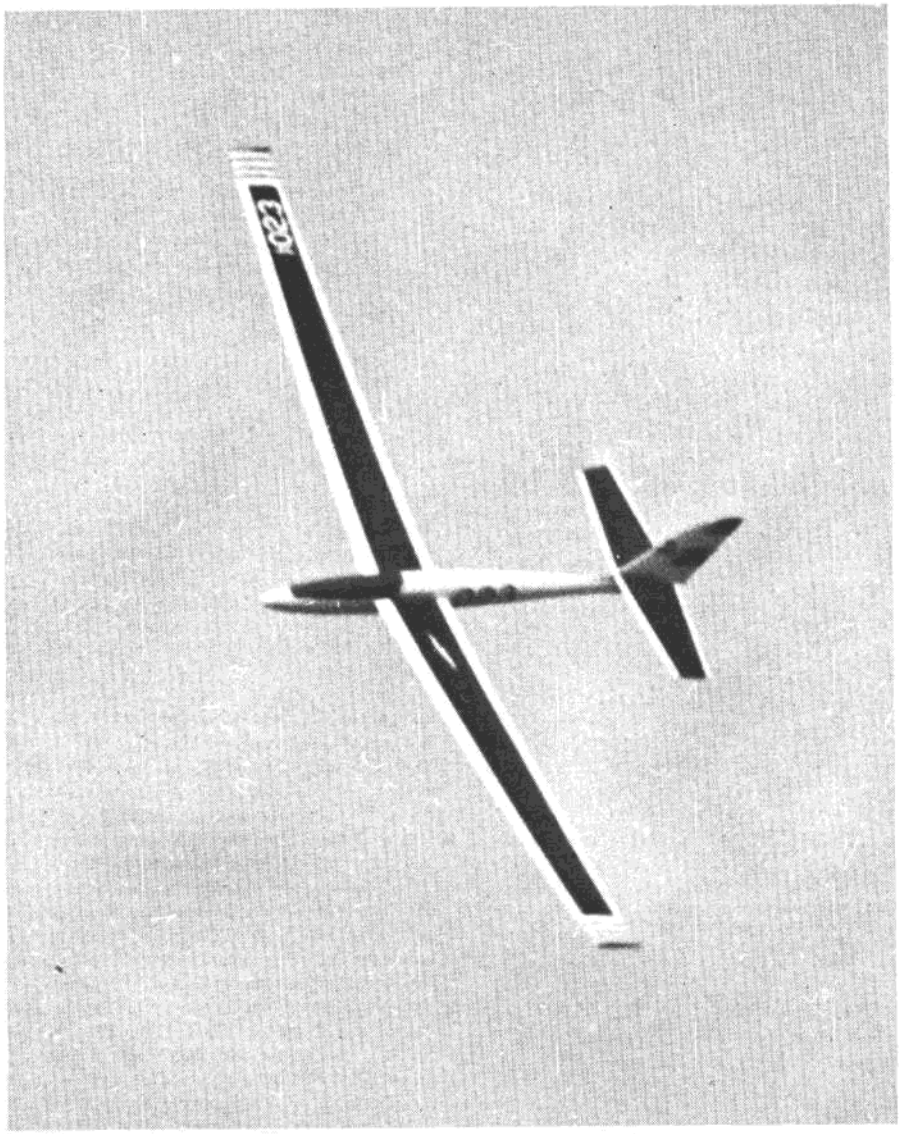
Hi-Pro

All-purpose thermal or slope soarer, depending on airfoil, with commercially available glass fuselage. Hi or lo stab location. Rudder and elevator controls.



Racer version rounds turn in the mist high over the lowlands of Washington State.

by HARLEY MICHAELIS

What's your RC soaring bag–high aspect ratio thermal hunters, winch, hi-start, power assist? Or is it slope soarers, racers, aerobatic, or just sport? Where do you like wings placed–low, mid, shoulder? Why not design your own highly professional, highly proficient bird? With a set of designing rules and the stock "Hi-Pro" fiberglass fuse that lends itself to these numerous configurations and objectives, you can produce a winner that reflects your own taste, touch and talent–your Custom Hi-Pro.

