Design by Steve Hills

SLYSIR

Text and photos by Rich von Lopez

This design, piloted by Steve Athans, won the ½A Combat unofficial event at the 1983 National Contest. The lightweight foam wing, with its great strength and rigidity, is a definite plus factor.

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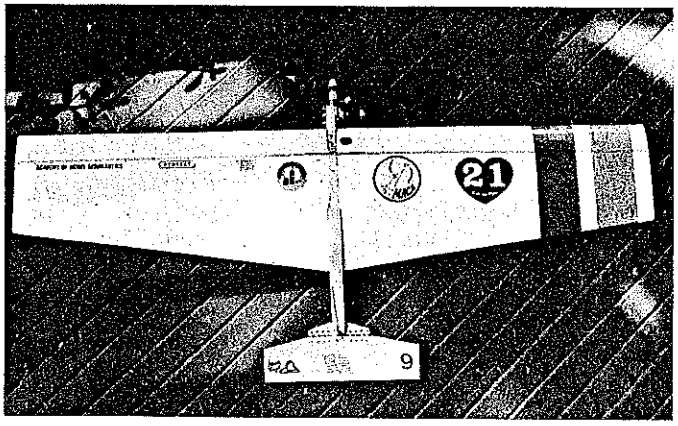
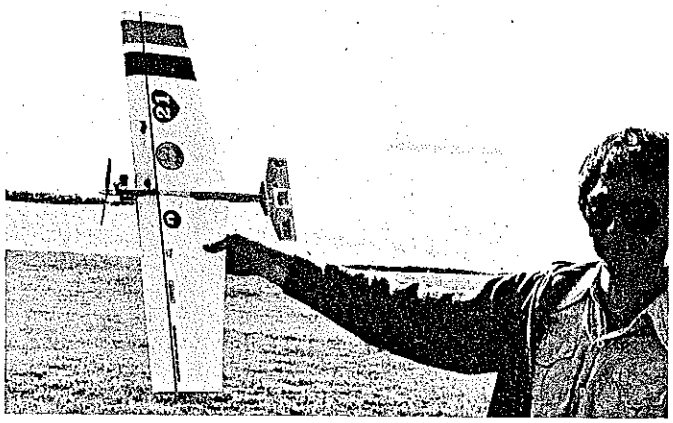
Build more than one model at a time, the author says, to assure yourself of always having practice models. Shown are four of six SlySirs that were built in one session. Foam-winged Combat models aren't any easier to build than open framework versions, but they have other advantages.

THIS IS THE BEST all around ½A Combat model that has been designed to date, in my opinion. There are wooden ½A Combat models that will fly just as well as this one, but as far as crash resistance goes, foam has it all over balsa models. That's quite a statement, but one that I believe to be true. I have been flying ½A Combat since 1965 and have designed three ½A Combat models that have been published, one of which was produced as a kit. You can see that I have a fair amount of experience. Steve Hills, the designer of SlySir, has been flying since 1955, and he has also designed several ½A Combat models, though this is his first design to published. A great many of the Combat pilots in Southern California have long recognized the soundness of Steve's foam designs and have used them year after year.

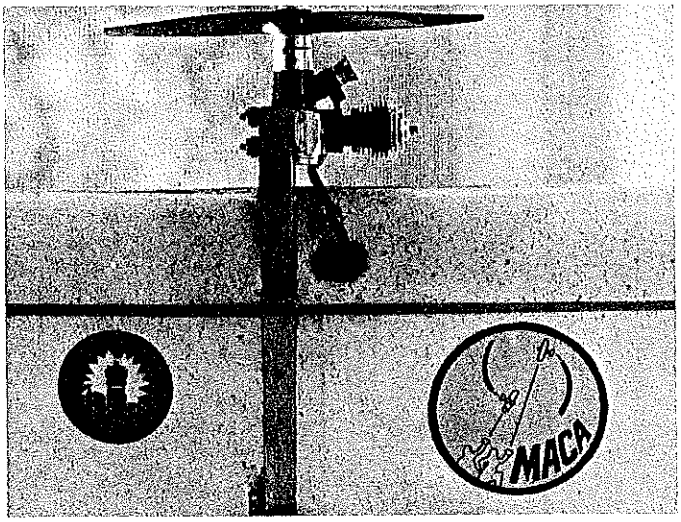
What makes this design superior to all the others? Its strength and light weight are the answers. These models come in at between 5 and 5½ oz. with 180 sq. in. of wing area. The design features tapering trailing edges and airfoil section to reduce the weight at the wing tips. The foam wings are not cored-out except for the lead-out slot in the inboard wing and the 1-in.-dia. hole for the bladder tank tube in the outboard wing. The rocket tube, when glued in place, actually acts as a spar to strengthen the center of the model.

