GEMINI MTS

By Ed Slobod

Photos by Dick Harty

The Gemini MTS is the result of three years of design effort by the author.

This is the Gemini MTS. MTS stands for Multi Task Sailplane. It is my judgment that in the not too distant future, the currently popular duration-landing contests will give way to the multi task contest. Granted the MTS contest is more difficult to run, but it is a much better test of man and machine and its coming is inevitable. Okay, so what makes a MTS sailplane different? Since one of the tasks is speed it will have to be able to carry large amounts of ballast and it will need to be strong enough for 12 volt zoom launches. Does this mean a sacrifice of the qualities that make up a good thermal-landing sailplane? I don't think so. To be competitive in MTS events, the sailplane needs to be more efficient than the pure floater. Sinking speed can be equal to the floater but that is unlikely, and even if it turns out to be slightly greater the increase in range (penetration) more than makes up the difference.

The Gemini MTS was designed to depart as little as possible from the characteristics of the Paragon and to have the additional capabilities required for MTS competition. At 43 oz. the Gemini MTS has a wing loading of 6.65 oz./sq. ft. which is about the same as the Paragon. In still air its sinking speed is only slightly greater. The Gemini MTS can be flown quite slowly and I would estimate that it is not more than 2 mph faster than the Paragon. The Gemini MTS is designed to be launched on a 12 volt winch and using a zoom release it launches about 75' higher than the Paragon.

Handling is very good, quite similar to the Paragon. Penetration is noticeably better empty and much better when both are ballasted. (To the same wing loading, of course.) Climb in thermals, a somewhat entangible quality, is excellent.

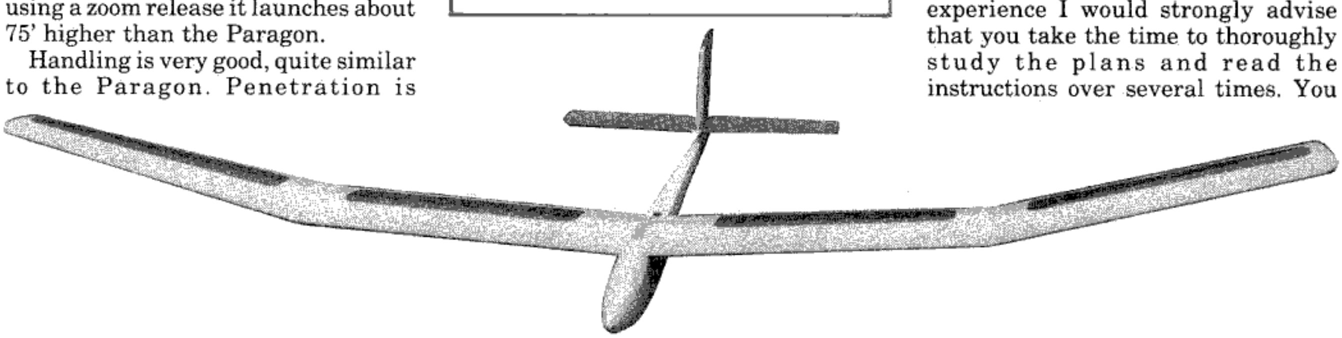
GEMINI MTS
Designed By: Ed Slobod
TYPE AIRCRAFT
Multi Task Sailplane
WINGSPAN
102 Inches
WING CHORD
Root 10"
Tip 7"
TOTAL WING AREA
930 Sq. In.
WING LOCATION
Shoulder
AIRFOIL
Semi-Symmetrical (MB 352515)
WING PLANFORM
Constant Chord Center
Double Taper Tips
DIHEDRAL EACH TIP
4° Center Panel
11° Tip Panel
O.A. FUSELAGE LENGTH
44¾ Inches
RADIO COMPARTMENT SIZE
(L) 8" x (W) 2⅛" x (H) 2"
STABILIZER SPAN
26½ Inches
STABILIZER CHORD (incl. elev.)
5" (Avg.)
STABILIZER AREA
133.5 Square Inches
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Fin Mounted
VERTICAL FIN HEIGHT
9¼ Inches
VERTICAL FIN WIDTH (incl. rudder)
6½" Avg.
REC. ENGINE SIZE
NA
FUEL TANK SIZE
NA
LANDING GEAR
NA
REC. NO. OF CHANNELS
2
CONTROL FUNCTIONS
Rudder & Flying Stab
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Ply & Spruce
Wing	Balsa, Ply & Spruce
Empennage	Balsa, Ply & Spruce
Wt. Ready To Fly	**42-45 Oz.**
Wing Loading	**6.50-6.96 Oz./Sq. Ft.**

At the recent LSF contest, Alex Bauer flew my prototype Gemini MTS to second overall, and second in the speed task. He made one speed flight of 10.4 seconds which was the fastest scored during the contest. The model carried 3½ lbs. of ballast during the speed runs. Prior to the contest there was still some question in my mind about whether it was strong enough for a 12 volt zoom launch with 3½ lbs. of ballast and whether it would go fast enough if it survived the launch, but not now.

