ISOBAR

A CLASSIC LOOKING SPORT FLIER FOR A GEARED 05 ELECTRIC.

By Norm Weis

It seems that most electric kits are of powered gliders or converted gas model designs. The few that have been designed lately, especially for electric power, are either variations of scale, or boxcar ugly. Every electric kit, it seemed, was designed ignoring the inherent advantages & limitations of battery power.

Observing the flight of my friends' kit built electrics, and a couple of my own, I formulated a few ideas that might increase performance and most certainly improve the appearance.

An electric, with its short run time, could benefit from a great glide ratio, and the ability to ride a thermal. A wing with an undercambered airfoil would do both, provided the weight was reasonably low, and wing area substantial. The airframe plus radio should weigh less than the motor and battery. The wing loading should be less than 11 oz./sq. ft. for an extended time fun-flier.

The design should take advantage of the relatively heavy battery, placing it well below the Center of Gravity. This calls for a deep fuselage, or a pylon mounted wing. With such a placement, dihedral could be greatly reduced, and if a bit of a sweep back is added, perhaps the dihedral could be eliminated.

With these thoughts, I proceeded to sketch out some cabin and pylon designs. I liked Lonzo's idea of growing the pylon out of the sharp edge of a diamond cross sectioned fuselage, but disliked the awkward shape for installing innards.

Why not a triangular cross section? Let the pylon flow out of the apex, and the gear take the spreading angle downward? A three over four battery pack, with its somewhat triangular shape, would slip right in. Top it with a no dihedral wing, with a bit of sweep back to ensure stability in both yaw and roll. The low C.G. would handle pitch stability.

I refined the sketch, and ran a 3-view. The front view looked like an isosceles triangle topped with a Hershey bar -- and she named herself "Isobar."

Isobar is built around the new Master Airscrew power unit consisting of spinner, folding prop, gearbox, and electric motor of approximately 05 rating. the unit is built for 6-cell operation, but will probably handle 7-cells for a somewhat shorter life. The motor has enclosed brushes (a can motor), but at the price it sells for, it is no big financial problem to replace the entire motor when the brushes go.

The 800 mAh Sanyo pack was chosen, along with the lightweight Futaba FPT-4NBL radio with (B.E.C.) speed control built-in. The receiver, which uses

ISOBAR

Designed By:
Norm Weis
TYPE AIRCRAFT
Sport Electric
WINGSPAN
58 Inches
WING CHORD
10¼" Center Panel, 8¼" Tip Panel
(Swept Back)
TOTAL WING AREA
570 Sq. In.
WING LOCATION
Pylon Mount
AIRFOIL
Undercambered
WING PLANFORM
Swept Back Outer Panels
DIHEDRAL, EACH TIP
0", 1", or 2"
OVERALL FUSELAGE LENGTH
37½ Inches
RADIO COMPARTMENT SIZE
Adequate For Small Equipment
STABILIZER SPAN
23"
STABILIZER CHORD (incl. elev.)
7"
STABILIZER AREA
161 Sq. In.
STAB AIRFOIL SECTION
Flat Bottom, Lifting Airfoil
STABILIZER LOCATION
On Top of Fuselage
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (incl. rud.)
6 Inches (Avg.)
POWER
Master Airscrew 05 Geared Motor
2.5 to 1, with Folding Prop
STATIC THRUST
24 Ozs. with 7 Cells
BATTERY
Sanyo 3 on 3 or 3 on 4
6 or 7 Cell 800 mAh
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Rud., Elev., Throt.

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Ply
Wing	Balsa, Spruce, Basswood, & Ply
Empennage	Balsa
Wt. Ready To Fly	41 Ozs. (2 Lbs. 9 Ozs.)
Wing Loading	10.5 Oz./Sq. Ft.

power from the motor pack, two lightweight S-133 servos (at .6 ozs.) are standard with this radio.

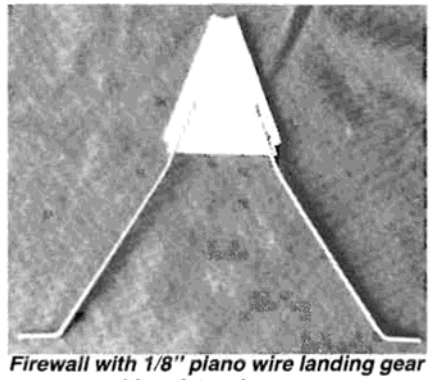
CONSTRUCTION

Fuselage:

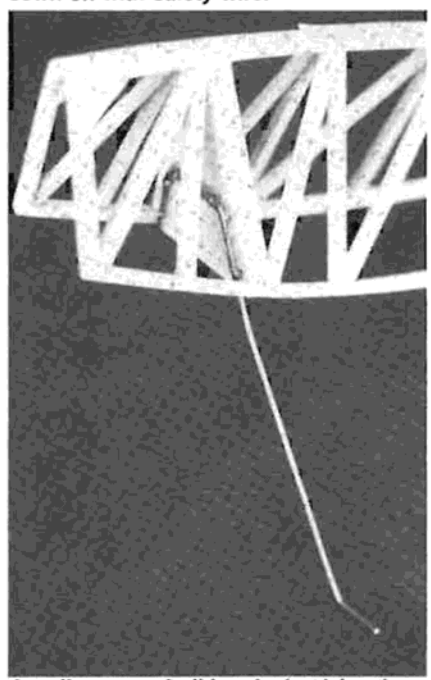
The triangular style requires stout longerons to withstand rounding, and still hold up during hand launching. The 1/4" sq. balsa sticks will also yield a proper stabilizer platform when laid side by side.

If the longerons are reluctant to take the curve, soak them for an hour in water, then pin them to the curve. You can go right on building, since CA glue is water reactant.

Note the front "vertical" members are not parallel, or truly vertical. The left side has its front member slanted back at the bottom, and the right side has its front

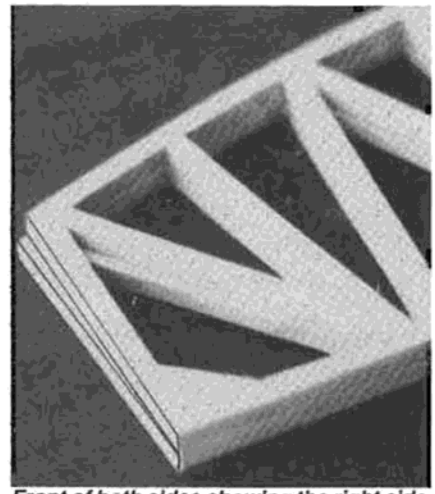


Firewall with 1/8" piano wire landing gear sewn on with safety wire.

