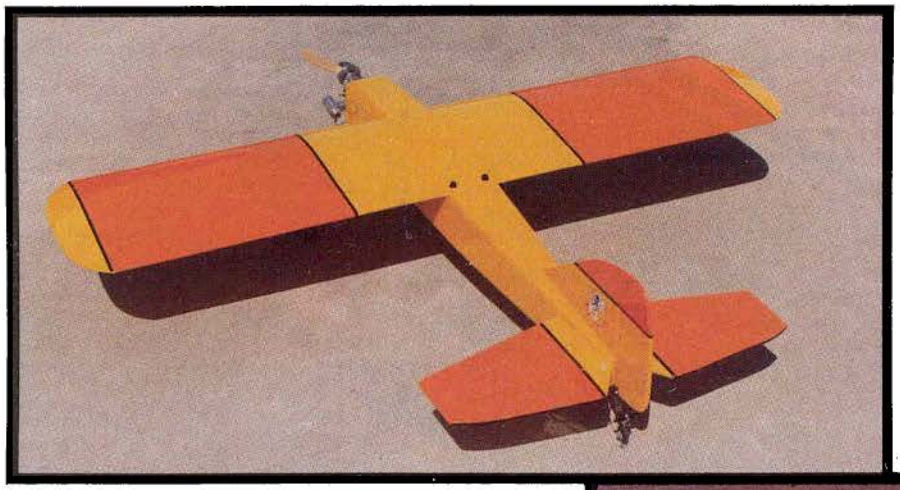
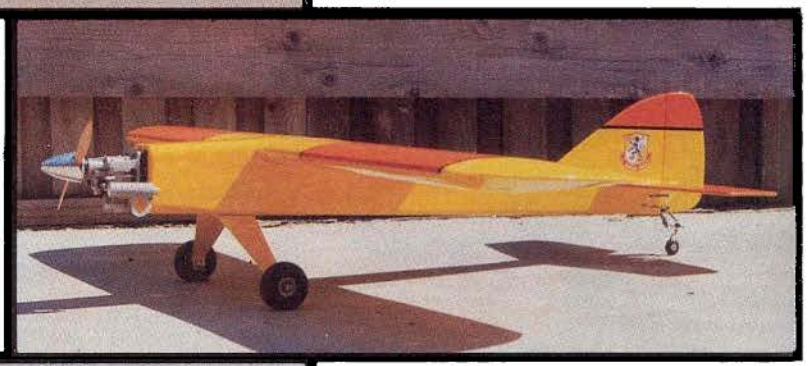


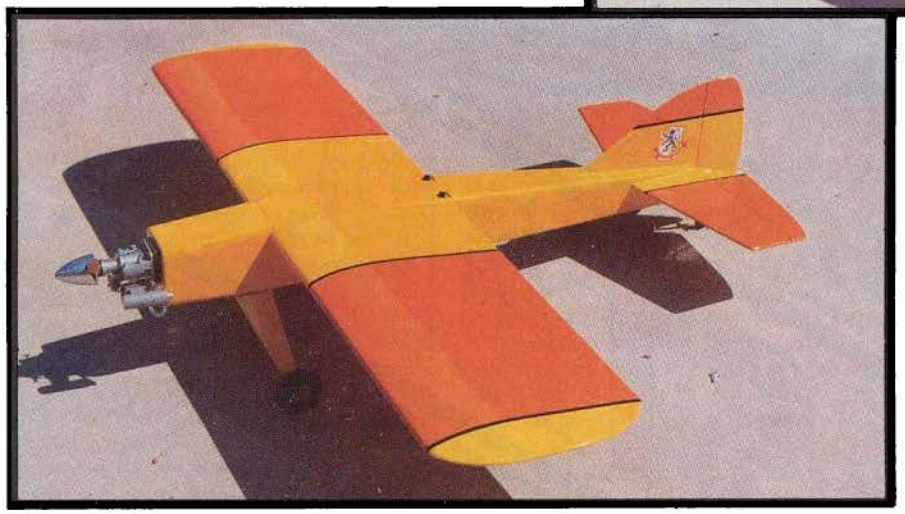
A sturdy, quick building sport flier for .45-.60 2-stroke engines.

By Alex Bouknight

BASIC .60

(SHOULDER WING)





The high wing version of the ''Basic .60'' is a good compromise of design in the sport type category. Although it could not be considered a primary trainer since it has very little self-correcting tendencies, its control feel can be made to be very docile. It would be an excellent choice for those who have mastered the basic skills of getting up and down in one piece and are ready to move to a more responsive craft. The engine power and control throws used will determine the nature of the beast.

