SEA LOON

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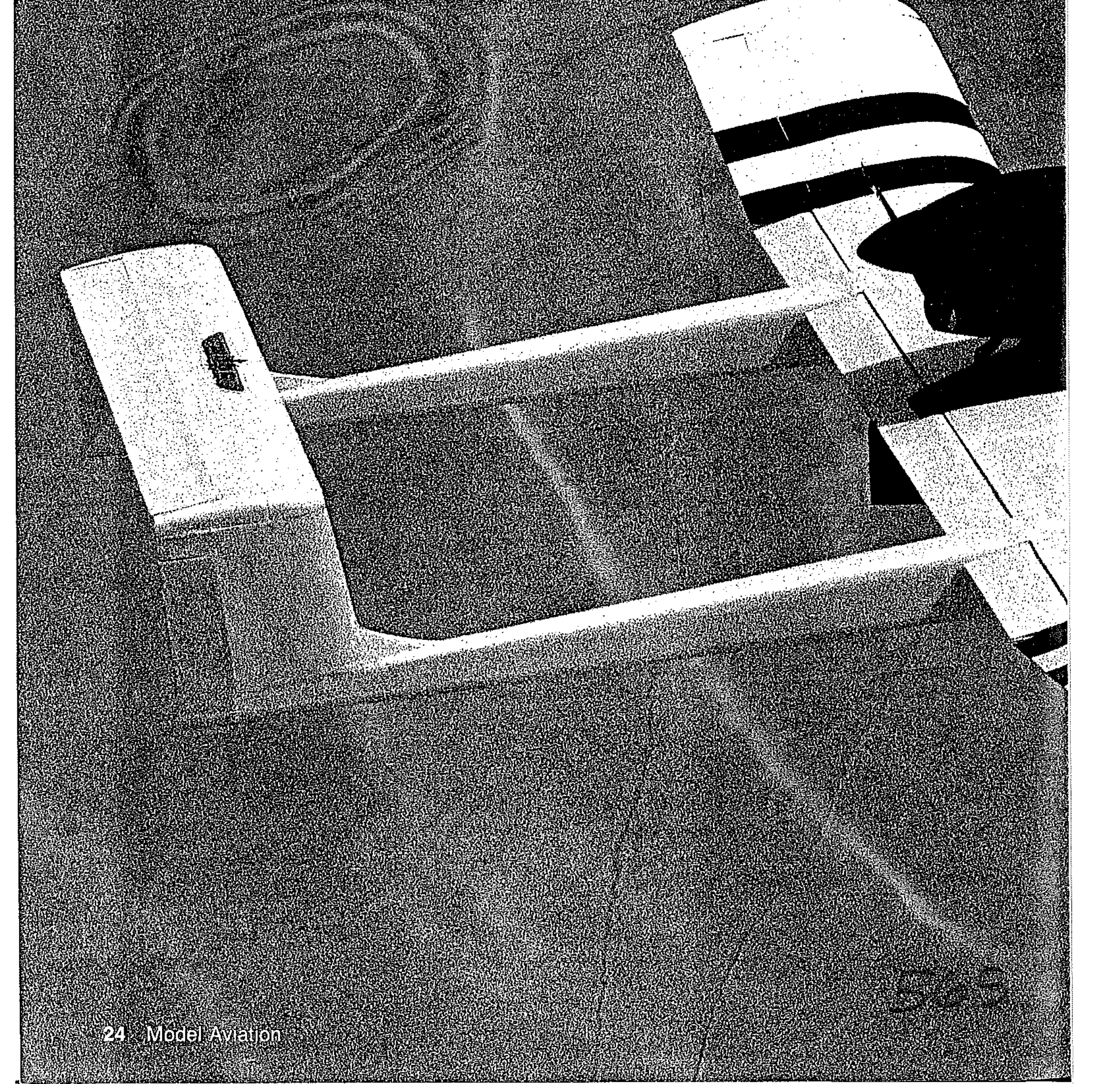
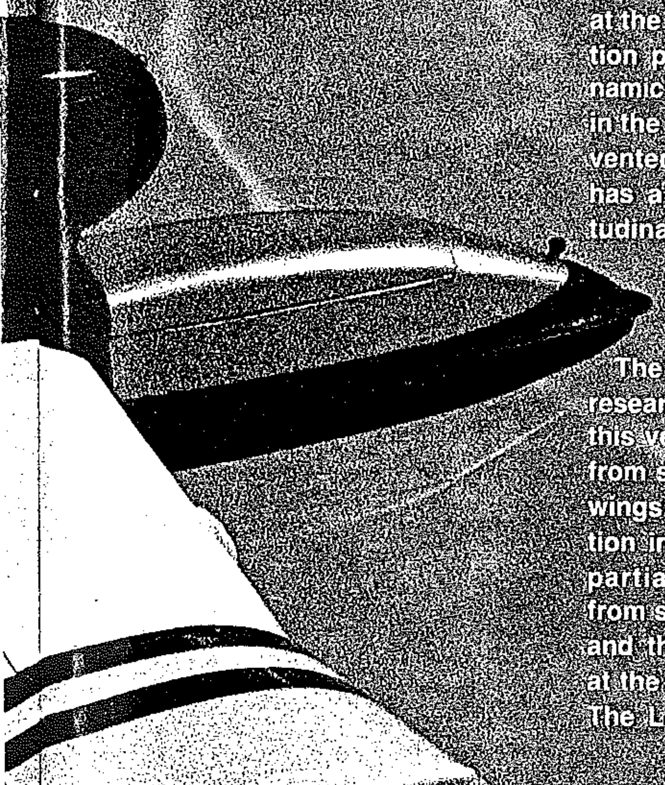


If that lake or large pond near by has been enticing you for years to use it as the runway for your models, this small flying boat (for a .15-size engine and five-channel radio) may just be the impetus to get you float flying.

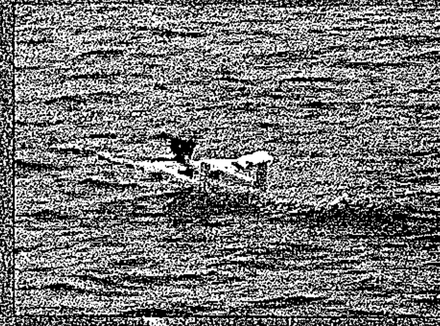
■A.J. Lennon

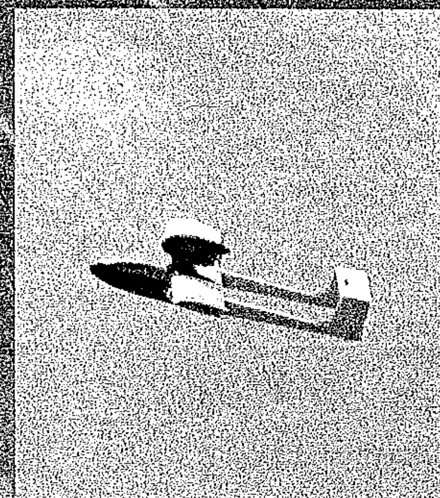


DURING THE LATE 1940s NACA did considerable research, both aerodynamic and hydrodynamic, investigating refinements to the "planing tail" type of hull. During these years there was still some interest in fast, long-range flying boats, and the NACA studies led to the development of a twin-engined design that possessed considerable stability.

In the NACA flying boat the hull terminated at the wing trailing edge in a deep, pointed, vertical step, and the conventional afterbody was replaced by two tapered booms fairing out of the engine nacelles. The horizontal tail plane was mounted between the vertical tail surfaces located at the boom ends. This configuration proved to have low aerodynamic drag and good performance in the water. The twin booms prevented the forebody roach, which has a negative impact on longitudinal trim during takeoff, and also contributed to transverse stability on the water.

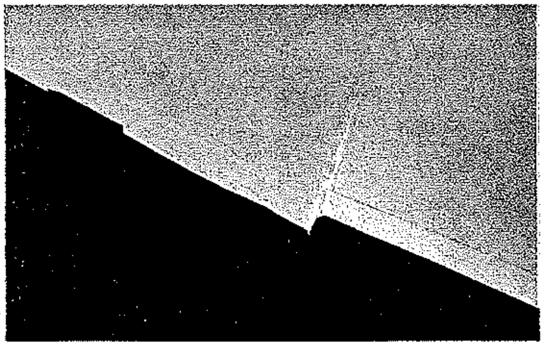
The Sea Loon both reflects this research and adapts it further. In this version, the booms originate from small floats mounted on the wings, the pusher engine's location in a nacelle above the wing partially shields the propeller from spray thrown up by the hull, and the horizontal tail is carried at the top of the twin fin-rudders. The Loon delivers excellent stability and control on the water.



