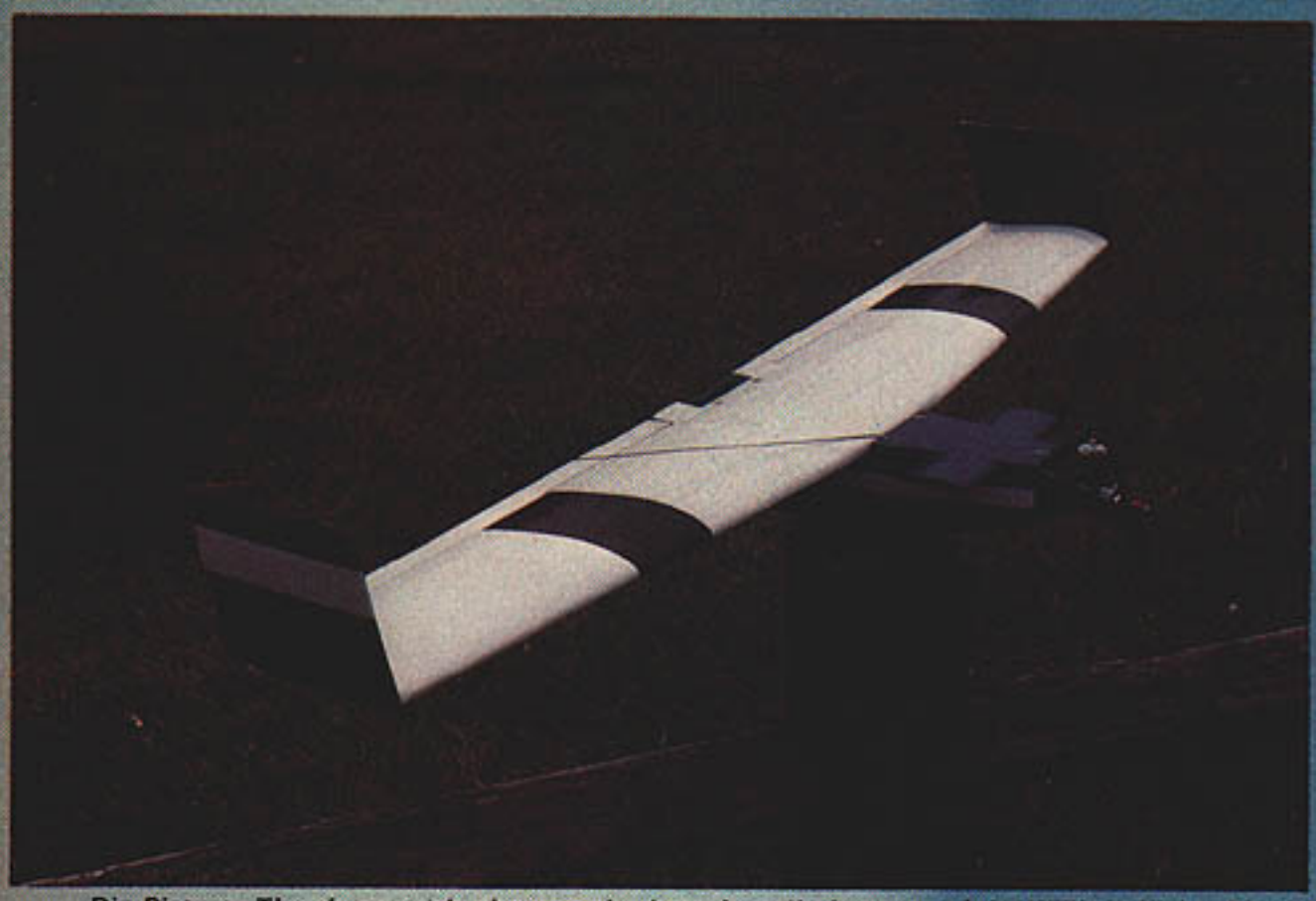
Dave Pastor displays his ½A RC cutie. He used a sliding servo tray for operating the strip elevons but notes that mechanical mixers will work just as well. Construction is super simple.



Big Picture: There's no trick photography here. It really is a snap of the Willit in flight. Above: Wide stripes on the upper wing surface of the completed model help with orientation when it is in flight. The small forward stabilizer? We don't know if the plane would fly without it.

This RC airplane is an interesting change of pace from more complex and conventional subjects. A Cox Black Widow engine, Ace Pacer foam wing, two-channel radio, two sheets of ⅛-in. balsa, covering film, and a few hours of your time are the main ingredients. Carefully remove the center pages for the full-size plan. ■ Dave Pastor

THE CALIFORNIA rain kept falling, and the snow pack was approaching 30 ft. in the mountains. The skiers were in their heaven, and I was looking for a project to take my mind off the weather. It had to be something that I had not done before, something unusual. The result was the Willit, an inexpensive model that can be built in just a few hours.

Let me answer the inevitable question, one that I've been asked many times, "Will it fly?" Yes! And the Willit is a fun model to fly. A Cox Black Widow .049, with the fuel pickup relocated to the bottom of the tank, pulls it along at a good pace with sufficient power for most maneuvers. It is very stable. After getting used to the strange configuration, you will find that you can trust it not to surprise you. It goes where you point it.

FUSELAGE CONSTRUCTION. The only curve that will be cut, with the exception of the hatch, is the wing saddle; make a template of this area out of cardboard. Lay out the fuselage sides, bottom, F3, and F4 on a sheet of 1/8 x 3 x 36 balsa. Cut a second balsa

