"TORC" TRAINER

By GEORGE CLAPP . . . Here's an R/C trainer that was designed over 40 years ago! Today's engines may be more powerful and modern adhesives may be more permanent, but functional beauty remains the same.

• The day is perfect, with warm sunshine and almost no wind. After some test glides over tall grass, I was quite sure my first gas powered model was ready to taste the air currents under the power of its Baby Cyclone engine. The Cyclone had run well on the bench before installing it in the ship, but today all we can get out of it is a pop now and then. My buddie's wife and mine are getting impatient, as it is also Sunday, with noon almost upon us. So we have to give up, muttering to ourselves.

The very next time out the Cyclone is ready, for some unexplainable reason. It roars into action almost on the first flip of the prop. Conditions are not as good this day, for there is enough wind to cause considerable drift and there are trees in the area. Oh well, we hand launch it into the wind anyway. The model climbs out in big circles, with only a minor scallop to its flight. As it circles, it looks like the climb will take it over a tall tree which it is drifting towards. The Austin timer now decides that the Cyclone has run long enough, the plane straightens out, and the long flat glide allows it to stay up for a considerable time, in the top of that tree!

This all happened about forty years ago, and as I remember, the model more often than not, ended up entangled in tree limbs. If you have ever flown a big free flight model and know the sickening feeling you get as it tumbles down from limb-to-limb after repeated prodding, you will really appreciate radio control. While the Baby Cyclone was probably as good as most engines of the day, and we now look back with nostalgia, it does not in any way compare with the easy-starting modern glow engine without ignition problems.

After a phone conversation with Bill Northrop in regard to my Fokker tri-motor "America" (August '76 **MB**), during which he stated that old-timers make great trainers, I began to think about my old gas job done again, this time as a trainer. After several kits of so-called trainers, I still needed one slow enough for these old reflexes. My TORC trainer presented here is the results. The name TORC, of course, is O.T.R/C scrambled a little.

The first flight of TORC was a revelation of simple R/C flying. Its takeoff was at 1/4 throttle, the balance was just about perfect, and its general handling was good. As long as the throttle was kept at 1/4, it had no bad habits, and would climb much as its ancestor did.

This all changed the first time I gave it full throttle. The Enya .40 at full bore has one full H.P., while the Baby Cyclone only had one-sixth H.P. wide open. It was a good thing I had gained a respectable bit of altitude at 1/4 throttle on that first flight, because when I gave TORC full power, it very rapidly came up and over in a loop with no up-stick! It became evident that something had to be changed. I flew it several times like this, using trim to help, but it was not enough.

I finally took the entire tail group off and reset the horizontal stabilizer with three degrees more of positive incidence. This is clearly shown on the drawing. Again, off we go to the flying field. This time it is much better, but it still has a decided climb at full bore.

Again it is back to my shop to give the model some down-thrust. The Enya had been mounted in the same manner as the Baby Cyclone, but the plywood was not aircraft plywood. I had used some regular 1/4 inch plywood I had on hand. I shimmed the rear of the Enya to give it about four-degrees down-thrust. TORC then handled real well at any throttle setting. The poor quality of the plywood soon produced a loose engine that I had to do something about. I then cut out this area and installed the firewall of 1/4 inch aircraft plywood. To this I installed the Tatone mount, inverted as shown on the plane.

TORC has been flown since May of 1977 on many occasions, such as fun flys, demonstration flights at static displays, and just for fun, whenever the weather and time would allow. It enabled me to improve my flying to the point where I was able to fly my Fokker at the Endicott, New York contest in July. I did well the first day, but the corn roast and beer Saturday night did nothing to improve my flying Sunday.

Another reason that I decided to do my old design over as an R/C trainer was the fact that I have four grandsons who I would like to interest in R/C flying. They range in age from ten to sixteen years old. TORC, because of its gentle nature, has allowed them all to fly it without any previous R/C time.

