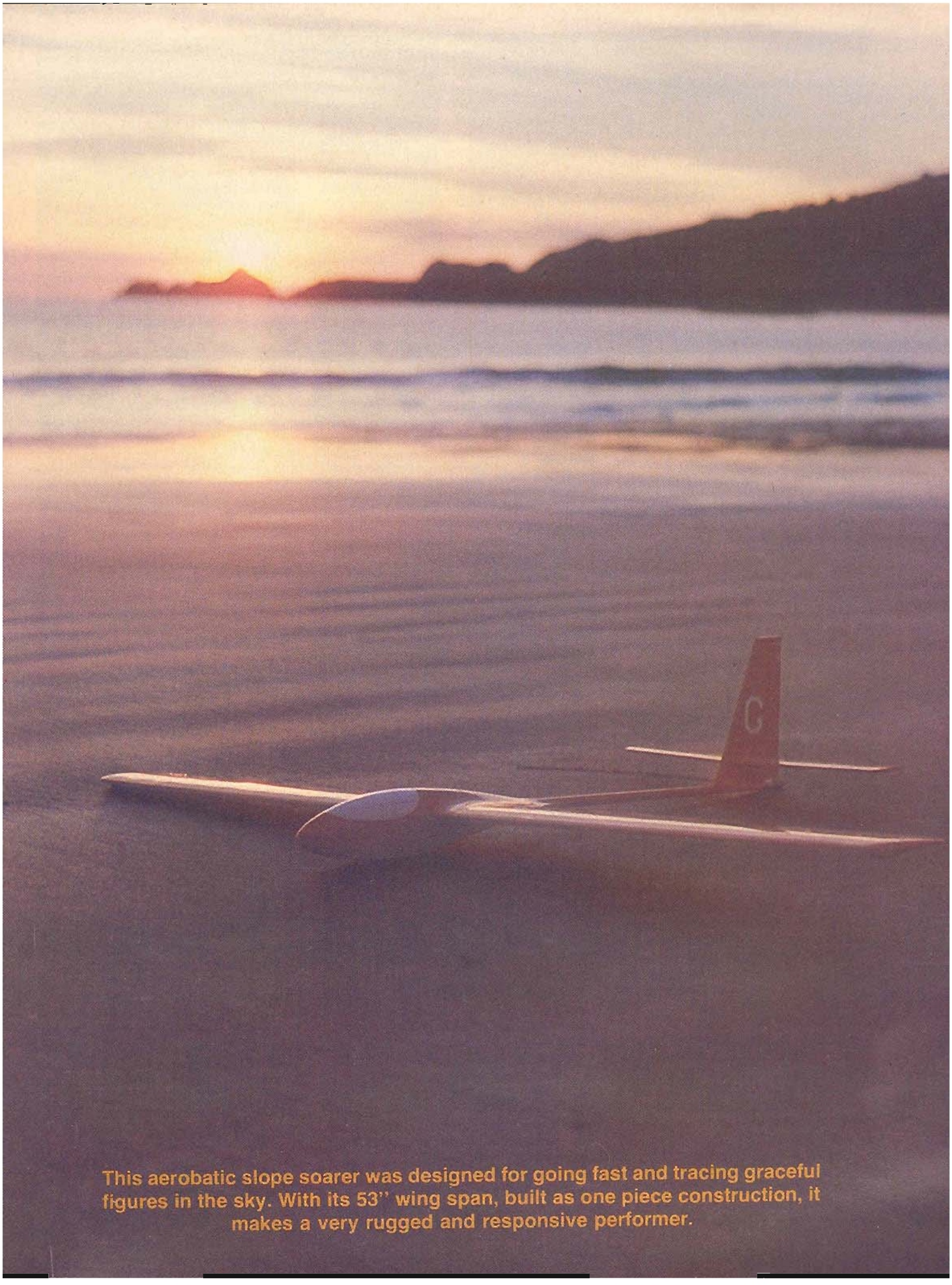


This aerobatic slope soarer was designed for going fast and tracing graceful figures in the sky. With its 53'' wing span, built as one piece construction, it makes a very rugged and responsive performer.

