

RADIO CONTROL

MICRO FLIGHT

OCTOBER 2000

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WHAT GOES AROUND, COMES AROUND

In my August column, I noted how flexible wings were intended to be used by NASA to land space capsules after they returned from space to the earth's atmosphere. Although the concept was dropped, our model flights of the 1960s had proved that it was feasible.

Forty years later, the has come to life again for use in the new space station's X-38 crew rescue-and-return vehicle. According to an item in the August/September 2000 issue of the Smithsonian's *Air & Space* magazine, this manned vehicle will be tested by being launched from an orbiting space

shuttle, after which a stowed steerable parafoil (another name for the flexible wing) will be deployed for final descent to Edwards Air Force Base for a touchdown on skids.

CO₂ REPORT

In the world of RC micro flight, electric power is dominant, although a few micro fliers prefer CO₂ power, mainly because it is a lighter power system (no batteries!)—lighter even than a

Cloud 9



by John Worth

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rubber-band system of equivalent power. Also, because of the high torque available from the pressure in the "fuel" tank, no gear reduction is needed; the CO₂ motor will swing a big prop at low rpm without the aid of gears.

One person who flies with both electric and CO₂ power provides an interesting comparison. Joe Malinchak of Greenfield Township, PA, has two 26-inch-span F4U Corsairs made from Hobby Club kits. Joe's electric

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POND BABY

A micro RC seaplane



by Dave Robelen • aplusfarm@hovac.com

I am completely inexperienced in the design of seaplanes. I lived near the ocean for many years, but salt water is very unfriendly to electronic gear, so I avoided operating models in it and was very satisfied as a landlubber. We now live on a farm with a pond. Considering how much fun I have had with land-based micro electric RC models, I decided to give a seaplane a try.

My inexperience probably worked in my favor because I had to check back issues of model magazines and study successful designs. In particular, I give credit to the late Don McGovern, who wrote much about seaplanes in *Flying Models*. Woody Blanchard

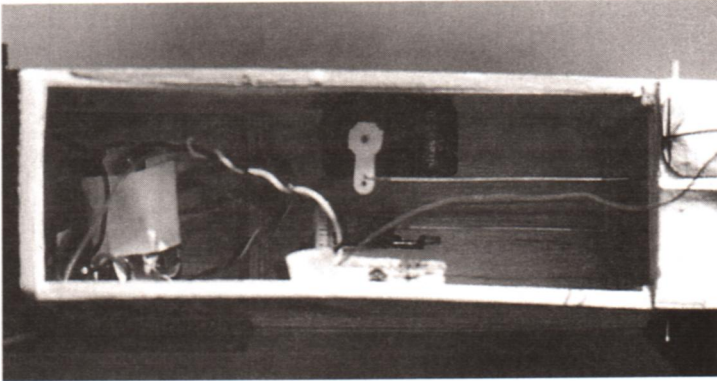
also gave me many useful concepts.

Armed with this information, I pulled out a fresh sheet of paper and began to lay out the features I wanted in Pond Baby. I faced issues I had never dealt with: how deeply would it float? What about the very high thrust line? Would the hull behave normally at this small size? Out came the handbooks to calculate how much water Pond Baby would displace; this led to the hull width I selected. Thrust line? Mount the motor with some upthrust and give it a try. Hull effects? Table this one, and assume the



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With the wing removed, you can see there's ample room for the RC gear.

model will work well! The rest of the design process followed Blanchard/McGovern thinking with some of my micro RC experience mixed in.

I avoided having to build a new wing by pulling the wing off my Pixie prototype. This also helped to determine the size of the rest of the airframe. The construction of the hull/fuselage (called a "hull" from now on) went quickly. I cut the tail out of 1/16-inch-thick sheet balsa and mounted it. I made the motor mount out of a sandwich of balsa and plywood and glued it to the wing, then I carved a set of tip floats out of soft balsa.

Because I'd be tossing this little bird into the water, I decided to paint the wooden parts and then wax them. I mounted the DC5-2.4 motor with a 4.2:1 gear set driving a 5.25-inch prop cut from a 6-inch Peck Polymers plastic prop. For good measure—and to cause a little confusion—I mounted a balsa replica of a glow-plug engine on top of the motor. The battery is a 7-cell 50mAh Ni-Cd positioned in the hull bottom to provide the correct CG. I used one WES-Technik servo and one cut-down Hitec HS-50 servo, and my speed control is an FMA Mini 5. A trusty Sky Hooks & Rigging receiver passes on the control wiggles, and the servos drive the controls with 0.015-inch-diameter wire pushrods run through a few bushings.

After strapping the tip floats into the predicted locations and clamping the wing assembly onto the cabin top, I fastened the long receiver antenna to several corners of the airframe—ending on the fin, to avoid its dragging in the water.

