SPORTSTER 40

A .40 powered high wing cabin design for the sport flier. It is easy to build and has an unusual fuselage shape.

By Richard J. Simmons

The designer and builder is a born again modeler, returning to the Hobby in 1977 after an eighteen year absence. He was born in 1924 and started constructing so-called solid models at the age of nine, progressed over the years through free-flight and control-line up to an unsuccessful experience with a Sterling Wizard, an R/C biplane (Cobb Micro-4 and too much vibration). He was self-employed in the construction field during this hiatus and his creative bent seemed to be satisfied by building an occasional house of his own design. He left that field of endeavor to go to work for the small town he lives in as Board of Health Inspector. (Getting too old and fat for manual labor.)

The model was designed about 1961. It was meant to be a single channel, rudder only, with the O.S. Pet in mind for power. Wing ribs and spars were cut out, then put away in a bureau drawer when interest waned. The winter of '76-'77 seemed to be a long one and out came the long forgotten ribs and spars. The end product was an O.S. 25 powered four channel version with strip ailerons. This proved to be a little too hot to learn to fly on, so the 40 size evolved. It's called the Sportster 40 because it was preceded by the Sportster 25 and, if the designer/builder's wife doesn't find out prematurely, it will likely be followed by the Sportster 60.

The construction is fairly simple though lengthy. A modeler who likes to build should enjoy it, although cutting out the parts is a little tedious. Only two adhesives were used, 15-minute epoxy for all plywood to plywood joints plus the spar joiners to spars, and ambroid for the rest. Other builders may not find the control system to their liking and should feel free to improvise. The designer is addicted to wire control rods with snap links on both ends. (A lot of snap links, 29 to be exact, with a Carl Goldberg pushrod connector at the throttle to round it out.) Twin pushrods to the rudder and a homemade transfer linkage from the separate elevator horns are a little out of the ordinary but the throttle, flaps, and barndoor ailerons have standard hook-ups. Differential ailerons are obtained with the use of 60° Williams Bros. bellcranks. (This ship is old in design but modern in someways. I was slightly insulted when I took the model to the flying field for the first time and overheard another model builder tell his model building son that all R/C planes looked like that years ago.)

One last comment. If you do not fully assemble the fuselage until the wing is finished, you will find the separate power module to be invaluable in aligning and keying the wing's location.

SPORTSTER 40
Designed By:
Richard J. Simmons
TYPE AIRCRAFT
Sport
WINGSPAN
57¾ Inches
WING CHORD
10½ Inches
TOTAL WING AREA
585 Sq. In.
WING LOCATION
High Wing
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Constant Chord
DIHEDRAL EACH TIP
One Inch
O.A. FUSELAGE LENGTH
41 Inches
RADIO COMPARTMENT SIZE
(L) 10" X (W) 3¼" X (H) 2¼"
STABILIZER SPAN
21¼ Inches
STABILIZER CHORD (incl. elev.)
6¼" (Avg.)
STABILIZER AREA
125 Square Inches
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
8¾ Inches
VERT. FIN WIDTH (incl. rud)
7¾ Inches
REC. ENGINE SIZE
.35-.45
FUEL TANK SIZE
8 Oz.
LANDING GEAR
Tricycle
REC. NO. OF CHANNELS
5
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Flaps
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa & Plywood
Wing ..... Balsa & Plywood
Empennage ..... Balsa
Wt. Ready To Fly ..... 80-88 Oz.
Wing Loading ..... 20-22 Oz./Sq. Ft

CONSTRUCTION

Please read entire article before cutting and assembling.

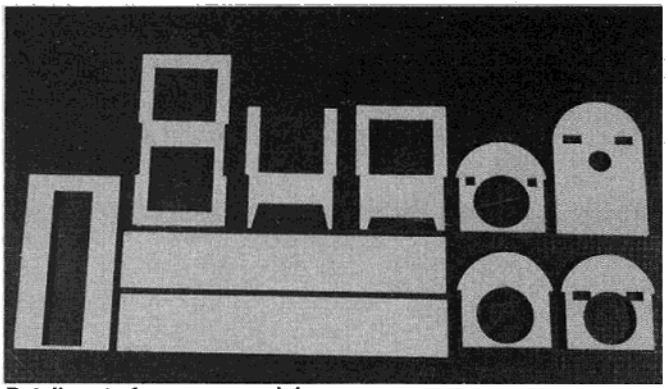
Fuselage Sub-Assemblies

Power Module:

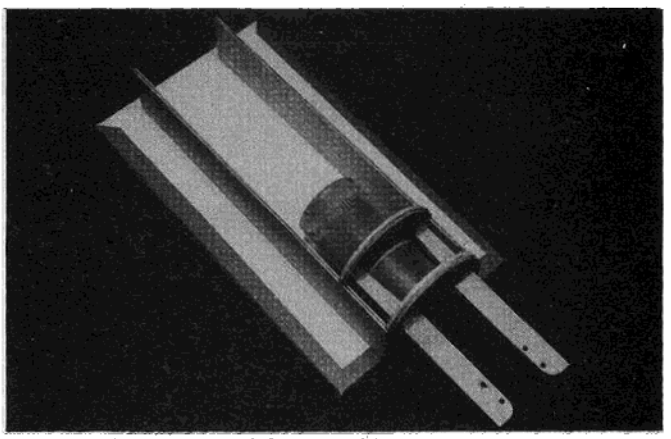
The use of a small table saw will be helpful in cutting out the plywood parts since most of them have a width of 3½". The motor mounts will have to be ripped to fit the engine of your choice. Mine was an O.S. 40 and about 1/16" was removed from the inside of each mount. Cement FW1 to the back of the firewall and A1 to the back of former A. I drilled the engine mounts before epoxying them to former A-A1 use a triangle to true the mounts both ways. A plywood spacer, the same dimensions as the mounting holes, temporarily bolted to the motor mounts may be of assistance. Slide the firewall over the mounts and epoxy into position. Ensure alignment by placing on the edge of a table or box. A weight placed through the tank hole will stop it from falling. This module should be constructed with as much accuracy as possible as it is the keystone of the model. Epoxy the side doublers in position using the edge of a table or a box again. Cement 1/8" x 1/2" balsa strips to the back of former D. Cut out the bottom piece but do not apply at this time. These are spacers to allow clearance for the installation of the landing gear mounting panel after the gear has been attached. The fuel tank must be placed in position before proceeding. You may find it easier to epoxy formers B, C and D to the cabin roof before attaching them as a whole to the side doublers. (Don't forget the fuel tank!) The 1/8" x 1/2" spacers on the back of former D will act as a stop for locating the unit in place. Install tank locks and 1" x 1" x 1/4" wing mounting blocks.

