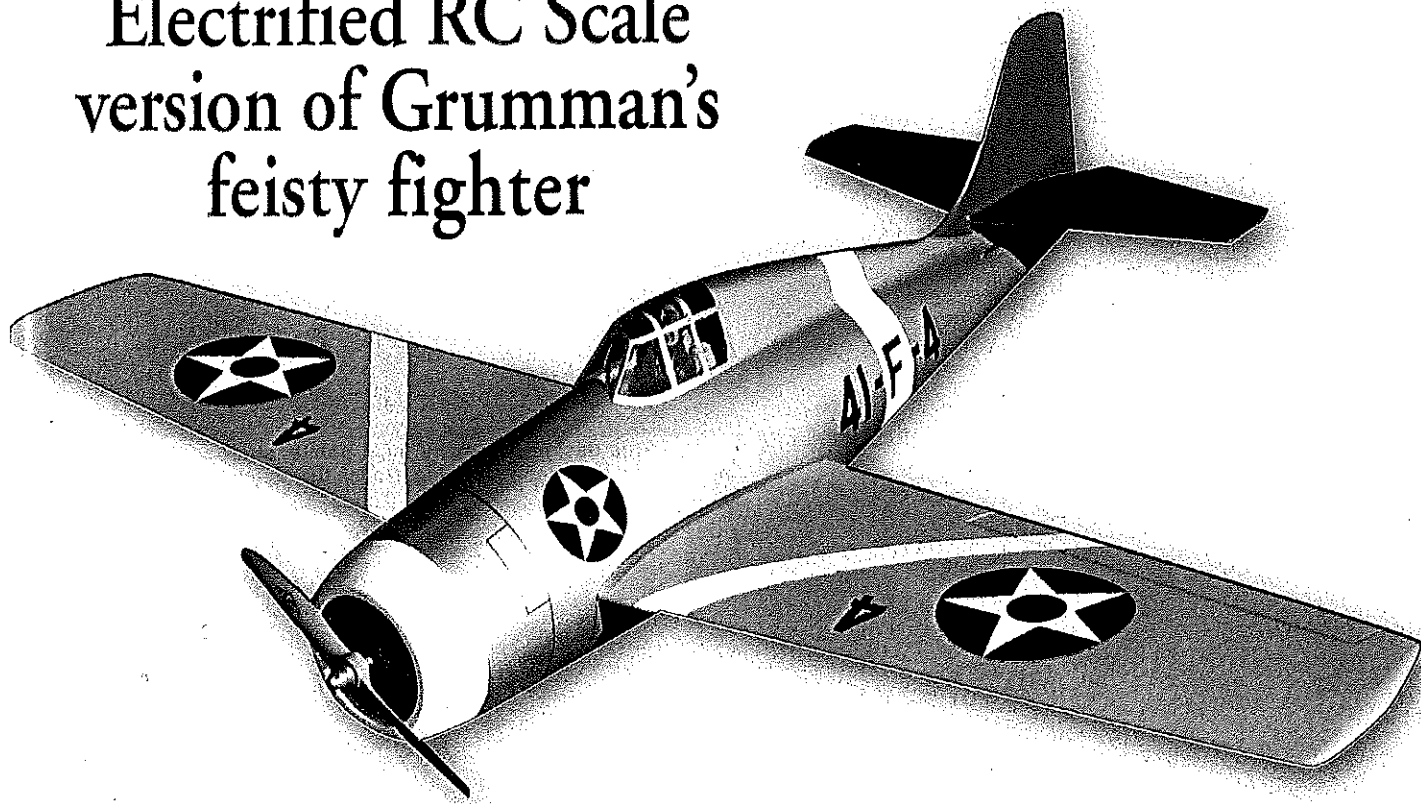


#956

Electrified RC Scale version of Grumman's feisty fighter



GRUMMAN F-4F

by Jim Ryan

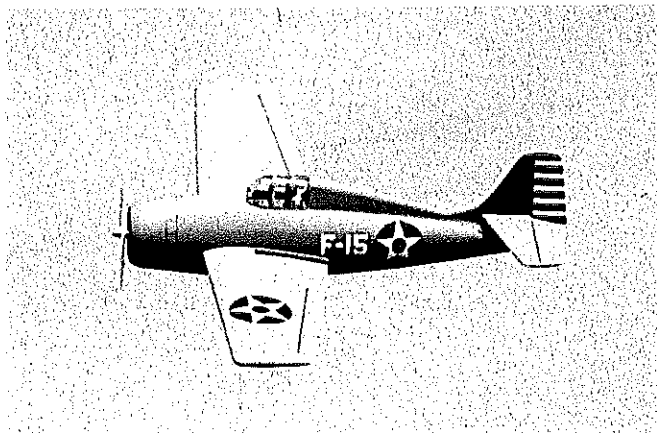
Wildcat

IN THE DARK early days of World War II, before world-class carrier fighters such as the Grumman Hellcat and Chance Vought Corsair entered service, hard-pressed US naval aviators depended on the obsolescent Grumman F-4F Wildcat to parry the Imperial Japanese Navy's attacks. Although their mounts were inferior to the renowned Mitsubishi A6M2 "Zero" in most respects, the Navy pilots used superior tactics and gunnery training to take the measure of their combat-hardened Japanese opponents.