I tried a number of different engine set-ups in the prototype testing. With a .45 2-stroke and using control throws in the minimum range, the ship had a very docile type feel with a very slow stall speed. The nose will drop straight forward with no tip stalling apparent. This would be the way to go if you are just interested in puttering around the field with a user friendly aircraft. Just keep the C.G. in the forward portion of the range for added stability.

If you choose to use a .45 size engine, care will have to be used in the wood selection and building process to keep the weight down or nose weight will have to be added. Lightening holes cut in the plank elevators and stabilizer would help this condition. All of the construction techniques are very straightforward with a box type fuselage and constant chord built-up wing. This will keep construction time down to a minimum.

If you are of the more brave at heart, a piped .45 or .60 2-stroke up front and larger control throws and you have a totally different aircraft. It proved quite fast and will wrap around itself due to the short fuselage moments and low aspect ratio wing. By moving the C.G. to the rearward portion of the range listed, a much more neutral stability is achieved and inverted flight is quite good, due to the symmetrical airfoil. Knife-edge flight is limited due to the lack of side area and there is some roll-couple with application of rudder, requiring some cross-controlling. The rudder will roll the craft in the direction intended so rudder turns are possible.

Incorporated in the design are a couple of things not found on most high wing sport planes. The separate elevator halves driven by a ''Y'' pushrod make the trim sequence much easier in removing unwanted roll with application of hard elevator input. The engine mounting method makes changes in thrust or changing whole engines no problem with no re-work of the nose required. The use of two aileron servos connected with a Y chord, one in each panel driving each aileron separately, is by far the easiest installation method with the most slop-free operation. The wing has no dihedral which eases construction and reduces the over-correcting tendencies if excessive dihedral is used.

Study the plans and read through the construction sequence to get a feel for the project. A little understanding goes a long way towards avoiding mistakes later on. I suggest the use of a wing jig to build the wing as true as possible. It is much easier to trim a straight aircraft with a true, unwarped wing. There are several wing jigs on the market that do a fine job. Order your materials and let's get to work.

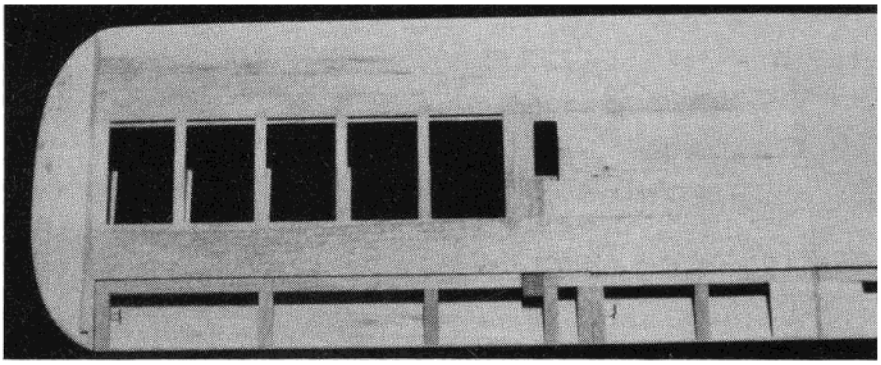
CONSTRUCTION

Wing:

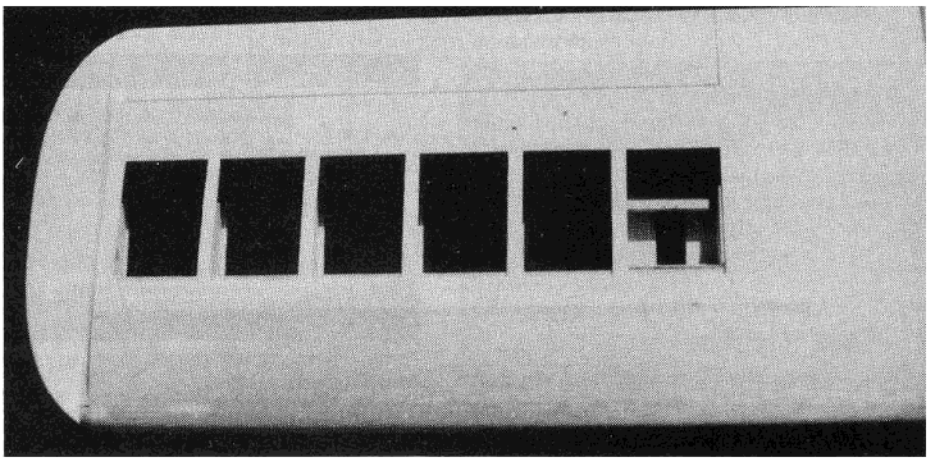
Prepare the 3/32'' balsa ribs with spar notches, jig holes, and centerlines drawn on

