F8F BEARCAT

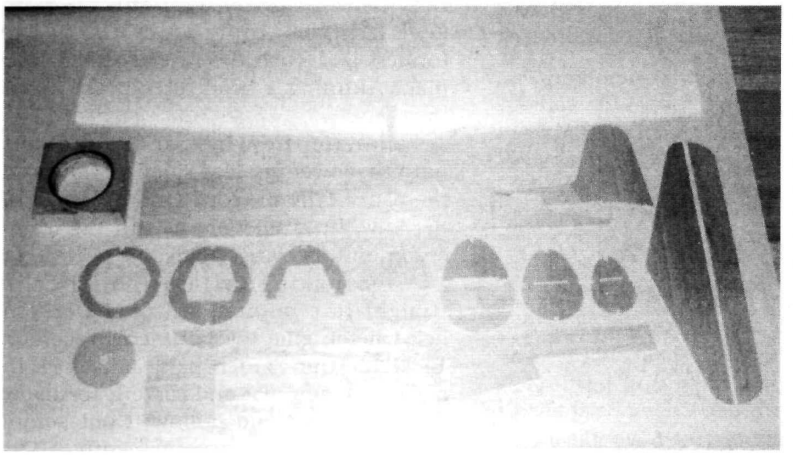
by Jim Ryan

WW II DREW TO A CLOSE just as a whole generation of advanced combat aircraft was entering service in the U.S. armed forces. One of the most impressive of these was the Grumman F8F-1 Bearcat, which was literally en route to the Pacific Theater at the time of Japan's surrender. Although the family resemblance to its famous forebear, the F6F Hellcat, is apparent, the Bearcat owed its inspiration to a detailed study of a captured German Focke-Wulf 190A.

Hot Speed 400 Warbird

To surpass the Fw 190, Roy Grumman directed his design team to build the smallest practical airframe around the same 2,100hp Pratt & Whitney R-2800 that powered the much larger Hellcat. All other factors took a back seat to minimum weight and maximum performance, and the result was astonishing. The fighter that rolled from the Bethpage plant on August 21, 1944, could take off across a typical runway, and it set a time-to-climb record (10,000 feet in 94 seconds) that stood throughout its service life and well into the jet age. Even today, a modified F8F-2, Lyle Shelton's Rare Bear, holds the world speed record for piston-engine aircraft with a blistering 528mph. For all that, the true genius behind the Bearcat was manifested in its outstanding handling characteristics and wonderfully balanced controls. The result was an aircraft that could make a strong claim as the finest piston-engine fighter in history.

Many modelers who have built my Speed 400 Hellcat design (see the July '97 issue of *Model Airplane News*) have suggested that I design plans for the other wartime Grumman fighters, the Wildcat and the Bearcat. The products of the "Grumman Iron Works" provided the decisive margin in history's greatest naval war, and these immortal fighters have held a special place in our hearts ever since. So with flight operations CNX'ed by rain one weekend, I sat down at my computer to design a model of Roy Grumman's masterpiece.



Begin construction by cutting a "kit." As you can see, the total parts count is low, and this makes for quick construction.

SPECIFICATIONS

Model: F8F Bearcat Speed 400

Type: 1/14-scale electric warbird

Wingspan: 30 in.

Length: 22.25 in.

Wing area: 170 sq. in.

Weight as flown: 18 oz.

Wing loading: 15.3 oz./sq. ft.

No. of channels req'd: 3 (throttle, elevator and aileron)

Power: 6V Graupner Speed 400, 7 or 8 Sanyo 600AE Ni-Cds, Micro BEC speed controller

Features: thinned Clark Y airfoil, foam-core wing, simple balsa construction.

Comments: while simple in structure, the Bearcat is very true to scale; the thinned wing and the lack of LE "crank" are the only significant deviations. Weight is critical, and the builder must resist the temptation to add surplus reinforcement. Because of its small size and short coupling, it's targeted to experienced modelers, preferably those who have some electric experience.