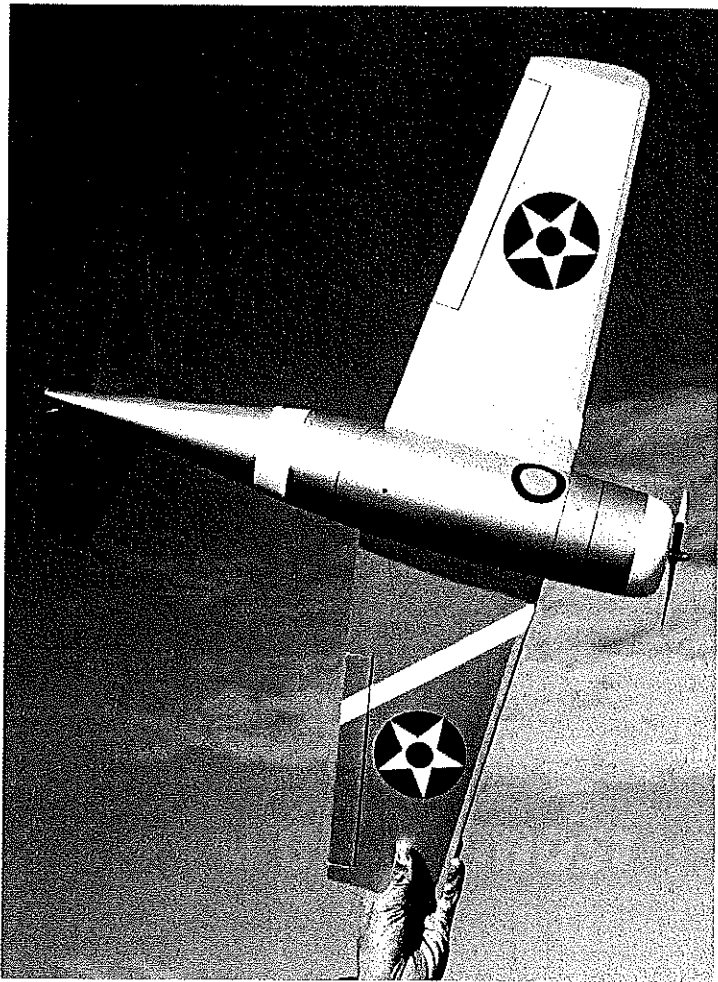
In the first year of the war, Navy and Marine F-4F squadrons confronted the Japanese Navy's best air crews in four major carrier battles and the grinding battle of attrition on and around Guadalcanal. These battles cost the Japanese many of their most experienced aviators; the result was that by the time Corsairs and Hellcats entered service in 1943, the tide of war had already turned.

US Navy fighters are among my favorites, and having built models of the Hellcat, the Grumman Bearcat, and the Corsair, the time seemed ripe to round out my collection of classic WW II carrier fighters.

For the Wildcat I stuck with my tried-and-true formula, scaling

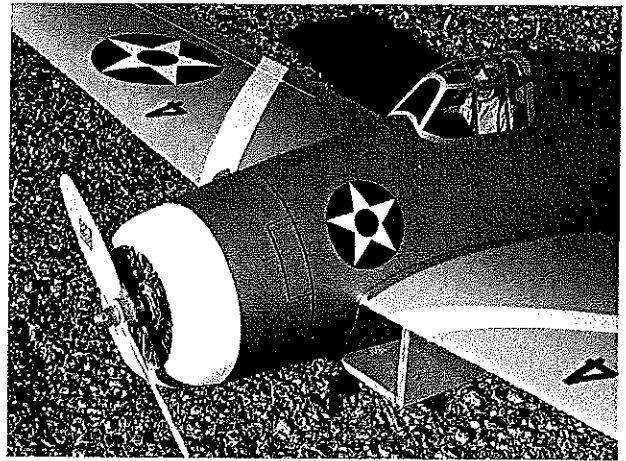


Jim's little Wildcat performs exactly as all of his other electric-powered warbirds do—outstandingly!

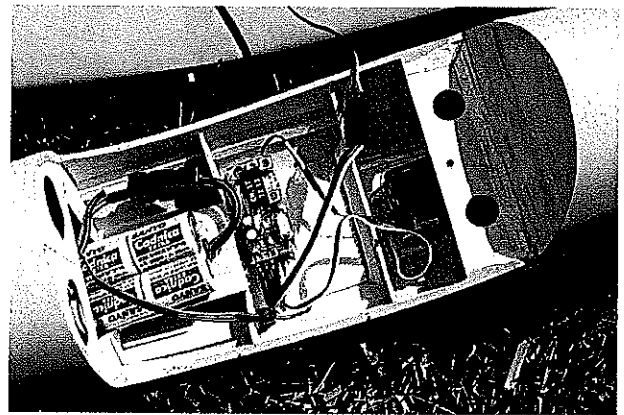


You can see the paint detail, including simulated retracted landing gear. You can use several paint schemes on this model.