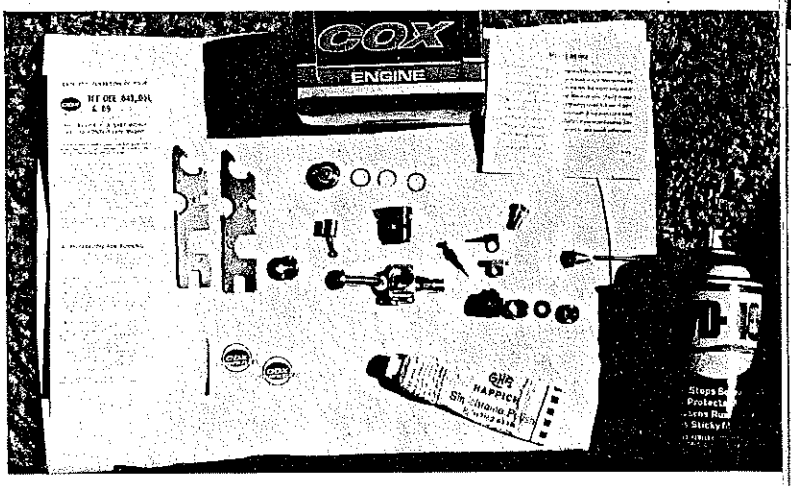
Foam gets its strength from its lightweight solid mass, so coring-out the wing will greatly reduce its strength advantage. Another advantage of a foam wing over a balsa structure is that there are no open bays that can distort when the covering flexes. The foam airfoil will remain constant. The 8-in. tapering front spar helps to hold the center section together, and it absorbs vibration from the engine. We cover our models with





Left: This particular model (No. 9) was first at a Fresno, CA meet on October 23, 1983. Outboard wing stripes were done with tempera water-based paint—to serve as both decoration and tip weight. Right: Designer Steve Hills holds SlySir No. 6 against a Pacific Ocean background at the beach flying site in Playa del Rey. Steve developed this design to help promote ½A Combat and to encourage those with limited budgets.





Left: Aircraft-type locknuts on 3-48 screws are good assurance for keeping the engine on tightly. A filter in the fuel line feeds the engine a clean mix. Right: Recommended engine is a Cox Tee Dee .049/.051—here disassembled for cleaning and fitting. Author uses WD-40 and Simichrome.

Fas Cal, a Mylar material with a sticky adhesive on one side. The covering gives the model much of its overall strength. The use of 36 or 45-lb.-test braided nylon fishing line for hinges on the stabilator provides strength and flexibility for crash resistance.

I would say that the Cox Tee Dee .049 or .051 is the finest ½A Combat engine ever made. If care is taken to set it up and to break it in, one can get hours and hours of reliable service from it. To find out how I set up this engine, read my Combat column in December 1981 issue of *Flying Models*.

I met Steve Hills in Lincoln, NE at the AMA Nats in 1979. As it turned out, we live fairly close to one another in Southern California. We have been doing lots of flying and building together since that time. Steve and I built eight of these models in one set of building sessions. I have since built an additional six models.

