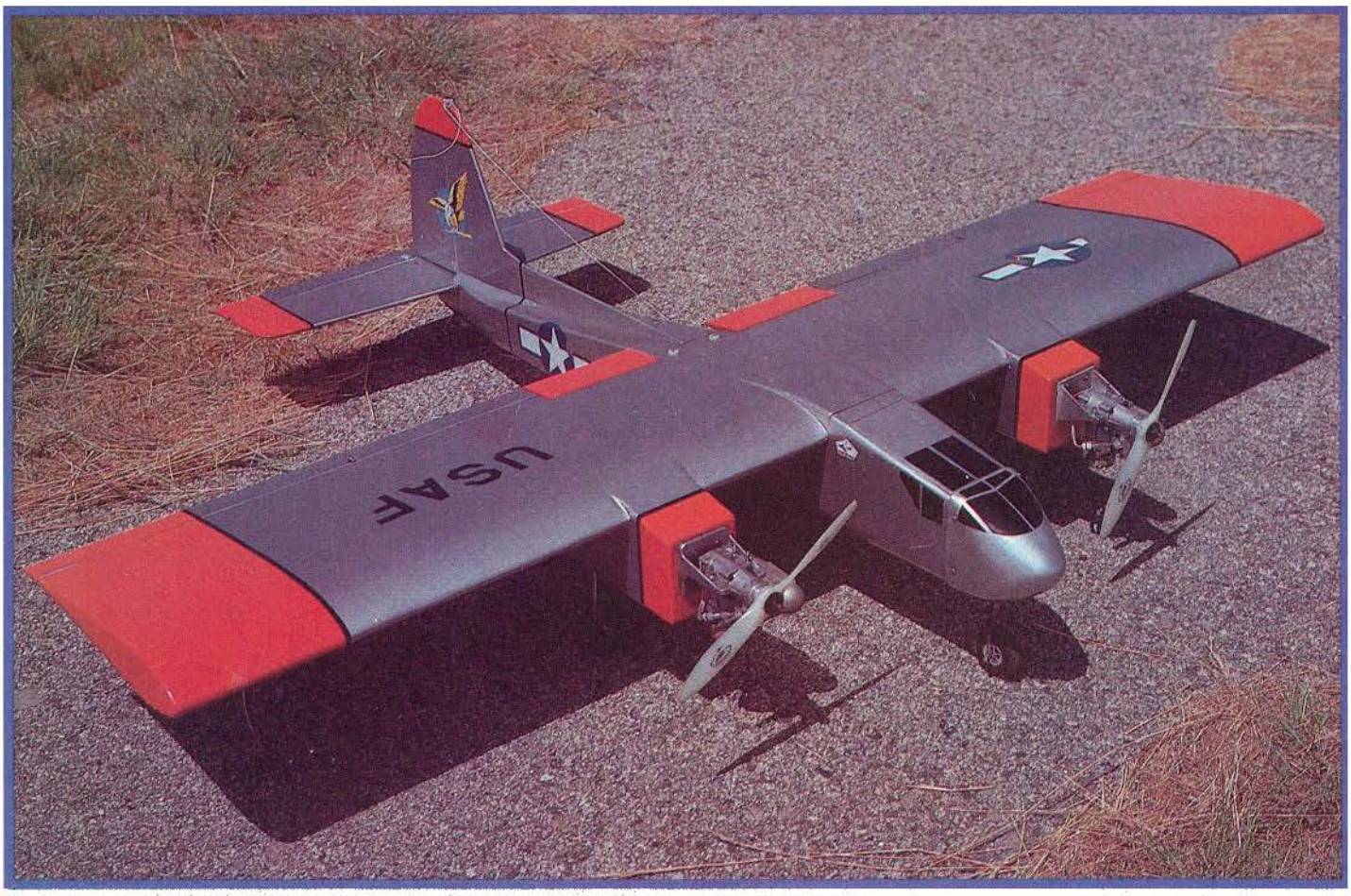
GEMINI



So you wanted to get into twin engine flying? Well, this is the way to start. This is definitely one of the heavenly twins. Try her and you'll never be single again.

By Mike Smith

It all started at the Scale World Champs at Le Bourget, France. "You're going to have to build a twin," said a little voice in my head.

