

S E R E N D I P I T Y



Webster defines serendipity as, "The faculty for finding agreeable things not sought for." Granted, an inanimate object of itself cannot find things. However, under the guidance of the pilot, many agreeable things not necessarily sought for or expected may occur with this sailplane. Therefore, I have christened it Serendipity.

Following many enjoyable flights with Happy Face, my first design effort, it was only natural to want to improve on that design. Thoughts and ideas for Serendipity evolved as I observed flight characteristics of Happy Face and other sailplanes. With the announcement of the latest RCM design contest, it was time to put those ideas on paper, build and test fly a prototype.

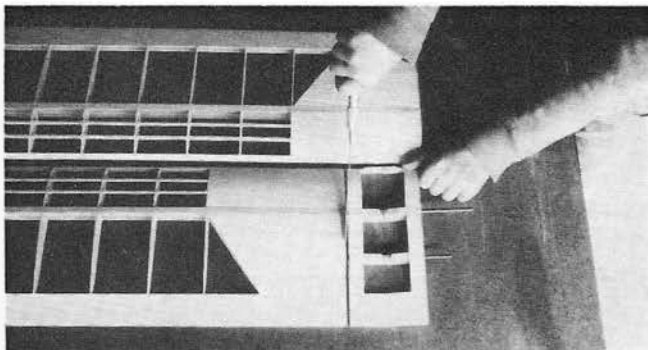
Serendipity, like Happy Face, is designed

for standard class competition. Certain design features of Happy Face have been retained, and new ones incorporated; the end result being where it counts, in improved performance. The wingspan has been increased to 98½" while retaining the 8" chord and the modified NACA 4309 airfoil. The flight characteristics of this airfoil section have proved to be excellent. Essentially the same moments have been retained but, due to the increased wing area, a slight increase in horizontal stab is required. The fine positive pitch control response of the flying tail of Happy Face dictated no design change here. However, it will be noted that the control horn is internal to reduce drag. Turn response has been improved by increasing rudder area and decreasing wing weight to decrease roll

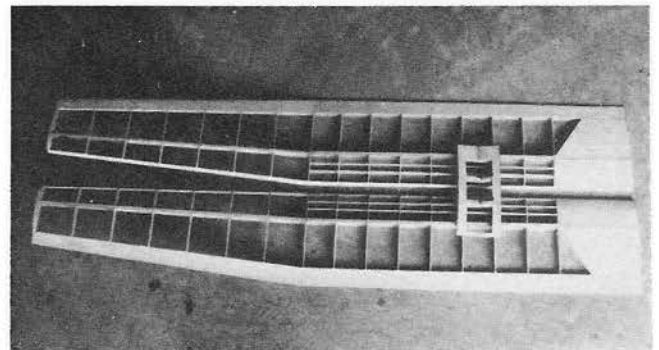
inertia. Greater airflow separation between the wing and horizontal stab is provided by the shoulder mounted wing. Wing turbulators, tiptlets and plug-in attachment are all features which reduce drag.

Construction techniques are straightforward and should present no problem for the modeler ready to venture forth on his/her first scratch-built model. One unique construction technique is the method of assuring a perfect wing joiner rod "wing to fuselage" alignment.

The wing joiner tubes are built into the wing during construction. The wing center section is then cut from the wing and incorporated into the fuselage. Conventional materials are used in construction, balsa, spruce, plywood, epoxy, aliphatic glue, MonoKote and the



Cutting wing center section from left wing panel.



Completed wing framing and center section.

normal hardware. Select materials carefully, build light and you will be rewarded with an excellent flying sailplane in which you can be justifiably proud.

CONSTRUCTION

Enough of the preliminaries — let's build.

Three comments on construction, if observed, will prevent the modeler from getting ahead of critical sequential building steps: (1) The wing center section which is constructed with the wing is required before the fuselage can be completed. (2) Do not glue in bulkheads 3 and 4 until called for. (3) The vertical fin, horizontal stab control horn and pushrod are assembled as a unit and then installed into the fuselage.

