R/C TYRO TRAINER

By HANK COHAN

● The Tyro Trainer is a powered R/C training glider designed to meet three objectives:

1. Smooth, slow, stable, and forgiving flight characteristics so that a beginning RCer with some free-flight experience can handle it from the start, including launchings and landings.
2. Quick and easy conventional (balsa and covering) construction.
3. Low cost airframe and engine.

These objectives have all been met.

Wingspan is 74 inches, overall length 40. Power is a Cox Babee .049. The prototype weighs 30 ounces with Heath GD-19 radio equipment. The wing loading is 9 oz/sq. ft., resulting in a low stalling speed, and corresponding low approach and landing speed. Nevertheless, the airplane is rugged, and easily repaired when damaged.

Rudder and elevator control are used. The generous dihedral provides lateral stability so that the airplane will fly hands off, even when trimmed to glide in large circles. The .049 engine provides adequate power to take it up several hundred feet on a tank of fuel.

The engine is mounted on a removable forward hatch, eliminating the need for ballast. For powerless soaring, a plain hatch and some weight in the nose is substituted.

Standard size materials are used throughout construction. Scraps left from cutting out the fuselage sides are used for the stabilizer frame . . . a single sheet of 3/16 x 2 x 36 balsa makes the elevators and rudder, with the leftovers being used to make the fin and sub-rudder.

CONSTRUCTION

All wood is balsa unless specified otherwise. All glue used in the prototype was Franklin Titebond except when epoxy is called out, when Hobbypoxy #1 or #4 is used as specified.

WING

The wing should be built first so it can cure completely while the rest of the glider is under construction, and any warps that develop can be worked out. A secondary reason is that this writer finds wing construction the least enjoyable and most tedious phase of model building, and tries to get through it before his enthusiasm wanes.

The original wing was built with 1/16 sheet ribs and the leading edge sheeting on the top surface only. It was unsatisfactory due to recurrent warping, and was replaced (after more than 80 flights) with the one shown on the drawing, using 3/32 sheet ribs and 1/16 leading edge sheeting top and bottom. This wing has proven to be much more warp resistant. A third variant suggested for consideration would retain the top and bottom leading edge sheeting, but utilize 1/16 sheet ribs with 1/16 x 3/16 cap strips top and bottom. This would be even stiffer than the second design, and would result in smoother covering. If this configuration is chosen make all the "C" ribs like "B", to allow for the cap strips.

Cut and notch wing ribs by your favorite method. For this model a 1/16 plywood rib template was made; and ribs traced with a fine ball point pen. For "A" and "B" ribs, trim "C" ribs to accommodate the 1/16 center section sheeting. Note that "A" ribs are each made in two pieces to accommodate the spar dihedral joint.

Start the wing by notching the trailing edges 1/8 deep for the ribs. Note that no notches are used at ribs "A" and "B", and at the tip ribs. An easy trick for notching is to use the edge of a fine flat warding file. A few trials on balsa scrap will show which file is right.

Pin the trailing edge over the plan (suitably protected with Saran Wrap or similar). Trim the lower leading edge sheet roughly to width (leave a little at the leading edge to sand later) and pin in place with its after edge lined up with the back edge of the spar location. Glue and pin the lower spar on top of the sheet. To reduce later frustration, wipe up any glue fillets at rib locations before they dry, using a scrap stick or steel scale.

Glue and pin the leading edge onto the sheet, using a straight edge to keep it straight, and again wipe away excess glue. Now fit all the ribs except "A", glueing to leading edge, sheeting, spar, and trailing edge. Shim up back half of "B" 1/16 inch. Check top spar in notches for fit and straightness, remove, then glue in place. Do not add top leading edge sheeting at this time. Add tip gussets.

Fit and glue the 1/16 shear webs between ribs, using the wood left from the leading edge sheeting. Fill the vertical space between the spars from the wing centerline to rib "B" with scrap 1/4 sheet, well fitted and glued. This will be the seat for the dihedral brace when the panels are joined. Allow wing panel to dry overnight, then remove from board.

