



# BORNE FREE

By David P. Anderson — Photos By George Otis



## ABOUT THE AUTHOR

David Andersen is a 37 year old computer engineer with Sperry Univac in St. Paul, Minnesota. He is Vice President of the Twin City Radio Controllers and he is a former performer with the Blue Eagles air show team. He has been active in R/C flying for eight years, having received his League of Silent Flight number 182 in 1971. Previous designs include the Mariha sport scale sailplane (*Model Aviation*, October 1976) and the Hatz Biplane (*Model Aviation*, August 1977). He is active in regional contests, such as the Suds City Soar-In where he is accompanied by his wife Rosemary and his daughter Heidi.



**W**ith its gull wing and T-tail, Borne Free is a distinctive combination of the old and the new. The gull wing was popular long ago, but the swept T-tail is definitely modern. The purpose of the gull wing is to raise the center of lift of the wing high above the Center of Gravity and the towhook position, adding pendulum stability. The T-tail raises the stabilator into smooth air above the wing's downwash and increases rudder effectiveness due to the end plate effect. This combination makes Borne Free a very stable, yet responsive, sailplane.

Why were gull wings so popular for full sized sailplanes forty years ago? The answer lies in the design requirements of sailplanes in those days. Modern full sized sailplanes are designed for aerotows and cross country speed. But early sailplanes were designed to be launched from winches, to circle tightly in the small diameter thermals found at low altitudes, to remain aloft close to the launching point as long as possible, and to make a precise spot landing. These requirements are very similar to what R/C sailplane designs strive for today (implying that model sailplanes are forty years behind their full sized counterparts). The inherent stability of the gull wing allows the pilot to fly at a greater

angle of attack on the launch and, therefore, achieve greater launch height. Even a small increase in launch height can greatly improve the pilot's chances of finding lift because thermals form only at altitude and increase in size and strength with height.

After release, the pendulum stability of the gull wing means that fewer and smaller pilot corrections are needed to maintain smooth flight. The smoother the flight, the lower the sink rate. Borne Free is exceptionally stable, yet has a very low sink rate. Elevator corrections are needed only in turbulence and very tight turns; flight is virtually rudder only. Borne Free is so stable that rudder control must be applied and held throughout a turn. The plane will immediately resume straight flight when the rudder is returned to neutral. This effect can be used to advantage when thermalling in light winds. Upon centering in a thermal, the rudder trim can be cocked to one extreme, causing a turn. Then the pilot may put the transmitter down on the ground; his services will not be needed for awhile. Borne Free will circle safely and smoothly, all by itself, drifting along with the thermal. This inherent hands-off stability makes the craft truly "borne-free". Hands-off flights have been flown in this manner many times; their duration

limited only by how far downwind the pilot would allow Borne Free its freedom. Note that it would be possible to meet the LSF Level I thermal flight requirement without even touching the transmitter! Smooth flying is all important in minimizing sink rate. Unnecessary control surface movements and an unsteady flight attitude must ultimately be paid for with loss of altitude. It is felt that any theoretical loss of efficiency due to wing polyhedral is small, indeed, compared to improvement in performance gained by smooth steady flight.

The Borne Free design was influenced by three earlier designs: Lee Renaud's brilliant Aquila (*R/C Modeler*, May 1975), Ottar Stenbol's beautiful Ghost 7 (*Zephyr*, September 1970), and the free flight design S-A-TT by Scipioni (*Model Glider Design* by Frank Zaic, 1944). The thin flat-bottom airfoil combined with a mere 7 oz./sq. ft. wing loading yields a low sink rate and a floating glide, but good penetration when down trim is applied. The diamond airfoil in the stabilator is a strong, rigid and light weight construction that originated with the Orion and Taurus and has been used in pattern ships to gliders ever since. The vertical fin is solid cross-laminated balsa for strength and rigidity. T-tails are traditionally a problem struc-

