

S.P.A.D. XIII C.1



By Bob Rich
Flying Photos by Ron Morris

A 1/5 Scale SPAD XIII C.1 of the 22nd Aero Squadron, American Army, 1918.

One of my favorite aircraft has been the WWI S.P.A.D. fighter. It's the right kind of airplane, two wings, wing struts, and the wind whistling through the wires. All that good stuff that makes for real airplanes.

I have made three SPADS, two VII's and one XIII in different scales and they have all flown well.

The SPAD has never really received the

recognition as the great aircraft it was because of the Ace system introduced by the French and followed by the Germans and the Americans. This system gave all of the credit to the pilots and very little recognition to the aircraft they flew.

The initials S.P.A.D. originally stood for Societe Pour les Appariels Deperdussin. When Louis Bleriot took over the company in 1914 the name was changed to Societe Pour Aviation et ses Derives so the initials stayed the same.



S.P.A.D. XIII C.1

Designed By:

Bob Rich

TYPE AIRCRAFT

Scale Biplane

WINGSPAN

63 inches

WING CHORD

11 $\frac{1}{4}$ " Top, 11" Lower

TOTAL WING AREA

1302 Sq. In. (Approx.)

WING LOCATION

Biplane

AIRFOIL

Modified S-13 C1

WING PLANFORM

Constant Chord

DIHEDRAL, EACH TIP

0

OVERALL FUSELAGE LENGTH

48 inches

RADIO COMPARTMENT SIZE

(L) 9" x (W) 6" x (H) 5"

STABILIZER SPAN

23 $\frac{3}{4}$ inches

STABILIZER CHORD (incl. elev.)

7 inches (Avg.)

STABILIZER AREA

160 Sq. In. (Approx.)

STAB AIRFOIL SECTION

Symmetrical

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

8 $\frac{3}{4}$ inches

VERTICAL FIN WIDTH (incl. rud.)

9 inches (Avg.)

REC. ENGINE SIZE

.50-.75 2-stroke

FUEL TANK SIZE

12 Ozs

LANDING GEAR

Conventional

REC. NO. OF CHANNELS

4

CONTROL FUNCTIONS

Rud., Elev., Throt., All

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage Balsa, Ply, & Lite Ply

Wing Balsa & Spruce

Empennage Balsa

Wt. Ready To Fly 144 Ozs. (9 lbs.)

Wing Loading 16 Oz./Sq. Ft.

Noted French designer Louis Bechereau designed the S.P.A.D. airplanes to take advantage of the new powerful inline Hispano-Suiza engines. Aviation experts at the time were well aware that the rotary engines had seen their best days and were on their way out.

The S.P.A.D. VII was put in service in the fall of 1916 with great success. It was replaced by the heavier, better armed S.P.A.D. XIII. The XIII was one of the planes that was instrumental in the Allies achieving air superiority, helping to win the war. Probably the best known SPAD was the one flown by America's leading ace, Capt. Eddie Rickenbacker.

This SPAD is 1/5 scale, giving it a 63" wingspan, large enough to add whatever details you may want to put on. The shapes and outline are scale, so if you are making yours for competition, select your prototype and copy it as to the details and finish



CONSTRUCTION

Tail:

Make the tail surfaces directly over the plans. Notice the fin tail post goes to the bottom of the fuselage. Select the wood carefully as the tail needs to be kept light but strong. The lightening holes don't hurt either.

The bottom part of the fin post will have to be trimmed to fit between the rear of the fuselage sides when the fin is mounted to the fuselage.

Solder the brass elevator horn to the 3/32" wire elevator joiner. A commercial control line elevator horn may be used if it's close to the right size.

Fuselage:

Build the fuselage using 1/8" lite ply for the fuselage sides and the bulkheads. If possible, cut the fuselage sides from the same piece of lite ply so the sides will bend evenly.

Glue the 1/8" aircraft ply doublers to the sides, one right and one left side naturally.

Ensure the fire wall and bulkheads are square. Use a rubber band at the rear of the fuselage to hold a piece of scrap balsa in place of the fin post. The outside dimension should be 1/2" at the rear of the fuselage sides.

Glue the balsa formers in place. Make sure former K1 is correct as it locates the stabilizer.

Locate and install the cabane struts. Each cabane strut is made from one piece of .032" x 1/4" brass and two pieces of 1/8" x 3/8" spruce. Sandwich the brass pieces between the spruce pieces. When making the top bend in the brass strut, leave enough brass for the wing mounting hole and for fastening the landing wire clevis. The bend should also match the wing airfoil. Note that the outside spruce piece is cut off flush with the top of the fuselage side. Use epoxy to mount the cabane struts to the plywood doubler.

Sheet the forward fuselage sections. The lower front section is carved from a soft balsa block.

Install the 1/8" sq. spruce stringers. Note where the stringers stop short of full length in the photos.

Fill the spaces between the stringers at K1 and at the headrest with scrap balsa.


The gun troughs were formed using 1/64" plywood.

I carved the removable cowling from white foam and covered it with two layers of heavy fiberglass cloth using epoxy resin. The cowl could be built-up using ply and balsa if that's your thing. The valve covers were also carved from foam and fiberglassed.

The landing gear is formed from 1/8" steel wire. The landing gear fairings are 1/8" aircraft ply sandwiched between two pieces of 1/16" aircraft ply. The straight wire axle is 5/32" wire.

The drawings show the scale wheel spacing, but I made mine a little wider so it wouldn't tip as easily.

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colors. In researching the SPAD I have found that many of the details and color schemes were different on each airplane shown.

I used the W. A. Wylam drawings as the main source for the dimensions and outline.

The Champlin Air Museum at Mesa, Arizona, has a very fine replica of the XIII. Profile Publications #17 is a good source and some of the English Windsock issues (Windsock Datafile 32) have very good information.

As I don't enter contests anymore, I have made mine for my own satisfaction. It is not a difficult airplane to build, but it does require some skill and attention to detail. As with any project, the more care used in building, the more satisfied you will be with the finished product.

If you are going to build this SPAD, it would be a waste of time and space to cover the construction item by item and step by step. Only the important points will be covered in detail, so by following the plans and photos you shouldn't encounter any difficulties.

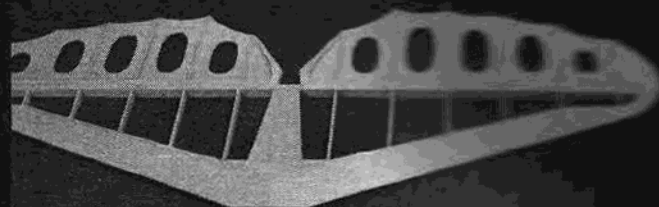
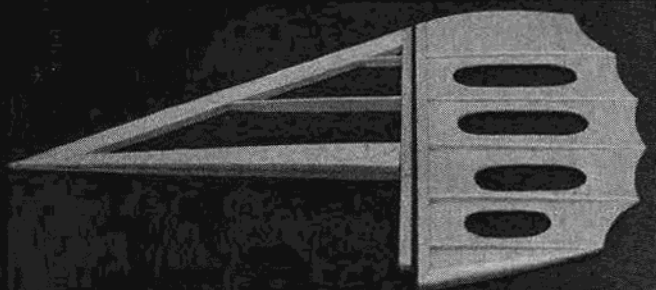
I would have preferred to use a 4-stroke engine, but the size wouldn't allow the engine to be hidden inside the cowl. I used a Fox .74 and it has worked out well. So the choice of engines is up to you. The room in the cowl allows for the length of a 4-stroke engine without moving the fire wall.

