

RCM's Art Editor, Dick Kidd, prepares the RCM Trainer for flight. Note Deans Proportional System with student "buddy box."

THE RCM BASIC TRAINER

Designed By H. L. STROUP

Last month, in the first installment of our Flight Training Course, we discussed some of the aspects of getting started in R/C. In this issue, we'll get down to the actual building of the Basic RCM Trainer, designed by Herm Stroup of the Memphis R/C Club. We hope you will follow this program through, step-by-step.

Construction Notes

Construction details will be fairly complete since the RCM Trainer is designed for individuals with limited flying and building experience. The length of these construction notes may give the impression that the model is time consuming and difficult to build. It isn't! During December I built two in three weeks—including six coats of dope. (I have a full time job, too.) K. K. McClure of the Memphis R/C Club recently cut out and assembled a completed fuselage in three hours.

Some of the building techniques and wood sizes used are rather arbitrary. So far I have built three and no two are exactly alike. Several of my fellow Memphis R/C Club members have built the Trainer and no two of them are exactly alike. Use

your own favorite building devices and experiment but don't distort the basic aerodynamics. All balsa used should be medium grade except for soft blocks for the wing tips.

Wing

The prototype was built with a conventional "built up" balsa wing but all subsequent models have used foam wing cores, no dihedral braces, and no spars, but with the center section glass clothed and epoxied. These wings are true, easy, cheap and require the use of dope only on the tip plates. Warner Industries, whose advertisement appears in this magazine, has both the Basic and Advanced RCM Trainer wings in stock.

After cutting the two wing halves, use the foam cutter to make the 45-degree angle at the tips. Contact cement a 3/16" sheet to each tip. Contact cement the Bristol plate to each wing half. The board will straighten some warps in the foam but avoid the warps in cutting, if possible. Match the two halves for proper dihedral angle and fit together. Epoxy the two halves together (use long pins to hold in

position) and let dry overnight. Spread a 4" wide coat of epoxy (or resin) across the center, lay on a 4" wide strip of glass cloth, then smooth another layer of epoxy on top. Seal the trailing edge and the tip plate with epoxy. The forefinger is the best tool for this. After the whole mess is dry, fine sand where the epoxy is used, then dope, Hobbypoxy, spray enamel, cover with Monokote, or cover with shelf paper.

If you insist on building a balsa wing—O.K. It will be a little lighter. The 1/16" ribs may be cut from the scrap stock left over from the wing and stab sheeting. Make a plywood or posterboard template. After cutting out all the ribs, stack and sand to exact shape. (A little care here will save building and flying problems later.) The two center ribs (one each side) should be cut from 3/16" stock . . . the scrap left over from the fin and rudder.

Pin the 1/2" x 1/4" leading edge to the plan. (Don't forget to lay waxed paper on the plans first.) Cement the bottom leading edge sheeting (1/16" x 3" x 26") to leading edge. Pin the trailing edge sheeting (1/16" x 1 1/2" x 26") to plan. Pin

the $\frac{1}{4}$ " square bottom spar to plan. Glue all ribs in place on 2-inch centers. This close rib spacing gives the wing strength and avoids fabric sagging between the ribs without a measurable increase in weight. Glue the two $\frac{3}{16}$ " center ribs at a slight angle (for dihedral). Glue the top spar in place. Glue the top leading and trailing edge sheeting in place. Cut and sand the $\frac{1}{2}$ " x $\frac{1}{4}$ " leading edge to airfoil shape. Add tip blocks, carve and sand. The 45-degree tip angle may be cut flat after the top of the block is cut and sanded to airfoil shape. Sand the two center ribs (use a flat sanding block) to correct dihedral angle. You may use a dihedral brace between the spars but it is not necessary. But glue the two halves together, one flat, the other blocked up to correct dihedral angle. After it is completely dry, glue in the top and bottom $\frac{1}{16}$ " x $\frac{1}{4}$ " cap strips. Cut these strips from scrap or purchase strips this size from your hobby shop. If the top strips resist bending over the airfoil shape—wet the top of them. Glue the center sheeting ($\frac{1}{16}$ ") from the center to the top of the third rib of each wing panel and wrap the entire center section with a 4 inch strip of glass cloth impregnated and coated with resin or epoxy.

