



Q'ICKSILV'R

By Gary Goynes

A SPIRITED SPORT FLIER FOR .40-.46 2-STROKE ENGINES

If the majority of sport fliers out there are like me, there are certain characteristics about each aircraft in your personal hangar that either make it a joy to take to the field anytime or other things such as handling characteristics, wind direction, wind velocity, etc., that determine if that aircraft goes or stays at home.

With these things in mind along with some others to be mentioned later, the Q'icksilv'r was conceived. This is the 5th generation of this aircraft along with a 25 size and a low wing model thrown in. A few changes were made here and there each time to enhance the flying characteristics. I'm now satisfied with the end result.

Let's list a few other things I wanted in a sport aircraft:

Exceptional speed and power: Aircraft can achieve speeds in excess of 100 mph straight and level plus leave runway on take-off and climb vertically out of sight (my favorite!), then flat spin back to a reasonable flying altitude.

Exceptional low speed and stability: Aircraft will practically hover in a 10 mph to 15 mph breeze. Nose high landings very comfortable and slow without any "snap" tendencies.

Tracks straight and true at any throttle setting. Can perform practically any

ABOUT THE AUTHOR

Gary Goynes is 53 years old and has been involved in model aircraft since the age of 14. These were Control Line and Static models.

He started in R/C in 1974 and has designed several models of various sizes. Gary prefers scratch-building over kits mostly for the added challenge.

Gary was born and raised in the northeastern Ohio area and moved to Texas in 1977.

He says it's a definite advantage living in the South with longer summer weather in which to fly.

Gary is employed by the Fluorocarbon Company as a plant engineer.

aerobatic maneuver including knife-edge loops.

Clean streamlined with neat appearance. Simple but strong lightweight construction. Able to be flown by anyone considered a sport flier (my 15 year old son has been flying #3 generation for over a year now).

Reasonably economical to operate. Easy to transport without the assembly and disassembly hassle. Very minimal cleanup (I hate cleanups). Due to pipe location a very small amount of residue will be on rear of fuselage bottom and bottom of horizontal stab. Takes but a minute or so for cleanup job.



This aircraft was originally designed around the O.S. 45FSR with Mac tuned pipe assembly. With the new O.S. 46SFABC the performance was enhanced slightly adding a little "frosting on the cake."

If you are still interested, let's get to building a Q'icksilv'r, its performance will astound you.

First check the bill of materials to see if you have all you need. This taken care of, you'll find this aircraft very easy to build and it doesn't take "400 forevers" to complete.

CONSTRUCTION

Horizontal Stab and Elevator:

The horizontal stab is made from four pieces 3/16" light balsa. Using plan measurements, cut the pieces and CA together. CA tips in place (note grain). Sand surfaces smooth and install 1/64" ply over top and bottom with slight overlap. Do one side and trim ply to balsa outline before doing other side. It's easier that way. I use contact cement for ply to balsa.

The elevator is made from 1/4" medium balsa. Cut to size per plan and install 1/8" music wire coupler with 5 minute epoxy. Make sure the leading edge is straight and both surfaces are true with each other.

After epoxy sets, cut hinge slots in stab and elevator and slide hinges into place. Sand elevator surfaces flush with stab and sand remainder to proper shape. Draw centerline down stab for location purposes later.

Vertical Fin and Rudder:

All are made from 1/4" balsa sheet. Measure from plan and make up accordingly but do not cut rear notch in vertical fin yet; we'll do that when fitting to rear top block. Again, fit hinges and sand to shape to eliminate any misalignment. We'll also fit fin at top block installation. Leave rudder a little long also to fit to fuselage bottom.



Wing:

The Q'icksilv'r uses a foam core wing. This, I've found, is a simple way to build a strong, straight, and true wing.

For those of you who haven't tried cutting foam wings, give it a try, it's really quite simple. There is some excellent foam cutting equipment on the market or you can

build your own as I did.

Let's assume your wing cores are cut and sitting in front of you. Let's put 'em together.

Lightly sand cores all over, careful, foam sands easily. Remove all the dust with a vacuum.

The cores are symmetrical so pick a top



and mark an "X" on each core for reference through the building process. Each wing panel is practically complete before panels are joined so you now have a left and right panel.

Cores should be 8/4" at each end; if they aren't, trim as necessary from trailing edge. They should be as identical as possible at this point.

White glue 1/4" x 1/4" balsa trailing edges and 1/4" x 1/2" balsa leading edges in place. Masking tape works well to hold in place until dry.

After glue has dried, cut in grooves for 1/4" x 1/2" (medium hard) balsa spars. Spars should fit groove snug but not so tight as to deform airfoil. White glue spars into place and set aside on flat surface to dry. Spars should be flush with surface. Again, when glue has dried, draw centerline down each leading and trailing edge. Use this line for reference while you're trimming balsa leading and trailing edges to foam surfaces.

Again careful, don't sand into airfoil and don't sand away reference line, it'll come in handy later.

