The author borrowed freely from the Stephens Akro to design a .40-powered RC Scale-like plane with full aerobatics capability. He added a smoke-producing system to improve the visual impact in show team exhibition situations. Design of smoker and smoker valve also included ● Brad Shepherd

THIS IS a very responsive model which is able to perform a full aerobatics schedule for an experienced RC pilot. I do not believe it should be built and flown by anyone who has not had a few projects under his wing and who may not be completely at ease with the transmitter. If you do want to build it, but are still new to this great sport, have an experienced pilot test hop it and check it out, then stand by until you feel confident in flying.

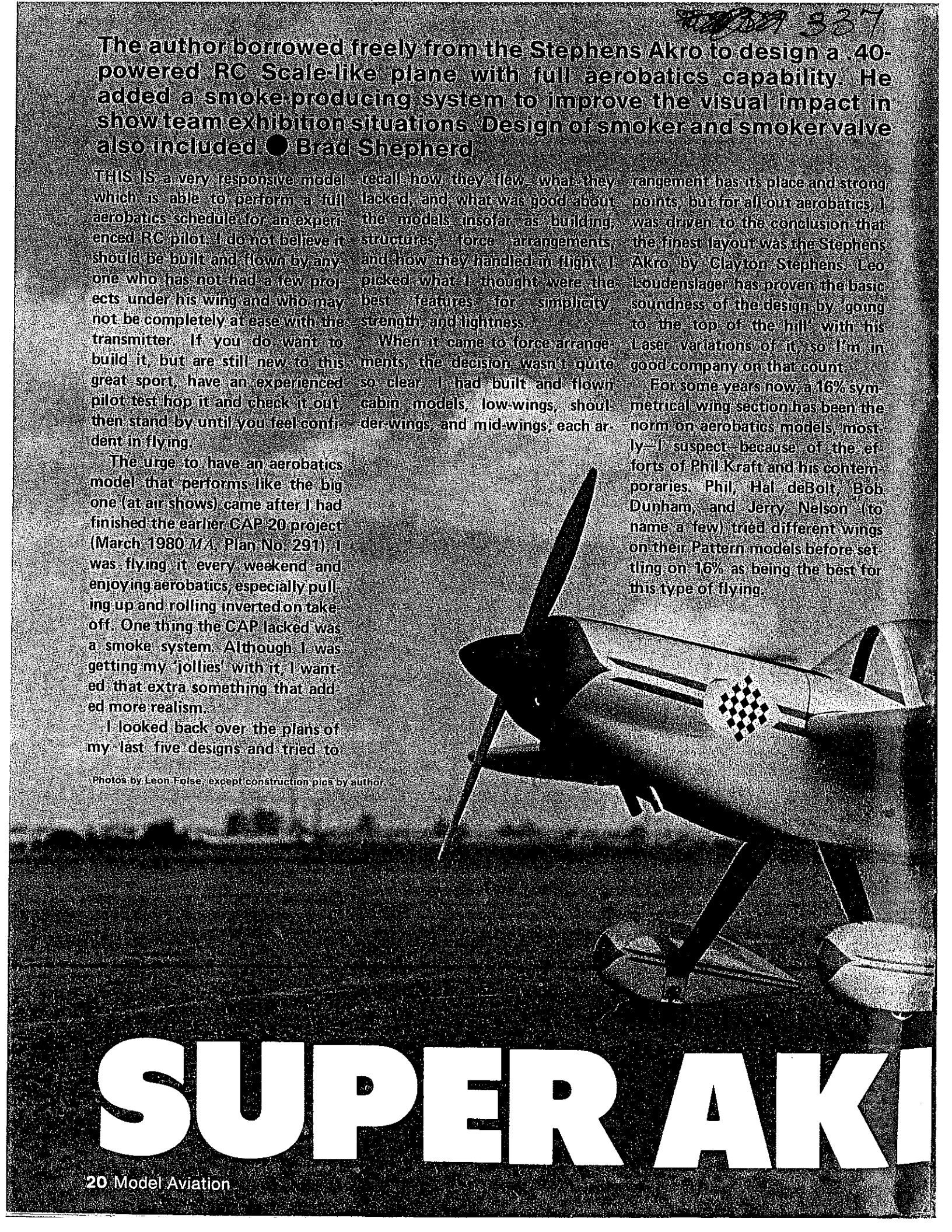
The urge to have an aerobatics model that performs like the big one (at air shows) came after I had finished the earlier CAP 20 project (March 1980 *MA*, Plan No. 291). I was flying it every weekend and enjoying aerobatics, especially pulling up and rolling inverted on take-off. One thing the CAP lacked was a smoke system. Although I was getting my 'jollies' with it, I wanted that extra something that added more realism.

I looked back over the plans of my last five designs and tried to recall how they flew, what they lacked, and what was good about the models, insofar as building structures, force arrangements, and how they handled in flight. I picked what I thought were the best features for simplicity, strength, and lightness.

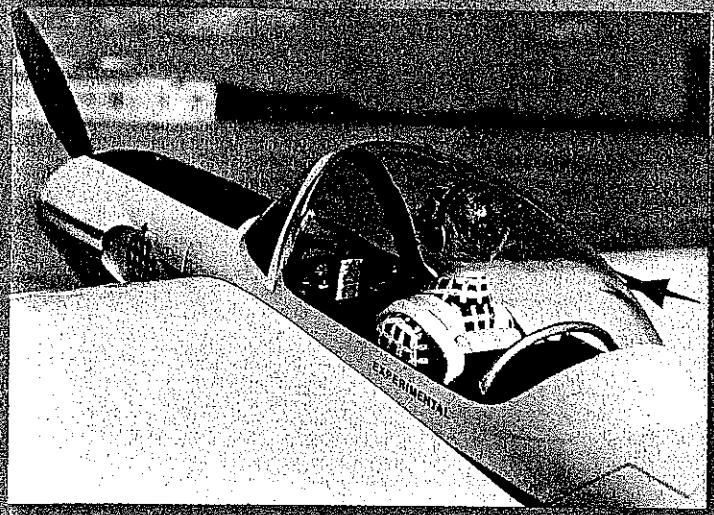
When it came to force arrangements, the decision wasn't quite so clear. I had built and flown cabin models, low-wings, shoulder-wings, and mid-wings; each arrangement has its place and strong points, but for all-out aerobatics, I was driven to the conclusion that the finest layout was the Stephens Akro, by Clayton Stephens. Leo Loudenslager has proven the basic soundness of the design by going to the top of the 'hill' with his Laser variations of it, so I'm in good company on that count.

For some years now, a 16% symmetrical wing section has been the norm on aerobatics models, mostly—I suspect—because of the efforts of Phil Kraft and his contemporaries. Phil, Hal deBolt, Bob Dunham, and Jerry Nelson (to name a few) tried different wings on their Pattern models before settling on 16% as being the best for this type of flying.

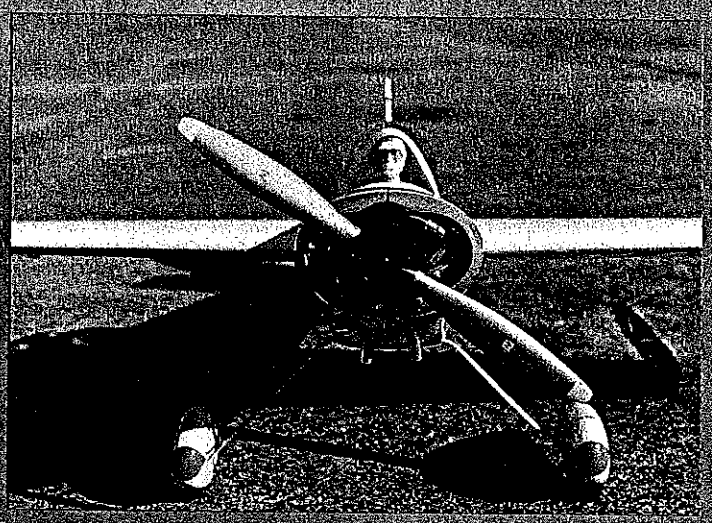
Photos by Leon Folse, except construction pics by author.



SUPER AKI

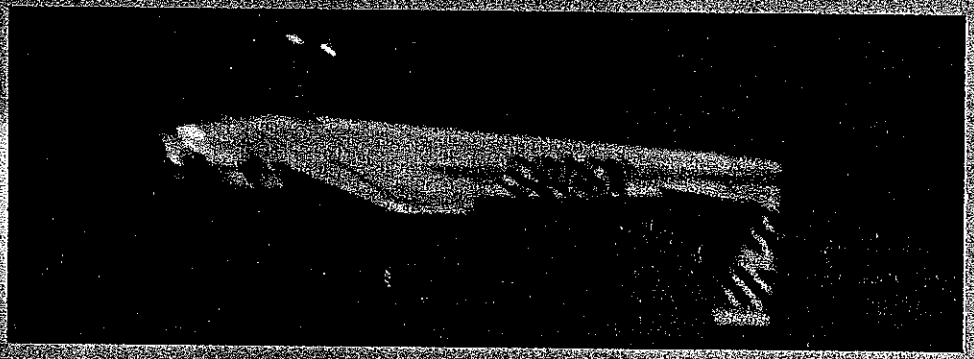


Realistic pilot is 2¾ in. from William Bros., spruced up with earphones and mike, glasses, shoulder harness and parachute straps.

