



Up, up, and away, good hand launch of the plane is single most important part of Combat.

Bee Ware

West Coast Slow Combat machine can hold its own in most situations; aggressively piloted in contest, can do it all!

The man himself, plane and tools of the trade. Smiling now, never during Combat action.



• The "Bee Ware" project started out with Slow Combat in the summer of '73. My flying partner, Larry Cargill, and I started working with airfoils. I had heard of some experiments which moved the airfoil high point forward. So I did some moving, ending at 20% with a blunt L.E. and a 98 mph machine that would turn like crazy. After learning more about combat, I wanted to get into Fast Combat; we used the same wing and many planes later settled on this design. The first two planes we built used a thin spar as in the slow planes, but we found these spars not strong enough. We blew off the outboard wings when we got these machines into some super tight turns.

Since these first planes I have done a lot of experimenting with minor changes; the wing tips actually make the plane turn tighter: There is an unusual characteristic about this design, the faster it flies the better it turns. On two tests comparing this design with a very popular kit, the "Bee Ware" obtained 10 mph faster speed using the same engine, setting, fuel and propeller. The "Bee Ware" must have a warp-free wing and the stab must be perfectly aligned. Our goal was to design a plane that would out-fly anything we had used and I feel we have achieved this.

I am not going into a lot of explanations on construction, as this is straight-forward and has been covered in previous Combat articles. I feel the "Bee Ware" needs particular attention placed on the trim, so I will share with you what we have learned.

CONSTRUCTION. Here we are building a machine that must be as strong, light, and warp free as possible. While you are selecting wood, and cutting out parts, the following instructions need to be followed: Use ¼" square spruce spars, select strong balsa for the T.E., light for L.E. sheeting, select a ⅜" square balsa L.E. that is strong, and straight. Select firm balsa for the center ribs; one rib is cut off forward of the spars.

For the bladder compartment, build up wing, gluing all ribs to the bottom spar, making sure the engine mount assembly will fit snugly between the two center ribs, and making sure all ribs are lined up at the T.E. Add lower T.E. sheet, and top spar. Now you are ready for the top T.E. sheet. To do this right the following will give you a good straight T.E.: With the wing on a flat building board with the T.E. on the edge of the board, glue and pin top T.E. in place pinning only at forward edge of T.E. and ribs. Now you will need a ¾" x 1" piece of straight lumber. Lay this down on top of the T.E. making sure the T.E. is flush with the edge of the building board. Use clamps with only the slightest pressure to draw the two T.E. sheets together, while perfectly flat against the building board. Let dry overnight. Next step is to add the 1/16" sheet web in the bladder compartment. Don't use any tubes here as they add weight. This system is simpler and works just as well as

(Continued on next page)



Preparing for a fast start, note size of pump used to prime the motor. Helper waits to attach battery clip and the hand flip to start.

BEE WARE . . . CONTINUED

combustion with the bellcrank mount, engine mount assembly and the $\frac{3}{8}$ " square L.E. Next add the L.E. sheeting. This can be done neatly and easily. After the sheets are cut to size, glue along the spar, and about halfway forward on the ribs. Pin or tape the L.E. sheet along the spar, and halfway along the ribs. After all sheets are done this way and dry, cut strips of masking tape, glue along L.E. and top and bottom of ribs. Then pull the sheets down to the L.E. and tape. When dry, shape the L.E., spend some time here, and make sure you have a blunt L.E., as this is an important factor in the turning ability of this design.

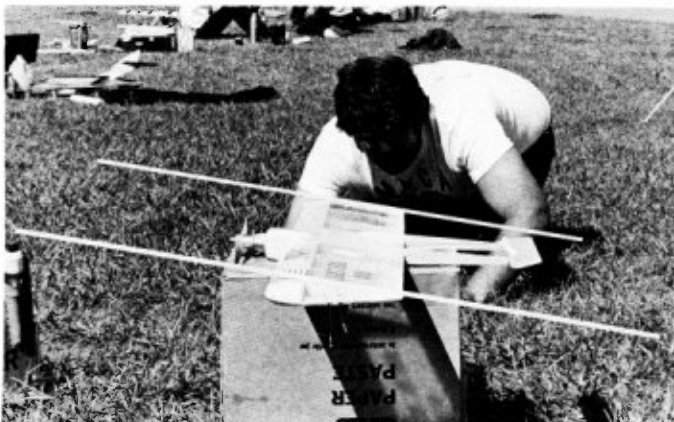
Now add the controls, using inside hole on bellcrank and making sure the pivot point hole is $\frac{3}{4}$ " from center rib, as this insures the correct amount of bellcrank throw. Add center sheeting, wingtips, tip weight, tip braces, capstrips, cut out vent hole, and bladder access hole, and add nacelle. Give the whole assembly a good sanding, and you are ready for covering. We use Fascal, which is stronger and less expensive than any other covering. This material is made for the photo industry, and several

hobby shops in northern California stock it.

