A Twelve-year-old Becomes National Soaring Champion /Jeff Mrlik

I got interested in RC Gliders through my dad. He built his first glider during the winter of '71-72. When spring came, I was busy with Little League baseball and only occasionally went with him, while he practiced. I wanted to learn to fly, but since my father was a novice with only one plane, I only flew a half dozen flights before the 1972 Nationals. My dad built his second plane for the '72 Nationals. It was a big one—a 14-foot original design. I went with him to the NATS. I really enjoyed the planes and the three-day contest, which was held at Miller Meadows in Chicago. Attending those Nationals really turned me on to RC gliders. After the Nationals, dad gave me his old plane, so I started practicing with him. I entered my first contest at Lancaster, Ohio, on October 8, 1972.

That winter ('72-'73) my dad and I started to plan for the 1973 Nationals. I wanted to try for a high placing in Junior, since I was impressed by the little Japanese boy who flew in the '72 Nationals. I asked dad what kind of plane I should fly, and he decided that he would build me an Astro-Jeff. It would be a rather large plane, using his balsa fuselage as a model from which to make a fiberglass mold and fuselage. He spent the whole winter building the first Astro-Jeff, making the mold, laying up the fuselage and building the plane. I painted the pilot and helped him whenever there was something I could handle. The plane was finished in time for the Toledo Conference, but he didn't win anything.

A couple weeks before the Toledo Conference, the club to which I belong (The Greater Detroit Soaring and Hiking Society) had its Annual Sno-Fli. I placed first in Junior and second over all, flying an Olympic.

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Date	Position	Entries	Location (Junior Placement)
10/8/72	6	23	Lancaster, Ohio
10/15/72	25	33	Salem, Ohio
1/21/73	6	15	Dansville, Michigan
2/18/73	2	32	Plymouth, Michigan (first Junior)
3/4/73	7	25	Plymouth, Michigan
4/1/73	9	17	Plymouth, Michigan
6/24/73	36	57	Benton Harbor, Michigan
6/30-7/1&73	19	30	Decatur, Illinois (first Junior)
7/8/73	16	66	*York, Pennsylvania (second Junior)
7/15/73	56	76	Dansville, Michigan
7/26/73	1	132	Lockport, Illinois (first Junior)
8/18/73	2	60	Warsaw, Indiana (first Junior)
8/19/73	1	65	Warsaw, Indiana (first Junior)
8/25/73	6	36	Syracuse, New York (first Junior)
8/26/73	9	54	*Syracuse, New York (first Junior)
9/23/73	5	52	Utica, Michigan
10/6/73	42	77	*Plymouth, Michigan (fourth Junior)
10/7/73	20	72	*Plymouth, Michigan (second Junior)
11/4/73	1	15	Plymouth, Michigan (first Junior)
12/2/73	19	25	Plymouth, Michigan
1/6/74	3	21	Plymouth, Michigan (first Junior)

*ECSS Contests (placed first in Junior and 14th over all)

Photos by Jerry Mrlik

ASTRO-JEFF

Grand Champion of the 1973 SOAR NATS, this soarer has set a standard of excellence for sailplanes. It's rated among the top RC glider designs of all times . / by Jerry Mrlik

Photos by Author

The Astro-Jeff is the result of an attempt to design an attractive looking, large RC sailplane which would have good thermal qualities, long range, good maneuverability, and a device to aid its pilot in making successful landings. Larger sailplanes seem to be scoring better and, as the soaring sport progresses, more fliers are using the big gliders to obtain the higher levels in LSF.

A great deal of thought and effort have gone into the design of the Astro-Jeff. Primary consideration was given to strength versus weight, and every attempt was made to optimize the usual design compromises.

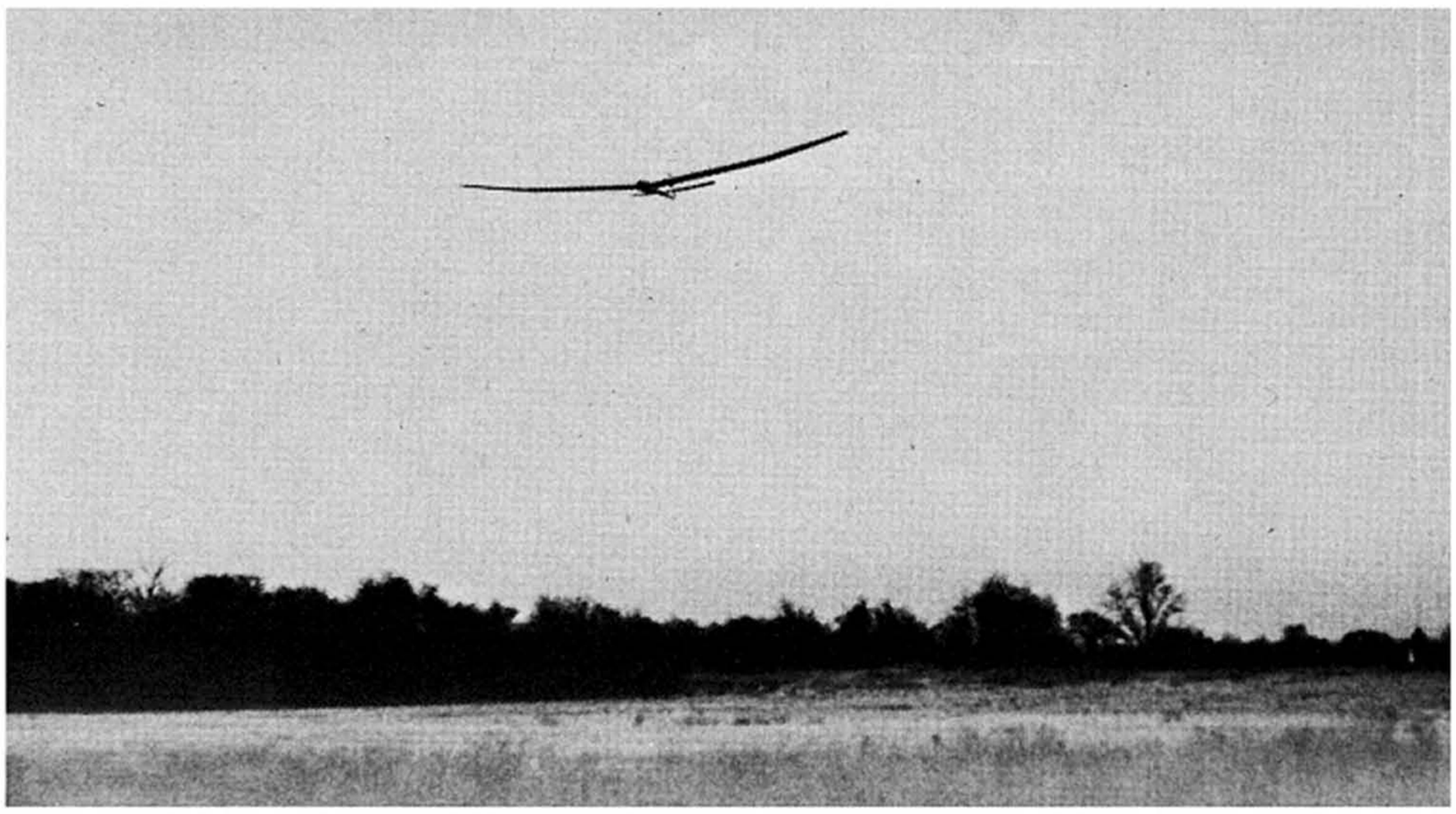
The biggest question was what to use for wing wires in a sailplane having close to 1400 sq. inches of wing area. Having witnessed numerous large sailplanes fold their wings on the tow, while using 125-lb. test line, I decided to design a wing system that would exceed the towline requirements. Making the necessary strength calculations, I decided on the 1/16 x 5/8" spring steel cross section. The advantages are several (greater strength with less weight): (A) The modulus of this section is the equivalent of using six pieces of 3/16" diameter music wire; (B) The weight savings are in ounces; (C) The spring steel blade, when used on edge, has the flexibility in the fore and aft direction equivalent to one piece of 3/32" diameter music wire.

