



MINIMOIA

John Read launches the Minimoia with a winch. Model has been entered in three contests and has gained one "First" and two "Seconds"!

Ever give a party and nobody came? That's the way it was in the summer of '78. Our R/C club planned the annual sailplane contest and added a new event --- scale. We invested in five shiny trophies and Xeroxed a bunch of sport-scale scoring forms. Three members volunteered to judge the event. And, of the thirty-plus contestants, none had a scale ship in the trunk! Of course, our immediate reaction was, "Howcum"?

Part of the reason why there were no scale models may be accounted for by the fact that there are only a few scale sailplane kits. Then too, the magazines haven't published many scale gliders --- in the United States, at least. European modeling magazines regularly feature scale R/C sailplanes and many of them fly as well as purpose-designed models. Then there's the problem of **documenting** scale R/C gliders. Many of the best references lie buried in obscure books that specialize in sailplane history. Just finding an acceptable three-view of a particular prototype may prove to be a major research effort.

Our design for the pre-War German sailplane, the Hirth "Minimoia," initially proved to be a difficult model to document.

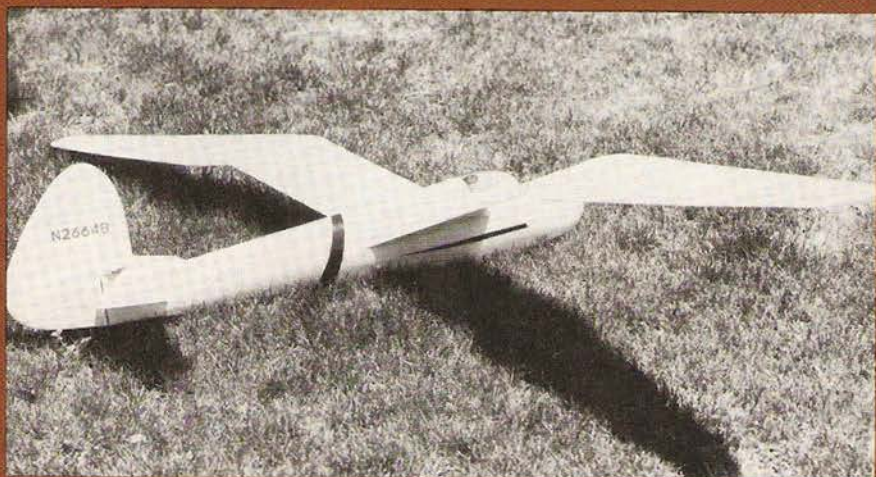
LEFT: Lori Gutierrez of Colorado Springs showing off John A. de Vries beautiful Minimoia.



But, since it was a production craft (110 were built!), we were able to locate enough information for a Stand-Off (sport) scale model of the beautiful gull-winged bird. When the model was half-built, however, the heavens opened up! John Read found Jan Scott --- who owns a real Minimoia! And, I discovered Jim Ealy --- who has Minimoia three-views! It would only take a

bit more digging to build our model as AMA Scale, since we used **scale** airfoil sections.