Control Module:

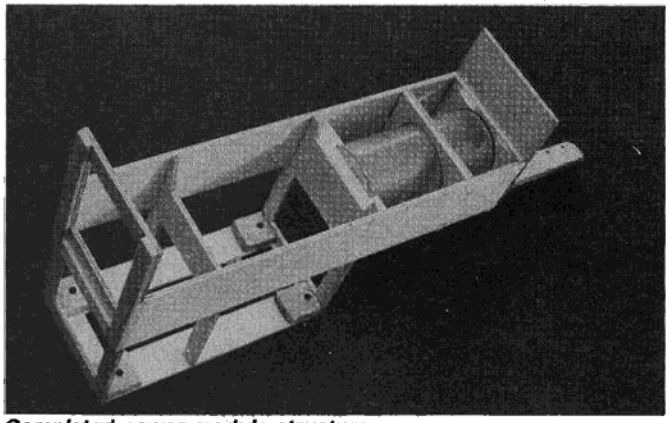
Cement the four sides together using a square for alignment. Cement the doublers in position. Hard balsa or 1/8" plywood should be used for the top doublers as you will be pushing down on these frequently to free the module



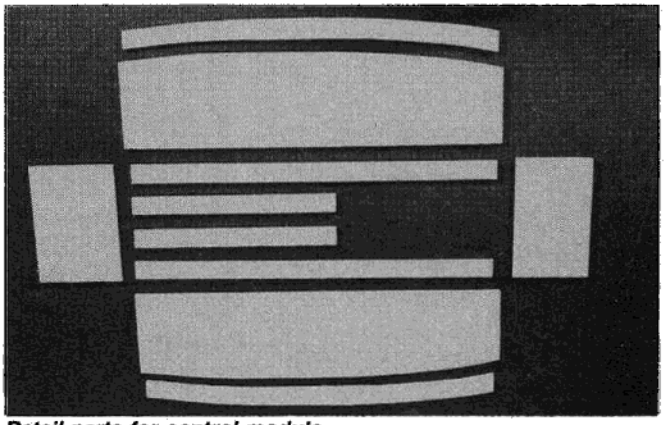
Detail parts for power module.



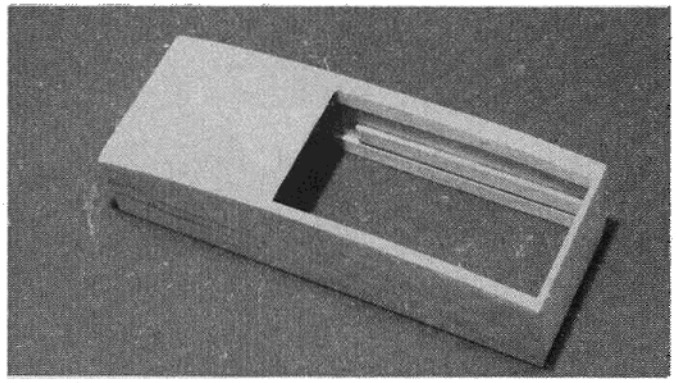
First step in power module assembly.



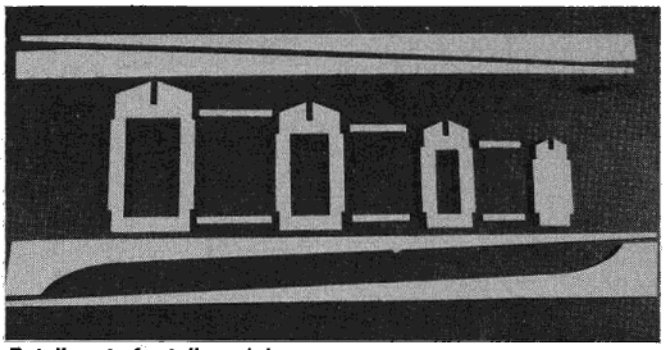
Completed power module structure.



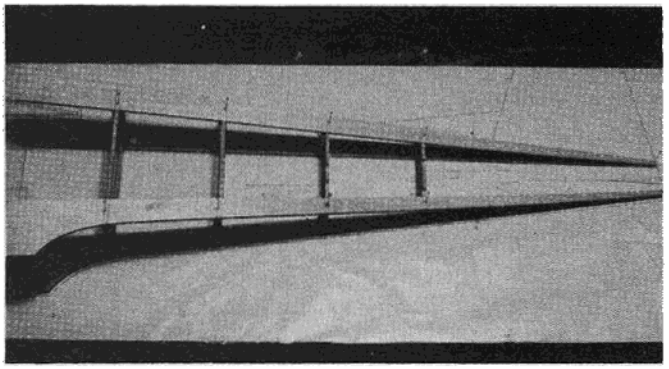
Detail parts for control module.