For wing sheeting you'll need six 1/16" x 3" x 36" balsa sheets soft enough to be easily formed. Cut all to length of 24 1/4". Set short pieces aside for center section. Cut two sheets 1 1/2" wide for trailing edge sheeting. Sheeting is applied with contact cement that is compatible with foam. If there is any doubt, try on a piece of scrap foam before taking a chance on ruining your cores and your nerves.

I draw a line for each location and mark each 1 through 8 on foam and each balsa sheet.

Apply adhesive to each surface and locate in proper position against each reference line. Once sheeting is in place, CA sheeting edges to leading and trailing edges. Be

Q'ICKSILV'R

Designed By:

Gary Goynes

TYPE AIRCRAFT

High Performance Sports

WINGSPAN

51 Inches

WING CHORD

10 Inches

TOTAL WING AREA

500 Sq. In.

WING LOCATION

Shoulder Wing

AIRFOIL

Symmetrical

WING PLANFORM

Tapered T/E

DIHEDRAL, EACH TIP

1/4 Inches (Approx.)

OVERALL FUSELAGE LENGTH

40 1/4 Inches

RADIO COMPARTMENT SIZE

(L) 10" x (W) 2 3/4" x (H) 2 3/4"

STABILIZER SPAN

20 1/2 Inches

STABILIZER CHORD (incl. elev.)

6 1/4 Inches (Avg.)

STABILIZER AREA

128 Sq. In. (Approx.)

STAB AIRFOIL SECTION

Flat

STABILIZER LOCATION

Mid-Fuselage

VERTICAL FIN HEIGHT

6 1/4 Inches

VERTICAL FIN WIDTH (incl. rud.)

6 1/2 Inches (Avg.)

ENGINE SIZE

.40-.46 Cu. In.

FUEL TANK SIZE

8 Oz.

LANDING GEAR

Tricycle or Conventional

REC. NO. OF CHANNELS

4

CONTROL FUNCTIONS

Rud., Elev., Throt., All.

BASIC MATERIALS USED IN CONSTRUCTION

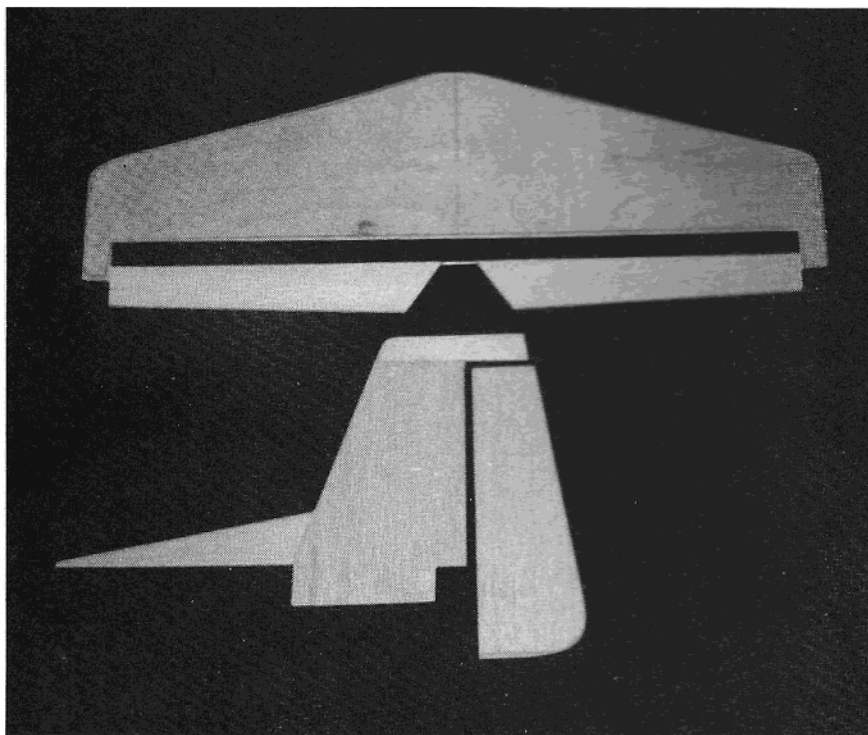
Fuselage Balsa & Ply

Wing Balsa, Ply & Foam

Empennage Balsa

Wt. Ready To Fly . 68-76 Ozs. (4 1/4-4 3/4 Lbs.)

Wing Loading 19.6-21.9 Oz./Sq. Ft.



Tail feathers built and ready for installation.

careful, most CA will "eat" foam! UFO works great from Satellite City.

Trim excess balsa flush with leading and trailing edges. Round balsa sheeting into leading edges and once satisfied with shapes, sand only enough balsa from leading edge face to remove reference line. If done properly, the leading edge will be straight and true.

Sand trailing edges flush but do not round edges. Trim excess from ends, keeping them square and lightly sand over all surfaces.

