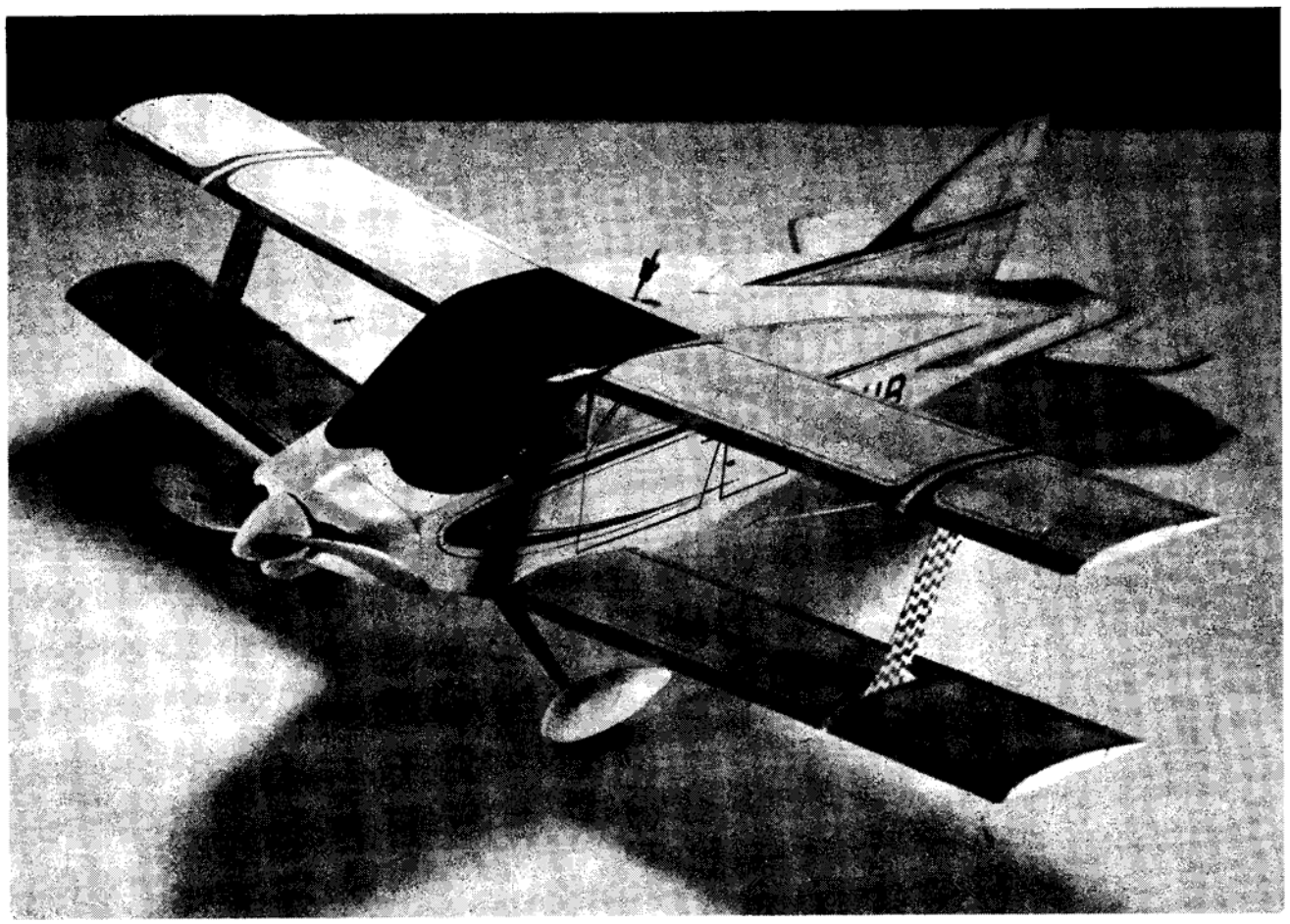


PHOTOGRAPHY DAVE REES

Dave Rees' Sorrell Hiperbipe lived up to its acronym with plenty of high performance at the 1983 Nationals to win the free flight scale gas event.

