start construction of the fuselage by marking the location of former 2 and 3 on the **inside** of the two fuselage sides. Be sure to use a square on the top edge of the sides when marking the location.
B. The fuselage is built upside down, start by pinning ¼" top block down on a flat surface. Add the two ¼" x 3/8" x 24" stringers, notice on the plans that they do not go all the way to the rear of the top block.

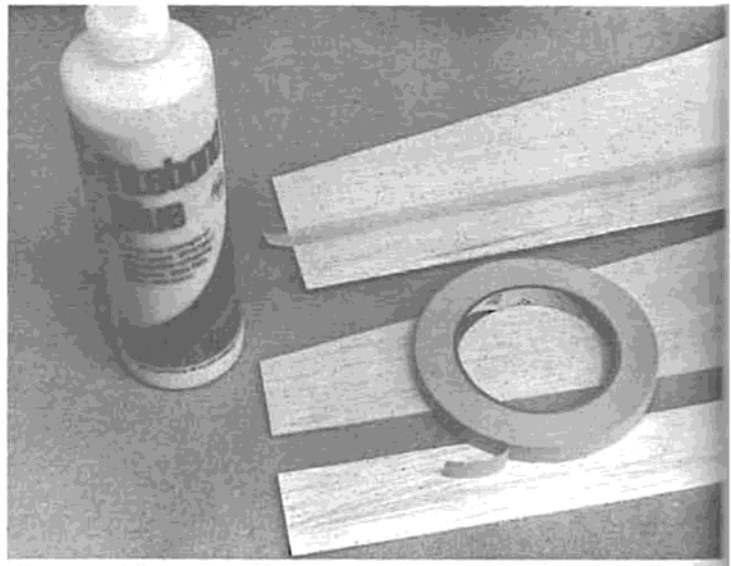
PLEASE NOTE:

The step-by-step photo sequence of the construction of the RCM Advanced Trainer is based on the assembly of the kit manufactured by Bridi Hobby Enterprises. Following these photographs you will find the text for construction of the RCM Advanced Trainer from the full size plans available from R/C Modeler Magazine. While the kit construction photos may vary slightly from the plan-built sequence for construction, they can be used as a guide.

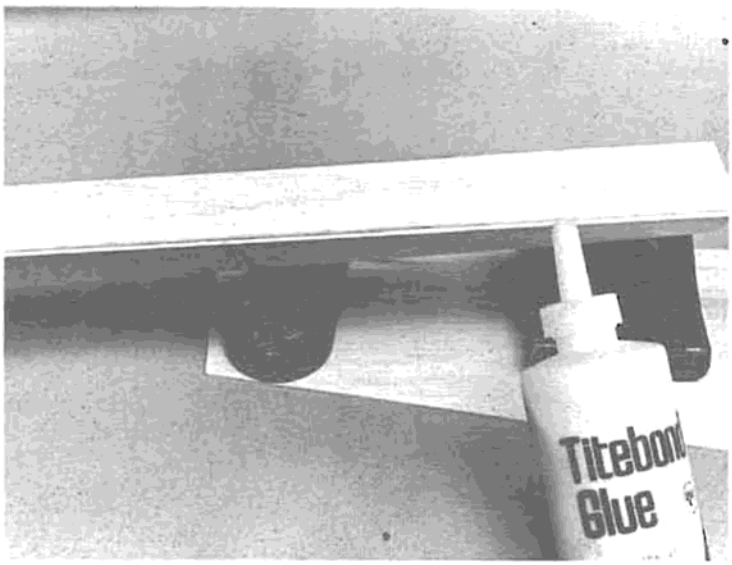
C. Add the ¼" x ¼" top block braces and cut the stringers as shown on the plans.
D. Add the two fuselage sides to the top block and Former 3 as marked on the inside of the fuselage sides. Note that Former 3 goes at the forward end of the top block and on top of the ¼" x ¼" cross brace. Block the sides to insure they are square (90°) to building surface. Be sure to block the rear of the fuselage sides open at least ¼" for the elevator horn. With the sides still blocked add the 1/16" sheet bottom starting at the rear and stopping at Former 3.
E. Slide the hatch under the front of the fuselage sides. Placing forward in proper position as marked on the plans. Do not glue in place. Now add Former 2 and the main landing gear ¼" ply mount plate.
F. Then add the 3/16" balsa tank compartment doubler being careful that they are up against Former 2 tight and that no glue gets on the hatch. If necessary place a piece of wax paper between the hatch and fuselage sides before gluing the doublers.
G. Add Former 1 (¼" ply) using epoxy glue; be sure it is tight against the tank compartment doublers. Now add the balsa motor mount doublers using epoxy. Be sure they are tight against Former 1 and align with the bottom of the fuselage.
H. Add the 1/16" ply bottom; note on the plans that it does not go all the way to the rear of the main landing gear plate. Complete the 1/16" balsa bottom sheeting.
I. Remove the fuselage from the building surface.
J. Add the cabin rear block, the cabin sides, then the cabin front block. The cabin front and rear blocks are not interchangeable; check the plans before gluing.
K. Place the hatch over the tank compartment and mark where the hatch hold down rear pins and front 1/8" ply hold down go. Glue in place, using epoxy.
L. Slide the left and right motor mount in place. Do not glue. Check the motor fit, then remove the motor mounts and cut as necessary. Now epoxy the motor mounts in place; be sure that the right thrust offset has been maintained.
M. Sand the entire fuselage.
N. Add the NyRod for the motor control and the nose wheel steering.
O. Coat the motor area and inside the tank compartment with coating resin, also the bottom of the hatch.
P. Add the completed stabilizer/elevator assembly, making sure they are square to the fuselage.
Q. Add the fin and dorsal.
R. Add the rudder hinges and pin as noted previously.
S. Cut a piece of the outside NyRod about 2 inches long and epoxy in place in the top rear of the fuselage to pass the rudder pushrod through. (See plans for angle.)
T. Add the two 1/16" ply main gear plate braces.
U. Add the triangular stock as shown on the plans.
V. This completes all the structure.



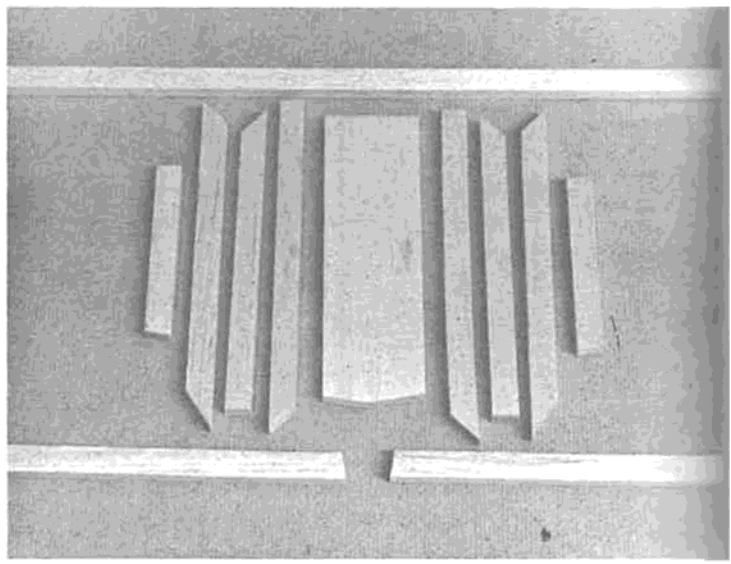
Parts layout of the RCM Advanced Trainer from Bridi Enterprises.



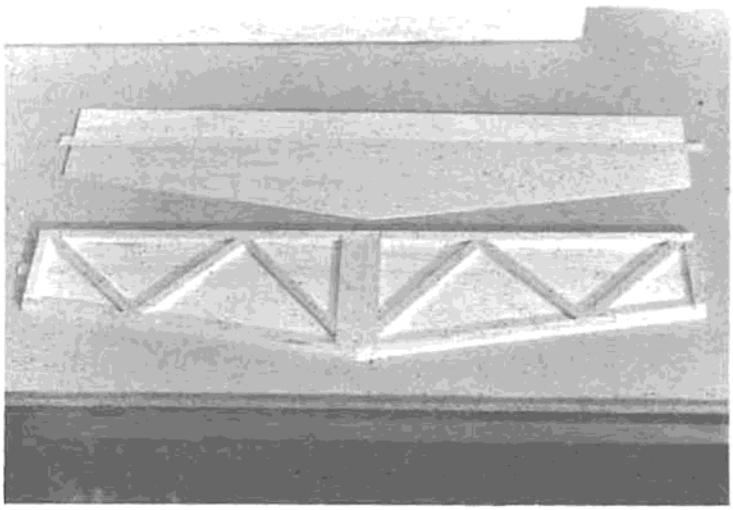
The top and bottom stabilizer sheets are joined with a piece of masking tape in preparation to joining them together.



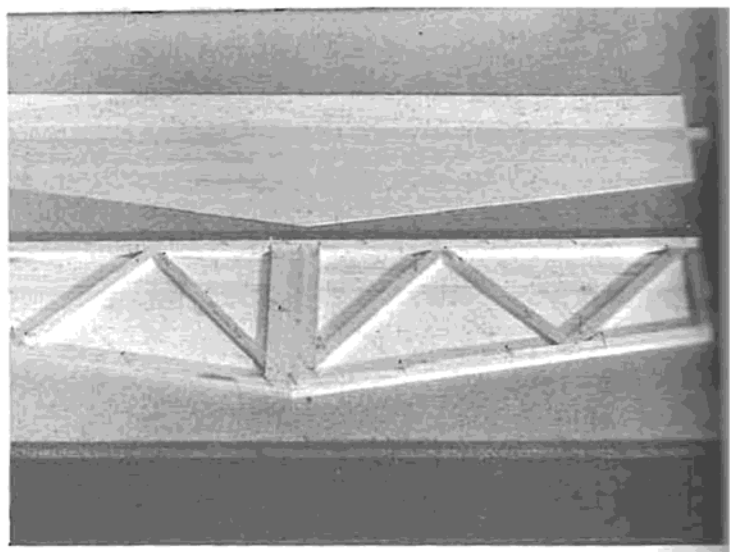
Bend the stabilizer sheets back on the masking tape and join together with a bead of Titebond glue, then weight down on a flat surface until dry.



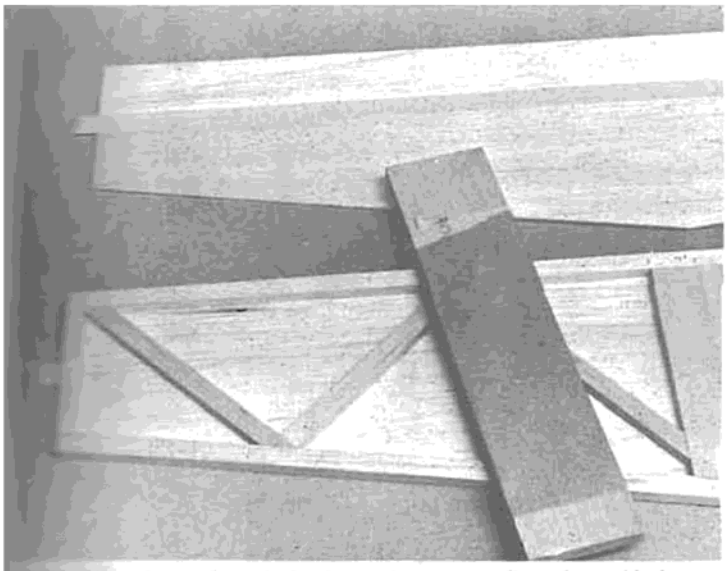
All of the parts of the stabilizer are precut and ready for assembly.



