

Two views of the finished model in the water, showing the clean lines and the pilot, who contributes greatly to the general appearance. Finish is gloss black and gold trim, after the JPS Formula I racing car.

COBRA 21
Designed By : David Thomas

LENGTH

28 Inches

BEAM

8.6 Inches

HULL FORM

Moderate Vee

REC. ENGINE SIZE

Electric or .09-.21 cu. in.

Glow Engine

REC. NO. OF CHANNELS

1 or 2

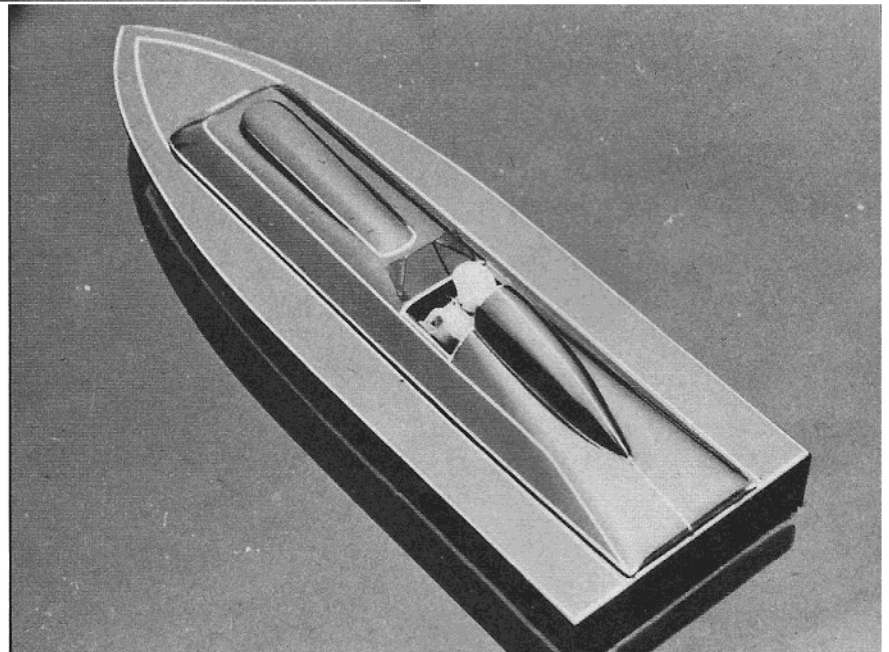
CONTROL FUNCTIONS

Rudder (optional speed

control or throttle)

BASIC MATERIALS USED IN CONSTRUCTION

Balsa & Plywood



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It has been evident for some time that there is a renewed interest in electric boats, and especially models capable of high speeds. Among the arguments in favor of such a craft are: silent running, easy starting, lack of mess, and reasonable

A unique 28" plywood boat that is quick to build and fast in the water. Can be set-up with electric or glow engine.

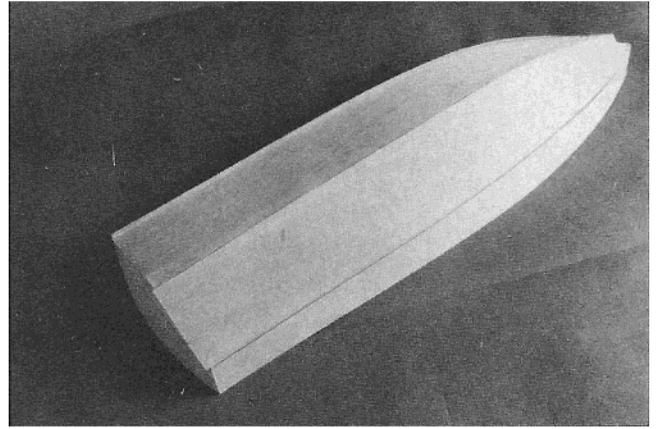
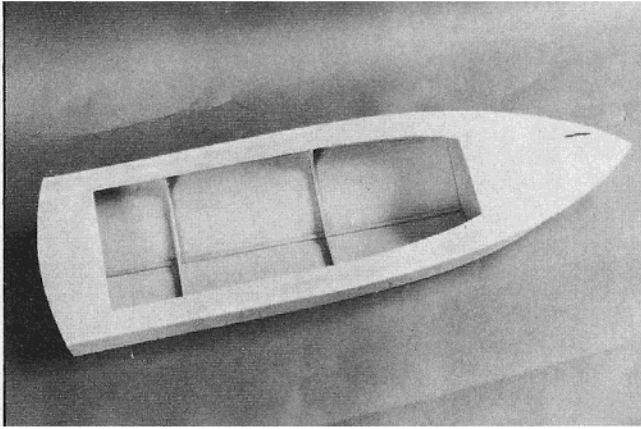
size. With all this criteria in mind, I looked around for the most powerful electric motor available on the market, and came up with the Kroker Sea Ram, a double-ended motor, capable of handling up to 500 watts. At about 80% efficiency, this gives an output, at the propeller, of some 400 watts, or just over one half horsepower, which is very good for an electric motor. Using 4D size nicad batteries, I figured on a running time of about 6 minutes at full speed, and some 10 minutes at half speed — but with the possibility of rapid recharging from two car batteries in 20 minutes at 10 amps. This would mean that the average modeler would be able to have at least three good runs in an afternoon's boating, and probably more.