The center sheeting is next. Mark reference line for end of center sheeting per

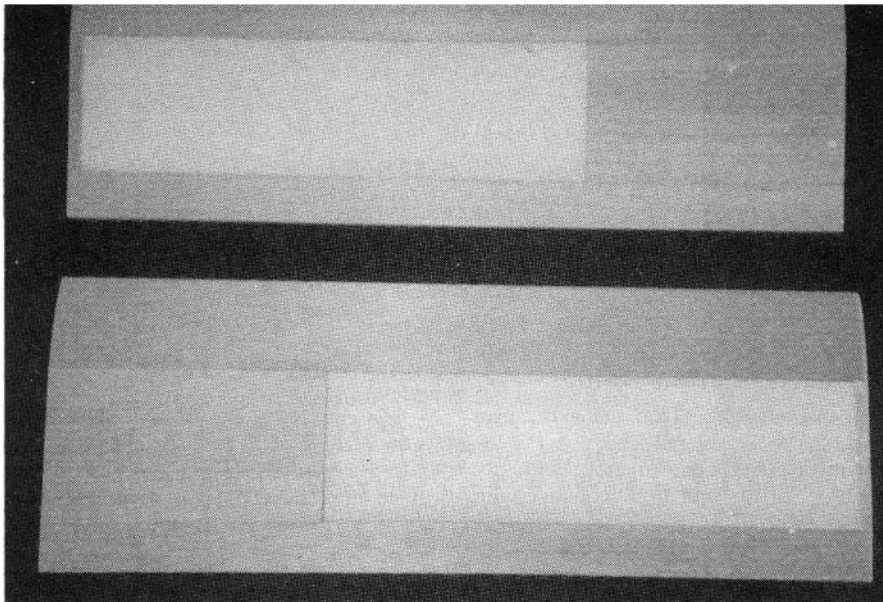
plan and snug fit pieces into place with contact adhesive. Once in place, sand lightly to flush surfaces and CA all sheeting together. Apply CA to each joint and go right behind with paper towel. This will keep all sheeting from lifting and locks them in place.

Install the four outboard 1/16" x 1/4" capstrips flush with wingtips (white glue). Once glue has dried, install 1/8" end caps with white glue and trim to shape once dry.

The ailerons are built from 5/16" x 1 1/2" x 36" tapered aileron stock, medium density. Cut to length per plan and cut center section pieces to proper length also.



Wing cores with leading, trailing edges, and spars installed.



With sheeting and tip plates installed, wing panels are ready for wing tips, cap strips, and ailerons.

Use Goldberg Aileron Horn set #403, 1/8". **Do not** substitute 3/32" rods. (Ailerons will flutter at high speed. Experience talking!)

Cut threaded portion to a length of 1-1/16" measured from tip to C/L of wire. It's easier now than later. Make up two horn sets per plan, one right and one left and fit to center section pieces. Put a dab of Vaseline on each end of wire and bushing and install in proper location on trailing edges.

Mark hinge locations and slot trailing edge and aileron for hinges. Fit horn wire to aileron and fit ailerons to trailing edges. Once ailerons are trial fitted into place, sand aileron surfaces flush with each wing panel. This takes care of any hinge misalignment.

Remove ailerons and cut to proper angle. Measure 10" from leading edge and cut off

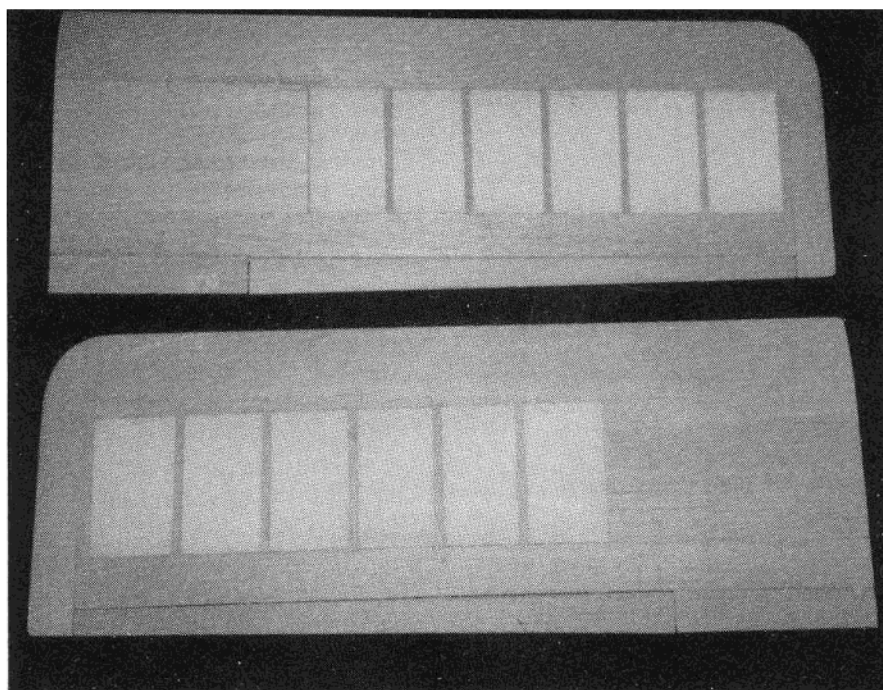
any excess center section.

Cut wingtip blocks from soft balsa either 1" thick or laminate two pieces of 1/2" together. Glue to 1/8" end caps and reinstall ailerons. Trim to shape per plan. Be careful at trailing edge and aileron tip, angle changes drastically and too much trimming will leave you with nothing to trim. (Again experience talking.)