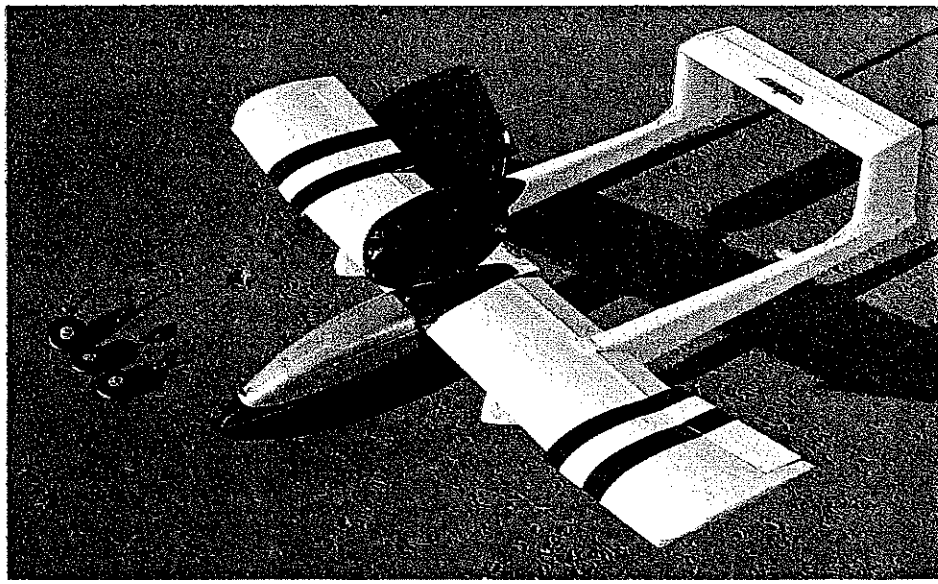


Left: The Sea Loon sits on the water's surface ready for its next flight. Top: Touch-and-goes with the flaps deployed are a terrific way to burn up a tank full of fuel. Above: Once clear of the water, the Loon makes a graceful climbing turn out over the lake.

In a flying boat, hull design is critical to achieving successful takeoffs. Accelerating for takeoff, the boat encounters the greatest water resistance at a point called the *hump*, which corresponds closely to the maximum trim (nose-up angle between the keel and the water). At this point, the elevators are ineffective and both hump resistance



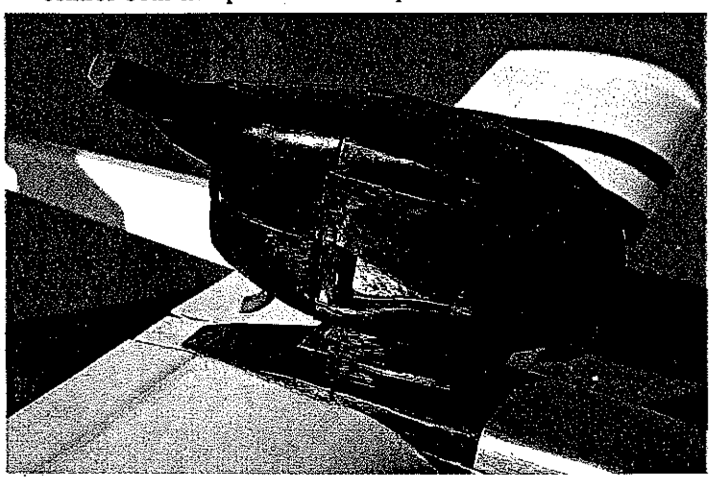
Note the details of the transition point from the normal leading edge to the drooped leading edge in this bottom view of the wing.

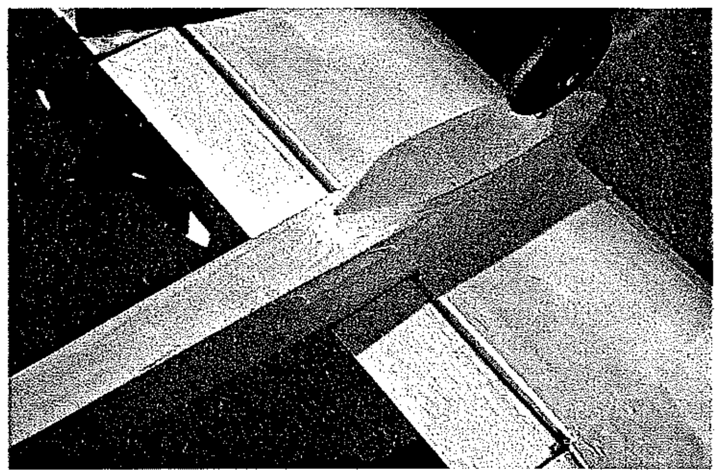


So it's not just confined to the water and so it can show off its great flying habits at the local club flying field, detailing is included in the plans for three removable landing gear wheels.

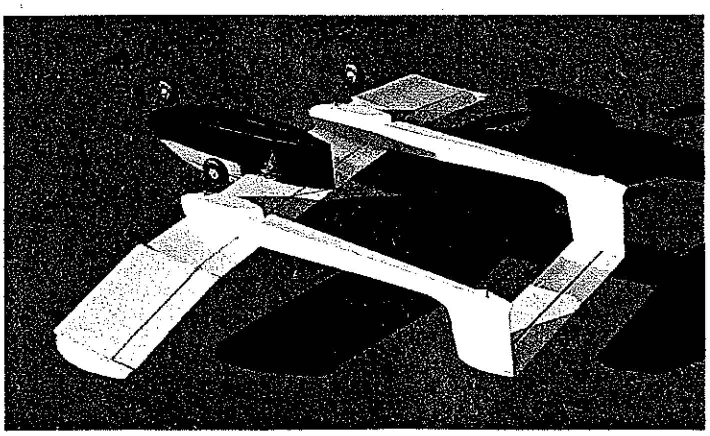
and trim depend on the hull design. A well-designed hull, assisted by some wing lift, obtains dynamic lift from its planing action on the water. Then, as the speed increases and elevators become effective, trim angles may be controlled.

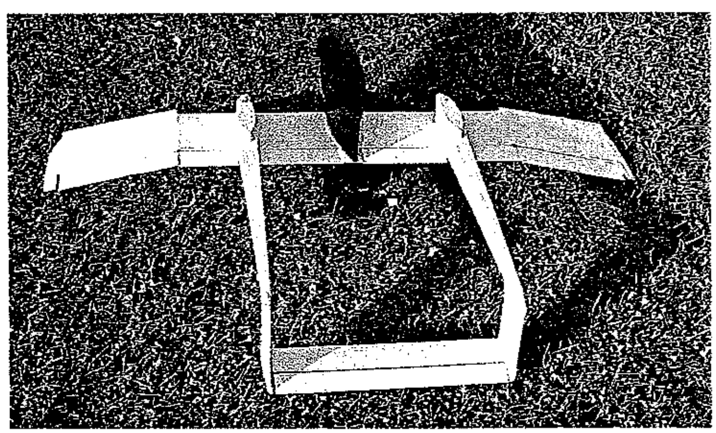
In effect, hull proportions and angles control both hump trim and hump resis-





Left: The NACA cooling scoop and exhaust stack add to the detailing of the engine nacelle. Even though inverted, most engines start easily; that's important as this model is difficult to handle when upside down. Right: Bottom of the wing, revealing the proper slot for the flap.





Left: The removable landing gear is fitted into holes according to the plans. Nose wheel is not steerable, though. Note the hull bottom and the pointed steps at the boom front. Right: Note the leading edge droop that is so crucial to this model's outstanding flight performance.

