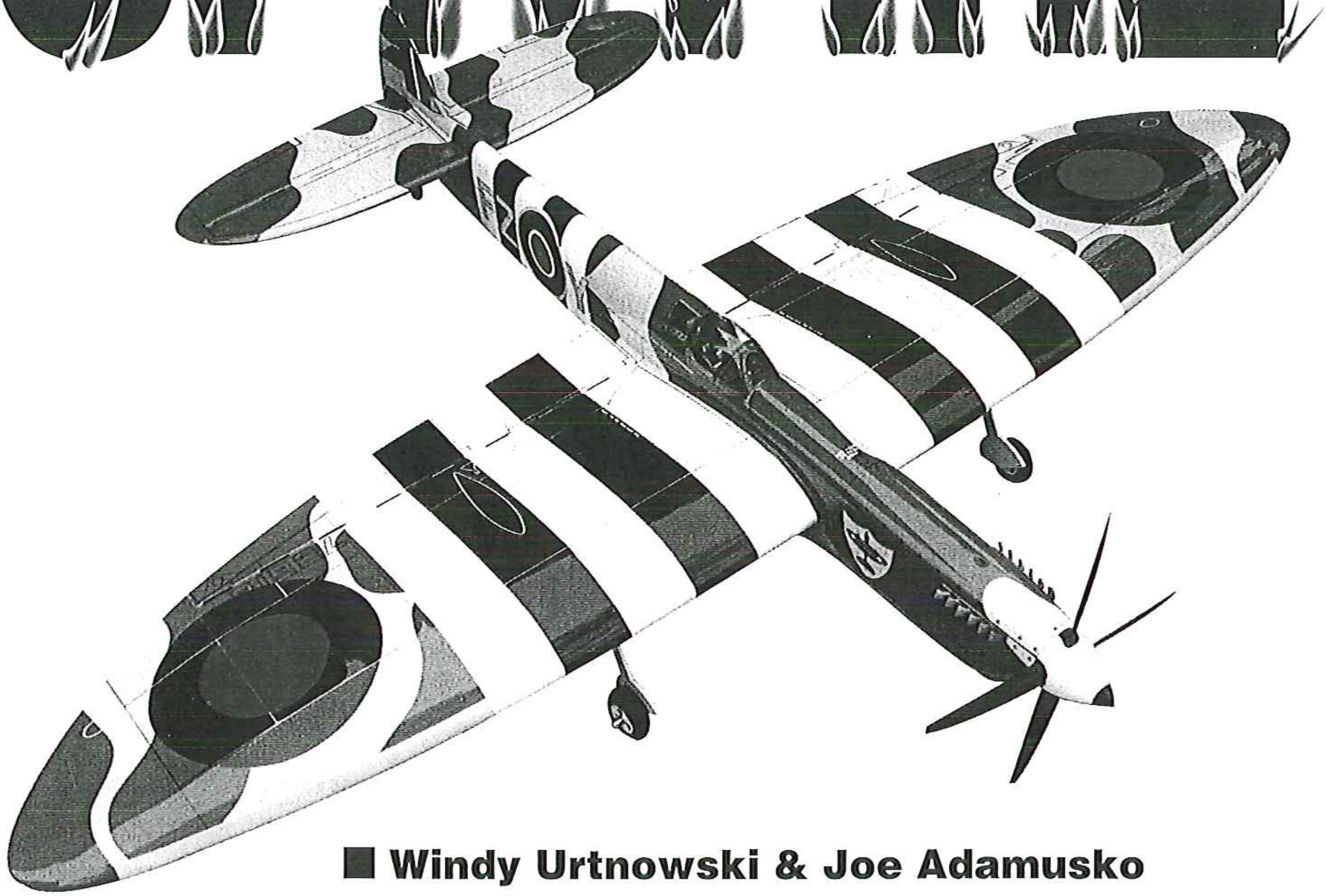
#848

SPITFIRE



■ **Windy Urtnowski & Joe Adamusko**

Joe Adamusko and I have shared a love of Spitfires for many years. In the spring of 1995 we committed to what was ultimately "The Spitfire Project." Little did we realize just how all-consuming the project would become, or how many people would contribute significantly to the final outcome.

Bob Martens created one of the finest sets of drawings for a CL Stunter. He did most of the drawings from actual parts and templates used to construct the original two Spitfire models.

Ed Gallagher was instrumental in the composite material work, expert machining of the spinner male molds and backplates by Ron Kieffer, anodizing by George Venturini; and vacuum-forming of the canopies was done by Dave Midgley.

As the design was evolving, we went back and forth almost endlessly. Joe and I drew up so many plans that the postman even commented on the increase in mail that spring. Joe massaged my drawings, I made changes to his, and eventually we arrived at the design you see here. It didn't come easily, cheaply, or quickly, but the result is exactly what we had in our minds' eyes in the beginning.

The airfoil is pure Patternmaster. Big Jim Greenaway, the designer of the Patternmaster, has a gift for fine wing design, and his help and feedback were instrumental in finalizing many aspects of the Spitfire's areas and force arrangements.

We wanted dead-reliable motor runs with a WW II fighter sound, so we chose Big Jim SuperTigre .60 "hemis."

We decided that this project should incorporate features seldom (if ever) seen in the world of "pro Stunt," among them:

• Molded leading-edge sheeting

• Aft top deck, bottom block, and nose block shaped from balsa molded over solid carved plugs

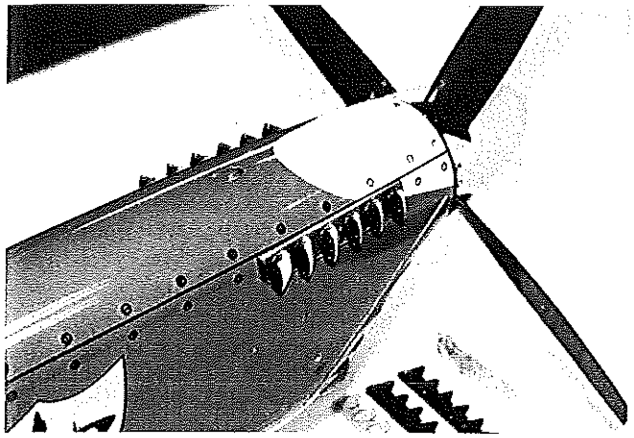
• Geodetic horizontal stabilizer construction

