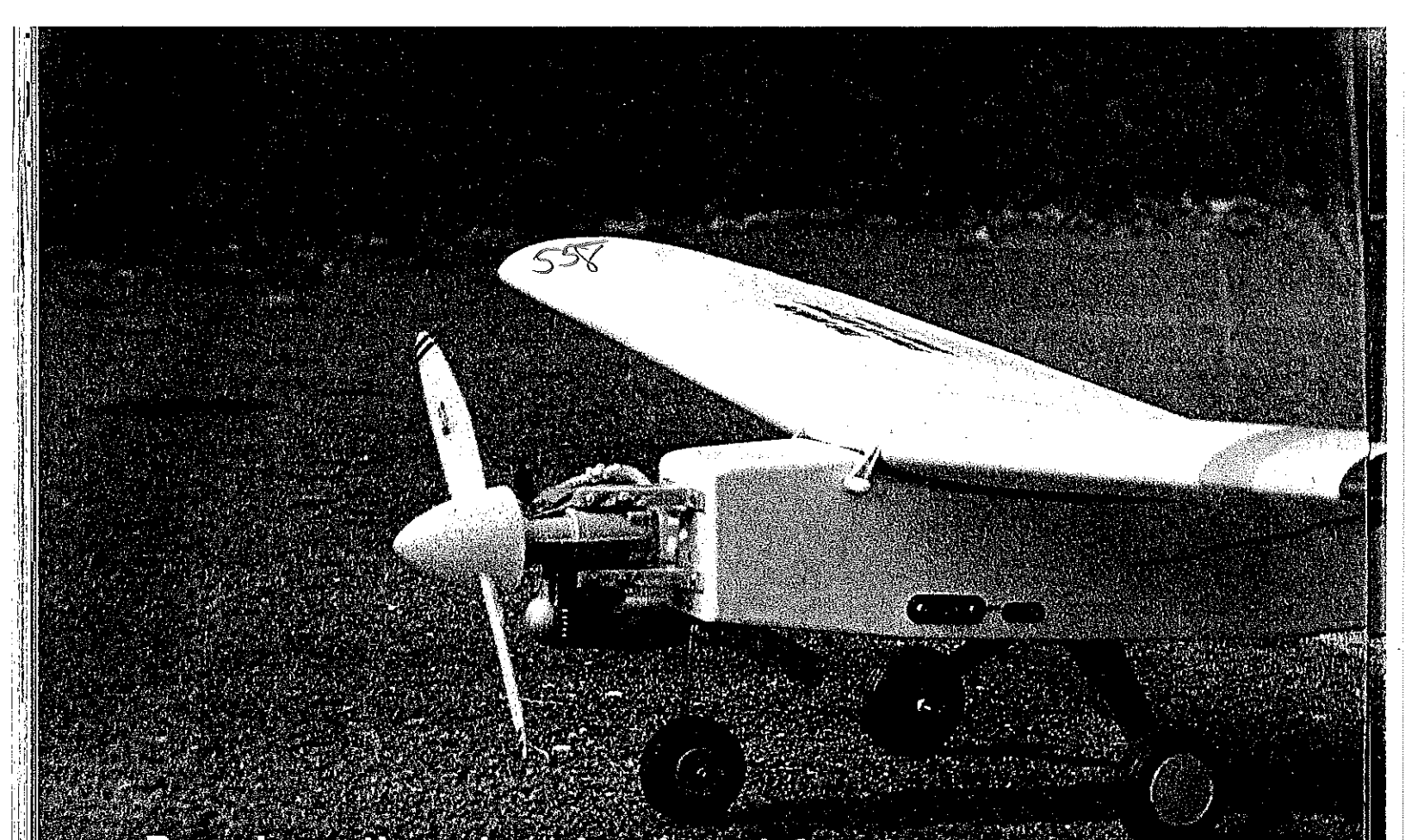


Sugar Pup

Based on the wing developed for the author's previous Snapshot Twin, this RC design rates high marks for stability and strength. Blending slow trainer-like performance with the capability for a faster pace and aerobatics, it defeats any tendency to become bored with one-style flying. A refresher on foam wing cutting is included in the instructions for building a sturdy unsheeted foam wing. ■ Luther Hux

IT MAY SEEM strange to those familiar with my fascination for the unusual to find me working on a three-channel trainer type. The name is certainly out of the ordinary—but then titling a new model can lead to a bit of desperation, since almost every name you can think of has already been used.

Sugar Pup is designed around the same wing that was used for the Snapshot Twin. The Twin is a very stable model—very resistant both to spins and to falling off in slow flight. Just how slowly it *could* fly was not revealed until I was forced to make a dead-stick landing. (The two .40s usually keep its land-

ing speed somewhat high.) I noticed that the unpowered Twin had a remarkably slow landing speed for a model that also performed well at higher speeds. I decided to cut a 4-ft. foam wing using the Twin's templates (intended for a 6-ft.) I then developed a utilitarian-type fuselage to see if I could get the same range of performance in a smaller sport model. It was from these experiments that the Sugar Pup evolved.

This model was intended for small-field flying and designed to have enough strength to survive little tiffs with the ground or trees.

Although the use of hardwood and Lite Ply compromises the light wing loading required for slow speed, the extra weight is offset by the use of small servos and a 250 mAh battery. Not only is wing loading kept within bounds, but the added ruggedness gives the pup the ability to shrug off cartwheels and other such undignified episodes.

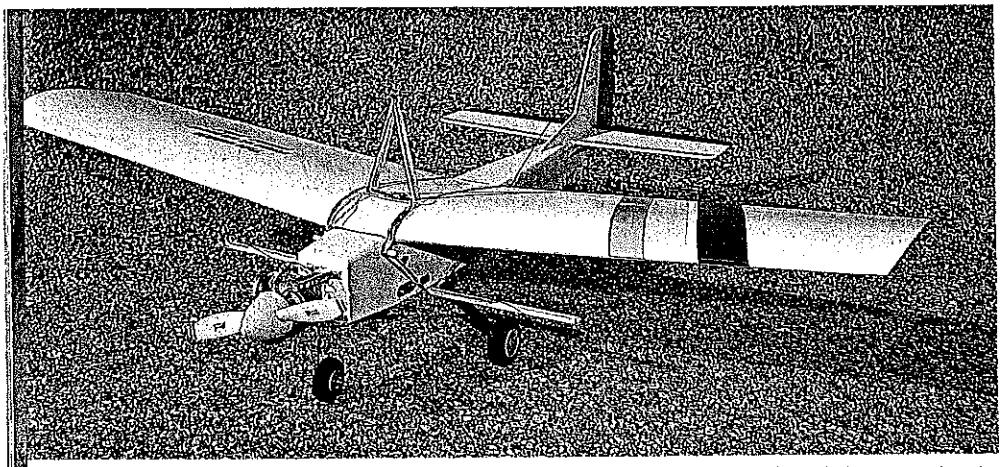
To achieve easy field inspection I chose not to use a cowl. The engine is side-mounted to keep exhaust off the wing and to better align the carb with the fuel tank (an idea I wish more manufacturers would design into their kits).

I was very pleased at how well the new model performed. It did very well at "near" axial rolls without the aid of ailerons. I did have trouble getting the model to spin and noted that it avoided sharp stalls by mushing as it approached a stall. Spins were possible if begun with a powered snap. Otherwise the Sugar Pup's natural stability avoids a spin. The stability is due to the change in airfoil from root to tip and the tip washout. The design causes a shift of the center-of-lift as the model approaches a stall.

It came as no surprise that the Sugar Pup, like most lightweight models, can "kite" with its nose into the wind, just hovering over one spot. But the eye-opener came when the

Big picture: With ruggedness and gentle flying characteristics, the Pup is a great model for a determined competitor at any local fun-fly event. Above: Our author's niece, Michelle, is fascinated with the accessories and small size of the model. Sugar Pup easily fits into any compact car.

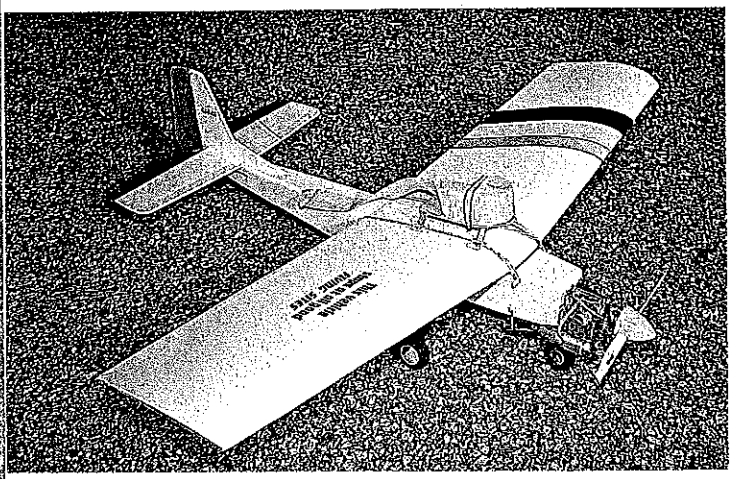
Sugar Pup

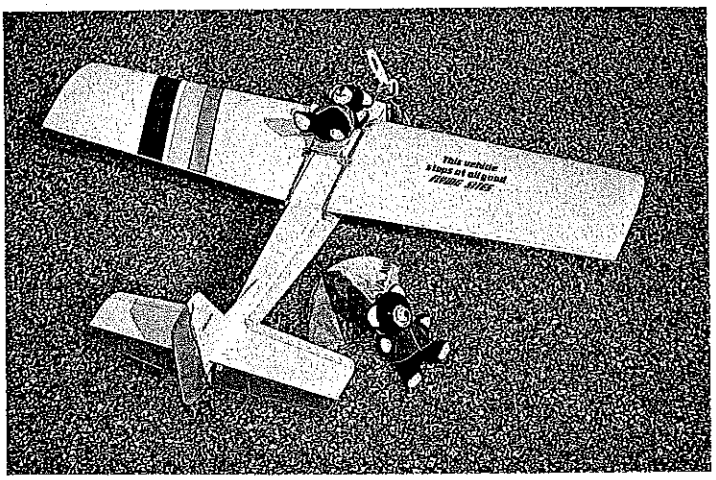


The triangle pattern of lights and the Pup's gentle nature made night flying easy for the author. Viewed from the front the lights show an alignment triangle; from the side, two vertical markers; from the bottom, two horizontal markers. A flashing tail light gives direction. Night flying requires a remote flying site and carefully-controlled conditions.

