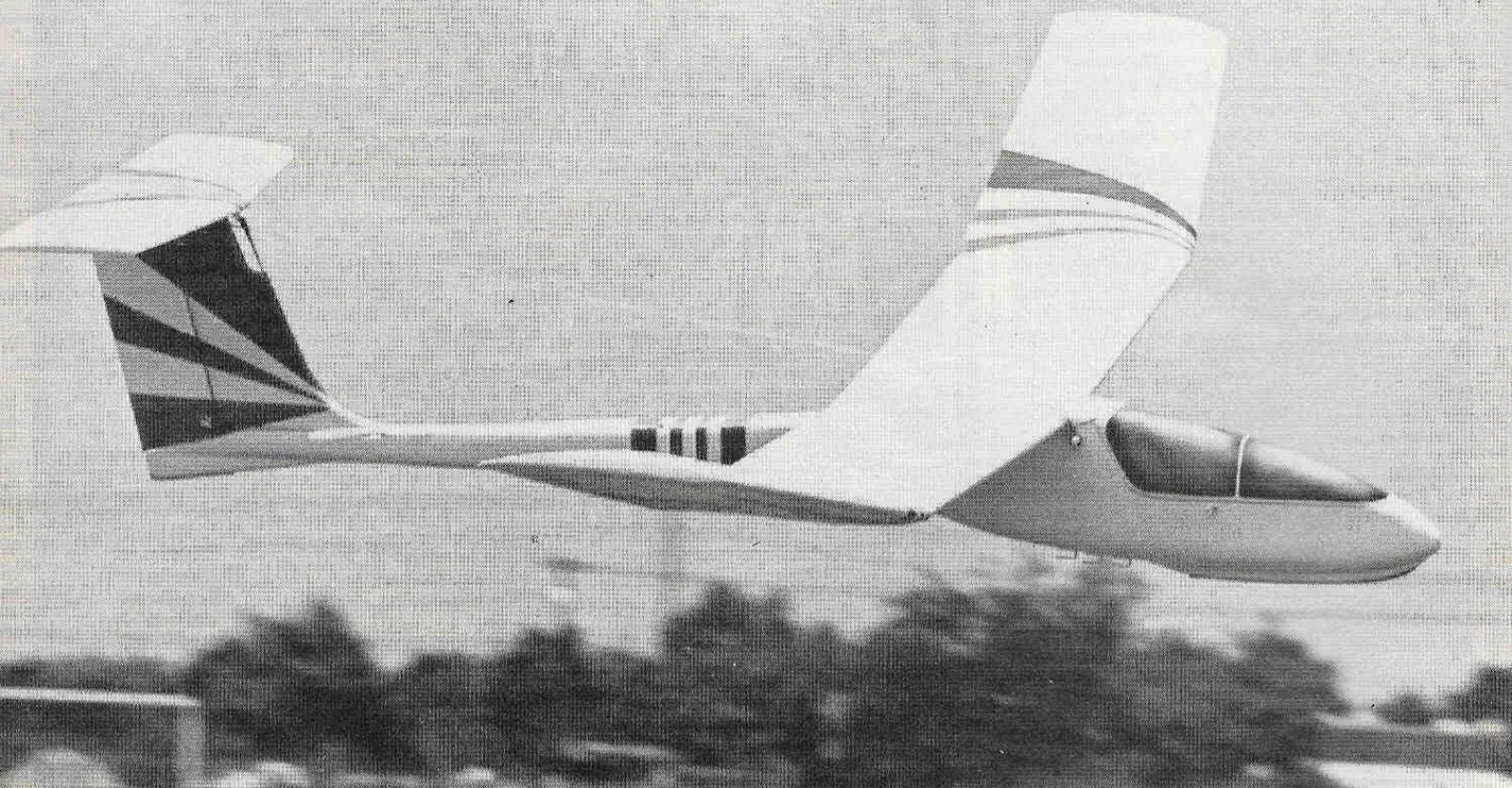


The Hightailer

by Howie Applegate



A 727-like tail and a three piece wing add character to this wooden R/C soarer.

