● The Sundancer sailplane design was conceived to do many things well. It is a high performance, ruggedly built good looking, economical and easily built Standard Class sailplane. The design uses a maximum performance airfoil with a speed range as broad as you will find anywhere, and can operate at low Reynolds numbers to take advantage of the low overall weight. Speaking of weight, how's 26 oz. with 7 oz. of radio included?

The fuselage design takes advantage of the pod and booms low drag characteristics. Turning performance is where the low drag figure shows up best as maneuvers with this model are crisp and accurate. Thermal turns are tight and flat while speed is maintained.

The wing has an aspect ratio of 16:1 with a thin undercambered airfoil and polyhedral. The airfoil performs well at light and medium wing loadings and has a broad speed range not found in most undercambered foils. "D" tube construction is used with spruce spars and leading edge resulting in a strong warp free wing.

The horizontal stabilizer has generous area and a lot of travel to provide positive control in the pitch plane. The Warren Truss design is easily constructed and fairly resistant to warping. The hinging mechanism provides smooth operation with easy field assembly, tear-down and storage without disturbing any control linkages. Another feature of the mechanism is that the elevator is securely positioned in all normal flight maneuvers, but if you have a hard landing the surface falls out unloading the control system which minimizes damage.

The generous use of spruce and plywood and just plenty of beef in the pod makes this plane stand up to punishment that would crumble many. The wing uses spruce structural members for impact resistance and torsional strength. The finish of the fuselage is important to ruggedness also. Glass and resin are hard to beat as they provide the most armor plate for the weight you can get.

The materials used are all standard lengths and thicknesses. All the blocks can be obtained in kits of assorted blocks sold in most hobby shops for about 89¢. The wing ribs are probably the toughest task of the whole project. I use the template method to carve out the set of ribs in a block and it works like a charm. Using blocks in the pod is the easiest method of making compound curves with minimum filling. The prototype has no filling material used in its construction.

To sum it up, the Sundancer represents a year's development effort aimed at making a truly competitive Standard Class soarer. It is light for good thermal performance and super sleek for minimum parasitic drag which gives an extra broad speed range for good penetration and slope soaring. The "trick" airfoil is nine percent thick and gives good lift in light air, while it does not get draggy in stiff conditions. The result of all these design innovations is a high performance Standard Class sailplane that is extremely light, surprisingly strong, and easy to build.

CONSTRUCTION

Now, let's get to the actual building process for the Sundancer. The stylized plans are layed out to complement the text of this article so what you don't find on one should be found on the other. Most everything is built right on the plans where

text to page 152

A rugged, easy-to-build Standard Class sailplane that combines economy with maximum performance for the sport or competition flyer. **By Robert Dellacamera.**

SUNDANCER

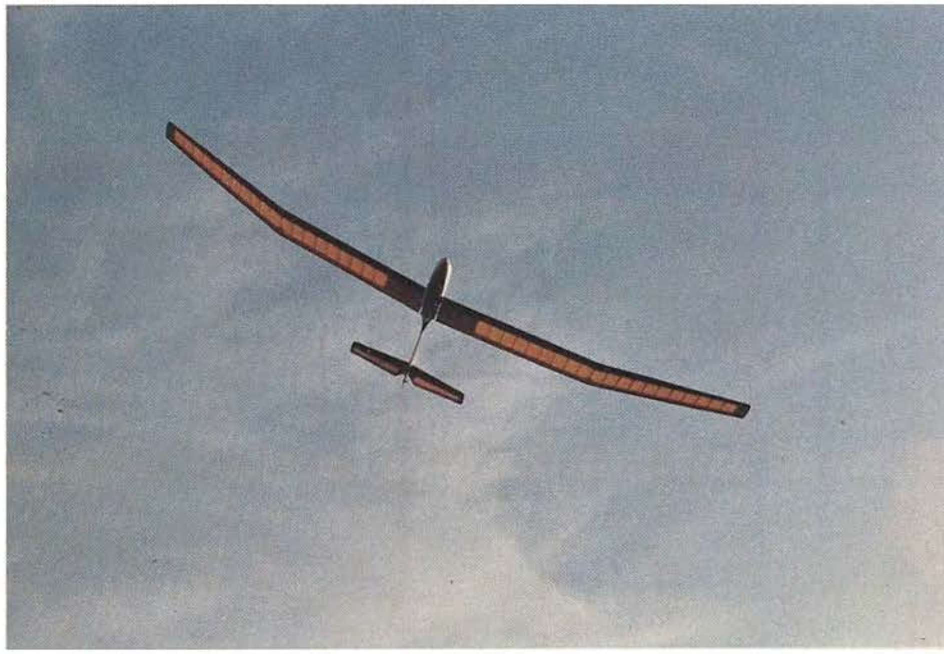
At only seven ounces per square foot wing loading, the Sundancer is a real light air performer. It floats on any semblance of lift, responding to every 'burble and bump' in the sky.

