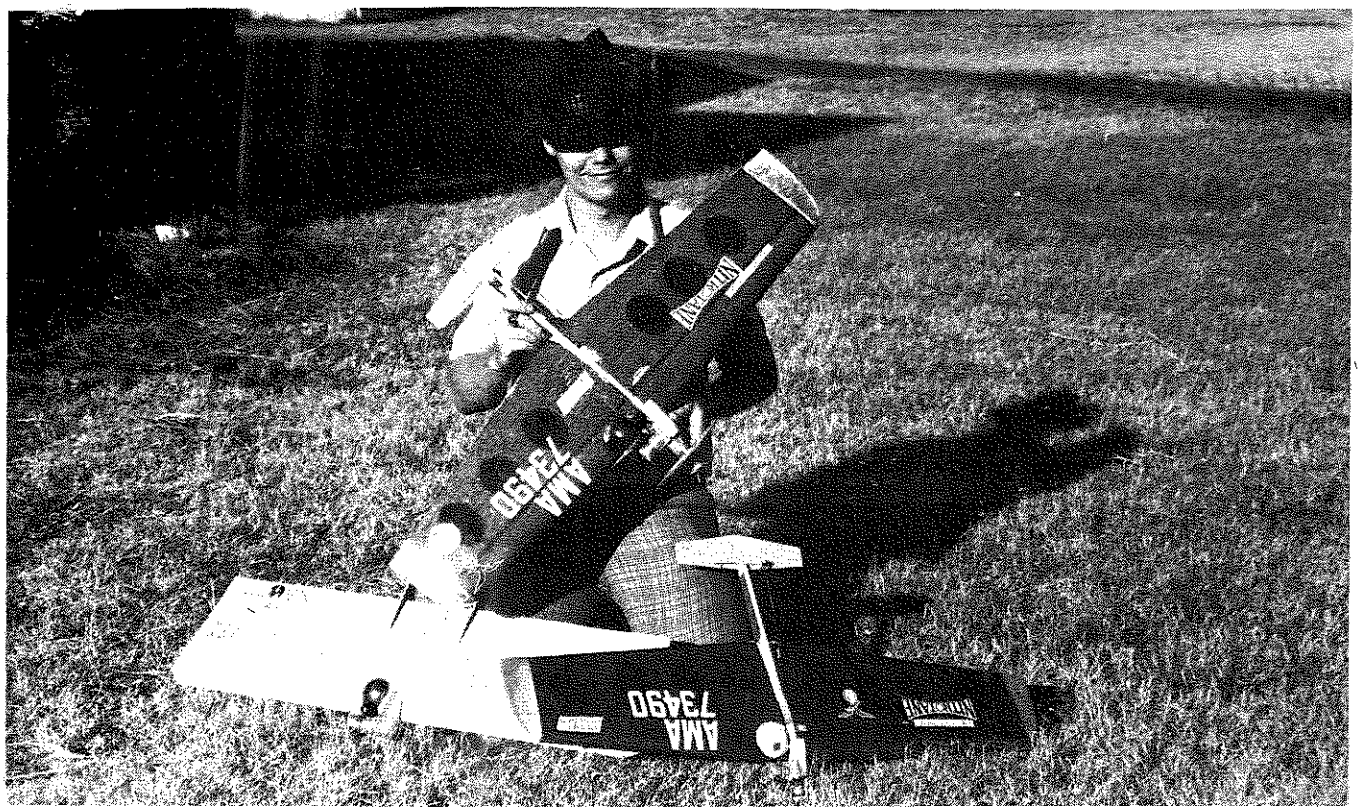

"SICKLE" * FAI COMBAT

PHOTOS BY AUTHOR

By STEVE FAUBLE . . . Even if you don't happen to like the design, the techniques which the author has developed for mass production of a somewhat expendable type of aircraft, will probably be of interest.