Having decided on the power requirements, I next got down to thinking about the hull itself. This needed to be big enough to accept the motor, 12

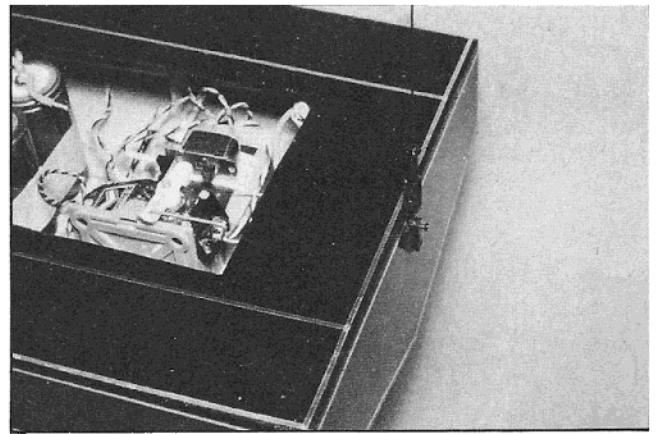
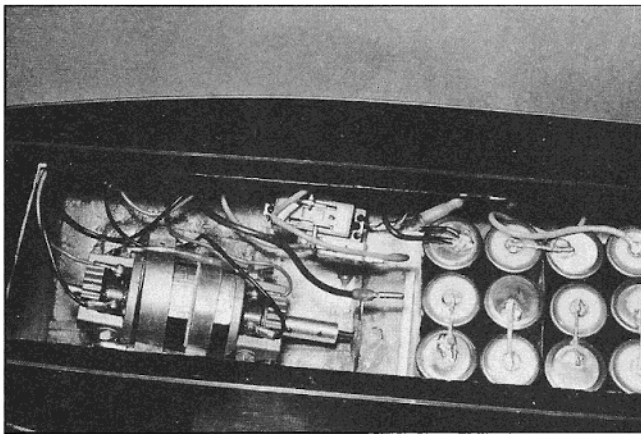
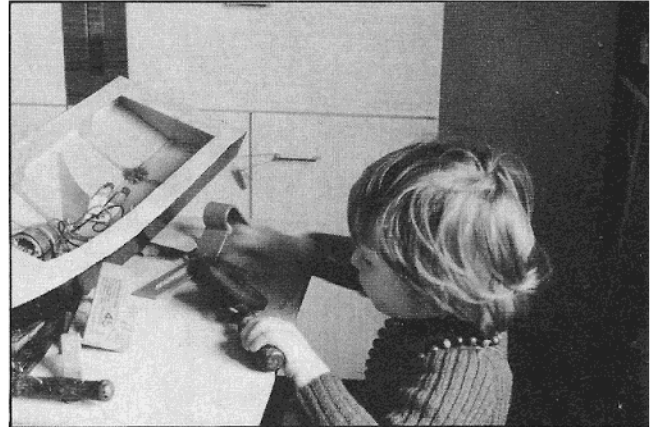
nicads and the radio gear, without being too cramped, while at the same time remaining a reasonable size for easy transportation and speed. The design finally came out at 8½" x 28", which is a decent size whichever way you look at it. The hull form is a moderate evolutive V, which gives smooth running if the water surface is disturbed, while the flattened V towards the stern gives good turning characteristics. The superstructure is unashamedly traditional speed boat, but looks quite pleasing, especially if provided with a pilot, and is easy to make.

Wanting a model that is easily reproducible, I chose to use plywood for the construction, together with epoxy glue and simple, easy to find fittings, so that anyone who feels like having a go at building a fast model boat will be able to do so without any problems.