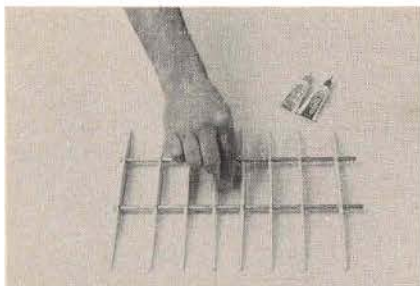
**PULLING ON A SINGING LINE  
MY LONGWINGED CRAFT BEGINS ITS FLIGHT  
FLEX-BENT WINGS GROAN ON  
THE OLD FORD MOTOR'S MIGHT.**

**TRUE FLIGHT BEGINS WHEN  
THE SILENCE STEALS  
AND THE WORLD IS FREE  
OF GEARS AND WHEELS**

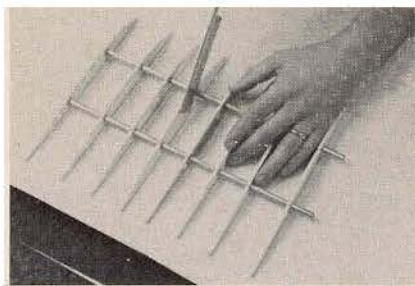
**A HAWK SPIRALS INTO THE THERMAL'S CORE  
UPWARD TOGETHER, AND HIGHER  
ONE BIRD OF FEATHERS AND BONE  
THE OTHER OF WOOD AND WIRE.**

**TWISTING AND TURNING AND  
YEARNING TO BE FREE  
TO CAST OFF THE RADIO'S GRASP AND  
BE A BIRD LIKE THEE.**

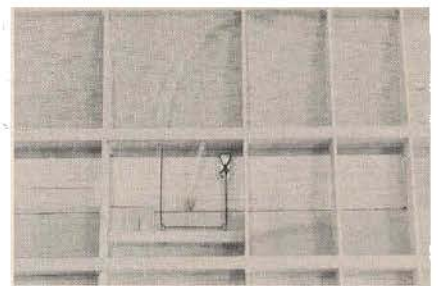




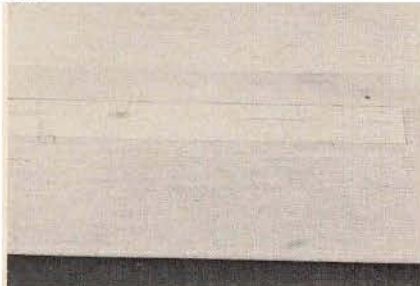
Wing center sections being assembled. Template is used to tilt root ribs 11°.



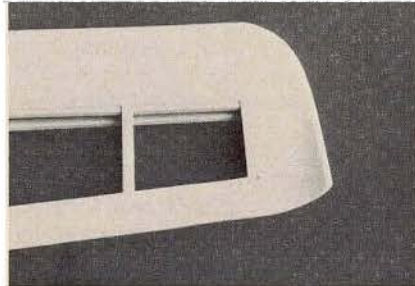
The two wing center sections being cut apart.



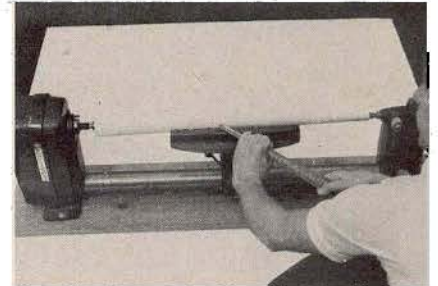
The spoiler details. Note the elastic sewing thread spoiler hold-down.



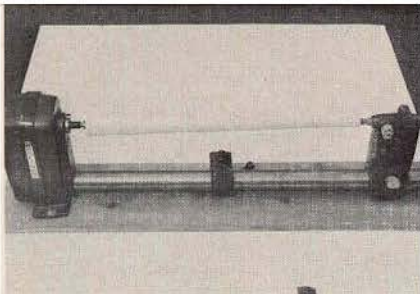
Spoilers hinged with Klett hinges.



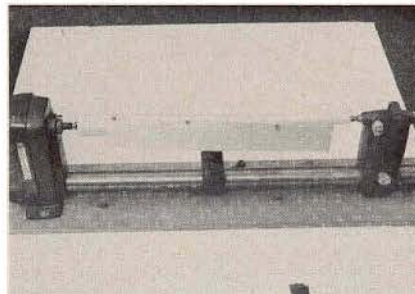
Vortex wing tip ready for covering.