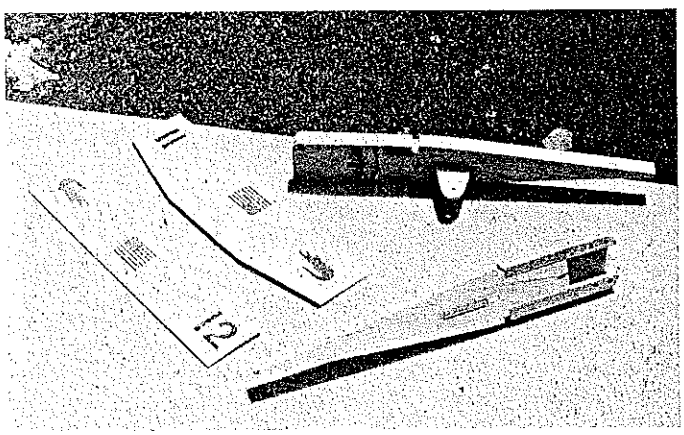
I had been waiting for the foam designs to be really refined before making the switch from balsa. I am now convinced that foam is the only way to go if you are going to fly Combat. I do not, however, think that you will save any time by building with foam instead of balsa, but crash damage is far less with foam—and repairs are quicker and easier. If these models are built correctly they will bounce on impact with the ground every time.

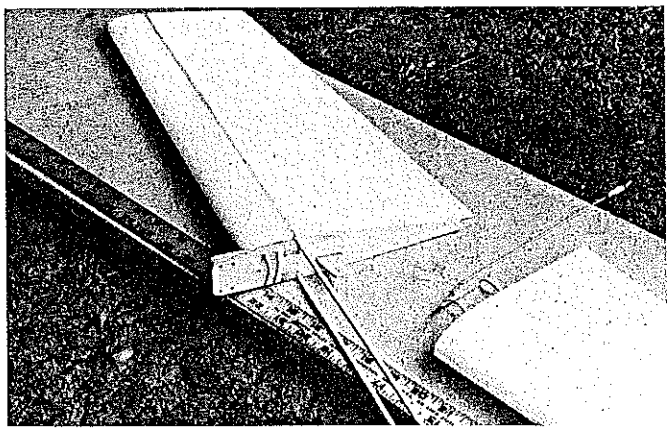
Make sure you have all of your materials, tools and adhesives before you start this project. You will need the following adhesives: 5-min. epoxy, slow-cure epoxy, aliphatic resin glue, and cyanoacrylate (CyA) glue. You could use some contact cement, but it is not absolutely necessary. You will need these tools: modeling knife, double-edge razor blades, razor saw, wire cutters, hammer, vise, propane torch, longnose pliers, center punch, paint brushes, various small files, hand or power drill, a set of drill bits, Dremel Moto Shop or access to one, lots of sandpaper of various grits, and all of the apparatus for cutting foam wings. The book published by *RC Modeler* magazine on foam wings can be of great help as can Paul Smith's Dragon article in the February issue of *Model Aviation*. There have been many other articles published on the subject of cutting foam wings; you will just have to go through back issues of modeling magazines in order to be thoroughly familiar with the different setups.

Decide on how many models you want to build, and then gather the materials for them. When you buy balsa sheets you will have to buy 36-in. lengths, which is a lot more than you need for one model. Make sure you check the wood densities called for on the plans before you buy the wood. There can be a tremendous weight difference from one sheet of balsa to another. If you use the wrong weight of wood, you will end up shifting the balance point (CG). Try to get your friends to build some of these models with you; in that way you can share the work and expense. Make a shopping list for your materials. Nothing is more frustrating than to get a project partly finished and find that you are short one item (and the hobby shop is closed, of course!).

Start by making all the templates. We like to use 1/16 plywood, as it is easy to work with. The templates include two for cutting the wing panels, two for cutting the spar notches, one for the center rib, one for the tail boom, one for the stabilator mount, one for the bellcrank mount, and one for the stabilator (this one is optional and may be made of thin cardboard). My favorite method for making templates is to use carbon paper and typing paper under the plans. I trace over each part I need on the plans, then I cut them out and glue them onto the 1/16 plywood. These are then cut out with a jigsaw. (If you don't want to trace over your plans, simply make photocopies of the parts you need from the plans.) Sand and file your templates to the exact shape shown on the plans. Remember, your final product will only be as good as your templates.

