

# Jolly Roger

*A .40 size mid-wing designed to challenge the .60 powered ships. Combining the looks of a Goodyear Racer with wood-and-foam construction, the Jolly Roger may just pirate away some of the glory of the larger machines.*

*Text and photographs by Stan Hines*

I hate models — those that don't resemble full scale planes. But, I like to try new ideas or combinations of ideas. This could be what makes someone feel he must design a new plane even though there are so many excellent ones already available.

After watching some superb flying by experts with .60 powered ships, some of us debated the possibility of designing and building a model to challenge their performance but powered with a .40. To do this would require a super light, yet strong design and a light, but powerful engine. I had a new ST G21- 40 so decided to try my hand at the project. The criteria for this plane would include: thrust and drag forces close together, so power is not wasted; parasitic drag reduced by fillets; smooth finish and wing tip plates to reduce tip vortex; control surfaces large enough to provide positive control at all times; and, finally, all this put together in a package that has both eye appeal and durability.

It was decided that a mid-wing would give the desired force alignment requiring the least compensation from level to inverted flight. A nearly symmetrical airfoil would also seem best and good stunt performance calls for a sturdy, high lift wing. For overall eye appeal a tapered, swept leading edge profile terminating in tip plates sounded interesting. To keep weight down a tail dragger style would help.

Jolly Roger is, therefore, an experiment combining the looks of a Goodyear racer with a wood-and-foam construction. With an MRC radio, four servos and a 10 oz. tank the dry weight is just 4½ pounds. Before we get to the construction let me tell you about the performance you can look forward to if you build her. Perhaps the best way to describe it is to take you along on the test flight.

Preparations were completed by simply adjusting all surfaces to neutral. The Center of Gravity was exactly where my calculations showed it should be by locating the radio gear properly. On the plans it will, at first glance, seem to some to be too far back, but remember the swept back leading edge? Because the engine was new and muffled, it had to be set very rich, use a 10/5 prop, and idle fast. So, we were not able to anticipate anything like the full power output of which this engine is capable.

As we taxi out of the pit area excellent ground handling is experienced even with the grass slightly longer than usual. Let's try some high speed, simulated, take-off runs to see which way she breaks. Tail draggers have a tendency to swing hard just as the throttle is opened and this one is no exception. There she goes, a hard break right — lets abort! Back down the field for another another run and this time we will hold in a little left rudder until she gets going good. Beautiful, right down the middle so everything is "GO".

Lift-off, and just a touch of right aileron and we have a very realistic, low angle, climb out. After gaining some altitude we roll in some right trim, about the width of the tab, throttled back a little and we have our first "hands-off" flight.

Unbelievable? Not at all. All the planning, calculations and careful construction were showing their worth. However, having a bird that

flies doesn't make it a winner, so let's see how she reacts to the controls. Easy turns had already been made and one characteristic was already evident: Aileron control was extremely precise, but not "touchy." We try a large loop, then a tight one. Almost no correction is required in either one to get a nice round one and no tendency to snap roll is evidenced. A slight amount of corkscrew will be worked out between rudder and aileron trim adjustments. The new engine is losing a few rpm's indicating it is hot, so let's shoot a landing and cool it off.

Throttled back to about half, we swing wide for our approach run over the tall hay field. Looks like we are a little high so chop some more throttle and drop the nose — Oops, dead stick. Still 50 yards short of the field the motor quit cold! Well, here's where we find out about the glide and several other characteristics. We start to flare out about 10 feet above the tops and hope for a relatively soft set down in the uncut hay. Really stretching the glide now, it looks like we may egen make the strip. Easy now, just a little more and we are over the end of the field. Drop the nose a bit, flare out again, watch that wing, and - - - touchdown! She was back on the grass as smooth as could be.

More of our design criteria had been checked out by this event. At slow flight, just above stall, all controls had functioned perfectly, even the ailerons. After a few more flights I was to apply the term "crisp" to her controls and I have had no reason to change since. Frankly, I have never flown a plane that seemed to have so little lag in its response to stick control. Almost no anticipation is required and no counter control is needed.

By now I hope you are anxious to get started on building one just like it. Construction is basically a form of laminations of foam and either balsa or plywood, or both. I use white glue on the large surfaces and epoxy on all other bonds, especially where there is likely to be high stress, such as the motor mount, landing gear, stabilizer and wing center joint.