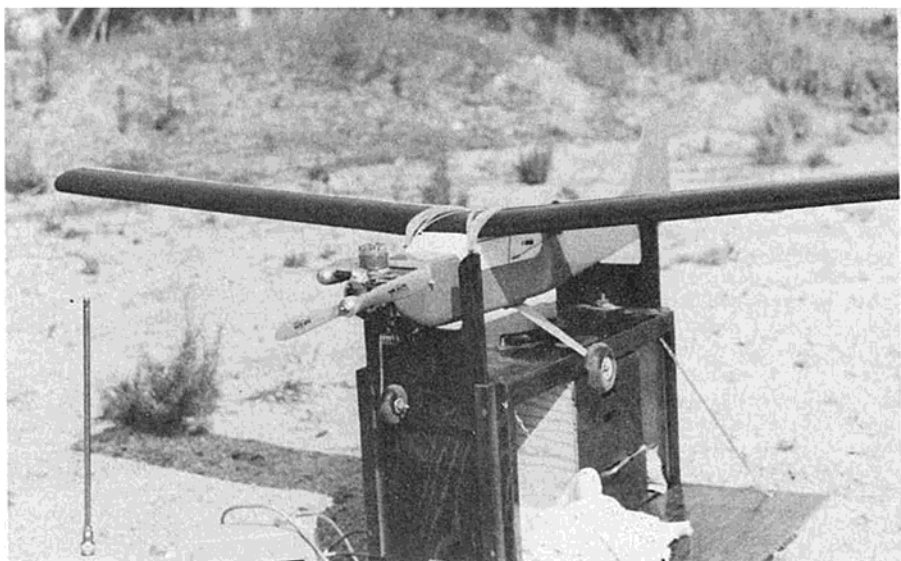
Punch a small hole in each wing rib to avoid the expanding and contracting of trapped air with temperature changes. Sand the entire wing frame with particular attention to the center section for smoothness. Apply two coats of clear dope to all the wood you can reach with a brush, fine sand again, then apply Scotch Tape to the top of all cap strips. This will preclude the possibility of the covering material sticking to the cap strips when dope is applied.

Stabilizer

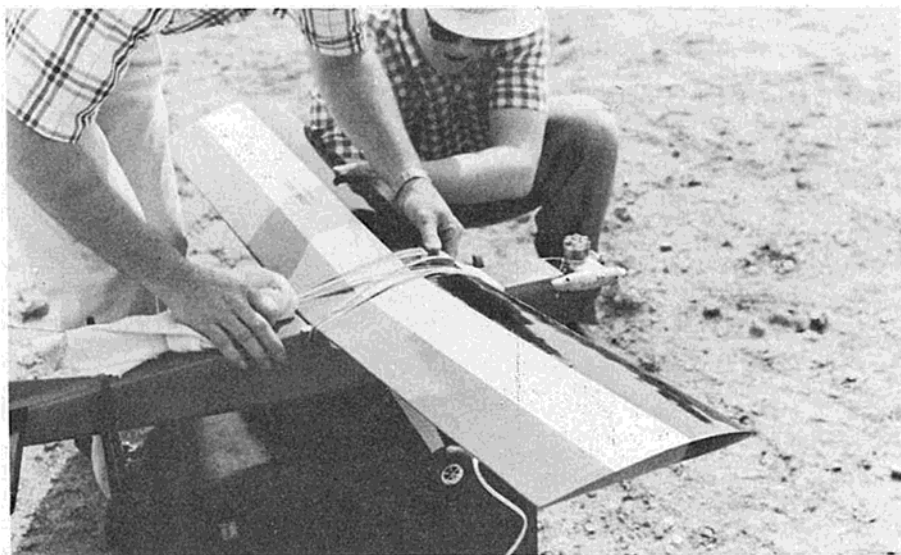
This is a basic sandwich of $\frac{1}{16}$ " sheet over $\frac{1}{8}$ " x $\frac{1}{4}$ " framing. If you use 6-inch width $\frac{1}{16}$ " balsa for the top and bottom, the job will be easier and neater. If you can't find $\frac{1}{16}$ " balsa in 6" widths, glue two 3" pieces as closely fitted as possible with epoxy while holding the two pieces together with Scotch Tape. Weight the glued pieces on a flat surface and allow to dry thoroughly. Mark a center line (from leading edge to trailing edge) then cut the top and bottom sheeting to the shape shown on the plans. Pin the bottom sheet to the plans, glue in the outside framework, then the inside. If hard use is expected, you may add more framing than is shown in the plans. Before the framing is dry spread a layer of glue on top of the entire framework and all the top sheeting. Weight it down on a flat surface and allow to dry overnight. Round all edges except the flat section of the leading edge that joins the fuselage top.