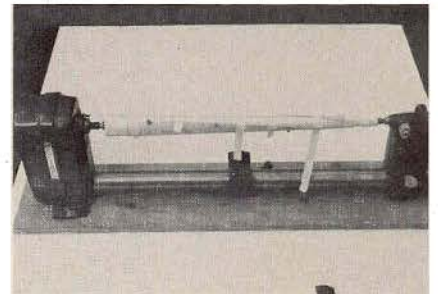
Cutting the boom form on a lathe.



The boom form wrapped with wax paper.



The first sheet of balsa tacked to the boom form.



The first layer of wet balsa wrapped around the boom form.

turally, but sweeping the fin reduces the moment of inertia about the fuselage axis. This fin design has proven to be rigid, but light and strong. A short section of Nyrod in the fin provides a large radius bend in the stabilator pushrod, eliminating the need for bellcranks so common to T-tail sailplanes.

The fuselage boom consists of two layers of 1/16" sheet balsa formed by wrapping the sheet balsa around a wooden form and bonding the balsa sheets together with contact cement. A

round boom cross section is desirable for a T-tail. The twisting forces on the fuselage caused by the inertia of the stabilator will be uniformly distributed around the fuselage, spreading the stress throughout the boom. This stress is probably greatest during a ground loop landing. But in the air, a round boom holds the tail rigid. The fuselage pod is carved from large pieces of balsa. The balsa for the pod costs between ten and twenty dollars, depending upon when and how it is bought, but the strong

streamlined fuselage that results is well worth the investment. Wing fillets carved into the fuselage not only reduce drag, but are important structural support for the wing rods and tail boom.

#### CONSTRUCTION

Borne Free requires a little more work to build, but it is worth it. You will also need access to a bandsaw and a wood lathe during the early stages of fuselage construction. The most difficult part of any scratch-built project is planning the sequence of construction. This is espe-

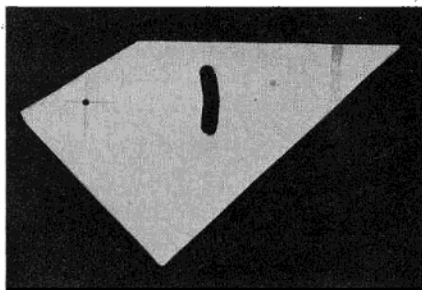
### BORNE FREE

Designed By: David P. Andersen

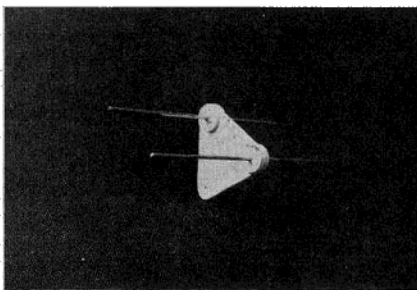
**TYPE AIRCRAFT**  
Open Class Sailplane  
**WINGSPAN**  
130 Inches  
**WING CHORD**  
Root 10" & Tip 6½"  
**TOTAL WING AREA**  
1165 Square Inches  
**ASPECT RATIO**  
14.4  
**WING LOCATION**  
Upper Mid-Fuselage  
**AIRFOIL**  
Flat Bottom  
**WING PLANFORM**  
Constant Chord Center

Single Taper Outer Panels  
**DIHEDRAL, EACH TIP**  
11° center, 5° middle, 9° tip  
**O.A. FUSELAGE LENGTH**  
56" (incl. rudder)  
**RADIO COMPARTMENT AREA**  
(L) 12" X (W) 2.2" X (H) 3"  
**STABILIZER SPAN**  
31 Inches  
**STABILIZER CHORD (incl. elev.)**  
3.9"  
**STABILIZER AREA**  
120 Square Inches  
**STAB AIRFOIL SECTION**  
Diamond  
**STABILIZER LOCATION**  
T-Tail  
**VERTICAL FIN HEIGHT**  
9.1 Inches

