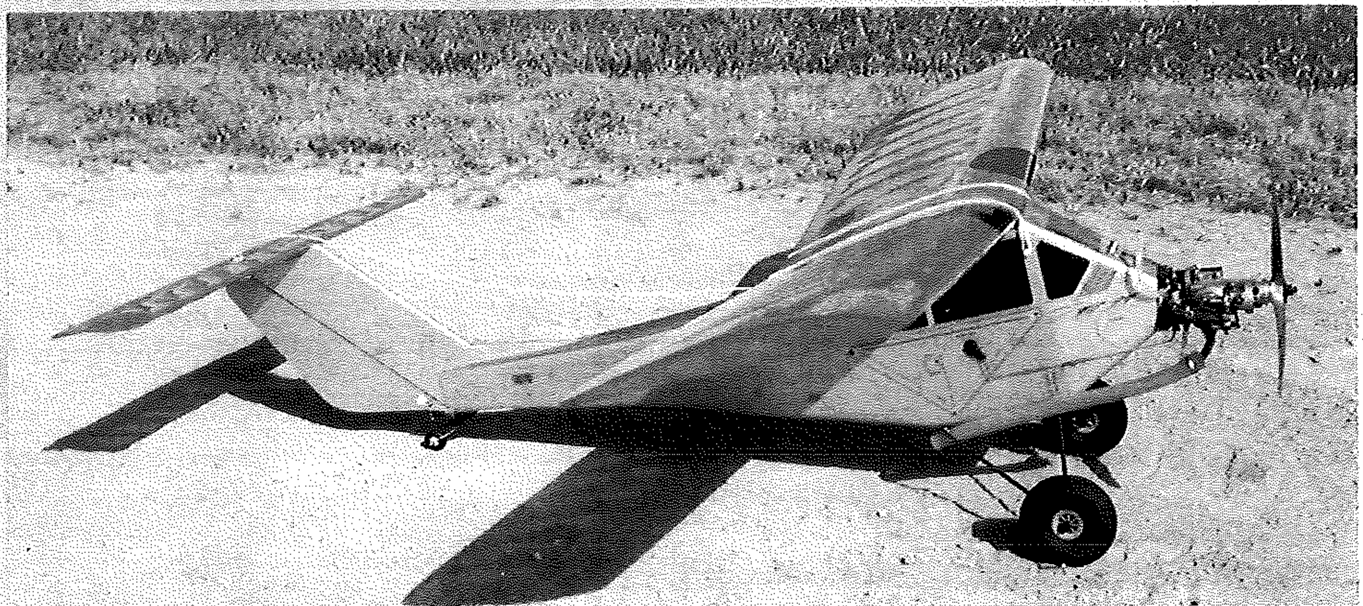

Big picture: The Duck in flight. Slow and gentle enough for beginners, it's ready for a burst of aerobatics in experienced hands. Above: The wings and the high T-tail are covered with transparent film; the fuselage is painted with lacquer auto primer, sprayed with Black Baron silver polyurethane. Fictitious panel lines, etc., and faux-scale oil leaks add to the fun.

ABOUT six years ago, one Saturday morning in early spring, I felt an irresistible urge to glue something together. Being between building projects, I turned to the scrap shelf, rounded up an assortment of leftover parts—the fuselage I'd scratch-built for a never-completed Electric, the forward stabilizer from an aborted canard glider, and a wing from a derelict Swizzle Stick—and started gluing.

By some combination of skill and luck, I managed to parlay that eclectic batch of structures into an exceptionally lightweight RC aircraft that's perfect for relaxed sport flying. What's more, it's proven the most enjoyable model I've owned—and the longest lived. I call the airplane Mud Duck.

Test flown on an O.S. .25 engine, this 60-inch-wingspan model was a delight for low, slow passes, lazy touch-and-goes, spot landings, effortless takeoffs, gentle hammerhead stall turns, and *very* casual loops.

Shortly afterward, I replaced the O.S. with a Saito .30 four-stroke purchased at a closeout sale. With its high T-tail and gangly, oversized wheels, Mud Duck was already a far cry from the superclean lines and sanitary retracts of conventional high-powered designs, and the dancing exposed rockers of the little Saito completed the maverick appearance.

This isn't a power ship; it's flown on the wing, not by dint of the engine. But even those who prefer vertical takeoffs have a hard time holding back a smile when they see Mud Duck dancing inches off the ground, tail high in the air, giant wheels dangling, and the little four-stroke putt-putting like a Briggs & Stratton. Hedgehopping over a low

Part aerial clown, part sage old Zen master, this 60-inch-wing-span, Saito .30-powered RC aircraft puts a witty new spin on the sport of Sunday flying.

Tom Chipley

Mud Duck

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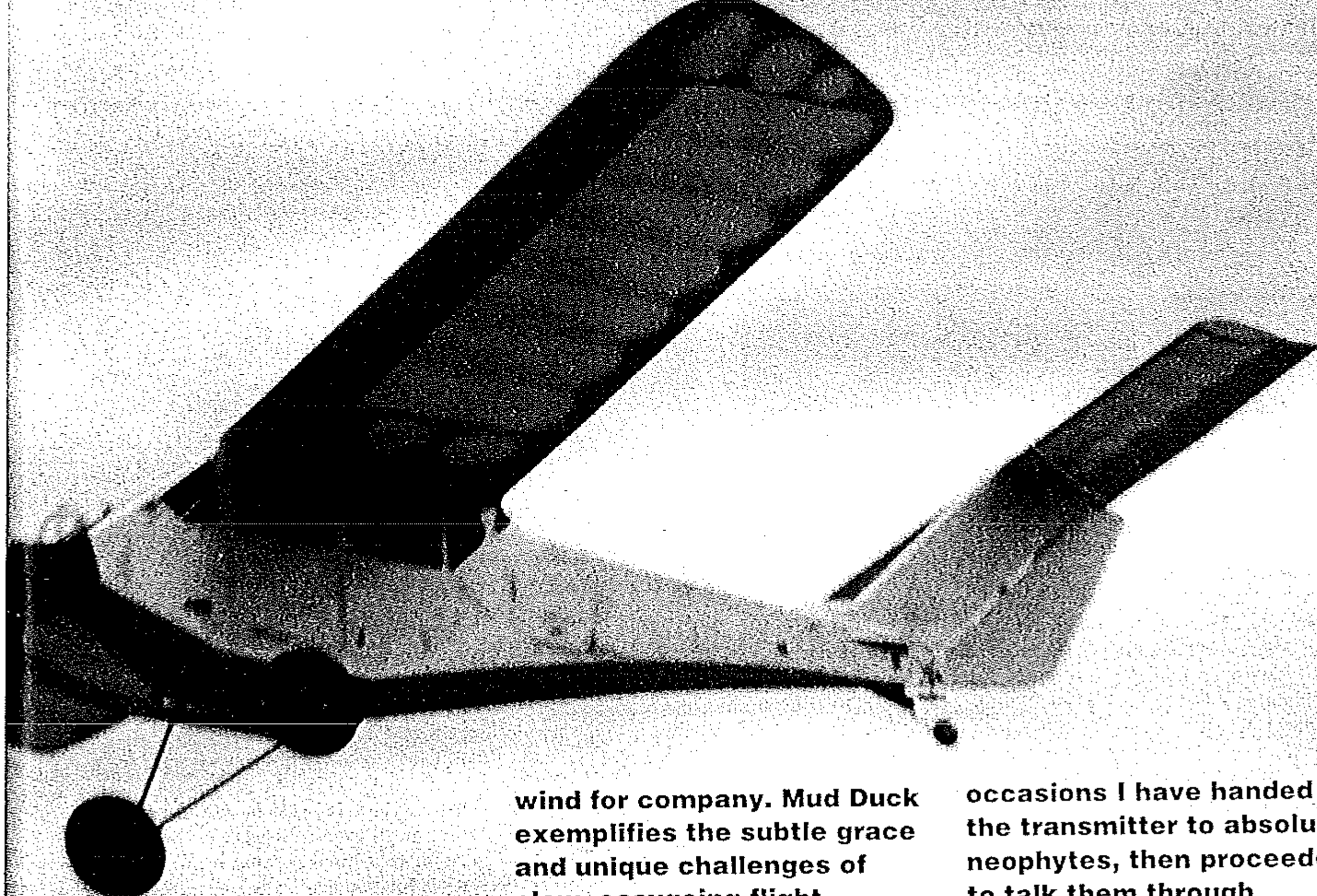
fence, turning ridiculously tight with the wing vertical, then hopping back over even lower, the Duck makes me laugh out loud. Pylon turns around the only killer tree on my field are also a hoot. This model is an aerial clown, an irreverent puppy, and a sage old Zen master all in one.