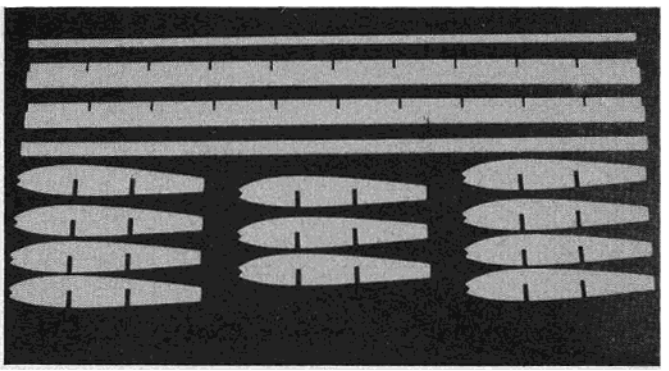
Completed control module.



Detail parts for tail module.

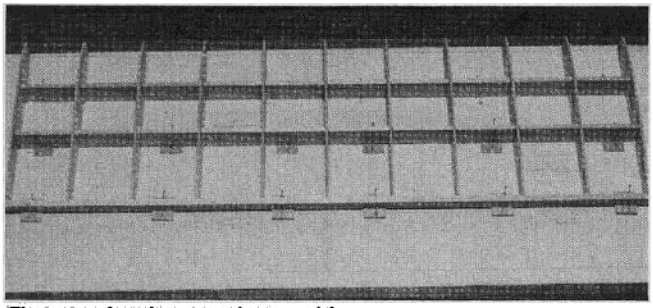


Completed tail module assembly.

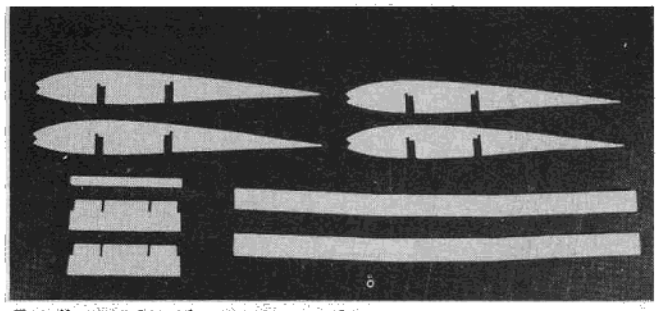


Detail parts for one wing panel.

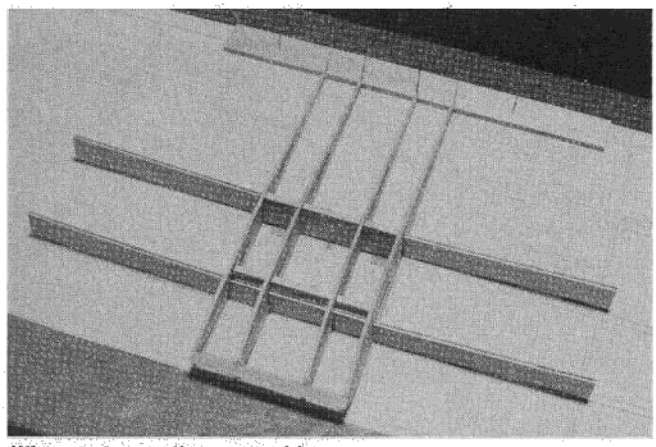
from its nest. Use the servo tray as a guide while cementing servo tray holders in position. Trays should slide smoothly but not loosely. Cover the bottom with 1/8" balsa applied crossgrain. Recement all joints for strength and add 1/8" plywood rectangles for receiving the module retainer bolts. Movability for balance was the original intention behind the sliding servo tray but it did not work out that way in practice. Tail



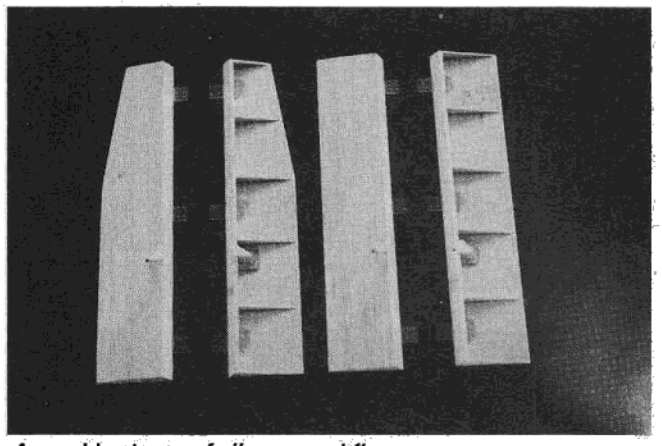
First step in wing panel assembly.



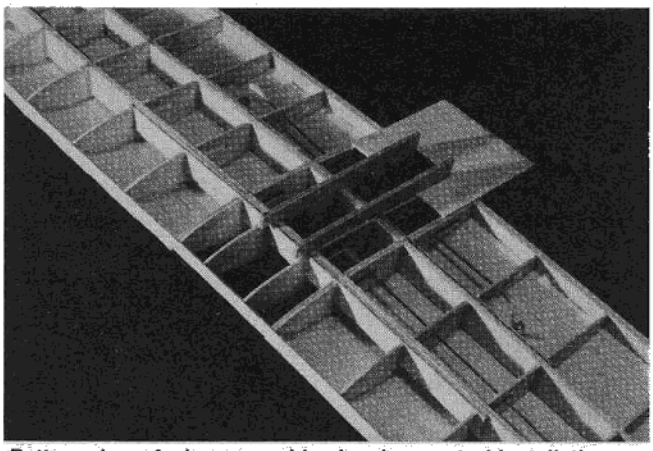
Detail parts for wing center section.



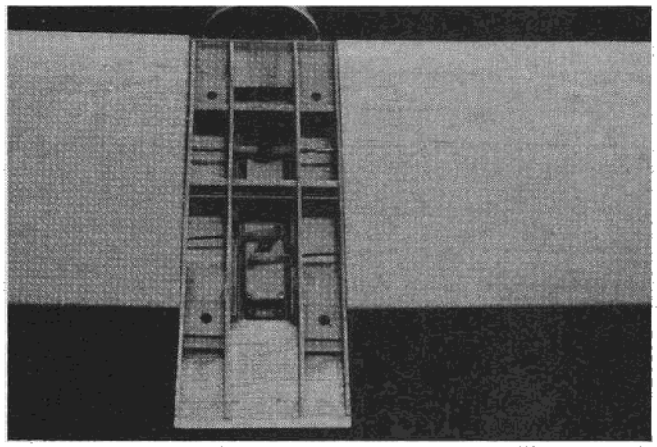
Wing center section assembly.



