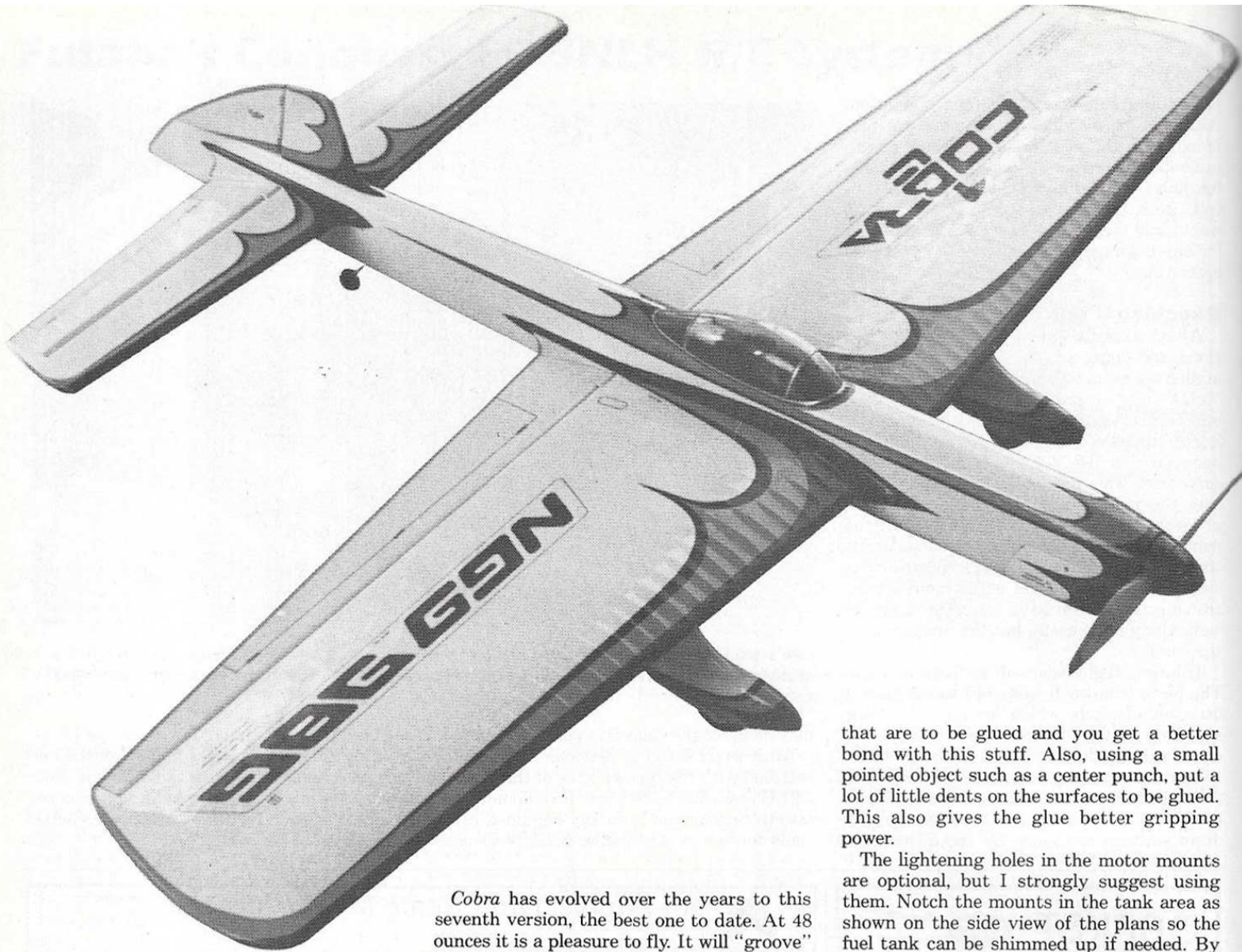




After five years of desperately searching for an airplane to really suit my needs, I finally settled on the *Cobra* for the 1976 season. Actually it was my wife's idea five years prior when I was still in the Army. She sent me a picture of a *Cobra* she found someplace and wrote "nice . . ." at the bottom. She must have known something then. I finally took her advice.

This present *Cobra* is the seventh in a series that was a second generation design of the *Argus*. The *Argus* was originally built in 1959 and flown in 1960 by Steve Wooley. *Argus* is so close to Bill Werwage's *Ares* that you can hardly tell them apart when looking at the plans. *Cobra*, about eighty square inches larger than the *Argus*, is also a Wooley design. All I did was improve a little on the original *Cobra* with Bill's help and bring it up to the present day's demanding standards. I'm not a "scientific" builder and not concerned with a lot of percentages. Therefore I use what seems to look good or simply "borrow" from other guys. I use no tapered trailing edges or differential flap control. The *Cobra* now is a very close cousin to Bill's *Juno*.