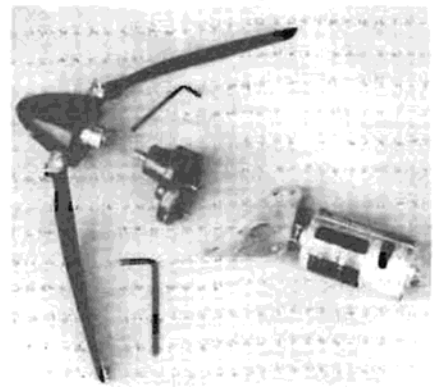


Landing gear bulkhead glued in place, setting the angle of the fuselage sides.

member slanted back even more. This will result in some down and right thrust, reducing attitude changes due to variations



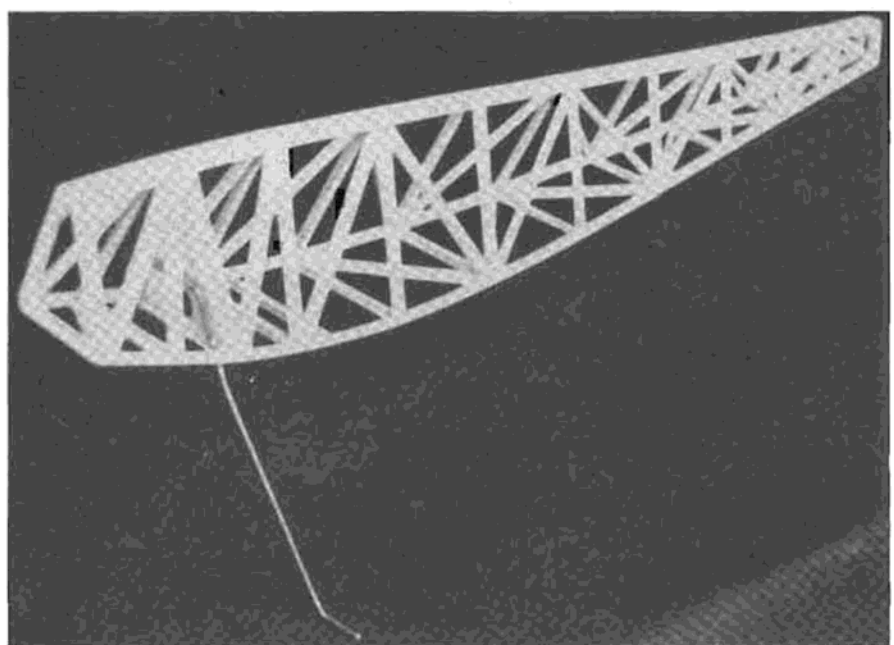
Front of both sides showing the right side somewhat shorter at the bottom longeron, resulting in down and right thrust.



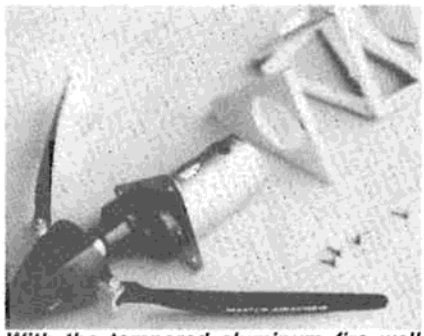
Master Airscrew, power plant, and author's motor mount in exploded view.

in power settings.

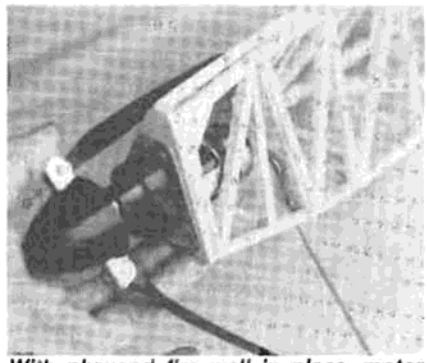
Block sand both sides of both fuselage sides, then sand a slight bevel to give a glue surface along the insides of the top longerons -- the "backbone." Run a long piece of masking tape along the backbone. This will act as a hinge while the landing



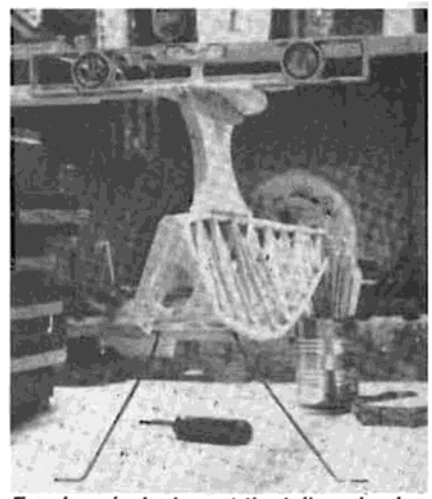
The rear cross brace was installed first, pinching in the sides. All other cross bars and diagonals are cut to fit.



With the tempered aluminum fire wall motor mount sandwiched between gearbox and motor, the assembly is ready for installation.



With plywood fire wall in place, motor assembly can be slid in place to mark screw hole locations.



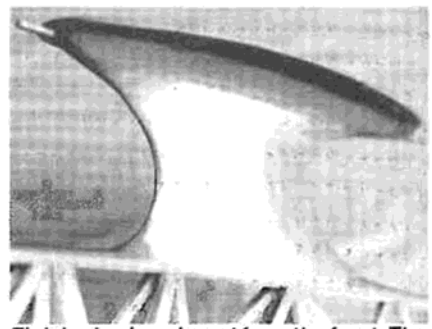
Fuselage jacked up at the tail, and pylon leveled, ready for epoxy.

gear bulkhead is installed, setting the angle for the main portion of the fuselage. Of course, the gear wire should be bent to shape and "sewed" onto the bulkhead with aircraft safety wire or stout thread. In either case, the "sewing" should be epoxy coated. After the cooling holes are drilled in the gear bulkhead, it is ready to be epoxied in place. If you wish to use Trexler "air wheels," make the axle portions of the gear longer to fit the wide hubs.

