By Alex Bouknight

OSPREY BIPE .60

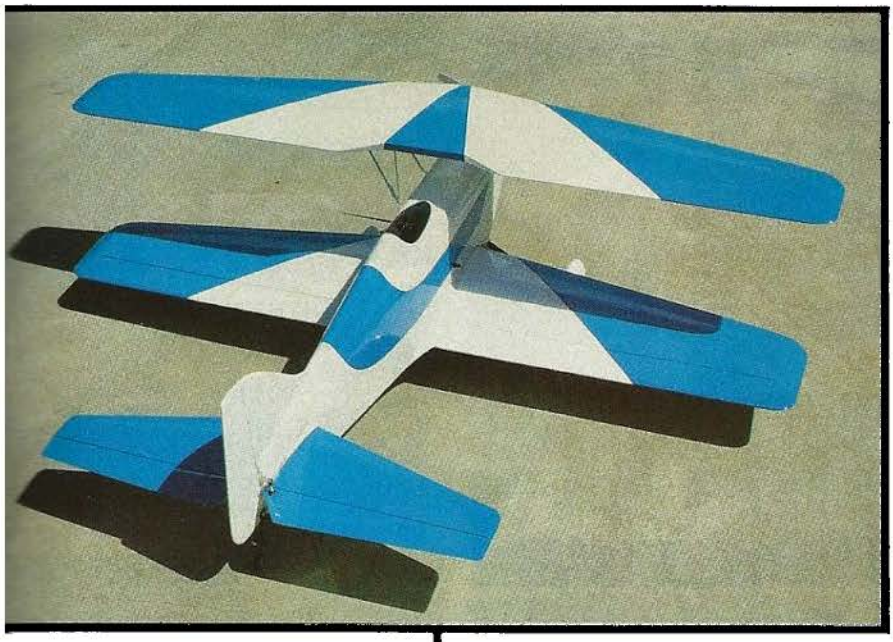
Alex Bouknight has designed another classic, only this time it's a bipe. Balsa is his favorite material and feels every modeler needs to build at least one biplane in their lifetime. This is a good one to start.

When you think of a model airplane, what is the first thing that comes to mind? The first thing I think of is balsa wood. All of us got our start modeling at some point in our lives with that first trainer type kit or Control Line model. The smell of ambroid still gives me that nostalgic feeling. Tremendous strides have been made with the new composite type materials, often found on the scale type ships, so construction of the whole aircraft can be accomplished without a single piece of balsa wood. Pre-fab kits abound that get you in the air in a hurry, and that is fine if you are in a hurry. I get as much satisfaction out of the building as I do the flying, and nothing beats balsa wood as a fun medium to work with. A workshop, some simple tools, and a little creative time is all that is needed to turn out a beautiful product of which you can be proud.

With each new project, I try to cover new ground, try something a little different. The Elliptic series had the elliptical wing, the Osprey, a mid-wing with neutral stability characteristics; why not a classic biplane? Nothing gives you a more classic look or feel and a perfect project for my favorite material, balsa wood. Besides, everyone needs to build at least one biplane in their lifetime, right?

On the subject of balsa wood, I have found a source of very top quality balsa wood for you scratch builders. Superior Aircraft Materials, P.O. Box 8082, Long Beach, California 90808, (213) 865-3220, sells some of the highest quality wood I have found to date and I would highly recommend them for your next project. I used them for the wood source on my prototype aircraft. Besides, if you are going to take the time to scratch build an aircraft, you might as well use good wood. Choose the wood carefully, and build light, and you will end up with a good flying ship.

The airfoil chosen is the NACA632A series which I have found to exhibit very smooth characteristics at all angles of attack and produces the high lift/low drag figures I wanted and is used on both wings and the stab. I designed the fuselage with symmetry around the thrust/stab centerline. The bottom wing and stab incidence is 0°. Effective dihedral is achieved through the L.E. taper on both wings with no actual dihedral needed built in. If the model needs a bit of negative incidence in the top wing, 1/2° to 1°, this can be done by putting a washer under the rear wing bolts. Build it with 0° and adjust during the knife edge trimming sequence.



OSPREY BIPE .60

Designed By:
Alex Bouknight
TYPE AIRCRAFT
Sport Bipe
WINGSPAN
57¼" Top — 55¼" Bottom
WING CHORD (Avg.)
8⅝" Top — 9⅞" Bottom
TOTAL WING AREA
1018 Sq. In.
WING LOCATION
Biplane
AIRFOIL
NACA 63A012 Top — 63A015 Bottom
WING PLANFORM
Tapered L/E
DIHEDRAL EACH TIP
0
O.A. FUSELAGE LENGTH
51¾ Inches
RADIO COMPARTMENT SIZE
(L) 12" x (W) 3½" x (H) 6"
STABILIZER SPAN
29 Inches
STABILIZER CHORD (inc. elev.)
6¼ Inches (Avg.)
STABILIZER AREA
174½ Sq. In.
STAB AIRFOIL SECTION
NACA 63A010
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
6¼ Inches
VERTICAL FIN WIDTH (incl. rud.)
7⅜ Inches (Avg.)
REC. ENGINE SIZE
.60 2-Stroke/.90 4-Stroke
FUEL TANK SIZE
16 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4 (5 servos)
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail. (2 servos)
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Ply & Spruce
Wing ..... Balsa, Ply, Spruce, & Pine
Empennage ..... Balsa, Ply & Pine
Wt. Ready To Fly ... 128-160 Oz. (8-10 Lbs.)
Wing Loading ..... 18½-23 Oz./Sq. Ft.

The thrust line is 1° down and 3° right, although the right thrust may have to be varied depending on the engine/prop combination that you choose. These settings are for an O.S. 61ABC with a Perry pump and Zinger 12 x 6 prop. The plane should pull a 5-second vertical climb with no rudder needed to correct for the torque effect if the right thrust is correct. The larger pitched props, 11 x 9, 11 x 10, required 4° right. Mounting of the engine can be either inverted or to the side, but, in any case, lay out your tank position so the centerline of the tank is in line with the needle valve on your engine. This will give a more even needle setting throughout the flight.

I left outboard "N" struts off the prototype to make the construction as simple as possible and speed up the set-up time at the field. I have encountered no problems with strength during the flight testing using only the main cabane struts. If you fly a lot of very high "G" maneuvers, inverted snaps, etc., you may want to add some functional "N" struts outboard for peace of mind.