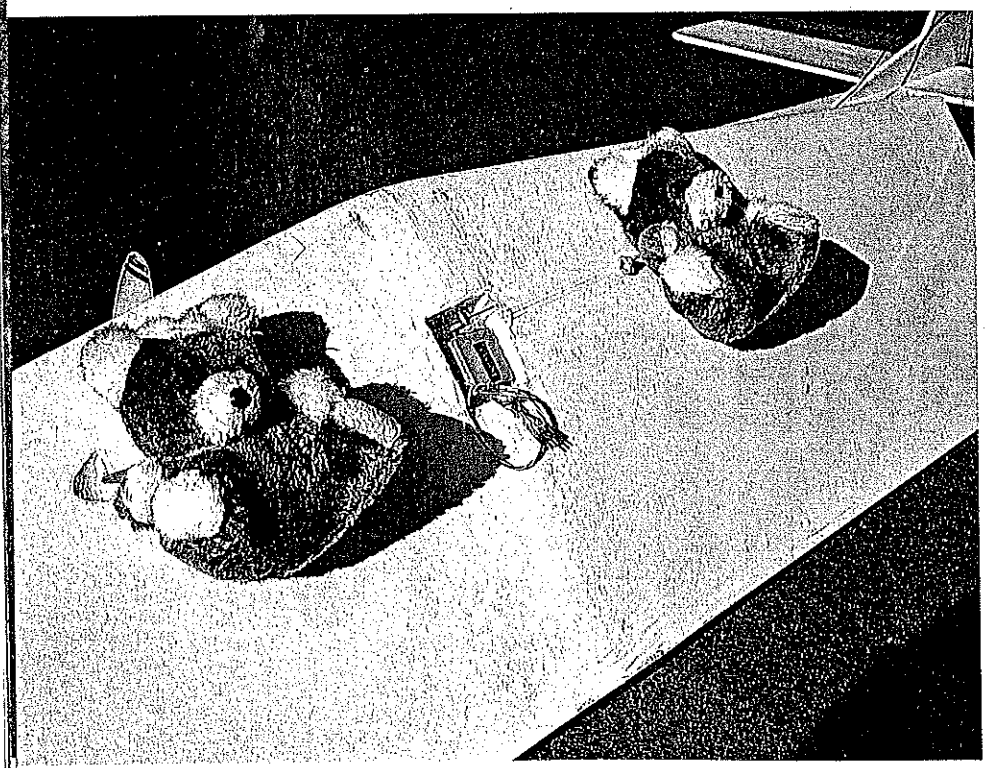
model stalled and dropped a wing tip. A lot of models would spin or spiral; but the Pup usually sets its wings level by itself, without your having to jump on the controls. In a choppy breeze the model rocks and settles. Give it a steady wind though, and watch it relax: the Pup will appear to be mounted in the sky as if it were a tethered kite.

To test this wing-leveling feature I reduced the power to a point where the model would fly but could not loop with full up elevator. The elevator stick was held at full up with a rubberband and the transmitter set on a stand. The flight was a roller-coaster event with repeated stalls and fall-offs followed by immediate leveling of the wings. Most who copied the test found their models in a spin or spiral. Flights with the

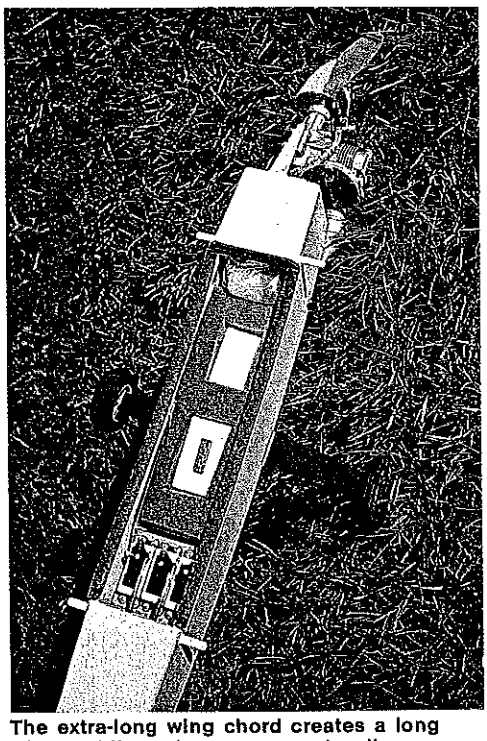




Left: The optional release rack works for all kinds of fun projects. Half a roll of streamer can provide a nice target to chase, but it's harder to cut the streamer than you think. Right: The release rack can be used for parachute drops as well. Watch out for size and weight; too big an object makes turbulence for the tail section and wobbly takeoffs. Tuck the chutes in carefully. If they come out into the airstream, they can really slow you down. Make the chutes just large enough to slow the bear's descent. Otherwise they may drift to unrecoverable distances.



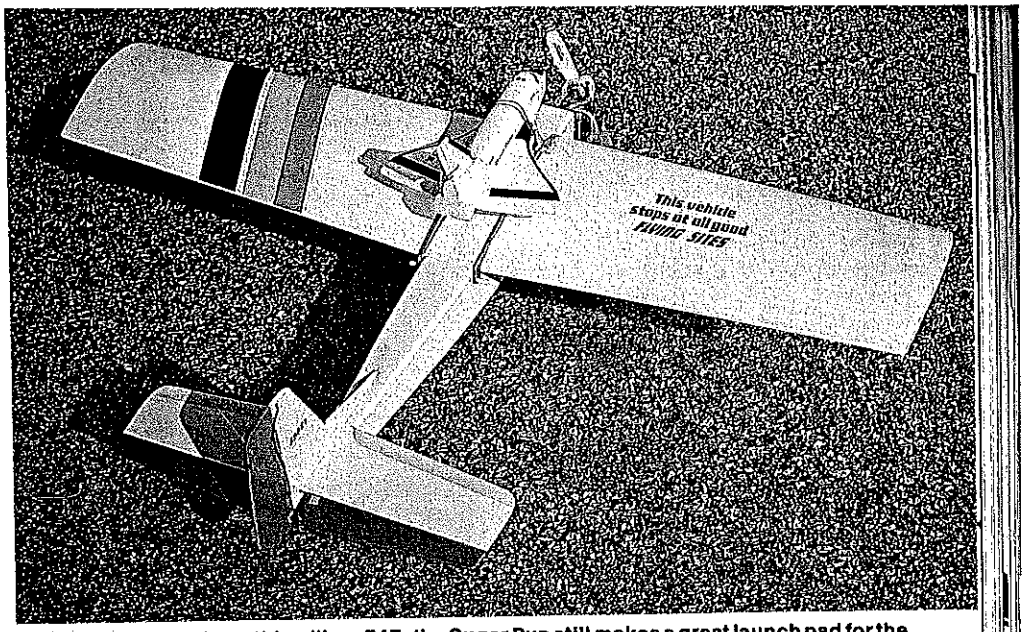
Two bears are twice the fun. Our author added a cable to an existing wing to release one bear with each direction of the servo throw. Release system is ultra-simple and works every time. Pull the pin, release the rubberband, and get ready to chase your bears. The kids love it!



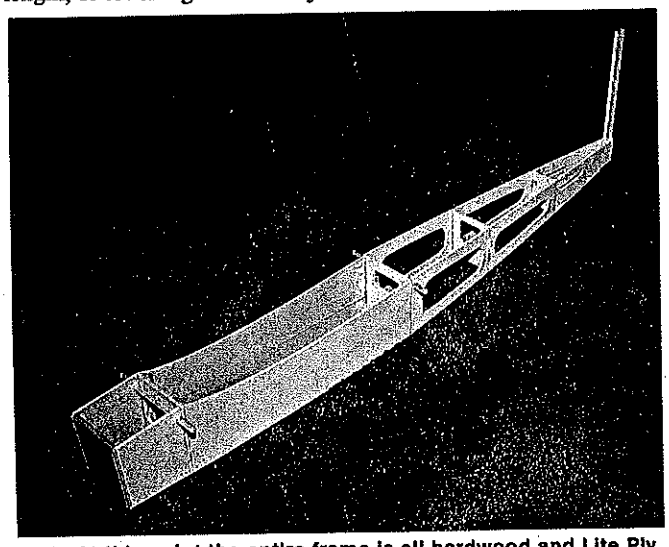
The extra-long wing chord creates a long wing saddle and easy access to all gear. Borrowing an idea from the camera people, radio gear is set in foam cutouts. An additional sheet of foam sits on the top for extra protection but was removed for the photo.

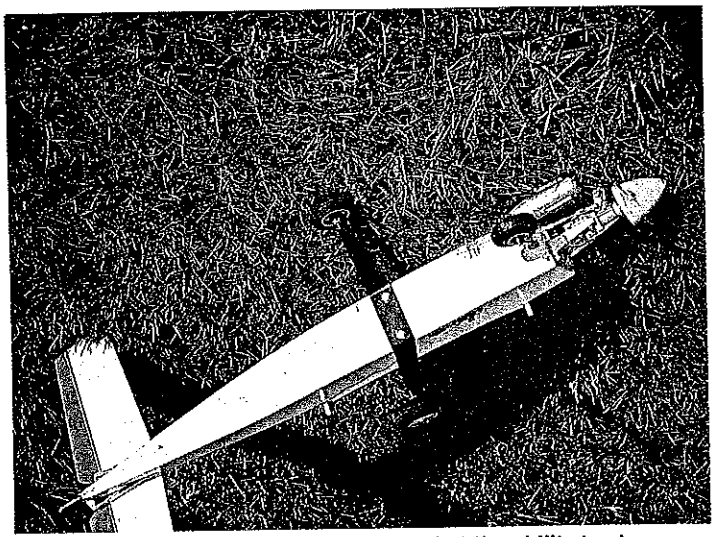
center of gravity (CG) farther back were less successful at self-leveling, so it is important to balance the model at or forward of the CG location shown on the plans.

Bill Winter took note of the Sugar Pup in his column when he saw this stability put to the test just a few feet from the ground. While showing him how I could do touch-and-goes and still keep the model within the runway area, I pulled up too sharply and stalled. Adding throttle slowly and giving minimal rudder commands, I was able to fly the Pup out of a wobbly position and onto the next landing. Bill noted that I wasn't supposed to get away with that; but on many occasions I have. The Pup has one bad side effect: it makes you cocky and quick to try a lot of things that dare the ground to come up and get you. Touch-and-goes from low stall turns at each end of the runway, or T&Gs within half the runway length, or touching the wheels just one foot from the end of the runway, or controlling it with your toes—all seem within this performer's reach.



While it doesn't look anything like a 747, the Sugar Pup still makes a great launch pad for the Styrofoam space shuttle available at most toy stores. Trim the shuttle for a gentle turn.



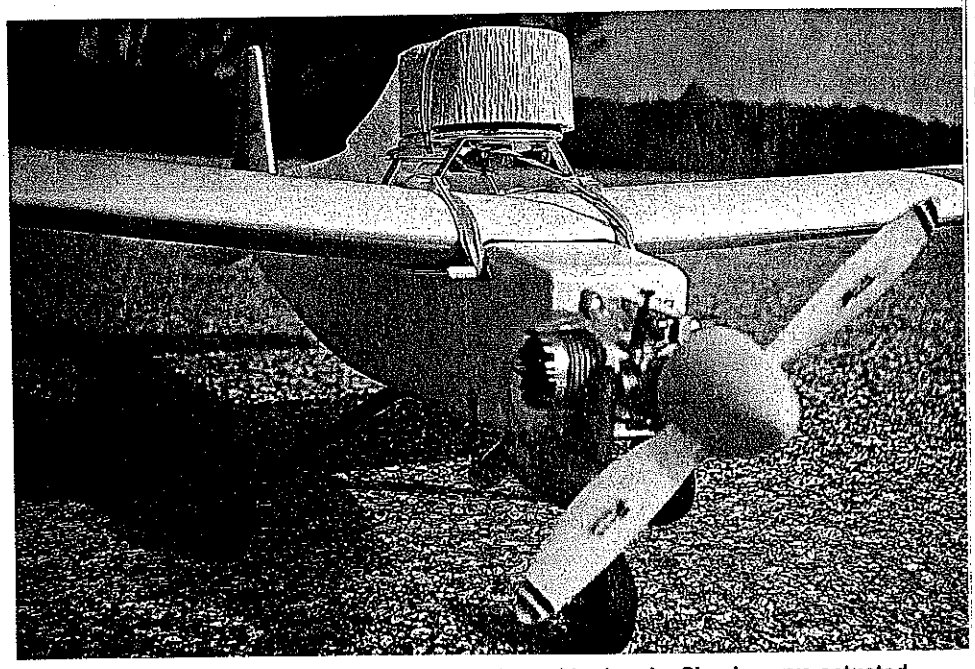


Left: At this point the entire frame is all hardwood and Lite Ply. This tough structure adds a little extra weight, but the ability to shrug off a cartwheel makes it worthwhile. Right: Using nylon bolts to hold on the landing gear helps to protect the model; the bolts will give way in a hard landing instead of ripping out the mounting plate. It is much easier to remove the broken studs than to replace the plate.