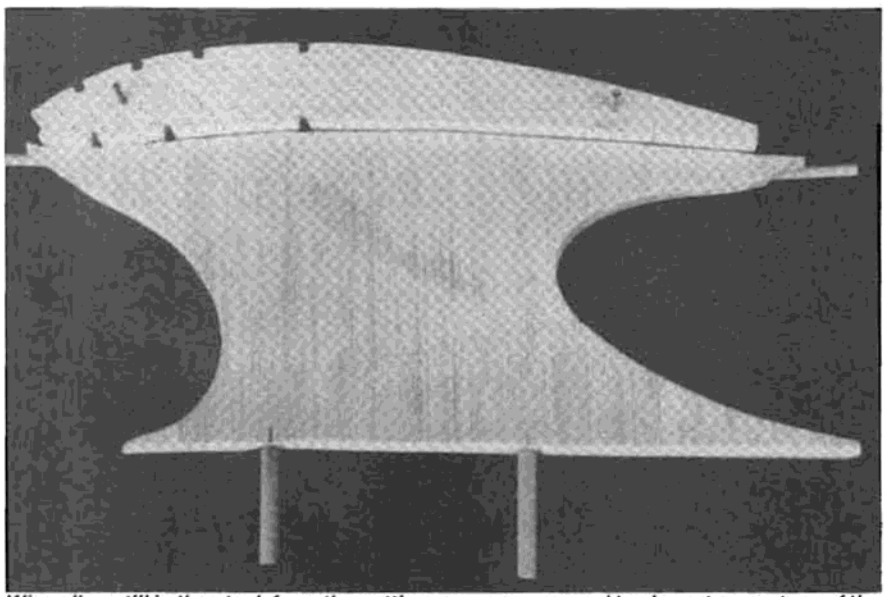
Once the epoxy has hardened, the bottom longerons at the tail can be squeezed together for a 1" overall width, and the rear crosspiece glued in place.

Next, with the fuselage upside down and the masking tape still secure, add some CA along the backbone, and sprinkle in a bit of soda. Foul odors are generated in the process -- better have a fan going -- but the resulting soda-CA fillet is exceptionally strong. Add more CA and soda until the glue fillet is about the size of a kitchen match. *(Editor's Note: Best to use odorless CA glue such as Satellite City's Hot Stuff UFO.)*

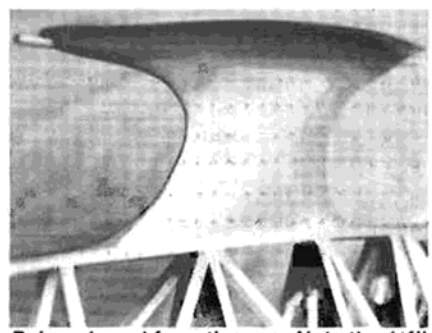
By now you are probably tired of sprinkling soda by hand. An ear irrigating syringe is handy for soda application. Just suck up some soda, and spray on the joint. With some practice, you can achieve a fine soda mist, or a solid shot. The fine spray



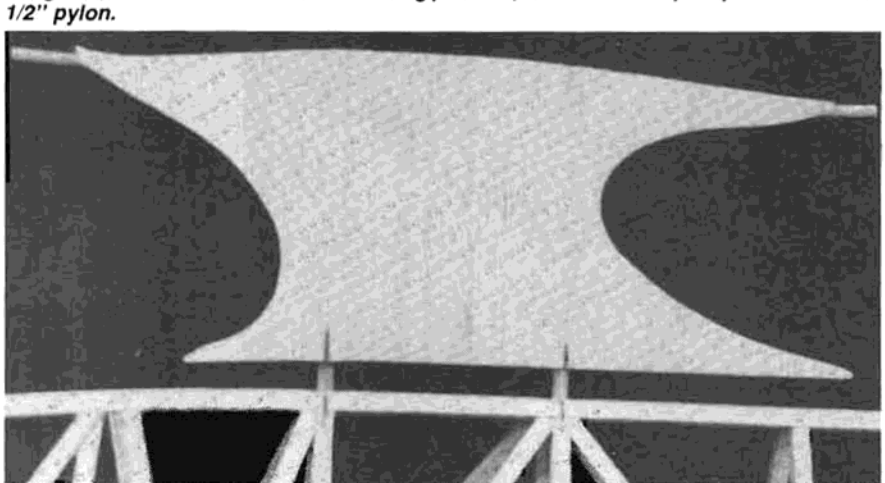
Finished pylon viewed from the front. The fuselage top extending to the nose will be curved downward later on to let cowl blend in with spinner.



Wing ribs, still in the stack from the cutting process, are used to shape top contour of the 1/2" pylon.

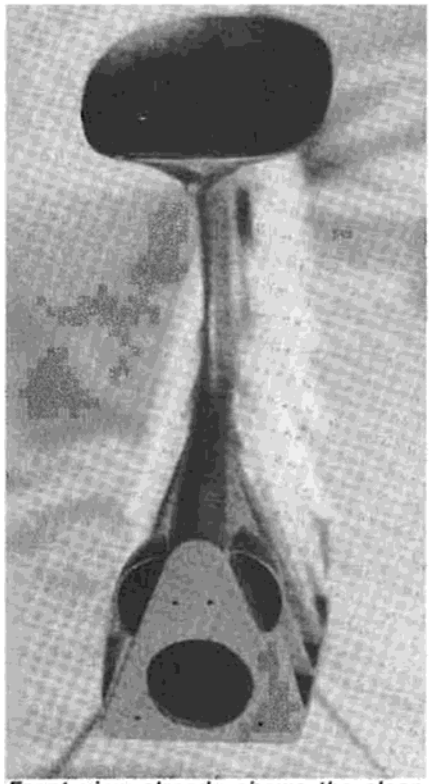


Pylon viewed from the rear. Note the 1/4" balsa wedges at bottoms of 1/4" birch dowels.



The 1/4" dowels attached to the pylon are slid into holes cut in the fuselage backbone.

1/64" ply and plastic spoons used to make airscoop seen at top left, and also shown installed on front of fuselage.



