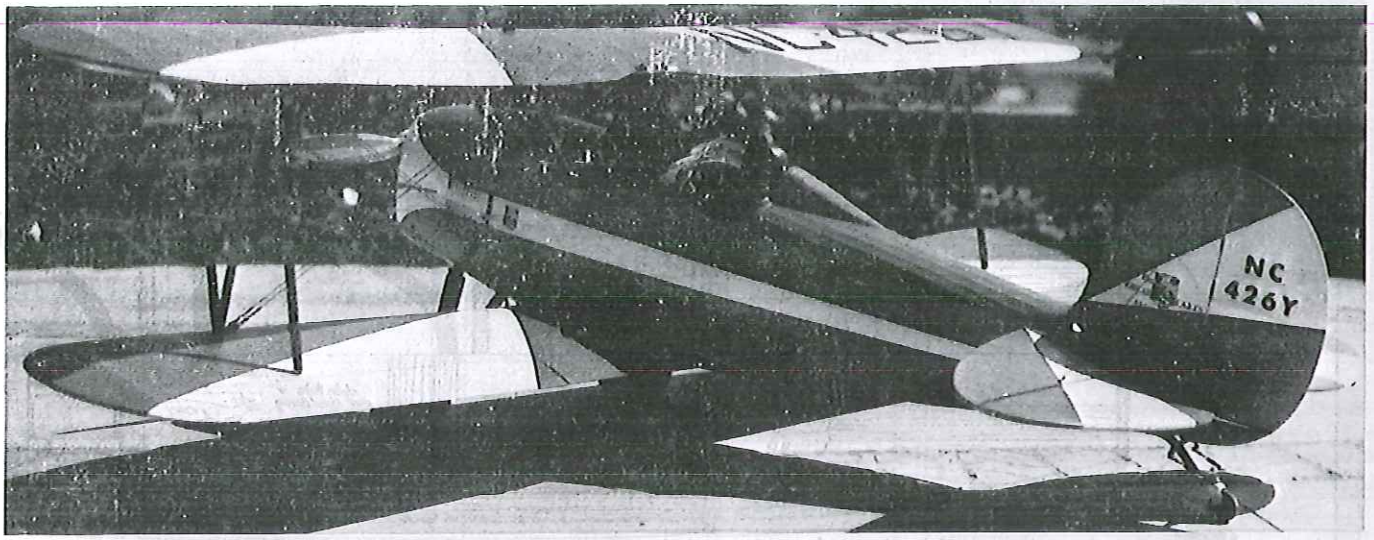


GREAT LAKES 2T-1E one fourth scale

By FRANK COMYNS . . . Probably the most famous and well-liked sport biplane of all time, the Great Lakes has been a favorite of modelers since it first appeared in 1929. This is the stock 2T-1E version.

• Mention the Great Lakes around an air enthusiast or pilot with gray hair (if any) and see his eyes light up. Many of them will probably say it was one of their favorite planes.

The Great Lakes was first introduced to the public at the Detroit Air Show of 1929, and was an immediate hit.

The first four planes off the production line had straight wings and were found to be tail heavy. It was impractical to move the wings further back, so after some serious calculating it was decided to sweep the top wing back 9.2 degrees to bring the center of gravity in line with the center of lift.

The swept-back wing and short coupled fuselage made an average sport plane look like a small pursuit plane of that time. Orders came in faster than the aircraft could be built.

The Cleveland aircraft plant was doing very well financially, when the big depression of 1929 hit, and as orders dwindled, managed to stay in business until 1933, but like many other aircraft companies of the '30s, finally had to close its doors.