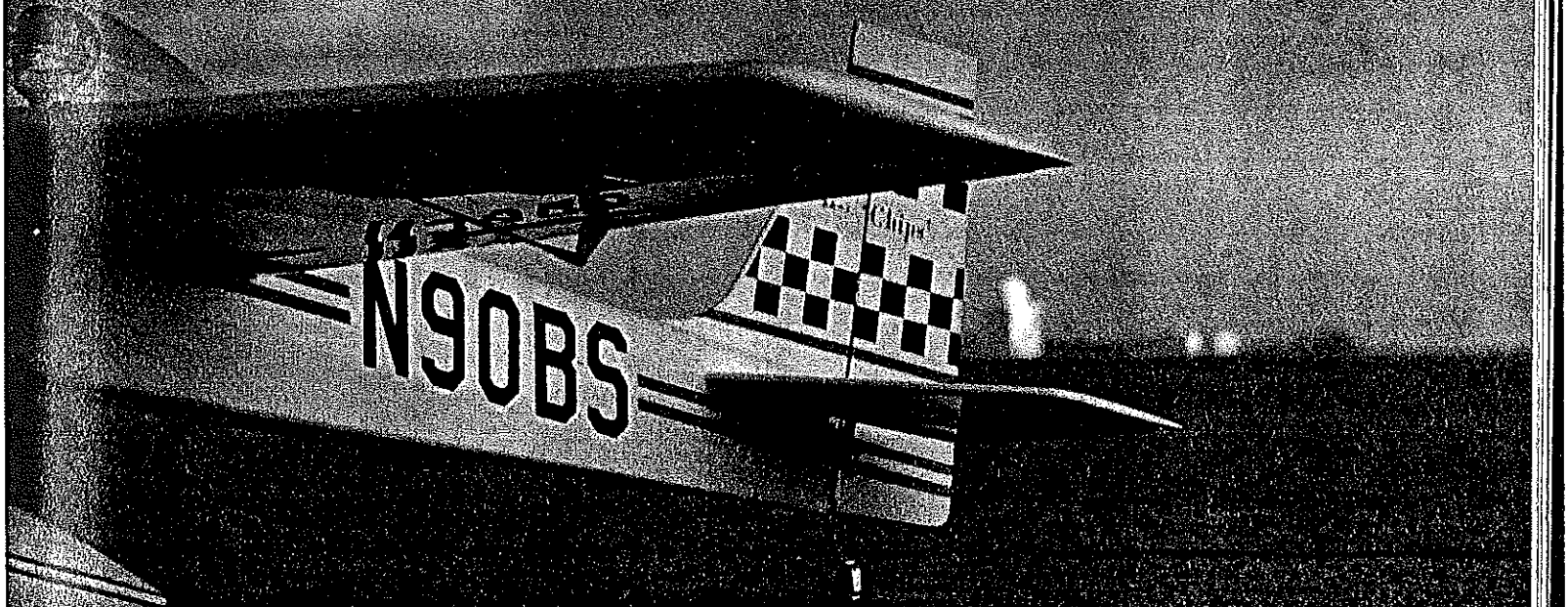


Ready and raring to go! Dummy stacks of ¾-in. aluminum tube go in drain holes. Easy details like this add to the overall impression.

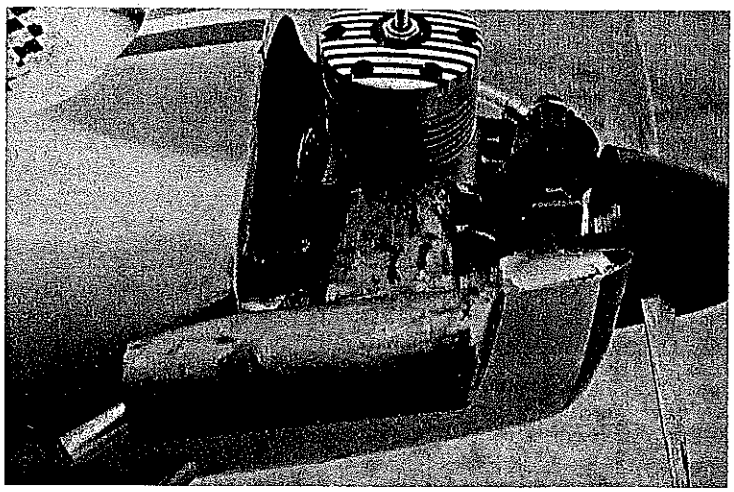
The author has every right to feel pleased with the results of his efforts, we think. The SA-1 looks good *and* does the job intended.



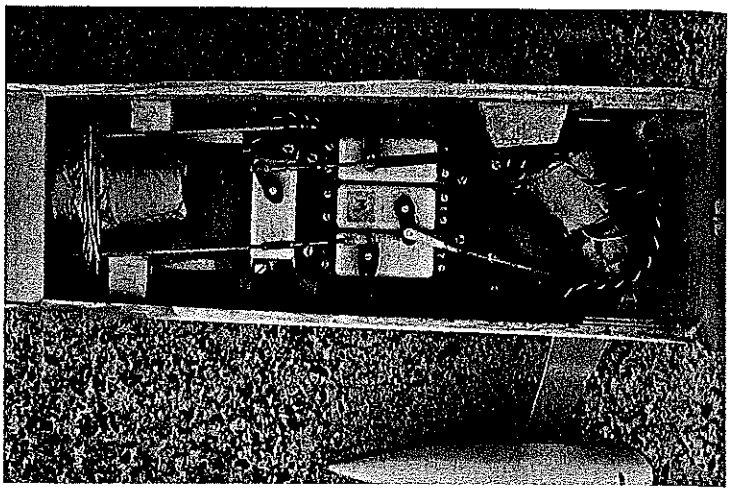
First flight and the cameraman wants a low inverted shot. First pass wasn't low enough—give it another try, he says. Here's the result, and only about two feet above the runway! Wheel pants removed due to scuffs they received on the first try, when the model nosed over—too much toe-in.



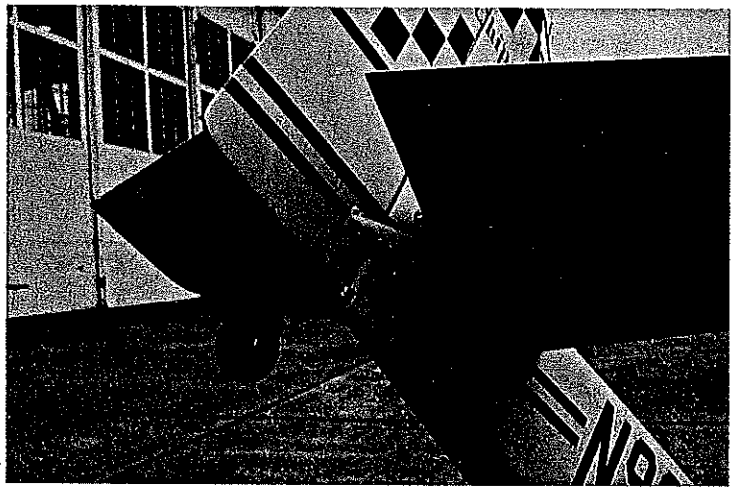
RO-1 `CHIPS'



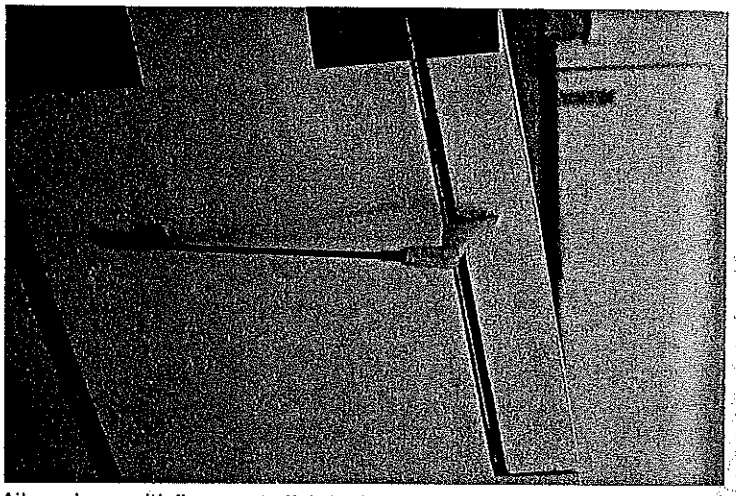
Author's current smoke chamber/muffler is made of steel. Note ⅛-in. brass smoker feed tubing going into exhaust stack. Also see drawings.



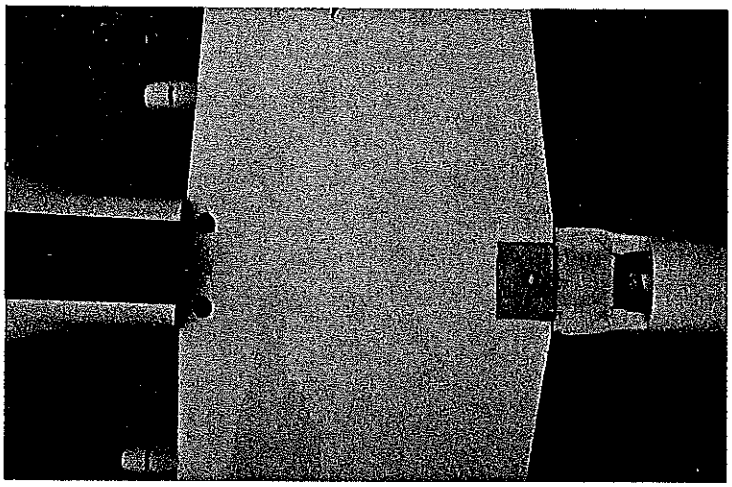
Radio installation. Note cable pushrods, ball joint connectors, fifth servo for smoker behind flight function servos. Compact, but it works.



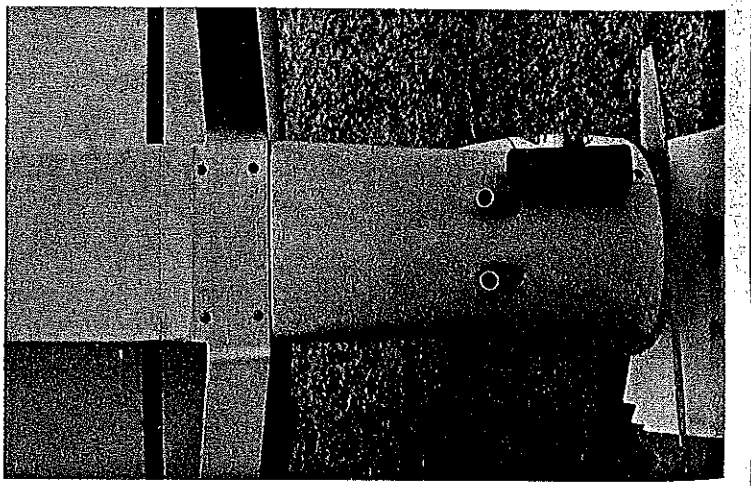
Tail assembly reveals use of Sullivan pushrods. Vertical fin, rudder, stabilizer, and elevator all from ¼-in. balsa. Control throws in text.



Aileron horn, with flange cut off, is buried in the aileron and glued with Hot Stuff. It's top-hinged for slight differential action.



Cabin section has been removed to reveal wing mounting system of three screws. Author's prototype used Super MonoKote for wing covering.



Underside shows method for mounting landing gear, dummy exhaust stack (drain holes), and outer end of the smoke chamber/muffler.