Takeoffs couldn't be easier (unless you turned them over to another flier). Just point the nose somewhere into the wind, and push the throttle forward. Very little rudder or elevator is required. Mud Duck will lift her tail, roll for just a few feet, and gracefully and gently rise skyward.

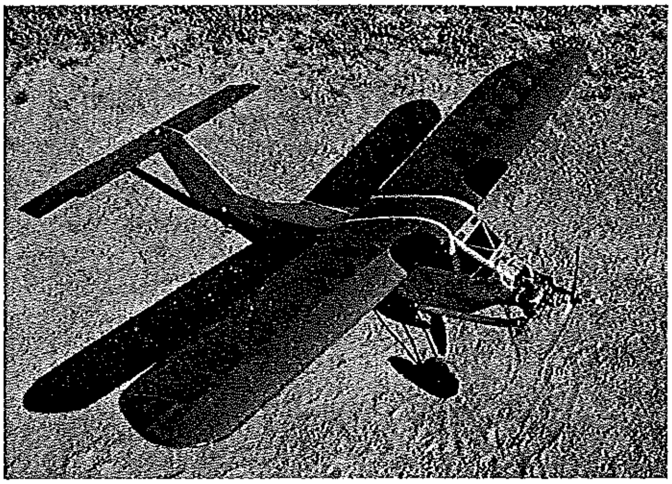
Don't force her up. She needs to fly on the wing and won't pull herself aloft with brute power. In fact, Mud Duck flies like most full-scale planes, responding to a gentle touch on the stick and a firm hand on the throttle. Like Old-Timer aircraft with their characteristically graceful lines, this model isn't intended to push the frontiers of aeronautical science. It's the kind of airplane that basks in the warmth of relaxed afternoons with good friends, or can be perfectly content alone with just the gentle wind for company. Mud Duck exemplifies the subtle grace and unique challenges of slow, easygoing flight.

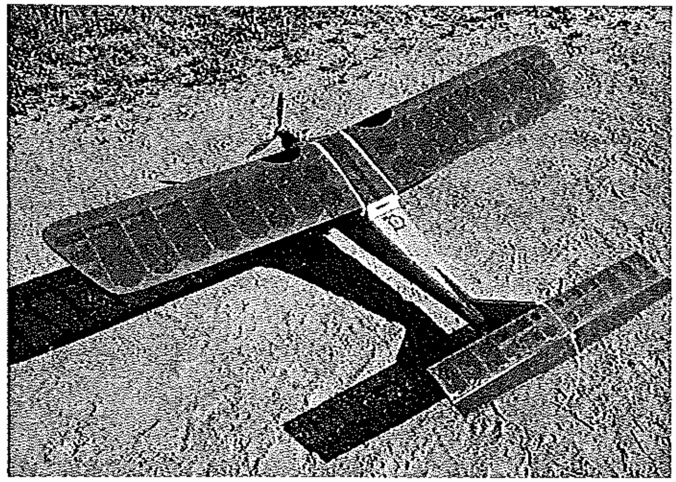
The large wheels are important both aesthetically and functionally, so resist the urge to substitute smaller or more aerodynamic ones. From an aerodynamical standpoint, the drag of the large, frontal-area wheels counterbalances the drag created by the high-mounted stab above the fuselage centerline.

Equally important to Mud Duck's success is its extremely lightweight construction. This model is designed to fly, not to crash. Lightness combined with ease of control make the Duck so responsive that the average Sunday flier is unlikely to crash it. With the help of an experienced instructor, even a rank novice should quickly master the skills necessary for solo takeoffs and landings. Indeed, on several occasions I have handed the transmitter to absolute neophytes, then proceeded to talk them through standard turns and level flight.

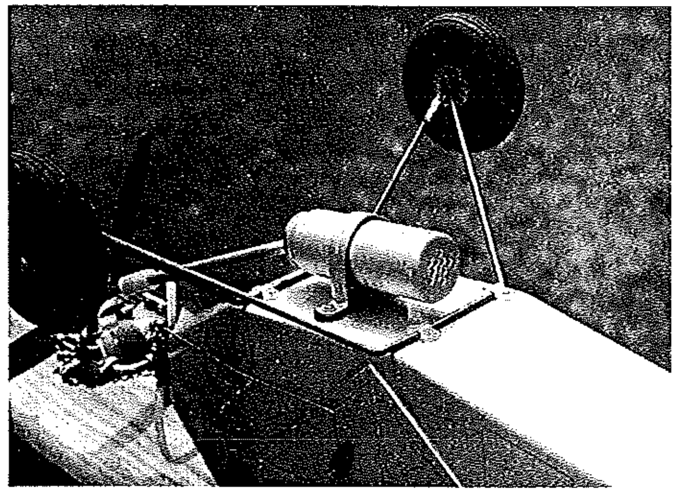


Mud Duck wants to fly straight and level, so the pilot must practically force her to do otherwise. After you release the control stick, the plane snaps back to level flight. Yet with short "blips" of the rudder, even absolute novices can turn safely without risking a spiral dive. Since everything takes place at low speed, the beginner has plenty of time to





Left: The high T-tail, gangly oversize wheels, and dancing exposed rockers of the little Saito .30 are a far cry from the superclean lines and sanitary retracts of conventional high-powered designs. Right: Transparent film on the wing and tail casts interesting shadows on the ground.



Left: Close-up of the pushrod/rudder coupling and the steerable tail wheel connection. Right: The scratch-built muffler mounted in place.

comprehend and react to what the model does. In contrast to most high-performance aircraft, you can fly entirely on reaction time without inviting certain destruction. With Mud Duck, it's safe to fall behind the curve.

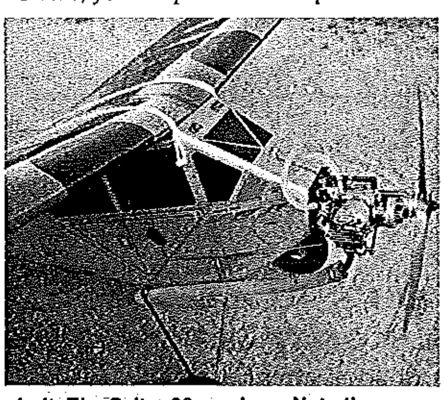
In the hands of a seasoned pilot, though, Mud Duck will perform like an air-show Super Cub—low-altitude loops and steep turns, hedgehops, kamikaze power dives, and one-wheel touch-and-goes. The stall characteristics are user friendly—she'll hang with the nose up, then gently drop her nose and mush on her way. With a good breeze, you can pull the nose up and reduce the throttle, and she'll hang in the air like a stringless kite.