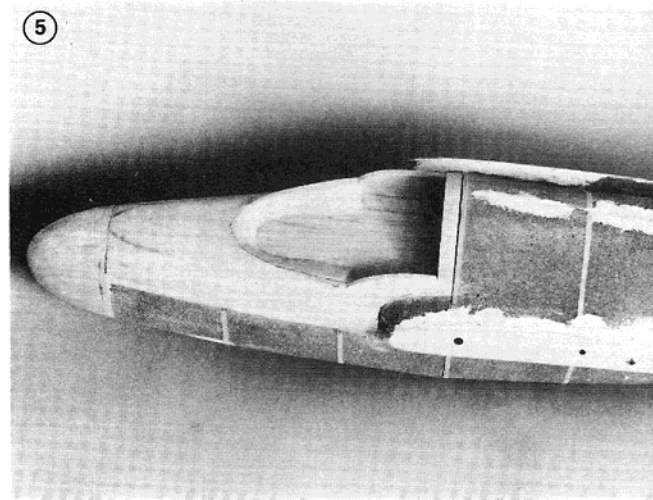
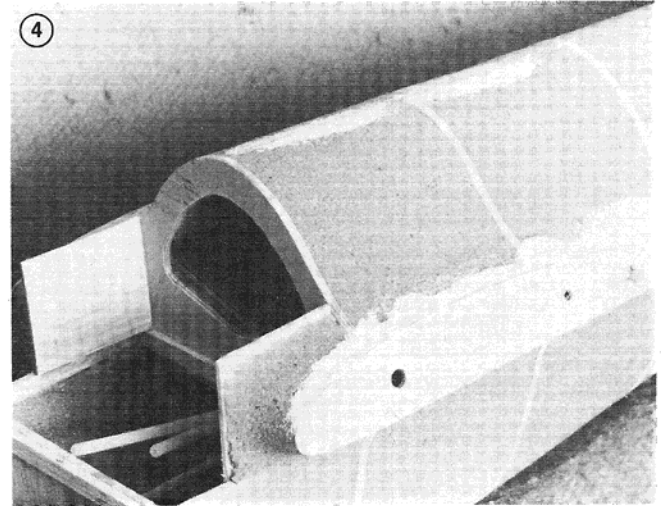
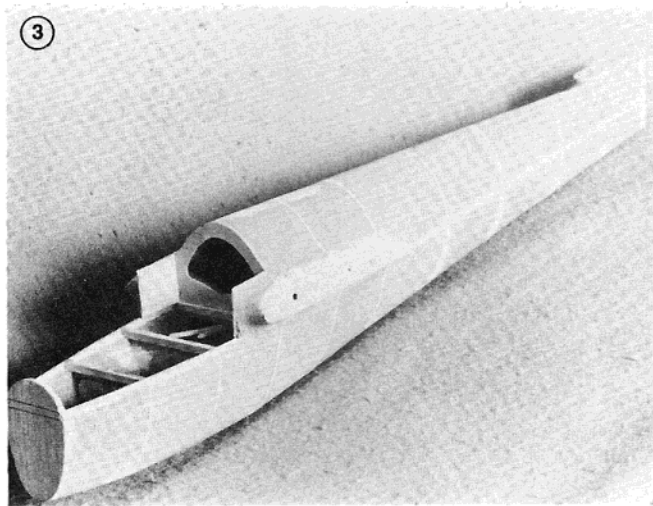
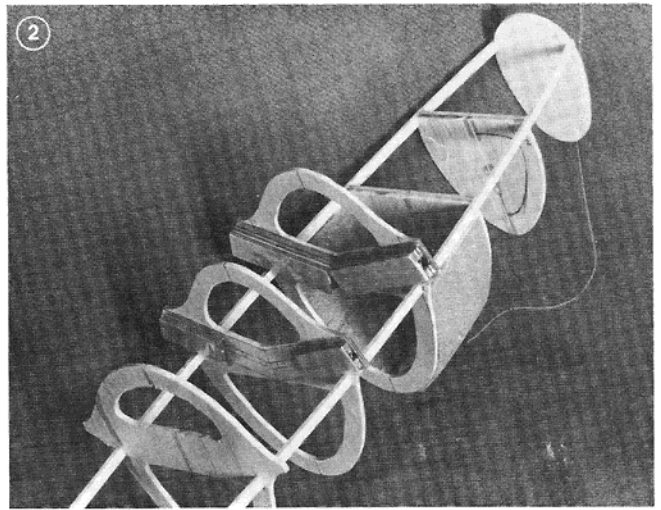
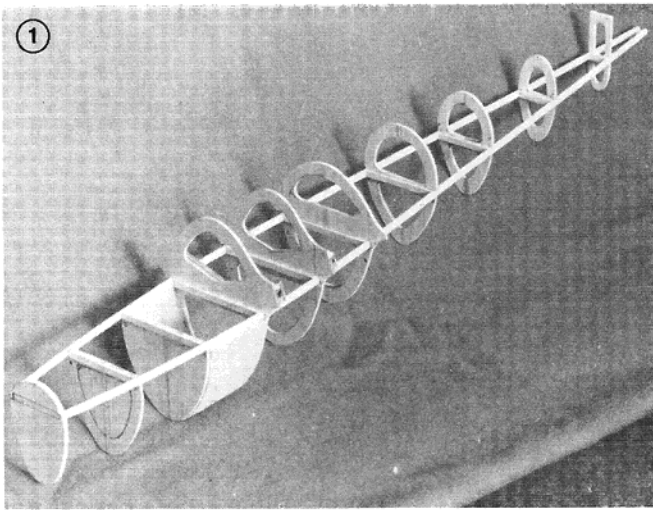
The "real" Minimoia was a 1935/36 product of the Hirth Segelflugzeugwerke. It represents a milestone in sailplane design --- the first one imported into the U.S. was also the first sailplane to truly "thermal" here. The Minimoia set the pattern for many high performance sailplanes that followed. The plywood covered fuselage is of super simple design --- aft of the cockpit there are no compound curves. The vertical surface (fin/rudder) is a one piece, all-moving control and the gulled and swept back wing holds both ailerons and spoilers. As with any scale R/C model, the builder should be cautioned that there were differences between the several examples of the