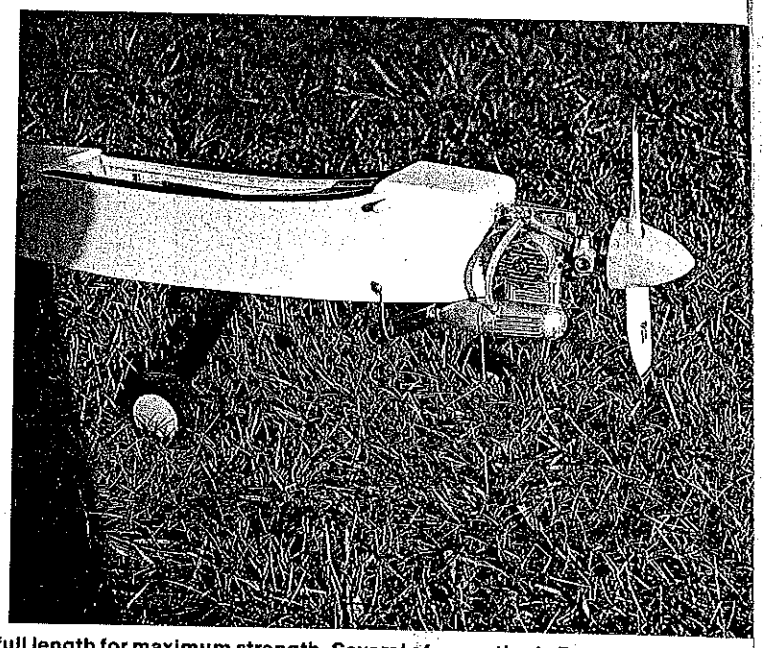
I found that Sugar Pup gave me more performance for a rudder/elevator model than any model I have flown to date.

However, if the weight of the model is increased, the Sugar Pup acquires a more typical performance profile. This was noticed when I loaded two extra battery packs aboard for night flying. Sugar Pup helped me through the flight but was more abrupt at stalls, and it landed faster. Flying with nothing to guide you but a few lights, incidentally, adds real excitement. The triangular pattern of lights used was different than the usual wing tips and tail locations. With this new pattern it was much easier to interpret the position of the model. For safety, these night flights were flown well away from populated areas.

I intended Sugar Pup to be a sport model but found that many who flew it at reduced throttle insisted it was a good trainer. Due to the requirement of cutting the foam wing, though, the model should not be attempted



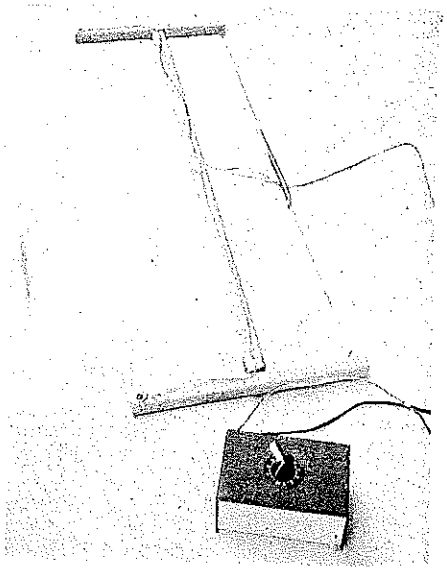
The release rack is held on with the last two wing rubberbands. Simple servo-actuated pin releases the small rubberbands that secure whatever is carried aboard to altitude.



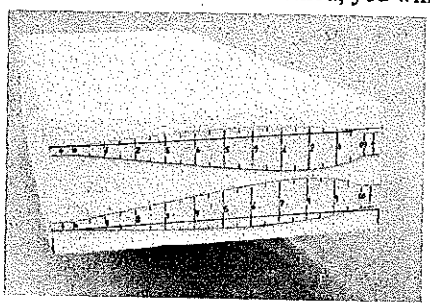
Left: Trailing edge spars for the stab and fin are offset so each can run full length for maximum strength. Several of our author's Pups were "quads" including a tail wheel along with the trike gear—for slow nose-high landings and takeoffs. Right: The exposed engine is a cinch to get at, and the side mounting makes for better fuel flow. The short exhaust extension and the muffler location keep the model cleaner.

by a novice builder without the aid of someone with experience. These instructions are intended for those who have at least completed a few factory kits satisfactorily and wish to move on to their first foam-cutting project. I admit that a constant-chord wing would be much easier, but that wouldn't make a Sugar Pup. I will provide full details on how I cut the wings, but I have not attempted to cover all of the methods available. Your resident expert may offer different procedures and tools from those listed here.

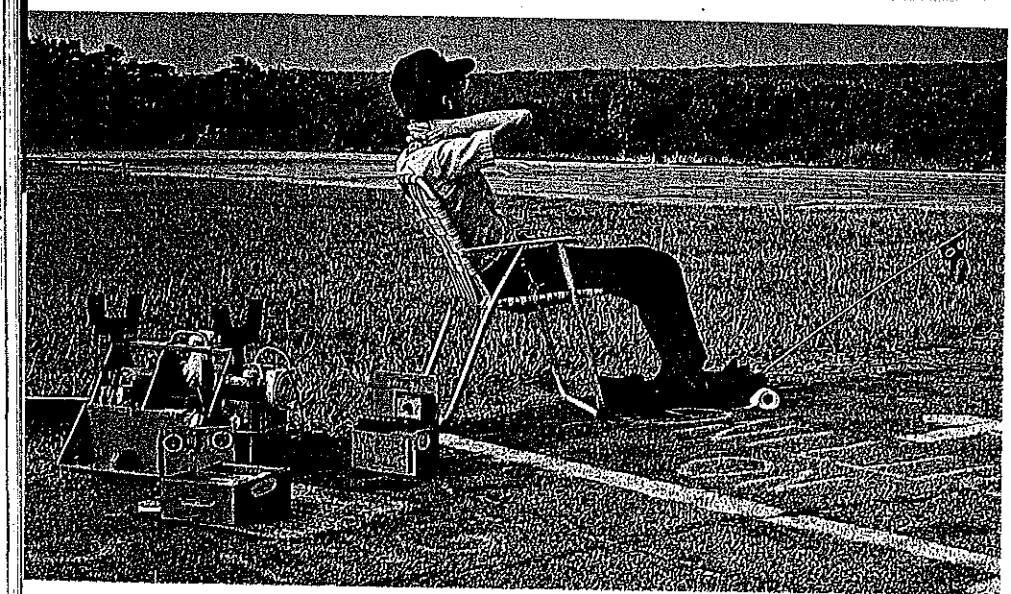
You're welcome to make well-thought-out changes to the design, but please note that this foam wing design is intended for the weight and power specified. Do not overload or overpower beyond the suggested range or you may break the wing in flight. Test models using a .25 and weighing 3 lb. have endured abrupt acrobatics with no signs of damage. However, I recommend a .15 or .20 engine for an easy-to-handle, lightweight model.



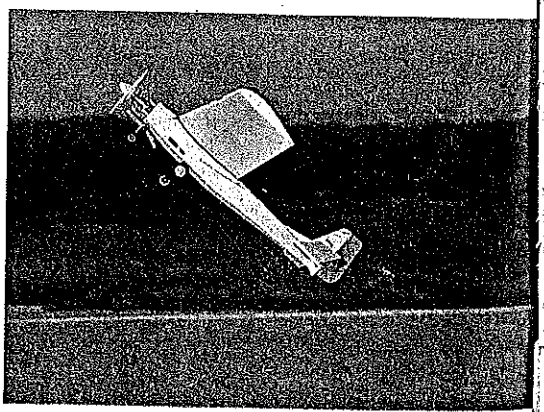
Foam-cutting techniques. To cut out a wing with the "hot wire" method, you will



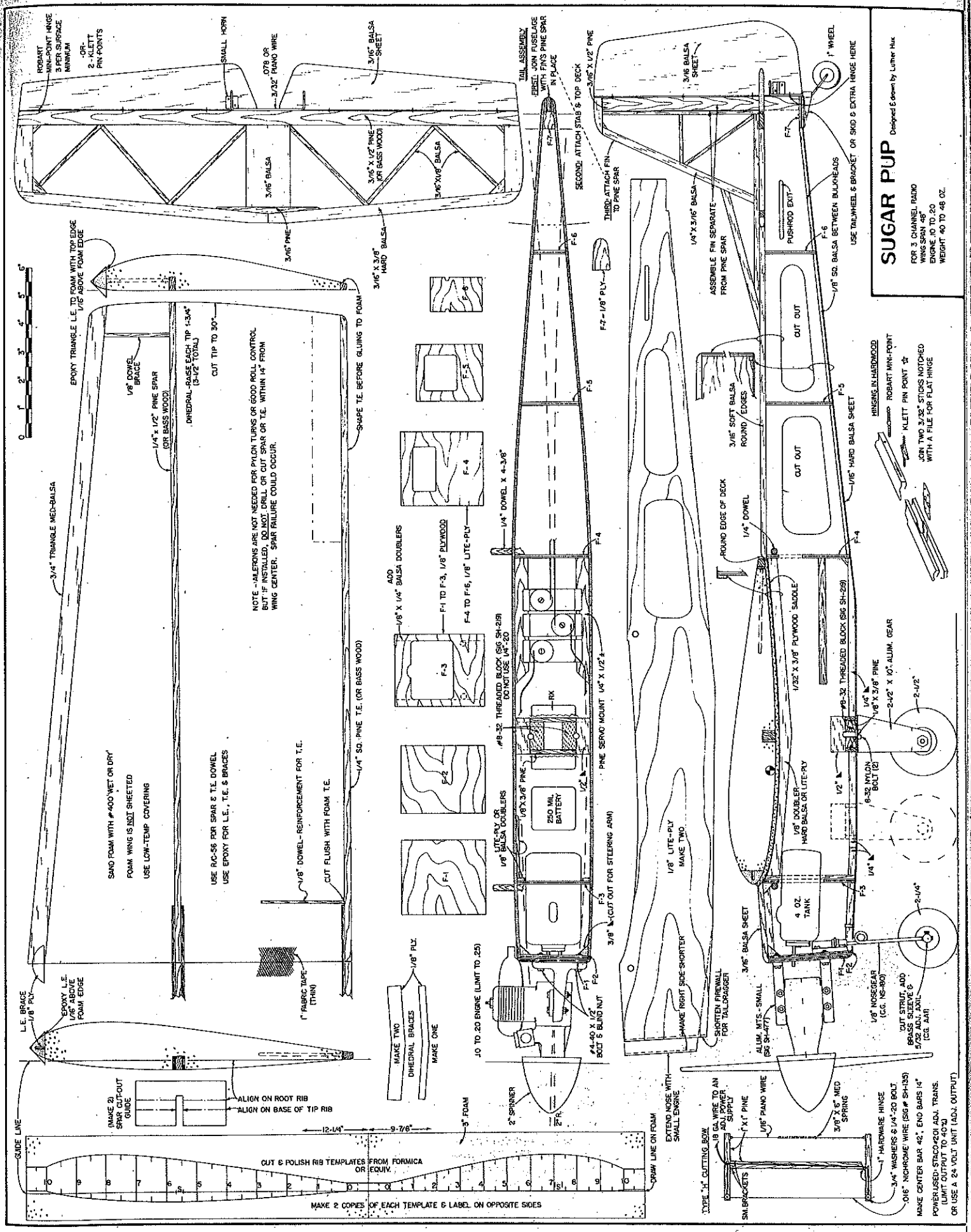
Left: This H-shaped cutting bow is easy to assemble from hardware store items. The variable transformer came from an electronics supply house; a DC power pack can also be used. There are several commercial bows available. The wood block on the transformer is to keep the output below levels that will break the wire. Above: Formica templates are double-back-taped to the foam blocks. Alignment marks on templates must match incidence marks on the blocks. Numbered lines keep the operators in step.