The Gemini MTS departs from conventional design in only one area; namely the use of a thick semi-symmetrical (bi-convex) airfoil section. This is not the place for a disertation on the relative merits of various airfoil sections. So we won't go into it. The Gemini MB253515 does the job and as an added free bonus we get a very strong torsion resisting wing. Also, if anyone cares, with this section the Gemini MTS does a very nice vertical "8" (inside loop followed by an outside loop).

The Gemini MTS can and has been built and flown by a number of modelers of just average ability in both areas but full realization of its capabilities will only be achieved by the more advanced builder/flier. Regardless of your building experience I would strongly advise that you take the time to thoroughly study the plans and read the instructions over several times. You



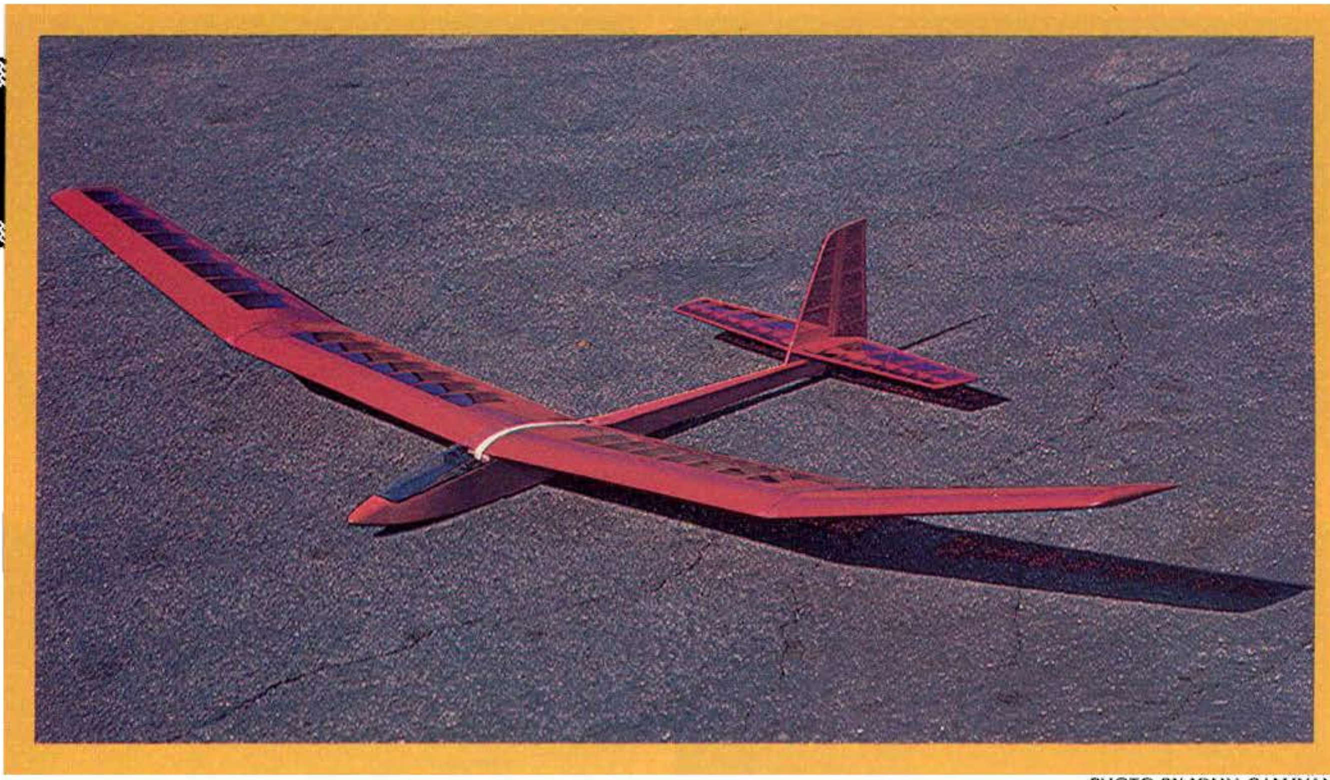


PHOTO BY JOHN GALLIVAN

may choose to do some things differently, and that's okay, but be sure you have all the assembly steps worked out in your mind, before you start.

CONSTRUCTION

The first step is to obtain all necessary materials and "kit" the wing. One way of transferring the wing ribs from the plans to the balsa is to obtain some 5 to 7 mil drafting mylar and to trace the rib outlines on to the transparent mylar. The mylar can then be cut to shape with scissors. It is thick enough to allow tracing along its edge so it is relatively simple to then trace all the patterns on to the balsa. The mylar can be used to make templates for the fuselage sides, formers, wing joiners, etc., and if you should ever want to make more parts the templates will always be available. All balsa parts should be made from medium firm stock with the exception of the wing tips which should be from very light balsa.

Wing Construction:

Step 1. Wing construction is started by positioning the bottom spars in place over the plans over 1/16" shims spaced 3 rib bays apart. Use a metal straightedge when you do this to be sure that the spar does not curve. Pin the 3/8" sq. support in place. Note the position of the tip panel support for built-in washout.