"**What!**" said I, figuring that a simple aircraft was problem enough in scale competition.

"Yep," continued the voice, "and it must have flaps, nose gear undercarriage, and be aerobatic. And it must sport a pair of good healthy .45s if we're going to compete on the international scene."

Well, I half listened to the little voice, and decided to have some fun while I got used to flying a two engined (I'd hate to really call it a trainer, but really it is) Walter Mitty fighter bomber!

ABOUT THE AUTHOR

Mike Smith is forty two years old, married and the father of a son and daughter. He is, by profession, a Creative Director in the advertising industry. He now runs his own consulting firm, operating in both the advertising and children's television areas.

He resides in Johannesburg, South Africa, and started R/C flying in 1978, entering his first Scale Nationals in 1980, and eventually making the South African national team for the 1984 Scale World Championships in Paris.

As international scale competition is now flown to the FAI F4C regulations, it became apparent in Paris that only high bonus aircraft would have a sufficient edge, and a twin seemed a good way to go — hence the development of this trainer.

This is definitely one of the heavenly twins, and one that'll get ooh's and aah's from the fellows at the field. It looks good on the ground, and keeps your ego intact while you're back on a trainer. And, of course, in the air the sound of those two little powerhouses in full song during a low pass is enough to turn on your local Joe Cool himself!

Try her. And you'll never be single again!

CONSTRUCTION

I will assume that this isn't your first aircraft, although it's almost docile enough. I'm not going to dwell on all the little steps in construction, but enough of them to make things clear. If you've built a Falcon or a Stik

GEMINI

Designed By:
Mike Smith

TYPE AIRCRAFT
Sport Twin/Trainer

WINGSPAN
63 Inches

WING CHORD
13 Inches

TOTAL WING AREA
819 Sq. In.

WING LOCATION
High Wing

AIRFOIL
Symmetrical

WING PLANFORM
Constant Chord

DIHEDRAL (each tip)
None

OVERALL FUSELAGE LENGTH
46 Inches

RADIO COMPARTMENT SIZE
(L) 11" x (W) 3" x (H) 4"

STABILIZER SPAN
23 Inches

STABILIZER CHORD
6 Inches (Avg.)

STABILIZER AREA
138 Sq. In.

STAB AIRFOIL SECTION
Flat

STABILIZER LOCATION
Top of Fuselage

VERTICAL FIN HEIGHT
9 Inches

VERTICAL FIN WIDTH (incl. rud.)
9 Inches

REC. ENGINE SIZE
2 x .35-.45 Cu. In.

FUEL TANK SIZE
2 x 10 Oz.

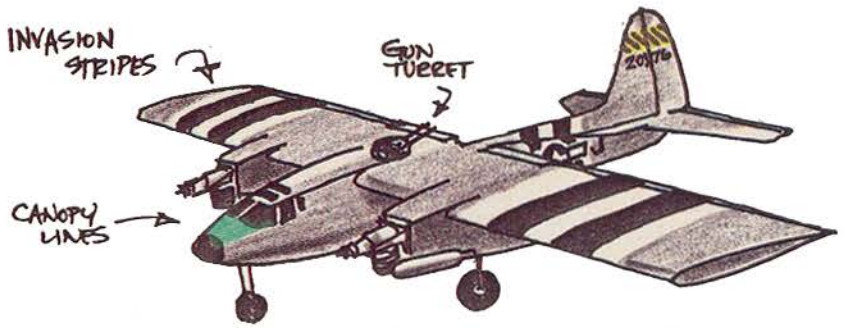
LANDING GEAR
Tricycle

REC. NO. OF CHANNELS
4-5

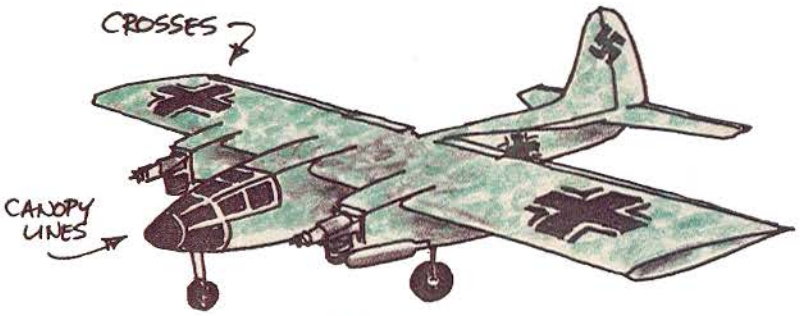
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.,
Optional Flaps

