

BY JACK HEADLEY

Thermal Soaring Semi-Scale Slingsby

SKYLARK



It all started when I won a giant family size bottle of Titebond at the Northrop Flying Wing Contest. At first I just dumped it on the work bench together with my slightly used wing, and got on with the serious business of hanging up the trophy as well as receiving the usual paeans of praise from the family — “Another dust collector, eh?” and similar tributes to my prowess.

About a week later I finally got around to cleaning up the work bench and I noticed it again, 16 ounces of the finest glue — and it wouldn't keep forever. What a challenge, enough stuff to cement the Queen Mary back together, or at least securely to the dockside! Restraining myself from placing an instant call to the Lord Mayor of Long Beach, I realized that this was a great opportunity to build my fabulous Cirrus-beater, planned for so long. A twelve foot span model, full of intricate ribs and spars, formers and longerons, stringers and spacers — in short, a structure that would make the famous bird cage Maserati look like an orange crate.

So it was quickly to the drawing board and an outline sketch was speedily prepared. After a few preliminary scribbles it was obvious that all those intricate pieces would use up enough balsa wood to enable at least one balsa distributor to instantly retire to Hawaii and live a life of luxury forever. So out they all went — all those beautiful ribs and spars — and a much simpler structure was devised. It then suddenly dawned on me that all this effort was to use up \$2.50's worth of Titebond, which graphically illustrates my grasp of the theory of economics, but by this time the project had gathered too much momentum to be stopped. So, balsa wood was bought, hacked, bent, glued, broken, sanded and doped. The results can be seen from the accompanying photos. Don't be put off by the size, it's an easy model to build, and comes apart into enough pieces so that transportation is no problem. Try one if you're a sailplane fan, it's a lot of fun.

CONSTRUCTION

It's always best to begin with the bits you don't like so that when most of the construction is over you end up making the bits you do like, and this gets all the building done a little quicker. So, now go to whichever bit you always put off until last, which may or may not be:

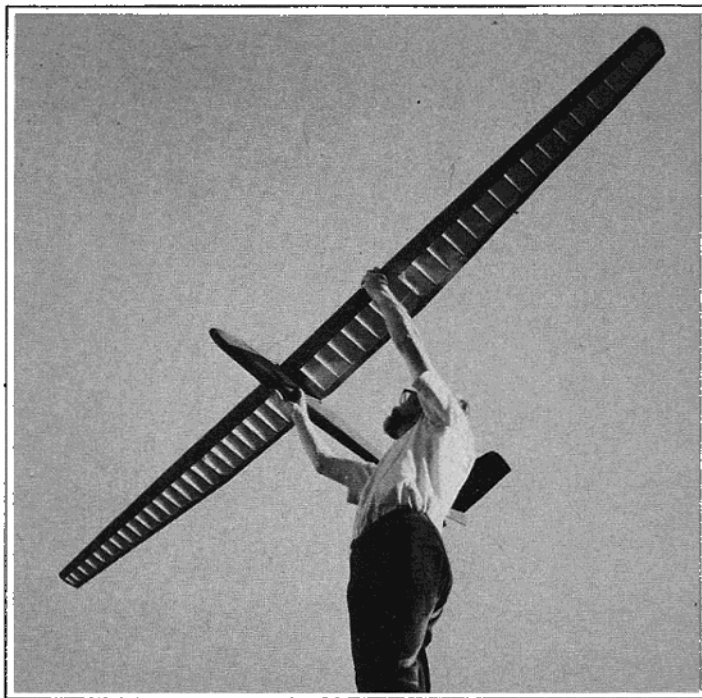
THE WINGS

By a careful study of the plans and photos you will have realized that the wings are made in three separate

pieces, the center section and the two tip panels, each four feet long. This system was chosen so that the wing dihedral joint could be built solidly into the center section, and also to allow an easy hook-up for spoilers, if required. (More on this later). All three wing pieces are, however, built in a similar manner.