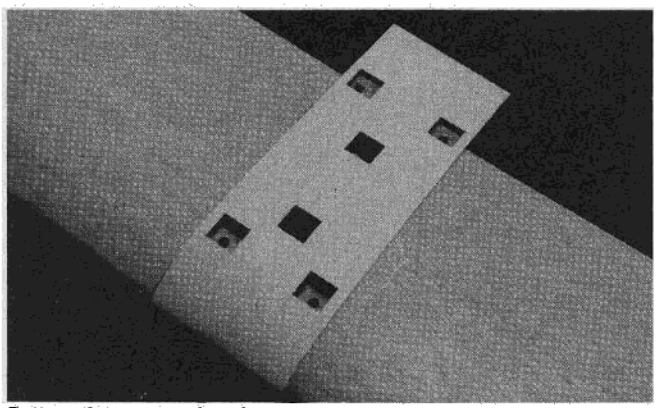
Assembly stages of ailerons and flaps.



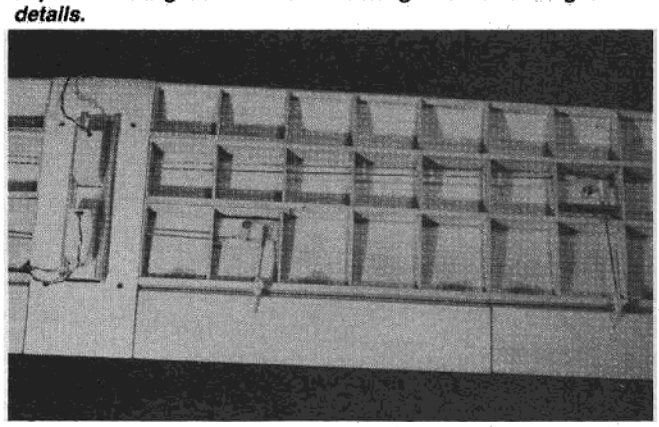
Bottom view of wing assembly showing control installations.



Top view of wing center section showing servos and wing mount details.

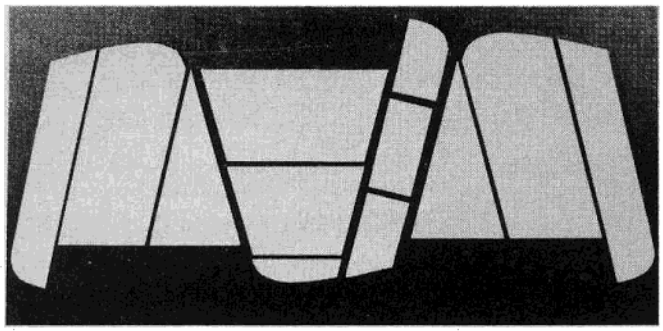


Pattern for access hatch.

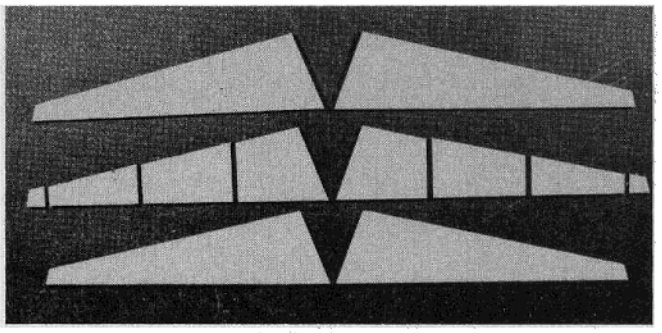


Bottom view of wing showing flap and aileron control installations.

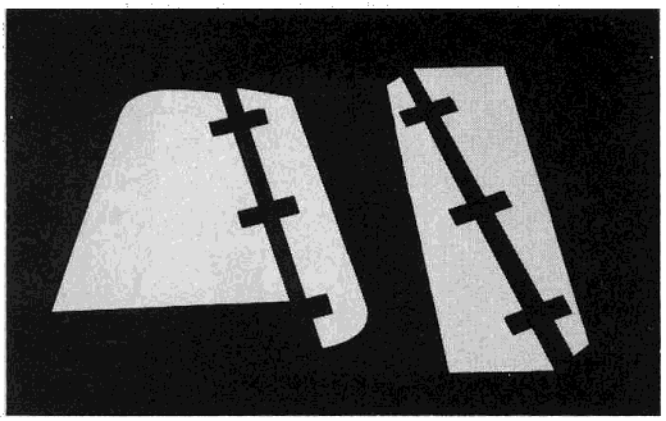
heaviness forced the location of the servo tray at its most forward point — flush with the front of the servo tray holder. A 1/8" piece of balsa was slid in place first to fill the void in the back of the tray. The battery and receiver area are covered by a 1/8" piece of plywood held in place under the top doublers by compressing the padding in that area. The switch, charging jack, and antenna outlet are mounted on the bottom of the module. I used a



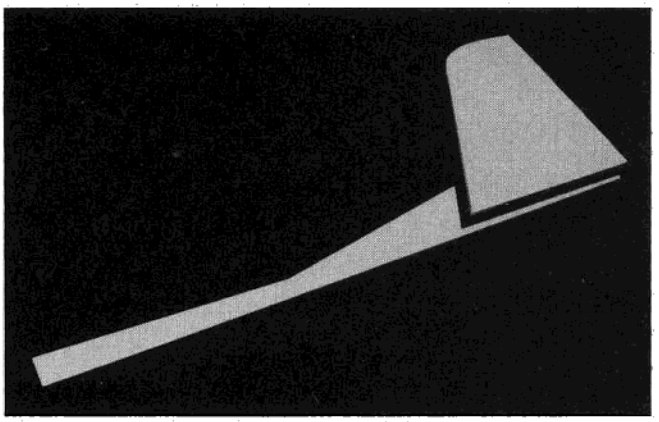
Detail parts for fin and rudder. Parts are laminated for stiffness.