I feel that item C is very important, since this flexibility reduces the chances of wing damage in a hard landing. The steel blade acts as a shock absorber. Using round diameter wires to take the towline forces means that the wing must be equally strong in all directions. The Astro-Jeff wing is designed to take the forces through the spars, then to the ply box which houses the nylon wing blade channel. This method requires no extra spars or ply ribs. The airfoil is a modified Cirrus section, flat bottomed.

The spoiler mechanism is simple, with no worry about linkage disconnection on a hard landing. No hook-up is required when assembling the wing. The spoilers are located on the wing outboard of the wing wash on the elevator, in order to prevent stab flutter.

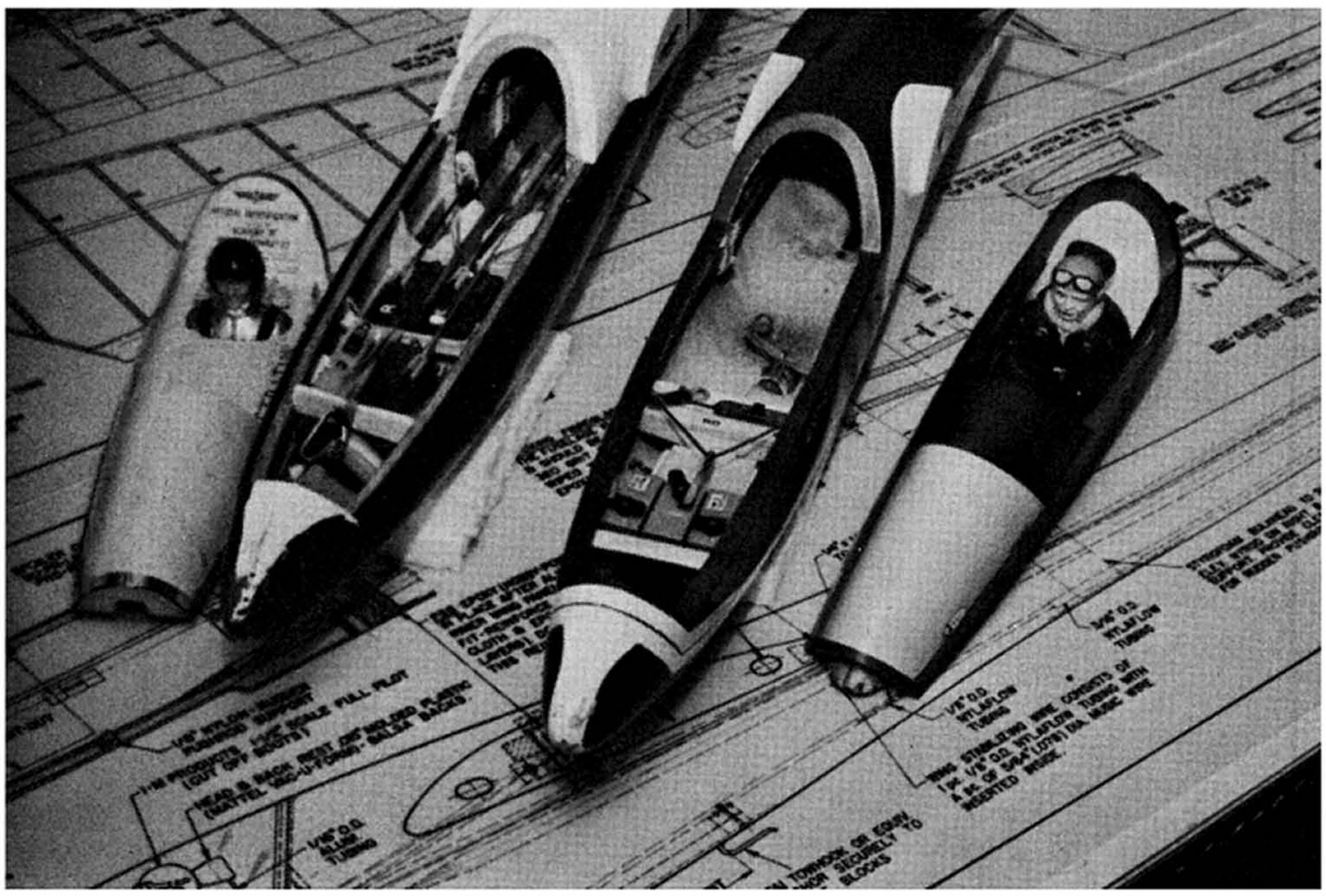
The rudder can easily be removed for transporting, adjusting or repairs. The canopy attachment is simple, positive and very reliable. All controls are internal, with no stress risers in the fuselage and, therefore, minimum drag. The scale pilot gives the sailplane a realistic appearance.

