

RV-6F

By Ed Westwood



As a sometime float plane designer, I am constantly looking for full-size float ships to duplicate in miniature. When I saw the float equipped RV-6 on the cover of kit planes, I was hooked — low aspect ratio, lots of dihedral, big floats, and a ventral fin. The prime requisites for any descent float plane model, let alone a scale ship. Of course, the vacuum-formed canopy, tip light lenses, and glass cowl were challenges to overcome.

After a day with my calculator, I came up with the dimensions and estimated performance. Too high a stall speed for the weight; not to worry, just add a little more wing. Not enough horizontal tail for comfortable tail volume; more tail area. Another check and it's a go.

I elected not to go with flaps to save the complexity and weight. My additional wing area took care of most of that. I selected a side-mounted Saito .50 for its great

reliability and performance, not to mention the ease of directing its exhaust underneath. I spent a week making the cowl, canopy, and tip lens plugs; then, another week casting the aluminum-filled epoxy male patterns. Having them pulled successfully really made my day.

My weight came out at 7 lbs. dry. I had some reservations about the ship's performance since I had designed it for 6 lbs. Not to worry, the NACA 23015 airfoil allowed me to stall the ship onto the water with the ventral almost touching. In the air, it proved as responsive as I had hoped. If you're looking for a scale float ship with real performance, give this one some serious consideration.

RV-6 Construction Highlights

Fuselage:

Construction is open frame with 1/64th plywood covering the sides back to F-4.

The rear sides are built to the cross-hatched plan lines to compensate for the shortening which occurs when the sides are drawn together. Additional 3/32" square stock is added to the upper longerons and inset enough to glue the turtledeck flush with the sides. Likewise, 3/16" square stock is inset .050" to keep the canopy flush with the



Full scale RV-6F.

RV-6F

Designed by:
Ed Westwood

TYPE AIRCRAFT

Sport Scale

WINGSPAN

52-1/2 Inches

WING CHORD

10-1/2 Inches

TOTAL WING AREA

548 Sq. Inches

WING LOCATION

Low Wing

AIRFOIL

NACA 23015

WING PLANFORM

Constant Chord

DIHEDRAL, EACH TIP

1-1/2 Inches

OVERALL FUSELAGE LENGTH

44 Inches

RADIO COMPARTMENT SIZE

(L) 8" x (W) 7" x (H) 3"

STABILIZER SPAN

19-1/2 Inches

STABILIZER CHORD (inc. elev.)

5-3/4 Inches (Avg.)

STABILIZER AREA

112 Sq. Inches

STAB AIRFOIL SECTION

NACA 0009

STABILIZER LOCATION

Mid-Fuselage

VERTICAL FIN HEIGHT

7 Inches

VERTICAL FIN WIDTH (inc. rud.)

6-1/2 Inches (Avg.)

REC. ENGINE SIZE

.40-.45 2-Stroke/.46-.50 4-Stroke

FUEL TANK SIZE

8 Oz.

LANDING GEAR

Floats (33"-34") or Conventional L.G.

REC. NO. OF CHANNELS

4 (5 with Flaps)

CONTROL FUNCTIONS

Rud., Elev., Throt., Ail., Opt. Flaps

C.G. (from L.E.)

2-5/8"-3.0"

ELEVATOR THROWS

3-8" Up — 3/8" Down

AILERON THROWS

1/2" Up — 1/2" Down

RUDDER THROWS

1" Left — 1" Right

SIDETHRUST

2-1/2° Right

DOWTHRUST/UPTHRUST

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BASIC MATERIALS USED IN CONSTRUCTION

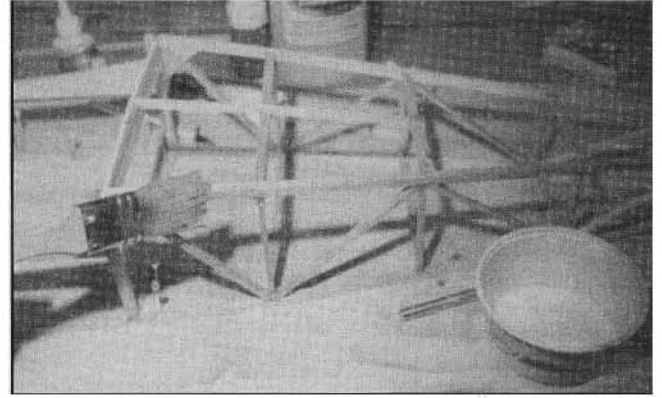
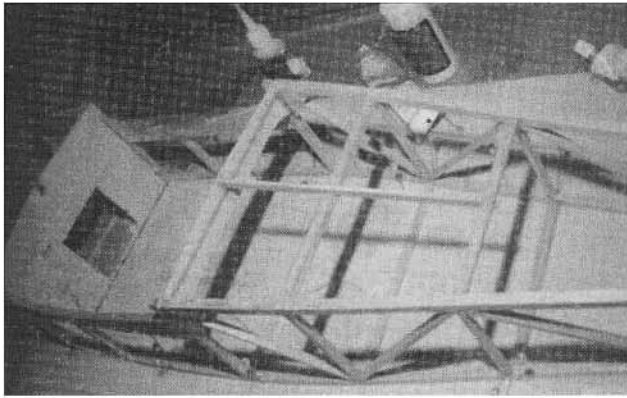
Fuselage Balsa, Ply, Spruce

