Zo Seagull

Gus Manuel

I once read Richard Bach's book *Jonathan Livingston Seagull*, and was fascinated with Jonathan's story. Like most innovators, engineers, and inventors, I identified with the spirit of Jonathan.

I live in an area of Long Island, New York that's saturated with sea gulls. I have a home on the Great South Bay, and sea gulls fly over my back yard all through the year. Their graceful flight is unique among birds. I am sure that they fly not only to find food, but also for the fun of flying. They soar and swoop in every direction when simple, straight-line flight would suffice.

Our local flying field is next to the wetlands that adjoin the Great South Bay. The sea gulls outnumber the considerable number of model fliers! The sea gulls wheel and turn overhead; they rise in the morning thermals, then peel off and head for the sea. In the afternoon we are treated with their return.

The sea gulls think that we put in two runways just for them to drop clams on—they drop them to break the shell and get at the inner meat!

I had been flying a model of a pterodactyl for some time, but it seemed out of place (and out of time) among the sea gulls. If I could make a pterodactyl that flew successfully, I figured a sea gull would be easy.

"If I could make a pterodactyl that flew successfully, I figured a sea gull would be easy."

I chose a set of moments that matched a .20-sized model that I had been flying for a few years. This took a lot of the guesswork out of the design. I used the same airfoil, nose moment, tail moment, target weight, power plant, and center of gravity.

What was new? The wing would have dihedral, anhedral, and contours to make it look more "gull-like." The tail would be shaped to look like a gull's when it spreads its tail feathers for landing. The nose would be shaped to resemble a gull head, including a yellow plastic spinner to represent the its beak. Of course, the gull would need movable eyes on the sides of its head to keep an eye on the modelers. The covering would be white with black accents.

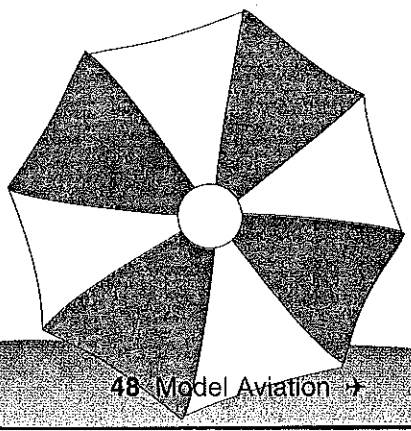
I had been experimenting with wing flaps to help with slow flight. These permit hovering in moderate winds, and hovering descents, just like the sea gulls do after dropping a clam. This sea gull was going to have flaps.