One final word before we look at the



ABOVE: Basic frame complete, showing cut-outs in formers to take installation. **ABOVE RIGHT:** Underneath of unfinished hull, showing side-skin overhang, ready to take glass-fibre or epoxy fillets to form spray rails. **RIGHT:** Even a kid can build it? The designer's 3 year old son working(?) on the prototype. **BELOW:** General view of motor and nicad layout. The servo which actuated the micro-switches can be seen top center. The switches are fixed to the servo case with servo tape, and this works fine. **BELOW RIGHT:** Radio installation and aerial fixing.



construction. This model was designed around the Sea Ram engine and equipped with it; the boat is very fast. Other engines could be used, but if they are, don't expect to get the same sort of performance from them — the Sea Ram is unique in its power output. It would no doubt be possible to fit the model with a glow engine up to .21 cu. in., and anyone wishing to do so should not hesitate. I have not had time to do so myself with the prototype, but have no doubt at all that equipped in this way, the model would remain stable and fast. If a glow engine is used, the inside of the hull must be thoroughly fuel proofed.

CONSTRUCTION

Having studied the plan, to make sure that you understand just how everything goes together, start by making a kit of the basic parts from good quality

plywood. Trace out or mark out, by pricking through the plan with a pin, the deck (either in one piece or in two halves), formers B1 through B5 and part K1. Now pin the deck face down on a flat building board, and mark accurately the positions of the formers. Using a small set-square — you can make one from a scrap of plywood — glue formers B2 through B5 in place on the underside of the deck, using the set-square to make very sure that they are vertical. Glue part K1 and former B1 into position, and then let the entire assembly dry. When it is quite dry, the 3/16" square hardwood keel stringer can be glued into place, again using a fairly fast epoxy glue. The stringer can be held in position while the glue is drying by carefully tapping modeling pins through it into the formers. The pins should be removed

when the glue is dry. Next, the chine stringers are glued in place, and then the under-deck longerons. Leave to dry and, then, using a long flat piece of wood with some medium grade sandpaper contact-glued to it, chamfer all the stringers so that when the skins are added, they will sit flat on the stringers. This is in order to provide a good gluing surface. Take time over this operation, and do it properly; the reward is an accurate and strong hull.

Now take some thick paper — Kraft, for example — and make a pair of templates for the bottom skins. This is easily done by laying the paper in place over one side of the bottom of the hull, holding it with a couple of pins so it won't move, and then creasing it along the chine stringer and the keel. When lifted

text to page 142

off, it can be cut with scissors along the crease marks. Check when it is cut out that it is, in fact, the right size. When the template is right, use it to mark out the skin on the sheet of 1/16" plywood. A good idea here is to make the skin slightly larger on the chine side, in case there is any error. (Don't do this on the keel side, because it will be quite difficult to get rid of the excess in that area.) When the skin has been cut out — you can use a sharp modeling knife for this thickness of plywood — put it in place and check that it is the right size. If all is well, it can now be glued to the hull, using a slow setting epoxy glue, to allow you time to get it in just the right place, and to hold it down. This latter can be done by raiding your wife's clothes basket for all the clothespins available. Use these to hold the skin flat on the keel and chine stringer. In addition, it is a good idea to drive a couple of pins through the skin over each former, to make sure that it sits tightly on them. Do the same with the second bottom skin, but this time you will have to use pins to hold it flat on the keel. Leave the hull assembly for a good 24 hours to let the epoxy cure completely.

The next job, with the hull still pinned to the building board, is to cut away any excess skin along the chine stringer, using a modeling knife and then the sandpaper, until the edge of the skin is perfectly flush with the stringer. Now, remove the hull from the building board.

At this stage, it is best to fit the motor and the propeller shaft, since without the side-skins, the horizontal alignment of the two can be checked more easily. I have not shown any particular engine mount, since there are so many. I used a polyester molding I made myself, but you could also use two shaped blocks of wood, or metal plates screwed to the mounting holes in the motor, bent to suit the hull floor, and epoxied in place. The important thing is to get the end of the motor as close to the front former of the motor compartment as possible, to keep the Center of Gravity in the right place. The prop shaft can be either a traditional rigid one, or a small diameter flexible drive — both are widely available at good hobby shops. If you are using the Sea Ram, the prop should not exceed 1.6" in diameter, and should have a fairly fine pitch. Drill the hole in the hull floor for the prop shaft tube, fit the tube, couple the shaft up to the engine, and then, with the hull suitably supported, move the whole lot around until the tip of the upper propeller blade just clears the bottom of the hull by about 3/32". At the same time, the motor and prop shafts should be in perfect alignment. This is extremely important, because any error in alignment will mean a loss of power. My own favorite trick is to get everything about right, and then couple one single nicad cell to the motor. At this very low voltage the motor will turn over very

slowly (depending on the motor used you may need two cells). Now move it all around until you get a maximum of revs from the motor with a minimum of noise from the coupling. This is the correct position. Again, my own favorite trick is now to Zap the motor mount and prop tube into place. Then glue the motor mount and drive shaft with liberal quantities of slow setting epoxy, and leave it for 24 hours. (Before applying the epoxy, check again with the nicad, to make sure it is still in line — it is much easier to move it when it is only lightly Zapped than when it is solidly glued in place! I know, I've done it!)