PURANAS

BY MARK GUMPRECHT

You ease the stick back just a bit further, trying to gain a few more precious feet of altitude. A quick turn, and then back along the slope, diving for speed. The sound of the wind whistling over the wings rises in pitch as the plane accelerates in the dive. You level out at cliff-top level and do a long four-point, a gigantic loop, or a few snap rolls, whatever suits your fancy, then begin to climb for altitude once again. What will it be this time? Perhaps a few outside loops or maybe a beach run followed by a vertical roll. This is what slope aerobatics is all about!

Puranas is designed for slope aerobatics; for going fast, tracing graceful figures in the sky. With a wing span of 53", it's smaller than the average slope ship. The most important consideration in deciding on the size was the planned one-piece construction. A larger plane would be too hard to work on without using a removable wing. One-piece construction gives a more rigid airframe which is important for high speed flight. The ailerons are permanently connected, saving the trouble of making some sort of detachable linkage necessary when detachable wing panels are used. A removable one-piece wing would seriously weaken the fuselage because of the mid-wing design. From past experience, I have noticed that aileron response is too slow for good aerobatics with wing spans above 65". The pilot must remain in one place, and by the time three rolls can be executed, the plane is almost out of sight. This can be detrimental in contest flying, as it is difficult to keep maneuvers within the visual limits, except by flying farther away. I find it hard to do accurate maneuvers when flying far away. A wing span of 53" gives the Puranas a fast roll rate, making it easier to do maneuvers closer in to the slope, but is not so small as to have that skitterish feeling of some smaller gliders. The smaller size also is nice when trying to fly on smaller, more confined slopes. The only disadvantage of smaller planes is increased sensitivity to turbulence, although it hasn't been much of a problem with this design. I've flown in some very strong winds with no problems, except the severe turbulence in the landing area where I fly.

The Puranas is designed along different lines than most slope stunters. I wanted to design a plane that was light and slippery, instead of heavy and fast. A heavy plane is more prone to breaking when it contacts the ground; a light, strong plane can take more bouncing about without getting hurt. Because I tend to build light planes, I decided to try a thinner airfoil of about 10-11% thickness. Then airfoils can perform well at slow speeds if they are lightly loaded. Several other tricks can be used to make thin airfoils behave. I always use a tip airfoil that is slightly thicker than at the root, with a blunter entry. This gives a wing with very gentle stall characteristics; I can still control the plane while holding full up elevator. No washout is used as it would have the reverse effect while inverted.

Most slope soarers rely on weight to overcome the drag of thick airfoils and boxy fuselages. Streamlining is very important if you expect a small, light plane to go fast. Every effort was made to reduce drag, as a clean airplane will go faster at lighter wing loading, and carry speed better. I used a pod and boom fuselage because I believe it is the cleanest configuration, as evidenced by trends in full size sailplanes. A fibergalss boom was used and has proven more durable than a conventional wood tail — it bends instead of breaking — yet is sufficiently rigid in flight. Since I began using the pod and boom configuration, I have noticed a definite improvement in L/D and speed, and no more broken tails.

Although not incorporated in this design, another plane of mine uses a fiberglass boom and plug-in rudder, mounted on music wire. This gives the ultimate in durability — there are no rigid joints to break. I have bounced the plane on its tail and sustained no damage. One disadvantage of a pod and boom fuselage, some will say, is lack of side area necessary for knife-edge flight. This is believed to be true because most planes have short, wide fins and need side area for good yaw stability. A tall, narrow fin with a good airfoil section is more efficient than a short, flat one — it generates more lift where it is needed — back in the tail, and eliminates the need for much side area. A flying stabilator, essential for good outside maneuvers, and a long tail-moment make for a smooth flying plane. The Puranas flies very well on ailerons and elevator alone, but I prefer to have rudder control for spins, snap rolls, and a little help on slow and 4-point rolls. I would recommend adding it if you feel you can squeeze in a third servo.

