HIPERBIPE

Looking for a super simple R/C biplane? This clean machine is Stand-Off Scale and flies on a .40 engine.

by Stan Hines

Photos by Bryce Petersen

It is just possible that one of the best home-built light biplanes at the 1973 Oshkosh EAA Fly-In last year was the "Hiperbipe." It is the product of Sorrell Aviation of Tenino, Washington, which is owned and operated by Hobie Sorrell and his sons, Mark, John, and Tim. Their main business is the repair and rebuilding of aircraft for their customers. However, like so many of us in the modeling business, after we have built and rebuilt someone else's design long enough we begin, after awhile, to feel that we could design a better one ourselves. The "Hiperbipe" was not their first attempt, however, it certainly is a very unusual looking aircraft which is what attracted my attention, almost as much as the article by Budd Davisson in the December, 1973 issue of Air Progress describing its flying characteristics.

Its unusual appearance comes from the use of an airfoil shaped fuselage. This is not exactly a new idea since it was first investigated by Mr. Bernulli back in the 1930's. The basic idea is to make the fuselage do double duty; to carry the passengers, and to provide lift.

Ever since reading of the design advantages of negative stagger which claims to give better biplane wing efficiency, I have wanted to build such a craft. I guess I was ready to bite when I saw the article on the "Hiperbipe," and particularly when a three-view plan was included. The thing that really hooked me was their philosophy (which parallels my own in modeling), "that each design must investigate a theory and it has to prove a point."

With the aid of a calculator and a metric rule, plans were enlarged to approximately 2 inches to the foot. I believe that I have reproduced this plane quite faithfully, although there may be minor details omitted such as wires, but I don't think they are important for a Sport-Scale plane. Only two intentional changes were made in dimensions which were partially for scale appearance and partially for flight characteristics. The first was an increase of ½" from 6½ (scale) to 7-inches in the chord of both wings. The second was a narrowing of the fuselage by ½" from 7 to 6½". The profile is as nearly scale as possible (a modified NACA 23022 airfoil). The other concessions to modeling were to make the wings removable for access to the interior, an engine access panel, a larger cooling air passage, and installation of ailerons on the lower wing only.

Construction

Since the thing that scares most modelers from building a biplane is the wings, let's start there. A look at the plans will show you that the wing structures are symmetrical airfoils and of a quite typical built-up construction. Rib spacing is even with the exception of the double ribs at the interplane strut roots and at the center-section. The ribs are cut from 1/16" hard balsa sheet notched for the 3/16" square upper and lower main spars. The leading edge can be made up from 1/4"x1/2" balsa or from commercially available leading edge stock. The leading edges are completed with two 1/16"x3/4" sheet top and bottom. The trailing edge is made of similar one inch sheets. Except for typical rib details, the plans generally show by a single line the centerline of the ribs. All ribs are capped with a 1/16"x3/16" strip as indicated on the typical rib drawing with the exception, again, of the center-section and the double ribs which support the interplane struts. Before capping these two areas be sure that you have installed the 1/8" plywood doublers in the area of the wing hold-down bolts at the center-section and that you have filled in all but the blackened area between the interplane strut ribs with scrap 1/16" balsa. The wings should be checked for straightness several times during this assembly. You are now ready to put the doublers on the main spars.

Use scraps of 1/64" plywood or 1/16" balsa cut to fit exactly between each rib. Pairs

of these were glued to the front and back of the main spars, making them into a single box type spar from one interplane strut to the opposite one. These doublers are not shown on the plan, but are essential for a cantilever wing of this thickness. At the center-section, the open side of the leading edge and trailing edge sheets are filled in with 1/16" sheet for appearance purposes as well as for strength.

Construction of the lower wing is handled in much the same way except for the 2 1/8" sweepback which skews all of the ribs as shown on the plan. The trailing edge construction is different also as noted on the plan due to the addition of the ailerons. The only tricky part to this wing is to be sure you understand the configuration of the center-section before you start building. You will note on the center-section rib profile the dotted line shows how the lower wing meets the lower center-section, with the trailing edge flowing into the upper surface. These center-section ribs are made of 1/8" hard stock and again before sheeting be sure you have placed the 1/8" plywood doublers as indicated on the plan for the wing attachment bolts. The ailerons are 1/4"x7/8" sheet carved to a tapered shape. Interestingly, strip ailerons are used on the full sized ship. On the model they are used on the lower wing only. Prior experience with a short span design indicated that this would be adequate. Once again, the 1/64" ply or 1/16" sheet doublers are used between each rib out as far as the intersection of the interplane strut.

