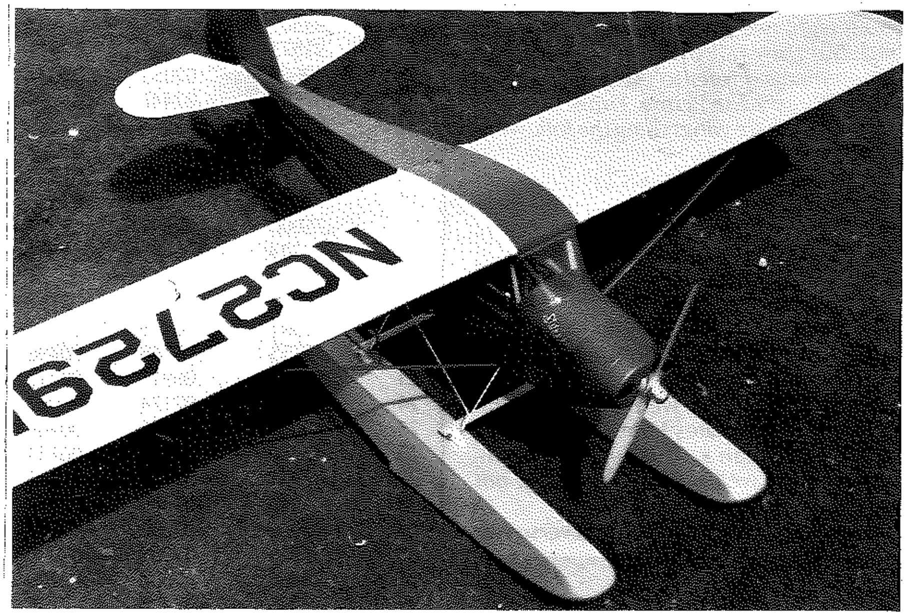

By BOB BENJAMIN . . . Make your next project an electric floatplane! Although designed for the Astro Flight Porterfield, these floats can be adapted to any model of similar size.

At the end of my recent product review on the Astro Flight Porterfield, I mentioned an interest in putting my airplane on floats, and promised to get a performance report to you if things worked out. As you can see, they worked extremely well! Because a very accessible small lake happens to be located about a ten-minute drive from my home, the thought of doing a float conversion on the Porterfield occurred as soon as I realized what a great sport scale airplane it is. Since the lake is literally in the shadow of the Washington State Capitol and is very popular with picnickers, joggers and a flock of tame ducks and geese, it was obvious that only the quietest, most unobtrusive models would be welcome. Based in part on the success of the Porterfield, my friends and I have standing permission from the Capitol Grounds and Buildings office to use the area. I doubt seriously that this would have happened had we shown up with the usual noisy airplanes.

Aside from the obvious public relations value inherent in flying electric, there is another concern I'd like to address here. As those of you who already fly electric are no doubt aware, there is still a strong preconception in the minds of many of our fellow modelers that electric airplanes are underpowered, overweight, and aren't practical. I have chosen to spotlight this scale electric floatplane as proof that the aforementioned notions need not be true.

We have all seen electric airplanes that were disappointing in performance. As has been mentioned in the several articles on electric flight that I have written for *Model Builder* in the recent past, I am convinced that using top quality equipment is essential to getting good performance in electric flying. Inexpensive motors, bargain wiring and connectors, any old prop, and the first battery pack that comes to hand just won't cut it. I'll be mentioning specific items of equipment with which I have had good results, but be aware, these are seldom the least expensive options available! I feel strongly that as long as modelers in general perceive that electric flight must for some reason cost less than "gas," they will continue to be disappointed with the performance of their airplanes. Quality doesn't come cheaply. However, if we are willing to pay for them, current state-of-the-art electric flight systems can be made to perform on a par with the "wet power" models with which they are compared.

Shortly after completing the evaluation of the Astro Porterfield for *Model Builder*, I replaced the kit wing with a custom-built one incorporating scale dihedral and rib spacing, plus ailerons, in order to improve scale fidelity for static judging, and to broaden the flight performance envelope. Power is an Astro Cobalt geared 25 motor, controlled by an Astro Model 200 proportional throttle. I have replaced the Sanyo 1200 SCR cells with SR 1250 Magnums, and the Tamiya connectors supplied with the system have been removed and Sermos connectors installed in their place. The radio remains the super-reliable Airtronics FM Vanguard. The use of 14 SR Magnum cells results in a weight reduction of ten ounces (this translates to over two ounces per square foot reduction in the wing loading), and the Sermos connectors provided a gain of several hundred rpm at the prop. The airplane as described (on wheels) weighs five pounds, eight ounces; this works out to a wing loading of 18.75 ounces per square foot. Using a thinned and undercambered Zinger 13/6-10 prop, scale taxi maneuvers and takeoffs from grass are effortless, and flights average between six and eight minutes. Aerobatics beyond the capability of the full scale aircraft (loops from level flight, Cuban eights, inverted flight) are easy, and the model must be flown at half throttle or less to perform at a believable scale speed.