The Puranas has one surprising but enjoyable, characteristic. With most slope designs, it is necessary to adjust the wing loading according to the lift conditions. This can mean adding up to a pound of weight in larger planes. In a crash, this weight can be very destructive. Because of the thin airfoil, large wing fairings, and pod and boom fuselage, the Puranas seems very happy in all conditions at a flying weight of 24-26 ounces, or about 12 oz./sq. ft. It penetrates well even in very strong winds. I've never found it necessary to add ballast; which is good, because there isn't really much extra room for it.

Because of the one piece construction and no need for ballast, assembling the Puranas at the field is simple — you just take it out of the car and throw it off the cliff.

CONSTRUCTION

The Puranas is not an altogether easy plane to build and I would recommend some building experience before attempting it. The radio installation is tight, so first determine if you can fit your radio in. The battery pack is the most critical — a KB-4M 450 ma Kraft pack fits very well. Also, some receivers may not fit. If you decide to use three servos, you may have to locate the hatch in a different place than shown on the plans. All linkages, except the rudder, are internal, to reduce drag, but may be made external to simplify construction.

Fuselage

First you must find a suitable fiberglass tube to use for a boom. It should be at least 1/2" in diameter, preferably tapered. You may be able to get something from a fishing pole manufacturer. Cut bulkhead B out of 3/32" plywood and two root airfoil templates out of 1/16" plywood. Locate some type of foam that can be sanded fairly well, and cut a piece the same length, width, and height as the fuselage. Make a template out of thin cardboard of the side and top profiles, and transfer the profiles to the foam block. Sand the foam to these two dimensions, but don't round the corners. Mark the location of bulkhead B on the foam block and cut the block at this location. Glue bulkhead B in-between the two pieces. Make sure you have already drilled the hole for the boom through the bulkhead. Don't use a solvent glue. Cut out a small piece of plywood the same diameter as the boom and glue it on the back of the foam plug where the boom leaves the fuselage. The wing fairings are built as part of the fuselage. Cut and shape two pieces of foam to extend the wing root on either side of the fuselage and glue them roughly in position. Cut the wing root templates where the wing brace extends from the fuselage and glue the templates in place. Be sure to subtract the thickness of the brace from the templates, and align them correct on the fuselage. The wing root should be directly in line with the boom. Now the foam plug is sanded to final shape, using bulkhead B and the root airfoil templates as guides. Shape according to the plans and the profiles drawn on the foam. The foam plug is now ready for glassing.

On the original, I used Hobbypoxy 2 and two layers of 6 oz. cloth with satisfactory results. But I have since learned of an easier method, as Hobbypoxy is hard to sand and 6 oz. cloth is a bit thick to follow the compound curves. Coating the foam with Devcon 5-Minute epoxy makes it possible to use polyester resin over the foam. Three layers of 4 oz. cloth would probably be better than 2 layers of 6 oz. cloth. Sand between each layer of cloth. After all the layers of cloth have been applied, sand the fuselage smooth. Using a razor saw and a cutting wheel, cut the hatch loose. Dissolve the foam out using acetone. Remove the plywood plug for the boom and insert the boom in the hole and through bulkhead B. Epoxy in place. Use 1/16" plywood webs between the boom and the fuselage and fill to final shape with micro-balloon and resin.