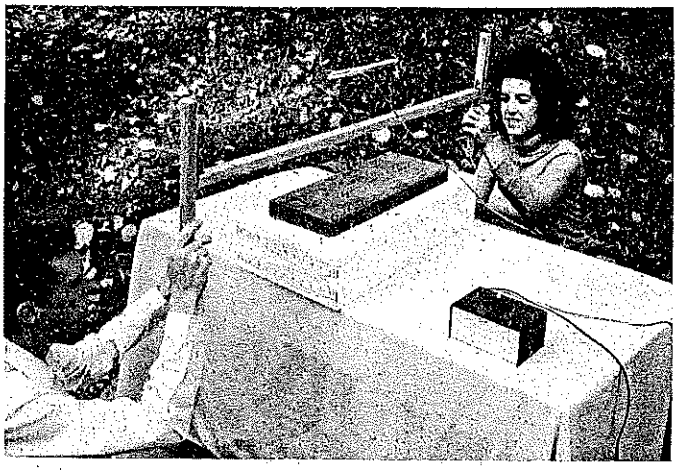


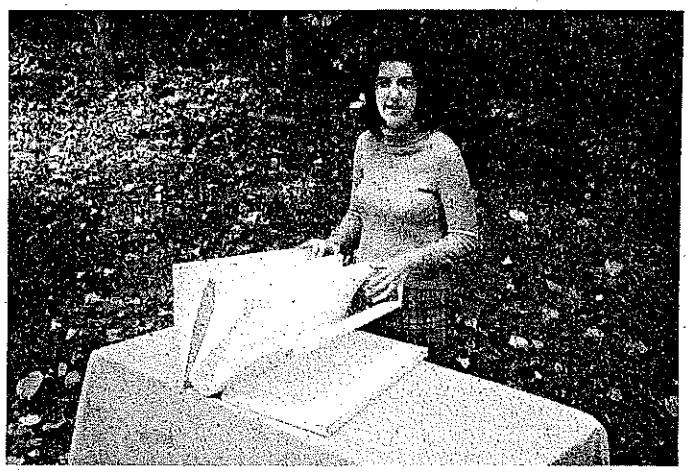
Not a recommended flying style, but the Pup was so easy to fly that our author wanted to try it with his toes. With all other traffic cleared from the field, he did seven touch-and-goes and proved to all present that flight-by-foot wasn't just luck with this stable, predictable model.



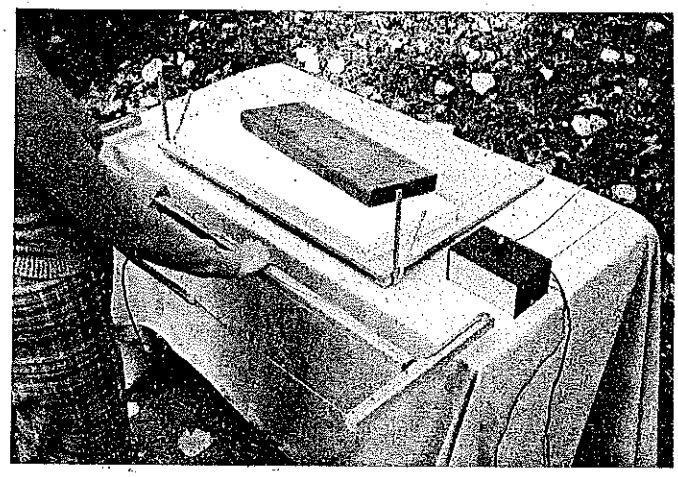
The largest recommended engine (.25) gives this model snappy takeoffs and out-of-sight vertical performance. Author warns against any engine stronger than a Schnuerle .25.

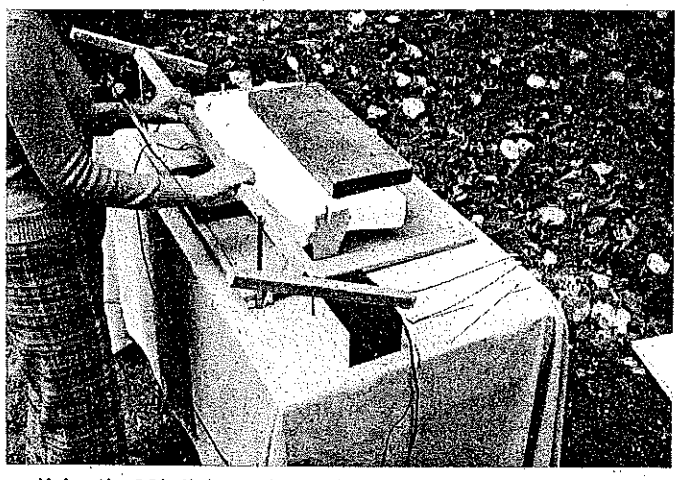

SUGAR PUP
Designed & drawn by Luther Huc
FOR 3 CHANNEL RADIO
WING SPAN 48"
ENGINE .10 TO .20
WEIGHT 40 TO 48 OZ.
ROBART MINI-POINT HINGE 3 PER SURFACE MINIMUM -OR- 2 - KLETT PIN-POINTS
SMALL HORN
.078 OR 3/32" PIANO WIRE
3/16" BALSA SHEET
3/16" BALSA
3/16" PINE
3/16" X 1/2" PINE (OR BASS WOOD)
3/16" X 1/8" BALSA
3/16" X 3/8" HARD BALSA
TAIL ASSEMBLY
FIRST: JOIN FUSELAGE WITH FIN'S PINE SPAR IN PLACE
SECOND: ATTACH STAB & TOP DECK
THIRD: ATTACH FIN TO PINE SPAR
3/16" X 1/2" PINE
1/4" X 3/16" BALSA
ASSEMBLE FIN SEPARATE FROM PINE SPAR
1" WHEEL
USE TAILWHEEL & BRACKET OR SKID & EXTRA HINGE HERE
PUSHROD EXIT
1/8" SQ. BALSA BETWEEN BULKHEADS
EPOXY TRIANGLE L.E. TO FOAM WITH TOP EDGE 1/16" ABOVE FOAM EDGE
3/4" TRIANGLE MED-BALSA
1/8" DOWEL BRACE
1/4" x 1/2" PINE SPAR (OR BASS WOOD)
DIHEDRAL-RAISE EACH TIP 1-3/4" (3-1/2" TOTAL)
CUT TIP TO 30°
NOTE - AILERONS ARE NOT NEEDED FOR PYLON TURNS OR GOOD ROLL CONTROL BUT IF INSTALLED, DO NOT DRILL OR CUT SPAR OR T.E. WITHIN 14" FROM WING CENTER. SPAR FAILURE COULD OCCUR.
SHAPE T.E. BEFORE GLUING TO FOAM
SAND FOAM WITH #400 WET OR DRY
FOAM WING IS NOT SHEETED
USE LOW-TEMP COVERING
USE R/C-56 FOR SPAR & T.E. DOWEL
USE EPOXY FOR L.E., T.E. & BRACES
1/8" DOWEL-REINFORCEMENT FOR T.E.
CUT FLUSH WITH FOAM T.E.
1/4" SQ. PINE T.E. (OR BASS WOOD)
1" FABRIC TAPE (THIN)
L.E. BRACE 1/8" PLY
EPOXY L.E. 1/16" ABOVE FOAM EDGE
ADD 1/8" X 1/4" BALSA DOUBLERS
F-1 TO F-3, 1/8" PLYWOOD
F-4 TO F-5, 1/8" LITE-PLY
1/4" DOWEL X 4-3/8"
#8-32 THREADED BLOCK (SIG SH-219) DO NOT USE 1/4"-20
RX
1/8" X 3/8" PINE
1/8" LITE-PLY OR BALSA DOUBLERS
250 MIL BATTERY
1/2"
PINE SERVO MOUNT 1/4" X 1/2"±
3/8" (CUT OUT FOR STEERING ARM)
#4-40 X 1/2" BOLT & BLIND NUT
10 TO 20 ENGINE (LIMIT TO .25)
2" SPINNER
MAKE TWO
DIHEDRAL BRACES
MAKE ONE
1/8" PLY.
3" FOAM
EXTEND NOSE WITH SMALL ENGINE
DRAW LINE ON FOAM
(MAKE 2) SPAR CUT-OUT GUIDE
ALIGN ON ROOT RIB
ALIGN ON BASE OF TIP RIB
GUIDE LINE
12-1/4"
9-7/8"
CUT & POLISH RIB TEMPLATES FROM FORMICA OR EQUIV.
MAKE 2 COPIES OF EACH TEMPLATE & LABEL ON OPPOSITE SIDES
F-1
F-2
F-3
F-4
F-5
F-6
F-7
F-7 - 1/8" PLY
ROUND EDGE OF DECK
1/4" DOWEL
3/16" SOFT BALSA ROUND EDGES
CUT OUT
1/16" HARD BALSA SHEET
HINGING IN HARDWOOD
ROBART MINI-POINT
KLETT PIN POINT
JOIN TWO 3/32" STICKS NOTCHED WITH A FILE FOR FLAT HINGE
1/32" X 3/8" PLYWOOD SADDLE
#8-32 THREADED BLOCK (SIG SH-219)
1/4" X 3/8" PINE
2-1/2" X 10" ALUM. GEAR
2-1/2"
8-32 NYLON BOLT (2)
1/2"
1/8" DOUBLER HARD BALSA OR LITE-PLY
1/8" LITE-PLY MAKE TWO
4 OZ. TANK
3/16" BALSA SHEET
2-1/4"
1/8" NOSEGEAR (C.G. NS-80)
CUT STRUT, ADD BRASS SLEEVE & 5/32 ADJ. AXLE (C.G. AA)
ALUM. MTS. - SMALL (SIG SH-477)
SHORTEN FIREWALL FOR TAILDRAGGER
MAKE RIGHT SIDE SHORTER
TYPE "H" CUTTING BOW
18 GA. WIRE TO AN ADJ. POWER SUPPLY
1" X 1" PINE
1/16" PIANO WIRE
3/8" X 6" MED SPRING
SM. BRACKETS
1" HARDWARE HINGE
3/4" WASHERS & 1/4"-20 BOLT
.016" 'NICHROME' WIRE (SIG # SH-135)
MAKE CENTER BAR 42", END BARS 14"
POWER USED: STACO 420 ADJ. TRANS. (LIMIT OUTPUT TO 40%)
OR USE A 24 VOLT UNIT (ADJ. OUTPUT)



