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Winter Hawk

The winter hawk, a primarily white bird native to the Scandinavian countries and is also found in other parts of northern Europe.

Named after a hawk native to the Scandinavian countries, this contest-winning Coupe d'Hiver evolved from some novel ideas and an ingenius use of available materials.

■John R. O'Dwyer

As Coupe d'Hiver grew in popularity, it inevitably came to be flown in summer as well. But summer winds and thermals caused problems for these designs with their light wing loadings and slow climbing characteristics. Being difficult to DT (dethermalize) from thermals, the models were often lost. Sometimes even moderate winds dashed them to the ground before they could gain enough altitude. Consequently the evolution has been away from light wing loadings and slow climb to much more Wakefield-like performance (and appearance).

While today's breed of small, fast-climbing Coupe is capable of winning competitions on hot summer days in moderate winds, it won't win under all conditions. For added prowess a compromise must be made using the latest technology in a reliable model. I also wanted a plane that could come out on top on those calm days when no thermals are present. Bob White has such a model in his Beau Coupe, but I shied away from his complicated wing structure and curved tips. Also, carving an efficient propeller seemed a difficult task.

I found a simpler approach. By harnessing a lot of new ideas and available components, I came up with just the model I wanted—quick-building, clean-lined, and competitive. The Winter Hawk was an immediate success. It was awarded the Ft. Worth Planesmen's Best New Design for 1983, and it has won and placed in many contests since. The model has accumulated some 20 trophies, and it won Open Coupe at the 1987 Nats in Lincoln, NE.

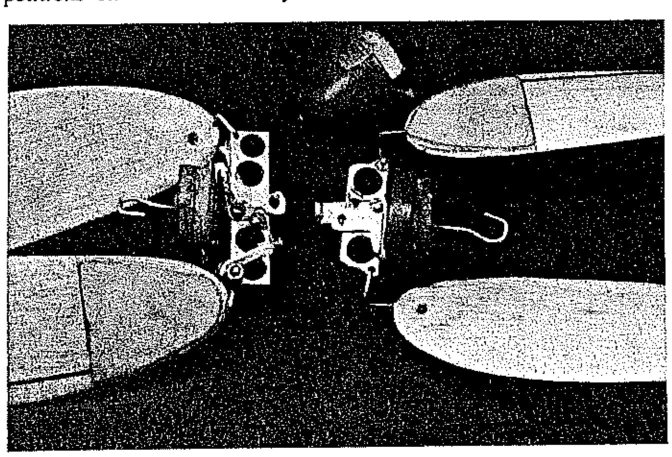
Basic specifications for the Winter Hawk are as follows: The wing, which uses a turbulated Sokolov airfoil, has an area of 164 sq. in. and an aspect ratio of 13:1. A small gurney flap is used on the left tip panel to maintain a flat left glide that helps keep it in thermals. The propeller uses the very efficient precarved blades available from Blue Ridge Models. It also uses a torque-sensitive prop stop that eliminates rubber bunching and improves transition from climb to glide. Overall, it's a clean, low-drag shape that still meets the 3.1-sq.-in. cross section requirement. The model has simple design features that allow fast building and repairs.

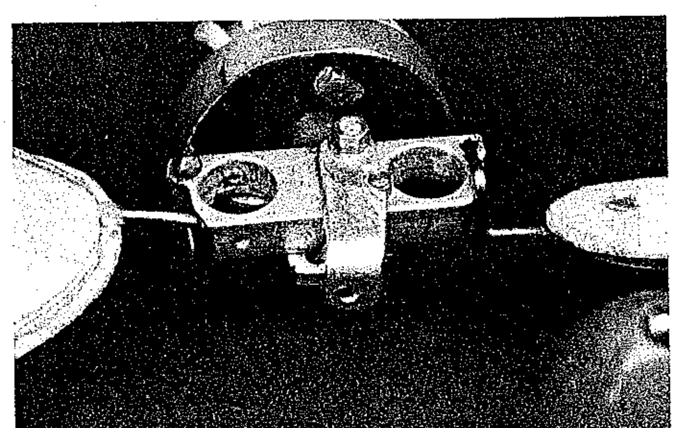
Fuselage. Make the body from a single piece of $\frac{1}{16}$ sheet balsa. A light, even-grained 3 x 36 sheet is first tapered slightly for the aft 24 in. to a width of $1\frac{7}{8}$ in., with a $\frac{9}{16}$ x 24-in. triangle removed from each side. Seal the inside with two coats of thick nitrate dope, allowing about two hours between coats. After the second coat is dry, immerse the sheet in hot water in the bathtub for about 10 minutes so that the balsa starts curling into a tube.