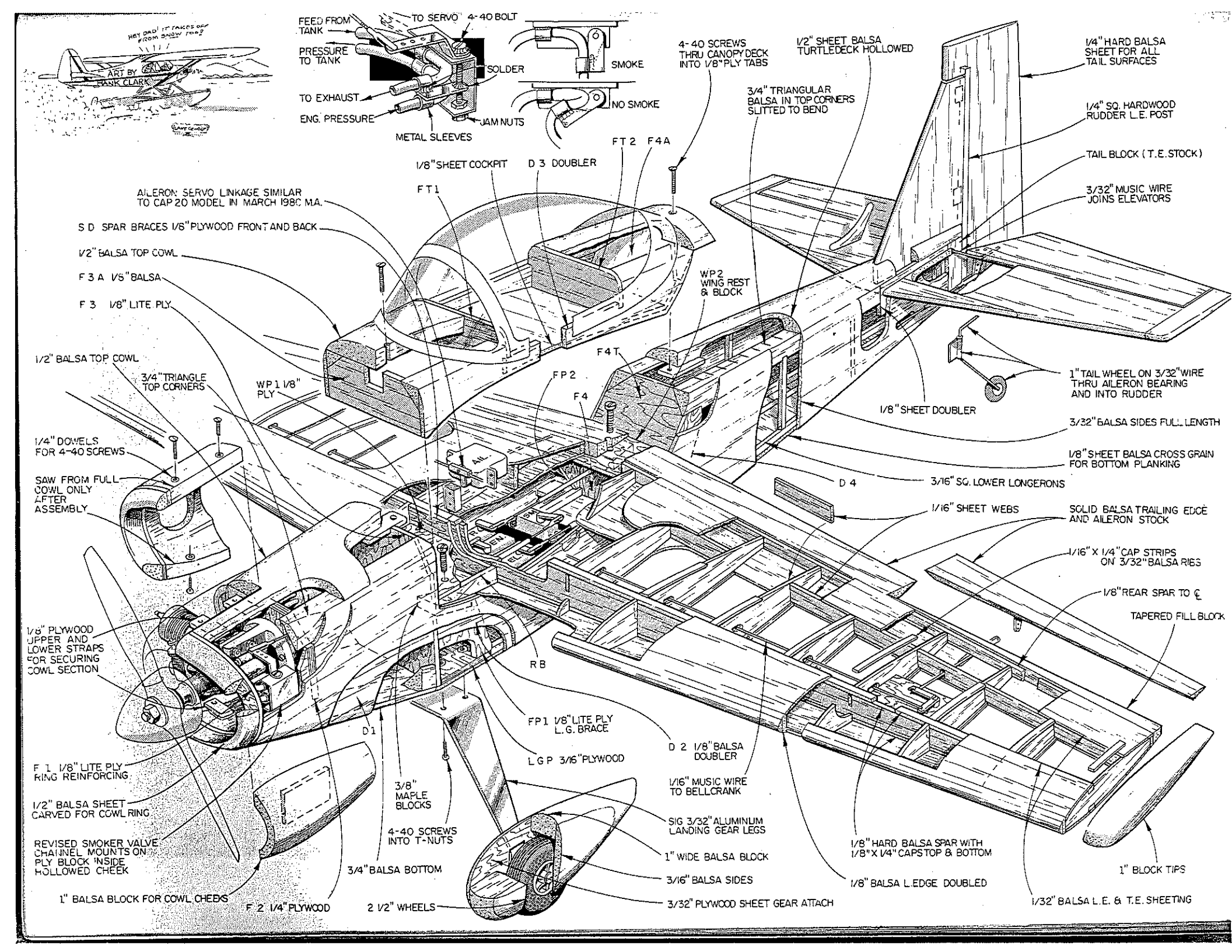
I have used 16% airfoils on most of my models, up to and including the CAP, but decided on the Stephens that I would try something different. I opted to use a 14% semi-symmetrical airfoil section close to the shape of the full-size Stephens, which has an NACA 23012. The idea paid off. The model handles beautifully in all maneuvers, with slight down control when inverted. It can be slowed almost to a walk, without falling off on a wing tip, when landing. Ailerons are effective right to touch-down.

After some picture taking by my good buddy, ex-modeler turned photographer, Leon Folse, we were ready to see it fly and how the smoker works. Early morning of test flight day turned out to be the usual for my South Texas location—slight breeze out of the south until about 10 a.m., then the winds came up.

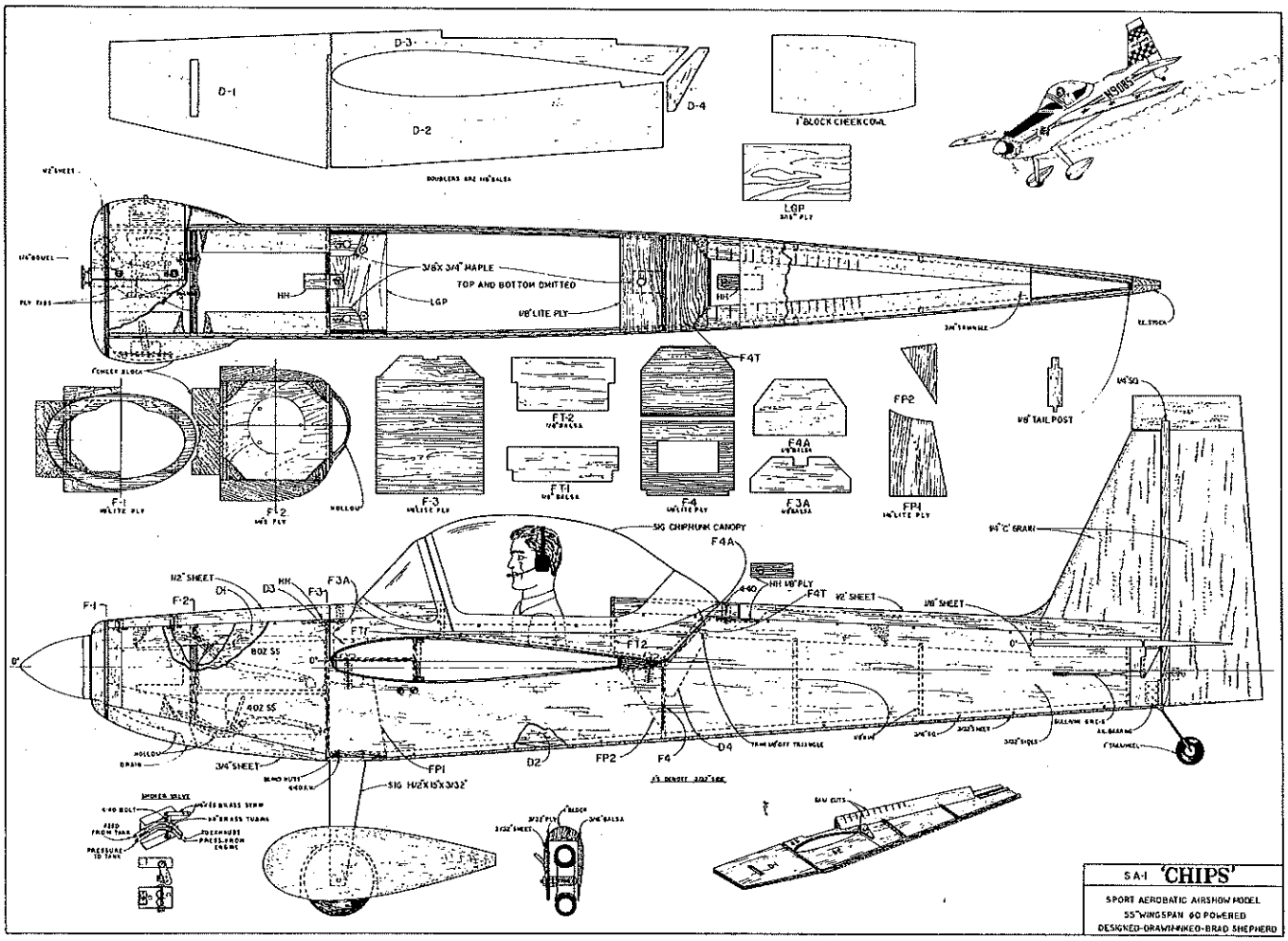
Filled up the fuel tank, and put some "juice" in the smoker tank. Fired up the engine, and got it adjusted. Kicked in the smoker, and it looked OK. Bolted on the wing and cockpit section, reloaded the tanks, and I was ready.

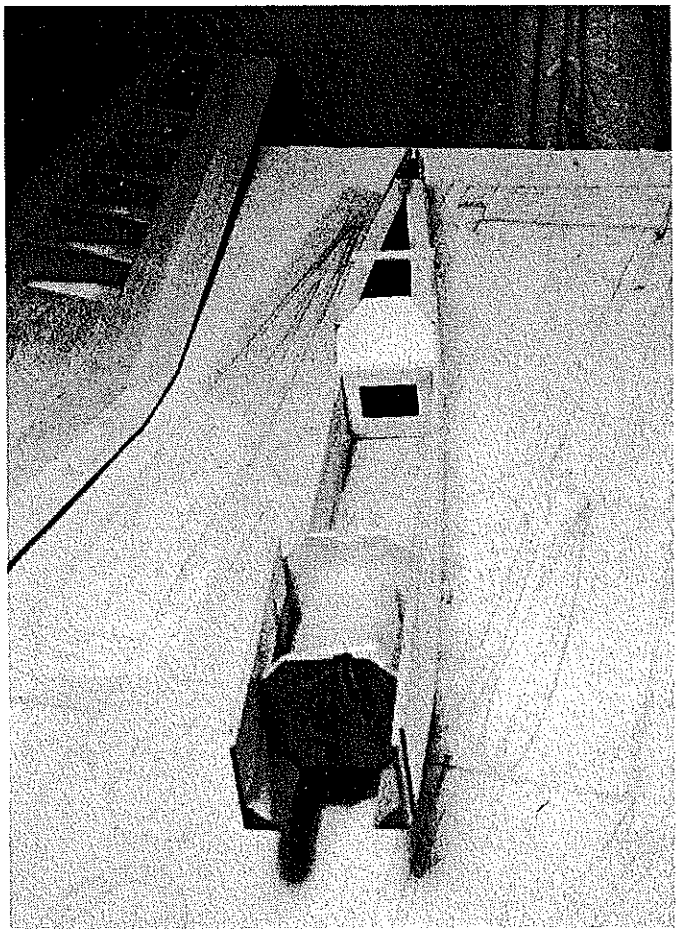
I taxied out, lined up, and gave it the throttle, but it nosed over, and no amount of up elevator helped. I chopped the throttle, and brought it back. In the process, the front bottoms of the wheel pants had been sanded off, and I decided to take them off and continue test flying. Looking at the landing gear, I realized that there was too much toe-in—the wheels were acting like a brake.