"You don't have to be a super pilot to fly the SPAD. If you can handle a taildragger, you can fly this one."

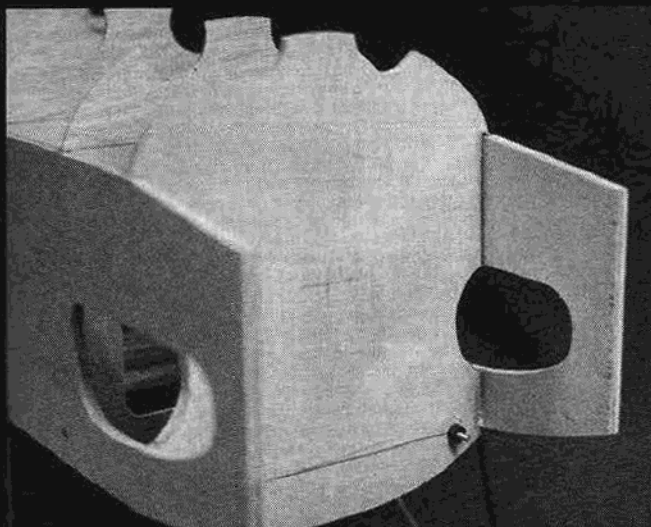
I used Super Jet for all of the construction except for epoxy in the high stress areas.

By now you should have made up your mind to build this plane so start by building the tail.

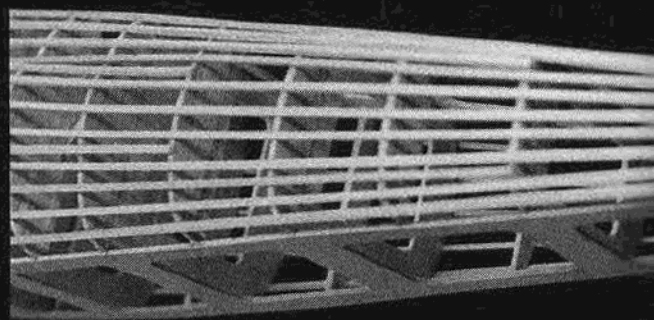
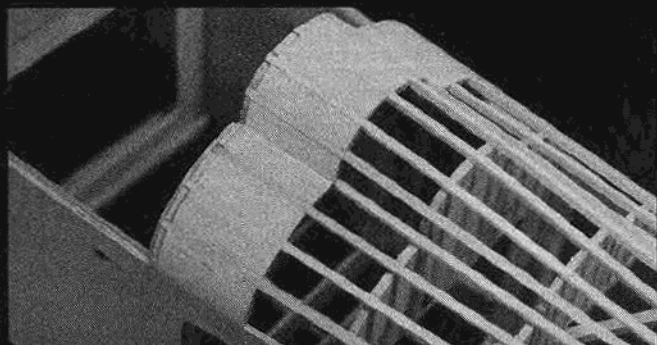




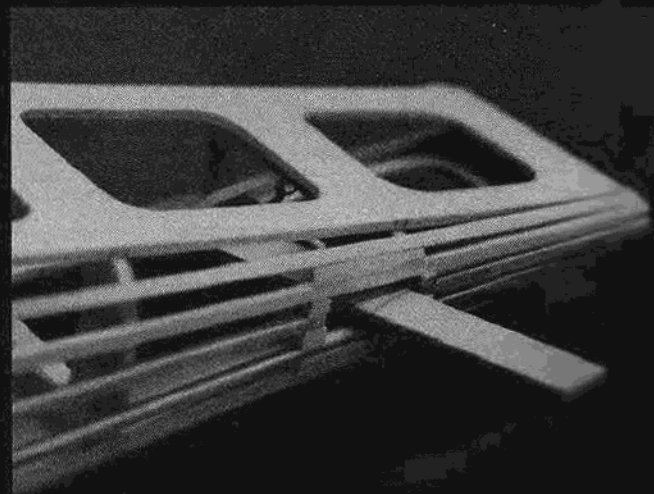
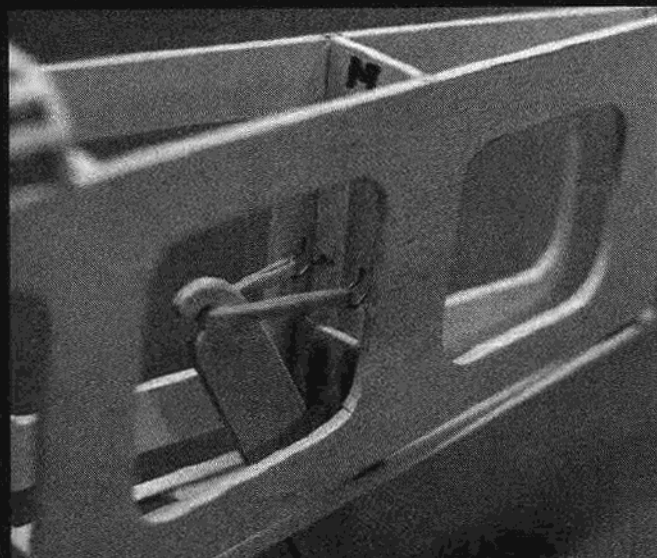
LEFT: Fin and rudder. Fin post goes inside fuselage sides at rear of fuselage. RIGHT: Stab and elevator, built-up balsa construction.



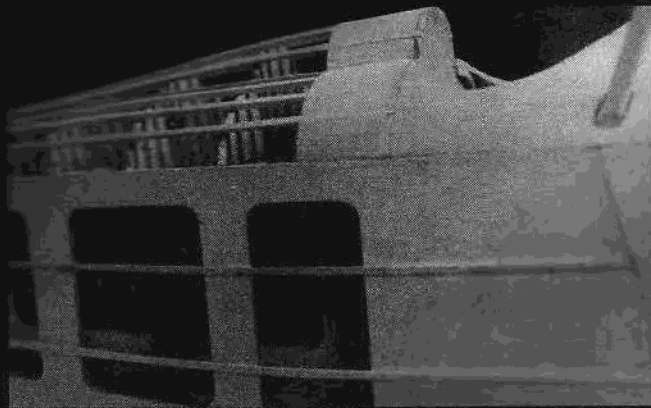
LEFT: Note cutouts for cooling in fire wall. RIGHT: Sheeting supports glued to front of Former F.