The Minimoia, photographed the day before its first flight. She averaged four minutes in "dead air," the first time off the high-start. All scale markings are from Jan Scott's full size Minimoia.

This 105" span scale gull-winged beauty was the inspiration of Col. John A. de Vries to design and John Read to build. The model scored 88.6 static points and a second place trophy in its first contest.

Photos By Merrie Anne Brandin



(1) 1/8" x 1/4" spruce crutch with all ten formers glued to cross-pieces. One section has hollowed foam blocks in place "to try it out." (2) Close-up of basic fuselage structure showing ply "boxes" built around the brass tubing wing rod holders. "Boxes" are epoxied to the rear of formers 4 and 5 before they are attached to the crutch. (3) Minimoa fuselage, with all of the spaces between formers filled with foam. White contour lines are the formers --- just sand the foam down until they show and the fuselage is contoured! (4) Close-up of the 1/16" ply wing root rib. Note the two wing-wire holes and the short length of protruding NyRod which houses the spoiler cables. (5) Speckles on the foam of the uncovered fuselage is filler. Foamed fuselage was covered with fiberglass cloth and polyester resin and then painted.

"real" airplane. In the photographs we've collected, we've found substantially different fin/rudder shapes, clear and segmented canopy construction and Minimoa's with and without a single, centerline landing wheel aft of the forward skid. Our drawings show two rudder shapes and the location of the landing wheel. But, it's a good idea to choose and document a specific airframe before you begin building your model Minimoa!