Wing:

First construct the two wing dihedral joiners. These are built up of ply for the front joiner and ply and balsa for the rear joiner. The joiners will then be epoxied between the spruce spars. Epoxy the appropriate size brass tubes into these joiners being sure to plug off the ends. From the bottom center of each joiner measure out both ways exactly 1/4" and scribe a line perpendicular to the joiner around its cross section. Using an X-Acto saw, cut partially through the joiner and tube leaving the bottom 1/8" ply uncut. These four partial cuts will assist in cutting the center section from each wing panel.

Wing ribs are cut from medium 3/32" sheet balsa. Make a template of the number 1 rib from 1/8" ply. Drill appropriate sized holes near the leading and trailing edge of the template. Cut 1/4" off the end of two nails and press fit these points through the holes so they extend about 1/32". This makes a slip proof template for quick and easy production of ribs.

Lay out the lower spruce spar, the short rear spar, and leading and trailing edges. These all extend to the wing centerline. Sheet with 1/16" balsa as shown on plans leaving a 1/8" gap at the wing center section joint. Scrap 1/8" ply makes a good spacer to accurately obtain this gap. Cut spar webs from 3/32" balsa with grain vertical to size shown on plans. Starting with the first rib outboard of the 1/16" sheeting, alternately glue a rib, web, rib, etc., except at the polyhedral joint and bay. Sand the spar webs flush with the upper spar interface and install the upper spar. Good glue contact between webs and spar is essential. The two dihedral joiners are now epoxied to the spars. Slide the front one between the spars; the rear one mates with the lower spar. Check that the joiners are parallel and their verticals lie on the wing centerline. Glue the upper rear spar to the joiner. Slice 1/16" from upper and lower mold lines of number 1 ribs and cut to fit between the joiners. Again, use the 1/8" ply scrap to position and align ribs at the wing center section break. This provides the correct space for the 1/16" ply ribs which will face these surfaces. Add upper trailing edge, 1/16" balsa sheeting and turbulators. When dry, the leading edge is carved and sanded to shape. Using an X-Acto saw, carefully cut

Serendipity is an updated version of the author's "Happy Face." Using the best of the old and many new improvements, this standard class sailplane is responsive where it counts. Excellent for first scratch-built sailplane.

SERENDIPITY

Designed By: Erroll L. Williams

TYPE AIRCRAFT

Standard Class Sailplane

WINGSPAN

98½ Inches

WING CHORD

8 Inches

TOTAL WING AREA

724 Sq. In.

WING LOCATION

Shoulder

AIRFOIL

NACA 4309 (mod)

WING PLANFORM

Constant Chord Center

Tapered Tip Panels

DIHEDRAL EACH TIP

8 Inches

O.A. FUSELAGE LENGTH

44¾ Inches

RADIO COMPARTMENT AREA

(L) 8½" x (W) 2" x (H) 2"

STABILIZER SPAN

25¼ Inches

STABILIZER CHORD (incl. elev.)

4½" (Avg.)

STABILIZER AREA

123½ Sq. In.

STAB. AIRFOIL SECTION

Symmetrical

STABILIZER LOCATION

Mid-Vertical Fin

VERTICAL FIN HEIGHT

9¼ Inches

VERTICAL FIN WIDTH (incl. rud.)

5" (Avg.)

REC. ENGINE SIZE

NA

FUEL TANK SIZE

NA

LANDING GEAR

NA

REC. NO. OF CHANNELS

2

CONTROL FUNCTIONS

Rudder & Elevator

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Spruce & Ply
Wing	Balsa, Spruce & Ply
Empennage	Balsa & Ply
Wt. Ready To Fly	35 Oz.
Wing Loading	7 Oz./Sq. Ft.

By
**Erroll
L.
Williams**

through the spars using the pre-cuts in the joiners as a guide. Also cut through the leading and trailing edge. Sand leading and trailing edges flush with the ribs letting the joiner stubs protrude. Face the wing panel and center section surface with 1/16" ply cut to fit.

Construct the opposite wing panel following the same steps. The partially completed wing center section is installed at the appropriate time. Leading and trailing edges are glued together at the centerline butt joint. Again carefully cut through the spars and separate the wing center section from the wing. The center section is now ready for installation into the fuselage.