BASIC MATERIALS USED IN CONSTRUCTION

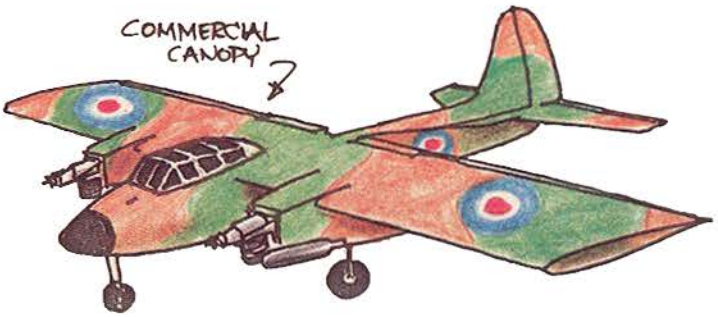
Fuselage ..... Balsa & Ply
Wing ..... Balsa or Foam & Balsa
Empennage ..... Balsa
Wt. Ready To Fly ... 140 Oz. (8 Lbs. 12 Oz.)
Wing Loading ..... 24.5 Oz./Sq. Ft.



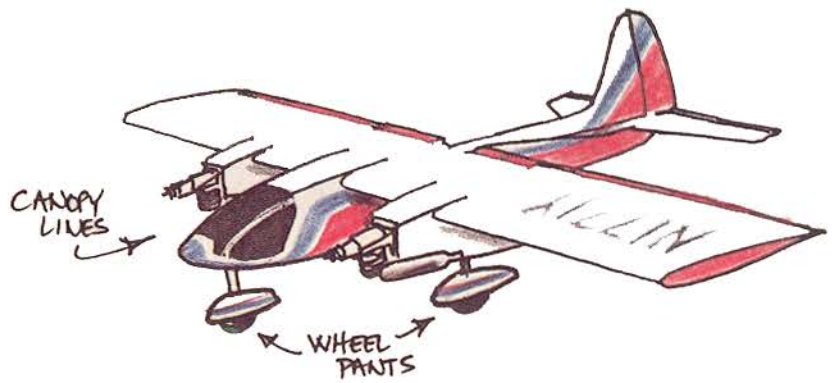
SORTA MARAUDER



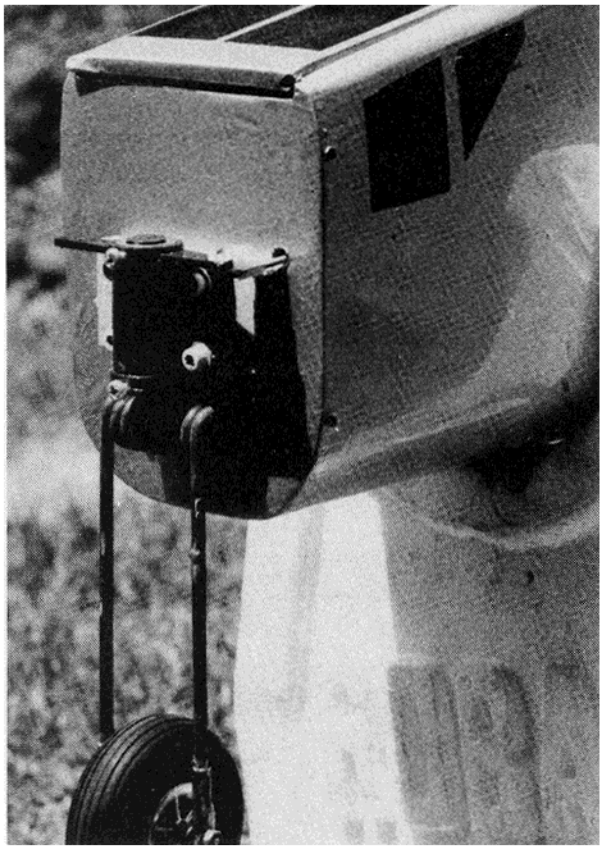
HALFA HEINKEL

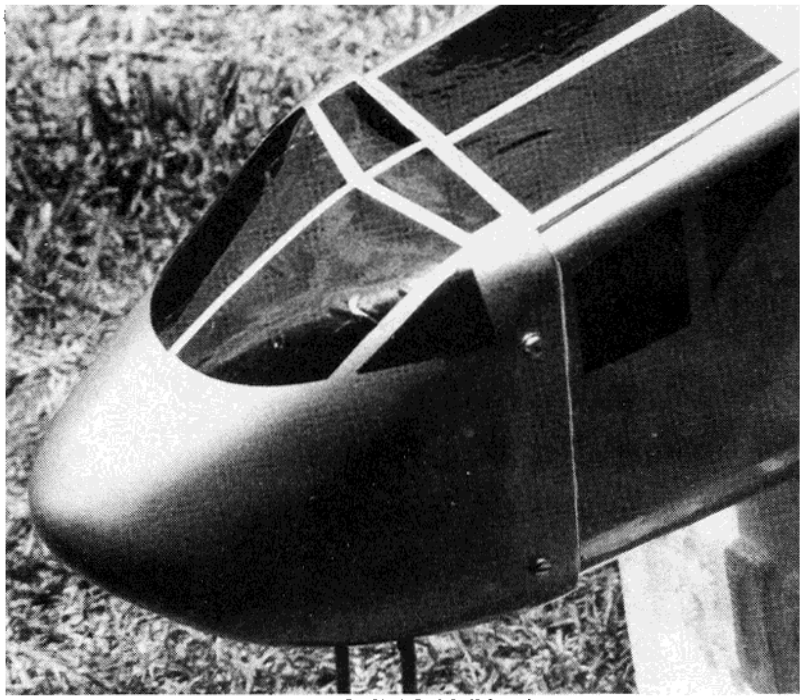


MAYBE-A-MOSQUITO



A PARTLY-NAVIA





LEFT: Nose gear installation. ABOVE: "Cabin" in place over nose gear.

you won't have any problems!

You do have a choice, though, between either a built-up or foam wing. Both are detailed on the plan.

Wing:

Start off by deciding on either a foam or built-up wing. It's up to you, as there's really no difference to the aircraft, performance-wise.

Foam Wing:

Cut a pair of templates from the plan, and two wing cores, each 31½" long. Trim the leading and trailing edges, and fit the balsa strips and the 1/2" hard balsa sheet at the center section TE in position. Cut two wing ribs out of 1/4" sheet balsa and fasten on as wingtips. Sand all of this to match the core profiles.

Rout out the runs for the torque rods and pushrods and epoxy in place, together with the ply bearing plates and aileron bellcranks. Be careful at this point, though, as you'll have to decide on your motor mounting details to give you the correct exit points for the throttle torque rods. See Figure 1.

You can now go ahead and sheet the cores with 1/16" balsa, using your favorite adhesive.

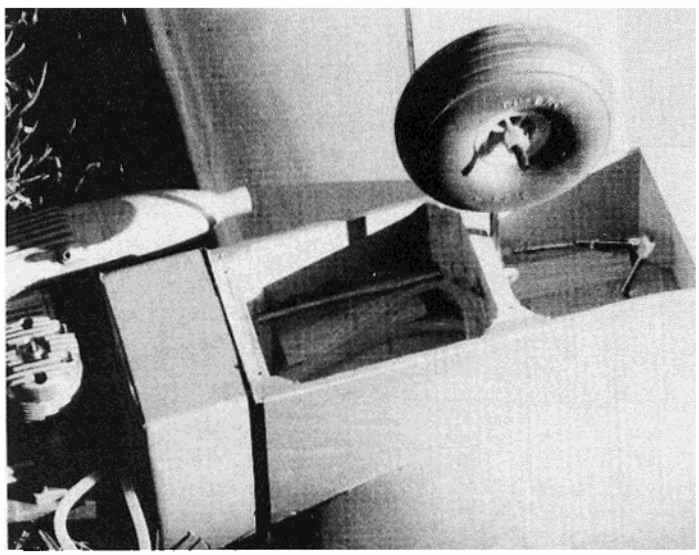
Sand everything, especially the joint at the LE and, when ready, epoxy the two wing halves together. **Note:** There is **no** dihedral in this wing — the joint is dead straight.