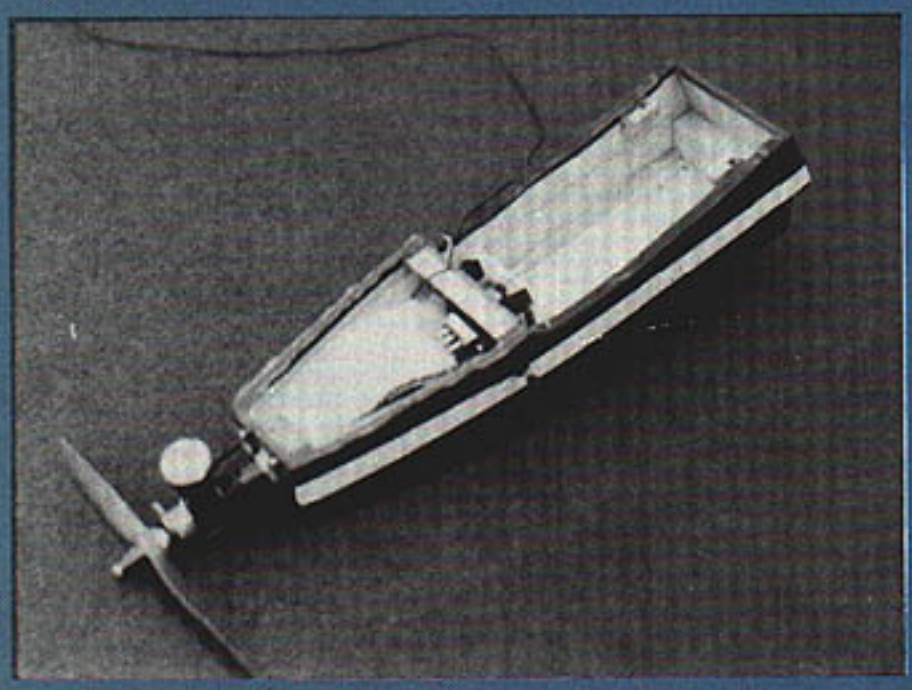
willit

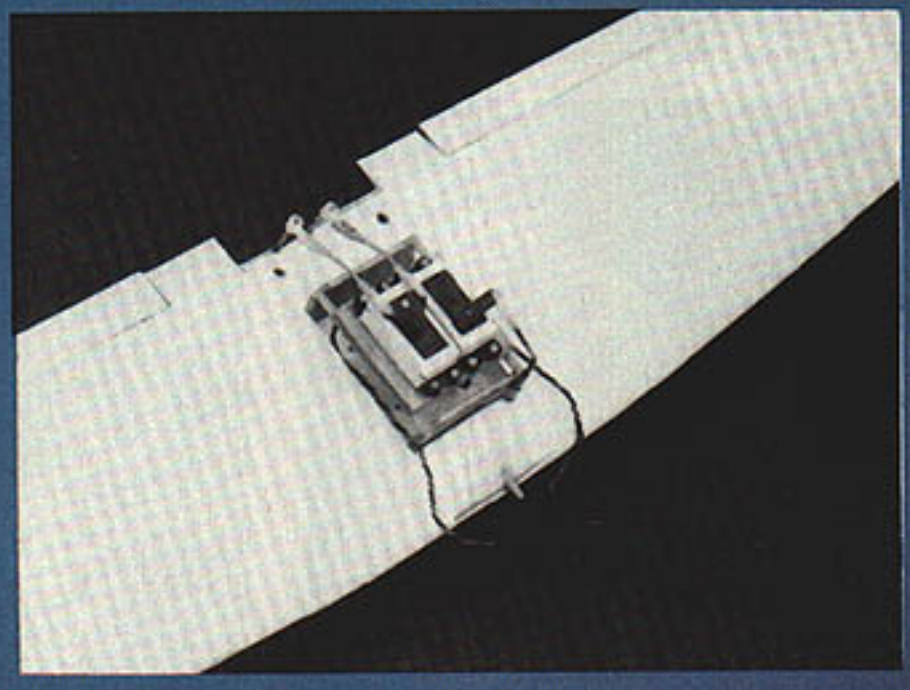
sheet of that size in half, and edge-glue it to make a 1/8 x 6 x 18 sheet. The top hatch, vertical stabilizers, and wing saddle doublers will be cut from the 6-in.-wide piece, taking care to orient the grain properly. What is left will be used for the canard doublers and the cross-grain front bottom fuselage sheeting. Do not trace or cut out the canard hatch at this time.

From a piece of 1/8 ply, cut out F1, F2, and the hatch hold-down pieces. Cut two pieces of 1/6 sq. balsa for the fuselage bottom corner fillers and two 3/8 x 3/8 x ¾ hardwood blocks that the wing hold-down screws will go into.

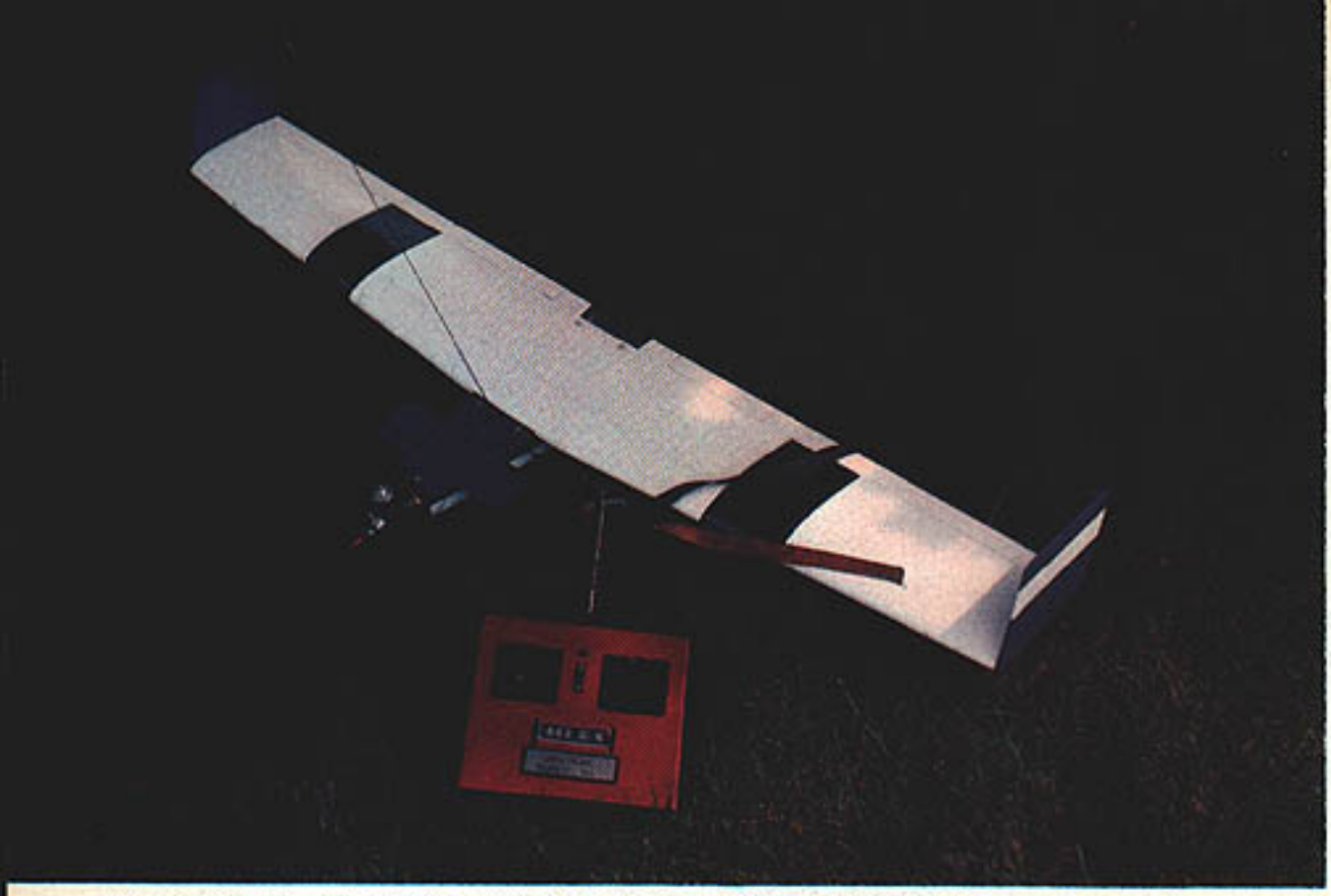
To assemble the fuselage, first glue the 1/8 sq. fillers to the fuselage bottom and the wing saddle doublers to the fuselage sides. When dry, glue the fuselage sides to the bottom and F2 and F4 between the sides. If this is done as one step, fuselage alignment will be correct.