The wet tube is slid onto a round mandrel of approximately 1.0 in. diameter. I found an old pool cue that is almost perfect. Wrap the tube with an Ace bandage or other cloth that's similarly stretchy and porous. Allow a day or more for thorough drying.

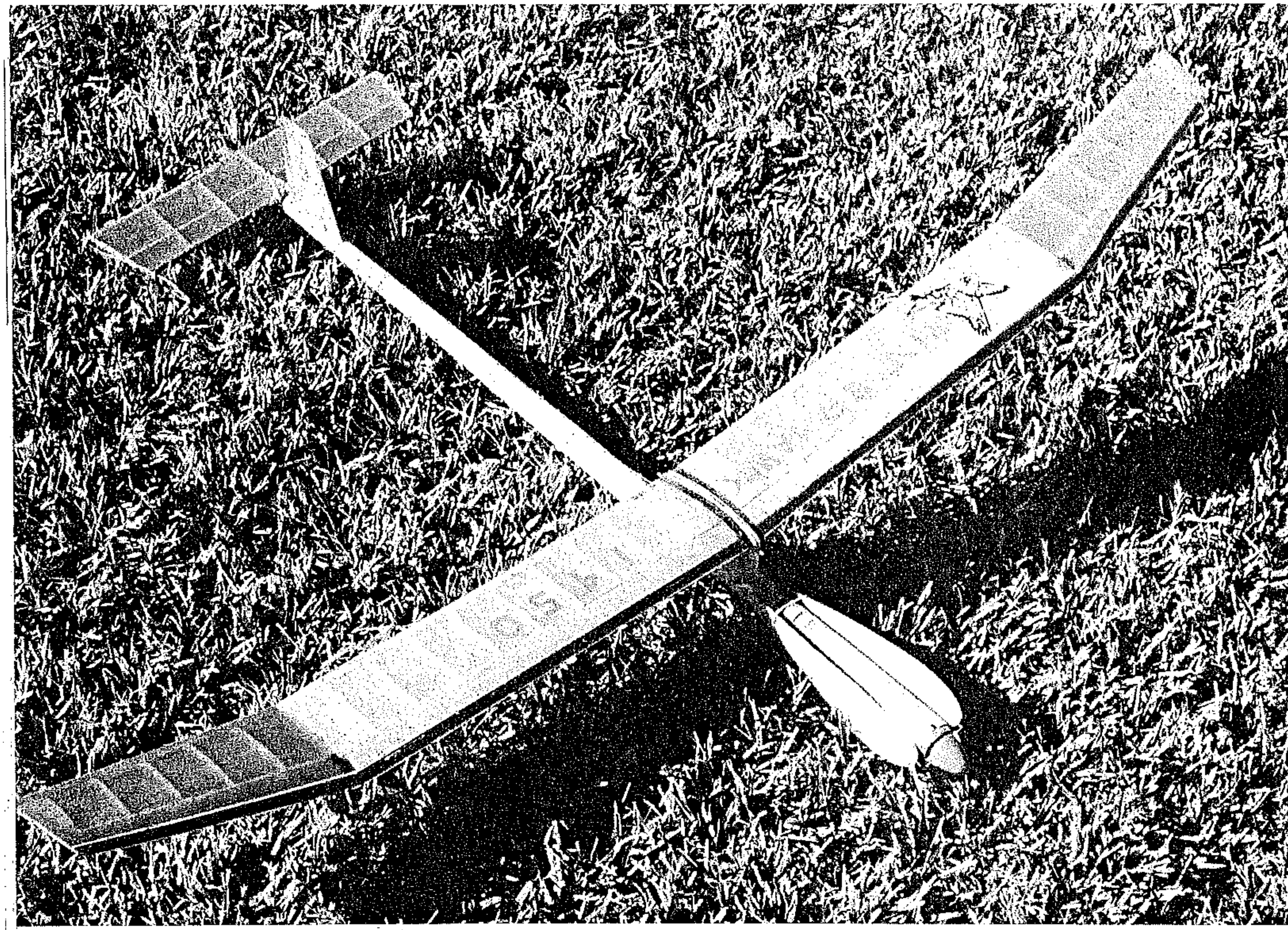
While the body tube is drying, build the wing mount pylon. Use three $2\frac{1}{2}$ x 3-in. pieces of lightweight, even-grained $\frac{1}{16}$ balsa sheet. Edge glue these together using CyA (cyanoacrylate glue) into a 9-in. strip with the grain running vertical. Apply a coat of dope to the exact center of the inside. This will help in forming around the two ribs that shape the pylon. You can transfer the contour of these ribs from the plan by first Xeroxing on paper and then ironing the shape onto the balsa sheet.