OUTER PANELS

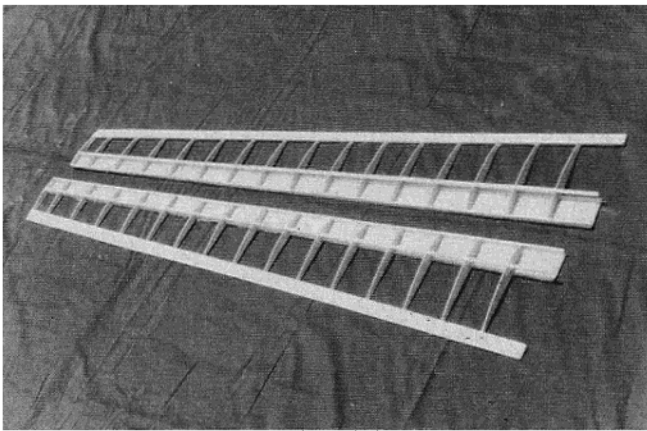
Pin down onto the plan (which should have been covered with waxed paper), the trailing edge strip and the lower leading edge sheeting. Cement the lower 1/8" x 1/4" spar to this sheeting making sure that all these spars are hard balsa. The lower cap strips, made from 1/4" wide pieces of 1/16" sheet, are then cemented into place. The 1/8" sheet leading edge piece is also cemented to this sheeting. While all this is drying the wing ribs can be made. A simple method for producing a set of tapered ribs is to cut templates of the tip and root ribs as shown on the plan, and then a set of blanks for the intermediate ribs. Pin all these together, with one of the template ribs on either side of the block, and then sand



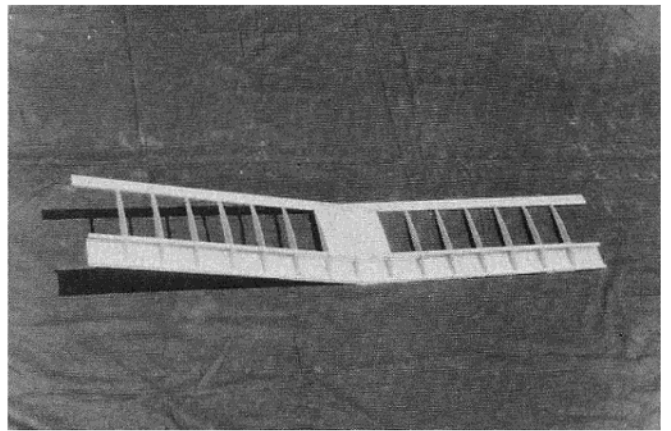
down the blanks until the templates are reached. Don't unpin the block yet, as this is the best time to cut the spar slots. After cutting the slots the block can be taken apart, and the edges of the ribs sanded clean. However, we've included a sketch of all the various ribs if you like to cut them out individually. Cement down all the ribs except the root ribs R2, which are added after the wing joining boxes are made. Install the upper half of the main spar, which is also hard balsa, and then the spar webs. These webs are 3/32" sheet at the root,

1/16" sheet between ribs R3 and R8, and then 1/32" sheet up to rib R12. No web is required past this station. Between ribs R2 and R3 the 3/32" hard balsa webbing is used on both sides of the spar, automatically producing the box for the wing joiners. Now add the root ribs which are in two pieces. Sand the 1/8" sheet leading edge to the airfoil profile then cement into place the upper leading edge sheeting, followed by the cap strips on the upper parts of the ribs. These cap strips should not be omitted, as they give considerable torsional stiffness to the wing.

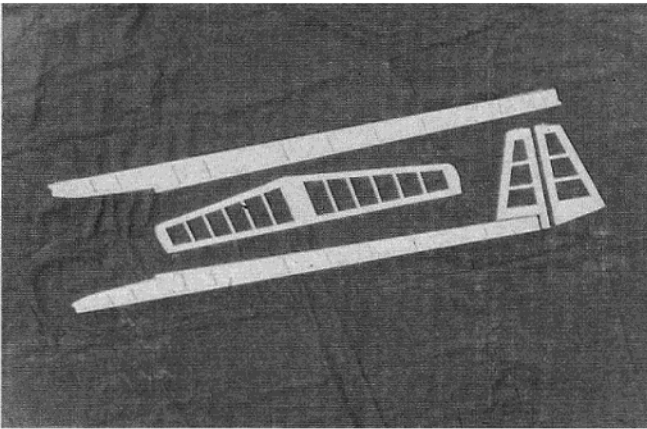
The framework can now be removed from the plan and the leading edge region cleaned up in preparation for installing the 3/16" sheet leading edge strip. This piece should be reasonably hard, as it's going to take a lot of knocks, especially during landings into heavy brush. Attaching the wing tip, made from block balsa completes the outer wing panel construction.