Wet and/or steam the fuselage sides forward of F2. Pull the sides together, and clamp F1 into position at the front. Let this dry, then glue F1 into place. Follow with short pieces of 1/8 sq. balsa for additional support, and add the front and rear hatch hold-





Left: Completed fuselage, wing and top hatch removed. The antenna is strung to one of the vertical stabilizers when the plane is assembled. Rear bustle was necessary to clear the elevon pushrods, though the drawing shows a simpler design allowing sufficient clearance. Note silicon seal around the hatch area. Right: From the underside of the wing we see details of the elevon linkage and the sliding servo tray.



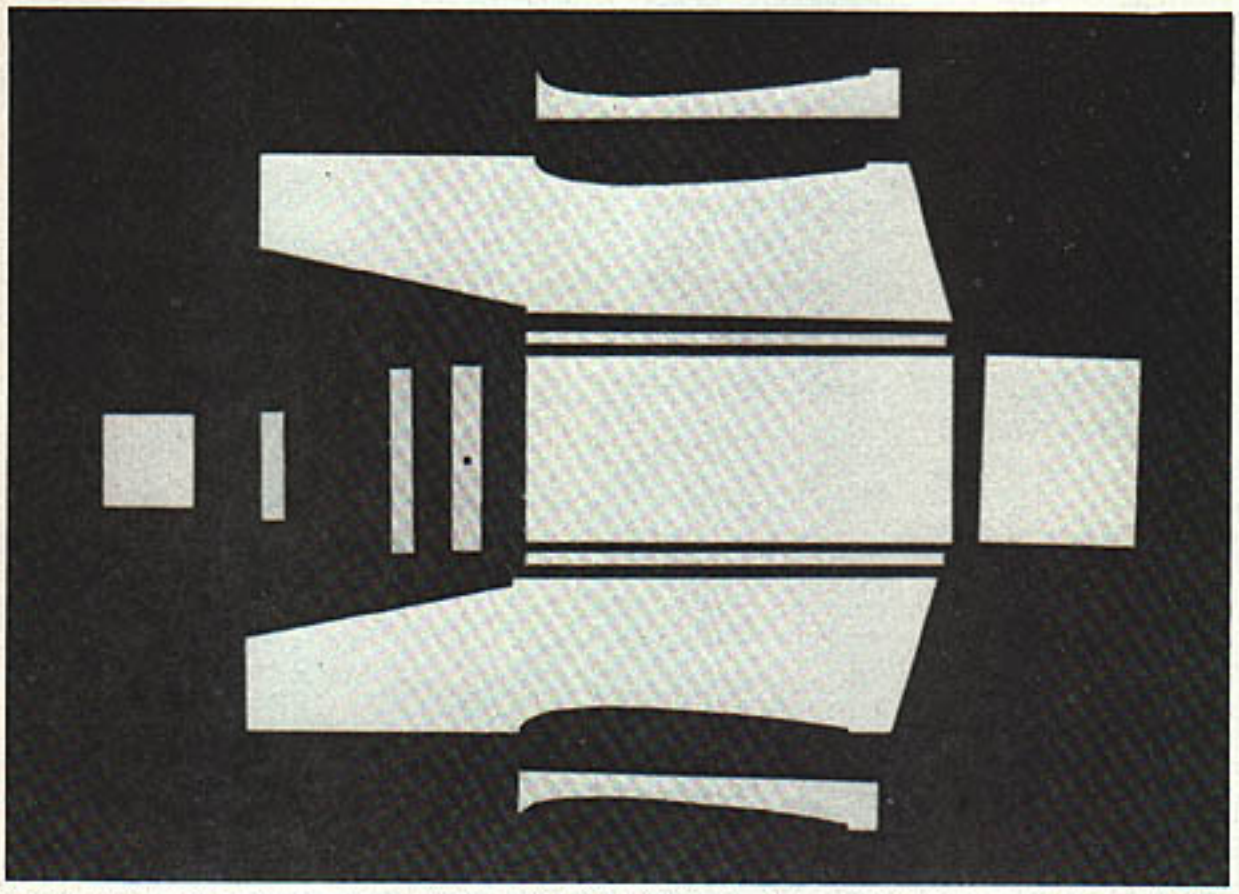
All you need for this one is a two-channel radio setup. It hand launches easily, and if you mount the prop horizontally as it begins to come up on compression, it will help save the prop on landings.

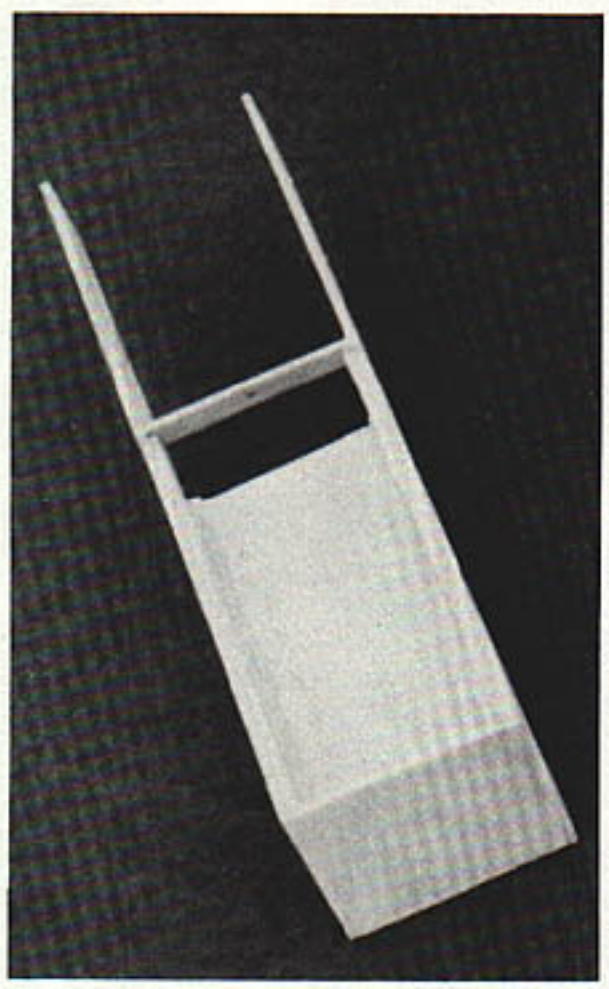
down plates. Lay the fuselage upside down on the wide sheet of balsa, and trace the exact hatch curvature. Remember, the grain of the balsa runs across the fuselage. Finish the hatch, add the cross-grained balsa under the forward fuselage, and mount the wing hold-down blocks. The fuselage is now complete. No, I didn't forget F3. The sole purpose of F3 is to keep your radio from coming in contact with the servos. Place this former wherever it is needed during your radio installation.