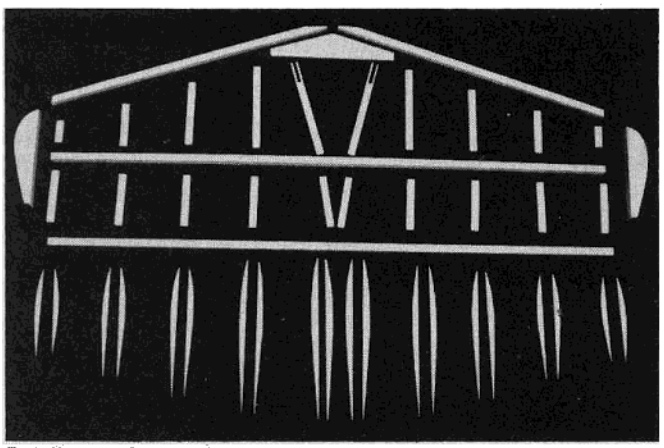
Detail parts for elevator lamination.



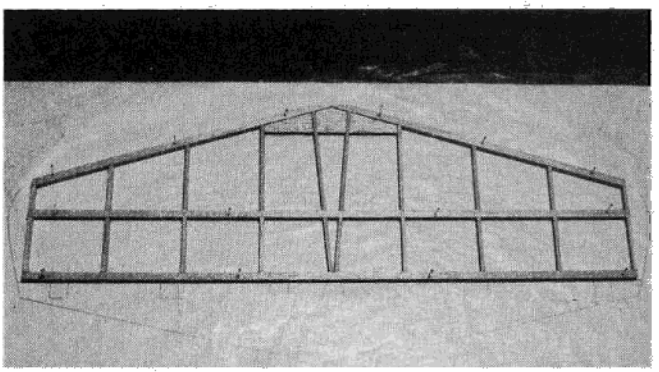
Fin, rudder, and elevator cores have cut-outs for hinges.



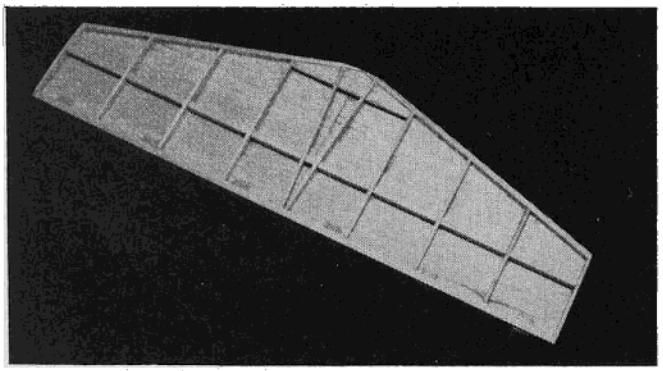
Aft fuselage spline and fin ready for joining.



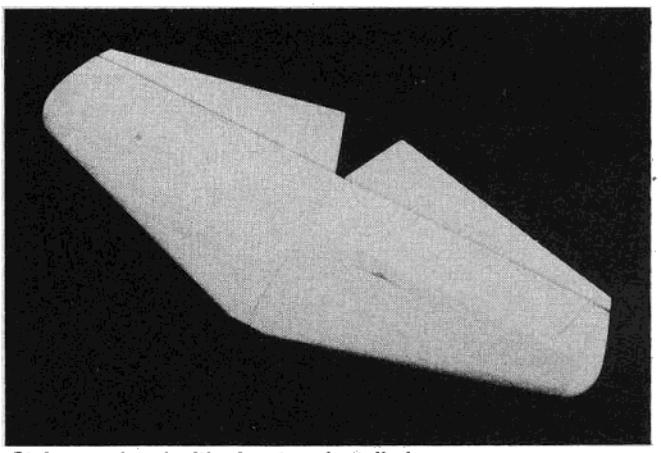
Detail parts for stabilizer.



First step in stab assembly.



Stab assembly prior to adding top skin.

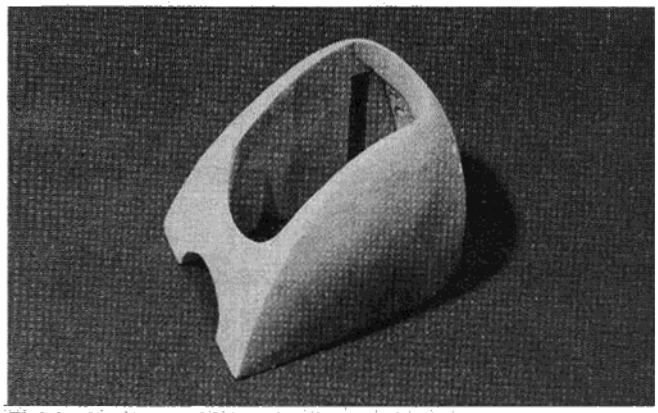


Stab completed with elevators installed.

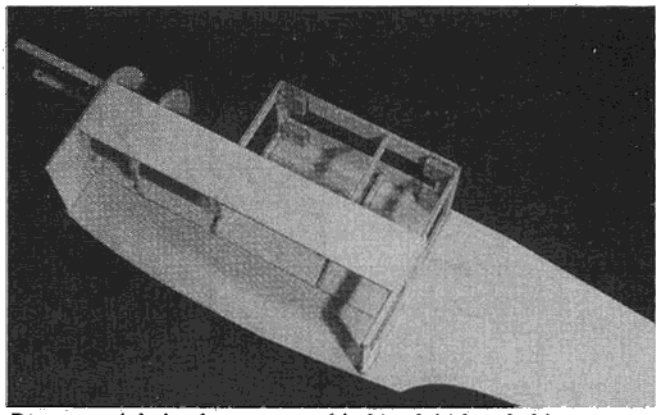
polypropylene hinge inserted at the tail to hold the end of the antenna which I just laced through the two bottom holes.