BASIC .60
(SHOULDER WING)

Designed By:
Alex Bouknight
TYPE AIRCRAFT
Sport
WINGSPAN
58⅜ Inches
WING CHORD
12¾ Inches
TOTAL WING AREA
744 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Symmetrical 15%
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
0 Degrees (None)
OVERALL FUSELAGE LENGTH
49¾ Inches
RADIO COMPARTMENT SIZE
(L)12½" x (W)3½" x (H)2¾" Avg.
STABILIZER SPAN
25 Inches
STABILIZER CHORD (incl. elev.)
7¼ Inches (Avg.)
STABILIZER AREA
181 Sq. Inches
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
6 Inches
VERTICAL FIN WIDTH (incl. rud.)
9 Inches (Avg.)
ENGINE SIZE
.45-.60 2-Stroke
FUEL TANK SIZE
12-16 Ozs.
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
Empennage ..... Balsa & Ply
Wt. Ready To Fly .... 96-128 Ozs. (6-8 Lbs.)
Wing Loading ..... 19-25 Oz./Sq. Ft.



Bottom view of right wing panel showing built-up aileron and center section. Note spruce horn block inset in aileron leading edge, and 1/2" balsa ribs (aileron bottom sheet not shown for clarity).

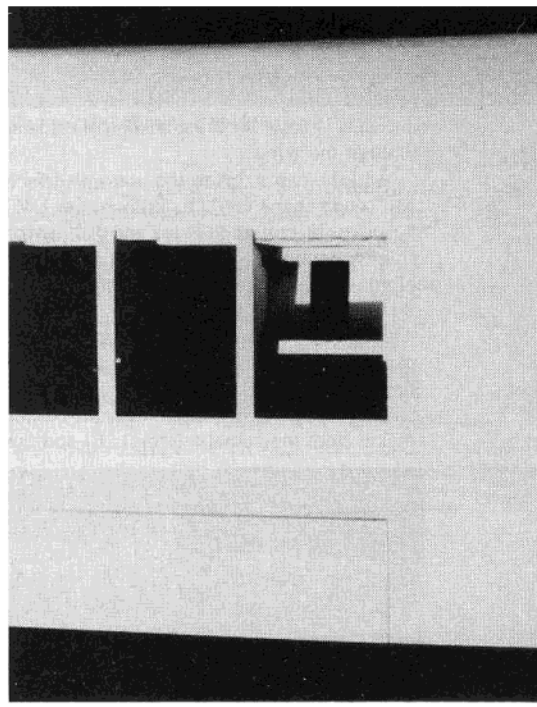


Top view of right wing panel showing all 3/32" balsa sheeting in place.

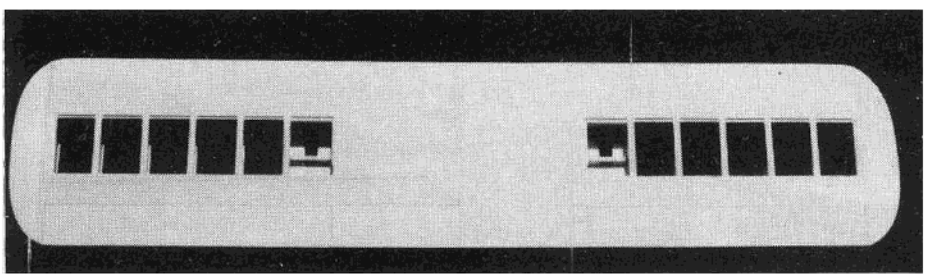
both sides. Drill the servo-lead holes on the ribs #2-#4 in each panel to route the servo wires to the receiver. The #1 rib and the tip plates are 3/16" balsa. Slide the ribs on the jig rods to the correct spacing. Adjust the dihedral to 0 degrees if your jig allows you to build both panels at once. Prepare two 1" balsa triangle leading edges by notching for the rib positions and drawing a centerline on the back surface. Pin to the ribs. Add the **top** 3/8" main spars to each panel.

To prepare the rear spar and aileron L.E. for the taper cut required; take two pieces of 1/2" balsa stock a bit oversized, and pin them together. I ran this through a table saw with the blade tapered to the correct angle and made one cut for both pieces. Repeat for the other side. Notch for the ribs on the front side of the rear spar, and draw centerlines front and rear. Pin the rear spar in place on the ribs. When everything is right, glue with cyanoacrylate.