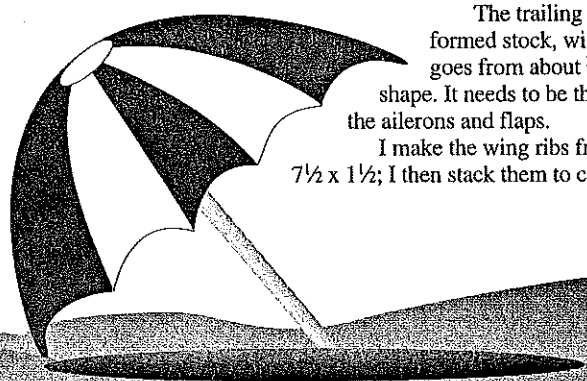
CONSTRUCTION

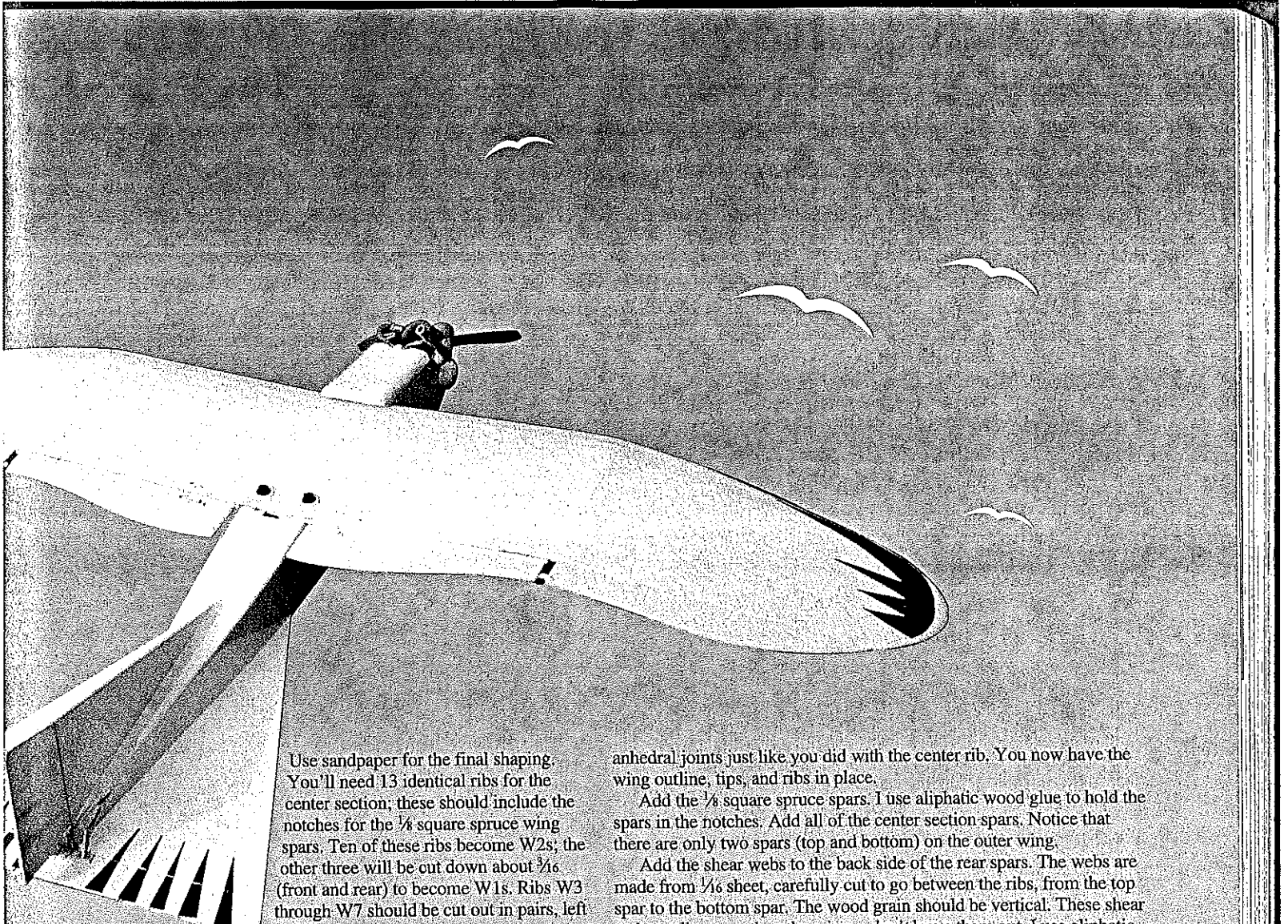
Wing: All of the wood is balsa, unless otherwise specified. The simplest way is to build the wing flat on the plans; when it's complete, break it for the dihedral and anhedral joints. The leading edge is ⅝ x ¾ rounded leading-edge stock. Two pieces are required—one for the two center sections, and the other piece the tip pieces. This evens the weight distribution if the two pieces are different weights. Use the same trick for the trailing edge.

The trailing edge is two pieces of 1½ aileron formed stock, with ½ inch of the thin edge cut off. It goes from about ⅜ to ¼, and conforms to the airfoil shape. It needs to be this thick at the rear to match up with the ailerons and flaps.

I make the wing ribs from 1/16 balsa by cutting rectangular pie 7½ x 1½; I then stack them to cut the ribs all at once with a band saw.







Use sandpaper for the final shaping. You'll need 13 identical ribs for the center section; these should include the notches for the ⅛ square spruce wing spars. Ten of these ribs become W2s; the other three will be cut down about 3/16 (front and rear) to become W1s. Ribs W3 through W7 should be cut out in pairs, left and right.

The leading and trailing edges should be cut to shape, then notched for the wing ribs. The leading and trailing edges have a notch about 1/16 wide and 1/16 deep to capture the ends of the wing ribs. This technique gives great strength to the wood-to-wood joint.

The leading and trailing edges will have to be shimmed up from the building board so the symmetrical wing ribs can be inserted. Leave out the W1 ribs at the center and the two anhedral breaks until the plywood braces are in place.

I usually insert all of the ribs in a section *without* glue, check the alignment, then run thin cyanoacrylate (CyA) glue into the joints, freezing them in place. Do the two center sections first, then the wingtips.

The rounded tip area to the outermost wing rib is 3/16 sheet—add this now. The LEs and TEs will have to be shimmed up like the center section, as will the 3/16 sheet wingtip. It should be in the center of the leading and trailing edges.

You should have four wing sections, with no ribs at the center or at the anhedral breaks. Prepare the ⅛ plywood dihedral brace, block up the ends of the center sections ⅝ inch, and fasten them to the dihedral braces with five-minute epoxy. Trim approximately 3/16 from the center rib (so it fits between the dihedral braces) and CyA it in place. Little pieces of ¼ triangle stock will ensure that the center rib withstands the forces that will be put upon it.

The wingtips come back down to the building board and are fastened in place with the anhedral braces. Add the wing ribs at the anhedral joints just like you did with the center rib. You now have the wing outline, tips, and ribs in place.