At this point, both halves should be sanded as necessary. Aileron leading edges rounded along with trailing edge of each wing panel. Ailerons should move 1/4" up and down with hinges in place. Keep gap minimal; we don't need any aileron flutter.

Install all 1/16" x 1/4" capstrips top and bottom. After glue has dried, blend into sheeting.

Lay one panel over the other and make



Wing panels ready for joining.

sure they are identical. If satisfactory, panels are ready to be joined.

One little note before joining panels: Set the wing on end at the center and draw an outline of the airfoil, bottom side on a piece of paper. Draw centerline through leading and trailing edge. This will be used as pattern for wing saddle later on fuselage.

There is no dihedral in this wing but because of the tapered planform there is 3/16" or so at each tip if joined upside down on flat board. It has been my experience with this aircraft that 0" to 1/2" dihedral or anhedral doesn't change the flight characteristics any that I'm smart enough to notice.

For sake of argument, fit the center sections making sure leading edges are straight. Once satisfied with fit use 5 minute epoxy to join panels upside down on flat surface. Make sure there is no twist.

BILL OF MATERIALS

Balsa Sheets

- 6 — 1/16" x 3" x 36"
- 1 — 3/32" x 3" x 36"
- 4 — 1/8" x 3" x 36"
- 3 — 3/16" x 3" x 36"
- 1 — 1/4" x 3" x 36"
- 1 — 3/8" x 3" x 36"
- 1 — 1/2" x 3" x 36"

Balsa Sticks

- 3 — 1/16" x 1/4" x 36"
- 2 — 1/4" x 1/4" x 36"
- 4 — 1/4" x 1/2" x 36"
- 2 — 5/16" x 1/2" x 36" tapered aileron stock

Balsa Tri-Stock

- 3 — 1/4"
- 2 — 3/8"
- 1 — 1/2"
- 1 — 1"

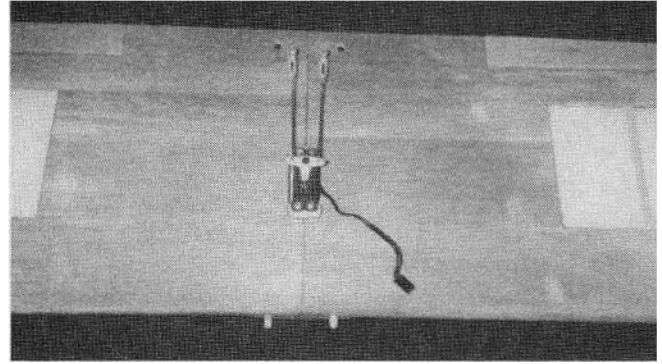
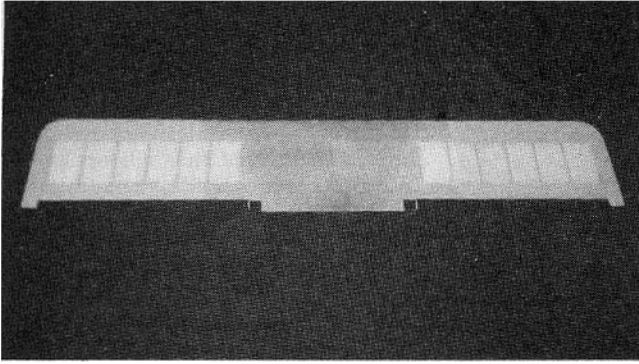
Plywood

- 1 — 1/64" x 12" x 36"
- 1 — 1/16" x 6" x 6"
- 1 — 1/8" x 6" x 12"
- 1 — 1/8" x 6" x 12" Lite Ply
- 1 — 1/4" x 6" x 12"

Accessories

- 1 — 1 1/2" x 1 1/2" x 8" Balsa (Canopy)
- 2 — 1/4" Dowel Rods
- 1 — 5/32" Music Wire
- 1 — Pkg 36" Dubro Flex Cable Set
- 1 — Du-Bro Steering Arm
- 3 — 2 1/4" D. Brown Wheels or, for Talidragger, two 2 1/4" + 1" tail wheel
- 1 — D. Brown or Kraft Mount
- 1 — Hallco #B-106-4 Gear
- 1 — Sullivan #FSS-8 tank
- 2 — Pushrod Exits
- 4 — Kwik-links with Rods
- 1 — 1/16" Music Wire
- 1 — Goldberg Tail Wheel Bracket
- 17 — Hinges
- 1 — Set 1/8" Goldberg Aileron Horn Set #403
- 1 1/2 — Sq. ft. 4-6 oz. Glass Cloth with Resin
- 2 — 5/32" Wheel Collars
- 3 — EZ Connectors
- 2 — Goldberg Short Control Horns
- 2 — Rolls Covering Material
- 1 — Set Foam Wing Cores

(Cores can be purchased from Wing Mfg. Co., 306 E. Simmons, Galesburg, Illinois 61401, 309-342-3009.)