Wing . . . Balsa, Ply, Spruce, Carbon Fiber

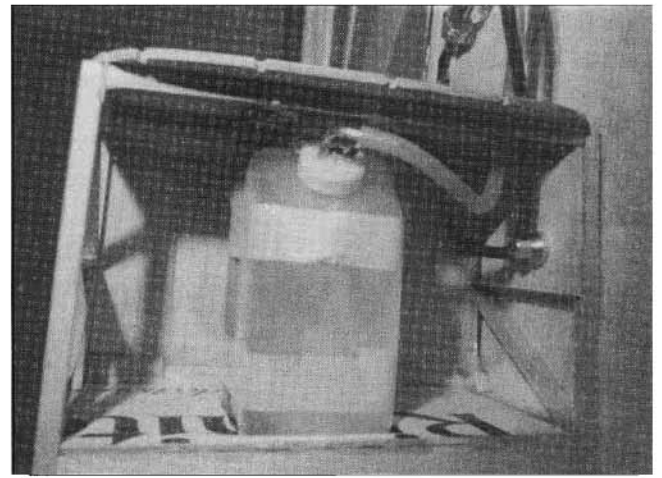
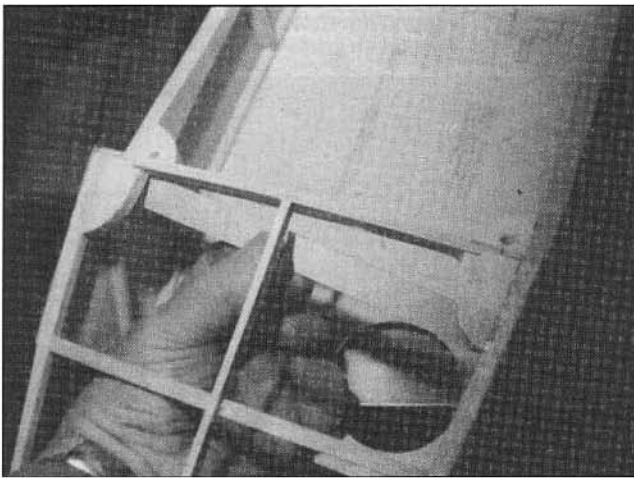
Empennage Balsa, Spruce

Wt. Ready To Fly . . 96-117 Oz. (6-7 Lbs.)

Wing Loading 25.2-30.7 Oz./Sq. Ft.



LEFT: Fuselage is assembled flat on the plans by cutting off the top of F-2. It and F-1 are attached after framework is removed. **RIGHT:** Ammonia was painted on structure in F-4 area to facilitate bending. Gusset supports were added after bending.



LEFT: Here, a 3/4" x 1/8" piece of lite ply is secured to the rear side of F-4 for battery plate support. **RIGHT:** Fuel tank is permanently taped to foam-covered support which in turn is secured to the fire wall and F-2 for additional stiffness. Quick fill valve is attached to a 1/16" ply plate. Plate is glued to inside side supports. NACA vent is cut through outer 1/64" plywood covering for access.

sides. As the sides are drawn together, the upper cockpit is dimensioned by F-10, the cockpit floor, but the wing saddle, F-9, will tend to stay straight and must be shimmed to match the slight curve of the floor above. Should a land plane version be desired, I recommend using 1/4" aircraft plywood for the keel pieces between F-1 and F-2. It should be recessed .060" for the aluminum strut. Substitute an Ernst tail wheel bracket for the ventral fin and insert the upper part of the arm in the lower rudder area similar to the water rudder installation for actuation.

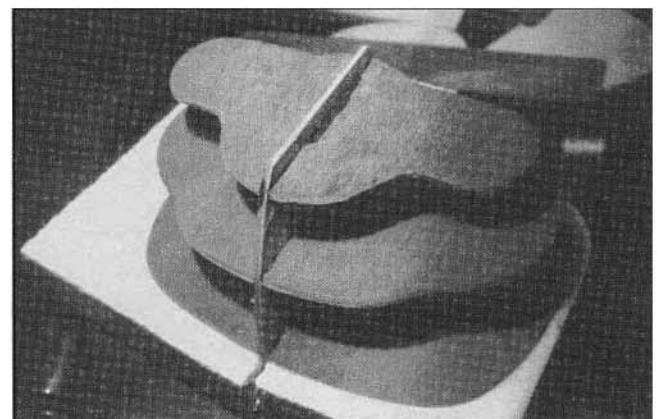
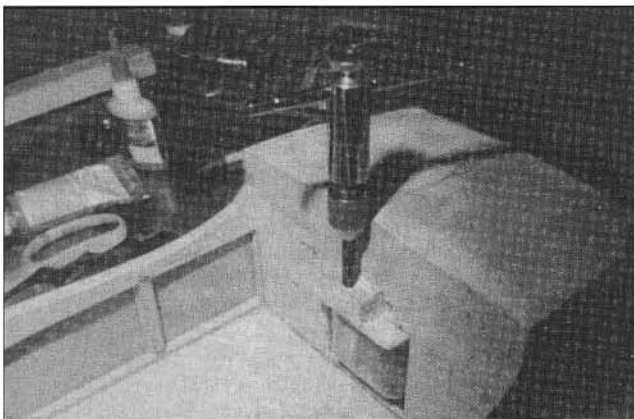
Wing:

This construction is straightforward. Remember to pin a piece of 1/4" stock to the plans over the trailing edge spar outline to keep the lower wing camber from contacting the plans. I found the best way to form the lower wingtip contour was to finish the top and add white foam between the underside span-wise tip ribs and sand to shape with 100 grit paper; then finish the lower contour with 1.5 oz. glass. I strongly suggest fitting the lights as the tip is being constructed to ensure a nice fit. The wing spar is designed to withstand 4.4 G's at the

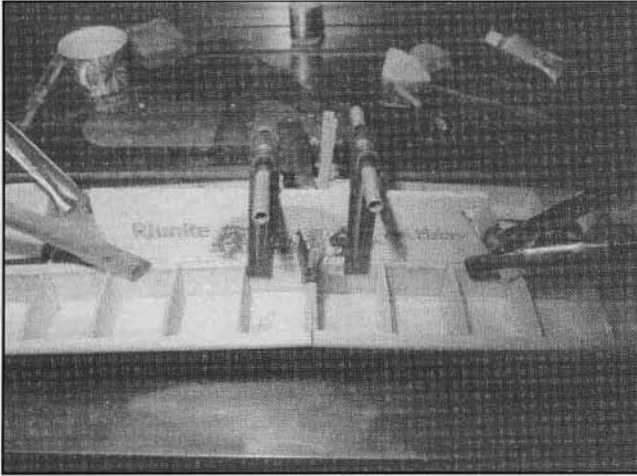
seven pound flying weight. Nonetheless, I added a piece of 1/4" x .007" carbon along the lower cap in the root area as doubler insurance. I did not configure my RV-6 for flaps; however, those desiring them need only build the ailerons with the extra ribs and cut them apart after construction. My experience with flaps indicates 25° will be ample. The aileron cut-away angle is 25°.

Tail:

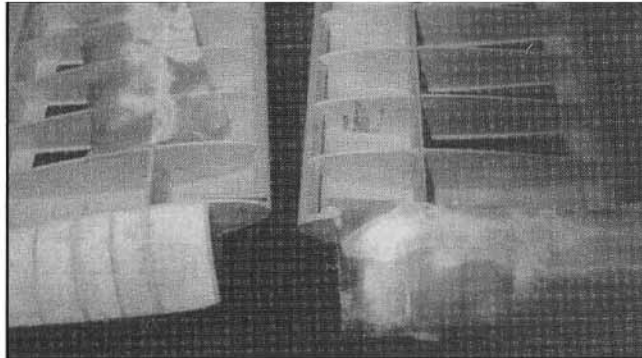
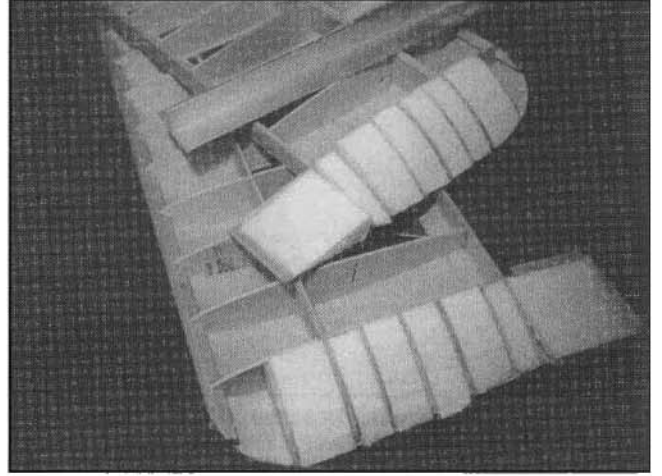
Do not be tempted to build flat surfaces here; follow the plans. The NACA 0009 airfoil is much more efficient and will keep flying right down to wing stall. Remember