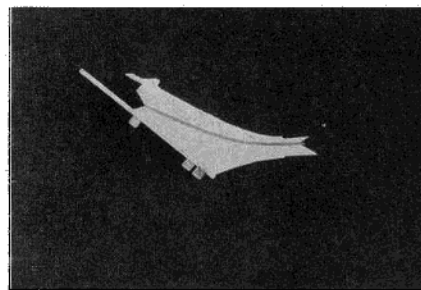
**VERTICAL FIN WIDTH (incl. rudder)**  
6" (Avg.)  
**REC. ENGINE SIZE**  
NA  
**FUEL TANK SIZE**  
NA  
**LANDING GEAR**  
NA  
**REC. NO. OF CHANNELS**  
3  
**CONTROL FUNCTIONS**  
Rudder, Elevator & Spoilers  
Optional Releasable Towhook  
**BASIC MATERIALS USED IN CONSTRUCTION**  
Fuselage ..... Balsa, Ply  
Wing ..... Balsa, Ply & Spruce  
Empennage ..... Balsa  
Weight Ready-To-Fly ..... 56 Oz.  
Wing Loading ..... 7 Oz./Sq. Ft. w/o ballast



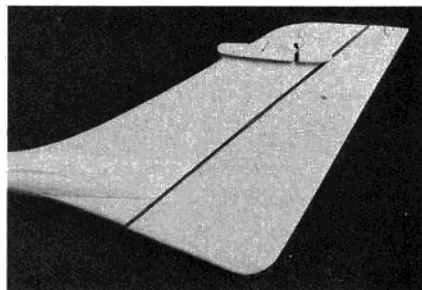
*The stabilator crank box side.*



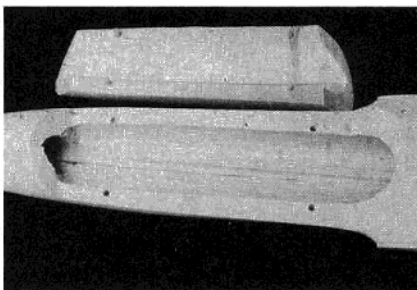
*The stabilator crank.*



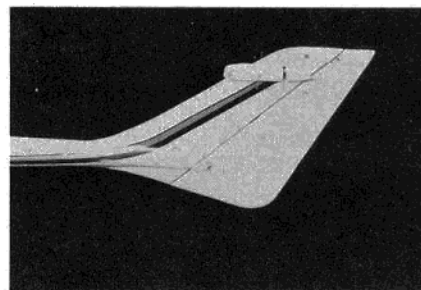
*Fin core with Nyrod and hinges in place.*



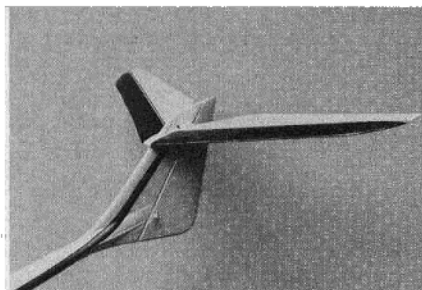
*The fin and rudder assembly ready for covering.*



*Radio compartment ready for installation of servo rails.*



*Finished and covered fin and rudder.*



*The completed tail.*

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cut along the overlap points with a straight-edge. Now apply contact cement and roll this piece in place with the wallpaper roller. Once again, a small triangle of balsa sheet will be needed to complete the large diameter end of the boom.

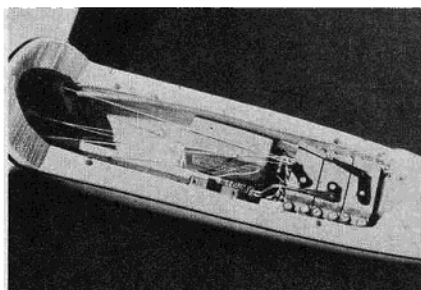
Fill any gaps in the joints with wood scraps and wood filler, then sand smooth, and cut the ends off square with a razor blade while the boom is still on the form. The boom can be removed from the form by tapping the small end of the form on the floor.

If you have difficulty making the boom, check the grain of the wood you are using. The pores of the grain should be close together and straight, indicating that the wood was cut approximately parallel to the radius of the tree. The wood should be straight-grained. It should be flexible even when dry. Booms have been made of up to 3/32" firm balsa without difficulty using this method.