1983 Nats F/F Gas Champ

Sorrell Hiperbipe

By Dave Rees

CO_2 power takes this contemporary biplane design through a realistic flight profile. Many interesting thoughts here.

The Sorrell *Hiperbipe* has appeared in almost every form of model airplane from radio controlled to peanut scale since its introduction in the mid seventies. The name is an acronym made from HIgh-PERformance-BIPlanE, and as a model it lives up to its name just as much as the full-sized prototype did. This plan will extend its flyability into the realm of CO_2 powered engines.

Many features recommend the *Hiperbipe* for modeling. The design is "up to the minute", which is a refreshing change in a free flight scale scene that seems to be dominated by subjects from the "Golden Age". The broad, boxy fuse builds easily, as do the wings, which have only the shape of one rib for both wings. The struts and landing gear are simple and rugged, permitting take-offs using the standard prop supplied with all engines. Lots of lift up front provided by the two wings plus a lifting-body tail end make it more suited for power application than rubber. My judgement tells me it would have tail heavy tendencies as a gum-band-twister, although I have never tried one. The ship flies surprisingly slow and steadily, making it a natural for AMA Scale events where realism of flight counts highly. A biplane bonus of 15 points will be received when flown in FAC Scale making this a rare subject that is ideal for both of the free flight scale rules used in competitive circles these days. The *Hiperbipe* can even be flown indoors due to its ability to be trimmed to fly in tight little circles, but a lot of motor adjusting is needed to avoid ceiling crashes.

This plan for the *Hiperbipe* is almost perfectly to scale. Dihedral was added to the top wing matching the lower one, and the stab was raised slightly to bring it closer to the thrust line and balance the drag couples. The airfoil was also changed. The best sources of scale data I have come across are listed on the plan, and these are a must for anyone trying to duplicate the paint scheme on the prototype. It would be nearly impossible to list which parts, struts, and stripes are what color from this masterfully conceived graphic design. The colors listed are chosen to closely match the original while staying in the region

of readily available commercial paints. Most judges will not quibble too much over exact shades; besides, fading occurs almost immediately. You may wish to pick a scheme from the subsequent *Hiperbipes* which have been built, some of which are really wild.

Construction notes

A little guidance will be helpful in the construction phase because there is a definite sequence of assembly in some areas, and terminal frustration can be avoided. Pin the two fuse sides, one on top of the other to the plans using 1/16 inch square strips with sheeted areas as indicated. Crack and "Hot Stuff" the sharp bend at B. Notice that the uprights at the door outlines are notched into the sheet just below the upper wing. There is no need for balsa any harder than medium (6 pound per cubic foot) anywhere in this design. Cut the holes for the wing spars and trailing edges in the 1/16 inch sheet mounting areas after they are pinned and glued in place, so they are in exactly the same spot on both sides. You will have four wings all aiming in different directions if care is not taken here. Also the precision of your incidence angles are set by the accuracy of these slots. Likewise, take care with the stab slot or a tilted stab can result. I used Ambroid glue throughout and let the sides dry for 24 hours to minimize warping.

Cut an accurately square cardboard rectangle notched at the corners to match the cross section behind the wing. Lightly glue in place until the cross formers are all installed, then remove. Sanding all formers to the same length in a stack helps, too. Take extra time here to get things as true as you can. Bend up landing gear wire and mount with the sandwich formers and gussets as shown. Stringers may be installed next. The center ones at the rear are wide to facilitate mounting upper and lower rudders after covering is in place.