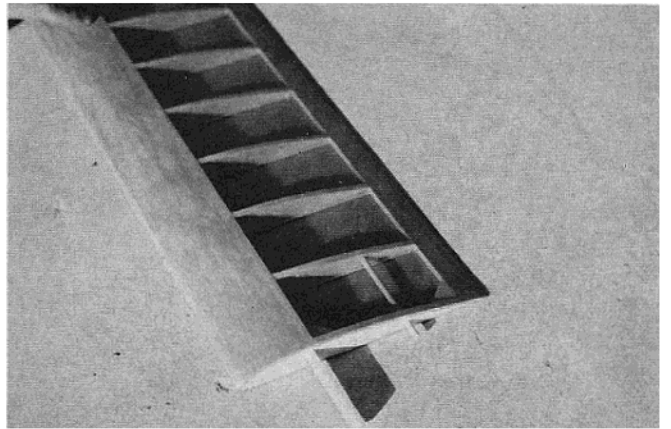
The basic outer wing panels ready for top sheeting.



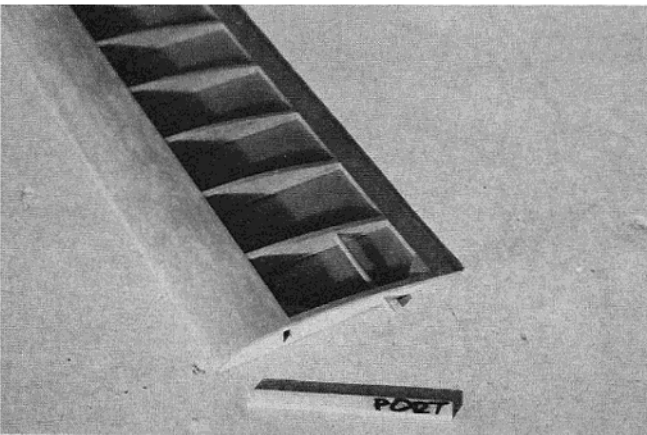
The center wing panel ready for top sheeting.



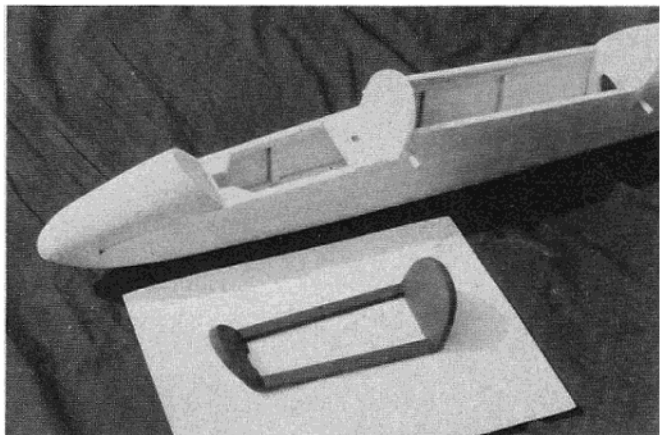
Basic fuselage sides and empennage framework.