Add the ⅛ square spruce spars. I use aliphatic wood glue to hold the spars in the notches. Add all of the center section spars. Notice that there are only two spars (top and bottom) on the outer wing.

Add the shear webs to the back side of the rear spars. The webs are made from 1/16 sheet, carefully cut to go between the ribs, from the top spar to the bottom spar. The wood grain should be vertical. These shear webs really strengthen the wing—*don't* leave them out. I use aliphatic glue on these.

Fill between the center rib and the second rib with 1/16 sheet on both sides. This will give the wing rigidity and strength in the center section. Carefully cut small rectangles of 1/16 sheet to fit between the spars and the ribs. Apply some aliphatic glue to the edges, and carefully lower the piece into place. When everything is dry, a final sanding is in order.

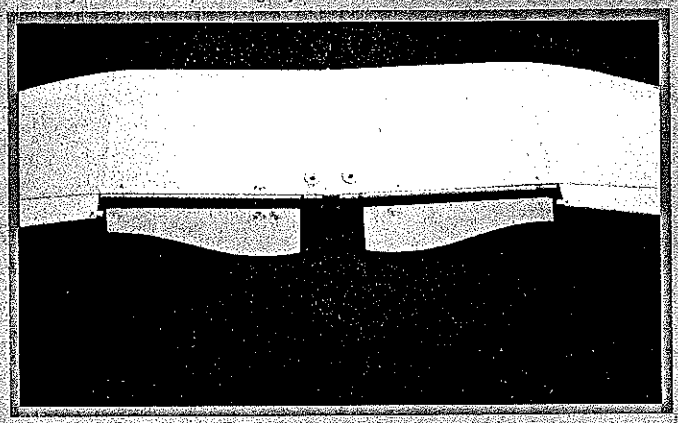
Flat sanding block: This should make a very serviceable tool for flat-sanding almost anything. I make mine from a piece of common pine that's ¾ x 2 x 12. I attach a 3 x 12 piece of #60 sandpaper to the block using rubber cement—coat the back of the sandpaper and the wood block with the rubber cement, wait until they're both tacky, then press them together. There will be a ½-inch piece of sandpaper folded up on each edge for a finger grip.

Make a second block for final sanding with #240 sandpaper (that's as fine as you will have to go under MonoKote).

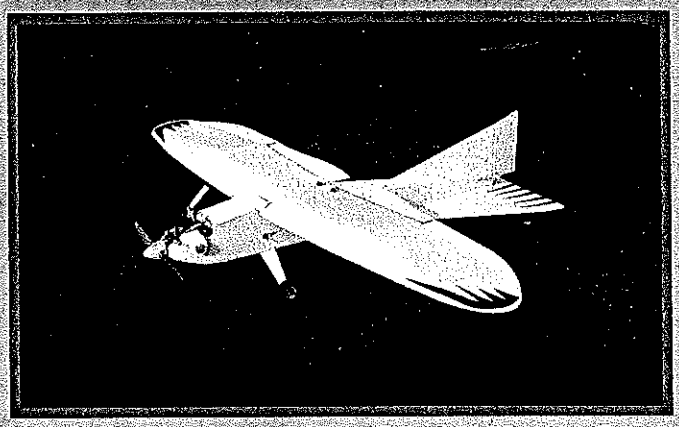
Fuselage: This is a cinch, after building the wing. It's a basic box structure, rounded on the edges (by the use of internal triangular stock). The sides and bottom are 3/16 sheet; try to match the

RC Seagull

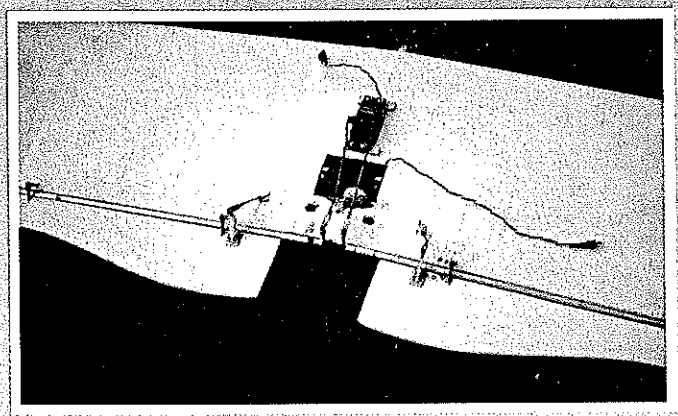
Photos by the author. Graphic Design by Carla Kunz