When cured, reinforce the center section joint with 6 oz. glass cloth and either epoxy or resin.

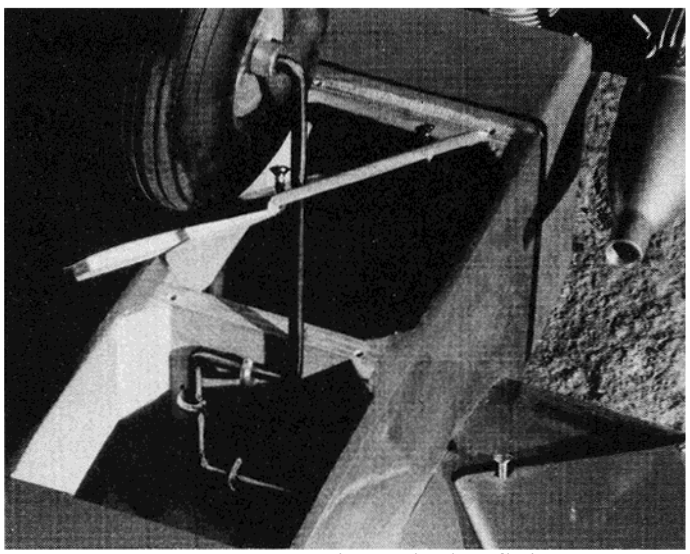
Drill 1/4" holes in the LE and epoxy the wing locating dowels in place as indicated. Don't drill the rear mounting holes yet — wait until you line everything up with the fuselage.

Built-Up Wing:

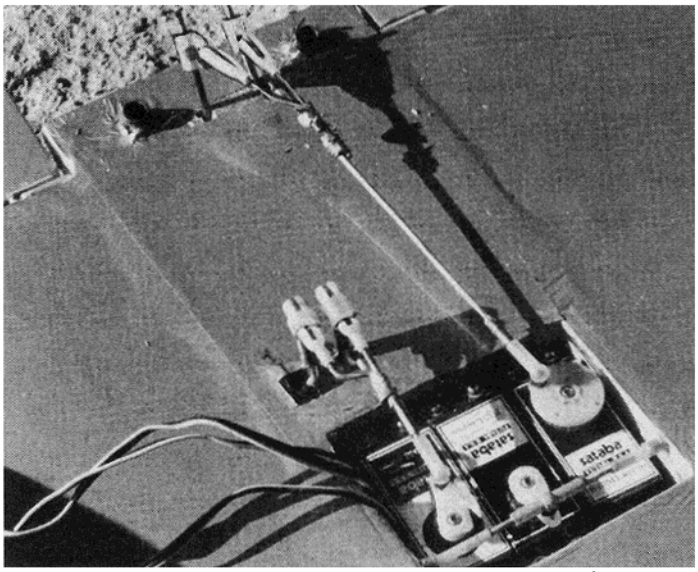
Start by cutting out all the W1 and



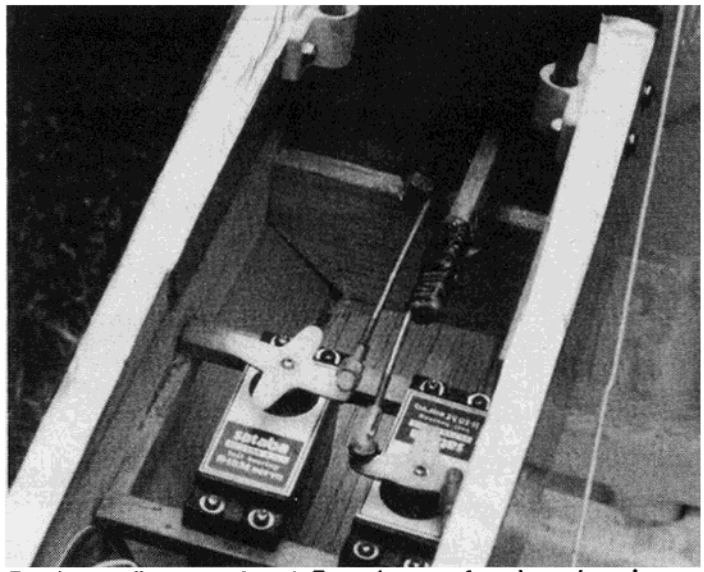
Throttle link-up in nacelle. Tank compartment in front. Motors mounted inverted to check for reliability before installing in scale competition twin.