• Handmade fiberglass spinners and cowlings

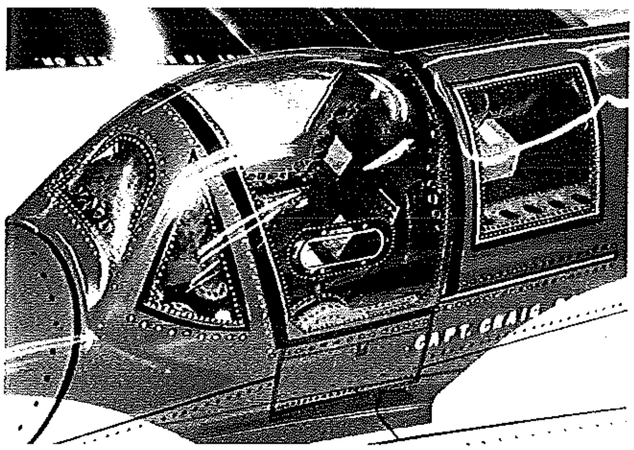
• Five-bladed carbon-fiber/epoxy composite props

• Composite molded (nonfunctional) exhaust stacks and landing gear details

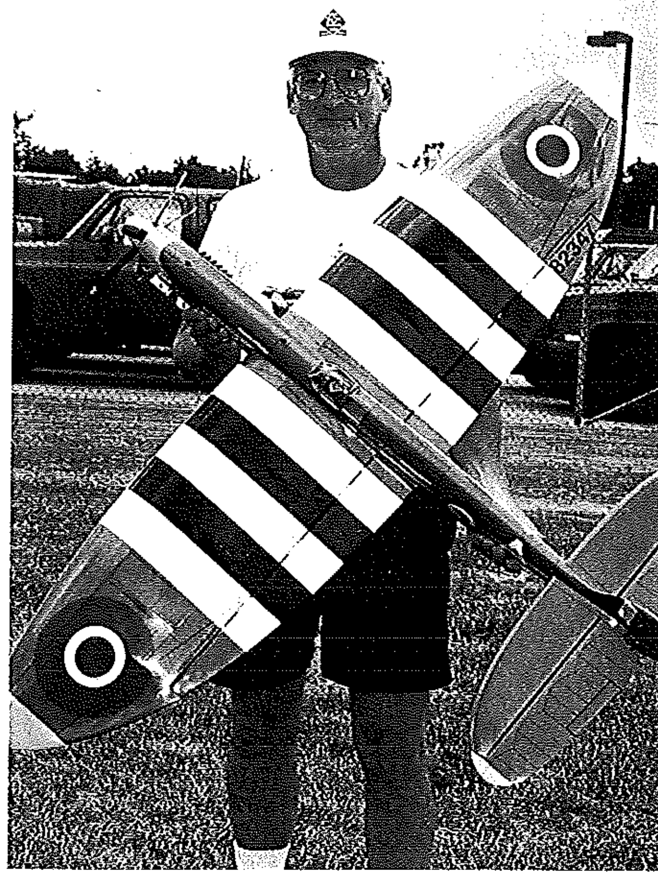
Photos by the Author Graphic Design by Carla Kunz



?olyester resin-cast exhaust stacks add another touch of 'ealism. The ends were hollowed with a burr on a grinding tool.



Canopy was molded from hand-carved plug by Dave Midgley. Rivet details were done by hand with ink. Note left-side "window."



Joe Adamusko with his model. This combination finished 16th at the 1996 Nats and also won Rookie of the Year.

The hardest part to make was the carbon-fiber prop. A couple of two-blade props were made to develop and refine molding techniques, then the five-blade was tackled. After trying many resins and curing agents, Epon 815 and TETA came out on top for the props we ultimately used.

Joe and I were thrilled after we test flew each other's models and found how well each performed. Lightning-bolt corners and smooth rounds, the sound of throbbing power, invasion stripes, five-blade props, roundels—it was truly an adventure.

CONSTRUCTION

Wing: One reason more Spitfires haven't been modeled is that the wing can be complex to build. Using the method Joe devised isn't really very difficult, and results in what Joe calls "wicked beauty."

A straight, rigid, warp-free wing is a prerequisite for any Stunt model; that's why we chose to use the proven rib alignment rod and support block method for the Spitfire. This technique also lends itself to the process of molding balsa leading edge sheeting.

The rods are type 303 stainless steel, ⅜ x 60 inches. These can be obtained in random lengths from any industrial supply company. The weight of the steel rods aids in keeping the wing assembly in alignment.

The rod end support blocks and center support block are made from ¾ soft pine. The end support blocks are 3¾ x 7 inches, with ⅜ holes drilled on centerline and spaced 2¾ inches apart. The narrow rod spacing ensures that both rod ends exit the R-9 tip rib, thus allowing for the trailing edge tip sweep to be constructed with the alignment rods installed.

SPITFIRE

Type: CL Stunt

Wingspan: 62 inches

Engine: SuperTigre .60

Construction: Built-up

Finish: Sig dope

The wooden support blocks must have accurate hole locations, which must correspond with the rib hole centerlines. The wooden outer support blocks and center support must allow for adequate clearance between the bottom of the rib profile and the flat building surface. The rods, support blocks, and the partially-assembled wing must be turned over to complete the construction.

A ½-inch-thick plate glass building surface 12 x 65 inches was used on top of a flat building board. This permits shimming of the plate glass for a dead-level condition and allows for rotating the wing construction fixture for easy access to the leading edge and trailing edge while working at bench level.

Cut the paper rib profile outlines out very accurately with a pair of scissors—making copies of the rib outlines will save the plans. Don't cut the leading edge notch, spar notches, leadout and rib clearance holes, or rod alignment holes at this time.