My first two *Cobras* had O.S. Max. 35's pulling them around. At 45 and 46 ounces they flew better than anything I had to date. By stretching the moments out to a 10-inch nose and a 16-inch tail and leaving everything else alone they balanced perfectly, were very steerable but not overly sensitive. All they needed was more power.

Cobra has evolved over the years to this seventh version, the best one to date. At 48 ounces it is a pleasure to fly. It will "groove" throughout the pattern but isn't so locked in that you have to fight it. You can easily put it anywhere you want to. *Cobra* will fly and turn with anything going today. It will turn too sharp if you get over excited with the handle. I had to learn to ease up a bit. Because of Steve Wooley's untimely death *Cobra* didn't get a lot of exposure and I believe it's a much better design than most folks realize.

Get out the tools

It's not too hard to make a case that your work bench is probably the most unrecognized but important tool you use. My own work bench is an inside flush door purchased at a building supply store. On top of the table is $\frac{1}{4}$ inch thick plate glass. The door and glass are shimmed and leveled to an absolutely true building surface.

Start by cutting out the fuselage sides according to the plans and draw a center line down the entire side length of the fuselage. Make sure the line passes through the center of the wing position.

Cut the openings a little oversize for the spar or I-beam, leading edge, trailing edge, and bellcrank. By making these cut-outs very slightly oversize we have the freedom to jig everything on their respective centerlines without building in stress or misaligning something else. Remember you have a right and left fuselage side.

Make the $\frac{1}{16}$ ply doubler match the fuselage sides perfectly and laminate them in place to each side using some thick cyano. A little hint. Sand all the surfaces very smooth

that are to be glued and you get a better bond with this stuff. Also, using a small pointed object such as a center punch, put a lot of little dents on the surfaces to be glued. This also gives the glue better gripping power.

The lightening holes in the motor mounts are optional, but I strongly suggest using them. Notch the mounts in the tank area as shown on the side view of the plans so the fuel tank can be shimmed up if needed. By doing this to the mounts you can eliminate half the weight from them.

Notice that the plywood fuselage formers (F1, F2, and F3) are $\frac{3}{32}$ 5-ply. I don't use $\frac{1}{8}$ ply simply because it doesn't seem necessary. Also, I don't use much epoxy during construction but this is one of the places I'll recommend it.

Epoxy these formers and the $\frac{1}{16}$ ply fuel tank compartment pieces only to one side of the fuselage, making sure they are perfectly perpendicular. When dry, glue the other half of the fuselage in place using epoxy. Pull the tail end of the fuselage together and glue in a spacer to suit your personal preference. Notice only two fuselage formers are used behind the wing to keep the $\frac{3}{32}$ wire pushrod from flexing.

I'll explain the sequence of building an I-beam wing for those who have never tried one. Construction is different from most other planes. There are a lot of parts to make and assemble even before the thing starts to look like an airplane.

The spar. Use medium hard "C" grain for the spar. Cut an inboard and an outboard per the plans, making sure the outboard is one inch shorter. Remember to use a centerline on everything concerned with the wing. It will be needed for lining up purposes later on. Double check both spars to be sure they remained straight. If not, discard them and cut another set. If you cut the spar to size on your very first cut, it will usually follow the grain of the wood and will end up bent every-time.

Here's a little trick I was shown. First

Cobra 7

By Mike Ditrich

Steve Wooley's classic "I"-beam stunter inspired this continuing series of precision Controline aircraft.

draw the spar on a $\frac{3}{8} \times 3$ sheet of balsa. Start slicing away the wood on each side, a little at a time, alternating from side to side until you get to the correct size. This way you are relieving the stress in the wood and should end up with a straight spar.

Another method which I prefer is to draw the spar on the wood and cut it out on a jig saw. For some reason this seems to relieve the stress in the wood on the first cut and you have a straight spar. Leave just enough material so you can sand the spar to the final size. Epoxy the spar together at the center making sure to line up the centerline with a long straight edge.

Determine where the landing gear will go.

Cut out, notch, and glue in a square piece of $\frac{3}{8}$ inch plywood as shown, in both gear positions. This $\frac{3}{8}$ ply prevents the landing gear from mashing into the doubler. Also you can tighten the J-bolts a little more at this spot.

Next laminate the $\frac{1}{16}$ ply doublers to both sides of the spar using a thick cyano like Zap A Gap Ca+. Again re-establish the centerline. Now laminate the $\frac{1}{16}$ ply tripler per plans using Ca+. Again re-establish the centerline. Cut out the center section and install the bellcrank as shown using a threaded rod purchased at the local hardware. Epoxy or solder the nuts in place. Connect the $\frac{1}{32}$ solid leadout wires to the bellcrank.