PURANAS
Designed By : Mark Gumprecht

TYPE AIRCRAFT	Aerobatic Slope Soarer
WINGSPAN	53 Inches
WING CHORD	7" root — 5" tip
TOTAL WING AREA	300 Square Inches
WING LOCATION	Mid Wing
AIRFOIL	11% Semi Symmetrical
WING PLANFORM	Double Taper
DIHEDRAL, EACH TIP	0.5 Degree
O.A. FUSELAGE LENGTH	35 Inches
RADIO COMPARTMENT AREA	(L) 8½" x (W) 2" x (H) 2½"
STABILIZER SPAN	17 Inches
STABILIZER CHORD	2⅝" Average
STABILIZER AREA	45 Square Inches
STAB AIRFOIL SECTION	Symmetrical
STABILIZER LOCATION	Mid-Fin
VERTICAL FIN HEIGHT	8 Inches
VERTICAL FIN WIDTH (inc. rudder)	4" Average
REC. NO. OF CHANNELS	2
CONTROL FUNCTIONS	Ailerons & Flying Stab

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Foam, Ply & Fiberglass
Wing	Balsa, Ply & Spruce
Empennage	Balsa & Ply
Weight Ready-To-Fly	25 Ounces
Wing Loading	12 Oz./Sq. Ft.

Wing

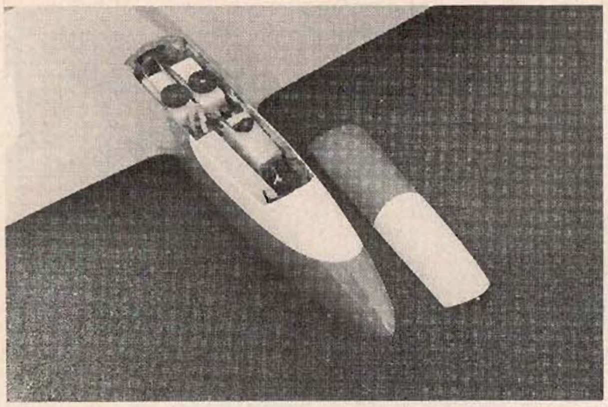
The wing uses all wood construction but would lend itself easily to foam construction if preferred. Cut out plywood templates of the root and tip airfoils, subtracting the skin thickness and aileron width. Mark the position of the spars. Make the rest of the ribs by stacking the correct number of 1/16" balsa blanks between the templates, pinning them together, and sanding to shape. Notch for the spars with a razor saw. Trim the backs of all the ribs so they form a straight line, and extend halfway into the trailing edge. Cut notches in the front of the ribs for the 1/8" x 1/4" leading edge. Position the 1/8" x 1/4" spruce spar over the plans and glue the ribs in place. Then glue the top spar in place. Make 1/16" notches in the 1/4" square balsa trailing edge and glue it onto the ribs. Glue on the 1/16" vertical grain balsa webbing while the spar is pinned to a flat surface. Glue the 1/8" x 1/4" spruce leading edge into the notches in the front of the ribs.

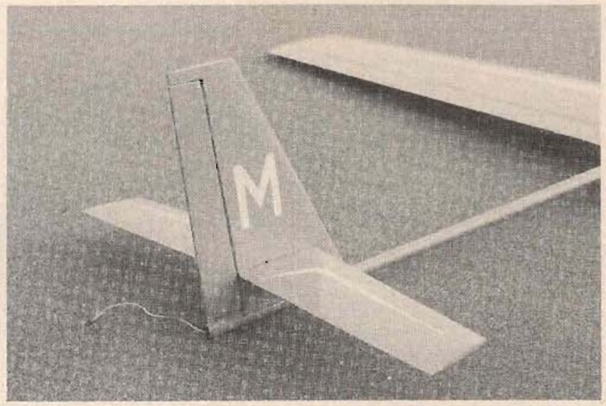
Bevel the edges so they follow the airfoil contour. Sheet the wing with 1/16" lightweight balsa, making sure the wing is true. Leave the sheeting off behind the spar next to the root section so the wing brace can be glued to the back of the spar. Now build the other wing panel. Install the wing tips on both panels.