Use 3M Spray Mount™ artist's adhesive to fasten the paper rib outlines to 1/16 light C-grain balsa sheet. This allows easy removal of the paper outline later and leaves only a very small amount of residue. Cut the rib outlines from the balsa sheet, allowing about 1/32 excess beyond the paper outline, then use a sanding block to shape the rib contours to the paper outlines.

Cut the rib leading edge notches to fit the leading edge and the spar notches to fit the balsa spar material. Be sure to keep the rib outline form attached to the rib blank. Use a piece of 3/8 diameter brass tubing, sharpened around the inside edge, to cut the holes for the alignment support rods in each rib blank.

Shape two spar joint bellcrank support gussets for the floating bellcrank support pin from 1/4 x 3/8 rock-hard maple and drill holes in both pieces at the same time.

The trailing edges are 1/4 square medium B-grain balsa, tapered to 1/8 inch. Be sure the leading edge of the shaped piece matches the profile thickness of the rib trailing edge. The leading edge is punk-light 3/8 square balsa; the spars are 1/4 square medium B-grain balsa.

Insert the rod ends through the holes in the wooden inner wing panel support block. Allow the rod to go through about ½ inch, then wind two wraps of masking tape on the rod ends so they can't back out of the holes while you slide on the ribs.

Start with the inboard R-9 tip rib and slide it the full length of the rods into an approximate position over the wing plan layout. Repeat until you complete the positioning of all inboard ribs. Use the center support or a piece of temporary clearance blocking to hold the rods and the inboard ribs off the work surface.

Slide the outer wing panel R-1 root rib onto the rods and position it over the wing plan. Repeat until the outboard R-9 tip rib is placed onto the rods. Install the outer alignment rod support block and tape the rod ends so they can't work out of the openings. When all of the ribs are on the rods, align them with the wing plan using a right triangle or a tri-square. Make sure there is a minimum of one inch clearance between the tip ribs and the rod alignment support blocks.

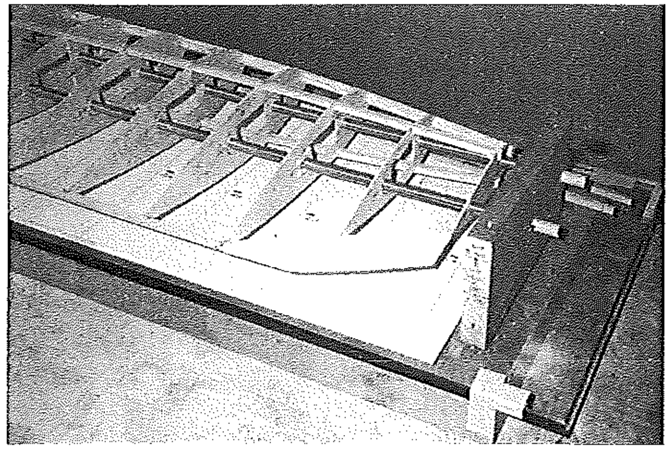
Install the rod center support block clamp and screw to ensure that the rods can't pivot during construction.

Attach the shaped trailing edge and tapered tip sweeps.

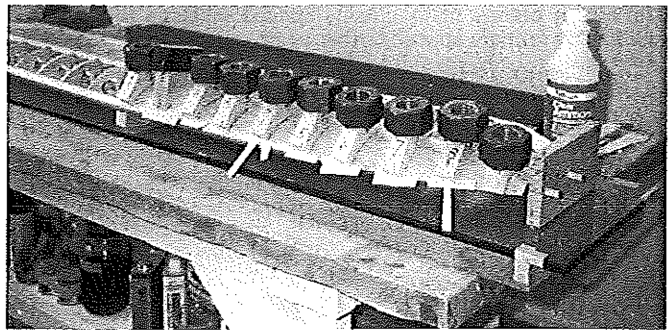
Add the 3/8 square leading edge material; use a 45° angle joint at the center to allow for more surface contact area and strength in the joint. Where the bend in the leading edge is most severe toward the tips, saw kerf cuts into the inside surface of the material to assist in the bending process. It is not necessary to glue the saw cuts, because the inside stock between the rib bays will be removed later.

Install the bottom and top 1/4 square spars. Be sure the spars are flush with the top of the rib profile, to prevent uneven leading edge sheeting installation. The spars will bend to the curvature of the rib profile thickness toward the tips. Use a long sanding block to true any high spots.

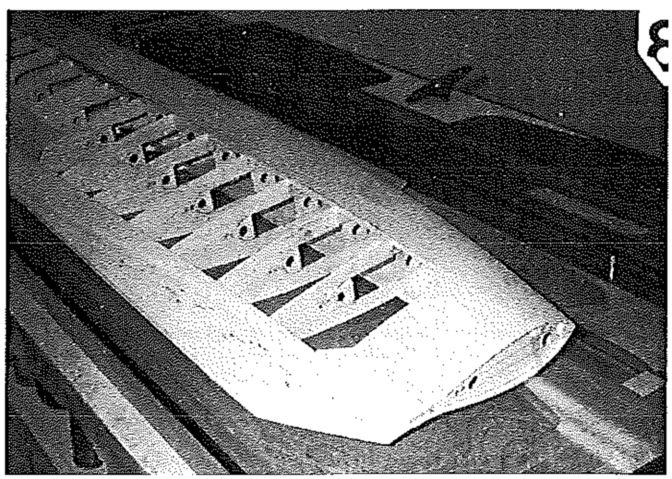
Install the light 3/32 A- or B-grain trailing edge sheeting on top of the wing panel, making a 45° butt joint at the centerline. Use the outline shown on the wing plan for the correct width and taper.



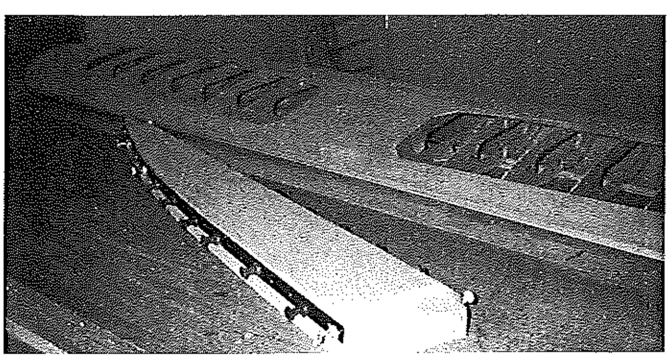
Wing frame in jig fixtures. Note rods, support blocks, and plate-glass base. Tape on rod ends keeps them in place.