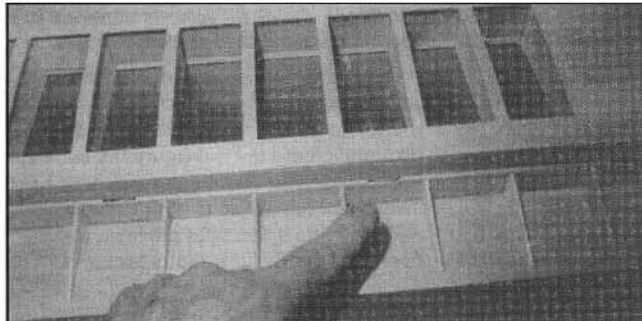
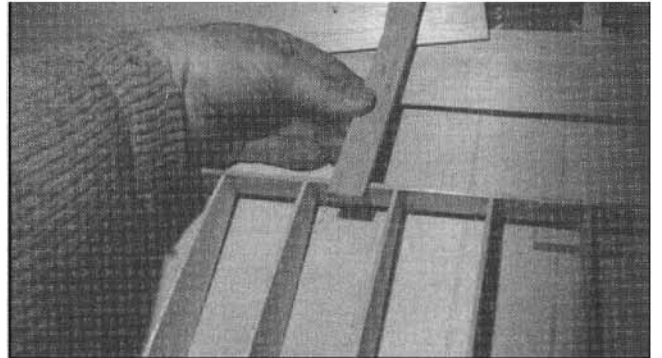
LEFT: Front fuselage hold-down block is tapped. **RIGHT:** The cowl plug formers are attached to a keel piece prior to filling in with foam and sanding to shape. After completion, a female mold was cast and the final cowl layed up.



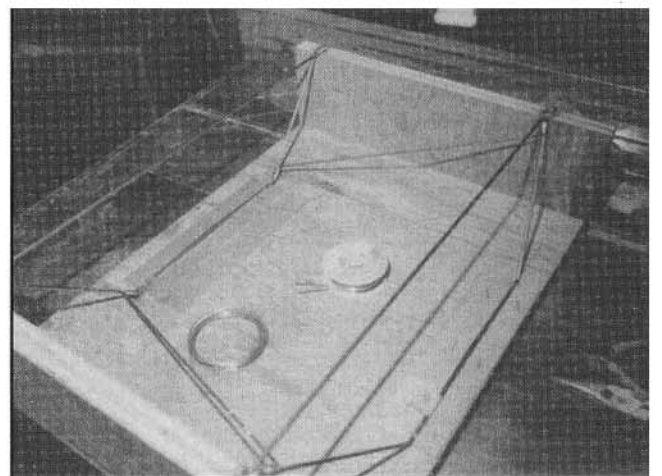
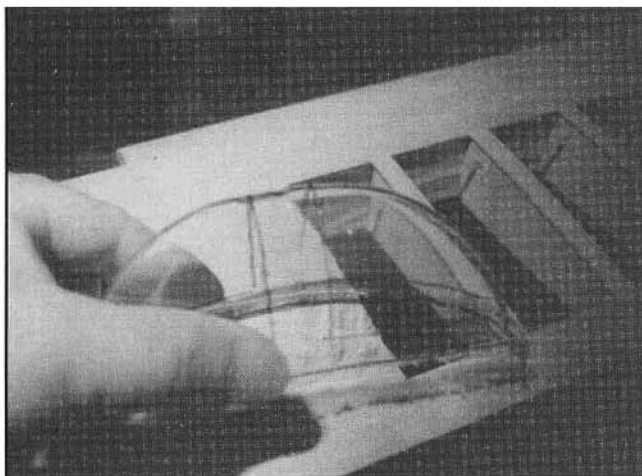
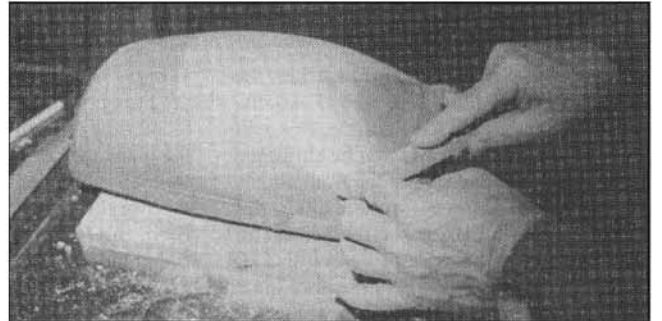
LEFT: Wings are joined with plenty of clamps and part of an old wine box for a dihedral pattern. **RIGHT:** With the tip ribs as patterns, the voids between are filled with foam and contoured with a sanding block.



