



Not many individual parts to this combat ship, and once you are set up, the wings can come off like a production line.

BUMBLE BEE for COMBAT

This is one combat ship that will go down ... up in history. At the Oshkosh Nats it got away from Phil and flew O.O.S. directly overhead! Aside from that, this foam wing ukie builds and flies fast! By PHIL CARTIER.

This plane is not the ultimate combat ship, but it does have a few things going for it, such as speed, maneuverability, ease of building and light weight. The speed depends mostly on the engine- prop-fuel combination that is used, but speeds of over 110 mph with a streamer are easily obtainable. Of greater importance is the less than usual loss of speed in tight maneuvers, even when propped for a high level flight speed. The relatively high aspect ratio wing is used to decrease drag build up in the turns and is combined with an airfoil that has good drag characteristics. The foam wing provides easy building. There is less than half the usual number of pieces in a typical balsa combat plane. The foam also contributes to an extremely light but strong structure. The total airframe weight is usually 7 or 8 ounces. When combined with a Supertigre G21 .35 the final weight is about 17 ounces.

"Now, to the cellar, slave!" Speak thusly to your trusty helper and prepare to cut the wing cores. Our R/C brethren have developed some good techniques for this which I have freely adapted. The basic essentials are a low voltage, high amperage power source, a cutting bow, low table and foam. I use a model train transformer and .020 music wire in the bow.

If you don't like to fiddle around, buy a hot

wire outfit. I can't afford to.

Begin by tracing the root and tip templates onto 1/8 inch ply; cut them out and sand smooth. Make them precisely symmetrical in outline by drawing around the template on a sheet of paper, flipping the template over and checking how well the outlines match. Sand where necessary and repeat until the outline of the template is symmetrical. Careful initial cutting will minimize the work necessary to get good, symmetrical templates. Apply the guide numbers and other markings to both sides of each template. Drill two holes on the centerlines for use in mounting the templates to the foam.

Square up one corner of the foam block. Most large lumber supply houses carry a bead type styrofoam of about 1.8 pounds per cubic foot which works well. Tape and block the foam to the work bench, taking care not to bend it. Add shims, if necessary . . . don't force it to lie flat. Most commercial blocks are warped. If the block is bent straight before cutting the core, the resulting wing will have a bend in the middle.

Pin the templates to the foam, using large finishing nails. Make sure center-lines are parallel to work bench top. Line up the leading edges of the templates about 1/16 inch from one edge. Start cutting at the leading edge, going quite

slowly and using the guide numbers to keep the wire lined up. Cutting speed should be about 1/10 inch per second. When cutting the matching core, pin the reverse sides of the templates to the foam. This will keep the same surface of the templates on the top of the wing, balancing out the effects of any slight irregularities between the surfaces of the templates.



The author with some of his combat ships. Solarfilm will go on foam without damage.

Make up two spar slot cutting guides from 1/8 inch ply that will give a slot that is a tight fit on 1/8 inch balsa. Different hot wire apparatuses will require slightly different guide spacing for the correct width slot. Cut the spar slots in one core and use it as a guide for marking and cutting the other core.

Cut a hole for the penbladder compartment in the right panel by heating a piece of 1/8 inch music wire nearly red hot and melting out a six and one half inch deep hole about one and a quarter inches in diameter. Also saw off a 1/2 inch thick section at the root, back to the main spar, to make room for the motor mount.

Make up two jig blocks for cutting the lead-out holes. Tape these about ten inches apart on the bench. Line up the core with them and tape down to the bench with a 3/16 inch block under the tip. Heat up the 1/8 inch wire again and run it through the wing, from tip to root, using the guides. It may require reheating to get all the way through. Use the same wire to cut out between the leadout holes at the root for the bellcrank. Now sand the cores thoroughly using 220 and then 360 paper.

Make up the motor mounts. The grain in the spacer must be horizontal, because the motormount-spar joint is subject to very substantial vertical forces which fracture the wood if the grain is vertical. Cut out the remaining pieces. Make up the bellcrank and mount and epoxy to the spar joiner. Trial fit all the pieces together, cutting and sanding if necessary to get tight joints.

Epoxy the main spars into the cores and use tape to hold the joints tightly together while the glue cures. Tight joints require less glue and mean less weight. Thread the leadouts through the inboard core and glue the spar joiner in place. Follow immediately with the outboard panel, tape the whole mess tightly together and block up on a flat table to make sure that it is straight while the glue cures.

While the epoxy is doing its thing to the wing, sand the booms and carve the stabilator. Attach the stabilator to the booms by epoxying the hinge pins in slots in the bottom of the stab. It is a good idea to reinforce the hinge with a u-shaped piece of 1/32 inch music wire epoxied to the booms. Just running the hinge pin through a hole in the boom is not strong enough.

Getting back to the wing, epoxy in the penbladder compartment, the motor mount, leading edge spar, secondary spar and the trailing edges, again using tape to hold the joints tight. Add the tips, bracing, and nylon tube lead out guides.

After allowing the epoxy to cure, sand everything smooth, taking off all the bumps and rough spots.

Vacuum the wing thoroughly to remove all the dust from sanding. This allows the covering to adhere better. Cover the model with Solarfilm, Pascal or Mylar. I prefer Solarfilm because it shrinks at a low enough temperature that the foam is not melted. Pascal and Mylar require higher temperatures, so shrinking them after application to the foam is quite tricky.

Poke small holes through the covering where the booms go and epoxy the tail in place. Hook up the controls and adjust for about 15° of movement in each direction. Coat all wood surfaces with three coats of urethane varnish, sanding lightly between coats. Install the engine and check the balance point. If necessary, add weight to put it where it belongs. The point shown on the plans gives a stable airplane that does not jump around. Make one last check for warps before heading for the field. They can be removed by judicious use of the iron and a little pushing. Heat the offending spot and hold it in place while it cools.

It doesn't make much difference what kind of weather you test fly in. Just be on your toes at the launch and through the first few maneuvers. If the plane flies with one wing high or low, or lightens on the lines when turning in one direction, find the warp and take it out with the iron. If it lightens in the turns in both directions, epoxy 1/4 to 1/2 ounce of weight to the outboard end of the spar. If more than 20° of stabilator travel is needed for satisfactorily small loops, add tail weight. Narrowing the line spacing at the handle will cure jumpiness and overcontrolling, but first make sure the balance point is not too far back. This is unlikely though, because the design tends to build nose heavy. When it is trimmed out, it won't require constant attention to keep track of it, yet it will turn with the best of the opposition.

When picking fuels and props, most people tend to go for maximum level flight speed. This is fine for advertising, and a few people are psyched out by idle comments such as ". . . only a hundred twenty-five with a streamer . . .", but the real test is in the turns. Haul a stop watch out to the center of the circle and time your favorite weapon through five or ten consecutive full control Figure Eights. Four seconds per Figure Eight is a good number to shoot for. Try different combinations of fuel and props to find the one that gives the highest top speed combined with the fastest time through the maneuvers and you will have a winning combination.

Good luck and good hunting!