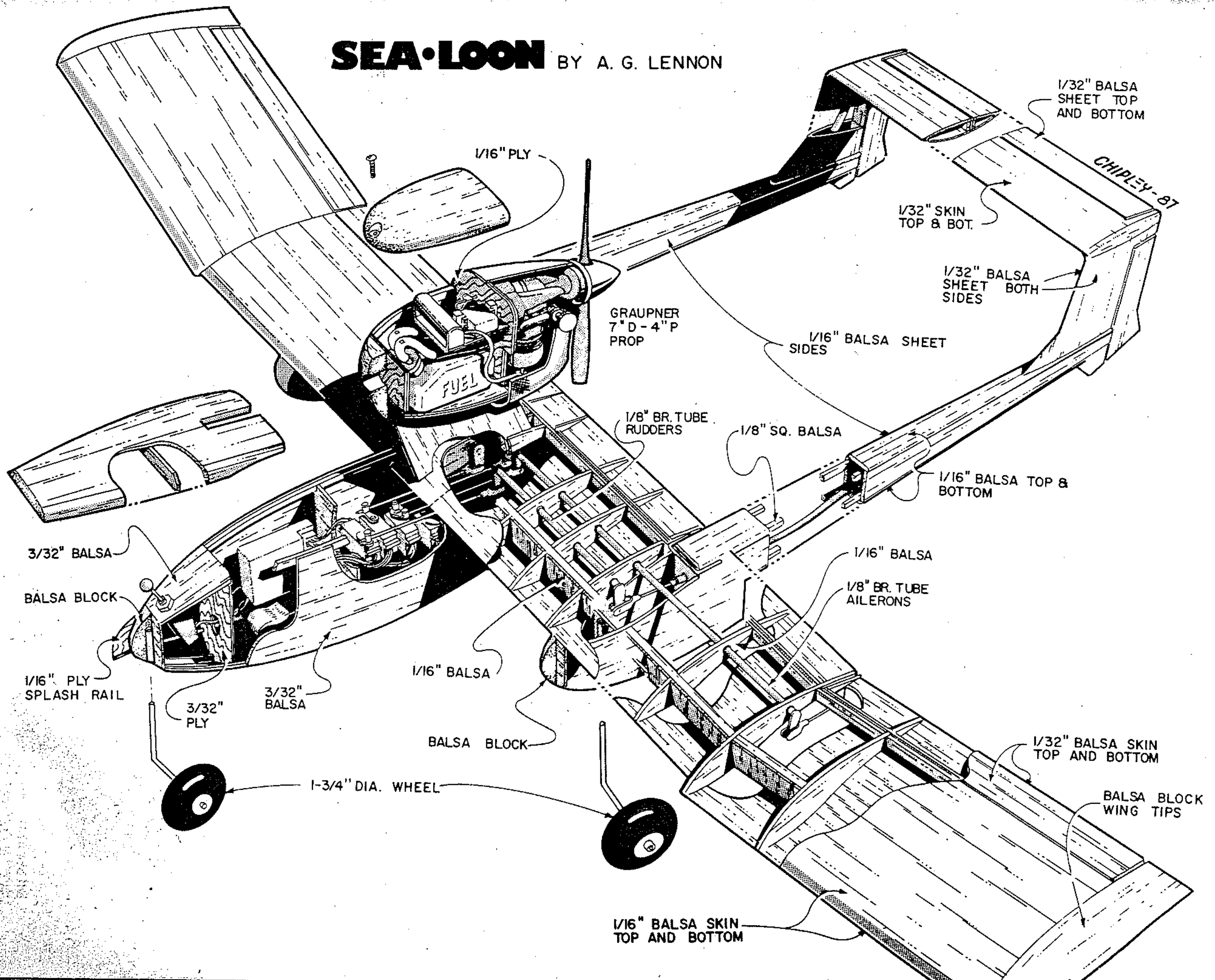
tance. We may theorize, in fact, that at hump trim the wing must *not* be stalled. A stalled wing exhibits increased air drag and a loss in effectiveness of the ailerons. When compounded by hump resistance, these characteristics could prevent takeoff, particularly when engine power is marginal.

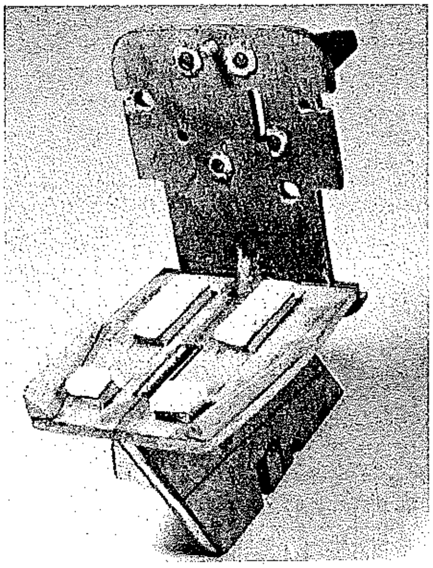
With full-scale flying boats this is not a problem. Hump trims of 15° in conjunction with wing airfoils that stall at 20° or more provide a healthy margin. For models, however—particularly for small, light aircraft that fly at low speeds and low Reynolds Numbers—scale effect has a major impact on stalling angles, which are in the low teens. In addition, during takeoff the model flying boat is operating in "ground effect," which reduces the angle of stall. Deployed flaps further reduce the stall angle.

For a model, then, hull design should be tailored to suit the wing's stall characteristics, which in turn depend on airfoil section, aspect ratio, and plan form.

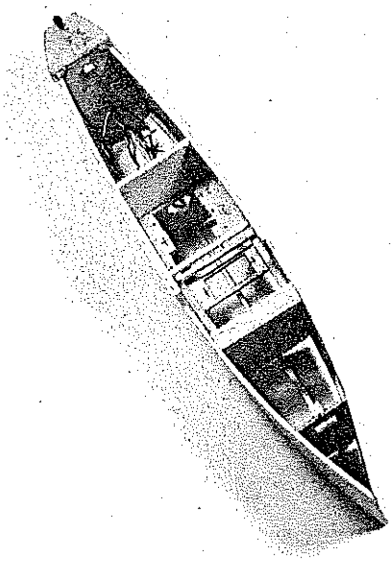
The Eppler 193 airfoil used on the Sea Loon gives the wing a gentle stall. Adjusted for aspect ratio and plan form, it will stall at 16°. Ground effect and half flap deployment

SEA•LOON BY A. G. LENNON

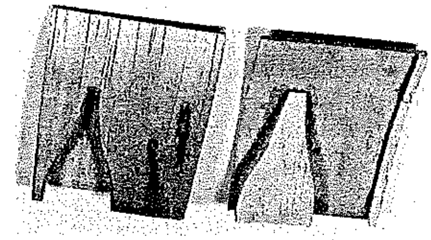




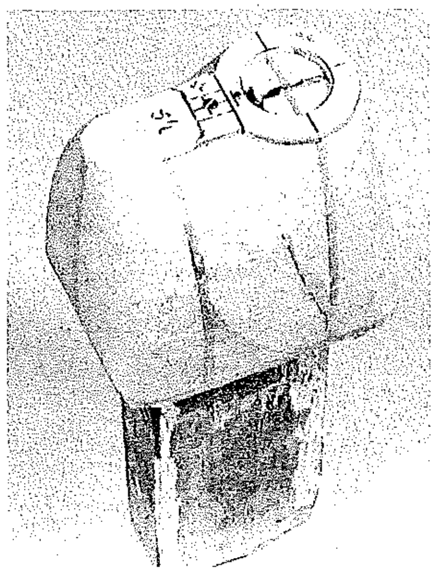
Nacelle assembly begins by installing the engine mount. Note the slot for the servo wiring. A servo extension cord will be needed.



The completed hull except for the bottom sheeting. Note location of bulkheads, servo mounts, and Du-Bro quick switch assembly.