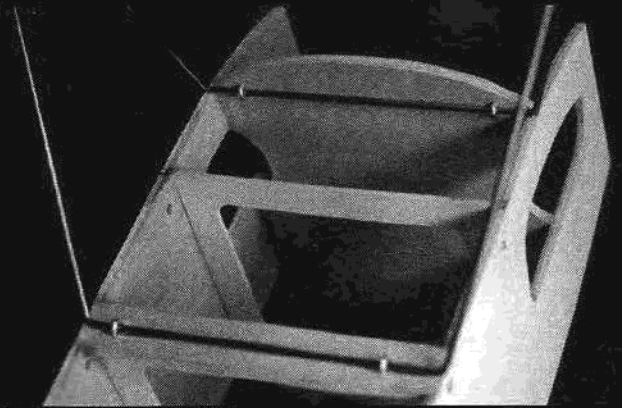
LEFT: Fill in-between stringers at Former F. RIGHT: Note that two stringers end at H1, and two end at J.



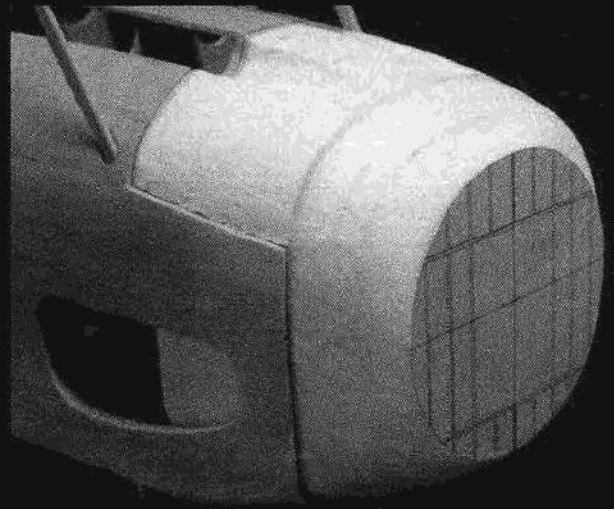
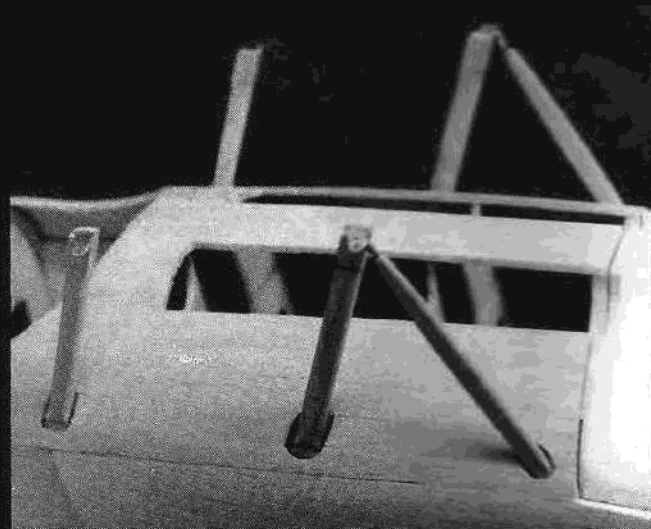
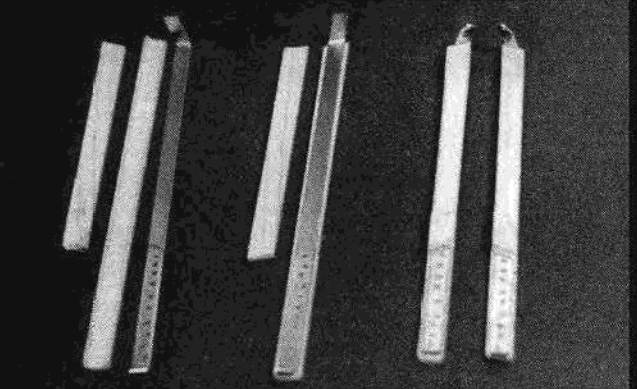
LEFT: Tail skid shock absorber. RIGHT: Balsa filler is used around tail skid opening for covering support.



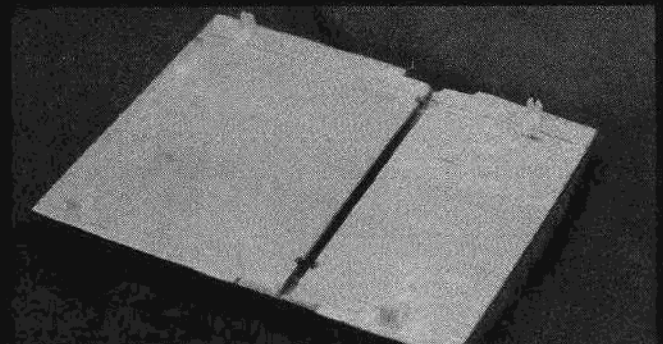
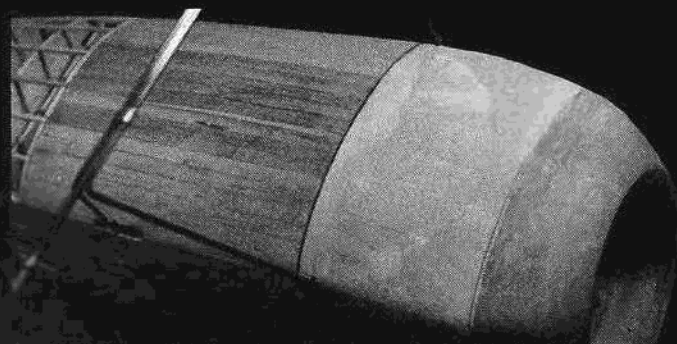
LEFT: Spruce stringers added to fuselage sides. RIGHT: Bolts mount landing gear to fuselage.



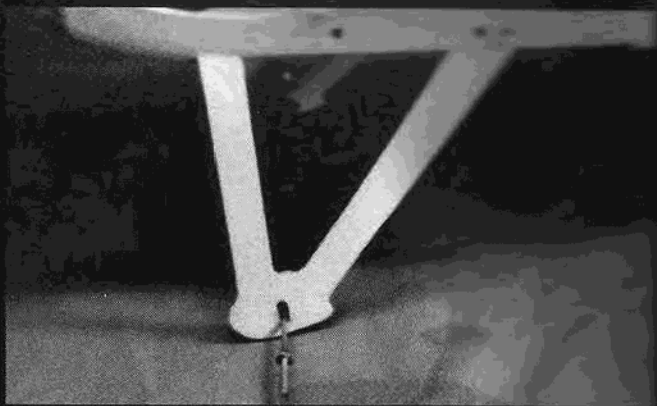
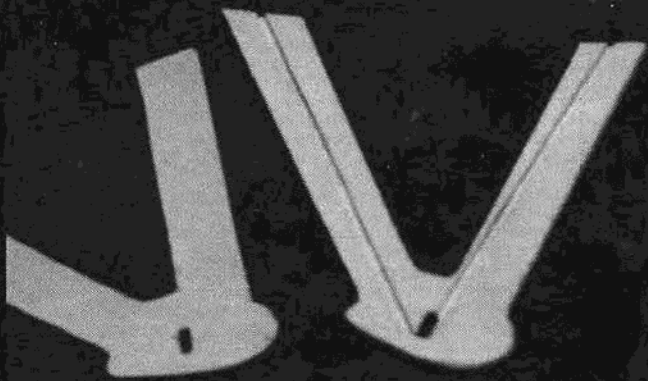
LEFT: Landing gear axle soldered at points shown give shock absorbing action. RIGHT: Spruce cabane struts epoxied to brass. Holes in lower part of brass make epoxy rivets.