After straightening the gear (and wheels), I

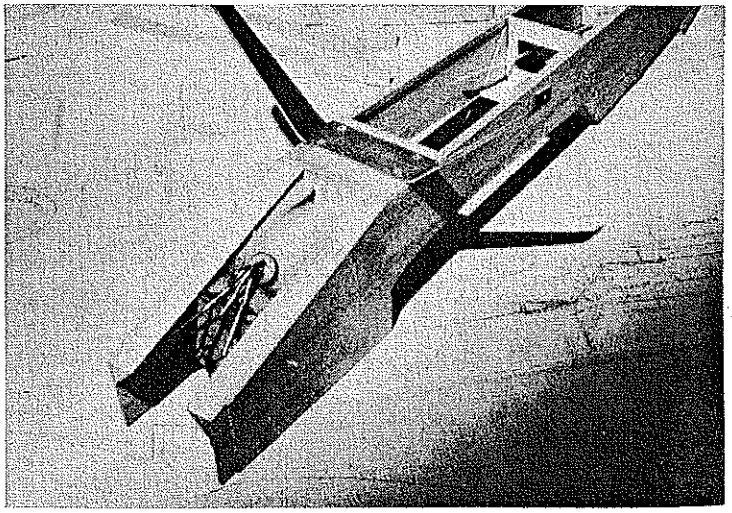

HEY DAD! IT TAKES OFF FROM SNOW TOO?
ART BY HANK CLARK
FEED FROM TANK
TO SERVO
4-40 BOLT
PRESSURE TO TANK
SOLDER
SMOKE
NO SMOKE
TO EXHAUST
ENG. PRESSURE
JAM NUTS
METAL SLEEVES
4-40 SCREWS THRU CANOPY DECK INTO 1/8" PLY TABS
1/2" SHEET BALSA TURTLEDECK HOLLOWED
1/4" HARD BALSA SHEET FOR ALL TAIL SURFACES
3/4" TRIANGULAR BALSA IN TOP CORNERS SLITTED TO BEND
1/4" SQ. HARDWOOD RUDDER L.E. POST
TAIL BLOCK (T.E. STOCK)
3/32" MUSIC WIRE JOINS ELEVATORS
1/8" SHEET COCKPIT
D 3 DOUBLER
FT 2
F4A
FT 1
AILERON SERVO LINKAGE SIMILAR TO CAP 20 MODEL IN MARCH 1980 M.A.
S D SPAR BRACES 1/8" PLYWOOD FRONT AND BACK
1/2" BALSA TOP COWL
F 3 A 1/8" BALSA
F 3 1/8" LITE PLY
WP 2 WING REST & BLOCK
F4T
FP2
F4
WP 1 1/8" PLY
3/4" TRIANGLE TOP CORNERS
1/4" DOWELS FOR 4-40 SCREWS
SAW FROM FULL COWL ONLY AFTER ASSEMBLY
1" TAIL WHEEL ON 3/32" WIRE THRU AILERON BEARING AND INTO RUDDER
1/8" SHEET DOUBLER
3/32" BALSA SIDES FULL LENGTH
1/8" SHEET BALSA CROSS GRAIN FOR BOTTOM PLANKING
D 4
3/16" SQ. LOWER LONGERONS
1/16" SHEET WEBS
SOLID BALSA TRAILING EDGE AND AILERON STOCK
1/16" X 1/4" CAP STRIPS ON 3/32" BALSA RIBS
1/8" REAR SPAR TO ℄
TAPERED FILL BLOCK
1/8" PLYWOOD UPPER AND LOWER STRAPS FOR SECURING COWL SECTION
RB
D1
FP1 1/8" LITE PLY L.G. BRACE
D 2 1/8" BALSA DOUBLER
LGP 3/16" PLYWOOD
F 1 1/8" LITE PLY RING REINFORCING
1/2" BALSA SHEET CARVED FOR COWL RING
3/8" MAPLE BLOCKS
1/16" MUSIC WIRE TO BELLCRANK
SIG 3/32" ALUMINUM LANDING GEAR LEGS
4-40 SCREWS INTO T-NUTS
1" WIDE BALSA BLOCK
REVISED SMOKER VALVE CHANNEL MOUNTS ON PLY BLOCK INSIDE HOLLOWED CHEEK
3/4" BALSA BOTTOM
3/16" BALSA SIDES
1/8" HARD BALSA SPAR WITH 1/8" X 1/4" CAPSTOP & BOTTOM
1" BLOCK TIPS
1" BALSA BLOCK FOR COWL CHEEKS
F 2 1/4" PLYWOOD
2 1/2" WHEELS
3/32" PLYWOOD SHEET GEAR ATTACH
1/8" BALSA L.EDGE DOUBLED
1/32" BALSA L.E. & T.E. SHEETING

FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 140



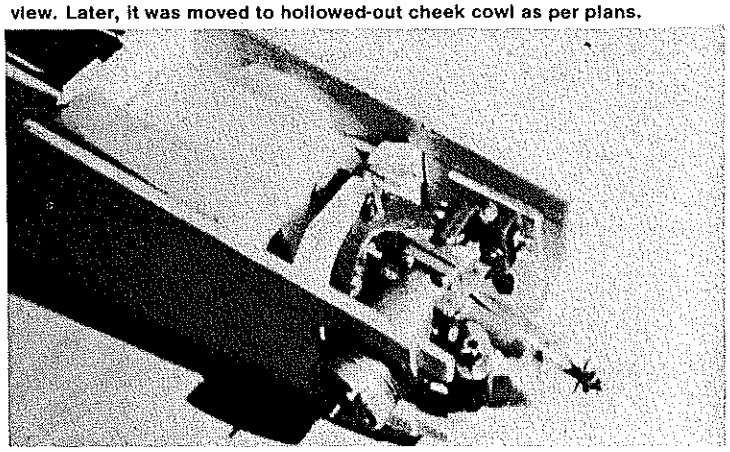


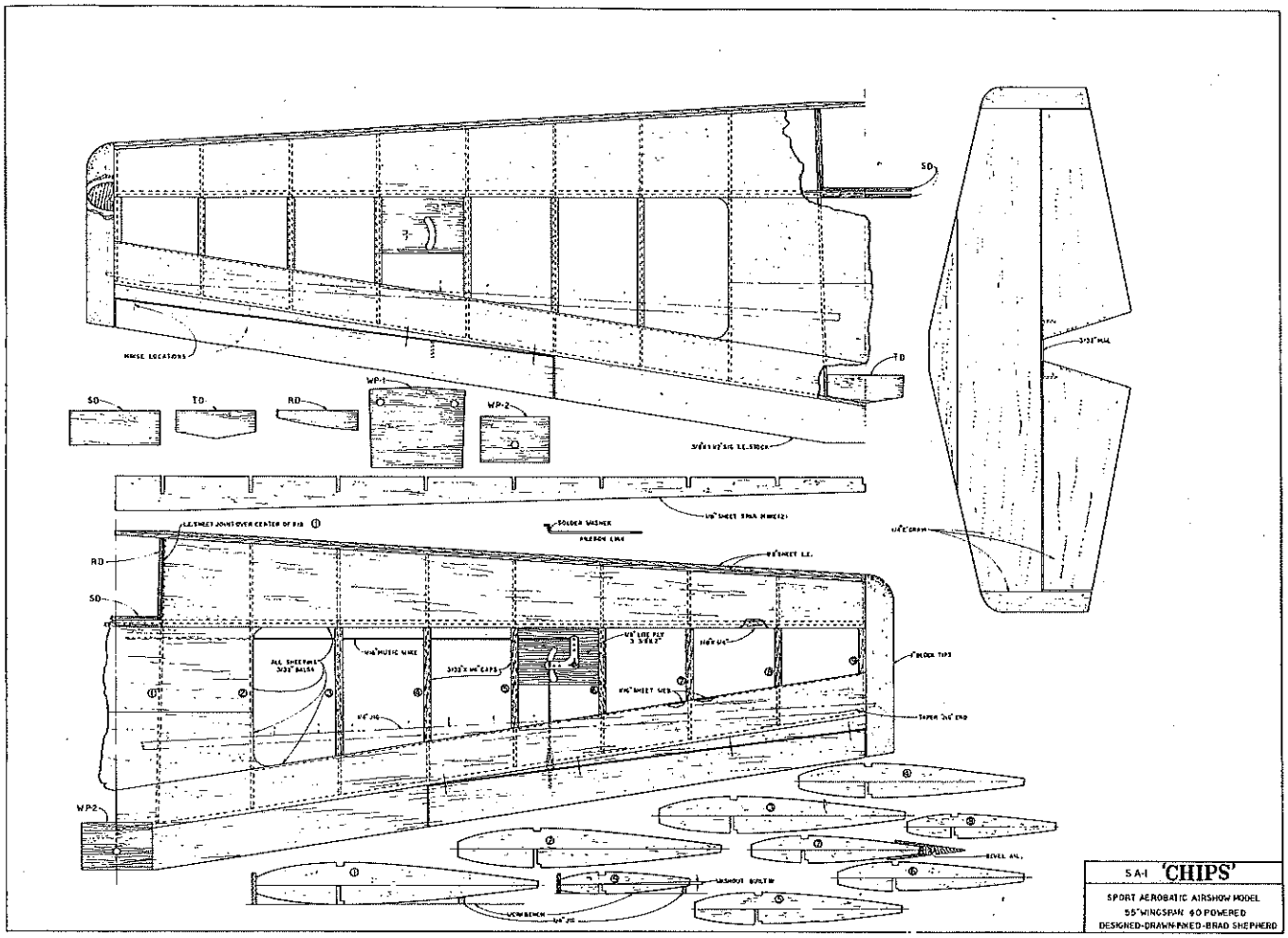
Early stage of fuselage construction. Fuel tank already installed.

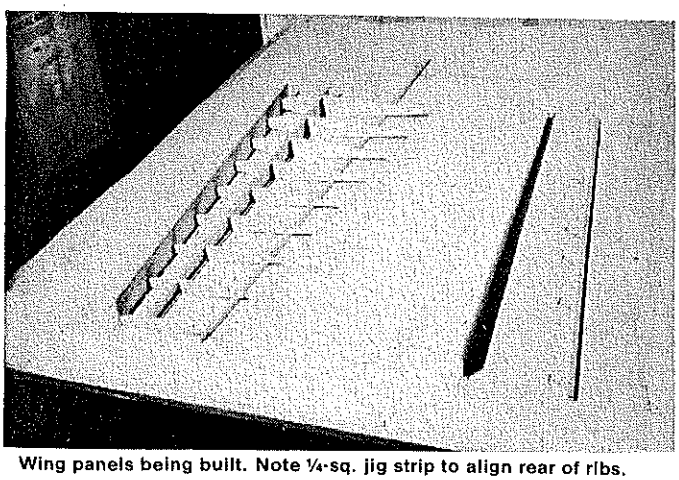


Smoker tank goes in the bottom. Note foam packing around it.

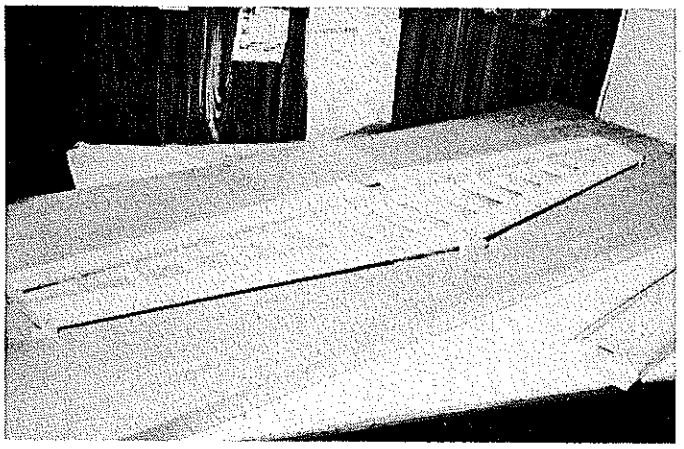
The smoker valve was trial-fitted at the bottom of the crankcase in this view. Later, it was moved to hollowed-out cheek cowl as per plans.