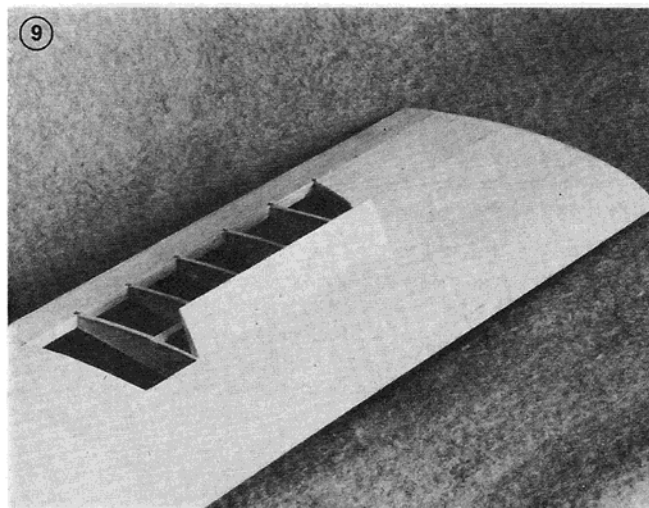
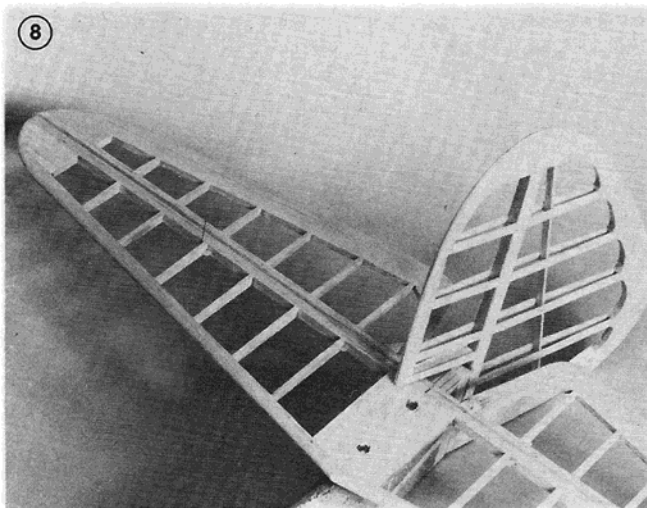
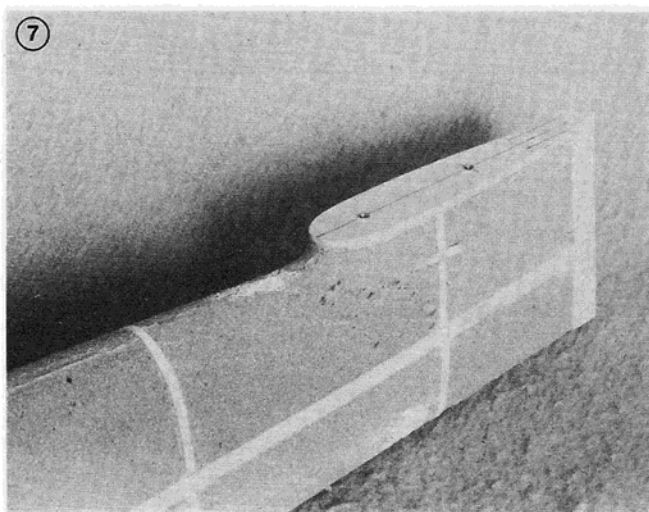
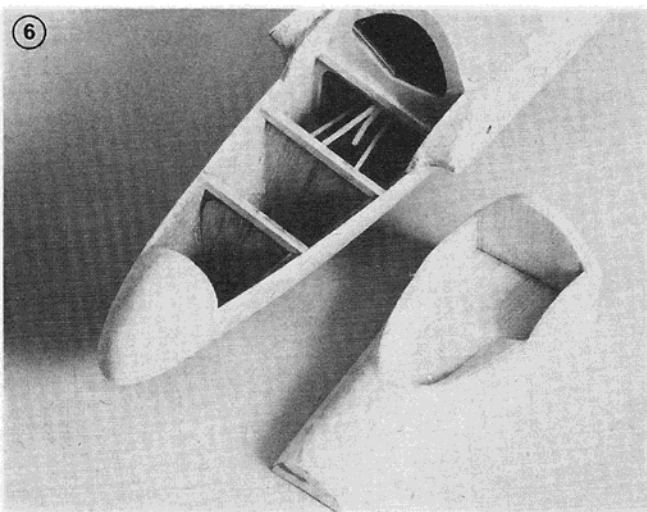
Our model is built to a scale of 1.88 inches to the foot. The scale was chosen to

give a reasonably sized and easily transported airframe. The span worked out to 105" and the 750 square inch area is about "right" for a three channel sailplane (rudder, elevators and spoilers). On the practical side, we decided not to use ailerons because they take up most of the severely tapered outboard wing panels on the real ship. The structure needed to support the ailerons would have added a lot of unnecessary weight --- and, we weren't sure that model ailerons would have been effective.