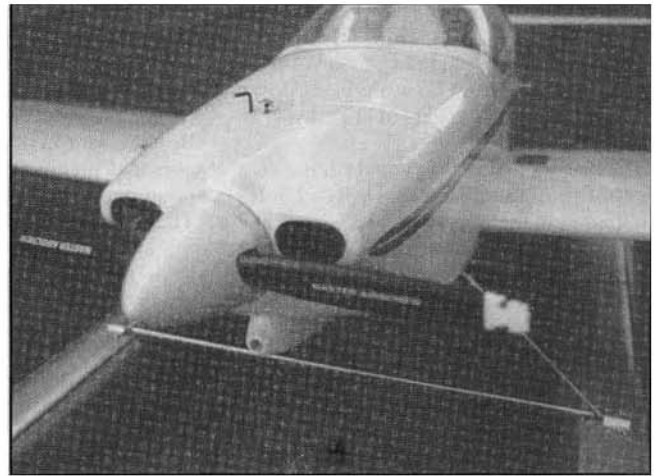
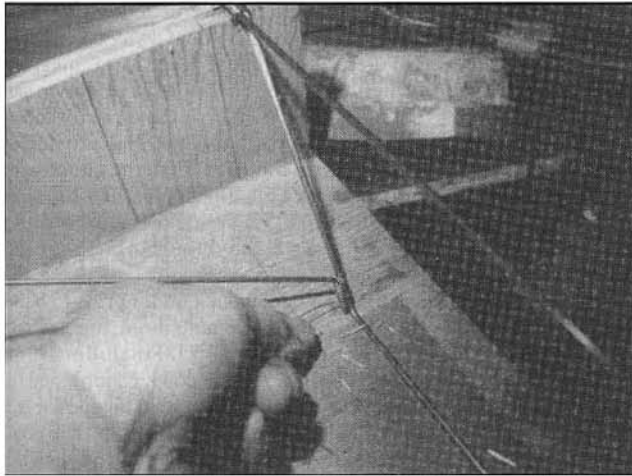
LEFT: Bottom of wingtips are glassed with 1.5 ounce glass cloth. **RIGHT:** A 3/4" wide sanding board is used to make notches for the hinges. Hinges are positioned just under the 1/16" cap sheet.



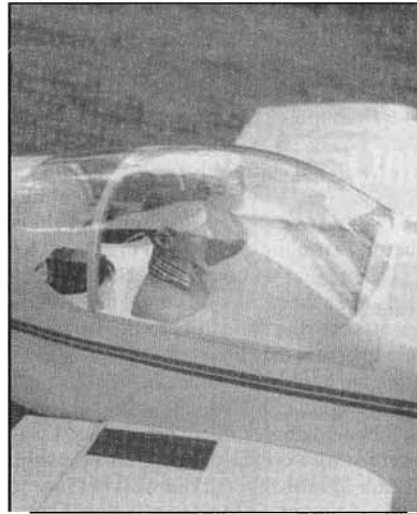
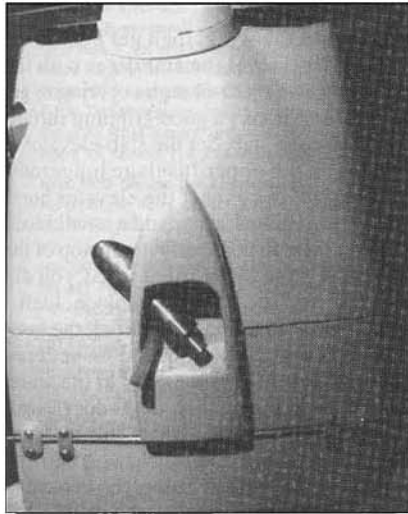
LEFT: Author points to the sanded notch in the top of the aileron L.E. so that the Easy Hinges can be easily slid in place. **RIGHT:** Finishing the aluminum filled epoxy canopy plug with a file prior to baking at 300°.



LEFT: Vacuum-formed wingtip light covers are shown here before trimming. Sill is recessed to keep them flush with airfoil surface. **RIGHT:** Float struts assembled in jig. Jig is essential for alignment during fabrication.



LEFT: Binding "N" strut to front down strut with #24 copper wire prior to soldering. **RIGHT:** Glass cowl really sets off the nose. Future cowls will be vacuum formed along with the canopy and tip lenses.



LEFT: Engine exhaust exits through bottom of carburetor intake. Note front strut attachments. **MIDDLE:** Williams Bros. 1/5th scale pilot busts are glued to the canopy floor with Goop. Elevator and rudder servos extend through floor in rear. **RIGHT:** 1/64" plywood fin-stab fairings really clean up the tail.

to notch the surface halves slightly at the hinge points; after joining, the Easy Hinges slip in much more easily and are automatically centered. The ventral is built with the internal water rudder shaft tunnel. Once covered, it is a simple matter to insert the shaft and then bend the lower angle to fit the water rudder. Should the builder desire the scale water rudder configuration, the Ernst .40 size water rudders are actuated as shown on the plans. I elected to go with the tacky water rudder since wing removal is greatly simplified without the cable complexity to contend with.

Floats:

If you elect to use commercial floats instead of cutting and finishing your own, I would recommend Kircher's 34FK's; for the RV-6 installation, I also advise cutting off the tangs and recessing the hardbacks under the strut attach points to receive 1" x 2" pieces of lite ply. This allows the float tops to be finished flush.

Strut Jig:

Spend a few minutes and build a jig. It's a simple plywood box and holds everything in place during the wrapping and soldering process. Just remember to shine up the wire

and brass clips before tinning. A soldering gun will be enough for heat; don't use a torch!