Maybe you've always wanted to build a sailplane, or perhaps you're tired of the run of the mill kits. Then you have arrived. Hightailer is here!

This ship may appear complicated to build, but it is quite straightforward. Probably this ship should not be a first airplane, but it certainly is not too challenging to the careful builder.

Hightailer may be somewhat unique by the fact that the wing is in three pieces; not the usual two, and that it is attached to the fuselage with rubber bands. This method of attachment gives you enough "give" to handle the rough landings we all have.

Wing Construction

The wing is perhaps the most time-consuming part of the airplane, so let's start with it. There are 52 wing ribs to slice out. I usually do this while watching television; that way I don't have to pay too much attention watching or cutting. After the ribs are cut out, proceed to cutting the plywood cap ribs, dihedral braces, and spar boxes. If you are going to use either the $\frac{1}{8}$ " aluminum or $\frac{3}{16}$ " thick plywood joiner, cut them out (carefully) at this time. After this mountain of parts has been fabricated, it is time for actual construction to start.

Begin by laying the wing plan on a flat board, large enough on which to build a

center-section panel. (I used a piece of $\frac{3}{4}$ " plywood about 12"x30"). Cover the plan with waxed paper or Saran Wrap and pin down the $\frac{3}{16}$ "x $\frac{3}{8}$ " lower spar. The $\frac{1}{16}$ "x $1\frac{1}{2}$ " lower trailing edge is next, but block this up with a piece of $\frac{3}{16}$ " sheet before pinning to the plan. The $\frac{1}{4}$ "x $\frac{3}{8}$ " leading edge may be added now, or added after the ribs are installed; but this must be blocked up $\frac{3}{16}$ " also. Now add all the W-1 ribs except the two outer and two inner ones. Glue the lower spar box cap to the top of the lower spar. Add the side spar box pieces now, but make sure they are the same height as the joiner. Bevel the outside edges, as shown, and tack glue them to the lower spar cap. Be sure to use the joiner as a spacer during the tack gluing operation; also, add the upper spar cap at this time. Next, glue the $\frac{1}{16}$ " ply dihedral braces D-1 to both sides of the lower spar, and D-2 to back of the leading edge. Cut the four remaining W-1 ribs to fit the spar box and the dihedral braces and glue them into place. Use the rib setting templates for the center rib and outboard rib.

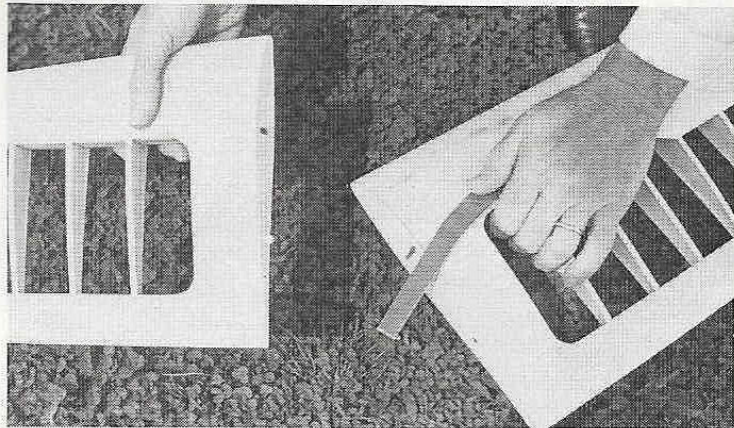
This is the time to add the $\frac{1}{16}$ "x $5\frac{1}{16}$ " shear webs to the top of the lower trailing edge. The grain of these shear ribs runs spanwise. After the glue is dry, sand a bevel on the top of the lower trailing edge and install the $\frac{1}{16}$ "x $1\frac{1}{2}$ " upper trailing edge. The $\frac{3}{16}$ "x $\frac{3}{8}$ " upper spar should be installed now. It may be necessary to relieve the bottom of the upper spar to fit the spar box. The $\frac{1}{16}$ " shear webs may be added at this time. The grain of these shear webs to be vertical. The left half of the center-section can now be built. The plan shows the position of the spar of the left panel in phantom lines. Build the left panel the same as the right, but

use the right to attach it on to as it already has the dihedral braces secured to it. After the two center panels are built, cut a $\frac{1}{16}$ " wide slot through the two center ribs at the T.E. and add the $\frac{1}{16}$ " ply dihedral brace D-3.