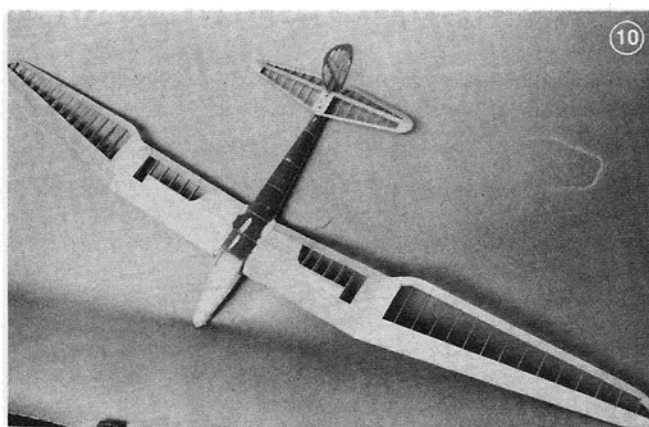
CONSTRUCTION

Fuselage:

The model Minimoa is built on a full length fuselage crutch. Built of 1/8" x 1/4" spruce, the crutch sets the fuselage alignment and locates all of the fuselage formers. They're simply glued behind the crutch cross-pieces. It's a good idea to pre-build the wing-wire holders and epoxy them to the rear of formers #4 and #5 before the formers are attached to the crutch. Wire alignment is eased --- and the 10½° dihedral angle can be measured,



(6) Nose and radio hatch. There isn't a lot of room for the radio installation but medium-sized rigs fit without too much difficulty. (7) Close-up of the 1/8" ply stabilizer mount. 6-32 blind nuts are installed on the bottom of stab mount then epoxied to former #10 and the 1/2" sq. balsa tail post. The NyRod just ahead of former #10 carries the fin/rudder pushrod. (8) Minimoa tail feathers. Stab is bolted into place and the fin/rudder permanently hinged to the rear of the fuselage with two large Kletts. Optional rudder construction and two scale rudder shapes are shown on the drawings. Stab and elevators are built "1/4" thick" and then sanded to a streamlined cross-section. 1/8" ply stab center section is hidden below the 1/4" balsa. (9) Inner wing panel with the scale-sized spoiler extended. Spoiler is made from a section of trailing edge stock and hinged to the spar with a strip of MonoKote. When the entire wing is MonoKoted, spoiler "gets" a double hinge. Note the 1/8" x 1/4" spoiler "rest," and the cap stripping of the top of the inner panel ribs. (10) The completed Minimoa airframe, ready for finishing. At this point, with all of the pushrods in place, but without the radio, the model weighed only 18 ounces! The fuselage foam "drank up" a LOT of resin. That, plus 4 oz. of balancing weight, resulted in a finished, ready to fly weight, of 54 ounces!



exactly.

We decided to try a polyurethane foam fuselage, so we filled the open spaces between the formers with foam blocks, that were pre-hollowed. The foam sanded easily --- each former acted as a built-in template. With the 1/16" plywood root ribs epoxied to the appropriate formers and the 1/8" ply stabilizer platform (with its 6-32 stab retaining blind nuts installed) glued to the rear of the fuselage, forming the wing fillets and stab fairing was simplified. The foam required some homemade, curved sanding

blocks to "flow" the fillets into the fuselage but the only tricky part of the process involved forming the front of the wing fillet. Since we wanted the entire cockpit area to form the radio hatch, we backed the fillet with 1/8" sheet balsa "plates" at its forward edge. Check the photos for this bit of construction.

The nose block and the cockpit hatch area were formed from laminated 3/8" sheet balsa and the fuselage skid was cut from spruce (1/8" ply is okay, too). The rather fragile foam must be protected so we

decided to cover it with 3/4 oz. fiberglass cloth and polyester resin. Big surprise! Before we fiberglassed the fuselage, the entire airframe (less radio) weighed only 18 ounces. Although we used the old toilet paper roll trick to absorb excess resin, we found that the foam "drank-up" six ounces! That's weight we don't want --- and can't use! It isn't as bad as it sounds, however. The finished model, ready to fly, only weighs 54 ounces --- and that extra resin gave us a sm-o-o-o-th fuselage finish.