Both nacelle hatches open showing u/c leg installation.



Aileron, throttle, and flap servo installation in wing. (Note split adjustment on throttles and flaps.)



Fuselage radio compartment. Enough space for a barn dance!

W2 wing ribs as specified. Sand them as a stack to ensure uniformity.

Drill all the holes necessary in the ribs for control runs at this point.

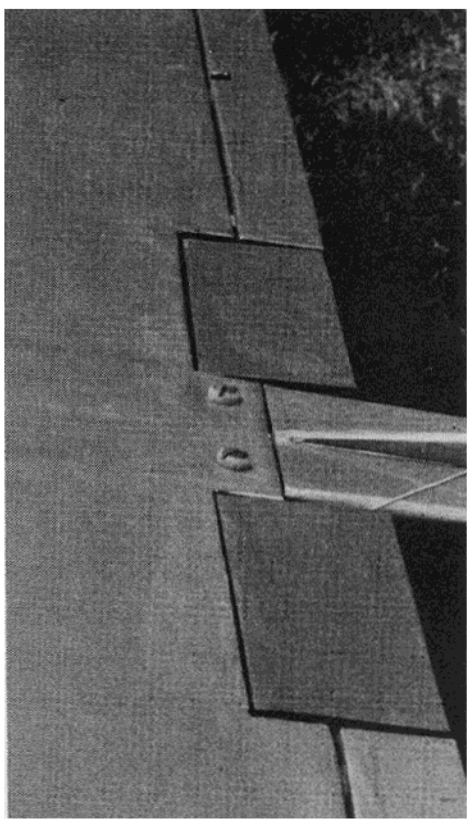
Pin down the lower 1/2" x 3/8" spar, and check the fit of the wing ribs. Block up the TE to 1/2" above your building board, check the fit of the LE into the ribs, and when you're satisfied that everything is absolutely square, glue all the joints with a drop of CA or thinned white glue from a brush.

Fit the 3/16" ply locating dowel reinforcement in place at the LE and cut and glue all the gussets in place as specified.

Using 1/16" sheet, fit and glue full depth spar webbing in place, ensuring the grain is vertical. The webbing goes out to the bay beyond the nacelle.

Fit all the control rods, and check the exit points of the throttle rods to be sure they will match the installation you've chosen for your engines! See Figure 1.

The flap torque rods are held in place by the nylon bearing and the 1/4" hard balsa TE at the center section. When all is in order, go ahead and sheet the wing with 1/16" sheet balsa. Sheet the top surface while the structure is still pinned to the board to avoid warps.



Ailerons, flaps, and wing bolts.

When both wings are sheeted and dry, join together with **no** dihedral, and reinforce the joint with 6 oz. glass cloth, epoxy, or resin.

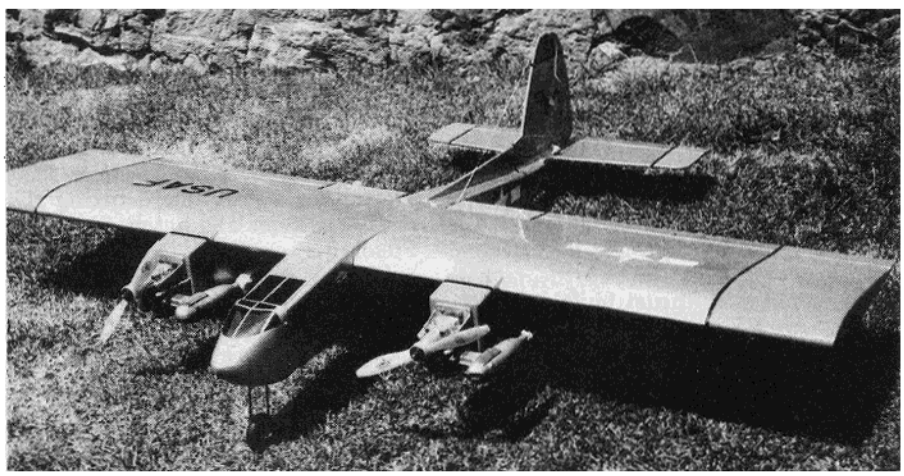
Drill for, and epoxy in, the 1/4" wing locating dowels. Don't drill the rear wing mounting bolt holes yet. These will be done while lining up the wing and fuselage.