At Toledo '74, Jerry and Jeff Mrlik took a respectable third place in the Sailplane Category with the Astro-Jeff.

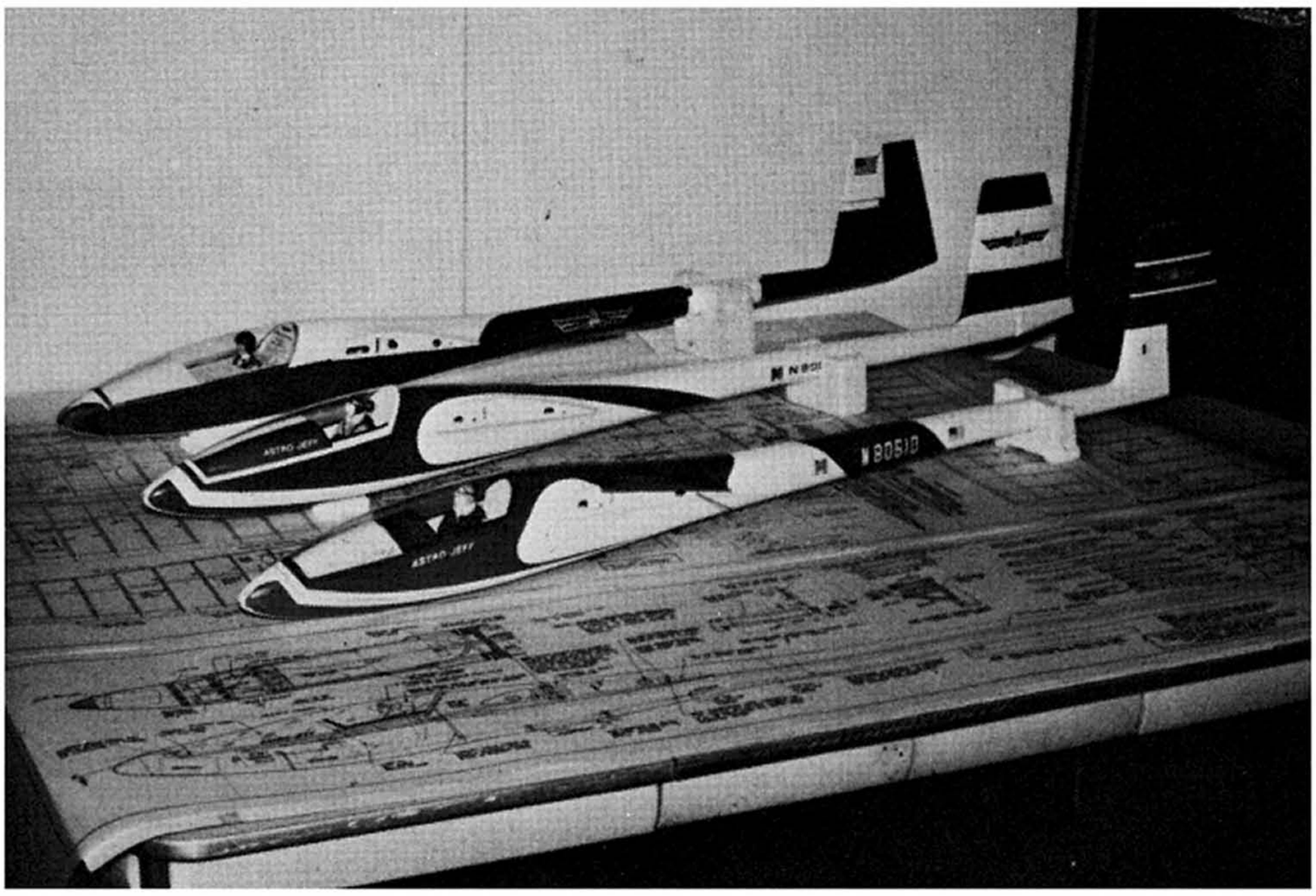


The Astro-Jeff is elegant in the air, floating on the lightest lift, yet solid in turbulence.

The radio compartment is spacious enough for any gear. The installation on the left uses a different method of spoiler actuation than the one shown on the plans. The spoiler linkage used in the Astro-Jeff is very simple to install and reliably accurate.



Three Astro-Jeff's on the author's workbench. Jeff's is in the foreground, Jerry's is next, and the balsa version is in the back.



The grades of balsa and plys indicated on the plans have been carefully selected, and should be followed explicitly. Carefully review the plans, and read all the notes.

The Astro-Jeff can be built with either a balsa or epoxy fuselage. The plans for either version are available from **AAM's** Plan Service. (See page 86.) The Astro-Jeff is available in semi-kit form for $48.00, plus shipping (check your local UPS office for the rate under 25 lb., and exceeding 84 inches combined length and girth), from Jeff's Models, 6730 Halyard Road, Birmingham, Michigan 48010. The semi-kit includes: (A) One assembled epoxy fiberglass fuselage; (B) One plastic canopy and dash; (C) Two spring steel wing strut blades (WSB); (D) Two nylon wing strut channels (WSC) with machined groove; (E) One fuselage strut box (FSB), machine grooved and assembled.

CONSTRUCTION

Fuselage: The epoxy fiberglass fuselage comes with both halves assembled. Sand interior areas for epoxying, per instructions on plan. Use Hobbypoxy No. 1 throughout, unless otherwise noted. Cut out the foam bulkhead, then epoxy the antenna Nylaflow tubing in the bulkhead, and provide clearance for the rudder pushrod and a hole for the elevator Nyrod. Epoxy the bulkhead to fuselage. Fit and epoxy the 1/4 x 1/4" spruce and 1/8" ply reinforcements. Cut out a slot for the towhook, and epoxy the maple towhook mounting blocks. Add the 1/8" Sig Lite-Ply support for the elevator Nyrod on the centerline of the fuselage. Trim the rear of the fuselage (per section H-H) and fit FRP. Epoxy the ply reinforcements, as shown in section A-A, making sure that the right side is longer than the left, and leave space for FRP. Place the VFJ jig in place, and fit 4F. Epoxy 3F, 4F and FRP in place. Drill out hinges for 1/32" hinge wire (RHP) and epoxy each in place.