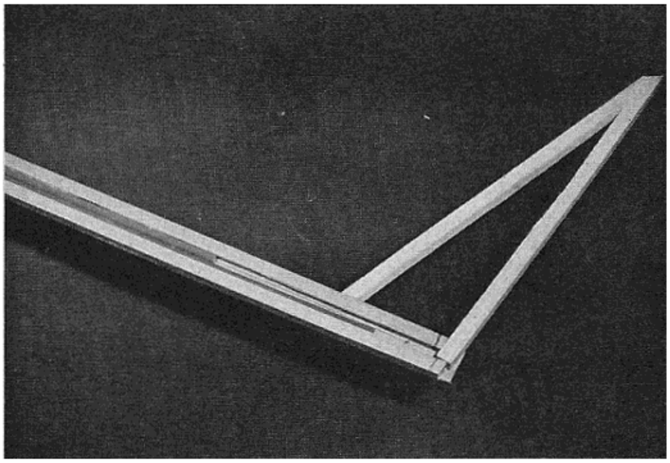
SUNDANCER

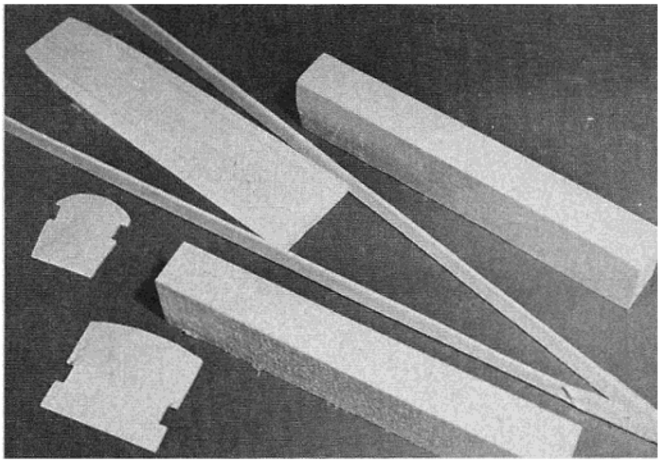
Designed By: Robert Dellacamera

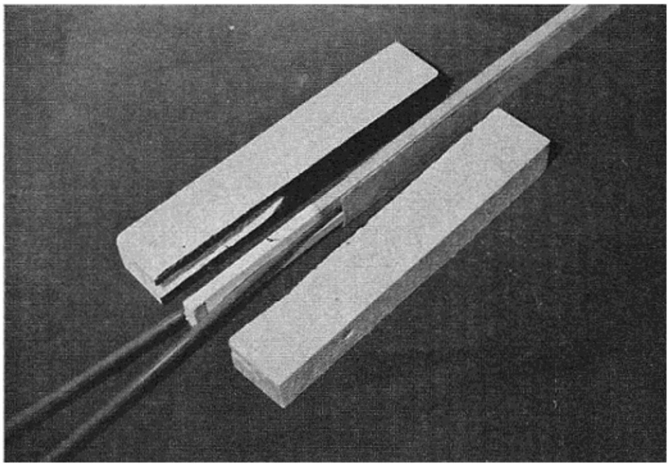
TYPE AIRCRAFT
Standard Class Sailplane
WINGSPAN
98 Inches
WING CHORD
6" Root — 4" Tip
TOTAL WING AREA
528 Square Inches
WING LOCATION
Mid-Fuselage
AIRFOIL
Cambered
WING PLANFORM
Double Taper Tip Panels
DIHEDRAL, EACH TIP
4° Inner — 8° Outer
O.A. FUSELAGE LENGTH
42¾ Inches
RADIO COMPARTMENT AREA
(L) 8" X (W) 2" X (H) 2"
STABILIZER SPAN
24 Inches
STABILIZER CHORD (incl. elev.)
4 Inches Average
STABILIZER AREA
96 Square Inches
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
1" Up On Fin
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (incl. rudder)
4 Inches Average
REC. ENGINE SIZE
NA
FUEL TANK SIZE
NA
LANDING GEAR
Skid
REC. NO. OF CHANNELS
2
CONTROL FUNCTIONS
Rudder and Elevator
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ...... Balsa, Ply, Spruce, Fiberglass
Wing .... Balsa, Ply, Spruce
Empennage .... Balsa and Spruce
Weight Ready-To-Fly .... 27-30 Oz.
Wing Loading .... 7.36-8.18 Oz/Sq. Ft.