Step 2. Epoxy the center wing joiners together using the bottom ridge lines to line them up. Also check against the plans to make sure the dihedral angles are correct. Don't install at this time.

Step 3. Position the ribs as shown, **do not glue**, and check to see that all of the ribs touch the work surface. Temporarily pin to work surface and to the 3/8" support.

Step 4. Pin several 1/4" thick shims to the workboard over the leading edge of the plan for the main panel. For the tip panel use a 1/4" thick shim at the root and a 1/8" thick shim at the tip. Put the leading edge pieces in place and check for straightness and full contact with all of the ribs. If any of the ribs are too long or too short they can be adjusted to fit by removing some material from the spar cutout. Do this only if the rib is 1/32" too long or too short. If more than 1/32", you should make a new rib.

Step 5. When all the ribs are properly fitted, remove the two main inboard ribs and the root rib of the tip and put aside until later.

Step 6. Now, starting at one end and working towards the other, glue in a rib then a shear web, then the next rib, and so on. If, for some reason, the shear webs are not quite long enough and the ribs move more than 1/8" from the position on the plans, cut a new web to restore the next rib in sequence to the shown position and continue on. Do not glue in the rib at the outboard end of the main panel but leave it pinned in place.

Step 7. Now lay the 3/8" x 1/8" spruce top spar in position and check that the top surface of the spar is flush with the top surface of the ribs, and in contact with the shear webs. If there are some high webs they should be sanded down. If any of the shear webs are low they will have to be replaced, if possible, or thin shims will have to be glued in place to fill the gap. Good contact is important — don't depend on large blobs of glue to fill the gaps.

Step 8. Now cut the leading and top trailing edge pieces to length and glue in place. The rib at the outboard end should be angled for the tip panel dihedral. Do not glue the T.E. sheeting to the outboard rib.

Step 9. Check for fit of the center joiner and if necessary trim to fit

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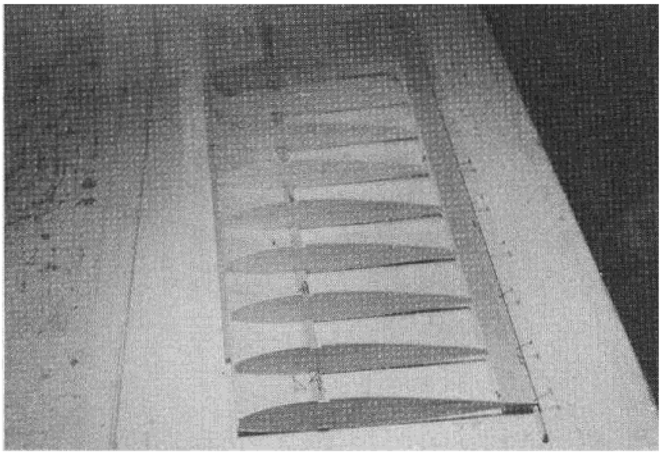
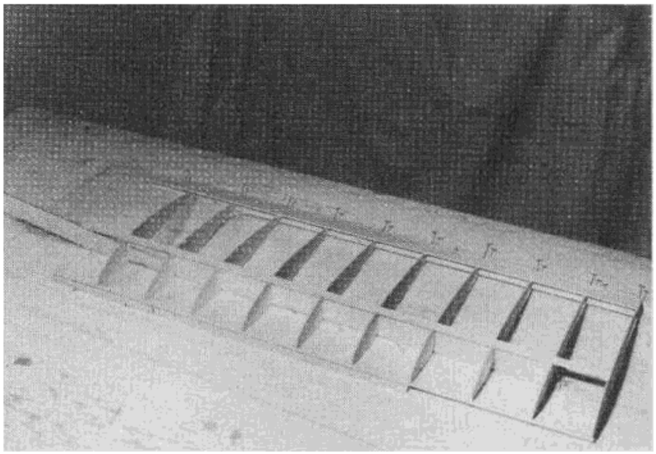
ABOUT THE AUTHOR

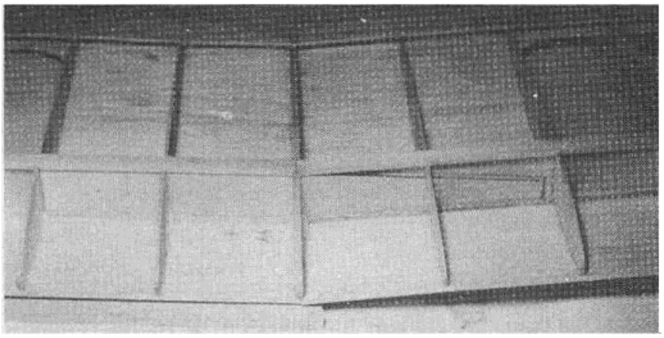
Ed Slobod began modeling airplanes in 1936, and has been active in the hobby to the present time. He has designed, built and flown all kinds of free flight models with his primary interest being in hand launches, tow line gliders, and rubber powered models. He attended an aircraft mechanics trade school and acquired an Airplane and Engine Mechanics license. He graduated from the University of Southern California with a degree in Mechanical Engineering in 1954. Ed became interested in R/C sailplanes in the late 1960's and, except for some old timer modeling for several years, he has devoted most of his activities to R/C sailplanes. Ed was employed for 19 years as a wind tunnel model designer by the Douglas Aircraft Co., and is currently employed by Hughes Aircraft Company as a wind tunnel model designer. Ed went into business of kit manufacturing in the early 1970's. His company, the Pierce Aero Co., has produced the Pierce Arrow, the Pierce 970, the Paragon, and the Ridge Rat.