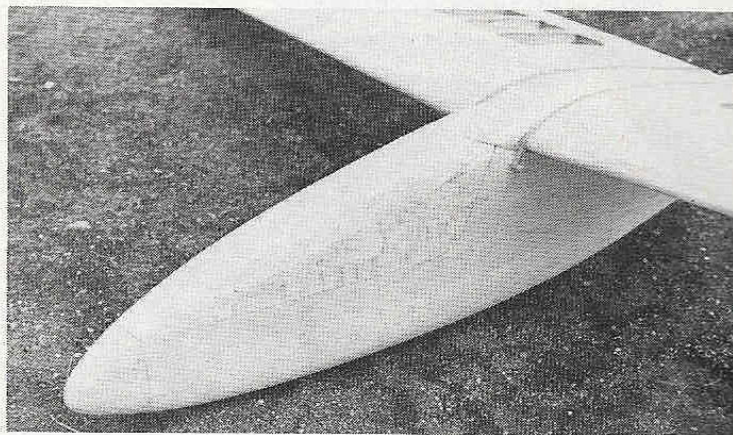
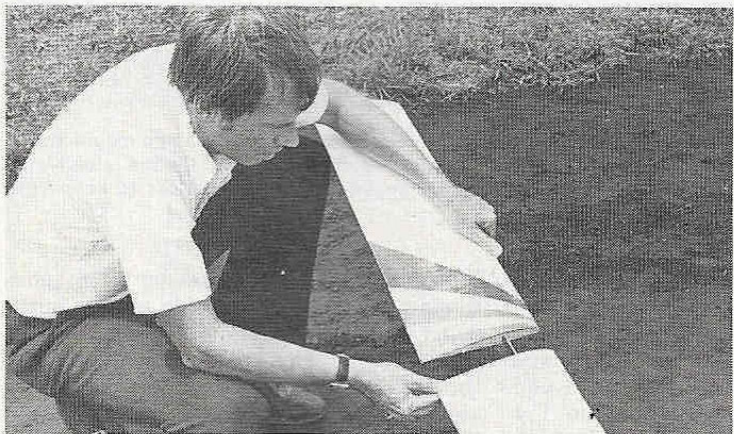
The outboard panels are built much the same as the inboard panels, except these panels have $\frac{1}{4}$ " washout in them. Also, the outer panels are tapered so the spar has to be blocked up $\frac{1}{4}$ " at the tip. Study the diagram on the plans as a guide for this setup. Use the joiner to build the spar box (tack glue only) and a piece of wood the same thickness as the joiner to align the outboard panel with the center-section. The four spar boxes now can be epoxied. Try to avoid getting epoxy inside the boxes. If you do, it can be removed with a small flat file.

Once the center-section and outboard panels are built, add the $\frac{1}{16}$ " sheeting to the bottom of the wing. Cut out the $\frac{1}{32}$ " ply rib caps (4 required). These ribs are to be the size of the wing section after planking, so cut them a little over size. They will be sanded to shape after they are glued in their final position. Tack glue the caps to the end W-1 ribs (tiny dots of glue, please, as these ribs should be removed before planking the top of the wing). They should be cut out to accept the wing joiners and drilled for the $\frac{3}{16}$ " dia. alignment dowels. Install the $\frac{3}{16}$ " alignment dowels in the center panels; use $\frac{1}{8}$ "x $1\frac{1}{2}$ " balsa for this. Glue a scrap piece of $\frac{1}{32}$ " ply to the inside of the outer panel W-1 rib.