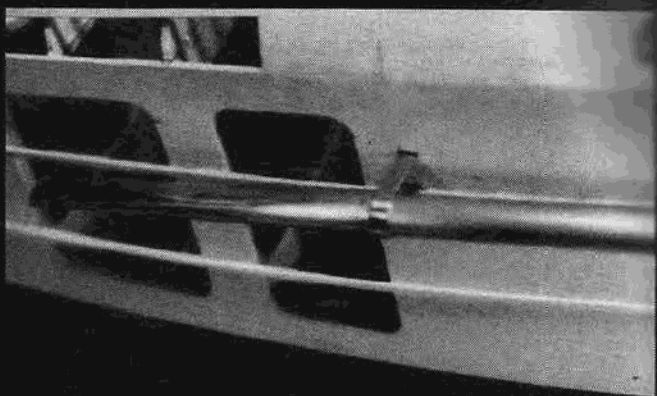
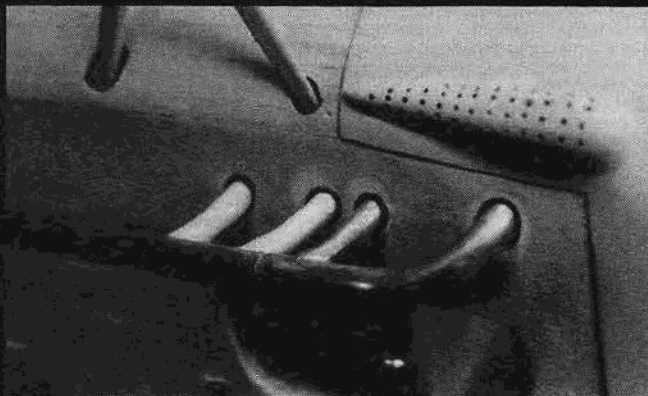
LEFT: Cabane struts mounted to fuselage. RIGHT: Styrofoam plug is slightly undersize to allow for thickness of fiberglass.



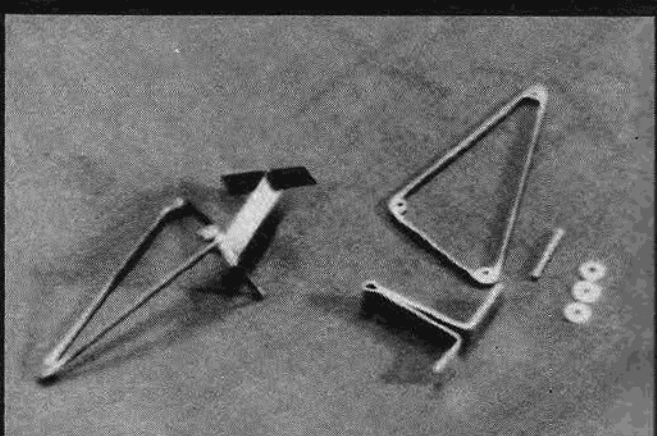
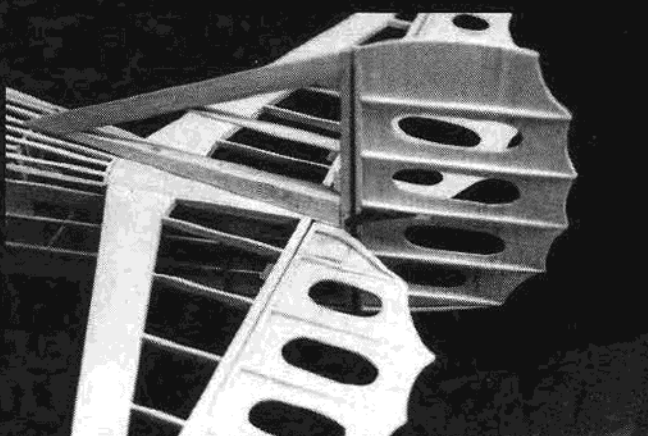
LEFT: Bottom of fuel tank compartment is planked with balsa strips. RIGHT: Fuel tank hatch mounted to fuselage with Goldberg angle hold-downs.



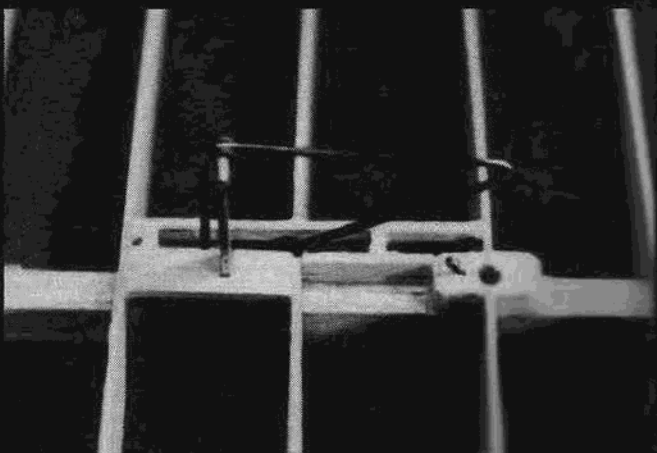
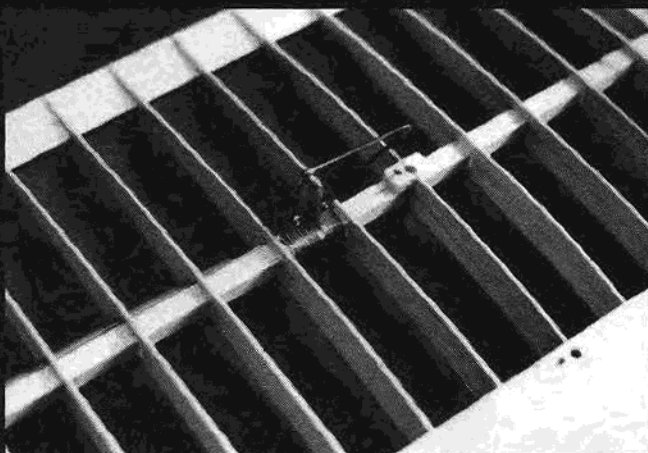
LEFT: Landing gear wire is sandwiched with 1/8" A.C. ply and two 1/16" pieces of A.C. ply. RIGHT: Plywood landing gear pieces to wire gear.