After fabricating ECHP, drill a 1/8" hole for ECHP, making sure the hole is in proper alignment (check by inserting a 1/8" tube and slighting from front). Install ECHP and mark the location of the 2-56 screw. Drill and tap for same. Fabricate ECH, and slot out the front hole in the vertical fin to match ECH.

Using the plan for templates, cut out two 1/8" ply root ribs. Clamp together and drill location of the two screw eyes with a 1/16" drill. (These will be used as dowel holes and to locate the remainder of the holes to the fuselage.) Drill the other holes (1/8" and 3/16") and cut out the 1/16 x 5/8" slot for the steel wing blade. Make this a close fit, so that proper alignment can be maintained. Mark the ribs left/right and place on the fuselage. Line up the bottom front edge and transfer the two 1/16" holes. Insert pieces of 1/16" wire (dowels) to hold and locate the ribs to the fuselage. Drill the 1/8" and 3/16" holes. Drill 1/16" holes at the top and bottom of the 1/16 x 5/8" slot. Remove the ribs, mark the opening for FSB (use 1/16" holes for reference) and cut out. Do the other side and insert FSB through the fuse-

A double wing securing system is necessary, so that the spoiler linkage will remain in equilibrium. Any amount of gap between the wing and fuse would delay spoiler actuation, thus causing an aileron effect in flight.

Spoilers deployed, the Astro-Jeff becomes a real target drone, capable of zeroing in on the landing spot.

lage. (Note: The four center round-head screws can be removed and replaced. After alignment, trim the width of FSB to fit the fuselage width.)

Place root ribs on the dowels in the fuselage and insert WSB through the ply rib and into FSB. Support the fuselage by placing blocks under WSB (both sides), and check alignment of the fuselage from the front to be sure that the fin is vertical. Tack-glue FSB to the fuselage with epoxy. Do not epoxy the ply ribs to the fuselage. When dry, remove blades, dowels and ribs.

Drill a 3/16" hole in the 1/2 x 3/4 x 5/8" pine block and locate it to the fuselage (use 3/16" tubing to check squareness). Tack-glue in place with epoxy. When dry, epoxy the pine block and FSB, using fiberglass cloth, as shown on plan. If eight- or ten-oz. cloth is not available, use several layers of lighter cloth to obtain the equivalent. Do not skimp on this reinforcement—use plenty of Hobbypoxy No. 2. Remember to rough up surface of FSB to insure good adhesion of epoxy.

Cut out the slots for the wing rubber bands, add the spoiler Pro-rods, and canopy hold-down block. Complete the radio installations at this time. The Kraft installation is shown and can be used as a guide. There is lots of room left, even for a thermal sniffer.

Rudder: Cut out the ribs, using templates. Pin ribs to plan, glue on the top spar, LE, top TE and cap strips. When all glue joints are set, remove from plan and cut off the tabs from the ribs. Glue in the bottom spar, TE webbing and spar webbing. Sand a bevel on the rear TE and glue in place. Next, glue in the gussets and cap strips. Sand the end faces and add balsa blocks. Shape blocks per plan. Locate hinge positions and epoxy in place. Drill the hinges and block, and secure by epoxying in toothpicks. Epoxy the balsa fillers and control horn. Assemble rudder, using RHP, and determine cap rib thickness between the fuselage and rudder. Remove the rudder, add the cap strips and sand completely.

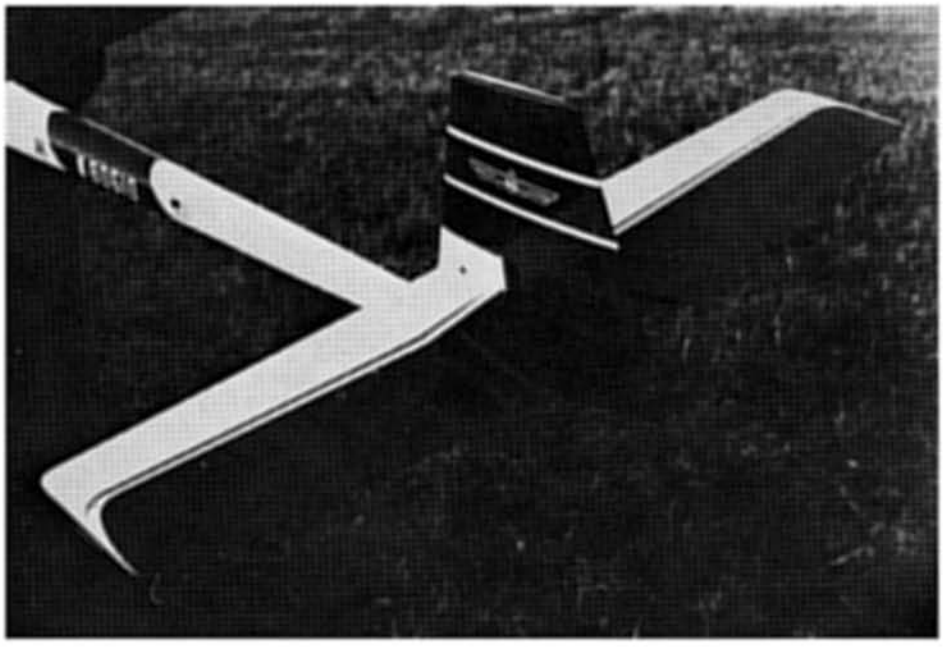
Elevator: Cut out the two aluminum templates 4E and 10E. Stack 14 pieces of balsa, clamp together with screws, and shape ribs. Use the plan templates to cut out ply ribs 1, 2, and 3 (make two of each). Stack pairs of ribs and drill 1/8" holes for the brass tubes, making sure that this dimension is the same as ECH. Make sure that there are tabs on all ribs for building purposes. Pin the spruce spar to the plan and glue all ribs. (Don't forget to tilt the root rib for dihedral.) Glue TE, LE, top spar and cap strips. When dry, remove from plan and remove tabs from the ribs. Glue the TE and TE webbing, after sanding bevel on the 1/16 x 3/16" TE and cap strips. Plug the tube ends and epoxy in place. Glue on balsa ribs and balsa tip blocks. Contour the balsa rib to the vertical fin and sand completely.