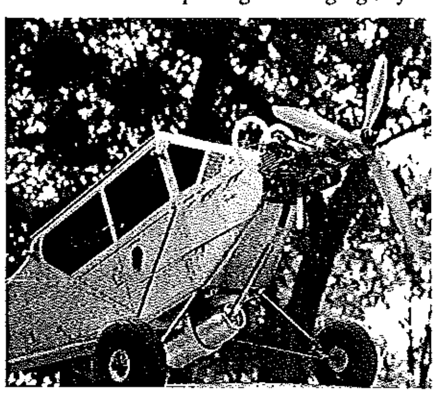
As the wind picks up, lightness becomes a liability on the ground, and Mud Duck requires some tie-down security. Don't try to land the model in very low altitude turbulence without an experienced hand at the controls.

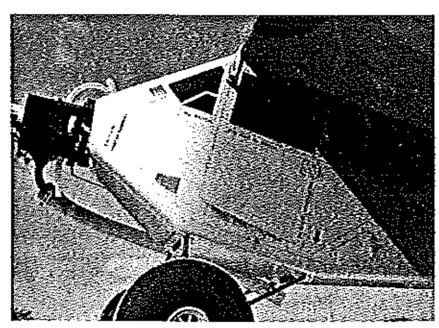
While not designed to penetrate, the structure will withstand the stress of normal flight and landing loads. The wing, despite its lightness, has proven adequate for the loads possible with the Saito .30 four-stroke and the given frontal area. Mud Duck is a tested and known package. Changing any part requires changing other areas in turn. If you insisted on attaching a larger engine, for example, you'd have to beef up the wing with thicker materials (leading edge sheeting). I don't recommend making modifications.

Construction. The structure is all-balsa except for the plywood used for the firewall, the wing dihedral brace, the sheeting on the vertical fin, and the landing gear mounting panel on the fuselage bottom. More or less conventional construction techniques are used.

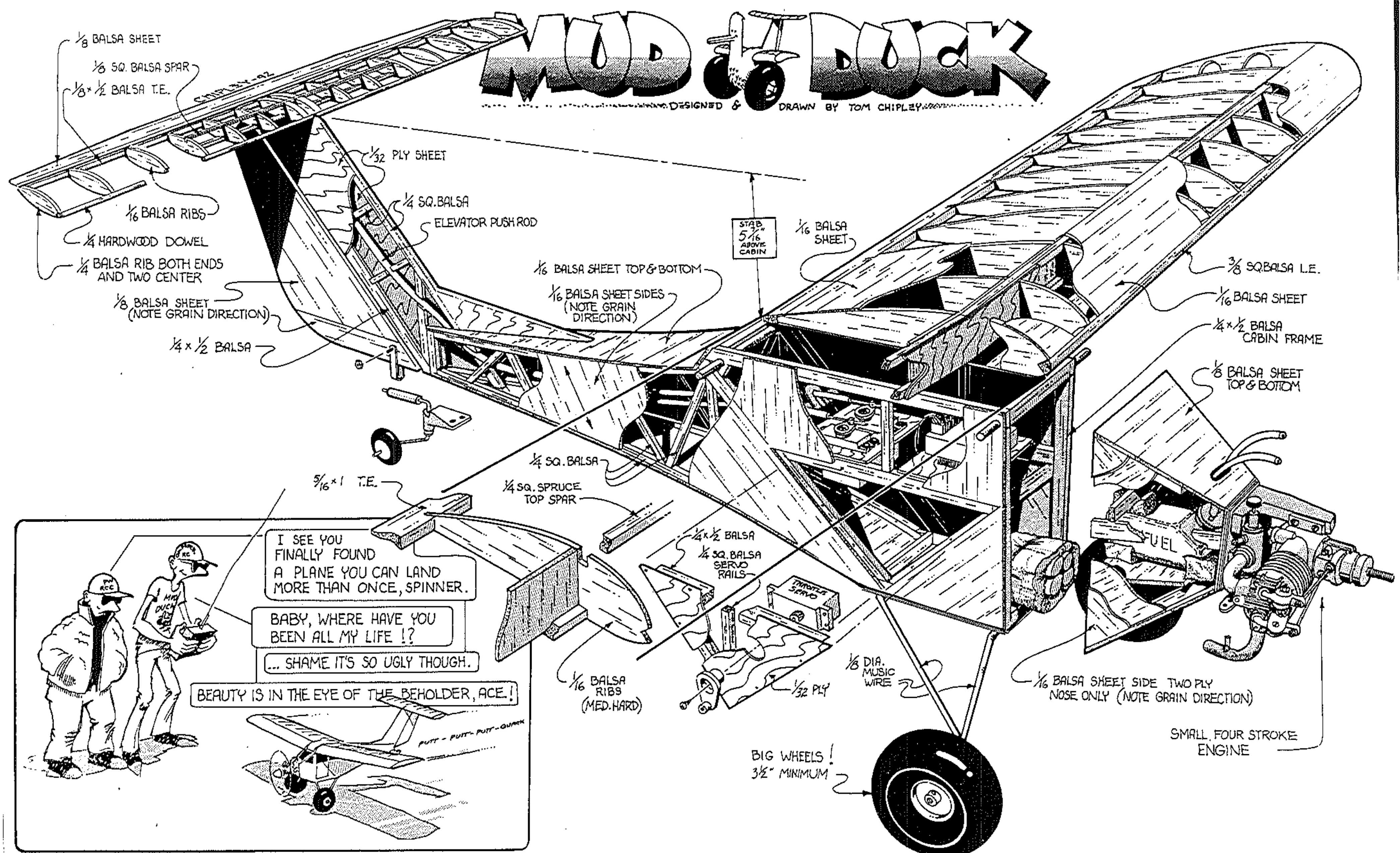
Use 1/16-thick sheet balsa for the wing and fuselage; additional thickness is unnecessary. The square and rectangular







Left: The Saito .30 up close. Note the exposed pushrods, open-air valves and springs. Center: Scratch-built muffler uses a small aerosol can, brass tubing, epoxy, and a small section of silicone tubing. Right: The author paid serious attention to replicating full-scale detail.