CONSTRUCTION NOTES

The airframe was designed in AutoCAD. The fuselage is a balsa semi-monocoque structure, and the wings are foam sheeted with 1/32-inch balsa. The weight goal for the empty airframe is 7 ounces. I use regular thin CA for most construction, but this adhesive will attack foam. For all wing construction, I recommend foam-friendly odorless CA or an aliphatic adhesive.

The foam wing-cores and vacuum-formed canopy are available from me for $24 postage-paid. Send check or money order to Jim Ryan, 6941 Rob Vern Dr., Cincinnati, OH 45239; (513) 729-3323; email: jimryan@sprintmail.com.

THE WING

The foam cores are lightly sanded and cleaned with a shop vacuum. The 1/16-inch sub leading edges are installed with odorless CA and trimmed flush. The wing skins are glued up from 1/32-inch balsa; I recommend Pica* Gluit, which won't leave hard glue ridges. After sanding and cleaning the skins, attach them with light coats of 3M Super 77 adhesive to save weight. Trim the skins flush with the sub leading edges, then install the 1/8-inch leading edge (LE) caps. Trim the roots and tips flush with the cores, then trim the trailing edge (TE) to the chord shown on the plans. Finally, install the 1/2-inch balsa wingtips and sand them to shape.

Cut the ailerons from the wing panels as shown on the plan and apply 1/8-inch balsa to the exposed TE. Trim 1/4 inch from the LEs of the ailerons and install their 1/8-inch balsa LEs. If you wish, you can trim the ailerons shorter and face their inboard ends with 1/32-inch balsa.

Before joining the wing panels, you need to bevel the roots to the proper angle. Align the root of the wing panel with the edge of your work bench and block up the wingtip 1 1/4 inches. Use a sanding block to bevel the root. Repeat with the other panel. Then, again blocking each wingtip up 1 1/4 inches, join the wing panels with thick odorless CA. Apply 1.5-ounce glass reinforcement tape to the joint with thin odorless CA.

Next, install the aileron torque rods. These are made of 1/16-inch music wire and 3/32-inch brass tube. Note that the torque rods mate with the ailerons at the very end, forming the inboard hinge for the surface. The easiest way to install the torque rods is to cut through the bottom sheeting, remove the underlying foam and then install the torque rods with thick odorless CA, being careful not to get any glue inside the brass tubes. Next, fill in the slot with 1/8-inch balsa and sand it flush. Cut the hinge slots and dry mount the ailerons. I recommend installing the 1/16-inch-ply aileron servo mount after covering the wing.

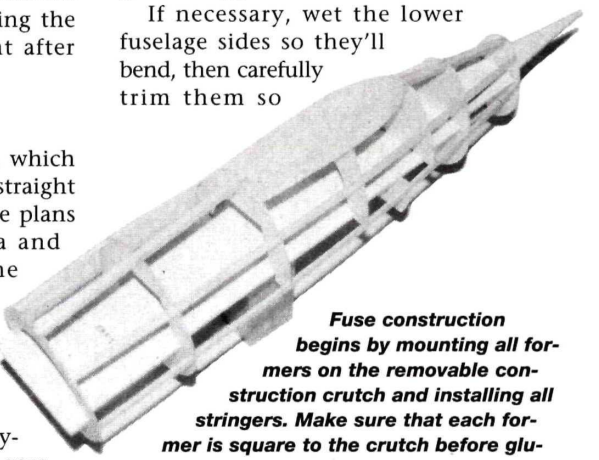
THE FUSELAGE

The fuselage is built over a crutch, which makes it easier to ensure a light, straight assembly. The crutch shown in the plans is cut out of 1/8-inch hard balsa and marked as shown. Note that the crutch is to be removed when the fuselage is complete. Do not glue any of the formers to the crutch!