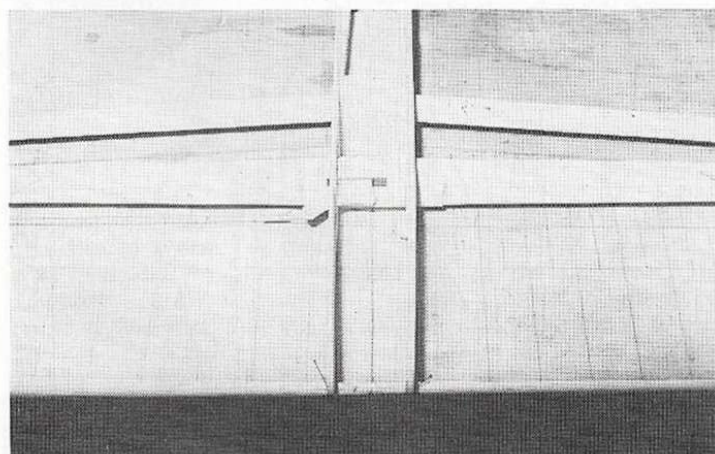
Bend two landing gear and determine



ARTWORK: MARY ANN LENGLE

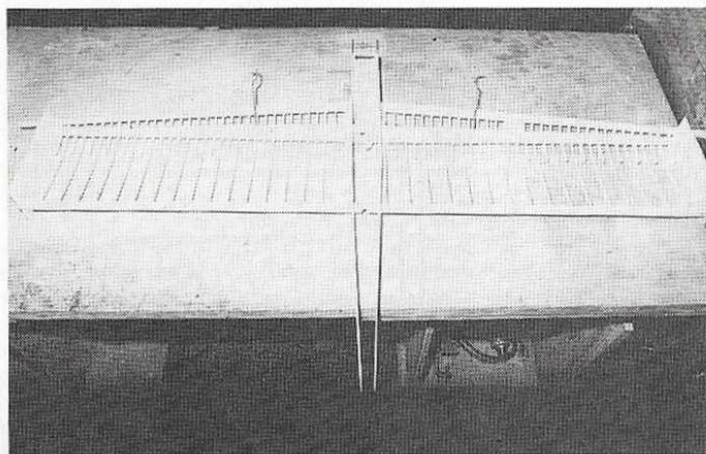
where each is positioned on the spar. Drill the spar for the J-bolts at this time. Cut the slot in the inboard side of the spar for the front lead-out wire.

You'll notice there is no cap on the top or

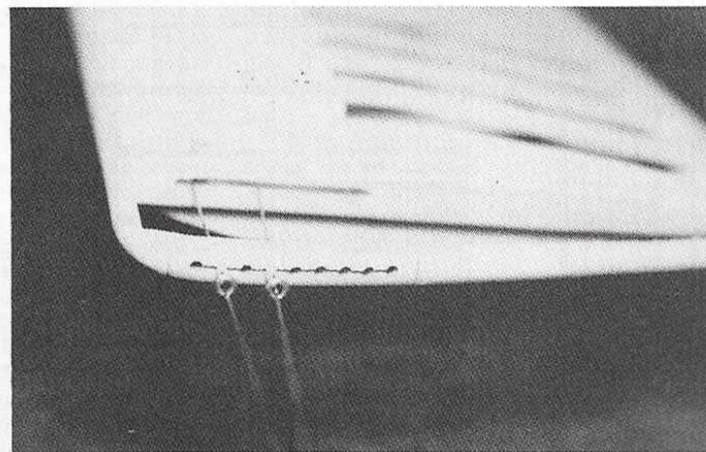
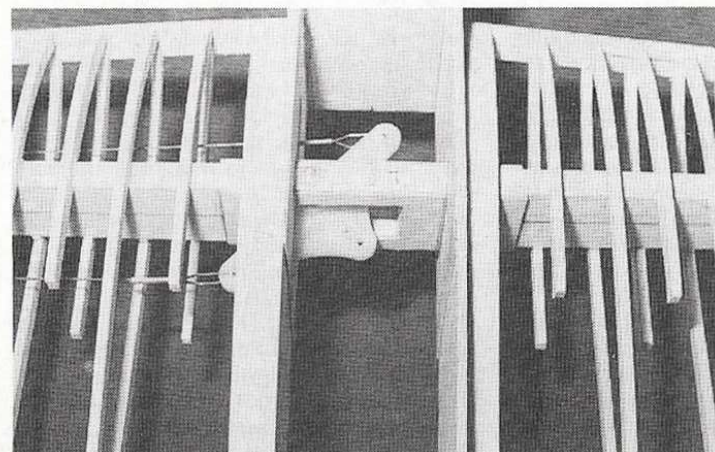