**Fuselage Pod:** The forward half of the fuselage is carved from two blocks of balsa. Select two medium density balsa blocks each 2" x 4" x 27". Mark the fuselage outline on both of these blocks

by placing the plans and a layer of carbon paper over each block and tracing the outline of the fuselage. Trace also the outline of the wing root and the location of the wing rods. Drill the wing rod holes at an 11° angle. Use a drill press. You may enlarge the holes later as required to fit the wing rods. Cut along the fuselage outlines. It is best to use a bandsaw for this cut. Pin or tack glue the pieces back in place and trace the fuselage top view outline on the topside of the fuselage blocks. Cut along this line with a bandsaw. Now rough carve the fuselage outside to within 1/8" of its final shape. A razor plane is the best tool for rounding the fuselage, but a wood carver's gouge is effective for the concave surfaces of the wing fillets. Do not cut closer than 1/4" from the root rib outline at this stage. Final carving of the wing fillets will be done later.

Break apart the fuselage halves. Trace the outline of the boom hole on the inside surfaces of the fuselage blocks. Also draw the outline of the inside surface as shown by the dashed line on the plans. Trace the outline of the battery pack in the nose area. Hollow out the fuselage along these lines using a wood carver's gouge. Test the fit of the battery pack by placing the two fuselage halves together with the battery in its carved recess. The two halves should go together tightly with only the slightest friction from the battery. Also measure the inside width of the fuselage as it is hollowed out in the servo area. The fuselage inside width should be about 1/4" greater than the length of a servo. Carve the fuselage floor rather flat in the receiver area and the towhook area. Carve away plenty of space for the stabilator pushrod. Test fit with a long stick to be



*The completed radio installation. Spoiler servo drives releasable towhook.*

sure the pushrod will have plenty of clearance. Once the fuselage halves are glued together, most of the inside of the fuselage will be inaccessible so be sure everything will fit now. Install the hook for the releasable towhook rubber band.

Last, carve the hole to receive the boom. Having already traced the outline of the boom hole from the fuselage plans on the inside of the fuselage block, now measure the diameter of your boom at the pod exit point, tape the fuselage blocks together, and draw a circle on the end of the pod blocks equal in diameter to the outside diameter of the fuselage boom where it will exit the fuselage pod. Untape the fuselage halves and carve the boom hole with a gouge using the boom outlines as a guide. As the final shape of the boom hole nears completion, test the fit of the boom in the hole by clamping the boom between the fuselage halves and observing how much gap remains to be removed. A perfect fit of the boom in the boom hole can be obtained by wrapping the end of the boom with carbon paper (carbon side out) and squeezing the two fuselage halves together with the carbon paper wrapped boom in position in the boom

hole. Hold the fuselage loosely in one hand and twist the boom with the other hand so that the carbon paper rotates with the boom. The high spots will be blackened by the carbon paper. Repeat this process, carving away the blackened high spots, until the fuselage fits tightly and evenly around the boom. This technique was inspired by my dentist. He finds the high spots in new fillings by having his patients bite carbon paper.

In order to proceed with the fuselage construction, the two wing center sections, each consisting of four Siglite plywood ribs epoxied to the brass wing rod tubes, must be completed. Bend and cut the wing rods from 7/32" music wire, and test fit the fuselage assembly by inserting the wing rods into the wing rod holes in the fuselage and the boom into the boom hole, and the battery in the battery recess. Bring the fuselage halves together. Slip the two wing center sections over the wing rods, to align these rods. It might be necessary to do more carving on the inside of the fuselage or to enlarge the wing rod holes in order to make everything fit together. When satisfied with the fit, take it all apart, remove the battery, apply white glue to the fuselage joints and boom hole, apply epoxy to the wing rod holes, and clamp the fuselage halves together with the boom and wing rods in place. Slip the wing center sections onto the wing rods, being careful that no glue touches the wing tubes, and strap the fuselage sides together tightly with plenty of masking tape. When the glue is dry, remove the wing center sections and build the wings and tail.