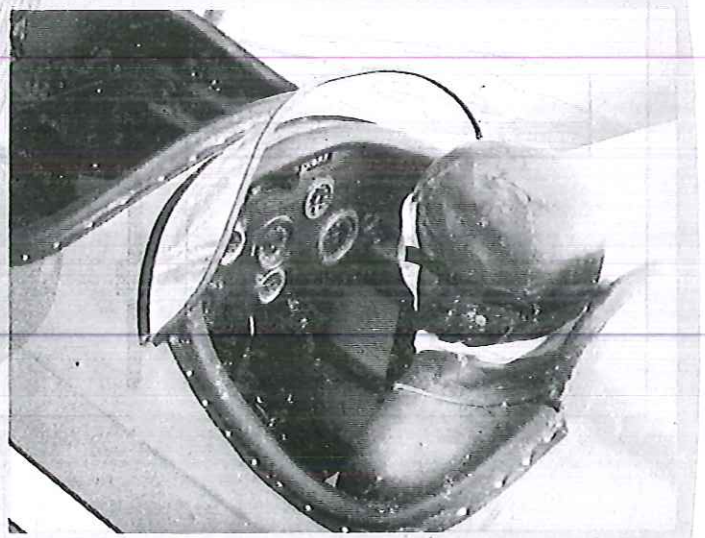
The Great Lakes has been a collector's classic since the end of World War II, and when available, can bring a price 10 times or more than the original 1931 tag of $2,985. Now, after many years, a new one, powered with an opposed Lycoming engine, can be purchased today.

Ask that old airplane enthusiast if he remembers "Tex" Rankin. No doubt he will, as "Tex" was one of the outstanding fliers of the 1930s, with many light plane cross-country records and the world record of 19 "outside loops", all in a Great Lakes.

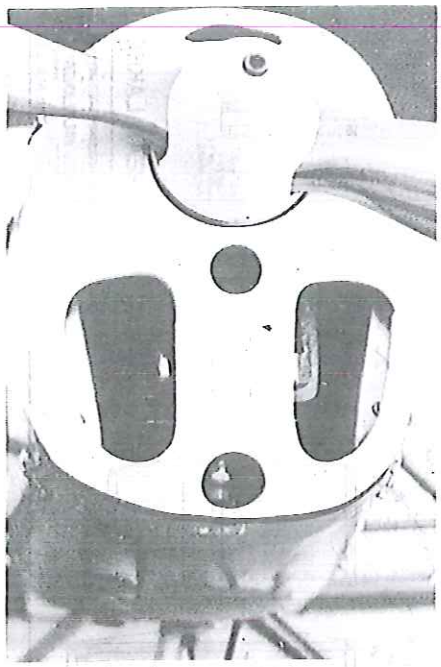
The 2T-1E, with the inverted Cirrus engine, was the last production model. The earlier Great Lakes had an upright Cirrus engine, and was designated a 2T-1A. The same cowl was used either way and could, with a little redesigning, be changed on the model.

Instruments for the front cockpit were an option to the customer. Some had no instruments at all, some had just enough for instruction. Few were fully instru-

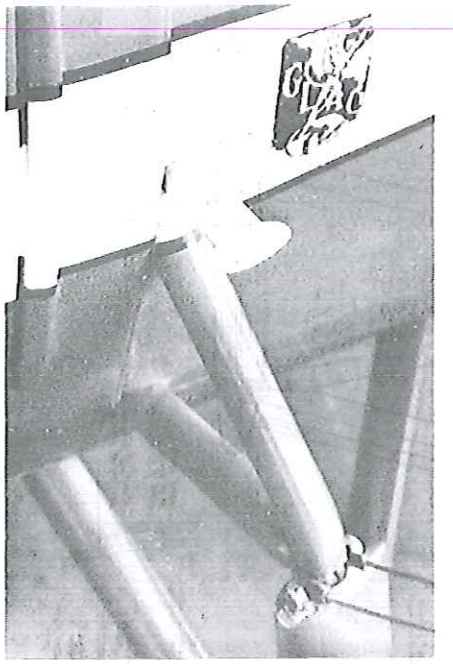
Frank shows how he safely turns the prop for pull-starting the Evra engine, from aside and behind.



