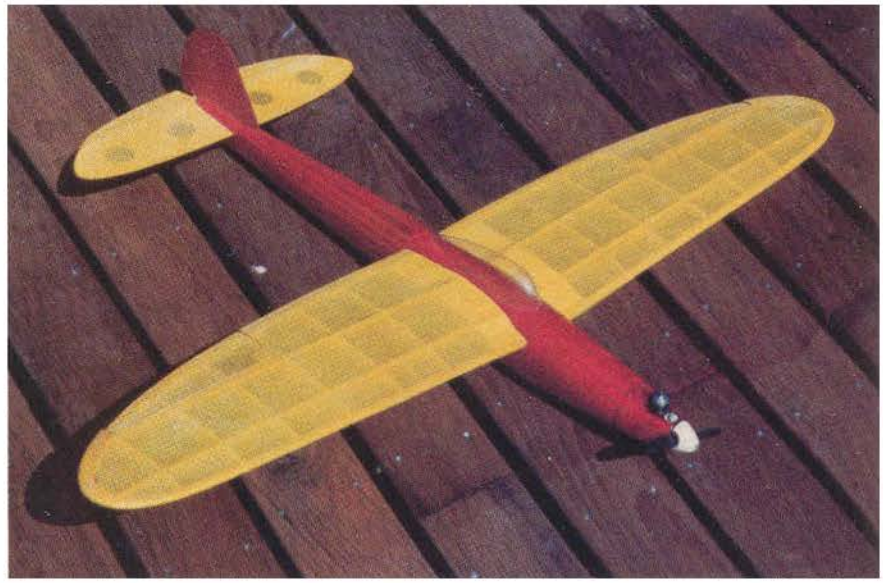
SKEETER



Need a break from large, high cost projects . . . why not give this little buzzzz bomb a try?

ABOUT THE AUTHOR

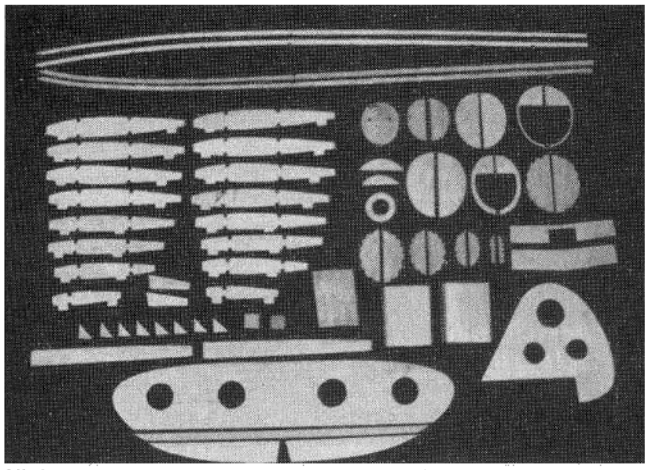
Colonel George Kyer graduated from the University of California, Berkeley, in June 1953 and became an Air Force Officer by way of the ROTC program. He graduated from pilot training in 1954 and flew fighters his whole career. These included the F-94C, F-102, F-106, and F-4. He had two Vietnam War tours in the F-4 in 1965 and 1969. He retired as Chief of Maintenance of an F-111 wing in 1979. He and his wife Gail have three grown children and five grandchildren. He currently resides in Carnation, Washington. His interest in model airplanes goes back to the forties.

As with most scratch designers, I developed Skeeter to satisfy certain personal requirements that no model now available fulfills. I fly out of a large pasture that doesn't have a runway. This restriction limits me to smaller models with no landing gear. I have tried models up to .40 displacement, but you have to have an arm like John Elway to launch them and my arm is more in the wet noodle class. I prefer small airplanes anyhow. I know that the large "models" fly more realistically and are crowd pleasers, but I could never see taking out a loan to buy an engine, going to the lumberyard to buy wood, or hire a moving van to transport the monster to the municipal airport to fly it. My hero is Ken Willard. I like small models so that I can throw two or three airplanes (with the wings on) in the back of my small