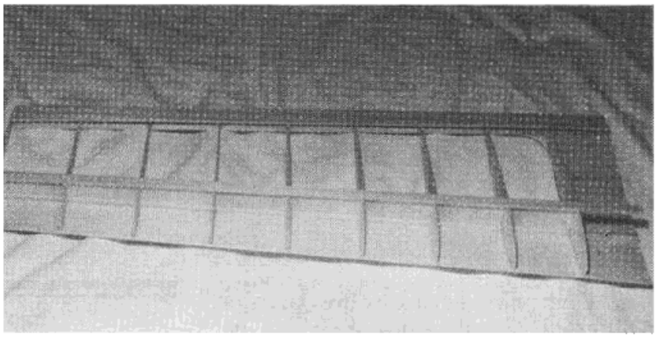
First step in wing construction. Read instructions and plans for the specific details.



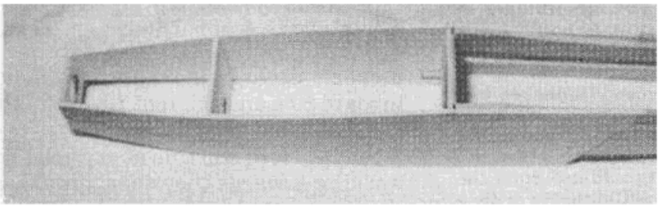
Inboard wing panels in second stage of assembly.



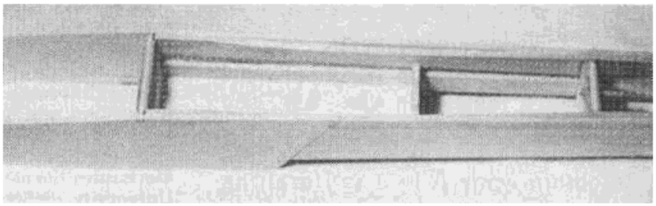
Inboard wing panels joined. Check plans for joiner plate details.



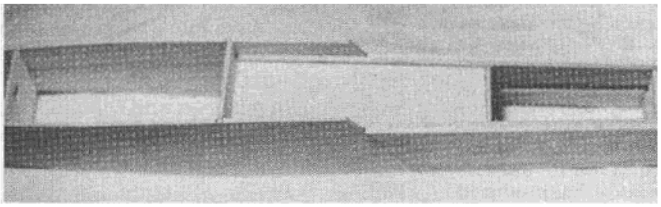
Tip panel in second stage of assembly. Panel must be properly shimmed and secured to building board prior to attaching top sheeting.



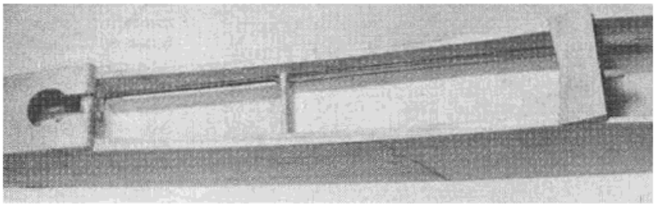
Forward fuselage area.



Top view of fuselage before wing saddle contour has been shaped in side panels to match contour of doubler.



Bottom view showing ballast floor installed.



Top view of fuselage showing wing mounting provisions.

between the spars. Epoxy in place, placing the bottom ridge over the centerline of the wing.

Step 10. Select a piece of straight grain medium 1/16" x 3" balsa and cut to length to be slightly longer than the main panel. Trim one edge with a straightedge and bevel to match the leading edge strip when flush with the rib contour. The opposite edge will wind up on the top spar about 1/8" forward of the aft edge of the spar. Glue the sheeting in place. Attach to the leading edge piece first then roll the sheeting towards the spar. Be sure that the sheeting is glued to all the ribs and that there are no voids. Next, add the capstrips and the sheeting at the root. Partially sheet the section at the outboard end but leave enough open area to enable you to install the 1/8" balsa sides in the last bay for the tip panel tongue.

Step 11. The tip panel is constructed in the same manner except that the sheeting will have to be trimmed to match the taper. When gluing the ply joiner to the spars, be sure it is centered chordwise. The root rib of the tip panel is cut apart and trimmed to go on both sides of the joiner but is not glued in place until the tip panel is plugged into the main panel.