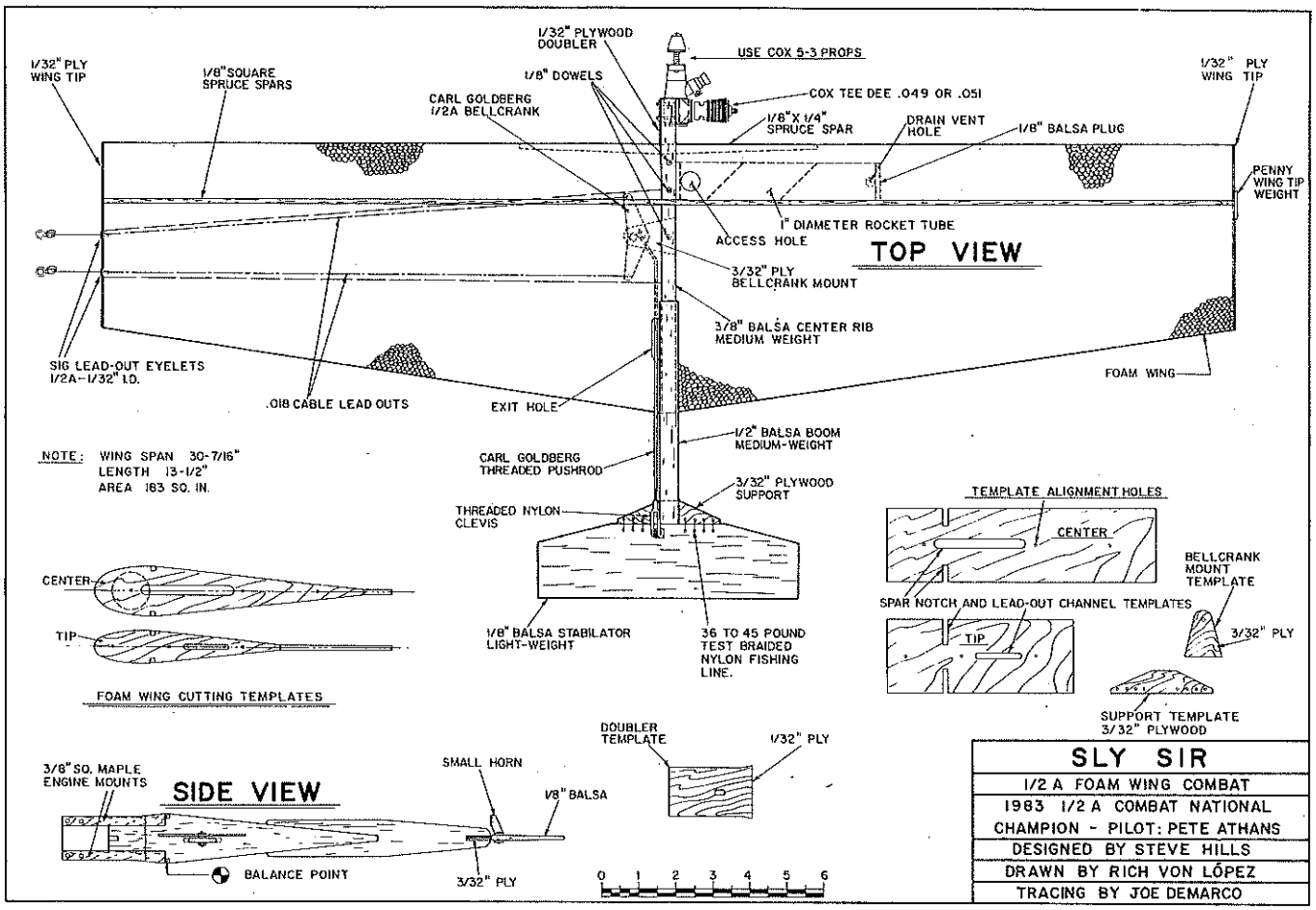
Read all you can about cutting foam. Once you practice a little, you will find that it isn't very difficult to do successfully. You will need to cut your foam into blocks that are 15 in. long by 8 in. wide on one end and





Left: Stabilators are sanded to an airfoil shape and covered with Fas Cal for strength. Note that all holes are drilled in the center rib prior to wing assembly. Right: It's important to test-fit the wing panels to the center rib before gluing. Ply doubler is sanded to feather into the rib.

FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 170



6 in. wide on the other by 1½ in. thick. We draw a centerline on the ends of each foam block before the templates are put in place. To do this we clamp a felt-tip pen in a vise at a height of ¾ in. and draw the ends of the blocks past the pen; in that way all of the centerlines will be exactly the same.