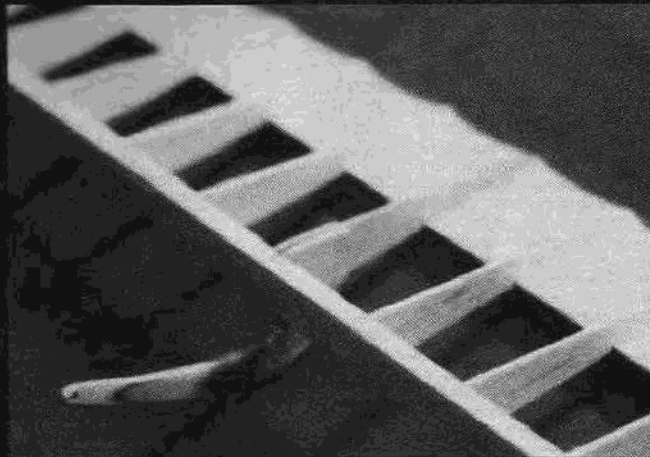
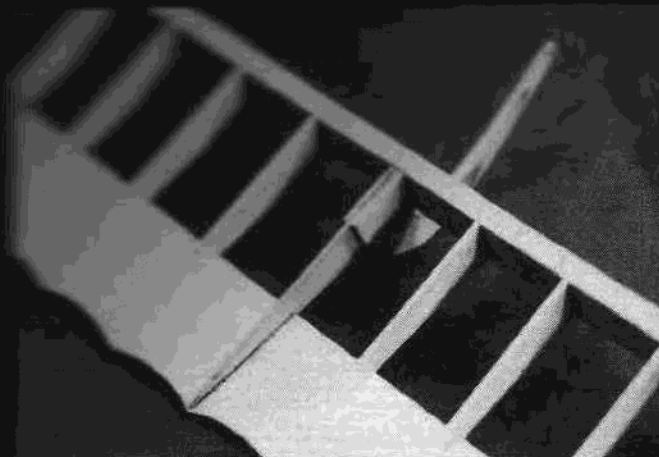
LEFT: Front of functioning exhaust system where it exits fuselage. RIGHT: Brass piece soldered to exhaust pipe mounts through fuselage side.



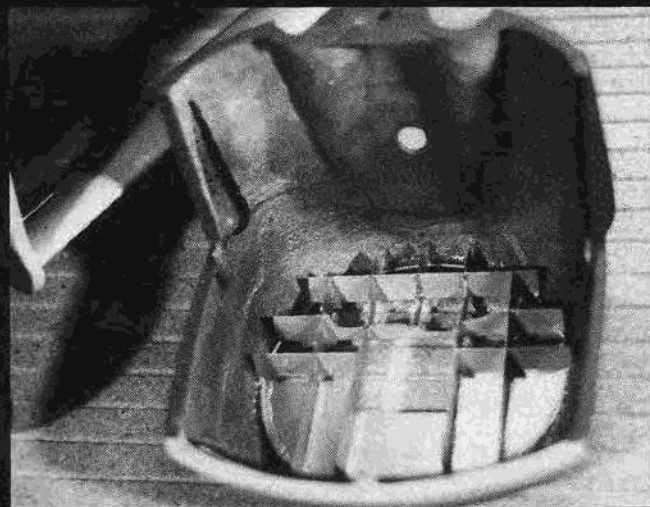
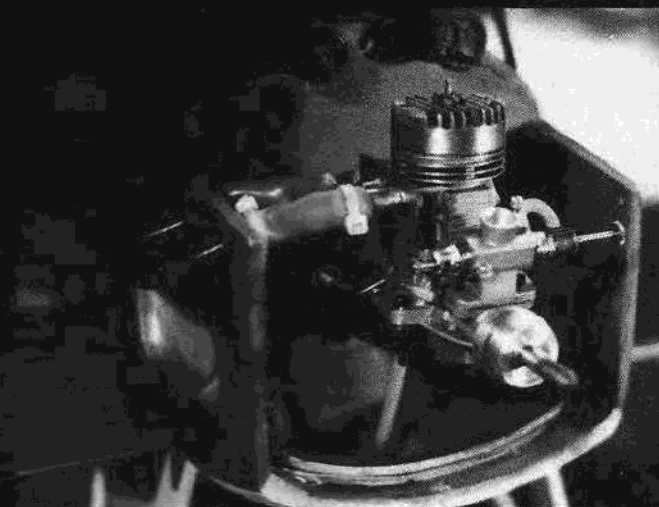
LEFT: Empennage mounted to fuselage. RIGHT: Aileron bellcrank fittings.



LEFT: Bellcrank mounted to spar. RIGHT: Note covering supports around bellcrank opening.



Aileron control horn mounted to 1/16" ply rib.



LEFT: Engine and exhaust fittings. Note part of lead weight required for balance. RIGHT: Fiberglass cowl. Note brass fins to deflect air up over engine.

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The landing gear is mounted to the fuselage with "J" bolts.

Solder the gear and axle as shown for shock absorbing action.

I made my tail skid scale, shock absorbing. With a little ingenuity a small

tail wheel could be mounted in the skid and made steerable.

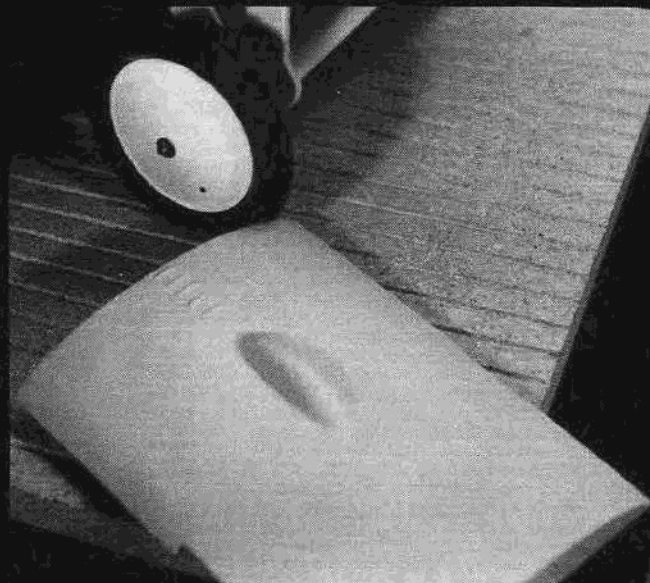
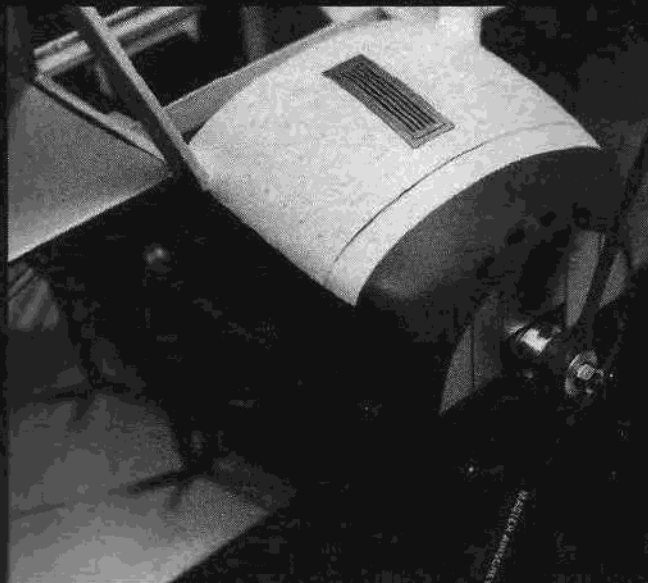
The lower fuel tank is held in place using four Goldberg angle hold-downs.