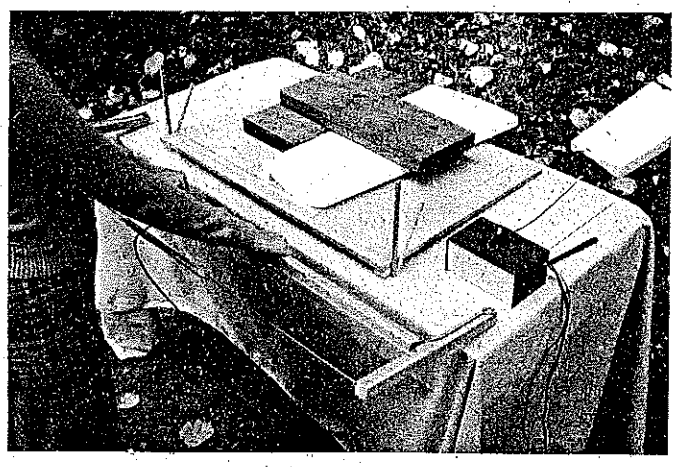


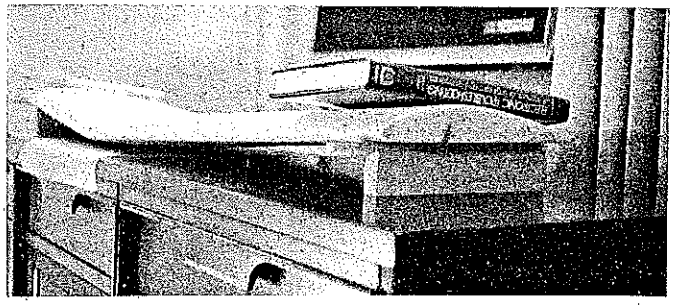
Left: The author counts off the numbered lines as the hot wire passes through the foam. His wife, Dawn, concentrates on staying in step. Cut foam outdoors or where there is excellent ventilation, as the fumes from melting foam are a health hazard. Right: Dawn fans out the finish-cut sections. When cut, the cores require only light sanding before ironing on the low-temp. covering. Sheet the foam for more strength.



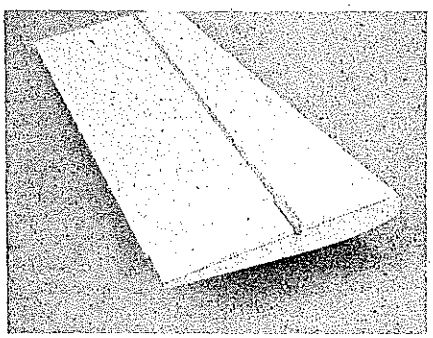


Left: Before templates are removed, LE and TE points are marked on foam. Using the 90° sticks on the cutting guide, trim excess foam from the wing core. Blocks of wood secure the core during this step. Right: The spar points are marked on the foam, and spar guides are aligned and attached. No numbering is required, just three quick strokes. The operator can feel when the wire reaches each corner of the guide.





Left: Tapered wing tips are easy. Just use the 30° guide sticks; set the wing in straight and keep the cutting wire level with the board as you cut through the foam. Keep the wing level with either wooden blocks and foam under the TE as shown here, or set the wing into the cradle it was cut from. Above: When joining the wing center section wooden blocks, hold both tips parallel. Wax paper below the seam protects both furniture and family relations from damage.

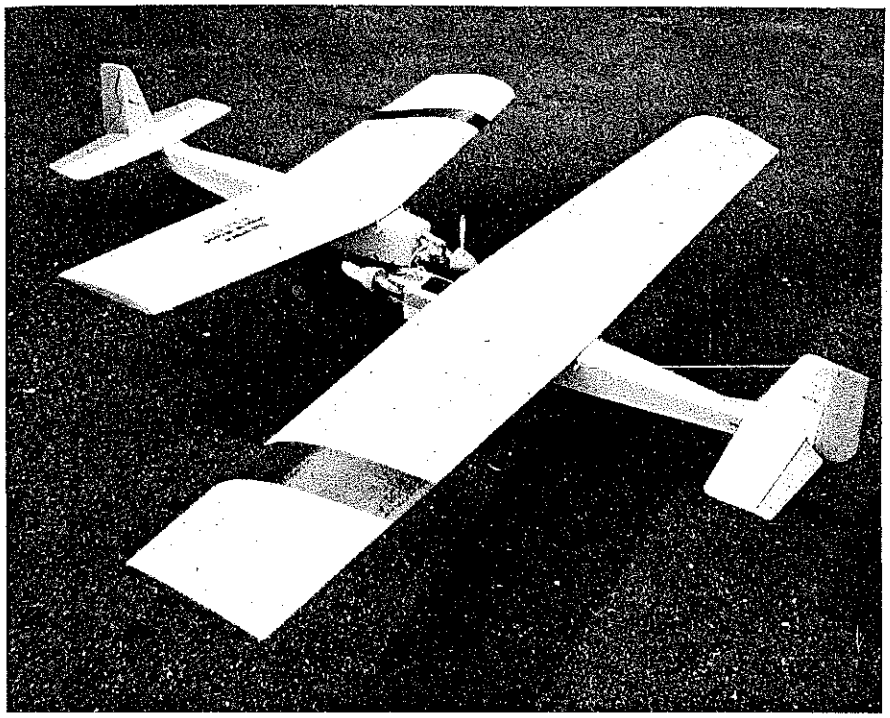


Slots are cut for the dihedral braces at the spar and TE. The spar is glued in with a pliable white glue such as Grrrip or Bond, available from craft stores. The rubbery white glue works best between the soft foam and hardwood. Rigid glue tends to fracture the foam beads when the wing flexes in flight.

need to buy or make several tools such as the bow and a cutting board.

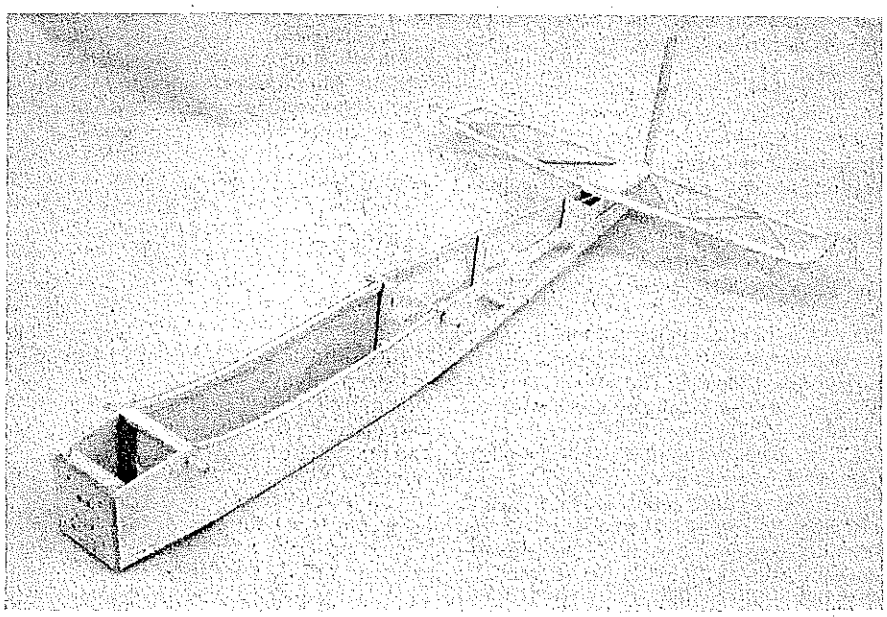
To assemble a type-H foam cutting bow, cut one 42-in. and two 14-in. pieces of 1-in.-sq. pine. The 42-in. length allows use of the bow on larger wings. Taper one end of the 42-in. piece about 20°. Position pieces in an H pattern as shown on plans. Brace the 90° joint with metal brackets, and join the beveled end with a hinge. Drill holes in one end of each short strip for ¼-20 bolts, and insert the bolt and two washers. Smooth the edges of the washers to prevent cutting the nichrome wire. Install two eyelets at the opposite ends of the short strips. Make up two 16-in. music wire leads. String the spring and wire leads between the eyelets.

Strip ½-in. insulation off the low-voltage wires, and tin them with solder. Place the

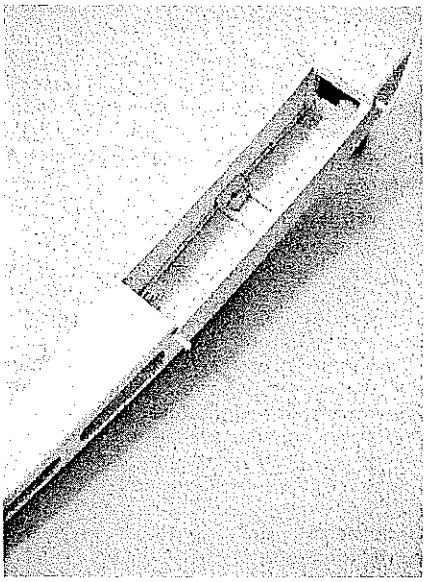


The long and the short of it. A 6-ft. wing was tried but is not recommended. The large wing makes you put in a turn request and then wait around for someone to sign it before it takes.

The firewall is made of two laminated ⅛-in. pywood sheets to survive the 11 holes drilled into it. Nose gear steering arm can be installed inside as shown on the plans, or outside below the fuselage for easy service.



The stab sits ½ in. in front of fin spar to clear the wire connector between the elevator halves. The hardwood fin spar runs inside the fuselage for additional strength. The wing saddles are capped with 1/32 ply strips to reduce creasing of the soft foam wing.



Lots of space for radio, but mini equipment makes for best performance. With this long compartment it's easy to come out tail heavy; mount all gear well forward for correct CG.

wire ends between washers and the wood, and staple the wire in position. Use additional staples to dress the wire to one end of the bow.

Place the nichrome wire between the washers at one end, and tighten up the bolt. The nichrome cutting wire can be ordered from Sig Mfg. if not available locally. Place one end of the bow on the floor, and press on the other end until the bow is square and the spring is stretched at least 3 in. Compress the bow about 1-in. further so the nichrome wire end is slightly shorter than the spring side, and secure the loose end of nichrome wire between the remaining set of washers. The low-voltage wire should be under the washers and the nichrome wire between the two washers.