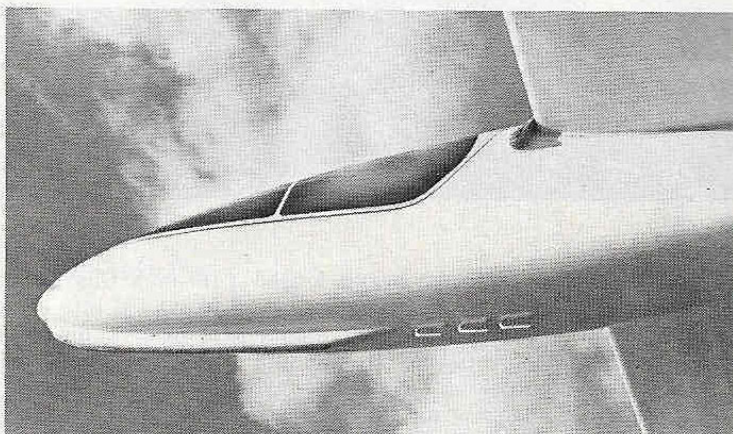
Bevel the upper leading edges and upper outboard spars, as shown on the plans. Remove the $\frac{1}{32}$ " ply rib caps and add the



The aluminum joiner slides into spar boxes. Dowel keeps panels in line. **Below:** Outer wing panels plug on. Scotch tape secures them in position. A gentle, snug fit. Leading and trailing edge must line up accurately.



Prior to covering. Wing holds canopy down, dowel keeping it positioned. **Beneath:** A choice of tow hook positions and the nose skid to slide upon. Choose forward hook for breezy weather, the rear for calmer conditions.



$\frac{1}{16}$ " upper wing planking sheets.

Building Tip: A strip of $\frac{3}{16}$ " or $\frac{1}{4}$ " sq. balsa may be used to hold down the planking on the leading edge and upper spar while the glue dries. Pin through these strips and planking directly into the L.E. and spar. These strips will eliminate the rippling of the sheets and hold them flat while the glue dries.

Glue on all the upper and lower capstrips and add the $1"x1\frac{3}{4}"x5\frac{3}{4}"$ soft balsa tip blocks. Trim and sand the planking on the center-section and inboard outer panel W-1 ribs. Glue the $\frac{1}{32}"$ ply rib caps and trim them to the airfoil contour.

Tail Assembly

The horizontal tail is a flying tail or stabilvator type with a flat undercambered section. The stab is designed to be light, yet strong. It has no full span spar, only a short center spar to attach the hinge to. Start by pinning the $\frac{1}{16}"x\frac{3}{4}"$ and $\frac{1}{16}"x1"$ lower leading and trailing edge pieces in place. Next, add the $\frac{1}{4}"$ square upper L.E. and the $\frac{1}{8}"x\frac{1}{2}"$ tapered stock to form the upper T.E. Now add the $\frac{1}{16}"x1"$ lower tips, $\frac{1}{8}"$ splice doubler and $\frac{1}{8}"$ thick spar, with the $\frac{1}{32}"$ ply spar doublers attached to both sides. The ribs can be glued in place at this time; also the $1"x4\frac{1}{4}"x\frac{3}{8}"$ soft balsa tips and the scrap balsa filler block to seat the elevator horn. Cut two pieces of $\frac{5}{32}"$ O.D. brass tubing $\frac{5}{8}"$ long and bind to the bottom of the spar as shown on the plans. These two pieces of tubing must be in line; to insure this, insert a piece of $\frac{1}{8}"$ dia. music wire or a $\frac{1}{8}"$ dia. dowel into the tubes before binding. Smear the thread bindings with epoxy, making sure

none enters the inside of the tubes.

Before adding the $\frac{1}{16}"$ thick center sheeting to the stab, make sure you have trimmed the filler block to the proper contour and cut the notches into the spar and plywood doublers. These notches should be $\frac{1}{4}"$ from each side of the center line of the stab; make them about $\frac{1}{16}"$ wide and about $\frac{1}{16}"$ deep. Now add the sheeting and capstrips. Note only the tops of the stab ribs get capped.