There is gobs of room in the fuselage to mount the radio gear and the fuel tank.

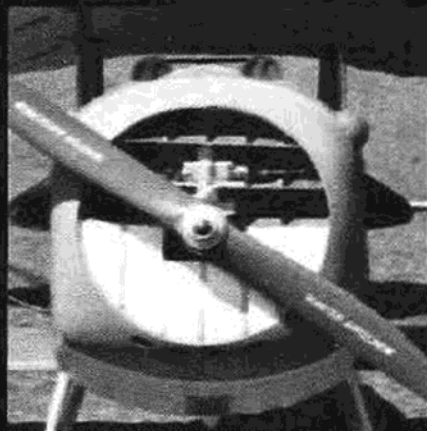
Decide what size fuel tank you are going

to use. I used a Du-Bro 12 oz. tank. I cut away the top of the fuselage formers so I could mount a flat tank platform. I held the tank to the platform with hooks and #64 rubber bands.

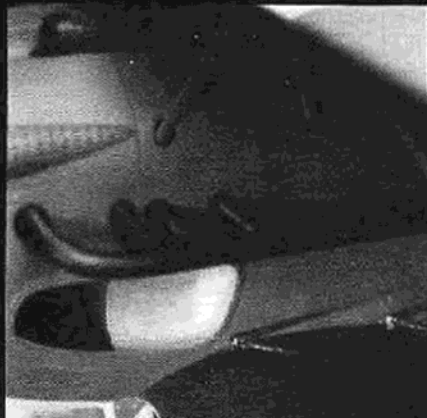
Cut away part of the bulkheads to mount the elevator and throttle servos. Be sure to



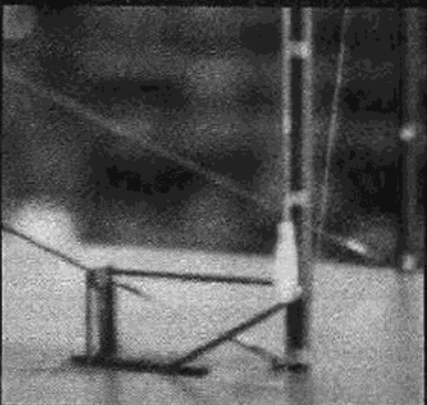
LEFT: Underside of nose. RIGHT: Removable fuel tank hatch provides easy access to radio and fuel tank.



Note upward tilt on cooling vanes.



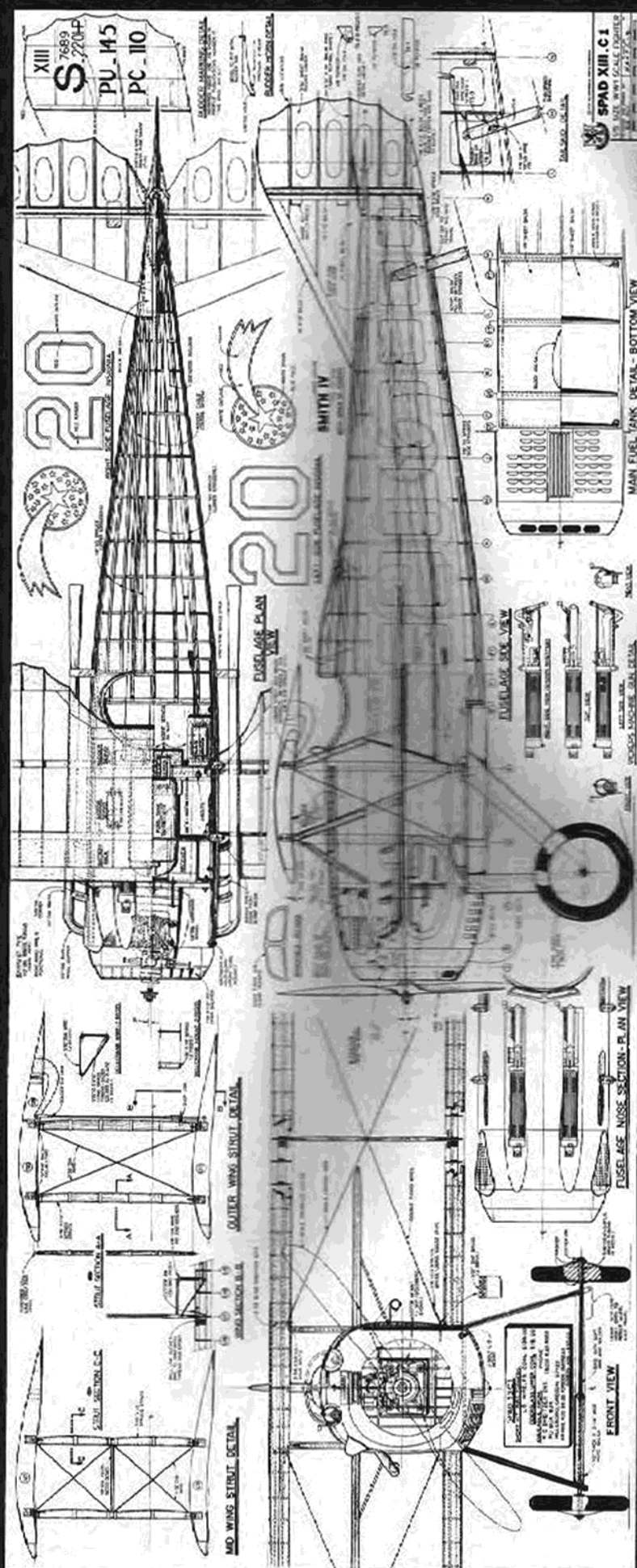
Soft balsa scoop to deflect cooling air out of cowl.



Aileron bellcrank and pushrod. Note: Landing wire goes through bellcrank mount.