Slip the 1/8" Siglite ply fuselage root rib blanks that you prepared when you constructed the wing center sections on to the wing rods and slip the wings on to the wing rods. With a sharp lead pencil, draw the root rib outline on the root rib blanks using the root rib of the wing as a guide. Remove the root rib blank, cut and sand to shape, and glue it to the fuselage. Repeat this process for the other fuselage root rib.

Attach the fin to the boom, and cut the canopy. Install the canopy hold-down pegs by drilling four 1/8" holes in the canopy edge and gluing short 1/8" dowel pegs in these holes. When dry, press the canopy in place on the fuselage. Press just hard enough for the canopy pegs to make a slight impression in the gunwales of the fuselage. Drill 1/8" holes in these impressions and press the canopy in place so that the canopy pegs fit into these holes. Coat the insides of the fuselage holes with glue and let dry to create enough friction for a firm fit of the canopy.

With the canopy in place, finish the final carving of the fuselage. Sand to a smooth finish.

Servo rails are a length of 1/8" plywood glued to the fuselage side and reinforced from below with a gusset of

balsa. The receiver is stuck to the fuselage floor with double-faced foam tape. Run the antenna through the fuselage boom to exit near the tail.

**Fin:** The most important part of this airplane is the stabilator crank and its crank box. Any misalignment, loose fit or excess friction will directly affect the performance of the plane. Fortunately it is easy to build. The stab crank is constructed of 1/16" warp-free plywood. Glue the four 1/16" ply circular spacers in place and sand the edges slightly rounded. Drill 1/16" holes for the stab rods using a drill press. These holes must be perpendicular to the stab crank so that the stab rods will be perpendicular to the fin. Install the 1/16" music wire stab rods in the crank. Glue in place with epoxy or Hot Stuff. Cut away any glue fillets that result.

Cut the crank box sides from warp-free 1/16" plywood. Do this by stacking two pieces of 1/16" ply with a strip of double faced Scotch Tape in-between, tracing the outline on the plywood with carbon paper and cutting on a jigsaw. Drill the 1/16" forward stab rod hole on a drill press. Peel apart. The two crank box sides should be *identical*. Do *not* assemble the crank box at this time; the crank will be needed for alignment of the stab tubes.

Cut out the 1/4" balsa fin cores and assemble them with a short piece of outer Nyrod over the plans on wax paper. Rough the Nyrod with sandpaper. Use epoxy to glue the Nyrod between the two fin cores. Assemble the rudder post complete with rudder hinges and glue it to the fin. Cover both sides of the fin with 1/16" sheet balsa, contact-cemented in place with the grain running vertically. Note that the grains of the outer layers are perpendicular to the grain of the fin core.

After the stabilator has been completed, assemble and glue the crank box with the stab crank inside. Be sure that the forward stab rod is 90° to the side of the crank box. Insert the inner Nyrod in the fin Nyrod, connect it to the stab crank and glue the crank box to the fin. Measure the forward stab rod angle to be sure that the stab rod forms a right angle to the fin. Add the 1/4" stab fairing and 3/8" fin top. Build the rudder over the plans. Cut slots for the hinges. At this point, the color scheme of the rudder must be decided. Cover only the leading edge of the rudder with Solarfilm and epoxy the rudder to the Klett hinges in the fin. Pin the hinges with round toothpicks. Note that two heavy duty Klett hinges are used in the lower edge of the rudder. The rudder must withstand ground shock - - - it is usually the first part of Borne Free to touch the ground in a normal landing. Coat the bottom edge of the rudder with epoxy to give it a hard surface. Re-coat the bottom of the rudder later after the rudder has been covered.

Attach the stab pushrod to the Nyrod

in the fin and glue the fin to the end of the fuselage boom. The fin may be inserted into the boom by squeezing the boom slightly to widen it. Before the glue sets, align the fin by placing a yardstick against the fin, laying the yardstick on top of the fuselage and beside the center seam of the fuselage. Align the fin vertically by laying a yardstick spanwise across the wing rod ends and sighting across this yard stick to the forward stab rod. Rotate the fin until the forward stab rod and the yard stick across the wing rod ends are parallel.