In order to hollow out the lead-out slot in the inboard wing, you have to poke a hole through the wing so a cutting wire can be passed through. We made a jig that holds a piece of .078 music wire, as follows. You will need a piece of 2 × 4 lumber that is 6 in. long. Drill a hole through the 4-in. width from the 2-in. side exactly ¾ in. from the edge. This hole needs to be very straight and accurate; if you have a drill press, use it. Cut the 4-in. section in half so that you have 2 × 2 × 6-inch pieces. These can be nailed to a door at heights of 20 in. and 25 in. The holes should be ¾ in. from the door. Make sure the holes in the two blocks are in line vertically. Your .078 music wire should now be able to travel up and down in a straight line. The inboard foam wing panel block is held below the wire, then the lower end of the wire is heated with a propane torch. The wire can then be dropped through the foam block, melting a straight hole on its way.

Line up the centerline of the wing templates with the centerline of the foam blocks, and hold them in place with 2-in. finishing nails. The wing templates have a long, thin extension at the trailing edge to assist in the cutting operation. The cutting wire always comes out first at the wing tip side; the extension guides the hot wire level while the other side of the wire finishes its cut. This keeps the airfoil constant throughout the cut.

Wing cutting is best done with two people, one on each side of the cutting bow. Start your cuts at the leading edge of the wing and travel slowly and evenly over the templates toward the trailing edge. Flip the block over, and do the bottom half of the wing in the same way. You will notice that you have extra foam material on the trailing edge; leave it there until later, as it will protect the trailing edge from dents in handling.

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Left: Pete Athans won the ½A Combat unofficial event at the 1983 AMA Nationals. Pete ran out of models and borrowed the author's SlySir for the final, winning match. Right: Some of the 31 fliers who entered ½A Combat at the Nats (the unofficial event was sponsored by Cox Hobbies).

There are other records in the FAI files which indicate that Soviet minds tend to seek and exploit loopholes in rules.

I could expand this previous sentence into an article that would be more appropriately published in some Journal of Social Psychology. Here, I will limit myself to expressing a hope that our political officials will leave no loopholes in the rules they are now trying to write about competitions involving nuclear weapons.

We did this record the hard way, and we're all proud to have put together a "real good" 4th of July picnic. The food was terrible: one dried-out ham and cheese sandwich. The aerial fireworks were spectacular. Approximately one million, eight hundred and sixty-six thousand consecutive explosions produced a truly revolutionary celebration.

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Cut all of your wings to this stage before you start cutting spar notches. We use the same cutting bow to do the spar notches. Pull out the wing templates and plug in the spar-notch templates. You will be able to use the same nail holes, as both templates are drilled in the same spots. We cut down the front, across the bottom, then up the back. Don't spend too much time in one spot, as the hot wire will melt more foam than you intend. Practice on some scrap pieces of foam. It's really easy once you get a feel for it. After you have done your first wing panel, check the grooves with your spruce spars. If they don't fit perfectly, make some adjustments to your templates, and try again.

Leave the templates in place on the inboard wing panel. A cutting wire can now be passed through the hole you made with the .078 music wire. We tape the end of the cutting wire to a piece of music wire, and simply push it through the hole. Each end of the cutting wire is held with surgical forceps. Alligator clips from your electrical power source are hooked up between the forceps and the wing on the cutting wire. We go around the lead-out slot twice and stop in the center of the slot, letting the cutting wire cool. When the cutting wire is pulled out (pull it out from the center rib side rather than the wing tip side), you will also pull out the foam material that has been cut out. Any remaining foam can be poked out with a wing spar.

A hole for the bladder tank tube must be cut. We do this with a 1-in.-dia. aluminum tube that has been sharpened (a Dremel tool will do it well). I found a shower curtain rod in a hardware store that was the exact size. Just push and turn the tube into the wing, and it will cut into the foam easily. Mark the aluminum tube at 5½ in. with masking tape so that you won't cut too far into the wing. Sometimes the round foam plug will come

out with the tube. If not, cut through the wing with half of a double-edge razor blade; the round piece of foam should just fall out.

Use your templates to draw the parts outline on the balsa or plywood sheets, then cut them out. Drill any holes that need to be drilled at this time.