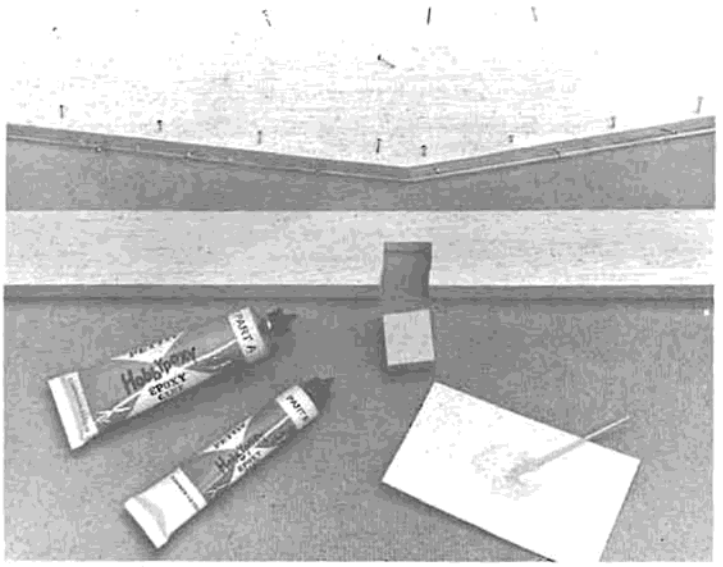
Glue all the internal stabilizer parts to the bottom stabilizer sheeting.



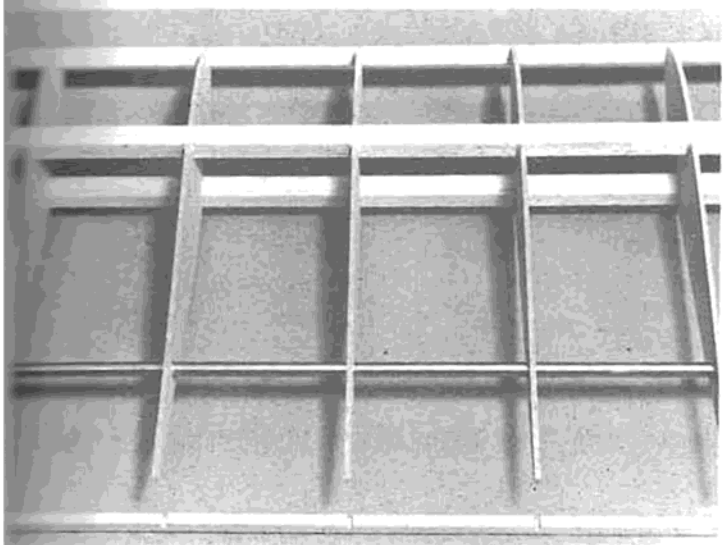
A close-up of the internal framework of the stabilizer ready for the top sheeting.



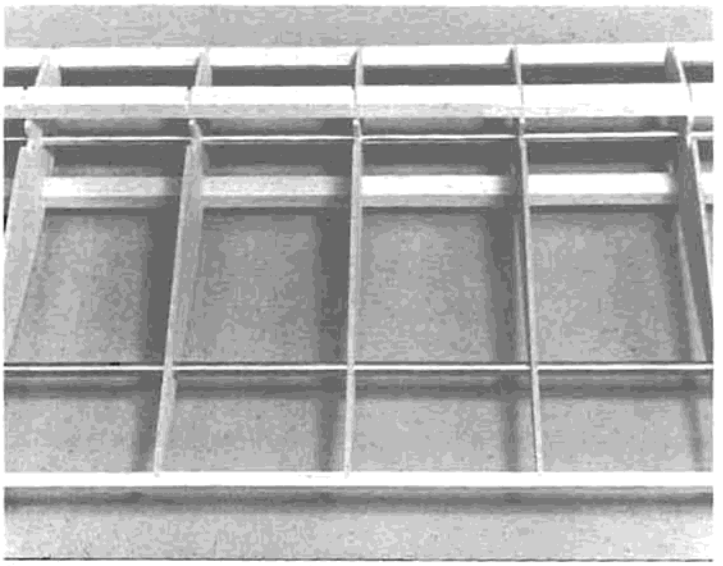
the pins and sand the internal structure flat, then add the top sheeting.



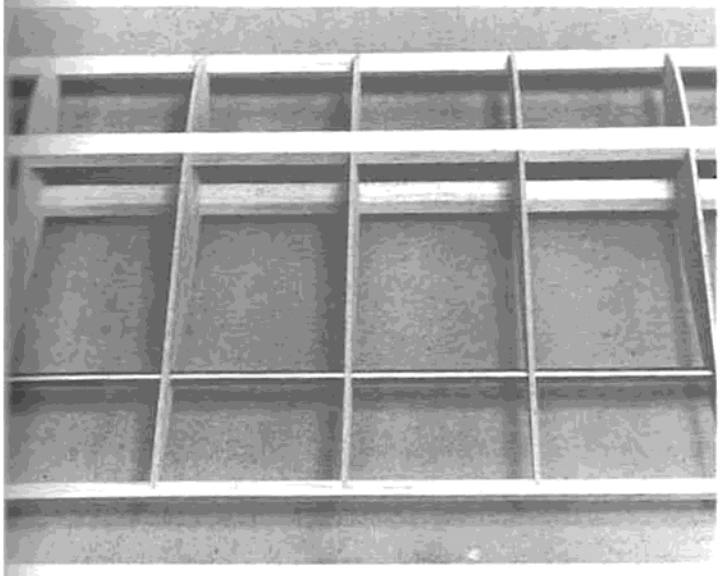
While the stabilizer is drying, epoxy the pine control horn block in place on the elevator.



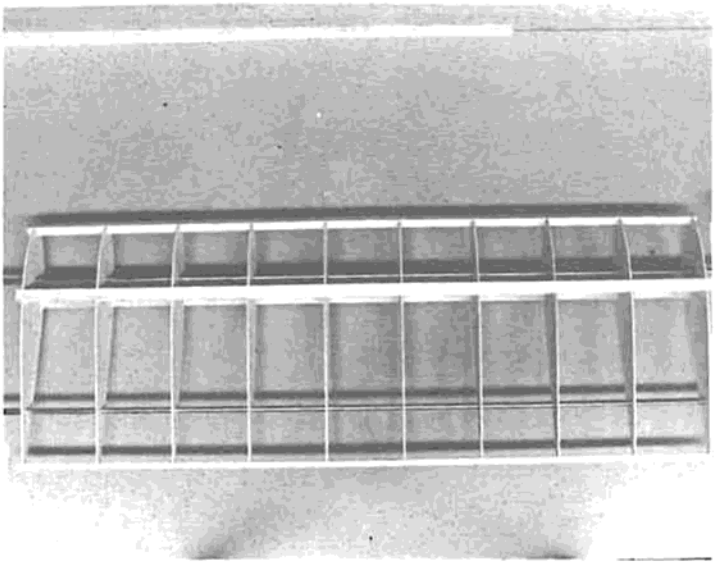
the wing ribs on the RCM Wing Jig and use the top and bottom spars the leading edge to properly position the ribs.



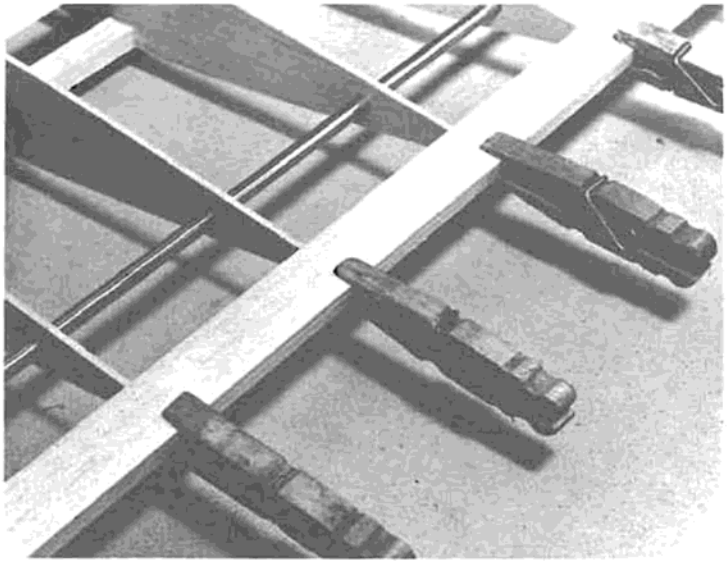
Glue the leading edge, trailing edge and bottom spar in place.



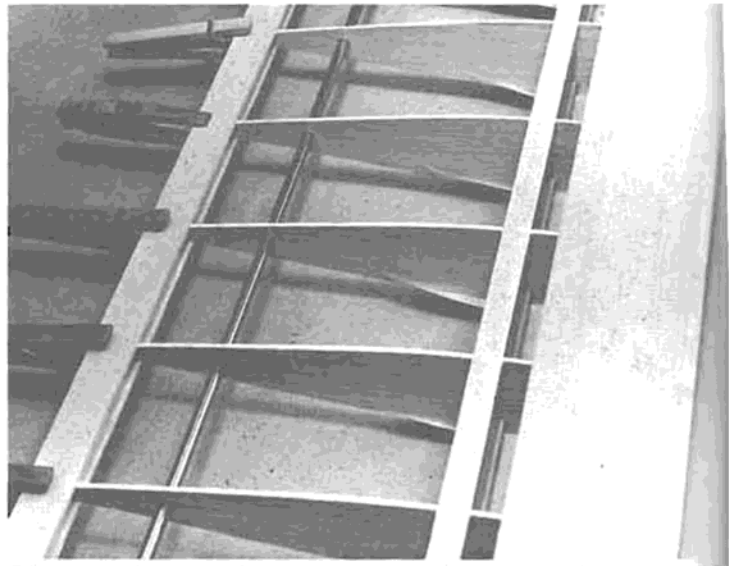
e the top spar in place.