The fuselage sides and bottom are simple to construct since they are built up flat. Pre-cut the 1/16" balsa sides and the 1/8" ply doublers from the plan. Lay out the bottom on 1/16" sheet to cover from the landing gear to the tail a little oversize from the top view plan. The excess will be trimmed off later, after assembly. The 1/4" foam sheet is easily cut with a sharp knife to the same size as the side. If anything it can be slightly undersize. The three parts of each side are easily aligned by the straight top edge. Liberally apply glue to the balsa and plywood doublers and sandwich the foam in between. If white glue is used you will find it has a tendency to cause the balsa to curl, but if you lightly wipe the other side with a damp sponge, that moisture will compensate for the glue and a nice flat sandwich can be had. I weight these parts down with magazines, books, or anything to provide even pressure until the glue sets. If you can, it is a good idea to let them dry overnight. Of course, if you are a speed demon you can use epoxy just as well, but at somewhat more expense.



*The Jolly Roger is an enjoyable and rewarding experience with a scratch-built, high performance ship.*

The bottom and top foam pieces are cut to fit **inside**, so they should be measured 5/8" narrower than the outside dimensions of the fuselage. Center the bottom foam piece on the bottom balsa sheet, and glue and press as for the sides. The top foam piece is not laminated to balsa and is cut to fit aft of the cockpit. All formers should be cut out and where indicated on the plan, laminated either to balsa or ply. Only formers E1 and F1 are not laminated.

When everything is thoroughly dry, lightly sand the edges of the formers to be sure that they are square and will make a good glue joint. Assembly of the fuselage sides with the firewall B, and formers C and D may be done upside down on the plan, using epoxy this time. Reinforcing strips may also be added at the firewall. 'Glad-Wrap' over the plans will prevent sticking. When this has set properly, the tail can be pulled together so they meet at the centerline, then epoxied. As soon as it can be handled, the fuselage may be turned over and the tail-post added. Note that the tail

wheel wire and tube were previously attached. If you have not left enough clearance the foam can be removed with a few gentle strokes of a hacksaw blade held in the fingers.

At this point, check for squareness which should be no problem if you have been careful. The tapered, foam insert aft of D should be added followed by the bottom piece aft of the landing gear. Glue the doubler at C in place so that the landing gear fits snugly, but do not epoxy the gear in just yet or it will make later work awkward. The motor mounts should be generously epoxied to the firewall and the side doublers. This construction is light, strong, and economical but, of course, commercial motor mounts can also be used. In this case the notches would not be required in the firewall.

The vertical fin and horizontal stabs are also foam laminates. These can be made by laying out the outlines directly on the balsa sheet, cutting the foam core, and then adding the framing. The top balsa sheet is then added, and the whole thing pressed like the

earlier components. When dry, trim to the frame and then shape the leading edges as shown. These will be the lightest, yet sturdiest tail surfaces you have ever seen and they absolutely will not flutter or warp.

The horizontal stab is mounted first, making sure that it is perpendicular to the tail-post. The vertical fin, which was sub-assembled minus the tail-post section is now mounted over the post and on top of the horizontal stab. Using this construction of a one piece, hardwood tail-post from the fuselage into the fin will prevent damage from noseovers. Use plenty of epoxy here. After former G has been installed, the area between the horizontal stab and vertical fin should be filled in with scrap balsa blocks. I like to rough carve them to shape before finally gluing them in place. Formers D2 and D3 should have been laminated to foam and may, along with E and F be glued in place. The stringer construction is now installed to complete the parts aft of the cockpit. For the Goodyear type appearance I covered this section with Silkspan, but it could just as well have been covered with sheet balsa if you prefer.

The bottom, forward of the landing gear, is filled in with scrap foam block and rounded to the shape indicated by the formers. This is then covered with 1/16" sheet balsa up to the nose block. The nose block is made up of 1/4" sheet laminated and epoxied which is then sanded to the desired final shape. You will find some alterations are necessary later, when the engine is installed, to clear the throttle.

The "deck" forward of the cockpit is made of one piece of 1/16" x 6" balsa sheet over the semi-circular formers. A stiff piece of paper should be used to make a template. The cockpit cut-out is laid out and cut before bending over the formers. Use 'Glad-Wrap' over the lower fuselage and pin the stringers and formers to it for a perfect fit. When this section can be removed, place a 1/16" doubler inside at the cockpit area. This gives that area strength when the wing cut-out removes the stringer. Also, the canopy adds some strength too.

