THE HP-10 HIGH PERFORMANCE SAILPLANE

by RICHARD E. SCHREDER

The HP-10 was designed to meet the following requirements:

1. Top quality performance.
2. Lowest possible price.
3. All metal construction.
4. Amateur assembly in 300 man hours.
5. Fast and simple teardown.
6. Good visibility and comfort.
7. Gentle flight characteristics.
8. Maximum pilot protection.

Conventional sheet metal design is too costly and difficult for the average home builder. Recent development of aluminum honeycomb panels offer great strength at considerable savings of weight. Heavy wing spars are necessary to carry all bending loads in conventional construction because even the heaviest sheet metal skins wrinkle when compressed by bending. Aluminum honeycomb panels can be designed to be rigid enough to retain their basic airfoil cross section without ribs and still resist compressive loads up to 82,000 lbs. per sq. in. (7075 T 6 aluminum). With all of the bending material located in the skin the resulting structure is relatively light.

Aerodynamically, the rectangular wing is just as good as a tapered wing if aspect ratios are equal. Better stall characteristics of the straight wing eliminate the necessity of twist or forward sweep, both of which add drag, especially at higher speeds. Most important of all, tooling for laying up straight metal honeycomb panels was only a small fraction of the astronomical cost of building eight tapered forms. Thus the decision was made to use an untapered wing.

Although a swept back conventional rudder tail assembly was laid out and considered, the final decision went to the V-tail because it is aerodynamically cleaner, lighter and more simple to build. Another important factor favoring the V-tail is the complete freedom from damage when landing in high grass or crops.

One of the figures shows a cross section of the wing construction. The wing is made up of eight 12 foot aluminum honeycomb sandwich panels. Both inner and outer skins are 7075T6 alclad sheets separated by .002 x ¼" hexcell aluminum honeycomb. Sheets are graduated in thickness to match the load being carried; overall thickness of each panel is a uniform thickness of 7/16". Longitudenal "Z" sections join inner and outer skins and provide an adequate flange for riveting to the sheet metal spars. Outer skins vary from .050 at the root to .016 at the tip. Inner skins reduce from .040 to .012. It is incredible that such thin skins can carry tenstile yield loads in compression but in personal tests a sample panel with .008 skins separated by ¼" thick honeycomb recorded 90,000 lbs. per sq. inch in bending compression before failure.

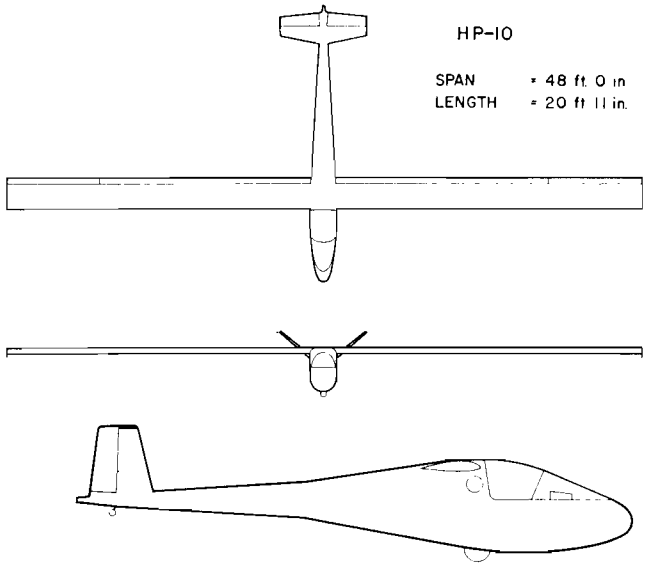
The four 12 ft. sandwich shells comprising each half of the wing come from the mold completely bonded with phenolic resin. Contours are mold-accurate and require no later filling. The two bottom surfaces are riveted together to make one 24 ft. bottom skin. The same is done with the two top panels. These two units are then riveted to the bent aluminum sheet spars. Three ribs, one at each end and one in the center, close the torsion box. Rolled nose skins rivet to the front spar, flap and aileron attach to the rear spar; thus completing the wing. Flaps and ailerons require no stiffeners and ribs are used only to close the ends of each.

The fuselage is of conventional aluminum monocoque construction, simplified as much as possible. The last seven feet of the fuselage is completely round with only one bulkhead at each end. The two halves are rolled from .050 2024T3 alclad aluminum. Six of the eight bulkheads are formed from aluminum sheet. 1 x 1 x 1/8 6061 T 6 angles reinforce the cockpit opening. The cockpit section is skinned with .040 2024 T3 alclad sheet.

The fixed forward portion of the canopy is bent in a simple curve to preserve good optical qualities which are usually lost in pulling compound curves. Twenty-four inch cockpit width and 42 inch depth together with plenty of leg room provide adequate cockpit comfort.

Tail surfaces are of more or less conventional construction except that only two ribs are used in each stabilizer and elevator. Tail surfaces fold vertically by pulling one pin from each main spar.

Wing panels are joined by splice plates bolted to one panel and pinned to the other. Aileron push pull tubes are routed on the aft side of the rear spar. Open wing interior can be



GLIDE RATIO & SINK OF HP-10