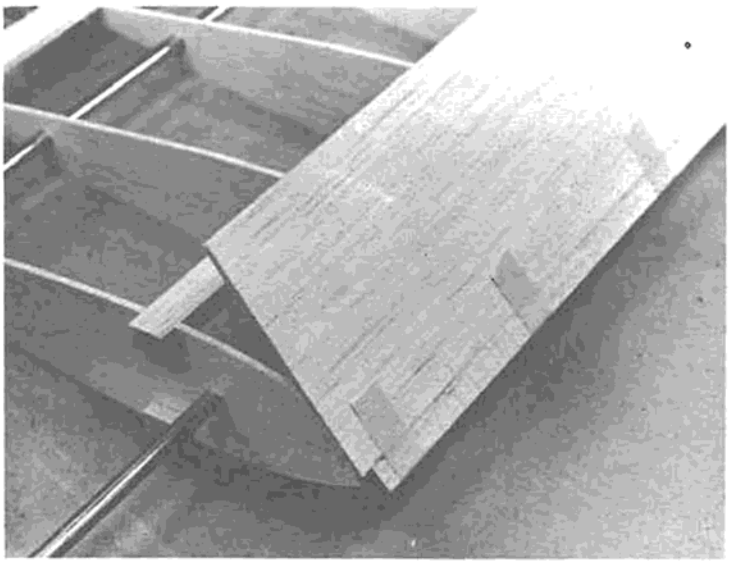
An overall view of the completed basic framework of one wing panel on the Wing Jig.



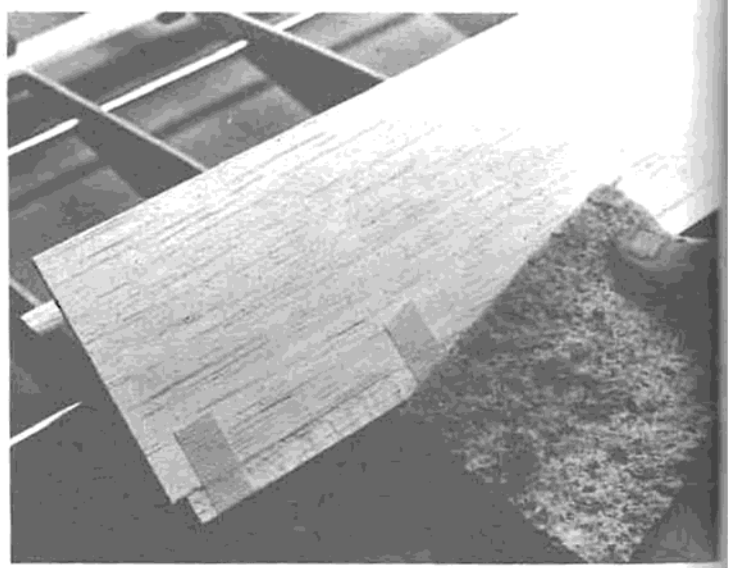
Glue the top and bottom trailing edge sheet in place and hold until dry with clothespins.



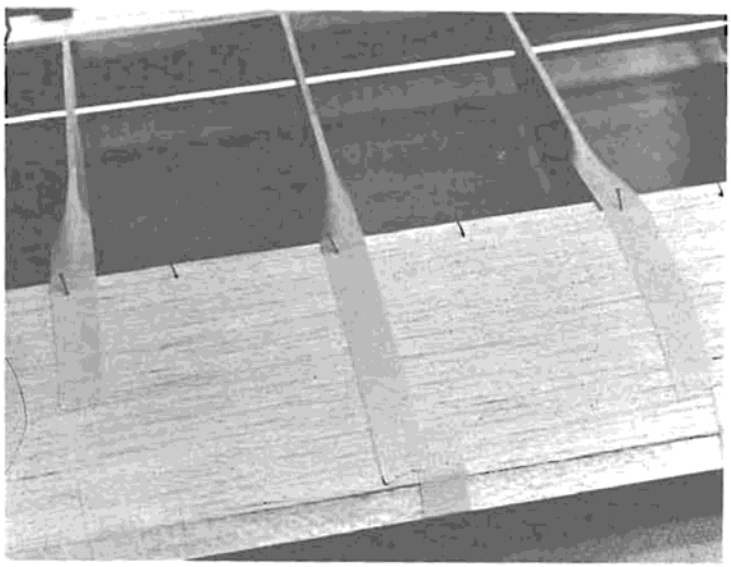
Glue the leading edge sheeting to the leading edge and hold in place with masking tape.



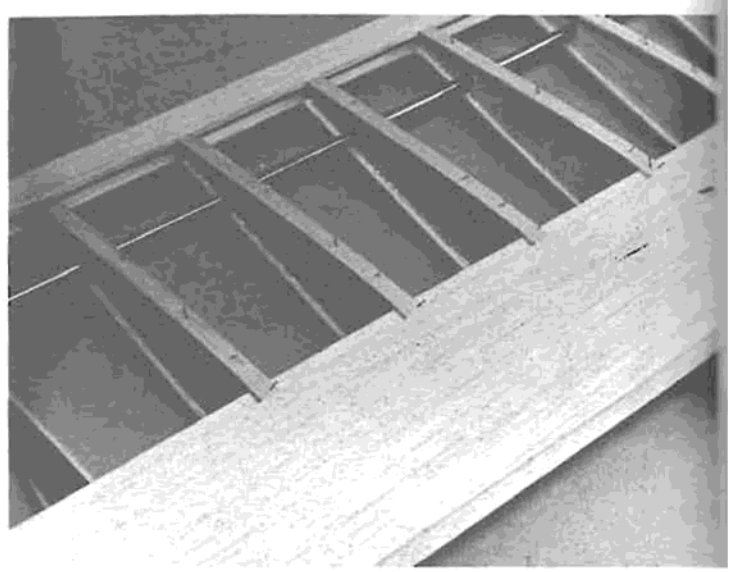
Close-up view of the leading edge sheeting ready to be formed to the contour of the ribs.



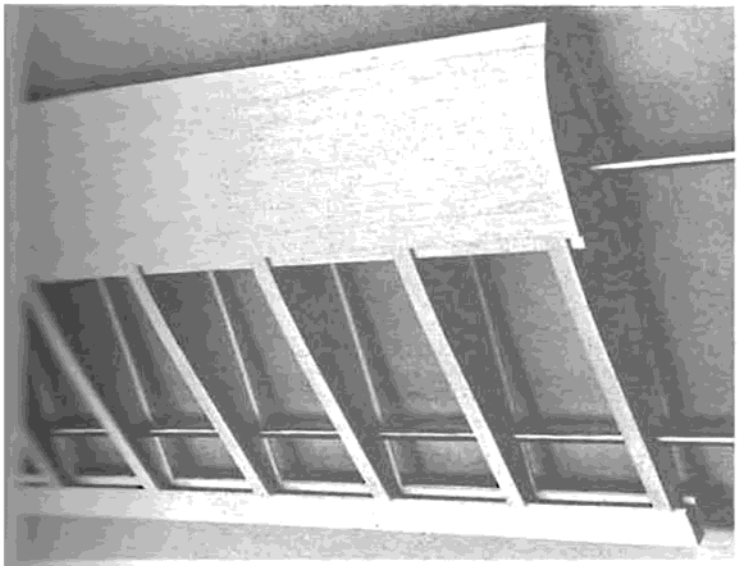
With a damp sponge moisten the leading edge sheet so it will more easily form to the contour of the ribs.



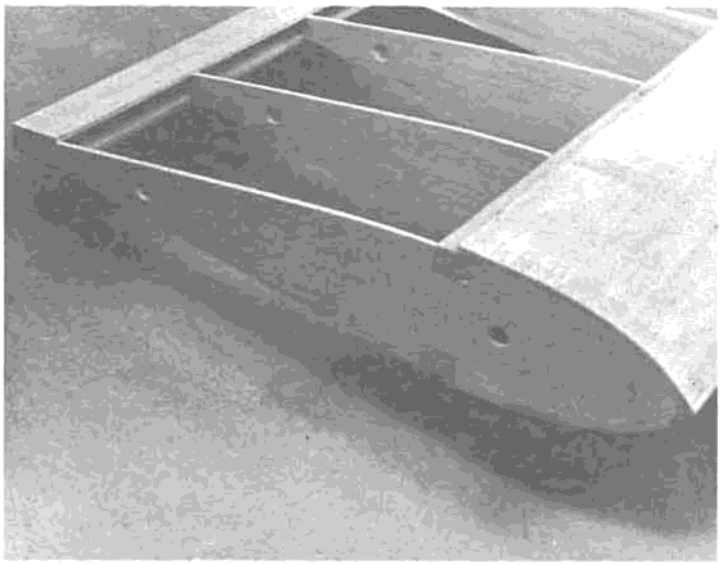
Glue the leading edge sheeting to the ribs and the main spar and hold in place with masking tape and pins.



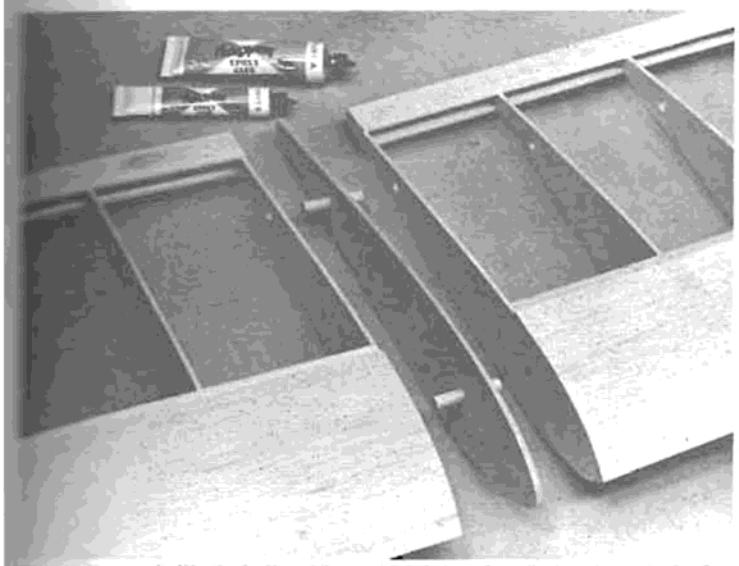
Glue all cap strips in place and hold with pins until dry.



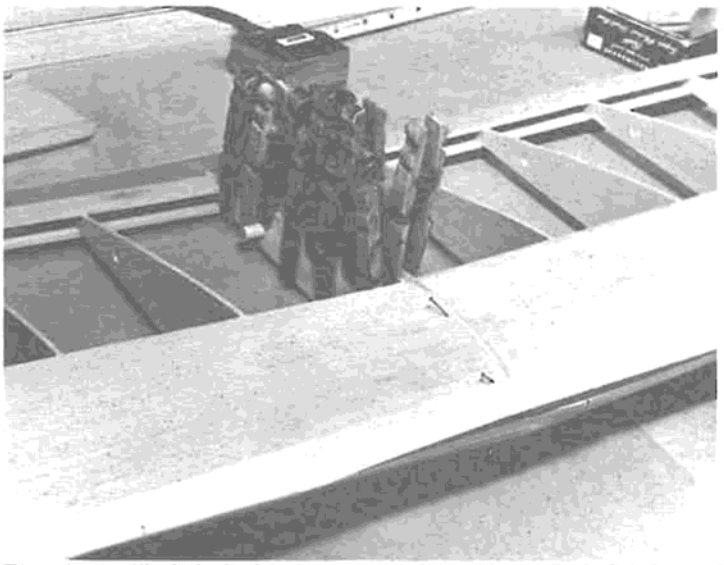
of the completed wing panel with all pins and tape removed.