The elevator may be cut to shape from $\frac{3}{16}$ " sheet and reinforced in the narrow center section with glue and fabric. If heavy stresses are expected, glue music wire across the center, as used with many elevators. For Galloping Ghost flying use trailing edge stock $\frac{3}{4}$ " wide. Round the leading edge of the elevator. The tapered trailing edge stock will keep the elevator out of the air stream while it is pulsing in neutral.

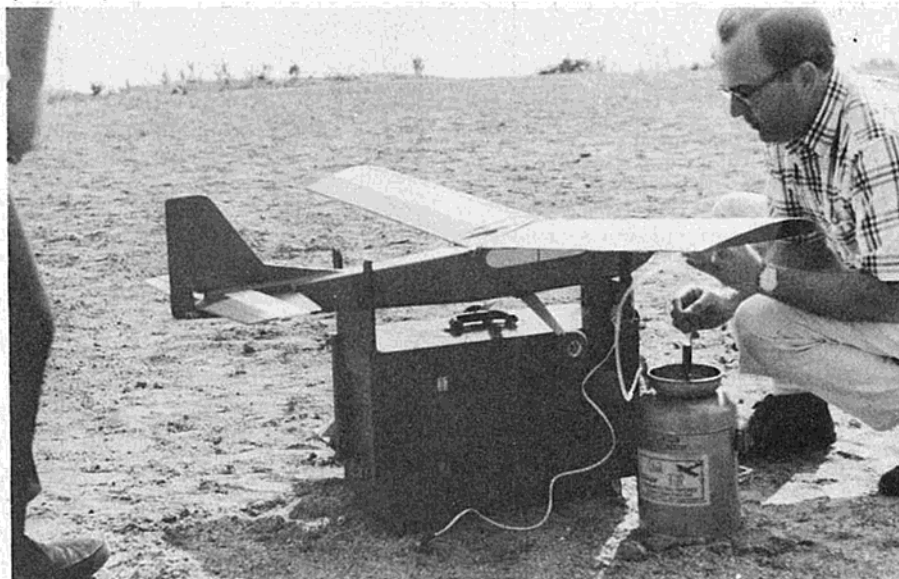
The fin should be butt-glued (same



The RCM Trainer cradled in the G & K Flight Box. Merco .49 muffler used on Enya .29 allows muffler to clear fuselage.



Above: Checking the wing position and the hold down bands after each flight is a must. Below: Satisfied that the entire aircraft is okay for flight Dick fuels the Trainer with the Argyle Model Products Quik Fill pressurized fuel tank. Starting battery is a 2 amp hour nickel cadmium cell with a Kavan glow plug quick clip.



technique as the stab top and bottom), weighted on a flat surface, and allowed to dry before cutting to shape.

Fuselage

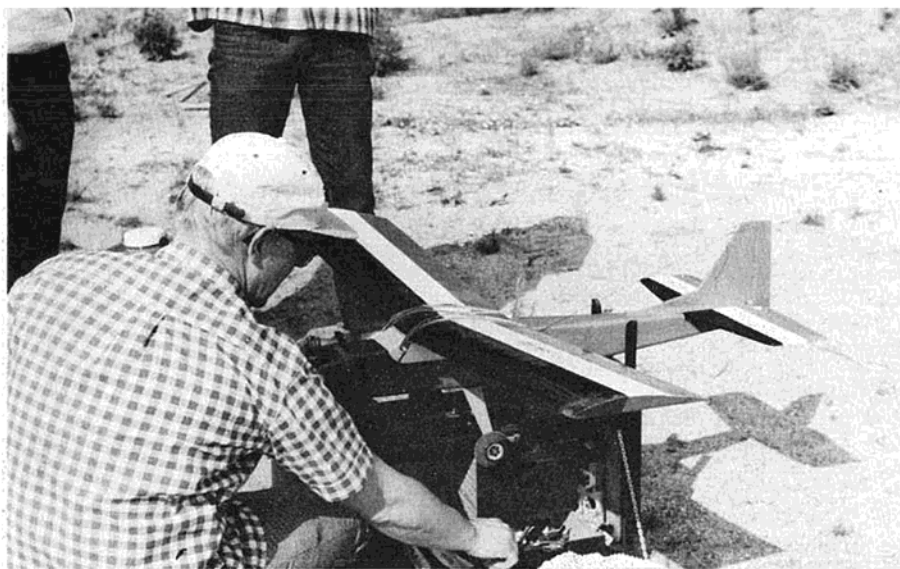
This is strictly "box construction" with corner longerons. These corners may be carved and sanded after the assembly is completed for a rounded fuselage contour. Two RCM Trainers were built with $\frac{1}{4}$ " corner longerons, then cut and sanded to an extremely rounded shape.