The vertical tail is needed to build the fuselage so it may as well be done now. The flex cable used to actuate the stabilvator runs up the leading edge of the fin so the fin leading edge is built up of several pieces. Start by cutting out the $\frac{1}{32}"$ thick plywood fin spar doublers. Glue the doublers to the built-up spar made of one piece of $\frac{1}{16}"x\frac{1}{2}"$ balsa and two pieces of $\frac{3}{16}"x\frac{1}{2}"$ balsa. The top and bottom of the fin are made up of similar laminations. The leading edge is made of one piece of $\frac{1}{8}"$ sheet and two pieces of $\frac{3}{16}"$ sheet; note that the $\frac{1}{8}"$ sheet is set back to allow the cable sheath to be installed. The leading edge also gets capped; both sides with $\frac{1}{32}"$ thick balsa, and the front of the leading edge with $\frac{1}{32}"$ thick balsa, cross-grained.

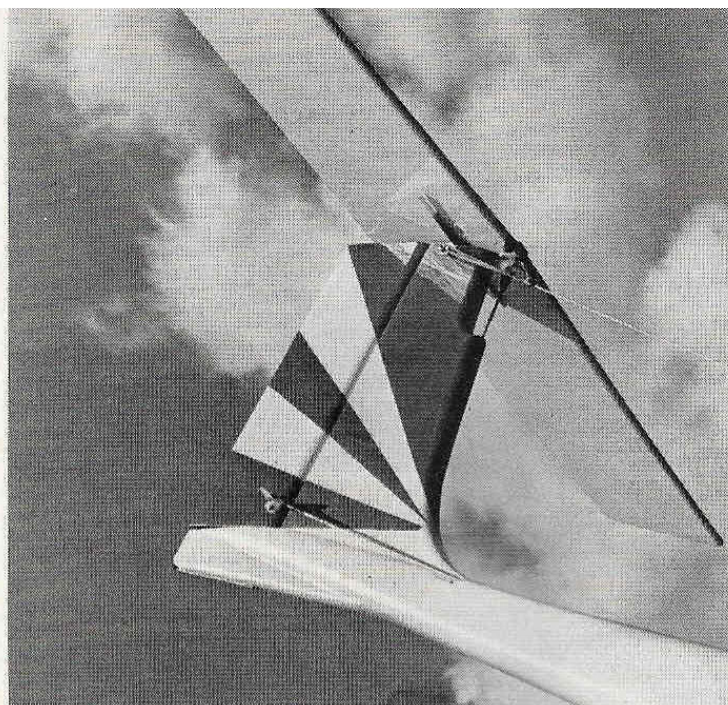
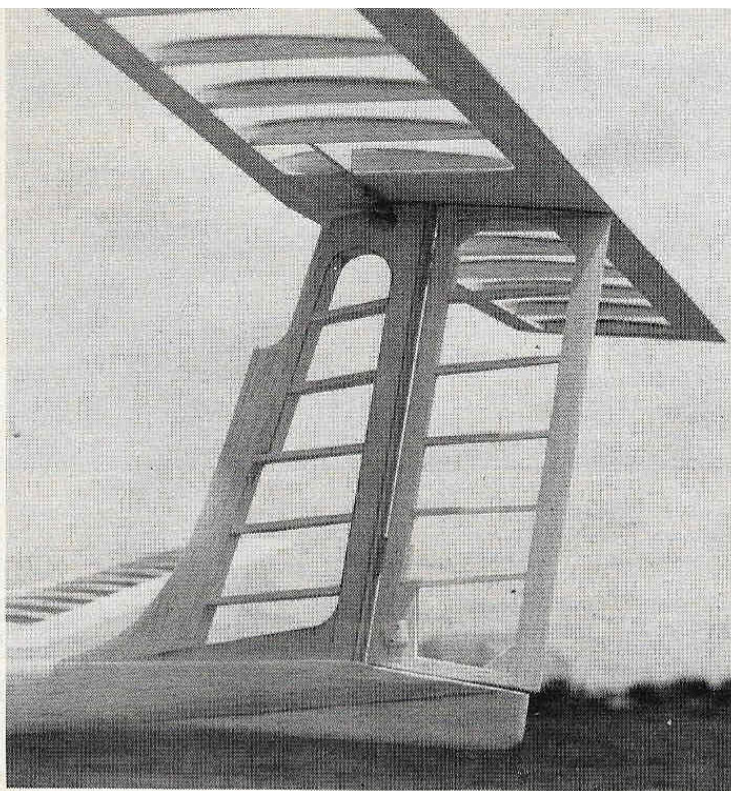
The rudder spar is $\frac{1}{2}"x\frac{3}{8}"$ balsa; the trailing edge is $\frac{3}{16}"x\frac{1}{2}"$. Both the fin and rudder use $\frac{1}{8}"x\frac{1}{2}"$ balsa ribs, except the top and bottom rudder ribs are $\frac{1}{4}"x\frac{1}{2}"$ balsa. The fin and rudder may be built directly over the plans. Don't forget the $\frac{1}{8}"$ thick balsa gussets and the $\frac{1}{2}"$ thick filler block for the rudder horn. Do not sand any airfoil shape into the fin yet, but, sand the sides flat, as it is necessary to be used as an integral part of the fuselage.