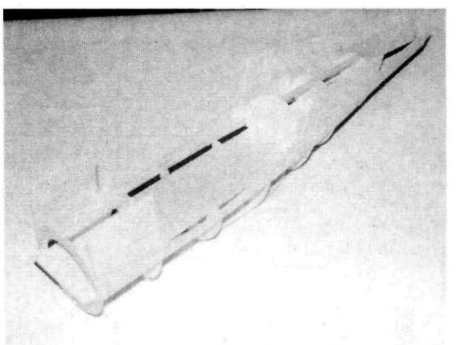
Slide each former over the crutch into its marked position. Dry-fit the 3/16-inch square top stringers into place and, after making sure each former is exactly perpendicular to the crutch, glue the top stringers to the formers with thin CA. Repeat this step for the 3/16-inch square bottom stringer, again making sure the formers are square to the crutch. Note that F-6A and F-6B must be beveled and joined at the proper 30-degree angle to allow removal of the wing. You'll also need to trim the slot in F-6B for the 3/16-inch stringer to seat properly. Finally, dry-fit the 3/32x3/16-inch upper and lower side stringers and CA them into place. You should now have a light and straight framework.

Secure the lower fuse sides to the lower side stringers with thin CA. Make sure the lower sides overlap exactly half of the side stringers as shown on section F-3 in the plans; the stringers will make it easier to glue the upper fuse sides to the lower sides.

If necessary, wet the lower fuselage sides so they'll bend, then carefully trim them so



Fuse construction begins by mounting all formers on the removable construction crutch and installing all stringers. Make sure that each former is square to the crutch before gluing the stringers. Also install the cockpit floor at this time.



With the fuse assembly inverted, the lower fuse sides are glued in place. Wet the sides, push them together and glue them in place.

FLIGHT PERFORMANCE

Be very careful checking the CG; this model is short-coupled, and it's tough to handle in an aft CG condition. I suggest you start with the CG 2 inches behind the LE of the wing where it exits the fuse and adjust it to suit your tastes. If you keep the weight at around 18 ounces, the Bearcat should fly just fine.

• TAKEOFF AND LANDING

I strongly recommend getting a capable assistant to hand-launch the model on the first flights. The model needs to be thrown straight and level. If the launcher lobs it upward, it's likely to stall. Hold the wings level and let it climb slowly as the speed builds up.

Landings are made with a straight-in approach, and the model is simply held just off the ground until it settles in. The Bearcat has very little tendency to tip-stall, but don't tempt fate with tight turns onto final.

• FLIGHT CHARACTERISTICS

The model does a good job of mimicking the handling characteristics and climbing performance of the original. For your first flights, I recommend 7 cells. I use 8 cells to improve the vertical, but I spend most of each flight at ½ to ⅔ throttle. Running 8 cells wide open shortens motor and battery life considerably.

• AEROBATICS

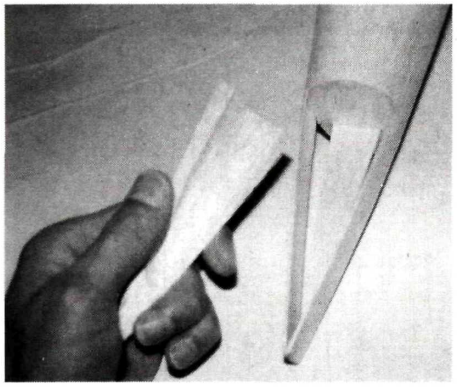
What's the point of a model that looks like a Bearcat if it doesn't fly like a Bearcat? This model is remarkably aerobatic for its small size and modest power. Huge loops and Cuban-8s are no problem, and the roll rate is very fast. I like making an overhead pass and then dropping through a split-S into a strafing run. The inverted performance is solid and predictable. It's a model you'll get comfortable with very quickly. Thank you, Roy Grumman!

they'll join tightly over the 3/16-inch keel stringer. Apply thick CA to the formers and push the fuselage sides into place, running a bead of thin CA down the seam.

Laminate the wing saddle doublers onto the lower fuselage sides as shown on the plans. Trim or block-sand the edges of the lower fuse sides flush with the formers around the wing saddle.

After making certain that they're straight (the pointed tail of the crutch helps here), glue the tail pieces together. Tack-glue the ½-inch balsa tail block in place with thin CA and carve it to shape, then remove it and hollow it out before gluing it back in place permanently.