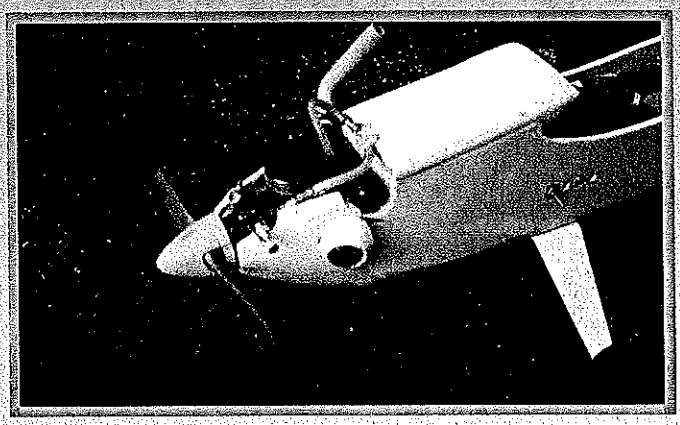
The wing with the flaps down, showing the details of the aileron torque tube and the "Fowler flap" air gap.



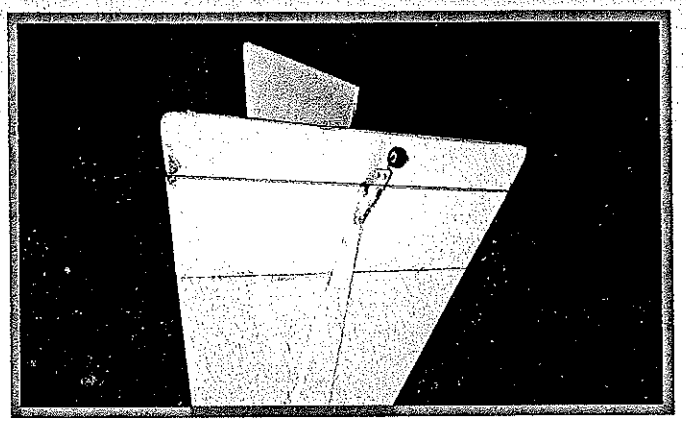
The front view, showing the black wing-and tail-surface trim. The forward fuselage blends into the spinner "beak."



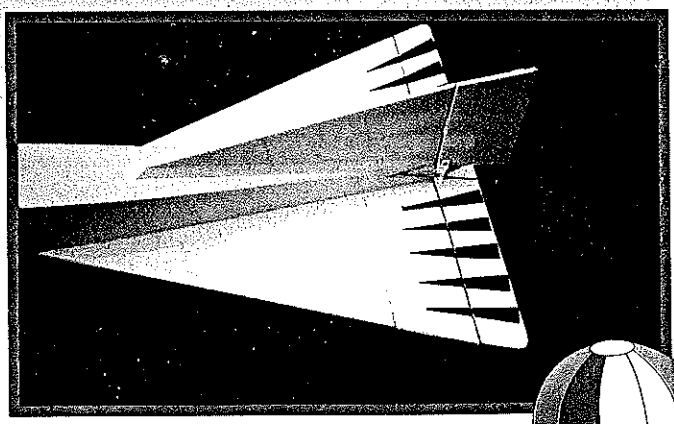
The underside details of the wing, showing the aileron and flap servos with their pushrods and control cables.



Details of the nose area, showing the eyes, "beak" (spinner), and K&B Sportster .20 engine orientation.



The underside of the tail section, detailing the tail wheel and bracket locations.



The triangular stabilizer adds to the gull effect; the shape resembles a landing gull's tail feathers.

stiffness of the sides. The bottom piece should be hard.

Cut out fuselage formers F1 and F2 from ⅛ plywood; cut F3 from 3/16 hard balsa, with the grain vertical. Glue F2 and F3 to the fuselage sides, with the bottom edges on a *flat* building board. Put ¼ triangle stock in the corners to reinforce the joints.

It is very important that you sight the fuselage for trueness, squareness, and lack of "banana" shape before you glue the tail ends together. Glue them together with CyA—a little dusting of balsa dust or microballons will help.

Add the bottom sheet, with grain running lengthwise. Carefully shape the ½ sheet nose bottom, making sure that all of the sides are square. Later, when all of the blocks and the nose ring are in place, you'll carve the nose to shape.

The lower nose ½ sheet should have straight sides as shown on the top view of the fuselage. Slide it in place on the bottom sheet—the sides should be drawn together and glued with CyA when things look perfect.

Add the ⅛ plywood firewall (F1) with five-minute epoxy. Be sure it is installed square to the fuselage—it determines the engine's thrust line. Fasten the Hayes filled-nylon .19-size engine mount to the firewall. It should be mounted in the center of F1, with the beams square to the fuselage centerline. Use 4-40 bolts and blind nuts.

Engine: I recommend the K&B Sportster .20. The Sportster series brings together of a lot of things that are right. The .20 is a simple engine; it's inexpensive, long-lived, powerful, easy-to-operate, reliable, AAC, Schnuerle ported, and quiet.