Cut the full length fuselage sides from $\frac{1}{8}$ " x 4" x 36" balsa. Both the wing rest and the fuselage bottom are left the full 4-inch width, and straight, in order to have two references with which to check incidence. (It allows more cabin space, too.) Make sure these sides are cut accurately, then pin them together and lightly sand any differences. Do not sand the wing and stabilizer rests. If these don't match, lay each side on the plans again and correct. Draw two lines (at right angles to fuselage bottom and cabin top) $\frac{1}{8}$ " apart for F2 and F3. Draw a line $\frac{5}{16}$ " from the bottom of the fuselage, then contact cement $\frac{1}{16}$ " sheet doublers from the top of the cabin to this line. The doublers should extend from the back line drawn for F2 to the forward line drawn for F3. If properly installed on both fuselage sides, these doublers act as guides for proper placement of the two bulkheads (F2 and F3). Contact cement the $\frac{1}{8}$ " balsa doublers from the nose to the front line drawn for F2. Contact cement the $\frac{1}{16}$ " plywood doubler on top of the $\frac{1}{8}$ " balsa doubler. Contact cement the $\frac{1}{16}$ " balsa doubler below the stab cutout. (End this doubler $\frac{1}{8}$ " from fuselage end.) Measure $\frac{5}{16}$ " down from the top of the fuselage, aft of the cabin, and draw a line. These lines should be drawn on the inside of each fuselage side. Measure $\frac{5}{16}$ inches from the bottom and draw a line. This line extends all the way to F2. Glue in the fuselage diagonal side stiffeners ($\frac{3}{16}$ " sq.) to these lines beginning at the bottom just behind F3. Contact cement the $\frac{1}{16}$ " plywood brace in back of the line drawn for F3 as a support for the hold down dowels. Again, match the two sides to make sure they are identical. While pinned together, drill holes through both sides for the wing and landing gear dowels.

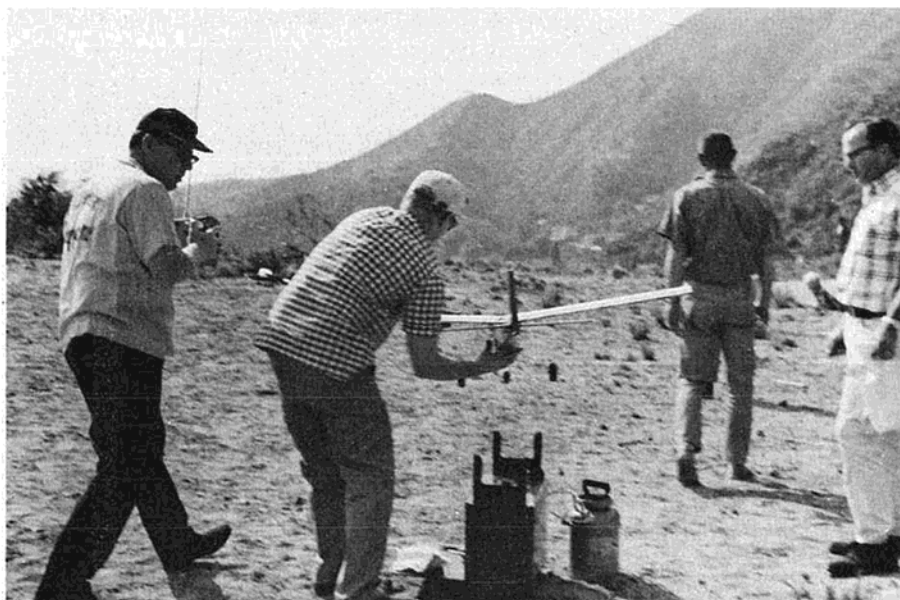
If hardwood motor mounts are to be used, epoxy them in place from the nose to the back of F1. At this point, you should locate the position of F1 (the $\frac{1}{4}$ " firewall) by measuring $4\frac{1}{2}$ " from F2 and drawing a vertical line at right angles. The motor mounts may be $\frac{3}{8}$ " square or $\frac{3}{8}$ " x $\frac{1}{2}$ ". If this type of mount is used it will be necessary to construct a mounting plate. I very much prefer to use a bulkhead mounted, combination motor mount and nose gear. Tatone mounts are excellent with either fixed or steerable nose gears.