At this point, I recommend you carefully slide the crutch out of the fuse assembly and apply 2½x2½-inch "doublers" made of 1.5- or 2-ounce fiberglass cloth to the inside surface of the lower fuselage sides between F-2 and F-3. Simply fit the patches in place, smooth them down and then saturate them with thin CA. You might also apply glass cloth doublers to the area right behind F-6 at the TE of the wing, since this is where you grip the model to hand-launch it. Also, install ¼-inch triangle stock to the joint between the wing-saddle doubler and F-3 at the LE of the wing to help rein-



The lower tail block is carved to shape, removed and hollowed out before being permanently glued in place.

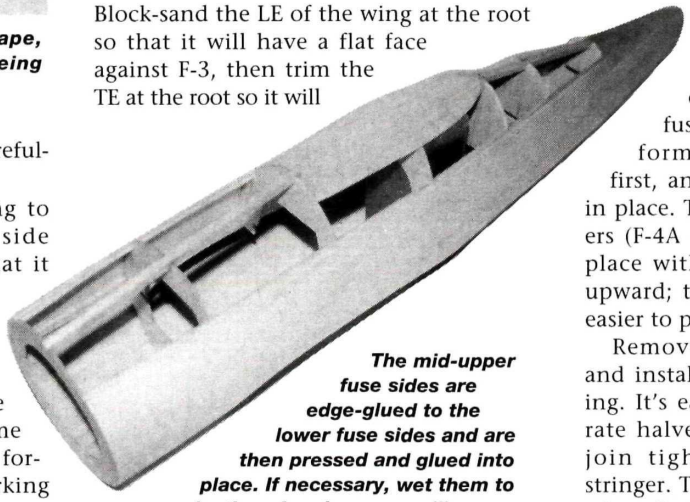
force this high-stress area. Finally, carefully slide the crutch back into place.

Edge-glue the mid-upper sheeting to the bottom sheeting and lower side stringers. If necessary, wet it so that it will conform to the upper formers. To minimize the chance of it becoming warped, I recommend you glue the lower edges of both sides into place and then tack-glue both sides into place at the same time by pinching them down against the formers, starting at the middle and working toward the ends.

At this point, you should remove the crutch before installing the top sheeting. By now, the fuse should be very stiff. Glue the lower edges of both pieces of top sheeting into place against the mid upper sheeting, then trim the pieces so they join tightly over the 3/16-inch top stringers. If necessary, wet the top sheeting to push it into place, and CA the joint. The main fuse construction is now complete.