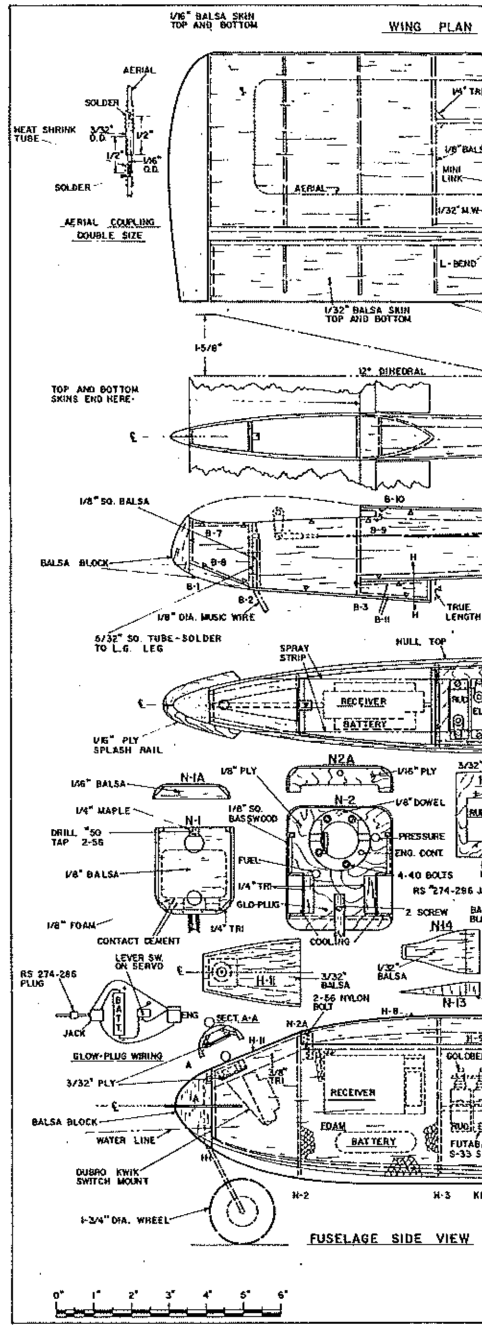
The left and right nacelle sides are pre-bent by soaking them in liquid ammonia. Note the details of the NACA engine-cooling scoops.



The form for the fiberglass and epoxy cowling. The spinner ring and its companion plywood piece are included in this assembly.

(20° out of a maximum deflection of 40°) reduce this to 12°.

The hull is designed with an 8° stern post angle (see drawing) and with twin afterbodies only slightly longer than the hull forebody. The result is a hump trim angle estimated at 8° measured from the forebody keel. Since the wing must rotate 12° before stalling, this hump trim leaves a healthy margin below the stall. The wing is set at 0° incidence to the keel. At level



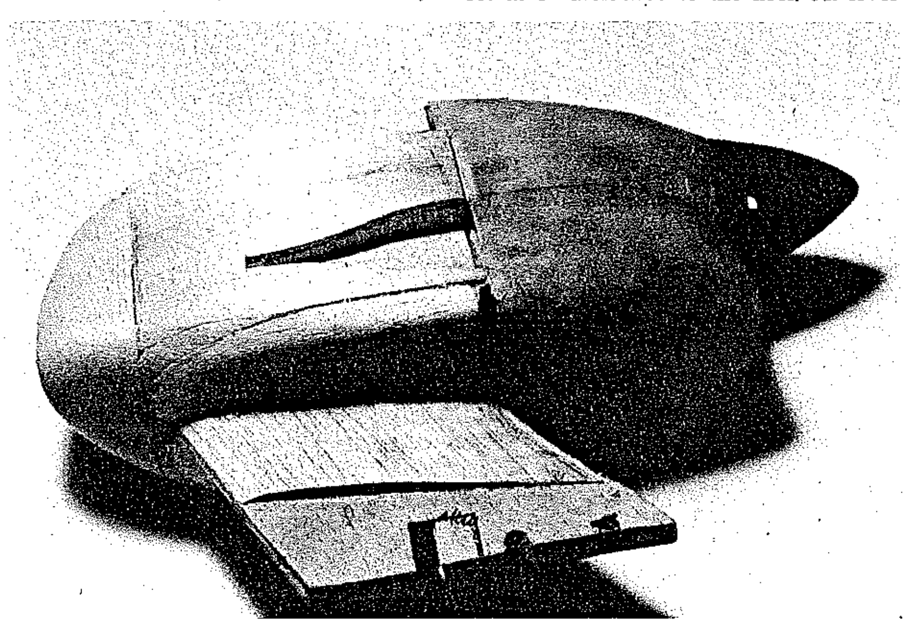
flight, with a speed of 45 mph, 0° angle of attack will support this model.

Once past the hump, wing lift increases. Planing action on the water and wing lift cause the hull to rise. The elevators, aided by the pusher prop slipstream, become effective. The plane now rides on the hull rear and the boom ends. A touch of up elevator, and takeoff occurs.

Drooped 20°, the wing's slotted flaps shorten the takeoff run; deployed at 40°, they permit landings at 20 mph. Flap deployment produces very little change in longitudinal trim.

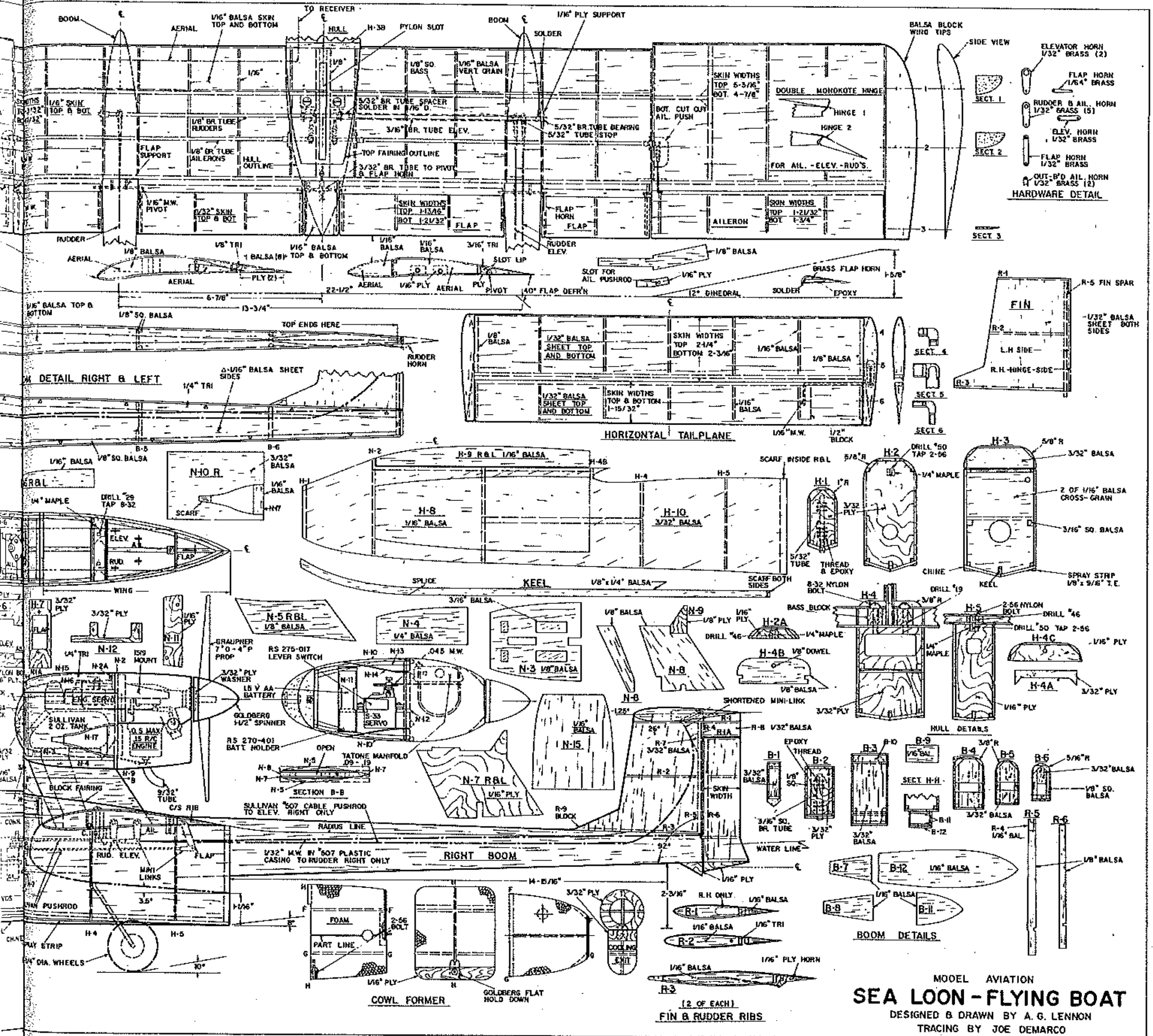
To provide a "beam loading" (ounces of weight per inch of maximum beam) commensurate with the Sea Loon's wing loading of 22 oz. per sq. ft. of wing area, a beam of 2½ in. was selected.