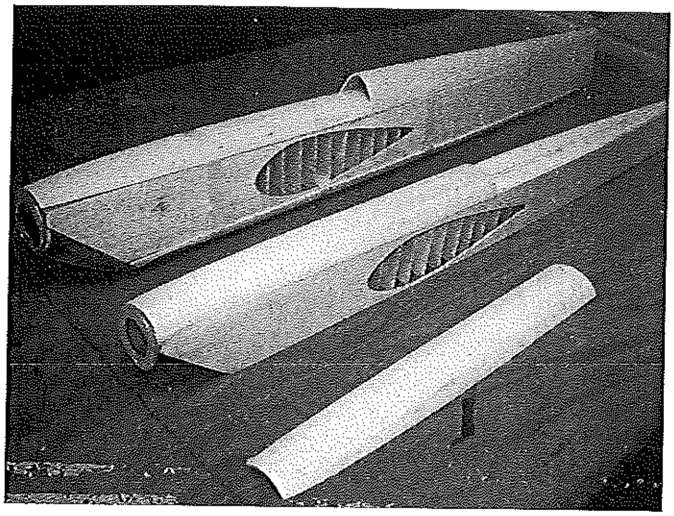
Leading edge sheet, soaked in ammonia water, is being molded here. Note large nuts used for weight at each rib station.



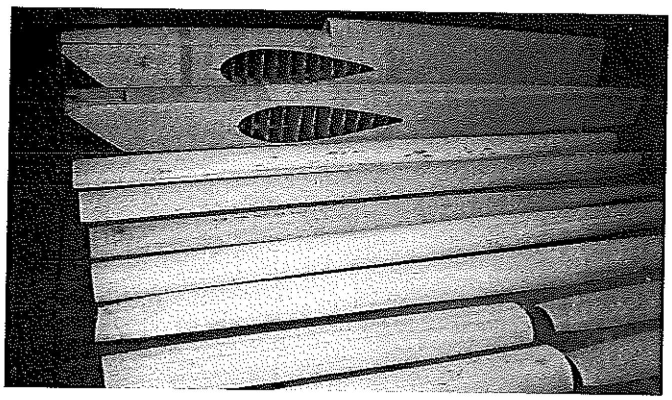
Wing structure removed from jig. Wing airfoil is "pure Patternmaster" and the building method is "wicked beauty."



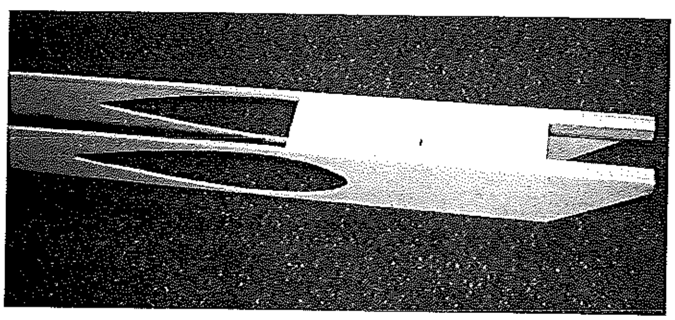
Control-surface shaping jig (foreground) has soft pine base and metal guides for leading and trailing edge thickness.



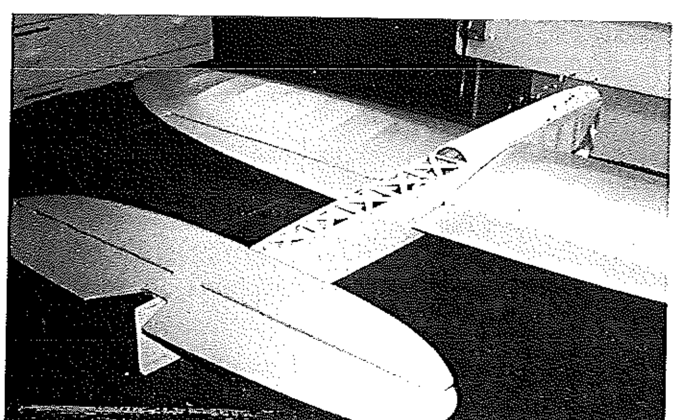
The author prefers many closely spaced fuselage formers to a few thicker formers spaced farther apart.



Lightweight fuselage parts were shaped from balsa molded over solid carved plugs. Text details mold-making procedure.



Rigid fuselage crutch is key to fuselage alignment and consistent engine runs. Cut maple engine mount beams carefully.



The ⅛ fuselage X braces add bending and torsional strength with very little weight penalty—do not omit them!

Pay special attention on the tip sweep area where the sheeting is laminated. This is a fairly exotic tapered reflex curve, and the centerline has to be maintained to avoid a built-in warp. It helps to soak the tip sweep portion of the trailing edge sheeting with ammonia water, inducing a preset bend. Use small C-clamps with scrap sheet balsa shims to pull and hold the laminate together, with masking tape as necessary to get a good finished result.

Install a piece of wing center sheeting (about 2½ inches wide) against the trailing edge sheeting. If the sheeting is too wide, it will interfere with the center alignment rod support block when the wing structure is turned over.

The leading edge sheeting is molded to shape by using the wing leading edge, ribs, and spars as a forming buck. Make reverse curve rib profile contour hold-down blocks for each rib station. These should be long enough to extend from the spar to the tip of the square leading edge stock. One-inch-thick balsa plank cut to the contour of each rib station will work fine.

Cut a piece of 3⁄32 A-grain light balsa leading edge sheeting to the outline shown. Tight sheeting joints are required here for best finished results, and only one piece can be molded at a time.

Soak both sides of the sheeting with ammonia water, using a sponge or paper towel, until the wood takes on a yellowish color. When the wood fibers have expanded, hand-work the sheet gently to a rough curved contour, then place the sheeting over the wing and align the straight edge with the spar.