Not many, but enough! Instrument panel in G.L.T. was sparse but adequate. Note on-off switch that caused radio problems.



Cooling baffles force air close to engine. Upright installation used same cowling.



Close-up of landing gear, step, flying wire attachment, and cooling louvres.

Steerable tail wheel is legal modification. Steering arms linked to rudder with springs.

mented front and rear.

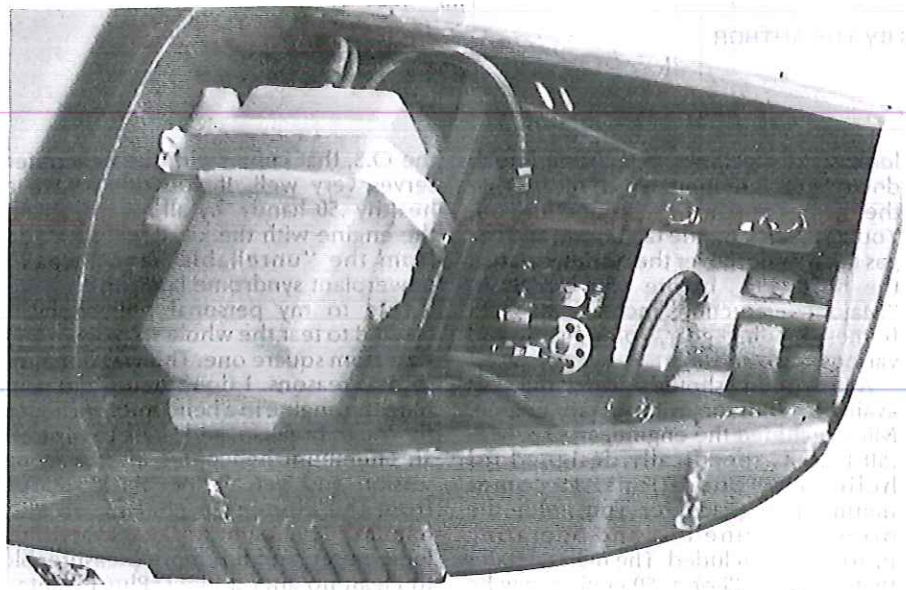
The quarter-scale model is as much a pleasure to fly, I'm sure, as the real one must have been. It is very stable in the air and handles nicely on the ground. The average modeler who can maneuver an advanced trainer would have no difficulty flying the Great Lakes.

The ailerons are a bit slow, but adequate for sport flying. The real Great Lakes must have been similar, as some pilots added ailerons to the top wing for aerobatic show work. So adding extra ailerons to the top wing of the model will be authentic.

Although most of the wood used can be purchased in hobby shops, access to a table saw will make construction easier and considerably cheaper.

You will notice that I use a lot of pine (white pine) for construction. I have found that white pine works nicely, being flexible and with little tendency to split. Go to a good lumber yard that handles different kinds of wood and pick out a board with straight, close grain on all four sides and light in weight. Weight can vary considerably from board to board. Although not always true, I have found that generally speaking, the whiter colored pine is best for our needs. A 1 x 6-inch piece, 6 feet long will be more than enough for this model. Spruce should be just as good, but a little harder to find, depending on your geographic location.

For the upper and lower wing mount reinforcement, look in the molding section of the lumber yard for 1/4-inch lattice. It comes in various widths of white pine and is handy for building large models.



Engine compartment, showing throttle hookup, tank, and choke. Extra plumbing is for smoke system. Busy but neat.

The Evra motor is powerful and reliable, but the transitorized ignition makes it very difficult to start by hand cranking. I was disappointed with the motor at first, but after making the cord starter, as shown on the plans, that problem was nicely solved, along with a safety bonus. Now I can stand to the side and behind the propeller to start the engine. A 18x10 or 8 Top Flight prop works good.