The first parts to be glued together are the stabilator mount and the tail boom. Use CyA or aliphatic resin glue. We like to use slow-cure epoxy over this entire unit for fuel proofing and added strength. Do not epoxy the tail boom where it will fit onto the wing.

Cut the 1-in.-dia. rocket tube (Estes BT50) to a length of 5½ in. (These tubes come in 18-in. lengths.) Coat the inside of the tube with slow-cure epoxy, fiberglass resin, or polyurethane varnish and let dry. (We like to let these parts dry overnight, so we do them first.) When the rocket tubes are dry, roll up some fine sandpaper, and sand the inside so there are no sharp edges. This is very important, as sharp edges or bumps will cause bladder tank ruptures. Cut two round balsa plugs for the ends of the rocket tube. Use 5-min. epoxy to glue them in place, making sure the inside surfaces of the plugs also have a coat of epoxy. Check the fit of the tube in the wing. Sand the outside of the tube so that the glue will adhere well, coat with a thin coat of aliphatic resin glue, and slide it into its hole in the outboard wing. Make sure that it doesn't extend beyond the edge of the wing.

Cut the bellcrank mount slot in the center rib. We drill two 3/32-in. holes at the slot ends where the bellcrank mount comes through on the inboard side. With a modeling knife we then cut out the slot. As you can see from the plans, the bellcrank mount has a taper, and so does the slot. You can use a small file to get the taper in the center rib. Check the fit often with the bellcrank mount. The taper is put in so the bellcrank mount cannot pull out of the rib. Glue the bellcrank mount in the slot with aliphatic resin. Now, glue the two maple engine mounts to the center rib with aliphatic resin. After this is dry, glue the 1/32 plywood engine mount doubler in place, again with aliphatic resin.

A rectangular hole ¼ × ⅛ in. must be cut in the doubler for the front spar. First, drill a hole through the area, and then carve it out with a modeling knife. When everything is dry, cut the mounts down to the shape shown on the plans on your Moto Shop. Sand down the doubler at the rear so that it tapers flush with the rib.

Center punch the location of the engine bolt holes, and drill them out. Put some CyA glue down each hole, making sure that it soaks into the wood. Redrill the holes. This prevents the holes from getting fuel soaked. Drill the holes for the dowels at the location shown on the plans, and glue the dowels in place with aliphatic resin.

Attach .018 stranded lead-out cables to the ½A bellcrank (C. Goldberg #263 or Sig #SH-234). Before you do this, sand over the lead-out holes in the bellcrank to take off any sharp edges which may cut the lead-outs. The pushrod hole in the bellcrank will have to be drilled to accept the threaded pushrod. We leave 1½ to 2-in. loops in the lead-outs from the bellcrank to the 3/32-in. brass or copper attachment tubes which we flatten to lock in the lead-out cable by placing them on a vise and hitting them with a hammer. If you have a crimping tool, you can use that.

Bend and cut the pushrod to the exact shape shown on the plans. Slip the pushrod into the bellcrank, and bolt the assembly to the bellcrank mount. We do not use the wood screw that comes with the bellcrank set; this is replaced with a bolt and nut. Add a drop of oil to the bellcrank bushing for smooth operation. Cut the excess from the bellcrank bolt.

A tapered groove has to be cut into the wing's leading edge to accommodate the tapered front spar. We mark the area with a felt-tip pen and cut some of the material out with a modeling knife. It can then be sanded to a perfect fit. You can glue some sandpaper to one edge of a scrap of ⅛ sq. spar to make an exact sanding tool for this operation. Fit the front spar in the center rib assembly, and test the fit with the outboard wing. If it is off, work on it until the fit is perfect.

Some of the inboard wing has to be cut out at the lead-out slot so the bellcrank will fit without binding. Try not to cut out too much foam, as you can create a weak spot. Mark the location where the pushrod will pass out of the wing, and melt out a slot with a hot wire. Again, do not make this slot too big.

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The inboard wing must be made to fit perfectly at the bellcrank area and also the engine mount doubler. The latter is easy to do with a sanding block, as only a sliver of foam has to be removed.