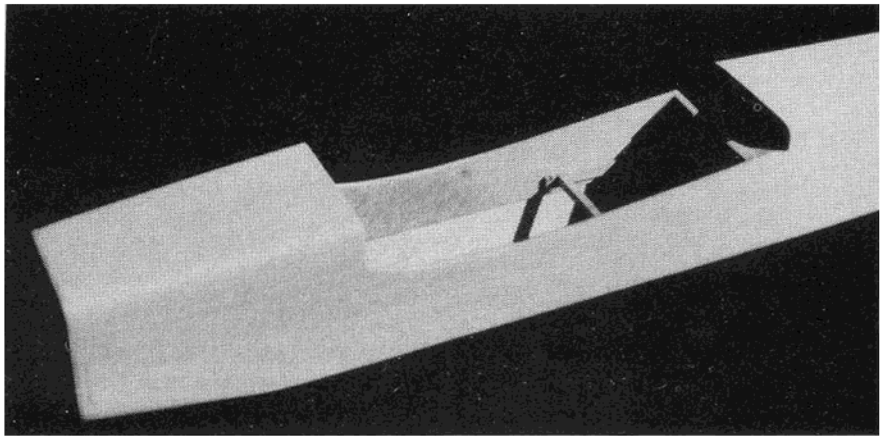
Edge glue full length pieces of 2" and 3" wide 3/32" stock for the forward portion of the sheeting for both panels top and bottom. Trim to fit and glue the **top** forward sheeting to both panels. The 2" rear sheeting may be added **top** and **bottom** for each panel.



Detail of aileron servo bay. Note spruce servo rails and bottom sheeting cut away.



Top view of wing ready to cover.



Fuselage wing saddle and radio compartment.

Finish by adding the **top** cap strips. The wing may be removed from the jig.

Add the 3/8'' **bottom** main spar to both panels. Cut to fit and glue the four dihedral plates to the main spars. Add the remaining balsa webbing to the positions shown. Next comes the ply dowel plates and balsa half-ribs in the forward center section, see plans. Use epoxy for strength here. The two 3/16'' balsa tip plates may be added to the outside of the #10 ribs.

Sheet the forward and center section of the bottom surface of each panel. Lay out the servo bays with balsa half-ribs and spruce rails for the servos that you plan to use. Cut out the servo outline in the bottom sheeting so the servo will barely fit through the hole and the depth is such that the control arm will just clear the sheeting. Cut a small hole in the **bottom** surface of the center section to route the leads to the receiver. A piece of thin music wire with a hook bent in one end is just the thing to fish the leads through the wing.

Add the cap strips to the bottom surface and rough shape the L.E. Prepare the 1/4'' balsa tips by cutting to shape and drilling for lightening holes if you desire. Carefully align with the centerlines front and back and 90 degrees from the tip plate. Finish by adding the 3/8'' balsa triangle supports and cap strips. Sand to a nice round contour on the edge.

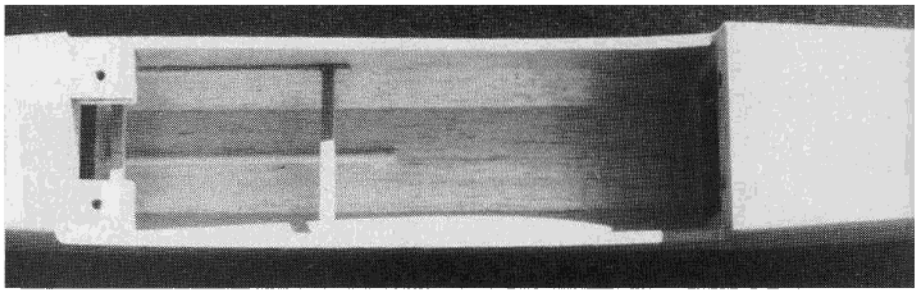
The aileron L.E. which was cut earlier makes both the actual aileron L.E. and the center section piece that butt glues to the rear spar between the #1 and the #4 rib position. This can be made as one piece and cut free after the major assembly is finished. Note the large balsa blocks under the wing bolt plate to keep it from being crushed when the bolts are tightened.

Position the top sheet of the aileron upside down on a flat work surface. Glue the L.E. and the 1/2'' balsa ribs in place. Next, the pine T.E. and the spruce horn blocks can be added. Sand the assembly with a large sanding block so the bottom sheeting will mate properly. Add the bottom sheeting and clamp until dry. The aileron may now be cut free from the center section.

Butt glue these two center section pieces to the rear spar using the aileron and the tip plates as a guide. The whole T.E. should be straight, tip to tip. Mark for the hinges that you plan to use and drill these holes. Test fit the ailerons in place. Sand or cut the 35 degree taper to the lower surface of the aileron L.E. for control surface movement. Pin the ailerons in place and sand the whole wing to a finished shape. Glass-cloth the center section with 3/4 oz. cloth 6'' wide on both surfaces, top and bottom. The fuselage is used to mark the dowel positions on the wing so the wing can be put aside until the fuselage is framed up. We will mark the dowel position through the tank compartment.