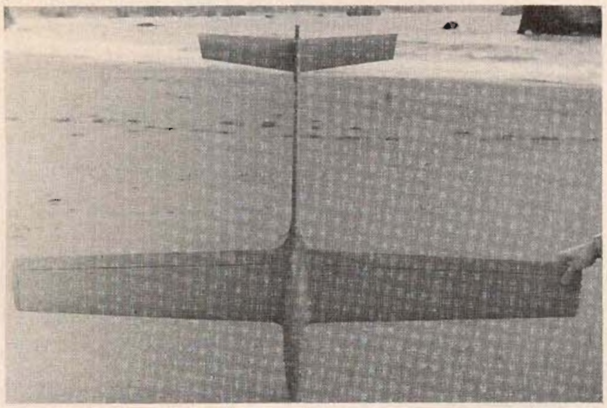
Now the wing panels are glued to the fuselage wing brace. If a foam wing is used, you might want to extend the braces. The wings should have just enough dihedral so they don't appear to droop. Epoxy the wing panels to the fuselage and wing brace, then glass the junction with 3/4 oz. cloth. Fill any irregularities with micro-balloons and resin. The aileron linkage is installed now by cutting a small hatch out of the top of the fuselage. Use 3/32" solid brass for the torque rod and a brass tube for the bearing. Insert the torque rod and bearing into the fuselage through the wing root and glue the bearing in place from inside of the fuselage. Solder a short control arm of brass to the torque rod. Make it as long as possible without hitting the top of the fuselage. Connect the aileron pushrods to the control arms with a clevis. Glass the hatch back in place and fill any cracks. Carve the ailerons out of tapered 3/8" balsa trailing edge stock and fit temporarily in place with hinges.

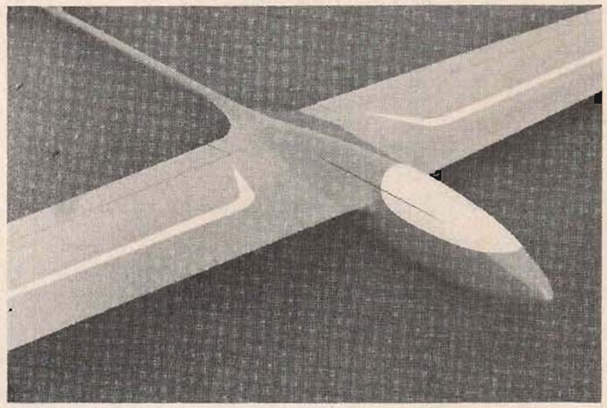
Tail Section

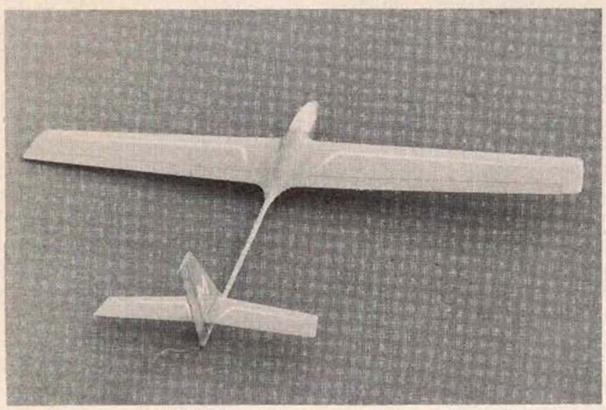
The stabilator is cut from 1/4" light balsa sheet and carved and sanded to airfoil shape. Install the plywood root ribs and cut slightly oversize slots where the brass tubes will go. Slide pieces of brass tubing into both stab halves and lay them onto a flat surface. Fill the slot with micro-balloons and epoxy; when dry, cut the halves apart and trim the tubes flush. Build the fin from 1/16" balsa sheeet with ribs to separate the skins. Leave enough space so the elevator horn will fit inside the fin. 1/16" plywood is used to reinforce the bearing area. Sand the fin to airfoil shape. The elevator horn is made from curcuit board material. I solder the brass bearing directly to the horn, then file them down so the horn will fit inside the fin. Remove the foil where the clevis will contact the horn. Make the horn just long enough to stick halfway into the boom when the fin is mounted. Make the elevator pushrod with 1/16" music wire and a 1/8" dowel. Solder a