Step 12. Allow sufficient time for the glue to dry thoroughly after which time the tip panel be removed from the workboard and propped up in position against the main panel with the joiner inserted between the main panel spars. Cut the 1/8" balsa box sides and glue in on both sides of the tip panel joiner. Be sure to withdraw the joiner before the glue has dried. The outboard rib of the main panel should now be cut apart, trimmed and glued. Now finish the top sheeting.

Step 13. The bottom trailing edge strip, sheeting and capstrips are installed with the individual panels pinned inverted to the plans. Shim up

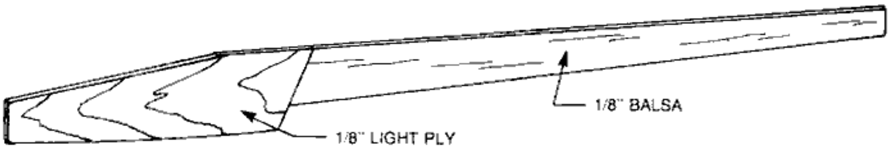


FIGURE 1

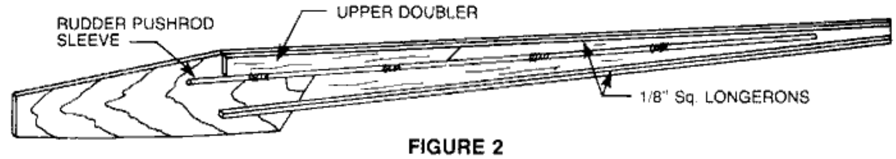


FIGURE 2

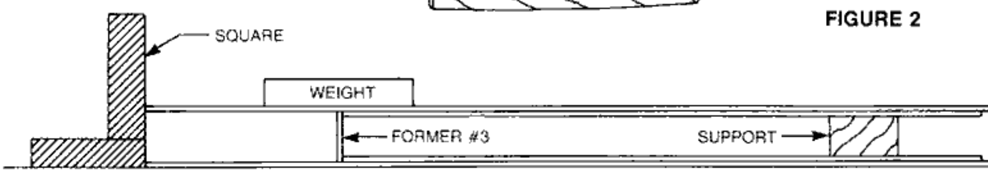


FIGURE 3

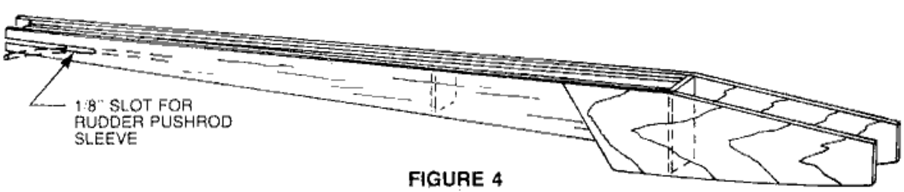


FIGURE 4

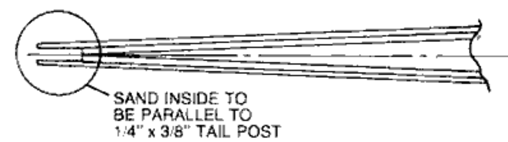


FIGURE 5

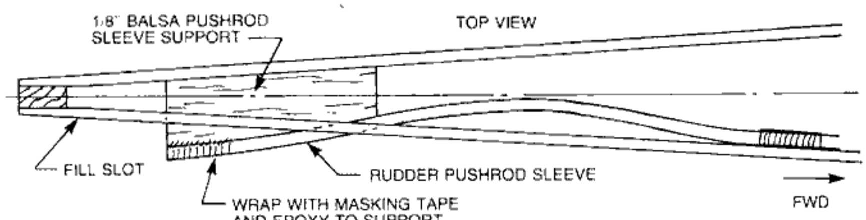


FIGURE 6

FIGURE 7

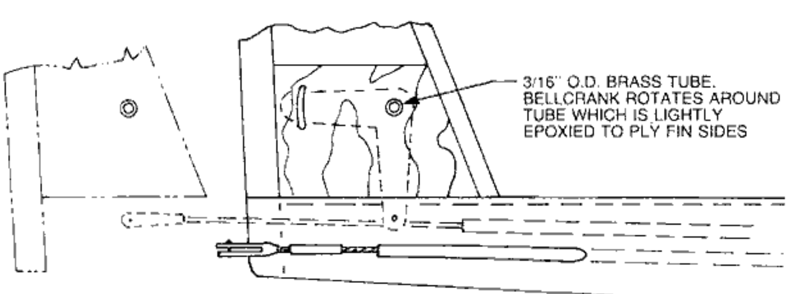


FIGURE 8

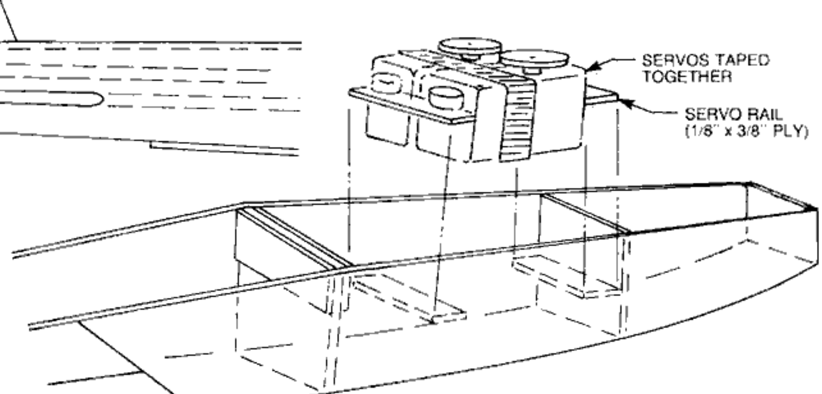


FIGURE 9

as required and be sure there is no twist in the main panel. The tip panel will have some wash out twist built in and it should be pinned down to retain this twist. Be sure to epoxy the main panel joiner to the opposite panel spars before completing the sheeting.

Step 14. Make up the trailing edge insert blocks and install as shown at the wing root and the outboard dihedral joints.

Step 15. Trim ends of tip panels and add tip blocks.

Step 16. Shape leading edge, wing tips and trailing edge, carefully. Sand entire wing smooth. Add fiberglass to top and bottom of center section and sand smooth when dry.