The fuselage can now be covered and the firewall area fuel-proofed. I suggest a lightweight heat-shrink covering. Cover the underside of the hatch. This will give it added strength and prevent warping.

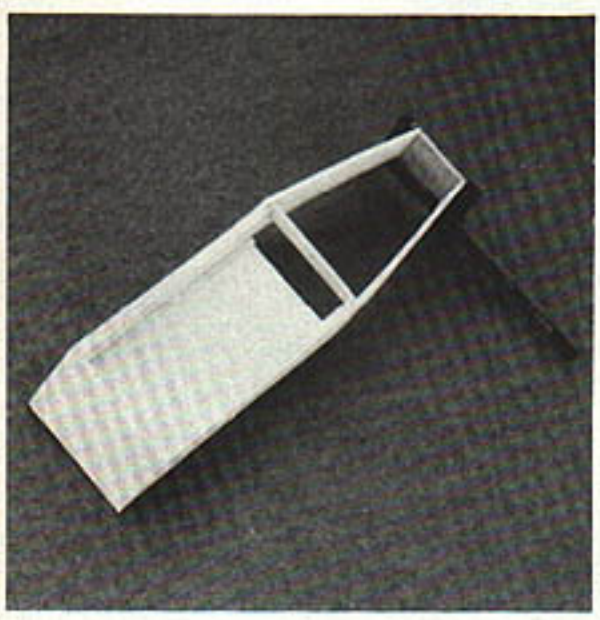
Wing. The Ace Pacer wing kit consists of three foam pieces (one constant-chord center section and two tapered wing panels) cut to the proper length, grooved for the spar, and trimmed for the trailing edge stock. Tapered