A 1/16" or 3/32" balsa planked fuselage might be a tad lighter. If you decide to go the planking route, just trim the periphery of each former (except at the wing roots!) to account for the thickness of the planking.

Note that we used an Airtronics adjustable towhook. It was inserted in the bottom of the fuselage and epoxied in place. Don't forget to add the nuts **before** installing the towhook, particularly if you build the foam fuselage!

Photos of the model's cockpit area show an elliptical tapered balsa "ramp" just inside the canopy base line. The "ramp" forms a groove into which the plastic canopy fits. No need to vacuum form a Minimoa canopy. The Sig 12" bubble is almost-right --- we used the rear portion. You can hold the cockpit area, radio hatch, in place using your usual technique. Ours is a friction fit, only. And please, please --- add a 2" scale pilot under the "greenhouse." Scale models without "someone" apparently driving look weird!

Wing:

Nothing unconventional here --- if you've built a tapered wing sailplane model, the Minimoa should prove little more difficult. Our Goettingen 693 airfoils were computer plotted, are flat bottomed, and can be cut out individually or produced by the stack sanding technique. Note that the ribs are notched to allow the leading edge sheeting to cover the spars **and** the spar webbing. Despite the fact that the Minimoa wing is gulled, the dihedral is almost "automatic." The top of the outer wing panels, when viewed from the front of the airplane, is flat. There's 10 1/2° of dihedral in the inner panels. Eight degrees are "taken out" at the panel joint and the remaining 2 1/2° is justified by the top taper of the wing ribs.

The wing is built in four panels --- two outer and two inner. Pre-cut the 3/8" x 1 1/2" trailing edge stock before building the outer panels as shown on the drawings. Cut the 1/8" plywood panel joiners, too. Note their rather odd shape, with a tad of widening toward the wing tip. That's because the thickest part of the Minimoa wing is just outboard of the panel joint. All panels are built flat on the building board and there are two areas of construction that really require concentration. The wing root ribs (1/8" balsa) and the wing-wire "boxes" must be carefully aligned. The former must match the fuselage root ribs and the latter, the fuselage wire retainers. And --- when joining inner and outer panels, the area **within** the wing spar at the joint must be carefully "packed" with balsa to retain the structural integrity of the wing spar.

Like in all good R/C sailplane designs, we've webbed the main spar with 1/16" balsa. The webbing extends to rib W-10 on both sides of the spar, and aft of the spar to the wing tips. Since the spoilers are installed in the inner panels, we capped the upper contour of the inner panel ribs with 1/16" x 1/8" balsa to keep the airfoil smooth. The spoilers are 1/4" x 1" trailing edge stock, hinged with a MonoKote strip

MINIMOA Designed By: Col. John A. de Vries

TYPE AIRCRAFT

Sport Scale Sailplane

WINGSPAN

105 Inches

WING CHORD

8 1/2" (Avg.)

TOTAL WING AREA

750 Sq. In.

WING LOCATION

Mid-Wing Gull

AIRFOIL

Goettingen 693

WING PLANFORM

Hirth Design

DIHEDRAL EACH TIP

10 1/2° at fuselage

8° anhedral at panel break

O.A. FUSELAGE LENGTH

46 1/2 Inches

RADIO COMPARTMENT AREA

(L) 8 3/4" x (W) 3 1/2" x (H) 3"

STABILIZER SPAN

27 Inches

STABILIZER CHORD (incl. Elev.)

5 7/8" (Avg.)

STABILIZER AREA

160 Sq. In.

STAB. AIRFOIL SECTION

Symmetrical

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

11 1/8 Inches

VERTICAL FIN WIDTH (incl. rudder)

8 7/8" (Avg.)

Rec. ENGINE SIZE

NA

FUEL TANK SIZE

NA

LANDING GEAR

Skid

REC. NO. OF CHANNELS

3-4

CONTROL FUNCTIONS

Rud., Elev., Spoilers,

Releasable Tow Hook

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Spruce, Foam
Wing	Balsa & Spruce
Empennage	Balsa, Ply & Spruce
Wt. Ready To Fly	54 Oz.
Wing Loading	10.4 Oz./Sq. Ft.