Cut out F2 and F3 from $\frac{1}{8}$ " ply and glue in place. Mount the fuselage side on a flat surface and check both bulkheads for exact right angle placement. Allow to dry before any further assembly.

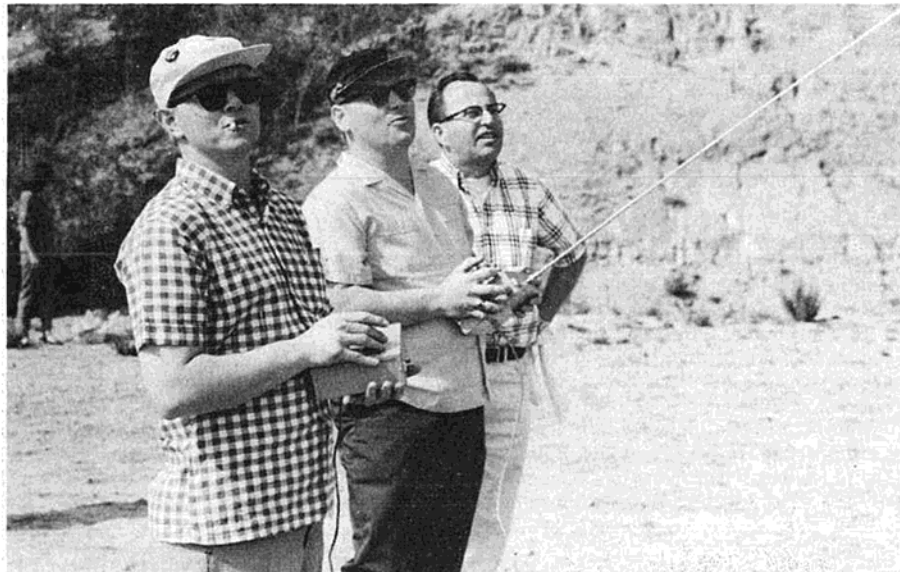
Cut the fuselage top to the length shown on the plans from $\frac{1}{8}$ " x 3" balsa. Draw a light line down the exact center, then cut to shape. (All fuselage lines are