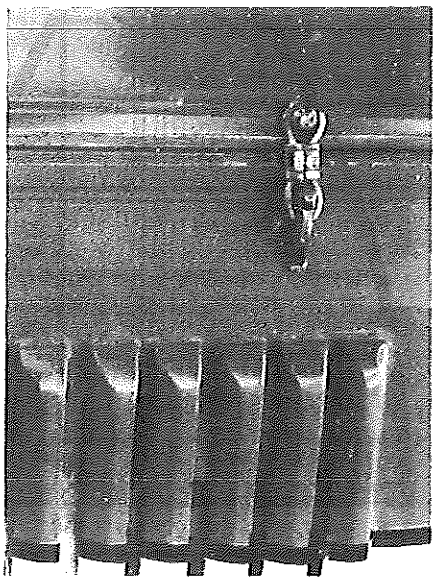
I would not recommend any motor smaller than the 1.9 cubic inch Evra, as this model is made sturdy for the extra vibration and power of a gasoline engine. Finished all up, without fuel, weight should be about 19 or 20 pounds.

An experienced builder could probably use more balsa and lighter plywood and fly it with a belt-drive or .90 size engine. Weight should not be over 15 pounds in this case.

Although cooling baffles for the engine are not absolutely necessary they do help to make it run cooler. I used two lightweight aluminum pieces 2-1/2 inches wide and 3 inches long. Make a right angle bend a half-inch from one end on the long side. Drill a hole near the top and bottom. They can be fastened to the front of the 1/4-inch plywood "A" former with small screws. The screws are installed through the two large openings in the front cowl.

Bend the baffles around the cylinder but keep them at least a 1/2-inch from the engine. If they should touch while running, it could cause radio problems.

When I finished my Great Lakes, I ran a wire from the ground tab on the magneto to a switch in the rear cockpit and back to a ground on the motor. This was my engine ignition switch cut off. I almost lost the ship a few times until I discovered this switch rig was interferring with my receiver. So don't make the same mistake.



Close-up of hood latch made from key-ring holder, also another view of louvres.

Now I have a homemade choke that runs back to the cockpit. It is a must, and can be used to stop the engine in an emergency.

FUSELAGE

Start on a piece of particle board or similar material by nailing a straight 1x2 board across the top, over the plans. Cover plans with wax paper. Line the 1x2 with the top of the fuselage frame. Assemble the two sides, one on top of the other, against the 1x2. The dotted sections in the lower wing cutout and stabilizer mount are built in and cut out later.

To frame up the two sides install the firewall. Use 1/2-inch brads and glue. The brads will make a stronger joint. I have a small hammer for this job, but they can often be pushed in with a nail set or sometimes forced in smoothly with large pliers.

Place the fuselage on a table, upside down, with the firewall top over and against the edge, and add the cross bracing.

Brad and glue the plywood motor mount to the firewall and assemble the engine section.

Now glue and brad the upper and lower wing reinforcement pieces to the inside top and bottom fuselage, then cut out the lower longerons for the bottom wing, also the stabilizer mount. The rest is more or less standard construction, as per plans.

Make the nose cowl by gluing pine blocks together, carved to fit the nose former. Hollow out and glue to the "A" former. A fiberglass cowl could be used, but it involves more work and I don't think anything is gained.

The receiver box is made of 1/4-x3-inch balsa. It is made the width of the inside fuselage so it can be screwed to the bottom of the top wing reinforcement piece. Use a 5/8-inch by #6 sheet metal screw in each inside corner. The receiver is packed in foam rubber and held in place with rubber bands hooked around the dowel pins. This places the receiver in a well protected central location without extension cords, which can sometimes cause trouble. A passenger can be velcroed on the box in the front cockpit.

Wrap the battery in foam rubber and place it just behind the firewall. Hold it in place with rubber bands attached to small screweyes opened up to make hooks. Use at least a 1000-ma battery, you are working too close to the safety margin with anything smaller.