REFERENCES

Archaeopteryx Avion Associates (Jim Ealy).
P.O. Box 120, Pottstown, Pa., 19464 ---

Three views.

"The Story of Gliding --- a book by Ann & Lorn Welch, John Murray, 50 Albermarle St., London --- Three Views and photographs.

"Flug und Modell-Technik --- the German model magazine. July, 1969 --- Smaller R/C Minimoa, 65" span.

and the MonoKote wing covering. Note that the spoilers are positioned by a 1/8" x 3/8" spoiler "rest" and that the wing covering is attached to a 1/8" x 1/4" balsa strip, just aft of the spoiler cut-out.

You'll note that we've used a 3/32" by 1/2" false leading edge as a gluing surface for the wing's sheeting. In the outer panels, the false leading edge tapers to 3/8" at the tip. The wing sheeting pattern is the same, top and bottom of the wing. The actual 3/8" x 5/8" leading edge is glued in place **after** the wing is sheeted --- and it's tapered in place, and rounded, by sanding. The 3/4" sheet wing tips receive the same treatment as does the outer panel trailing edge.

Tail Feathers:

The only unusual feature of the stabilizer is the 1/8" plywood mount, epoxied flush with the bottom surface, in the center section. It's drilled to match the fuselage stab mount and then the entire stab center section is filled with 1/4" sheet balsa. Bolt head clearance holes are then drilled in the balsa --- and the Minimoa's horizontal tail surface is easily removable.

As we noted earlier, there are several Minimoa rudder shapes that are scale. We chose to build the rounded version. In any case, assemble the entire fin/rudder outline, flat on the board. Laminate it from bass strips or cut it from 1/4" sheet balsa. When the glue dries, lift the outline and glue it to the vertical spar detailed on the drawings. Add the 1/16" rear "false" spar --- which keeps the rudder ribs apart. Then, it's simple to form the rudder ribs from balsa strip --- 1/16" x 1/4". The spars give the ribs the proper curvature --- and make for a **light** vertical surface. Use two large Klett hinges to hold the fin/rudder in place.

Finishing:

We used MonoKote to cover the wings and tail surfaces and painted the fiberglass fuselage. Since we duplicated Jan Scott's Minimoa, the model is entirely white with dark blue license numbers and decoration. Trim MonoKote did the decorating job.

Unless your radio just won't fit, we recommend the radio compartment locations shown on the drawings. John used his "largest" servos from his MRC five channel, and they fitted the spaces, easily. There's space in the front compartment for any nose weight you require (we needed 4 ounces on the prototype model) to balance the model. The model will fly well within the balance range shown on the drawings (3" to 3 1/2" aft of the inner panel leading edge). Our model flew with a 4" aft C.G. --- but it was "twitchy." Although the C.G. range appears to be pretty far aft, don't forget the severely swept outer panels affect its location. And --- balance the model **laterally** as well as longitudinally! It **do** make a big difference!

Flying:

Be prepared to be astounded! The Minimoa model flies just like the real bird. It is absolutely **silent** in flight --- eerie, even! And, there's a slight trick to turning

the bird. Establish a turn with the control stick and then feather-in a **slight bit of opposite rudder** and hold it until you want to roll out. The model will go around like it's on rails! There's enough rudder action to handle high-start launches and the Minimoa goes straight up on a winch. If there's **any** thermal action around, the model will act like an elevator.

Our completed model was photographed on Friday, test flown on Saturday and entered in the Rocky Mountain Soaring Society's scale contest on Sunday. It averaged over four minutes in dead air on Saturday and out durationed the other eight scale entries (all kits!) on Sunday. It was first in static judging and gained the second place trophy. John was still "sorting out" the Minimoa's landing characteristics. We think we have a winner! □

**By H.E
RCModeler
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