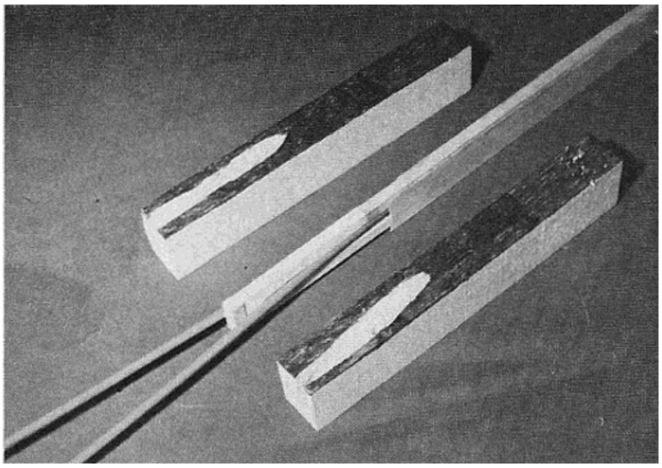
If you use a light hi-start or low winch voltage with gentle back pressure on the stick, the Sundancer will grab a lot of altitiude without a lot of exciting skywriting. For heavy wind conditions, ballast to about thirty-five ounces and watch it penetrate.

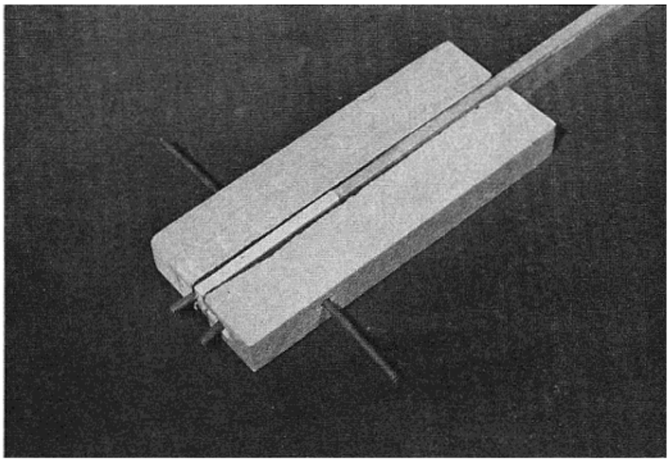


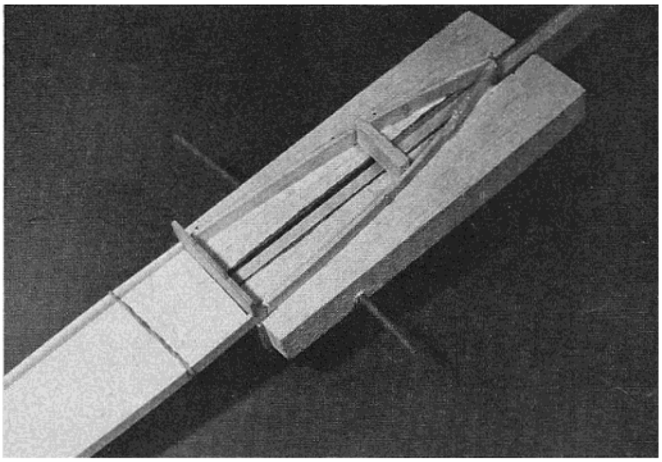


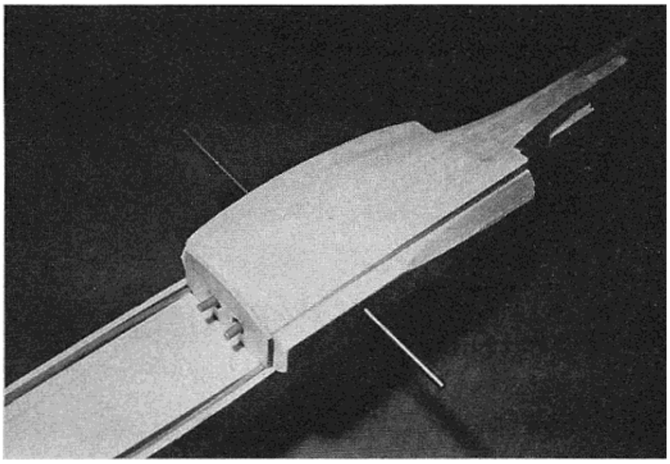




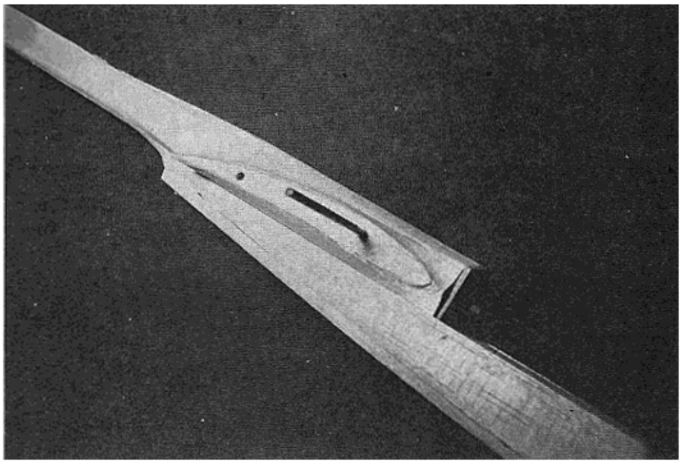


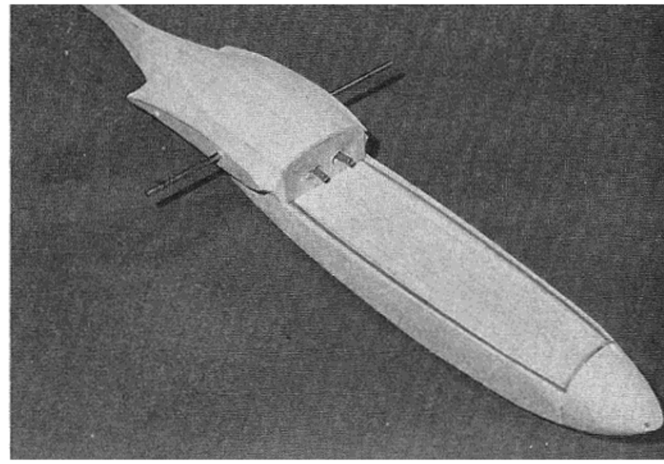