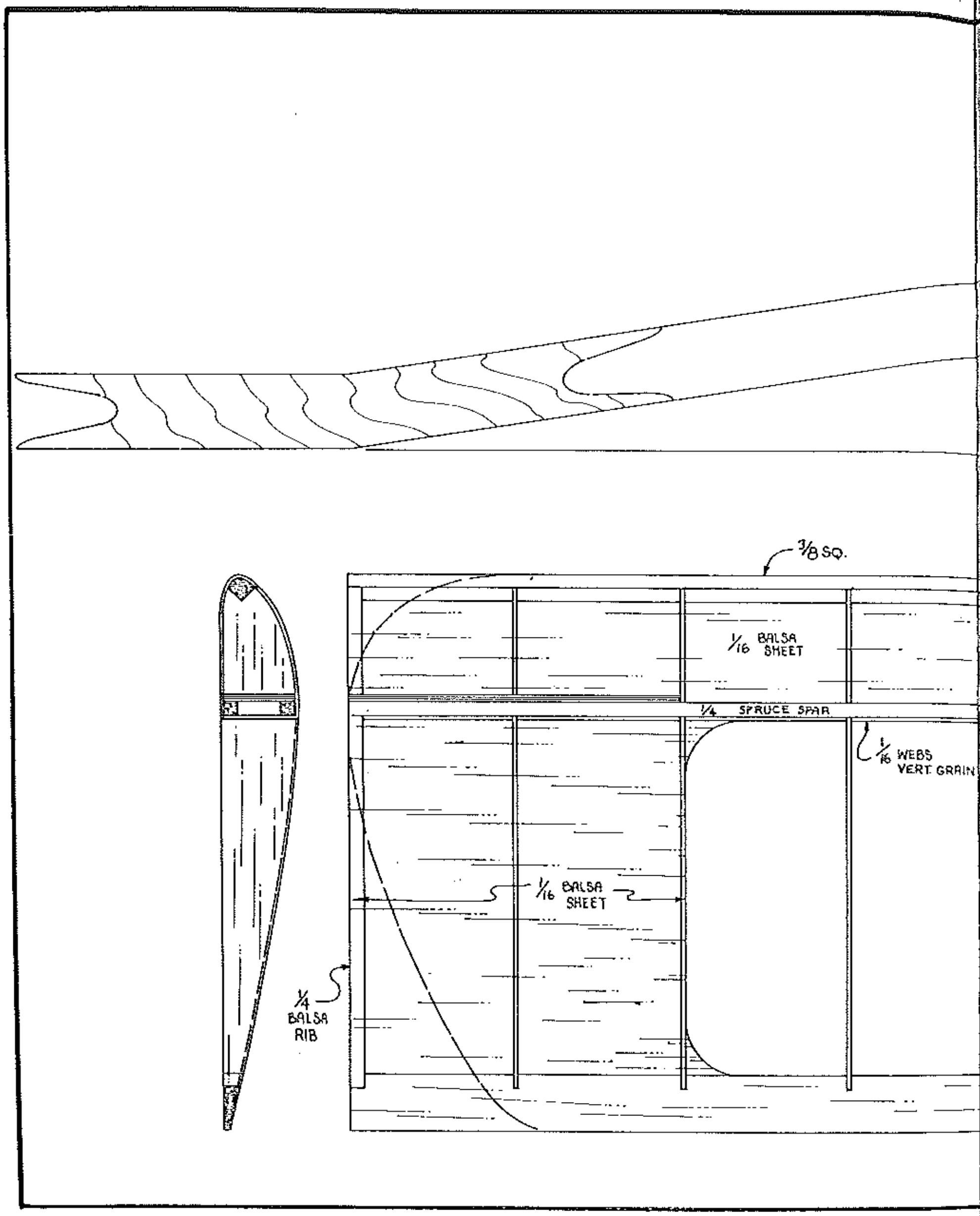

MUD DUCK
DESIGNED & DRAWN BY TOM CHIPLEY
1/8 BALSA SHEET
1/8 SQ. BALSA SPAR
1/8 × 1/2 BALSA T.E.
1/16 BALSA RIBS
1/4 HARDWOOD DOWEL
1/4 BALSA RIB BOTH ENDS AND TWO CENTER
1/8 BALSA SHEET (NOTE GRAIN DIRECTION)
1/4 × 1/2 BALSA
1/32 PLY SHEET
1/4 SQ. BALSA
ELEVATOR PUSH ROD
STAB. 5 1/16" ABOVE CABIN
1/16 BALSA SHEET
1/16 BALSA SHEET TOP & BOTTOM
1/16 BALSA SHEET SIDES (NOTE GRAIN DIRECTION)
3/8 SQ. BALSA L.E.
1/16 BALSA SHEET
1/4 × 1/2 BALSA CABIN FRAME
1/8 BALSA SHEET TOP & BOTTOM
1/4 SQ. BALSA
1/4 SQ. SPRUCE TOP SPAR
5/16 × 1 T.E.
1/4 × 1/2 BALSA
1/4 SQ. BALSA SERVO RAILS
THROTTLE SERVO
FUEL
1/16 BALSA RIBS (MED. HARD)
1/32 PLY
1/8 DIA. MUSIC WIRE
1/16 BALSA SHEET SIDE TWO PLY NOSE ONLY (NOTE GRAIN DIRECTION)
SMALL FOUR STROKE ENGINE
BIG WHEELS! 3 1/2" MINIMUM
I SEE YOU FINALLY FOUND A PLANE YOU CAN LAND MORE THAN ONCE, SPINNER.
BABY, WHERE HAVE YOU BEEN ALL MY LIFE !?
... SHAME IT'S SO UGLY THOUGH.
BEAUTY IS IN THE EYE OF THE BEHOLDER, ACE.!
PUTT - PUTT - PUTT - QUACK

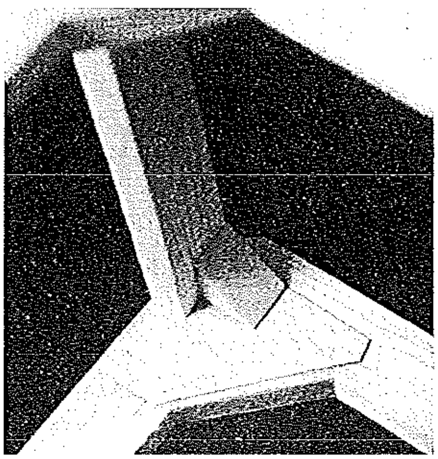
Don't omit the spar webbing. It prevents the spars from flexing as compression forces the top spar down and tension pulls the lower spar straight and taut. Likewise, it's important to make sure that the web grain is vertical. All the forces are trying to either compress the web or stretch it out. A small section of wood will withstand these forces rather well if the load is applied along the direction of the grain, but will fail miserably if the forces are applied across the grain. Wood is a very linear building material.

Let me add at this point that the compression strength of balsa varies greatly with the weight and hardness of the sample. Bitter experience has taught me that very soft balsa (used for extremely lightweight wing spars, for example) will compress rather easily, permitting the top spar to cave in upon itself and destroy the wing. The same lightweight material, however, performs much better when used in tension.

To assure structural integrity, the top spar should be 1/4-in.-sq. spruce as indicated on the plan. If desired, you may scarf join a balsa spar beyond the sixth wing rib. In that case, make the joint at least three times as long as it is high (a 1/4-in.-sq. stick would be at least 3/4 in. long).

This advice is based on empirical data acquired when one of the prototypes suffered a top spar compressive failure during a full-speed power dive. All things considered, the fuselage survived the vertical impact rather well. The tail section broke away completely but was easily reattached. Since the blow was concentrated toward the bottom of the plane (it was slightly inverted at the instant of impact),

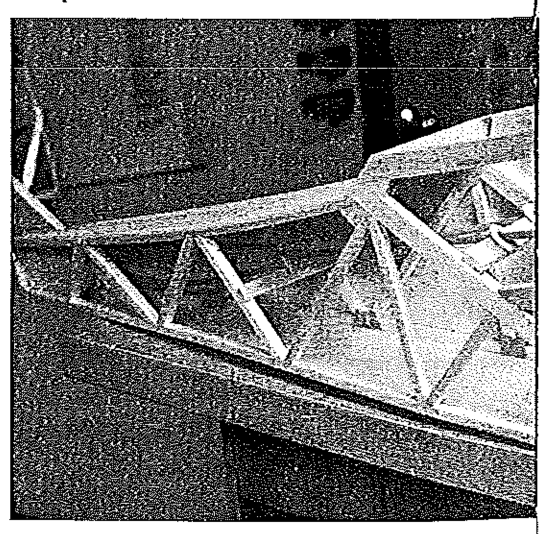




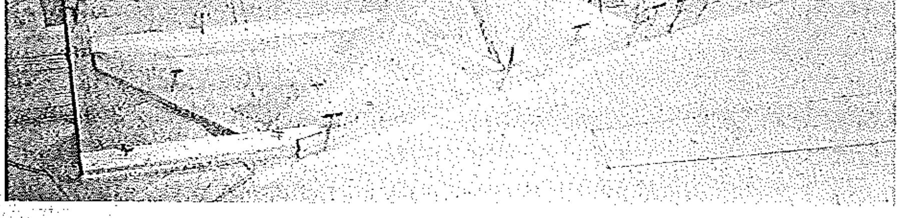
the lower fuselage sheeting popped off cleanly through the plywood landing gear mounting platform, and it too was easily refitted. The engine, which was attached to its plastic mount with screws rather than bolts, broke free with minor damage to the cast metal (one corner of the engine mounting flange and the carburetor mounting flange) and absorbed some of the impact.

The accident was far from a total loss. We learned how *not* to build a wing.