Tension on the cutting wire should cause the wire to sound like a guitar. Add #64 rubberbands until it sounds a note close to middle C. When current is applied to the cutting wire, it will stretch and lower the pitch. Be sure the spring is still stretched and holding pressure on the cutting wire after you apply voltage.

Attach an AC power cord and the low-voltage leads from the bow to the transformer as marked on the manufacturer's instruction sheet. I use a Staco #201 2-amp variable-output transformer. Place the transformer in a large utility box so there will be enough air to prevent overheating. Position the knob to match the 0 to 100 on the dial through full throw. Because of the danger of getting full voltage (and snapping the cutting wire), you should install a stop block at 40% on the dial to limit the voltage. This is the maximum setting you will need, and even this voltage could be a shock hazard if used around a wet area or on a metal surface such as a washing machine, etc.

You could purchase a ready-to-use 24-volt pack for about $50—or look into the use of battery power, which is safer. You can also experiment with one of the battery-powered cutting bows advertised in the modeling magazines. (They range in cost from $30 to $100.) I have not worked with any of these myself, so I cannot comment on them.

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happening around town. Spreading the word through these vehicles visibly increases the number of spectators who come to watch a contest. Each event makes a few more people aware of our club and our hobby.

Special event flyers. The traditional contest information sheet distributed by the club sponsoring a contest is written in AMA rule book language for the benefit of the contestants. We also produce a separate announcement, written in layman's terms, to invite spectators to come watch a contest or participate in a seminar. We include the name and phone number of a club member to contact for additional information. These announcements are placed on bulletin boards in high-traffic areas such as shopping malls, public libraries, hobby shop windows, etc.

Display window exhibits. We obtained permission to put a Control Line model exhibit and information placards in a local shopping mall's unused display case. The display was in place for two weeks to promote an upcoming contest.

Our exhibit attracted so much attention—it was on display far longer than we could have sustained a manned mall show—that the mall merchants demanded to be allowed to use the previously unwanted display case. Doing the window exhibit gave us exposure to such numbers of people that we're eager to do another—but still waiting for the display case to become available again!

Entry-level Control Line events. The instant a modeler masters his first Control Line trainer, he joins the ranks of the sport flier. At this point, participating in a contest with the other club members seems far beyond his grasp. To bridge this gap, the Norfolk Aeromodelers include an entry-level event at each contest.

To be effective, the event must be one that anyone can fly using simple off-the-shelf items. Our most popular entry-level event is Profile Sport Scale (rules appeared in the April 1984 *Model Aviation*, page 73). Anyone who can fly a profile replica of a full-scale aircraft for 10 laps can compete.

Many profile Control Line kits are patterned after a full-scale prototype. Some, like the Sig Shoestring or Sterling's Beginner Series, make good Control Line trainers, permitting someone's first model to also be entered in his first contest. Featuring an entry-level event at each contest gives the new flier something to look forward to, maintaining his interest and enthusiasm. It bridges the gap between sport and contest flying and builds confidence.

To summarize, our efforts produced the results we aimed for. Club membership continues to grow. The number of active fliers has doubled. The father-and-son flying team that first flew the club trainer two years ago are now among our most aggressive Combat fliers. Some of the people who built their first model at the recreation center are now regulars who join us each Sunday. The local hobby shop has Control Line merchandise in the store, and the owner is quick to point out the new Control Line kits that just went onto the shelf.

This doesn't mean that our promotion efforts have stopped. We realize that everything we put into action got us to where we are now, and we want to keep it that way. Promoting the sport is an evolutionary process, and there is always a refinement that needs to be added—like a car pool to get Junior modelers to the club field. But that's a problem—no, a challenge—the Norfolk Aeromodelers will gladly deal with.

SAFE FLYING IS NO ACCIDENT

Lancaster/Norman

Continued from page 97

without losing the energy represented by their considerable length. Seven-inch Sleek-Streak propellers were cut down to a diameter of 6¾ in. for the prototype. Only two-bladed props have been used thus far to fly the model, but flying three-bladed props will add to the realism.

The fully-wound motors are temporarily held in place by placing an 8–10-in. length of 1/32 piano wire vertically through each nacelle so as to pass through the wire hook of each prop assembly. A hook is bent into the lower end of each pin so that the pins themselves can be attached through hook-eyes imbedded at the appropriate spacings in a piece of 1 x 2-in. pine strip.

When all the motors are wound the pine strip is pulled down vertically from the plane. By simultaneously removing the pins from the prop assemblies, this action permits all the motors to unwind. The model is launched—horizontally, but firmly—into the prevailing breeze.

At its best, model aviation captures the beauty and the excitement of manmade flight. Even with this fragile replica, the spark of one of history's great aircraft is rekindled.

Sugar Pup/Hux

Continued from page 105

Cutting board. To aid in cutting foam blocks and in special angle cuts, you will need a cutting board. The board is made with a 3-ft.-sq. sheet of ¾-in. plywood. The sheet must be flat and true. Using a triangle to ensure accuracy, attach 12-in. polished hardwood strips on each end at 90° to the board and 3 in. from one edge. Use 1-in. blocks under the board to gusset the strips. Also attach two wood strips at 30° for cutting the tip angles. Draw a line with a

marker pen from the front edge of one guide to the other. The line should show you where the cutting wire will cut when moved down the vertical strips. Then add a series of 90° lines every 6 in. to aid in squaring a block of foam on the board.

Wing templates. Begin by rough-cutting two Formica plastic laminated strips large enough for the two wing rib templates. Join the pieces, smooth side out, with strips of double-back tape. Cut out the paper template patterns, leaving an excess edge of about 1 in., and spray the backs with a light coat of contact adhesive. Allow to dry completely. Press onto the Formica strip and cut out patterns with a narrow-blade jigsaw. Leave all of the drawn outline of the rib when cutting. Then sand on a disk sander until the rib is very smooth and the line is nearly gone. The finished surface must be free of any ruts or nicks that will catch the nichrome wire. Remove the paper template carefully and store on wax paper. Separate the identical rib copies. You should have four templates: two mirror copies each of the root and of the tip.

Align one of the paper templates, a set of matching rib templates, and a straightedge parallel to each other on your work table. Raise the straightedge enough so that you can slide a triangle along the edge and over the surface of the rib templates. Use the triangle against the straightedge to line up the leading edges of the template and the paper pattern. Align the triangle on the first line of the paper master. Using a permanent marking pen, draw the same line on both copies of the Formica templates. Repeat for each mark, and number the lines to

match the paper master. Note that all the numbers start at the trailing edge—where all cutting begins. Repeat this process for the remaining templates.

Produce and mark two spar cutout guides in the same manner as used to produce the rib templates.

Purchase 2- or 3-in.-thick foam blocks from a hobby shop or a mail order house such as Sig. Alternatively, check with a home insulation contractor for expanded bead foam.

Select a safe area to set up your cutting board. I prefer to work outside because of the poisonous gas released as the foam is cut. The work area should be dry and well ventilated. The table's surface should be a nonconducting material such as wood or Formica. The output of the power supply is similar to the AC output on a large train transformer: safe if used with proper precautions but dangerous if you're careless.

Use scrap foam to get a feel for the cutting speed and temperature. Foam cutting is a skill that must be practiced to perfect it. To prevent the foam from slipping during cutting, place a weight on top of the foam. A scrap of plywood works well. I dial my transformer to the 25 through 30 position on the dial for 24- to 36-in. cuts. Make a few test cuts, allowing the wire to sink through the foam.

Proper cutting requires a balance between three items: the wire's temperature, its tension, and the speed at which you attempt to cut. You will have to develop a feel for what is actually correct, but the following will help get you into the ballpark.

The wire should cut at roughly one mark per second. You should call out the numbers on the template at about the rate you would call out the seconds on a clock, one (thousand) half (thousand), two (thousand) half (thousand), three . . . , etc.

If the wire drags and makes you go noticeably slower, increase the temperature by a small amount. Note that the wire does not glow red. It remains the same color as it heats. You can tell if it is hot by noting that the bow changes shape when the wire stretches. If the wire is too hot it will melt a large gap as you move over the template, and there will be no drag. You should then reduce the voltage a little.

When you feel you are getting the right balance and the surface of the foam looks smooth, check the tension. Using a template with a 90° angle in it, begin a test cut. Look at the corners of the cut and see if the middle area is as sharp as the two end cuts. If there is any rounding in the middle, the wire is too loose. Add more #64 rubberbands or a stronger spring, or both. Be sure the spring is still stretched after you have applied voltage. When exiting a cut on a wing, you should see the wire exit at nearly the same time along the entire length of the foam.

Note that excess speed can create the same effect as having the tension too loose. Developing the balance for a good cut comes with experience. If you see deep lines along the span of the cut, it can mean that one of you (foam cutting is generally a two-person job) is hesitating and not moving at a consistent speed—or the wire could be too hot.

Cut your stock foam into wing blanks. Mark the block for 24-in. lengths, and position it on the board's cutting mark. Check to see if the edge is against the 90° guidelines for a square cut. Heat the wire, and start cutting.

Mark one end of the blank the length of the short template and the other end the length of the long template. Position the marks to match the cut line on the board, and make the cut. The blank will now have the wing's shape with a swept leading edge and 90° corners for the trailing edge.

Draw a guideline 1 in. from the bottom edge at each chord end of the blank (from leading edge to trailing edge) to align the position of the templates. These lines must be parallel to each other to correctly position the incidence of each template. Apply several coats of double-back tape to the templates, and position them as shown on the drawings. You can also use spray adhesive or pin them in place with small nails pushed through holes drilled in the templates. Note that the base of the tip template matches the guideline. On the root template you will match the guide line drawn through the templates so that part of the rib sets below the line on the foam. Templates must be pressed firmly in place.

Cuts should always start from the trailing edge and move to the leading edge. The flatter surface at the rear of the wing is more tolerant if you do not have your act together as you start a cut. The front of the wing is more rounded and usually reveals any errors in alignment between the two workers. When the cutting is in progress the caller reads out loud the numbers on the root template as he passes them. As the wire passes the marks between the numbers, the caller says, "half." This one-syllable cue further defines the position without requiring more numbered marking.

The helper should follow the lead of the caller and attempt to be at the number on the tip template when the number is being called. Speeding up or slowing down to get in cadence with the caller must be done proportionally so the wire is never moved too slow or too fast. Being off by a ¼-number will not hurt near the trailing edge, and you should get the rhythm by the time you approach the leading edge. Please agree to start on the same side of the template (top or bottom), or the results will be useless. Since I find it easier to make the cut with the wire resting on top of the template, I always turn the foam so my cut will be on top.