LEFT: Wing panels joined and center section glassed. RIGHT: Aileron servo installed in the wing.

Once panels are joined, sand joint smooth and install 1/16" x 2" x 3" ply wing bolt plate. I set this plate flush with surface mostly for looks but it is necessary or the trailing edge will crush from wing bolts. (Again experience talking.)

Glass center section per outline on plan. Four to six ounce cloth is recommended for strength.

I realize this is a laborous task which I used to do entirely by hand. If you plan to do many wings in the future as I have, go down to your local discount store and purchase an electric orbital sander for about \$25.00. It cuts the time and work by probably 2/3 and only leaves blending of edges to do by hand but again be careful; the sander with 80 grit paper will make short work of bare balsa.

After all sanding is completed to your satisfaction, cut hole for aileron servo, make up ply mounts, and fit linkage.

Fuselage:

The fuselage for the Q'icksilv'r is straight forward but a few little hints here and there I've learned after building several may save a little wear and tear on your nerves.

Using two sheets of 1/8" x 3" x 36" balsa for fuselage sides (same density, medium light) add a 3/4" piece of 1/8" sheet to rear of fuselage sides with CA, also add a piece of 1/8" x 3/8" x 5 1/2" long balsa to top of each balsa side starting at front. CA into place. Mark left and right side at this point to keep things in order.

Cut out the front and rear 1/64" ply doublers leaving a little overhang. Mark their location on fuselage sides (note angles) and contact cement them in place. Set aside on flat surface with some weight on doublers until dry.

Once dry, trim 1/64" ply to outline of balsa sides and draw C/L per plan down inside of each. Square nose end of each side and mark firewall, bulkheads, and rear

cross brace location. Trim rear ends square and exactly 37" overall length.

Put fuselage sides together with ply doublers inside and hold together with masking tape. Lay piece of masking tape down approximate C/L of fuselage side outside surface and transpose inside C/L to outside of fuselage side.

With everything held in position, trim fuselage sides to proper outline per plan. Cut slot for horizontal stab (bottom of stab sits on C/L). Cut slot slightly narrower than stab and trim (top side of groove only) until you've got a nice snug fit. Stab should sit approximately 1/8" to 3/16" inside rear of fuselage sides to allow clearance for rudder and elevator coupler.

Mark location of wing saddle and using the pattern made earlier, cut in wing saddles (0° incidence) with reference to your fuselage C/L. Lay over wing to check fit.

Once satisfied, separate sides and make up firewall, bulkheads and 1/8" wing dowel plate. CA dowel plate to bulkhead #2 per plan and drill all holes. Locate motor mount in position on firewall and install 4-40 blind nuts.

Align C/L of fuselage side with C/L on firewall and once in exact square alignment, CA firewall to fuselage side.

Set bulkhead #2 in its approximate location (don't glue) to hold other side and CA other fuselage side to firewall (make sure they are square and true). Once fuselage sides are glued to firewall, set bulkhead #2 and #3 in their approximate location, pull tail together and CA (tail only) in place.

Set wing on wing saddle and align, slide bulkhead #2 into position against leading edge and mark location. Do same with bulkhead #3 against trailing edge. Remove wing and CA bulkheads in position. Install 1/4" x 1/2" rear cross bracing.

Cut out 1/4" x 1 1/2" x 2 3/4" ply landing gear plate. Locate position per plan. Use two pieces 1/8" balsa scrap on each side of plate for proper depth into fuselage bottom. CA into position.

Cut 1/4" ply wing hold-down plates per plan, fit to front of bulkhead #3 and fuselage sides. Once satisfied with fit, CA into place. Fit 1" (hard) tri-stock under plates and CA into place.

Install all tri-stock to rear of bulkhead #3 and fuselage sides.

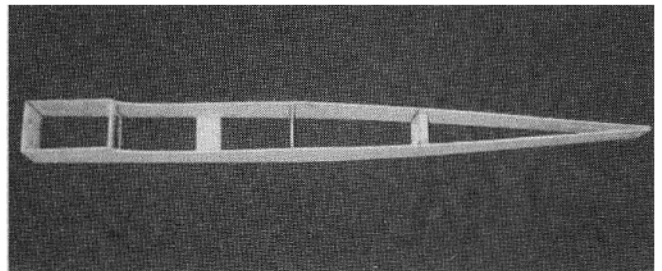
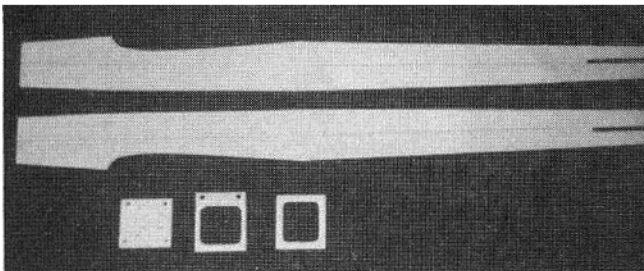
The prototype uses a 2+1 servo tray arrangement so make up servo tray rails from ply, mount tray to rails and locate against bulkhead #3. With servo's in place, set fuselage on 1/8" scrap pieces simulating bottom and use a 1/32" spacer between bottom and servos. Once in proper location, CA rails to fuselage sides. Remove tray and servos and install 1/4" tri-stock in rear corners of rails. Install small pieces of tri-stock under front rails also. Install all remaining 1/4", 3/8", and 1/2" tri-stock through to firewall. Clear wing dowel, fuel line, and cable holes.