• What makes a good combat flyer? If you're not one of the very fortunate few who was blessed at birth with nerves of steel, the reflexes of a gunfighter, and the eyesight of an eagle, you must practice. This means flying actual matches with their accompanying whumps, thuds, and sudden silence. All of these sounds mean that you must lock yourself in your room and build more airplanes. These new planes will, in all too short a time, end up in the trash can with their brethren.

In order to make this building as painless a process as possible, I have tried to design a production capability into my planes. What you see in this FAI Combat plane, the "Sickle", is the end result of many months of thinking, testing, and actively trying different techniques to reduce building time.

The first thing I decided was that cutting all those ribs then sheeting the leading edges, etc., had to go. This left a foam wing, of one type or another, as the alternative.

I built a couple of planes using the now standard method of a top and bottom spar set into a groove cut in the foam. I felt that in order to get the spar to fit correctly, too much time was required. I next decided to cut the foam wing in half, lengthwise, at the high point, and simply sandwich a spar, full depth, in between the two pieces of foam. This worked well, but the spar was heavy, and if balsa was used, expensive.

This is when I remembered an article in an old *Model Airplane News*. This article, by Bill Northrop, who is now the editor/publisher of **Model Builder**, had described an interesting technique. He had designed a biplane called the "Spruce Goose", and in this article, he described how he had formed a block of spruce into a rib shape, complete with lightening holes in the center, and then simply sliced off completed ribs on a table saw. *(Whaddya know! Somebody read it! wcn)* Using this technique, you could have lightening holes, complicated shapes, and even composite construction. You could thus combine many separate pieces into a few simple parts.

The first component I tackled using this rediscovered technique was the spar. Now, instead of four separate parts I would have only one. As you can see by looking at the plans and pictures, the spar assembly is sliced off a block as a single piece. The material used is mainly white pine that starts out as a 2 x 4 plank. The two long 3/4 inch slots are cut in the middle of a table saw. The balsa web pieces are then glued into this slot to stabilize the long, spindly parts. Next, the taper is cut to conform with the outside edges of the foam wing.

When I got to this point, I ran into the problem of how to mate the now solid center section of the spar to the motor mount and mono boom. The answer is to have these 3 main parts interlock. The center rectangular slot is formed by drilling four 1/8 inch diameter holes in the spar block and then connecting these holes with a jig or coping saw. The motor mount was the part that I attacked next.

I have long favored a one-piece motor mount for the true surface that it gives the motor. No more warping the motor's case when you tighten the mounting bolts. This true surface gives you both longer engine life and a few extra rpm. The problem has been that maple is heavy, and if you drilled lightening holes on each piece, it was very tedious. Now I could, using the

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sliced block idea, drill the lightening holes and the engine mounting holes in 4 or 5 motor mounts all at the same time. This lowered the amount of work required to a level that a solid mount is worthwhile.

A drill press is required to drill these holes so that they will be true throughout the block. At the same time, I made the mount in the shape of an "H" laid on its side. This was done to reinforce the critical joint between the motor mount, boom, and one-piece spar.

The boom now fell right into place in the design. A block of balsa cut to the shape shown, complete with lightening holes, two 1/8 inch dia. holes at each end of the slot for the bell crank mount, and the slot for the stabilizer are formed, using a table saw and drill press.

Don't let the lightening holes scare you off. When they are covered with silk and doped, the boom is quite strong in both tension and torsion. Wingtips, complete with lightening holes, and the elevator, can also be formed this same way, in blocks of balsa.

Now that we have all of the blocks cut into the correct shape with the assorted holes and cut outs, we are ready to slice off the parts for 5 to 10 planes all at one time. Simply set a guide on the saw at the correct width and cut away. When you have all of these parts cut, you are ready for the foam wings.

If you don't have any experience in cutting foam wings, RCM has a good book on this subject. Cut the foam part of the wings using the dimensions and airfoil templates given on the plans. The next step is to cut the foam 90° to the chord at the high point. This is where the spar will be sandwiched during assembly. To make this cut, make a simple jig as shown in the photos and cut from *the bottom up* in one smooth motion.