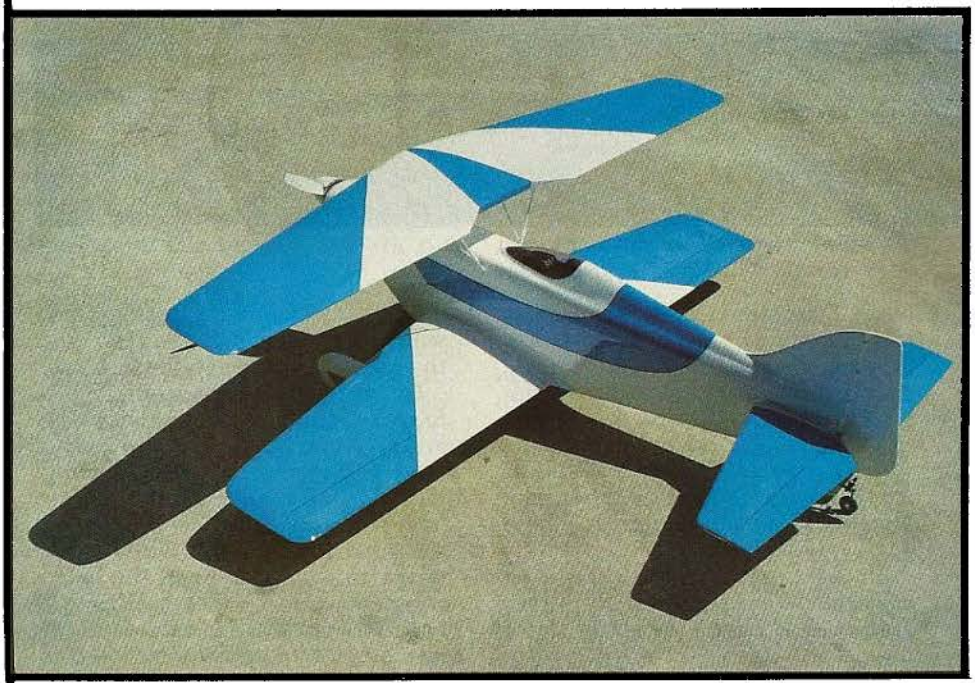
I have included a list of the materials that you will need along with an accessory list to complete the project. Get the materials ordered and study the plans to get a feel for the project. Let's get started.

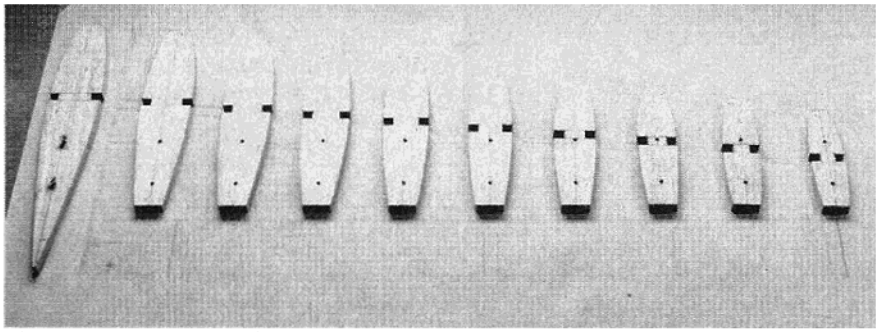
CONSTRUCTION

Bottom Wing:

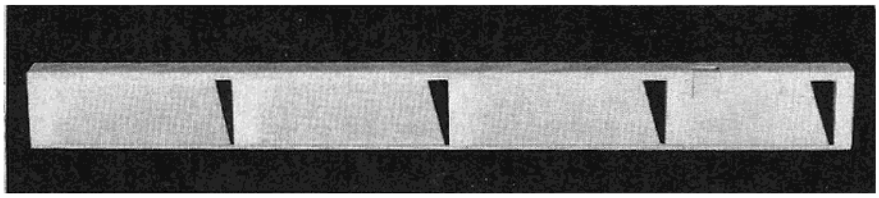
The construction process begins with the bottom wing, and you will need a wing jig. The A-Justo-Jig is highly recommended and allows both panels to be built at the same time. (See ad in this issue.) This allows accurate alignment at the center section and builds a straight, true wing with no wash-in or wash-out. Use the Hot Stuff Super T type glue on all joints except where noted. This keeps the weight down and speeds up the building time. The holes drawn on the ribs are the jig rod locations. Adjust the dihedral on the jig so the mid-line of all the ribs is on a straight line or 0° dihedral. This will put taper on the top and bottom surface; see plans.

Prepare the basic wing components, ribs. L.E., aileron bay spars, and main spars. Draw centerlines on the ribs and the inside of the L.E., and aileron bay spar. Notch the L.E. and aileron bay spar for the rib locations to the 1/8" depth shown. Note the taper on the aileron bay spar and the aileron L.E. Thread the ribs #2-#10 on the jig rods with the spacing shown on the

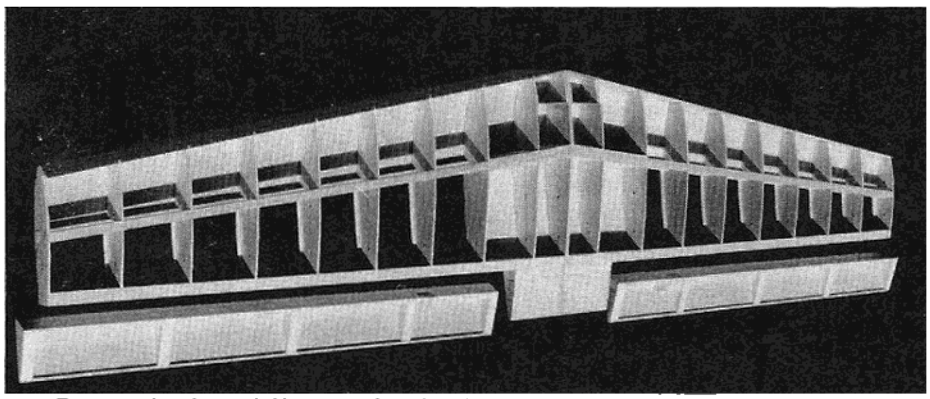




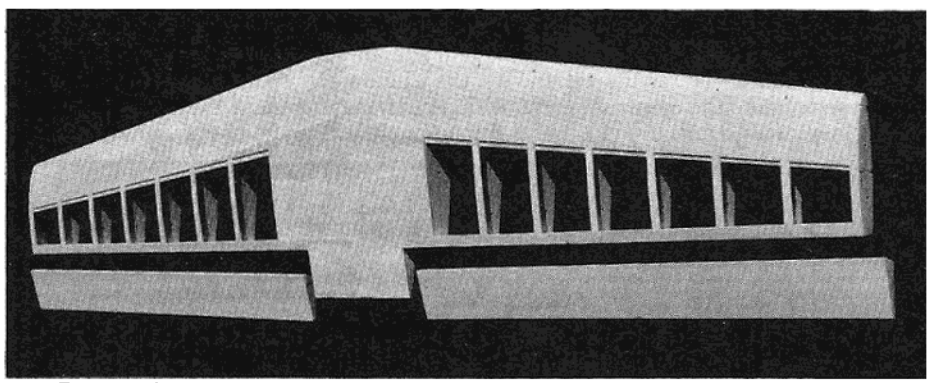
Set of ribs for bottom wing.