Front view already shows the clean aerodynamic lines of Isobar.

will instantly freeze a balky joint.

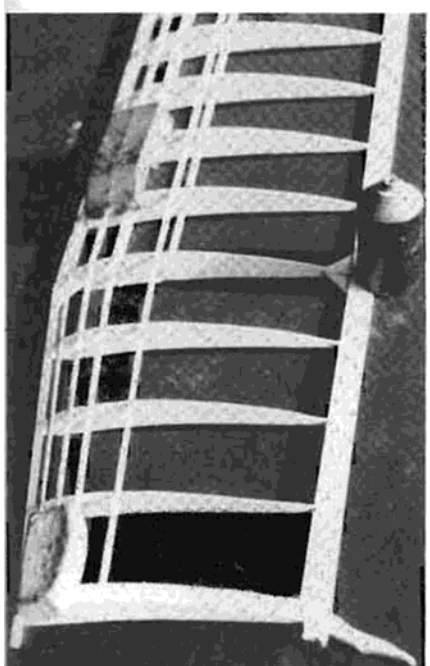
The tape can now be removed, the excess soda brushed away, and the bottom crosspieces and diagonals installed. Omit the bottom diagonals in the bays on either side of the gear bulkhead, and the two bays aft. The last open bay will be the cooling air exit and finger access area to check battery temperature. It will also give access to the servos for elevator and rudder adjustment.

Although a template for the 3/16" fire wall is shown on the plans, it's easier to hold the plywood to the previously block sanded front of the fuselage, then draw the fire wall outline direct, freehanding a nice rounded top. Epoxy in place.

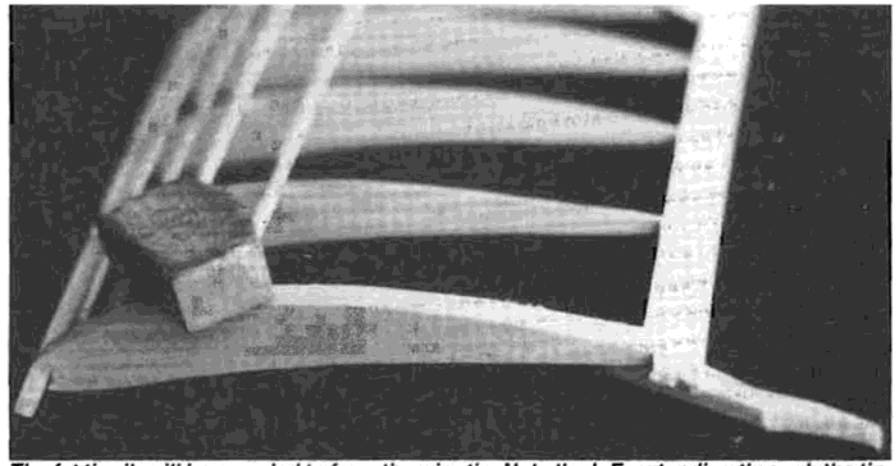
Cut the 1-7/16" diameter motor hole for the Master Airscrew unit. Should a different motor be installed, one with external brushes, you will have to add "keyhole" extensions to the motor hole. At our elevation of 5400 feet, the Master Airscrew 2.5 to 1 unit provides 24 ozs. of static thrust, enough to make a 41 oz. airplane a very lively climber. A geared Astro Cobalt 05 at 28 oz. thrust, also at 5400 feet, will do more but also weighs more.

If you plan to use a heavier motor, or a larger or longer battery pack, consider moving the pylon aft 1/2" to 3/4".

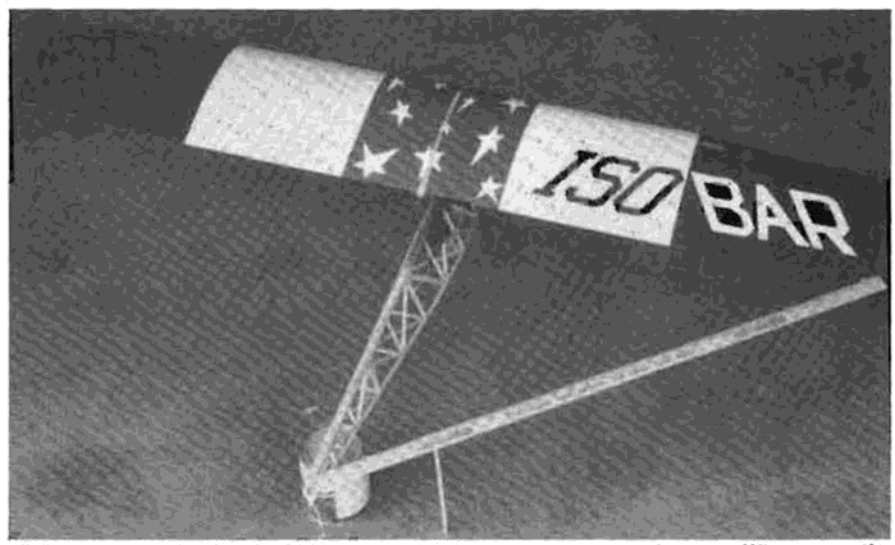
A very simple motor mount can be cut from a piece of .020" to .032" thick tempered aluminum, 7075 T-6, or similar.



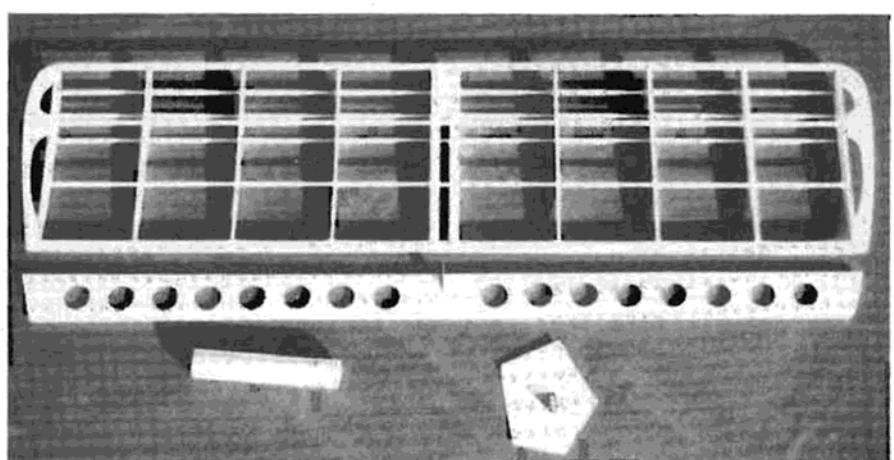
Washout is placed in the wingtip sections by shimming the T.E. of end rib 1/4" and weighting all other surfaces while spars and turbulators are installed.