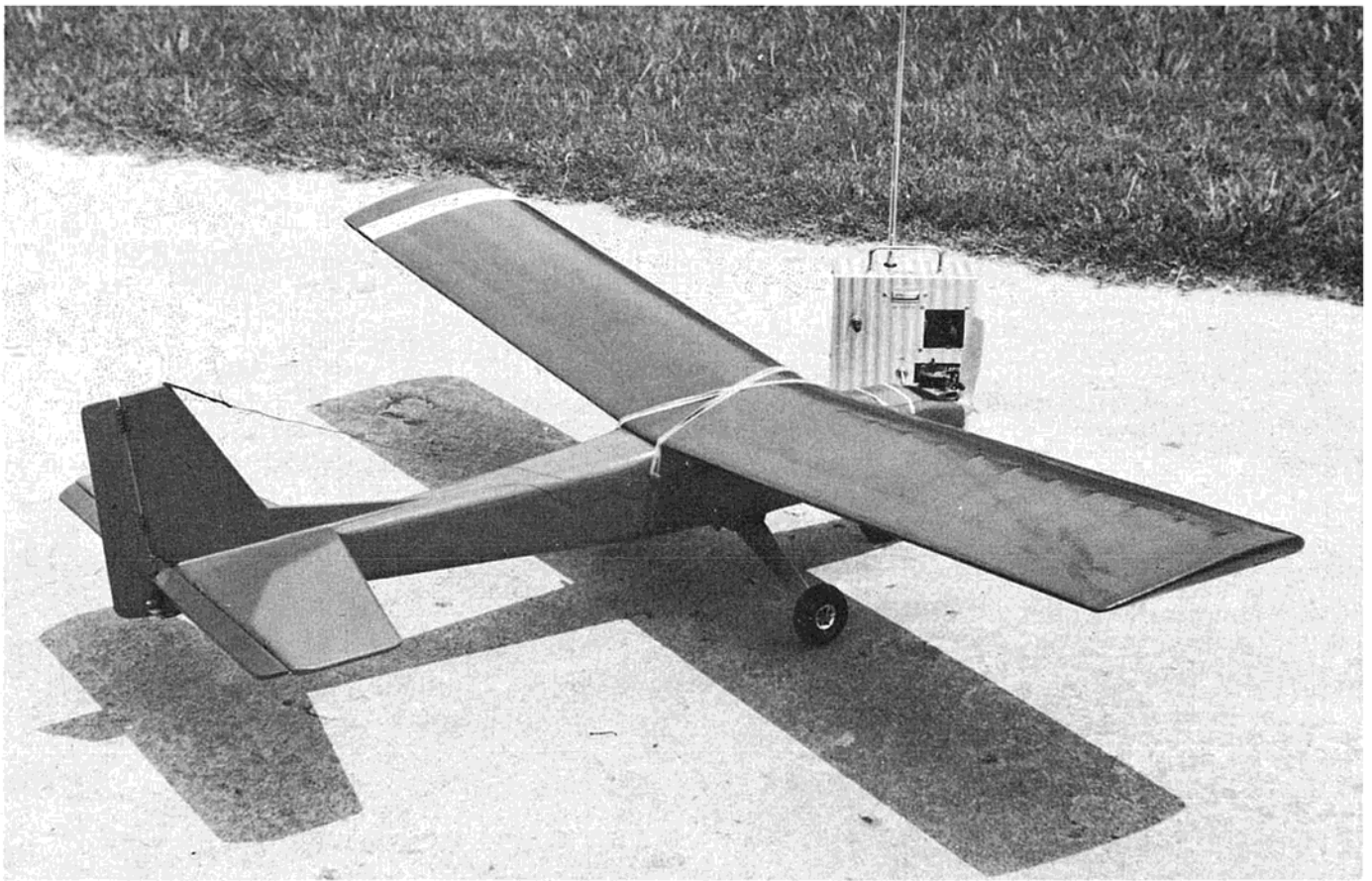


A thorough ground check before each flight can save your aircraft!



Above: Chuck Cunningham checks control response as Don Dewey prepares to launch. Below: Don flies the Trainer from the "buddy box" as Chuck watches for any necessary corrections. Cunningham's forefinger depresses the switch on the Deans transmitter that allows the student to control the plane. A spring release on the switch allows instantaneous take-over by the instructor.





The author's original prototype now has in excess of 400 flights, Rand L.R.3, Controilaire Galloping Ghost.

straight except for the rounded nose.) After cutting, measure opposite sides at various points along the length to make sure they are equidistant from the center line. The top should be absolutely symmetrical. Glue the corner longerons and cross braces in place and pin to a flat surface.

Cut and assemble the fuselage bottom in the same manner as the top. Make sure the longerons end $\frac{1}{8}$ " from the rear of the bottom piece. Notch the longerons to accept F3, and use a razor saw to cut across the $\frac{1}{8}$ " bottom (at the point shown on plans). Saw a notch in the longerons above the bottom saw break. This will allow a sharper bend in the fuselage bottom. The cuts may be filled with glue after assembly.