Transfer the wing and stabilizer contours the same way. The two pylon ribs are assem-





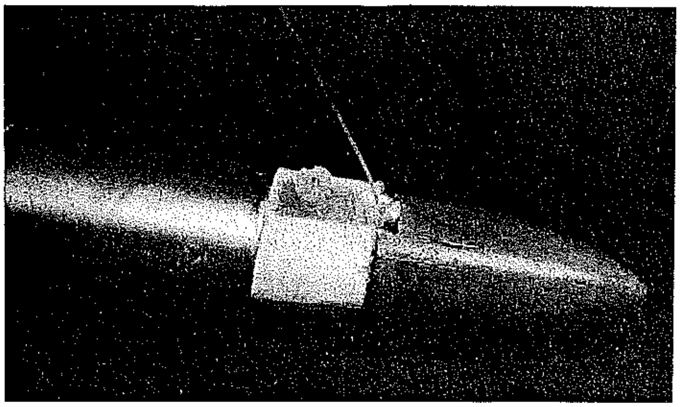
Left: The propeller hubs for #8 (left) and #9 (right). The number eight hub uses wheel collars to secure the propeller blades; #9 is lighter and has less drag. The spinner is carved from basswood. Right: Close-up view of hub #9 showing the simple spinner adapter. These hubs include the best features of several different designs. Complete construction and operating details are contained in the text and plans.

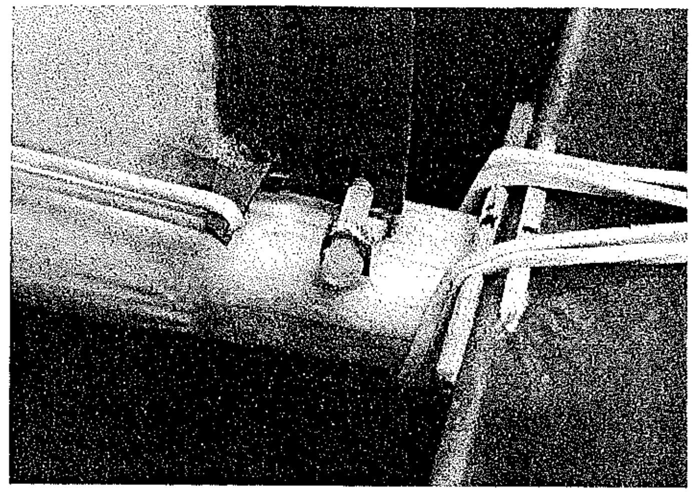


Top: The completed Winter Hawk, its propeller blades folded as in flight mode, at rest between flights. The model has a simple structure that allows fast building and repairs, and a clean, low-drag shape. Above: The author demonstrating his motor winding setup. A good stooge, winder, and torque meter are a big help in reducing contest hassles.

COUPE D'HIVER (pronounced dee vair), means "Winter Cup." It is a class of model which originated in France in 1944 as a simpler alternative to Wakefield. In fact the style has often been referred to as a "½A Wake." Originally designed to be flown in winter events where thermals are nonexistent, many of the early models had nearly 300 sq. in. of wing and huge propellers, making them more like Indoor models than Wakefields. The class was given FAI recognition with the designation F1G.