Fuselage Construction:

Step 1. Join fuselage side pieces. Use 5 minute epoxy (see Fig. 1).

Step 2. Glue 1/8" sq. balsa longerons in place (see Fig. 2).

Step 3. Add 1/8" balsa upper doubler (see Fig. 2).

Step 4. Wrap pushrod sleeve with one wrap of masking tape at approximately 4" spacings and epoxy sleeve to fuselage. Be sure to make a left and right hand side (see Fig. 2).

Step 5. Pin fuselage side to workboard over plans and glue in Former #3. Use square to be sure it is perpendicular to fuselage side.

Step 6. Glue other side to Former #3 as shown in Fig. 3. Use square all around.

Step 7. Cut 1/8" slot for rudder pushrod sleeve (see Fig. 4).

Step 8. Sand inside of fuselage sides at rear to be parallel to 1/4" x 3/8" tail post (see Fig. 5).

Step 9. Pull sides together with a scrap piece of 1/4" x 3/8" temporarily pinned in place. Be sure sides have same amount of bow.

Step 10. Glue in Former #5.

Step 11. Glue in Former #1.

Step 12. Glue in Former #2.

Step 13. Glue in ballast tray.

Step 14. Glue in lower doubler.

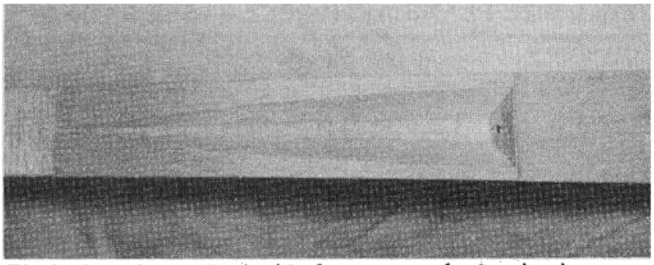
Step 15. Glue in Former #4.

Step 16. Drill hole in tow block for snug fit with 1/8" wire.

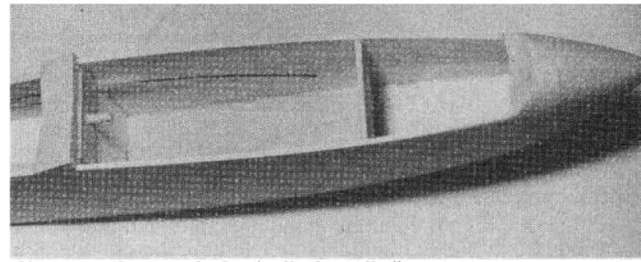
Step 17. Epoxy tow block to Former #1 and ballast tray.

Step 18. Drill 1/8" ply for tow hook clearance, fit and epoxy to fuselage side edges and rear of tow block.

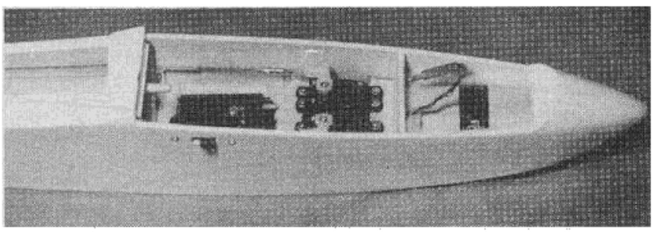
Step 19. Fit and glue in 1/8" balsa



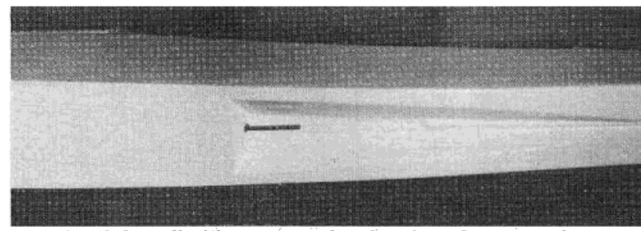
Blocks have been attached to form recess for tow hook.



