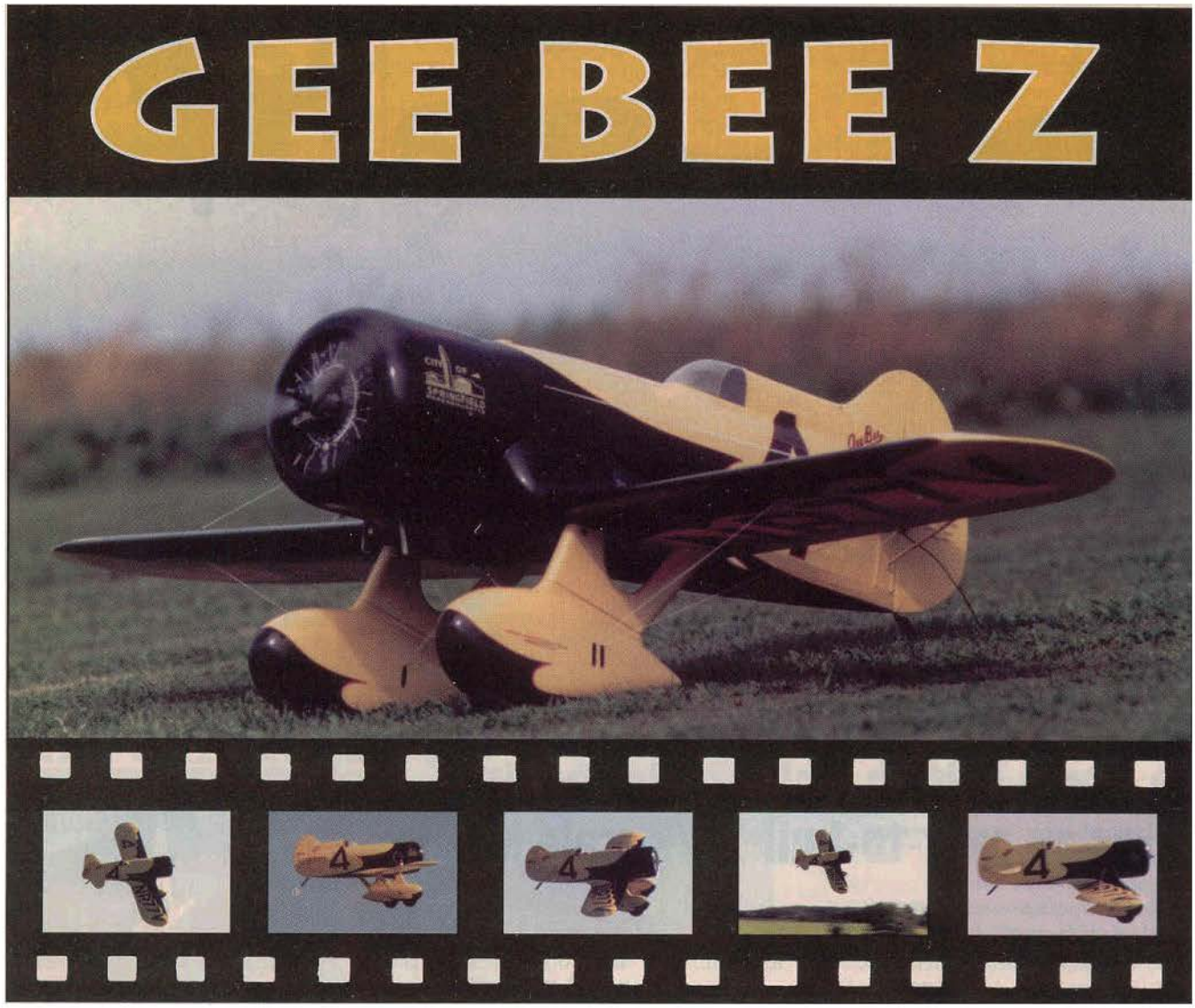
GEE BEE Z



SPORT SCALE FOR .40 POWER

By Adrian Page

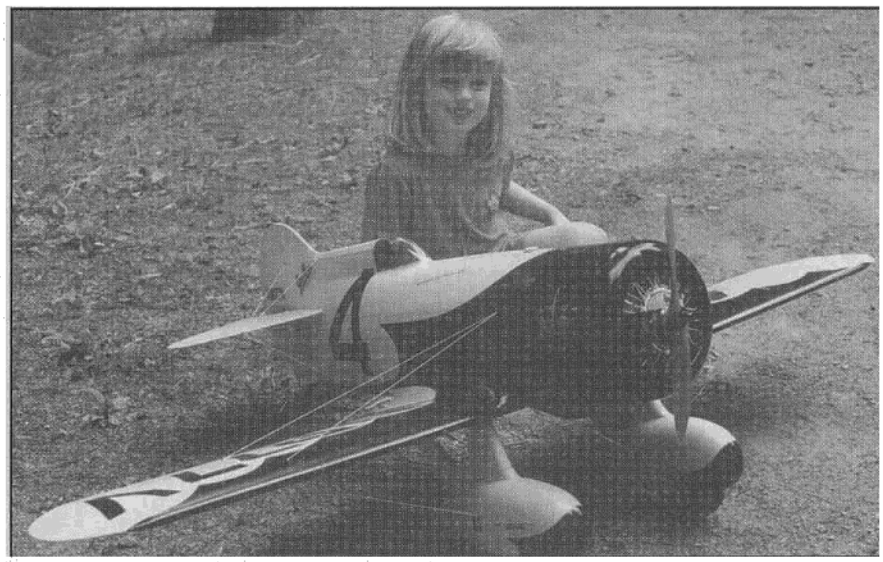
Introduction

With the number of full-scale Gee Bee replicas built in the last 4 or 5 years, it has become apparent they were excellent flying aircraft. They were just a little ahead of their time. I know ... the all-out racing machines were supposedly very dangerous and tricky to fly. Well duh... When you put 750 hp in a 23-foot span airplane with a fuselage the size of a DC 3 engine nacelle, you aren't going for safety, you're going for world record speed! Enter the subject of this article, the Gee Bee Z. It won every race it entered and set the world land plane speed record for '31. It was an absolutely stunning example of Art Deco styling.

Gee Bee Z makes an excellent subject for a model. I had so much fun with a .20 size Gee Bee R2 I designed recently, I thought a larger size would be nice. Since I already had an R2, I thought I would like to try the model Z. Most models of the Gee Bee racers seemed to be big and expensive (and heavy), and I wanted a .46 size that was cheap, simple to build, and would fit in my car in one piece. Once again, there was nothing on the market that came close to what I had in mind, so I had to do it myself. I think you will agree, the resulting design is a great success!

CONSTRUCTION

The Gee Bee Z is a simple stick and former design with a constant chord D tube wing. If you have never built a model from sticks and formers before, I think you will be pleasantly surprised at how easy and lightweight it is. I like to start construction with the wing, as you will need it to space



Lauren, age 4 (daughter) giving a sense of scale.

certain formers, etc. The plastic cowl, canopy, and wheel pants are available direct from me (see end of article).

Wing:

Cover the plan with wax paper, then pin a 1/4" sq. balsa shim over the spar location. Pin down the T.E. sheet and the 1/4" sq. T.E. Put a strip of wax paper over the shim, then pin the spar over the shim (use the ribs to align it). Leaving the center rib loose, glue the rest of the ribs to the T.E. and spar. Install the top spar and the 1/4" sq. L.E. Glue the wing bolt blocks and rear landing gear plate in place (with "T" nuts installed). Sand the T.E. to match the airfoil and install the top T.E. sheet. Remove the wing and the shim from the board. To set the center rib at the correct angle, block up the tip rib 7/8" and use a small square to set the center rib 90° to the building board. Flip the wing over and install the bottom sheeting. It was at this point that I clamped the wing to my 4' level and installed the 3/32" shear webs. Now install the front landing gear plate, 3/4" tri stock bracing, and the L.G. block. Build the other wing half and join the two. Use a 1-3/4" block under one tip to set the dihedrals. Cut away part of the center rib for the front dihedral brace and glue it in place, then install the rear brace. Glue the front wheel pant mounts and the 1/4" scrap for the wing dowel hole in place. Pin a 3/8" sq. x 36" long shim to the board so you can pin the wing down with the pant mounts hanging over the edge. Place a 1/4" shim under the tip of the T.E. and shim the T.E. as necessary to keep it straight. Once the top L.E. sheet is installed, the wing will retain this twist known as wash-out (this is why it won't tip stall). Sheet the bottom center section and build the servo box. Now, sheet the top center section and add all the capstrips. Glue the wingtips down the centers of the tip ribs, then add the bracing and filler blocks. Sand the L.E. to shape. Put a strip of 2" fiberglass wing tape around the center section with thin CA.