Place the weighted hold-down blocks onto the sheeting at each rib station, working from the center of the panel toward the ends. Make as many fine adjustments in this process as required to get the sheeting firmly seated against the wing leading edge framework. If necessary, use thin balsa wedge shims to apply the weighted pressure evenly at each rib station.

Remove the weighted hold-down blocks when the sheeting has dried (approximately 1½ hours). Repeat this process until all four of the molded leading edge sheeting pieces are made.

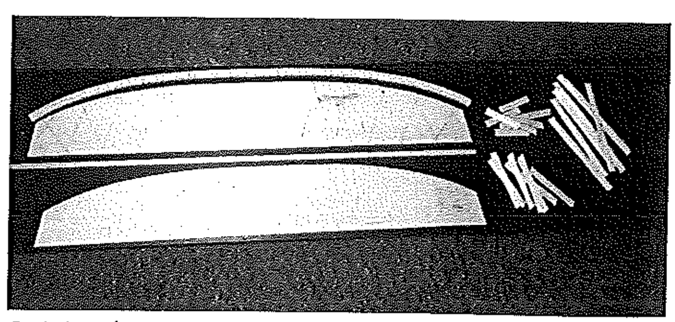
When the molding process is complete, the rigidity of the leading edge point is no longer required, so the extra stock at the inside of the leading edge point can be removed between the rib bays to save weight. Use a sanding block to remove the excess material and leave a radius at each rib intersection point.

Glue one molded leading edge sheeting panel in place at a time. Ambroid glue works well for applying the sheeting because of its working time and adaptability to use in a glue gun.

After the sheeting has been trimmed and adjusted for minimum overhang at the tips and leading edge point, establish a location mark at the center of the wing where the end of the sheeting will be positioned. Apply glue to the leading edge rib profiles only and temporarily place the sheeting on the wing, aligning the end with the mark at the wing center. This establishes a footprint for the rib spacing glue pattern.

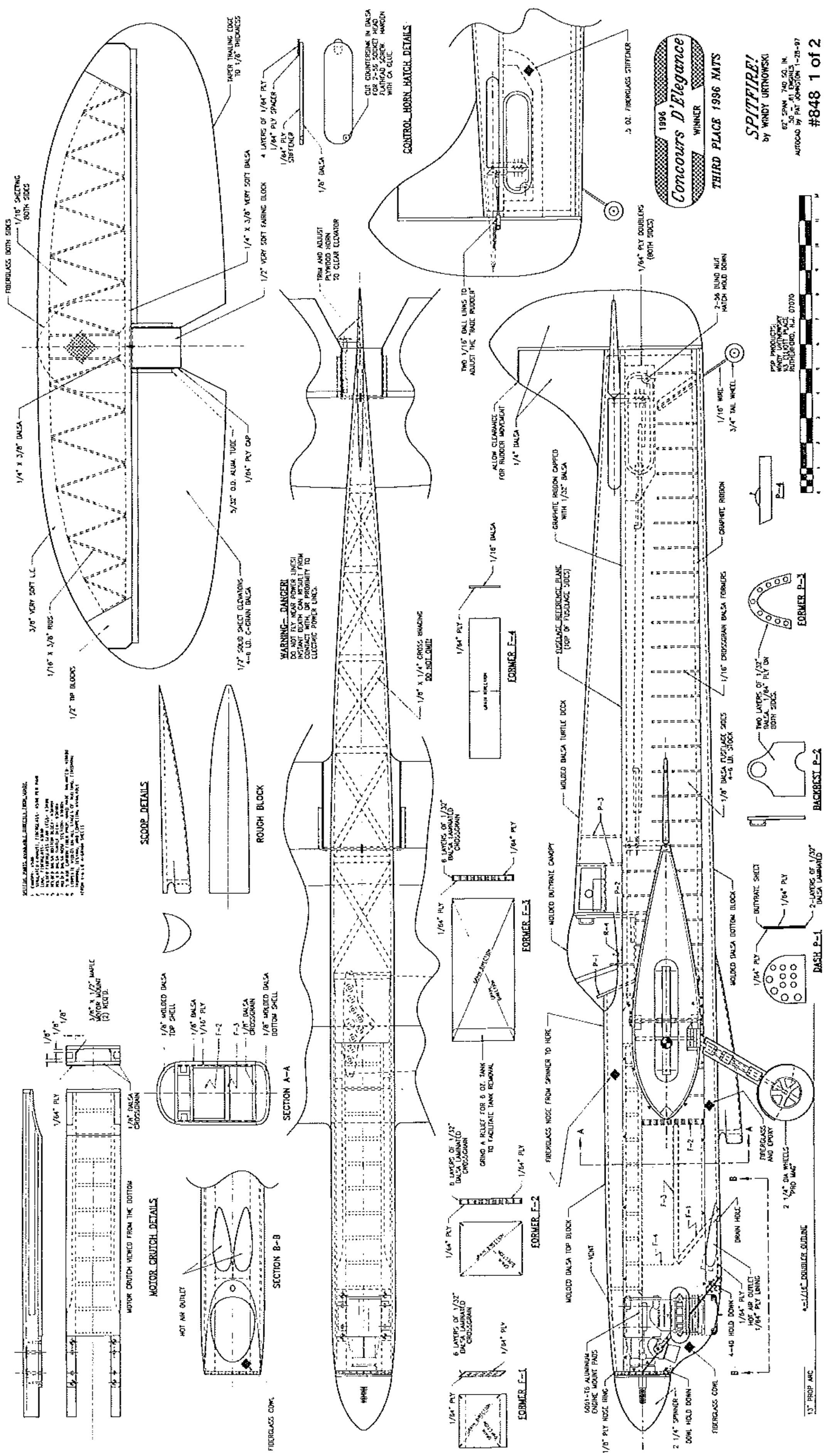
Remove the sheeting and preglue the rib contact surface area and the leading edge point and spar contact areas with a thin layer of cement and allow to dry. This technique of pregluing makes for the best possible bonded joint.