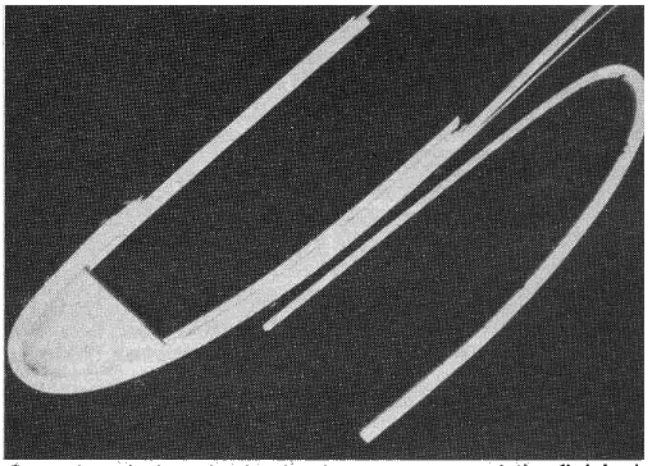
By George Kyer

Bill of Materials

4 — 1/16" x 3" x 36" light balsa (wing sheeting, ribs, tail section)
1 — 1/8" x 3" x 36" light balsa (aileron keel)
5 — 1/8" x 3/16" x 36" light balsa sticks (fuselage stringers)
16 — 1/16" x 5/16" x 36" light balsa sticks (wing LE and TE)
12 — 1/8" x 1/4" x 36" light balsa sticks (fuselage planking)
2 — 1/2" x 1/2" x 1/2" light balsa (aileron blocks)
2 — 1½" x 3/4" x 2" light balsa (cowl blocks)
1 — 1/16" x 3" x 36" hard balsa (fuselage bulkheads, fuselage keel)
1 — 1/16" x 6" x 12" ply (fuselage bulkheads, dihedral braces)
1 — 1/8" x 3" x 3" ply (firewall)
1 — 1/16" x 1/4" x 12" basswood (elevator joiner)
1 — 1/8" x 1/2" x 12" basswood (wing hold-down block)
1 — 1/8" x 1/4" x 12" basswood (servo rails)
1 — 1/4" x 1/4" x 12" basswood (servo side rails)



All the parts cut out for the "kit" and ready to go.



One wing during the lamination process, and the finished product after shaping and sanding.

pickup, drive to my pasture, pull one out, crank it up, and fly; no muss, no fuss.

Skeeter was created with certain design parameters in mind. (1) It had to be shoulder or mid-winged. I didn't want a top winged trainer type airplane, and a low winged airplane makes hand launching difficult. I settled on a shoulder wing because a mid-wing displaces too much of the room for radio equipment in a small airplane. (2) It had to be for an .020 because I had a Tee Dee that was not being used. (3) It had to be aesthetically appealing. It could not be what I call a "cookie cutter" design that compose 90% of today's models. The only way you can distinguish one from the other is by the name. Specifically, no constant chord wings or square wing tips; no strip ailerons, and no slab sided fuselage. I wanted something with lots of curves, reminiscent of Marilyn Monroe rather than Cher or Twiggy.

Skeeter resembles a WW II fighter more than I envisioned, but I believe it has graceful lines. It also flies well. I am particularly pleased with the way it grooves. It is not at all "twitchy" like most small models, but it can be overly sensitive if excessive control throws are used. Use those recommended on the plans. It is fast because of its low drag, but very easy to control because it goes where you point it. Stalls are very predictable with no wing drop. I am not a hot dogger, so I can't say it will perform all aerobatic maneuvers, but it loops, rolls, and does inverted flight with ease. As most authors say about their designs published in model magazines, Skeeter flew right off the board with no changes in configuration. I did increase elevator throw for more elevator authority at low speeds.

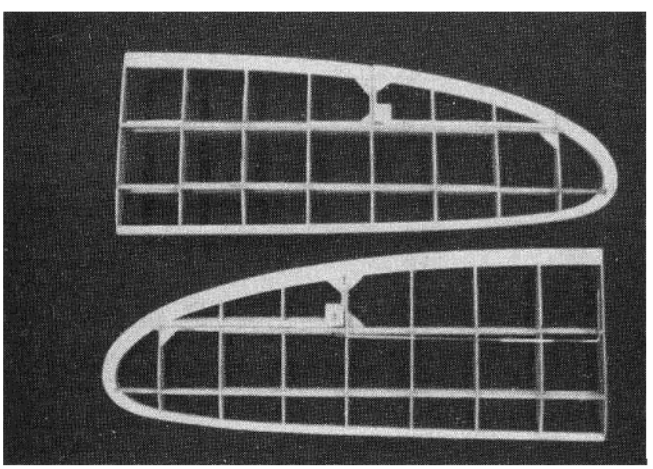
The only negative feature of the model was the limited endurance with the integral fuel tank. I could only get about 3-4 minutes flying time on a tankful. I finally got exasperated and made a 1/2 oz. tank from a fiberglass catalyst bottle since a comparative sized commercial tank was not available. I had also yearned for the ability to make low approaches, spins, and power-on stalls — all impossible without a throttle. I found that Cox made an exhaust restrictor throttle for their reed valve .020. I obtained a cylinder, piston, throttle sleeve and put it on my Tee Dee engine. Performance did not suffer much with 20,000 rpm at max throttle and a reliable 9,000 rpm idle. The radio compartment was cramped with a Tower Hobbies' micro airborne pack with two servos. Finding room for a third servo required re-engineering the interior. The main change was moving the aileron servo as close to the wing trailing edge as possible. This moved the C.G. aft and I had to add nose weight for balance. Adding a 1/2 oz. servo increased the weight from 9 ozs. to 11 ozs. I recommend that if you decide to build the model, build it with two servos and the remote 1/2 oz. fuel tank. Both alternatives are shown on the plans.

