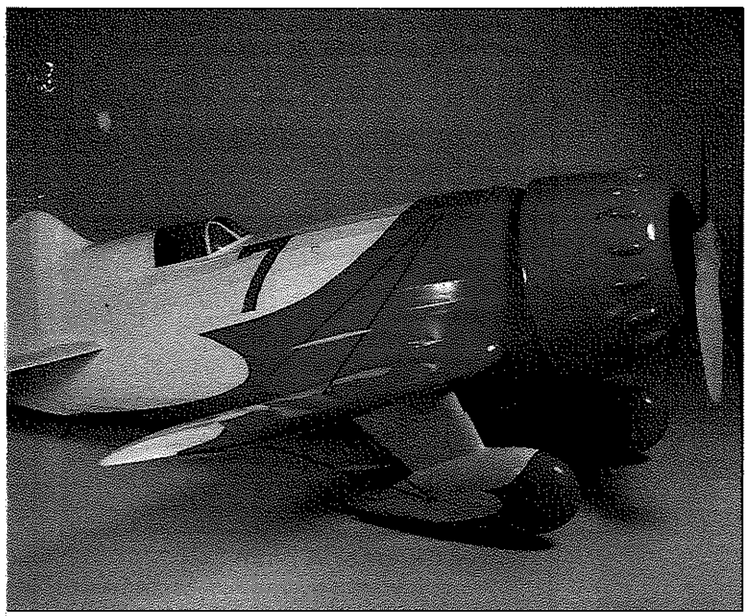
GEE BEE R-1/R-2 HYBRID

BY R. J. THEISS



(Above) The author's pretty little CO_2 racer has been a completely successful modeling project, whereas the full-size R-1/R-2 Hybrid, like all of the 1930's Gee Bee Super Sportsters, was fraught with misfortune; pilot Roy Minor ran it into a ditch while testing for the 1934 National Air Races, and Cecil Allen lost his life and demolished the aircraft when he crashed just after takeoff in the 1935 Bendix Race. (Right) Two models on lot—one slender, one not! Ms. Hope Trivette displays the author's latest project.

As with most builders of miniature aircraft, I found myself wanting to knock the socks off the rest of the gang with a really unique project—you know, one of those strange designs that is sure to invite the comment, "It ain't never gonna fly, no how!"

Although the Gee Bee Super Sportster is certainly no stranger to the serious modeler, it does (due to reputation and appearance) qualify as a doubtful flier.

To top it all off, it was my intention that a CO_2 motor would be doing the honors up front—yet another reason for most to have their doubts about my racer's ability to perform.

Though you might question my innermost thoughts during the period of design and construction, I must confess to having had thoughts of nothing but success. My confidence was based on research into both the real craft and models of the blimp-like speedsters. Much to my interest were recent engineering studies that have shown the Gee Bee R-1, R-2 and R-1/R-2 racers to have been among the most efficiently designed craft (for their large radial engines) ever built. Research has also established pilot error as the major cause of every accident related to the Super Sportsters.

Before going any farther, let me define my use of the term "free flight" as applied to this model. It was my desire and intent that my racer perform just as realistically as possible. No jump takeoff with a spiral to an altitude from which a powerless glide of duration might be expected.

The real R-1/R-2 required power throughout its flights and it seemed reasonable to expect the same from my scaled-down job. The idea of taking off from a hard surface, flying at only inches above the pavement for about fifty yards and then landing on the same hard surface, may not be normal—but it is scale.

In contemplating the design of the model, I came to recognize three areas of major concern. First off, I was faced with a heap of frontal area. This is probably the main reason why most modelers have stayed clear of the Super Sportsters. The second major challenge was torque. When Jimmy Doolittle flew the R-1 to victory at Cleveland in 1932, he had it; and with the powerful little CO_2 swinging a 7x6 wood prop, I would have it, too. Which brings up the last and certainly not the least challenge—bulk and weight with not much wing area to support it.

Sounds almost insurmountable, doesn't it? And still I was sure that I could build and fly the craft with success. My plan was as follows: With torque generated about the axis of the engine drive shaft at the front of the plane, it seemed logical to generate any dampening effort around the same axis, also at the front of the plane.