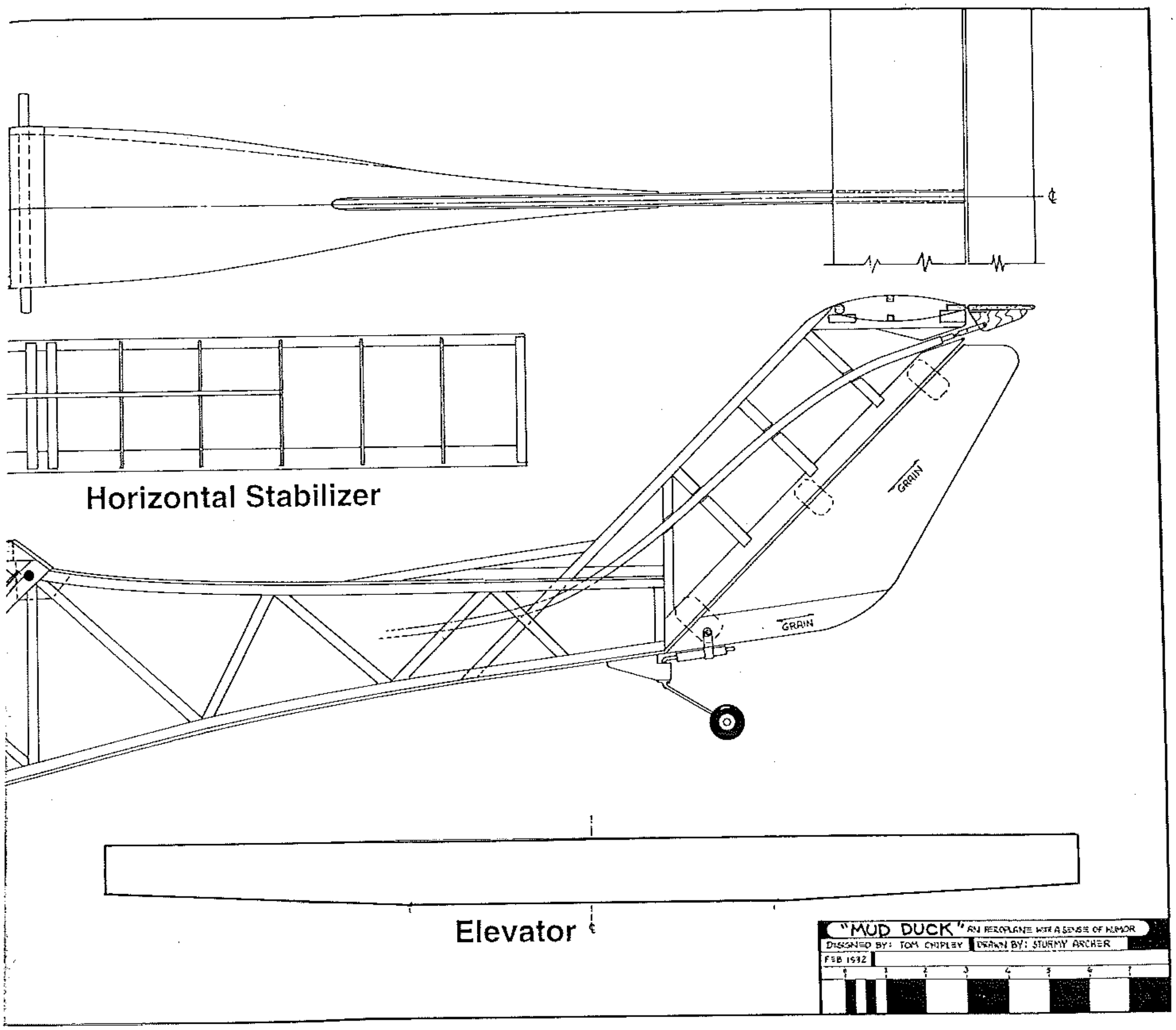
The throttle servo is mounted to a removable side panel, through which the servo arm projects to operate an external wire pushrod. This method of throttle



Above: Detail of cross brace at the upper forward fuselage corner. Note the triangle stock brace. With a thin coating of CyA, even soft balsa becomes a rigid section. Below: The second fuselage side being built over the first, with waxed paper protecting the joints. The curved top and bottom stringers are pinned in place while the instant CyA cures. Right: Build the pushrods in place *before* sheeting the fuselage. Note the use of horseshoe fasteners.



Full-Size Plans Available . . . See Page 204



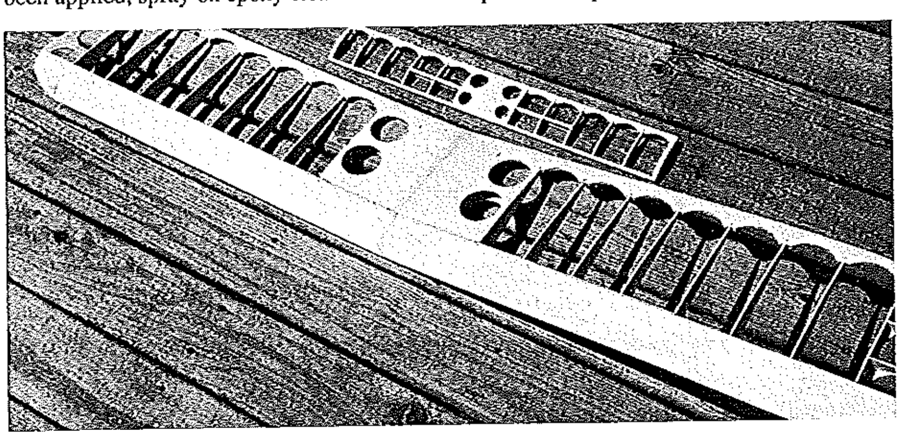
edge with a No. 2 pencil, position the card on the painted surface where you want the smudge to be, and rub off some of the graphite with your finger. This leaves a realistic smudge with a straight edge, as in Scale aircraft—sort of a faux-scale technique. It's wonderful recreation—maybe a bit heavy-handed, but all in fun.

When the graphics and weathering have been applied, spray on epoxy clear-coat in two parts for superior fuel proofing. In my experience, the supposedly fuelproof spray-on polyurethane finishes are in fact readily attacked by hot fuel and exhaust. They certainly aren't sufficiently fuelproof to please me.