In the center-section, instead of the plywood doubler as in the upper wing, I carved a doubler from a scrap piece of hard balsa about 1" by 1/2" by 2", long to give the correct dihedral which is 1/2" under each wing tip (on the lower wing only). With a little experimentation, you can get this quite well and then solidly epoxy it in place. This together with the sheeting top and bottom gives an adequate strength to this center-section. Wing tips in both cases are made of 1/4" sheet cut to the shape shown. At the leading edge of the top and bottom a 1/4" scrap block is added as shown on the plans and these are carved to an attractive shape as you are lightly rounding the tip blocks. You will note that the capstrips on the tip ribs are offset to the inside rather than being centered over the rib as they are on all others.

You are now ready to sand both wings and cover them with your favorite material. I used orange Super MonoKote.

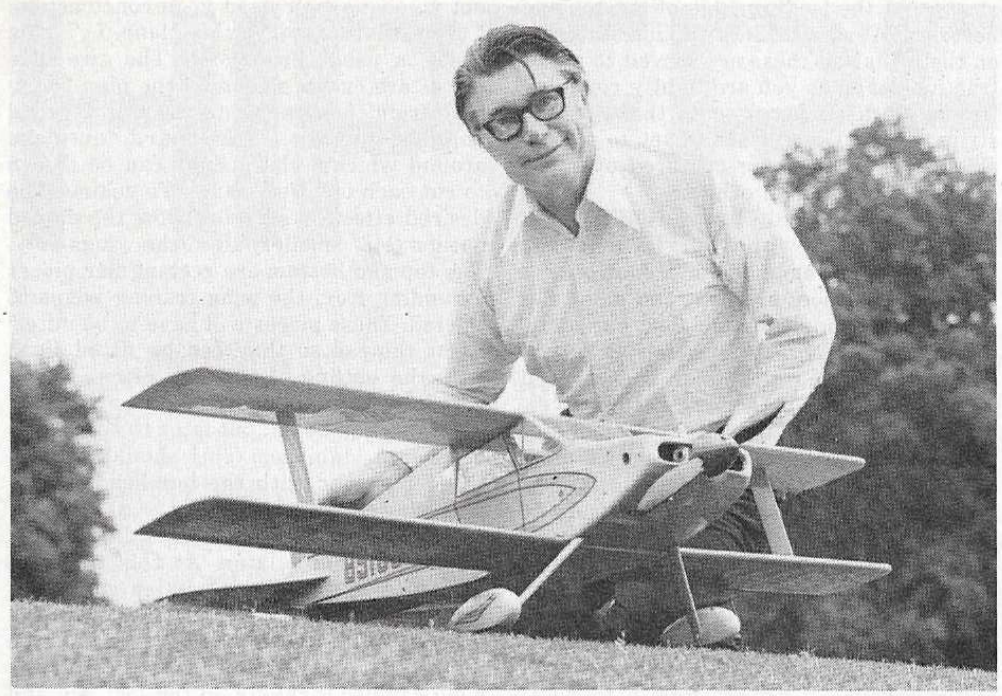
The tail surfaces are next and being flat they are extremely simple. The horizontal stab is made with a 1/4" framework cut to the shape shown on the plan and covered with 1/16" sheet on both sides. Before covering, taper the trailing edge to a point so that the top and bottom covering will meet at the trailing edge. If white glue is used for assembly of these surfaces, be sure to press them until dry to prevent warping.

The vertical stab is made in a similar fashion except using a 1/8" frame. The rudder post should be hard straight 1/8"x1/2" balsa so that it will give you a solid hinge attachment. The sub-fin is constructed in a similar fashion. A construction note here: If you leave the rudder posts extend approximately 1/4" beyond the imaginary fuselage line, this can be trimmed during final assembly so that the end fits on the horizontal stab thereby giving you a better surface by which to epoxy the two units together. At this point it would be well to decide on the type of tail wheel attachment you are going to use and modify it as necessary to attach firmly to the sub-fin. I used a metal one which had to be rebent slightly to make a neat fit. When the assembly is completed and the glue set, these surfaces will be finish-sanded and covered. The control surfaces are made of balsa sheet as shown on the plans. These are also sanded and covered at this time, but not assembled to the stabs.