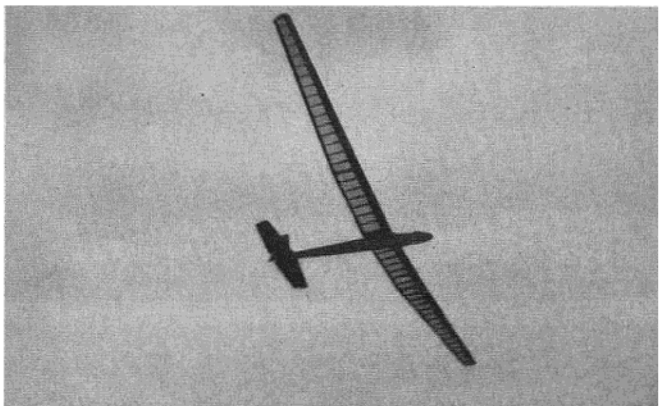
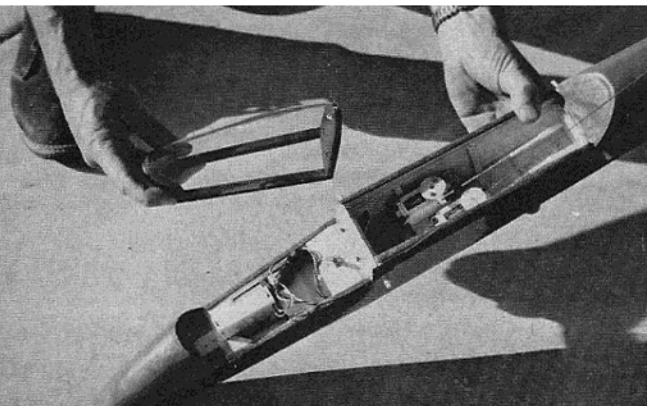
A close-up view of the wing joint.



ABOVE: Detail view of a wing panel and joiner. BELOW: Completed canopy and radio installation.



ABOVE: Cockpit area and canopy frame. BELOW: The Skylark in flight.



CENTER SECTION

This is built in a similar manner to the outer wing panels. It is initially built flat, and in one piece, then cut in the middle and cemented back into place at the correct dihedral angle. Begin construction by pinning down the trailing edge strip and the bottom sheeting. Cement into place the lower spar, the lower cap strips, and the 1/8" sheet leading edge piece as before. All the R1 ribs are glued into place next, followed by the upper spar, and the webbing between the spars. The wing boxes are made by cementing 3/32" hard balsa sheet, grain running vertical, on each side of the main spar ends. The R2 ribs at these locations are now installed, together with the 3/16" dowels, which help to locate the outer wing panels. The wing is now cut in the middle, and the wing joiner W3 cemented into place. After this has dried the R2 ribs at the center are glued in, and then the remaining leading edge sheeting and the center section sheeting is attached. Glue into place the 3/16" x 3/8" leading edge, the upper rib cap strips, and the center section is finished, except for the wing fairing. This cannot be made until the fuselage is completed. When the fuselage is available, pin it to the center section, with a scrap of wax paper separating the two. Cement into place W1, and then W2, which can be pinned temporarily to F3. Now the fairing is attached. (It's easier to bend if you first soak it in hot water.) Add the 1/16" ply re-inforcing pieces when this sheeting is completed.

WING ASSEMBLY

The wings are joined by hardwood strips 1/4" wide, fitted into the boxes provided at the end of the wings. These joiners must be quite a tight fit, as any sloppiness here will result in too much wing bending at these joints during flight. The dowels provide additional alignment for the outer panels. When the model is being prepared for flight make sure the wing center section and the outer panels line up correctly, then run a couple of turns of masking tape around the joints. This provides a little more stiffness to the joints and, incidentally, prevents the wing parts from separating in flight.

TAIL ASSEMBLY

The tail assembly is simply constructed. The fin, rudder, and horizontal stabilizer are made from 3/16" sheet balsa strips, with ribs from 3/16"

square balsa. Choose some good springy wood for these components. The elevators are from 1/8" sheet balsa joined by a strip of 1/4" x 1/8" hardwood. Solarfilm hinges were used on the original, after covering was completed. Add scraps of 1/32" ply locally where the control horns are attached for added strength.