Nose section ready for radio installation.



Typical radio installation.



Tow hook installed in recess after fuselage is covered.

rudder pushrod sleeve support (see Fig. 6).

Step 20. Cover fuselage, top and bottom, with 1/16" sheet balsa. Leave bottom at rear open until after elevator pushrod hook-up has been made.

Step 21. Cut slot in top sheeting for elevator bellcrank (see Fig. 7).

Step 22. Hook up elevator clevis to bellcrank — snap clevis closed. Move rudder (fin) forward and glue to fuselage. Especially rudder post r fuselage sides. Finish covering bottom of fuselage (see Fig. 8).

Step 23. Before covering forward bottom of fuselage with 1/8" ply, the servo rails should be installed. To do this, first tape the servos together with a 1/16" to 1/8" spacer between them. The rails are made from 1/8" aircraft ply and should be slightly longer in length than the width of the fuselage where they will be installed. Mark the mounting hole locations on the rails while holding in position under the servos. Drill for the mounting screws. Mount servos to the rails. Now prop fuselage up level on workbench and ballast to prevent movement. Trim ends of servo rails carefully so that the servo and rails can be just slid into place. Shim under servos so that the pushrods and servo wheels are on same level. Tack epoxy the servo rails. When dry remove the servos and epoxy all around rails where they join fuselage sides (see Fig. 9).

Step 24. Epoxy 1/8" ply to forward bottom.

Step 25. Add triangle stock to fuselage bottom.

Step 26. Add nose block and triangle stock aft of Former #1.

Step 27. Add small block aft of nose block.

Step 28. When dry shape nose block area.

Step 29. Contour triangle stock on fuselage bottom.

Step 30. Add 3/16" dowels and 1/16" ply reinforcement plates to Formers #3 and #5 if you haven't already done so.

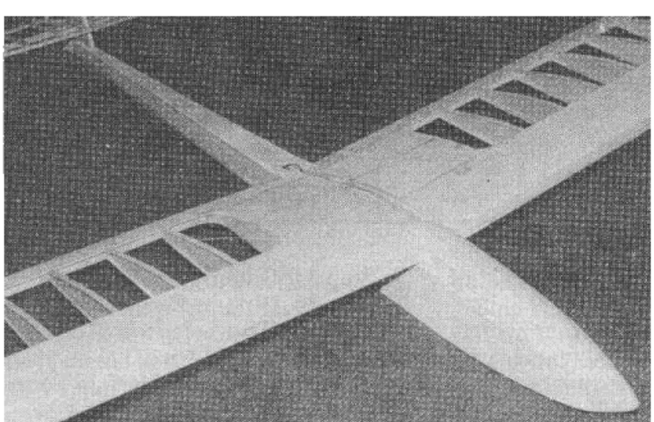
Step 31. Shape a block of balsa to fit open forward fuselage and over front of wing. Tack glue to fuselage. When dry, contour as shown on plans.

Step 32. Make cutout in fuselage sides to match bottom contour of wing.

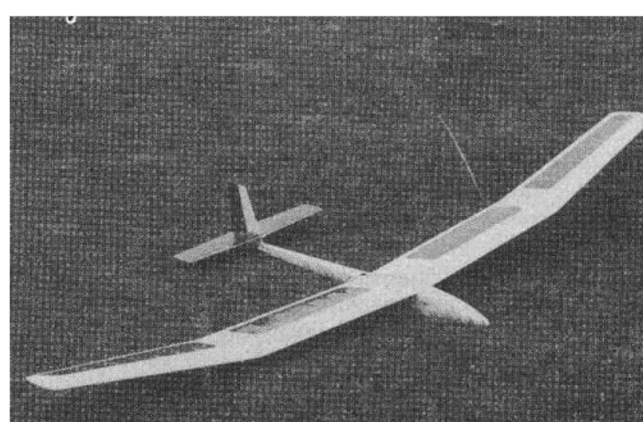
Step 33. After fuselage is assembled, sand smooth, round corners if you wish. Cover entire fuselage with 2 oz. fiberglass. If any weave shows after sanding out, apply a second coat of resin. Squeegee off or blot off excess resin. When dry sand smooth. Apply primer and paint as preferred.

Horizontal Stabilizer Construction

Step 1. Select a piece of firm 1/4" balsa and cut to 3¼" long by 1-3/16" wide. Cut the "V" grooves for the 7/32" O.D. tube and the 3/32" O.D. tube carefully so that you do not miss the 1-3/16" distance between centerlines. You can check this as you go by holding the tubes in place in the grooves. Slip the 3/16" I.D. brass tube and the 1/16" wire into the tubes and check at both ends, by slipping the pre-drilled elevator bellcrank over the inner tube and wire. If you prefer you can make rounded tube recesses by



Gemini ready for covering and finishing.



And . . . ready to take to the skies.

using appropriate size dowels wrapped with sandpaper. When the fit is correct, tack epoxy the tubes in place.