Fuselage length, accomodating any current gear, is 42" and soarers of nice appearance from about six- to ten-ft. span may be built around it. Cross sections are nicely rounded, but sides are subtly flat so panels can still butt directly to them without need for shoulders. With a plywood post attached to the stab fin rear, you can hang on a wide assortment of tails–low, full-flying, T-tails, V-tails, and swept tails. With interchangeable plug-in panels for wing and stab, you are ready for different conditions. One moment you have a bomb for the slope, and the next a super-sensitive thermal machine–let your imagination be your guide!

Plans details a rugged racer for work in stiff winds from 15 knots and up. Speed and maneuverability were the only objectives and well-achieved. Without good head wind, hand glides were extremely difficult. Stability was much better than expected, permitting extended hands-off flight and mild stalling characteristics, in spite of sharp leading edge on the near symmetrical airfoil used. Of course, for thermal work, sections such as the Eppler 385, NACA 6409, 6412, etc., can be used. The old standby flat-bottomed Clark Y sketched on plans has given me much thermal pleasure. Recently I took the NACA 6412, made the bottom flat and got a great thermal airfoil which I recommend highly.

If you have the photographic equipment or an amateur photographer friend who does, an accurate set of airfoil templates for tapered panels are quite easy to come by. Make a good-sized drawing of the airfoil you want to use and photograph it with a lens that gives a big image on the negative. Measure chord in millimeters at all rib stations. Make a series of prints on paper strips (double weight paper) that correspond to chord, using a ruler with millimeter scale on the easel to adjust the image to size. When dry, cut out templates and use as guide in cutting the balsa ribs. Reference marks for LE, TE, spar positions, etc., may be put on the master pattern and will be in the same relative position on each smaller pattern.

Here is a set of "rules" for designing your own ship, with the Hi-Pro fuse as a constant. These rules came from successful personal designs–the Duo-Flex, Tri-Belle, Fliteglas Miskeet, Dumas Mod-Pod, all published designs. This set of ten rules upholds some simple aerodynamic laws, and unless they have been repealed lately, they should work for you, too. Do some sketching and work up a real eye-catcher. Dazzle your friends with your original creation!

(1) Choose an airfoil suited to your purpose and, by studying how it has been balanced on other models, determine its apparent best CG location–1/3 back on Clark Y, 45 percent back on 6412, etc.

(2) Spot this CG on the fuselage profile so it's about twice as far to the end of the ship as it is to the tip of the nose.

(3) On constant taper wings, make root chord about 1/6 of ship's overall length and taper so tip is 40 to 60 percent of root chord, as pleases your eye.

(4) Make span 1½ (Mod-Pod) to 2½ (Miskeet) times overall length. Smaller spans and aspect ratios are best at the slope, faster and more maneuverable. For multi-purpose ships AR's 12 to 15/1 are good–up to 20/1 on good thermal ship.

(5) On other wing platforms, part constant chord with tapered tip section, make root about 1/7 overall length to yield similar areas as in No. 3.

(6) Make stab area 15 to 20 percent of wing area–less on larger ships. Reduced areas bring nose up; just lose a stab half in flight and see. Very little movable elevator is needed for normal flight correction–more for aerobatics.

(7) Make vertical tail combined area about 6½ to 7½ percent of that of wing. Make moving area 50 percent or better, especially on slope ships–less is needed on T-tails (perhaps 1/3).

(8) On slope designs, little or no incidence

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might be used if elevator control is involved, but on thermal ships set wing for 2½ to 3 degrees to slow down. Stab can be 0-0, but of course, is easily trimmed when all-moving.

(9) Work for 3 to 5 degrees airborne dihedral, remembering those skinnier wings will flex.