The airplane as described above was put onto the floats shown in the photos and on the drawings. Total weight ready to float rose to seven pounds, two ounces. The airplane comes onto the step within thirty to forty feet, and on all but glassy smooth water is off cleanly within fifty to one hundred feet after planing. As is the case with the wheeled configuration, best scale cruising speed is achieved at around half throttle. The overall impression is one of convincingly scale-like operation. Though I have chosen not to do "unusual attitude" aerobatics in the float configuration, I have no doubt that the airplane would handle them. The Porterfield has also been flown off water with the heavier SCR battery pack; the extra performance inherent in these cells, easily makes up for the added weight.

Editorial considerations dictate that this be a discussion of the practicality of flying electric airplanes on floats, and of the specifics of the Astro Porterfield conversion. There isn't room to discuss float flying technique in general. I will suggest that if you aren't an accomplished float pilot you might want to take a look at the excellent three part series Ed Westwood recently published on float flying in *Model Aviation*. There have been several good articles on float planes in *Model Builder*, and our own Mitch Poling has made many references to electric float flying in his Electric Power column. A point of interest is that Mitch favors flat-bottomed floats for electric models. Suction generated between the water and the lower portion of the float body is one factor that can prevent successful takeoffs. A V-bottom appears to increase the likelihood that floats will not break free easily, while a flat bottom often makes takeoffs easier. A V-bottom in full-scale use allows the float to ride much more smoothly in rough water and is necessary to prevent unacceptable transfer of shocks to the airplane and its passengers;

the configuration has the same effect in model operations in addition to being desirable to us because it looks "scale." The Astro 25-powered Porterfield has the power to handle the "semi-scale" floats presented with no trouble.

The treatment of the lower hull edge, or chine, is another source of potential trouble with regard to hydrodynamic suction; the sharpest edge you can get between the float bottom and sides is what you want. A rounded corner is real trouble. A commercial line of plastic floats introduced many years ago with such a round chine worked very poorly and I suspect contributed in large part to the misconception that a floatplane requires a big increase in power over its wheeled counterpart to be able to get off the water.

The angle between the fore and aft underbody of the float, referred to as the rotation angle, is very important. This design uses an angle of twelve degrees, as recommended by Mitch, the idea being to allow the airplane greater freedom to rotate back on the floats when in the planing mode in order to place the wing at a sufficiently positive angle to insure enough lift to break free of the water. As electric airplanes may not have as much reserve power as their "wet power" counterparts, which commonly use an angle on the order of seven degrees, I have incorporated the greater angle. The depth of the step has also been increased somewhat over what you may be used to seeing, in order to help reduce suction on the after bottom surface. I mention these design concerns in order to provide you some guidelines in the event you choose to modify the float design I have provided. There is of course no reason to think that these particular floats must be used only on the Astro Porterfield. I see no reason that they should not work well with virtually any two-inch scale lightplane model or similar size sport models, regardless of power source.

Two interesting observations have been made that may be of value to other electric float modelers. As you may recall from the original Porterfield article, I mentioned having left the rear portion of the left main cabin window open to provide cooling air exit area and for access to switches and charging connections which were mounted inside for anticipated protection from spray. It happens in practice that the cooling air exiting through the open window completely prevents water from entering the cabin. I have *never* found any evidence of water inside the cabin.

I will mention at this point what may already be obvious to those of you who fly electric: the electronic throttle and motor battery cannot be waterproofed, although the rest of the airborne system may be if you so choose. The need to air cool the power system demands an "open" mounting. I'd suggest that you totally avoid salt water, fly carefully, and flush and force-dry your gear if you get it wet.

The second goodie may well apply to all electric floatplanes using geared motors. Using a wood prop, I was prepared to accept tip and leading edge erosion from contact with spray. In several months of active flying, the prop has been seen and heard to hit spray on nearly every flight. In some cases contact has been significant, as when taxiing crosswind to the beach in choppy water where it is necessary to use quite a bit of power to maintain heading.

As I write this there is *no* discernible erosion of the original prop. My guess is that at the low speeds at which we turn our propellers with geared electric systems (my prop runs at just under 6000 rpm static) they aren't hitting the water droplets fast enough to be damaged. I'd appreciate hearing from those of you who have been trying this sort of thing to learn what you've experienced.