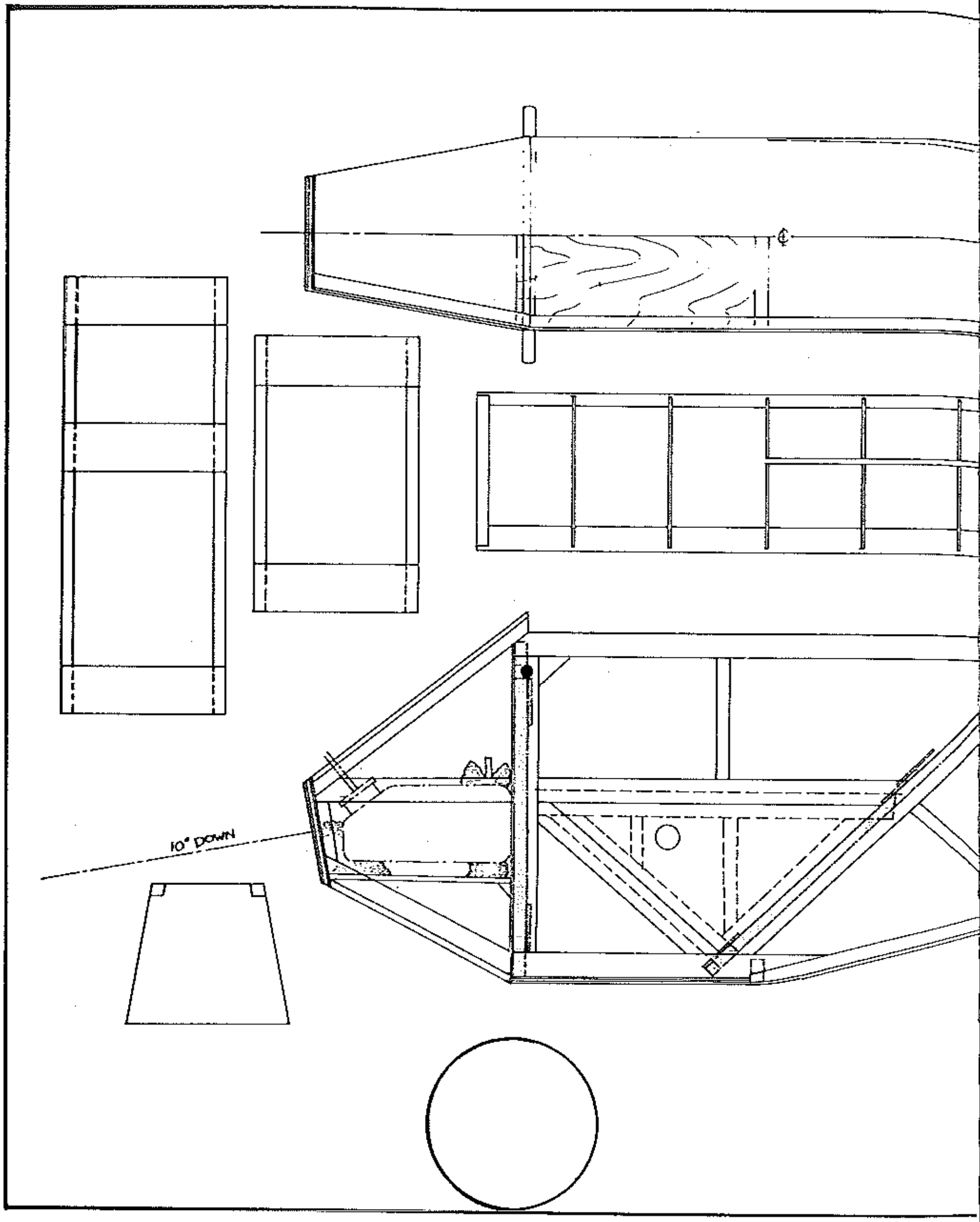
Most steps in the construction should be adequately explained by the photos and captions. Keep in mind, however, that the joints must be neatly done, especially when using the rapid-cure CyA (cyanoacrylate) adhesives. Fuzzy ends seem to work nicely for epoxy and aliphatic resin adhesives, but CyA's thrive on a precise fit.

The strength of any wood-to-wood joint is directly related to the surface area covered by the adhesive. The glue bonds *only to the surface of the material* and has no effect on the wood beneath. Like most woods, balsa is quite strong when used in compression or tension, so relatively thin sections can be safely used. It's important, however, to reinforce the joint area with gussets or triangle stock corner fillers. These provide great strength with minimum weight.

After attaching the top and bottom wing leading edge sheeting with slow-setting CyA, I coated all interior joint lines with aliphatic resin, applied with a small brush, before attaching the spar webbing. I also used aliphatic resin for the webbing to assure the best possible joint/area coverage. This D-tube wing structure is extremely strong and light; it resists twisting almost as much as it resists bending.



RC Mud Duck
Type: Sport
Wingspan: 60 inches
Recommended engine size and type: Saito .30 four-stroke
Number of RC channels recommended: Three
Expected flying weight: Not available
Type of construction: Built-up
Type of covering/finish recommended: Transparent covering—wing and tail; paint (lacquer auto primer, polyurethane spray)

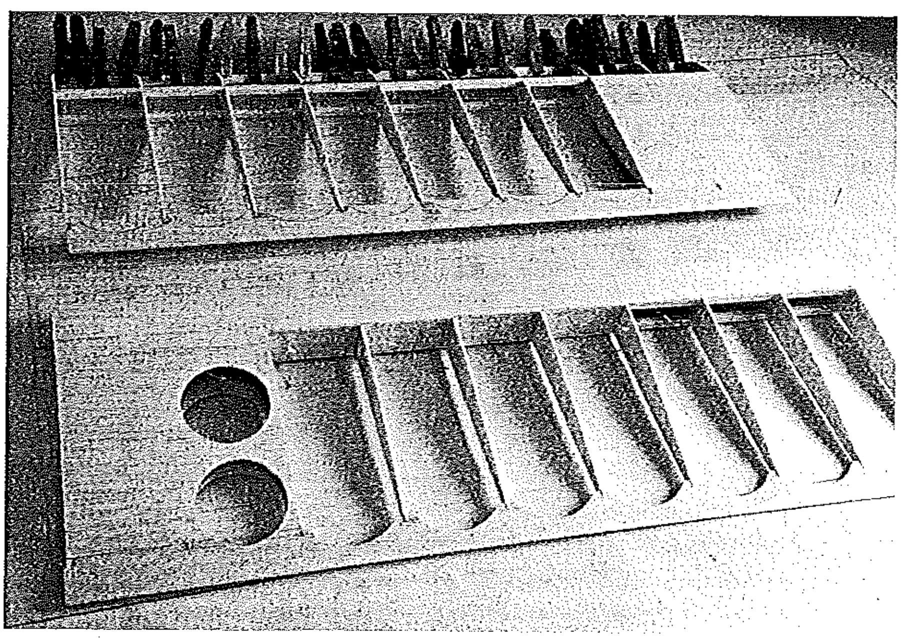


sections used to frame the fuselage are aligned to follow the forces imparted by the wing during flight and by the landing gear upon contacting the ground.

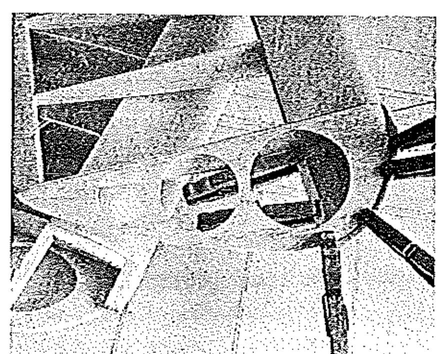
Sheet the entire fuselage, including the vertical fin (since it contains the elevator pushrod), with balsa or thin ply. I recommend that you paint the sheeting rather than covering it with heat-shrink film. Every time I've tried iron-on films with the Duck, I've had problems with fuel seeping under the covering and eventually soaking the engine area with oil. Painting the fuselage requires more work and time, but the finish should last longer and give you less trouble. Also, the painted finish lends itself to lettering and other creative graphics—faux oil leaks, weathering—that can be applied with a fine-line permanent marker such as a Sanford brand Sharpie.

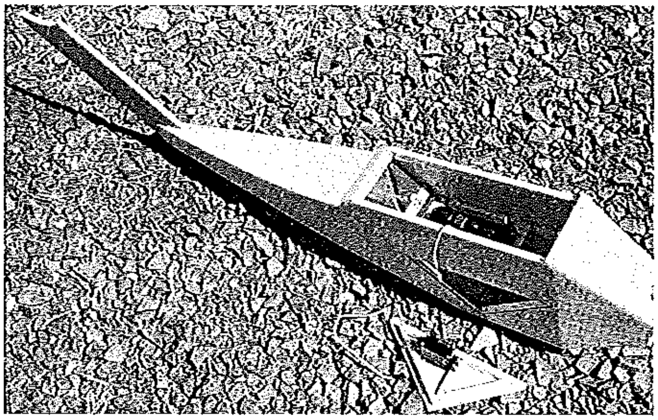
I used lacquer auto primer followed by a spray coat of Black Baron silver polyurethane, then drew completely fictitious panel lines, ports, inspection plates, and louvers using a penny, a small bottle cap for circle templates, and a small triangle for the straight lines.