PHOTOGRAPHY: MIKE DITRICH

The fuselage sides and the main spar, the "I" beam (above left), have been aligned and set in position over a full-size set of plans prior to adding the wing ribs. The top side of the wing has been completed (above right) and the entire assembly turned over, ready for the bottom ribs (note the wing tip templates



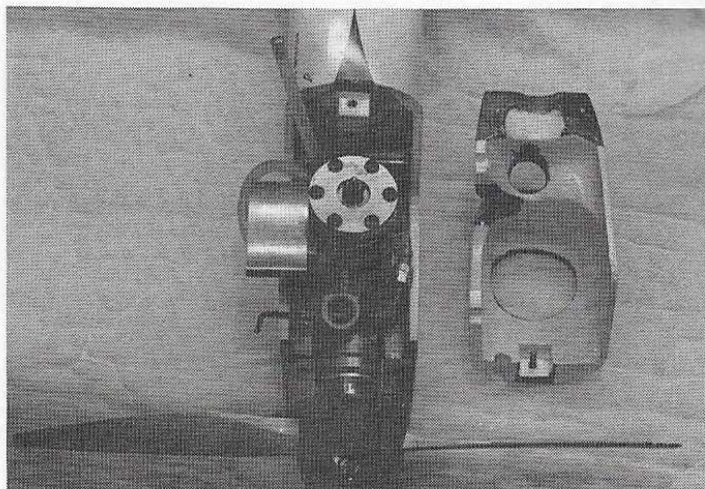
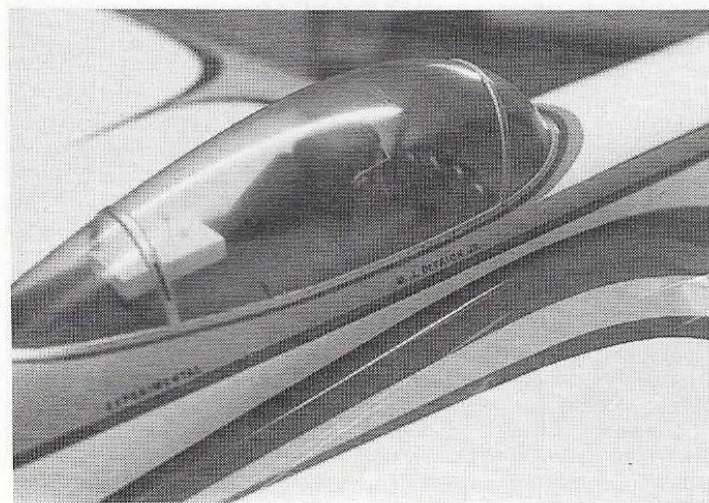
which align the end of the wing; after the wing frame is complete, they will be carved away to the tip rib profile). Note the use of triplers (below left) in the bellcrank area of the wing. Maple stock is inset at the wing tip (below right) to handle the load of the adjustable leadouts.



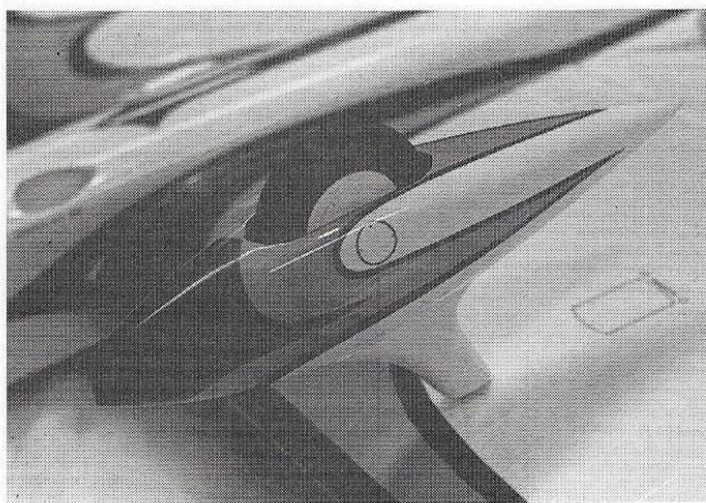
Cobra 7



The area above the engine head is cut away to provide easy access to the glow plug (above left). Note also how the fuel overflow vent exits the bottom of the cowl. The engine cowl is removable (one screw and it's off) for access to the SuperTigre .46 (above right) in Mike's *Cobra*. The muffler on Mike's engine is



from Bob Paul. To give the *Cobra* a "straighter" look, Mike used a SIG 10-inch bubble canopy (below left) and added a cockpit and a Williams Bro. pilot. Wheel pants are carved from two slabs of light 1/2 inch thick balsa (below right). Wheels are 2 1/4 inch Williams Brothers.



the bottom of the spar like most I-beams. I've decided to eliminate this. Don't ask me why, I just did. But you can use the caps if you prefer.