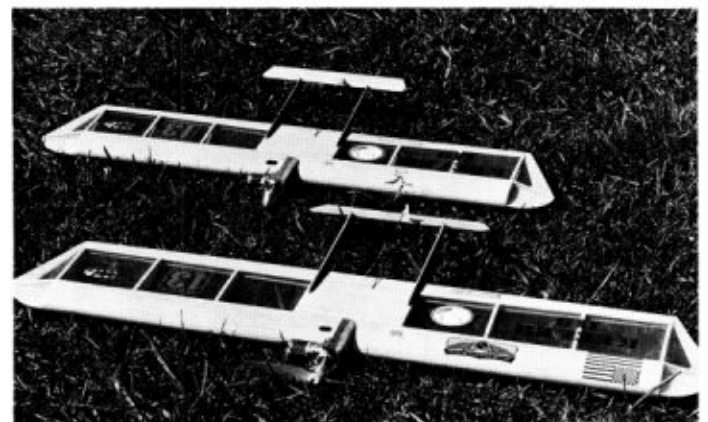
After the wing is covered, try my method of controlling warps. Since I have developed this method, there is no need to check for warps while flying. Once the wing is covered and before the booms are installed, sight down the T.E. and make sure it is straight. Now set the wing up on the bench, block up the wing level so you can get back about 5' and sight down the wing, from tip to tip. Now select two 36" lengths of straight stock; I use $\frac{1}{4}$ " sq. spars. Place one on each wing tip, about $\frac{1}{2}$ " from the outboard rib, making sure the stock is centered on the wing and resting on the T.E. sheeting, and the L.E. sheeting as well. Get back and sight down the wing; you will be able to spot the slightest warp easily. Work out warp with a hot iron, making sure the T.E. is kept straight. When you get the two pieces of stock lined up, you have a perfectly warp-free wing. Just for fun, slip a building pin between the stock and a T.E. Look down the wing again and you will see now just how small a warp this system can detect. All that is left to do is to add the booms, again taking care to get them align-

ed, or you will have problems. I use a small dab of 5 Minute Epoxy to tack on the booms. After they are set in place, go around the booms with epoxy, and also go around the motor mount and nacelle area. To seal the covering, you need to fuel-proof the bladder compartment. I open the vent hole, pour in about one ounce of Hobby Pox Clear Paint, tape over the hole, and roll the wing around, coating the entire bladder compartment. Then cut away the covering from the bladder access hole and drain out the epoxy. Give all wood parts a coat of Hobby Pox; a second coat makes a nice finish. Install control horn, making sure there is equal throw up and down. We have found that the best position for the pushrod is $\frac{5}{8}$ " above the stabulator; use this location as a starting point and experiment.