CONSTRUCTION

While an attempt was made to show both the original 1936 design and the R/C version on the drawing, it was the trainer I was most concerned with, as the original free flight was not published during the period of its origin.

Although the construction is quite normal, there are a few points that should be explained. All of the material marked spruce on the drawings was cut from straight-grain pine on my ship, because I had the pine on hand. Spruce would be better. Balsa verticals, cross pieces and diagonals were used aft of the wing to keep the tail light. By selecting light balsa for the large tail surfaces and using the Enya .40, my ship came out balanced without adding any ballast.

The wings on the original were not called upon for the stress of aerobatics, so the 3/16 square spars were added. They junction at the strut attachment points. The struts are also fastened in a different manner than on the original because of this. The wings have been put through very high stress with no structural failure. The struts on TORC are needed.

The landing gear wire was increased in size and the Arco No. 64 rubber bands added as per drawing. This gear will take a lot of abuse and is quite unusual during ground operation.

FUSELAGE AND LANDING GEAR

Construct both sides using 1/4 sq. pine or spruce for longerons and all members forward of the trailing edge of the wing. Aft of this point, I used balsa cross pieces and diagonals to keep the tail light

The 1/16 plywood sides are now glued on, making sure you have a right and a left.

The two halves are then assembled upside down, with plywood bulkhead and cross pieces in cabin area only. A good flat surface is needed for this. Make a temporary diagonal cross piece and tack-glue it in at the rear rectangle formed by top, bottom and sides. Add another temporary cross piece in the open top and glue on bottom 1/16 skin.

Let dry completely. This is the foun-

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dation for a true fuselage.

Next draw rear together, glue and clamp. The vee-shaped piece shown on drawing was not used on my trainer version because I used a tail wheel. A piece of 1/16 plywood will later go on bottom rear for this. With the rear fastened securely, add the cross pieces to the whole rear of fuselage. Add gussets and let dry.

The 1/4 inch aircraft plywood motor mount is now cut out. Open it in front as shown, back to firewall. Wet plywood sides forward of cabin area on outside, this will help bend front sides in to epoxy on what was the motor mount on original model. I brought the front sides in with a clamp.

Now cut and fit vertical 1/4 inch ply firewall as shown and epoxy it in place. *Do not* add bottom front block as yet. Do not use five-minute epoxy for any of this. It dries too fast to penetrate wood and hold well.

The landing gear parts are now bent. Remember the main vertical section in front is one piece. So is the rear section.

This now slides down over the fuselage in position shown and is epoxied in place along with block "A". Note on drawing how plywood motor mount previously mentioned and marked "B" on drawing is tight against top of landing gear main legs. Now shape and add 1/8 x 5/8 hardwood pieces each side of main gear. The 1/16 music wire cross piece is now added below fuselage.

Wire wrap ends of rear legs to main gear and solder. This floats free on steel strut fitting. *Do not* attach this strut fitting yet. The 3/16 pine fairings on main gear are slotted for wire, shaped and epoxied, each half over wire.

The 1/16 cowling and 1/8 plywood former "F" are now cut out. Make sure you cut out the former for the size tank you want to install. Fit and apply these to fuselage, notching cowl piece where it goes over landing gear wire.

The formers on top can be added now. Fit and glue five top stringers. Notice formers are not notched for stringers. The 1/4 plywood piece that forms the top of the windshield is now added, along with the small pieces of 1/16 plywood on each side. The cowling is drilled for acceptance of the two 1/8 dowel pieces and they are glued in. Drill for 5/16 wing dowels and install.

Now completely coat the whole front end, inside and out, with epoxy. Fill in areas at tail as shown, to make nyrod exits. Add nyrod tubes and support with 1/8 x 3/8 balsa cross pieces drilled for tubes. Make sure nyrod ends will line up with servos.