Little help is given by the manufacturer on how to mount the CO_2 engine; in fact, no screws are provided when purchased. Here's my system. Buy six #1-64 slotted head, screws 1/4 inch long from a hobby store catering to the model railroad trade. Brass or steel will work equally well. Make up the plywood firewall and motor mount from the plans but do not drill screw holes as yet. The large hole and slots will allow you to slide the tank through the firewall which is glued to the fuselage framework. The motor is screwed to the mount with the two center screws and the outer four hold the mount to the firewall. Thrust changes are made by installing washers under appropriate screws between the mount and firewall, and the entire motor can be removed for servicing or replacement. Drill all screw holes in the mount and firewall with a sharpened piece of .031 diameter music wire which approximates the root diameter of the screw threads. Screw all screws into the plywood taking care to not strip out the wood "threads" that will be created. Remove the screws and apply Hot Stuff™ to each hole to make the "tapped" holes more permanent. Drill the outer four holes in the mount larger (about .070 inch diameter) to provide clearance for the screws' outside diameter. With a little care in use, nuts should not be necessary.

Vacuum formed parts

While working in the nose area, carve a soft balsa block into shape for the vacuum formed cowl. Scoop out the engine air inlet areas 1/4 inch deep and drill a hole in each so the vacuum will draw the plastic into them. Plastic, .015 thick, is just right to form with good mold fidelity and yet not so thin that it gets weak. Either styrene or CAB (cellulose acetate butyrate) will work well. Coat the form with several layers of well sanded balsa filler so the grain will not show in the final plastic cowl. After the plastic is formed over the mold, trim the air inlets only near the base of each, thus creating the effect of a sheet aluminum cowl. A small hole is needed for the engine shaft in the center, leaving everything else there for strength. When the excess is trimmed away from the outer edges, and no trace of a radius remains, cut a piece of 1/16 inch sheet balsa to just fit inside the cowl where it meets the firewall. Glue to the cowl with Ambroid. This sheet is now cut out to fit around the engine and its mount, providing a large glue area to attach the cowl as well as stiffening it. Vacuum-form the spinner in the same way.

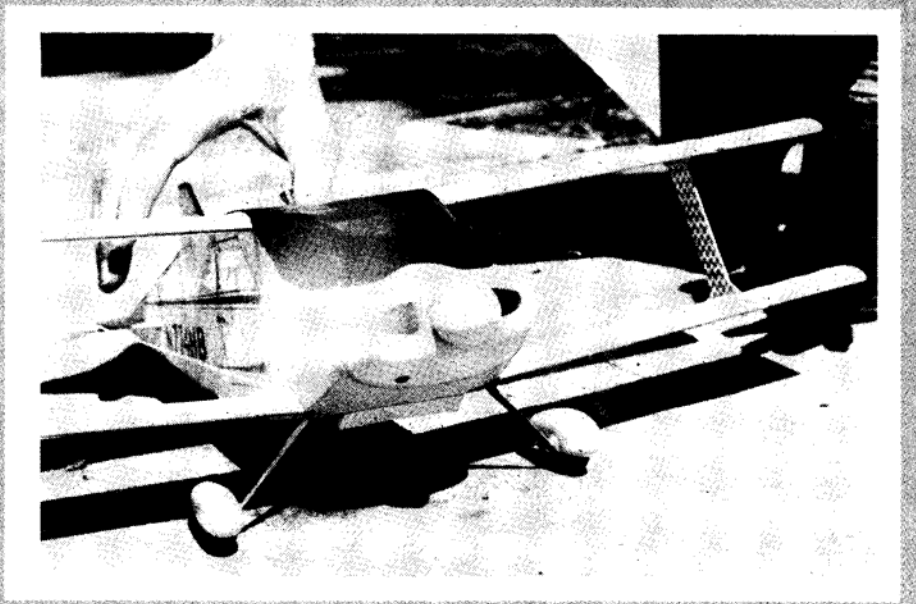
The stab and rudder, which are of standard design, should present no construction problems. When the glue is dry, file all the gussets into a radius with a rat tail file to preserve the graceful curves of this design. The wings also are straightforward. Leave plenty of excess at the root of the spars and trailing edges, as they will be inserted through the fuselage slots and spliced at the centerline after covering. The leading edges are cut off even with the first rib since they are butt joined to the fuselage.