Tail Module:

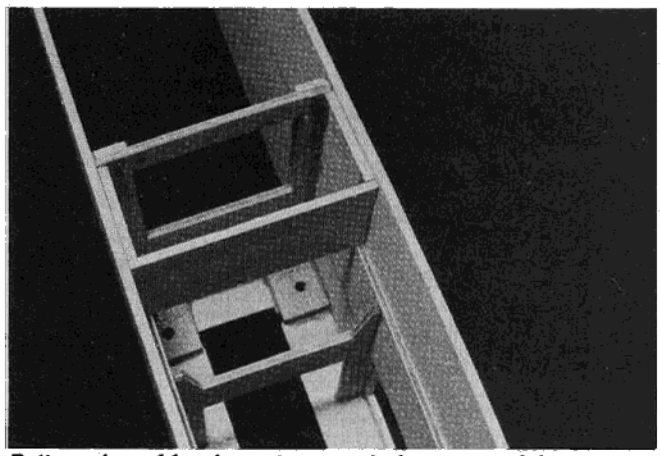
Cement the 1/8" x 1/4" stiffeners to the fronts of formers E, F, and G. Position the left side doublers on the plan and scribe the former locations on them. Remove from plan and pin the right side doublers in place. Scribe the former locations again. Cement the



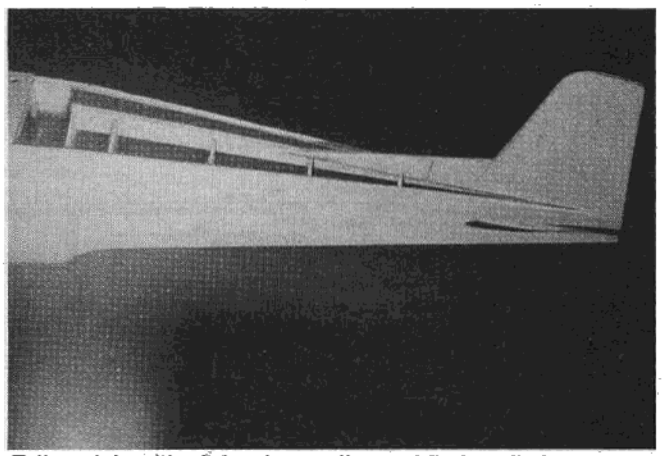
Finished nose cowl is made of several pieces.



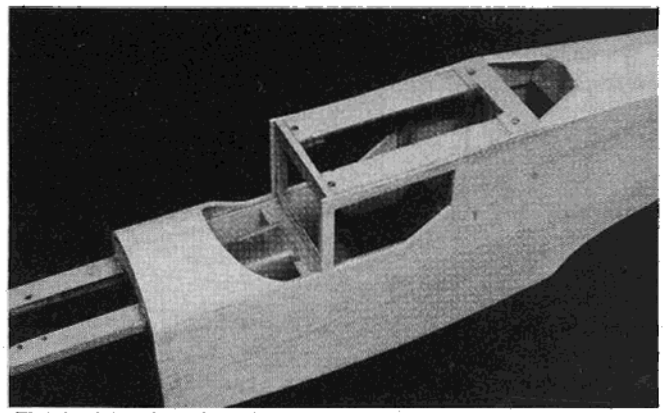
Power module is shown assembled to right hand side.



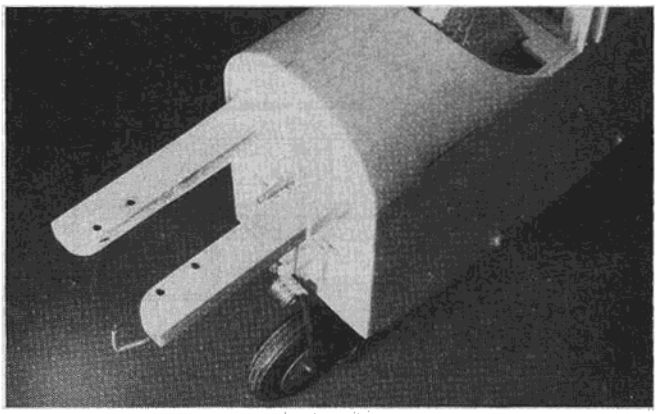
Bottom view of fuselage at rear end of power module.



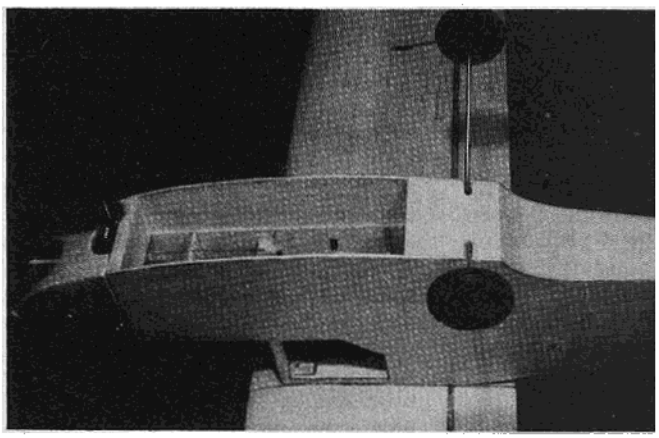
Tail module with aft fuselage spline and fin installed.