By keeping the trailing edge of the balsa cowl thin, along with having a nose cone between the CO_2 motor and firewall, I not only relieved frontal pressures, but also induced a smoother flow of air around the fuselage than was possible with the real craft. As the drawings and photos show, unlike the huge radial engine on the real craft, my tiny single-cylinder motor gives little resistance to the flow of air around the nose cone and over the leading portion of the fuselage.

I used the same flow of air to cope with my second major problem: torque. Notice that four fins are mounted to the nose cone portion of the fuselage running almost the full length of the cowl to which they are attached. I felt that it would be of an advantage to mount these units as shown rather than having two on the vertical plane and two on the horizontal. Quite possibly, the 45-degree mounting system could provide some needed lift in this area. Notice also that I added fins of thin acetate window material to the trailing edges of these mounting units. These fins are bent in a common direction, utilizing the prop wash as a resistant force to the generated torque.

The remaining problem of weight would have to be controlled by the design of my little fatty. I had determined that the maximum weight should not exceed 3-1/2 ounces. I used only the lightest balsa, including the wheels, which I turned with my Dremel tool.

As was most obvious, the tail feathers would have to increase in size. Dashed lines indicate this added area of a slip-on boot made of acetate window material. (These finally replaced the basic trim tabs added during tests.)

FUSELAGE

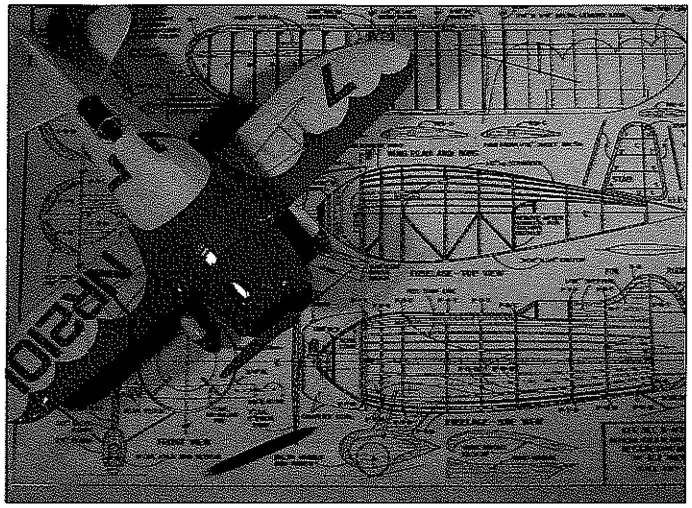
In preparation for construction, cut out and shape all of the formers and ribs from 1/16-inch balsa sheet. Mark the stringer positions on the edges of the formers with a soft pencil (the pencil marks will not interfere with the glue joints and never bleed through the finish as ink often does). On fuselage formers F-3-B and F-4-B, I have shown areas to be cut out so as to accommodate the installation of the wing root ribs. The material to be removed is best cut partway through and then left in place during the construction of the fuselage.

The marked positions of the stringers on formers #1, #8 and #9 should be maintained; however, the markings on the rest of the formers should serve as indicators only. A light variance from these marks may be necessary so that the stringers have a natural flow from fore to aft.

Setting these units aside, build the horizontal crutch. With the crutch pinned over the drawing and on a flat board surface, glue former F-9-T into position. Work your way forward, adding each top half former to the crutch. The first stringer to be glued in place is the very top center one, which runs from former F-6-T forward. This stringer establishes the top profile line of the fuselage.

Starting from the rearmost former F-9-T, install two stringers at a time on exact opposite sides. By cutting the stringers about five inches too long, you can provide yourself with a good leverage for their bending over the last two forwardmost formers, producing a rather abrupt curve. This is the procedure to use for the entire top half of the fuselage. With all of the stringers in position, add the fin unit and sheeting between formers F-7-T and F-8-T.