The Fuselage

The construction and alignment of this fuselage is extremely simple. Whether or not you have ever used foam construction, I urge you to use it in this plane. 1/2" foam sheet is used throughout. The two side pieces are cut as shown on the plan to extend from the firewall to the tail. I would suggest cutting a cardboard template around which a sharp knife can be drawn to cut each identical panel. To achieve the desired effect be sure to follow the dotted outline (1/16" smaller) aft of the wings only. The top and bottom are rectangular pieces extending from the wing trailing edges to the tail. These pieces will have to be mitered at the tail so they can be fitted flush with the outline of the side pieces. Don't worry too much about a good fit at the tail since this will be cut out later to accept the horizontal stabilizer. This should be dry-fitted together with the bulkheads to assure yourself of a square fit.

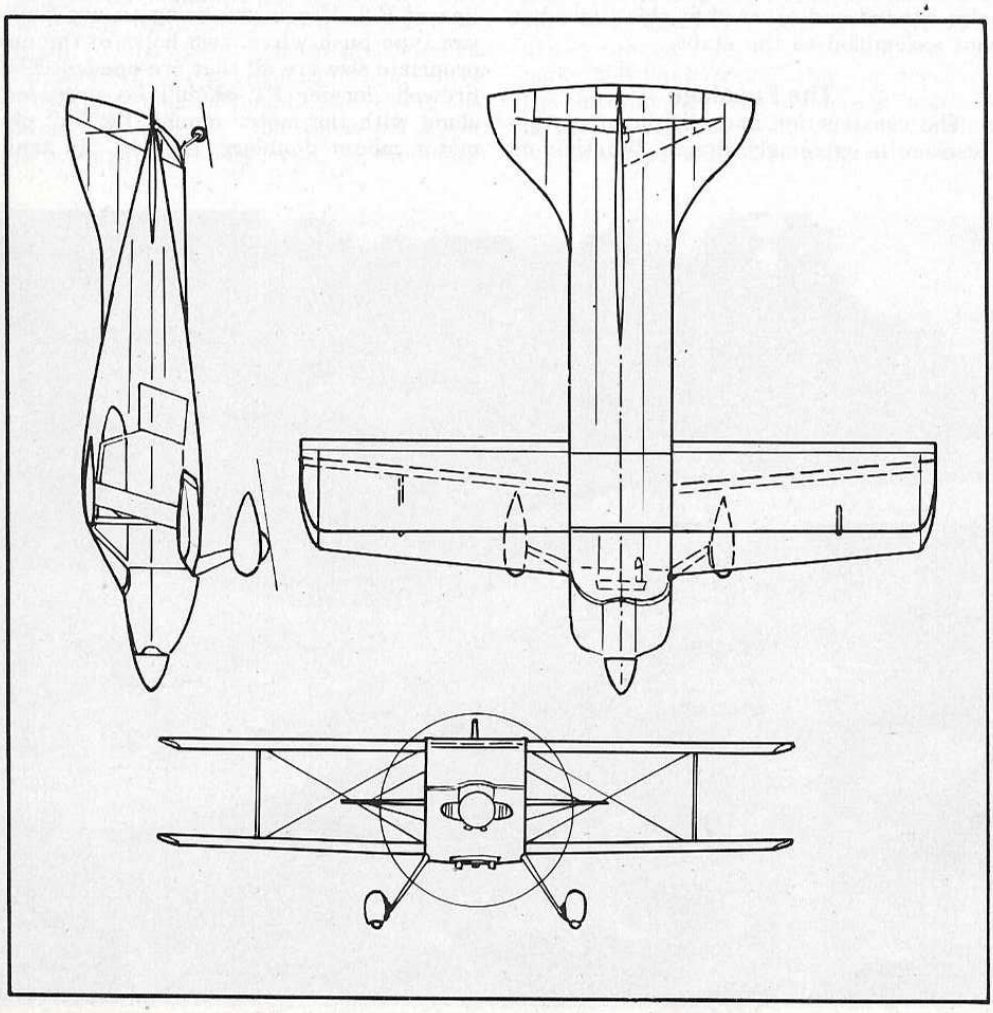
Do not make the wing saddle cutouts in the foam until later. At this time the 1/16" plywood and 1/16" balsa doublers should be made. Note that the balsa will extend 3/16" in front of the foam in order to cover the sides of the firewall. Lay out the wing saddles carefully on the 1/16" ply and make sure both are identical. In order to avoid misalignment due to any slight irregularities in cutting the foam, I suggest you lay out a centerline on the inside and outside of each foam piece, and on each plywood and balsa part. Check the fit of these pieces carefully before gluing. Mark the 3/16" setback on the balsa pieces, overlay the plywood, and cut out the wing saddles on the balsa. You are now ready to glue the doublers to the foam. Be careful to make a right and left hand panel, use plenty of glue in the assembly, and press these as well until they are set. If you are going to use dowel pushrods, cut out the rectangular section shown by the dotted line of F-3. If you are going to use Sullivan type push wires, two holes of the appropriate size are all that are needed. The firewall, former F1, should be prepared along with the motor mount, the 1/8" ply motor mount doublers, the 1/8" ply tank