Turn plan over and oil or wax so that left wing can be built by the same process. When both panels are complete to this stage, trim the spars, leading and trailing edges to make a good fitting dihedral brace and the 1/8 sheet leading edge brace. Now mate the wing panels, with one pinned flat to the board and the other tip raised 12". Use Hobbypoxy #1 epoxy for the spar joint and brace. Be sure that the raised wing is not in a warped position, and allow at least 12 hours to cure.

When thoroughly dry, bevel leading edge top and apply top sheeting while the panel is pinned on your board. Allow to dry, remove pins, and pin the other panel flat, then repeat above operation. This process will help prevent built-in warps. Last, cut tips from 3/16 sheet or two crossed laminations of 3/32 and glue in place. When all is thoroughly dry, sand carefully to prepare for covering. Note that it is not necessary to sand the trailing edge to a knife edge. Leave it 1/16 or so thick. It doesn't significantly affect the performance, and it's much more damage resistant.

The prototype wings were covered with silk, applied wet. Precede this with two coats of dope and light sanding of the wing structure where the silk is to be fastened. Silk adds much strength and is light. If you want to use Monokote or a similar material, you're on your own. Heavy weight Silkspan can be used, but is more liable to puncture on rough terrain.

FUSELAGE

Laminate two sheets of 1/16 balsa crossgrain, large enough to make bulkheads F2, 3, and 5, and two pieces of 1/8 for F-1, using Titebond, and allow them to dry under pressure overnight. F4 and F6 are made from 1/8 plywood. *(When laminating sheets with Titebond, the water base causes joined sheets to curl away from each other . . . almost uncontrollably. To overcome this problem, wet the outside sheet surfaces at the same time that glue is applied. The sheets will then remain flat. wcn)*

The fuselage sides are cut from 3/32-3x36 medium sheet. Try to get two sheets well matched in density and grain, so they will bend equally in assembly. Pin and clamp the two sides together and sand the edges to bring them to identical shape. (Save the scrap pieces for use in the stabilizer). Separate, pin to the work board, and add the longerons, uprights, and 1/16 sheet doublers from the nose to the front of station 6. Note that the grain of the doublers is vertical, to provide more stiffness and split resistance to the fuselage. Titebond was used here. Clamp or weight the doublers well to get a good joint, and allow the sides to dry.

Be sure to make one left and one

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right side.

When the sides are dry, bevel the tail ends slightly as shown on the top view, and join at the tail and bulkhead 6. Five minute epoxy such as Hobbypoxy No. 4 will speed things up here. Be sure the fuselage is lined up at this time; it will be too late when the epoxy cures.

Give the epoxy 30 minutes to set, and install the remainder of the bulkheads. Bulkhead 5 is positioned to accommodate the servos to be used, leaving room for the servo mounts. The top and bottom 3/32 sheeting is now applied, grain crosswise. If the model is to be flown on rough fields, the bottom may be covered with 3/32 plywood instead of balsa from F6 to the noseblock to help withstand wear.

Make and install the nut blocks for the hatch retaining screws, using epoxy, and complete other details as shown on the plans. Now sand the entire fuselage, rounding all corners as depicted in the typical section view, but do not round the top from F-6 to the nose. The wing and the hatch will rest on this area.

The hatch is made by laminating hard 1/16 sheet crossgrain to the top of a piece of 1/4 sheet. When dry, cut to rough shape and drill 5/32 clearance holes for the nylon 6-32 hold down screws. Tack-glue the hatch in place, using the screws to hold it until dry. Glue the nose block to the fuselage nose but not to the hatch. Now shape both hatch and nose to a pleasing shape. Remove the hatch, add the 1/16 plywood pads at the screw holes and drill.

Build the engine pod as shown. A Cox Babee .049 was used in the original and provides adequate power. Locate the mounting holes in the firewall to suit the engine, being sure to mount the blind nuts on the back of the firewall before adding the upper fairing blocks. The blocks must be recessed to clear the blind nuts. The 3/16 balsa fairings on the pod strut are used to stiffen the strut; deletion may result in excessive engine vibration. Sand the fairing to shape, and put the pod assembly aside until later; its mounting location is determined when the glider is otherwise complete.