After removing the top half of the fuselage from the plans, cut the stringer tails flush with former #1. Repeat the tail-to-front procedure used on the top half of the fuselage and you will be rewarded with a recognizable shape that is unmistakably Gee Bee. Glue the rudder outline pieces together over the drawing, then glue the unit onto the fuselage, adding the 1/16-inch square balsawood braces to either side.



WING AND TAIL

In designing this unit, I employed a single large, lightweight spar. Notice that the wing is built in four separate sections. The two center sections will be passed through the fuselage to join at the center line where they will establish the angle of dihedral. The outer two panels are joined with a guide pin and may be removed for travel, storage or for a desired change in the angle of incidence.

To begin construction, mark the rib spacings on the spars with a soft pencil. The gluing of the ribs at these positions follows, making sure that the trailing edges of each rib are in perfect alignment. Next comes the fastening of the leading edges, followed by the wing tips and trailing edges. These are best preglued over the plans so that they will hold their shape while being added to the spars and ribs.

I wrapped up the remaining framework by building the stabilizer/elevator units. Preshaping the leading and trailing edges along with the tips of these units pays off with a super clean structure.

LANDING GEAR

Each of the Gee Bee's gears and pants are one smoothly faired unit. After shaping all the parts separately, using the drawing outlines as template guides, glue and pin the units together as shown. The aluminum pins add much needed strength to the gears and very little weight.

WING/FUSELAGE FUSION

I designed the wing sections to join at the centerline of the fuselage so that the shock loads from the stiff wheels and gears can be transmitted throughout the wing and entire fuselage, rather than through a relatively small portion of the wing root section only. Using an X-acto knife, complete the slitting of the lower section of formers F-3-B and F-4-B, remove these sections, slide both wing panels in place, square them up with the fuselage and glue the angled butt ribs together along with every location where the wing and fuselage framing meet.

COWLING

Feeling energetic, I actually built two cowls for the Gee Bee. The first was based on the R-2 model, which in real life had the smallest engine used in the R series. This cowl, though having a bit tighter fit at the fuselage, presented the least frontal area of any Gee Bee Super Sportster. The R-1/R-2 Hybrid's cowl had a larger gap at the fuselage.

I used two different methods of construction for the cowls—lay-up and plank. The plank method is a rather standard approach and requires lots of shaping and sanding. Actually, the lay-up method has been around for some time, too. It's done by turning a form from a block of wood chucked into a drill press. This is encased in a thick coat of fiberglass resin. Over the resin goes a thick polished coat of candle wax, then a coat of mat medium (a water-based art material). The actual cowl is made of two clear doped layers of the thickest silkspan you can get. Next comes a thick core layer of clear dope loaded with balsa dust, then two more layers of clear dope with silkspan, and two final coats of hand brushed red dope. The hand carved blisters should be added before the final two coats of red.

MOTOR MOUNT

I've shown the motor mount plug in three-views on the drawings. This hardwood piece fits into a slot that conforms to the wedged shape of the shank. Cut the forward tip of the cone along the line indicated on the drawings. This portion of the nose cone can be removed when pulling the motor, tank, and charger units. It is held in position by wood dowel pins as shown on the drawings. Having cut this unit free, slip the mount plug into its receiver slot and drill a hole from side to side through both units. The fixing and slotting for the charger completes this phase of work.

COVERING

Holding manageable-sized sheets of Japanese tissue over two segments of stringers on the fuselage at a time, trace the outside stringer edges by drawing the side of a newly sharpened pencil along their lengths. Cut out the sections along the penciled lines and label them with a soft pencil. Do the same for the top and bottom panels of both outer wing sections, the horizontal stabilizer, the elevator, and for either side of the rudder. Now you have all of the covering material, patterned, shaped, and labeled, for the entire craft. Using a 1/2-inch flat brush, lay thinned white glue along the outside edges of the stringers just prior to placing the tissue over the framework. When the entire fuselage and rudder have been covered and have dried to a firm tautness, two brushed coats of thinned clear dope will affix the tissue into its final shape.