Make up and hinge all control surfaces for either wing as shown on the plans.

Nacelles:

Cut four nacelle sides from a medium grade of 1/8" balsa sheet, together with a matching set of 1/16" ply doublers as shown on the plan. The doublers run from the front face of the firewall to just in front of former N4, as indicated on the plan. Laminate the sides and doublers together. Be careful though, you need to make two pairs of nacelle sides, two right hand, and two left!

Cut out two former N1's and two N3's from 1/4" ply and drill N3 for the L/G mounting "J" bolts as shown on the plans. Don't forget to do this, as there's no way you're going to get these holes in later! You can also decide at this stage which way your engines are going to mount, and drill for the mounts accordingly. Watch out for the relationship between tank and carb though, because there's no space



Ready for another sortie!

for vertical adjustment of the tank to get the heights right. You'll have to do it with the engine.

Cut a pair of N2's from 1/8" ply, and cut out the center to suit the tanks you'll be using. It will also help to drill for the throttle pushrod at this point.

Cut another pair (you'll be seeing double of everything at this point!) of N4's from 1/8" balsa and you're ready to start putting this lot together. See Figure 2.

Lay a right hand nacelle side down, and glue formers N1 through N4 in place, checking to ensure they go in square, and that N1 has the right amount of downthrust built in. Use epoxy on N1 and N3, and reinforce with triangular stock as shown. Complete by gluing the left hand side in place, again checking for square and reinforcing.

Note: Do not sheet the top and bottom yet as you'll need access!

Build the second nacelle in the same manner and, when dry, install the nacelles on the wing skin. But only do this after the linkages are fully installed in the wing. The nacelles are glued directly onto the wing skins, and the joint reinforced with more 1/4" triangular stock. A 1/2" triangular stock piece slips in-between the rear of N2 and the wing LE to lock the units together.

Note: The LH nacelle is fitted with 0° side thrust but the RH nacelle has 2° right thrust. Don't miss this — it's important!

Sheet the nacelle tops with 1/8" balsa, crossgrain, fairing into the wing surface, and make the double hatch covers for the bottoms. Cut the rear hatch cover to clear the L/G leg and now is the time to check that everything works before fitting the nacelle bottoms and hatches.

Fuselage:

Having done all the hard work already, you can now start taking it easy!

Cut out the formers from balsa and ply as specified, **remembering to cut out the former centers for your pushrods,** and the two fuselage sides. Glue the two 1/16" wing saddle doublers in place. Make up the fuselage bottom out of 1/4" balsa sheet (it's crossgrain), trim to taper and draw on the centerline. Pin in position on your building board, then pin and glue the formers in position over the plan, checking for square. Glue on the fuselage sides, starting from F1. See Figure 3.

Reinforce former to sheeting joints with triangular stock where indicated.

Construction is a little more difficult than an average Ugly Stik, but the rounded fuselage bottom is worth the effort. You could, though, cut the formers square and have a flat bottom. Add the fuselage top next, crossgrain. Remove from the building board and, using a long sanding block, sand the edges of the sides and bottom sheets to allow for the angled corner sheets. The front hatch builds as shown, although you might not need it. I put it in originally for the radio, being worried about the fact that twins normally need weight up front to get the C.G. in the right place. I was so conscious of this, that I built the tail end incredibly light, so light, in fact, that even after mounting the radio at the rear of the compartment under the wing, I still had to add 3.5 ozs. of lead to the tail!