I have modified my engine by turning the cylinder so it has a rear exhaust, with a transverse shortened muffler. The side-exhaust version will work just fine. An O.S. .25 FP could be substituted.

You will need to use a fuel that has at least 2% castor oil. I now run all of my engines on Omega 10% nitro fuel from Morgan fuels. I believe that this fuel contains 18% synthetic and 2% castor, plus some "slickening" additives.

As a further tip, let me tell you about the J-B Weld trick. It's a way to keep a muffler from disassembling itself due to vibration and spreading parts all over the high weeds. J-B Weld is a steel-filled two-part epoxy that is capable of withstanding the heat of the exhaust system.

Take the muffler apart, spread some J-B Weld on all the joints, then reassemble everything. It is very unlikely that any parts will fall off now. As an added insurance I spread a small amount on the engine exhaust flange then mount the muffler. This mounts the muffler rigidly to the engine, and it also keeps the exhaust goo from exiting at the flange line. If you should ever have to take any of the pieces anything apart, the heat from a propane torch will soften the epoxy sufficiently for disassembly.

Mount the engine on the engine mounts. I drill and tap the plastic with a 4-40 thread. The engine, with its spinner and prop, should clear the nose ring. This is so the nose ring can be mounted concentrically with the spinner; the model's nose is built-up using the nose ring as a guide.

Sand the front edge of the lower ½-inch nose block until the nose ring is about ⅛ clear of the spinner, and concentric with the engine drive washer. It may now be glued in place. Remove the engine; it has served its purpose as a jig.

Use pieces of ½ balsa to fill in behind the nose block; ½ triangle stock is also useful. You want the nose area to have sufficient balsa, so you can carve a sea gull head-shaped transition from the circular spinner to the rectangular fuselage. The fuselage should be rectangular approximately halfway between F1 and F2.

The top of the fuselage is still exposed. Fill in the joint between the sides and top and bottom sheets with ⅜ triangle stock. This will enable you to round the fuselage corners somewhat without fear of sanding through the edge. The top rear fuselage sheet can now be added.

Mount the engine control cable and the fuel tank in the forward compartment. I recommend a Sullivan six-ounce slant tank with two fuel tubes (one for the clunk and one for the vent). Hook the vent to the muffler for pressurization. The vent should come out the right side of the fuselage top near the muffler; the clunk tube should come out the left side near the needle valve. (*Left* and *right* refer to the "pilot's" view.)

I recommend Prather pink fuel tubing; it stays on fittings, and withstands the heat of the muffler. I strongly recommend using a fuel filter—preferably a Sullivan Crap-Trap. (Don't forget to fill the tank on the tank side of the Crap-Trap.) So many fliers do not use fuel filters; they end up crying "Dead stick!" and can't imagine why their engine stopped. I always ask them how far they think their automobile would go without a fuel filter—about halfway home!

I recommend one of the Sullivan units for the control cable. Mount the cable so that it comes out in line with the throw of the throttle control arm on the engine. Leave plenty in the fuselage; we will connect it to the servo later.

The fuel tank should be mounted as far forward and as high as possible. Cut a block of fairly stiff foam rubber to place under the tank. The ½ x 3 sheet that will be used as the top-forward fuselage tank cover will have to be carved out to clear the tank top. X-Acto makes a round carving tool that makes carving the inside of balsa blocks an easy job.

Some people make this top block removable by using screws. Instead, I check the tank for leaks *before* putting it in the fuselage; then I cover the top block and fasten it in place with General Electric clear RTV. This way I have the rigidity of a glued top block, and I can still get at the tank without too much hassle.

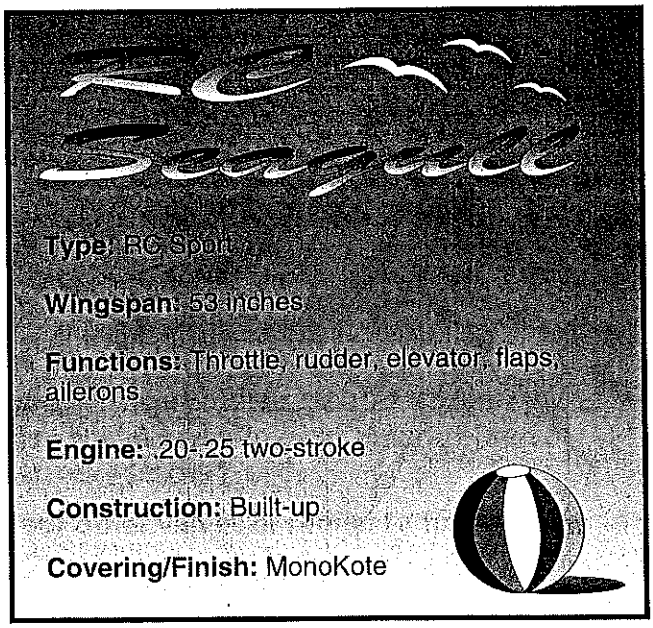
This sea gull uses 10-inch aluminum landing gear (Prather medium dural gear), and two-inch Dave Brown Lite wheels. Use ¼-20 nylon screws to fasten the landing gear to the fuselage. The nylon screws will break off on a really hard landing without tearing out the bottom of the fuselage.