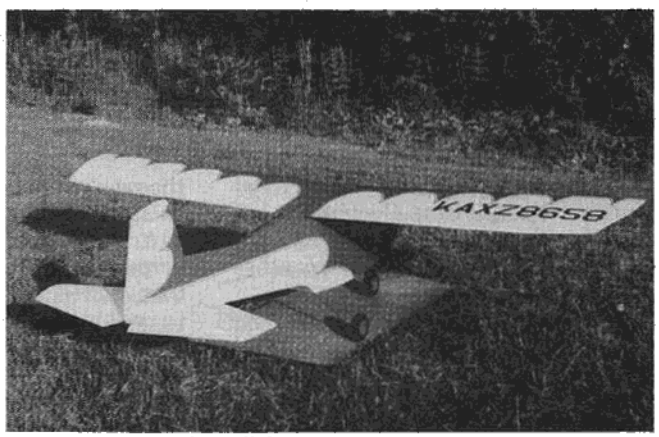
Finished fuselage in cabin area.



Forward fuselage with nose gear installed.



Bottom view of cabin area.



Finished and ready to fly!

also serve as keys to hold wing in position. This is where the power module comes in handy. The servo tray holders must fit snugly but not tightly in the opening of the cabin roof. Make any adjustments at this time. This is also a good time to measure the distance from the ends of the wings to the forward engine mounting holes to see that the alignment is shaping up.

Construct the aileron and flap servo tray out of 1/8" plywood. The tray must fit snugly inside the holders. Mount the servos on tray and install tray in position using four small flat head screws or notch cabin roof for clearance of round head screws.

Notch the rear spars of the wing panels to receive hinges. Sheet top of wing panels, lapping balsa over leading edge spars. The top of the wing panels were fabric covered and clear doped at this time. The fabric was carried to the bottom of the rear spar.

The wing mounting bolts were recessed inside the center section on the model for appearance. Access is gained through small hatches cut in the wing covering. Similar hatches are used for access to the aileron and flap servos. If you do not wish to recess the bolts, you must block in that area solid with scrap balsa. Finish sheeting the bottom of the center section, again lapping balsa over leading edge spar. You will have to bevel the bottom of the leading edge spar first, so sheeting will follow contour of ribs. Fill in the area of the front mounting bolts with scrap balsa even with top of spar joiner. A piece of 3/32" plywood is cemented over balsa and spar joiners to serve as a bearing for mounting bolts. The front portion of the center area is filled also, because you will be cutting a circular groove in the underside to receive the top of the windshield. A 2" length of scrap balsa plus the 3/32" plywood bearing is cemented in place for the rear mounting bolts. Place the wing in position on the power module and drill and tap for 1/4-20 mounting bolts.

Install ailerons and flaps. Hinges are cemented to rear spar and top covering. Hook up all aileron and flap control linkages and test the operation of the servos. Make sure the flap servo is at limit of travel before flap reaches full extension. Down aileron movement should be about 1/2" with about half that for up movement because of the differential bellcranks.

Make a pattern for the access hatches out of heavy paper. The hatches are centered over the mounting bolts and servo arm retainer screws. Sheet the top of the center section, again lapping balsa over leading edge spar. Secure the hatch pattern in place and cut through the balsa at the front side of the hatches only. This is the hinge side. After fabric covering is applied and all painting is finished, the pattern is again secured in place and the remaining three sides are cut at that time. It is advisable then to apply several coats of clear dope to the underside of the hatches so they will retain any curvature. I have had varying degrees of success with this innovation depending on the fabric used. The plastics would probably work best. If the hatches don't stay in place, a piece of Scotch Tape will keep them closed for flying.

Sheet the bottom of the wing panels after first beveling the bottom of the leading edge spar as you did on center section. Round the leading edges and finish fabric covering.

Make each wingtip from four pieces of 1/2" sheet balsa or from balsa block if you can find very light stock. Use the center section rib as a pattern, making it slightly oversize to allow for sheet balsa covering. Carve and sand to the shape shown on plan. Do not bevel the top of the wingtips in any way and do carve bottoms in a concave shape as is also shown. Cement the tips to the wing and finish sanding and clear doping the entire wing.

Fin, Rudder and Elevators:

These are a sandwich of 3/32" balsa with a 1/16" balsa cross-grained core that has cut-outs for hinges. When the 1/16" core pieces are joined, a straightedge along the hinge line will be beneficial. After the fin is assembled, it should be joined to the 1/4" spine before shaping. The rudder and elevators are beveled to a 1/16" edge at rear, using the core as a guideline. All of these parts were covered and clear doped at this time.

Stabilizer:

Pin all 1/4" spars in place over plans and cement 3/32" x 1/4" rib cores in proper locations. The center cores must be notched for leading edge spar joiner. Remove from plan, sand, and add ribs top and bottom. Sand ribs for conformity and bevel the leading edge spar in preparation for sheeting. Groove the rear spar for hinges and cement them in place. Sheet the bottom of the stab. Do not attempt to cover the full length of the stab in one piece. Cover the top of stab similarly. Shape the stab tips to match the wing tips. Round the leading edge and finish sanding the entire stab. Apply the fabric and clear dope. Elevators may be added at this time.

Cowling:

Assemble the sections of the cowl as shown on plan. If you cement the four inner sections, top and bottom, you will find it easier to shape and sand the interiors prior to joining them to outside sections. Use a piece of scrap motor mount stock when assembling the sections that are grooved to ensure a snug fit in that area. Rough sand to profile shape. Cut an opening in front to fit the engine you are using. The O.S. 40 required the removal of the glow plug, needle valve and retainer, muffler and muffler extension, to make cowl removable. This is a good time to locate and drill the necessary holes for tightening the mounting bolts, attaching muffler, etc. Cut hole for nose gear, and shape and sand to finished contours. Cut slot for muffler and any necessary grooves in interior to provide clearance for removal. Finish and paint the cowl to your preference. Slim balsa wedges (1/16" x 3/8" x 1") are cemented to the outside of the motor mounts where they meet the firewall to hold the cowl in place. Bevel the front of the shims and sand them down until they hold the cowl snug without spreading it.

Fuselage Assembly:

Cement the power module to the right fuselage side, making sure cabin roof is flush with flat portion of fuselage top. Remove all excess cement from windshield mounting area and bottom of cabin doubler. Lay left fuselage side on building surface and cement power module to it, again removing excess cement. Use a triangle to ensure fuselage sides are in alignment at tail.