Step 2. Next, select a firm piece of 1/8" x 1/4" balsa, cut to 10⅞" in length and taper to 1/8" on one end.

Step 3. Epoxy the 1/8" square spruce to top and bottom allowing 1-7/16" overhang at the root end. Make two spars.

Step 4. Commercial 1/2" x 1/8" trailing edge stock is cut with the 1/8" side square with one of the surfaces. Use a light cut with a razor plane or a long sanding block to trim the edge so that it is square with an imaginary chordwise centerline.

Step 5. Now make up your shim pieces and pin to plans. Note that the trailing edge shims are angled on the top surface to support the trailing edge such that the trailing edge centerline is parallel with the workboard. Cut the tube assembly apart and to length. Slip the inner tube and wire in place then slide the tube assembly into the spars and pin to plans over the shims. Do not pin through spars. Do the same for the leading and trailing edges.

Step 6. From 1/2" wide stock, cut the ribs to length and glue in place. Note that the root ribs are 3/16" thick, the first rib outboard of the root and the tip ribs are of 1/8", and the rest of medium 1/16".

Step 7. When the glue has dried, remove from board. Check that the horn still fits properly.

Step 8. Now add all the gussets and fillers as well as the 1/8" x 1/2" firm balsa supports that go up against the tubes.

Step 9. Go over all glue joints with a slightly thinned coat of glue and over the tubes and tube assembly attachment area with epoxy.

Step 10. When dry, carefully razor plane and sand the stab to the streamlined shape shown. Sight from both ends as you go as well as using a straightedge to be sure that you have a smooth progressive taper. Add the 3/8" thick soft balsa tips and contour to match rib shape. Round off the tips. Add 1/8" balsa pieces at the root — leading edge area and sand to match rib contour.

Step 11. Go over entire stab with 400 grit paper.

Fin & Rudder Assembly:

Step 1. Cut out the two 1/16" ply tube supports.

Step 2. Locate and drill the 3/16" diameter and the three 3/32" diameter holes. Do this with both pieces held together on the bench.

Step 3. Glue the three frame pieces to one of the ply sides.

Step 4. Apply glue to the face of the frame pieces and place the other piece on top. Before the glue sets up, insert the 3/16" diameter brass tube into both pieces and, using a square, check that the tube is perpendicular to the plywood top piece. Do this at a number of different radial positions around the tube. If necessary, slide the top plywood as required to properly align the tube.

Step 5. When dry, block sand the edges square and straight.

Step 6. Place on plans and construct the fin around it.

Step 7. Build up the rudder.

Step 8. When dry, remove from plans. Bevel forward edge of the rudder as shown if you plan to use a tape hinge.

Step 9. Sand edges round and go over entire fin and rudder with fine sandpaper. Do not cover fin at this time as the fin will have fiberglass applied up to the top of the plywood pieces after assembly to the fuselage.

Covering & Finishing:

At this point all of the construction should be completed and the model ready for covering and finishing. If you have fiberglassed the fuselage you should mask off the portion of the fin above the plywood, and apply two coats of K & B primer. After sanding smooth, one or two coats of K & B or Hobbypoxy should result in a slick looking fuselage.

The remainder of the model is covered with MonoKote. I would advise against using any of the low heat plastics or any woven covering material on parts of the model that have open structure such as wings or tail surfaces.

Pin the rudder to the fin with the rudder defected such that the face of the beveled edge of the rudder is against the aft face of the tail post. Apply a strip of 3/4 Magic mending tape full length. Unpin and deflect fully opposite and apply three pieces crosswise, top, bottom, and middle.

After covering, install the radio gear, etc., and adjust for centering and throw. The elevator should be rigged so that the leading edge is about 1-1/16" above the top of the fuselage.

Strap the wing on with a few rubberbands and check balance. The model should balance approximately 3/8" aft of the spar. Add nose weight as required. Inspect the wing carefully for warps. The main panels should be straight and the tip panels should have some washout. Anywhere from 1/8" to 1/4" is okay but they both should be the same. Let us hope that at this stage you do not have to unwarp a wing panel. It is not easy to do. Slight warps can be reduced or removed using a hot heat gun and two pairs of hands, or one pair of hands twisting the surface while passing it back and forth in a jet of stream from a tea kettle.

Flying:

The Gemini MTS does not fly much differently than other thermal sailplanes so the procedure of hand glide, nose weight and trim adjust is the same as you have done before. This also applies to the initial winch or high start launches. Where the Gemini launch procedure differs from others is that while it launches well on 6 volts, it does better on 12 volts, and preferably with a zoom release. Here it is just a matter of your practicing using a 12 volt winch and learning how to get the most from a zoom launch.

In essence, you pre-load in the usual fashion before release and stay on the button all the way — about 3/4 of the way up if you have been holding any back stick, you ease off or apply a little down to level off. When the model passes over the turnaround and starts down, you get off the winch button and give the stick a jab of up. Try to fly, after release, at a climb angle of 45°. You should practice with the ship empty, also with various amounts of ballast and in both calm and windy conditions. □

From RCModeler Apr. 1982