Carve the forward fuselage round, sand the fuselage edges round, final sand, and cover. It is easier to cover the fuselage before adding the tail feathers. I recommend white Super MonoKote. It stands the test of time, it goes on easy, it cleans easy, and will probably be available in ten years for the inevitable repair job. The sea gull in the accompanying pictures was two years old (and a veteran of more than 500 flights) when the pictures were taken.

Tail: The tail feathers are made from light 3/16 balsa. Make the transverse three-inch section of the stabilizer first. Open slots on the fuselage sides for the stab. Glue the stab in place, checking for perpendicularity to the fuselage centerline and squareness to the fuselage bottom.

Measure and cut the rest of the stabilizer. Notice that the triangular fill-in has the grain running along the edge. A simple way to measure this is to hold a three-inch sheet below the fuselage, and line up the front edge with the proper place on the fuselage side, while lining up the rear edge with the transverse stabilizer that's already in place. Use a pencil to draw the line. Sand for a final, perfect fit. Use the leftover pointy end of the three-inch sheet to make the second side. Fill in the small triangular opening that will be left using the same technique.

The fuselage sides will be covered with



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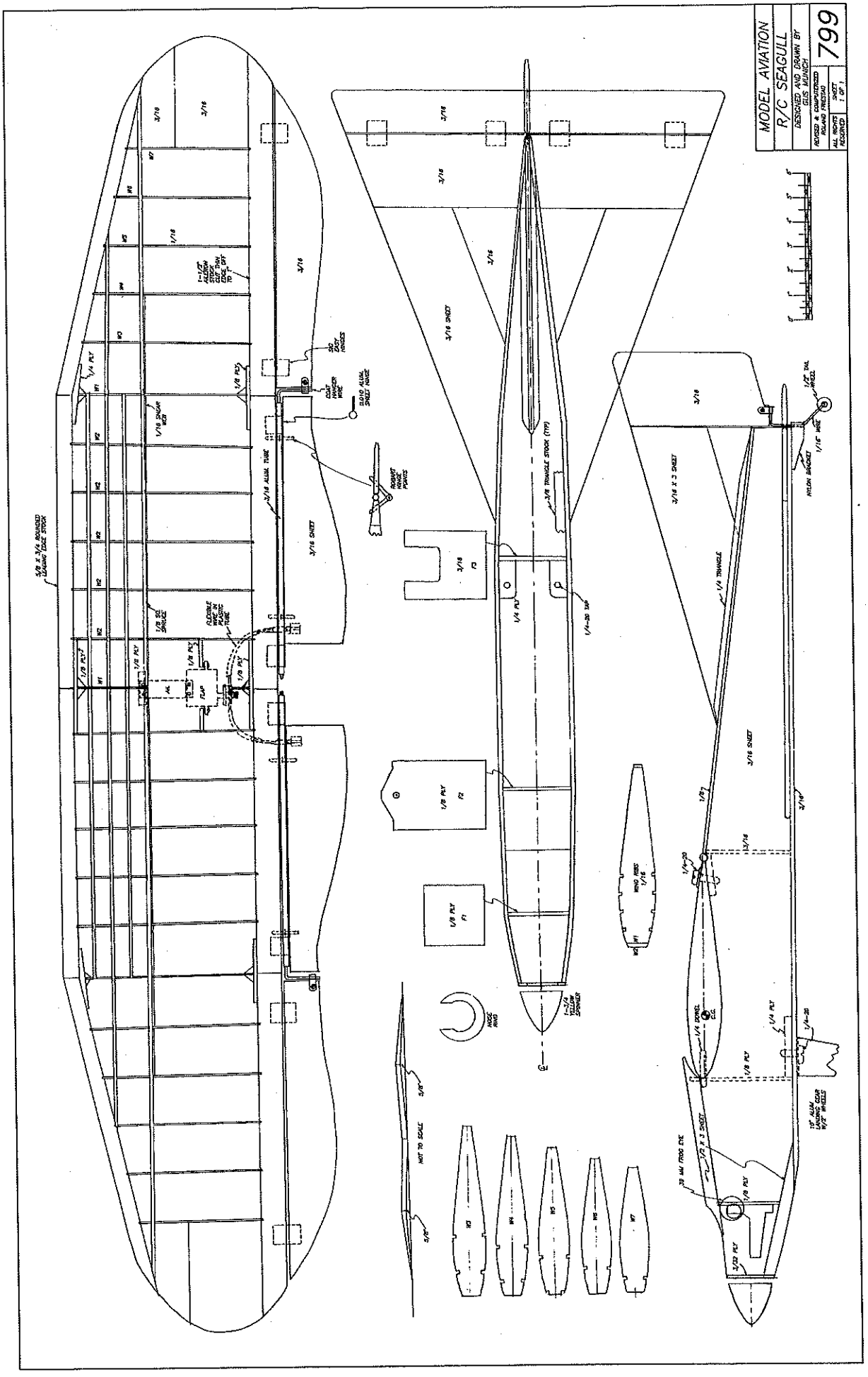