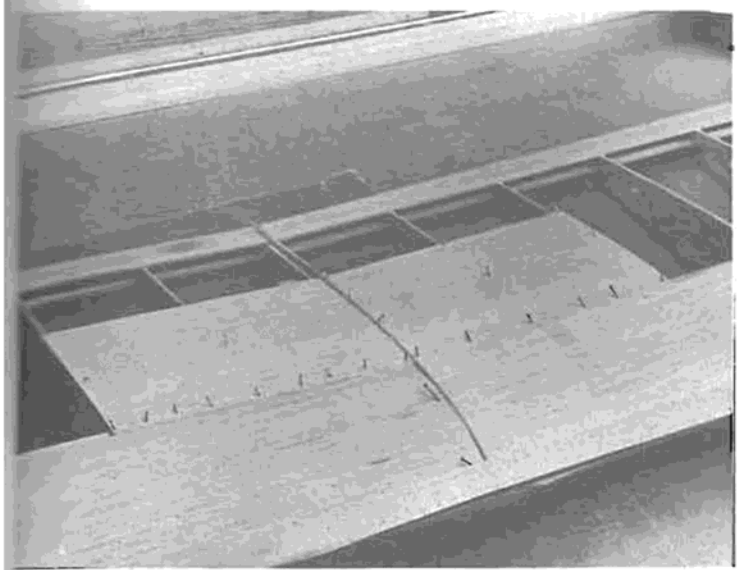
The wing panel is removed from the RCM Wing Jig and the ends sanded flush.



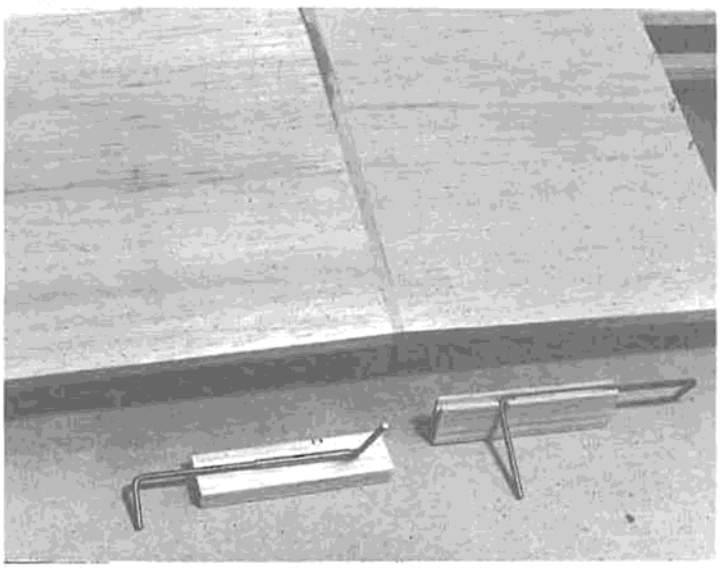
pre-tapered dihedral rib with panel joining dowels in place ready for



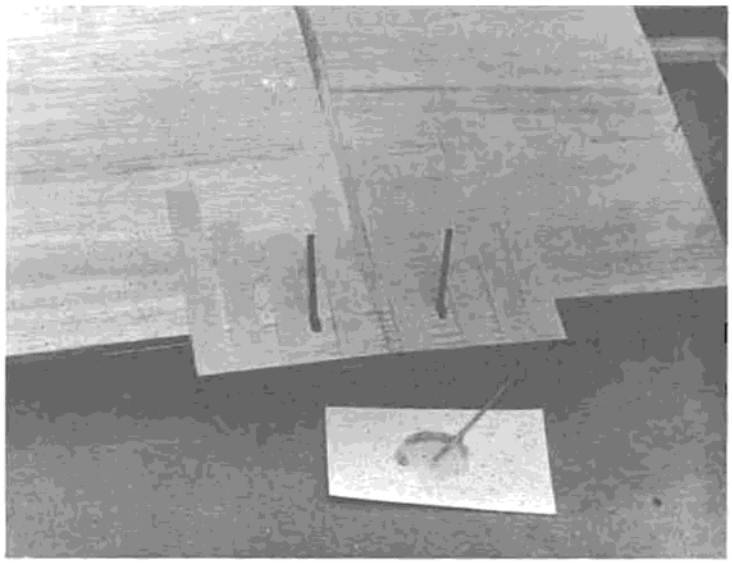
The center dihedral rib has been epoxied in place and clothespins and masking tape are used to hold the panels in place until the center section has dried.



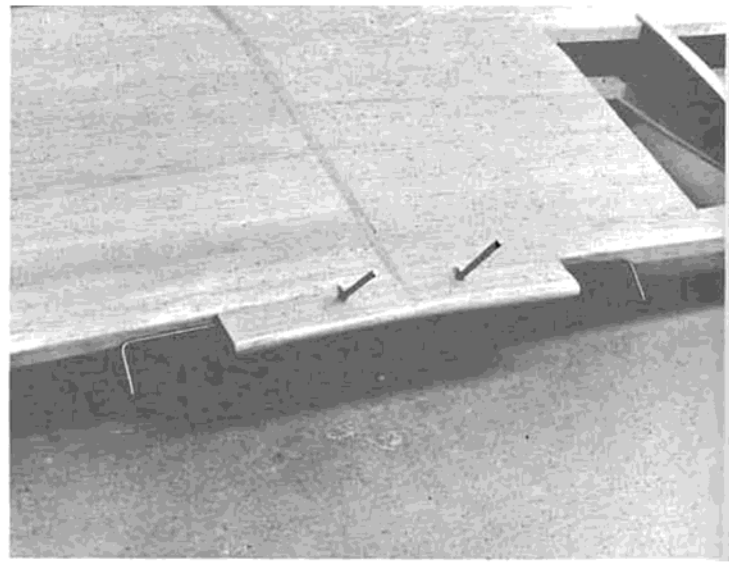
Adding the center section sheeting.



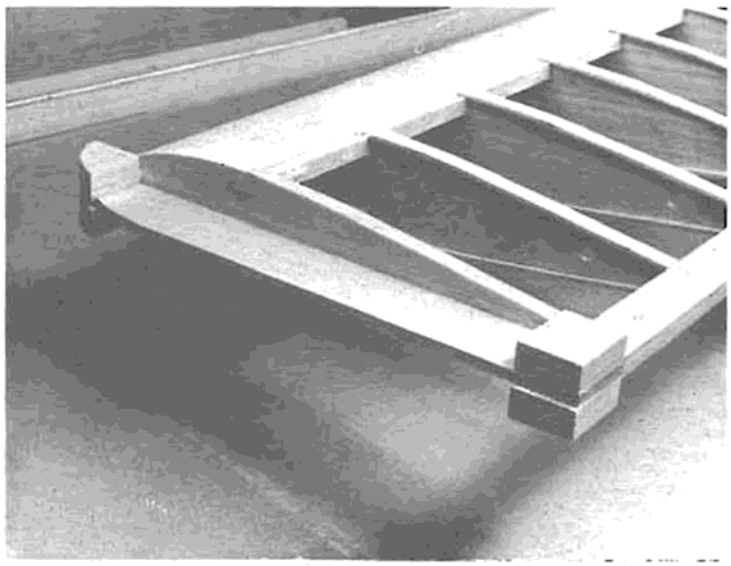
Preparing the grooved center section trailing edge blocks and aileron linkages.



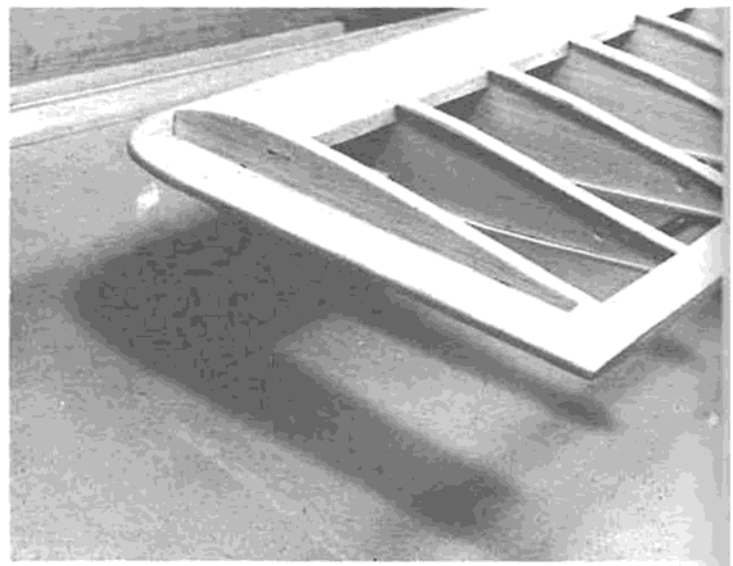
Center section trailing edge blocks and strip aileron linkages are held in place with masking tape until the epoxy glue dries.



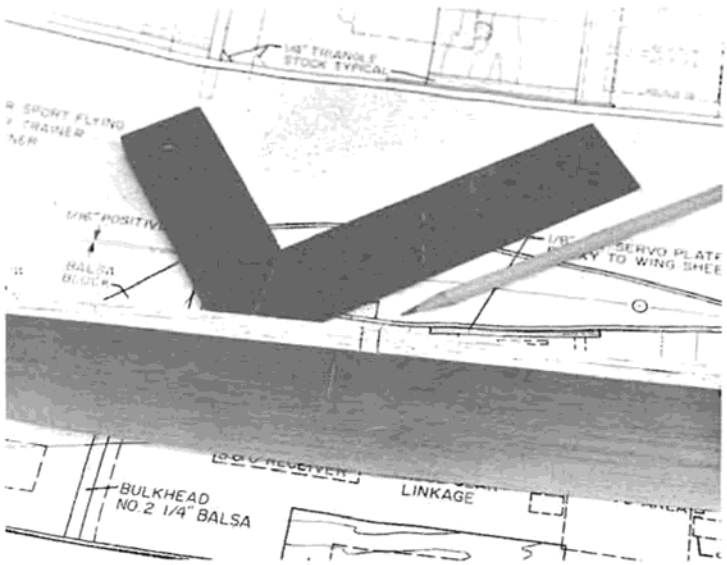
The completed wing center section.



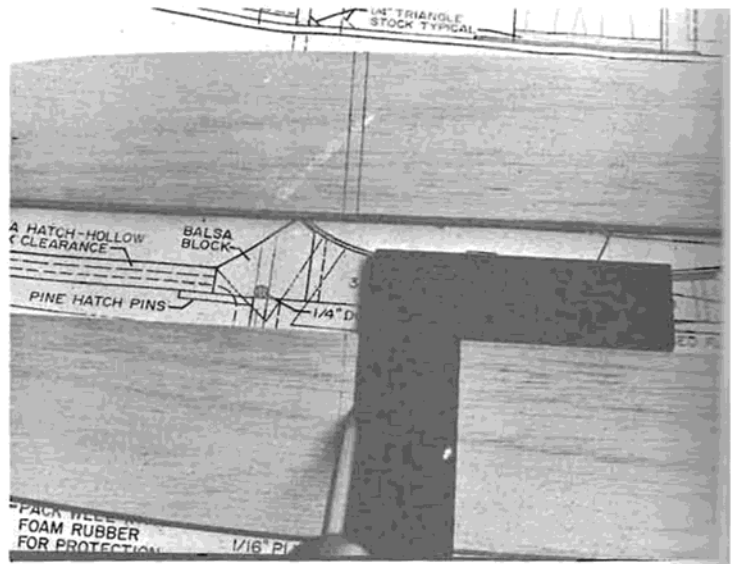
Building up the leading edge and trailing edge of the wing tips.