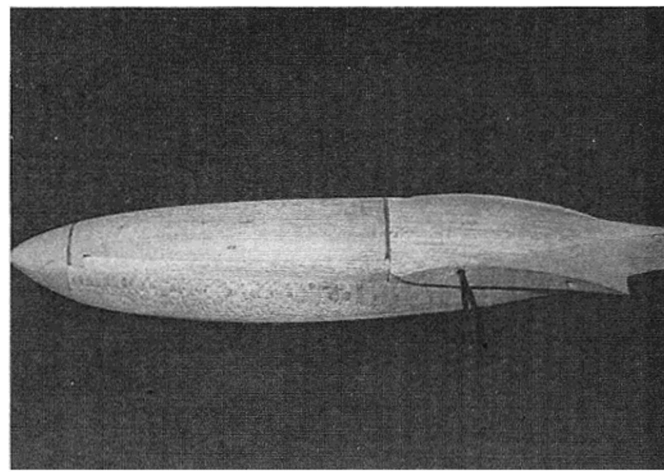


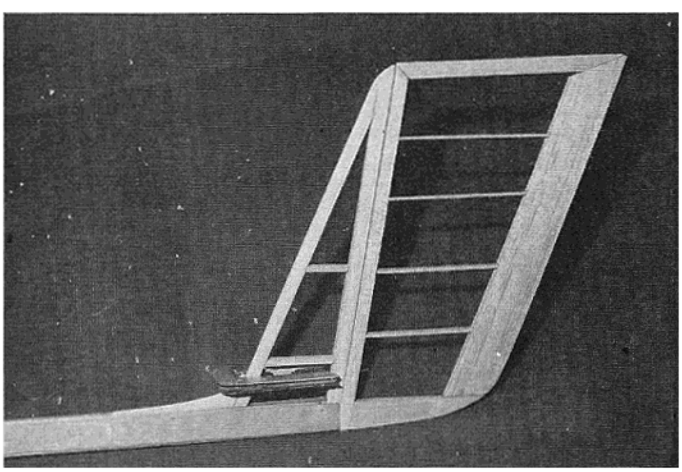
1ST ROW: (L) Boom and fin basic structure. (R) The components that form the fuselage pod. 2ND ROW: (L) Fairing block assembly detail. (R) Control rod relief detail. 3RD ROW: (L) The assembled center section. (R) Bottom view of the pod to the center section assembly. 4TH ROW: (L) A view of the center section carving process. The right side is near completion while the left is still rough.