Position wing on fuselage and install wing dowels per plan using 5 minute epoxy. Once epoxy sets up, realign wing in exact position and drill and tap holes for wing hold-down bolts. Remove wing and run CA into holes. Re-tap. Wing mounting is now complete.

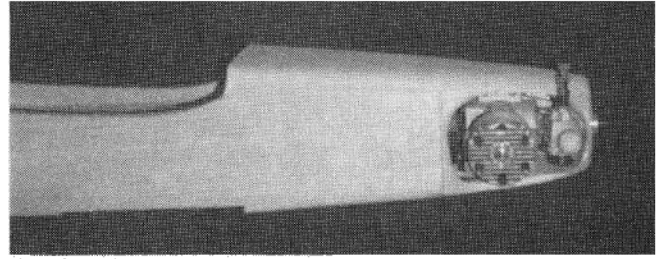
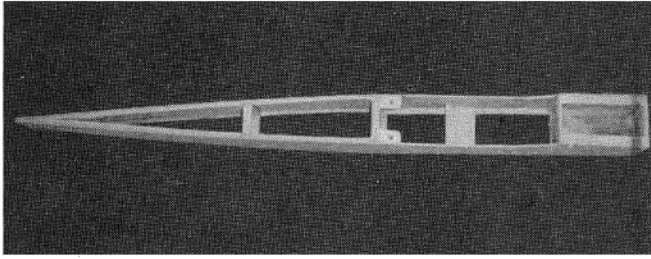
Make installation of fuel tank next. A #FSS-8 Sullivan tank is used. A couple of hints to keep from kinking tubes is about all the detail here.

K&S makes a spring bender that works well or use a piece of "weed-eater" line the i.d. of brass tubes. Brass tubes should extend approximately 3/8" to 7/16" through firewall. After fitting, remove tank assembly and set aside.

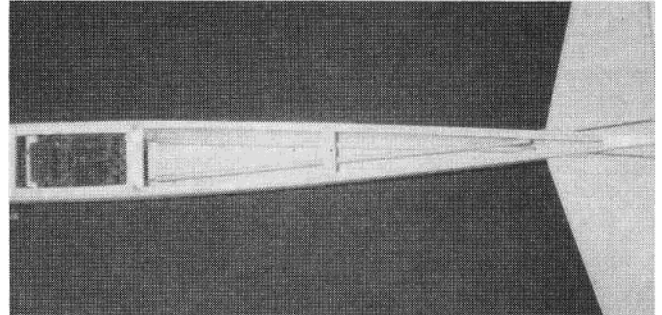
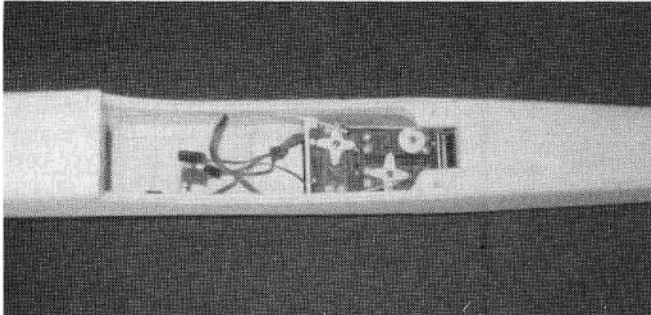
Make up and install 1/8" balsa wing



LEFT: Fuselage sides with 1/64" plywood doublers installed along with firewall and bulkheads ready for installation. RIGHT: Fuselage sides joined along with rear bracing and landing gear plate.



LEFT: Wing blocks and fuel tank installed. RIGHT: Nose pieces added and engine installed.



LEFT: Servo installation. RIGHT: Bottom of fuselage showing pushrod installation.

saddle (see plans for outline).

Install cable housing, notch bulkhead #2 slightly for clearance at bottom of 1/8" wing saddle. Cable assemblies lay along fuselage side next to wing saddles; leave cable housing a little long and cut to proper length at final assembly.

Nose section is next. Make up spinner ring and 1/2" x 2" sq. balsa nose block. Align and glue together. Install motor mount and engine in place, remove carburetor from engine and plug openings with piece of paper towel.

Prototype used Goldberg 2 1/4" spinner. C.B. or other type will require different installation. We'll cover the Goldberg here. Cut 1/16" thick spacer from scrap cardboard to same diameter as spinner ring. Sandwich between spinner backplate and ply spinner ring. Align carefully and tack glue about four places to spinner ring block assembly and spinner backplate. Mount assembly on engine, clear balsa block as necessary for flush fit.

Make up 3/8" x 3" balsa top block and fit into position. Rear should be exact flush and vertical with wing dowel plate. CA into place once fit is achieved.