Skeeter is very esoteric. It is not an instant gratification design. It is also not for the beginner for either building or flying. It requires building techniques that are not common in today's R/C models, but they result in strong, light models.

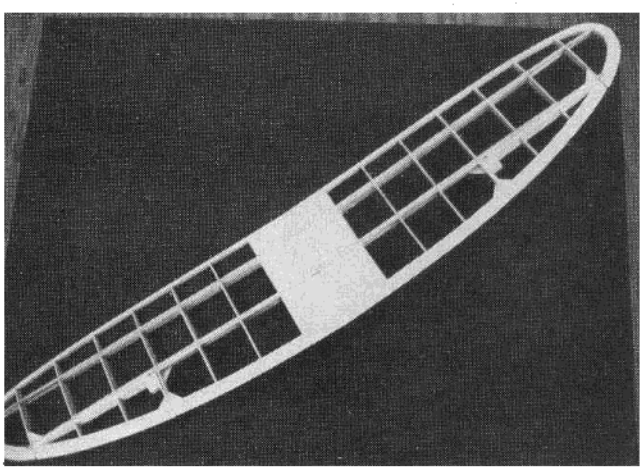
Well, if you want a unique model and this article has piqued your interest, get the plans and follow along on the construction sequence. Oh, by the way, have you wondered why I named it Skeeter? Have you ever heard an .020 turn 20,000 rpm?

CONSTRUCTION

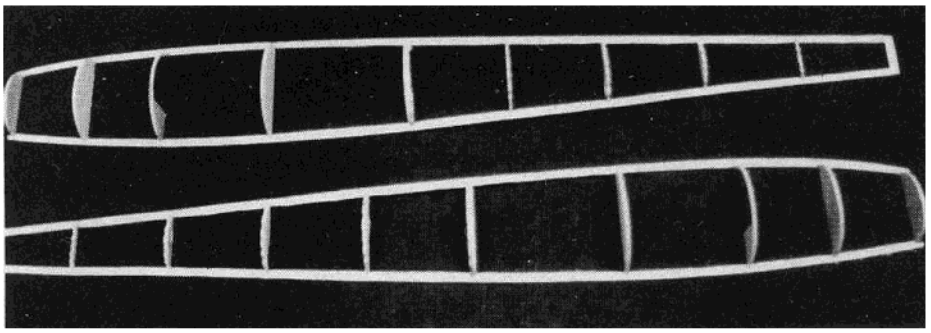
First of all, make yourself a kit by cutting out the various parts. I have found that copying the plans on a 1:1 ratio copying machine is the best way to preserve the plans and have accurate templates. After copying, I use "UHU Stick" glue to adhere the templates to the wood. If you cut the parts out within ten minutes after gluing, the template will easily peel off the wood. Balsa wood selection is important to keep the weight down. I do not recommend beefing up any part of the model. I have over thirty flights on the original with only a scuffed



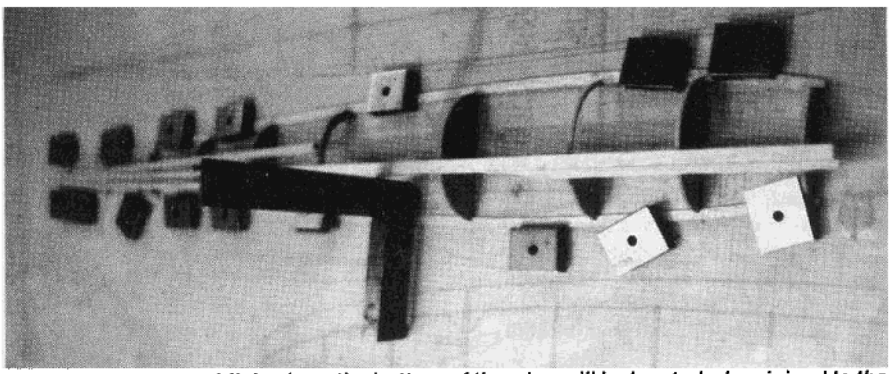
The completed wing panels before joining. One has the aileron torque rod in place, but not cemented yet.