Covering

Now it's time to cover all four wings and the tail pieces. Do not shrink tissue until final assembly is completed or warping is sure to occur. Install the copper wire hinges in the rudder and stab movable portions using Hot Stuff after covering has been completed.

Before covering the fuselage, there is some inside work to be done. I chose to not put a complete interior in mine for three reasons: 1) the CO_2 tank is there and spoils the effect no matter how good a job you do, 2) the plane is so small that a really top notch job would be difficult to do unless you are good at building ships in bottles, 3) such a small plane can ill afford *any* extra weight. The basics must be done, however, to avoid detracting from your appearance score. The window framing areas should be painted either white, black, or turquoise after careful study of the available color pictures. The dashboard is glued in next with photo copies of instruments stuck to it. The scuttle area is best made from black construction paper and glued in now. Refer to FLYING MODELS, Feb. '83, F/F column for a more detailed description of the procedure for installing the side windows. Tinting the CAB plastic will look realistic and help hide the fact that the interior is not there. Buy a package of RIT Forest Green fabric dye and mix the whole thing into a half gallon of warm water. When dissolved, soak the plastic in it until the desired shade is reached; then rinse and dry with a soft cloth. A word of caution here: the dye is not completely stable in ultra-violet rays, so make the color slightly darker than you want—the sun will fade it back to the optimum. Trim to size and glue to the side framing with Ambroid glue. Cover the sides first, followed by the bottom, then the top. The bottom will have to be covered wet to avoid wrinkles.

First item to assemble is the stab in its slot at the back of the fuselage. Glue in place permanently—flight adjustments can be made with the movable elevator portion. Next the rudders, lining them up at right angles to the stab (and fuselage of course). Using all this as a reference, slide the lower wings into their slots in the fuse and prop them to the right dihedral on your workbench using small blocks of wood. Finally, glue them in this position, and splice the spars and trailing edges with scraps of balsa at the centers. Cut a 2 inch wide piece of 1 inch thick styrofoam to fit across the fuse just behind the wings. Scoop out a pocket for a snug fit on the CO_2 tank and glue the foam to the fuse frame with small amounts of white glue which does not dissolve foam. Install the motor for the last time, carefully bending the tubing as shown on the plans. A gummed reinforcement is stuck on the underside of the covering where the tubing exits. I have tried all sorts of devilishly ingenious ways of disguising the fill pipe, all of which



Mounting the CO_2 motor required a little thought since the manufacturer gives no mounting instructions. The system devised allows precise thrust adjustments as well as easy removal for servicing or replacement.

proved to be almost inoperative when it came to actual flying. Finally I learned that, as in any competitive situation, reliability is the best design philosophy, and let it all hang out. You simply grab the filler, push as hard as you want to against it with the charger, and the job is done—all while the airplane is resting, ready to fly, on its wheels. Enough said.

The top wings go on last, saving the windshield/overhead plastic until all painting is completed. Poke the spars and trailing edges through the fuse slots; but before gluing everything fast, slit the tissue where the wing struts fit and slide them into place to help match the two wing dihedrals together. Now glue and splice the center as was done on the lower wing, only a bit tidier as all can be easily seen through the windows here. Remove the struts by gently springing the wings apart. Complete the landing gear legs and pants now. The legs must be made of a material that will stand a fantastic amount of shock and flex, so never use anything rigid; even wood will sooner or later fail. Instead, take a different approach: Scotch Magic tape. That's right, just bend it over, stick it to itself, and trim the back edge to shape. It will take paint beautifully and never come off. Very light too. The pants will require an extra piece of wire wrapped and soldered to the leg wire to keep the pants straight and strong. Epoxy them fast.