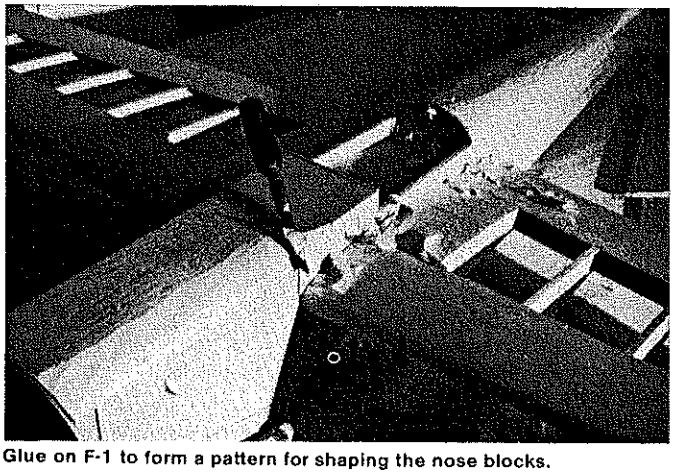


Wing panels being built. Note ¼-sq. jig strip to align rear of ribs.

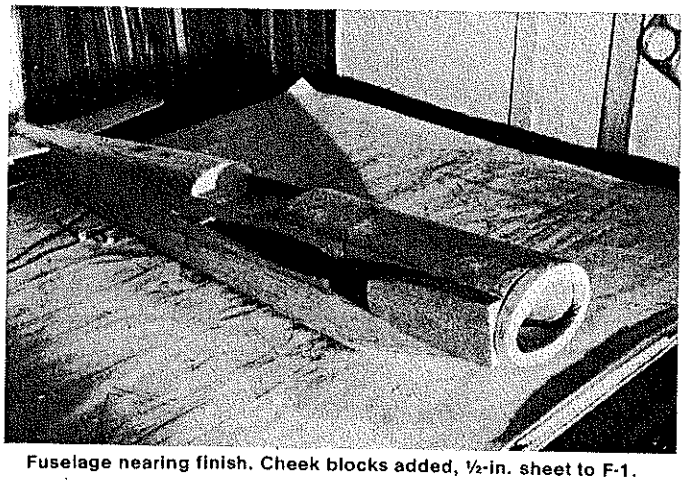


Wing halves being assembled. Note blocks at center and at tips.

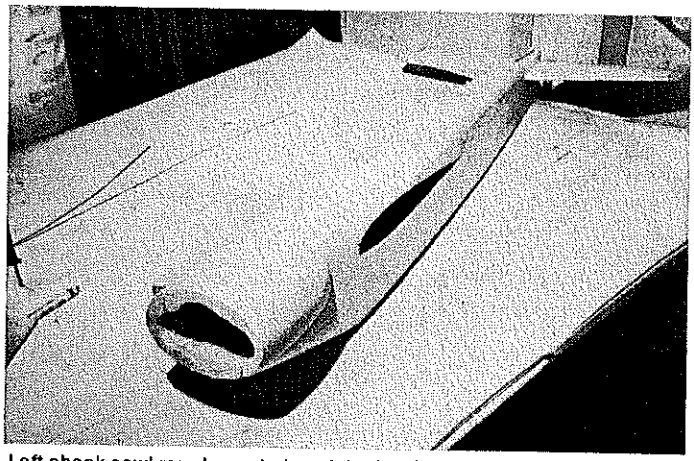
Cockpit section being built, separated from wing and rest of fuselage with polyethylene. Balsa floor (3/32-in.) conforms to airfoil shape.



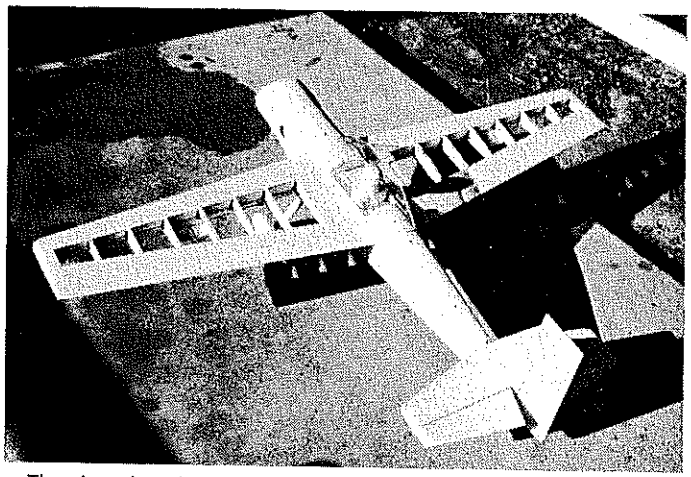
Glue on F-1 to form a pattern for shaping the nose blocks.



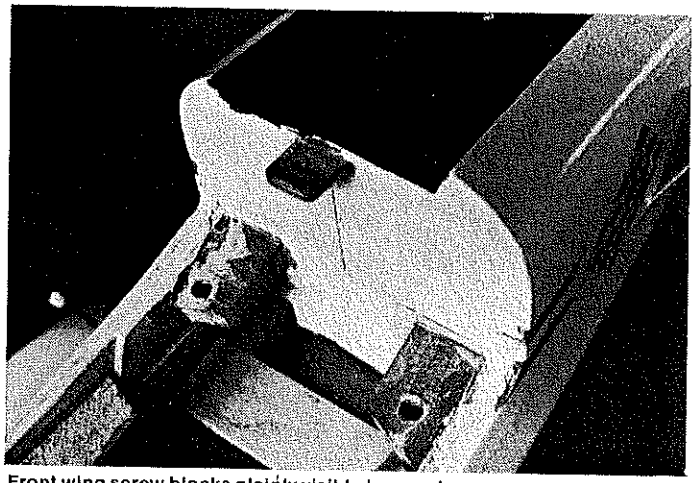
Fuselage nearing finish. Cheek blocks added, ½-in. sheet to F-1.



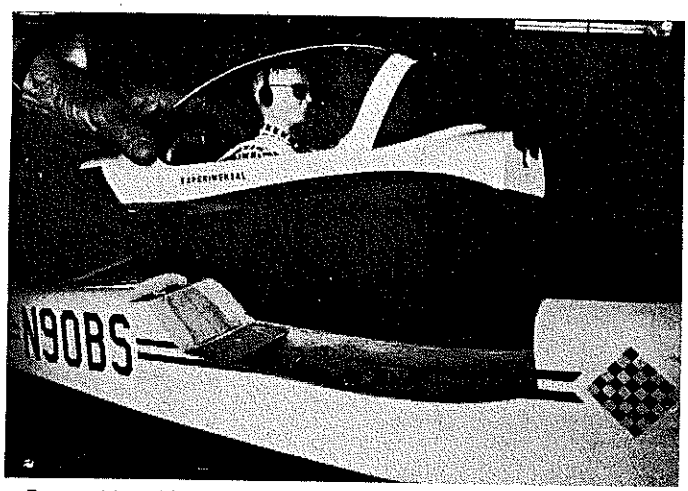
Left cheek cowl rough-sanded, and the fuselage begins to come to life.



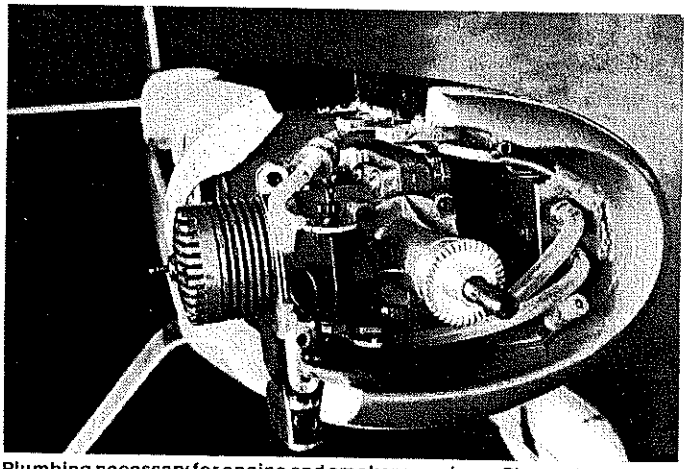
There's a charming beauty in a finished framework ready for covering.



Front wing screw blocks plainly visible here—plus canopy hold tab, HH.



Removable cabin section (Sig Chipmunk canopy) is neat and smooth.



Plumbing necessary for engine and smoker seen here. Plugged top tube is for filling fuel tank; plugged bottom tube is to fill smoker tank.

fired up and taxied out again. This time it got off without any problem. It flew straight and steady but needed up control for level flight—until I could feed in up trim (all I could get), and then it was OK. Felt out some turns, and it handled good. Tried a roll, and the roll rate was about like the full-size Stephens, 180° per second. Loops were nice, round, and steady—playing the throttle on the back side to keep from building speed. Took it up, and slowed it down . . . slammed elevator and rudder . . . spin entry was good. After a couple of turns, I let the sticks go back to neutral, and it recovered instantly. Rolled it on its back, and the surprise came—I needed very little down to hold it.

Leon Folse was still there with his photo gear taking shots while I was flying, and we decided to try to get a shot of it inverted. I rolled it over and came across the strip, then rolled it upright after the pass. Leon said to try it again and to get a little lower if I could. (I thought to myself, "he's gone bananas.") Throwing all my good senses and caution to the wind, I said "OK, get your trigger finger ready." Made a turn out over the grass, rolled it over, and eased it down to about 2 ft. off the deck, and he got a shot of it. Don't know if that's confidence in my Kraft radio, the K&B .40 engine, and my airplane—or just a case of going a little 'loco'—but we pulled it off. Since then, I've made many inverted passes with the smoker going, and it sure looks great.

The commercial smoker valve I had installed when the model was being built leaked, and I never did get the smoker working really right on those test flights. After getting home that morning, I took the valve out, and set about to design my own. What I came up with is shown on the plans. It works every time, while completely blocking off the pressure when closed, with no load on the servo. All it does is simply pinch off the silicone tubing for a positive shutoff. The smoke starts and stops the instant the valve is opened or closed. I am still experimenting with the smoke chamber on the exhaust and the feed fitting in the exhaust to get denser smoke.

Running a .40 with a smoke system presents a problem not associated with using a .60 or larger engine—there's just not as much exhaust heat available in the muffler to work with. As of this writing, I have added a double-walled chamber on the end of the Du-Bro spring-type muffler (a tube within a tube—¾-in. and 1-in. aluminum tubing), which is working pretty good. The next step is to add some coarse steel wool between the

spring and chamber to see if that helps. Incidentally, if you own a propane torch, buy some Cleanweld Turner Aluminum Brazing Rods (I got mine at the local Fed Mart), and practice a little on some light gauge aluminum. This stuff is great once you get the hang of it. I not only built the double chamber, but also a complete muffler to go inside the cowl on my next model.