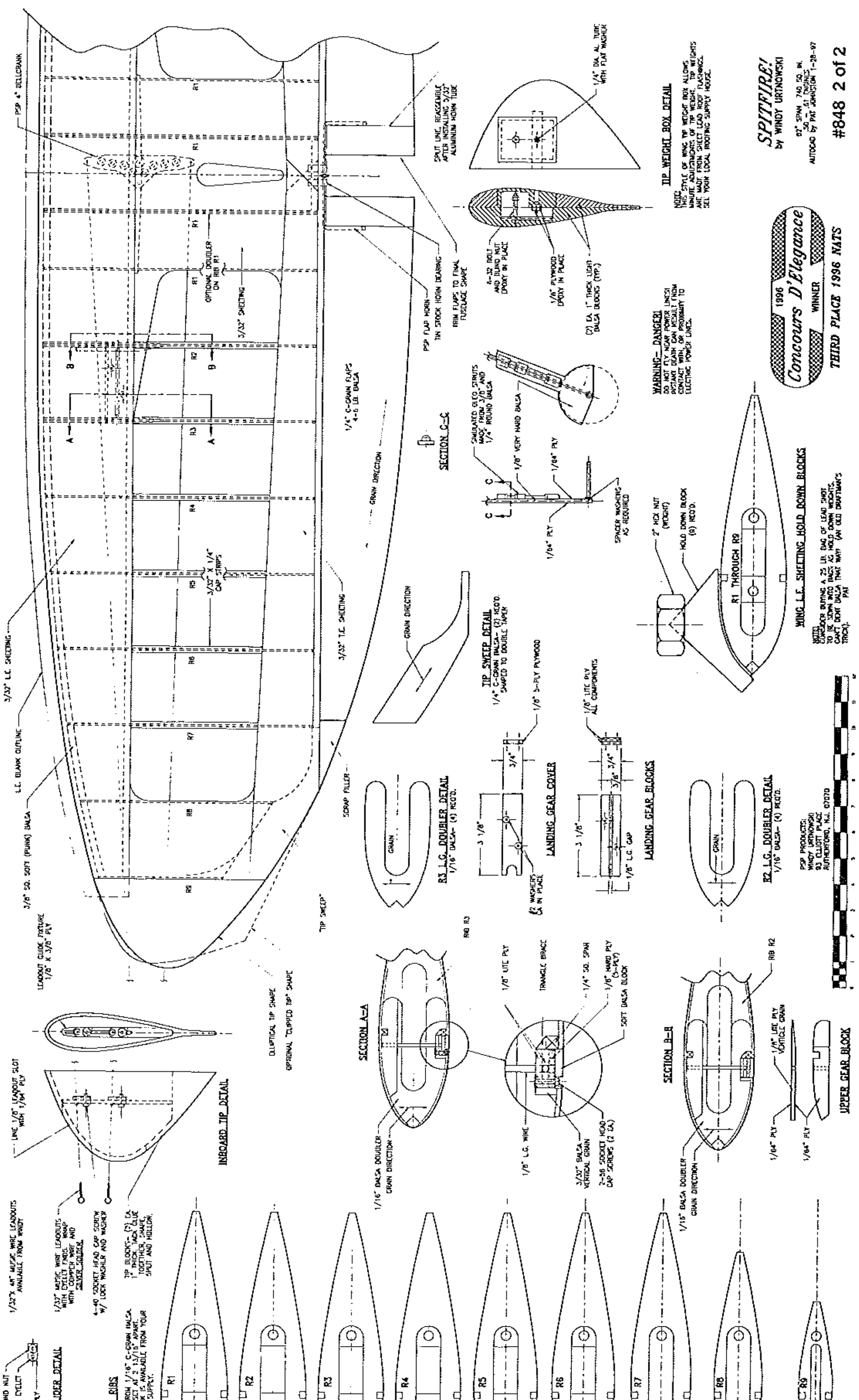
Reapply glue to the rib profiles and add a liberal bead of glue along the spar and leading edge. Position a leading edge sheeting piece, and use pieces of masking tape spaced about ½ inch apart



Stab is a ½-inch-thick flat geodetic structure. Top and bottom sheets are 1⁄16 balsa; ribs are 1⁄16 C-grain.

Full-Size Plans Available—see page 181




SPITFIRE!
by WINDY URTNOWSKI
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1996
Concours D'Elegance
WINNER
THIRD PLACE 1996 NATS
TIP WEIGHT BOX DETAIL
WARNING— DANGER!
SECTION C–C
TIP SWEEP DETAIL
LANDING GEAR COVER
LANDING GEAR BLOCKS
R3 L.G. DOUBLER DETAIL
R2 L.G. DOUBLER DETAIL
WING L.E. SHEETING HOLD DOWN BLOCKS
R1 THROUGH R9
SECTION A–A
SECTION B–B
UPPER GEAR BLOCK
INBOARD TIP DETAIL
LINE SLIDER DETAIL
WING RIBS
R1
R2
R3
R4
R5
R6
R7
R8
R9

to hold the sheeting in position (pins just leave holes that you have to deal with later).

Set the sheeting at the spar by using tape partially wrapped around the spar and over the top edge of the sheeting. Don't tape down so tightly that you deform the long edge of the sheeting. Be sure to have good glue coverage on the leading edge point—a good bond with the sheeting is important for subsequent shaping of the leading edge radius.

Pull the sheeting over the ribs and leading edge point, and hold it in place with masking tape wrapped back under the leading edge point. If the glue contact and application on the ribs is not perfect, remember that you can reglue this area later in the process when you turn the wing over.

If you encounter a stubborn area where the sheeting does not make good surface contact with a rib, use one of the weighted hold-down molding blocks as a clamp. Be careful—too much weight may cause a warp, especially at the tip sweep area.

Install a piece of scrap sheet under the center joint of the installed sheeting to act as a butt-joint support for the adjoining section. Install the tip sheeting between the leading edge and the tip sweep reflex curve. Cut and fit the remainder of the center wing sheeting, but do not install it at this time; save it for the final installation of the top spar joiner gusset, bellcrank, pushrod, and leadout wires.

Turn the wing unit over to complete the bottom. Handle the unit gently; raise the center of the wing structure and pull out the center support. You might notice a slight sag in the wing structure from the weight of the rods, but this is normal.