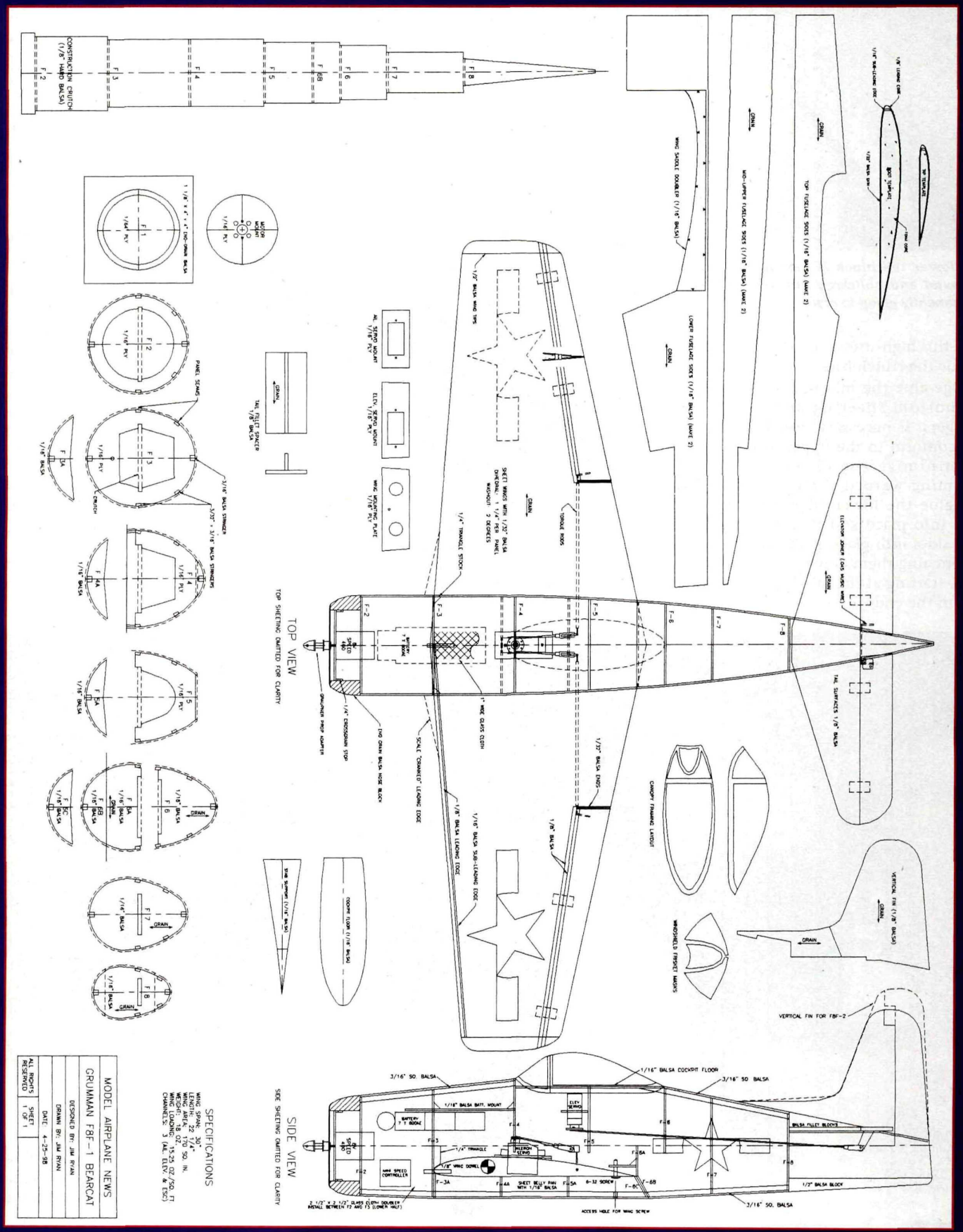
WING INSTALLATION AND BELLY PAN

Block-sand the LE of the wing at the root so that it will have a flat face against F-3, then trim the TE at the root so it will fit into the wing saddle. Tap the 1/16-inch-ply wing mount for a 6-32 nylon screw, glue the mount in place in the fuselage and reinforce the joint with 1/4-inch-balsa triangle stock. Drill the screw hole through the wing and install the 6-32 nylon wing screw. Square the wing with the tail of the fuselage, pinning it in place in the proper position. Drill the LE of the wing to accept the 1/8-inch locator dowel. Remove the wing, install the dowel and re-install the wing with a sheet of wax paper sandwiched between the wing and fuselage. Install the belly pan formers on the bottom of the wing, being careful not to glue them to the fuselage. Glue the front and back formers (F-3A and F-6A) in place first, and then dry-fit the keel stringer in place. Then trim the middle two formers (F-4A and F-5A) until they can fit in place without bowing the keel stringer upward; this makes the belly pan much easier to plank.



The mid-upper fuse sides are edge-glued to the lower fuse sides and are then pressed and glued into place. If necessary, wet them to make them bend more readily.

Remove the wing from the fuselage and install the 1/16-inch belly pan sheeting. It's easiest if you do this with separate halves and trim them so that they join tightly over the 3/16-inch keel stringer. Trim and sand the front and rear edges flush with the formers. Cut an 1/8-



FSP01991

F8F Bearcat

This Speed 400 model was CAD-designed by Jim Ryan and features a thinned Clark-Y airfoil, foam-core wing and simple balsa construction. It is true to scale and, with a weight of only 18 ounces, is remarkably aerobatic. WS: 30 in.; L: 22.25 in.; motor: Speed 400; 3 channels; 1 sheet; LD 3. $14.95.

To order, call (800) 537-5874.

inch access hole over the wing hold-down screw (this will leave the screw trapped in place so that it won't get lost) and re-install the wing on the fuselage. Sand the joint between the belly pan and fuselage sheeting flush, being careful not to sand through the sheeting.