Cut the left and right fin fairings from 1/2" soft sheet balsa using the plans for a pattern. Drill a 1/4" hole through the left fairing for the rudder Nyrod. Glue the fairings in place on the fin, round to shape with an X-Acto knife and sand smooth. Glue the rudder Nyrod in place. Drill a 1/4" hole in a small block of balsa and slip this block onto the forward end of the rudder Nyrod. Glue this block to the fuselage wall anywhere aft of the canopy. The rudder Nyrod is thus affixed to the fuselage at only two places. This allows the rudder to flex with ground contact, protecting it and the rudder servo.

**Stabilator:** This type of stab construction probably originated with Ed Kasmirski's Orion and Taurus pattern ships in the early sixties. It will also be familiar to anyone who has built an Aquila.

Cut out the tips and spars and then assemble the stab over the plans. File two notches in the top of the root ribs and file two notches in the bottom of the next ribs. These notches will receive the aluminum stab tubes. Assemble all but the bottom spars, bottom root planking, and stab tubes over the plans. Cut four stab tubes from 1/16" I.D. aluminum tubing. Remove the stab from the plans. Lay the stab halves on the bench inverted, with the root propped up on a 1" block, the tips on the bench. Epoxy the stab tubes into the root rib notches, using the stab crank for alignment. When dry, remove the stab crank from the stab tubes, add the bottom spars and bottom root planking. Round the leading edge and taper the trailing edge of the stab.

**Wing:** Begin wing construction with the wing center sections. Cut ten rectangular pieces of Siglite 1/8" plywood, each 1" x 10" or larger. Trace rib W1 on one of these pieces and stack all ten pieces with a strip of double-faced Scotch Tape between each piece to hold the stack together. Drill two 1/4" holes through the stack at the wing tube locations. Use a drill press so that all pieces will have identical hole spacings. Remove and save the bottom two pieces. These will become the fuselage root ribs. They will be cut after the wing is completed and glued to the fuselage. Cut the remaining eight stacked pieces on a jig saw. These are the wing center section ribs.

Assemble all eight center section ribs on two 1/4" brass tubes over the plans. The brass tubes should be roughened with sandpaper to create lots of scratches for the epoxy to grab onto and to clean the surface.

Epoxy the ribs to the brass tubes. Use the root rib dihedral guide to set the root-most ribs outboard exactly 11°. Weight the ribs down flat to the work surface with a big heavy pair of binoculars until the epoxy cures. When dry, cut the brass tubes with a razor saw and save the binoculars for the flying sessions soon to follow.

Return to working on the fuselage pod at this time. The wing center section is needed for alignment of the wing rods during fuselage construction.

The remainder of the wing construction is very conventional and familiar to anyone who has scratch-built a sailplane before. The wing is built on a flat surface directly over the plans covered with wax paper. Start with the wing outer sections. Trace the top view outline of the wing tip block on a 1" x 1 1/2" soft balsa block. Cut out and glue to the tip rib. Glue the wing ribs, spars and dihedral braces in place for the wing outer section. Sheet the top surface forward of the spars. Let the glue cure overnight. Remove the outer section from the work bench. Draw the curved rear view of the up-turned wing tips on the rear end of the wing tip block. Carve the concave upper surface of the wing tips with a wood carver's gouge and round the lower surface with a razor plane. These vortex wing tips will improve stability and reduce side-slipping in tight turns.

Return the outer panel to the plan-covered work surface, propping up the wing tip 1 1/2". Build the middle wing panel over the plans. Sheet the leading edge, but do not add the sheeting aft of the spar near the gull anhedral joint yet. A tighter joint will result if this sheeting is added after the gull anhedral joint has been formed.