The engine servo is mounted upside down to the bottom of the upper wing reinforcement. It is a little difficult to get to it through the bottom wing opening but can be done. Mount it on 1/4x1/2-inch plywood servo rails glued and nailed at each end with 1/2-inch brads. Use flexible tubing to hook to the throttle, with a Du-Bro ball joint bolted to the throttle arm. My smoke actuating servo is also mounted on the same rails. Do not mount servos too rigidly.

Windshields are mounted in place with pins, then epoxied. When set, remove the pins. Put a piece of masking tape along the base of the windshield about 1/8-inch from the fuselage. The tape will protect it and make a line to work to. Fill in along the bottom of the windshields with a good filler, sand lightly, then remove the masking tape. Put 1/4-inch auto trim tape around the base of the windshields.

The cockpit padding is 3/8-inch plastic tubing slit down one side and worked over the 1/32-inch cowling. This is covered with artificial vinyl leather obtained in yardage stores. Fold over the edge and hold in place with pins. Glue the pins on the inside with epoxy or cyanoacrylate glue and nip off the pins inside when dry.

Louvers are not as difficult to make as they may first appear. Cut 36 pieces of 1/4-inch triangle pine molding each two inches long. Cut a 1-1/2 x 3-inch hole in the side cowls where the louvers are to be located. Glue the triangle pieces in with a 1/8-inch spacer between each one. When glue is set use a sandpaper block with medium coarse paper and sand down to about 1/8-inch thick. Round off the top and bottom so that it blends into the cowl. Then using medium weight sandpaper sand up and down to round off each louver. Finish with fine sandpaper.

To get the seam effect on the engine cowl, use trim tape as used for cars. It is thicker than model tape, showing up better when painted over. Use 1/4-inch first then 1/8-inch centered on top. Put it on the last thing before painting.

WING

The modified NACA M-12 airfoil used on the full-size plane looked good to me, so I used it on the model. It worked so well I will probably use it on any other models I should build in the future.

As shown on the plans, 1/8-inch balsa ribs were used. I haven't tried 1/4-inch foam core board but, after talking to some other modelers, think it should work good on this model. I intend to try it some time.

To prepare for laminating wing tips and tail outlines, first saw a pattern out of plywood or particle board . . . be sure to undercut 1/4-inch. Saw four 1/16 x 3/4-inch strips off a pine or spruce board. If the bend is too sharp for the 1/16-inch strips, soak them in hot water for about 15 or 20 minutes. They should then easily bend around the 3/4-inch pattern. Hold them in place with rubber bands for half an hour or so then remove and let dry. When dry, glue and replace. If long model airplane rubber is not available use knotted dime-store brands. Let set overnight.

I have also used closely spaced nails in a board to form a pattern, using clothespins to hold the laminations together. It is a little easier if a bandsaw or jigsaw is not available. Either way should work OK.

Use a sharp plane to smooth the edges then saw down the center and plane down to 1/4-inch. This gives you two perfectly matched wing tips.

Glue a 1/16 x 1/8-inch strip centered inside. Use clothespins to hold it in place until dry. This will strengthen the wing and tail outlines and make a better joint for the rib ends.

While the wing tips are drying, set up the basic wing structure, which is typical of most built up wings. I always build the ailerons in place then cut the trailing edge out later.

The ribs are notched into the aileron spar 1/16-inch. I use a bandsaw for this but a wide blade saw with fine teeth, such as a keyhole saw should do the job just as well.

On each end of the 1/4-inch brass torque tube, insert a piece of wood dowel and slide a 1/4-inch inside diameter brass tubing over the end to reinforce it for the No. 6 bolt.

If the pushrods on the wing servo are set as shown on the plans, a slight differential is built in, giving slightly more up than down, which helps banks and turns.

The ailerons must work freely. A little bit of very light lube with silicone will help. Do not use oil, as it will get sticky and in time make matters worse.

Wing struts are made from 5/16 x 9/16 pine cut to a streamline shape. The ends are slotted lengthwise with a thick saw blade such as a keyhole saw. Most keyhole saws are sold with a fine-tooth metal blade that is just right for this job.