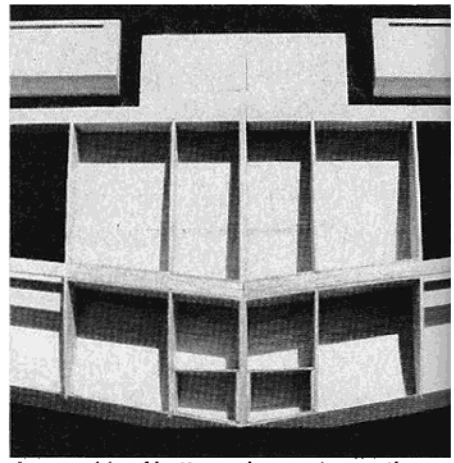
Aileron sub-assembly.



Bottom wing framed. Upper surface has been sheeted.



Bottom wing sheeted on both sides.



Lower side of bottom wing center section showing 3/32" ply wing dowel plates between ribs LR 1 & 2.

plans. Epoxy the two #1 ribs together and position on the jig in the center position. Pin the L.E. and aileron bay spar in place, aligning the centerlines with the lines on the ribs. Add the top main spars. The bottom main spars will be added later after the wing is removed from the jig. When the alignment is exactly right, glue these parts together.

The next step is to add the ply wing dowel plates on each side of the #1 rib at the L.E. Epoxy the two front plates in place. Glue the four balsa 1/2 ribs to the #1 and #2 ribs. Add the two rear ply dowel plates using epoxy. These will be marked and drilled later with the wing in position on the fuselage.

Cut one piece from each aileron L.E. to make up the center section blocks and glue into position on each side of the #1 rib. Add the two remaining balsa filler blocks at the #1 rib position and taper to fit the rib contour. Glue the pine T.E. to the rear of the filler blocks. Sand the entire wing structure so the sheeting will have nice flush joints to glue to. Be careful not to alter the airfoil shape.

Edge glue a piece of 3" and half a piece of 2" 3/32 sheeting together after trimming the edges with a straightedge to make the forward portion of the sheeting. Repeat for the other panel. Hold in position and mark your cut line along the main spar mid-line. After the piece fits correctly, glue into position with aliphatic resin glue. Repeat for the other panel. Cut the 1/2" wide sheeting that goes over the aileron bay spars from the aileron sheeting pieces and glue in place. Finish the sheeting for the entire top surface, including capstrips, using the scrap pieces for the center section. Let this dry overnight.

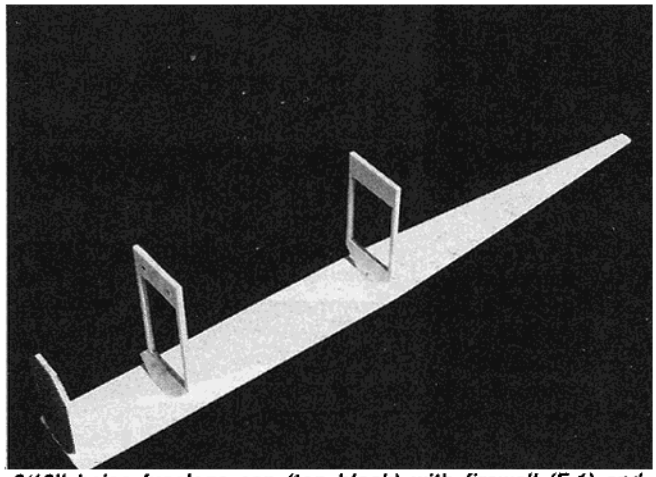
The wing may be removed from the jig. Add the bottom main spars. Cut to fit and glue the servo rails and rib doublers to the servo bays. Add the balsa webbing to the center section. Cut holes to route the servo wires to the center section exit hole. Sheet the entire bottom surface of the wing with capstrips. Cut out for your servos.

Sand the L.E. to the correct contour. Sand excess material from the end of the #10 ribs and install the tips. Finish sanding the entire wing until it is ready for glass cloth and covering.

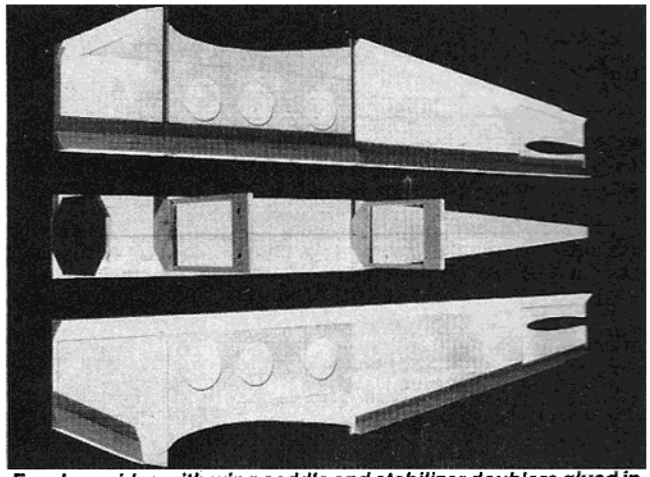
Construct the ailerons upside down on a flat work surface. Glue the aileron L.E. and the pine T.E. to the top sheeting. Add the balsa ribs and spruce horn blocks. You may want to add a couple of 1/2" balsa blocks around the horn blocks to give them more area in which to glue. Sand until the bottom sheeting has a nice flat surface to glue to. Add bottom sheeting to each aileron. Trim to fit the aileron location and temporarily install with hinges to test fit. Sand or cut taper to L.E. for freedom of movement at hinge line; see plans.