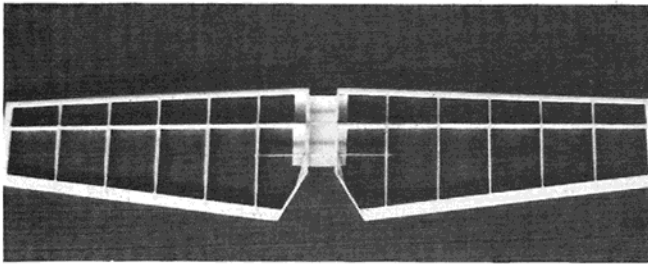
The outboard wing panel is mated with the inboard panel during construction to assure a perfect fit. Prop up the inboard panel 4/8", making sure that the leading and trailing edges are at equal heights above the work surface. The spar leading edge of inboard and outboard panels form a continuous line. The polyhedral joint is strengthened with a 1/8" ply spar web and a 1/16" ply doubler at the leading edge. Construction sequence is similar to the inboard panel. Note that the web is 1/16" balsa and that the last two bays have no web. The wingtip is made from 1/4" soft balsa beveled to an approximate 60 degree angle and faced with a 1/16" ply tiplet. Fit and glue the rib at the polyhedral joint. Shape the leading edge. Leading edges of right and left wing panels should be shaped the same. A template will assist in this operation. Upon completing the wing structure, assemble to center section and balance. The wing tiplets are glued in place following covering.

Fuselage:

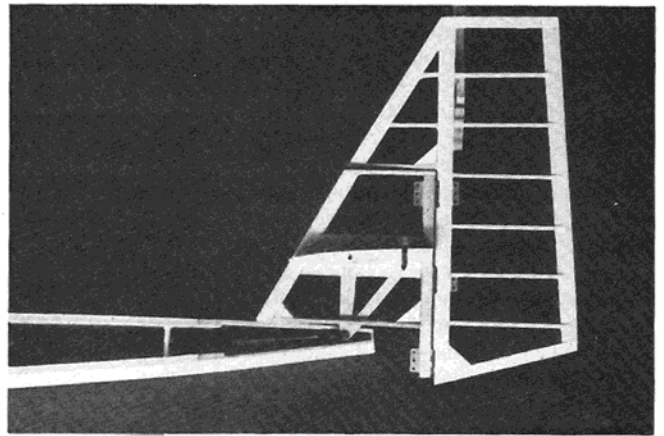
Although the prototype sides are constructed from Foamcore, the plans depict 3/32" hard balsa sheet. The rear bottom is made from 1/8" hard balsa. Cut out the sides and bottom to the outline denoted by the heavy triangles on the fuselage side and plan views.

Glue the 3/16" x 3/32" spruce longerons to the fuselage sides and the 3/16" triangular balsa longerons to the fuselage bottom. Make bulkheads 1 through 4 from 3/32" ply and 5 through 8 from 3/32" balsa. Plan the control rod installation and drill appropriately located holes in bulkheads 3 through 8. If you intend to install the receiver antenna internal, now is the time to drill holes in bulkheads 2 through 8 to accept an outer Gold'N-Rod sheath. Glue bulkheads 5 through 8 to the fuselage bottom using a gauge to obtain the correct angle. Pin the fuselage bottom to the work surface and glue sides to bulkheads and bottom. When dry, glue in bulkheads 1 and 2, and then the front bottom and nose block.

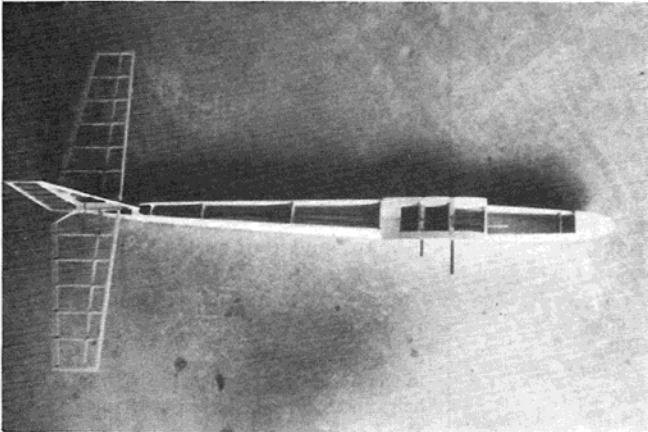
Temporarily tape 100 grit sandpaper on the bottom of the wing center section which is then used as a sanding block to bevel the fuselage wing saddle. Assemble the wing and position on the fuselage saddle. With the fuselage on a flat work surface, check that opposite panels are equal heights above