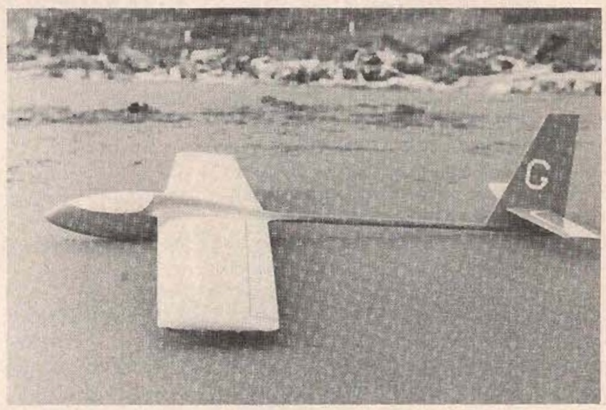












clevis to one end. Make a slot on the top of the boom where elevator horn inserts. Make it long enough to allow sufficient movement of the elevator horn.

Put the elevator horn in the fin, insert the pivot bearing through the bearing in the horn, and epoxy the pivot bearing in place. The elevator pushrod is then connected to the horn while inside the boom. Epoxy the fin to the boom and slip the elevator horn down in the slot. Don't get any glue on the horn or pushrod. Cut a slot in the fin for the back pin of the stabilator and fit the stab to the fin, bending the stab wires slightly so they won't slip.

Finishing

The fuselage is filled and sanded, then painted with your favorite finish. The wings and tail are covered with MonoKote or some similar material to keep the weight down. Seal the ailerons with a thin strip of covering. Install the radio securely. The antenna can be run inside the boom.

I use several layers of Mystic clear plastic tape to protect the bottom of the fuselage. Make sure the plane balances as per the plans or slightly farther forward. The ailerons should have ±5/16" throw and the stabilator ±1/4" at the trailing edge. I use differential on the stabilator — more down than up — so less stick movement is needed for outside and inverted maneuvers. No differential is used on the ailerons.

Flying

Head out to your favorite flying site, and if the lift is good, throw your creation off. After you trim out, check the balance by putting the plane into a dive. Neutralize the stick. If the plane tucks, it's tail-heavy, if it pulls out it's nose-heavy. Ballast the plane accordingly. A nose-heavy plane is harder to fly than a correctly balanced one — more correction is needed during rolls and more elevator is required for loops. When balanced correctly, very little elevator is needed for inverted flight. The Puranas accelerates very quickly for such a light plane, so it's easy to gain the speed to do rolls even in light lift.

Tracking and handling are very smooth at all speeds. When the lift gets strong, the fun really starts. Most any pattern maneuver is possible with enough speed. Stall recovery is very fast and the ailerons work right up to stalling speed. Landing is fairly easy, but you must work at losing speed because the

text to page 142

PURANAS

from page 51/48

Puranas would rather fly fast because of its clean lines. The hill where I fly has an almost vertical face and a very abrupt edge, which causes severe turbulence over the landing area. Landing really gets the adrenalin flowing because I never know what's going to happen. Often the plane is flipped up-side down and side-ways; it takes all your concentration just to keep the wings level. The landing approach consists of spinning halfway down the face of the cliff, then hauling the plane up over the lip of the hill, trying to lose enough speed to land.

Any landing where you hit with the wings level is good, but occasionally turbulence may throw you against a bush or tree. At times like that it sure is nice to have a strong but lightweight plane — a heavy plane would surely break itself.