(10) On panels with tapered element, twist tips downward, starting about 3/4 out from root. A four-in. tip should have 1/4" to 3/8" twist (washout).

Construction

Fuselage: Smooth any irregularities where halves meet and join in good alignment with masking tape placed externally across and along seam line. Lay fiberglass tape along bottom seam. Use an acid brush on dowel handle to reach back inside. Use fiberglass resin only to join, avoiding excess which adds weight. Let this cure and then seam top. Extra cloth can be laid up where wings butt, and also around canopy opening, nose, etc., to strengthen. Smooth imperfections with epoxy putty and wet sanding.

Canopy: Place oversize clear canopy (comes with fiberglass fuse, $19.95 postpaid from Dumas Products, Inc.) over fuse opening, holding tight with masking tape placed across. Then outline opening with masking tape. Remove and trim off excess. Fit base to opening, recessed thickness of canopy material. Paint up base, attach name plate, and secure canopy with contact cement or epoxy. Remove any excess to fit opening nicely. To keep fuse from spreading under canopy, secure a ply member across fuse just forward of servos, using cloth and resin. Receiver may slip under this base.

Wing support systems: Plans detail use of various sizes of fiberglass rods in the Micro-Flite brand by Browning Arms Co. which are the source of the Crawford shafts commonly found at RC shops. No. 4, as thru fuse, is most commonly-found size in stock, about 9/32" OD. No. 4's slip easily into No. 10's (check your archery outlets for these, No. 5's, and the tempered aluminum tube that may be used for reinforcing the No. 4's).

Wing construction: The plans incorporate some changes deemed wise after much wringing out of the original racing Hi-Pro and won't correspond strictly to photos. Span was chopped to reduce flex in tight turns and increase speed. The fiberglass rods will bear up when balsa members fail. My original 55" MonoKoted panels weighed only 8 oz. each. For high stress applications, the fiberglass rods as spars have considerable merit.

A Hi-Pro rod set can be directly ordered from Martin Archery Co., Rt. 5, Box 127, Walla Walla, Wash. Send them $6.50 for postpaid set of rods, including one tempered aluminum, to build wing as plans show. A No. O rod, ¼" OD (nice for pushrods) are 50 cents each with above order. Holes are cut with tool depicted on plans, which has a bit of common pin centered in it. In the photographic airfoil template process, the master rib is marked with a pair of X's that represent hole centerlines. Punch through template with pin into balsa, then press cutter and turn to cut.

Stab: The supporting No. 4 is fixed, and the clips, set in the ends, allow the stab to

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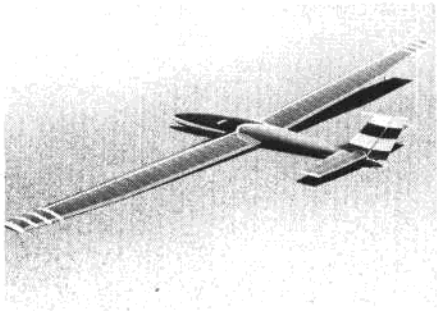
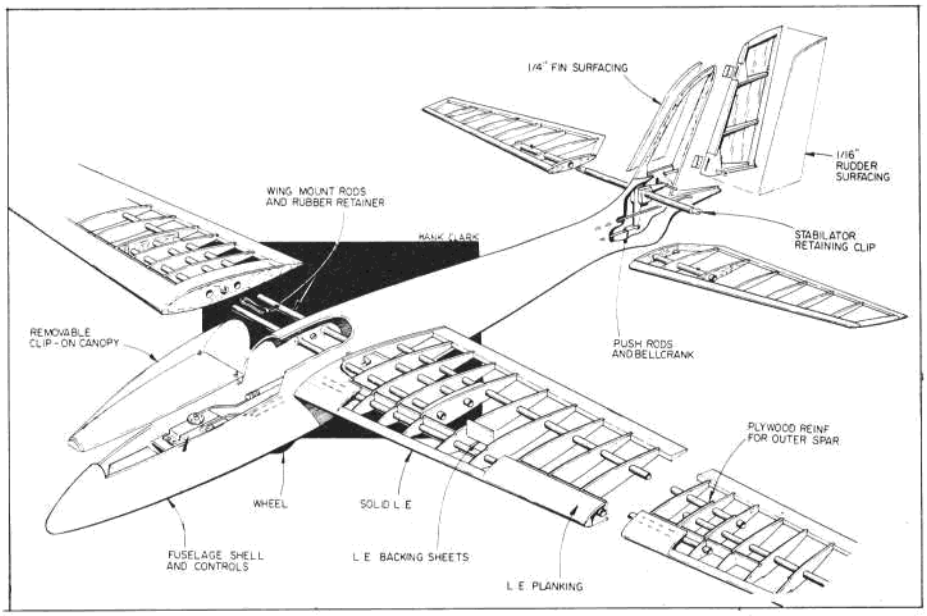