Make up balsa chin block. Chin block is installed between nose block and firewall. Trim until proper fit is obtained. Draw C/L across end grain of chin block at firewall. Chin block slides into line flush with firewall. CA into position.

Remove engine and mount assembly, separating at cardboard spacer. Cut 3/8" x 3" balsa side blocks, lay over side and mark outline from inside engine compartment. Trim to snug fit with fuselage side. Don't glue yet! Remove and make up other side same way. Now locate and install both. Make engine cut-out and install 3/8" and 1/2" tri-stock. Trim and sand nose to shape. Refit carburetor to engine and install engine and mount assembly clearing areas as necessary. Clearance for muffler will allow ample clearance for tuned pipe header

also. **Note:** If building a taildragger, omit nose gear information below.

Locate nose gear opening and clear for nose gear and coil.

Set up steering arm and cable assembly, clearing balsa as necessary. A Du-Bro EZ connector is used for steering.

Install wing on fuselage and install wing filler block.

With wing bolted to fuselage, cut 3/16" x 3" balsa rear top block to exact length. Lay piece of masking tape down middle of top block and draw C/L.

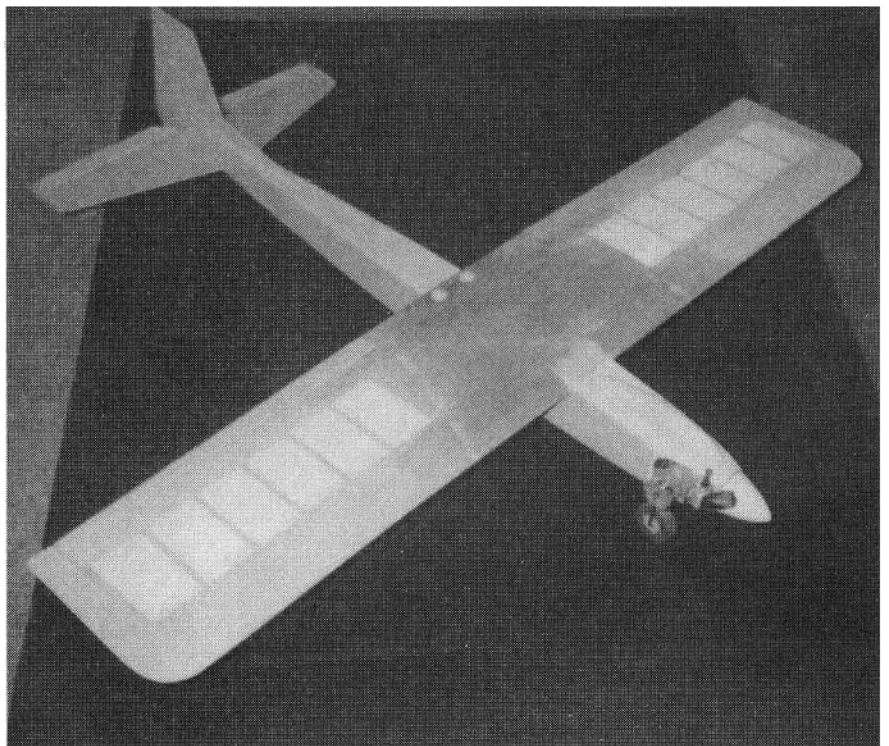
Now cut notch in vertical fin per plan and align rear of vertical fin with rear of top block, mark location and cut slot in top block. Again make snug fit. Mark C/L on

ends of top block and remove tape. Recheck top block to fuselage and when satisfied, CA into place. Careful! Don't get CA on wing. Once cured, trim top block to sides and blend into wing trailing edge.

Clear tri-stock at rear of slot and fit vertical fin to slot. Slide horizontal stab into position. Vertical fin should sit flush on horizontal stab and square with rear of fuselage. Fit dorsal fin to vertical fin and CA to it.

Install one piece of 3/32" x 3" balsa bottom sheeting (cross-grain). Sand flush with end of fuselage and sides. Cut bottom hinge slot in fuselage and fit all tail feathers per plan.

Install 1/8" bottom sheeting



Q'icksilv'r, ready for covering.

(cross-grain) from bulkhead #2 to landing gear plate. We'll leave remaining sheeting off until after pushrods are made and linkages checked for any binding.

Make up pushrods and fit to horns and servos. Make up balsa canopy per plan and fit to top block; keep it light.

I completely build an aircraft including radio gear, pushrods, linkages, etc., then disassemble all to cover; saves a lot of slipped screwdriver marks, etc.

Install remaining bottom sheeting and fill gap at landing gear plate with scrap balsa. Sand entire fuselage to shape.

Fit landing gear to plate with four #4 screws per plan.

Bend landing gear as necessary to achieve a level wing/fuselage. This completes building process.

Disassemble and cover with your favorite covering material and color scheme.

Our prototype was done in metallic green Aerospa and silver metallic Black Baron film with automotive black stripping tape.

Assembly:

Five minute epoxy is used on all assembly. Remove covering slightly inside all joint lines and fit into position once satisfied with alignments, epoxy into place. Wipe off excess with alcohol. Install fuel tank and thick CA glue brass tubes to firewall.