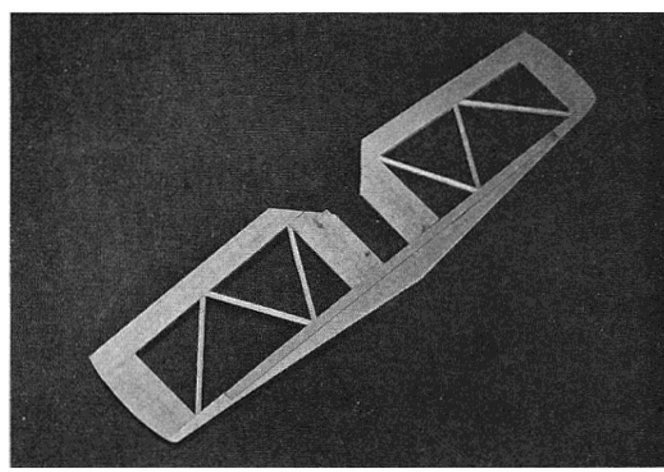


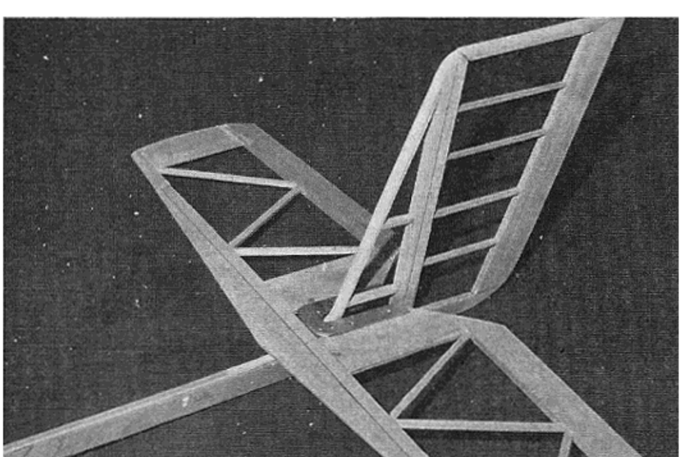


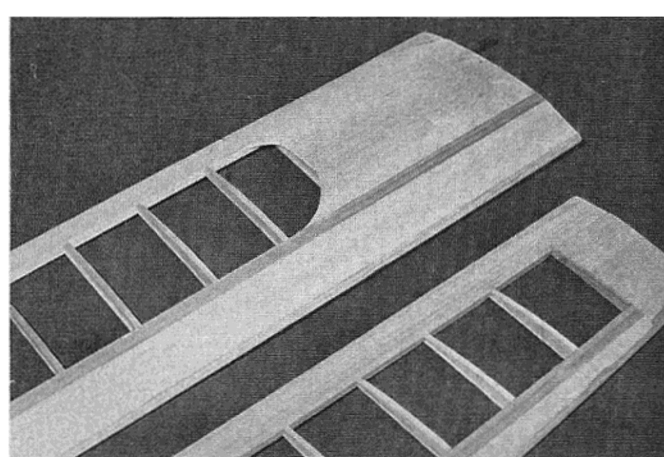
1ST ROW: (L) Incidence detail photo. Use root rib template to outline the airfoil section. (R) View of pod with canopy block removed. Note outer NyRod ends. 2ND ROW: (R) Completed pod with canopy block in place. 3RD ROW: (L) Vertical fin and rudder without horizontal tailplane. (R) Plan view of horizontal stabilizer. 4TH ROW: (L) The completed empennage. (R) Wing tip and root detail.