Both top and bottom of the wing and horizontal tail units should be covered before brushing on the clear dope. When the dope has dried enough so as not to be tacky, pin these units to a flat board to resist warpage. I have had tremendous luck with doping both the top and bottom of the wings and tail surfaces before pinning them to the board. Both sides dry evenly with this method.

FINISHING

Lightly sand all surfaces with the finest grade of wet-and-dry paper you can find and spray the entire ship snow white. When dry, trace the shape of the red trim from the lines provided on the drawings and cut the patterns from medium weight stationery. Using a very soft pencil, trace the patterns onto the wings, fuselage and so on. Narrow masking tape provides the edge for the trim color coats. Any little frays that remain after the tape has been removed can be cleaned up with a single-edge razor blade. The shape of the fuselage trim coat pattern on my model took lots of cutting and refitting. I really can't provide a short cut for this process.

MOUNTING THE MOTOR COWL

I've shown the template for the mounting fins on the drawings. Final fitting will require a bit of shaving and sanding so as to ensure perfect alignment. The adjustable torque fins are glued into position just prior to the final mounting of the cowl itself. Set them at 30 degree pitch for starters. I used the short stick pins (about 3/8-inch long) to hold the cowl onto the mounts. One pin for each fin should be ample.

TEST FLYING

The right choice of people for the test of my prototype Gee Bee was something to consider. A guy could put a real kink in his reputation at a time like that. Of course, my son Shawn would have to be with me. In fact, he would be flying so that Dad might chase the thing should it be necessary.

My first test procedure was a taxi run with only five seconds of power. The roll was slightly to the left, as I expected, and was about 50 feet in length. I added three seconds to the power run for each of the next three tests. Now, with a reasonably powerful run of about 14 or 15 seconds, the indication was still a tendency to roll to the left. I added a sizeable clear tab to the rudder and held the timing to 15 seconds for test number five. (Incidentally, I have a log book for the recording of all tests and flights. It helps a great deal when test flights are a number of days, weeks, or months apart.)

Test five called for a still larger trim tab, this one 3/4 of an inch by two inches in length. Of course, I realized that some of the rudder trim might have to be removed when the full power of the initial engine run was utilized. Most CO_2 powerplants burst with energy for the first few seconds of the run.

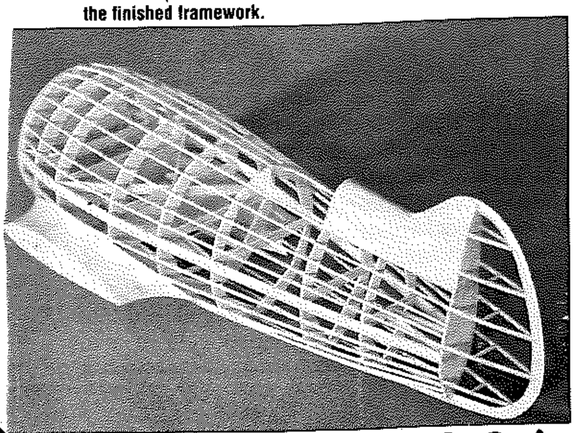
It seemed that it was time to readjust the torque fins for any additional help with my left turn problem. They were now set at 45 degrees.

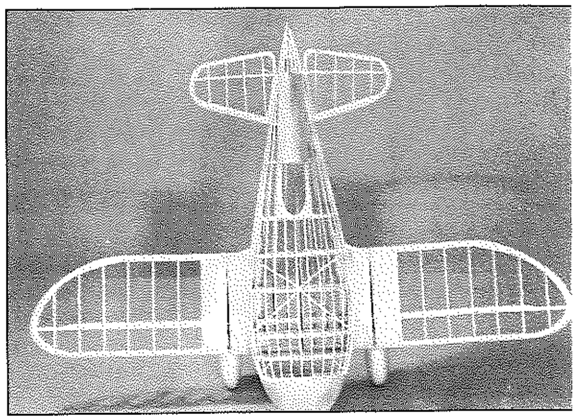
Run number six was a doozy. The power timing was near enough to lift the tail within a few feet from the start and hold the craft at the edge of flight for about a 200 foot distance. I now added two good-sized trim tabs to the elevators with a slight up position.