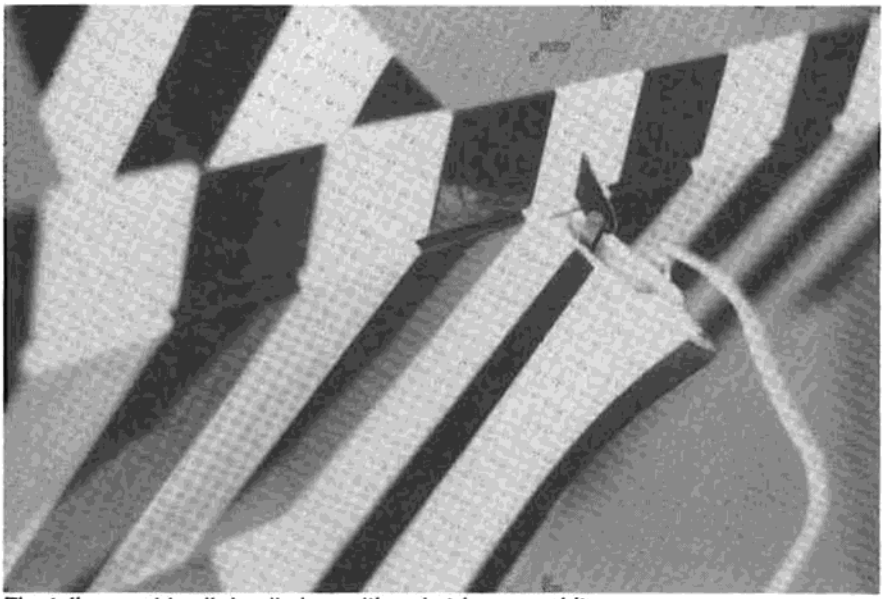
The fat tip rib will be rounded to form the wingtip. Note the L.E. extending through the tip rib.



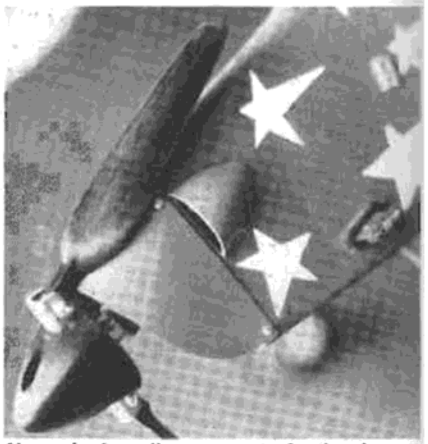
Finished wing is lightly rubber banded to pylon for squaring up. When exactly perpendicular, wing is pressed down to cause wing locator studs to indent the pylon platform.



Finished stab and elevator with hole cutting tube and spare micarta control horn.



The tail assembly all doodled up with red stripes on white.



Nose design allows prop to feather in any position.

Flag Blue. What a comfort it is to build electric. You are free to use any paint you like, fuelproof or not.

There are no removable hatches on the plane. With iron-on film, it's easy to remove a panel or two, accomplish the repair, and replace the skin. The fuselage is externally mounted, reducing the possible causes for surgery.

Temporarily install motor and try the cowl piece for a smooth line from pylon to spinner. Adjust the down curve of the fuselage to accomplish the continuity.

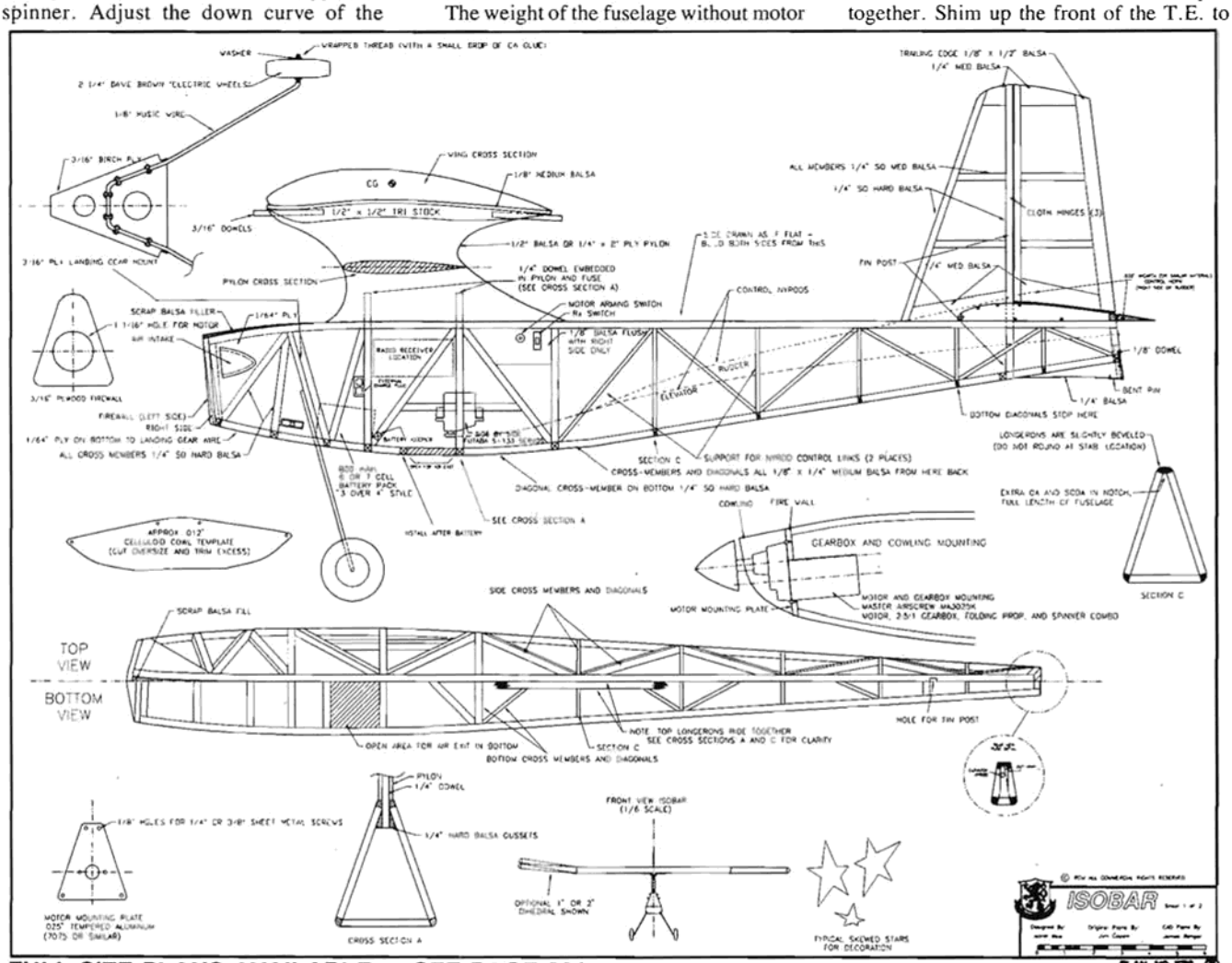
Smooth all surfaces with fine grit, and feather all ply edges. A fingernail file is used to sand the area around the gear legs. Use filler and sandable primer to get a smooth finish on the nose, air scoops, and pylon. Paint those areas not to be covered with film. Tape over the axles, and spray paint the gear legs while you are at it -- there is no reason that bare wire has to look like bare wire.