FUSELAGE

Begin by cutting out the two basic fuselage sides from two similar sheets of medium hard 3/32" balsa, using the pattern shown on the plan. Mark the locations of the various frames and 3/16" square strips onto these sides, and then glue the edge strips, spacers, and sheet pieces into place. When these have dried, join the two sides by means of frames F2 and F10 initially, followed by F1 and F9. Note that the fuselage cross section is tapered, the bottom having the smallest width. Now insert the remaining spacers and the 3/16" sheet in the nose region. Sand all over and particularly the top and bottom surfaces, which should be sanded flat. Now cement into place the first of the 1/4" sheets for the fuselage bottom, after which the remaining two 1/4" sheets, roughly carved to shape, are glued down. Make the nose blocks, and add these, plus the 1/4" sheet wing rails, then frames F3 to F8, followed by the turtle deck sheeting. This can easily be bent to shape if it's first soaked in hot water for a few minutes.

You are now ready to do lots of sanding, especially on the fuselage bottom. Sand away until fair curves are obtained, taking care not to remove too much of the fuselage sides. When satisfied (the plan shows how the finished cross sections should look) cement the fin and horizontal stabilizer in place and drill the holes for the wing attachment dowels. The latter are not installed until after the covering is completed. The skid, if required, is also attached after the covering is finished.

CANOPY AND FRAME

The framework for the canopy is made after the fuselage is completed, but not covered (this way you don't ruin a good paint job). Make the two end frames, C1 and C2, by pinning into place roughly shaped pieces of 3/16" sheet. Sand these to the local contour of the section and then cement onto the rails, which are also 3/16" sheet. This is also best done on the model, using wax paper to separate the fuselage from the canopy framework. When all this has dried remove

the wax paper, give a final sanding, and then paint. The original was sprayed matte black. The celluloid canopy can now be shaped, the original being cut down from a SIG 14" teardrop shape. Cement into place and do the final trimming, again on the fuselage. A couple of stubs of dowels protruding from Frame F2 locate the aft end of the canopy, and the front end is latched down with a heavy pin and two scraps of brass tubing, one in C1 and the other cemented into the nose block.

COVERING

The original was covered with Solarfilm; transparent yellow on the wings, and solid red on the fuselage and tail assembly. This was the first model on which I'd tried this covering material, and it proved very satisfactory.

RADIO

Radio installation is quite conventional, sufficient space being provided for any modern two servo system. On the prototype the servos were fitted in the space below the wing, and the receiver and battery pack in the cockpit region. The servos were mounted with servo tape to a false floor, consisting of 1/32" ply cemented to a scrap piece of hard 3/32" sheet which, in turn, was cemented to the local spacers. Be sure to give the plywood a couple of coats of clear dope for a better base for the servo-tape. If the larger type of servos are used, remove the spacers in this region and cement the plywood directly to the 1/4" sheet fuselage bottom. Gold-N-Rods were used to hook up the servos to the controls. The receiver and battery fit in the cabin area. Cut a suitable hole in Frame F2 to pass the wire connectors through. Pack around the battery and receiver with foam rubber, but do not make the final installation until after the model is balanced.

FLYING

Ballast the model so that the Center of Gravity is close to the main spar. Check the rudder deflection which should be at least 30° each way, and also the elevator deflection which should be 20° up and down. The O.S. servos used in the original wouldn't give the required rudder travel, so a bigger servo wheel was constructed out of 1/8" ply, and bolted to the top of the existing control. It's always better to have a little too much control than not enough. Think of the embarrassment of launching a new model and then watching it sail away into the

distance totally unresponsive to the controls!

Try the first flights on a reasonably calm day as the model will fly quite well in very light wind conditions, and also it's quite a big model to hold until you get used to it.

The prototype showed no peculiarities in flight. It flies quite slowly when compared to smaller models, loops well, and has a very flat spin (the latter being discovered accidentally after a mid-air with a Cirrus).

LIFT SPOILERS

After watching landing techniques at the local glider slope, there seemed to be a need for a little more controlled method of making landings, or at least reducing the speed of contact with the ground. This, as has already been mentioned is one of the reasons for making the one piece center section so that a set of spoilers could be investigated, and hopefully a better landing pattern developed. □

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