If you think glider flying is slow and boring, build a Puranas and be surprised. □


RIGHT WING PANEL
NOTE: WING PANELS ARE SHEETED WITH 1/16" LIGHT-WEIGHT BALSA. SHEETING DELETED ON WING PLANS TO CLARIFY INTERNAL DETAILS
1/8"X1/4" SPRUCE LEADING EDGE
TIP SHAPE IS CUT FROM 1/32" PLY-THEN SANDWICHED BETWEEN 1/4" SHEET BALSA, TOP AND BOTTOM
1/16" BALSA SHEET WEBBING (VERTICAL GRAIN)
LEFT WING PANEL
1/8"X1/4" SPRUCE SPARS, TOP AND BOTTOM
LEAVE CLEARANCE FOR BULKHEAD BRACE 'B'
1/4" SQ. BALSA
ALL WING RIBS 1/16" BALSA SHEET
3/32" I.D. BRASS TUBE BEARING
3/32" BRASS TORQUE ROD
NOTE: NO WASHOUT NECESSARY. NO WASHIN ALLOWABLE. MAKE LEADING EDGE BLUNTER TOWARD TIPS. 0.5° DIHEDRAL AT TIP.
AILERONS ARE CARVED FROM 3/8" BALSA SHEET
WHERE WING PANELS OVERLAP, LEFT PANEL IS SHOWN IN PHANTOM LINES (-- ------ --).
1/4" BALSA- SAND TO AIRFOIL SHAPE
WING PANELS ARE EPOXIED TO FUSELAGE. GLUE OUTER PART OF BULKHEAD BRACE 'B' TO BACK OF SPARS. 'GLASS JUNCTION WITH 3/4 OUNCE CLOTH.
ROOT AIRFOIL (10.8% THICKNESS)
TIP AIRFOIL (11.3%)
1/16" MUSIC WIRE INSIDE 1/16" I.D. BRASS TUBING
REMOVABLE HATCH
1/16" I.D. BRASS BEARINGS
1/16" PLY ROOT RIB FOR STABILATOR
1/16" PLYWOOD FORM
R5
WING ROOT AIRFOIL SECTION
WING TIP SECTION
R4
1/16" SHEET BALSA RIBS
SECTION A-A
BULKHEAD BRACE 'B' 3/32" PLY- MAKE ONE
THIS THICKNESS REPRESENTS FIBERGLASS COVERING ON POD
1/16" BALSA SHEETING- BOTH SIDES
R3
CUT L.E. FROM 1/8" SHEET BALSA
R2
HINGE LINE- FOR OPTIONAL RUDDER
KPS-14 SERVOS (RUDDER AND ELEVATOR)
SECTION B-B
ELEVATOR HORN- CUT FROM 1/16" FIBERGLASS BOARD
1/16" PLY
A
B
1/16" SHEET BRASS AILERON HORN
1/16" PLY ROOT TEMPLATE
FIBERGLASS BOOM (SEE TEXT)
1/8" DOWEL PUSH ROD
R1
C.G.
KPR-4A RECEIVER
SOLDER CLEVIS TO PUSH ROD
1/4" SHEET BALSA
R5
© RCM. ALL COMMERCIAL RIGHTS RESERVED.
RUDDER RIBS R2 TO R4 ARE CUT FROM 1/16" SHEET BALSA
R4
FUSELAGE POD IS MADE WITH A STYROFOAM PLUG. COAT WITH DEVCON 5 MINUTE EPOXY BEFORE GLASSING. DISSOLVE STYROFOAM (WHERE NECESSARY) WITH ACETONE.
PURANAS
KRAFT KB-4M (450 MA.) BATTERY PACK
THREE LAYERS OF 4 OZ. FIBERGLASS OVER POD
R3
3/16" SHEET BALSA
R2
R1
DRAWN BY MARK GUMPRECHT
INKED BY PAUL PLECAN
0 1 2 3 4 5 6