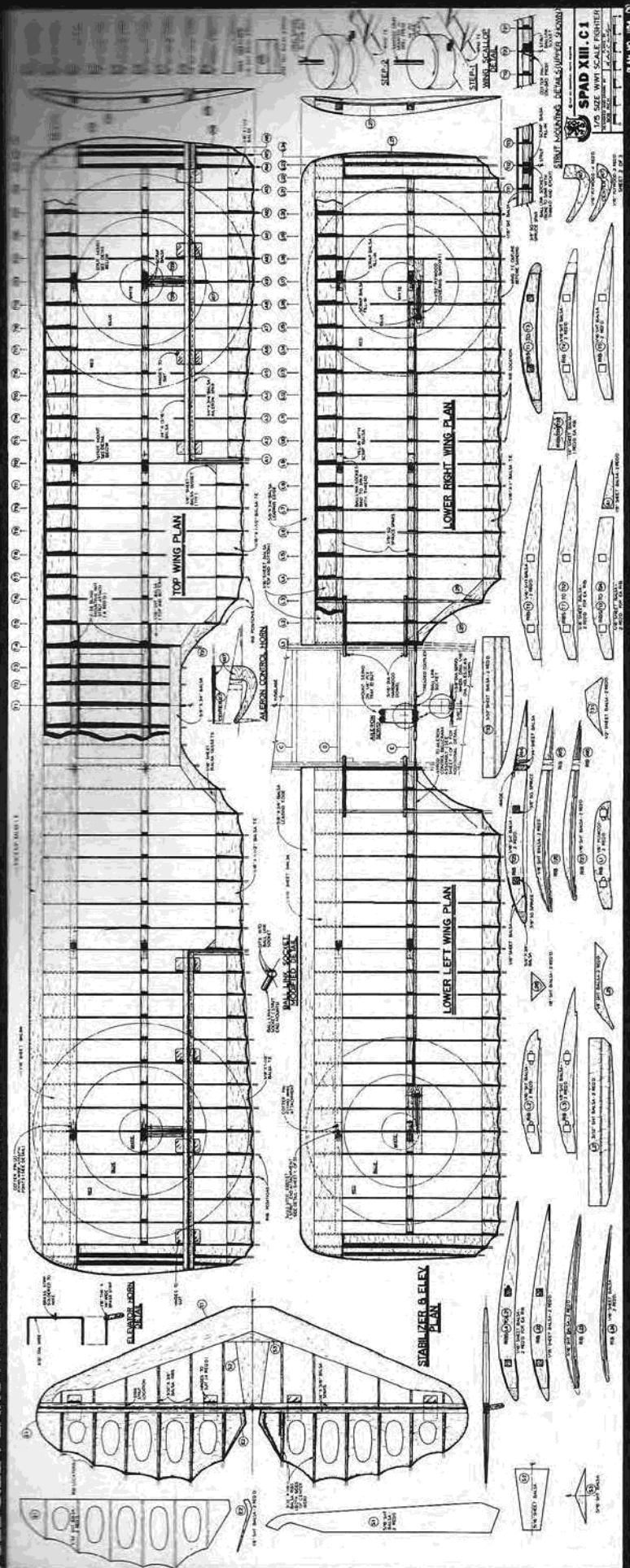


Aileron horn and pushrod.

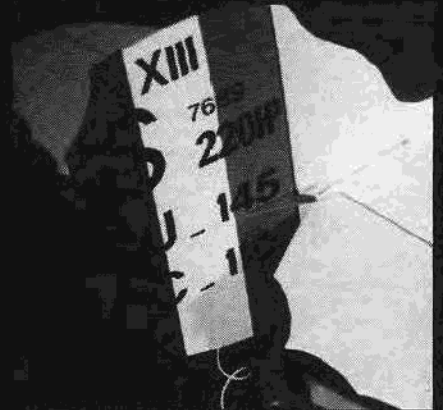


FULL SIZE PLANS AVAILABLE SEE PAGE 223

FULL SIZE PLANS AVAILABLE SEE PAGE 223



Machine guns mounted in gun trough.



Letraset transfers used for rudder markings.

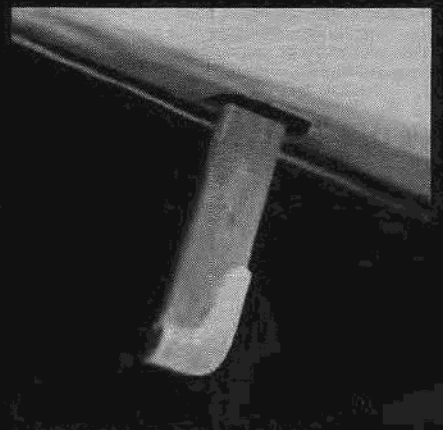
keep everything as far forward as possible, remember it has a short nose.

The exhaust system is a little work but it's worth the effort.

The right side exhaust pipe is functional and is made from copper and brass tubing. The front (first) bend out of the cowl is made from 1/2" o.d. thin wall copper tubing. It joins with 1/2" brass tubing for the long exhaust section.

I borrowed an electrician's conduit bender to make the bends in the copper pipes.

The second exhaust tube out of the cowling is 3/8" o.d. copper tubing. A hole is filed in the brass tubing for the joint so the exhaust gases are able to escape from the two front pipes. The exhaust pipes are



Brass sheathing on tail skid.

soldered to a piece of sheet brass that is mounted to the inside of the fuselage side. Be sure to leave enough pipe on the inside of the fuselage to attach the muffler fittings or silicone tubing from the engine exhaust.

The third and fourth pipes are dummies carved from balsa.

If you want the engine to be quieter you can make an expansion chamber out of a small can or sheet metal.

The exhaust system on the left side is a dummy carved from balsa.

Wings:

By now you should be pretty happy with the results so it's time to start on all of those ribs in the wings. Build both wings directly over the plans. The top wing is built as one piece. Do not install the special 1/16" ply rib in the aileron until the aileron is removed from the plan. Note that there is no dihedral, the wings are flat.

Do not add the leading edge sheeting at this time, there is work to do first.

The ailerons are hinged at the top of the ailerons so the relief angle is from the top to bottom, not a "V".

Fasten the brass tubing to the center of the lower wing spar as shown in the plans, wrap with thread and glue securely.

Prepare the ball link sockets by making the two cuts as shown in the drawings. These cuts allow the ball links to be held snugly, but easily snapped in and out.

Mount the ball link sockets on the wing spars so the hole in the socket is directly over the X marks on the plans.

The sockets are mounted on the bottom of the top wing and the top of the lower wing spar. Wrap with thread and glue securely.

Trial fit the top wing to the fuselage, make sure it is aligned correctly. Mark where the 2-56 wing mounting bolts go. After the holes are drilled, reinforce the area for the struts and the 2-56 blind nuts.

Build up around the ball link strut mounts with scrap balsa so there is a support for the covering. Be sure not to get glue in the ball link sockets.

When sheeting the wing leading edges, sheet the top of the lower wing first so the rigging fittings (cotter pins) can be installed through the sheeting and spar, bend and glue in place.