Center of Gravity:

Many seaplanes will fly well with the C.G. as far back as 30%. The RV-6 is not one of these! Keep the empty C.G. at 26% as shown on the plans, right over the lower spar cap.

CONSTRUCTION

Fuselage:

First cut the canopy bottom pan, fuel tank support, and the major bulkheads, F-1, F-2, and F-4 from lite ply. The wing saddle, F-9, is cut from 1/4" balsa sheet and a tapered piece of 3/32" sheet is added after assembly to match the canopy bottom side contour. For the Saito engine mount, add the doublers, drill F-1 as shown on the pattern, and install the 6-32 blind nuts securely. Now, lay up the two sides over the plans, remembering to extend the rears to the cross-hatched lines to allow for the shortening that occurs as they are drawn together during joining. I cut off the tops of F-1 and F-2 to allow the fuselage to be joined flat on the plans. I added the tops

back later. Wetting the 1/4" square longerons and the F-4 area with ammonia will ease the task of drawing the rears together.

For the land version, the lower front keel piece between F-1 and F-2 should be made from 1/4" aircraft plywood rather than 1/4" balsa sheet. Cut out and bend as per the plans, the .060" landing gear strut and drill it for four 10-32 bolts. Use the holes to position the blind nuts in the plywood keel. Next, install the Sullivan SS-8 fuel tank. I drilled the 3/16" fuel line holes in F-1 and installed a filler valve in a piece of 1/16" plywood glued to the inside of the side supports. I secured the tank to its support with some foam and strapping tape, then secured the support/tank to F-1 and through F-2. After checking the fuel lines for proper function, I finished the front top with the formers, stringers, and 1/16" sheet. The 1/64" plywood was added last. The elevator and rudder servos were installed next and their pushrods dimensioned. I also added a 1/8" balsa plate just behind F-4 for the battery support.

Finally, I installed the turtledeck formers and ran a straightedge sander down

them to ensure single curvature. 3/32" sq. balsa was installed along the upper longerons to provide the sheet a sill for a flush lower edge. The wing hold-down blocks were installed but not drilled yet.

Wing:

Begin by making plywood rib patterns for both wing and ailerons. Drill #52 holes in them, pin them to your 3/32" sheet, and start cutting. Remember, if flaps are desired, two extra flap ribs will be required. Drill all the ribs for the antenna tube (and aileron tubes if ailerons are to be used separate from flaps). Cut the wing TE spars from straight 1/8" sheet. Bevel them and notch the upper edges down a hinge thickness at the hinge points. I used a sanding block for this. Now, cut some 2" pieces of 1/4" sq. stock and pin them over the plans across the wing trailing edges. The TE is pinned in place over the plans to the 2" blocks. The lower spar cap is laminated and positioned. Install the ribs next. Pin the rib rears to the previously positioned TE and check to ensure the tops are flush. Glue these in place and then add the upper fabricated spar cap and LE. Now complete the second wing and install the dihedral doublers. Block up one wing 3" for joining. Sheet the upper surface as shown, remembering not to glue the TE cap where the hinge depressions have been sanded out. Invert the wing and add the tip ribs. Cut foam pieces to fit between the tip ribs and secure them with epoxy. Now, sand the foam blocks to the lower wingtip contour. Finish the tip undersides with 1.5 glass. Cut out the wing light lenses and fit them to the wingtips carefully. The ailerons are fabricated next, with their leading edges notched to match the wing trailing edges below the upper 1/16" sheet is installed. If flaps are to be used, the ailerons will have extra doublers installed for the control horn hard points. In this case, the flaps are still actuated similarly to the plans, only the links are ganged together. Invert the fuselage and fit the wing to the saddle. Temporarily install the ailerons and check for equal end clearance; then drill and tap the hold-down holes.

Tail:

Both the horizontal stabilizer and vertical fin are built two-sided. The elevators and rudder are single sided. Prior to gluing the two sides together, remember to sand in hinge slots. Since the stabilizer is symmetrical, one end must be blocked up during joining to ensure the elevator hinges lie in a straight line; the same is true for the elevators. For the tip blocks, I sanded them to shape, painted, and installed them after covering the basic surfaces.

Floats:

If you don't have foam-cutting equipment, Kircher R/C products makes a suitable substitute. Try his 34FK's. At our scale of .1818, the Zenair floats scale down to 31" long and 5-1/2" wide. I found these dimensions contrary to successful model float operation and opted for longer, narrower units. For my floats, I covered the

bottoms of the cores first with 1/64" ply using Core Bond as the adhesive. The 1/4" x 3/4" x 33" balsa hard-backs are glued flush in the dadoed top slots with Tite Bond. The 1/64" ply upper sheet is Core Bonded on and trimmed to allow a 1/16" overhang on the bottom front. Epoxy is filleted in the chine joints to form the seal. The 1/64" ply does not have to be glassed, it is strong enough by itself, but remember to prime them first before applying the finish coat. The six access hole covers and two edge rails can be added here for additional scale realism. The drawings show the scale water rudder set-up. I opted for the tacky one because of its simplicity.