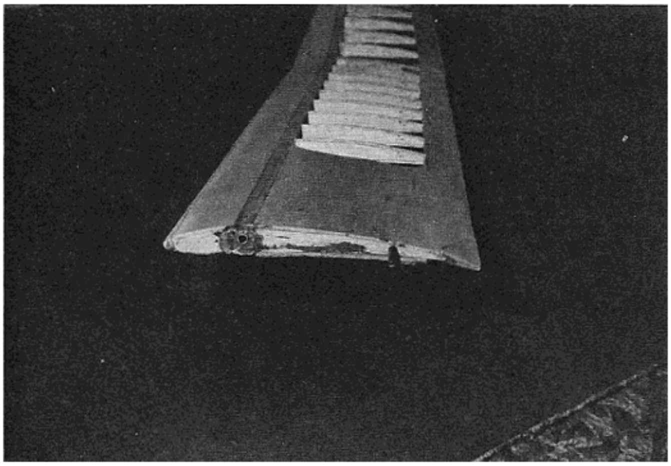
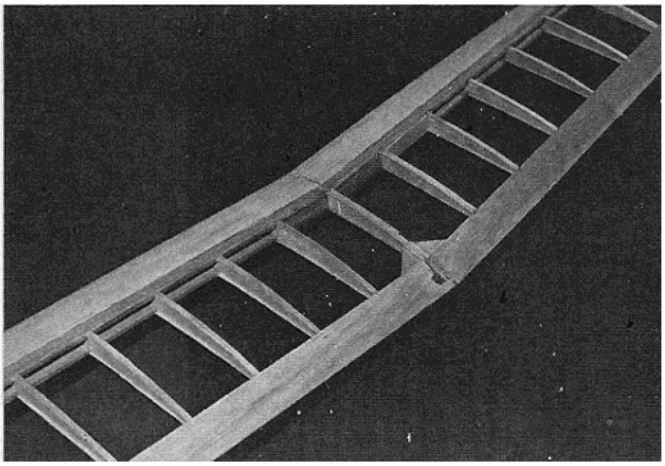
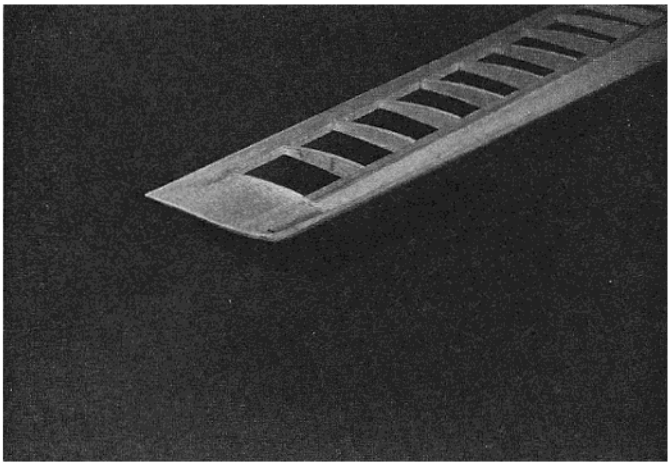
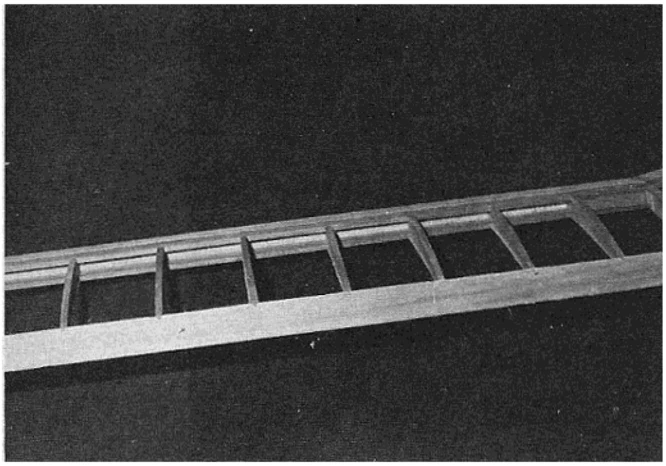
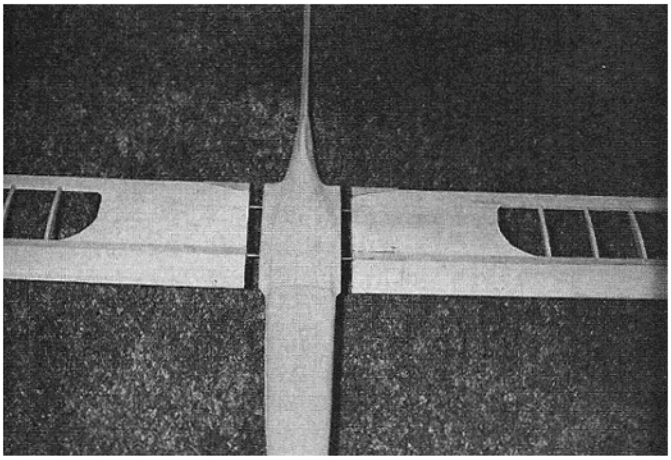
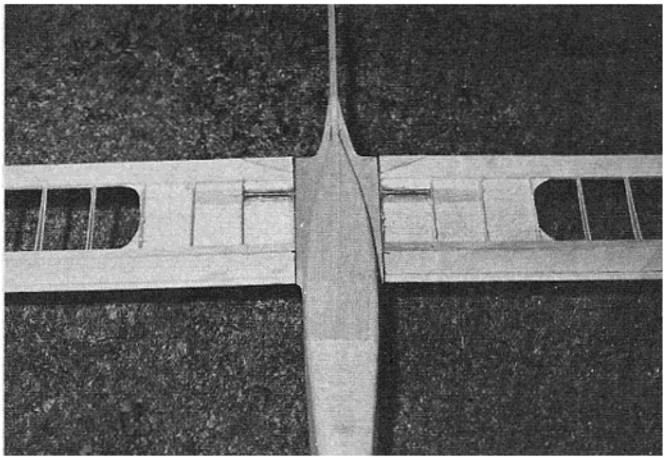




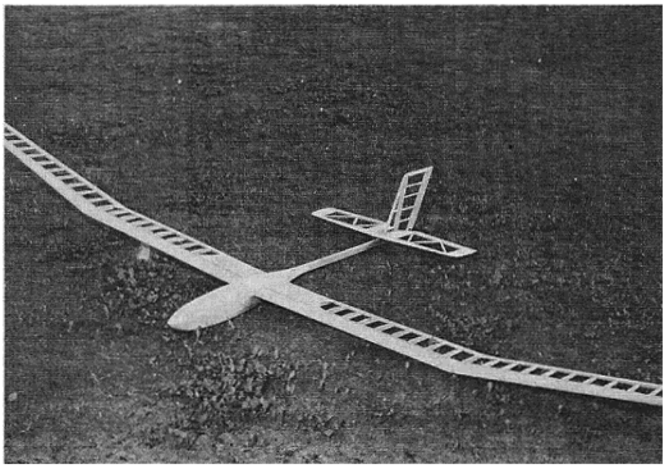






1ST ROW: (L) View of wing root. (R) Detail view of polyhedral joint. 2ND ROW: (L) Wing tip detail. (R) Wing shear web, spar, and rib cap detail. 3RD ROW: (L) Top view of wing joint detail, wing partially inserted. (R) Bottom view of fully inserted wing panels. Bottom sheeting not yet applied. 4TH ROW: (R) The Sundancer, completely built, sanded, and ready for covering.



possible. The two wing panels are built at the same time, one against the other, as a matter of fact. This self-aligning process, if used correctly, turns out beautiful wings very rapidly. So follow the procedure of the text and you should not have any problems.