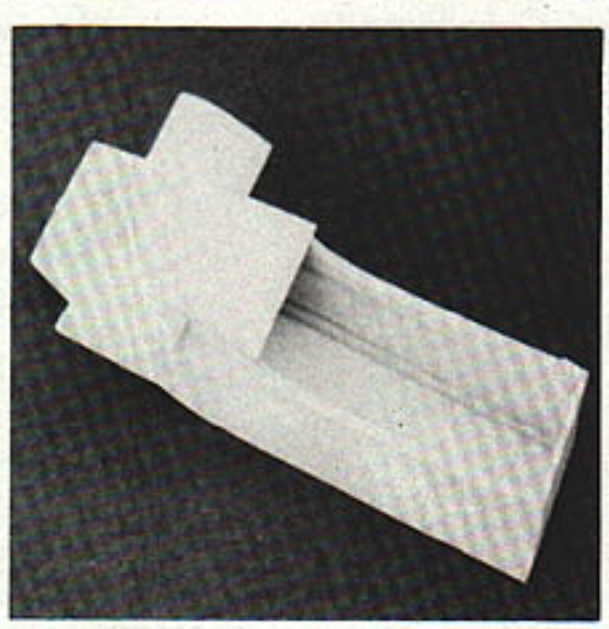
Continued on page 176



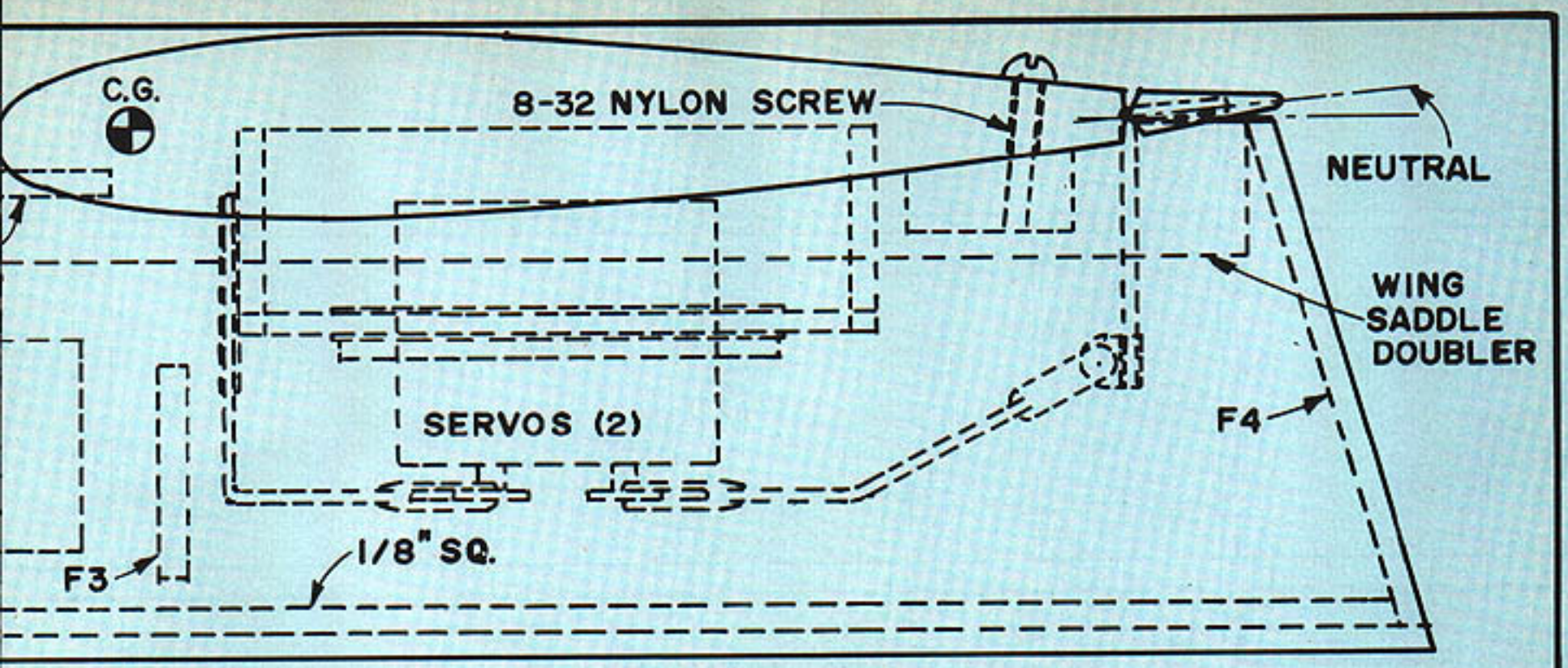


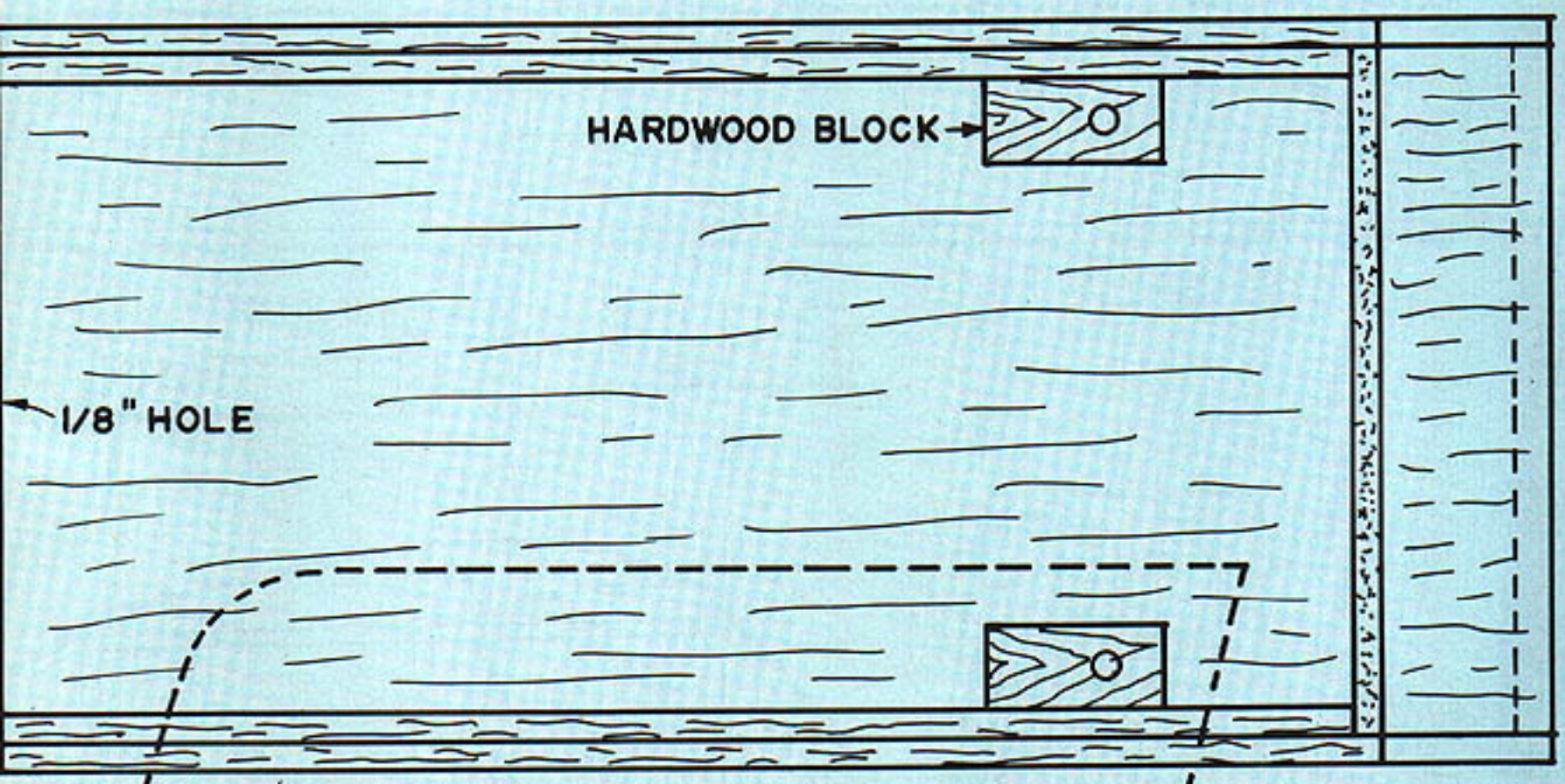
Above: All of the pieces necessary to build the fuselage. As is usually the case when building from plans, it's best to cut out a "kit" of parts right at the start. Right: First step of assembly. The fuselage sides, bottom, F2, and F4 have been assembled with proper alignment.

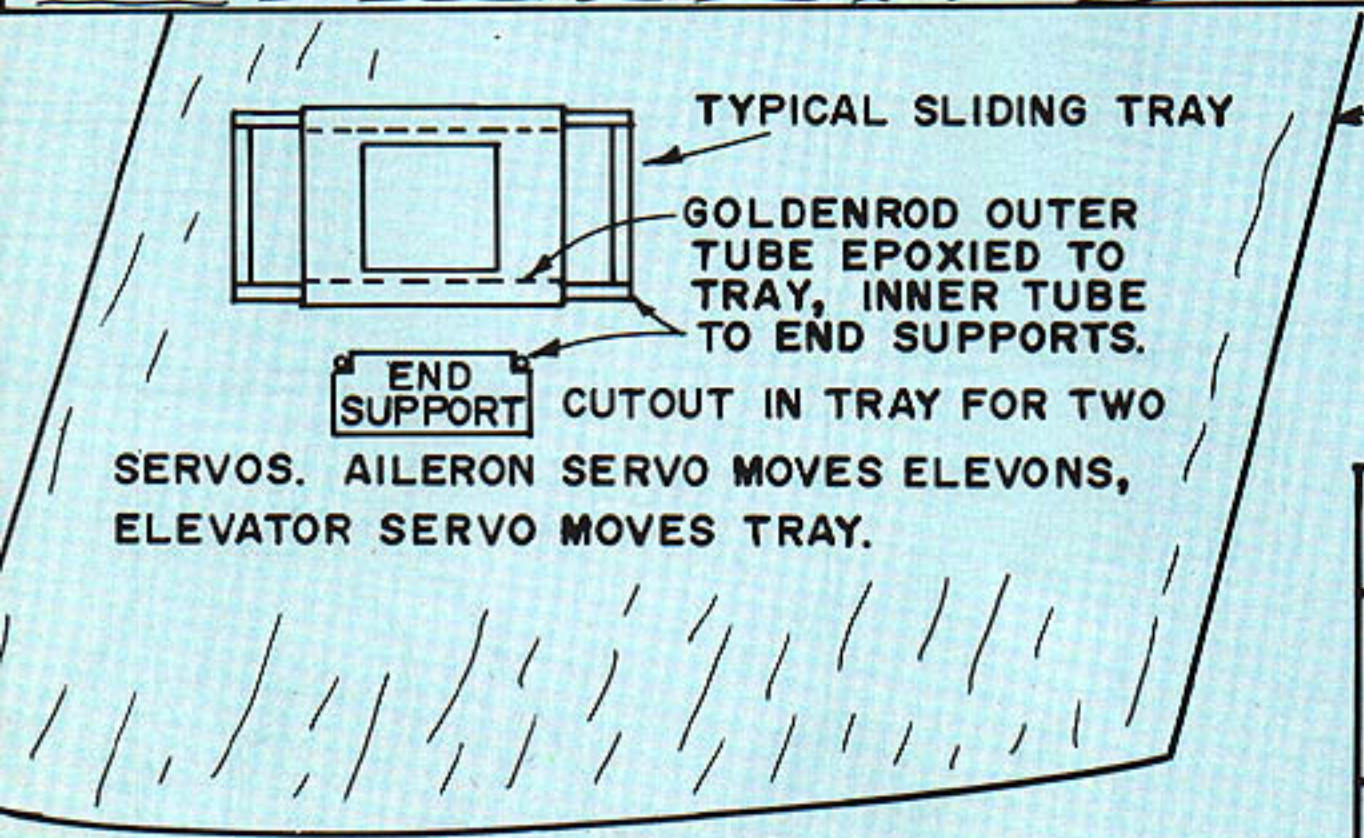




Left: Wet the fuselage sides ahead of F2, pull together, clamp the firewall into place, and allow to dry to form the front of the fuselage. Center: With the firewall and hatch hold-down plates glued on, the hatch outline can be traced from the sides and cut out. Forward elevator is part of the top hatch; doublers are glued to the bottom, and then it is carved and sanded to an airfoil shape. Right: Fuselage ready for finishing.