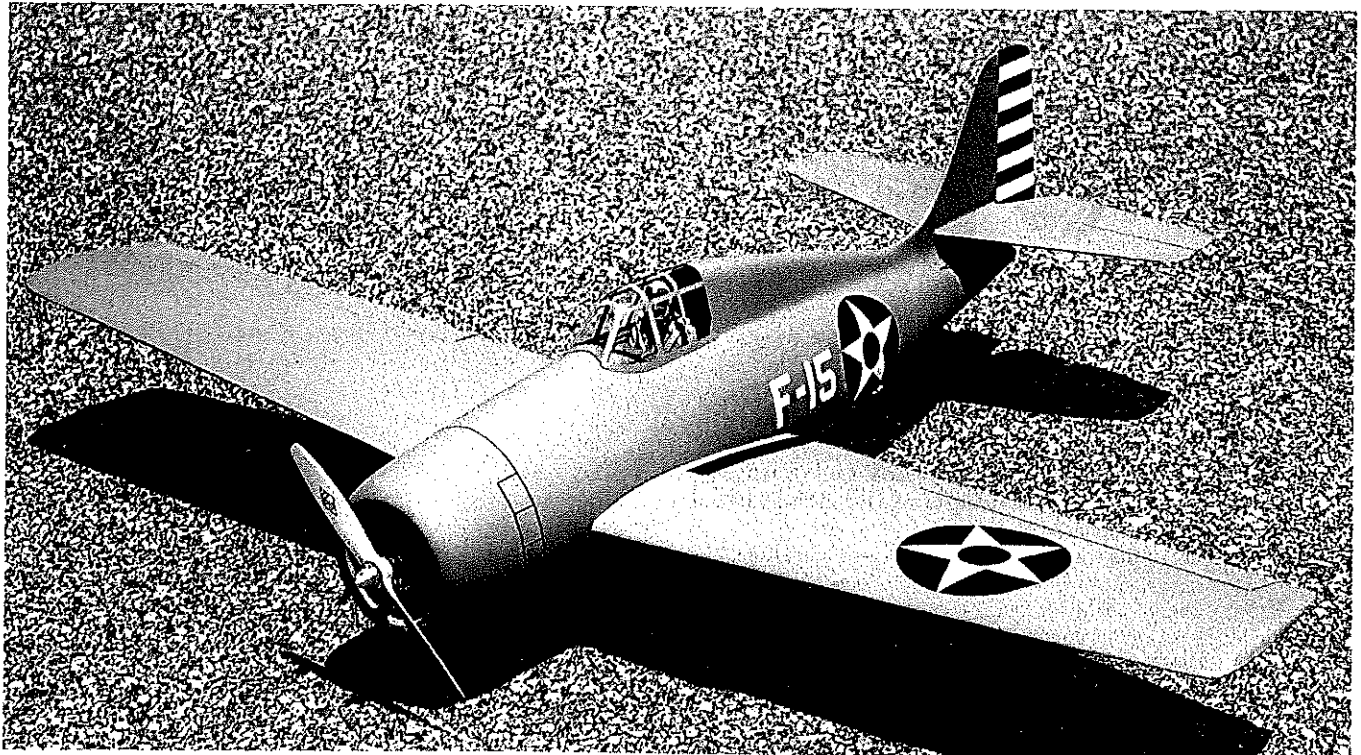
Flight shots courtesy of John Vago Static shots courtesy of the author



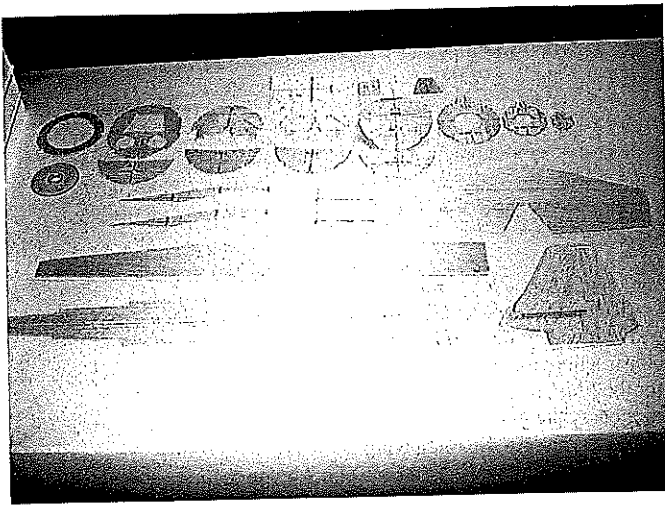
This design has many focal points, such as the ring cowl and the canopy framing. Notice the simulated radial engine!



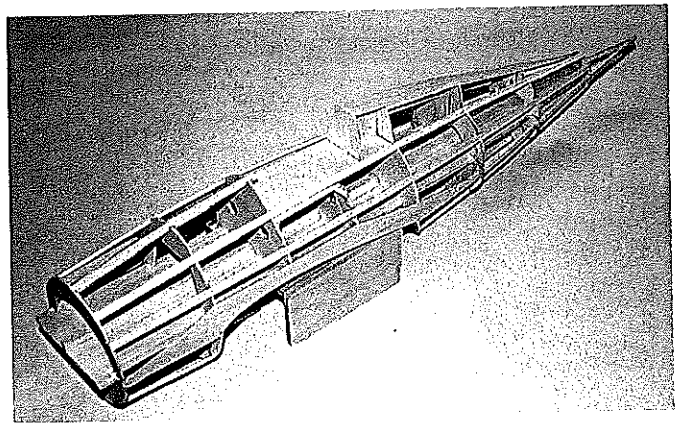
There is a great deal of room in the model's wide fuselage for the radio gear and batteries. Keep it neat!