Fuselage:

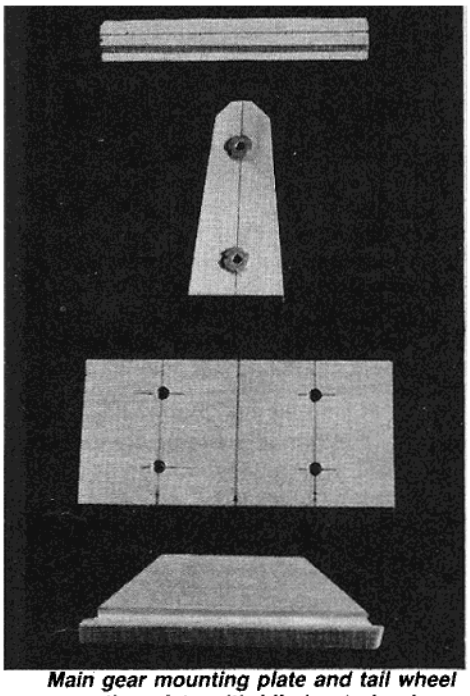
To begin the fuselage construction, cut out the major assembly parts needed to frame up the main body. You will need to determine the engine size that you plan to use as this will affect the nose length. A .90 will



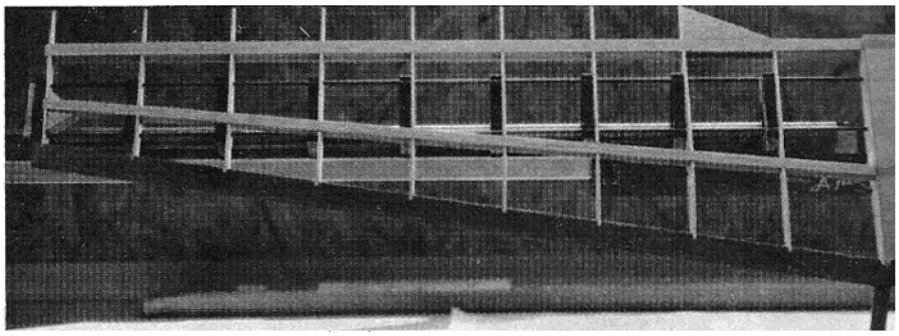
3/16" balsa fuselage cap (top block) with firewall (F-1) and bulkheads F-2 and F-4 glued in place.



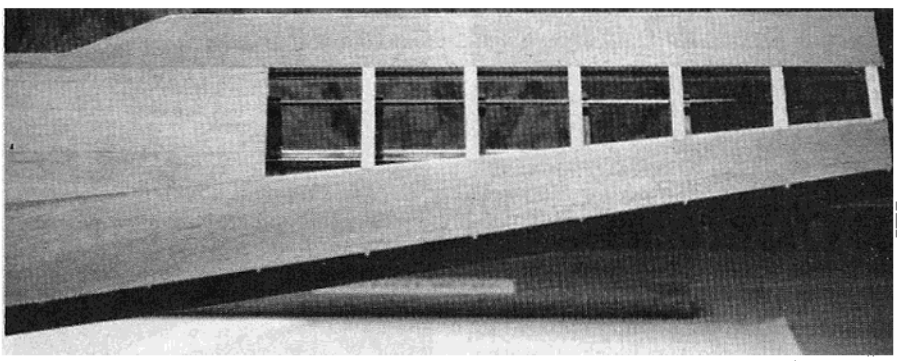
Fuselage sides with wing saddle and stabilizer doublers glued in place. Corner triangle stringers also glued in place. Note lightening holes in wing saddle doubler.



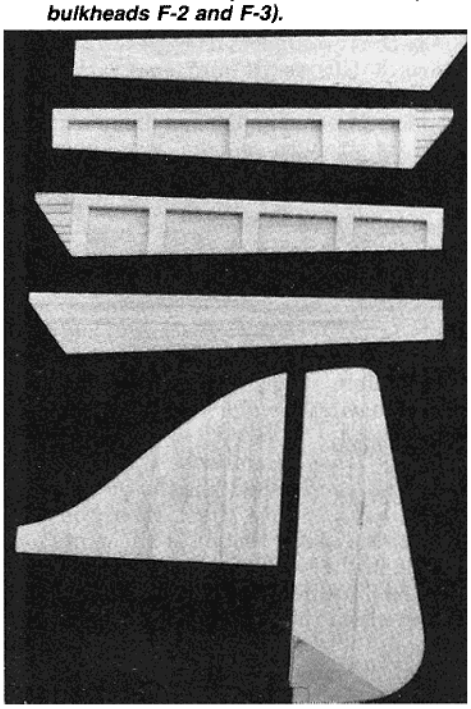
Main gear mounting plate and tail wheel mounting plate with blind nuts in place. Also shown is a spruce strut block (see bulkheads F-2 and F-3).



Upper wing being framed on wing jig.



Upper wing being sheeted while on wing jig.



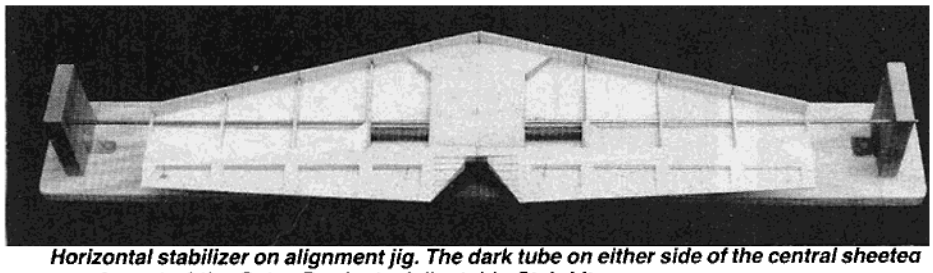
Fin, rudder, and elevator components. Note plywood doubler at lower part of rudder.

require a shorter nose moment for the correct balance point than a .60. Draw centerlines on the top and bottom surface of the top block. Mark the bulkhead locations at 90° to the centerline on the bottom side. The fuselage will be constructed upside down on your work surface, so these lines will face up during construction. Also, mark centerlines on the firewall, all bulkheads, landing gear, and tail gear plates. Assemble the two-piece tail post and mark centerlines.

Prepare the firewall by laying out your engine mount and drilling the necessary mounting and fuel line holes; see plans. Remember to offset the mount to allow for the right thrust so the center of the spinner will align with the centerline of the fuselage. Epoxy in the blind nuts to the backside of the firewall and drill for the throttle cable.