One maneuver I get a charge out of is to come across the field into the wind full bore—kick in the smoker, pull up, then do a 360° roll, breaking over into the same heading at which the maneuver was started. I haven't tried a tail slide yet, or Charlie Hillyard's "corkscrew," but a knife-edge all across the field with the smoker going sure looks good. Snap rolls are good at half throttle; in fact, if you're not really 'with it' and sharp on the sticks, it goes past 360° very easily.

Landings are a joy if you like tail-draggers. You don't drive it in like a trike gear job. Reduce throttle on the downwind leg. After making the turn into final, keep just a little power on (it's a clean aircraft, and glides easily). About two feet off the deck, chop power, and it will make one of those "kiss the tarmac" three-point landings.

Construction. I usually cut out all the parts and check them for accuracy against the plans. Then the building goes along pretty quick while you're assembling and gluing.

I built the wing first, as it has to be completed before the fuselage can be finished. I drew each rib on the plans so that you have the option of cutting each rib individually, or of making a pattern of the root and tip ribs and carving a stack. If you choose to carve the ribs, stack nine pieces of 3/32-in. sheet balsa a little larger than the root rib; put the root pattern inside the first and second pieces, and the tip pattern outside the last piece. Pin these together, and carve and sand around the ply pattern. Use a Zona Saw to cut the spar slots. After taking the stack apart, sand the bevel off of each rib,and they should then be ready to use.

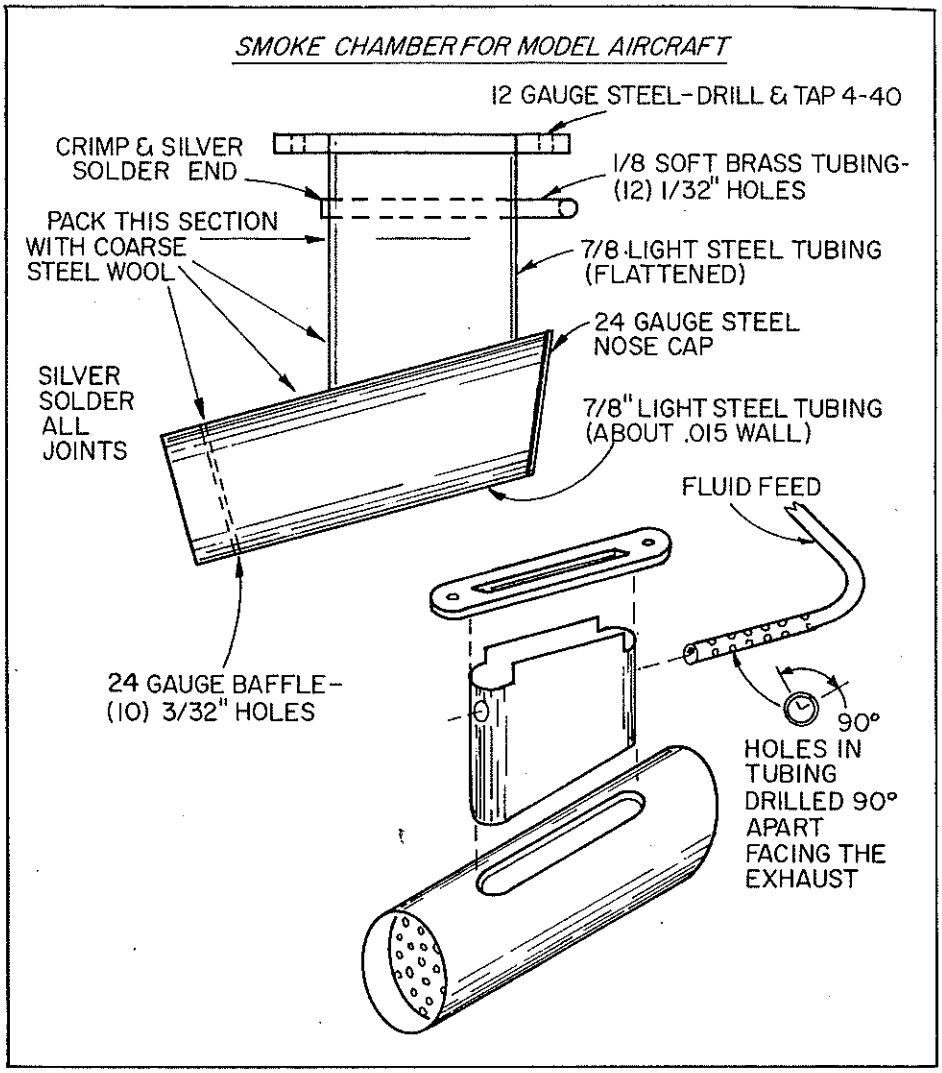
Cut the ⅛-in. full-depth spars from the same piece of straight-grained balsa sheet. Pin a ⅛ x ¼ spar cap over the plans, then glue and pin the sheet spar on the forward edge of this. Pin the ¼-in. jig in place on the plans; remember to trim the taper into the jig at rib #9 position. Pin ⅛-in. leading edge sheet over the plans, then check-fit each rib, and trim where necessary. Glue and pin each rib in place. Glue ⅛ x ¼ top spar cap.

Slice in half two 3/32 x 3 x 28 pieces of C-grain balsa for the trailing edge (T.E.) sheeting. Glue a piece of ⅛ x 5/16 x 28 to two of the 1½-in. sheets on the very edge, at a 90° angle (note rib #7 on the plans). When dry, glue and pin these sheets on rear edges of ribs, butting the ⅛-in. segment against the end of each rib.

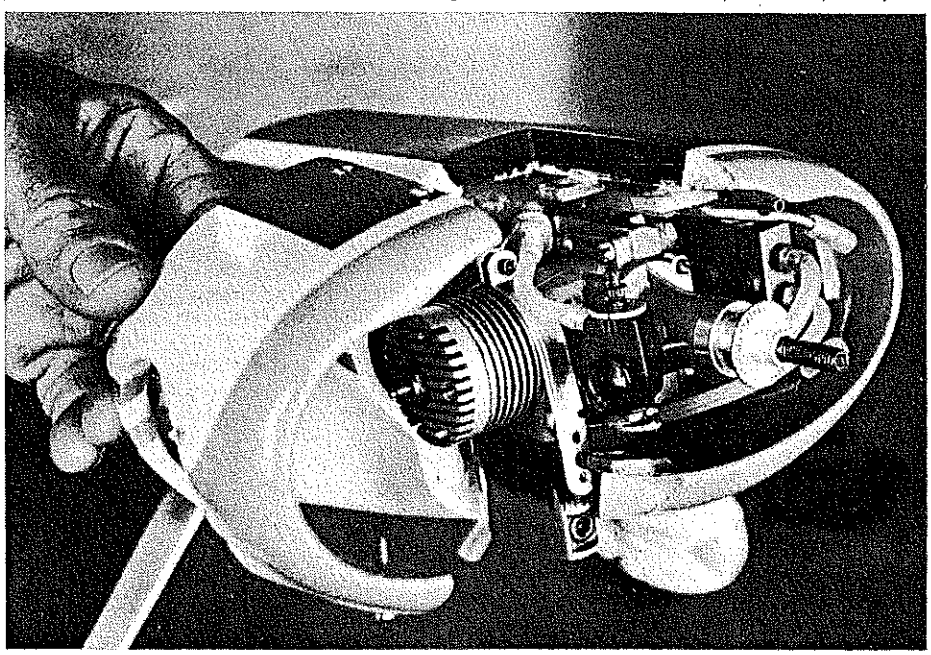
Use a piece of 3/32 x 3 A-grain balsa for the top leading edge (L.E.) sheet. Trim and sand one edge to fit snugly against the ⅛-in. sheet L.E., then pin in place with the end of sheet over the center of rib #1. Mark where the sheet meets the rear edge of the top ⅛ x ¼ spar cap; unpin and slice this portion off the sheet, using a straight-edge.

I use cellulous model cement at the leading edge and on the spar, with white or cabinet glue on the ribs, because it is slower drying. Lay a bead on each rib first, then a bead of model glue on the spar and on the front edge of the sheet. Place the sheet on the wing and pin well at the leading edge, then roll it down and pin to the spar cap. Check to see that the ribs have not pulled away from the jig when the leading edge sheet was glued on. The center section sheet between #1 ribs goes on after the wing is assembled. Cut

Continued on page 114



This is the smoke chamber now used by the author. It was designed and built after the article was submitted, so it isn't referred to in the text (but is shown in pictures). Being of steel, it holds heat much better than the previous aluminum unit, and the added heat produces better smoke. Also, the feed nozzle with many small holes does a better job of distributing smoker solution than the author's earlier single hole fitting. Smoker solution? The author currently is using 50-50 diesel oil and Old English Lemon Furniture Polish! But he's still experimenting, and says that auto transmission fluid and diesel oil, pre-heated by wrapping tubing around exhaust twice before injection, looks promising—and may give better "hang" time because of the heavier oil. (Commercial rights to this smoke chamber design are reserved to the author, Brad Shepherd.)



Removable section of the cowling. It's mounted on ply tabs. Author's prototype uses K&B .40.

1975. I think the thing that means most to me is that yours are simple models—mostly three channels—without ailerons. It's kind of the unspoken practice in my club that says, 'no 2-3 channel plane, except for beginners, of course.' A newcomer arrives, and the minute he feels comfortable flying by himself, he must get to a Pattern ship, or at least a 4-ch. sport plane.

"It bothers me. I guess because I've really had more fun per dollar spent with 3-ch. trainers. First, a Tri-Squire modified into the Mk. II design, and then an old deBolt Rebel. I probably have 300 flights on the two of them, and the biggest thrill was the first time I ever did a touch-and-go with the Rebel.

"Sure, I have tried the 4-ch. planes, a Skylark and a Super Joy Stick, but not with any extended success. But at my field, I just feel out of place with a 3-ch. ship. They don't say anything but the feeling is there.

"On the other side of the coin, they really are a great bunch. I'm more creative and artistic than electronically or mechanically minded, and they are a great help to me in getting things to work."

One wonders if this situation, all too common, might be another reason for the tremendous growth of Gliding. When peer pressure decrees that you must have ailerons, you must be an aerobatics pilot.

Many of us don't want that; we like to "watch" planes, and relax in our flying. Possibly the majority of pilots like aerobatics; the sky is filled with machines diving, climbing, twisting in random fashion. Precision aerobatics by Pattern pilots are exquisite to observe, but we don't have to follow suit if we like other things better.