Now we can start making all of these separate parts look like an airplane. Using a straight edge and either a try square or lines drawn on a building board, assemble the motor mount, one piece spar, and mono-boom, using epoxy. When this joint is completely cured, epoxy the bellcrank mount into the slot in the boom, and the stabilizer into the rear of the boom. The stabilizer must be straight and true, or your plane will fly just as crooked as your stab.

You will note that the bellcrank is located completely behind the spar. This is so you can drill or melt two straight holes in the rear portion of the foam for the leadouts. This way, no coring out of the wing is required. Don't worry about this rearward placement of the bellcrank. It is, contrary to popular belief, not where this bellcrank pivot-point is placed that controls line tension. It is, rather, the position of the leadouts in the wingtip and their relationship to the center of gravity that is the controlling factor. See the July/Aug. 1966 issue of the old *American Modeler* if you have any doubts.

Since the wing was not cored out in the usual manner, I felt this would make the plane too heavy. This prompted me to use what has been called "Dutch lightening holes". As the name might lead you to believe, this method of lightening a foam wing was originated by a Dutch FAI flyer. I make them by slightly flattening a tin can, heating it and then using it like a cookie cutter. This removes a plug of material for lighter weight, but since a skin of dense material forms around the inside of the hole that is left, very little, if any, strength is lost.

The foam is covered with paper. Silkspan, tissue or even wrapping paper can be used. The paper is held on with a coat of thinned white glue. This is applied to the raw foam and the paper then smoothed on. A second coat of this thinned glue mixture is brushed on over the outside of the paper to seal it and to allow a light coat of dope to be applied without melting the foam. As an alternative to the second coat of glue mix and dope, a light coat of polyurethane varnish can be applied. This polyurethane will fuelproof the plane with no possibility of melting the foam, but it is also very heavy, so keep this coat thin.

If you subscribe to **Model Builder**, a very serviceable decal can be made by cutting out the return address from the envelope and, using white glue, sticking it in place.

I decided to present the FAI version of this plane, the "Sickle", rather than the AMA version, the "Scythe", because I would like to stimulate interest in this now world championship class event. Some of the most inventive (I guess!) design work is now being done in the FAI class of combat. This is primarily happening in Europe, because of the introduction of glow engines by various Americans. This added power and speed has made much of their old equipment out of date, and a lot of searching for new designs has taken place in the last few years. Many of their ideas are excellent, and I have used some of them in formulating this design.

The Europeans made me readjust my thinking on making the change to foam wings. They also made me try an FAI plane with over 300 sq. inches of wing area. This is a size that would have been standard for an AMA plane of only a few years ago. I got the original idea for a full depth spar and no leading edge structural member from an article by Richard Wilkins in *Model Aviation*. I have also subscribed to his philosophy of not making combat planes a showcase of building skill. The plane may very well have a life of only 5 minutes or less, so why take all the extra time to make it pretty. Simply build them straight and don't worry if the edges are sanded perfectly, as long as they are functional.

The tip shape is one that I have used for 10 years. This shape was suggested by an article on the original "Hooptee" rat racer years and years ago. This article, in M.A.N., had three pictures of wingtip samples taken in a wind tunnel. The tip with the shape shown had noticeably smaller vortices, indicating lower drag.

The use of a foam wing allows easy tapering in thickness and chord, and also the use of progressive airfoils.

This would only be possible in a balsa plane by having 5 or 6 different ribs.

I hope that these new design techniques I have developed will lead to new thinking by everyone on how we have been building planes for years. If you would like a nice flying FAI combat plane, build a "Sickle", put one of the new Fox .15's in the nose, and go flying. You will also note that the lack of a leading edge structural member allows the easy adapting of both rear rotor and rear exhaust engines to this design.

Best of luck in your next match, unless you happen to be flying against me and remember M.A.C.A. is where it's at! •

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