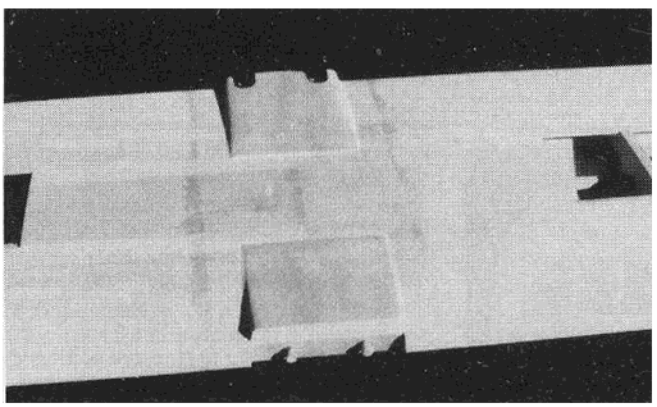
Fuselage:

To begin the fuselage construction, prepare the bottom sheeting assembly with the 1/4'' balsa tank compartment bottom and rear sheeting, and the main gear and tail gear ply plates. The gear plates will need the blind nuts installed and glued to the **inside** surface of each along with centerlines. Make the joints at the gear plate very square so the alignment stays true. Mark a centerline down the entire length of the inside surface of this assembly as a reference line for the bulkheads.

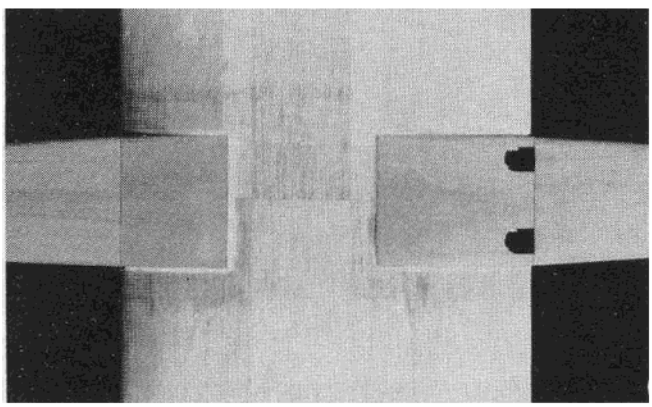


Radio compartment detail. Note spruce servo rails, spruce wing mount, blocks, and plastic antenna tube.

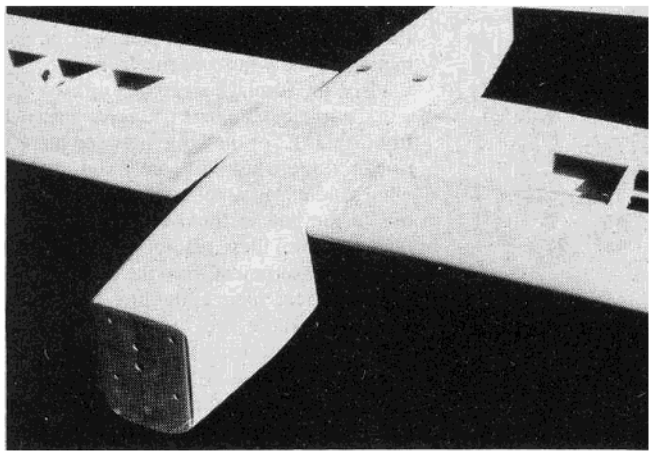
The sides are built as a sub-assembly before joining with the bottom sheeting. Cut the 3/16'' balsa sides to the correct size and shape. Mark the position of all bulkheads, along with the wing and stab incidence lines to the **inside** surface of each side. Cut to size and glue the 1/32'' ply doublers to the inside of the tank and radio compartment. Use thinned epoxy and weight until dry. You will notice that there is a slot left in the firewall, at the #2 and #3 bulkhead position. Add all the triangle stringer stock top and bottom to the inside of each side. Some material will have to be removed