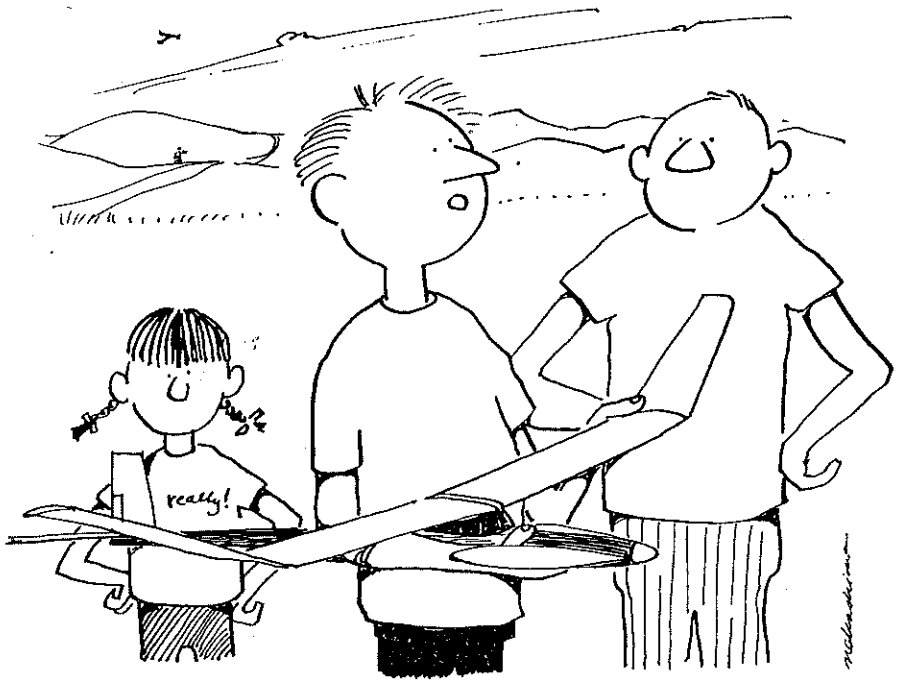
Due to the shorter chord at the wing tip, the wire will move slower there and make a larger-diameter cut. The template has been adjusted for this.

Set the voltage on the transformer and position the wire ⅛ in. behind and above the entry point (T.E.). The caller announces

"ready" and then if the helper agrees, then "start." Enter the foam and drop down to the template surface. The caller then announces the "half" mark on the lead-in part of the template. As the "zero" position is called, both should have the wire settled on the template and be matching each other's speed. Note that the lead-in part of the foam is cut off, so errors and lumps here are not important. You may extend the length of the lead-ins about a half-inch beyond the edge of the foam to make ramps. This helps start-up by resting the wire on the template before starting into the foam; but remember to keep the T.E. of each template the same distance from the edge of the foam.

Also remember to position the templates to produce left and right wings. With thick foam—hard to find—you can cut both wings from one piece as shown in my photos. Cut several extras while you have things set up.

To accurately trim the lead-in and lead-out scrap from the wing, make short marks on the edge of the foam at the "zero" and "10" marks before removing the templates. Also make the "s" marks for the location of the spar cut. Then remove the templates and cradle the wing in the bottom foam scrap block. Place on the cutting board and



"I try to make my planes immaculate because everything else in my life is so messy."

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!

align the marks on the foam with the cut line on the board. Then set the cold cutting wire against the cutting guides and confirm that the wire will cut on the marks. When the wire is properly aligned, bring up the heat and cut. Repeat for the opposite edge: cold wire to perfect the cut position, then go back to hot for cutting.

Apply double-back tape to the spar cut-out guide. Position one at each end of the wing, using the guide lines to square the templates. The tip guide aligns with the ½-in. line at the base of the airfoil. The root guide also sets the ½-in. line at the bottom of the airfoil but uses the guide line already on the foam to level the guide and prevent a twist in the slot. Set the cutting wire near the foam inside the guides. Bring up the heat, and make three distinct cutting motions: down, over, and out. Keep the wire parallel to the wing surface to prevent distortions in the cut. In other words, don't exit one end of the wing long before you exit the other end.

Next, cut the dihedral at the root by blocking up the tip 1¾ in. Keep the wing in the bottom foam cradle. Position the wing (with the wire cold) so the wire will cut the minimum amount off the root section. Check to see if the wing is square on the board by matching the T.E. with the board's guidelines. Make the cut, keeping the wire parallel to the board.

To cut the tip angles place the wing bottom-side-up in the top foam scrap. This will keep the incidence of the wing square with the board. Again, position the foam to cut the minimum off the span. Using a cold wire on the angled guides, check to see where the wire will exit the foam. Keep the wire parallel to the board, and make the cut. The wire should exit right at the top edge of the airfoil tip. Do not set up the cut to exit down in the scrap foam cradle.

Use a razor blade to trim the 2 in. x ⅛-in.-wide slots for spar braces. Also cut another brace slot at the T.E.

Lightly sand the foam with an unfolded piece of 400 or 600 wet-or-dry sandpaper to polish the surface. Be careful not to let the edges of the sandpaper dig into the surface.

With the completed foam panels in hand we can begin assembly of the wing.

Cut the ends of the ¼ x ½-in. pine (or basswood) spars to match the angle of the wing tips, then cut to length. Glue in place

using a pliable white glue such as R/C-56 or Grrrip.

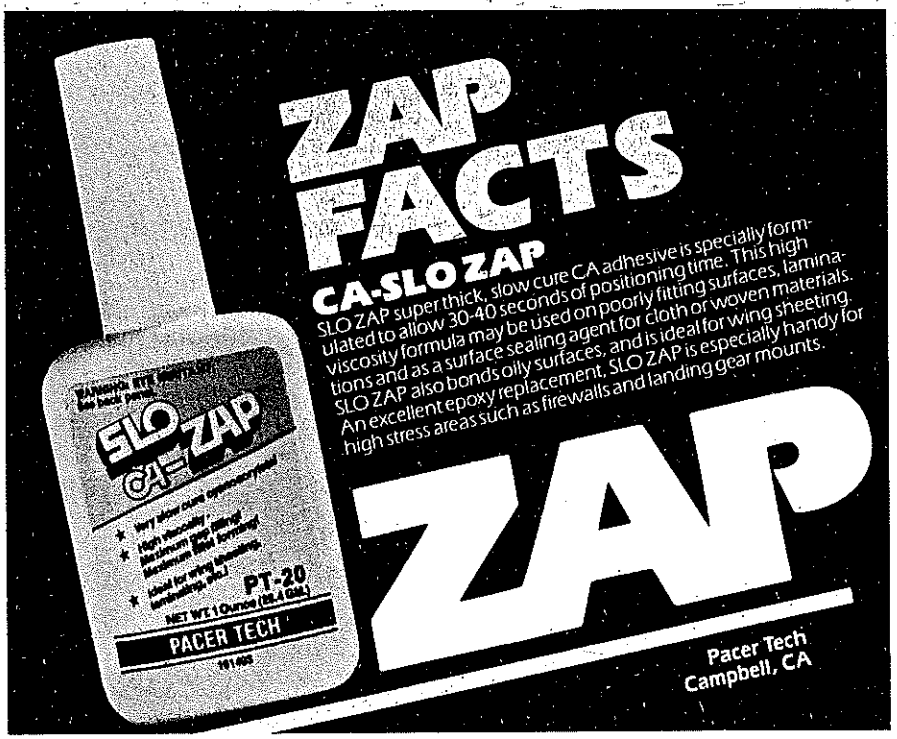
To reinforce the trailing edge against compression by the rubberbands, imbed a ⅛-in. dowel in the foam and cut flush with the T.E. as shown on plans. Make the hole in the foam T.E. with a hot pushrod wire. Use the same process for the wing tips at the L.E.

Taper the top edge of the ¼-in.-square pine (or basswood) trailing edge before gluing to the foam with epoxy. Sand all hardwood before attaching to foam or balsa.

Glue the ¾-in. balsa triangle leading edge to the foam with a 1/16-in. edge protruding above the top of the foam's L.E. Trim excess wood flush with the foam surface and sand to shape. To prevent accidentally cutting into the foam, use a point light source across the room to cast a shadow on the foam as you trim or sand the L.E. The light must be on the L.E. side of the wing. When the balsa matches the foam there will be no shadow. The centerline of the triangle L.E. should center on the root rib and fall well below center on the tip rib. This ensures that the L.E. will have the proper change in shape to match the change in airfoil.

Cut dihedral braces and test-fit them in their slots. Cut a slot in the L.E. for the wedge-shaped brace. Prepare a level surface for joining the wings by placing waxed paper at the center and a 1¾-in block at each tip. Make the blocks about 6 in. long

ACE & SPINNER



so the tip will be held parallel to the work table. Sight across the blocks to ensure that both tips are parallel. Minor alignment errors at the root are far less important than any alignment error at the tips. Apply 30-minute epoxy to the dihedral braces and the root section of foam, and jig in place to dry. Position a weight such as a book on top of each wing tip to hold the tips flush with the dihedral blocks. You can install the T.E. brace after the epoxy sets.

Apply a thin fabric tape with R/C-56 around the root joint. Do not use a heavy-gauge tape that will leave a ridge in your covering.

Cover the foam wing with a low-temperature film that is labeled as suitable for foam—such as Coverite's Black Baron Film, Solarfilm, or Hobby Lobby Superkote. The "tex" type coverings can also be used but will require a sealing coat of paint.

The tail surfaces must be completed before finishing the fuselage. Build up the stab on the plans. The only differences from a typical tail surface assembly are the hardwood spar T.E. and the spar brace at the L.E. Sand the ends of the hardwood to a rounded shape before assembly. It is difficult to sand balsa and hardwood equally when joined together.

The plans suggest two easy ways to install hinges in hardwood. I use several Robart Mini-Points per surface. Klett also makes a strong point hinge that uses a wire hinge pin and is fairly easy to mount in basswood. The balsa elevator is slotted as usual and tied together with a .076-dia. wire.

The fin is also built-up on the plans but does not include the pine spar at this stage. The fin is attached to the spar after the spar is assembled into the fuselage. Attaching the fin to a spar that runs down inside the fuselage assembly, instead of merely mounting it on the stab surface, strengthens it considerably.

Fuselage. Begin by producing all parts illustrated on the plans. I suggest making identical fuselage sides by joining two pieces of rough-cut ⅛-in. Lite Ply with double-back tape and cutting both sheets with one cut. Use any warp or curve in the Lite Ply to your advantage by laminating the rough-cut pieces curved in opposing directions (as they will be when the finished pieces are assembled). Be careful if you are using instant copies for cutting templates: many machines are set to reduce about 1 or 2%.

If you are using a lightweight engine you may wish to extend the nose about ½ in. to maintain balance without adding nose weight. Also, if you do not use the nose gear you can reduce the firewall's height about ⅜ in. and taper the sides to match.

Mark the bulkhead and servo rail positions on the wood before separating. Note which piece will be the right side—with the bulkhead markings inside. Trim the firewall edge by 1/16 in. for thrust offset.

Position the sides upright over wax-paper-covered plans. Glue F-3 and F-4 in place. Install the ¼-in. wing dowels and wing saddle doublers. These will help brace up the frame before joining the ends. Position the fin's pine spar in place with two balsa wedges. Wrap with rubberbands to hold the epoxy-glued joint. When measured front and sides, the spar should be 90° from the surface of the plans.

Glue F-7 in place for the tail wheel or skid mount. Position F-5 and F-6, and glue in place.