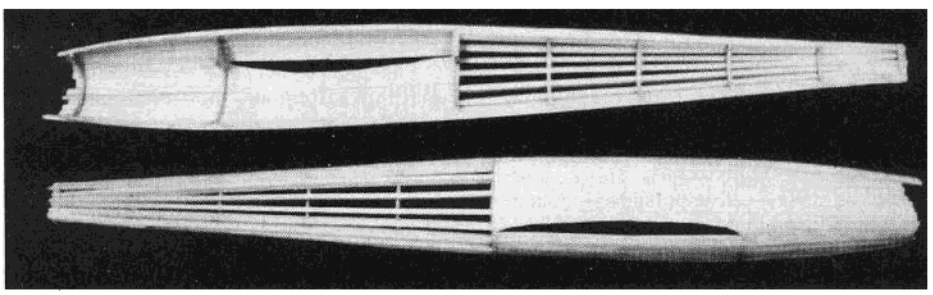
The completed wing.



Both fuselage sides completed with bulkheads glued to keels.



Use a square to establish where the bottom of the wing will be located when joined to the fuselage. Move the square along the entire wing bottom.



Completed fuselage halves before sanding. Note the bottom wing location already cut out.

fuselage bottom and cracked wing leading edge (from hitting a big dirt clod on landing) to show for them.

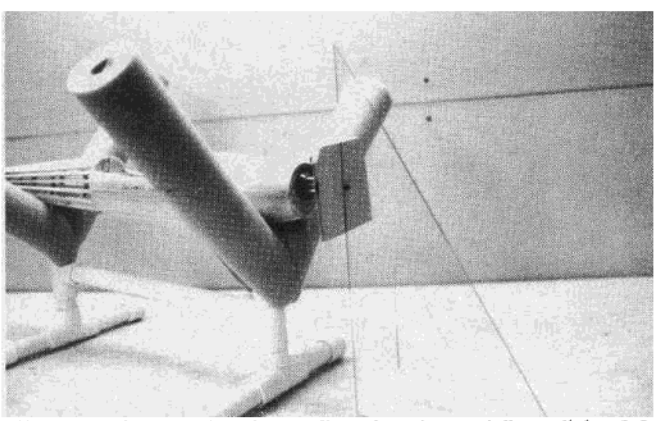
Cut all your stringers and planking strips with a balsa stripper. It is easier to select a sheet of light balsa and strip your own than to select individual sticks. It's cheaper too. Also, if you square up the balsa sheet before stripping, all your sticks will be straight and true.

Wing:

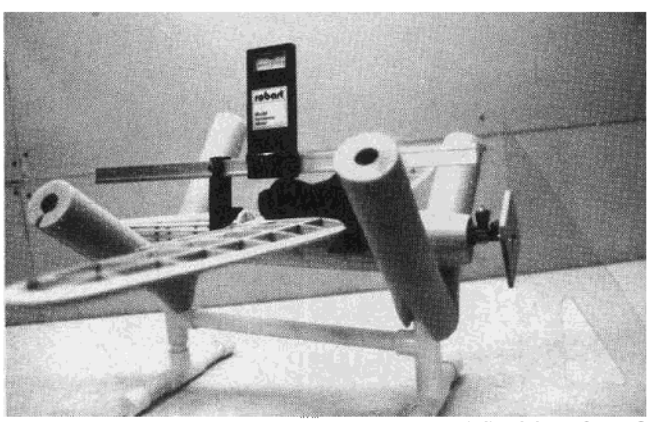
The wing construction is unusual in that the leading edge (LE), tips, and trailing edge (TE) are built in one piece by laminating 1/16" x 5/16" x 36" light balsa strips. Build a tip jig from a minimum 1/4" thick scrap of balsa or ply. Cardboard may work; I haven't tried it. Pin the jig over the plans and bend successive strips around the jig. Boiling the strips in a shallow pan will