The Fuselage

The fuselage is typical slab construction, consisting of $\frac{1}{8}"$ sheet sides and $\frac{1}{4}"$ sheet top and bottom. Start by cutting out F-1 and F-2 from $\frac{1}{8}"$ thick ply; then F-3, F-4, F-5 and F-6 from $\frac{1}{16}"$ thick ply. F-7 and F-8 are made of two thicknesses of $\frac{1}{16}"$ balsa, cross-grained for strength. Next will be the $\frac{1}{32}"$ thick ply triplers for the nose, and the $\frac{1}{32}"$ thick ply doubler for the tail section. Cut out the $\frac{1}{8}"$ balsa sides; note that the splice is near the nose between the canopy and wing. If you use 48" long balsa, you won't have to splice. Add the $\frac{1}{16}"$ thick balsa doublers. These run from behind the trailing edge of the wing, all the way forward to the nose block. I prefer to use a contact type cement for securing flat sheets together, but Tite Bond is acceptable too. Make sure the sheets stay flat while the glue is drying. Secure the $\frac{1}{32}"$ ply triplers and the $\frac{1}{2}"$ wide and $1\frac{1}{4}"$ wide $\frac{1}{32}"$ ply triplers. Also the $\frac{1}{32}"$ ply doublers at the tail section.

Take the vertical fin; it should already have both sides sanded flat. Glue the two fuselage sides to each side of the vertical fin; make sure both fuselage sides are aligned because 10 minutes from now it will be too late. Start gluing in the bulkheads now, starting with F-8 and working forward. Glue in the bottom $\frac{1}{4}"$ balsa triangular stock and the $\frac{1}{4}"$ sheet balsa belly.

This is probably a good time to make your initial servo and control rod installation. The stabilvator cable and sheath runs down the inside of the fin leading edge and then run toward the left or right servo. The rudder pushrod runs down either side



Stabilizer sits atop the fin. Note antenna hooked to hinge mount screw.
Left: A flex cable fits inside fin leading edge to fly the stabilizer.
Below: The structure ready for covering. Stab is sparless to keep light.

of the fuselage to its proper servo. I used Golden Rods in my airplane, so I glued the outer sheaths inside the ship and pulled out the inners so I could do my sanding without anything sticking out in the way.

The $\frac{1}{8}$ " thick balsa wing saddle quadrupler can be backed up with a piece of $\frac{1}{32}$ " balsa to fill the space between it and the $\frac{1}{16}$ " balsa doubler. Cut the canopy sides of $\frac{1}{8}$ " thick balsa and add the $\frac{1}{16}$ " thick balsa doublers, these are to be cross-grained. The canopy sides may be glued to the $\frac{1}{4}$ " thick balsa bulkheads C-1 and C-2. These canopy sides should nest on the $\frac{1}{32}$ " ply fuselage triplers. Outside edges of the triplers should be rounded slightly with sandpaper and the inside canopy doublers may need a slight taper to help both parts mate.