Fuselage:

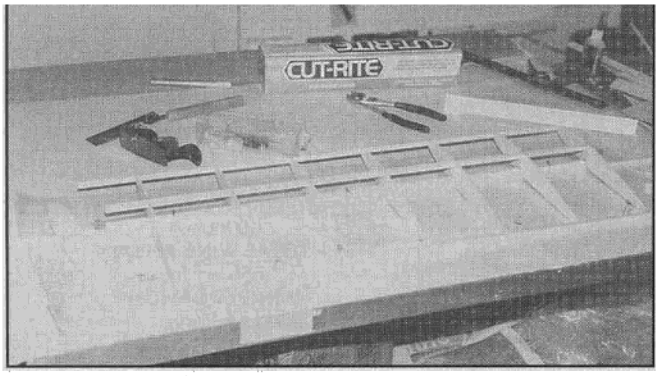
The fuselage is made of spruce longerons with balsa uprights and formers. If you own a table saw, you can cut a lot of the uprights in one go, just remember to cut four out of spruce for the firewall area. Diagonal braces are not shown in the photos, but are on the plan, do be sure to use them. Build two side frames over the plan side view, then join them over the top view (pin down securely). Cut out the formers and mark the stringer locations on them with a soft pencil. Add all the top and side formers, noting that F1 is lite ply. Also, be sure to add the "T" nuts in F1 now. Add the rudder post and R1. With the fuselage still pinned down, add the 1/8" x 1/4" stringers at the positions where the top sheeting ends. The stringers are installed by pinning them in place one at a time, then making a cut on both sides into the former to make a notch. (Some stringers will fall on longerons, just glue them on flush and plane off the excess.) Plank the top of the fuselage with 1/8" x 3/8" strips — use sheet for the nose. The rest of the stringers are notched into this sheeting. Add the 1/8" x 1/2" strips and the stringers between the rudder post and F5B. Taper the rudder post to match the drawing. I built a Styrofoam cradle to hold the model while I worked on the bottom side. It has come in handy for covering and painting, as well as transporting the model to the field. Install the lower formers and the wing saddle along with their associated stringers (use the wing to locate F4). With the wing in place, run a drill bit through the holes in F1 and F2 and into the wing. Glue the wing dowel into place. After you have installed the wing bolt blocks,

GEE BEE Z

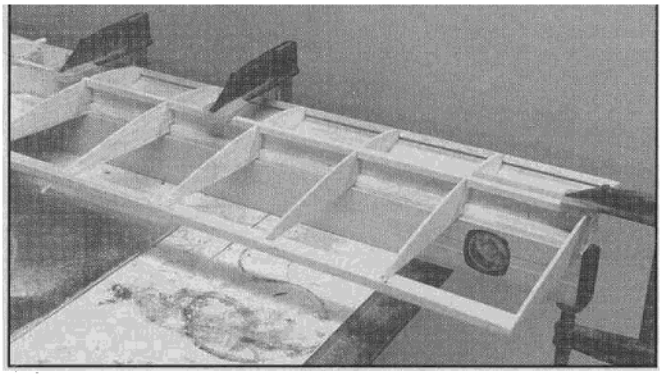
Designed by:
Adrian Page
TYPE AIRCRAFT
Sport Scale
WINGSPAN
56-3/4 Inches
WING CHORD
10 Inches
TOTAL WING AREA
550 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Semi-Symetrical
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
7/8 Inches
OVERALL FUSELAGE LENGTH
34 Inches
RADIO COMPARTMENT SIZE
10" (L) 4" (W) 4" (H)
STABILIZER SPAN
18-1/2 Inches
STABILIZER CHORD (inc. elev.)
5 Inches (Avg.)
STABILIZER AREA
92 Sq. In. (Approx.)
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
2-1/2 Inches
VERTICAL FIN WIDTH (inc. rud.)
4 Inches (Approx.)
REC. ENGINE SIZE
.46 2-Stroke, .56 4-Stroke
FUEL TANK SIZE
10 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.
C.G. (from L.E.)
2-1/2 Inches
ELEVATOR THROWS
7/8" Up — 7/8" Down
AILERON THROWS
3/8" Up — 3/8" Down
RUDDER THROWS
1" Left — 1" Right
SIDETHRUST
3° Rt
DOWNTHRUST/UPTHRUST
0°