Struts:

Using the patterns, bend the down struts, bind them to the spreaders with #24 copper wire and solder them together. Next, lock the struts in the jig with some small brass clips. The "N" struts probably will take a couple of tries to get the right length. I used a coat hanger to dimension them and transferred it to 3/32" K&S steel. The float attach clips are fashioned from .025" brass. 3/4" x 1" pieces are positioned over a hardwood block which has a 5/16" x 5/32" slot cut in it. Lay two pieces of 1/8" wire over the clip and rap them sharply. Trim the corners and drill them for #2 Allen head wood screws. Now, lay the clips over the strut stubs and solder them on. In securing the struts to the floats, be sure to center the clips so that the #2 screws catch the hard-backs beneath.

Covering:

I had no choice in covering since I was duplicating a cream-painted full-size ship. Cream MonoKote worked well but has no matching paint, so I had to mix Super Poxxy white, yellow, and brown. I would suggest just going down to the auto paint store with a piece of cream MonoKote in hand. For a few bucks (no more than the cost of three cans of Super Poxxy), they will match it. Remember that MonoKote likes to be as tight as possible before you go after it with your shrinking iron and gun. Heat does not make up for sloppy covering! I painted my canopy floor before covering just to save me some masking. My Williams Bros. 1/5 scale Sportsman pilots were painted for me by Cindy down at Hobbytown in Tacoma. I secured both the pilots and the Hobby Lobby instruments with Goop.

Cowling:

Cut out the shaft and cooling holes; then fit and secure the cowl backplate with glass and epoxy. Next, install the engine sans muffler and try a cowl fit. The head will protrude out the side slightly, so start cutting the opening carefully. Don't cut too large a hole to start; the hole should be approached from the **too-small** side. The engine can be shimmed slightly from side to side to get the shaft centered. Now, when you cut the bottom hole, leave the lower backplate intact for one of the #6 socket head attach screws. Drill the cowl backplate for the screws, position the cowl, and drill on through into the fire wall. Secure

the cowl. The carburetor scoop was fashioned from balsa and cut away on one side to clear the exhaust pipe. Next, measure carefully for the needle valve extension and choke wires, then drill the cowl for them. Remove the cowl and install the fuel lines and throttle linkages. Fish the choke wire through its hole during reassembly. The needle valve wire must be secured with a long Allen wrench through a cooling hole. If you plan to make your own cowl, the plans show the basic cowling ribs to build up a plug, cast a female mold, and lay one up. However, for \$35.00 including shipping, I'll send you the cowl, canopy, and tip lenses, all vacuumed formed on one sheet. I even mark the cut lines for you. The cowl needs only a light sanding to roughen the surface prior to backplate installation and painting. I attached the carburetor scoop with Goop after painting.

Tail Installation:

Lock on the wing, then get behind the ship and eye-level the stabilizer with the wing. Cut away just enough covering to get the 5-minute epoxy a good gripping surface and secure the stab. Set the stab-elevator at 0°-0° with the upper fuselage longerons. Don't forget to connect the elevator horn. The fin is installed next. Add a small block at the fin spar to connect with the top of the stabilizer spar cap. Line it up as you did with the stab and epoxy it in place. I left a bit of excess covering loose along the fuselage rudder post so it could be secured around the fin rear spar. Slip in the water rudder shaft, then attach the rudder. Next, slip the subfin up the water rudder shaft and attach the subfin. Now, bend the bottom of the shaft 4" below the bottom of the subfin 90° and solder on the .020" water rudder. Please resist the temptation to leave the shaft straight with the water rudder soldered to the rear. The 3/32" shaft diameter is enough to slow the ship down appreciably. If you use the Ernst .40 size water rudders, Proctor pulleys with SS fishing leader will work well for the connections. My suggestion here is to leave off the cables and lock the rudders up during early check out flights since chances are you will have to get back inside at least once.

Trim and Numbers:

I got my trim and numbers from "Signs Now" in Tacoma. I suspect most sign shops have similar capability. Only buy 6" or so of the extra material for the trim since its around \$9.00 a square foot. My numbers and trim piece cost around \$7.00. We hope another RV-6F will show up soon with a paint scheme more easily duplicated.

Canopy Attachment:

After trimming the canopy for a flush fit all around, assemble the simulated separation roll bar. Sand it carefully and paint it and the connector bar aluminum. Fit this assembly to the upper cockpit frame and make sure the canopy still pulls down at the sills. Once satisfied, scuff up the inside edges and secure it with RC-56. I used masking tape to hold it down tight while it dried. I left off the rear fin-stab fairings

during initial flights since I thought I might need some tail weight, and this area is the best place for it. After a couple of flights, it turned out I did not need to adjust the C.G. at all, so I installed the fairings with Goop for adhesive and several pins held them in place until they dried.