The writer once was part of the mad rush in the days when aerobatics were developing; we could do consecutive rolls properly, fly inverted, spin, etc. It bored us. Whether a plane be rubber-only, 2- or 3-channel, it is a special art to fly them properly. The measure of a flier's ability is his competence in the air, no matter what he flies.

Competence earns respect. And what of all the Scale people? We urge everyone to to their thing, what pleases them most, and to heck with the narrow-minded who don't know enough about the hobby, overall, to understand what they are looking at.

Bill Winter, 4330 Alta Vista Dr., Fairfax, VA 22032. Fellows, please put address on letters (we have earnest kids we can't answer because they didn't give an address). If reply is necessary, do include a pre-addressed and stamped envelope; we use a roll of stamps a week. Help!

Super Akro/Shepherd

Continued from page 27

Burma, India theater, and he also was one of Chennault's boys (sent home in bad shape after 600 combat hours).

Wanted you to see that wood. Bob has been around lumber mills all his life, and knows wood—he is a surgeon at curing and cutting wood. The logs are Engelman spruce, indigenous to his region (Oregon). Lighter than Sitka, it is not quite as tough as Sitka in some ways. But properly selected and cut, it has more advantages than any wood Bob has seen—we use it, and agree without reservation. Around here, we buy planks and get them ripped up. Supposed Sitka is brittle and snaps easily—we encountered that in building (not flying) our Aristocrat. For our ¼-scale Vagabond, Bob was pleased to cut our spruce. It is white, straight-grained, a beautiful material. Srull "swiped" some from us for an incredible RC Santos Dumont which outdoes those Japanese movie monsters.

Sitka weighs 28 lb./cu. ft., Engelman weighs 24. Since useful balsa weighs about 10 to 12 pounds for such crates, the smaller dimensions of Engleman mean that you don't have to accept a serious weight increase. This wood is stable, holding shape however it is worked—super trailing edges, spars, curved, shaped, faired, keels, whatever. We convinced Bob to make this wood available to modelers at large. If you are into monsters, drop him a line (G-S Products, Box 488, La Grande, OR 97850). We can't remember when we first ran into Bob Smurthwaite, a gentleman and scholar, and a true friend of all modelers.

Aileron Syndrome? We have a disquieting, but very nice, letter from an active RCer who wishes to remain anonymous. (A fellow retiree, he lets his hair down.) Let's just quote:

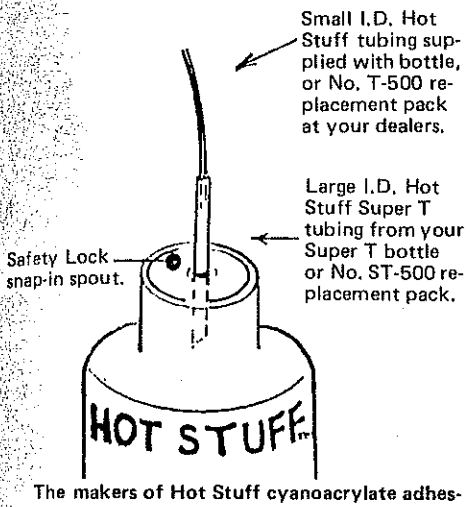
"I have been building and flying RC since

and glue the cap strips in place. Let the panels dry overnight, then trim the ⅛-in. L.E. sheet flush with the rib sheeting.

I use an inside panel door purchased at a lumber yard for a building board. Draw a straight line at least 54 in. long on the door or on your workbench. About at the center of this line, draw another short line parallel to it and 7⅜-in. behind. Cut a piece of ¼-in. scrap balsa 11/16-in. wide, and pin it to the jig block. Pin a ¼-in. piece under the trailing edge of the tip rib. Place the other panel on the long straight line, and check the spar, T.E. sheet, and L.E. sheet for a square fit. Trim where necessary, and then pin the panel along the straight line at the rear edge of the spar cap and to the 11/16-in. jig at the center section. Pin a ¼-in. piece under trailing edge of rib #9.

Epoxy ply piece TD to the inside of the top T.E. sheeting, butting against the ⅛-in. T.E. spar. Epoxy the two SD pieces to either side of the spar in the center section, and clamp them

MINIMIZE HOT STUFF TUBE CLOGGING



The makers of Hot Stuff cyanoacrylate adhesive, Satellite City, recently have forwarded to us a user's solution to the sometimes-problem of clogging in the small diameter applicator tubing. This is more prevelant in high humidity situations. Since the solution to this problem, as devised by Mr. Carl F. De Filippo of Winchester, MA, may be of widespread interest, we reprint it here.

Enlarge the 1/32-in. hole of the spout (original Hot Stuff only) with a round toothpick. Insert a 1-in. length of Hot Stuff Super T tubing about ¼ in. Cut the small-diameter tubing, supplied with each bottle, in half—and insert into the Super T tubing. (Super T tubing is available at hobby shops—part No. ST-500).

When the bottle is righted after each use, the slightly increased weight of the Hot Stuff within the large Super T tubing creates a vacuum, causing any Hot Stuff remaining in the small tube to be pulled back into the bottle.

If the small tube ever does clog, it can always be cut without changing the I.D. (tapered spouts get larger and larger as clogs are cut off). If replacing the small tube is ever necessary, the Teflon-to-Teflon fit makes it quick and easy.

with clothespins until dry. I use Sig's Kwik Set epoxy for this job. Epoxy the RD pieces to each rib #1 flush with the bottom contour. Epoxy the ⅛-in. leading edge joint.

Trim about 3/16 in. off the long edge of the remaining two 3/32 x 1½ trailing edge sheets, then glue them in place, butting against the ⅛-in. T.E. spar. Glue a 1/16-in. balsa joiner inside the 3/32-in. T.E. sheets at the center section. Cut and fit the 3/32-in. L.E. sheeting in the same manner the T.E. sheeting was fitted, then glue in place. Glue cap strips on ribs #3, 4, 7, 8, 9.

Bolt the aileron cranks to the Lite Ply mounting plates, bend the plates slightly to conform to the rib shape, and epoxy to ribs and spar cap with 5-min. epoxy. Glue the short cap strips to #5, 6 ribs. Sheet the center section between #1 ribs, and glue the sheeting behind the spars. Glue 1/16-in. sheet webs between the ribs and trailing edge sheeting, making sure the wing is pinned down solid to the jigs for the correct washout. Once these pieces are in place, the wing becomes very rigid.

Let the wing dry overnight while pinned down. Remove the framework from the door (or workbench) and the jigs. Epoxy the WP-1 piece to the ply RDs and the SD ply doubler. Sheet the top center section behind the spar; don't sheet leading edge between #1 ribs yet. When the sheeting has dried, sand the entire framework—I use 220-grit and a long block to knock off the high spots.

Pin one panel at a time on the workbench, upside down, at the trailing edge, with polyvinyl sheet or waxed paper underneath. Trial-fit the ⅜ x 1½ trailing edge piece, and trim where necessary for a good fit against the ⅛-in. T.E. spar. Glue this in place. When dry, pin the other panel down, and repeat the procedure.

When you lift the wing after it has dried, you will notice a slight reflex on the T.E. toward the tips. Don't sand this out; just sand the joint so the transition from the 3/32-in. sheet and the T.E. stock is smooth. The top of the wing will be smooth all the way.

Glue the ⅛-in. forward L.E. piece in place. Glue the tip blocks on. When they have dried, shape the tip around rib #9. Round off the front as shown, then sand the final shape with 100-grit paper. Epoxy the WP-2 piece in place after sanding the T.E. straight. Give the wing a final sanding with 220-grit.

Continued on page 118

Fuselage. Lay out the fuselage sides on 3/32 x 6 x 36 balsa. Note that the sheet is not the full length of the fuselage side; it lacks ½-in. on the front end. I use a ball point and draw the thrust line as a reference. All the lines are straight, so a ball point and straightedge make this an easy task. Draw the wing center line ¼-in. above and parallel to the thrust line; the stabilizer center line is 1 in. above the thrust line and parallel to it. Lay out the former locations with a 90° triangle against a straightedge on the thrust line. After cutting out the first side, use it as a pattern for the other side. Make a cut in the sides behind F-3, from the top, to the center line of the root rib. Make another cut, also from the top, to the center line at the rear of the cockpit between the F4-A and F4-T former locations.

Glue the 3/16-in. bottom longerons on each side—don't forget to make a right and left side. Glue doublers D-2 in place on each side, butting against the 3/16-in. longerons. Use ⅛-in. scrap between D-2 and D-1 when gluing, and also between D-2 and D-4. Glue D-3 in place, lining up with the top edge.

Lay out and cut the ¼-in. slot for the stabilizer, and glue on the ⅛-in. reinforcement. Glue ⅛ x ¼ stiffener strips to each side. Trim ⅛-in. off the top ¾-in. triangle piece as shown on the side view, and glue these to the sides. With a Zona Saw, make a series of cuts in the triangle so that it will bend to the fuselage shape. Cut the top portion of the fuselage between F-3 and F4-T along the wing center line, and remove these pieces. Carefully trim the 3/32-in. sides down to the doublers, D-2 and D-3, where the wing goes.

Lay out the engine bolt holes on F-2. Drill for and install the bolts through the firewall. Solder short pieces of music wire across the head slots of the bolts, then install the engine mount. Tighten the mount, and epoxy the bolt heads to the rear of the firewall.

Pin down the sides over the top view. Slip formers F-3 and F-4 in their slots to assure squareness of the fuselage. Trim a little off the top triangles where they meet as per the top view. Glue the ⅛-in. tail post and the top triangle with 5-min. epoxy. Slip F-4 out, put 5-min. epoxy in the slot behind D-2, and install the former. Epoxy F-3 in place, then the F-2 firewall, and F4-T. When all this has dried, unpin the fuselage, turn it over, and glue forward bottom ¾-in. triangles—also the LP landing gear plate.

Position the landing gear, and drill the mounting holes. Install blind nuts for the gear, then smear on a little epoxy to hold in place.

Prepare the tanks and install them. One comment I'd like to make here is that, after drawing the plans, I realized that a Sullivan RST tank would probably work better for the smoker tank than the SS that I used and drew on the plans. Install the smoker valve pushrod tubing; note that it goes on the left side of the fuel tank. Install the throttle pushrod tubing. Glue the top ¾-in. triangles in place over the tank. The tanks are packed in foam.

If you use cable pushrods as I did, install the tubing now—using two ⅛-in. balsa sheet bulkheads between F-4 and the tail post to keep them stiff. Epoxy FP-1 pieces in place, and then the maple blocks to the front corners of the radio compartment (for the wing hold-downs); also install the rear hold-down ply plate and block. Epoxy ply pieces FP-2 to the sides, making sure there is a good glue joint where they meet F-4 and the ply plate.