BASIC MATERIALS USED IN CONSTRUCTION

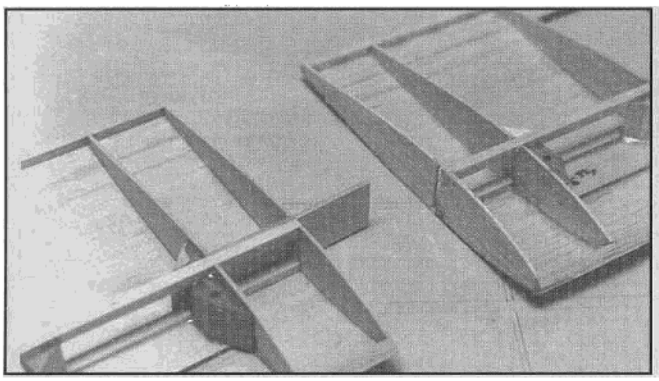
Fuselage	Balsa, Ply & Spruce
Wing	Balsa, Ply & Spruce
Empennage	Balsa
Wt. Ready To Fly	93 Oz. (5 Lbs. 13 Oz.)
Wing Loading	24.3 Oz./Sq. Ft.



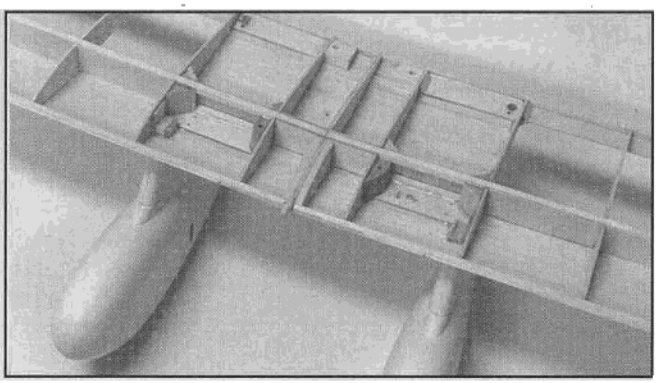
Wing ribs, L.E., T.E., and spars glued in place over plans. Note 1/4" sq. shim under spar.



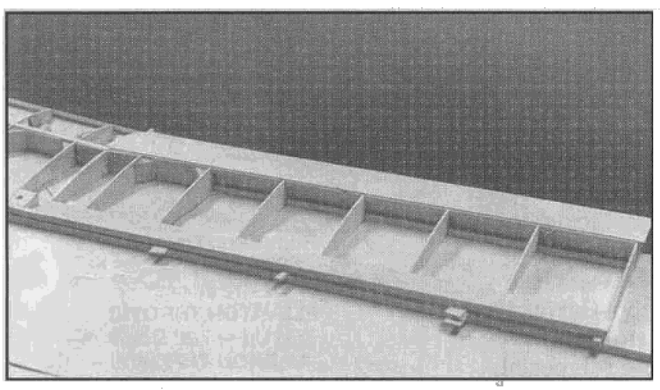
Shear webs are glued to spars while wing is clamped to author's level. This helps ensure straight wings.



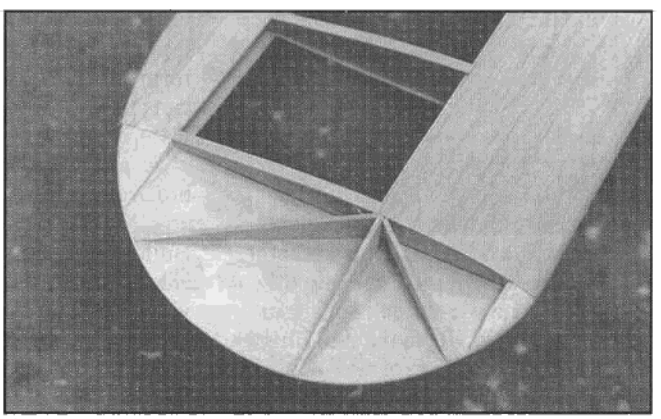
Join the wing halves with plywood dihedral brace. Author uses CA cement for all construction.



Ready for top sheeting. Note landing gear mounting blocks and wing bolt mount blocks in center section.



Prior to gluing top sheeting in place, wing is shimmed at T.E. to provide the required wash-out (see text).



Wingtip detail showing webs and filler blocks — very strong.

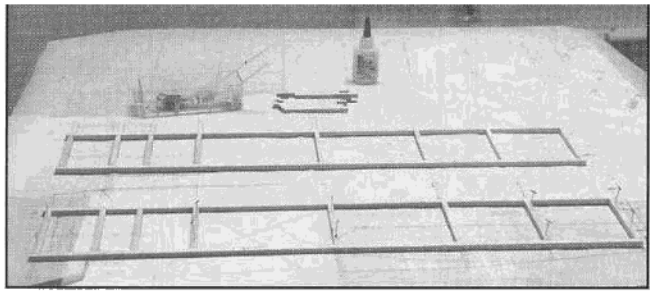
add the belly formers and sheet in with 1/16" balsa. Turn the plane over and build the wing fillets. I covered the fillets with 1/2 oz. fiberglass cloth and resin. The rudder and stab are sheet, with sticks glued on to simulate the fabric-coated surfaces on the original; round the front edges and taper the rear. The ply piece for the strut mount is glued to the stringers, as is the piece that goes around the stab. The little strips on the strut mount are glued on after covering (this is for a cloth-covered model, with plastic covering, you would have to add it later).