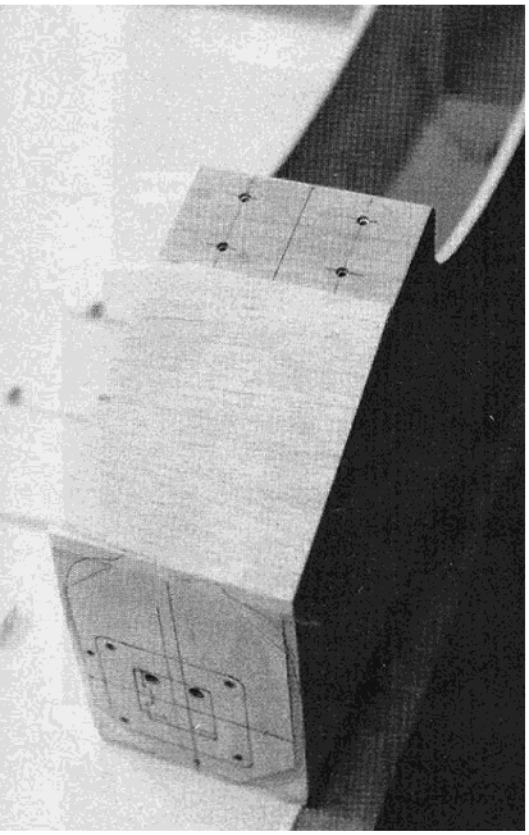
Prepare bulkhead #2, #3, #4 to allow clearance for the fuel tank and pushrods. Very carefully lay out and drill the dowel holes in the #2 bulkhead for the wing dowels; see plans for placement. Notch the top of the #3 and #4 bulkheads at the centerline if you plan to run an internal antenna installation with a NyRod tube. Drill for the mounting holes and epoxy in blind nuts to the main and tail gear plates.

The sides are built as a sub-assembly before they are joined to the

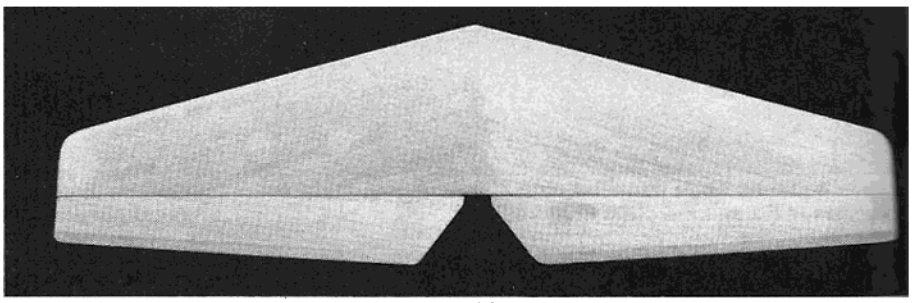


Horizontal stabilizer on alignment jig. The dark tube on either side of the central sheeted area is part of the Gator Products Adjustable Stab kit.

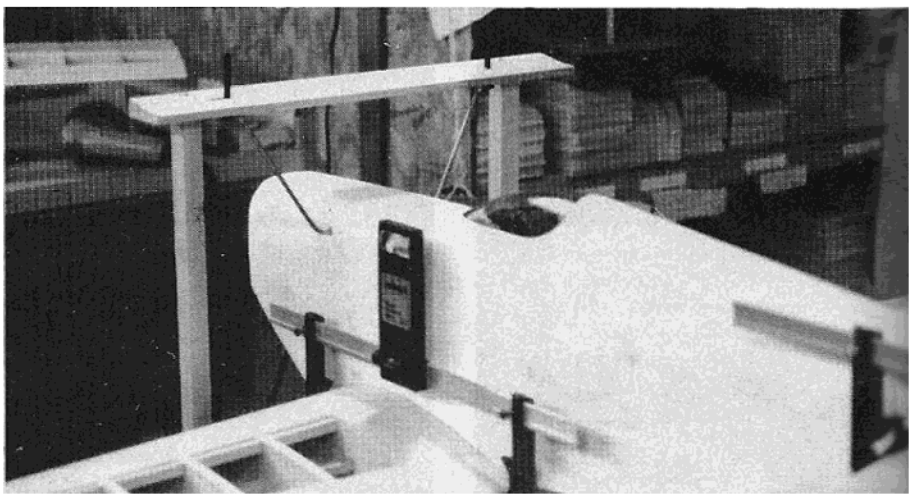
bulkheads and top block. Use the slow type epoxy on all the side to bulkhead joints so you have time to get the alignment right. Aliphatic resin works well on the top block to stringer joining. Add the tail post assembly to draw the sides together. Wet the sides slightly to pull the bow towards the tail. When everything is accurately aligned, clamp and let dry overnight. The fuselage should be straight and



Forward fuselage showing firewall, landing gear mounting plate, and bottom wing saddle.



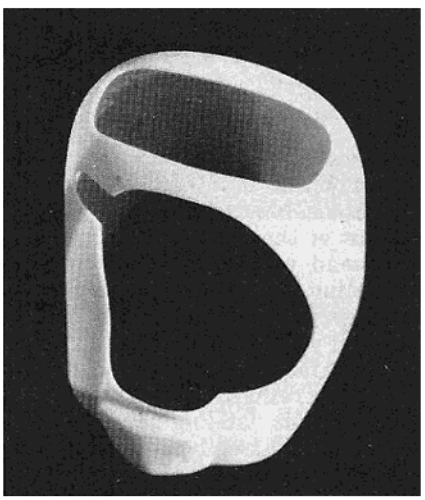
Sheeted and sanded stabilizer-elevator assembly.



Partially built holding jig to align cabane and top wing. Note Robart Incidence Gauges on bottom wing and stab.

top block. Edge glue the necessary 3/16" sheeting to make up two sides. Be sure the top edge is very straight as it joins with the top block. Cut the tapers to the sides and mark the location of all bulkheads on the inside of each side, one right and one left. Add the balsa tail doublers, cross grain, to the inside of each side. Cut out the wing and stab airfoil shape to each side. Add the various balsa triangle stringers to the inside of each side; see plans. Epoxy in the four 1/32" ply doublers to the inside of each side in the tank and radio area. Since this is such a large side area, cut numerous lightening holes in the ply pieces before gluing to try to save on the weight build-up. There should be a space left between the ply doublers for the #2 bulkhead.