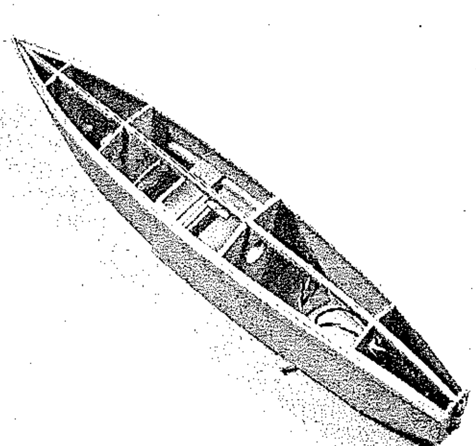
The Sea Loon wing incorporates an outboard leading edge droop, illustrated in the drawing. This, again, is based on NACA

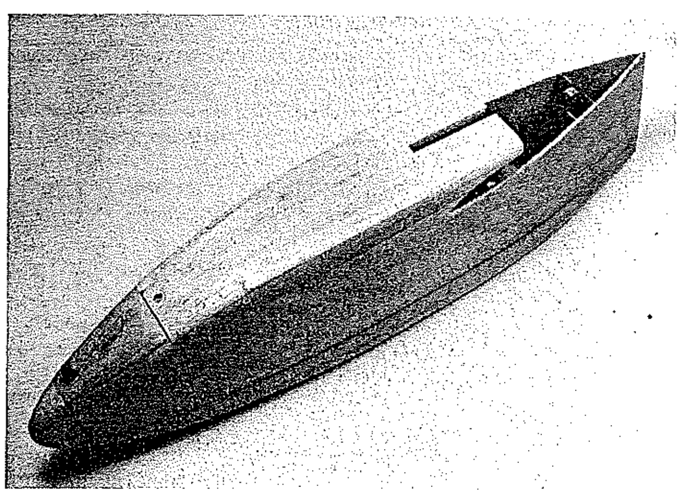


The assembled nacelle and engine cowling. Sand the pylon to a streamline cross section.

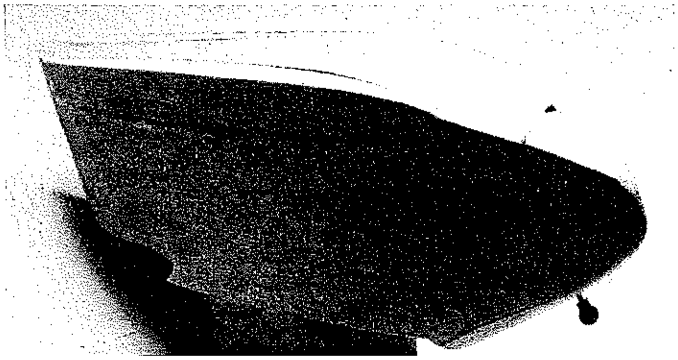
Full-Size Plans Available . . . See Page 188

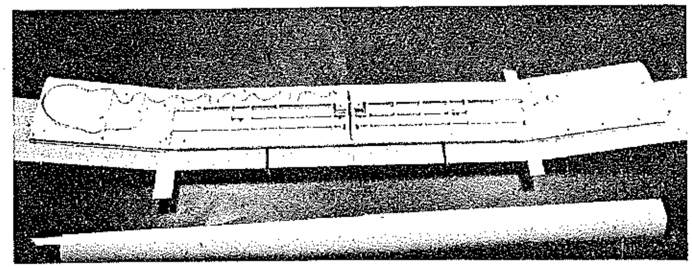




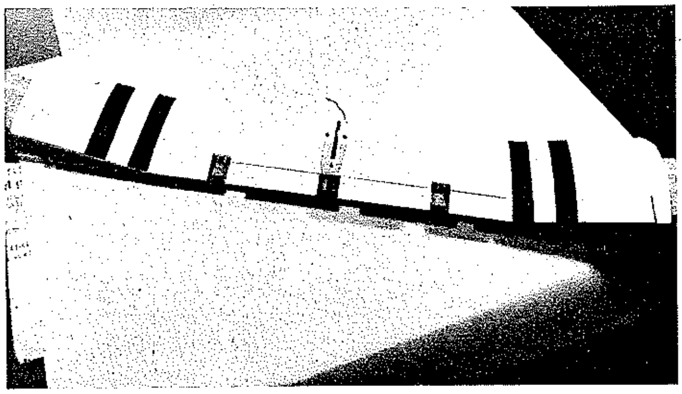


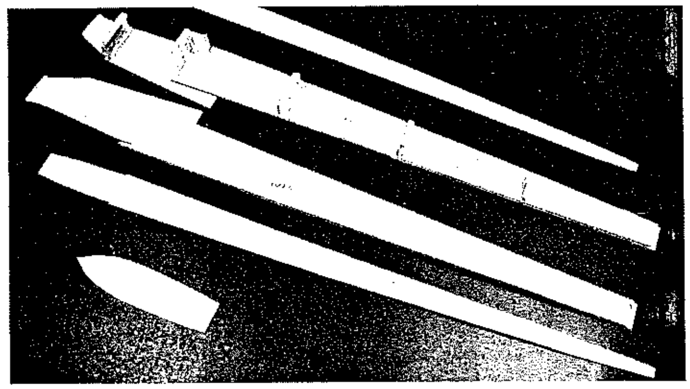
Left: With the keel and 1/8-in. sq. chine strips in place, sand the keel and hull sides to conform to the hull's "V" cross section. Then add the right and left spray sheets and spray strips. Right: The completed hull, including the cover. The drawings reflect a recent modification in that the cover now ends at the wing leading edge and a balsa faring extends back from the cover. See the text for more water-proofing hints.



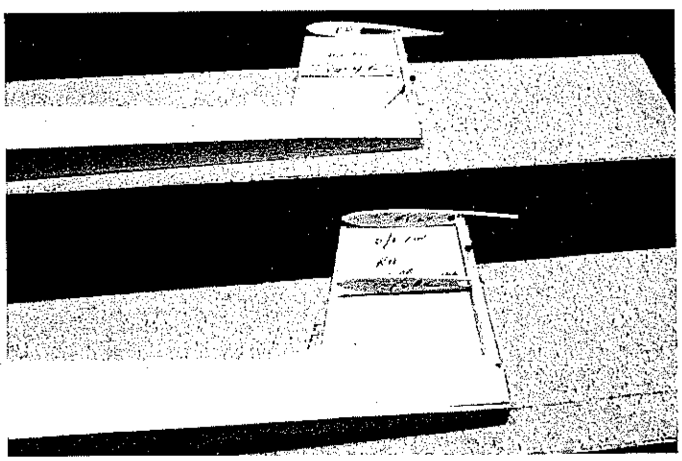


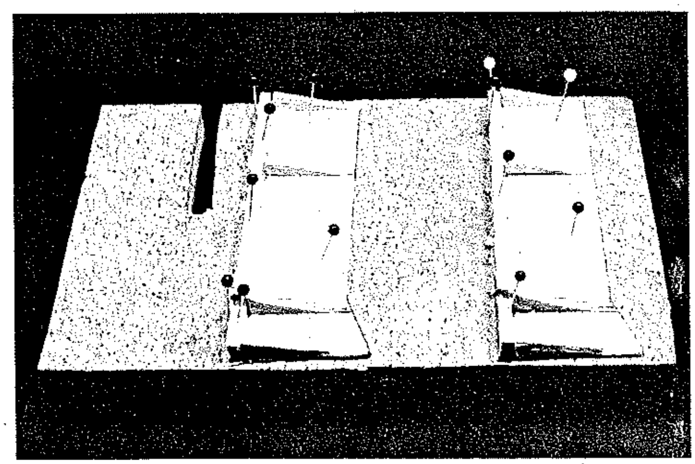
Left: Spray strips and sharp corners help reduce the spray thrown up by the hull. Above: Wing assembly is done on a jig made of 1/8-in. corkboard and ½-in. plywood. Mylar strips prevent glue from adhering to the cork. Note the author's antenna installation.





Left: The completed and covered wing. Note the area that's been left uncovered where the fairing will glue on. Right: Boom construction. Preassembled bulkheads are glued to one side as is the ¼-triangle stock. The outer control cable tubes should be installed at this time.