Finishing

If you decide to paint the airplane like the original, you will soon learn the true meaning of the word HIPER. But if you are already a "hyper-modeler" as most scale fliers are, give it a try. After all, there are only two colors!

Mask the windows so no paint can get on the outsides and stuff a few facial tissues inside the fuse to protect the interior too. Spot glue the cowl to the firewall using two dabs of rubber based adhesive such as Pliobond™. For masking, I used the movable rubber cement used by advertising layout people because of it's low "tack". Normal rubber cement simply tears the tissue when removing the masking. The right stuff is carried by most good art supply stores. Water-shrink all tissue and let dry. Now spray everything in sight with well thinned Aero Gloss Swift White dope using an air brush. Notice that I used no clear dope first. There is plenty of it in with the white to form a good covering, and why add more weight? Paint only one coat, which should be enough to make the already white tissue look almost opaque. I know the original had a high gloss finish, but if you put on that much paint, this airplane will become unflyable—a "shelf" model forever. Be satisfied with a sheen about like an eggshell. Paint the spinner, backplate, and wing struts separately while you are spraying with the airbrush. Now think of the whole thing as a blank, white canvas just waiting for an artist's painting.

I know of no substitute for lots and lots of careful masking to achieve the trim scheme on this aircraft. You will like the way the paint noted on the plan sprays and looks, resulting in a vivid contrasting color that seems to glow against the white background.

A very thin coat covers very well, too. I prefer enamel trim sprayed on a dope base, because if a mistake is made, it can be removed with enamel thinner on a "Q-tip", and there is no effect on the background dope. Study the plans and pictures to see how to mask for the trim colors. Use 8½ × 11 plain white typing paper, cutting the outlines and cementing them on the back. Do the wings and tail trim first, using the airbrush choked down to a narrow spray pattern to reduce overspray on unwanted areas. Remove the masking and do the fuse sides next, plus the landing gear. The numbers on the fuse were too small to spray reliably, so I sprayed an area of white tissue with the Turquoise. The numbers were then cut out with a razor blade and glued in place with thin white glue. Now for the pin-striping.

You will need several sizes of French curves and a small draftman's ruling pen. It would have been very nice to use a Rapidograph pen for the stripes, but the paint gums up the insides, so use the ruling pen which can be easily cleaned out. A little practice will soon show you how much paint to put in the pen to not blot and make the stripe wide at the beginning. Trace around various parts of the French curves, keeping about 1/16 inch from the previously sprayed trim. All trim is edged on both sides with pin stripes. Edge the front and back of the interplane struts with pin stripes before putting on the checkers. An easy mask can be made by cutting out every other square from a sheet of 1/8 inch graph paper. Rubber cement it to the strut and spray Turquoise. When dry, re-position the graph paper to form the checkerboard and spray again.

When you have finished all the painting, and have regained your composure once more, slide the struts into their places in the wings. After one last final check of wing alignment, fasten them for good with Hot Stuff. Since the windshield is still not in place, the last thing before buttoning it up is the rigging. The tail rigging is a simple, single loop presenting no problems. The wings require threading through in two sets of double holes shown on the plans. Drill two cross holes in the 1/16 diameter aluminum tube spreaders using a sharpened piece of .031 music wire. Plug the ends with a blob of glue and paint all silver. Thread the guy wires through all these holes and knot and Hot Stuff each. Resist the temptation to use a heavier monofilament for these wires. I chose .005 diameter stuff because it is stretchable in this small size and will give before it breaks the structure in the event of a mishap. Smaller thread means less drag too.

The last thing to do is the windshield. Actually, it can be formed anytime during the construction phase, I just haven't mentioned it until now. I sucked all three items, the cowl, spinner, and windshield/overhead, all on one sheet in a large vacuum former. Balsa blocks were used as a form similar to the cowl. When trimmed, soak the windshield in the green dye until it matches the side win-

The slow, steady flight characteristics coupled with the biplane bonus points make the *Hiperbipe* ideal for competition free flight scale.