A braver person would probably have headed straight for the pond, but I still had a few concerns about flotation. When the family was elsewhere, I headed for the bathtub. Hallelujah! It floats—and at about the right level as well.

Bearing in mind all the unknowns, I headed for the pasture and a hand-launched flight. Right from the start, Pond Baby behaved like a dreamboat (sorry!). Power affects pitch trim slightly: full power holds the nose fairly level and fast, while power-off, trim is a little nose-up. Ready for sea trials!

AT THE POND

With a fresh battery charge, I switched the radio on and slipped Pond Baby into the water. Would the rudder have any effect while taxiing on water? Sure; I taxied out from shore and turned the bird into the slight breeze. Full throttle brought Pond Baby up on step very quickly, and things looked great; then, while I held full throttle, it suddenly cut back and started to surge up and down.

The solution was a "buggy whip" antenna for water operation.

Having solved the signal problem, I went back to the pond. Now, when Pond Baby started to pick up speed on the step, it would suddenly whip around in a "water loop." I had overdone the tip floats' streamlining by bringing their rears to a point, and when one touched the water at

speed, the drag was excessive. The solution? I cut out two patches of very thin soda-can aluminum and fastened one to each float to create a "planing" surface.

Recharge, and back to the pond. At last, Pond Baby whizzed across the surface and lifted off with just a touch of up-elevator. Neato! After a couple of laps, I realized that I had never made a water landing; perhaps I should try it. Power back and trim for a nose-high touchdown; looking good until it touched the water! I was reminded of a Disney film about poor birds making awful landings. Pond Baby was not broken, but I hadn't sufficiently sealed the cabin around the wing, so water sloshed around inside.

Dried out and with a better cabin seal, things were coming together: smooth liftoff and cruise and then set up a landing with more speed so that the touch-

down would be in the planing attitude similar to a takeoff (just like a tail-high landing with a tail-dragger). This was the fix! I explored the flight envelope: Pond Baby looped, rolled and did a nifty stall turn, but its real charm lies in the water operations.

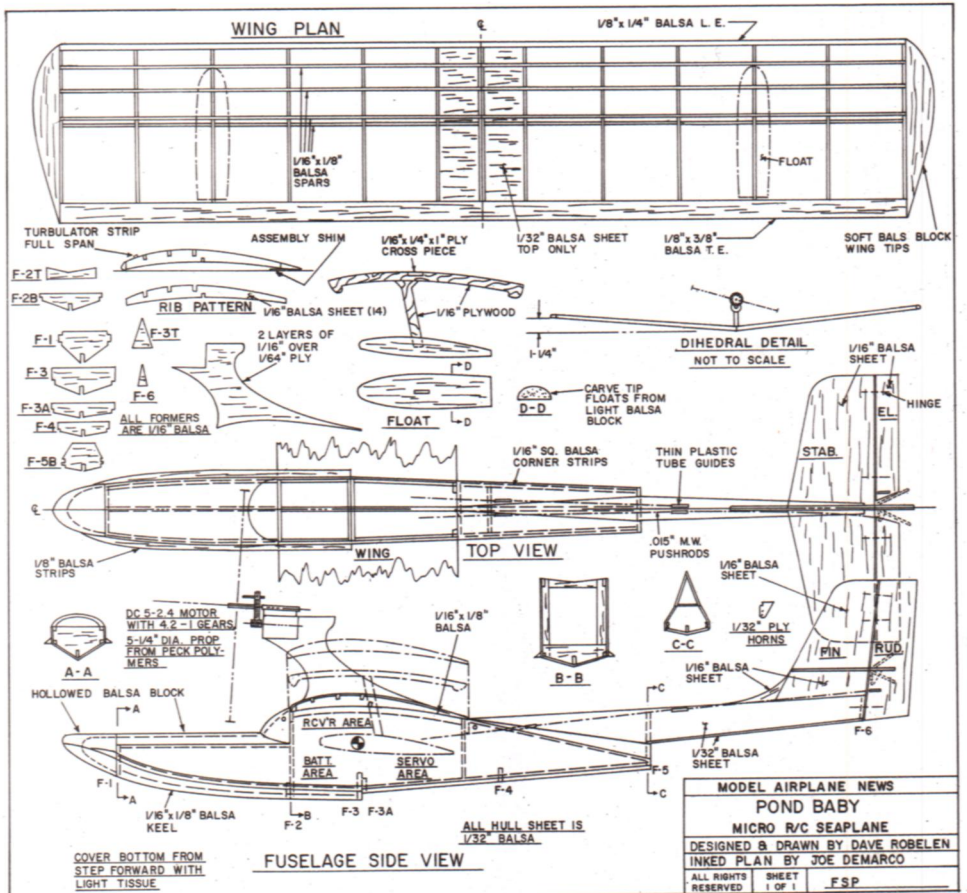
CONSTRUCTION

In micro RC models, wood selection is vital to control weight. I used mostly 1/16- and 1/32-inch balsa sheet; one sheet of 1/16-inch, 3x36-inch balsa should weigh no more than 15 grams (1/2 ounce), and the 1/32-inch stock should weigh half of that. The same applies to nose blocks: the lighter the better. I strip my stock from the lighter sheet wood, and I use Goldberg medium CA and Hobby Lobby's Oracover Light for the wing. You'll also need 1/64-inch plywood and 0.015-inch-diameter music wire.