Fuselage:

The pod and boom fuselage is made up from spruce, plywood and balsa. All the exotic contours are carved from block and are not too difficult. The control rods are internal and contribute to the aerodynamic cleanliness of the total sailplane. The fuselage components should be cut out before starting as the progressive assembly technique uses each succeeding piece as an alignment fixture. Start with the boom by gouging a groove in the inner surface of the 1/4" square spruce. Lay out the right plywood side, then glue on the 1/4" square spruce leaving just enough room for the control rod tubes. Glue on the left boom side and, while it is drying on the plans, make the vertical fin and rudder out of 1/4" square balsa, 1/16" ribs, and trailing edge material. While this is drying, the 1" x 1" x 6" balsa blocks should be hollowed out so the control rods will fit inside where they exit the boom. Then glue these blocks to the front end of the boom. To help keep the alignment true, glue the center section former B to the front end of the boom and blocks making sure the stringer notches are clear of the balsa block.

The radio tray is made from 1/4" sheet with plywood laminated to areas of stress and at mounting points. The radio components are mounted from the bottom so the radio and tray can be slipped in and out with ease and the rats nest of wires can be lost in the bilges. This method of mounting is excellent as the electronics can be moved from one model to another quickly and cleanly. This tray now becomes the alignment fixture for the front fuselage.

The stringers are cut 15¼" long and joined at the rear with some cloth in order to make a hinge. With the stringers together mark off both sides 7" from the hinge end. Place the hinged stringers in the notches on former B with the pencil marks on the former, and the hinge line centered on the boom. Trial fit the assembly a few times and, when it seems right, glue it securely. After the glue is dry, bend the front of the stringers around the radio tray and glue the stringers for former A, glue carefully so that the radio tray is still removable. The 1/8" pod sides cover the lower side of the fuselage from the top of the spar to the bottom. Glue on the pod sides putting the 1/4" square mini former at the bottom edge between the battery and receiver areas.

The 1/4" sheet bottom is put on in the cross grain manner to do two things for you: (1) make for an easy no-bend assembly, and (2) increase the ruggedness of the bottom. For a more bullet proof bottom, laminate a strip of thin plywood on and, when finished, add a hardwood skid. Glue on the nose and wing fillet blocks and temporarily tack on the canopy block. Take the plywood wing root rib, outline the center section block for the correct incidence angle and wing rod holes.

Now grab your wood rasp, gouges, motor tool, knife, sandpaper or what have you, and create those compound curves to your hearts content. The more sleek the curve, the less parasitic drag and the better the performance of the finished plane. After the fuselage is shaped, take off the canopy block and hollow it out to fit your electronics — the line on the plans is a suggested limit. The fuselage is now ready for the control installations, final assembly and finishing.

Wings:

The wing is a conventional "D" tube construction with the spars on the surface in deference to the thin airfoil, while fuselage to wing mating is accomplished with a tube and rod.

Make up one tip and two root ribs out of 3/32" plywood to be used as templates for cutting out the rest of the ribs. Save the plywood ribs and use them in the root rib position. Make 26 constant chord ribs for the center panels and 2 sets of twelve tapered section ribs. Notch the trailing edge for the ribs with a hack saw blade.

The plans are laid out in the manner they are for a reason, so you will get nice straight wings with no hassle. Try it! It works.

Make the two inner panels first by pinning down the trailing edge stock back to back. Take a 1/16" strip and shim the front edge of the trailing edge (T.E.) to the correct angle. Pin down the bottom spar and the leading edge and lay in the ribs making sure they are centered in the T.E. slot so you have room for the cap strips later. Don't try to put on the bottom sheeting now, as it will mess up the T.E. angle and will not stay up close to the front of the ribs. After all the ribs are in place, glue the top spar and the top sheeting on and don't touch a thing until the glue is set. Put the top cap strips on and let them set. Now you can take the pins out, put the front wing webs on and then sheet and cap strip the bottom. Don't sheet the top center section of the wings, the tubes aren't in yet.