Sand everything, and fit the tail feathers, again checking for square, and then drill for the wing dowels in F2. Mount the wing bolt threaded blocks in place and, after checking alignment and incidences, drill the rear mounting holes in the wing. Fasten in place, and fit the balsa fairing block to the wing top. Sand to shape.

While the wing with the main gear and wheels fitted is in position, you can now fit the nosegear, as the ground angle gets adjusted this way.

Make a nose "cabin area" either from solid balsa block carved to shape or, as I did, from glass cloth and resin over polyurethane foam.

Installation:

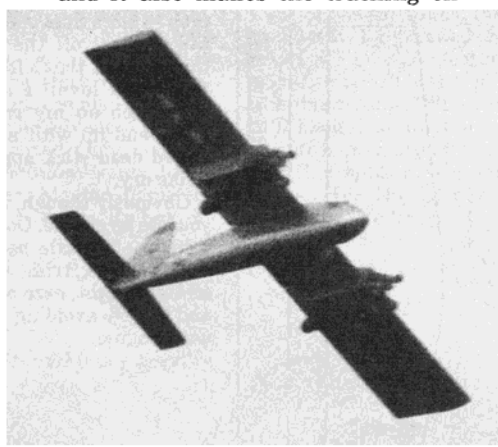
With most of the control runs already in place in the wing, installation is simple. Position the elevator and rudder servos, together with receiver and battery, in the best position in the fuselage to suit the C.G.

Finishing:

Use whatever you prefer, but keep it light! I used MonoKote and MonoKote trim sheets for a semi, semi-scale effect. Have fun though --- with different finishes you can produce anything from a WW II Mosquito to a Rockwell AeroCommander!

Set Up:

The controls are reasonably sensitive, especially with the more powerful engines, so don't overdo the throws. The prototype flew with 1/2" each way on elevator, 3/8" each way on ailerons, and 2" each way on rudder (you'll need this if you lose an engine, and it also makes the tracking on take-off simple). 3/4" down flap is more than enough. The flaps are very effective and really help slow down what can be a pretty hot approach. Don't, however, drop them too soon, because if you're not quick enough on the down trim and your airspeed's too high, you'll suddenly find yourself at 1000'!



Flying:

Know your engines! There's nothing to flying a twin if your engines keep turning. It's the same as flying any single, and this plane is very forgiving and easy to handle. It doesn't seem to have any vices.

Set up the engines to give you the same top end rpm, and then come back and check the middle and bottom ends. They don't have to be exactly the same, even 100 rpm difference at the top end doesn't seem to make a lot of difference in flight. They must accelerate reasonably equal though, or you'll be stirring away on the rudder like a maniac on the take-off run!

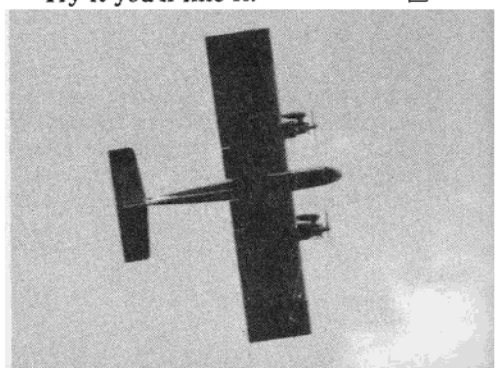
What's the handling like on one engine? **Fantastic!** Gemini is so stable that I've managed minor aerobatics on a single engine . . . and it doesn't seem to really matter which one! I put it down to the offset thrust lines, so make sure you have them built in.

Even turns into the "dreaded" dead engine are no sweat at slightly reduced throttle. You'll get a positive rate of climb on half throttle on a single .45, so relax! The two O.S. .45 FSR's I have in the plane are so reliable that I've rarely had an engine die on me.

I set the engines a fraction on the rich side of them peaking, and this is in the region of 11,000 rpm on a 10 x 6 prop — more than enough power to fly the aircraft off the runway at 3/4 throttle, and that's from a field 6000' above sea level! I also fly with a stopwatch on my transmitter so I never end up with a difficult, badly placed dead stick approach with the tanks dry.

Obviously though, be careful when you lose an engine. Do all the standard things — throttle back, identify the dead engine, trim with rudder for straight flight, ease open the throttle and land — avoiding turning into the dead engine.

Try it you'll like it! □



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