white MonoKote where the triangular fill-in will be glued. You can't glue anything to MonoKote, so a 3/16 x 13 strip of covering will have to be removed from the fuselage side.

The rest of the stabilizer can now be glued in place. It wouldn't hurt to make a small fillet of microballoons and CyA to fill in any unevenness on the joint.

The vertical stabilizer is a repeat of this construction technique, except that ¼ triangular stock is used as a fillet. Again, this means removing the MonoKote on the top deck—it has to be wider to allow for the fillet.

The stabilizer and fin can now be covered. Make the elevator and rudder from soft 3/16 sheet and cover them. While you're at it, you might as well make and cover the flaps and the ailerons.

Hinge the rudder and elevator to the fuselage. I have found that Sig Easy Hinges are generally trouble-free and are easy to install. The trick is to get the slots right in the center of the mating parts; use a #11 blade.

Add the tail wheel and bracket. Du-Bro makes a filled-nylon tail wheel bracket that has stood the test of time. The tail wheel should line up with the rudder, and should trail backwards by about 45°. A simple tin-can metal bracket will tie the tail wheel to the rudder.

The aileron servo is mounted by cutting a rectangular hole in the center-bottom wing surface. Mount plywood plates on the 1/16 wing surface for the servo mounting screws.

The aileron horn linkage is a bit unusual: It has to couple torque out to the ailerons, *and* it has to take into account the dihedral-and-anhedral angular mismatch. The 3/32 Goldberg aileron horn sets can be placed in the center of the wing, just as you would on any strip aileron-equipped aircraft, but the outer ends must be modified to mate up with the 3/16 diameter aluminum-tubing torque rod.

To do this, I cut the end wire (that is normally inside the plastic tube) about 1½ inches from the bend that goes to the threaded portion. I discard the plastic tube, and bend the wire in a zig-zag pattern so that it just slides into the aluminum tube. I then coat the wire with five-minute epoxy and slide it in. I then make a similar wire end (from coat-hanger wire) for the other end of the tube.

When finished you'll have an aileron horn

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with an aluminum-tube extension and a wire end. The wire end is needed to overcome the plane difference between the aileron-horn extension and the hinge line of the mounted aileron. Make a left and right side, but don't mount them yet.

The wing may now be covered. The aluminum tubes rotate in sheet-aluminum hinges. I use .010 aluminum sheet; it's available as roof flashing at hardware stores. Fold the one-inch strip around the tubing. This gives you two tabs to insert into a slot on the wing.

The ailerons can be mounted to the wing now. The tin-can bracket connects the aileron to the torque rod ends. Check the whole works for free movement. Now you can see why the loop linkage at the ailerons is needed.

For the connection to the aileron servo I recommend that you use a Z bend at the servo and Du-Bro nylon Kwik-Links at the aileron horn end. These can be threaded in or out for aileron adjustment.

All of this bother was needed to preserve control stiffness out to the ailerons. A wire wouldn't be stiff enough, and would result in aileron flutter.

Add the flap servo. It must fit under the lugs of the aileron servo, flat on its side. Once the servo is in place, mount ⅛ plywood blocks (supported by balsa blocks) to accept the servo-mounting screws. I've found that if you use socket-head mounting screws it gets a little easier to mount the flap servo—you can use a ball-head hex driver to snug the screws down.

The servo should have a round wheel, with opposing Du-Bro E-Z Connectors mounted with nylon washers. The two flap-control rods connect to the flaps with two very flexible braided-steel wires inside plastic guides. Sullivan Flex Push cable (.056 diameter) serves me in several similar setups.

The two cables pass the servo wheel (traveling in the wingtip-to-wingtip direction) then curve 90° to exit the underside of the wing (traveling in the front-to-back direction now) for connection to the flap control horns. Don't mount this yet—just think about it.