Now lay out the outer panels on the plans exactly like the inner panels and before you do any gluing, block the inner panels in place with the polyhedral brace installed and aligning properly at an eight degree angle. Use the tapered shim for the T.E., so you will get the correct washout effect. Then finish the outer panels using the same technique used on the inner panels. You will be surprised how quickly you get two nice wing panels. Now install the wing tubes by butting the two panels together and epoxying in the tube in one piece. The trailing edge of the wing is so thin you can't put tubes of the correct size in, so put the rod right in the wing. Cut and bend the rod before installation and then use plenty of epoxy to fill the cavity from the T.E. to the rod. Put the rest of the shear webs and top sheeting on and then hack saw the wings apart. Presto, perfectly aligned wing panels.

Horizontal Stabilizer:

The stabilizer itself is a Warren Truss design with a spruce spar for strength and a unique hinging and mounting mechanism. To build, cut, pin, and glue right on the plans. The mounting and hinging mechanism serves two purposes — to increase the "crash worthiness" and to make for easy take-down and storage. The stabilizer simply slips on the front at the hinge platform in assembly and, if you have an encounter with an immovable object, it just falls out, hopefully saving servo gears in the process. During normal operation, the stab is held in securely by aerodynamic pressure so no rubber bands or other hold-down paraphenalia is required.

The hinging device is made from 1/32" ply and 1/8" spruce in a sandwich. The hinge is brass tube epoxied in place at the 1/3 chord point relative to the stab when it is in place. The horn can be internal, a la Cirrus, or external for ease of adjustment and/or repair. The external configuration is shown as it is practical for most modelers. Make sure the ply piece with the extra notches in it goes on the bottom of the sandwich for cleanliness and ease of assembly, and that the whole assembly is square when the stab is on. A couple of coats of glass and resin will increase the strength of this critical assembly.

Final Assembly:

Bend up the wing rods as shown on the plans. Make up the brass tubes for the fuselage noting the aft tubes don't go completely through. Trial fit the tubes, rods, and wings until the whole assembly is at the correct angle for incidence and dihedral, then epoxy the tubes in place.

Use your favorite hinge on the rudder. The method I use is the nested tube arrangement. It gives a smooth operating rudder with no binding or air leakage between the fin and rudder. The outer tube is the outer red tube from Sullivan control rods and the inner tube is brass, 1/8" I.D. I like plenty of rudder throw so the short rudder horn is hand made from 3/32" ply. I don't know of any commercially available horn that short.

The elevator horn has a 1" lever arm so it operates quickly also. The Goldberg short horn was used externally on the prototype.

Hinge the canopy block from the front with some MonoKote trim or tape on the inner mating surfaces. Now install control rods, bend up the rod endings and, finally, sheet the fin sides with 1/16" balsa. I saved the fin sheeting to last so that if you opted for the internal elevator horn, you could still do it.

Finishing:

Use your favorite film on the surfaces. Shrink the horizontal stabilizer carefully to avoid warping. Put on and half shrink the bottom first, then put the top on and half shrink. Now play both sides to full shrink gradually countering any twists with pressure and heat.

For the fuselage, you can't beat glass and resin for quick, tough and slick pre-finish. Use a couple of layers of light cloth, instead of medium or heavy cloth, as it goes around the curves better while giving adequate strength. The prototype is finished this way and does not show the wear and tear it has seen. When you complete the glass, resin and paint; the fuselage will look like it came out of a mold.

Weight And Balance:

The original model weighed 26 ounces as it came off the building board which included 7 ounces of radio. This model was not intentionally built light, there are just not many places to put the weight. The model balanced at 45% chord with no lead in the nose and using a small 225 ma battery pack. If you use a 500 ma battery you should get away from using any lead. In any case, start with the C.G. at 30%-35% of chord and go from there. The model will fly with the C.G. as far back as 50% and, while performance will increase, stability will decrease and it will be work to fly. Use the aft C.G. in contests when you want the most out of the model.

Flying:

Make no mistake about it — this model is a light air performer. At just 7 oz./sq. ft. wing loading, it floats on any semblance of lift. If you are used to "plastic wonders" you will have to learn some finesse in your flying, as the model sees every burble and bump. Retain the wings with tape. This may sound "Mickey Mouse" but it serves a dual function. First, the wing joint is tight and, second, the drag of the wing joint is reduced appreciably. To prove it, fly the model without the tapes and watch the performance go down and listen to the increased noise level. I use electrical tape and break the adhesive a little by running it through the fingers twice. This way you don't pull off any paint or wing covering on removal of the tape.

Hand glide the model in still air until you are properly trimmed. Make sure the washout is equal in each wing, not a lot — just equal. If one wing quits before the other, the model eats sky quickly. If you use a light Hi-Start or low wing voltage with gentle back pressure, you will get ample height without a lot of exciting skywriting. For heavy conditions ballast to about 35 ounces and watch it penetrate.

Conclusion:

I hope you enjoy the construction and flying of the **Sundancer.** It is not difficult to make a really high performance model with just a little patience and attention to detail. If anyone has a contest win with the model, I'd like to know about it, since that was the motivation for the design. □

From RCModeler July 1976