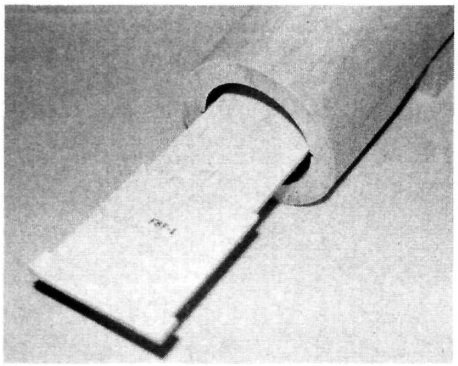
EMPENNAGE

Fit the triangular stab base into place between the fuse sides and secure it with thin CA. Assemble the wing to the fuse and trial-fit the stab on the stab base. Make certain the stab is parallel to the wing, and if necessary, sand the base or add shims to correct any error. Remove the wing and stab and glue the tail fillet blocks into place using a T-shaped 1/8-inch-balsa spacer as a guide (be careful not to glue the spacer in place). Carve and sand the tail fillets to shape.

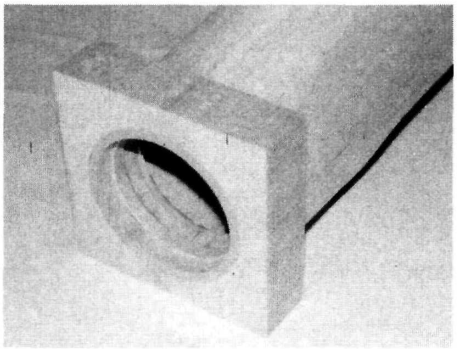
The tail feathers are simple 1/8-inch balsa sheet stock. Glue the vertical fin pieces together and let them dry. Cut the elevator hinge slots and test-fit them. Now remove the balsa spacer from the tail fillet. If you've been careful with the glue, it should slide right out. You can add an 1/8-inch-balsa spacer to support the tail fillets behind the stab, but make sure you leave room for the music wire elevator joiner. Cut a slot in the turtle deck to accept the key at the forward end of the fin fillet. Dry-fit the vertical fin and stabilizer and test-install a 1/16-inch music wire elevator joiner (you can use an 1/8-inch dowel joiner if you prefer). I found it easiest to wait and permanently install the vertical fin and stabilizer after finishing.

COWL BLOCK AND LAST DETAILS

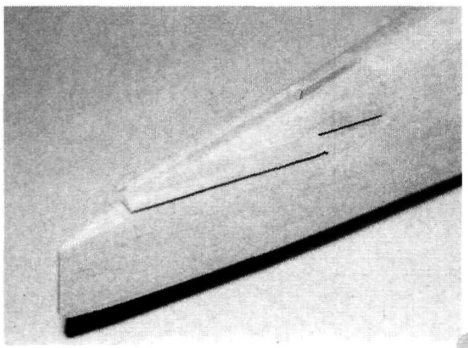
The cowl is a block of end-grain balsa that is carved to shape. Vacuum-forming it or carving it from blue foam would be easier and cheaper, but neither would have the needed combination of light weight and high strength (remember, the Bearcat is going to take landings right on its blunt chin). Note that the block is bored for the motor opening and a 1/4-inch-wide strip of cross-grain balsa is glued in place to provide a shoulder for positioning the motor mount. Draw datum lines on the front of the block and use them as a guide for installing F-1, which is really just a sanding guide. Then glue the block in place onto F-2 and carve and sand it to final shape. I recommend waiting until the model has been covered to install the 1/16-inch-ply motor mount with thin CA.