Reinstall engine and fit fuel lines. Clear as necessary. Once all fits are made, fuelproof engine compartment. I use Formula #2 Hobbypoxy. Be sure you plug all motor mount and linkage holes before doing this. Also put old piece of fuel tubing

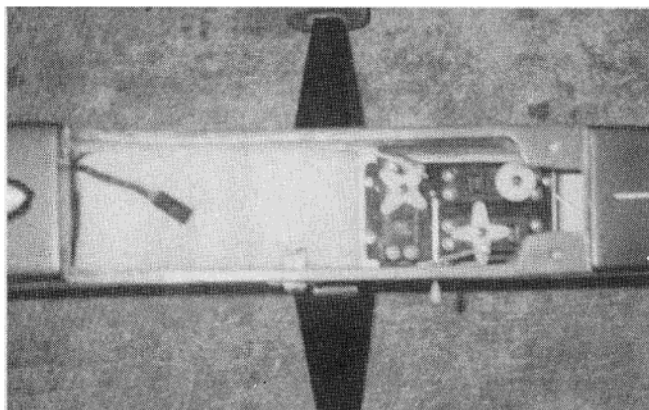
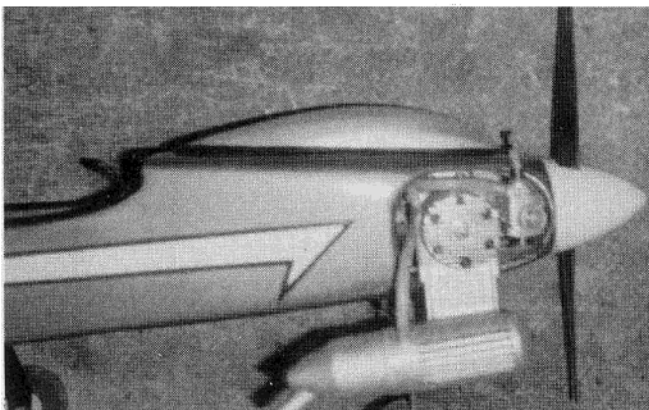
over brass fuel lines.

Hinge all surfaces. If you're using polypropylene hinges, rough the surface before installing.

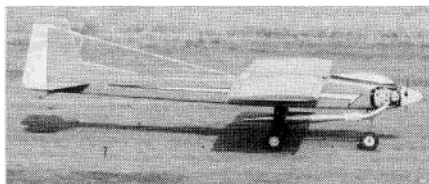
Reassemble all remaining components and install Goldberg tail skid bracket or if building a taildragger, install a tailwheel bracket and tailwheel assembly.

Note: A little word of caution about nylon kwik-links. Due to the high performance of this aircraft, check kwik-link pins, especially on elevator every so often. I have found after a few months of flying the pin will actually wear in half! So keep an eye on 'em and replace as necessary. **Note:** Fuel tubing "keepers" over links helps.

Let's discuss the engine for a few moments. If your engine is new, I would



LEFT: Engine installed in finished model. Keep everything neat and tidy. RIGHT: Plenty of room for R/C equipment.



suggest you run a few tanks of fuel through it with muffler before installing pipe assembly.

Once broken-in "go for it."

Here are a few specs I've gathered that may save some grief.

Mac offers a muffled tuned pipe assembly for this engine with header cut to proper length. This is the easiest way but if you buy separate components, the header length should be 4 1/8" to 4-3/16" long measured from base of pipe where it joins header block along outside radius.

The difference I have found between the muffled tuned pipe and tuned pipe is approximately 200 rpm favored by the latter.

The muffler equipped engine should tach approximately 12,900 to 13,100 rpm.

With pipe installed rpm will increase to approximately 14,900 to 15,200 rpm. Aircraft performance will also increase dramatically so be "on your toes."

The above figures are based on 10% Red Max fuel and 10 x 6 Master Air Screw prop.

A little note of caution: Don't try to squeeze every last rpm from your engine. You'll only wear it out prematurely and eat glow plugs in the process. A tad rich on straight and level with no sag on vertical is about right.

Once everything has been installed, test run engine and vibration check radio equipment.

Recommendations:

Set up the control surface throws for trim flight accordingly, elevator 1/4" up and down, ailerons 1/4" up and down, rudder 7/8" left and right.

Check C.G. per plan and you're ready.

Flying:

With the controls set up as per recommendations, the aircraft will be fast but docile.

Advance throttle slowly, aircraft will stay on the ground until you decide to lift off. A little up elevator is all that is required. Once airborne, trim to suit your personal preference. Check roll rate, with recommended throw, rolls should be comfortable. With increased ailerons throw, rolls will be faster than you can count.

Landings are a dream but you must slow the aircraft down. Once on final approach with engine at idle, add elevator gently, nose will rise slowing aircraft to a very gentle landing.

This concludes the Q'icksilv'r. I believe you'll find this aircraft to be one of the more enjoyable ones in your hangar, I sure have, but of course I'm a little prejudice I suppose.

Happy Landings!



**From
RCModeler
Sep. 1992**