Turn the assembly over at the trailing edge by reaching under the leading edge with both hands and grabbing the rods. Once the unit is turned over, you may remove the wing plan form, make any minimal alignment adjustments, and reinstall the center support.

Check and measure the wing ;tructure for proper alignment and ;traightness before securing the wood ;upport blocks to the building surface. nspect the joints and double-glue all ·ib-to-sheeting contact areas. Use a ong sanding block to true any high ;pots.

Install the trailing edge, leading ;dge, and tip sheeting. Cut clearance ıotches in the ribs behind the spar :enter joint to accept the hardwood spar oint bellcrank support gusset. Epoxy he gusset to the spar, allowing enough :learance for wing center sheeting. Be ;ure that you have installed the correct ;usset for the bottom of the wing. You vill be able to fit the bellcrank support)in into the hardwood gusset hole from he top of the wing. Epoxy the top spar oint gusset in when you make the final nstallation of the bellcrank and)ushrod. Complete the bottom center heeting.

Pull the rib alignment support rods rom the wing. Remove the tape from he rod ends and center support block. ʾlace a pad or soft covering on the ıuilding surface under the wing—you lon't want to put any dings in the wing heeting. Remove the outer wing panel lignment rod support blocks and trial- pin the rods by hand or by using a pair ıf Vise-Grip™ pliers on the ends of the ods. Scrape off any glue from the rod urfaces that may cause a hang-up and rack ribs when you withdraw the rods.

Slowly pull out the rods, one at a ime. When both rods are out, use a azor knife to cut out the alignment rod upport tabs in the ribs. Reglue the ıottom rib sheeting joints. The base ving core (with hardwood spar joint ;ussets and bellcrank) should weigh bout eight ounces at this stage.

Finish-sand the wing sheeting joints nd shape the leading edge radius. nstall the landing gear blocks, wing ips, leadout guide, tip weight box, rib apstrips, and controls, and fit the flap nd hinges. Double-tissue around the ving root and center of the leading edge sheeting joint for added strength.

Stabilizer: Choose two four-inch-wide ight C-grain pieces of 1/16 sheeting, pproximately the length requirement for he span of the stab. Square off one long dge of each piece of sheeting to be the railing edge and cut the leading edge urve to shape.

Mark the geodetic rib locations on the ottom stab sheeting. Prepare a piece of unk-light 1/4 x 3/8 balsa for the trailing dge spar and cut 24 1/16 x 3/8 C-grain rib lanks for subsequent installation on the ottom stab sheeting.

The stab leading edge is punk-light 3/8 alsa. Saw kerf cuts halfway through on he inside surface and soak with mmonia water. Bend the leading edge to onform to the curve contour on the stab lan and allow the ammonia water to vaporate. Tape a piece of waxed paper o a flat building board and pin the ottom stab sheeting with the geodetic ayout lines on it. Glue the trailing edge par into place.

Install the leading edge. Apply glue to ne saw kerf cuts along the inside edge to nsure a rigid structure. Cut, fit, and glue ne ribs into position on the layout lines, vorking from the center of the stab oward the tips. Don't forget to add a crap piece of trailing edge spar material s a doubler at the center of the stab ontrol horn location.

When the glue has set, remove the old-down pins and use a sanding block o level and true any high spots. Attach ne top sheeting, using a minimal amount f slow-setting epoxy applied only to the heeting contact area. Weight the tructure until the epoxy cures.

Shaping the taper on a set of curved heet balsa flaps or elevators can be a ifficult task to perform accurately by eehand knife carving and sanding. Our pitfires' control surfaces and tip sweep ailing edges were shaped in sanding gs constructed from a base of soft pine ght gage sheet metal strips used as leading edge and trailing edge thickness guides.

Using the paper tracing for accuracy, mark and cut the control surface from a piece of 4-6 lb. C-grain balsa. Remember to position as much of the wood grain as possible running with the curved length of the trailing edge, to help prevent warping in the finished piece.

Begin removing the balsa stock from the trailing edge portion of the control surface blank, using a sanding block. Start with 60- to 80-grit garnet or aluminum oxide paper, concentrating on the curved trailing edge area. Avoid making deep scratch marks, because you will have to deal with removing them later. Sand diagonally from the trailing edge to the leading edge, across the length of the workpiece.

Use successively finer sanding block grits to work across the entire surface of the piece, using the leading edge and trailing edge thickness guide strips as sanding limits. Sand with care until you are satisfied with the result.

Repeat the sanding techniques described earlier to complete the removal of material from the opposite side of the control surface blank. For finish sanding, place the piece on a flat surface and block-sand it with a fine-grit (220) abrasive paper.

Fuselage: Construction is typical Big Jim type, with very rigid, vibration-resistant engineering. No blocks need be carved—all "shells" are available, as is the canopy. The removable cowling is molded fiberglass, bulletproof, and slightly lighter than a wood version.

The fuselage design and construction are dedicated to lightness, straightness, and strength. Some features may seem unnecessarily complex, but they contribute immeasurably to the suitability of the Spitfire as a top-caliber competition Stunter, and are definitely worth the extra effort. For all its size and strength, the Spitfire fuselage weighs only 10 ounces!

The engine mount crutch is the central element on which the balance of the fuselage is aligned. It is an enclosed box, with 1/64 plywood sandwiching the maple engine mount beams and the spanwise balsa spacers. Select a matched pair of maple mount beams; the beams should be adjacent when they're cut from a larger piece. Be sure that you orient the grain of the beams so that the mounting bolts are squeezing the grain together. This will go a long way toward keeping the engine mounted securely.

The doublers must be 1/16 plywood—don't be tempted to skimp on this to save a little weight. This is the lightest material we can use that will resist the twisting of the fuselage from torque. The results are consistent, reliable engine runs and long-term fuselage integrity.

Lightweight fiberglass cloth over the entire nose area to just aft of the wing leading edge adds to the strength and longevity of the fuselage, and just about eliminates any chance of stress cracks and finger dings.