• **Wing.** Lay the plan flat and cover it with wax paper. The trailing edge (TE) must be shimmed up to match the airfoil angle. Clamp the edges into place and then glue in the ribs, tilting the two center ones for the dihedral. Add the top spars and center sheeting; when the glue is dry, flip the assembly over and glue in the bottom spar. Use a sanding block to trim the angle at the wing center, then glue the panels together. Glue on the tip blocks and sand the whole works.

Only the wing is to be covered with film, and it has undercamber, so covering techniques are different. Use a trim-seal iron that heats only a small area. Start with the bottom surface, and tack the covering to the spar at the ends and then at a few spots in the mid-

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die; tack the film to the rib bottoms and then the edges. Seal all of these seams tightly before you shrink the film. Work your way around the wing, and finish by checking for warping. If necessary, use heat to straighten the wing and then set it aside.

• **Tail.** The tail surfaces are $\frac{1}{16}$ -inch sheet with rounded edges. My hinges are 0.005-inch-thick drafting Mylar sliced into $\frac{3}{16}$ -inch widths. Slit the tail as necessary, and slide the hinges into place. When the gaps are as narrow as they can be without hindering movement, put a drop of CA on each hinge, and check the bond by gently tugging on the controls. Make horns out of thin plywood, and glue them into place where shown. Set the tail parts aside.

• **Hull.** Glue the $\frac{1}{16}$ -inch strips around the edges of each side (one left, one right). Join the sides at the wing area first, using the bulkheads for that area. Keeping the pieces square, work over the top view to install the front and rear bulkheads and then the rest of the cross-pieces. Add the keel strips, and sand the bottom smooth before you install the $\frac{1}{32}$ -inch planking. Keep the seams tight, and your hull probably won't leak! Before you add the tail boom, plank the back of the hull with $\frac{1}{32}$ -inch sheet. I used patches of masking tape on the top outside of the tail boom to hold the sides together while I put a thin bead of glue along the inside of this seam and then added the bulkheads and bottom sheet. Fasten the tail boom to the hull and move back to the nose. Trim the two front blocks to the outside shape and then rout them out to about a $\frac{1}{8}$ -inch wall thickness. (Use a Dremel tool and an X-Acto gouge.) When you're satisfied with their positions, glue the blocks into place and blend with a sanding block. The $\frac{1}{8}$ -inch chine strips are important; they should match the shape shown to throw the spray clear of the prop.

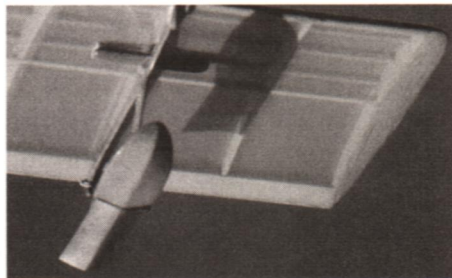
Install round toothpicks as wing dowels, and temporarily strap the wing into place. Using the wing as a reference, install the tail assembly on the boom, keeping the parts true. Make the motor-pylon sandwich of balsa and plywood, but do not glue it into place yet; make two tip floats of soft balsa, and fasten them to their struts.

Sand the wooden parts again, and vacuum away the dust. Before I painted my Pond Baby, I put a layer of tissue on the bottom of the hull from the step forward. I bonded this on with thin white glue, and when that had dried, I coated the wooden parts with sealant (hardware-store lacquer sanding sealant at full

strength). When it's dry, smooth it with 320-grit sandpaper. I sprayed on auto-parts-store colored paints (touch-up lacquer) thinly—just enough for adequate color. Finally, I sprayed all the wood with a couple of coats of Krylon Crystal Clear lacquer.