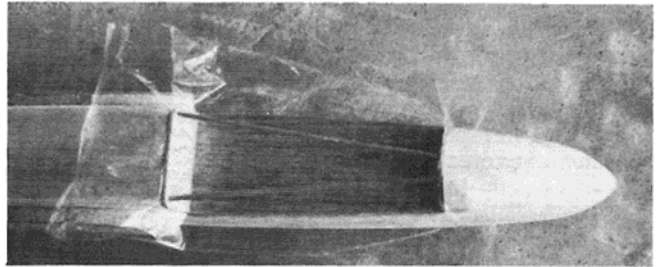
Horizontal stab frame.



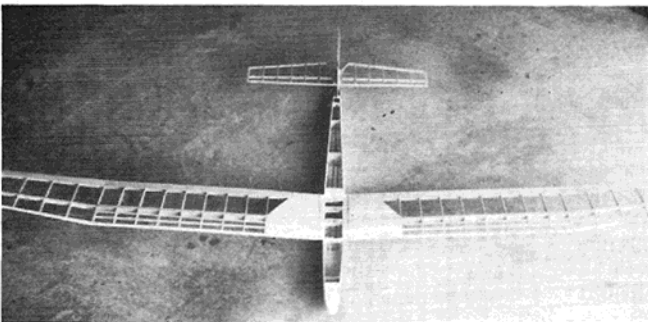
Vertical fin, rudder and pushrod being installed into fuselage.



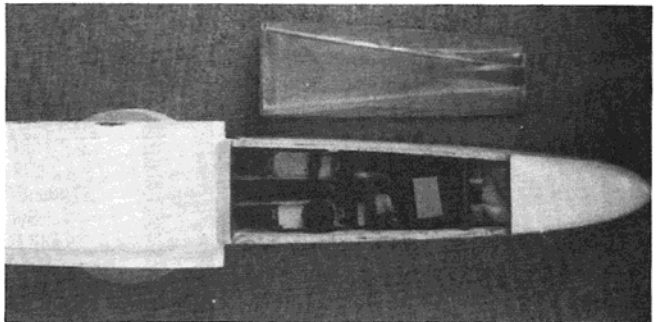
Fuselage with empennage and wing center section in position. Note routing of Gold'N-Rod.



Canopy frame under construction.



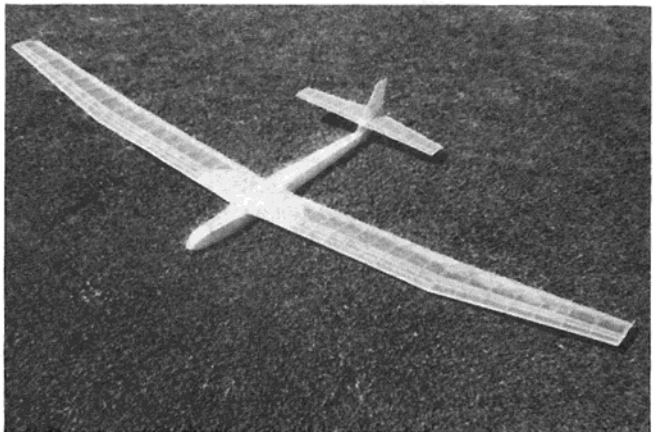
Framing minus fuselage top sheeting.



Radio installation. Servos mounted with 1/16" thick Scotch Mounting Squares.



Full radio gear.



View of completed Serendipity.

the surface. Check that the distance from each tip to the fuselage tail is also equal. When satisfied, index center section to the fuselage. Epoxy center section to the fuselage saddle. Bulkheads 3 and 4 are

epoxied to the fuselage and rear surface of the wing joiners. Epoxy the spruce launching hook block to the fuselage bottom and bulkhead 3.

Install the outer Gold'N-Rod sheaths.