The fuselage is prepared for covering at this time. The original was covered with colored tissue, an easy and lightweight treatment. If color is not desired, or if it is to be painted, use Silkspan; it helps keep balsa from splitting. The fuselage should receive two coats of fuel-proof dope before covering, including the interior from the nose to F-6. Four coats of fuel-proof dope thinned 50-50 were applied after covering.

TAIL

The tail assembly is very simple. The stabilizer is built up using the 3/32 scrap sheet left from the fuselage sides. It is covered on both sides with 1/16 medium sheet, sanded, doped, and covered as was the fuselage. Do not cover the areas where the fin will be mounted, and where the stab contacts the fuselage. A little time could be saved making it from solid 3/16 sheet, but the solid stab will be somewhat heavier and not as stiff as the built-up, therefore the latter was selected for the prototype. The elevator is a single piece of 3/16x2 sheet sanded to a taper towards the trailing edge and rounded on the leading edge.

The fin is build up from 3/16 scrap and is tissue covered; the rudder is 3/16 sheet, treated like the elevator. Mount the fin to the stab, and when dry enough to handle, install the control surface hinges and the control surfaces. Be sure to use pins or pieces of round toothpicks to secure the hinges in all surfaces. Mount the entire empennage on the fuselage by glueing.

CONTROL SYSTEM

The push rod system on the prototype is Nyrod, but 1/4 square balsa push rods with wire ends will work as well. The rudder push rod emerges from the top of the fuselage about five inches forward of the fin spar. The elevator push rod exits the fuselage right side at a point about four inches forward of the stabilizer spar. The push rod system must be adjusted so that it works smoothly and with no binding.

FINAL ASSEMBLY AND BALANCING

Install the radio equipment with the battery and receiver well padded with foam rubber. Place the battery as far forward as possible. The switch will be best protected from engine exhaust if located on the left side of the fuselage . . . the bay between F-3 and F-4 is convenient.

Assemble the entire model, including the unfinished hatch. Now place the engine and pod unit (on its side) on the hatch; a rubber band will help keep it from falling off. Balance the model at the point shown on the plan by moving the engine unit as required. DO NOT ALLOW THE MODEL TO BE TAIL-HEAVY. Tail-heavy models are unstable, and there is no point in creating extra problems.

When balance is correct, mark the hatch for the pod strut location. Remove the hatch, cut a 1/8 wide slot clear through to accept the strut end, and epoxy the pod to the hatch. The assembly may now be fuel-proofed and painted as desired. That completes the airplane construction.

Check the wing carefully for warps, and eliminate them before flying. The prototype wing has deliberate washout (trailing edge up) of 1/8 inch at both tips. This is achieved one panel at a time. Brush a coat of thinned (50-50) dope on both sides of one panel. As soon as the dope is dry to the touch, weight the panel down on a flat board with a 3/16 wedge under the trailing edge at the tip. Piles of magazines make good weights. Allow it to cure at least 24 hours; 48 is better. Inspect, and if correct, repeat on the other panel.

For test flying it is advisable to have an experienced RC flyer help test and trim. If none is available, use the following procedure:

Range test the radio system per manufacturer's instructions. With receiver and transmitter on, set control surfaces to neutral by adjusting the push rod clevises. Now find some benign terrain . . . soft sod and/or high grass, . . . Choose a time of zero or light wind, and hand glide the airplane. This requires a run and a straight, slightly nose down javelin launch.

When your knees have stopped shaking, analyze the test and make corrections to get a straight, nose-down glide. Make the adjustments at the clevises, one-half turn at a time. Do not allow any trace of a stalling tendency or turn as it will be exaggerated under power. When the glide is good, fire up the engine, test the control system, and if all is well, have your helper give the plane the same kind of launch. If it doesn't start to climb, give it just a touch of up . . . be careful, it's more sensitive under power.

Allow it to climb at about a 15 degree angle to about 75 feet, then put it into a shallow turn. Be sure to keep her upwind of your transmitter until you get familiar with her characteristics. When at a safe high altitude, set the transmitter trim levers so she will glide hands off. She's all yours. Have fun! ●

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