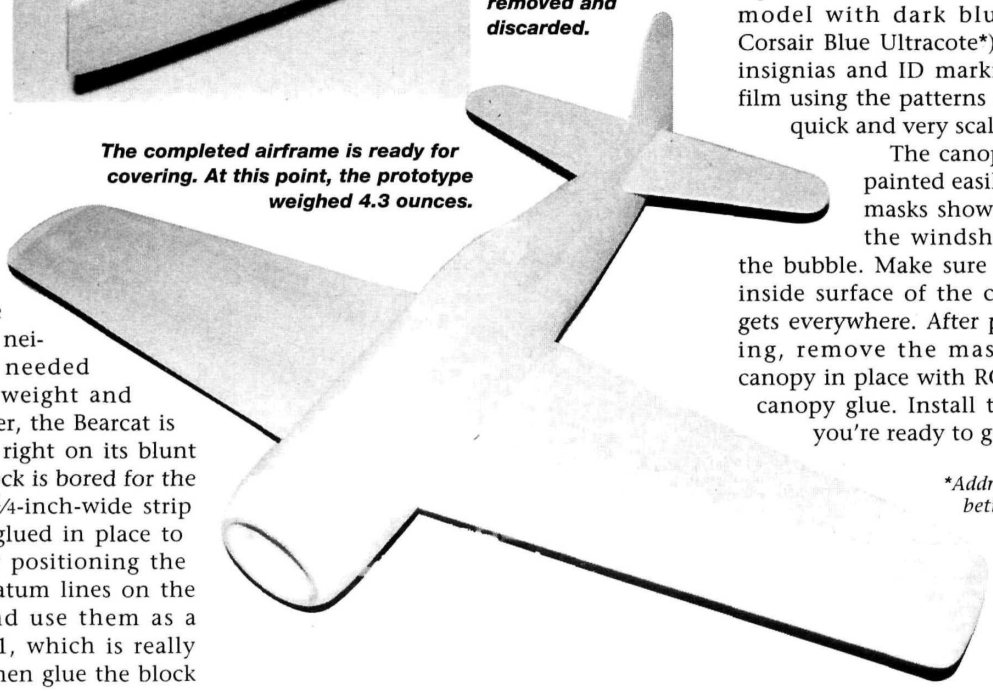
After the fuselage has been completed, slide the construction crutch out the front and discard it.



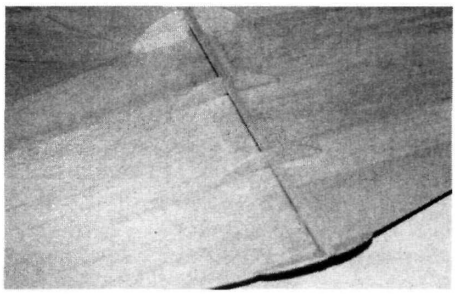
The cowl block is glued in place and then carved and sanded to shape. It also provides the mounting surface for the plywood motor mount, making the nose very strong.



The tail fillet blocks are glued in place with the help of an 1/8-inch balsa T-shaped spacer. The fillet blocks are carved and sanded to shape, then the spacer is removed and discarded.



The completed airframe is ready for covering. At this point, the prototype weighed 4.3 ounces.



The belly pan formers are glued to the bottom of the wing, and then the 1/16-inch balsa belly sheeting is added. Make sure that you install the nylon wing-mounting screw before building the belly pan so it will be trapped in place.

Install the elevator servo mount with thin CA. I recommend installing the aileron servo mount after covering. Cut the battery mounting plate out of 1/16-inch balsa and install it on F-3 and F-4, using 1/4-inch triangle stock to reinforce the joint. Apply a strip of Velcro® to the mounting plate so that the Ni-Cd pack can be secured. I use .038-inch music wire for the pushrods to keep weight to a minimum. Another option for the elevator is to install Kevlar pull/pull cables. If you opt for music wire, I've found that Sullivan* 2-56 brass couplers (no. 512) are perfect for these small models; just solder them in place and add a small nylon clevis.

FINISHING

Although I like painting my models, I recommend film covering for a small naval fighter such as this. After covering the model with dark blue film (I prefer Corsair Blue Ultracote*), cut the national insignias and ID markings out of white film using the patterns on the plans for a quick and very scale finish.

The canopy framing can be painted easily using the frisket masks shown in the plans for the windshield and tape for the bubble. Make sure you mask off the inside surface of the canopy; overspray gets everywhere. After painting the framing, remove the masks and glue the canopy in place with RC-56 or equivalent canopy glue. Install the hardware, and you're ready to go fly.

**Addresses are listed alphabetically in the Index of Manufacturers on page 174.*