TOSSETTE

By ED DEPUE . . .Here's an easy to build, lightweight hand-launched sailplane that is tailor-made for small fields and schoolyards. Construction is straight-forward and basic. Performance is outstanding.

• When I set out to design a small glider, I knew that I wanted an easy to build, lightweight, handlaunch-type sailplane to use in the nearby schoolyard for some fun flying. The Tossette has exceeded my goals by being not only fun to fly, riding up on the lightest of thermals, but proving itself to be a competitive flyer against other small sailplanes. It won the First Annual I.S.S. R/C Handlaunch Contest in June 1984, flying with a variety of very well-designed, and good-flying small gliders. The Tossette does very well on the slope, also, staying aloft in breezes that are too light for gliders the size of the Wanderer and Gentle Lady to fly in, and yet still able to penetrate any strong breeze as the others do while being maneuverable and fun in a smaller space.

I kept the structure of the Tossette simple for ease and speed of construction, using carbon fiber to reinforce typically weak areas. If you plan to launch the Tossette from a standard high-start or a winch, replace the inside wing panel balsa spars with the same size spruce spar material.

Using the "low tech" method of airfoil development, I took an Eppler 205 outline and added undercamber to it and drooped the trailing edge some. It looked like it ought to work OK (I can hear the high tech plotter types groaning) and it does! I guess you can call this a *very* modified 205.

Cut the ribs, formers, fuselage sides, braces, etc., before you begin building. The wing, although undercambered, goes together quickly. Read through the building sequence before starting.

Begin with some 3/16 x 3/4-inch trailing edge material and shave it down to the 1/8 thickness shown on the plans, or you can simply shave some 1/8 sheet to shape. I use a Master Airscrew razor plane. This is an excellent little tool which makes an easy job of it. Cut the slots in the trailing edge 1/8-inch deep. For this cut, I used two fine-tooth hacksaw blades glued together. The resulting slot is just the right size for the 1/16 ribs. Set the trailing edge aside for now. It goes on last. Read on.

Precut all 1/16 shear webs two inches in length (vertical grain), and a little taller than the final size. After you glue them in, you sand them to the exact size with a 4-1/2-inch piece of 1/4 x 1/2 spruce, with sandpaper glued to one edge.

Pin the right outer panel spar to the plan and glue the poly brace in position. Glue W3 against it, and then add the shear web between W3 and W4 location. Keep the back of each rib down on the plan as you proceed. Install and glue W4 and the next shear web, then W5, etc. on out to the tip. Glue the leading edge in place, then take a W2 rib and cut it into two pieces where the poly brace will intersect it. Remove a small amount of wood from each piece of the rib to allow for the thickness of the brace. Trial fit these pieces before gluing them in. Sand the shear webs and poly brace so the spar rests snug against all pieces. Add the top spar and turbulators now.

Lift the assembly from the plan and pin down the right inner panel spar in place. Carefully align the outer panel to the plan and spar. Prop it up to the correct height of 3-3/8-inches, measured at bottom spar and W7, and glue. Now, take all the W2 ribs and shear webs, and glue them down.

W1 ribs require 1/16 shims under the rear to allow for sheeting. Install 1/16 W1 rib, then fit and glue dihedral brace to spar and W1. Glue the leading edge on now. The 1/8 W1 center rib is treated the same as the W2 poly rib. Install the center rib, sand shear webs and plywood brace to fit spar. Now glue top spar and turbulator in and when the glue is set, lift the assembly from the plans.

The left side of the wing is done just like the right side, but when you get to the point of installing the left center top spar, you fit the right wing assembly to the left one and block it up to 3 inches at the poly rib, and glue them together. Now put the top spar and turbulators in. Remove the wing from the plans.

With the rear of wing off the edge of your building surface install T.E. material. Starting with a center section, fit the trailing edge to the ribs. Check for proper alignment by placing a small straight edge across the top of the trailing edge and the top of a rib. The straight edge should be flat against the trailing edge and the first 1-1/4-inch of the rib. Glue the piece of trailing edge when properly aligned. Do the remaining pieces the same way. Be sure to have the trailing edge at each wing tip extend past the last rib (W7). Now build the tips on the wing. Cut a hole in the center section leading edge and slot the 1/8 W1 for 1/8 hold-down dowel.

MATERIALS LIST

5 Sheets 1/16" x 36" balsa
4 3/32" x 1/4" x 36" balsa
4 3/32 " x 3/32" x 36" balsa
4 1/8" x 1/8" x 36" balsa
2 1/8" x 1/4" x 36" balsa
2 1/8 x 3/4" trailing edge balsa
1 2" x 6 3/4" x 1/4" balsa
1 1" x 2" x 2 1/2" balsa block
1 2" x 4" x 1/64" plywood
1 5/8" x 2" x 1/8" lite plywood
1 2" x 18" x 1/32" plywood
1 .007" x 1/4" x 36" carbon fiber laminate
2 Sullivan #507 push rods
2 Goldberg control horns

Sheet the center section top and bottom. Sand the sheeting to match trailing edge and spars, and shape the leading edge. Reinforce the wing joints with glass tape and CyA glue or epoxy. Install hold-down dowel and add the 1/64-inch plywood piece where hold-down screw goes through the wing trailing edge. Drill a small hole in each rib so expanding air can escape while you are covering the wing. Finish-sand the wing.