Center Wing Section: Make aluminum templates for all balsa wing ribs (seven templates required). Cut balsa for stacking, with appropriate template ribs 1BF through 11BF, 1BR through 11BR, 12B through 22B, and 23B through 37B. (Note: 22B and 23B are identical templates, except for spar width, so cut accordingly.) Assemble stacks, drill holes and bolt together with long screws, or fabricate screws using bicycle spokes. Both right and left ribs can be cut together. If both right and left ribs are cut together, mark alternate ribs R and L when disassembling stack to maintain a consistent taper. Add 3/16" holes to ribs 1BF through 8BF for spoiler Pro-rod (5/16" from bottom of rib, other dimensions on plan).

Fabricate the spar box as follows: Glue VWR to top and bottom spars. (Glue VWM and five pieces of 1/8 x 3/8" Sig Lite-Ply braces, fitted to length. Determine thickness of RN by stacking FN and WSC. The total thickness of these, when subtracted from the 3/8" spar, is the thickness of RN (nylon sheet has a .03 tolerance, and this variation is made up with RN).

Rough up the top, bottom and rear of WSC (nylon) for better adhesion. Epoxy RN to VWR (between spars), and WSC to RN (Hobbypoxy 1 or 2). Coat WSB (steel blade) with light oil, or silicone film, and place in WSC (oil film will prevent epoxying WSB in place). Epoxy FN to WSC and spars. Glue or epoxy VWF to FN and spars. Place this assembly in position on sheeting, with root rib in place to insure proper alignment, and clamp the entire assembly (do not glue root rib to sheeting). Slide WSB to insure slip fit. Make sure VWR/VWF match spars, and check ribs 1BF through 11BF for correct height

The tailfeathers of this bird are well-proportioned. That large rudder makes for solid response.



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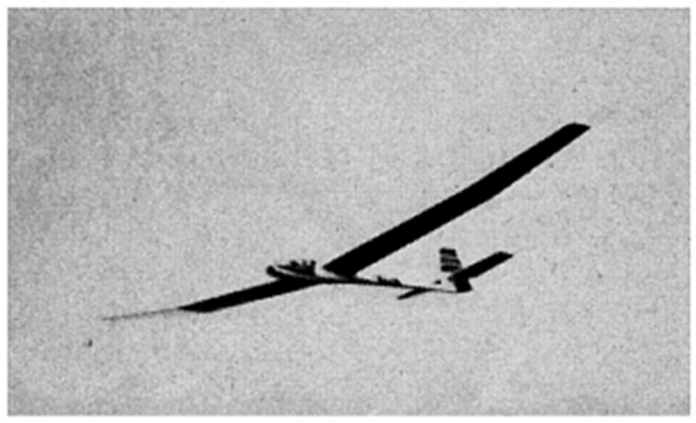
ASTRO-JEFF

(Continued from page 22)



with spar box. Let the above assembly dry thoroughly, then wrap with nylon thread, per plan.

Pin down and glue bottom sheeting, cap strips and stringers. Sand spar box assembly square at the root rib and glue to bottom sheeting. Glue on the false leading edge. Notch the ribs to accept the stringers and glue ribs 1 through 11, front and rear, along with 12B. Cut a strip from 1/8" hard balsa 18¼" long for horizontal webbing (check height between spars on ribs 12 and 21 for dimensions). Cut these pieces with excess length, and glue webbing and ribs 12 to 21B in place. Glue in PB1, PB2, and PB3. Cut 22B to fit and tilt, per plan. Add TE webbing (grain is horizontal), gussets and top stringers. Slide WSB into the spar box and glue in the root rib. Add spoiler linkage and Pro-rod. The inner portion of the Pro-rod should be cut off to a known dimension, at the root rib, for reference. Use the plan as a guide. When making SW (spoiler wire), be sure that there is enough clearance in the Ace Swing-in-Keeper to provide a swiveling effect with the keeper. If using 1/16 wire, drill keeper with a No. 50 (.070) drill. Glue in the screw eye and tubing reinforcements, and epoxy the 5/32" OD brass tubing.

Sand a bevel on the underside of the top rear TE and glue. Frame the spoiler opening with balsa, per plan. Shape the top of the front false LE, and glue all top sheeting and cap strips.

Spoiler Construction: Cut ply to fit opening, with 1/32" clearance on back and two sides. Lay out holes per plan, stack ply top to top, clamp to board and drill holes. Use Hobbypoxy 1 for gluing spars, while they are clamped to a rigid surface. I recommend a combination square ruler. Epoxy in place ribs S1, S2, linkage lever rib and spring return rib. Clamp ribs with clothes pins. The spoiler has the curvature of the wing, so place the spoiler ribs (per plan) for right and left, to avoid interference with balsa ribs. Insert 1/8" ID brass eyelet and crimp over in the linkage lever, as shown in enlarged view S. Fit spoiler in wing opening, and notch balsa ribs to miss spoiler spars.

Outer Wing Section: Pin bottom sheeting and TE to plan. Glue cap strips and bottom spar in place. Mark completed inner wing panel for the 36" polyhedral point, as shown on plan. Block up 3¼" at this point, and glue PB1, PB2 and PB3 to spar and bottoming sheeting, making sure to bend PB1 as shown. Glue in false LE and ribs. Place washout shim at TE, glue in top spar, and three thicknesses of vertical spar, and three thicknesses of vertical webbing. Also glue in the TE horizontal webbing and gussets. Sand the top of the false LE, and glue on the top sheeting, TE (bevel underside of TE) and cap strips. Sand LE and glue on the hard balsa LE. Sand the wing tip and glue on the tip blocks. Shape the LE and sand the complete wing. Use MonoKote or equivalent for spoiler hinge.