The flaps are mounted to the wing using Robart Super Hinge Points with steel pins. Notice how the hinge point is below the aileron tube. This serves two purposes: it enables you to hinge the flaps even though the

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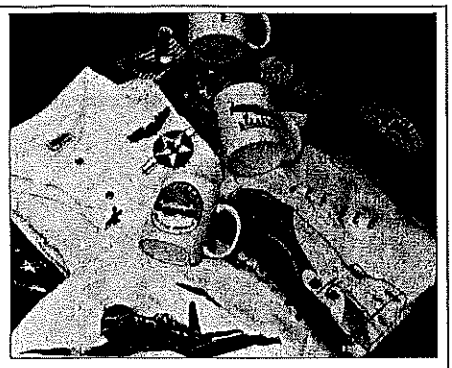

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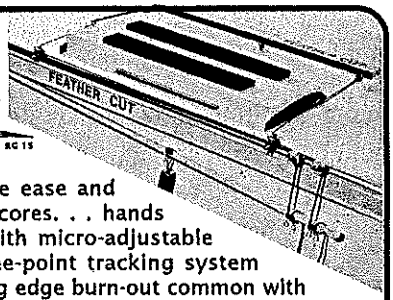

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aileron torque tube is in the way, and it makes a wide gap when the flap is in the down position—no gap with the flaps are up. This gap is important—it allows air to bleed through the gap and flow over (and down) the top sides of the flaps. The action is similar to Fowler flaps, but without all the linkages. There should be no pitch change from flaps-up to flaps-down with this arrangement.

The flap horns are large Du-Bro T-style nylon control horns. Once these are in place, add the flexible cable linkages to the flap servo. Remember: The left and right flex cables go to *opposite* sides of the servo wheel. As the servo turns, both cables push or pull. The flaps should go down approximately 50°.

Slotted exit holes in the wing are helpful until the cable run is operating smoothly. The plastic sheath should be fastened at both ends so that the servo movement is fully transmitted to the flaps. Balsa filler pieces are helpful in obtaining a good curved path without any binding.

When complete, securely fasten the components with a fillet of balsa dust (or microballoons) and CyA. The flaps should have equal deflection. The hinge points fit into drilled holes fastened with CyA when the action is smooth and looks right.

I have equipped six airplanes with this style of flaps, and I have been very pleased with the added degree of flight control they afford. With the flaps down, the sea gull is actually more stable and easier to control, even when it's practically standing still.

Check for wing-tail alignment by measuring from each wingtip to the rudder hinge line; when the measurements are the same the wing is aligned in that dimension. Next, stand to the rear and check for alignment with the elevator. It is important to get the wing lined up with the elevator; if it's not you are going to have some funny looking maneuvers!

Drill through the wing and fuselage blocks with a #7 drill for the wing bolts. Drill perpendicular to the wing top surface—the holes in the blocks will be slanted. Add a 1/16

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plywood one-inch diameter reinforcement, so the bolts will have something to bear against.

I use white K&B epoxy paint to seal the engine compartment, the tail fillets, and anything else that isn't covered with MonoKote.

Some of the sea gulls in this area are dull gray, some are pure white, and some have a few black accents that are most noticeable on the wingtips. I added black accents on the tops and bottoms of the wing tips, as well as some black triangles on the tail to simulate feathers. If you want to add the black accents, use black iron-on MonoKote. Avoid the trim sheets—the MonoKote will still be there in ten years, and the fuel will not have affected it.

I used 39mm frog eyes from a craft store. They are attached to the MonoKote with silicone glue. An alternative would be the largest flat eyes you can find. (When the sea gull is 100 feet away, it's hard to see painted-on eyes.) These eyes have movable pupils that always look down; they're very cute.

Those of you in the middle of the country may not see sea gulls—cover the model with gray MonoKote, add some black accents and some claws, and call it a hawk!

Flying: Set up the aileron throw at ± ½ inch; the elevator at ± ½ inch; and the rudder at ± 1¼ inches. Make your own adjustments from these initial settings. If your radio allows variable flap settings, so much the better (mine has a switch).

Extensive flying tips are really not needed. The design is very docile and controllable; it's fully capable of any maneuver you can handle. The trick is to fly the model *like a sea gull.*

You will like touch-and-gos with this model. Instead of adding a bomb drop, perhaps you should add a clam drop!

Good luck with your Seagull. If you wish to write, include a self-addressed stamped envelope if you would like a reply.

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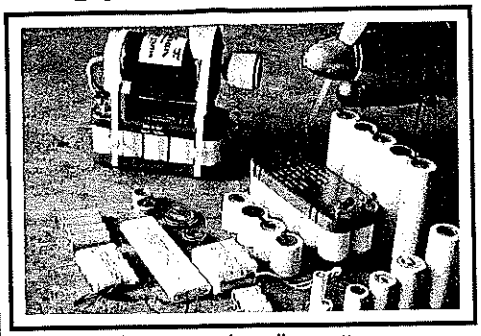

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