We are now ready to glue the wing to the center rib with 5-min. epoxy. This is one of the most critical steps, so be careful. Do the inboard half first. Spread some epoxy on all of the contact surface areas of the wing panel. Be careful not to get any epoxy on the lead-outs, bellcrank, pushrod, spar notches, and front spar groove. You can use the front spar and scrap ⅛ sq. wing spar material to help locate the wing in the correct position. When you press the wing to the center rib, line up the trailing edge to the center of the rib. We use masking tape to temporarily hold it in place. Hold the inboard wing to the center rib until the glue hardens. Pull out the front spar and the scrap wing spars so that any stray globs of epoxy won't glue them in place.

The outboard wing panel is a lot easier. Mix enough epoxy to coat the outboard side of the center rib and the front spar grooves. Slip the front spar through the engine mount doubler into its groove on the inboard half. Put your scrap wing spars in place so they extend about 2 in. into the outboard wing side. These will serve as guides. Press the outboard wing onto the center rib. Line up the outboard trailing edge with the inboard wing trailing edge. Use masking tape to hold this in place and to keep the front spar in place. Hold the wing until the epoxy hardens.

Find two wing panel cradles that are of the exact size (having matching cut-out lines). These will be used to hold the wing panels in perfect alignment while the spars are drying. Spread some aliphatic resin glue all along the spar groove on the top. Slip the top spar in place. Put the wing in the cradles, spar facing up. Make sure that the wing panel cradles are on a perfectly flat surface. Put some weights on the spar to hold it in place while it is drying. When this is thoroughly dry, do the same to the bottom spar.

Sand the spar ends flush with the wing tips. Press the 1/32-in lead-out eyelets in place on the inboard wing tip. CyA-glue these in place. Use filler (micro-balloons or baking soda) around the eyelets where they come through the wing tip. (Make sure that you do not cross the lead-outs when you feed them through the eyelets.) You can use 5-min. epoxy or contact cement for foam to glue the 1/32 plywood wing tips to the foam.

We make all of our lead-outs the same length, about 2½ in. extending beyond the wing tip. Pull one lead-out as far as you can, then bend it at 2½ in. If you do this with all of your models, chances are you won't have to adjust your handle from one model to another. We use the metal eyelets from line-parts packages on the lead-out ends along with ⅜-in. lengths of brass or copper attachment tubes. You can flatten or crimp these the same way you did on the bellcrank

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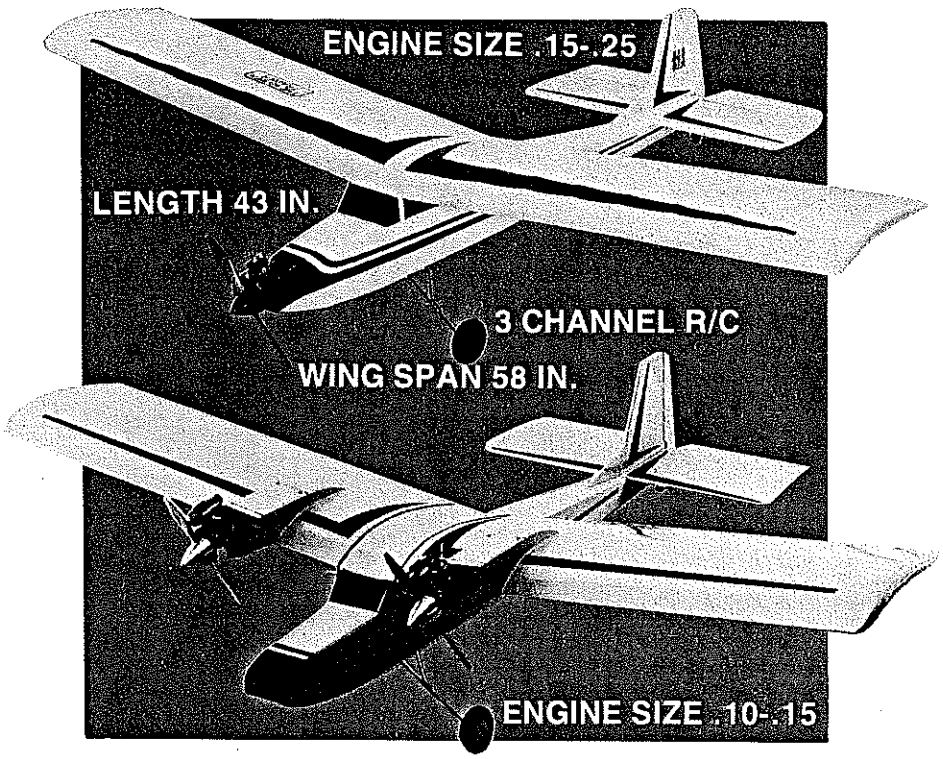

THE TWIN TRAINER

side.