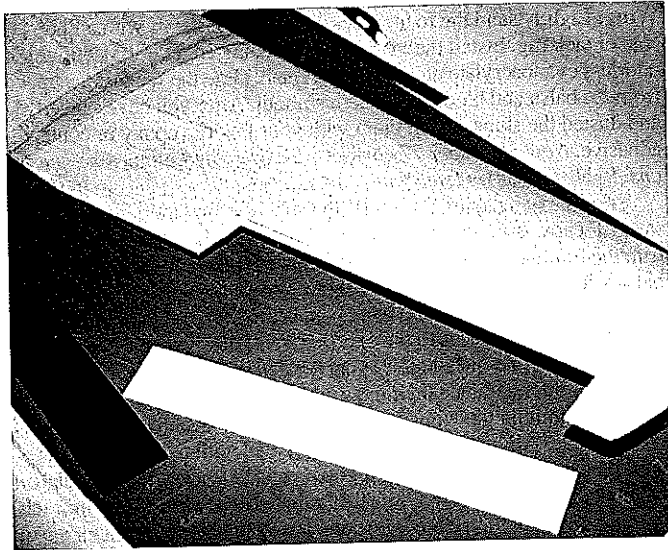
Anyone for a dogfight? The Wildcat looks ready for action sitting in its custom cradle. This airplane has character!



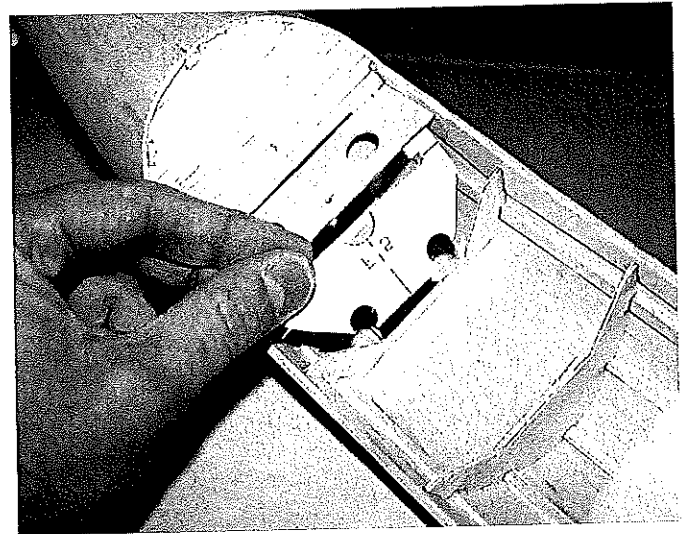
Begin construction by making a "kit" of the pre-cut parts. This speeds assembly considerably.



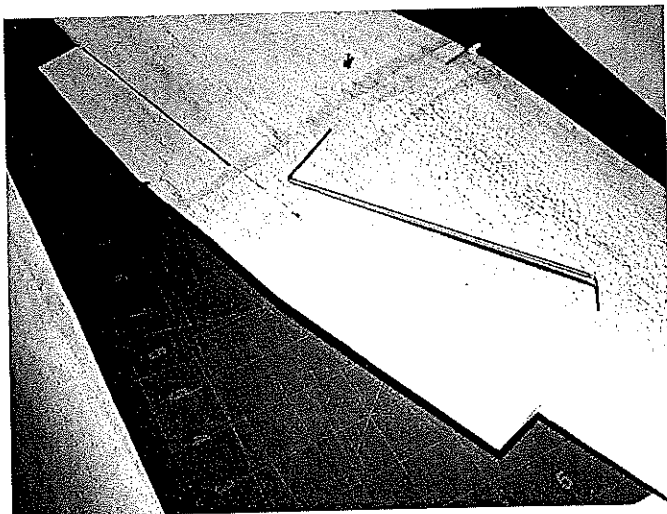
Assemble fuselage formers and stringers over the disposable internal crutch. This assembly is light and strong.



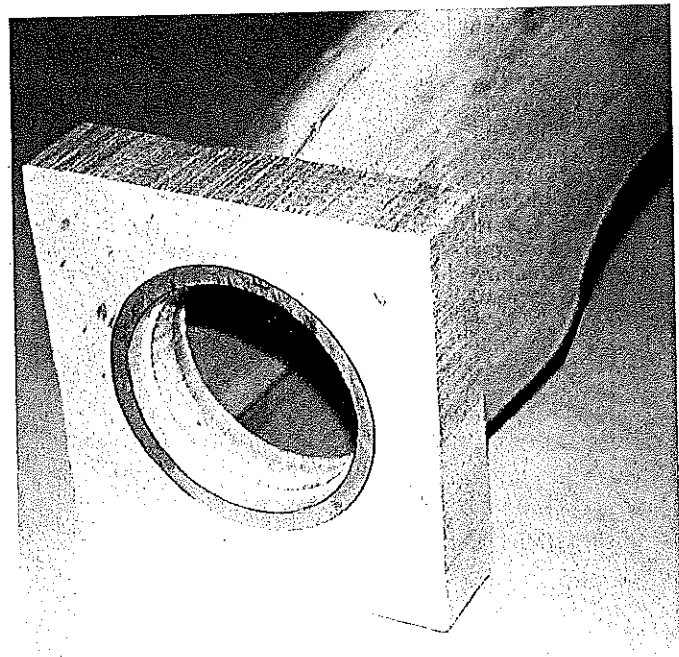
Join two wing panels with an inch dihedral per panel. Reinforce center joint with fiberglass tape, then cut ailerons free.