The leading edge is cut from medium hard 1/4 sheet. It's 3/4 inch high at the root and tapers to 9/16 at the tip rib. The trailing edge is also cut from medium hard 1/2 sheet. Use the same method to cut out these parts as was used on the spar to insure straight pieces.

I prefer to join the leading edge center section joint and the trailing edge center section joint using epoxy. Make sure the centerlines are straight and the leading edge joint has the proper bevel for the 2-inch taper of the leading edge at the tips.

Make a rib template from .020 aluminum or whatever material you prefer using the pattern off the plans. Lay the rib template at the top edge of a 1/8 inch sheet of balsa and, using a knife, cut along the airfoil. Slide the template down a 1/4 of an inch and cut along the airfoil again. Presto! You have a rib. Now just make sixty-one more!

Using the same method, cut out the false ribs, the 3/4 inch thick ribs that go next to the fuselage and the 3/8 inch ribs where the landing gear exits the wing. Don't forget to cut two tip rib jig templates. They will help align each end of the wing during assembly. Though it seems like you've been working for weeks on this thing (and you probably have) and it still doesn't look like an airplane, be

patient.

Slide the leading edge, trailing edge, and the spar through the fuselage. Be sure the in-board wing is longer. It will be necessary to notch the spar opening so the bolt holding the bellcrank in place can pass through. Fill this notch later with scrap.

This is probably where I do things a little differently from the traditional I-beam building technique. I start the wing construction in the upright position. First, draw a full size layout of the wing planform on a large sheet of paper and tape it to the glass table top. Line up the fuselage, leading edge, trailing edge and spar using the centerlines on each part to get the proper height. A square will help position all the blocked-up parts to the drawing. Also set up the tip rib jig at either end. It will be necessary to cut out a small piece of the wing drawing to tack glue scrap balsa blocks to the glass at strategic locations. Everything is pinned to these blocks to keep the assembly from moving. I've spent a whole evening just lining things up and triple checking everything and it was well worth it. Things can't be too straight you know.

Now it finally starts to become fun. Glue the ribs in place, using cyano, starting at the fuselage and working on out to the tips. Trim each rib only at the trailing edge as you proceed. This puts a natural taper in the wing.

When all the top ribs are in place, very lightly sand them while the wing is still

pinned down to the blocks. Do not contour the tip rib template yet.

Turn the half completed wing over and bolt the landing gear to the spar using J-bolts. This is a good time to see if the wing sits level on the gear. If not, make adjustments so it does. When satisfied, permanently mount the landing gear to the spar. Epoxy or solder the nuts to the J-bolts and cut off excess to save weight.

Pin the wing upside down to the balsa blocks and tack glue the wing tip jigs to the glass. Add the bottom ribs and sand very lightly. While still pinned to the blocks, glue in 1/8 x 1/4 wide vertical struts between the ribs about half way between the spar and trailing edge. This keeps the ribs from sagging slightly when covered. Remove from the table and blend in tip ribs to match the airfoil.

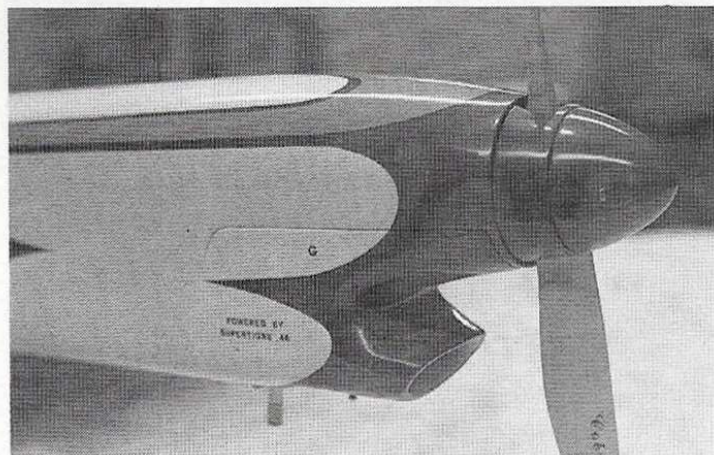
The wing frame is complete and probably seems like you've been working on it for six months. But aren't we having fun?

Relieve some or all of the leading edge, inside the fuselage, to allow for a larger fuel tank if needed.