With the canopy sides in place, glue on the $1" \times 2\frac{1}{2}" \times 11"$ balsa canopy top block and the three belly blocks, then add the triangular scrap balsa block to the top of F-1; this piece must be backed up with a $\frac{1}{32}$ " thick ply strip. Drill a $\frac{1}{8}$ " dia. hole

through this block on a slight angle and about $\frac{1}{2}$ " into the canopy block. This hole is for a $\frac{1}{8}$ " dia. dowel, which keys the canopy into the nose. After all the fuselage blocks are in place, sand the forward and canopy filler blocks flush with the F-1 bulkhead. Now glue the $1\frac{1}{2}" \times 2" \times 2\frac{3}{4}"$ balsa nose block in place. Try to avoid getting glue into the $\frac{1}{8}$ " dia. dowel hole.

Miscellaneous Parts

This is probably the time to make the miscellaneous parts, as they are needed before final finishing is complete. First, let's build the sub-rudder and nose skid. Both are made of $\frac{1}{8}$ " balsa, the skid, two thicknesses, the sub-rudder, three thicknesses, cross-grained. The sub-rudder may be glued to the fuselage so that it can be sanded with the fuselage.

The stabilizer hinge is made of a piece of $\frac{5}{32}$ " dia. brass tubing about $2\frac{1}{4}"$ long; the side plates of .015 or .020 thick brass. Do not cut the side plates to size yet; drill them first (together), then trim to size.

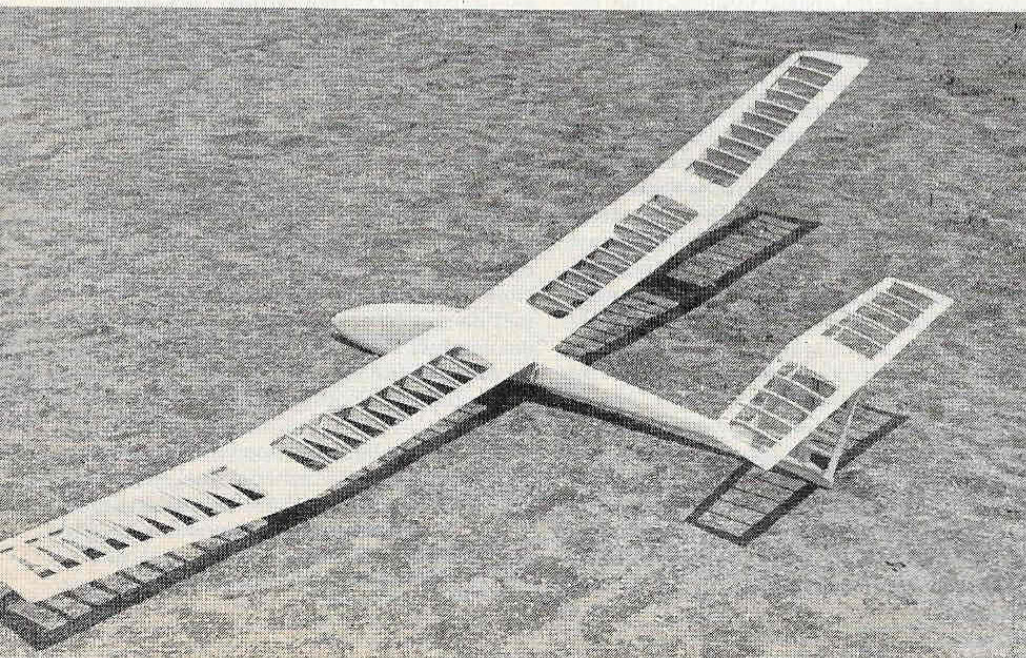
This way you may make errors in positioning the holes on the side plates, but it won't effect the function of the part. Take a piece of $\frac{1}{2}"$ thick balsa and drill it to suit the hole positions of the side plates. Now assemble the hinge on the balsa. Do not tighten the screws much as you may squeeze the balsa too much and the hinge won't fit the fin. Solder the tube to the side plates and make a trial fitting on the fin. The fin must be notched to accept the hinge tube. Do this with a small rat-tail file. Bend the tow hooks of $\frac{1}{16}"$ dia. wire; insert them into a piece of $\frac{1}{8}"$ thick plywood, then bind and epoxy the hooks to the plywood. It will be easier to carve and sand the belly without the hooks in place, so don't install them until after covering. You also may want to bend the $\frac{1}{16}"$ dia. wire nose skid and .045 dia. wire tailskid at this time.