The Winter Hawk's wing uses a turbulated Sokolov airfoil. Wing area is 164 sq. in., and the aspect ratio is 13:1. A small gurney flap is used on the left tip panel to maintain a flat left glide.





Above: Close-up details of the elevator trim adjusting screw and the dethermalizer line at the rear sandwich assembly. Right: Details of the rudder adjusting screw. The rubberband that tensions the rudder is at left, and the stabilizer rubberband holddowns are at right.

bled on the two bulkheads to form a short winglike structure. Center the long 9-in. strip on the nose with about ⅝ in. of the strip below the rib. This is the side that will be attached to the fuselage. Make the plywood wing mount and snuffer tube, but don't mount them at this point.

Remove the body tube from the mandrel when dry. Starting at the front and working toward the rear, carefully join the seam with CyA. Sand this smooth, and apply a coat of sanding sealer. Sand again lightly, then wrap the tube with a layer of Japanese tissue. Use thinned dope to adhere the tissue while smoothing out the wrinkles.

Though it will have to be removed later at the attachment points for various components—e.g., the pylon, rear rubber support band, and tail parts—it's easier to apply the tissue now rather than later in the building sequence. The tissue is easily removed by lightly cutting the shape to be excised and then brushing thinner on that area.

Cut the bottom of the pylon roughly to shape, then finish by rubbing it fore and aft on a piece of 180-grit sandpaper wrapped around the body tube. Sand and seal the pylon, then cover it with Japanese tissue. Attach the pylon to the body tube at the location shown on the plans, with the tube seam on the bottom.

Fin, rudder, stabilizer, and DT system. Construction is fairly straightforward. The aft spar of the fin should be long enough to protrude slightly through the bottom to strengthen the attachment. The fin should line up vertically with the pylon, while the flat side of the fin airfoil is parallel to the body tube centerline. Don't attempt to install the DT (dethermalizer) line until the glue inside the tube at the fin spar is thoroughly dry.

The little sandwich assembly at the rear could incorporate an aluminum tube, but Teflon has less friction and weighs less. When the glue holding the forward DT guide is dry, the 12-lb. monofilament line is fed into the forward tube until it comes out the open rear end of the body tube. Slide the line into the tube in the sandwich assembly. Fit the latter in the notch cut into the upper side of the body tube, and carefully glue in place. A short piece of 1/16 aluminum tube is used to secure the end loops in the DT line by squeezing with pliers after the correct length is set.

The stab assembly will have to be completed prior to installation. Although the 60° tilt of the stabilizer in the dethermalized position is rather extreme, it's necessary to ensure that the model will fall out of a thermal.

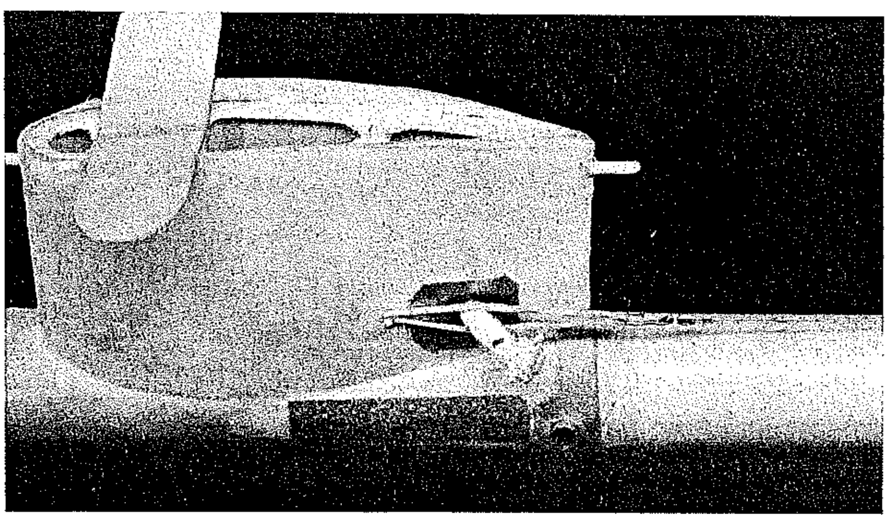
While the use of small nylon screws for tail trim adjustments may seem a little complicated, they're much more precise and reliable than shims and trim tabs. You'll appreciate the extra effort required. The 2-56 nylon screws from FAI Model Supply are slightly oversized and hold their settings very well, something that isn't true of metal screws.