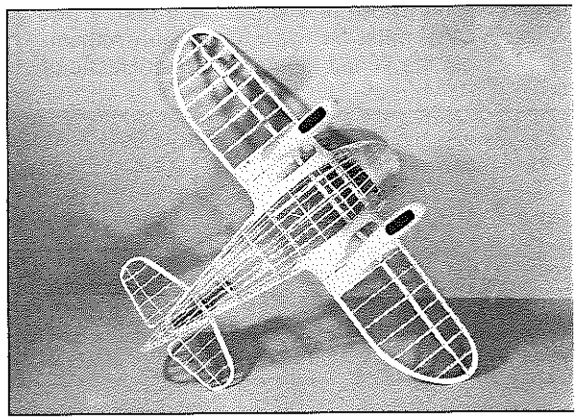
Having gained some confidence, I decided to go for broke. Run number seven was with the normal starting procedure, and I am sure was just as thrilling as the first time Russell Boardman poured the power to the real Gee Bee R-1 back in 1932. The final run of the day was a series of intermittent high-speed ground rolls and brief flights of five or six inches altitude, covering lengths of about 15 to 20 feet. Each time the ship was lifted by what I suspected was a slight gust of wind, the left wing would dip slowly until the left wheel tapped the concrete lightly. This skipping occurred about five times during the run of over 275 feet. The "flight" path still had a slight arc to the left. A bit of a pain—however, by the end of the first test day, I figured that still having the plane in one hunk put me well ahead in the game.

So, if you are wondering how my bright red-and-white project turned out, consider the fact that you are reading this, and that the author is not given to self-humiliation. In fact, I think I'll show up at the next F.A.C. Nats and raise a few eyebrows. **MB**

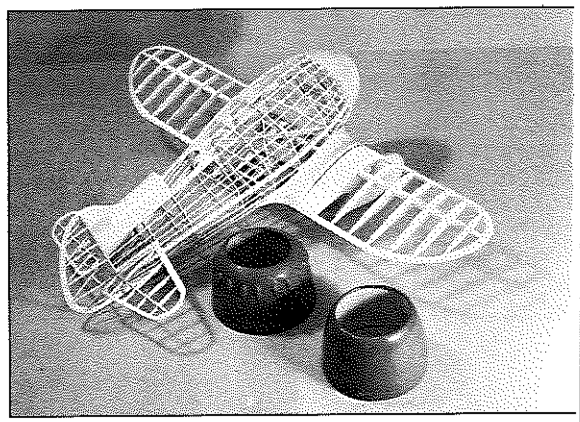
The completed basic fuselage structure. Not as complex as it appears—just a crutch with formers and stringers top and bottom. Japanese tissue covering adds tremendous rigidity to the finished framework.



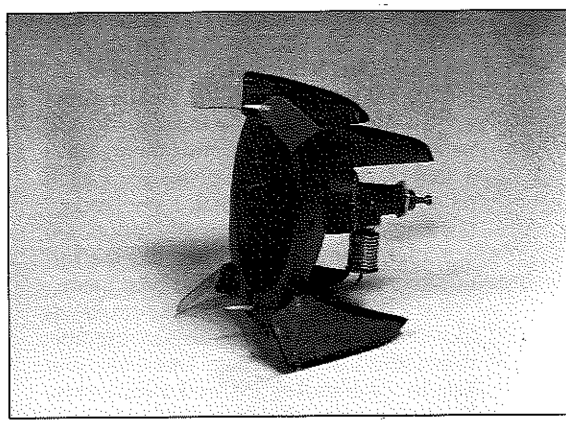




Top and bottom views of the completed basic structure. Keep it light for best performance.



Cowl on the left is the correct scale shape and was made by laying-up doped silkspan over a wooden form; process is fully described in text. The other cowl is the more streamlined R-2 unit used for flying and is made of balsa planks.



Front end of the fuselage is removable. Clear plastic vanes at the trailing edges of the cowl supports are the author's attempt to counter the torque from the CO2 motor—explained in text.

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