Place the top block on a flat work surface upside down, and epoxy the firewall, bulkhead #2, #3, and #4 into position. Be sure everything is square with the centerline and 90° from the



Modified Sig Liberty Sport cowling.

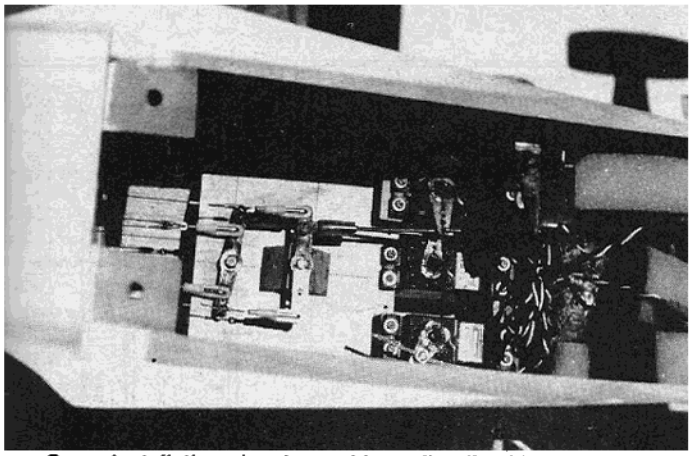
top block. Prepare the two spruce strut blocks and epoxy to the #2 and #3 bulkheads, remembering to slot for the music wire struts.

The sides may now be joined to the

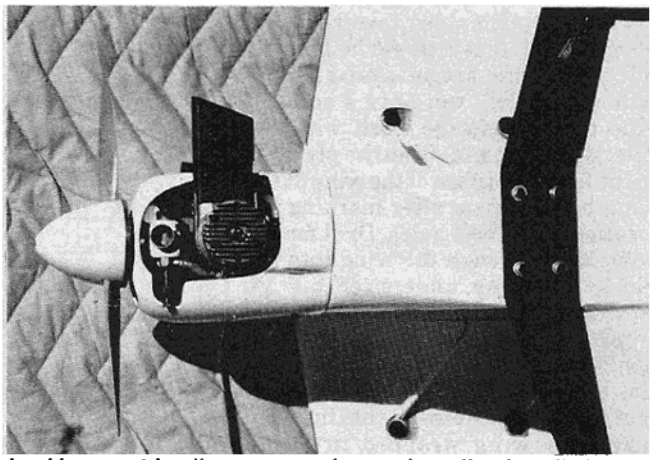
the sides 90° from the work surface. Mark and drill the strut holes in the sides.

Add the two support triangles to the firewall. Cut to fit and epoxy the spruce landing gear support triangles in place. These give the landing gear plate its strength so take your time and get an accurate fit. Fuelproof the entire inside of the tank compartment area and the front side of the firewall. Epoxy the main and tail gear plates into position and be sure the centerlines are square with the top block. Lay out your tank position and add supports as necessary. The fuel tank bottom sheeting will be added **after** the wing dowel holes have been marked.

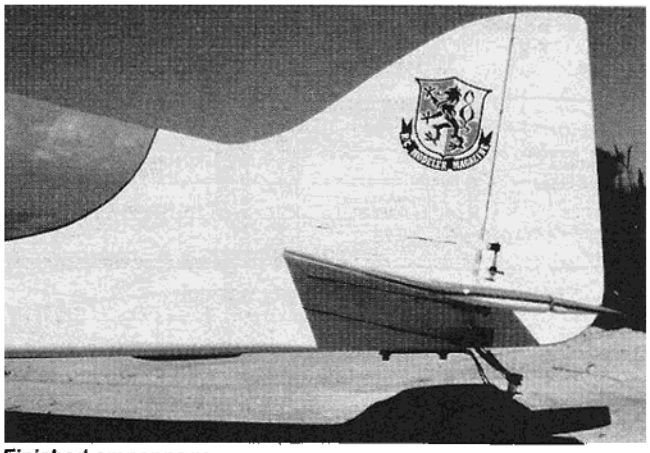
Cut out two fillets from 1/32" ply and sand to finished shape. Do not install yet. Relieve the L.E. of the wing at the center section so the wing will fit in the saddle between the #2 and #4 bulkhead on the fuselage. There needs to be a 1/32" gap so a 1/32"



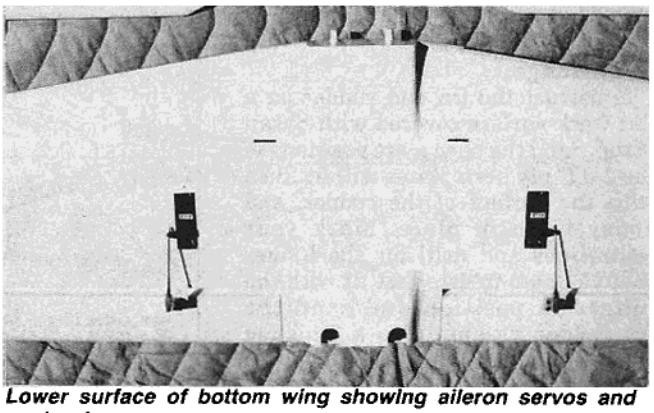
Servo installation showing rudder pull-pull cables.



Looking up at landing gear, engine, and cowling installation.



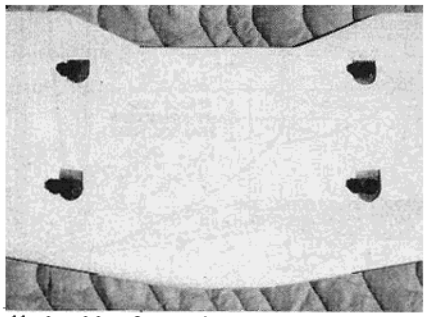
Finished empennage.



Lower surface of bottom wing showing aileron servos and pushrods.

ply plate can be added later to the dowel area; see plans.