Epoxy the plywood doublers to the fuselage sides and sand a taper into the sides (on the inside) aft of the wing cutout so that the thickness is about 3/32 at the tailpost. This will reduce the overall weight of each side by about four grams and reduce the amount of nose weight to balance by at least the same amount. Taper the aft edges of the plywood doublers so they blend into the balsa sides, to avoid creation of any stress risers. Don't omit the carbon "tow" along the top and bottom edges of the fuselage sides; it adds tremendously to strength and rigidity, at negligible weight penalty.

Position the engine mount crutch inverted over the fuselage plan view, then tack-glue the fuselage sides to the crutch, using a triangle to assure that the sides are perpendicular to the building surface.

The "many, closely-spaced formers" fuselage design may look like overkill, but this will provide for a much stronger and straighter fuselage than fewer, thicker formers. It will also allow you to sand the fuselage sides smooth and fair, without that "starving horse" look. Note that the grain of each former is spanwise.

Accurate, true installation of the wing and horizontal stabilizer into the fuselage is vital to a trimmable, competitive Stunter. If you invest the extra time it takes to "do it right—the first time," you'll reap the reward throughout the lifetime of the model.

Put the fuselage frame top-down on your flat table and block it to assure that the wing reference line is at 0° parallel to the table top. Use the wing section centerlines drawn on the fuselage sides forward and aft of the cutout as reference lines, and check both sides. Spot-glue or pin the sides securely, so that the table top becomes a large reference plane. This assures that the wing centerline, horizontal centerline, and engine thrustline are at 0° to each other. This alignment is the most important of all.

When you make the cuts in the bottom of the fuselage to allow the wing to be installed, make them at an angle—both front-to-rear and top-to-bottom. If you make the cuts "square," then no matter how carefully you make the glue joints, they will eventually cause cracks in the finish.

Knock out the formers in the wing cutout area (they've done their job) and place the wing temporarily, assuring that it's centered laterally on the fuselage centerline and that the leading edge and trailing edge reference marks are aligned with the reference lines forward and aft of the cutout area.

You'll probably have to make some small adjustments in the cutout to get this alignment, but take your time, work precisely, and don't be satisfied with anything short of perfection. Once you glue the wing in, you can't go back to change things!

When you're satisfied that the wing sits in the cutout the way it should, glue it in with slow-curing epoxy. While the epoxy sets up, check, recheck, and re-recheck the alignment.

After the epoxy has cured, check the fit of the cutoff parts of the fuselage sides that will be glued back under the wing. These will undoubtedly require some adjustment, and the best bet is to trim them so that the straight (bottom) lines of these pieces align with the straight (bottom) lines of the fuselage sides. It's much easier to shim the saw cuts than to try to sand or shim the longer bottom lines. When these two pieces have been reinstalled, add the plywood and balsa doublers below the wing.

Let everything cure solid—overnight, if you can wait—then remove the fuselage/wing assembly from the table top so the horizontal stabilizer can be installed.

The pushrod's length sets the fore/aft location of the stabilizer, with the flaps and elevators set at 0°. Set the stabilizer on the top of the fuselage, centered along the fuselage centerline, block the flaps to 0°, then make sure that the distance from the flap hinge line to the elevator hinge line is the same on both sides (at the stabilizer tips).

Ideally, when these two measurements are exactly 18 inches, the elevators will be at dead neutral. As long as the measurements are equal and within 1⁄16 inch or so of 18 inches, you can adjust the elevators to 0° by resoldering the pushrod wire—which is why it's designed that way and why the aft access hatch was provided.

The important thing here is to get the horizontal stabilizer centered on the fuselage, the flap and elevator hinge lines parallel, and the stabilizer "flat" with the wing (not tilted). You may have to sand the fuselage sides slightly to get the stab flat. Sight from the front and rear, looking for the wing and stab trailing edges to be aligned. When everything is right, glue the stabilizer on with slow-curing epoxy.

The 1/8 fuselage X-braces aft of the wing add tremendous bending and torsional strength with very little weight penalty—don't be tempted to omit them. As you install the braces, sight along the fuselage from time to time to assure that you're not building in a twist; once the braces are installed, the fuselage will be almost impossible to bend.

It's best to glue the nose block on with epoxy, for strength and fuel-resistance. The turtledeck and bottom blocks can be glued on with thin CyA. The turtledeck will need to be relieved to clear the horizontal stabilizer.

When you're ready to glue on the long bottom block, install the cowl temporarily so you can align the bottom block with it; this is a much easier way to assure a tight cowl fit than trying to fit the cowl to an already installed bottom block.

Begin the block installation at the front, just behind the cowl, and proceed aft, gluing a few inches at a time. After all of the blocks are glued in, run some thin CyA down inside the fuselage along all the seams between the sides and the blocks.

The last major construction step that requires careful alignment is the vertical stabilizer. Assure that it's aligned along the fuselage centerline and perpendicular to the plane of the horizontal stabilizer. The turtledeck will need a slot to clear the vertical stabilizer. Use slow-curing epoxy to glue the vertical stabilizer in, and check, check, check until the epoxy is rock-solid.

Finishing and Detailing: Selecting paint schemes was fun, because Spitfires have come in almost every camouflage scheme imaginable. The invasion stripes we used make a dramatic presentation in the maneuvers.

We got a genuine WW II-vintage Spitfire color chart and had acrylic lacquer pigments custom-mixed to match. Adding these pigments to Sig Lite Coat clear dope yielded the exact colors of low-shrink dope for traditional Concours finishing of both Spitfires.

The simulated wing-mounted radiators shown on the plans are best used for static judging only. We found during many test flights that they tended to soften the outside corners, so we don't use them for competition flying. This was really the only significant disappointment in the whole Spitfire project.

Trial by Fire: The Spitfires made their debut at the 1996 Nats, and it was an unexpected pleasure to find that at appearance judging, I was in the front row alone, Joe was in the second row alone, and the pilots voted the Spit the Concours winner. Joe finished 16th overall in Expert, I got third, and Joe was PAMPA's 1996 Rookie of the Year.

Possibly the hardest part of developing any scalelike model is getting the compromises right. You want the "look," but precision Stunt performance has to be there, too. In the case of the Spitfire, all the early back-and-forth effort during the design phase really paid off. This is the best model either of us has ever flown.

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