Sheet the top of the fuselage from wing trailing edge to fin leading edge with 3/32" balsa applied cross grain. Build up the fuselage above the wing center section per

plans. Add the 3/8" balsa blocks aft of the nose blocks and sand the fuselage to shape.

Horizontal:

Cut the horizontal control horn from 1/16" ply. Drill holes per plan and epoxy short sections of brass tubing in these holes and file nearly flush to form bushings. Make up the spar from 1/32" ply laminated to 3/32" balsa. Construct the stab halves over the plans but do not sand to shape until joiner tubes are installed.

Cut four 2 1/8" lengths of 1/16" ID brass tube joiners and plug off one end of each. With a chisel make a slight indentation in each joiner tube to provide a press fit with the 1/16" piano wire inserts. Cut two 4 1/4" lengths of 1/16" piano wire. Thread one wire through a short piece of 1/16" ID tube and then through the control horn pivot bushing. The other wire goes through the rear bushing. Now add a joiner tube to each side. Lay the stab halves on a flat work surface, prop up the tips 1/16" and epoxy the joiner tubes to the ribs and spar. Sand the stab to shape.

Vertical:

Construct the fin post by laminating 1/32" ply between two pieces of 1/8" x 1/4" hard balsa. Three hinges are built into this assembly. From 1/16" ply make two identical horizontal stab pivot supports. Drill a 3/32" hole at the pivot point and cut out the slot using the control horn as a locating guide. Scribe a line through the pivot point angled down 1 1/2 degrees from horizontal to assist in locating the horizontal stab root stubs. Build up the fin and rudder but do not join until after covering. Glue the stab stub to the fin. A length of 1/16" ID tube inserted through the pivot will assist in aligning the pivot axis perpendicular to the fin. Slip the control horn into the fin and epoxy the 1-1/16" length of 1/16" ID brass tube pivot axis in place.

Glue the 3/32" balsa "fuselage to fin" interface to the fin. Attach the horizontal stab pushrod to the control horn with a clevis. Insert the pushrod into the outer sheath; slide assembly forward and glue the fin to the fuselage. Attach the rudder and install rudder pushrod.

Canopy:

The canopy framework is built directly over the fuselage opening to assure a perfect fit. Saran Wrap between fuselage and canopy frame will prevent gluing to the fuselage. Pin the canopy base to the fuselage and glue the front and rear formers in place. Drill a 3/32" hole through the front former into the nose block extension. Install the two 3/32" dowels. Remove the canopy frame and install a 1/4" length of 3/32" dowel in the canopy hold-down hole. After painting the inside of the canopy frame to the desired color, the clear plastic may be glued to the frame. Duco Glue is an excellent adhesive for this purpose and it dries clear. Trim the plastic and the canopy is complete.

Covering and Finish:

The prototype flying surfaces were covered with MonoKote. This brand of heat shrink plastic covering was selected for its superior quality to impart torsional rigidity to open structures such as wings and tail surfaces. The fuselage was finished with white enamel aerosol spray and a top coat of polyurethane for protection.

Assembly:

The horizontal stab is joined with two 4 1/4" lengths of 1/16" diameter piano wire. Wing joiner rods are cut from 3/16" and 5/32" diameter steel rod to the lengths shown on the plans. The wing assemblies easily to these straight rods. Tape the "wing to fuselage" joint to hold the wing in place. A square cross section battery pack fits snugly into the battery compartment. Thin (1/16") servo tape provides a fast and efficient method of installing servos. A thin coating of epoxy applied to the fuselage sides at the servo mounting location provides a sure-grip surface for the tape. Balance the aircraft to the C.G. location shown on the plans.

Flying:

Hand launch over a grassy field to establish preliminary trim of the flying tail. These adjustments are made at the servo end due to the concealed horizontal stab control horn. Final trim is made after observing flight characteristics from a prolonged glide following a hi-start. Hi-start launches are very stable and the fine flight characteristics of Serendipity verify that the design objectives have been met. On the third hi-start flight a light thermal was caught at about one hundred feet and worked up to about six or seven hundred feet. Tight circles, required to stay within this thermal, were easily made.

Happy building and flying.

**Editing By Hlsat.
RCModeler
Nov. 1980.**