SKEETER

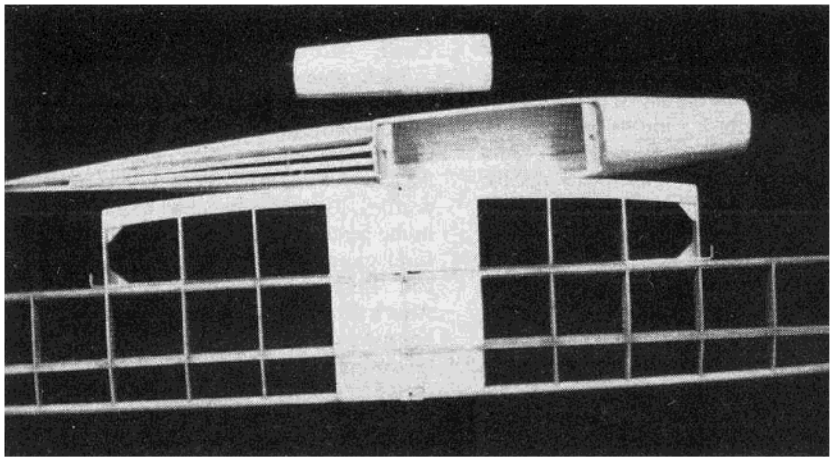
Designed By:
Col. George Kyer
TYPE AIRCRAFT
Sport
WINGSPAN
32 Inches
WING CHORD
6 Inches
TOTAL WING AREA
160 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Elliptical
DIHEDRAL EACH TIP
1⅛ Inches
OVERALL FUSELAGE LENGTH
25 Inches
RADIO COMPARTMENT SIZE
6" x 1½" x 2"
STABILIZER SPAN
12 Inches
STABILIZER CHORD (incl. elev.)
3¼ Inches
STABILIZER AREA
29 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Mid Fuselage
VERTICAL FIN HEIGHT
3⅛ Inches
VERTICAL FIN WIDTH (incl. rud.)
4½ Inches
REC. ENGINE SIZE
Tee Dee .020
FUEL TANK SIZE
Integral or 1/2 Oz.
LANDING GEAR
None
REC. NO. OF CHANNELS
2 or 3
CONTROL FUNCTIONS
Ail., Elev., Throt. Opt.
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Ply & Basswood
Wing ..... Balsa, Ply & Spruce
Empennage ..... Balsa & Basswood
Wt. Ready To Fly ..... 9-11 Ozs.
Wing Loading ..... 8.1-9.9 Oz./Sq. Ft.



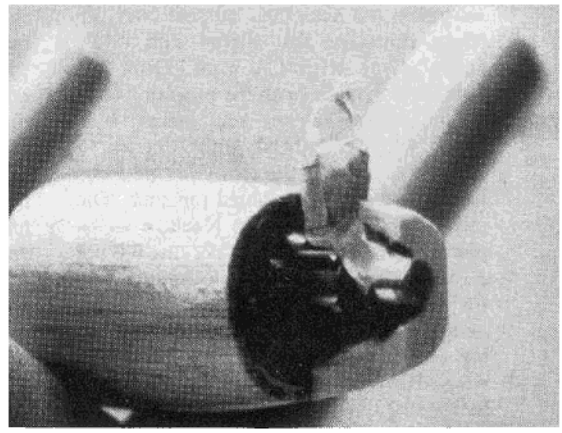
Use a 90 degree triangle to align the plywood firewall for 0-0 degree thrust line. Do not cement in place yet.



Wing being secured to fuselage saddle and final location of plywood firewall using triangle and incidence meter for accuracy.



Completed wing, fuselage, and top fairing.



One half of the engine cowling tacked in place and sanded to outside fuselage contour. Be sure to protect the engine with masking tape.

soften the balsa for bending. Allow the strips to dry before gluing. Use an extra strip around the last strip to prevent pin indentations in the outside strip. Glue the strips together using aliphatic resin glue applied with a brush. It sands more easily than CA glue. For added strength after shaping the LE and TE, you could dribble CA glue over the structure. Mark a centerline around the inside and outside of the laminated outline for a shaping reference. Cut slightly undersized 1/16" slots in the LE and TE and 1/8" notches in the tips for the ribs and spars. Tightly fitting ribs will make assembly easier.

Sand the TE to 1/4" beginning at the front spar on the wing tip. Then taper the TE to 1/16" on the rear edge. Shape the LE. Before assembly, partially cut through ribs 6 and 7 where the ailerons will be cut out after assembly. Construct the wing over the plans. The "legs" on the ribs will insure accurate rib alignment. Assemble all ribs and 1/8" square spruce top spars. Glue with thin CA. Remove wing from plans and add bottom spars. Note the rear bottom spar does not go all the way to rib 1, to allow for aileron torque rod movement. Repeat for opposite wing. Add the gussets and shear webs (ensure that the grain is vertical for the shear webs). Cut ribs 6 and 7 where previously scored and cut the ribs flush with the top and bottom rear spars. Remove the scrap. Tack glue a 1/32" piece of scrap on the rear of the top rear spar as a spacer between the spar and aileron keel. This will be the hinge line. Also tack a 1/16" piece of scrap on the aileron side of rib 5 as a spacer between rib 5 and 5A. Fit and glue the aileron keel. Sand the aileron keel to conform to the wing.

Bend the aileron torque rods from 1/16" music wire. Use 3/32" aluminum tubing as end bearings. Notch ribs 2, 3, 4, and 5 at the rear of the top rear spar for the torque rod. The top of the bearings should be flush with the top of the spar. Add the 1/2" x 1/2" x 1/2" light balsa block to the aileron where the torque rod will fit.