The weight of the fuselage without motor or wheels, is now 6½-7 ozs.

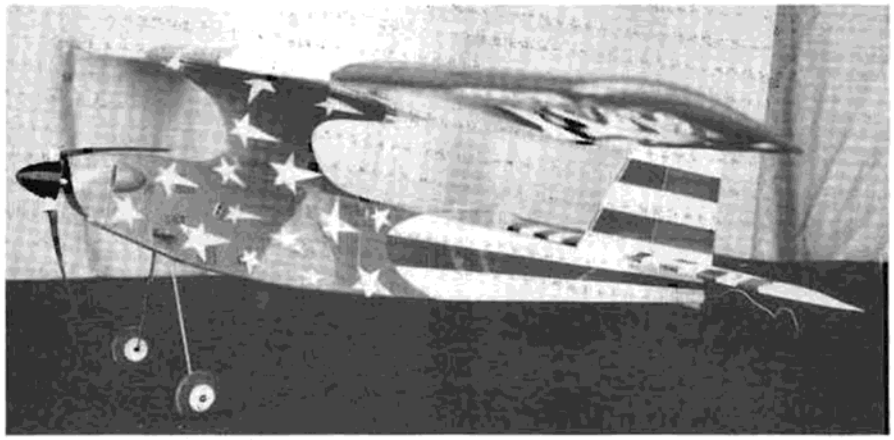
Wing:

The 13 main ribs are already cut, leaving only the tip ribs, which can be cut in pairs from hard balsa. You may wish to notch the smaller 1/16'' ribs after the wing is laid up. No matter how good the plans, precut notches seem to wander out of line. The two thick end ribs can be cut from scrap 1/2'' soft balsa, or two layers of 1/4''. This rib should be notched on a slant for the L.E., and notched about 1/8'' deep for the 1/8'' sq. turbulators and spars.

Notch one of the T.E. strips 1/8'' deep to accept the ribs. Use a saw with the proper width of cut. I use two hacksaw blades taped together. Shim up the front of the T.E. to



FULL SIZE PLANS AVAILABLE — SEE PAGE 201



match the curve of the rib, using scraps of 1/16" balsa at each rib site. Better keep wax paper between shim and T.E. Set L.E. in place and set ribs, pushing each one up against the L.E., then pushing tail end of rib down into T.E. slot. Small drops of glue will hold things until the entire wing structure is complete, then each joint can be given another touch of CA.

Treat the right and left tapered sections in the same manner, but do not glue butt joints of L.E. and T.E., since we will want to set the washout first.

You have a small choice at this point on the treatment of the tapered sections. The top of the wing can be a straight line, or some dihedral can be added. The "flat" wing will give a distinctive look to the plane, but will result in a "neutral" roll condition, requiring some added attention while flying. The dihedral version will yield positive roll stability, "hands-off" flying, and increased rudder sensitivity.

For the flat wing, hold center section flat against the table, and prop up T.E. of wingtip 1", and L.E. of tip 3/4". For the dihedral version, prop T.E. 2" and L.E. 1¾".

While in this position, glue the T.E. and L.E. where the tapered section meets the center section, then proceed to install top surface 1/8" sq. spruce and hard balsa to the center section.