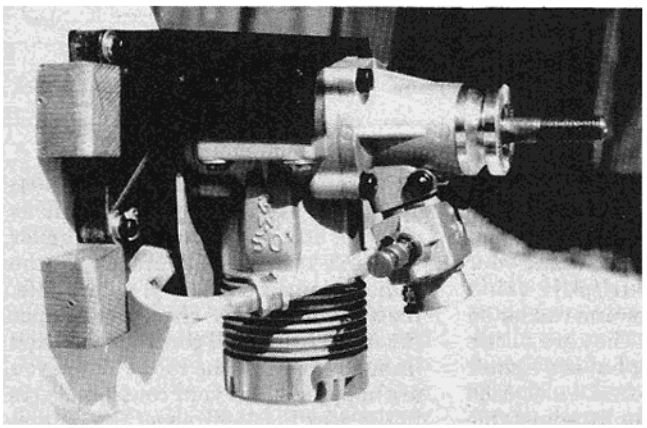
With the fuselage upside down on your workbench, place the wing into position on the saddle and check the tip to bench height of each tip and sand the saddle to make these readings even. Mark a centerline on the bottom surface of your wing. Align this with the centerlines on bulkhead #4. Measure from the centerline at the tail to each tip/aileron bay spar junction to see if the wing is 90° from the fuselage centerline. Adjust as necessary. When everything lines up just right, make some alignment marks so you can position the wing in this exact place again.



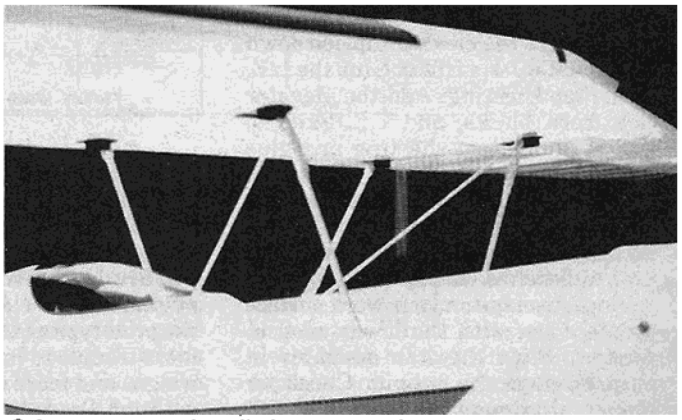
Underside of top wing at center section.

Temporarily put the fillets in place as spacers and take an incidence reading on both panels. It should be 0°. Sand the saddle as necessary. Remove the wing and glue some 3/4 oz., 6" wide glass cloth to both sides of the center section using Hot Stuff or resin. Construct the front belly pan; see plans. Glue the 1/32" ply dowel plate to the front of the pan. With the wing in position, you can now mark the dowel locations through the tank compartment opening. Drill for the 5/16" dowels and install with epoxy. Add the fuel tank compartment bottom sheeting being sure to fuelproof the inside surface.

Glue the spruce wing bolt blocks



Inverted engine on Hayes mount. Note cowl attach blocks.



Cabane structure installation on top wing.

and support triangles together with epoxy. Sand taper to get a good fit between the sides and the #4 bulkhead. When you have a good fit, glue to the fuselage flush with the fillet when in place. Glue the ply plate to the bottom surface of the wing at the wing bolt position, after marking the location of the bolt holes. Drill for the wing bolts through the wing into the blocks using an undersized bit. Be sure to re-check the incidence to be sure it is correct. Tap the blocks with a 1/4-20 tap for the wing bolts and drill the wing holes to full size. You can now add the fillets to the fuselage using the wing wrapped in Saran Wrap to hold them in position until dry. This will hold them to the exact wing contour and make a nice tight joint.

Empennage:

Construct the fin and rudder on a flat work surface covered with Saran Wrap. Sand the horn plate positions so the 1/32" ply horn plates will fit flush with the surface of the rudder, and epoxy them in place. Mark your centerlines and drill for the hinges that you plan to use. Test fit with the hinges in position and sand the fin/rudder assembly to a finished shape.

Build the stab and elevator as if it were a small wing. Draw centerlines on the back side of the L.E. triangle stock and both sides of the ribs. Draw a centerline on the front side of the T.E. after it has been tapered and notched. Cut the airfoil shape to the center section block being sure to use light wood.

I used a jig during the construction to hold everything straight and true, so drill the ribs for the jig rods if you plan to use this method. Pin the L.E. and the T.E. to the ribs and center section block. Glue with Hot Stuff when the alignment is right. Add the gussets and 1/16" sheeting to the top surface. When dry, remove from the jig and finish the bottom surface sheeting. Add the tip blocks and sand the L.E. to shape. Mark and drill for your elevator hinges on the stab T.E.

Construct the elevator upside down on the flat work surface. Glue the L.E. to the top sheeting. Add the elevator ribs, horn blocks, and T.E. Sand to accept the bottom sheeting and glue the sheeting in place. Taper the L.E. for control surface movement and drill for your hinges and control horns. Test fit with the stab and sand the entire unit to finished shape.

Place fuselage on your work surface upside down with the lower wing in position. Slide the stab assembly in place through the cut-out. Check for proper alignment. It should be 90° from the fuselage centerline and level with the wing when viewed from the rear. The incidence reading should be 0°. When everything seems right, glue in place with the slow setting epoxy.

Lay out your servos and make your pushrods. I used pull/pull cable systems on the elevator and rudder on the prototype aircraft. They are a little more trouble to lay out but are lighter weight and more slop-free. I also used a Gator Products plug-in adjustable stab kit for fine tuning the stab trim (Gator R/C Products, 3713 Pompano Dr., Pensacola, Florida 32514, (904) 476-8639). Keep the tail as light as possible and move the battery under the tank if necessary. Mount all the radio gear as far forward as possible. Install servos and check for proper function. Attach all control horns and linkages and test the radio. When you are happy with all your control set-ups in the rear fuselage, sheet the bottom rear section with cross grain 3/16" balsa. Sand to a nice round contour. The rear belly pan may be added to the lower wing to contour with the bottom rear sheeting.

The cowling used on the aircraft is a Sig Liberty Sport cowling. The original configuration is too wide so I cut 1" out of the center section and then constructed and glassed it in the usual way. With your engine in place on the firewall, cut out the necessary material for engine clearance and access to your fuel lines. I chose to use a Perry pump on my installation since my engine was inverted.

Sand the nose of the fuselage to accept the cowling, test fit. The turtledeck is built as a separate unit and then attached to the fuselage. Build the unit upside down adding the sides and the front bulkhead. Sand the bottom surface so it will be flush with the fuselage when gluing. Check for alignment and glue the fin and turtledeck in place. Sand the fuselage sides to be flush with the turtledeck. Cut out the canopy base plate and canopy bulkhead. Finish the canopy interior as you desire. Trim the back and bottom edges of the canopy for a nice fit over the base plate and bulkhead. When finished, glue in place. Mask off the canopy to prevent damage and sand whole fuselage to finished shape.