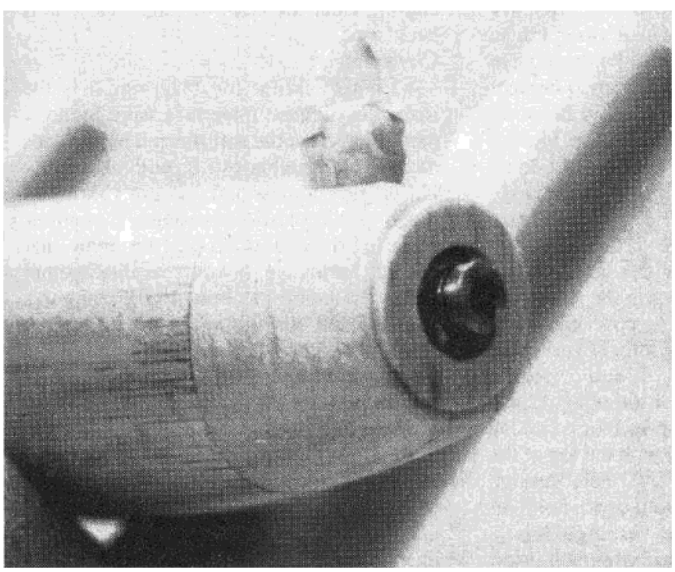
Put a trench in the block for the "L" in the rod. Secure the servo end of the rod so it is vertical. Place a short piece of 3/32" aluminum tubing on the rod where it fits in the trench. Glue the tube with the torque rod in it in the aileron block and the aileron bearings in their rib notches. Be careful not to glue any of the tubing to the rod. Fill in the aileron block with balsa filler. Join the wings using 1⅛" dihedral under each wing at rib 8. Cut the center wing ribs and add dihedral braces. Sheet the wing. Note the sheeting is inset between the ribs and spars. Sand the whole structure. Cut the TE to separate the ailerons and remove the spacers. Note how the small aileron tube keys the aileron to the torque rod. Add 1/16" ply pieces to the center of the LE and TE where the wing hold-down will rest.

Tail Section:

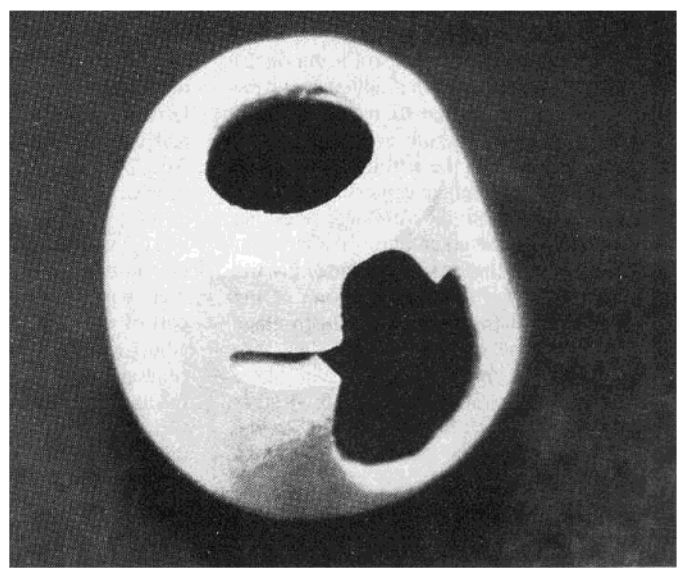
The vertical fin and horizontal stabilizer are each made with 1/16" light sheet balsa. The elevator is constructed by gluing the two sheet balsa pieces to the basswood joiner. (See section on covering for hinging elevator to stabilizer. I also prefer to cover the tail section prior to final assembly.)

Fuselage:

Cut the keel out of hard 1/16" balsa in two parts, upper and lower. The tailpost is 1/32" balsa. Relieve the inner top keel, where the rudder will be inserted, to 1/32".



Completed cowl with spinner ring in place. Locate correct spinner position using the spinner, then remove the spinner.



Completed cowling.

Assemble the keels and tailpost over the plans, shimming the tailpost with 1/32'' scrap. Glue with CA glue. Glue the bulkheads in place (with the exception of 1, 5, and 7) between the keel pieces. It is critical that the bulkheads are 90 degrees to the plans, and that the two fuselage sides match perfectly when glued together. The most daunting part of the fuselage is the planking. It is daunting only because it is not a common R/C construction technique. Lay the first 1/8'' x 1/4'' light balsa strip parallel to the fuselage centerline with the top edge 1/16'' above the bottom of the wing. Have it extend at least 1/8'' past bulkhead 2. Each succeeding strip has to be tapered lengthwise so that the rear of the strip occupies the same proportional space on its bulkhead as the front does on its bulkhead. Each strip also has to be beveled on each side so that it will fit snuggly against adjoining strips. It requires each strip to be hand fitted, but it is more easily accomplished than described.