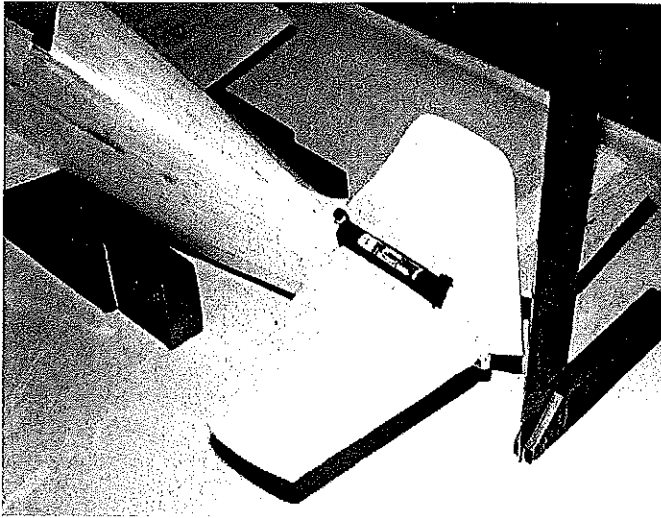
After you have completed the Wildcat's fuselage, remove the "crutch grips" of formers F-4 and F-5.



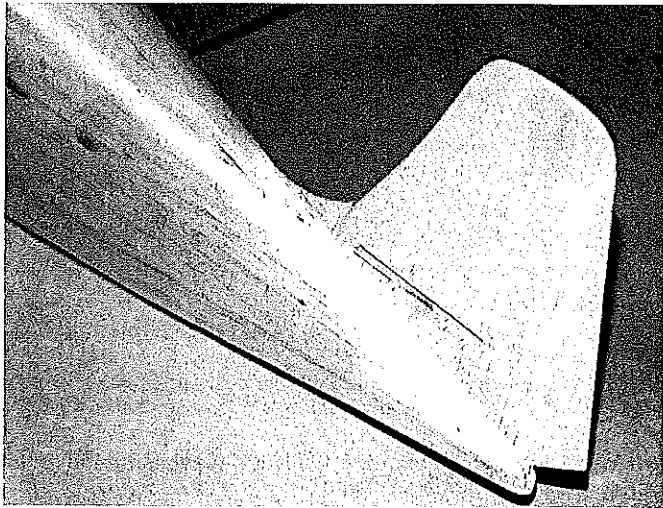
Install aileron torque rods in a slot cut in the bottom of the wing, and then fill the slot with scrap balsa.



Glue $\frac{1}{64}$ plywood F-1 former to front of balsa cowl block. Glue block to front of fuselage and carve to shape.