Left: Attach right and left fins to booms. Note the location of the cable sheath as shown in the upper boom. Right: Assemble the rudders as shown here, again pinning the pieces to the corkboard jig. The left-side sheeting and the plywood water rudders are still to be added.

research in "wing design for spin resistance." The configuration increases the stalling angle of the drooped portion by a good 10° and also provides effective aileron response at high angles of attack. This is the third design in which the author has incorporated such a leading edge droop; all three confirm NACA research.

As the drawings show, this Sea Loon incorporates some beneficial modifications on the original design. The hull has been lengthened one inch, mainly to move the flap servo forward for easier access but also to avoid nose ballast. The NACA low-drag air scoop inlets and outlet have been enlarged slightly for better engine cooling on the ground, and the block wing tips extend to the drooped leading edge.

Note the offset servo wheel on the aileron servo in the hull. This feature provides aileron differential, with much greater upward than downward aileron deflection. The result is smooth, banked turns without adverse yaw and, hence, no rudder action.

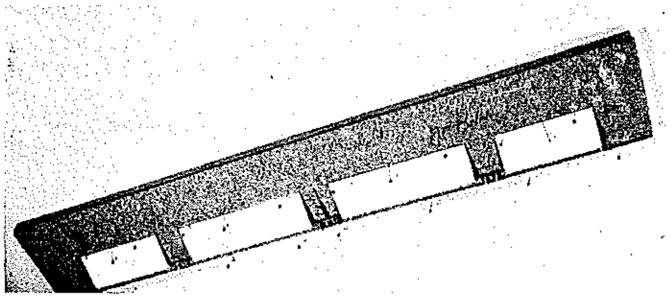
Engine Starting. The inverted engine, in its nacelle position, is easily started with an electric starter. There is room between spinner and horizontal tail plane to permit this. However, after priming the engine, flip the prop by hand several times to make certain that no fuel is trapped between piston and cylinder head. If unusual resistance is felt, tip the model so that the Tatone manifold is downward, permitting the trapped fuel to drain out through the cylinder's exhaust opening.

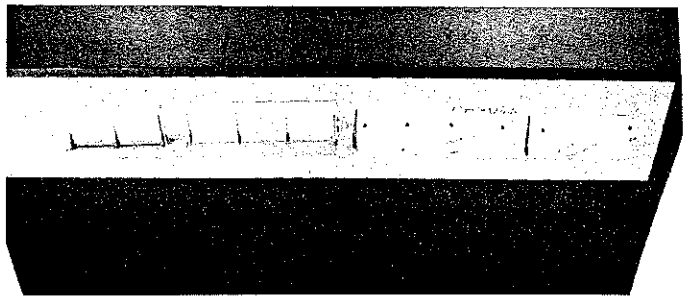
Trying to start the engine with the model inverted so that the engine is upright is awkward and not recommended.

Flying. This is a small model. Waves only three to four inches in height would have an impact comparable to that of three- to four-foot waves on a full-scale ship—that is, would make takeoffs dangerous if not impossible. With the Sea Loon, therefore, successful water takeoffs require dead calm, or at most a gentle ripple condition.

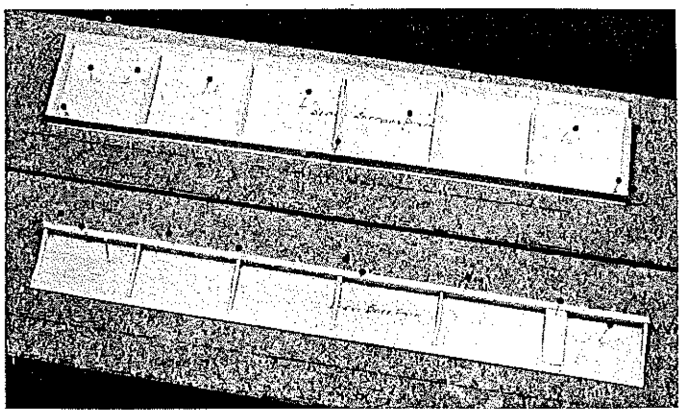
On the positive side, the model's small size and light weight permit hand launching. The wing tip droop paid off on a couple of the author's bad hand launches (upward instead of level or slightly down). Good piloting plus good aileron control averted the otherwise inevitable crash.

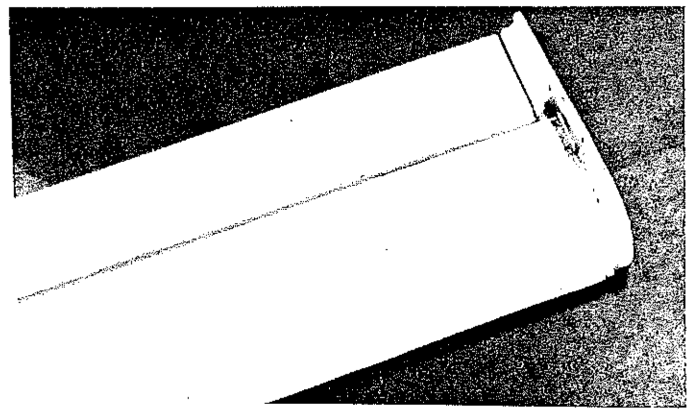
Water takeoffs will be shortened with half flap deployment. Landings with flaps fully deployed can be made on water or grass. The removable tricycle landing gear



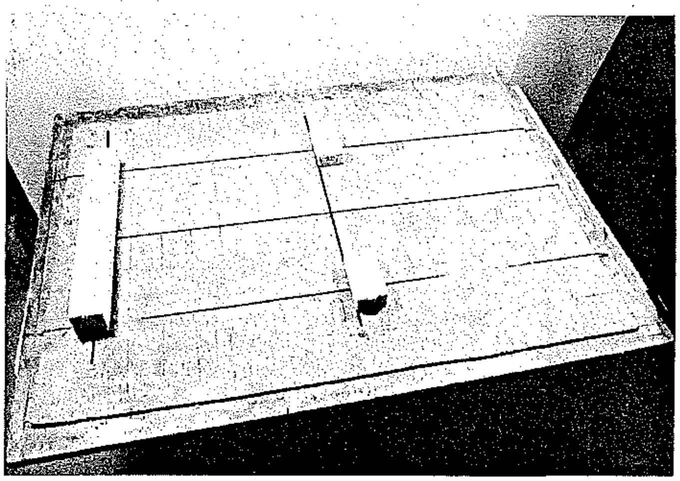


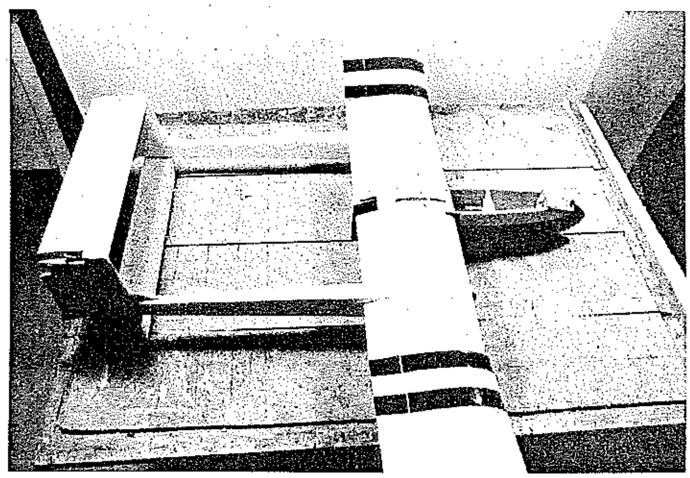
Left: Flap assembly. The two sections on the left are complete; the two on the right, missing the upper sheeting, detail the rib locations. Upper sheeting is attached at one end then wrapped over the ribs and glued into place. The outer ply ribs are indented to provide space for the 1/64 brass torque arms. Right: The finished flaps with torque rods, arms, and plywood supports. Aligning flap leading edges are ¼-in strip.





Left: The stab and elevator assemblies. A strip of trailing edge stock holds the lower stab sheeting against the front of the rib undersides. Right: The underside of the horizontal tail plane. the right hand balsa tip block reveals the location of the rear elevator control horn.