To create the fake oil leaks and wear smudges, I simply dragged my thumb over the still-wet inked line. Another method is to turn a business card face down, scrub one

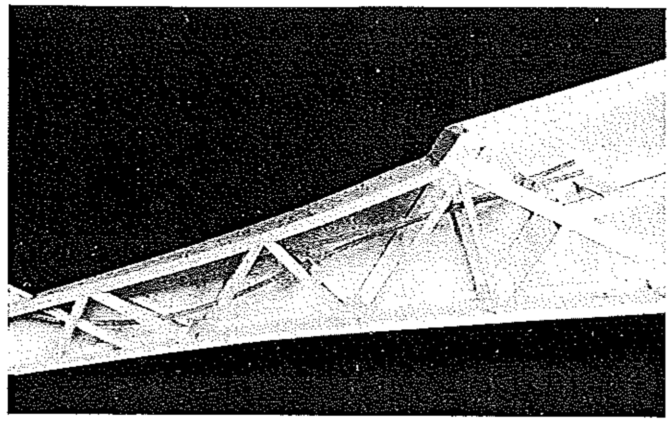


Left: The wing is $\frac{1}{16}$ balsa sheet except for the $\frac{1}{4}$-in.-sq.-balsa LE, TE, and spars. Below: Note lightening holes in the $\frac{1}{8}$-in. balsa wing tips. Clothespin clamps are used in tip assembly. The LE was cut too short, had to be pieced to fit. Right: The wing and stab ready for covering. The finished wing structure weighed just seven ounces.

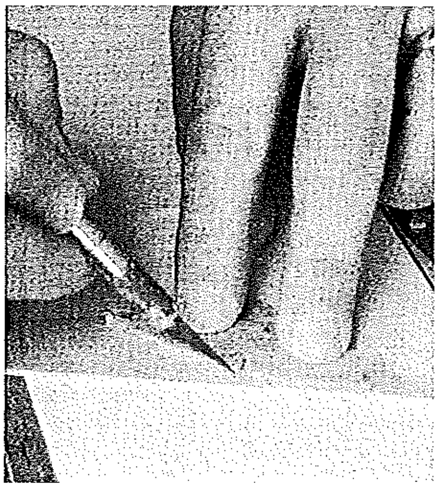




Completed fuselage with vertical fin. The fuel line exit hole will be sealed with silicone rubber after the fuse has been painted/finished.



With the fin LE stick glued to the bottom sheeting, the pushrod flows smoothly from fin to servo, minimizing friction of the inner rod.



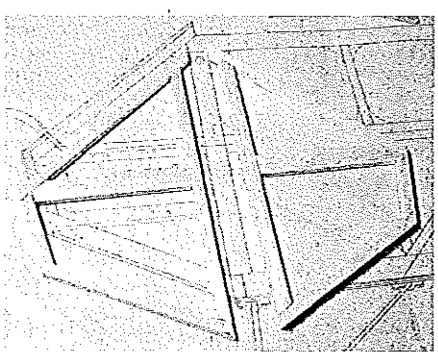
Using a plywood template to cut the stabilizer ribs from scrap material. Make sure the grain runs from front to rear.

the main fuselage first in order to accurately fit the nose piece as you build it up.

Note that the nose structure is double sheeted for strength. Use 1/16 balsa for both the basic structure and the doubler material, but try to attach the second layer of balsa with the grain running in a different direction. I used scrap pieces for the nose doublers and was satisfied with the results.

The nose is simply glued to the main fuselage, so make an effort to fit the joining surfaces nicely. For absolute rigidity, make the final attachment with epoxy. Blend the edges smoothly with a careful sanding.

This is an unconventional but effective way of achieving a nicely tapered nose.



The basic nose section frame has been built over the waxed paper-covered plan, and one side has been sheeted. Sand as necessary.

For photographic purposes, one side of the fuselage was left uncovered to better show the pushrod and fuel tank installations and the servo locations. *You* should cover each fuselage half as it is completed, since the strength of the sheeting is helpful when pulling the tail together for gluing. In fact, the 1/16 balsa top and bottom sheeting serves as the only cross-fuselage bracing. When you pull the fuselage halves together after installing the cross braces at the corners of the cabin area, you'll see that the sides take a natural curve. The sheeting will permanently locate that curve.

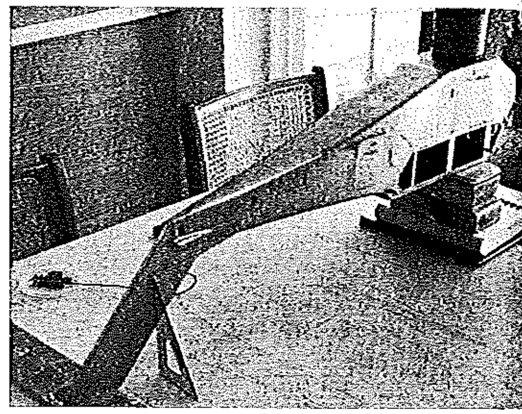
Tail surfaces. The prototype used a horizontal stabilizer having a few ribs covered with 1/32 sheet balsa. There were no spars. Finding this difficult to fabricate though quite strong, I opted for a more conventional rib-and-spar technique for the version shown. To reduce weight and enhance appearance, I removed excess material from the trailing edges of both the wing and stab, with the result that the wing and tail structures resemble one another.

Once I get started with the little sanding drum on my Dremel, balsa goes flying in a cloud of dust. No wood should be given a free ride. If it doesn't work for a living, convert it to sawdust.

The vertical fin, a lamination of 1/32 ply and 1/4-in.-sq. balsa sticks, contains the pushrod and enclosure tube for the elevator. Build the 1/4-in.-sq. balsa structure over the plans, and glue it to one of the thin ply sides; the side should be cut a bit oversize to permit accurate trimming later. Notch the balsa sticks for the pushrod, slip the pushrod housing in place, and glue with either five-minute epoxy or CyA and accelerator. I like to roughen the pushrod tube with sandpaper before gluing.

Trim the ply sheeting on the first side, and glue on the second side to complete the sandwich. Trim this in turn when dry, then sand a nice contour to the leading edge and a shallow "V" to the trailing edge at the rudder attachment point.

Since the 1/4-in.-sq. sticks at the leading edge extend through the fuselage and are glued to the bottom sheeting, a hard balsa must be used. In contrast, the interior balsa sticks can be dead-soft material.



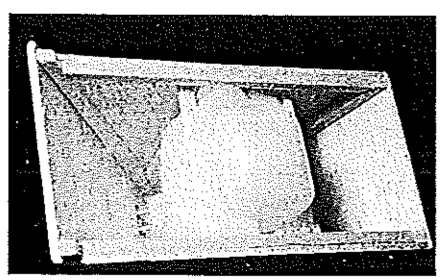
Epoxying the stab to the fin. A drafting triangle squares the fin with the tabletop; a spiral-bound book is useful for fine adjustments.

Position the horizontal stab on the vertical fin, and carefully adjust the alignment. As shown in one of the photos, I set the fuselage on a tabletop and shimmed the final leveling adjustment with the pages from a spiral-bound book. This permits very accurate adjustments.

The height of the stabilizer plane above the fuselage wing saddle is indicated on the plan. Take the time to make sure that everything is in accurate alignment, then use five-minute epoxy to join the stab and fin. A little time and care here will be repaid with a true-flying fuselage.