Float Attachment:

The floats are secured to the struts with #2 screws. After wing attachment, the whole assembly is secured to the plane with four flat straps and #4 sheet metal screws in front, and the brass clips with #4 sheet metal screws in the rear. Back prior to covering, I had fitted the struts to the fuselage and cut a slot in the front keel blocks under the front strut wire. This allowed the wire to depress into the covering as the straps were tightened.

Wheeled Version:

Sig's Smith Mini-Plane pants and 2-3/4" wheels are the right size. The tail wheel pant on the full-size ship can easily be added over the 1" tail wheel for added scale realism.

Radio Equipment Installation:

I cut the film in the rear and connected the previously sized pushrod to the rudder horn. A hooded pushrod exit guide finished the opening nicely. I added some Velcro tape to blocks on the underside of the cockpit base plate, and with a bit of foam secured the receiver. I slipped the throttle cable through the Du-Bro E-Z connector on the mini-servo control arm. With the radio on, I ran the engine servo to idle cut-off and secured the arm and locked the cable. Since the cable had been secured on the engine throttle arm similarly, the throttle system was complete. In the same manner, I connected the elevator and rudder servo arms for proper throw. The aileron servo was installed in the wing with the front screwed into the top spar cap and the rear into a shim block to get the link arm angle right. The strip aileron horn adjustable brackets were then connected to threaded pushrods at the rear with snap links and "Z" bends up

front. The switch-charge jack assembly was positioned in line with the exterior trim, and secured. I attached the battery to the plate previously positioned just behind F-4 with foam and rubber bands. The control throws were set at: 3/8" up and down on the elevator, 1/2" each way on the ailerons, and 1" each way on the rudder. Slipping the antenna in the wing tube finished it up and the wing was reattached.

Flying:

After equipment check-out and engine run up, it remains only to launch the ship and do a little taxiing. For the first take-off, try just 2/3 throttle and just enough back pressure to hold the nose up a bit. The ship will fly off the water when it's ready. Look for 150' or so, no wind. Once you're used to it, full-power can be applied for take-offs, but be ready for a bit of right rudder. Although the ship can be landed "hot," I prefer to stall it in since the airfoil allows it. With a little wind, take-offs and landings take less than 50'. Enjoy.

Materials List

Spruce:

4 — 1/4" x 1/8" x 36"
2 — 3/32" x 1/4" x 36"
4 — 3/32" x 3/32" x 36"

Plywood:

1/2 sq. ft. 1/8 lite ply
6 sq. ft. 1/64 ply (float version)
1 sq. ft. 1/64 ply (wheeled version)

Balsa:

1 — 1/4" x 3" x 36"
2 — 1/8" x 3" x 36"
4 — 1/16" x 3" x 36"
7 — 3/32" x 3" x 36"
8 — 1/4" x 1/4" x 36"
1 — 3/16" x 3/16" x 36"

Fiberglass:

3 sq. feet 1.5 ounce cloth

Covering:

2 rolls Cream Film

Brass:

1 — 3/4" x 12" x .025" (float clips)

Misc:

16 — #2 1/4 sheet metal screws (SMS for float clips)

10 — #4 x SMS
2-1/4" Spinner
8 oz. tank
Antenna tube
3/32 threaded strip ailerons w/adjustable horns
2 — hooded pushrod covers
Quick links
5-Minute Epoxy
Tite-Bond
Fast & Slow CA
Cowling, Canopy, and tip lenses

Product Manufacturers Listed In This Article

Carl Goldberg Models Inc., 4732 W. Chicago Ave., Chicago, IL 60651.
Klett Plastics, Ft. Worth, TX 76114. #373
Pushrod exit guides.
Du-Bro Products Inc., 480 Banner Rd. Wauconda, IL 60084. *E-Z Connectors.*
Sullivan Products, 1 No. Haven St., Baltimore, MD 21224. *Clevises.*
K&B Manufacturing Co., 2100 College Dr., Lake Havasu City, AZ 86403. *Paint.*
Top Flite Mfg., 1610 Interstate Dr., Champaign, IL 61831. *MonoKote.*
Franklin International, Columbus, Ohio. *Tite Bond.*
Sig Mfg. Co. Inc., 401-7 So. Front St., Montezuma, Iowa 50171. *Core Bond.*
Ernst Mfg. Co., 37396 Ruben Ln., #B, Sandy, OR 97055. *Water Rudders.*
Williams Bros. Inc., 181 Pawnee St., San Marcos, CA 92069. *Pilot Busts.*
Kircher R/C Products Inc., 9 Sheffield Way, Clark, NJ 17066. *Floats.*
Electric Products, Inc., Carson, CA. *Goop.*
Ed Westwood, 909 So. 173rd St., Spanaway, WA 98387. *Vacuumed formed cowl, canopy, and tip lenses.* \$35.00 includes shipping.
Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002. *Pulleys.*



**From
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