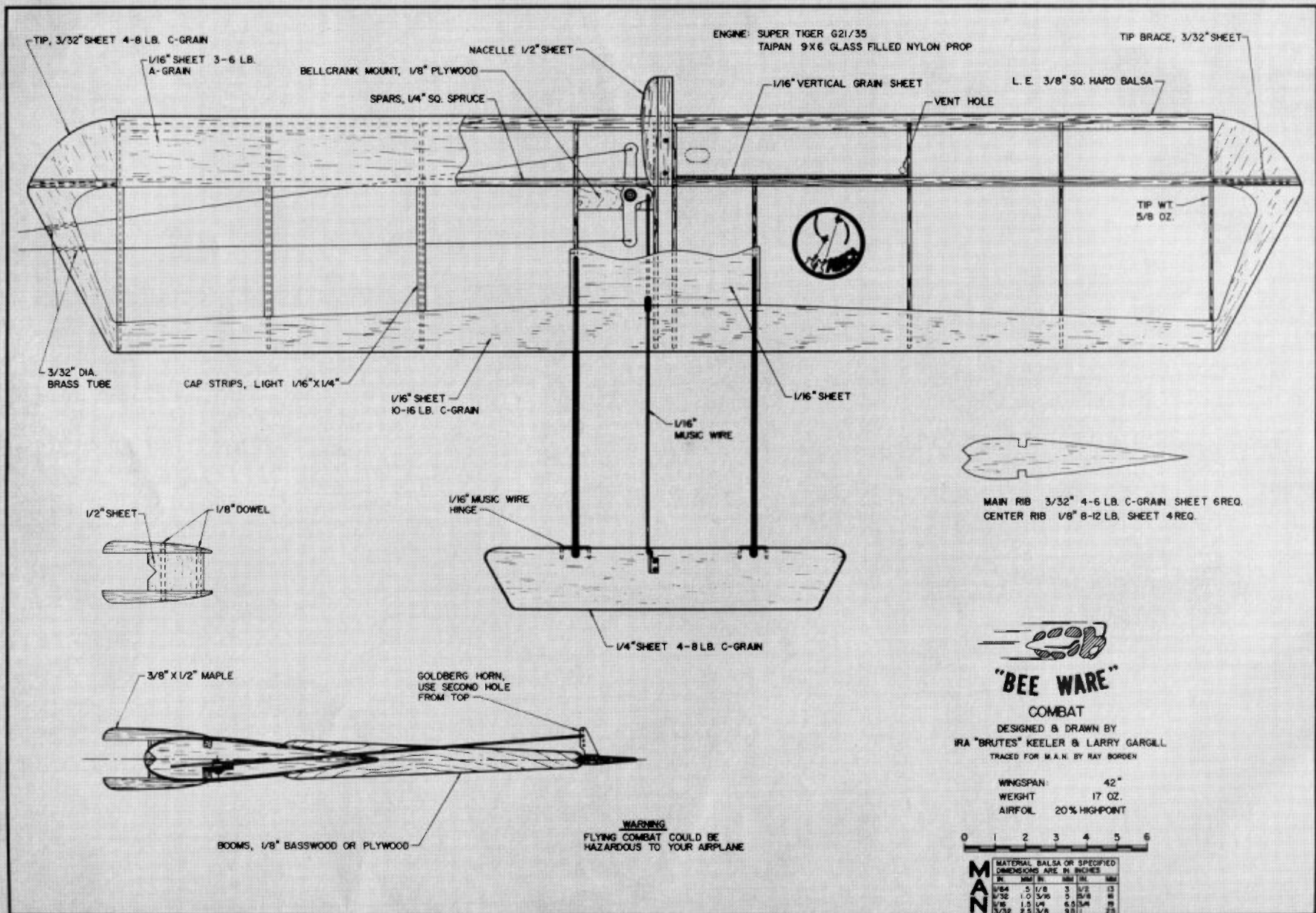
FLIGHT TEST AND TRIM. Bolt on a strong engine as this machine needs to go fast in order to perform. If you fly it at 100 mph it will seem rather sluggish, so kick it up to around 115 mph, and you will find a super-tight turning machine on your lines.
(Continued on page 92)



Checking for warps, using straight sections of wood; details in text.



The big and the small of Slow Combat, both very clean and efficient.



SUPER FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 94.

Bee Ware

(Continued from page 26)

If you experience some coming in, or outboard wing up, check again for wing warp; also check the stabulator for the slightest misalignment, and if okay, try adding a small amount of tip weight to the outboard wing.

The "Bee Ware" will fly very steadily when it is trimmed, and will turn tight, provided the air-speed is over 105 + mph. This design won't necessarily put you in the winner's circle, but it will improve your game.

You may find it difficult to locate some of the materials used in combat, Fascal, Basswood, engines, etc., but this will no longer be a problem if you belong to M.A.C.A. The Minature Aircraft Combat Association has a monthly newsletter which from time to time lists suppliers of combat equipment. Members can get help locating materials and information through the newsletter. I hope you will join M.A.C.A. if you are not a member. Annual dues, including newsletter, are \$5.00. Send check to M.A.C.A. c/o Tom Southern, Treasurer, 2207 Paul, Longview, TX. 75601.

I would appreciate hearing from you about the "Bee Ware," M.A.C.A. or Combat in general. My address: Ira Brutes Keeler, 330 Azalea Way, Vacaville, CA. 95688. ■