The heavyweight aluminum foil heat sink should be a tight fit on the snuffer tube to conduct the heat away efficiently. The foil is not glued to the pylon when the tube is cemented in place.

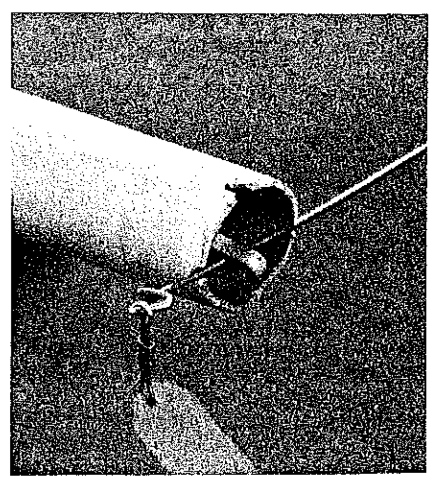
A small S-hook is formed with one end open and a closed end in the forward loop of the DT line. This will help in easily replacing the small rubberband before each flight.

The nose of the body tube is reinforced with a one-inch-wide band of silk, nylon, or graphite cloth liberally coated with five-minute epoxy. After the epoxy is hard, cut off the nose to the correct down- and side-thrust angles. An adjustable protractor-triangle is a great help here.

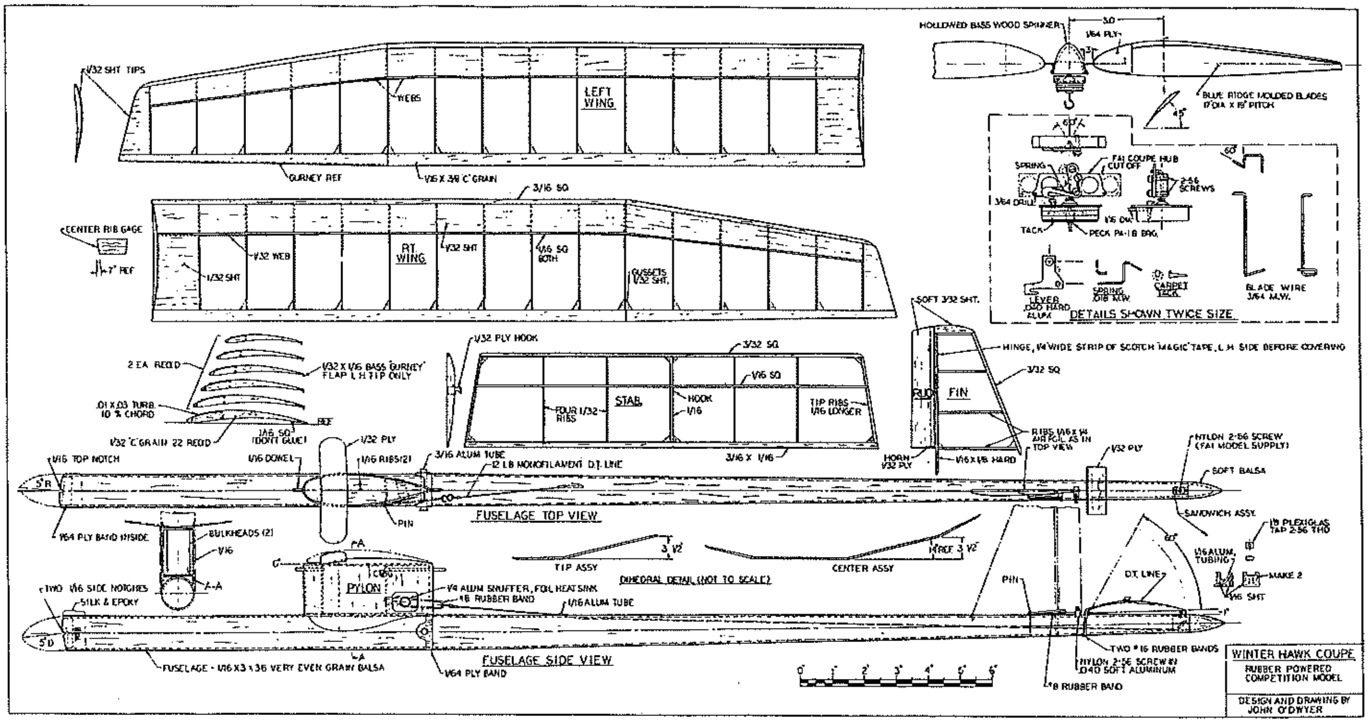
Cut the three small notches in the front end as shown on the drawing. Recoat the front edge with a little more epoxy. Add the small balsa bullet shape to the rear end, and the unit is finished.