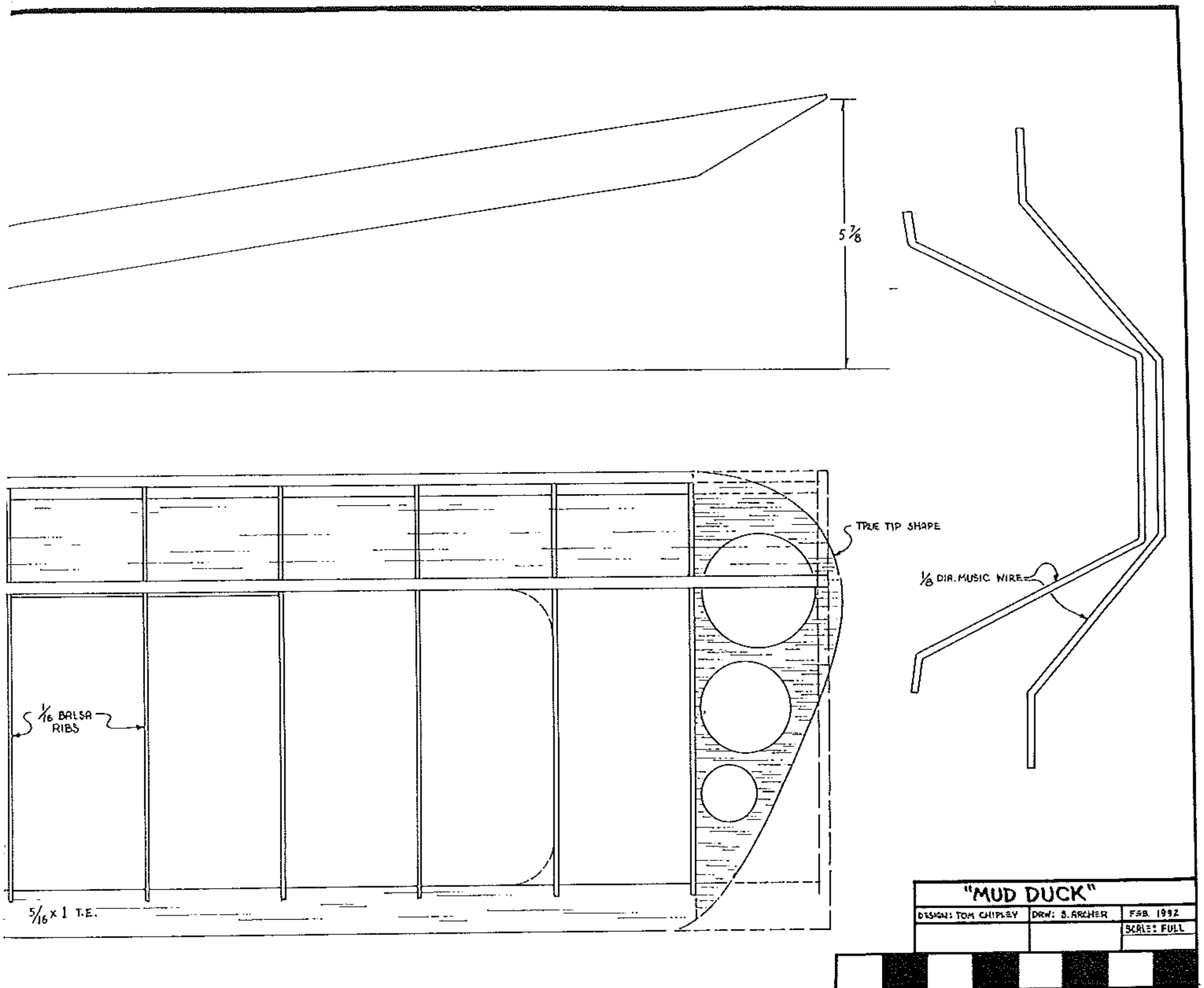
Wing. Conventional construction is used. To simplify building the tips, however, cut the leading edge sheeting sufficiently long to include the wing tips. I neglected to do so and had to piece the tip sheeting together.

Continued on page 140



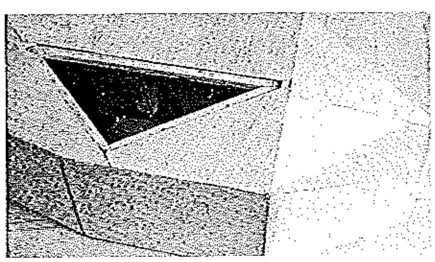
The fuel tank has been secured with foam and a balsa cross brace. The fuel line exits through the top sheeting behind the firewall.

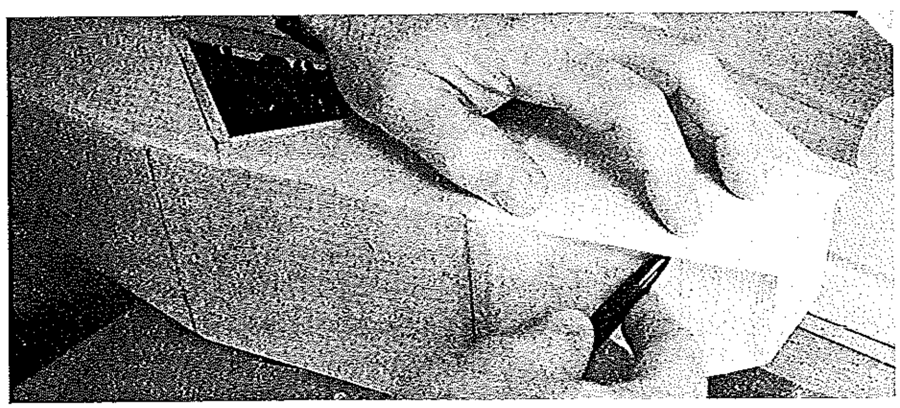
Full-Size Plans Available . . . See Page 204



operation obviates the difficulty of routing the throttle pushrod through a rather tightly filled forward fuselage, while also permitting access to the lower central fuselage area for installation and removal of batteries, etc. This exterior control look is reminiscent of the Ford Trimotor. I consider it an important part of the model's aesthetics.

The fuselage is built in two major sections: the nose and the main structure. Construct





Left: The second layer of 1/16 sheet on the sides of the nose being installed cross grained to the first. Note the opening for the throttle servo panel. Below: Fitting a scrap piece to complete the second layer of sheeting. Mark the underedge, trim, and glue.

F3A, F3C, and F3D be held together?

- Why did 90% of the model helicopter-related industry fail to respond to our request for financial support?
- Why was only F3A included in the public awards ceremony on closing day?
- We need to begin raising money for the 1993 F3C team *now*!

RC Mud Duck/Chipley

Continued from page 40

That's a lot more trouble, and the tips look unsightly through the translucent covering. The correct length for the sheeting is shown on the plan.

The vertical-grain balsa webs are glued to the outside trailing edge of the spars. This is easier than sandwiching them between the spars, and while they aren't quite as strong in compression, the difference is mostly academic. Don't even consider omitting the webs: You'd be risking an inflight wing failure. As many of you know, having the wing fail in flight is explosive, frightening, dangerous—and expensive.

I chose very hard trailing edge stock for the wing, then removed much of it with a sanding drum after construction. The finished wing is extremely light for its area, and it hasn't failed even under the maximum stresses possible with the Saito .30.

Let me remind you again that this little plane simulates the slow-motion look of full-scale flight and aerobatics (such as they are), and the structure is safely adequate for that. Installing a larger engine would require both a bit more wing structure and a tad more judgment in flight. Mud Duck represents a balance of power, weight, and surface area. Flown as designed, it will provide many years of safe, enjoyable recreation. Happy landings! ✈

RC Flying/Myers

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$43,000,000 and only got $30,000,000 this year, so it will have to lay off two-thirds of its full-time employees. (You do the political mathematics. It defeats my engineer's logic.)

Two MAPTs were built on abandoned dumps by modelers, who handed the paved runways over to the county after their money was spent. The clubs who use the facilities; the LIDS, Merokes, and Cobras, police the activities, including providing RC frequency management, volunteer field controllers for safety rules enforcement, instructor pilots, and license examiners. If the county spent any money on the MAPTs, the effect is mighty hard to see. You still reach them over potholed dirt paths through