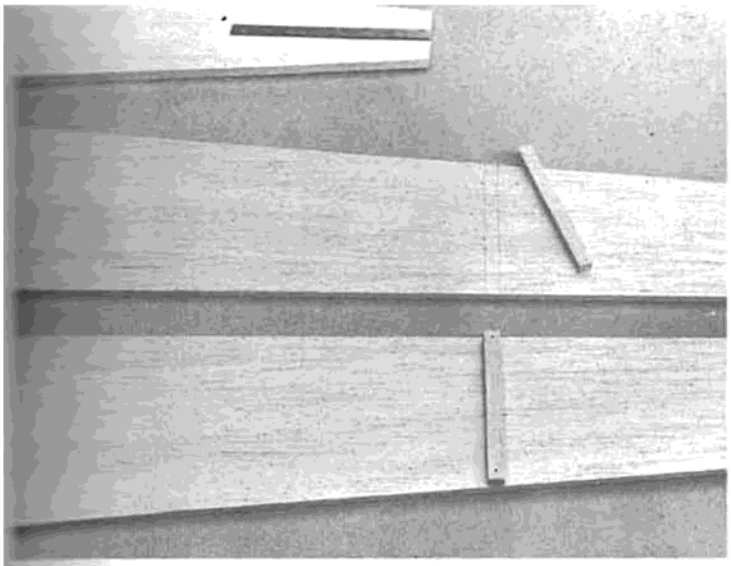
The leading and trailing edge of the wing tips sanded to proper airfoil shape.



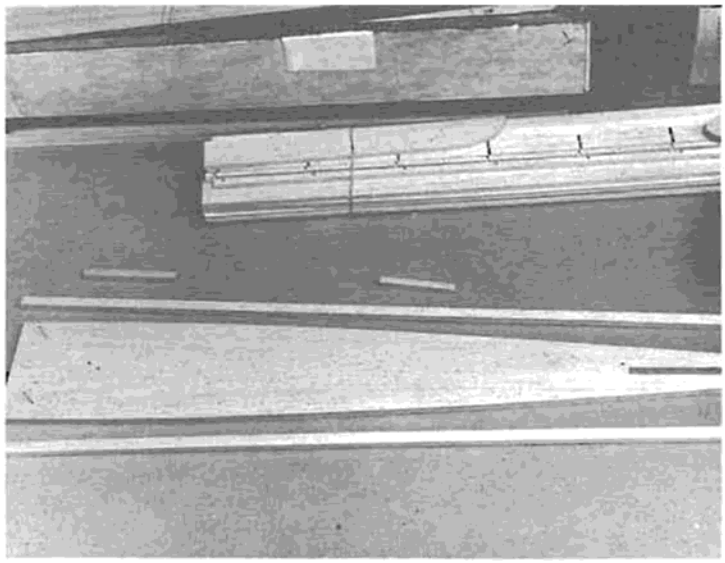
The next step is to mark the location of all fuselage formers on the fuselage sides.



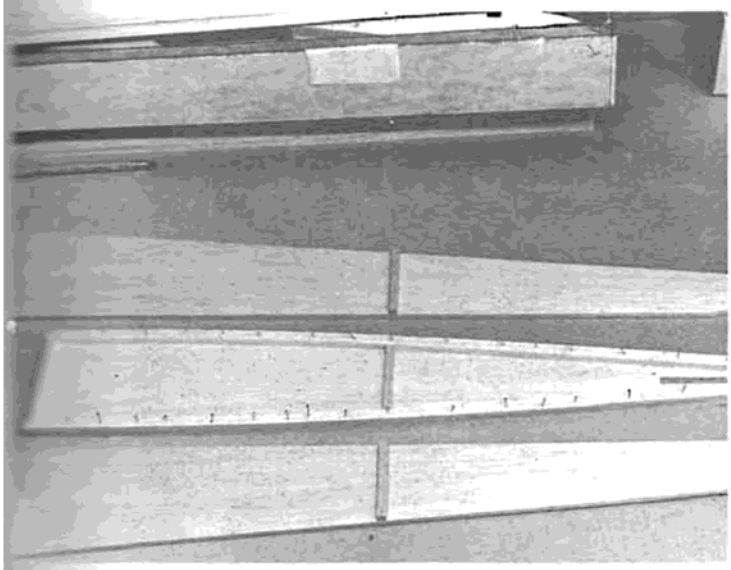
Be sure to use a carpenter's square to properly locate the position of the fuselage bulkheads.



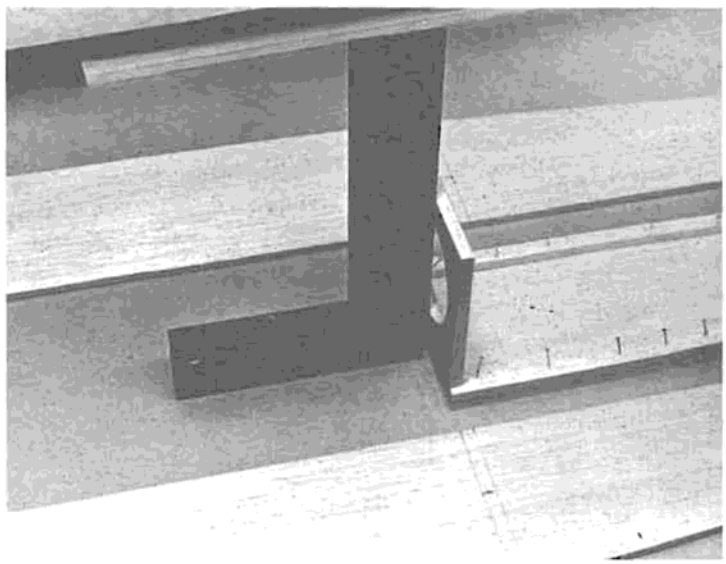
Gluing the vertical fuselage supports in place.



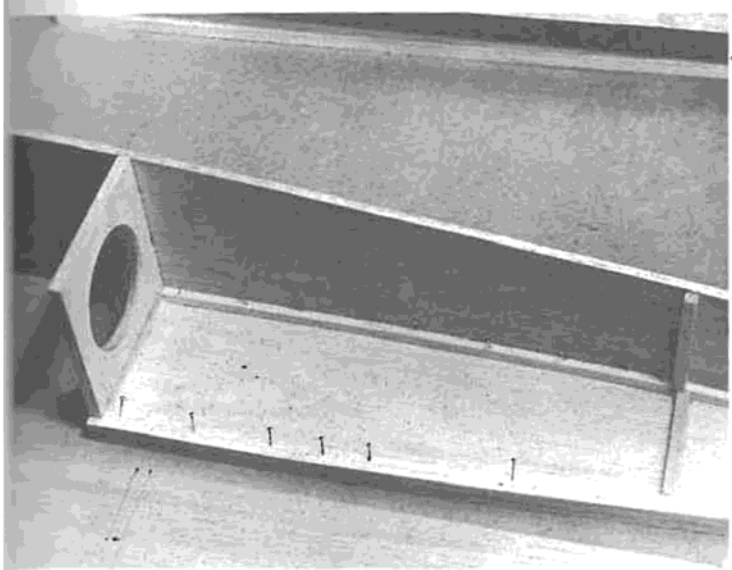
Gluing the longerons to the fuselage top sheeting.



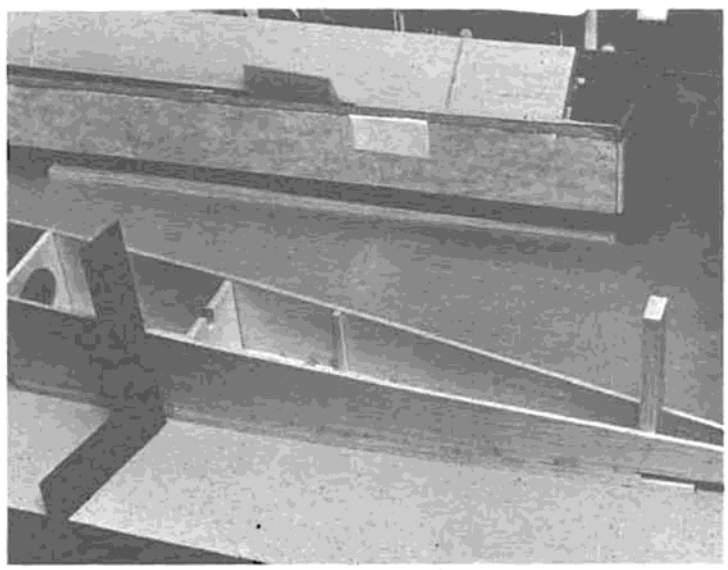
Top sheeting longerons and cross braces glued in place.



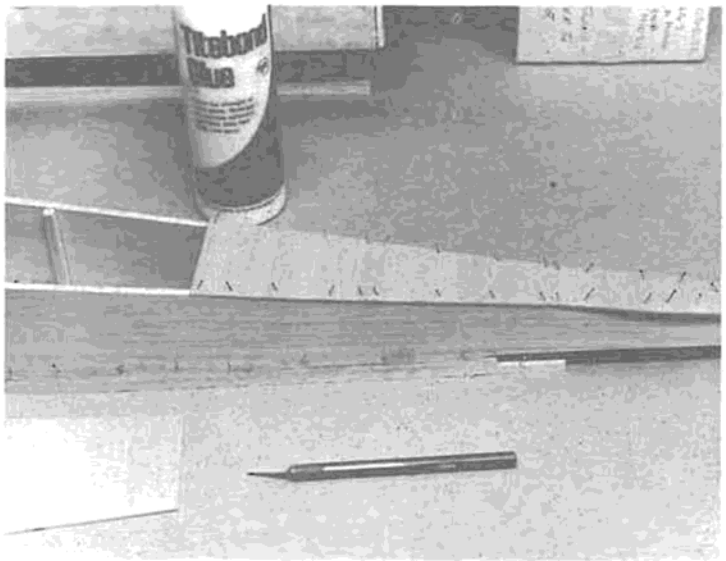
Gluing the bulkheads to the top sheeting and checking alignment with a carpenter's square.