A low angle shot captures the flavor. Lee can't wait for Bryce to finish up with the Brownie so he can turn the crow-chaser loose. The design responds with elegance. Simple to rig this bipe.

platform, and the 1/16" ply air baffle.

Due to the width of the motor section on this plane, it allows us to locate the fuel tank on the opposite side of the motor mount from the sidewinder mounted engine. This not only simplifies the fuel lines, but also reduces the leaning effect of maneuvers since the fuel level changes relatively little. A further advantage is the added weight which helps to balance the plane. The doublers on the motor side of the mount provide rigidity and a warm air baffle while on the opposite side the plywood floor will support the fuel tank in a level position as well as adding some stiffness in the horizontal direction. After this sub-assembly is completed and attached to the nose, the 1/4" side nose blocks can be added. The right side block can be marked for later cutting of the access hatch. The nose block is laminated from three 1/4" sheets as shown on the plan. You will note the innermost former is smaller because it is overlapped by the side pieces and the top and bottom sheets of the cowling. The two forward nose pieces are added after the cowling is finished. The top deck and cowl are 1/8" sheet with the grain running lengthwise. Use two pieces butted at the firewall. The cowl piece should be wet and finger molded to the inner nose block.



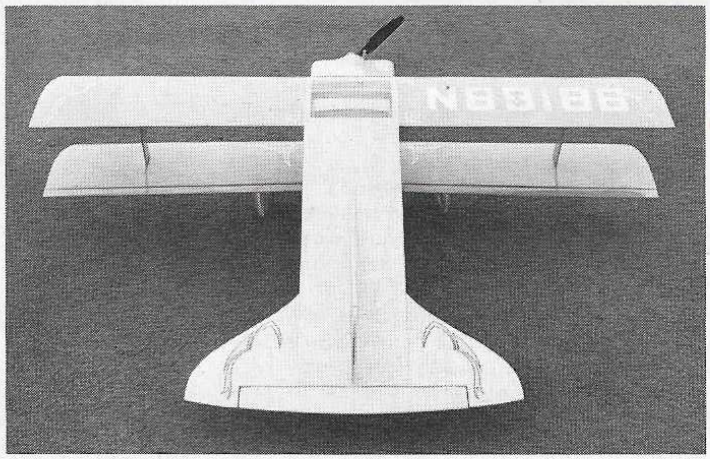
Before adding the bottom cowl, the landing gear must be attached. This can be done with "J" bolts or a method I prefer which is to laminate the wire between pieces of plywood as shown on the plan. The wire is 5/32" dia. bent as shown. It is best to make a template of coat hanger wire to get all the angles right before bending the hard stuff. Until I got a Dremel Moto-tool with a cut-off disc, I could never get a good clean break in this large wire. Using it to cut slowly, I now get a neat end without burr or distortion and no work.

The bottom cowling is cross-grained and fitted flat up to the inner face of the nose block. Don't worry about engine clearance since some can be cut away later. On the under side only use 1/8"x1/4" strips to plank form the nose cone. Trim off all excess flush with the inner nose block and add the two larger ones. These should be carefully blended by hand sanding to give a pleasing effect.