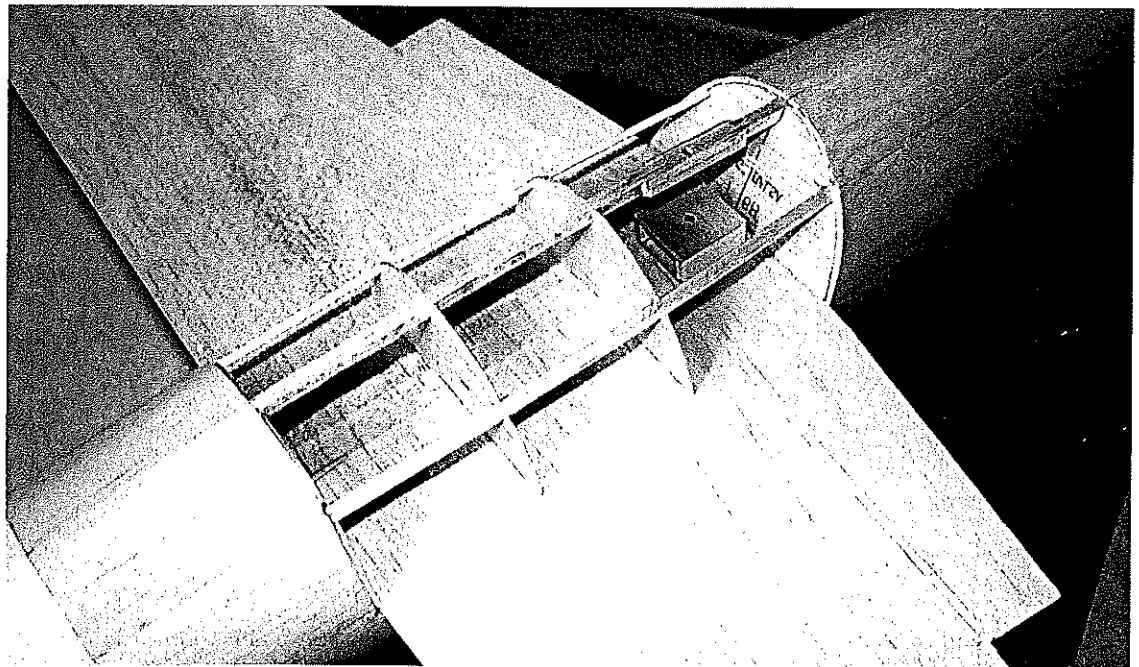


Once wing is mounted, glue tail assembly in place. With wing resting on blocks, square vertical fin to building board and set stabilizer incidence with small spirit level.



Once vertical fin is glued in place, apply filler to make smooth radius from fuselage to raised headliner fairing.

Assemble formers, stringers for belly pan with wing fitted to fuselage; be careful not to glue them to fuselage. Note "keeper box" for wing mounting screw.



the airframe to 170 square inches of wing area and aiming for an all-up weight of 18 ounces. At this size the F-4F has a proportionally fatter fuselage than any of my efforts to date, so weight control is crucial.

With the F-4F's midwing configuration, I also had to pay special attention to the structure around the wing saddle. Given the fuselage's shape, my favored practice of crutch-built construction worked especially well. The Wildcat has lived up to all my expectations and is one of my favorite models, so let's get started!

CONSTRUCTION

The airframe was designed with AutoCAD. The fuselage is a conventional structure using former, stringer, and balsa-sheet construction, and the wing is foam sheeted with balsa. The weight goal for the finished empty airframe is 7 ounces. I use regular thin cyanoacrylate glue for nearly all construction and odorless cyanoacrylate for the foam wing.

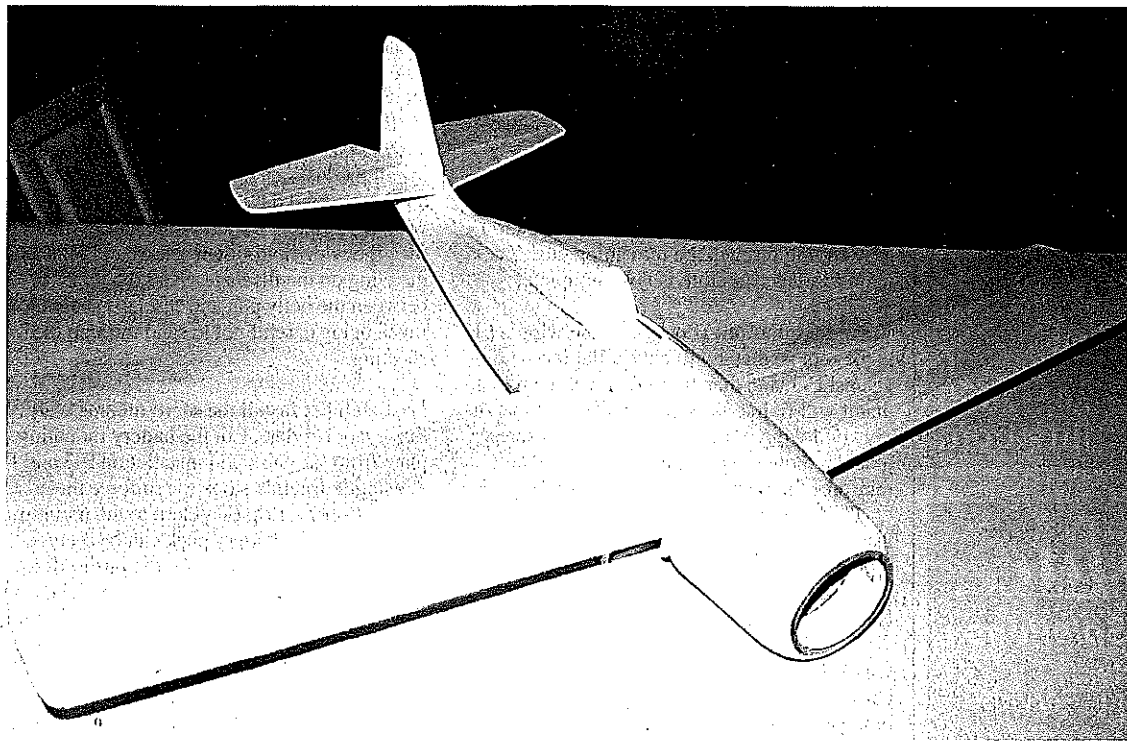
I suggest that you start with a "kit," by precutting all major parts to shape. You can accomplish this in one or two evenings, and construction will go much more quickly. I transfer the part templates to the sheet wood with the acetone transfer method, which is quick and easy to do. (I'm offering a parts pack including the foam wing cores and a vacuum-formed canopy. Send \$24 [including shipping] to me at the address at the end of this article.)