Make SS (spoiler swivel) and file a screw, so that the screw clamps SW, but has clearance for the brass eyelet. Add spring and adjust.

Balsa Fuselage Construction: Begin by cutting out all bulkheads B1 through B12, using templates as shown on plans. Using 1/8" Sig Lite-Ply, except B7, which is 1/4" ply. Bulkheads B3, B4 and B5 include shaded portion for initial build-up on the jig. Mark a vertical centerline on the bulkheads, and drill out the two holes for attaching to its corresponding jig piece (see charts for dimensions). Make jig from any grade commercial plywood, making sure that the vertical members J1 through J8 are 5/8" wide. Mark the vertical and horizontal centerlines in the J pieces, and lay out the top hole (see chart for dimensions).

Drill a clearance hole, and assemble the bulkhead with bolt and nut, lining up the two matching vertical centerlines. Tighten the bolt, clamp bulkhead to jig piece and drill bottom clearance hole (using bulkhead as a jig). Repeat procedure for all eight bulkheads and jig pieces. Disassemble bulkheads. Mark jig base with fuselage centerline. Glue and nail jig together, making sure that the jig is square and that the centerlines are aligned. Use plan for spacing J1 through J8, making sure that the angle of J7 is maintained. This bulkhead sets up the incidence in the wing. Let the jig dry.

Cut the 3/4" triangular longerons with a razor saw in two directions (perpendicular to its length, as shown on plan) so that it will bend to the contour. Make right and left longerons. Splice and glue the 3/8", 1/2" and 3/4" triangular longerons, leaving the front long (trim it later). Leave the right rear bottom longer for the angle at the rear. Cut out B22-L, B22-R, B13 and RTG (gauge). Glue B22-L and B22-R to its 3/8" triangular stock (the bottom is flush). Trim the 3/8" and 1/2" triangular stock to accept B12, B13 and RTG. Glue B10, B11 and B12 to the plan view, and tack-glue RTG. Cut out B15 and glue B13 (with B15) to B22-R and B22-L.

Place jig on plan view, lining up centerline. Anchor it to the building board. Assemble bulkheads B1 through B8 to jig, with screws and nuts. Glue in the 3/16 x 3/16" front stringers. Cut out and glue B19 in place, and glue 3/8" triangular stock at the front. Make aluminum clamps and epoxy FSB to B7. Clamp should be inside the outer edge of B7 by at least 1/8", leaving room for RB1. Check alignment by inserting WSB.

Place jig blocks at the rear of the fuselage and at B10 (see side view for dimensions). Glue the bottom assembled longerons to B7 and B8 (hold in place with rubber bands) and place on the two jig blocks. Glue the top, right and left longerons (trim like the bottom ones) to B13, B12, B11 and B10 (clamp around with rubber bands). Glue B9 and clamp. So far, the triangular stock should be flush with the bulkheads on all sides. Continue gluing and clamping the triangular stock to the bulkheads, while fitting it at B1. Trim the inside edge, per section B1. Cut out and glue B17. Glue 3/16 x 3/8" spruce to B8. Glue 1/32" sheet filler in front of B22-R/B22-L, and sand to plan taper when dry. Do not remove from jig.

Cut out, add taper and glue S1-L/S1-R (the taper goes outside) to B1 through B8 and the 3/4" longerons. Cut out, add taper and glue S4-L/S4-R to B17, B6, B7, B8 and the top 3/4" longerons.

Add the elevator Nyrod, fitting it at the rear and through B13. This is a good time to think about the antenna too. You can epoxy a 3/16" OD Nylaflow tubing the full antenna length, while putting the actual antenna inside a 1/8 OD Nylaflow tubing. Tie a knot in the antenna wire end and slip this through the other tubing.

Cut out S2-L/S2-R, the two pieces of S5, S3-L/S3-R and the two pieces of S6 per template shown and glue to jigged fuselage in the sequence noted above. Cut out RB1s along with the wing root ribs, as shown on plan sheet two. Drill corresponding holes, while stacking these four pieces to insure proper alignment. Cut out, drill hole and epoxy the 1/2 x 3/4 x 5/8" pine block used for the spoiler, as shown on plan sheet one. Fill in the space between S6 and RB1 with 1/8" balsa sheet, fit and glue.

Sand the rear of the fuselage. Remove RTG, cut out B14 and glue. Glue the four pieces of 1/16" ply to B22-L/B22-R and B14. Drill a 1/8" hole for ECHP (see section K-K). Fabricate ECHP and assemble. Mark hole location and drill and tap for 2-56 screw. Cut out and glue B16 and LE of fin.

Saw the upper end of J1 to J8 and remove the top of the jig. Remove all screws holding the bulkheads to the jig. Remove fuselage by lifting vertically.

Cut a piece of 1/4 x 1/2" to the required length for anchoring your towhook. Add blind nuts and glue block to B6/B7.

Cut out SB1, ST1, SB2, ST2, SB3, and ST3 per plan template, and glue to fuselage in sequence noted above. Glue in the 1/4" gusset and 1/16" sheet on vertical fin. Add extra 1/16" sheet at the base of the fin for a fillet (see section H-H).

Fill in space between S3-L/R and RB1 with 1/8" balsa sheet, fit and glue. Glue balsa blocks in the space at the front and rear of RB1 and the fuselage. Glue 1/8" balsa on the top side of nose. Sand the canopy opening and glue B21, B20 and B18. Drill hole in B1/B20 and epoxy tubing in place. Hollow out the pine nose block (can be made in two

pieces and glued) and shape to outline of B1 section prior to gluing.

Get a big basket and start shaving. I used a small X-acto razor plane and very course sandpaper block, while keeping an eye on the various sections B1 through B12. You can see the different sheets and triangular stock change with the eye. It is really fun now. For the fillets, use sandpaper on a dowel. The larger the dowel, the larger the fillet.