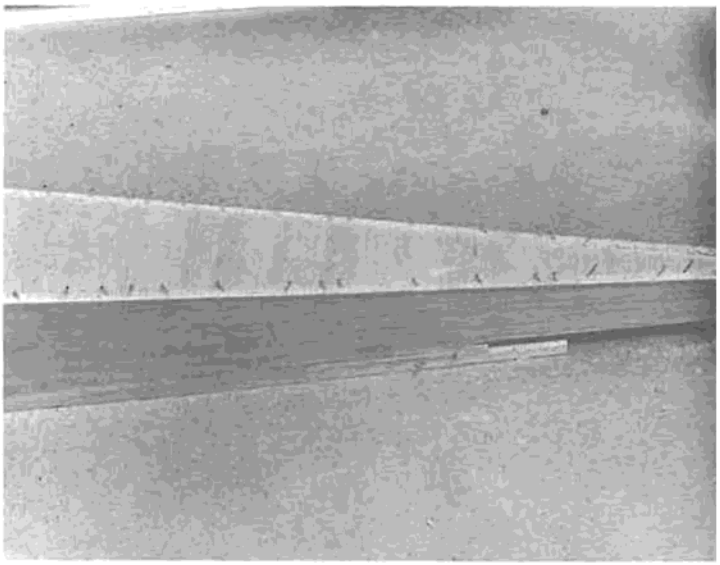
Joining the top sheeting with bulkhead in place to the fuselage sides.



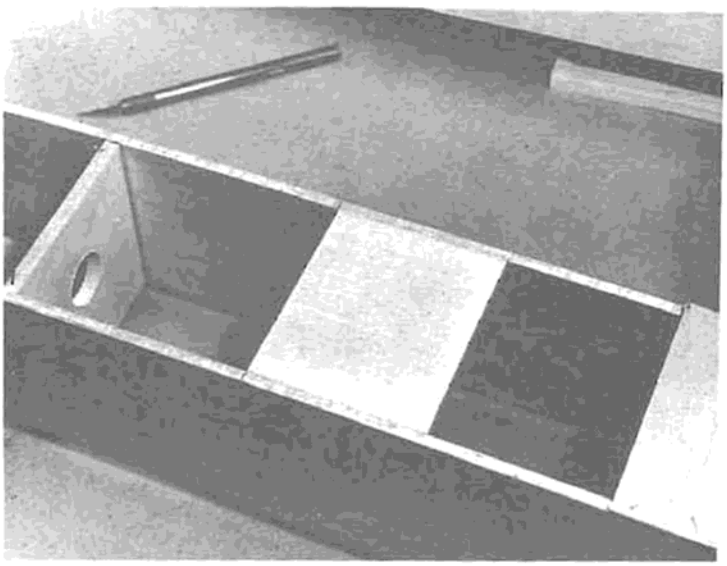
As the fuselage bulkheads are glued in place to the sides, check alignment with a carpenter's square.



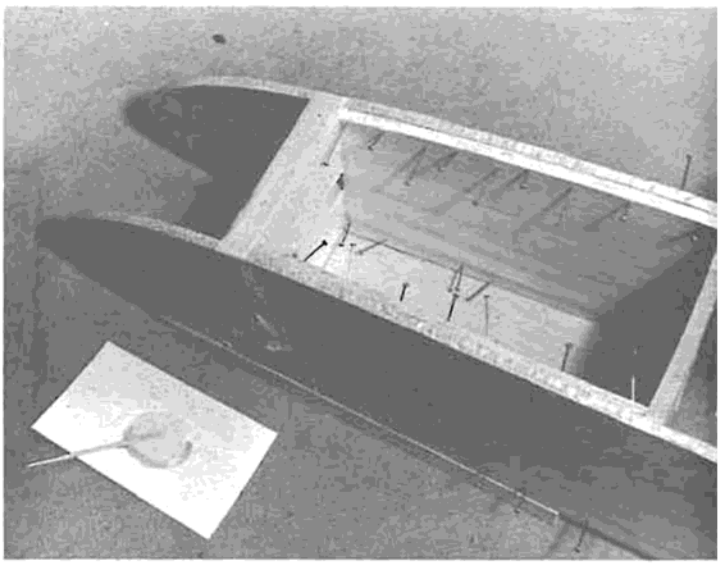
Top rear sheeting is glued and pinned in place using Titebond glue.



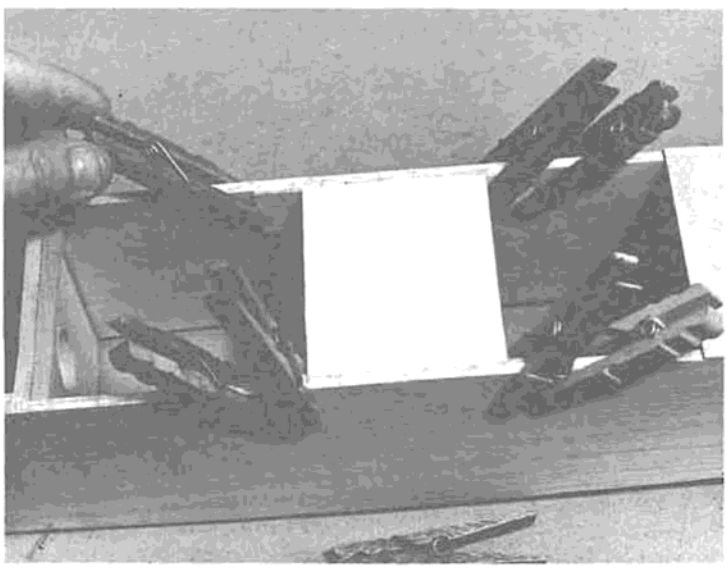
A close-up view of the top rear sheeting.



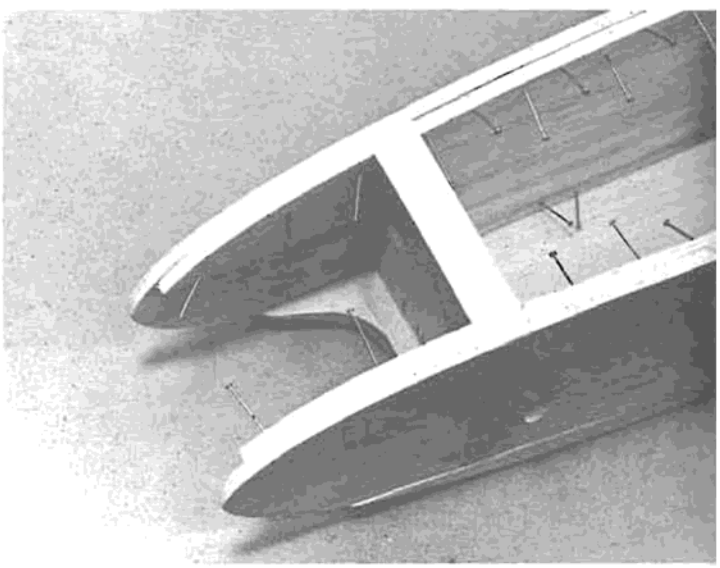
Plywood main landing gear brace is glued in place with epoxy.



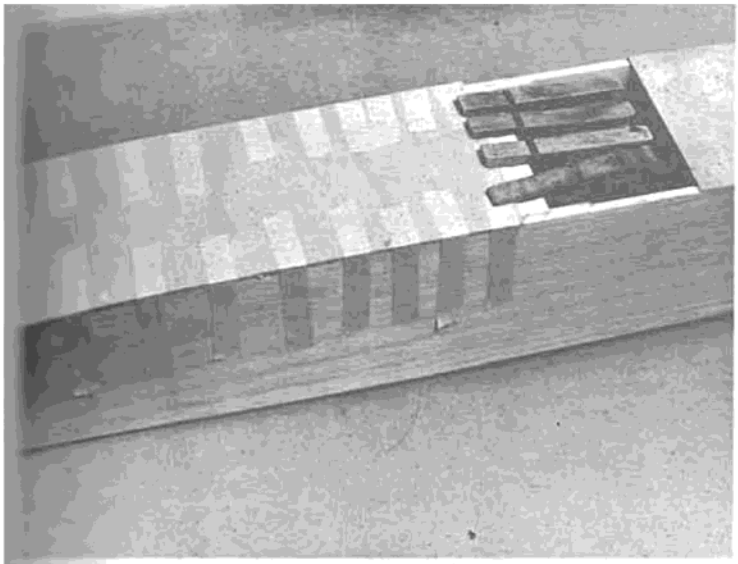
The firewall and fuel compartment doublers are epoxied in place.



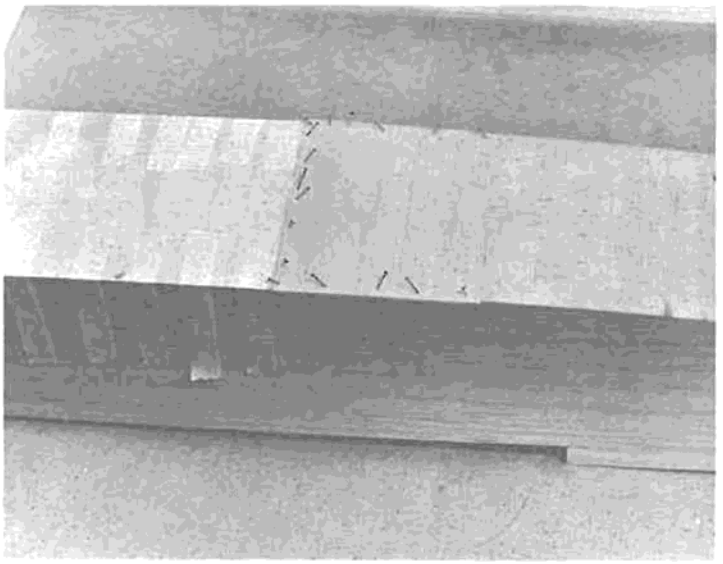
1/16" plywood main landing gear support braces are epoxied and clamped in place with clothespins until dry.



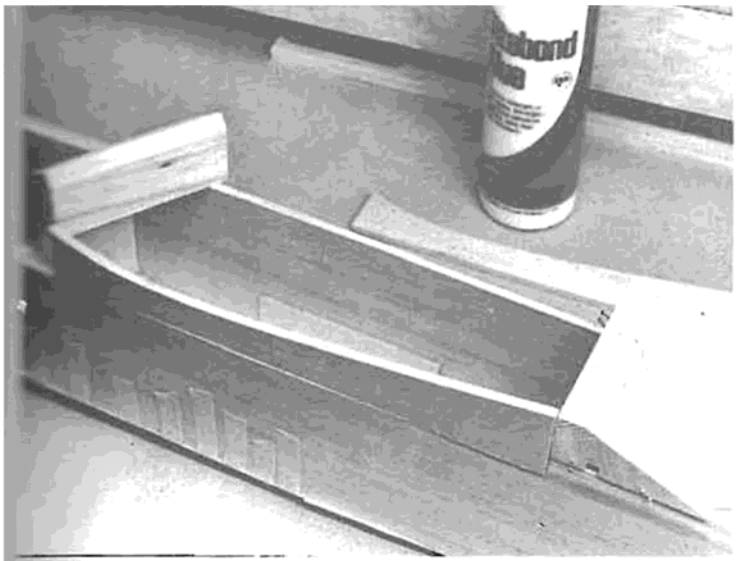
The nose doublers and beam motor mount supports are epoxied in place.