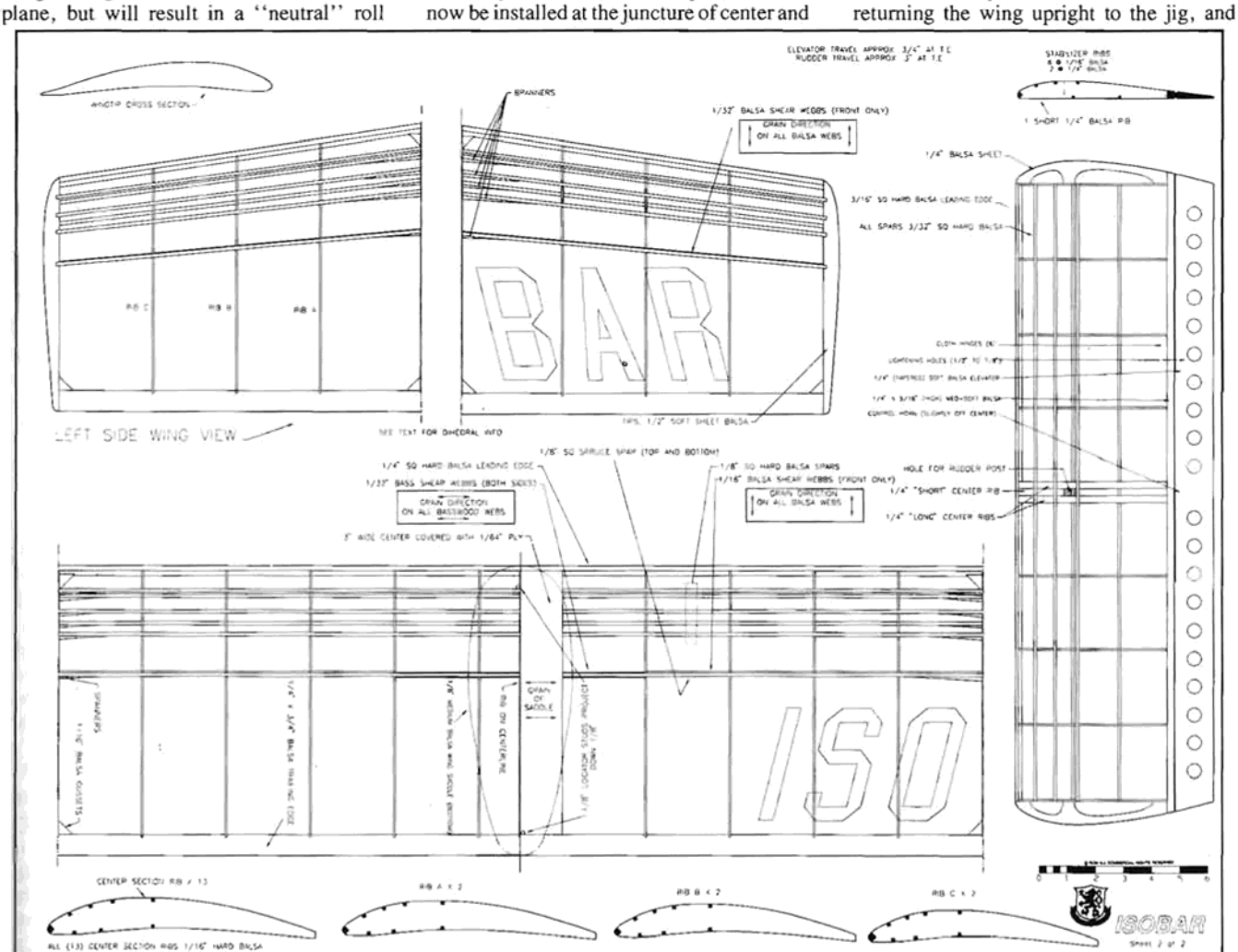
If you have not notched the tip ribs yet, lay on the 1/8" sq. member, and mark and cut notches to fit.

The spar and turbulator "spanners" can now be installed at the juncture of center and tapered sections. Also glue in the right angle gussets at this point and at rear of tips.

When dry, invert and friction fit the bottom 1/8" sq. members a few at a time, returning the wing upright to the jig, and

ISOBAR MATERIALS LIST

10 — 1/4" sq. x 36" med. balsa
3 — 1/4" x 1/8" x 36" med. balsa
1 — 1/8" dia. x 20" piano wire
2 — T.E. 1/4" x 3/4" x 36" med. balsa
4 — 1/16" x 3" x 36" balsa, 3 hard, 1 med.
1 — 1/32" x 3" x 36" med. balsa
1 — 1/32" x 3" x 9" basswood
1 — 1/8" x 3" x 36" med. balsa
2 — 1/4" x 3" x 36" med. balsa
8 — 1/8" sq. x 36" spruce
6 — 1/8" sq. x 36" hard balsa
5 — 3/32" sq. x 36" hard balsa
1 — 3/16" sq. x 36" med. balsa
1 — 1/2" x 36" triangular med. balsa
1 — 12" x 12" x 1/64" plywood
1 — 6" x 6" x 3/16" birch plywood
1 — 2½" x 8" lightweight plastic or celluloid sheet (.010" to .020")
1 — 1/4" x 12" birch dowel
1 — 3/16" x 12" birch dowel
9 — fabric hinges
2 — NyRods
1 — bottle CA glue
3 — rolls covering film, 1 red, 1 white, 1 blue
1 — pair 2¼" Dave Brown "Electric" wheels
1 — 3-channel radio
1 — Master Airscrew 2.5 to 1 power unit
1 — 6 or 7-cell Sanyo 800 mAh battery pack, 3 on 3 or 3 on 4
1 — 3" x 3" .020" to .032" tempered aluminum sheet, 7075 or similar



FULL SIZE PLANS AVAILABLE — SEE PAGE 201

gluing from the top. When finished, glue the spanners on the bottom members. Since the tips are of minimal area, the spanners will do the job of dihedral braces quite nicely. The wing is rigid enough now to forget the jigging and move on to the spar webbing.

The 9" center portion will be fitted on both sides with 1/32" basswood, with grain running horizontally. Saw the three center ribs just in front of the spars, using a saw with a 1/32" width of cut. Slide one basswood brace in place and epoxy, using clothespins to hold while setting. When hard, saw the back side of the three ribs, and repeat the process. All other webbing is 1/16" or 1/32" balsa installed with the grain **vertical**. CA glue is fine for gluing the balsa webbing.

Cover the bottom center portion of the wing with a 3¼" x 10" piece of 1/64" ply. Cut 1/8" holes for the locator studs (use scrap 1/8" sq. spruce). Glue in place, then cover the top with an equal piece of 1/64" ply. Let the studs extend about 3/16" below wing. Sand the entire wing, especially the 1/64" ply at leading and trailing edges. Make the L.E. nice and round as a sharp L.E. does little and can steal a lot of lift. The bare bones wing should weigh 5 ozs. or less.

If you opt for the red, white, and blue motif, lay on the white over the four bays from the L.E. break extending inward. Then lay on the red and blue, making the blue 10½" wide. Shrink tight, then cut out the Isobar letters from contrasting colors of the same covering film, and iron on, puncturing any bubbles with a pin as you go. Do the same for the skewed (crooked) stars, placing them at random. The completed wing should weigh between 6-7½ ozs., depending on the covering material used.

Make a small mark at the exact center of the wing at L.E. and T.E., then place the wing on the pylon and use a rubber band to hold it. Later you will fly with four or five rubber bands. Adjust the wing so that it is centered and measures the same from each wingtip to tail, then press down to dent the pylon platform. Remove wing and drill the dents about 1/4" deep. Add a bit of CA to harden the hole.