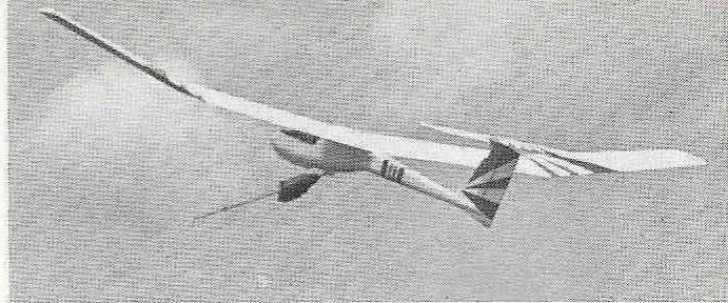
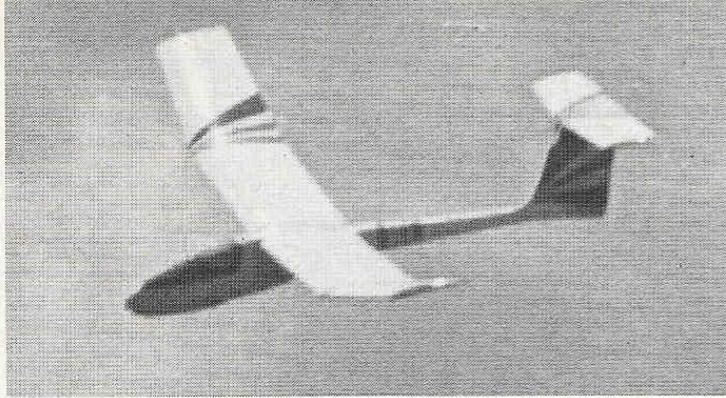
Finishing

Finishing is probably the most difficult and time-consuming part of building models. Sand the wing leading edge to shape, carve and round the wing tips and sand the sheeting/capstrip joints to provide a good covering surface. The same applies to the stabilizer. Taper and sand the rudder to shape shown on plan. The fin leading edge should have a somewhat elliptical, or rounded leading edge, but have less curvature where it fairs into the fuselage. The sub-rudder should be tapered toward the tail and rounded toward the nose. Carve and sand all the nose, belly, and canopy blocks to shape shown on the layout; also, sand the $\frac{1}{4}"$ planks on the fuselage rear deck and rear belly.

Drill and insert the $\frac{1}{4}"$ dia. wing tie-down dowels. Do not glue in the dowels yet (do this after covering). Next, rubber band on the wing center-section, but first insert some scrap $\frac{3}{32}"$ balsa sheet between the wing and the fuselage. Cut and fit the soft balsa fairing block. When you are happy with this fit, glue the block to the wing, not the canopy.

The original ship was covered with white Super-MonoKote on the wing and stab.





On the way. Hi-start launch here, no bad habits. It weighs 3 lbs. 4 oz.
At left: A good looking Soarer no matter what the angle. Responds well.
Center and below: Lunchtime at Grumman. The radio and ballast fill nose.



The fuselage and vertical tail was Silkspan and white butyrate dope. MonoKote was trimmed with red and blue trim strips and painted areas with red and blue dope. The canopy was airbrushed to resemble glass: first by painting black, then blue over the black, almost covering the black (the corners should remain black); then spraying white over, but not covering the blue: finally, highlighting with some black streaks. Because my fuselage was white,

I overcoated it with clear butyrate which gave it more shine and helps keep it clean.

Before final assembly of the stabilvator hinge, the hinge tube should be trimmed to fit between the hinge tubes on the stab. Make sure the stab is centered on the hinge tube. Use a piece of Golden Rod inner tube for the hinge pin; sand it to proper dia. if necessary. Connect stabilvator cable and rudder pushrod, then install the radio and batteries.

Flying

Check the balance of the assembled airplane. Leave the canopy off. My ship needed about 7 oz. of lead in the nose. When the canopy is put on it will probably make little or no change in the balance. Try a few hand launched test glides for final trim adjustments and when you are satisfied with your test glides, hang it on the hi-start. You'll soon know why this ship is called the "Hightailer". ☺