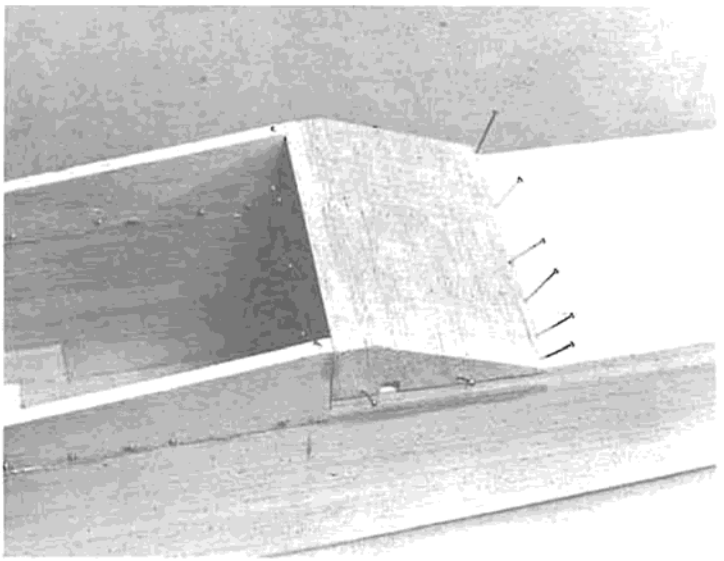
The lower front fuselage plywood sheeting is glued and taped in place until



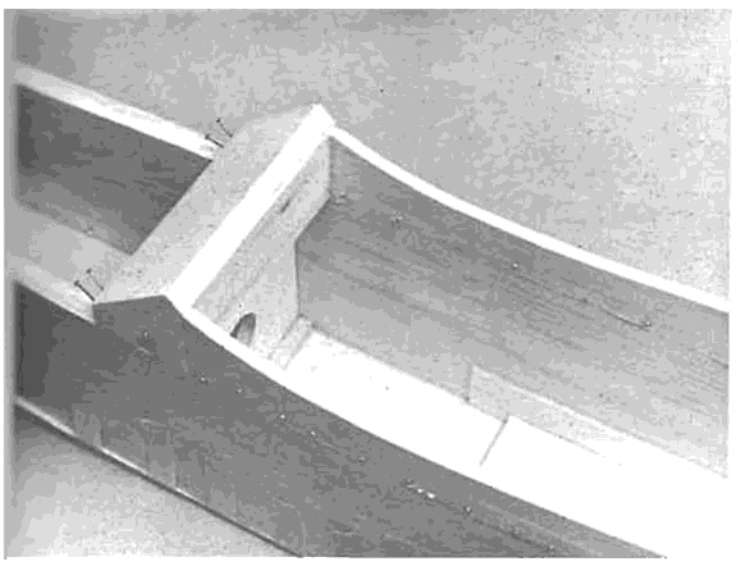
The bottom rear balsa fuselage sheeting is glued and pinned in place following the plywood sheeting.



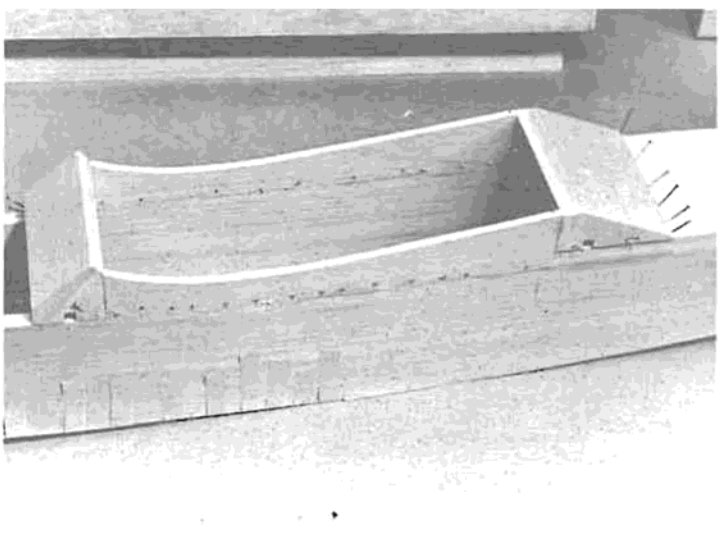
The upper cabin parts are glued in place with Titebond glue.



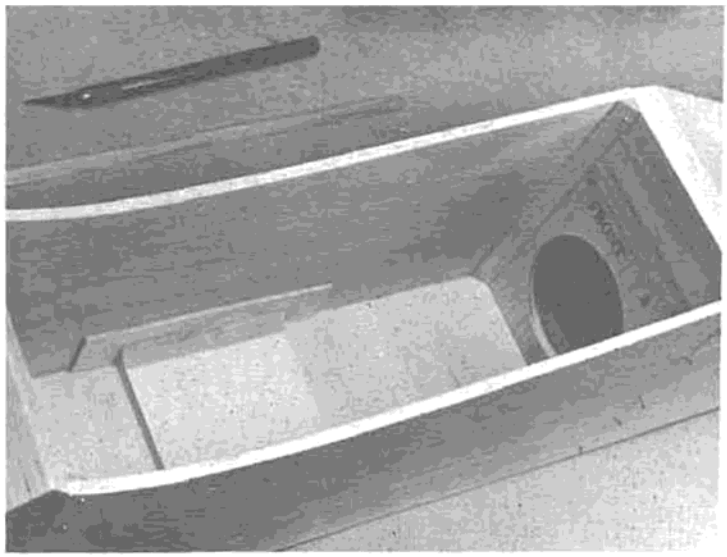
The rear cabin block is glued and pinned in place.



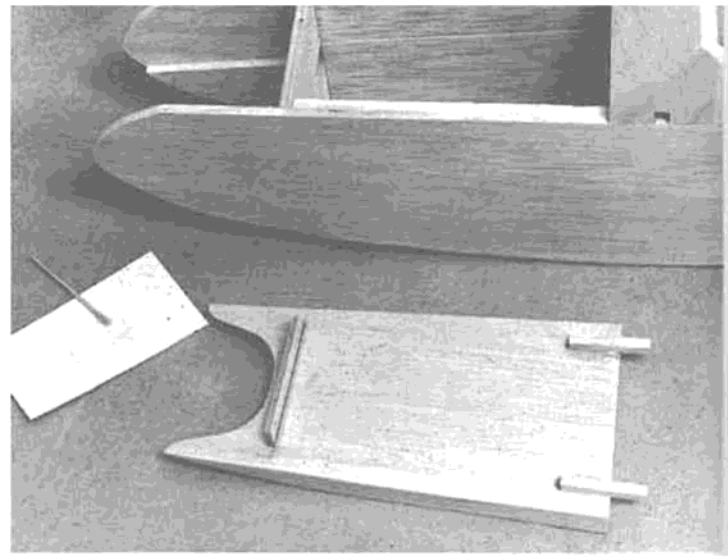
The front cabin block is glued and pinned in place.



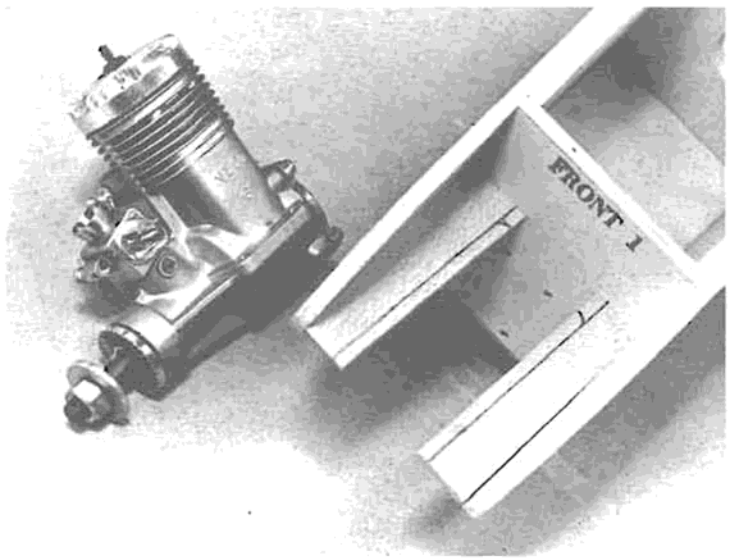
An overall view of the completed cabin structure before sanding.



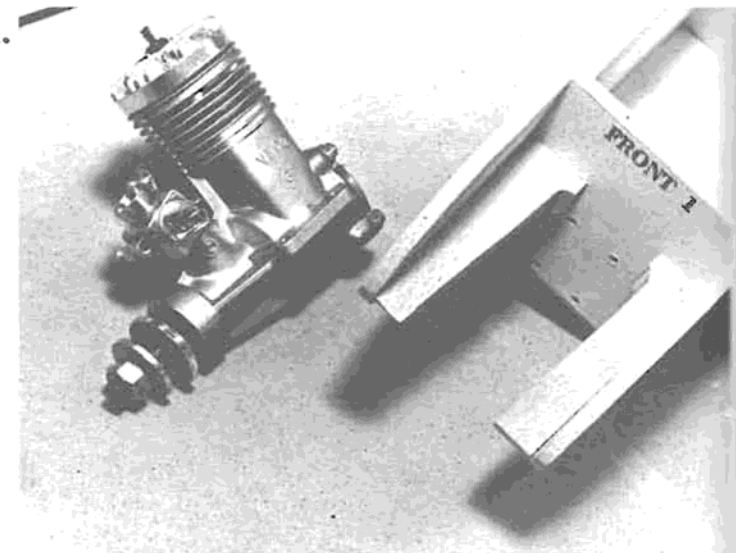
An interior view of the cabin structure showing the main landing gear platform and support braces.



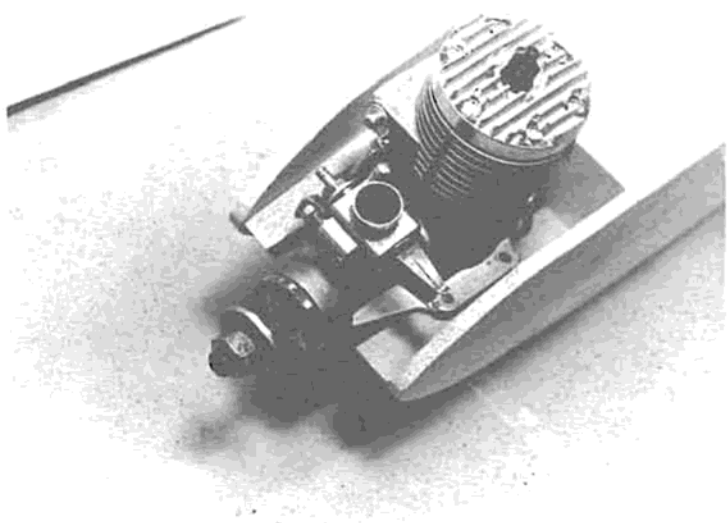
The hatch is constructed using the plywood front hold down support and spruce locating guides.