The wing pylon with the plywood wing mounting saddle installed. Note the dethermalizer fuse, rubberband, heat shield, and snuffer tube. Also note the ply-reinforced rear motor peg.



This simple but effective motor-restraining system consists of a pin locked into two notches in the fuselage by pressure from the wound motor until the propeller is installed.



Wing. Again, fairly straightforward construction techniques are used. Make a template for the 22 identical wing ribs by tracing the Xerox copy you made previously of the largest rib onto a piece of aluminum or 1/32 plywood. Use the template to cut out the ribs. Orient the template slightly nose-down on the wood grain so that the grain is parallel with the edges of the narrow rear end of the rib.

Stack the 22 ribs on a short piece of 1/16-sq. stock in the upper spar groove, and sand out any imperfections. Use a sanding block for the front and back edges so that all are the same length.

Build the two center wing panels first. Cover the plans with wax paper to prevent sticking. Tack glue small pieces of 1/32 balsa to the forward edge of the trailing edge bottom surface. This holds it at the proper angle for the airfoil shape.

Pin a length of 1/16-sq. stock to the plans 1/4 in. forward of the trailing edge. The rib back ends rest on this strip but are not attached with glue. Two of the ribs are used to locate the leading edge, since, depending on how much sanding was done to the ribs to even up the ends, its location may not exactly match that shown on the plans.

Make a dime-sized puddle of CyA off to the side. Dip the leading and trailing end of each rib in the puddle, and locate the rib between the leading and trailing edges. Make sure each rib is straight as it is installed.

The center ribs are tilted 7°. Add the top 1/16 spar and the gussets. The latter are very important in strengthening the thin ribs. Note that these gussets are small 30 x 60° triangles with the grain parallel to the hypotenuse.

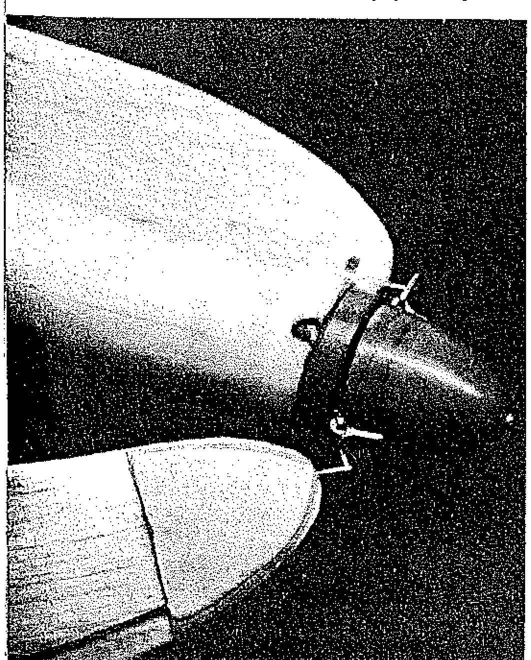
Remove the pins from the front and back edges, and lift the wing panel from the wax paper. Add the lower 1/16 spar. The 1/32 balsa sheeting on the leading edge is easier to size and install with the panel free of the plan.