Check the wing saddle cutouts by fitting the wing in place. Make any minor adjustments to their shape or height to achieve a proper fit. The wing saddles should now be finished by adding the 3/8"x1/2"x1" maple blocks in areas where foam has been removed as indicated on the plans. These blocks should be epoxied in place between the plywood inner and balsa outer doublers and should be flush with the wing saddle. When you are ready for the final fitting of the wings much later in the construction, fit the wings in the wing saddles, one at a time, and carefully drill through the wing into the wing block with a small diameter (1/16") drill. If all of the holes are where you thought they should be, they can be enlarged so that No. 10-24 flat-head nylon attach bolts will pass through the wing holes. The attached blocks should be drilled out somewhat smaller so that they can be tapped to receive the nylon bolts. A few cents invested in a regular metal cutting tap allows you to use this procedure which beats trying to line up factory made wing attachments.

The rest of the fuselage is completed by making the cut-outs for the horizontal stabilizer and mounting it in place. Check for squareness in every thing you do and then add the vertical upper and lower stabs. When these have been securely epoxied in place, notch the four corners of the fuselage from the trailing edge of the wing to the tail. These notches are about 1/16" deep and are used solely for locating the 1/8" dia. hardwood dowels which are used not only for structural strength in the model, but also to simulate the tubular steel framework of the original. You will have to miter these dowels at the tail to make them fit neatly with the horizontal stab. It is intended that they protrude approximately 1/16" above the top and side foam surfaces, so don't set them too deeply. 1/16"x1/4" strips are used to make a surface around each stabilizer to which you

Most biplanes become involved when it comes to mounting the top wing on struts, at a relative angle of incidence. No sweat with the "Hiperbipe."



Well that makes sense. The wide body is just more wing area. Everything helps in lift department. It eases construction too. Note stab planform.

will be able to attach the final covering. 1/16" strips were used forward of the leading edges of the stabilizers.

At this point it would be a good idea to locate and install your control rods for the elevator and rudder. The exit points of your control rods at the tail will also require an island of 1/16" to which you may attach your covering. The elevator and rudder surfaces should not be added until after the model is covered.

I think now we should return to the landing gear and make the wheel and leg fairings. The wheelpants should be made wide enough to accommodate the wheels you intend to use, including a collar on the outside. The leg fairings should be epoxied to the wire and pants, but not to the fuselage. A 1/16" gap can be left at the top without causing any serious appearance problems and allow full flexibility of this Whitman type landing gear.

The windscreen area is finished by a piece of leading edge stock between the protruding side pieces. This is further supported and braced by 3/32" diameter aluminum or brass tubing or rod cut and fitted as shown by the dark lines on the plan. If done carefully and epoxied in place as shown, these become structural members supporting the center portion of the wing. The tubing can be left natural, but the leading edge stock should be painted either black or to match the color of your plane before the windscreen is actually fitted in place. Sig clear plastic material is used for this windscreen and for the center-section of the upper wing. The side windows are simulated by using either chrome or black MonoKote or paint. The door outlines and the trim accent are 1/16" black tape.

The Pre-Flight Check

Unless we've forgotten something, you are about ready to install the engine and radio gear, assemble your plane, and go out to fly. Before you do it though, check that center of gravity again. It should be almost at the leading edge of the upper wing. It can be as far back as 3/4" if you want to have a super quick airplane, but it is not recommended. Finished, the plane should weigh approximately 5 1/4 to 5 1/2 pounds including any counterweights you need to put in the nose to balance it. With this weight, 635 square inches, a Webra .40 and a 10/8 Top Flite Power Prop, this ship will really move. It has a beautiful scale-like take-off from our grass field with none of the point losing corrections needed. There really isn't much I can say about its flying characteristics since its most everything I imagined it would be. Although I am not a pattern flyer, this ship appears to have a great deal of capability in this area. I'm having a lot of fun with it and it certainly draws its share of admiring glances everywhere I take it. I've been building models for a great number of years and I can't remember a single one that I thought was a prettier airplane or that I admired more. I hope you will try building one, and I also hope you will enjoy it as much as I do.