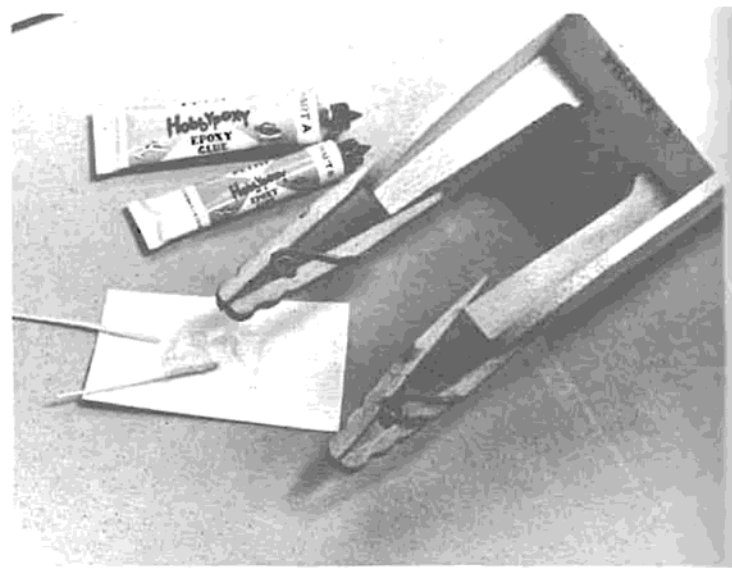
The beam motor mounts might have to be trimmed to fit your particular engine mount spacing.



The motor bearers have been trimmed away to fit the chosen engine – in this case a Veco .61.



The engine is temporarily positioned and thrust angles are checked.



The fuselage sides are epoxied to the motor bearers after engine positioning and thrust alignment have been determined.

BUILDING THE ADVANCED RCM TRAINER FROM RCM PLANS

Rudder:

A. Cut the rudder from ¼" medium balsa sheet and saw a ¼" pine insert as shown on the plans and epoxy in place on the rudder.

B. Cut the vertical fin and dorsal from medium ¼" balsa following the grain pattern shown on the plans. The balance of the rudder, fin and dorsal, will be assembled later.

Elevator:

A. Butt glue two sheets of 1/16" balsa together for the top of the stabilizer and another two for the bottom of the stabilizer using masking tape to hold each unit together while drying.

B. When the bottom stabilizer sheeting has dried cut it to outline shape and, from the plans, mark the position of the tips and center diagonals. Pin the lower stabilizer sheet to the building board, then glue in place the trailing edge spar, tips, leading edge spars, and diagonal fillers.

C. Using a sanding block and #240 cabinet paper, sand the structure flat, then glue the top sheet in place and allow to dry overnight.

D. Cut the elevator from 3/8" balsa to the size shown on the plans and taper as shown in the side view. Cut a notch in the center of the stabilizer and glue a 3/8" pine insert where shown using epoxy.

Wing:

A. The wing will be built on the RCM Wing Jig as described in Chapter 6 of the Flight Training Course.

B. Make a plywood template of the basic rib and sand carefully to final shape.

C. Using your plywood rib template, cut 20 ribs from medium grade 3/32" balsa.

D. Using your plywood template, but ignoring the spar cut out, cut one center rib from ¼" balsa and taper the rib as shown. This will provide you with the proper dihedral when the wing panels are glued together.

E. Stack all of the ribs together with the plywood template on top and sand lightly with #360 or #400 paper to assure that all ribs match the plywood template.

F. Taking your plywood template carefully drill a ¼" hole in the template as indicated on the master rib plan shown on the drawings.

G. Lay the template over each of the ribs, one at a time, and carefully drill a ¼" hole where shown. It is imperative that all of these holes be in exactly the same place on each rib to insure proper alignment of the wing when installed on the jig.

H. Place all ribs, except the center rib, on the ¼" rods. The center angled rib is added later.

I. Notch the top and bottom main spars at each rib location so that they will be flush with the top of each rib. Then add the top and bottom main spars.

J. Select two hard pieces of 3/8" square balsa and notch on the triangular side at each rib station. Add the notched leading edge and make sure that the 3/32" leading edge sheeting does not protrude over the top of the leading edge.

K. Select two lengths of ¼" x 3/16" balsa and sand to a slight taper as shown on the plans. Notch the widest section of the trailing edge at each rib station and then add the notched trailing edge.

L. Using Hobbypoxy Formula 4 glue, apply glue to each joint at the rib and leading edge junction, spar and rib junctions, and rib and trailing edge junctions. Do not remove the wing panel from the jig.

M. Add the 3/32" front and rear top wing planking using Duco cement or Titebond glue. Use plenty of pins and allow to dry for at least 8 hours. You may have to dampen the outside of the leading edge sheeting to insure that it will form properly over the ribs. Use a combination of straight pins and masking tape to make sure that the sheeting forms properly to the contour of the ribs.

N. Add the 3/32" x 3/8" balsa cap strips between the leading and trailing edge sheeting. This is done on the outer five ribs only. If you have built two wing jigs, one for each panel, you can now repeat steps A through N for the other wing panel.

O. Allow the wing to dry overnight then release the hold down blocks on your wing panel and turn the wing panels over. Add the leading and trailing edge sheeting and cap strips to the bottom of each wing panel.

P. When both wing panels have been completed remove from the jig and join the wing halves as follows:

   a. Make sure that the spars, leading and trailing edges and sheeting at the center rib location are perfectly flat and parallel.

   b. Glue two small lengths of ¼" dowels approximately 1" long into the center ¼" rib which you have sanded to the dihedral angle. Be sure an equal amount of dowel protrudes from each side of the rib.

   c. Coat the center angled rib with Hobbypoxy Formula 4, then slide the two completed wing panels on the dowel; this will insure a true wing. Block up the tips the necessary amount to insure a good butt joint at the center and allow the wing to dry.

   d. Add the center section 3/32" sheet planking on the top and bottom of the wing.

   e. Add a length of ¼" x ¾" pine at the trailing edge center section. This should be pregrooved to accept a Du-Bro strip aileron Hook-Up #AL-295.

   f. Sand the center section with medium grade sandpaper using a length of 2" wide fiberglass cloth, wrap around the center section and apply at least two coats of Francis Resin (Francis Products, 1514 Brommer St., Santa Cruz, California 95060) or two coats of epoxy resin to completely fill the glass cloth. Be sure to coat the aileron linkage with Vaseline before coating with resin to insure that they will remain free.

   g. When dry, add the ailerons which are made from ¼" x 1¼" medium hard balsa using a minimum of three hinges per aileron.

   h. Add the 3/16" sheet wing tips and make the leading and trailing edge filler blocks from scrap balsa as shown on the wing plan.

   i. Sand the completed wing with progressively finer paper and try to fair the fiberglass center section as smoothly as possible into the balsa wing sheeting.

Fuselage:

A. Begin construction of the fuselage by cutting two sides from 3/16" medium balsa sheet. Mark the location of former 2 and 3 on the inside of the two fuselage sides. Be sure to use a triangle or square on the top edge of the sides when

marking the location.

B The fuselage is built upside down and is started by pinning the ¼" sheet balsa top block, cut to the outline of the fuselage sides, down on a flat surface. Add two ¼" x 3/8" x 24" stringers to the ¼" top block making sure that they do not go all the way to the rear of the top block as indicated on the plans.

C Add the ¼" x ¼" top block braces and cut the stringers as shown on the plans.

D. While leaving the top block pinned to the board, add the 2-3/16" fuselage sides to the top block and former 3 (cut from ¼" balsa, grain vertical) as marked on the inside of the fuselage sides. Note that former 3 goes at the forward end of the top block and on top of the ¼" x ¼" cross brace. Block the sides to insure that they are square (90 degrees) to the building surface. Be sure to block the rear of the fuselage sides open at least ¼" for elevator horn clearance. With the sides still blocked, add the 1/16" sheet bottom cross grain sheeting starting at the rear and stopping at former 3.

E. Cut the hatch from ½" balsa and slide the hatch under the front of the fuselage sides, placing in the proper position as marked on the plans. Do not glue the hatch in place. Now cut former 2 from ¼" balsa (grain vertical) and the main landing gear from ¼" plywood and glue in place.

F. From the plans cut the 3/16" balsa tank compartment doublers, being sure that they are up against former 2 tightly when installed and that no glue gets on the hatch. If necessary, place a piece of wax paper or Saran Wrap between the hatch and fuselage sides before gluing the doublers in place.

G. Cut the firewall (former 1) from ¼" plywood and install between the fuselage sides using epoxy glue – be sure it is tight against the tank compartment doublers. Now add the 3/16" balsa motor mount doublers underneath the area where the motor mounts are to be installed. Be sure they are tight against former 1 and aligned with the bottom of the fuselage.

H. Add the 1/16" plywood bottom to the nose of the aircraft. You will note from the plans that this 1/16" plywood does not go all the way to the rear of the main landing gear plate. Now complete the 1/16" balsa bottom cross sheeting.

I. Remove the fuselage from the building surface.

J. Shape the cabin rear block, cut the cabin sides from 3/16" balsa, then shape the cabin front block, making sure to drill the ¼" dowel hole through the front and rear cabin blocks as shown on the plans. Glue the cabin blocks and sides in place.

K. Place the hatch over the tank compartment and mark where the hatch hold down rear pins and front 1/8" ply brace are to go. Fabricate these and glue in place using epoxy.

L. Cut the motor mounts from 3/8" maple, or other suitable hardwood, and then slide the left and right motor mounts in place, but do not glue as yet. Check the fit of your motor, then remove the motor mounts and cut as necessary. Now, epoxy the motor mounts in place making sure that the right thrust offset has been maintained as shown on the plans.

M. The basic fuselage structure is completed and can now be sanded, starting with 220 cabinet paper and then using progressively finer sandpaper.

N. Add the Gold'nRod's for the motor control and the nose wheel steering.

O. Coat the motor area, inside the tank compartment and the bottom of the hatch, with Francis' Surfacing Resin.

P. Add the completed stabilizer and elevator assembly making sure that they are square to the fuselage.

Q. Add the ¼" vertical fin and dorsal with epoxy glue.

R. Cut a piece of the outside Gold'n Rod about two inches long and epoxy in place in the top rear of the fuselage to pass the rudder pushrod through (see the plans for the proper angle).

S. Add the two 1/16" plywood main gear plate braces cut to the shape shown on the plans.

T. Add the ¼" triangular balsa stock as shown on the plans for vertical bulkhead support.

U. This completes the structure of the RCM Advanced Trainer.

It is recommended that a Goldberg standard steerable nose gear be used as well as a Hallco large dural maingear. A 2¾" Du-Bro low bounce wheel should be used for the nose wheel and a pair of 3" Du-Bro low bounce wheels on the main gear. The main dural gear may be attached with four round head sheet metal screws or, alternately, can be secured in place with 4-40 or 6-32 screws and blind mounting nuts.

Make sure that your aircraft is sanded as smoothly as is possible working down to 400 wet-or-dry paper, used dry. If you have "dinged" any part of the plane during construction and it has not been removed by sanding, simply dampen the area with a wet cloth and allow to dry. The "ding" will pop out and you may lightly sand the area again. If you have small chunks knocked out of the airplane, such as at the corners of the sides and top or bottom sheeting, fill these with vinyl spackling putty (obtainable at any hardware store) which comes in tubes and small cans. Drill your motor mounts for the engine of your choice. Again, we recommend using a K & B front rotor .40 RC or O.S. Max .40 RC engine until you have become proficient with your aircraft.

The hinging of the control surfaces, the installation of the radio equipment, and the covering and finishing of your aircraft will be covered in subsequent chapters.