Top Wing:

Construct the top wing in the same

BILL OF MATERIALS

(1) — 1/32 x 6 x 36 Ply
(1) — 3/32 x 6 x 4 Ply
(1) — 3/16 x 6 x 2 Ply
(1) — 1/4 x 6 x 36 Ply

(1) — 3/8 Triangle x 6 Spruce
(2) — 1/2 Triangle x 36 Balsa
(8) — 1 Triangle x 36 Balsa

(4) — 1/16 x 3 x 36 Balsa
(6) — 3/32 x 2 x 36 Balsa
(22) — 3/32 x 3 x 36 Balsa
(5) — 3/16 x 4 x 48 Balsa
(1) — 1/4 x 4 x 36 Balsa
(4) — 1/2 x 4 x 36 Balsa

(4) — 1/8 x 1/2 x 36 Balsa Stick
(8) — 3/8 x 3/8 x 36 Balsa Stick
(4) — 1/8 x 1/8 x 36 Pine Stick
(1) — 1/8 x 3/8 x 36 Pine Stick
(1) — 1/2 x 1 x 8 Spruce
(1) — 5/16 x 1 x 6 Spruce
(1) — 3/8 x 3/4 x 4 Spruce
(1) — 3/4 x 1 x 8 Spruce

(1) — 1 x 1½ x 14 Balsa Block
(1) — 1½ x 1½ x 16 Balsa Block
(1) — 1 x 4 x 5½ Balsa Block
(1) — 3/4 x 2 x 3 Balsa Block

(1) — 1/8 x 36 Music Wire
(1) — 5/32 x 36 Music Wire

(1) — Spinner — 2½" — C.B. Assoc.
(1) — Engine Mount — Hayes AL-60 MT.
(1) — Engine — .60 size (2-stroke) O.S. 61 ABC, Webra, Rossi, YS, etc.
(1) — Fuel Tank — Kress RK-TS 16 oz.
(1) — Pkg Fuel Tubing (Medium)
(1) — Main Landing Gear — Hallco B105-5
(2) — Main Tires — 3" — Dave Brown
(2) — Wheel Pants — Great Planes Cap .21 (.60)
(1) — Canopy — Available From Alex Bouknight
(1) — Tail Gear — C.B. Assoc.
(1) — Tail Wheel — 1¼" with 3/32 collar
(23) — Hinges — Robart Steel Point
(3) — Rolls Covering Material — Two Wings/Stab/Elev.
(1) — Radio Set — 4 Ch/5 Servos — 2 for Ailerons
(1) — Y-Chord for Ailerons
(3) — Pull-Pull Cable Systems — Golden Gate Hobbies — 2 Elev/1 Rudd or Spruce Pushrods
(1) — Throttle Cable/Ball Link Hook-Up
(6) — Control Horns — 2 each Elev Half/ — 2 Ailerons for Cable System or 4 with Spruce Pushrods
(2) — Metal Clevises/Pushrods — Ailerons
(6) — 1/4-20 Wing Bolts
(10) — 6-32 Bolts, Washers, Blind Nuts
(1) — Wing Jig — A-Justo-Jig, etc.
(1) — Pkg 3/4 Oz. Glass-Cloth for Wing Center-Sections
(4) — 5/16 or 3/8 Solder Lugs for Cabane Struts
Any Painting Supplies that you need for the Fuselage

Alex Bouknight
P.O. Box 1902
Greenville, Texas 75401
offers .030 Canopy $5.00
Add $5.00 for U.P.S.

manner as the bottom wing leaving off the ailerons; see plans. I sheeted the entire top surface of the wing and removed it from the jig. Drill and tap the four spruce wing bolt blocks and glue in place with epoxy. Position the top wing over the fuselage with the bottom wing in position. Build a holding jig to keep the top wing in proper alignment while you prepare the cabane struts to the proper length and angle. A good alignment method is to have the T.E. at the center section of the top wing 3/4" in front of the center of the rear strut as it exits the fuselage. Be sure to establish a 0° incidence line, same as the bottom wing and position the wing in the same position as shown on the plans. Keep the distance from the fuselage centerline to the wing tips the same and the distance from wing to wing the same at each tip.

Be sure to "tin" the music wire before trying to solder the braces to it. Heat the wire with a torch and apply the silver solder. Wipe off the excess with an old rag. If you cannot wipe off all the solder, it has made a bond; if not, try again. Now that you can get a good bond, wrap the joints with small copper wire and silver solder together. Add the solder lugs to the ends of the 5/32" wire. Be sure to build up a heavy bridge of solder at the bend angle of the lugs for strength. If you cannot find lugs that seem stiff enough, solder two lugs together in each position to double the thickness. These may be moved slightly up and down to get the incidence just right. With the struts finished, put the top wing into position and be sure the alignment is right. Epoxy the struts into position in the spruce strut blocks in the fuselage. Finish sheeting the top wing and sand to finished shape. Cover the center section with 6" wide glass cloth and resin or Super T.

Finish the fuselage and cover the wings as per your choice of finishing method. Build and finish the wheel pants, install the landing gears, tires, pants, and the rest of your onboard gear. Give everything a final check to see if everything is right and functioning properly. You cannot fix it in the air and it would be a shame to waste all of this work.

On the day of your first flight, be sure the engine is broken-in properly and running right before you take off. Do a radio check, vibration check, range check. Check the control surface movements for direction and amount of throw. Be sure the engine will hold a constant setting in the vertical position without going lean.

After you get a feel for the craft, trim for straight and level hands-off. Fine tune the right thrust for the torque effect of the engine. Thrust plates are nice for this. Let the model pull a 5-second vertical climb with no rudder input. If it pulls to the left, increase the right thrust until it will climb straight with a neutral rudder setting. Fine tune the aileron trim for straight inside and outside loops. If it drifts the same direction in both cases, re-check the lateral balance and add weight to the light tip

I have included a C.G. range on the plans. Start in the forward portion of the range and move the balance point aft a little at a time until it feels right to you. At the most rearward position, the C.G. will be right over the A.C. and the elevator should be at 0°. I noticed that the craft required very little rudder input to hold the nose up in a knife edge due to the large side area. If too much input was fed in, the model wanted to drift to the bottom and upright itself. You may want to reduce the amount of rudder throw that is listed on the plans to keep from overcompensating as long as the stall turns are not affected too much. The 1° downthrust and 1/2° negative incidence in the top wing helped a tendency to drift towards the bottom with application of rudder. Use washers under the rear wing bolts for the adjustment.

Hope you enjoy the craft as much as I do. Be careful and fly safely.

□

From RCModeler Mar. 1989