Wing: Lightly sand the foam cores, and clean them off with a Shop-Vac or tack rag. Install the 1/16-inch sub-leading edges (LEs) with thick, odorless cyanoacrylate and trim them flush. Glue the wing skins up from 1/32 balsa and block-sand them smooth. After you have sanded and dusted the skins, attach them with your favorite epoxy or contact adhesive. *Now 3M Super 77 contact adhesive contains acetone and is unsuitable for use on foam wing cores.*

Trim the wing skins flush with the sub-LEs, and then install the 1/8-inch LE caps. Trim the roots and tips flush with the cores, and then trim the trailing edges (TEs) as shown on the plans. Install the 1/2-inch balsa wingtips and carve them to shape.

Cut the ailerons from the wing panels as shown on the plan view and apply 1/8 balsa strips to the exposed TE. Trim 1/4 inch from the LEs of the ailerons and install their 1/8-inch balsa LEs. You can trim the ailerons shorter and face their ends with 1/32 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 workbench, and block up the wingtip an inch. Use a sanding block to bevel the root. Repeat with the other panel. Then, again blocking each wingtip up an inch, join the wing panels with thick, odorless cyanoacrylate or epoxy. Apply 1.5-ounce fiberglass reinforcement tape



Finished airframe is ready for covering. Prototypes were covered with ultra-light fiberglass cloth and then painted. Film covering or tissue and dope will also work well.

to the joint with thin, odorless cyanoacrylate.

Install the aileron torque rods. They are fabricated from $\frac{1}{16}$ -inch music wire and $\frac{3}{32}$ -inch brass tubing. 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 mount them with thick, odorless cyanoacrylate, *being careful not to get any glue inside the brass tubes.*

Fill in the slot with $\frac{1}{8}$ balsa and block-sand it flush. Cut the hinge slots and dry-mount the ailerons. Install the $\frac{1}{16}$ -inch plywood aileron servo mount *after* you finish the wing.

Fuselage: The fuselage is built over a crutch, which is indexed for each former location. Before beginning fuselage construction, glue the $\frac{3}{16}$ square hard-balsa spine down the center of the crutch to make it more rigid. Make sure that the crutch is flat and straight. It is to be removed when the fuselage is complete. *Do not glue any of the formers to the crutch!*

Before you begin assembling the fuselage framework, assemble F-6, F6-A, and F-6B. You *must* bevel and join them at the proper 30° angle to allow removal of the wing. Glue the reinforcement strips and extension stringers onto the wing-saddle doublers. Notice the partial cutouts in the "crutch grips" of F-4 and F-5; you will remove these sections after you have completed the fuselage.

Slide each former over the crutch, into its indexed position. *Be especially careful to keep F-2 square to the crutch and not induce warpage while adding the stringers; this former determines the motor's thrustline.*

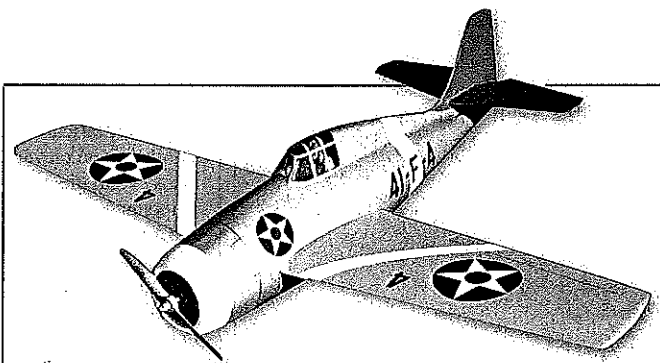
Dry-fit the $\frac{3}{32} \times \frac{3}{16}$ stringers and wing-saddle doubler assemblies into place. After making absolutely sure that each former is perpendicular to the crutch, glue the stringers to the formers with thin cyanoacrylate. The stringers that are part of the wing-saddle assembly extend past F-9 by approximately two inches.

Assemble the F-10, F-11, and F-12 cockpit formers, and glue them in place on formers F-4, F-5, and F-6. Glue the F-13 subturtledeck in place atop formers F-12, F-6, F-7, and F-8. The pointed rear tip of the turtledeck seats between the top two stringers just ahead of F-9. You should now have a light and straight framework.

Glue the lower edge of the fuselage side panels to the side stringers with thin cyanoacrylate. It's best to install each pair of panels simultaneously so that stresses aren't induced in the assembly. Make sure that the side panels overlap exactly half of the side stringers; it helps to make a light pencil mark at the

center of the side stringers at each former.

If necessary, dampen the fuselage panels so that they'll bend readily, and then carefully push them into place and glue them with thin cyanoacrylate. Glue the upper fuselage panels in place edge to edge with the fuselage sides. It's best to start at the middle of the panels and work toward the ends. Add the rest of the fuselage panels.



GRUMMAN F-4F

Wildcat

Type: Electric RC Sport Scale

Wingspan: 30.6 inches

Power: Speed 400 motor with eight HE1000 NiMH cells

Flying weight: 18 ounces

Construction: Balsa, plywood, foam

Covering/finish: Fiberglass cloth, modeling paint

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Once all fuselage panels are in place, glue the bottom tail block in place and carve it to shape. Plane or block-sand the turtledeck panels flush with the subturtledeck and add the turtledeck cap, which is laminated from two layers of $\frac{1}{8}$ balsa.