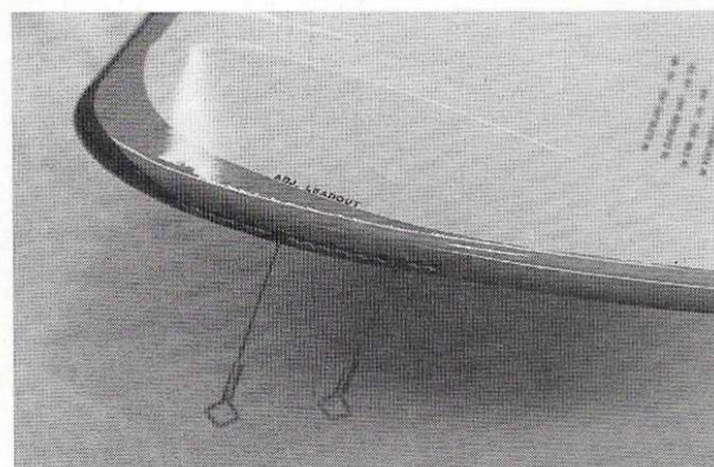
Glue a 3/8 inch soft balsa block between the motor mounts in the tank compartment area and sand flush with top of fuselage sides. The tank compartment is complete and the 3/8 inch block gives rigidity to the nose.

Now comes the time to install all the internal control paraphernalia. For an adjustable

Cobra 7



To keep nose weight down, Mike used a 2-inch MIDCO plastic spinner (above left). The air scoop really helps add a rakish look to the nose and directs the cooling air past the engine head through a "tunnel" in the bottom of the nose and out two exhausts (above right) just forward of the wing. Leadouts



leadout guide I use some maple stock drilled for brass eyelets. I probably assemble the flaps differently than most folks also. I cut the flaps to shape, then figure the proper spacing between them and epoxy in the $\frac{3}{32}$ control horn before tapering each to its final shape. This way they lay flat and there is less chance of a warp being built in. When dry, glue a $\frac{1}{8}$ balsa cap to the leading edge of the flap over the control horn wire to hide it from view. Sand the flaps to the desired taper and round off the edges that are to be hinged.

Notch the trailing edge of the wing to clear the $\frac{1}{8}$ cap over the control horn so no binding occurs when the flaps are deflected.

Cut a vertical $\frac{1}{8}$ inch slot in both sides of the fuselage, at the trailing edge of the wing, from the bottom of the fuselage to the hinge line on the wing trailing edge, enough so the completed flap assembly slides into place. Use a scrap piece of $\frac{1}{8}$ balsa and fill in the cut-out area.

I prefer cloth hinges simply because the hinge line is completely sealed which seems to make this plane turn as tight as you want. They're simple to apply and do not bind. I've used them on my last four stunt planes with equal success.

The hinge material I used is called taffeta. It is 100 per cent polyester and can be found in fabric stores. Use the plain smooth white kind which is only .006 inch thick. This plane has over two hundred flights and the hinges still show no signs of wear. Cut them two inches wide and butt them next to each other

the entire length of the hinge line using Sigment cement. They almost disappear when the wing and flaps are covered with tissue. As for fuel proofing the hinges, just let the natural painting process take care of that.

At this point, add the $\frac{3}{32}$ ply doubler to the trailing edge of the wing as shown. Also, I like to glue $\frac{1}{16}$ balsa doublers with the grain running vertically on the inside of the fuselage around the trailing edge area for added strength. This is the only area where I purposely beef up the airframe. My Cobras are quite fragile things. I believe most stunt planes are over built.

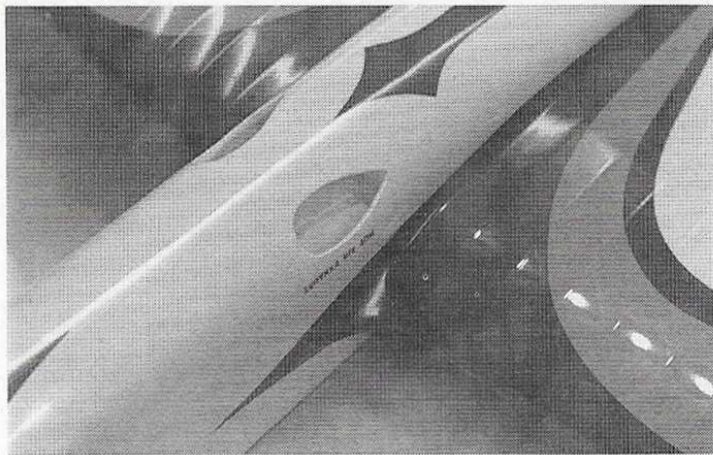
The rest of the plane is built much like any other. I prefer $\frac{3}{32}$ ribs in the stab and elevator. Don't ask me why, I just do.

Don't be afraid to hollow all the blocks as much as possible to save weight. After applying tissue to everything, the structure becomes quite strong.