Build the vertical and horizontal stabilizers next. Cut the 1/16 x 1/8 diagonal pieces from 1/16 sheet stock. While building the horizontal stab. be sure to note the slot for the vertical stab. When complete add the carbon fiber laminate where the plans indicate. Cut slots through corners with a razor saw (Xacto #239) or razor blade. Push C.F. in slots, (1/64 plywood can be used although slightly heavier), and glue with thin CyA. Make sure the C.F. is deep enough not to be sanded while shaping. Place vertical stab. into slot provided in the horizontal stab. and glue at 90 degrees. Note that the vertical goes to the bottom surface of the stab. This "Fin in the slot" is a lot stronger than simply gluing the fin on top of stab.

Now the fuselage. Be sure to add the C.F. stiffeners to the fuselage sides (you can substitute 1/64 ply in all areas where C.F. is called for on the plans), and glue with thick CyA. Mark the inside of each side where the vertical 1/8-square pieces are to go, and mark the rear 1/16 vertical stiffener locations also. Install all 1/8-square longerons, then wing saddle pieces to each side, then the 1/8-square vertical locators and 1/16 stiffeners. Cut 1/16 sheet doublers to fit and glue in place. Taper longerons at rear, and keeping the side aligned over a straight line, glue in F2, then glue rear of sides together. Add F3 and F1 now. Fit the 1/16 sheet pieces behind F3 to form finger box and glue. Install control push rods now and if you are going to run the antenna through the fuselage, plan your route and make an exit for it now. Glue the 1/32 plywood floor, top and bottom sheeting, and nose block to fuselage. Add wing screwblock, horizontal former, and tail skid now. Tack glue the radio hatch on and then sand the fuselage assembly to shape.

Place the wing on the fuselage with the wing hold-down dowel in the hole in F2 former. Hold the wing in place with rubber bands. Measure from the rear of fuselage to each tip, and adjust until equal then drill through the wing and screw

block. Remove wing, tap block for the 6-32 nylon screw. Put thin CyA on threads in plywood block and tap again. Now put the wing back on the fuselage, and using the eyeball method of alignment, glue the tail feathers onto the fuselage in line with the wing. Finish sand the whole thing.

I had originally used a 4-40 screw wood shear on hard landings, preventing damage. But one day, at the neighborhood school, with my arm warmed up and my back good and limber, I was throwing as hard as I could to see how high I could launch the Tossette. On the last of these launches, the 4-40 screw head popped off and the wing fluttered to the grass behind me. The fuselage, without the wing, will go quite high indeed. Just before the fuselage hit the hard, unforgiving black top of the basketball court, I vainly applied full-up elevator; that changed the angle of impact but not the result. The nose was destroyed, the fuselage was broken completely directly behind the wing, the stab. broke, all the R/C gear tore loose. . .a real basket case. I took the broken Tossette home and stuck it on a shelf and just left it for awhile. Lacking time to build a new one, I repaired it in time to fly it to victory in the I.S.S. Hand Launch Contest. The Tossette is a winner even when it is bent!

I used super-MonoKote to cover the airframe. Use care with the stabilizers. Cover each side of the stabilizers before you shrink the covering. Cover the fuselage and radio hatch. Do the bottom of the wing first, one panel at a time. Iron the outside edge all around the panel, then attach the MonoKote to each rib bottom before shrinking. Cover the top of the wing last. I put 3/32 of wash-out in each tip for good luck. I used hinges made from MonoKote on the first Tossette. On the second, I used Rocket City strip hinges, cut 3/32 wide x 1/2 long. The control horns are from Carl Goldberg 1/2A control line bellcrank sets (2). An alternative is to make and use plywood horns. Use servo tape to mount the servos. Install your radio as far forward as you can. Try to balance without adding any extra weight. If you use a battery larger than 100 m.A., you can place the servos or receiver under the wing. Do whatever it takes to balance it. Do not add any more than absolutely necessary. Try to keep the weight under 12 ounces for best performance. The first Tossette weighed 8.2 ounces but I made every effort to save weight, so if you build one that weighs 9 ounces, you are doing pretty good.

Set up the control throws per the plans, I fly with dual rates and use 1 inch of throw each way for rudder on low rate, and all I can get on high rate. For elevator 1/4 inch on low and 3/8 inch on high. The big rudder makes a great deal dethermalizer on high rate, full rudder and down elevator will bring you down in a hurry. The large rudder is good for stunts, also, if you are so inclined.

Let's go fly your shiny new little airplane. Test glides first. Controls feel okay? Make any changes before you try any tosses. Easy now, not too hard before you are warmed up. You do not *have* to get maximum altitude to find lift. Some of my most memorable flights have come from low (20 ft.) launches, and weak thermals. I have had flights last four and five minutes and never gain more than 50 feet above ground level. I can take the Tossette, my transmitter, and ride my bicycle over to the school and get in an hour or so of satisfying flights on the Saturday and Sunday mornings when the weather is good for flying and I don't want to take the time to pack up my big planes, winch, retriever, batteries, flightbox, chair, lunch, etc., and spend the day at the club flying field.

I've made an ultra-light high start from 50 feet of 1/4-inch flat rubber and 150 feet of 10 lb. test monofilament line and a 6-inch parachute. I use it when I feel lazy, as it's not quite as challenging to find lift from the higher altitude the high start gives, and it is easier on the body.

I know you will have fun with your Tossette, and if you enter a hand launch contest with it, the Tossette will definitely challenge the competition. You will be amazed, I am sure, at how tight a circle a small light glider like this can maintain in a thermal. •