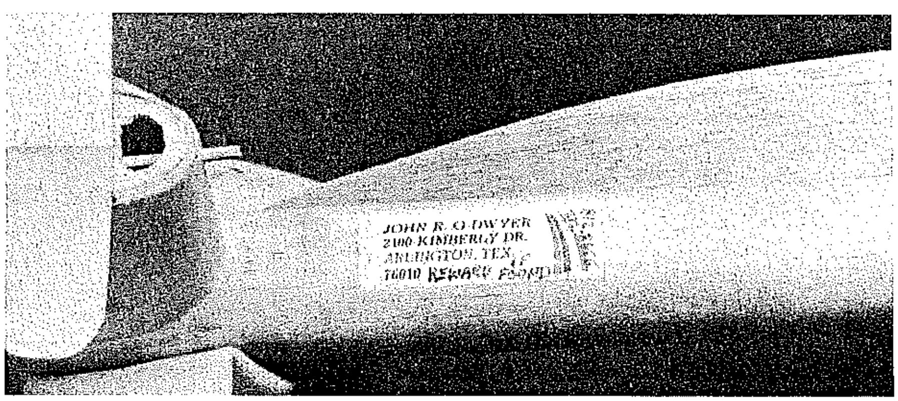
Repin the panel on the plan with the outermost end pinned down in line with the tip panel and the center rib raised 3½ in. from the surface. Glue the leading and trailing edges, spars, and 1/32 balsa sheeting directly to the center panel, and then build the outboard tip panels.

The vertical-grained spar webs at the joint should be a tight fit against the transition rib. Sand each wing half to the correct leading and trailing edge shape. It's easier now than when both halves are joined.

With one center panel pinned to the building board, trial fit the other panel at the center, supporting it as shown on the plan. Some sanding may be necessary to match the rib surfaces. When satisfied, glue the panels together and add a ½-in.-wide strip of silk or graphite reinforcing cloth over the top of the joint.

Remove the structure from the board, and add the spar webs. If you have some, CyA a few 6-in.-long strands of graphite or glass fiber on the bottom side of the leading and trailing edges and on the top spar across the center joint. *Continued on page 185*





Left: The completely assembled propeller assembly showing the 1/16-in. dowel in the upper notch in the nose. Right: A very important feature of any Free Flight ship. No matter how fail-safe your dethermalizer might be, a monster thermal can still carry it OOS. The label identifies it.

ers use .40-size engines with stock mufflers and draw from a common fuel source. Racing in heats of four, they're scored two ways: finish position after 10 laps (first through fourth), and best lap time. Again, a large number of umps and officials are needed to conduct the race.

Fifteen-year-old Jerret Cangie from Redmont, WA is a red-hot devotee. Unfortunately, Jerret and mechanic/flier Bill Petterson of Seattle flooded their engine and failed to start up within the required 90-second window following the signal. The young men told me that they practice at local contests about every two weeks.

Diametrically opposite on the adrenalin scale, or so it seems, are the docile Free Flight Scale models, both indoor and outdoor types. These aircraft are very carefully judged for realism and fidelity. Their workmanship indicates patience supreme.

As always in Free Flight Scale, the variety was great. Rubber or gas power, modern or antique aircraft—what a treat to view such exceptionally fine building skills. We also envy them the small boxes needed to transport those lovely creations.

A Nats is like a banquet—a huge crowd of diners as well as a regiment of servers, cooks, and dishwashers. But the staff gets neither wages nor tips. Vince Mankowski—quartermaster general, headwaiter, chief cook and bottle washer, etc., etc.—arranged for a little compensation in the form of dinner for his loyal army. A D.J. with old-time music had even us old folks tripping the light fantastic. A heartwarming touch! But, Vince, whatever happened to the dessert!?

Winter Hawk/O'Dwyer

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Prepare the wing for covering by painting where the tissue attaches with two coats of sanding sealer, sanding lightly between coats. This greatly improves the Japanese tissue adherence.

Cover the bottom surface first with a good grade of Japanese tissue. The type supplied by Peck-Polymers works very well in my experience. Attach the tissue with thick dope to every rib and the bottom spar to assure an accurate lower contour. Nitrate thinner on a brush is used to slightly release the adhering dope to pull out wrinkles.