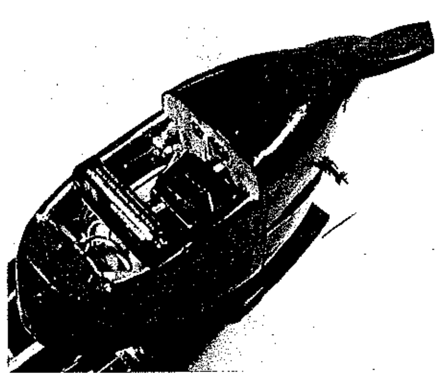


Left: The simple jig used to assemble the hull, wing booms, and horizontal tail plane. Text and drawings provide additional details. Right: Final assembly. At this point the four hull servos have been installed and the elevator and rudder pushrods connected to their proper surfaces.

shown in the drawing is optional. Basically, it's needed only if landings are to be made on pavement. The nose wheel is not steerable.

The onboard glow plug heating arrangement really works: No in-flight inverted engine quits have occurred. Note that when both the throttle lever and trim lever are in the down position the engine is shut down and the glow plug heating circuit deactivated. At full throttle, the circuit is also deactivated.

Recently, I flew a larger flying boat from the shore of a large lake without a pickup boat standing by. The glow plug arrangement in the inverted engine was identical to that in the Sea Loon. After a six- or seven-flight session, I taxied the model back to shore under its own power and then deliberately shut the engine down.



The open nacelle reveals the engine servo, switch, and on-board battery. Note the piece of toothpick CyAed to the servo to prevent the roller lever from jamming the servo arm.

Three of my fellow RC club members, John Jeffrey, Dick Murray, and Ken Sharkey, have flown the Sea Loon—and backed up its virtues with the comment, "It's a good airplane."

Construction. The Sea Loon's structure is based on the "stressed skin" concept. All surfaces are sheet balsa and there is a minimum of internal components. This construction is light yet surprisingly strong.

Note that the "true-lengths" of curved surfaces such as hull sides, nacelle sides, etc. are shown on the drawing.

Build all components according to the guidelines in the drawing. Detailed instructions for assembly of each major component follow.

Nacelle. Successful nacelle assembly depends on the correct sequence of operations, as follows: *Continued on page 32*

Assemble the engine mount and cut the slot for the servo wiring. Solder the wiring (see diagram) to the Radio Shack jack and mount it on its ply base. Rough-shape the balsa nose block and hollow it out. Epoxy the jack and mount it in position.

Install bulkhead N1 and add the sides. Install the servo extension cable through the slot in the nacelle strut.

Using contact cement, attach the fitted tank to the foam pads. Using all three outlet holes in the tank plug—for engine fuel, manifold pressure, and fueling—is recommended. Plug the open end of the fueling tubing with a rivet or small screw.

Mount the Radio Shack battery holder to the ply base using 3/16 bolts and nuts. Complete the soldering of connections for the glow plug wiring (see wiring diagram). Mount the battery holder on its base using epoxy.

Install the servo mount, again using epoxy. Install the servo, connect it to the servo extension, and mount the engine. Connect the .045-in. music wire pushrod and mini-link clevis to both servo and engine throttle arms. Using cyanoacrylate glue (CyA), attach the Radio Shack roller lever switch on the servo as shown.

Attach the nacelle cover components to the nacelle.

Make the cowling by laying up two layers of medium-weight fiberglass on the form (see photo and drawing). Assemble the ply spinner ring and its companion piece using Hobby Poxy #2. When the adhesive has cured, dissolve the styrofoam core with acetone (or gasoline), then trim and cut the cowl on the parting line.

Epoxy the top portion of the cowling to bulkhead #2 and align the spinner ring with the spinner. (Note the 3/32-in. plywood washer on the engine crankshaft.) Position the rear cowl plywood and, making sure it is flat, attach the hold-down assembly with the #2 shoulder screw.

Install the lower cowling and fit the rear cowl hold-down assembly so that the cowling closes properly. Positioning both on the nacelle, epoxy the cowl to the rear hold-down assembly. To prevent bonding the lower cowl to bulkhead #2, insert waxed paper between the hold-down assembly and the bulkhead.

Finally, sand the nacelle to shape.

Hull. Prebend the hull sides using liquid ammonia. Arrange weights and supports to hold the sides in the bent position until dry.

Do the subassembly for bulkheads parts H1, H2, H4, H4A, and H5. Install 3/16-in.-sq. servo mounts and 1/8-in.-sq. balsa on sides. Assemble the sides and top front of the bulkheads (with the switch). I used X-Acto clamps for this operation.

Install the ply servo mounts and the keel. Install 1/8-in.-sq. balsa at the chines. Sand the keel and chines to meet the "V" of the bulkhead bottoms. Fit the bottom planking at the right and left sides of the keel and cement it to the keel, bulkheads, and chines. Add nose block and sand to shape.

Continued on page 34

Add the spray strips and sand to the contours shown in the bulkhead portion of the drawing and in one of the accompanying photos. Attach the cover components to the hull and to the radius corners.

Wing. Assemble the rudder-elevator torque tubes and the aileron torque tubes. Note that the 3/16-in.-dia. elevator tube rides on the 1/8-in.-dia. rudder tube. Study the drawing carefully: These torque tubes are the hinges that transfer the output of the single elevator and single rudder servos into the two sets of pushrods necessary to operate the twin elevators and rudders. Solder the bushings inside the 3/16-in.-dia. tube ends to complete the hinges.

The stops (5/32-dia.) are soldered to both sets of tubes to prevent end-play. The 5/32-dia. bearings are supported by 1/16 ply plates. Both ply and bearings are epoxied to the ribs. K&S Engineering brass tubing and 1/4-in. brass strips are used. Solder the horns securely to the tubes.

Make a jig of 1/8-in. corkboard on 1/2-in. plywood. A 1/32 x 1/8-in. strip of balsa is cemented to the jig as shown to cater to the slight undercamber of the E-193 wing section. Mark the rib locations on all three lower wing skins. Pin the skins on the jig as shown. Cement the 1/8-in. trailing edges (TE) in position. Position the lower 1/8-in.-sq. spar and all three sets of torque tubes on the skins. The rib cutouts will locate them.

Install the ribs and epoxy in the ply bearing supports (all seven). Add the upper 1/8-in.-sq. spar and the 1/16 balsa webbing between the ribs. Add the balsa and ply dihedral joint reinforcements and the 1/4-in. triangular stock. Install three drilled blocks for the wing hold-down.

The antenna is installed along with the brass tubing coupling (composed of 1/2-in. lengths of 1/16 and 3/32 tubing) shown in the drawing. However, it is necessary to cut the antenna before installation and then join the two pieces later with a coupling made up of two 1/2-in. lengths of brass tubing. The 1/16 brass tube section is a free-sliding fit into the 3/32 tube section. A bit of solder should be melted onto the 1/16 tube, then filed down so that there is a good, tight electrical connection—yet one which still permits us to readily disconnect the two sections.

Measure the antenna carefully before cutting at a point four inches from the receiver. After soldering the coupling halves to both sections (using heat-shrink tubing over the solder joints) and joining them, measure again. It will be necessary to cut a bit of the far end of the antenna to compensate for the coupling. It is important that the antenna be the same length as it was before it was first cut!

I have used this procedure on five models, each with its own antenna permanently installed in either fuselage or wing, with absolutely no problem. It permits moving the receiver from model to model easily.

Install the aileron outboard pushrod and clevises on the horns and run them out through the ply guides. The aileron push-

Continued on page 36

rods of 1/32-dia. music wire are attached to the mini-link clevis by using ¼ in. of the threaded portion of the 2 - 56 coupling (supplied with No. 507 cable sets) soldered to the music wire. To permit adjustment of the ailerons for trim purposes, tap the mini-link 2 - 56 so that the threaded coupling will turn reasonably freely in the clevis. There are access holes in the outboard skins of the lower wing for this purpose.

The rear elevator clevis is a shortened mini-link. It is connected to the elevator cable using the ¼ in. of threaded coupling (which is drilled its full length). The carburetor clevis is attached to the .045-in.-dia. music wire pushrod in similar fashion, but the brass coupling must be drilled 3/64 dia. to accommodate the wire.

Bend and pin the lower wing skin leading edge (LE) to the rib contour and cement securely. Cement the center-section upper wing skin to the spars and ribs, except at the LE. Fit the outboard upper wing skins at the inner ribs. Cement them to the spars and ribs, again except at the LE.

Using ½-in. masking tape to hold the skin in place, cement the upper skins to the ribs and the lower skin. This is done by placing three-inch lengths of tape along the chord of the sheeting on 1½-in. centers to hold the wing skin leading edges while the cement is setting up.