Place the 1/8" x 1/4" spacers and the control module front stop in position but do not cement. Insert the finished control module in place and inspect for a flush fit. If it is not a flush fit, trim the spacers until it is. Cement the spacers and the stop in place. Do not fill in bottom at this time.

With control module in position again, cement control module rear stop flush with rear of module. Be careful not to cement to module. Cut and fit rear stop doublers and cement in place. The control module should now fit flush but not tight; the module moves freely in and out. I strengthen the opening by heavily cementing 2" strips of nylon fabric in the four inside corners. Make sure area is smooth and then sand corners of module until it again moves freely in and out.

Cement tail module in position making sure doublers are up tight against former D at top and separated at bottom by width of main gear mounting panel. Place mounting panel in position temporarily to

ensure this. Pin or tape fuselage sides together and weight down to ensure good bonding.

Place wing in position on cabin roof and cement former E1 to fuselage sides flush against rear of wing. Cement spine and fin in place.

Cement stab in position and measure from wingtips to ensure correct alignment. Fill in the area at the rear of the stab with pieces from original stab cut-out. Attach rudder and elevators now if you have not already done so.

Install control horns, elevator pushrod transfer linkage and control rods. Test for operation.

Cover top rear of fuselage in continuous pieces. Bevel edge that abutts the fin and spine. Cover the area in front of the windshield in two pieces by soaking balsa in warm water for a few minutes and letting it dry overnight, taped to a can or bottle of the same diameter. Cut out for windshield using pattern on plan.

Attach the main gear to the gear mounting panel at location shown on plan. I drilled two holes in four places and attached it with thread and cement. Foolproof! You will also have to drill mounting panel for control rods. Remove rods while installing panel. Cement mounting panel braces in position and reinstall control rods. Cement bottom 1/8" x 1/2" spacer between panel and former D.

Locate and cement nose gear mounting panel in place so model sits level with thrust line. Drill mounting holes and install gear. Before filling in bottom of area behind gear, you may want to consider it as the place for adding weight necessary for balancing the model. After that, fill in with 1/8" x 1/4" spacer and final 1/8" sheeting.

After rudder and elevator servos are hooked up and tested, sheet the bottom of the fuselage. Cement balsa cross-grained. Curved area behind main gear is covered in one piece, again by the soaking and drying method. Leave a little opening around main gear to allow for its movement.

Cement a piece of 3/16" x 1" x 3½" balsa across rear of cabin roof. Bevel it and the top fuselage sheeting until wing fits flush. Do not trim 3/16" thickness at rear since this governs incidence. Cement a piece of 1/8" x 1/4" across front of cabin roof and trim this until wing center section rests on cabin roof. Cement a 1/8" x 1/4" piece of balsa on both sides of the cabin roof. Trim and sand to make wing saddle. Redrill holes for wing mounting bolts.

Windshield and windows were installed after all covering and painting were completed. Cut a semi-circular groove about 3/32" wide and 3/16" deep and 3½" in diameter in the underside of the wing center section to receive the top of the windshield. Use a paper pattern of the windshield until you get a perfect fit. The windshield should protrude about 1/8" above the wing saddle. The windshield was attached by just running a bead of cement down where it meets former B.

The window frames were made from 3/32" x 1/8" balsa to fit snugly inside window cut-out. Butyrate was cemented to the backside after painting and they were installed so the 3/32" facing protruded slightly from fuselage sides.

Bill of Materials

1 — 1/8" x 6" x 48" Plywood — Fuselage formers, spar joiners, servo trays.
1 — 3/32" x 1" x 8" Plywood — Wing mounting bolt bearings, transfer linkage.
4 — 3/16" x 1" x 36" Strip Balsa — Wing main spars.
2 — 1/4" x 1/2" x 36" Strip Balsa — Wing rear spars.
4 — 1/4" sq. Strip Balsa — Wing leading edge spars, stab spars.
8 — 1/6" x 4" x 30" Sheet Balsa — Wing sheeting, fin, rudder & elevator cores.
2 — 1/16" x 3" x 30" Sheet Balsa — Stab Sheeting.
1 — 1/2" x 3" x 36" Sheet Balsa — Cowl & wing tips.
1 — 1/4" x 3" x 36" Sheet Balsa — Cowl & spine.
3 — 1/8" x 4" x 48" Sheet Balsa — Fuselage sides, formers, control module.
2 — 1/8" x 3" x 36" Sheet Balsa — Formers, stops, doublers, cowl.
2 — 3/32" x 4" x 36" Sheet Balsa — Wing and stab ribs.
1 — 3/32" x 3" x 36" Sheet Balsa — Fin, rudder, elevators.

Miscellaneous

3 — 2½" wheels, 5/32" steerable nose gear, 5/32" wire for main gear, 22 polypropylene hinges, 8 large control horns, 2 — 90° bellcranks, 2 — 60° bellcranks, 2 — 1/2A bellcranks, control rods, snap-links, 4 — 1/4-20 nylon bolts, 4 small nylon bolts and washers, 3/8" x 1/2" x 18" hardwood motor mount stock, butyrate plastic, * 8 oz. fuel tank.

Most of the Balsa and plywood was purchased from Balsa U.S.A., the rest from the local hobby shop. * The fuel tank was homemade from a tapered plastic bottle found in those de-mineralizing filters used by the housewife for her steam iron. (Deem was the trade name.) The taper must go to the front to provide a sump for the fuel. The neck was cut off and Sullivan's Innard's used. An 8 oz. round tank of your choice can be substituted if you can make the necessary alterations in formers FW1 & A.

The model was covered with a polyester fabric and finished with Aero-Gloss. The wings and stab were completely sheeted on this version although the original was only sheeted to the front main spar and ribs cap-stripped. The stab was sheeted in the same manner. Your readers can take their choice. □

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