Landing Gear:

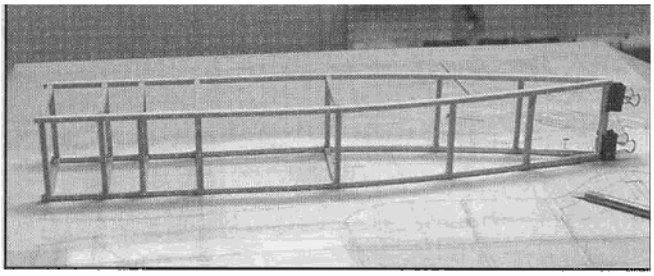
This was the most challenging design problem to overcome on the entire model. The landing gear extends 9" from the bottom of the wing. This is very tall for a 34" long plane. Also, the open part of the strut fairing won't allow a simple, straight rear brace to be installed, and I didn't want a pair of 9" levers ripping the bottom out of the wing all the time, and I felt some shock-absorbing device was necessary. The little loop in the rear leg brace solves both problems. On the plus side, the 4" wheels are scale, and ground tests in my backyard revealed that you can taxi over a garden hose with 4" wheels. Bend up all the required wire parts and clean them thoroughly where they will be soldered. Put a piece of aluminum foil over the bottom of the wing (to protect it from solder splashes) and use the wing as a jig to align the gear parts. Bind and solder and install the two washers. Trim the plastic parts from the sheets and sand the mating surfaces flat. Glue together with CA and reinforce the joint with 1" glass tape using thin CA as resin. The bolt-together joints are required to allow assembly over the wheels and gear legs. I used Dave Brown Lite Wheels.

Cowl:

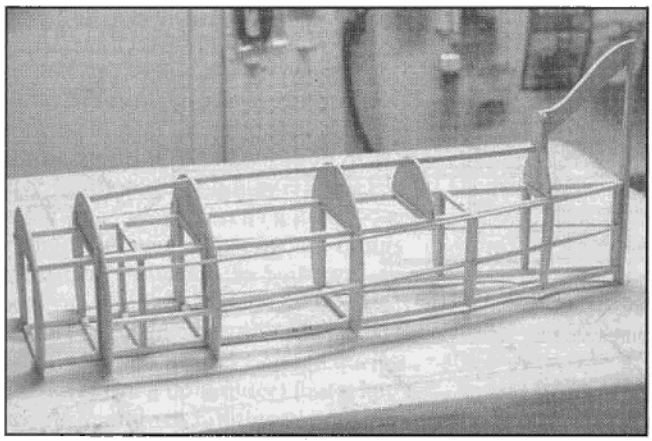
Join the two halves with 1" glass tape. Bolt the four pieces of 1/8" ply to F1. Place the point of a compass on the center point of the firewall and scribe the arc of an 8" circle on the ply pieces. Cut these out and reinstall. Now bolt on your engine and slip the cowl over the mounts. When



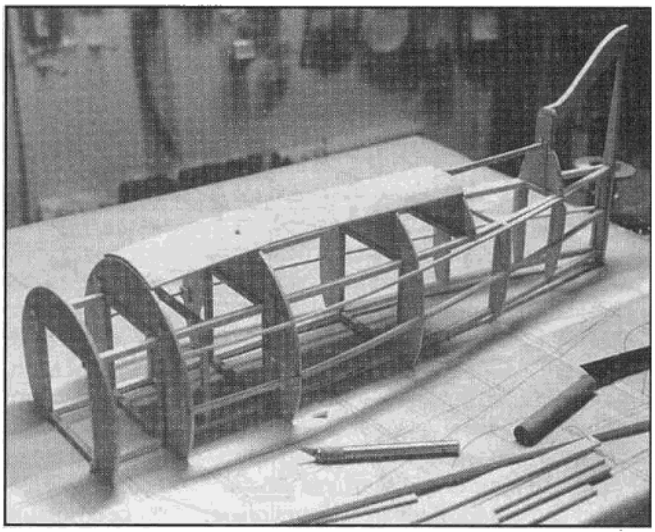
Build the fuselage sides over the plans. Don't forget to add the diagonal braces shown on the plans.