Install triangular cross-sectioned strips onto the rear spar. These are positioned in front of both the ailerons and the flaps (four pieces). The latter is sanded to form the flap slot lid.

Booms. Assemble the bulkheads. If installing the landing gear, lace and epoxy a piece of 3/16-sq. brass tubing to bulkhead B2. Cement both the ¼-in. triangular stock and ⅛-in.-sq. strips to the four boom sides. Attach the bulkheads to the boom sides and install the plastic tube sheath for the elevator and rudder.

Add the top and bottom boom sheeting. Note that the bottom sheeting (compared to that shown in photo) has been shortened at the front to permit access to elevator and rudder horns.

Add pieces B8, B9, B10, and B11. Defer installation of B12 (the lower forward skin) in order to provide access to the rudder and elevator horns during final assembly. Add the balsa nose blocks and sand to shape. Sand the top corners, and add ⅛-in. ply skeg at the lower rear end of the boom.

Fins. Install the fin spars at the correct angle (92°, as shown in drawing) to the bottom skin. Add the right-hand skins and the ribs R1, R2, and R3. The R7 rib is added on the right-hand side as well, and the elevator tube casing is attached to it with CyA.

Add the left-hand skins; cement the LE liberally and tape with masking tape as for the wing LE. Add blocks R9 and sand the LE to radius. Add R4.

Rudders. Assemble the right-hand skins

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and LE spars and ribs as shown. Note the $\frac{1}{16}$ ply rudder horn/rib. Add the left-hand skins and sand to shape. Add the $\frac{1}{16}$ ply water rudder.

Flaps. Assemble and solder the center $\frac{1}{16}$ music wire pivot, the $\frac{3}{32}$ brass tube, the $\frac{1}{32}$ inboard horn, the two ply flap supports, and the two $\frac{1}{64}$ brass flap horns. Check the solder joints carefully for adequate strength. Use a hot soldering iron and thoroughly clean the areas to be soldered.

Assemble the boom $\frac{1}{16}$ music wire pivots, the two ply flap supports, and the two $\frac{1}{64}$ brass horns. Solder carefully as above. Epoxy the $\frac{1}{16}$ music wire outboard pivots into the outboard ply flap ribs.

After covering the flaps (I used MonoKote) assemble as shown, carefully aligning the flap leading edges and epoxying the $\frac{1}{64}$ brass horns to the ply end ribs. Note that the ply flap supports are in position. The width of the two outboard spaces must clear the boom sides for free flap operation.

Ailerons. Assembly here is similar to that of the elevator. Note that the aileron ply inboard rib extends to the aileron LE to provide the aileron horn.

Stabilizer and Elevator. See the two accompanying photos for a clear illustration of stabilizer and elevator construction. Note the $\frac{1}{2}$-in. balsa rib near the right-hand end of the elevator. The $\frac{1}{16}$-dia. music wire elevator torque rod is inserted into this rib, and the spar is grooved so that the rod is submerged in the balsa structure. In one of the photos you see the right-hand stabilizer tip block on the stabilizer end; the elevator brass horn is visible.

Covering and Installing Hinges. I chose a MonoKote covering, and took care to leave a generous $\frac{1}{4}$-in. overlap at all seams to prevent leakage.

Ailerons, rudders, and elevator are "one-side" hinged using the double MonoKote procedure shown at the right-hand end of the wing portion of the drawing. By providing both hinging and a gap-seal this method affords effective control. Be sure that these surfaces operate freely in both directions.

Leave the underside of the wing bare where the booms make contact so that balsa-to-balsa cementing can take place. Cement the stabilizer end blocks to the stabilizer and shape them.

Drilling and Tapping. It is suggested that the three drilled holes in the wing and in the hull and nacelle hold-down blocks be used to align the mating holes in the hull and nacelle maple blocks. Ensure that wing and hull alignment is correct before drilling. The same applies to the two covers. Use a No. 29 drill for 8 - 32 threads and a No. 50 drill for 2 - 56, and tap the holes accordingly.

Final Assembly. The simple jig for assem-

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Safety/Preston

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botched. It may also be prudent, if the student is not very skilled, to have him deliberately start the dead-stick approach a little high, figuring that the first "dead-stick landing" will not really be a landing at all but merely a pass down the centerline of the runway at an altitude of 50 ft. or so.

Practice makes perfect, so don't settle for just one successful attempt. Have the student repeat his approaches until he is comfortable in knowing how his model will perform in a true emergency.

None of the above discussion answers the question of when to attempt a return to the runway if the engine dies on the climbout. My recommendation would be to always avoid a turn back to the runway, if at all possible. I've seen a lot of models "re-kit" themselves when this was attempted. However, knowing the glide performance of your model will help you make the correct decision in such circumstances.

Have another safe month.

John Preston, 2812 Northampton St., N.W., Washington, DC 20015.

Sea Loon/Lennon

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bly of hull, wing, booms, and horizontal tail plane is a necessity. (The drawing provides dimensional detail.) The blocks are styrofoam.

Install the four servos in the the hull and attach the five clevis-and-pushrod assemblies to the flap, aileron, rudder, and elevator horns protruding from the wing center section underside.

Install the wing on the hull. Pushrods for aileron, elevator, and rudder pass through the opening provided in bulkhead H3; the flap pushrod passes through bulkheads H3 and H4. The wing may then be bolted to the hull and the pushrods installed in the connectors for the appropriate servos.

Position the wing-hull assembly on the fixture, with the keel resting full-length on the board. Install the booms, cementing them liberally to the wing, and align. Add the horizontal tail plane as shown and cement.

When the cement has set, install the rudder and elevator pushrods in the booms from the front. The connection to the rudder horn is made by a right-angle bend in the 1/32-dia. music wire pushrods.

Attach the rudder and elevator clevises in the booms to the appropriate horns. Connect the rudder L-bends and the cut-down elevator rear clevises to the rudder and elevator horns.

Adjust the threaded couplings in the forward rudder and elevator clevises so that when the rudders and elevators are in neutral position the forward horns are vertical. Add the lower boom cover B12 and cover it with MonoKote.

The nacelle is installed in its slot in the wing and is liberally cemented after pulling the engine servo extension wiring forward in the hull.

Add the wing-strut balsa block fairings and install the upper and lower wing skins and ribs to fill the gap between the flap inboard ends. The holes in the ribs for the 1/16 flap torque rod should fit closely to the rods to prevent leakage.

Sealing. Use silicone to seal the wing-to-hull connections below the wing. The hull openings are sealed by covering with MonoKote after adjusting the servo-pushrod connections (see photo). A slit in the MonoKote will permit the receiver battery-charging jack to be pulled out for charging. Masking tape will seal this slit. The hull cover is installed over the MonoKote seal.

Landing Gear. The removable tricycle landing gear shown in the photos and drawings is optional. Its installation does not significantly alter the center-of-gravity (CG) location.

Where the landing gear legs enter their sockets, melt on a bit of solder which can be filed to provide a firm yet easily removable connection.

Exhaust Manifold. The Tatone .09-.19 the ends of which are threaded 2 - 56 to accept 2 - 56 nuts as shown in the nacelle top view. Use No. 2 lock washers under the nuts.

However, if you possess a Dremel drill and drill press a better method is at hand. Drill (No. 50) and tap (2 - 56) the bosses on each side of the engine exhaust (OS Max .15 RC) ½-in. deep. Drill corresponding holes in the lower half (engine inverted) of the manifold. This permits bolting that half of the manifold directly to the engine with 2 - 56 bolts (⅜-in. long) and No. 2 lock washers. The upper half of the manifold is then installed. The holes for the normal attachment method are plugged with short 4 - 40 bolts after being tapped for 4 - 40 threads.

The brass exhaust tube is held in the manifold by a small self-tapping screw (supplied with Goldberg flat hold-downs) inserted in a 1/16 hole drilled through both manifold and tube. Bending the brass tube so that the exhaust does not impinge on the wing requires that it be heated to red-hot and bent very carefully to avoid buckling.

Now that you've built your Sea Loon, you're ready to try a first launching. Wait for a day when the water is quiet, or barely rippling—and watch her break free of the water's bond. You're going to enjoy this flying boat.

Radio Technique/Myers

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The second training session—Review the Fundamentals. This means that the student should *do each maneuver at least once.* As instructor, all you are looking for is confidence that the student can keep the airplane upright and level, and that he/she understands turns.

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