For thermals, a bit more dihedral and a larger rudder help. Empty weight is 1½ lb.



A high-tailed thermal version with optional power pod. Engine drag does hurt the glide.

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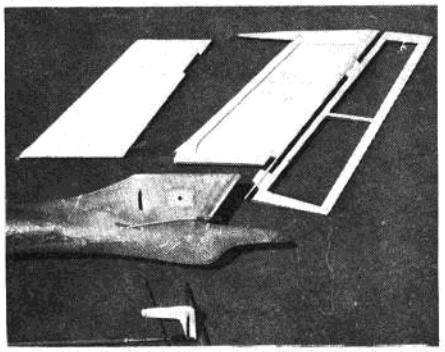
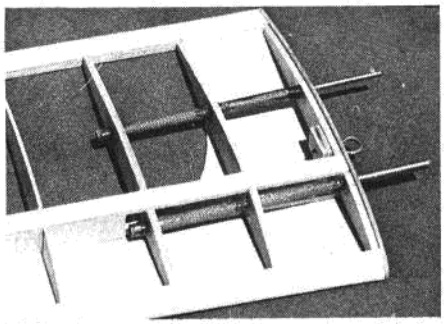
travel. Pushrods and linkages must of course be in before adding upper fin. The big bellcrank will pass through the fuse, so can be first attached to pushrod. Be sure everything moves nicely before final joining.

Several photos of my thermal Hi-Pros are shown to illustrate some different possibilities, other than those the plans show.



All-moving stabilizer may be pivoted front or back. Fin fits into rear fuselage.

Here fiberglass rods are not used as spars, but some No. O's are set into panels in ply ribs. These No. O's decline 1/4" in 4". I have 3/16" wire up front, and 1/8" in rear, running into 1/8" ID Nyrod, with everything epoxied together. The protruding wires run into 5/8" sq. bass (pine is fine) blocks jammed and epoxied against 1" by 4" plates of 1/8" ply epoxied against sides internally. No. O rod is set in the blocks. The base for the engine mount is fiberglass, formed right on the fuse after being treated with release agent (polyvinyl alcohol). The upright of ply is secured to base with cloth and resin. I attempted to position it so the mass of the Tatone Tankmount and Cox 09 were at the CG. Blind nuts are set in the rear of the ply firewall. Cheeks are balsa. The protruding wing rods pass thru holes in the base to neatly secure.



This wing uses hard balsa spars and balsa webbing. Arrow shaft for wire joiners are angled for dihedral in wing.

On the Hi-Tail version the bellcrank pivots on 1/8" wire. A length of 1/16" OD brass tubing was soldered to a bit of 1/16" wire, bent into right angle and hooked to bellcrank top rear hole with keeper. Near the top of brass tube, a bit of music wire runs into the tube, soldered into position vertically, with a three-in. crossbar of 1/16" music wire soldered at the top, to plug into the stab halves. One upper fin cheek can be affixed to framework, and this linkage operation finalized before adding other cheek. If you want a low or shoulder wing, fillets could be formed directly on the fuse with epoxy putty.