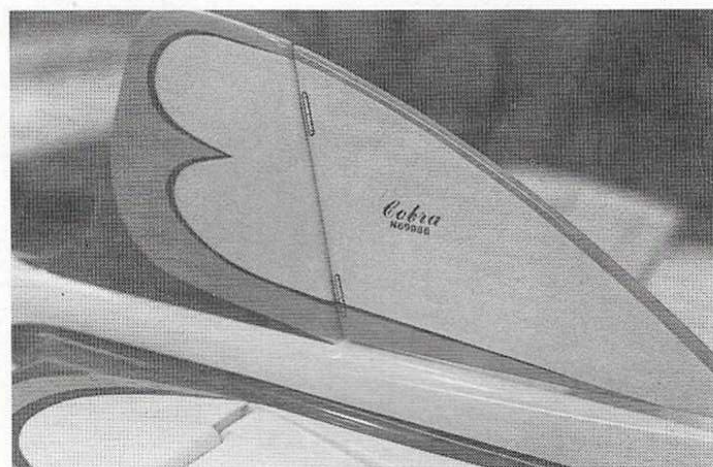
The fillets are SIG Epoxolite. Let them dry for three days, then sand with number 80 grit to roughen them up. This will make the dope stick better. Brush on five coats of Aerogloss clear, full strength, then finish in the normal way. Try not to spray the dope too wet on the fillets. That tends to soften the dope underneath and will pull away from the Epoxolite.

The bare wood was prepared with Supercoat clear. SIG medium weight Ply Span covered the wing, tail section and all the wood surfaces and used applied with Supercoat.

This might surprise some folks but no filler was needed. Ply Span is very smooth and



are adjustable (below left) using eyelets plugged into the holes drilled in the maple stock in the wingtip. The rudder is adjustable (below right), hinged with two tabs made from .020 inch thick brass stock. The small lettering on the airframe is rub-on, while the panel lines are inked on.



hides the grain well. Let the clear fill the paper, lightly sanding between coats until you get the desired smoothness. All dope was applied with a brush up to this point. Spray on your favorite primer and colors. Spray four coats of SIG Lite Coat and let dry for two weeks. Wet sand with 1200 wet paper with a few drops of liquid dish soap in the water and this stuff cuts perfectly and leaves no scratches. Spray on four or five more coats of Lite Coat, let dry for two weeks and then hand rub with DuPont #7 white polishing compound. No further sanding should have been needed if the clear went on smooth enough. As a gauge to judge weight buildup, the paint job added six ounces from the bare wood to the finish.

Trim colors are dark grey, light blue, and red on white. The dark grey was my daughter's idea, but my wife had the last say in the trim colors. She doesn't want me to do anything stupid!

This is the first Cobra in the series to utilize a bubble canopy. This was just for a change of pace. If you prefer, use the turtle deck that is more like the original Cobra. If you decide to use a turtle deck, put the canopy just ahead of the wing trailing edge. Make the turtle deck two inches high at that point and taper it back to about $\frac{1}{4}$ inch high at the end of the tail. Personally I like the bubble canopy better because it seems to give the plane a flatter look in the air.

The canopy starts out as a SIG 10-inch, cut down to about seven or eight inches. The

two simulated frames are made by laying several layers of masking tape on top of one another about $\frac{1}{8}$ inch apart. Fill in between the tape with SIG Epoxolite. When it sets up to a point where it is almost too hard to work with, (about 45 minutes) carefully remove the masking tape and there you are, a simulated frame. Actually the SIG canopy is rather thin and so I found the frame necessary to stiffen it up a bit.

I raided my mother's supply of ceramic paints to do the Williams Brothers pilot. These paints come in many colors and dry to a realistic flat finish.

The instrument bezels were cut from $\frac{1}{4}$ inch O.D. brass tubing. The instrument dials, also from William's Brothers, were glued to the instrument panel and the bezels epoxied over these. To give the instrument panel a three dimensional look, I cut out sections of real panels in aviation magazines and glued these to $\frac{3}{32}$ balsa and then glued the balsa to the instrument panel. Colored pin heads were used to simulate indicator lights. For the shoulder straps, elastic bands were borrowed from my wife's sewing kit and dyed black.

Before we get into the flying discussion there are a few more construction odds and ends to mention. The adjustable rudder utilizes .020 brass tabs as hinges. The rudder can be bent to the amount of offset needed for flight trimming.

A 4-inch bellcrank is used with the push-rods in outermost holes to slow down the control action a bit. Handle spacing is adjusted to get proper "stick" feel.

After a period of time, maple motor mounts will compress slightly from tightening down the engine. Use aluminum pads the length of the motor mounts in the engine compartment to prevent this. Epoxy and screw them in place using very small wood screws.

Ink lines were applied with a Tacrograph pen and Pelikan T ink. The surface to be inked must be clean. Do one small area at a time, then apply one "dust" coat of clear over the lines to prevent them from smearing.

The dry transfers were purchased at an office supply store. After rubbing the letters on to the surface of the plane, again apply one "dust" coat of clear to the letters to seal them.