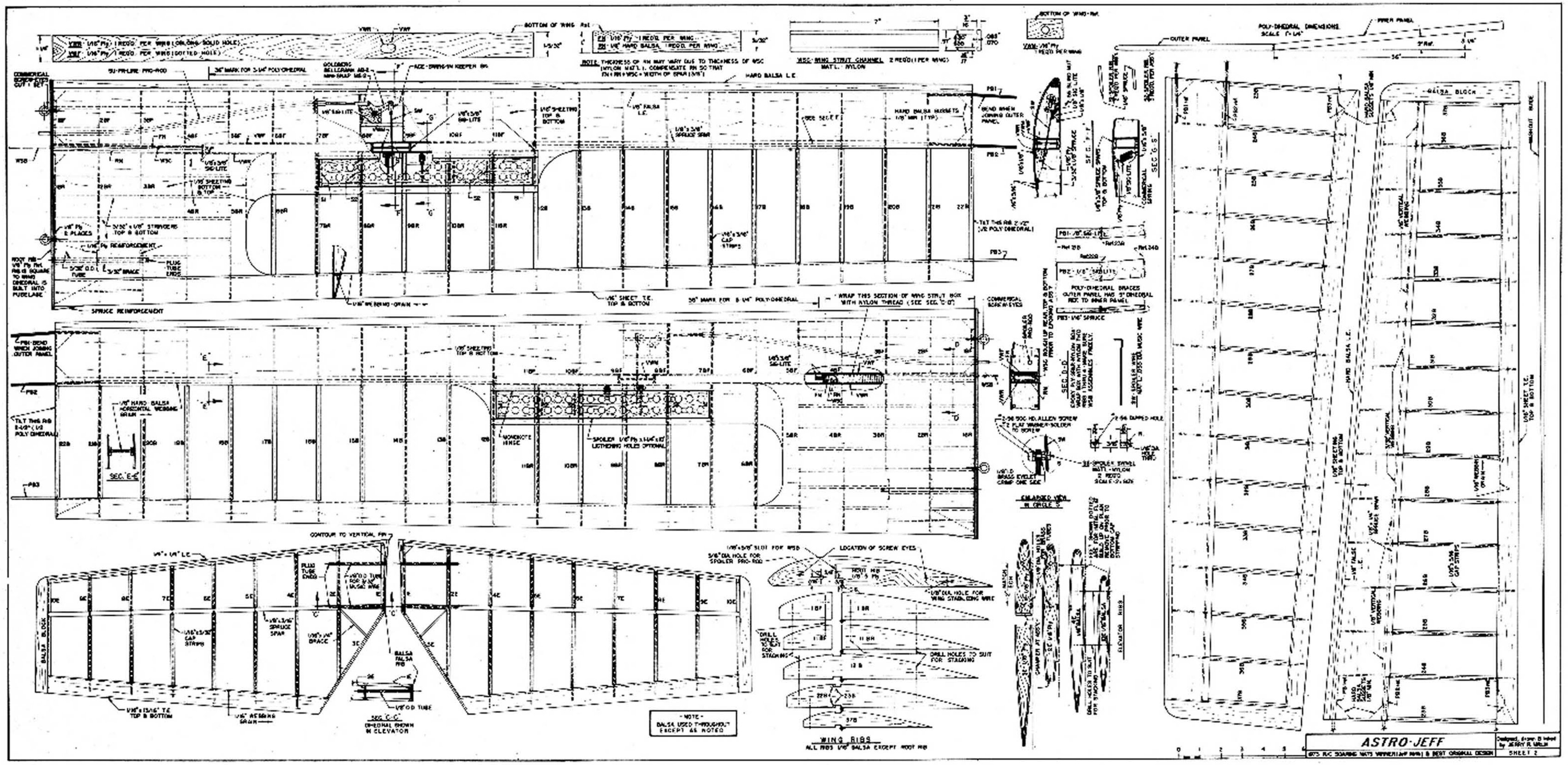
Cut out the towhook opening and fiberglass with Hobbypoxy 1 or 2 and three-oz. cloth. Remove shaded area from B3, B4 and B5 by sawing. Make canopy, radio installation, and pushrods and you're ready to apply the finish. I'll leave the rest to your preference.

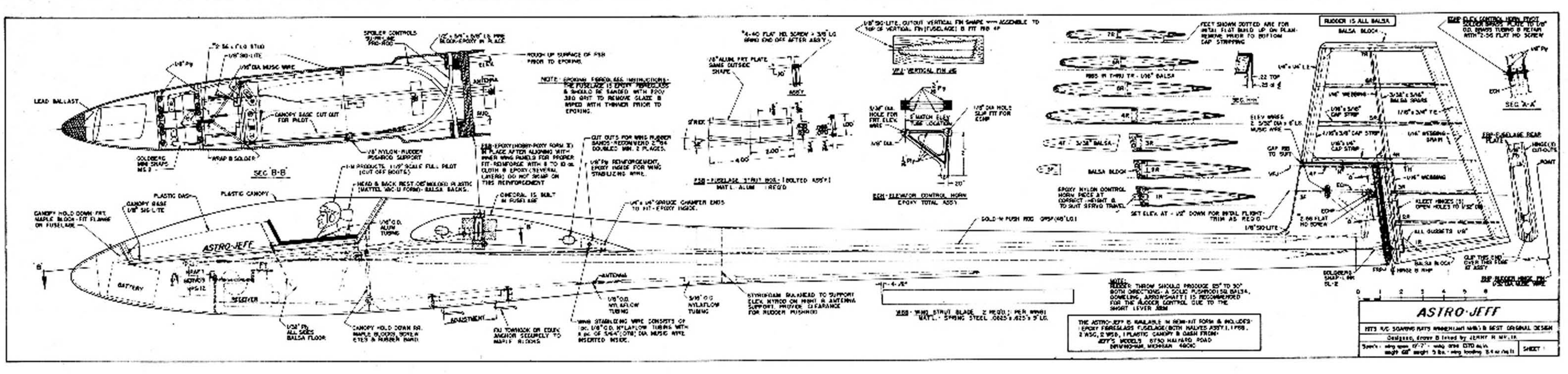
Finish: The finishing method used was MonoKote on all flying surfaces, and the fiberglass fuselage was painted with Ditzler Acyrlic Lacquer.