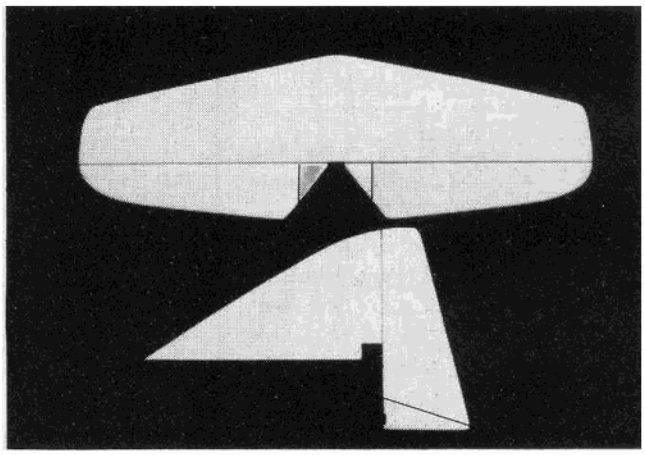
Balsa blocks are attached to wing providing a smooth transition from fuselage. Spruce dowels up front engage a plywood former in fuselage.



Top view of wing attached to fuselage with nylon bolts.



Firewall with thrust line drawn in. Engine must be mounted off center to provide two degrees right thrust (see plan).



Complete tail group is constructed from balsa sheet. Note 1/32" plywood control horn doublers on rudder.

towards the rearward portion of the triangles when the sides are pulled together at the tail-post. The tail area gets some 3/32" balsa vertical grain doublers to beef up around the stab. When dry, cut out the stab slot and add the 3/8" balsa support triangles.

Prepare the 1/4" ply firewall by cutting to the correct size and marking for centerlines and mount location. Drill for blind nuts, fuel tubing, and throttle cable exit. Epoxy the blind nuts for the engine mount on the **back** side of the firewall. Prepare the #2 and #3 bulkhead in a like manner. Remove the necessary material for clearance of the fuel tank, pushrods, etc. Drill the #2 bulkhead for the two 5/16" dowel holes in the position shown on the plans. Make up a tail-post with 1" triangle and 3/16" balsa sheet for the tail-post block.

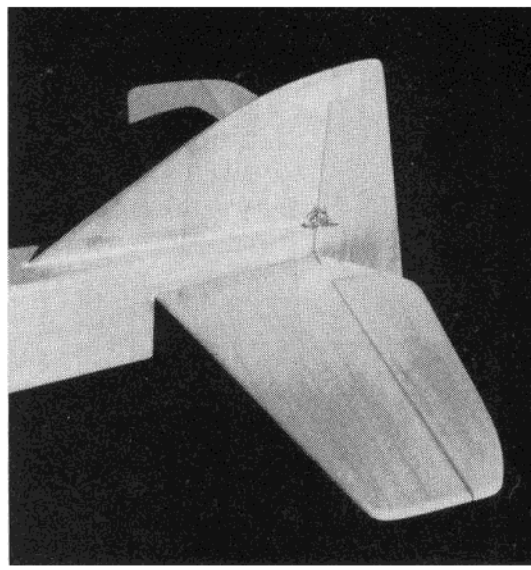
Now that all the major components are ready, position the bottom section on a flat work surface right side up. Glue the firewall and bulkhead #2 and #3 in place aligning the centerlines, 90 degrees from the work surface and also square, 90 degrees from the centerline. You can run an internal antenna installation by running a piece of NyRod from the radio compartment to the tail, glued to the bottom sheet. The receiver antenna will slide into the NyRod.

After it is dry, the sides and the tail-post can be added. Clamp together and carefully check to see if everything is straight and true. Slow-set epoxy is nice for the bulkhead to side joints in that it allows plenty of time to get the alignment right before the glue sets. Carefully cut the four 3/8" spruce triangles that support the main gear plate. Use epoxy for strength here. This will keep you from ripping the gear plate off every time you make a less than perfect landing.

Add the other support triangle and fuelproof the entire tank compartment. The tank compartment top will be added **after** the wing dowel positions have been marked. Make up the wing bolt blocks with two pieces of 5/16" spruce block and 3/8" spruce triangle, one for each side. Glue together with epoxy and sand until there is a nice fit between the sides and the #3 bulkhead. This will require a slight taper to the back side. When the fit is good and tight, epoxy in place. Plan your radio installation and add the necessary servo rail supports to the inside of the sides.

Empennage:

The stabilizer is constructed of 5/16" balsa sheet, edge glued in two pieces. Choose medium-soft wood here and cut some lightening holes in the stabilizer and elevator if you are going to use a .45 size engine to correct for balance. Cut out the elevator halves and file a notch for the horn plates. Notice that the horn plates; one for each elevator half, are made of one 1/4" ply and one 1/16" ply glued together, one slightly overlapping the other, see plans. This will give a much stronger glue joint than a plain butt joint. Mark and drill for your hinges and test fit. Sand all the edges to a nice round contour.