Thick CA glue was made for planking. Just run a bead along each strip and hold in place until it sets up. Try to avoid gluing the strips to bulkheads 3 and 6. These bulkheads are used only for fuselage contour and will be removed when planking is completed. The bottom of the wing airfoil is cut out of the fuselage as each strip is added above the first one. A 90 degree triangle is used to locate the airfoil bottom across the entire chord. Remember, the airfoil shown on the plans is on the fuselage centerline, but you are locating it on the fuselage sides, so dihedral has to be taken into consideration. That is why the fuselage bottom wing cut-out is 1/16'' above the bottom of the wing shown on the plans. Plank the fuselage solid above the wing centerline.

Laying the 1/8'' x 3/16'' light balsa stringers is very simple. The only stringer that is critical is the one parallel to the centerline where the stabilizer rests; thus, the stringer determines the stab angle of incidence which is 0 degree. Taper the stringers where they join the tailpost. Remove the fuselage half and build the other side. Put a series of pin holes on the wing side of bulkheads 4 and 8 so you will know where to cut the tops of the fuselage above the wing. ''Hollow out'' the stringer bulkheads and bulkhead 2 with a Dremel tool. Remove bulkheads 3 and 6. Remove the 1/16'' ''lip'' on the inside of the keel so that the keel is flush with the inside of the planking. This will give maximum radio compartment volume. Generously dribble thin CA glue on the inside of both fuselage halves. Join the two sides. Drill the fuel line and engine mounting holes in bulkhead 1 and add 2-56 blind nuts. Glue bulkhead 1 to the front of bulkhead 2 and the planking. This determines the thrust line which should be 0°-0°. Using a razor saw, cut the top of the fuselage where the wing fits using the previously made pin holes as guides inside bulkheads 4 and 8. Install the 1/8'' x 1/2'' basswood wing hold-down blocks.

Now comes the critical part of assembling the whole airplane. Attach the engine to the fuselage and place at least a 4'' ply plate in place of the prop. Set the fuselage in a cradle that will hold it firmly. Place a 90 degree triangle on a reference surface (table top) and against the prop disk. Adjust the fuselage in the cradle until the disk is 90 degrees to the reference surface. This will give 0 degree thrust. Put the wing in the wing saddle and ensure the tips are equidistant from the nose centerline. Put an incidence meter on the wing. Fit the wing in the saddle until the meter reads 0 degree. Drill the wing mounting holes in the wing and the fuselage wing hold-down blocks. Add 2-56 blind nuts to the wing hold-down blocks. Tentatively fit the previously covered stabilizer for 0 degree incidence and the vertical tail will be vertical. It cannot be completely accurate at this time because there will be some flexing in the stringered part of the fuselage during covering. Final adjustments will be made after covering the fuselage. Add formers 5 and 7 to the fuselage top that fits over the wing. Carve and sand the fuselage top so that it fits the top of the wing and flush with the top of the entire fuselage. Drill a 1/8'' hole through the top where the wing hold-down bolt will be inserted. After the fuselage top is attached to the wing in final assembly, insert and glue a plastic soda straw through the hole and down to the ply plate where the wing hold-down bolt will rest. This creates a ''tunnel'' for the bolts.

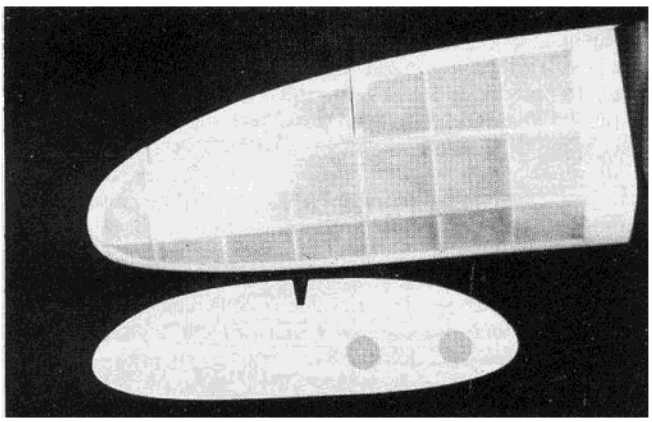
Cowl:

Tack glue the two light balsa blocks together on the inside. Cut the blocks the exact length, taking into consideration the spinner ring which will be added later. Cut the cowl 1/8'' larger in both the top and side profiles. Tack glue the cowl to the firewall in the center. Sand the cowl flush with the fuselage and roughly round it on the spinner end. Remove and split it in two pieces. Attach the engine to the firewall and plug all openings. With a Dremel tool, start hollowing each block from the rear forward, fitting them frequently over the engine. When you hollow them out far enough forward to determine where the engine thrust washer will protrude, glue the two pieces together and tack glue to the firewall. Add the spinner ring and put the spinner on the engine. Align the spinner ring with the spinner and glue to the cowl. Shape the cowl. Remove the cowl and hollow to final thickness. Fuelproof the cowl and firewall and install the fuel lines. Since I don't plan on engine removal, I glue the cowl to the firewall and cover the fuselage with the engine installed. If I have to remove the engine, I cut the cowl off and tack glue it back.