Empennage:

The main rear spar of the stab is an odd 1/4" x 5/16" size. Cut this and the 1⅜" x 23" elevator from the piece reserved earlier. Also cut from 1/4" stock, the two full, and one half center ribs. You can gang saw these three, and the eight 1/16" stab ribs, notching this time for 3/32" turbulators and "spars." Assembly is straightforward with 1/4" tips lying flat on the construction board.

Plane or spoke shave the 1⅜" x 23" 1/4" plank elevator until the T.E. is about 1/16" thick. Bevel the L.E. slightly. If the width shrinks to 1¼" in the process of forming -- don't worry -- the original model had a 1" elevator and flew satisfactorily. Cut the lightening holes, using a sharpened piece of 1/2" to 3/4" diameter aluminum or copper tubing. Sharpen by cutting away material from the **inside** of the tubing, using a sharp scalpel. Sharpening the outside will cause wedging and splitting of the elevator. Do not try to drill the holes with an ordinary drill bit, unless the work is sandwiched between solid keepers. Bore the holes by hand, with pressure and some rotation, with the work backed by solid soft wood. Plan the holes so that you leave some solid wood at the center and the tips.

In order to save weight and simplify construction, I've lately been making my own control horns from some .035" micarta, a reinforced resin plastic commonly used in industry since WWII. Any thin, strong sheet material will do, even some of the aluminum used for the engine mount. Slot the control surface and score the control horn where it meets the wood, by coarse sanding or by drilling 1/16" holes. Drill the two or three clevis holes in the horn, making sure the holes are straight off the hinge line, then epoxy in place. I've never had one fail.

Use a razor saw to cut slots for fabric style hinges. Forces on the control surfaces are quite light, permitting one to cut hinges in half, and use pieces 1/2" x 3/4" at each location, including rudder. The NyRods selected should be the lightest available, approximately .175" o.d. on the carrier tube. A 3/16" dowel can be used to locate routes, since it has the same diameter.

Sand all surfaces of stab, elevator, fin, and rudder with fine grit. Cover with white film. Razor out some 1½" wide red stripes and doodle up the tail a bit.

Final Assembly:

If you have used the Master Airscrew propulsion unit (prop, spinner, gearbox, and motor) the Futaba with speed control and 133 servos, and battery according to the plans, the C.G. will come out very close. Otherwise, mockup the plane with all items, NyRods, and covered wing, stab, fin, and rudder. Pin and tape all items in place, then determine where the servos and receiver must go. The battery may have to be relocated. Have the plane in proper flight position, with the bottom of the stab level when checking C.G.

If in doubt, go for a slight nose heavy condition. Flight when tail heavy is too hard on the nervous system. Besides, a 1/4 oz. weight added to the tail would be much better than an ounce added to the nose.

The charge plug should tap off the main battery and extend through the fuselage side. Also, the fuselage holder is external for easy replacement. Avoid as many connectors as possible, using crimp or solder joints in order to keep resistance to a minimum.

A thrust test will tell you the efficiency of your system. Attach a 0 to 64 ounce spring scale with string to the tail assembly and let the plane, under power, take a tail level attitude. The spring balance should read at about 22 ozs. with 6-cell and 24 ozs. with 7-cell.

Once all internal items are installed, cover the fuselage with white to the rear of pylon, add red stripes, and then apply the blue and the stars. Note how the star sides form straight lines. The same film used for covering is easily used to add all stripes and stars.

If you are going for top performance at the expense of a fancy "paint job," cover with micafilm. The weight savings will be approximately 3 ozs.

The fin and stab should be attached with epoxy. First prop up the tail to flight position, then add a generous amount of glue to stab platform and underside of the fin. Of course you have removed covering film where stab meets fuselage. Pin in place, check to be sure everything is square, then carefully view from front and rear for proper alignment.

When attaching the wheels, first add any brass tubing shims to the wheel axle holes if the fit is too sloppy, then coat the inside surfaces with vaseline or light grease. This will prevent CA from sneaking in and freezing the wheel. Now slide a small washer onto the axle, then the wheel, and another washer. Scuff up the outside 1/4" of the axle with a file, then wrap thread outside of both washers. Move the wheel sideways a bit to get clearance, check for free wheeling, and add a tiny bit of CA to each thread. When dry, add a bit more, checking for free wheeling. If you are into touch and go flying, you might enjoy a pair of 2½" Trexler® "air" wheels. When trimmed properly you can achieve "hands-off" take-offs and landings.

The elevators should travel up and down 3/4" from center, and the rudder, 1½" each side of center. The final weight should be between 40-42 ozs., and with a wing area of 3.96 ft.^{2}, results in a wing loading of 10.5 oz./ft.^{2}.

I like to felt pen my name, address, and specification on the underside of the wing, then cover with clear tape. Things like weight, wing loading, and thrust are items, fellow fliers are often asking about a new design.

If you want an absolutely wild machine, drop in a geared Cobalt 05 FAI with a 12 x 6 wood prop. With 34 oz. thrust, she'll go very nearly vertical. We have one in the works.

The 7-cell powered Master Airscrew Isobar turned out to be as lively as expected. With its minimum weight and low frontal area, the tail pops up immediately, and in 15 feet she is off, even in a no wind situation. She climbs at 20°-25°, and mushes with little fall off on a wing if you overdo it. Power off stalls are straight ahead when

entered from a slight angle of attack. Stalled at a 30° climb attitude, there is a momentary wing drop and immediate recovery. She will not spin, taking a wide spiral instead. In level flight, power settings make little difference in pitch or yaw. Responses to all controls are normal. Banking on turns is normal for a rudder only aircraft. Roll stability is adequate, but once a turn is established, it tends to stay in the turn rather than right itself, as a plane with lots of dihedral would.

The plane can be mushed into a landing with nearly full back stick. A somewhat faster approach, and you can grease it in for a perfect ten.

We fly at an elevation of 5400'. The performance at sea level would be noticeably greater.

Put against a Playboy or a Bomber, the Isobar is livelier in the climb, about equal on the thermal, and much more distinctive in appearance.

Nothing matches the head-on view of a pylon mounted no dihedral wing and triangular fuselage. Isobar is a pleasant marriage of the old and the new, with a unique look, and outstanding performance.

□