Laminate F-2 centered on F-1 to make the firewall. Mark and drill the aluminum engine mounts. I prefer to drill the holes for bolts and locknuts rather than tap the aluminum mount. Bolt the engine to the mounts. Position the mounts on the firewall and determine if you can install the engine as shown and still have the muffler clear the side or bottom of the fuselage. Do not mount the engine upright. This places the carb too far above the tank centerline and directs the exhaust spray into the wing saddle. You can rotate the engine a few degrees to get as close to the centerline and as high up as possible. Mark and drill for the engine mount blind nuts.

Mark and drill the holes for the nose gear block. Note where the engine mounts are positioned and try not to locate the blind nuts for the nose gear under them. Mark and drill holes for the fuel lines and the throttle cable. It is easier to do so now than

Continued on page 188

FULL-SIZE PLANS

No. 555 Double Duty **$10.75**
RC Basic/advanced trainer for .10/.15 engine spans either 67¼ or 59 in. Two plan sheets.

No. 556 Avro Lancaster **$6.50**
FF Rubber Scale has 4 motors, spans 51 in.

No. 557 Wildcat **$5.00**
CL Sport profile for .35 engine spans 44 in. Foam wing.

No. 558 Sugar Pup **$5.50**
RC Sportster for .10/.25 engine. Foam wing spans 48 in.

No. 193	Stiletto: CL Stunt model (McDonald) winner 1976, 1980, 1982 FAI World Champs.	$ 3.75
No. 239	Blue Birds: RC Ken Willard's formation plane, 4-channel, .10/.15 power.	$ 3.75
No. 262	Crashmaster: CL Crash-proof trainer, two sizes—.15/.30 and .35/.40 power.	$ 3.75
No. 302	Mini F-16: RC Sarpolus' .049 ducted-fan sport flier for 2-channel. Balsa wings, tail, fuse structure.	$ 1.25
No. 310	1930 Fleet Biplane: RC Sport Scale for .35/.40, 4-channel. Wingspan 56 in., ⅛ scale. Two sheets.	$ 2.75
No. 314	Drake II: RC Ken Willard's flying boat for 3-channel, .15-power. Fly from land with removable gear.	$ 6.25
No. 326	Taylor Cub: RC Don Scull's Schoolyard-Scale for .049s, 2-3 channel. Spans 50 in.	$ 3.75
No. 332	Zephyr: RC Small, 2-channel glider for hand-launch or tow, thermal or slope soaring.	$ 3.50
No. 386	Laser 200: RC Sport Scale replica of championship Aerobatic flier. Uses .40 power, 4-5 channel. Two sheets.	$ 2.00
No. 414	Electric Sparky: RC Electric-powered fun flier for 05 motor, 3-channel RC is scaled-up 1939 rubber-power favorite.	$10.75
No. 438	Cruiser: FF Embryo Endurance rubber-power fun ship has big-model characteristics.	$ 8.50
No. 440	Cavalier: RC Old-Timer-like new design has a huge wing for slow, easy flights. For .35 power, 3 channels. Two sheets.	$ 2.00
No. 444	Firebolt: RC Pusher canard sport/pattern uses .40 pusher engine and 4-channel. Has swept-forward foam wings.	$17.25
No. 447	½A Miss America: RC Old-Timer ½A Texaco model for .049 glow, 2-channels.	$ 8.50
No. 454	Sweet P-30: FF Neat, stick-and-tissue Outdoor Rubber P-30-class model is a contest-winner.	$ 6.50
No. 457	Spectre: RC Electric-power for 05-size motor uses 3 different wings for sport, soaring, or aerobatics.	$ 2.00
No. 460	4-40: RC Shoulder-wing sport flier for 4-cycle, .40-size engine, 4 channels.	$ 7.00
No. 465	Blue Max II: RC Fun-fly sportster for .40-size engines spans 52 in. Lightweight structure.	$ 6.50
No. 470	Stroker: RC Mid-wing sportster uses .40/.45 four-stroke engine, spans 60½ in., tail-dragger.	$ 7.00
No. 478	Buttercup: RC Cute, elfin sportster uses micro 2-ch. RC or pulse-rudder. Spans 27 in., for .020/.035 power.	$ 6.50
No. 490	Weekender: RC Low-wing sport flier for .20-size 4-stroke engine spans 47½ in.	$ 3.00
No. 499	4-60: RC Doc Mathews' great sport flier for .60-size four-stroker engine spans 70 in. Two sheets.	$ 5.75
No. 500	Fokker D.VIII: RC Sport Scale model of WW I monoplane uses .90 four-stroke engine, spans 83½ in. Two sheets.	$12.75
No. 502	Bill Winter's Vagabond: FF Sport flier is down-sized, .02-powered version of 1940s cabin plane. Spans 33½ in.	$18.00
No. 503	Buzzbat: RC Slope-soarer spans 60 in., uses 2 RC channels.	$ 2.25
No. 505	P-38 Lightning: CL Sport Scale fighter spans 65½ in., weighs 10 lb., uses twin .35s. Two sheets.	$ 7.50
No. 506	Playmate: RC Sport flier for 3 RC channels, .15/.25-size engines spans 60 in.	$11.75
No. 512	Extra 230: RC Giant Scale acrobatic plane spans 8 ft., uses Quadra engine. Two plan sheets.	$ 6.50
No. 513	Black Beauty: RC Slope-soaring racer has foam wing, 3-ch. RC, spans 114 in.	$16.50
No. 514	Henry T: RC Sportster for ½A, 2-3 channel RC spans 52 in., has adjustable wing flaps.	$ 7.50
No. 515	Westland Whirlwind: RC Sport Scale WW II twin-engined British fighter for .10-size engines spans 55 in. Two sheets.	$ 4.75
No. 517	Fake Ford: RC Sportster for three ½A engines, 3-ch. RC Spans 50 in. Two plan sheets.	$11.50
No. 518	Project P-13: FF Scale German WW II flying wing pusher/tractor for rubber power; spans 26 in.	$ 5.75
No. 519	Gee Bee R-1: CL Profile sport flier for .25 engines spans 36¼ in.	$ 3.25
No. 520	Flight Assistant: Wheeled flight box carries lots. Two plan sheets.	$ 4.75
No. 521	Comet Jr. Clipper Plus 35%: RC Old-Timer sportster for ½A engine, 2-ch. RC spans 48½ in.	$11.50
No. 522	Sorta Pitts: RC Reminder-scale biga for .40/.60 engines spans 43 in. Two plan sheets.	$ 6.50
No. 523	Dawnwalker: FF Superlight Unlimited/Mulvihill rubber-powered competition plane spans 42½ in.	$10.50
No. 525	Hi-Tech 2002: RC Canard ducted-fan for .45 engines spans 39 in. Two sheets.	$ 4.00
No. 526	Ki.61 Hein: CL Mostly-cardboard sport-scale WW II Japanese fighter for .40 engine spans 60 in. Two plan sheets.	$10.00
No. 527	Miss RJ: RC World Champion FAI Pylon Racer for .40 engines spans 51 in.	$11.50
No. 528	Swallow: RC Lightweight "hotdogger" for .40-size four-stroke engines spans 58 in.	$ 5.50
No. 529	PBY Catalina: FF "Skinny Scale" for two CO-2 motors. Spans 32 in. All-sheet-balsa construction.	$ 8.25
No. 530	Tsunami: CL Profile scale ½A spans 21½ inches. All-sheet-balsa construction.	$ 3.25
No. 531	Terrible Coupe: FF Rubber-powered Coupe d'Hiver spans 48 in. A contest-winner.	$ 2.25
No. 532	Baby Bird: CL Tiny, Thunderbird-like Stunter uses .049 diesel or glow, spans 34½ in., has flaps.	$ 4.75
No. 533	Cessna C-37: RC Schoolyard Scale of famous 30s plane for .049/.10 power, 2-ch. spans 42½ in.	$ 4.00
No. 534	1938 Challenger: RC ½A Texaco Old-Timer spans 47½ in., for .049 engine, 2-channel RC.	$ 6.00
No. 535	Atrix: RC AMA Class D Sailplane spans 110 in., uses 4-channel RC system.	$ 5.50
No. 536	Cyrano II: FF P-30 Rubber flying wing pusher spans 28 in. From Barnaby Wainfan.	$ 7.25
No. 537	Cessna 208 Caravan: CL Sport Scale for 02 electric power spans 37 in.	$ 3.25
No. 538	Wildfire: CL FAI Speed plane holds Canadian record. Asymmetric wing spans 37 in. TO dolly plans incl.	$ 3.00
No. 539	Simitar Slow-Motion .15: RC Tailless "flying plank" for .15 engines spans 60 in. uses 3-ch. RC	$ 5.75
No. 540	Sparrowhawk: RC Sportster spans 40 in., has flaps, tri-gear. For .15 engines, 5-ch.	$ 3.50
No. 541	Parakeet: RC Sport biplane for .15/.25 engines, 3-channel RC equipment spans 42 in.	$ 8.75
No. 542	Miss Grand Rapids: FF Jumbo Rubber Scale monoplane spans 37 in.	$ 6.75
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after the engine is bolted on.

Epoxy the firewall in place with the fuselage sides positioned in the stepped edge of the firewall. Wrap rubberbands to hold the side against the firewall. Gusset with triangle stock.

Cut ⅜-in.-wide strips from 1/32 plywood, and glue them to the wing saddles. Glue 3/16-sheet nose block and shape to match the L.E. of the wing.

Build up the bolt-on landing gear platform. Use the small #8-32 bolts suggested. During a hard landing, these smaller bolts may break; but they won't tear out the platform as larger bolts will. You may use Sig's pre-drilled blocks or tap your own in plywood.

Add ¼-in. triangle stock to the bottom edge to gusset the floor in the radio compartment. Use ⅛-in.-sq. balsa between the bulkheads from F-4 to the tail.

Complete the tail by installing the stab and top deck. Leave a gap between the stab spar and the fin spar for the elevator connector wire. Add the fin to the fin spar. Test-fit the hinging of control surfaces, but do not glue hinges until covering is completed.

Install the pushrods before closing up the floor. Position the servos to check pushrod locations. Install the nose wheel block, pushrod, and steering arm. Also install the tank and check the position of the throttle pushrod around the tank. I recommend placing the tank in a plastic bag with the opening sealed by a rubberband in front of the tank's stopper. Since some of the tank is visible, you can see if there is a leak without finding fuel soaked into the wood.

With all hard-to-get-to installations out of the way, you can sheet the floor with 1/16 hard balsa. Run the grain from side to side for maximum strength.

Complete final shaping and sanding. Seal all holes in the firewall with paint. Cover the entire model with lightweight heat-shrink film. Avoid heavy paint jobs. The fuselage and tail on my model were covered with Coverite Permagloss. Perhaps you've noticed how much I like day-glow orange Permagloss for the rudder. Install the radio with advice from an experienced modeler and/or guidance from the manufacturer's instructions. Position your equipment to keep the CG at or forward of the location shown on the plans. The CG is shown without fuel aboard.

Flying. If you are a novice, have an experienced pilot get the model airborne. At about 300 ft. altitude let the model glide at low idle, and trim it for a good flat glide. (Note the adjustments needed on your trim controls, and correct on the ground later by adjusting the pushrod lengths.) Then power up and fly without changing the trim. If the model climbs excessively, add more downthrust by shimming the engine mounts. A model under full power will climb, but it shouldn't try to loop. Note that Sugar Pup does very well at a nose-high, slow flight angle.

Now have some fun!