Now the landing gear may be installed using lots of epoxy. Be sure to check for a level stance before the glue sets. You can now trial mount the engine and locate all the access holes such as: plug, exhaust fuel fill and overflow, etc. A drain was added at the firewall so that spilled fuel would not collect in the nose. After all openings are made, the cylinder head cooling air baffles are added inside the top in order to direct air into the vertical slot. The entire area inside, and in front of the firewall, should be epoxied or coated with white glue rubbed in with a finger tip to fuel proof this area. Further fuel proofing is needed for the exposed foam

core of the sides. Cover this from the nose to the wing cut-out with 1/32" balsa strips.

The entire fuselage should then be sanded and doped twice before filling with a softened latex filler such as DAP. Thinned to about the consistency of white glue and brushed on well, it makes a filler that is easily sanded to a smooth finish. Fillets of the same material in its original state are made with the fingers. Gobs of this are pressed in place roughly the way you want and allowed to stand for 5 to 10 minutes. You can then wet a finger and mold it into a nearly perfect fillet that will require very little sanding to finish. I find that trying to sand a small radius, inside corner, very difficult without undercutting the adjacent surfaces. So, a little time spent here with a wet finger is really a great time saver. If you goof, just smooth it down and repeat the process.

When the filler is completely dry, it should be sanded down, except the fillets, to the wood. Do not cut through the doped wood surface, but remove all the patches of filler so your finish will not be wavy. Give it one more coat of dope to seal the filler and then finish sand with 200 - 400 wet/dry paper, slightly dampened, but not wet. When satisfied with the finish, spray or brush on the final coats of color. I used a metal flake auto spray, but this must age some before it becomes fuel proof. Now add the canopy.

This design is slightly unusual in that the forward half of the canopy comes off with the "deck" and the rear half stays on the fuselage. To do this a 14" canopy is cut down as shown on the plan to 10" with a 1/2" overlap at the joint. This is a neat arrangement which allows full access to everything from the engine to the radio/servo area, (with the wing removed). I have built several planes where one or more components, usually the fuel tank, was buried and, sooner or later, I had to cut the plane apart for some repair. There are also planes that are time consuming to assemble; Jolly Roger uses only 2 wing bolts and one "deck" screw for fast, accurate, field set-up. This is made possible through the use of dowels for alignment. The theory behind this method of attachment fortunately has not been crash tested, but should the nylon bolts shear, the deck being fastened to the wing should come off without damage.

Wing construction could be simplified by use of the conventional foam wing. I experimented with a method to make the wing lighter and stronger. In the process I discovered some other advantages, too. Each wing panel is made up of two flat bottom cores of foam. This allows one to build the top half directly over the plan on a flat

surface assuring you of a warp free wing. When the top halves are glued to the spars it is turned over, cradled in the foam scrap left from cutting the cores, and the bottom halves of the foam core are glued to the other side of the spars. Don't forget to add the plywood inserts first, of course.

When completely dry, this core is strong enough to be covered with 1/16" sheet balsa without fear of warping. Overlap the leading edges as shown and then sand to the final, rounded shape. Be sure to use epoxy at the centerline joint and use tape as well. It will all be inside the fuselage, so don't worry about an absolutely smooth finish at this area. The ailerons are solid, hard, sheet stock shaped to a streamlined form as shown.

The wing mounting brackets are positioned in the fuselage, bolted and epoxied. To accurately locate the bolt holes in the wing ply insert, install the nylon bolts up through the brackets so they protrude slightly above the wing cut-out. Position the wing carefully and press down lightly to let the bolt tips mark the underside of the wing. Now you have the exact location for drilling the holes. The dowel in the leading edge is now located by installing the wing cushion tape and lightly bolting the wing in place. Holding the wing down firmly in the cushion, mark the dowel position through the hole in the former. Drill the hole and epoxy the dowel well because this one will carry much of the stress between the wing and the fuselage. Finish the wing by adding the tip plates, filler, and color.

Rig with your favorite radio and then head for your favorite field for what I predict will be an enjoyable and rewarding experience with a scratch-built, performance ship.

The day we made our flight tests there were the usual number of club members watching. Their reactions were almost identical. Words like "realistic," "great," "smooth" and "beautiful" were heard. I predict you will say the same about your model, as well.

**From  
RCModeler  
July 1974**