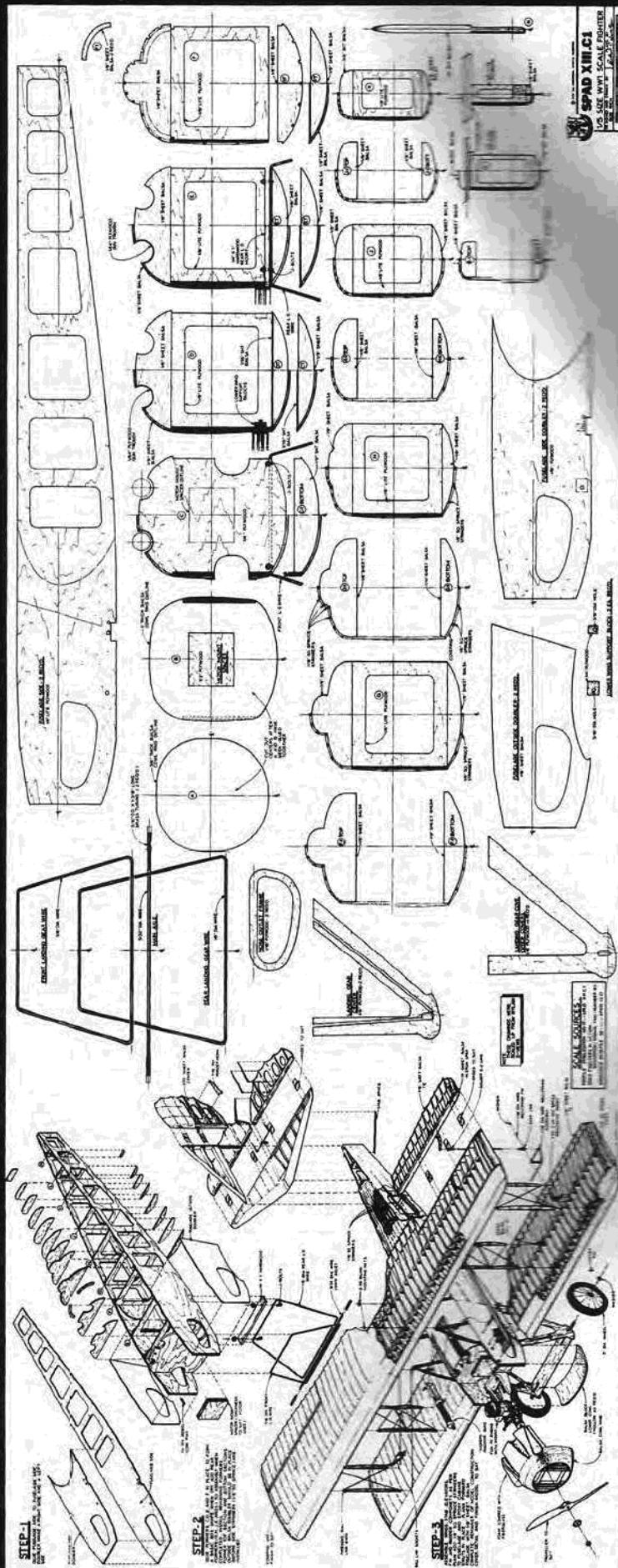
Sheet the bottom of the top wing first so the rigging fittings can be installed.

After all of the individual parts are constructed, glue the stab to the fuselage. Be sure to raise the front of the stab so the stab incidence is 0° in relation to the top of the fuselage sides.

Install the elevator servo and connect the pushrod to the elevator to check the elevator throw. I set the full throw 1" up and 1" down at the trailing edge of the elevator. The throw on low rate is 1/2" each way.

After installing the fin, check the operation of the pull-pull rudder control system. I used 12" pieces of small plastic tubing for the rudder cables to go through at the rear of the fuselage to eliminate any chance of the cables rubbing on the formers.

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FULL SIZE PLANS AVAILABLE SEE PAGE 223

Set in as much rudder throw as possible, it helps the steering out the ground.

The aileron drive system is scale, like the full size plane.

The bellcranks are made of 1/16" wire bent to a triangular shape. When the triangle matches the plan, solder 1/16" i.d. brass tubing in each corner. Use a good silver solder, we don't want a failure here. Make the bellcrank mount from a .032" x 1/4" brass as shown on the plan. Do not mount the bellcrank mounts until the wing has been sanded and ready for covering. Mount the bellcrank so the aileron drive is in line with the lower wing rear strut. Wrap the bellcrank mount and spar with thread and glue securely. Make the bellcrank slot from 3/32" balsa and sand to match the airfoil.

Covering the top of the lower wing will require a little care but it's not hard. Just make careful cuts over the fittings.

The flying surfaces should have

incidences as shown on the plans. The stab is 0°, lower wing at +1¼°, upper wing at +2°. If your incidences are close it's okay. If they aren't, correct them by enlarging and shimming the lower wing rear mounting hole and by using washers on the top wing cabane struts to get the correct incidence.

Trial fit the wing struts, remember no dihedral in either wing.

The drawings and the photos show the method I used for attaching the landing and flying wires.

The struts and the rigging hold the bottom wing securely in place.

The wire rigging is very functional so make sure it is done well.

I set the aileron throw 3/4" up and 3/4" down on high rate and 1/2" each way on the low rate.

Covering/Finishing:

Use your favorite cloth type covering, I'm partial to Goldberg Colortex.

After enough coats of nitrate dope to

thoroughly seal and fill the weave, it's ready for your color scheme. I used the Aerogloss flats.

The rondelles, large numbers, and the comet were made using Goldberg UltraCote Plus and it works great.

I have included the circle and comet drawing I used in case you want to use them. If you follow the colors I used, the bottom of the wings and stab are the color of unbleached muslin.

I changed the cooling shutters from the scale shutters to ones that would allow better engine cooling.

The upper horizontal shutters are angled up. By blocking the lower shutter area, most of the air is forced up over the engine cooling fins and out the lower side vents.

I made a ring to fit inside the front cowl opening from a coat hanger and soldered the sheet brass fins to it. The fins have to be filed away to allow for the engine carburetor. The ring was held in place with Pacers Zap-a-Dap-a-Goo.

Flying:

Before any flights are attempted, be certain the plane balances properly. The balance point is marked on the plans, 3½" back from the leading edge of the top wing.

Remember a nose heavy plane doesn't fly well, a tail heavy plane doesn't fly long. I think that great aeronautical engineer Leonardo de Vinci said that.

Whatever weight it requires for balancing, don't hesitate to add it to the nose. Mine took 22 ozs. of lead in the nose, but if you are more careful in building the tail area you shouldn't need that much. I used wood I had on hand instead of being wise in my selection.

There were usual butterflies before the first flight and during the take-off. But there was no reason for any jitters at all. A touch of down trim was all it needed and the controls were all on the high rates.

It takes off like most taildraggers but ground handling is poor on a smooth surface because of the skid. It can be steered with hard rudder and gunning the engine a little. With a little practice it's not hard, just a challenge.

Once the speed is up and the rudder is effective, it's just like any other taildragger. It's not a great acrobatic model but it does fly well and I will admit it looks great in the air.

I was a little worried about the landings. I was afraid it might land like its full size counterpart, very squirrely when slowed down for landing. But not to worry, it's very stable and floats to a gentle touchdown. Even a dead stick landing was no problem.

You don't have to be a super pilot to fly the SPAD. If you can handle a taildragger, you can fly this one. Just make sure the plane balances properly and the engine is reliable.

Building the SPAD was very enjoyable and it's great to fly. If you want one, now is the time to get started.

Good luck and don't forget to keep the wheels down on landing. □



Numbers and comet from Goldberg UltraCote Plus.



Camouflage pattern close to one shown in Profile Publications #17. Exhaust pipes painted with heat resistant black paint.