Build both center sections over the plans. Do *not* add the dihedral braces at the gull anhedral joint at this time. Install the spoiler cable tube before gluing the leading edge in place. Add the spoiler cable screw eyes before planking the wing. Leave a 1 1/4" space for the spoiler when planking the wing. Make the spoiler blade next. It is simply a piece of 1 1/4" trailing edge stock. Select stock that is extra lightweight but warp-free. Recess and epoxy the Klett spoiler hinges to the spoiler, lay the spoiler in place and trace around the hinges on the wing. Remove the spoiler and route the hinge outline slightly to recess the spoiler hinges on the wing. Make the spoiler horns and attach them to the

spoilers. Be sure that both horns project exactly the same amount beyond the edge of the spoilers or else the spoilers will not come up together. Epoxy the spoiler hinges to the wing. Remove the wing panels from the work bench and install the three spoiler supports for each spoiler from below. The spoilers will probably not be perfectly flush with the wing at this point. It is best if the spoilers are a trifle higher than the wing. Plane and sandpaper the wing panels smooth — this should make the spoilers flush with the wing. Do not round the leading edge near the anhedral joint yet. Do that later. Make four small hooks from pins. Epoxy these hooks near the trailing edge underside of the spoilers and at the bottom of the wing webbing of the front spars. The hooks will hold the 1" loop of elastic sewing thread that will hold the spoilers closed. Use only fine elastic sewing thread. Majesty brand is good (55¢ for 36 yards; that is enough to build 984 gliders!). Thread a piece of spoiler cable. Use Carl Goldberg 1/2A control line flying line — it's Dacron. It won't go limp in wet weather. Test the spoiler action. The spoilers should lay flat and come up to 90° without much effort. Trim away any friction, but the seams around the closed spoilers should be tight. Air flow through the spoiler seams can kill lift and cause drag even when the spoilers are down.

Form the anhedral gull joint by laying the inner and outer wing panels on the work bench, upside down. The outer panel should lay flat with its top section hanging over the end of the work bench. Butt glue the two wing panels together, clamping the end ribs with clothespins and propping up the root end of the inner wing panel 2 1/2". After the glue has dried, cut away 1/8" of the ribs at the anhedral joint where the ribs meet the spars. Slide the Siglite dihedral braces into these slots. Glue well and clamp the braces to the spars until dry. Complete the sheeting of the center wing sections and complete the finishing touches on the wings.

#### COVERING

For ease of covering and light weight, cover the fuselage with Solarfilm. Coat the seams in the Solarfilm along the bottom of the fuselage and nose with 5-minute epoxy. This will prevent the seams from peeling back because of ground contact. Coat the bottom edge of the rudder with epoxy after it is covered. It has been found that covering the middle and outer wing sections with Mono-Kote instead of Solarfilm made the wing flutter-proof in a prolonged dive.

Both surfaces of the spoilers should be covered. This will prevent the spoilers from warping.

#### FLYING

Balance Borne Free 2 3/4" behind the leading edge of the wing at the root. Both prototypes have required 2-3 ounces of lead shot in the nose in the cavity ahead of the battery pack. Don't worry about weight too much. A seven ounce wing loading is very light for a plane of this size.

Rudder throw should be 45° to either side. Stabilator throw should be 3/16" up and 3/16" down as measured at the rear stab rod.

Balance the center of the fuselage on the edge of your hand with your fingers pointed toward the tail. Any tendency to tip towards one wing should be corrected by adding weight to the light wing tip.

Check the wings for warps by laying each of the panels on a flat surface. Also, hold one wing upside down with the root up to one eye. Sight along the root rib bottom to the bottom of the outer dihedral joint. You should see two parallel lines if there are no warps. Correct any warps by twisting and heating the wing.

Having passed all these tests, it's got to fly reasonably well. I've never found test glides over tall grass to be very useful. I prefer to simply toss the plane off the biggest river bluff I can find or launch it from a winch or high start. Use a shallow climb angle at first. Any sudden turn on the launch is probably caused by part of the wing stalling. Correct with *both* rudder and some down elevator.

Borne Free performs well in the speed, precision and aerobatic tasks, but there are a few other designs that are better. Borne Free's forte is soaring: Finding and using thermals, big enough to follow a thermal for a mile, stable enough to become a dot in the sky hands-off, and maneuverable enough to circle in a tiny bubble of lift at tree top level. Borne Free likes to fly high and far, to follow the hawks and roam the sky. That's my kind of soaring. I hope it's yours too.

I wish to express my appreciation to my flying companions, Bob Hansing and Art Haynes, whose suggestions have been incorporated in this design. □

**By H.E  
RCModeler  
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