Glue the other fuselage side to F2 and F3. Apply glue and insert the top and bottom between the fuselage sides. Pin and hold with rubber bands until dry. Epoxy the firewall (F1) in place. Glue the $\frac{1}{8}$ " plywood main gear rest in place. Make sure this piece extends to the outside of each fuselage side. Glue $\frac{3}{16}$ " sheet on the bottom from the gear rest to the bottom of the firewall. Glue the $\frac{3}{16}$ " sheet cabin front (windshield) in place. Cut a piece of $\frac{1}{8}$ " balsa to exactly fit in the tank compartment opening. Glue another larger piece of $\frac{1}{8}$ " sheet on top of the first piece. In this way the top piece overlaps the firewall top and may be carved to shape when the fuselage nose section is later shaped to streamlined contours.

Fit and glue the $\frac{1}{8}$ " tail piece between the sides flush with the end. Install the $\frac{3}{4}$ " x $\frac{3}{4}$ " tail block (made from leading

edge stock or carve to shape from soft block left over from wing tips). Cut the top of the block diagonally to permit free elevator movement. Contact $\frac{1}{16}$ " ply sheet to the cabin floor and to the floor of the battery compartment. Do not round the fuselage corners until the stab and fin are installed. Several methods of fuel hatch hold downs may be used . . . screw, dowels, etc. I prefer to use a heavy rubber band around the whole nose.

Mount the stabilizer by aligning its center line with the center line drawn the length of the fuselage top. Since the top and bottom of the fuselage are left flat it is easy to check vertical as well as horizontal alignment. Cement the fin using the center line on the fuselage and stabilizer for alignment. If the ship is to be flown with heavy equipment, glue in fillets of $\frac{1}{4}$ " triangular balsa on each side of the fin and below the stab.

After everything has dried "round off" the corners of the fuselage by carving and sanding. The nose may be rounded and tapered on the bottom, top, and sides. The hatch cover should be held in place while the nose is being sanded in order to mate perfectly. Install the wing and main gear hold down dowels.

Next month Part III of RCM's Flight Training Course will go into the covering and finishing of your RCM Trainer.

Material Sizes

Fuselage

- 2 sides— $\frac{1}{8}$ "x36x4
- 1 top— $\frac{1}{8}$ " x 3
- 1 bottom— $\frac{1}{8}$ " x 3

- All 'hold down' dowels $\frac{1}{4}$ inch
- Cabin doublers (sides) $\frac{1}{16}$ x 3 (scrap from stab sheeting)
- Nose doublers $\frac{1}{8}$ balsa
- Inside nose doublers $\frac{1}{16}$ ply
- Firewall $\frac{1}{4}$ ply (or laminate 2 $\frac{1}{8}$ ply with epoxy)
- 2 bulkheads $\frac{1}{8}$ ply
- Cabin floor $\frac{1}{16}$ ply
- Corner spars, braces and framing $\frac{3}{16}$ sq.

- Main gear doubler $\frac{1}{8}$ ply
- Nose bottom $\frac{3}{16}$ balsa, taper and round to main gear doubler

Hatch—2 pieces $\frac{1}{8}$ Balsa (one inside to fit opening, the other glued to it, placed on top and shaped to fuselage contours)

- Front of cabin $\frac{3}{16}$ balsa
- Fuse doubler below stab $\frac{1}{16}$ balsa
- Tail block $\frac{3}{4}$ leading edge stock or $\frac{3}{4}$ block shaped to triangle

Wing (Built up version)

- Ribs $\frac{1}{16}$ sheet (2 center ribs $\frac{3}{16}$)
- Leading edge— $\frac{1}{4}$ x $\frac{1}{2}$ (shaped after sheeting)
- Leading edge sheeting $\frac{1}{16}$ x 3 balsa
- Spars 1 Top—1 Bottom $\frac{1}{4}$ inch square
- Trailing edge sheeting $\frac{1}{16}$ x $1\frac{1}{2}$ balsa
- Trailing edge $\frac{1}{4}$ sq.
- Top block 1 x 2 soft balsa
- Fin and Rudder— $\frac{3}{16}$ sheet.

Stab

- Top and Bottom sheeting $\frac{1}{16}$
- Framing (Leading, trailing edges and tips) $\frac{1}{8}$ x $\frac{1}{4}$
- Inside framing $\frac{1}{8}$ sq.
- Elevator $\frac{3}{16}$ sheet.
- (For GG use $\frac{3}{4}$ inch cord trailing edge stock.)