Slots are out into the 1/16-inch plywood insert for the .055 wire wing fitting attachment. Assemble with ample alphatic glue and clamp.

Be sure to make the N-struts far enough apart at top and bottom to keep them tightly in place when snapped in. Trim and finish off with sandpaper. Wire can be bent slightly if necessary to get a good fit to wing.

The hand holds on the top wing over the front cockpit were not used on all models, so may or may not be built in.

There are three 5/8 No. 6 sheet metal screws through .035 aluminum fittings on each side for rigging wires. Drill a pilot hole for each one in the hardwood block at the base of the outer wing struts.

Run the six screws into place then back them out. Put a few drops of cyanoacrylate glue in the holes to harden the wood threads left by the screws. When set, run the screws back in. These six screws are removed to disassemble the wings, the flying wires are left on the fuselage.

The fuel gauge is made of balsa or pine turned on a drill or carved out by hand. It is held in place with a piece of 1/8-inch plywood. Just cut a notch in the bottom of the center rib and put a 1/4 x 1/4-inch balsa stick on each side. Stick a printed fuel gauge on the back flat side.

The gas cap on the top wing is made out of a 3/4-inch plastic cap off a bottle or tube.

TAIL STRUCTURE

Begin the tail by making the laminated outlines first, using the same method as used on the wing tips.

The ribs could be shaped first, but the easiest way to build tail surfaces having airfoils is to build them flat, then shape after assembly. Sand with coarse paper to a symmetrical shape, with the maximum thickness at the spar. Glue sandpaper to a 1 x 2 x 12-inch block, fine on one side, coarse on the other, to give all the ribs an even contour.

After the tail section is framed, make saw cuts in the tips with a hacksaw as shown on the plans. Force some glue into the slots and insert pieces of 1/32-inch plywood. Doing this takes little time and insures that the tips will not work loose in the future.

Hinges are the new extra large Robart Super Hinge Points. They are easier to install than the conventional hinges.

The brace wires are bolted directly to the tail rather than using fittings, for a reason. Besides making the job easier, it lessens the chance of static noise interference to the receiver.

Be sure to install the stabilizer and elevator before the fin and rudder. They are covered and finished on the fuselage.

LANDING GEAR

The landing gear on the Great Lakes is a bit more complicated than average. Bend the front 3/16-inch music wire first, which is also the axle. It bolts to the front of the firewall and should be assembled, with the rest of the gear, on the fuselage.

Bend the 1/8-inch rear wire and bind and silver solder to the front wire.

The pine streamlining can be added now or later. Do not use balsa, as the pine is needed to strengthen the wire.

The upper fuselage landing gear braces are made of 1/8-inch wire. The ends are heated red hot and bent around a 5/32-inch rod. Let it cool slowly. Bend the other end to a right angle. They slide through the 1/4-inch brace on each side and bolt to the back of the firewall. You will have to elongate the hole in the fuselage to take the bent wire.

Take a piece of 5/32-inch brass tubing and spread one end out by tapping a center punch in it. Cut it off about 3/8-inch long and insert it into the loops of the 1/8-inch wire. Spread out the other end and tap each end with a flat hammer to make a tight fit. Add streamlining.

The shock strut is made of a 1/2-inch inside diameter brass tube. Put a one-inch long piece of 1/2-inch outside diameter in the top for reinforcement and press down in a vice so it will fit over the upper landing gear brace, then file to shape.

The lower section is 1/2-inch outside diameter brass tube that slides into the upper against the spring. If you use a tubing cutter, it will press in the sides enough to hold against the spring.

The bottom is reinforced with double tubing one-inch long, also add a piece of 1/16-inch aluminum 1/2-inch wide inside the end for extra strength and flatten in a vice. Drill and slide over the axle. The spring should be fairly stiff. I figure the tires will take the good landings, and the spring shocks the hard ones. What? You say you never make hard landings. OK, better put good springs in anyway!