The name *Cobra* and the serial number were drawn on white household contact paper and then cut using a new #11 blade. This is the stencil. Leave a couple inches all around to catch the overspray. Stick the stencil onto the wing and spray the trim colors. Do not spray too wet as this will have a tendency to wrinkle the edges slightly. As soon as the paint sets up, carefully remove the stencil.

As you can see, this is not a high tech plane. No carbon fiber or space age metals. It is the trailing edge of technology. Back to the basics and it works.

Out at the field

At practice work on the starting technique so you get that first flip start almost every time. Use the same routine, filling your tank and preparing for each flight so when at a contest those little butterflies won't have you wondering if you remembered everything.

The Cleveland Launch. Instruct your



PHOTO: WARD VAN DUZER

The so-called Cleveland launch is demonstrated. Joe Rhinehard holds the plane slightly nose high, off the ground as Mike prepares for an official flight at the '89 Team Trials. Keeps dirt out of the engine.

helper, if you have one, to hold the plane off the ground while the engine is started and until the moment of launch. This prevents stuff from being sucked into the venturi which could shorten the life of the ring. If a helper is not available, connect your stooge to a piece of 2x4 foot, $\frac{1}{4}$ inch thick plywood. It could be hinged in a couple of places for easy transportation. Preserve the wood so it doesn't get oil soaked, and keep it clean.

Take care of the little details that add up to big details, like checking battery leads, glow plugs, control lines, handles, props, fuel filters, fuel lines. It's just a matter of making sure everything is in working order. I read someplace that "thorough preparation makes its own luck". A sign with this saying is posted in my workshop. When I start feeling lazy I look at the sign.

Classical stunt planes have been making a comeback over the years. It seems to be a style that will never fade away. They have nice curves and don't look like they all came from the same mold.

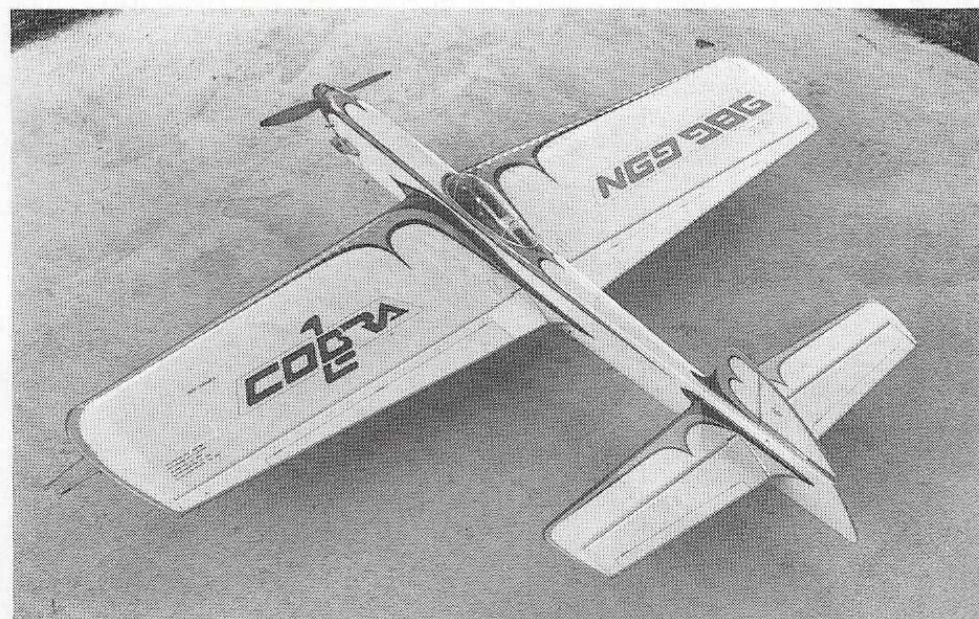
Personally I believe a slow pattern is much

nicer to look at. At 48 ounces, the *Cobra* is capable of a very slow pattern maybe because the wing loading is only .08 ounces per square inch. I read someplace that .075 was ideal. Divide the wing area into the total flying weight to get wing loading.

Last item on the pre-flight checklist is appearance, the so-called impression points. Be as neat and clean as possible, dress nicely but conservatively. Handle yourself with confidence and your plane with respect.

I need to thank my wife Jean for putting up with all this madness over the years. Without her understanding and support I wouldn't have gotten to know the two guys who really helped the most. Bill (the doctor) Werwage, gave freely of his patience, technical input, engines, props, and trying intelligently to answer my dumb questions while Les (the mechanic) Nering helped with building techniques, engines, painting and control system.

If you try a *Cobra*, let me know how you like it. But don't beat me with one at the local contest.



Final, finished weight was 48 ounces and at that, the *Cobra* is capable of a nice, slow pattern. The plane is a classic example of classic Stunt technology using many tried and proven methods of construction and finish.