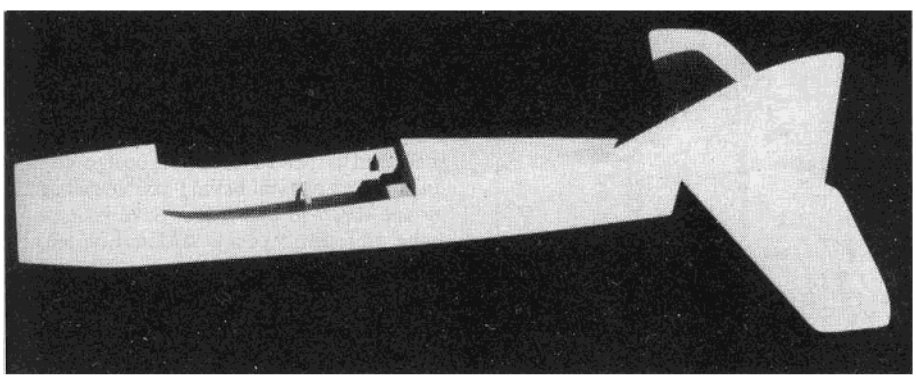


Tail group attached to fuselage.

The fin and rudder are constructed in a like manner with 1/4" balsa stock. The rudder has two 1/32" ply horn plates that are inset into the surface so they are flush when sanded. File the horn plate positions and glue in place. Mark and drill for the hinges and sand to a finished shape and contour.

Plan your radio installation and make up your pushrods for the elevator and rudder control. I use 5/16" dowels with threaded wire ends to attach the clevises. Remember the rudder has a single and the elevator has a "Y" wire end arrangement. Mark and drill your fuselage for the exit holes for the pushrods. A piece of outer NyRod glued in the hole and sanded flush makes a nice exit guide. Tape the stab./elev. and fin/rudder into place to test the operation of the control surfaces. Also, you will need to temporarily install the control horns. Check for ease of movement and alignment as the pushrod operates. It would be much easier to fix this now with the top sheeting off than later after the model is finished.

When you are happy with the operation, the top rear sheeting of 1/4" balsa may be cut to shape and glued in place. Be sure to slot for the fin. When this is dry, give the whole rearward portion of the fuselage a



Finished fuselage ready to cover.

good sanding, rounding the contour to a nice flowing shape. The next step will be the mating of the wing and fuselage.

Place the fuselage right-side up on a flat work surface. Begin to remove material from the L.E. of the wing between the #2 ribs until the wing will barely slip into the wing saddle. Measure the distance from the tips to the bench. Sand the saddle on the high side until these readings are the same. Take a measurement from the center of the tail to the rear spars at the tips. Square the wing until these are the same. Take an incidence reading of the wing near the fuselage. It should be 0 degrees. Sand the saddle until this reading is correct.

I chose to add a 1/32'' ply plate glued to the L.E. at the dowel position to give the dowels added strength. Sand just enough material off the L.E. to slip this piece between the #2 bulkhead and the wing, and glue in place. With the wing in the correct place, mark the dowel hole locations with a short pencil through the tank compartment opening using the holes drilled in the #2 bulkheads as a guide. Glue the dowels in place with epoxy.

Lay out the 3/32'' ply wing bolt plate with a centerline and drill for the two wing bolts in the positions shown. Add the wing bolt plate to the top surface of the wing. With the wing in position, use the two pre-drilled bolt holes to mark the two wing bolt blocks in the fuselage. Drill undersized and tap for the 1/4-20 wing bolts, test fit. Check to see if the incidence is still 0 degrees; if not, sand the bolt blocks slightly or add material to correct. You may now add the tank compartment top sheeting, fuelproofing the bottom side. Sand the whole fuselage to a finished shape.

The two wing blocks in the center section of the wing are 1/2'' balsa stock, cut oversize, and sanded to the same contour as the fuselage. Drill for the bolt locations in the rear block and glue in place. A large sanding block with 60 grit paper is nice to rough shape these blocks to the fuselage height. Finish sand with 220 grit paper.

With the wing as an alignment guide, the stabilizer and fin may be glued in place. Be sure to align the centerlines and level with the wing when viewed from the rear. The incidence should be 0 degrees, check! The fin is 90 degrees from the stabilizer and even with the tail-post.

Finish the fuselage and wing with your favorite method. MonoKote is a good lightweight choice, especially if you are going to use a .45 size engine or do not have much stick time. Light airplanes always fly better due to the lower wing loading. There is no need to spend a lot of time on a painted finish if you are still having trouble getting up and down in one piece. Save yourself some grief, give it your best MonoKote job, and concentrate on getting more stick time.