CO_2 and electric motors are predicted to take over this event because their gradually diminishing power ideally suits the flight profile required. The usual tail stand of the glow engine is eliminated.

dows. When you're satisfied that all is complete, glue it in place with Ambroid glue applied with a hypo. Bolt the prop to the motor with the plywood disc behind it. The spinner, carefully cut to fit the prop, is glued to the disc with Pliobond so it can be removed when desired like the cowl. Now for flying.

Flight trim

The motors are set pretty well for the right power setting when they leave Mr. Brown's factory, but run it a few times to be sure. This is a deceptively large airplane for the singles, so you have to turn up the speed a bit to make it climb. The twin will pull it more comfortably but uses up gas faster. This is the reason I went to the 10cc tank; you can crank up the speed or use a twin and not run out of CO_2 too quickly.

I will discuss two methods of flying this airplane, one for FAC and the other for AMA competition. FAC is the least difficult, since only duration is important and hand launch is always used. The idea is to trim in a similar manner to a rubber powered ship, with a spiraling climb and circling glide while you tweak this and that, noting improvements in time with a stopwatch. When you get to the point where everything you try results in *less* time, you know you're there. My *Hiperbipe* was not torque sensitive and therefore required no compensating thrust offset to the side. Only the rudder needed to be turned to make it fly docilely in either right or left circles. A very forgiving design.

The AMA Gas scale event is a different ball game. Forget about that maximum duration you've been used to and try to make the airplane fly like a real one. The rules say take-off, flight and landing approach should be "realistic and true-to-parent-aircraft" to receive maximum points. Touch-down is fortunately not scored. You can get a possible 30 points for each, which is multiplied by five and added to the scale score. Even if your flight, by some miracle, was judged to be perfect, your final score would be 300, compared with the maximum scale score possible of 450. This looks like the emphasis is tipped 20% in favor of the scale judging part--you know where to expend the most effort don't you?

What makes a model look like the real thing in flight? Go over to your local general aviation field and spend an afternoon watching the planes coming and going. Take movies if you have an outfit, for later study at home. Notice how much less the power to weight ratio is than that of most models. The *Hiperbipe* is a fairly high performance aircraft, but still does not take off and climb like even a well-trimmed rubber powered model. They need a fairly long take-off run and climb out at a very shallow angle. There is no stall when the power is cut for landing approach which is smooth, steady, and shallow-angled as well. Accustom your eye to what this flight looks like, then go get your model and try to trim it to duplicate their attitude as closely as you can. Your wheels must track dead straight and lots of downthrust will be needed to make up for the lack of turn required for that long straight take-off. Once you get the ship to take off with a run of say 30 feet or so, concentrate on the flight itself. You should do this testing in the less windy part of the day. There is absolutely no need for a flight of more than 30 or 40 seconds. A two minute one will not only risk losing the airplane, but carry it far from the judges, making it harder to see the exact flight characteristics. Stay as close as you can to the judges for the whole flight. A tiny spec in the sky can't be judged for transition, approach, or much of anything.

A final comment

There is a good reason why CO_2 and electric power are predicted to take over this event. The basic run pattern of a glow engine is inverted from what is needed for this event. It begins with the proper power setting and gets faster until the fuel runs out, invariably resulting in some amount of stall. It's bound to be a point loser even if you reduce the usual tail stand to a slight dip. CO_2 engines begin with maximum power for take-off and gradually diminish in a smooth curve until landing. I had one lucky flight at the Springfield Nats where the *Hiperbipe* made a runway landing with the prop still ticking over, gradually rolling to a stop. Very realistic.

I hope you will try a gas scale entry of this or any other type at next year's Nats. See you on the flight line! ☙

It's a refreshing change to see an "up to the minute" design in an area dominated by "Golden Age" subjects. The broad boxy fuselage also builds easily as do the wings with their constant chord.