Now you can remove the construction crutch. By this point the assembly should be stiff. Remove the crutch grips from F-4 and F-5 by cutting through the remaining tabs. The main fuselage structure is now complete.

Wing Installation: Block-sand the wing's LE at the root so that it will have a flat face against F-3, and then trim the TE at the root so that it will fit into the wing saddle. Tap the $\frac{1}{16}$ plywood wing mount for a 6-32 nylon screw, glue the mount in place in the fuselage, and reinforce the joint with $\frac{1}{4}$ 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 wing's LB to accept the $\frac{1}{8}$ -inch locator dowel.

Cowl Block: The cowl is a block of end-grain balsa that is carved to shape. Notice that the block is bored for the motor opening. 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. Glue the block in place onto F-2 and carve and sand it to final shape. I recommend waiting until the model is covered to install the $\frac{1}{16}$ plywood motor mount.

Empennage: To have the necessary strength at the stabilizer mounting, make the vertical fin from $\frac{3}{16}$ balsa. To reduce weight and improve the appearance, block-sand the fin to taper from $\frac{3}{16}$ inch at the stabilizer slot to $\frac{1}{8}$ inch or less at the tip. You should also sand it to a symmetrical airfoil section. Cut the stabilizer and elevator halves from $\frac{1}{8}$ sheet stock. With the pieces trial-fit together, fit the empennage assembly to the fuselage.

Assemble the wing to the fuselage. Pin the vertical fin in place so that it's 90° to the wing and aligned with the axis of the fuselage. Glue the tail fillet blocks (made from $\frac{1}{2}$ balsa stock) in place on either side of the vertical fin, but be careful *not* to glue them to the vertical fin at this time. Remove the vertical fin and replace it with a spacer made from scrap $\frac{3}{16}$ balsa.

Carve and sand the turtledeck cap and tail fillets to shape. Remove the spacers and slip the vertical fin back into place, again making sure that it's 90° to the wing. Dry-fit the stabilizer in place, and check to make sure that it's at 0° incidence relative to the bottom of the wing. When you're satisfied with the alignment, glue the vertical fin in place with thin cyanoacrylate, but leave the stabilizer loose for the moment.

Cut the elevator hinge slots and test-fit them. Install the music-wire elevator joiner (or you can use a $\frac{1}{8}$ -inch-diameter dowel joiner if you prefer). I found it easiest to wait and permanently install the stabilizer *after* covering.

Belly Pan: With the wing mounted on the fuselage, install the belly-pan formers on the bottom of the wing, being careful not to glue them to the fuselage. Dry-fit the three belly-

pan stringers in place. The center stringer is laminated from two layers of $\frac{3}{32} \times \frac{3}{16}$ balsa. You may want to add a "keeper box" to hold the wing screw in place in the wing.

Remove the wing from the fuselage, leaving the screw in place in the wing, and install the $\frac{1}{16}$ -inch belly-pan sheeting. Trim and block-sand the front and rear edges flush with the formers. Drill a $\frac{1}{8}$ -inch access hole over the wing hold-down screw, and reinstall the wing on the fuselage. Sand the joint between the belly pan and fuselage sheeting flush, being careful not to sand through the sheeting.

Last Details: Install the servo mounts with thin cyanoacrylate. Cut the battery mounting plate from $\frac{1}{16}$ balsa and install it on F-3 and F-4, using $\frac{1}{4}$ triangle stock to reinforce the joints. Apply a strip of Velcro to the mounting plate so that the battery pack can be secured.

I use .038 music wire for the pushrods to keep weight to a minimum. On a model this small, I prefer to make my control horns from $\frac{1}{32}$ plywood, mortised into the surfaces for added strength.

Finishing: The Wildcat is suitable for film covering, but I like to finish my warbirds with fiberglass and paint. Tissue and dope also works well. I covered the prototype with .56-ounce fiberglass cloth and painted it with enamel paints. It's a replica of the F-4F-3 that Lieutenant "Butch" O'Hare flew when he earned the Medal of Honor on February 20, 1942.

You can paint the canopy framing easily using the frisket masks shown in the plans. Make sure you protect the canopy's inside surface with masking tape; overspray gets *everywhere*. After painting the framing, remove the masks and glue the canopy in place with Formula 560 or equivalent canopy glue. Install the hardware, and you're ready to go fly.

Flight Testing: Be careful checking the center of gravity (CG). I suggest that you start with the CG two inches behind the LE of the wing where it exits the fuselage, and adjust it to suit your tastes. If you keep the weight near 18 ounces, the Wildcat should fly fine.

Get a capable assistant to hand-launch the model on the first flights. It needs to be thrown straight and level. If the launcher lobs it upward, it's likely to stall. Hold the wings level and begin a shallow climb. Landings are made with a straight-in approach, and the model is held just off the ground until it settles in. With the washout in the wing, the Wildcat has forgiving stall characteristics.

I've been extremely pleased with this model's performance and handling. I use eight cells to improve the vertical, but I spend most of each flight at half to two-thirds throttle. With the new HE1000 NiMH cells, endurance is in the seven- to nine-minute range. The Wildcat will do huge loops and Cuban 8s, and the roll rate is surprisingly fast. Inverted flight is solid. The Wildcat really is a joy to fly. **MA**

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