Glue the bottom 3/32-in. sheet in place, with the grain running across the fuselage. Trim ½-in. off of two pieces of T.E. stock, and glue them to the tail post as shown on the top view of fuselage. Tack-glue the rear ½-in. top sheet in place, and roughly carve to shape. Take a long straightedge, and using the center line on the formers and the tail block, draw a center line for the fin. Cut a ¼-in. slot on this center line. Glue the top and bottom front blocks to the fuselage.

Put the wing in the saddle on the fuselage, using the center lines on the formers to get the wing in the proper place. Then pin down the wing. Use a yardstick to measure from the wing tips to the tail post; shift the wing slightly until the measurement is the same on both sides—the wing then is square with the fuselage. Drill the mounting holes in the blocks for the ¼-20 nylon screws. Unpin the wing, tap the holes, then screw the wing in place. Trial-fit the stabilizer; get it parallel with the wing (and square with the fuselage), then glue it in place.

Lay poly sheet over the wing, and pin the two cabin sides in place flush with the existing sides fore and aft of the wing. Glue 3/32-in. sheet inside the two sides directly over the wing. Glue formers FT-1 and FT-2 in place. Glue the blocks on the front and back of the cabin section, getting a close square fit where they butt against the top forward block and rear ½-in. sheet. Glue F-1 in place, using center lines to get it positioned properly.

Carve the top and bottom blocks to their rough shapes, using F-1 as a guide. Remove the wing. Glue the H-H pieces under the front block and rear ½-in. sheet as shown on the plans. Mark the top cabin blocks over the center of the H-H tabs, drill ¼-in. holes, and glue pieces of dowel in the holes. When dry, drill through the center of the dowels and into the H-H tabs—while holding the cabin piece in place. Insert 4-40 blind nuts under H-H, taper the tops of the dowels with an X-Acto #11 blade to receive the flat-head bolts, and screw the cabin to the fuselage.

Glue short pieces of 3/32-in. sheet behind F-1 to the sides, then glue the cheek cowl blocks in place. Glue ½-in. sheet to the front of F-1, noting the rough shape in the photo of the fuselage. Shape the cheek cowls and front end around F-1 with a small block and 100-grit paper.

Sand the entire fuselage to rough shape. Remove the rear ½-in. sheet behind the cabin, hollow as shown on the side view, then glue permanently in place. Glue fin in place—use 90° triangles to get it square.

Using an X-Acto saw blade with the stiffener back removed, cut the cowl away as shown on the plans. Glue the ply cowl hold-tabs in place on the inside of the top and bottom blocks. Glue pieces of dowel to the removable cowl section over the center line of the tabs as was done on the cabin top. Drill holes for the 4-40 screws, and mount blind nuts on the ply tabs. Carve the inside of the cheeks to approximately 3/16-in. thickness,

Continued on page 122

and shape the air outlets as shown in the photos. Drill the drain holes underneath F-2; I used ⅜-in. aluminum tubing for an exhaust effect. Paint the entire inside of the engine compartment with slow-drying epoxy to fuel proof it, after first covering the engine mounting bolts with 1-in. lengths of fuel tubing.

On the cabin interior, I painted everything flat black by adding some talcum powder to black dope, then fixed up the dash with some instruments, switches, throttle and mixture control. Trim the canopy until it has a good fit all around.

Glue in a 1-in. balsa block to the bottom of a 2⅝-in. William Bros. pilot; carve the balsa to conform to the plastic shape, then trial-fit it under the canopy, and trim the block until the pilot looks 'right.' After painting the pilot, I added earphones and mike, glasses, shoulder harness, and 'chute straps made from white shoelaces for a little added realism. Glue the pilot in.

Use two strips of ½-in. masking tape over the canopy, fore and aft, to hold it on the cabin top in the right place—then carefully run a bead of Hot Stuff glue around the edge of the canopy where it joins the balsa. Mask off the canopy before doing any finishing.

Lay out the ailerons with a straightedge and ball point as shown on the plans. Carefully cut out the ailerons, and sand the bevel as shown on rib #7. Cut the hinge slots on the top edge, as this gives a slight differential action when the ailerons are moved. I cut the flange off of a nylon horn, gouged a slot in the bottom of the aileron and Hot Stuffed the horn to the aileron. Install 1/16-in. music wire pushrods, bend the aileron links as shown on the plans, then solder a washer on the 'dogleg.' Sheet the top center section of the wing between #1 ribs. Use a ¼-in. drill bit from the bottom up for the bolt holes in the top sheet. Cut a square of sheet out of the bottom center section behind the spar for the aileron servo. I mounted the servo on a tray flat against a piece of ⅛-in. ply, then used Du-Bro's dual connector ball link to tie the two pushrods together.

Make the tailwheel assembly as shown on the side view, using an aileron horn bearing. Insert a piece of 3/32-in. brass tubing in the bearing, then insert the 1/16-in. music wire with a wheel collar under it, and bend the wire to shape. Mark the rudder where the wire is inserted, drill a ⅛-in. hole, and epoxy a piece of nylon tubing in the hole. Cut the hinge slots for the rudder, and trial-fit it. Cut the hinge slots for the elevator and stabilizer, and glue them in place, then the same with the rudder.

Finishing. Everyone has their own finishing technique; here's how I did mine. I covered the wing with Super MonoKote. For the trim, turn the iron down to where there is just enough heat to stick the Super to the Super. Try it on some scraps first.

I doped the rest of it—sanded smooth—then doped on some light silkspan over all of the balsa, doped a few more coats of clear, and sanded with 220-grit until it was smooth. Put on a coat of balsa filler-coat, sanded it off, and checked for small blemishes by holding it up to a light. More filler-coat and sanding until all the wood was smooth.

I matched the cream MonoKote by adding yellow, a small dab of red, and a small dab of black to white dope—kept dabbing and 'diddlin' until the dope matched a piece of scrap cream MonoKote.

Install the radio gear, and keep the center of gravity (CG) within the limits shown on the plans. As I mentioned in the beginning, this is a very responsive model, and the control surface throws should be kept within limits, at least for test flying. The elevator throw measured at the widest point is ½-in. up and ½-in. down. The

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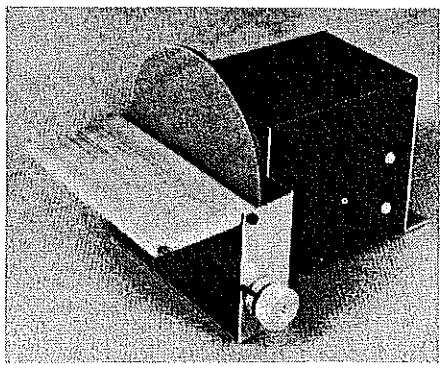


Hobby Sander, @ $24.95, Charlie's R/C Goodies, P.O. Box 192, Van Nuys, CA 91408.

We don't have to shill for Strick's 4-in. Hobby Sander, previously distributed by another firm at $39.95, because many of our buddies have them. This bench sander has an adjustable tilt table, sits at your elbow, and is especially ideal for guys who do a lot of stick framework—such as rubber and schoolyard scale. Of course, it has more uses—fastest way to accurately bevel cross-piece ends, blocks, etc., to any desired angle. Double-ended shaft accepts grinder or second sanding disk. Available accessories include 45-90° miter guide, grinding wheel and extra adhesive-covered sandpaper in various grades. You'll like it. Send 'em $.50 for a brochure covering this item and other special values.

product review product review product review

ailerons are set for ¼-in. up and 3/16-in. down. Rudder should have all the throw you can get without hitting the elevators.

This project has given me a lot of real enjoyment. I get excited every time I fly it. I hope your experience, if you decide to build it, is the same. Have fun, that's what it's all about!

Heli-Fli/Burdin

Continued from page 34

rotor shaft. Adjust the location of batteries, etc., to get this location. Don't change the CG location to accommodate for flying conditions as you would with a fixed-wing aircraft. In the Helicopter, the CG should always be under the main shaft, and flying conditions should be adjusted with trim. (JS)

A couple more comments before we FLI:

1) Your flying site should be smooth asphalt, not grass, for this training program. Early maneuvers require sliding across the surface, and when you do lift off, we don't want the grass snagging your skids as you struggle into the air.

2) Choose a flying site that gives you some peace to work without interruption from interested bystanders. You can't concentrate with people asking questions. And remember, you're a little dangerous while training. You don't deserve an audience yet, and you don't want one either.

3) Most manufacturers have a wide stance landing gear that they recommend for training. My Revolution 40 assembly manual described a simple set of skids made out of ½-in. plastic water pipe. It's cheap and easily made into a strong fixture. The wide stance prevents many tip-overs in the early days of training which, in turn, saves rotor blades and Helicopters.

OK, into the air—almost!

Check List

Pre-flight

1. Flight kit stocked with spare parts and tools.
2. Radio—control and range check.
3. Radio—full battery charge.
4. Correct weather for flight.
5. Main rotor tracking.
6. Transmitter trim settings.

Post-flight

1. Check all nuts, bolts and linkages.
2. Main rotor coning angle, lead/lag, pitch—as required.
3. Tail rotor drive mechanism.
4. Servo mounts and condition.
5. Fuel system.
6. Bearing lubrication.
7. All other alignments.

HELI-FLI LEVEL 2

The maneuvers in this level are to be accomplished in calm air.

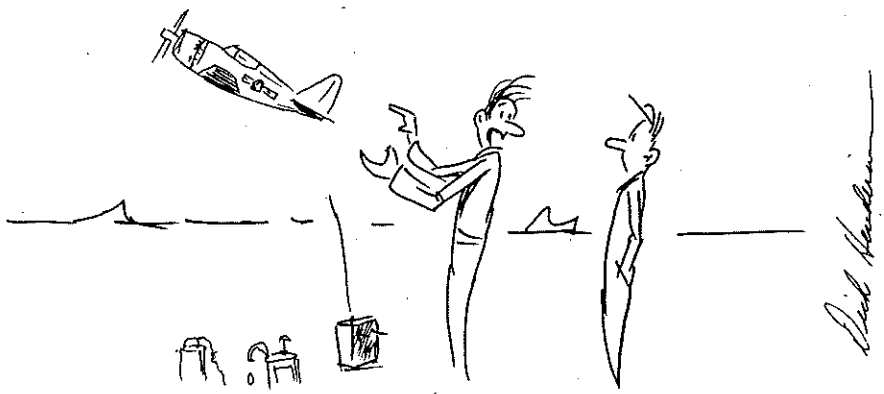
Task Descriptions and Measurement Criteria

1) The student will trim the cyclic and yaw controls so as to allow a "zero altitude hover" (ZAH) with the transmitter trim levers in the neutral position.

2) The student will be able to maintain the position and orientation of the Helicopter within a 1-ft. square while executing the ZAH maneuver. Position and orientation will be maintained tail-in for a period of one minute.

3) The student will be able to maneuver the Helicopter over a triangular course, 6-ft. on a

A HENDERTOON™



"RCHLGUSMA??. . . Radio Controlled Hand Launched Gear Up Scale Model Aircraft."