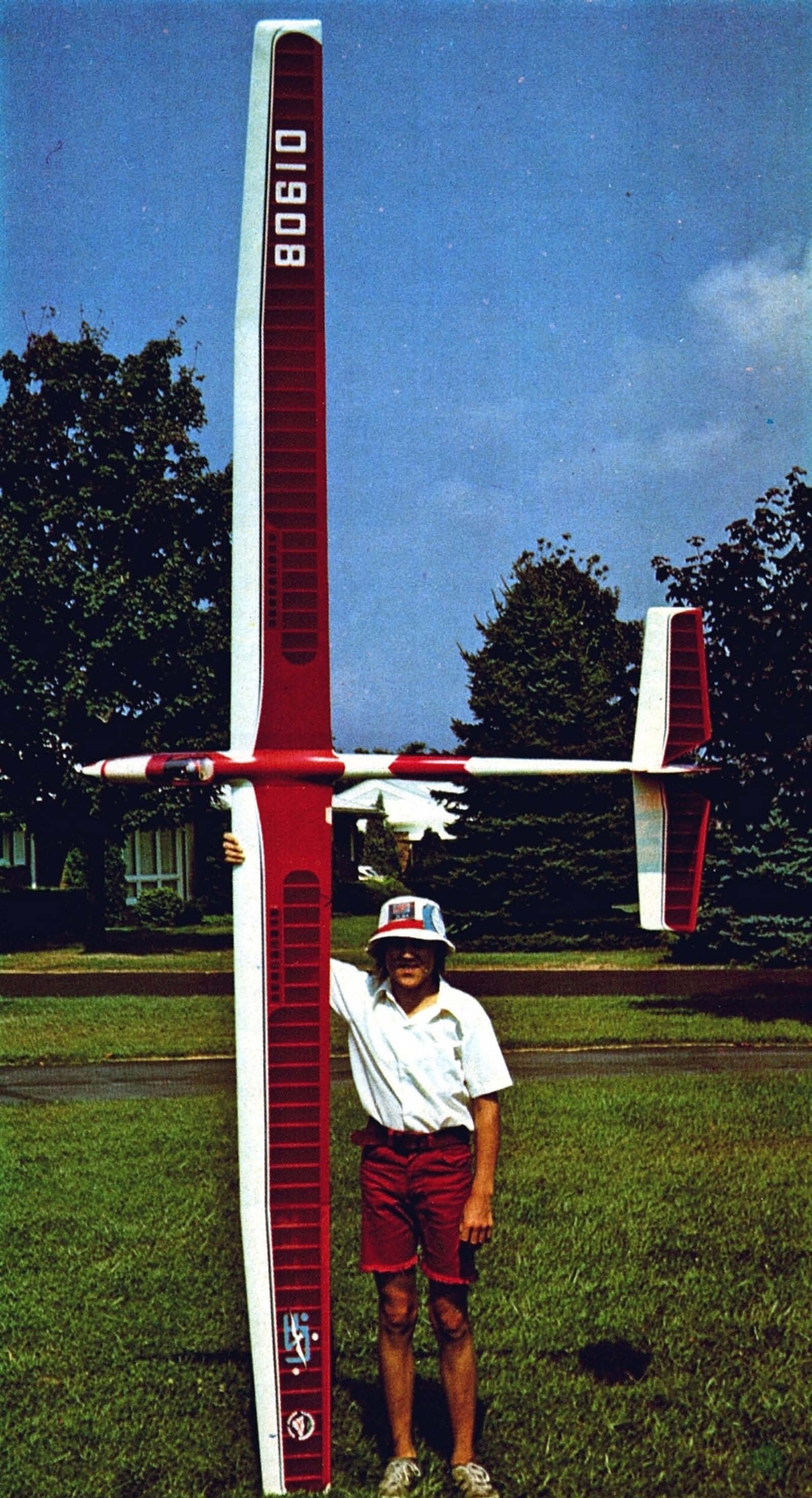
FLYING

Before you go to the field, check all surfaces for warps, and assemble the rudder, stabs and wings. Check all controls for proper function and make sure that the linkages are not sloppy. Add nose weight until the model balances at the CG shown. Make sure that you have 1½° down elevator when the transmitter is at neutral and the trim is centered. Place the towhook approximately 3/4" forward of the CG.

Disassemble the model, pack up and head for the field. Before flying, range check the equipment again. You have made a new installation, so don't rush it—make sure to try your controls again! Oh yes, do you have the frequency pin? If there is a slight breeze, don't use a hi-start for the first flight, since you have not optimized the towhook position. If you have a strong arm, give it a strong throw and check it out. When you're satisfied, hook it up to the winch line, point the nose up about 30°, tighten the line and keep standing on the winch to obtain sufficient height before pulsing the winch and release. Get the model to fly level hands-off and see what it's doing by checking right and left turns. Smooth out the turns and you're on your way. Make long approaches on the initial landings, until you get the feel of it. Make several flights, moving the towhook back to a comfortable towing position. The Astro-Jeff will really tow up, so work at it. I would recommend that when you're ready to try the spoilers, you don't start at a low altitude. Instead, start up 25 to 30 feet, then put the spoilers up slowly and be ready to apply up elevator. Play with coordinating the spoiler with up elevator, and the spots will come with practice. If you have any questions or comments, contact me through AAM.


ASTRO·JEFF
WING RIBS
ALL RIBS 1/16" BALSA EXCEPT WOOT RIB
- NOTE -
BALSA USED THROUGHOUT EXCEPT AS NOTED
POLY-DIHEDRAL BRACES
OUTER PANEL HAS 5° DIHEDRAL
HARD BALSA L.E.
BALSA BLOCK
SPRUCE REINFORCEMENT
SEC. E-E
SEC. C-C
SEC. D-D
SEC. G-G


ASTRO·JEFF
SEC B-B
SEC A-A
RUDDER IS ALL BALSA
FUSELAGE STRUT MOUNT - (BOLTED ASSY)
ELEVATOR CONTROL HORN
VERTICAL FIN ASS'Y
WING STRUT BLADE - 2 REQ'D. PER WING
THE ASTRO-JEFF IS AVAILABLE IN ARF-KIT FORM & INCLUDES:
EPOXY FIBERGLASS FUSELAGE/BOTH HALVES ASSY'D. 1 PRE.
2 WSG. 2 PRS.
1 PLASTIC CANOPY & DECAL FRONT
JEFF'S MODELS 8750 HAYARD ROAD
DEARBORN, MICHIGAN 48126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