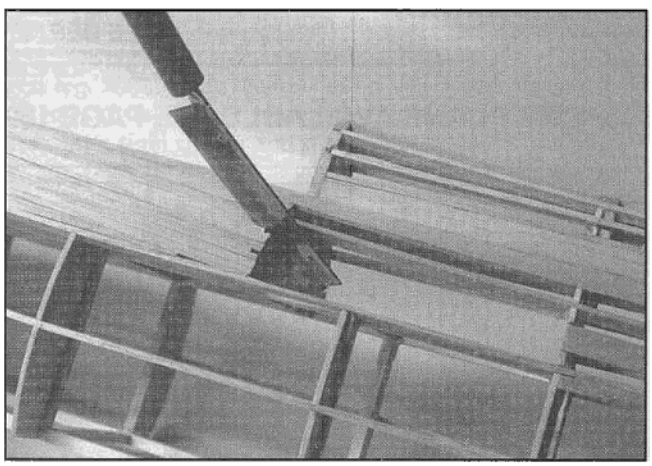
Fuselage sides joined over top view. Pin down securely!



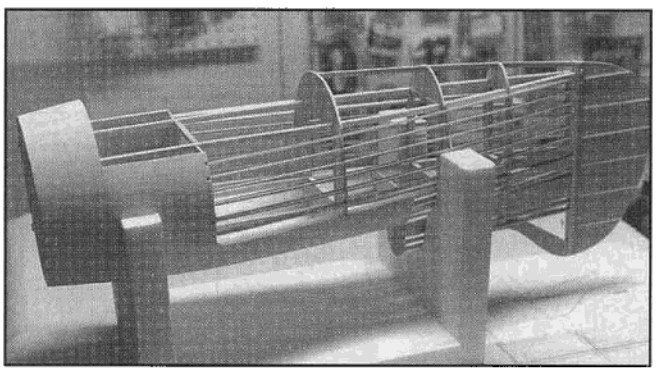
Adding the formers and vertical fin.



Forward sheeting being attached. Fuselage is still pinned to building board.



Method of notching for stringer.



This cradle is very useful. Make one and you won't regret it (1" foam).

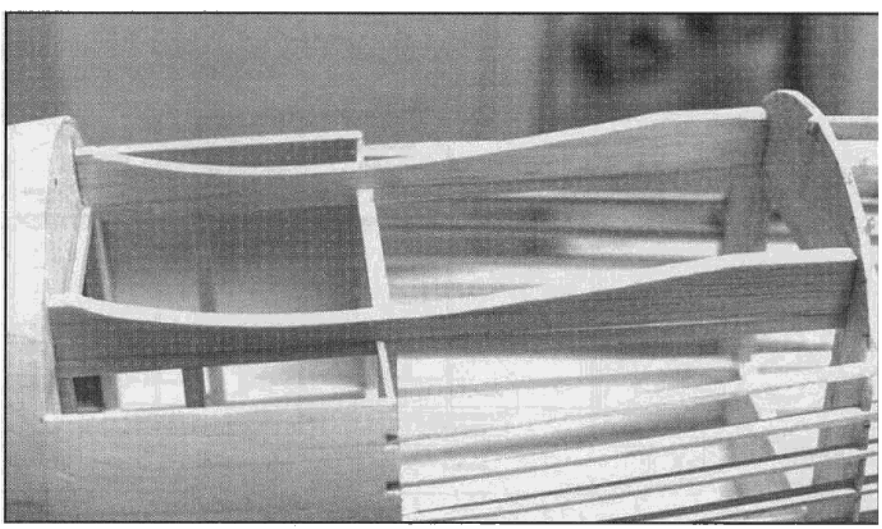
everything lines up as you like it, glue the mount to your cowl with thick CA. This method has turned out to be very durable.

Covering:

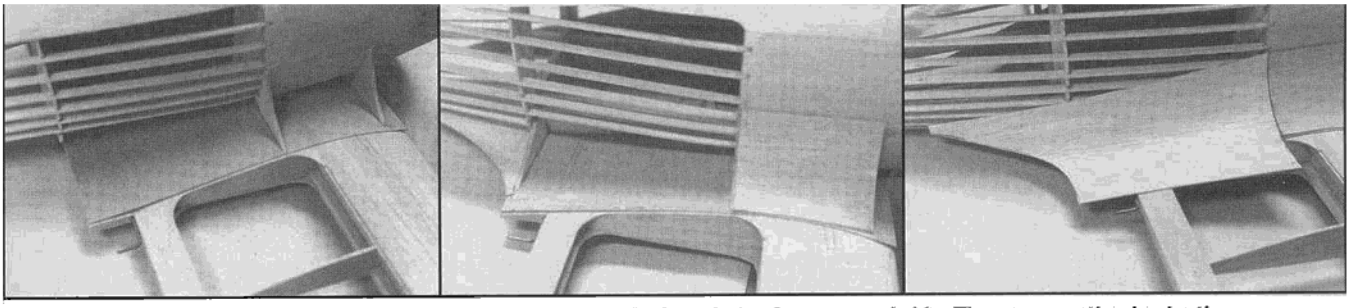
I covered the prototype with Sig Coverall and dope. Many builders of my smaller Gee Bee report good results with 21st Century paint over plastic film. You might want to try it if you don't want to go the cloth route.

Radio:

I used a Hitec Focus 4 and standard servos. You won't need dual rate, mixing, or gyros — this plane is very well mannered. I ran the antenna inside the fuselage in an outer NyRod tube, just leave a couple of inches hanging out the back.



Wing saddle installed.

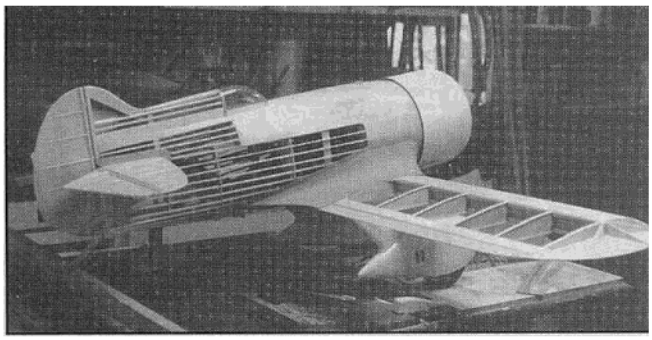


The wing fillet is built-up using a plywood base with sheet balsa formers and skin. The nose section is plastic.

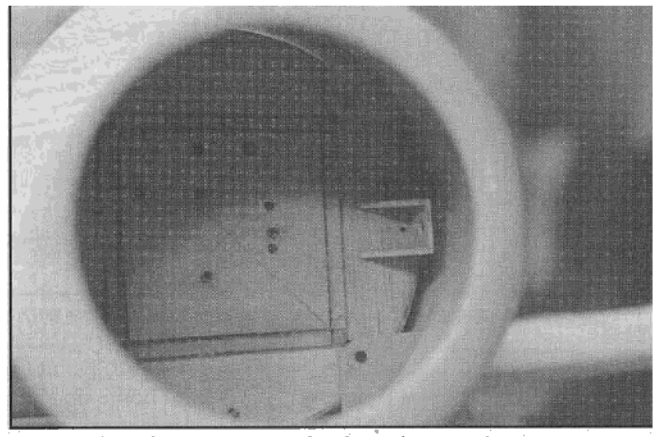
Test Flight:

After all that work, I finally get to go and fly the thing. Now, when you build a prototype, you are on your own as far as C.G., prop size, and thrust angles. The big question, **will it fly?** is just a little bit bigger! I picked a day when there weren't a lot of people at the field, just in case things went awry. Anyway, the Saito was well run in on the bench and I had double checked everything twice, so it was time to go for it. I noticed during run-up (I use a tail holder) that when I went from idle to full throttle quickly, the left wing panel would drop about an inch and a half and then level off again. The torque from the Saito was compressing the suspension in the left gear leg. So ... when you get out on the runway, feed in the power slowly, use a little right rudder and some up elevator. Do not be tempted to let the tail come up and run it on the mains for take-off. More on this later. My first take-off is pretty good, I get some height and trimmed it out. It needed about four clicks of down — that's all! (I guess it pays to build the wing on a 4' level.) Stall tests were next — it won't, it just does a right circle and doesn't sink much either. This thing is so stable, I got confident right away. I did a loop, a roll, and tried knife-edge flight, and the guy standing next to me is ooing and aahing like mad.