Standard tires were 24 inch by 5-1/2 inche (6-inch on the model) high pressure. "Airwheels" 22 inch by 8-1/2 inch (5-1/2 inch on the model) were extra. The low-pressure 22-inch wheels were the most popular. The 5-1/2 inch Du-Bro wheels are just right and work nicely.

TAILWHEEL

As far as I know, no planes came from the factory with steerable tailwheels, but were added on in later years. So either a skid or wheel is acceptable. Both are shown.

The tailwheel spring is made of three thicknesses of .035 hard aluminum 1/2-inch wide. Make a bearing of nylon (outer Nyrod) with a No. 10 nut forced over each end to hold it onto the spring. If trouble is encountered getting the nuts over the nylon, warm it until soft then try again.

Use a No. 6 bolt on the caster with micarta or similar material for the cross-arm. Metal may be used, but there is always the chance of static noise.

Du-Bro ball joints are used to hook the coil springs to the rudder cross arm. Run a cutoff brass threaded coupler, drilled to take the spring, into the nylon socket. Put some tension on the springs.

When assembled, coat all the nuts with epoxy to keep everything tight. When final assembly is made on your model be sure to lock all screws and bolts in place with a drop of glue to prevent any loosening by vibration.

COVERING AND FINISH

I used a lightweight polyester cloth for covering. It can be purchased in fabric stores, and is used for lining drapes, clothes, or whatever. Ask the clerk for 100 percent polyester sheath lining or "Applause." It also comes under different trade names, the clerk will know. Be careful not to get preshrunk.

Use dope to attach it. Then tighten with a flatiron set by starting at a medium temperature and gradually raising it until the fabric tightens in a few seconds when the iron is passed over it.

Of course Coverite is excellent for large models but expensive. Do not use the plastic coverings. They do not have the strength for a model this size.

I don't think I ever finished any two models alike, so use your own favorite method. I'm still looking for the perfect finish.

Acrylic lacquer was the big thing when my model was ready to paint, so thought I would give it a try. It was nice to work with, but when fully dry, I found it was too brittle for fabric and tended to crack. So if you use acrylic lacquer add a plasticizer.

The Great Lakes came in a variety of colors, but usually used the same layout trim, which was a basic color with the nose of a different color that tapered to a stripe the length of the fuselage. I just made believe I had bought a standard Great Lakes and added some extra trim to personalize it.

The wing registration numbers, upper on the right and lower on the left, were usually black, six inches high, four inches wide, one-inch thick, with one-inch spacing. Rudder numbers are 3/4-inch high, between the first and second rib from the top, although pictures show them in various positions.

The Great Lakes trademark is made by tracing on clear Monokote or similar plastic covering with pen and India ink. The ink seems to adhere better if a little pressure is used on the pen. I use a Rapidograph but a Speedball should work just as well. If trouble persists, try rubbing with toothpaste to cut the glaze of the plastic.

When dry, trim to the edge of the drawing and then iron on another layer of clear plastic to seal it. Use just enough heat to make it stick. Too much heat will cause wrinkles. Trim the second piece of plastic a little larger and it is ready to mount on the fin.

Use rub-off or decals for lettering. Spray very lightly with a clear spray to protect them.

CONCLUSION

The 2T-1E doesn't seem to have any bad habits as far as I can see. I have spun it power off and on. It comes out in less than a turn. It loops, snap rolls, and rolls nicely, but is a bit slow.

Do not try rolls too low (guess this is good advice for any model). Takeoffs and landings can be made realistically with smooth ground tracking.

Well, this about sums it up, so get started, you won't be sorry.

Most of my information was obtained from William A. Wylam's very detailed drawings in *Model Airplane News*, May 1956: Peter Westburg's excellent drawings of the 2T-1A, December 1977 to February 1978 **Model Builder,** and U.S. Civil Aircraft, A.T.C. Numbers 301-400, Volume 4. •