Install all the gear necessary to finish the model. Pressure test your fuel tank for leaks and clunk placement. Check the control surface operation for correct direction of movement. Adjust the control throws to your level of experience; in the minimum range if you are used to a trainer, and more sensitive if you want a hot-rod. Adjust all the surfaces so a neutral trim setting on the transmitter will give a 0 degree incidence setting.

Minimum	Maximum
Elev.: 5/16''	9/16'' up & down
Rud.: 1⅛''	1½'' left & right
Ail.: 5/16''	9/16'' up & down

Break the engine in on a test stand before it is installed on the model. This will teach you the operation of that engine and insure it will hold a needle valve setting before you try to fly. Adjust the throttle linkage so full down trim on the throttle will kill the engine. Install the engine with a 2 degree right thrust plate to begin the trimming. This will counter the torque effect of the prop. If you plan to use one of the larger pitched props, say an 11 x 8, 11 x 10, etc., for a .60 2-stroke, 3 degrees right will be necessary to give a neutral rudder setting in a vertical climb.

Check the C.G. and shift or add weight as necessary to balance correctly. Stay in the forward portion of the range if you want more stability. Hold the model by the nose and tail and do a lateral balance, adding weight to the high wing tip until they balance. Fix everything now **before** trying to fly.

On the day of your first flight, do a range check with someone holding your plane with the engine running to test for vibration problems. Make sure you have a reliable idle so the engine will not die every time you throttle back. Hold the model in a vertical position to see if the engine goes lean; if so, adjust a bit richer.

If you have any doubts about trimming, ask one of the more experienced fliers to take the ship up and trim it for you. Have him check the model out to be sure there is not something that you missed in your set-up. It is good to have another set of eyes review your work, just as a precaution.

The ground handling is very predictable due to the forward gear placement. Take the ship up and trim for straight and level hands-off flight. Pull a couple of easy loops. If the ship tracks to one side, the elevator halves are probably not even and acting like ailerons; correct. Pull a straight vertical climb with no rudder input and see what the model does. If it climbs straight for 4 to 5 seconds with no pull to the right or left, you are home free. If it pulls to the left, there is too much torque effect and more right thrust is needed. If it pulls to the right, reduce the right thrust with a smaller degree thrust plate. Small trim changes can be made with rudder trim.

The pitch of the prop will affect the rudder trim also. Higher pitched props give more torque effect to the left, lower pitched props will reduce the pull of the nose to the left in a climb. Once on the ground, adjust your clevises so your transmitter trims are in a neutral position while maintaining the same control surface position. Keep playing with the engine/prop combination until you find one that is right for you. Fly safe and enjoy. □

Basic 60
Material List

All balsa unless noted.
All dimensions in inches.

8 — 3/32 x 2 x 36
18 — 3/32 x 3 x 36
2 — 3/16 x 4 x 48
2 — 1/4 x 4 x 36
1 — 1/4 x 4 x 48
2 — 5/16 x 3 x 36
1 — 1/2 x 4 x 36
2 — 3/8 triangle x 36
5 — 3/4 triangle x 36
2 — 1 triangle x 36
4 — 3/8 x 3/8 x 36
2 — 1/8 x 1/8 x 36 pine
1 — 1/4 x 1/4 x 12 spruce
1 — 5/16 x 1 x 8 spruce
1 — 3/8 x 3/4 x 2 spruce
1 — 1/32 x 4 x 48 ply
1 — 1/16 x 4 x 4 ply
1 — 3/32 x 4 x 16 ply
1 — 1/4 x 4 x 20 ply
1 — 3/8 triangle x 16 spruce
1 — 5/16 dowel x 6 spruce or birch

Accessory Completion Guide

1 — Spinner, 2½'' C.B. Asso.
1 — Engine mount, Hayes AS-60 for .60 engine
1 — Engine, .40-.60 (2-stroke)
1 — Fuel tank, 12-16 ozs.
1 — Pkg. Fuel tubing, medium
1 — Main landing gear, Hallco B105-5
2 — Main tires, 3'' Dave Brown
1 — Tail gear, C.B. Asso.
1 — Tail wheel 1'' with 3/32'' collar
19 — Hinges, Robart steel point
2 — Rolls covering material for wing
1 — Roll for fuselage or paint supplies
1 — Radio set, 4Ch/5 servos 2 for ailerons
1 — Y-Chord for aileron servos
1 — Throttle cable/ball link hook-up
5 — Control horns
2 — Spruce dowel pushrods
5 — Metal clevises/pushrods
2 — 1/4 x 20 wing bolts
10 — 6-32 bolts, washers, blind nuts
1 — Pkg. of 3/4 oz. glass cloth for wing center-section.

From RCModeler Feb. 1992