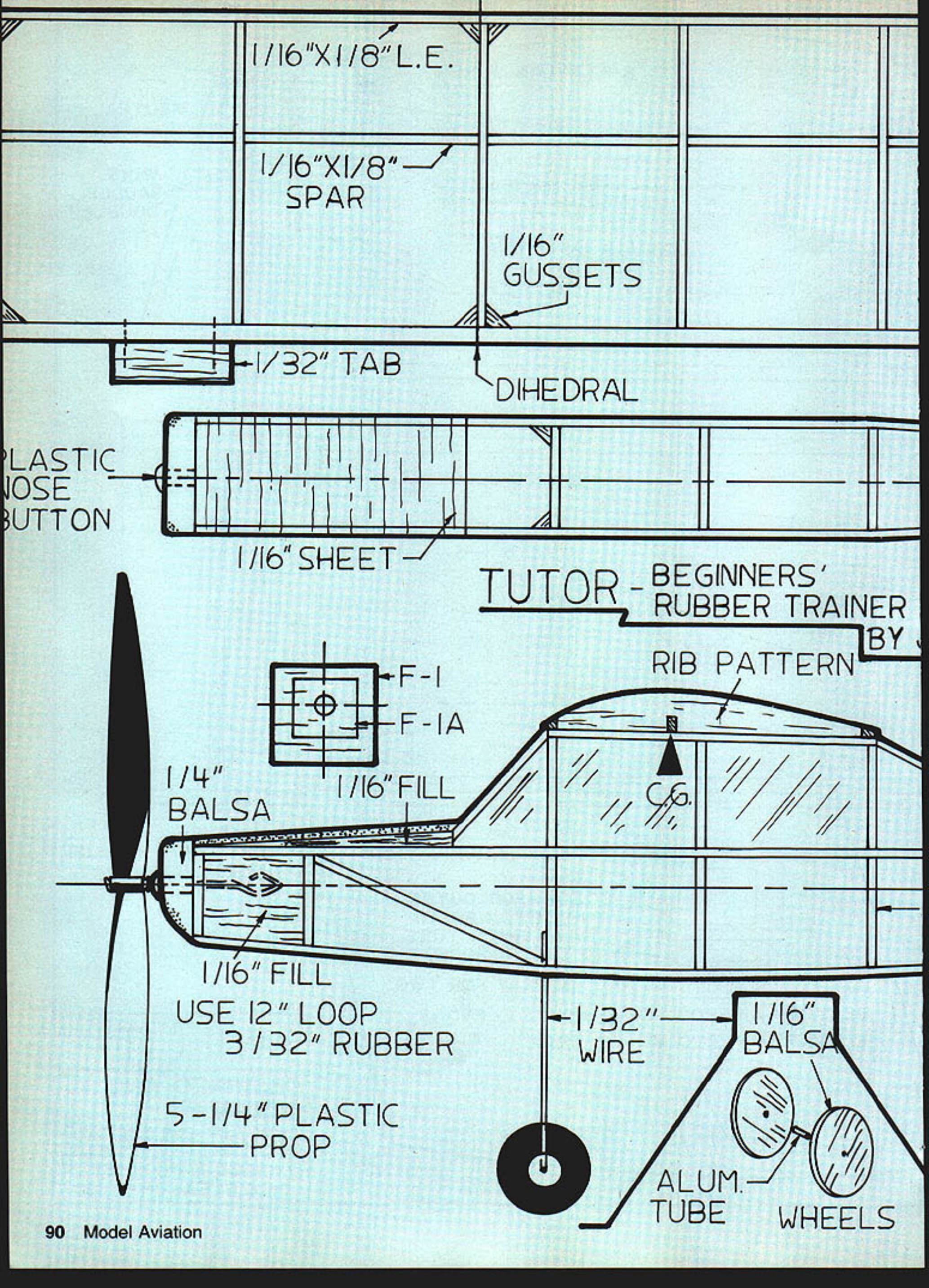


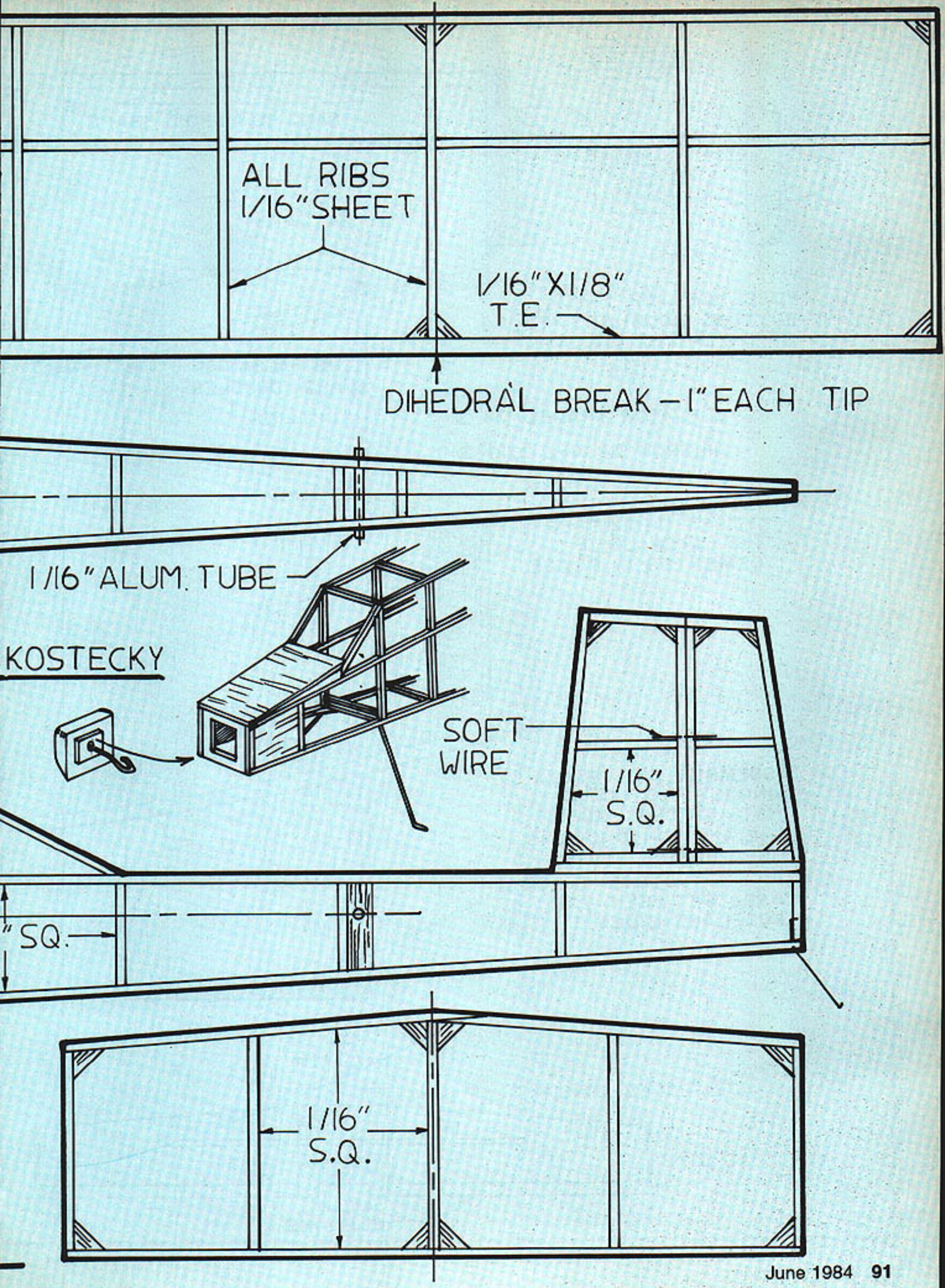


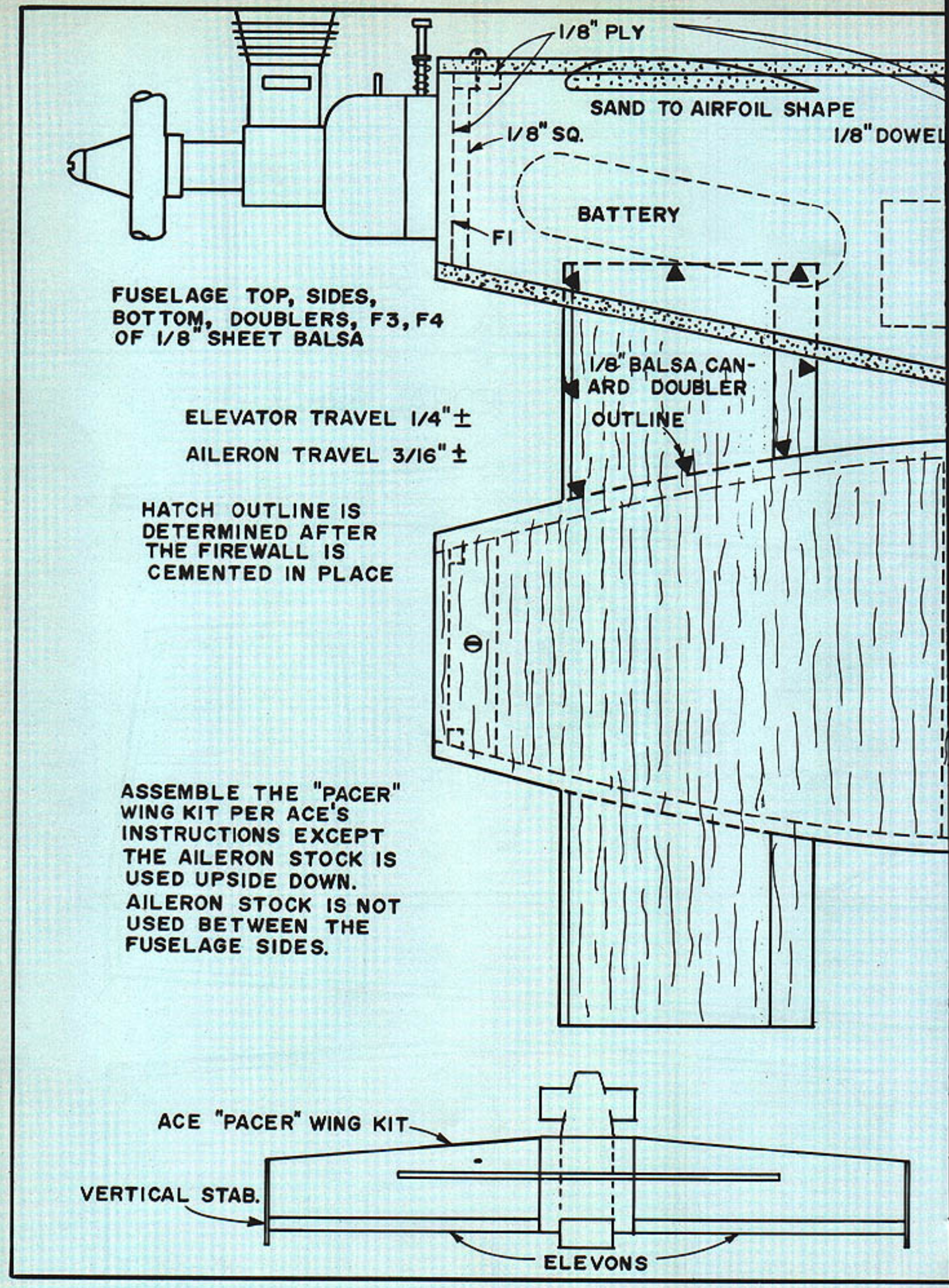
WILLIT

DESIGNED AND DRAWN BY:
DAVE PASTOR

TRACED & INKED BY:
DICK GLEASON 1984


1/16"X1/8" L.E.
1/16"X1/8" SPAR
1/16" GUSSETS
1/32" TAB
DIHEDRAL
PLASTIC NOSE BUTTON
1/16" SHEET
TUTOR - BEGINNERS' RUBBER TRAINER
BY
RIB PATTERN
F-1
F-1A
1/4" BALSA
1/16" FILL
C.G.
1/16" FILL
USE 12" LOOP 3/32" RUBBER
1/32" WIRE
1/16" BALSA
5-1/4" PLASTIC PROP
ALUM. TUBE
WHEELS


ALL RIBS
1/16" SHEET
1/16" X1/8"
T.E.
DIHEDRAL BREAK – 1" EACH TIP
1/16" ALUM. TUBE
KOSTECKY
SOFT
WIRE
1/16"
S.Q.
" SQ.
1/16"
S.Q.


1/8" PLY
SAND TO AIRFOIL SHAPE
1/8" SQ.
1/8" DOWEL
BATTERY
F1
FUSELAGE TOP, SIDES, BOTTOM, DOUBLERS, F3, F4 OF 1/8" SHEET BALSA
1/8" BALSA CAN-ARD DOUBLER OUTLINE
ELEVATOR TRAVEL 1/4"±
AILERON TRAVEL 3/16"±
HATCH OUTLINE IS DETERMINED AFTER THE FIREWALL IS CEMENTED IN PLACE
ASSEMBLE THE "PACER" WING KIT PER ACE'S INSTRUCTIONS EXCEPT THE AILERON STOCK IS USED UPSIDE DOWN. AILERON STOCK IS NOT USED BETWEEN THE FUSELAGE SIDES.
ACE "PACER" WING KIT
VERTICAL STAB.
ELEVONS

Ni-Cd/Kelly

Continued from page 85

$10.00 last year at a drug store. I guessed that there might be room inside the case to add some electronics. I found two interesting features when I removed the back. 1) It had a button which is intended to stop the movement so the second hand could be synchronized. When a pad on the pc board is shorted to the positive battery terminal, the movement is inhibited. 2) Another pad labeled "E" caused the alarm to beep when shorted to the negative battery terminal. It looked like there was room for some modifications, so I sketched out a circuit.