TAIL SURFACES

The tail surfaces are made from stock sizes shown on print. The ribs are glued in place without the air foil shape. The leading and trailing edges are blocked up with 3/16 pieces, or to the center of the unshaped ribs. The tips are added, also blocked up, and left to dry. During this building, the main spars of the horizontal stabilizer and elevator, also the main spars of the vertical fin and rudder, are lightly glued in place to keep them together while sanding ribs to a symmetrical, streamline shape. After sanding to shape, separate parts with razor blade and notch the fin and stabilizer for 1/8 square pieces. Add 1/8 balsa planking to center of stabilizer and sand to shape. Round off spars for control operation and make slots for nylon hinges. Add plywood for control horns to both elevator and rudder. Epoxy and pin hinges after covering tail group parts separately. Fit small balsa block under horizontal stabilizer. Assemble and glue horizontal stabilizer to block after covering ship.

WING AND STRUTS

The wing on TORC is fourteen inches shorter in span than on the original 1936 model. The Clark "y" airfoil was laid out with coordinates on TORC. The side-view shows the main ribs, as well as the two tip ribs, in dotted lines. It is suggested that the two 1/8 ply ribs that the strut music wire fittings are attached to be made first. Then use one of these as a pattern to cut the other 16 balsa ribs. Two of the 16 will be modified for the tip ribs. It is my practice to finally fasten all ribs together very carefully with T-pins, making sure the resulting block of ribs is square. Then cut all bottom notches on a table saw. This can't be done very well with nose and top notch, but if carefully cut individually, they will line up when put together. After cutting spar notches on saw, touch up nose and top notches with file and fit the leading edge and top 1/8 x 1/4 piece into these before separating them.

Make one left and one right wing panel, leaving butt ends of main spar long enough to later add center section. Cut the angle on the bottom of the ends of main spars to match the ends of dihedral splice shown. Do this before assembly.

Now cut out tip pieces and glue them together on flat surface. When completely dry, add these to tips in this manner; because the tip progressively rises as it comes around from the trailing edge to meet the leading edge; place a 3/16 shim under it at point "A", and a 5/16 shim under it at point "B". The part that joins the trailing edge will have to be tapered on the bottom to match the 1/4 thick trailing edge. Glue it well at all joints and leave to dry. When dry, taper bottom of main spar to match and add top 1/8 x 1/4 ply and two bottom 3/16 square spar ends.

At this point, the 1/16 M.W. strut fittings are still not in place. Now join the two wing halves together with the plywood dihedral splices, by carefully blocking up each panel for dihedral. Add leading and trailing edges to center section, also 1/8 x 1/4 top piece. Allow long-setting epoxy to dry overnight.

Next fit the bottom planking in from the top of the center section and glue well. When dry, apply top of center section, top leading edge, and 1/16 x 1/4 cap strips.

The 1/16 music wire strut fittings are now bent and secured in place with 1/16 plywood scraps as shown on drawing. Use long-setting epoxy for this. After these are completely dry, add the 1/8 pieces that go along each side of the plywood rib and also the gussets at the trailing edge. Now carve and glue on turtle back block.

The struts are made from 3/16 x 11/16 spruce, and I believe, are fully explained on prints. Epoxy wire fittings with long-setting epoxy after binding with heavy black thread.

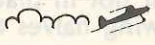
To prevent tip stall at slow speeds, I put about two degrees of wash-out in the wing tips. This was done by fastening the wing on the fuselage with rubber bands and attaching the wing struts to the wing. Move the bottom strut fitting back and forth until each wing has the same amount of wash-out; mark its location and fasten it to belly with small R.H. screws. This is done before covering.

Take each wing panel and spray it with water, block it up on a flat surface with about twice the required amount of wash-out and let it dry overnight. It will spring back some.

After the Tatone inverted motor mount is fastened with blind nuts from back of firewall, epoxy on bottom nose block and shape.

TORC is now ready for windshields, windows, and covering.

After tank is installed, seal all around with General Electric clear silicone seal. As noted in photos, I used 1/2 inch soft copper pipe to divert the exhaust oil from side of fuselage.



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