The next job is to make templates for the side skins; cut them out, and fit them in place, using pins to hold them. However, this time the bottom edge of each skin should be cut 1/4" longer than necessary. When they are securely glued in place, this projecting edge should be reduced with sandpaper to exactly 3/16" from the stern to B2, and then reduced progressively to zero at the bow. Then, using some epoxy mixed with micro-balloons, make a smooth fillet in the angle between the side and bottom skin, as shown on the plan. This provides a very efficient high-lift spray rail. A good trick to get this smooth is to run a length of Scotch Tape along the fillet while it is still wet, and leave it there until all the glue has set. Then the remaining irregularities can be removed with fine sandpaper. Finally, the bow block is made from balsa blocks and faired into the line of the hull with a small plane and sandpaper.

The rudder assembly can be a commercial one, or you can make up your own with some .032 brass sheet, music wire and a brass tube. The turn fin is shown, but did not prove necessary on my model. If an i.c. engine is used, the boat will be much lighter, and it may be necessary. The water cooling pick-up tube is optional — the Sea Ram is provided with water cooling facility; other electric motors generally don't have it.

At this point, a stand is very useful for holding the model still while you are working on it, so why not make one? The radio installation is not at all critical, except that if an electric motor is used, the receiver and antenna should be mounted as far towards the rear of the hull as possible. In the prototype, no form of noise suppression was fitted to the Sea Ram, and at no time was any interference experienced, though this may not necessarily be the case with other electric motors. A couple of TV chokes should handle any difficulties in this direction.

The superstructure is made from 1/4" balsa sheet and three 1/16" plywood formers (T1, T2, & T3) and is very simple to construct. Once made, it is carved down to the approximate shape and then sanded down with sandpaper to the final outline. Do not omit the air scoop,

and do not put a floor in the cockpit — this allows a flow of air through the hull, cooling both motor and nicads.

Motor control may be achieved either by using micro-switches actuated by a servo, or by using a commercial electronic speed controller. However, if you are using the Sea Ram, be careful. This motor can draw up to 40 amps on a big prop, so make sure that the controller you use can handle this current. The only suitable one I know of is the controller made by Kroker Engineering. For most other electric motors, the Astro Flight controller will handle 20 amps with ease.

If micro-switches are used with the Sea Ram (they are available from Kroker Engineering and I used them in the prototype), then three should be used, to give Off — Series — Parallel switching. This is because if the motor is switched directly from Off to Parallel, the model will just sit in the water with the prop ventilating. A circuit is included on the plan to show how the switching should be wired up, using cams driven by a servo.

A word of warning concerning electric motors: with a new motor, it is always a good idea to run it in, using a high capacity battery — such as the car battery — for about an hour without any load, but at about 75% of the rated voltage. This is to allow the brushes to bed themselves in properly. If you run a brand new motor directly on heavy load, any high spots on the brushes will burn grooves in the commutator, thus reducing the efficiency and power output of the motor.

All that remains now is to finish the model. I brushed three coats of Hobby epoxy Formula 2 onto the model, leaving for 48 hours each time, and rubbing down with 400 grade wet-and-dry emery paper, used with a mild soap solution. This gives an incredibly smooth finish. Any good quality paint can be used, three or four coats, rubbed down with 600 grade between coats; the last coat rubbed with 1000 grade (if you can find it!) and then finished off with silicone wax car polish.

As far as charging the nicads are concerned, anyone not too sure about this can refer to Model Power Boating in the the October 1977 issue of RCM where I have plenty of details. Alternately, your model shop should be able to give you any information you require.

RUNNING:

Once everything is charged-up and ready, off you go to the local lake to try the boat out. Before doing anything else, check that all radio functions work correctly, and that when you give a right rudder command, the rudder, in fact, turns the boat to the right! Place the boat in the water with the bow pointing out towards the center of the lake, make sure there are no obstructions in the

way, and let it go. If the Center of Gravity is in the right place, you will find that at high speed the hull will not slam. If it does so, then the Center of Gravity is too far aft. One cure for this is to fit high lift spray rails to the hull bottom from B3 aft to the transom. These will have the effect of lifting the stern at high speed, thus eliminating the slamming. If your model is very light, it may skid slightly in tight turns — if this is the case, fit the turn fin. After a couple of minutes running, bring the boat in, take off the cover, and check that the motor is not running too hot, and that there is no water in the hull (water and electrics just don't mix!)

And there it is — I hope that anyone building this model has as much fun with it as I have had with the prototype — and if anyone fits an i.c. engine, do write and let us all know how you got on. Happy boating! □

RCModeler

Sep. 1978