Use a razor blade and a metal yardstick to trim the excess foam from the trailing edge. Make a ⅜-in.-dia. bladder tube access hole and drain vent hole. Check the plans for the exact location. Sand the entire wing smooth, but don't round or thin the trailing edge. The trailing edge should be as square and sharp as possible. Coat the engine mount area and about 1-in. into the foam area with slow-cure epoxy. Put some epoxy around the bladder tube access and drain vent holes, and fill in any gaps or holes around the front spar.

If you are going to decorate your model, now is the time to do it. We use different product and organization stickers. You should put your AMA number on your model. I usually put my name on my models, also. We have found that the pre-mixed tempera paint (for posters) works well on foam, but it is heavy; don't use too much. A simple stripe or two on the outboard wing (tip weight) will give your model enough color to be distinguished by the judges when it is in the air. Having worked at the AMA Nationals as a judge, I know that color on a model helps with accurate scoring.

We have found that Fas Cal is a very strong covering material for this structure. Cover the wing with one sheet of Fas Cal on top and one on the bottom. Use a sealing iron to adhere and shrink the covering. Experiment with scraps of foam and Fas Cal to get the right heat setting on the iron. Our iron sets at about 45% of the maximum heat. Heat guns get too hot and will melt the foam. For extra strength, you can add a 4-in.-wide double layer of Fas Cal to the center section of the model.

Sand the Fas Cal just a bit where the tail boom will be located. Use 5-min. epoxy to glue it in place. Sand the stabilator to an airfoil shape. Add nylon hinge material to the area where the control horn will be located; use CyA glue. Cover the stab with Fas Cal, and add a double layer to the leading edge where it will be sewn to the mount. Using 36 or 45-lb.-test braided nylon fishing line, sew on the stabilator. You will need some large-eye sewing needles for this task (sizes 18 to 22).

We tie a knot on a 36-in. length of fishing line and melt the end over a flame so the knot won't unravel. The line should only go through each hole twice. Don't tighten up on the line until the stabilator is lined up with the trailing edge of the wing. Tighten the line and check the alignment again; when it is perfect, put a drop of CyA glue in each hole. Trim off the excess line.

Locate the control horn, and screw it in place. We just push a pin through the stabilator where the wood screw will go to serve as a pilot hole. Hook up the mini snap clevis, and adjust the pushrod so there is equal travel up and down. Use the top hole on the control horn.

Epoxy one penny to the outboard wing tip between the spars. Coat the wing tips with clear polyurethane varnish. Also coat all of the edges of the Fas Cal to completely fuelproof the structure. Bolt on your Tee Dee .049 or .051, and you will be ready to fly.

½A combat is flown on .012 lines of 35-ft. length. Use the inside holes of a small Sullivan Pylon Brand handle (IJ-2). Cox Tee Dee .049s like a good bit of nitromethane in the fuel. We run about 25%. Bladders are made from 3/16-in. latex tubing having a 1/32-in. wall. We have found that the very small black neoprene tubing works real well for the fuel line. We recommend that you use a small Hi Johnson fuel filter. To fill the bladders, you will need a disposable plastic syringe. Make an adapter from medium fuel tubing and a 2-in. length of 3/32-in. brass or copper tubing so that the end of the syringe will fit into the small neoprene fuel line. The adapter should be securely fastened to the syringe with copper wire.

Check for warps before you make your first flight. If you notice any warps after the first flight, iron them out. Make adjustments to the pushrod and control horn until you get the desired turning radius. Practice all you can until you know exactly what the model is capable of doing. Practice Combat flying. You will then be ready for serious competition. Good luck!

You can buy SlySir wing cores from Phil Cartier/Core House, Box 300A RD #2, Palmyra, PA 17078. Write for prices.

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