A simple resistive load is provided to discharge the transmitter or receiver battery through the normal charging cords. This provides a satisfactory load of about 300 mA and also serves to divide the battery voltage down to the equivalent of a single cell. The 1.5 V clock battery is also divided down to provide a 1.5 V reference. These two signals are fed to an IC op amp (operational amplifier) used as a comparator.

When the battery voltage drops to below 1 V, the output goes high and raises the reference voltage through a diode, resulting in a clean toggle action. This turns on the NPN transistor, which sounds the alarm. I didn't want to risk zapping the 1.5 V clock circuit with the 9 V output of the op amp, so I provided separate transistors to interface with the clock. The op amp output also lights an LED and starts charging the capacitor through a 1 MΩ resistor.

Four seconds later, after eight beeps, the second op amp senses that its input voltage is higher than its 1.5 V reference, and its output goes low. This turns on the PNP transistor, which causes the clock to stop (including the alarm). The LED remains on until the battery under test is removed and the switch is turned off (even if you forgot to set the alarm when you started). The one-cell jack is a convenient test point for monitoring the normalized voltage, and can be used with external resistors for other batteries.

I had to cheat a little to get everything into the available space, though. I found it necessary to remove the 9 V battery from its can (there's a shrink sleeve inside over the contents, and the ends are readily solderable). A 6 V camera battery could have been substituted to eliminate this little problem. I mounted the parts wherever they seemed to fit conveniently and glued them in place with drops of gap-filling cyanoacrylate adhesive. It still looks neat on the outside though, and still serves its original purpose as an alarm clock.

Parts List

1 Copal Quartz Alarm Clock
1 324 Quad Op Amp
1 14-pin DIP Socket
2 Charge Jacks
1 3.5mm Phono Jack
1 PNP Transistor (any PNP will do, e.g. 2N3702)
1 NPN Transistor (any NPN will do, e.g: 2N3704)
2 Diodes (any silicon diode will do)
1 Light Emitting Diode
1 10 uF Capacitor, 10 DCWV
1 16Ω 2 W Resistor
1 13Ω 2 W Resistor
1 4.3Ω 1 W Resistor
1 4300Ω 0.1 W Resistor
2 2200Ω 0.1 W Resistor
3 1 kΩ 0.1 W Resistor
1 1 MΩ 0.1 W Resistor
1 DPDT Slide Switch
1 Radio Shack Red Label 9 V Battery

Willit/Pastor

Continued from page 88

aileron stock is also included with the kit.

Assemble the foam wing with 5-min. epoxy; using white glue, attach the spar and the trailing edge stock. When dry, trim the trailing edge stock flush with the wing panels.

Place the wing on the fuselage. When you are sure that it is properly aligned, hold it in place with rubberbands. Insert a ⅛-in. drill through the hole in F2 and, turning it with your fingers, drill a hole into the foam wing.

Cut a piece of ⅛-in. dowel, and make sure that, when in the wing, it will fit into the hole in F2 (now is the time to find out, not after you mix the epoxy). Once it fits, epoxy the dowel into the foam wing. While the epoxy is hardening, hold the wing in

place with the dowel in the hole. Reinforce the dowel-wing joint with a scrap of fiberglass cloth and epoxy.

With the wing held in position, carefully mark, then drill, the mounting screw holes through the wing and mounting blocks with an 8-32 tap drill. Remove the wing, and tap the blocks. A few drops of cyanoacrylate (CyA) glue will harden the threads in the block. Be sure to follow this step with the tap again to remove the raised (and hardened) fuzz. Enlarge the holes in the wing to accept a piece of outer Goldenrod (or other tubing) that will fit closely around the 8-32 nylon screws. Epoxy a piece into each hole to keep the wing from being crushed when the screws are tightened.

Determine how you are going to operate the elevons. I used a sliding servo tray. Mechanical mixers will work just as well. Make the appropriate cutout in the foam wing, and use epoxy to attach the servo-mounting pieces to the wing.

Lay out the aileron stock *upside down*. Remember, the neutral position is when the elevons follow the curve of the *bottom* of the airfoil. There will be no aileron stock between the fuselage sides. The stock between the fuselage and the tapered panel seam is fixed and is used as the aileron linkage bearing support. From the seam to the wing tip is the elevon.

Bend and install the strip aileron control rods as you would for any strip aileron installation. Position the horns to obtain the straightest pushrods. To keep the wire from breaking out of the small aileron stock, I add a small piece of 1/32 ply, top and bottom, on each elevon where the hole is drilled. Use your favorite hinging technique.

Cover the wing with a low-temperature covering film directly over the foam. Cover the rudders, and attach them.

Final assembly and checkout. Go back to the fuselage, and glue F3 as far to the rear as is practical. This former's sole purpose is to keep the receiver and associated cables from fouling the servos.

Mount the servos and hook up the radio. Adjust the elevator throw for ±¼ in. and the ailerons ±3/16 in. Check to see that all combinations of elevator and aileron control are free of binding. Screw on the engine. Put the receiver and battery into the fuselage with as much lightweight foam as necessary to keep them in place.

Mount the wing, and check to see that the aileron horns do not touch the rear of the fuselage with full-up elevator and full aileron deflection. Check the center of gravity (CG), and move the radio as necessary to get the balance point in the correct place. Do not use ballast unless absolutely necessary, since only 1 oz. of additional weight is an increase of more than 5% in the total model weight.

The flight characteristics are similar to a normally-configured model. The one thing that is definitely not normal is Willit's appearance in the air. Be prepared for an audience—and for praise for your piloting skill from those who think that flying wings are touchy.

Flying Near Airports? Be Careful!

Free Flight or Radio Control flying near airports, or in any situation which might involve the possibility of models being in the vicinity of full-scale aircraft operations, must be avoided—or conducted so as to eliminate any dangerous situations. Models should not be flown in the proximity of full-scale aircraft operations unless the flyer has someone else with him for the sole purpose of watching for full-scale aircraft and supervising the flying so as to prevent accident possibilities.

PROTECT YOUR RIGHT TO FLY!

Cougar/Abel

Continued from page 97

wing root attachment structure and the ⅛-in. music wire windshield side formers/wing supports. The music wire is attached to the firewall using landing gear straps and wood screws and attached to the 1/16 plywood wing root structure by tacking in palce with a cyanoacrylate (CyA) adhesive such as Jet, Hot Stuff, Zap, etc.