After the wing, fin, and stabilizer are completely covered, spray with water to shrink taut, then brush on two coats of nitrate dope. Thin the nitrate one-to-one and plasticize it with a few drops of TCP or castor oil before applying.

Allow the dope to cure for several days, then check for warps. No washin or washout is used. The gurney flap on the left tip panel seems to eliminate the need for any special warps. Steam flat any twists that are present. This makes the wing much easier to check prior to a flying session.

Propeller. Though the propeller assembly may appear complicated at first, it really isn't. The unique prop stop mechanism, which combines the best features of several other systems, deserves much of the credit for the Winter Hawk's winning ways. To convince you to try it, I'll list some of these features:

• The mechanism is torque actuated, not tension sensitive. When the rubber motor torque drops to about 1 in./oz., the lever engages the tack head to stop the rotation. The motor can be several inches shorter than the distance between the rear peg and the prop shaft hook. This eliminates unpredictable center-of-gravity shifts due to the rubber bunching at the end of the prop run. The short motor also prevents the prop assembly from falling out (which would cause disqualification if parts were dropped—and probable propeller loss). Torque actuation actually saves altitude. In contrast to a tension-type propeller, which causes the nose to drop as the prop slowly finishes the last few turns, the torque-actuated prop folds while still pulling.

• The lever can be engaged onto the tack head prior to attaching the propeller to a wound motor. This will prevent the prop from turning while the flier checks alignment, looks for indications of thermals, and lights the fuse. When you're ready to launch, simply rotate the hub backwards a small amount until you hear a click, and the propeller is free to turn.

I use this system on all my rubber-powered Wakefields and Mulvihills with folding propellers. It has shown 100% reliability.

To make the hub for the Winter Hawk, first obtain an aluminum Coupe hub from FAI Model Supply. Either leave the hub full length (1⅜ in.) as shown in the photo, or cut it off as shown on the drawing to reduce weight and drag. Remember that all the hub components on the drawing are shown twice their actual size for clarity. A half-size reduction of this area of the drawing at your local copy machine might help to prevent a "big" mistake.

All parts are drawn to an accurate scale. To prevent confusion, however, they are not dimensioned. Drill the holes with a hand drill, cut them out with an X-Acto jeweler's saw, and file them to shape. Of the 10 or more propeller assemblies using this mechanism, probably no two are exactly alike, yet they all seem to work well. In other words, this stop mechanism does not require precision machining as with a Montreal type.

The propeller blades by Blue Ridge Models are twisted very accurately. I obtain mine through FAI Model Supply. Form the contour airfoil with a slight undercamber. It's important to remember that the edge with the greater curve is the leading edge.

When shaped, draw a pencil line from the apex of the inner curve to the center of the tip. This line should be about ½ in. from the trailing edge at its widest point on the forward surface. Locate the blade wire on this line 3/16 in. from the fold pivot, as shown on the drawing. Draw around the wire on the blade, and groove it out to accept the wire flush with the surface. Use five-minute epoxy and a 1/64 plywood doubler to secure the wire. I use several clothespins to clamp the plywood until the epoxy sets.

The blades are held onto the hub with small brass washers soldered on the end. If the model can tolerate the added weight, 1/16-I.D. (inside diameter) wheel collars can be used, as shown in the photo. The collars allow rapid blade replacement.

You will note that the greatest blade area is forward of the wire. This places the center-of-pressure forward of the elastic axis, causing the pitch to increase under load and gradually reduce as the torque decreases. Slow-motion videotapes have confirmed this effect and also show the need for turbulator strips to prevent flutter. HO model-railroad-scale 2 x 4-ft. pieces of basswood seem to work great as a turbulator on the blades.

Set the blade pitch angle as shown on the drawing. Adjust the angle by twisting the wire. Track the tips (with both tips in the same plane) by bending at the point where the blade wire acts as a stop against the aluminum hub. I apply a dab of red paint to the tip of one blade to aid in tracking.

A spinner will protect the hub mechanism and reduce drag. Being unable to find a suitable 1-in.-dia. plastic spinner, I made one from basswood.