I chose to build my floats using a traditional approach; balsa formers and a balsa keel are "egg crated" together, reinforced with chine strips (stringers), and covered with 1/64" plywood, which is in turn covered with two ounce fiberglass cloth. There is no reason why the outer plywood skin could not be replaced with firm 3/32" balsa. While the very thin plywood requires the stiffening of glass cloth and resin, balsa skins might well be surfaced using silk (or silkspan) and dope, or even plastic film. I'll detail the construction process of the floats as I built them, and let those of you who want to innovate take it from there.

Cut the keels and formers from medium-hard l/8" balsa sheet. You don't need rock hard (heavy) wood, but do avoid mushy stuff that won't provide any stiffness. Note how the formers are slotted on top, and the keels on the bottom, to allow assembly. Build each float in turn over the top elevation on the plan, assembling upside down so that the flat upper surface lets you build a true structure. I used Hot Stuff Special T exclusively. Epoxy is needlessly heavy. Water-based glues are not acceptable for float construction. Install the four 3/16" sq. chine strips while each float is on the board. Bevel the chines and true the outer surfaces of the bottoms, then add the bottom sheet before removing the structure from the building board. Now you can sheet the tops. Add the l/8" ply inserts for the strut brackets. Drill mounting holes for the bracket screws and install blind nuts. When the bracket installation is the way you want it, true up the sides of the framework and install the remainder of the skin. Do be sure to check alignment regularly while completing the skinning; once you close up the structure, it's guaranteed to stay the way you built it! Add the soft balsa nose/bow fairings and a 1/16" ply plate at the rear of the float on which you will mount your water rudder and sand the entire outer surface to finished contour. I used two-ounce glass cloth attached with Sig polyester resin over the 1/64" ply skin and achieved a smooth, rigid surface within acceptable weight limits. I would be just as comfortable with glass over 3/32" balsa. Dope and fabric or silkspan would be just as waterproof, but I doubt that it would afford the same resistance to puncture. I personally would not be comfortable with a plastic film, although it should work if you are aware that the seams may need regular resealing to remain waterproof.

I made my water rudder from a piece of K&S brass sheet soldered to a short length of 1/16" wire. This was captured between two wheel collars which were mounted to a small brass plate from "behind" (actually the front) with two very short 2-56 screws trimmed to thread into the collars without locking the shaft. The plate is itself screwed to the ply reinforced transom (aft former) of tee chosen float. An extension of the 1/16" shaft accepts another wheel collar to which a brass sheet control horn has been soldered. I used small Proctor pulleys to run dual cables from the tailwheel steering horn on the rudder, down the rear float strut, and back to the water rudder horn. A push-pull linkage using concentric plastic tubing should work as well at the expense of looking less scale-like. My water rudder is on the small side in order to reduce weight and to minimize its effect while the airplane is running on the step. At the expense of having to use a moderate amount of power to force turns out of the wind when in displacement mode, it works just as intended.

Make up the mounting struts as shown. My float struts plug into 1/8" I.D. tubes at suitably reinforced points along the lower longeron (the front point being shared with the wheel landing gear assembly), and consequently the float struts are two-piece. If you choose to use a simpler external attachment, you can form the struts as single units. I'd suggest that you jig the floats in position on your work surface and assemble the struts using sheets of stiff cardboard or some other suitable material to hold the upper ends of the struts in position while the diagonal braces are fitted, wire wrapped and soldered. I used 1/16" x 1/2" aluminum bars from the local hardware store as cross braces, drilling them to fit under the rear attachment screw of each of the strut brackets. Adding these before soldering the struts will make the job easier. The critical factor in this operation is to shoot for an incidence angle of one degree positive between the lower * surface of the wing and the tops of the floats. Although it's not difficult to make up a jig that will hold everything in the proper relationship, most of us find that the final job of wire bending and soldering leaves us with something other than the exact incidence required. Adding appropriate shims between the strut brackets and the float tops will allow you to adjust for the exact incidence you want. Be certain, when you are finished, that the floats lie absolutely square to one another and that you have the aforementioned minimum of one degree of positive incidence between floats and wing. Without this, you may find that you are unable to rotate the airplane far enough back on the floats while planing to position the wing at enough of a positive angle for takeoff.

Keep 'em accurate, keep 'em light, and go out and try electric float flying. About the only disadvantage I have found so far is that quiet power doesn't scare the local ducks, and I have to wait for them to paddle out of my takeoff path at their own speed before I get to fly! ●

* SEE SKETCH ON PLANS LOWER RIGHT CORNER.