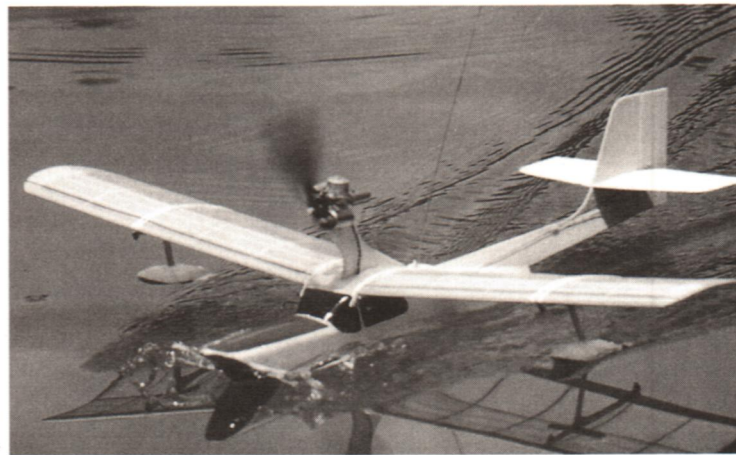
ASSEMBLY

Glue the motor pylon to the wing, and then glue the motor assembly into place with medium CA used sparingly. The motor leads have to be extended to reach through the wing, and there's a connector in the cabin. I use the tiny "Unisex" connectors from Cloud 9 Micro RC, which is also an excellent source of tiny slide switches and 50mAh batteries. For best results, I use a 7-cell pack of 50mAh Ni-Cds; feel free to experiment with new products. Use light servos (I've used WES-Technik and lightened HS-50s with equally good results) and mount them on the cabin walls toward the rear with double-



A piece of aluminum can be used to create a planing surface on the tip of the float.

For such a small model, Pond Baby sits well in the water and taxis smoothly. For water operation, it needs a "buggy whip" antenna.

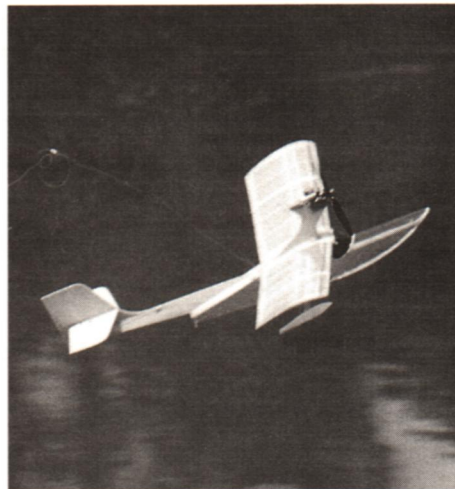


sided foam tape. Make a light control connection between the servos and the surface with lengths of 0.015-inch music wire; I glued in several short pieces of thin plastic tubing to support this. Choose the lightest receiver and speed control you can afford (mine came from Sky Hooks & Rigging), and install them in the forward part of the cabin. Lay the battery on the bottom where it will give the correct CG.

Slip the propeller onto the shaft, and secure it with hard-plastic tubing pressed onto the shaft. Charge the battery and range-check your system—power on and off. Finally, coat the painted areas with paste wax; we want the forward bottom to be slick, and the rest should shed water readily.

FLIGHT TIME

At first, fly in a clear area over grass—minus the tip floats. Bring the motor to about half power and push Pond Baby



smoothly into the breeze. And remember that these are serious test flights—no time for fun! Be objective: all trimmed for smooth flight? Good climb on full power? Plenty of control at all speeds? How about that flat landing approach? Great! I can cruise around for 6 minutes—just loafing—or less than that if I try maneuvers.

Water time! We did the bathtub thing, so skip right to the swimming pool or whatever. Reinstall the tip floats and put a narrow strip of foam tape on the bottom of the wing along each cabin side. Check carefully for obstructions—trees, power lines, etc. You'll need a boat or a casting rod in case you need to retrieve Pond Baby.

Switch on and set Pond Baby in the water.

SPECIFICATIONS

Wingspan: 20 in.

Length: 18.75 in.

Wing area: 80 sq. in. (0.56 sq. ft.)

Weight: 80g (2.82 oz.)

Wing loading: 5 oz./sq. ft.

Power: DC5-2.4 motor with 4.2:1 gears and 5.25-in. plastic prop

Battery power: 7, 50mAh Ni-Cd cells

Controls: 3-channel micro

Comments: easy to fly off water and in confined areas; handles moderate breeze; top speed—approximately 25mph; minimum speed—approximately 12mph.

Throttle up just a little, and before a full-speed run, get a feel for the low-speed steering. Line up parallel to the shore and let it rip! When Pond Baby lifts up and is planing on the forward bottom, just a touch of up-elevator will give the neatest liftoff! Cruise around but save some battery power to taxi back after landing. Remember the flat skimming approach? Great! When Pond Baby is on the water and taxiing, enjoy knowing that electric power will not quit and leave Pond Baby stranded offshore. Smile at the spectators and prepare to recharge and go again.

Enjoy; and let me know if I can help in any way: Rte. 4, Box 369, Farmville, VA 23901; (804) 392-3451.

See the Source Guide on page 16 for manufacturers' addresses. †