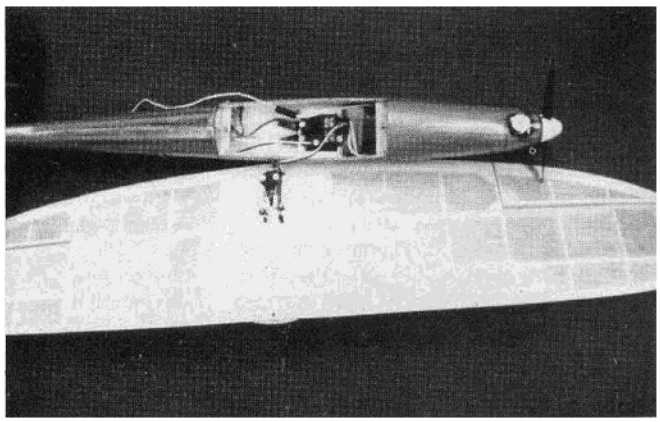
Covering:

I used Micafilm for covering. It is the strongest, lightest material I have found. I particularly like the soft sheen it has. It does have two drawbacks. It will show any building sloppiness and it doesn't shrink as much as the plastic coverings. It requires more pulling and stretching than just outright shrinkage. It would require another article on the best techniques for using this material, but don't let me scare you. Try it and maybe you will be convinced it's the best covering material available. You will save an ounce of weight too, which is about 10% on this model.

I will not go into detail on covering except for the horizontal stab and wing. I used Micafilm as hinges for the elevator and ailerons. Cover the bottom of the stab and elevator separately first. Then lay the stab on a flat surface with the bottom down. Put a 1/32'' shim between it and the elevator. Lay the covering material over the top of the two



Covering the control surfaces. See text for details.



Completed aircraft. Note radio component location.

pieces while holding them together tightly. Iron the covering material on the top surface down the hinge line and then complete the rest of the top surface. After trimming, fold the elevator all the way over so the top of the elevator rests on the top of the stab. Run a little thin CA glue down the hinge line. This will prevent delamination of the material after extended movement. Use the same technique on the ailerons.

Final Assembly:

Place the model in the cradle and set it in position with the 90 degree triangle as previously described. Secure the wing in position and glue on the fuselage top. Slide the horizontal and vertical stabs in position. Ensure the horizontal stab is square to the fuselage and use the incidence meter to obtain 0 degree incidence. Glue in position. Make sure the vertical fin is vertical, then glue.

Radio Installation:

You really have to plan ahead because of limited volume in the fuselage. I even made the forward fuselage of this model 1/4'' deeper and wider than the prototype because of the ''squeeze'' factor. The aileron servo may have to be moved to the rear of the rear spar if you build it with three channels. First, lay the battery pack, fuel tank, receiver, and servos in their tentative positions. Check the C.G. as shown on the plans. Move the different items around to achieve balance. I have flown it successfully with the C.G. between 25%-35% of the chord. Try not to add weight. After determining where the aileron servo will be located, cut a hole in the wing center and install the servo. I used basswood blocks. I used Du-Bro aileron ball links for the linkage. Be sure to add 3/32'' tubing over the torque rods because most aileron hardware is made for 3/32'' wire. The elevator servo is mounted on 1/8'' x 1/4'' basswood mounts that are mounted on 1/4'' x 1/4'' basswood side rails. These are screwed together so the servo and mounts can be removed from the side rails. If they are glued together it will be impossible to remove the battery and tank. I used 3/32'' aluminum tubing with Goldberg true 1/16'' rod, inserted, crimped, and CA glued, for the elevator pushrod.

Flying:

I recommend your first flight be performed over high grass on a calm day in case you have trim problems. Check control throws for a maximum 3/16'' up and 3/16'' down for ailerons, and 3/8'' up and 3/8'' down for elevator. If your model balances at 25%, you will need to keep a little higher speed on final for enough elevator authority on roundout. Ensure the engine is running reliably and launch the model at about a 10 degree angle with a vigorous throw. It will be at flying speed almost immediately. You will find the flying characteristics very predictable and smooth. Just don't overcontrol. Good flying!

□

From RCModeler July 1991