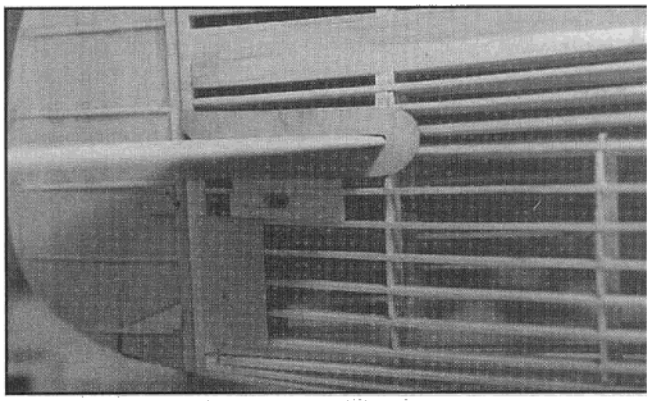
Then I absolutely nailed the very first stall turn; it pivoted around the C.G. like a pinwheel and dropped straight down without a wobble. I figured I should land while I look like such an expert. The Z has a nice flat glide and doesn't bleed off speed very quickly (really). This takes a bit of getting used to, I mean it's supposed to fall out of the sky like a brick when you cut the throttle, right? Well it doesn't, and I overshot a 300' runway — twice. On my third try, I came in long and low and I'm pretty far down the runway, but I go for it anyway. I flipped it. Oh well, no damage done. The gear legs are still in one piece. On the next flight, in an attempt to reduce glide ratio on final, I reduced the idle speed of the Saito too much and was able to explore dead stick flight. It will go quite a long way dead stick, but not quite as far as I need. Touch-down was in the hay field and came with a very violent flip. Aside from the fuel tank coming loose inside, no damage. The gear legs are still attached. (I'm pretty paranoid about those gear legs.) It turns out this thing is tough as a boiled owl. Have fun with your Gee Bee!



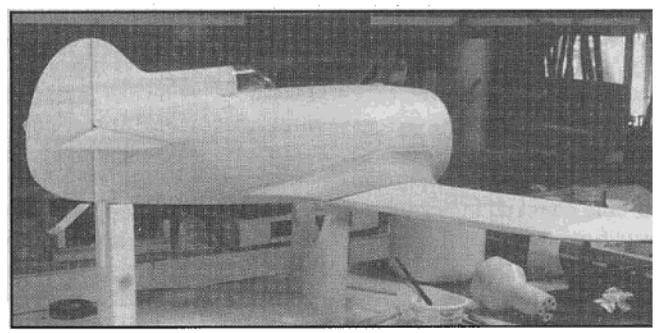
Framed up, ready to cover.



Details of cowl mounts, very simple and super strong.



Rear fuselage details. Note the thin plywood used around the stab mount to attach the covering.



Covering installed and ready to paint.

BASIC FLYING NOTES

Engine:

As mentioned earlier, I wanted a Gee Bee that would perform well on a .46 2-stroke, but I used the new Saito .56 4-stroke in mine and it turns an APC 11 x 6 at 11,500 rpm. While I did not actually install a .46 2-stroke in the model, I did take tach readings of several such engines at the field. The most impressive reading I took was a Magnum .46 with a Tatone Pitts muffler — 12,700 on the same prop. 'Nuff said!

Take Off:

Feed the power in slowly and hold a touch of right rudder and up elevator. Do not try to run up on the mains; the engine's torque pulls the nose down and you will probably do a high speed flip. Take off in a "3 point" attitude and you will never have a problem.

Low Speed Flight:

Contrary to popular belief, this is an aerodynamically sound design. Stall tests of the prototype show it to be almost stall proof. It just does a right hand circle, and doesn't sink much while it is doing it. You might want to read the specs again — what we have here is a floater. One small "bug" I have found is torque will pull the nose down if you throttle up suddenly at minimum air speed, as in a "go around."

High Speed Flight:

With the Saito .56, it goes about 85 mph and is smooth as silk. Vertical is very good. If you put it in a banked turn, it will stay there longer than any plane I have ever flown. It is extremely neutral. There is no twitchyness of any kind — a very realistic performer!

Aerobatics:

On the very first flight, I did a huge loop, axial rolls, knife-edge, a stall turn, and a split S. Ailerons are a bit tame at the throws indicated — about one roll in 1.5 seconds, but if you want to change direction, it will bank and yank with amazing speed! (It is, after all, a pylon racer.) No aileron correction is required during knife-edge.

Landing:

With 550 sq. in. and a weight of 5 lbs. 13 oz., you will have a very low sink rate. I found it a challenge not to overshoot the runway in zero wind conditions. Speed does not bleed off in a hurry. This plane lands long, low, and flat. Always land in a 3-point attitude. I have been unable to grease it in on the mains. Maybe it could be done on pavement.

Plastic parts available direct from Adrian Page, RR #1, Berwick, Nova Scotia, Canada B0P 1E0, phone (902) 538-7395, or fax (902) 538-7738, for $30.00 U.S. Plastic parts include: cowling, wheel pants, landing gear leg covers, and clear canopy.