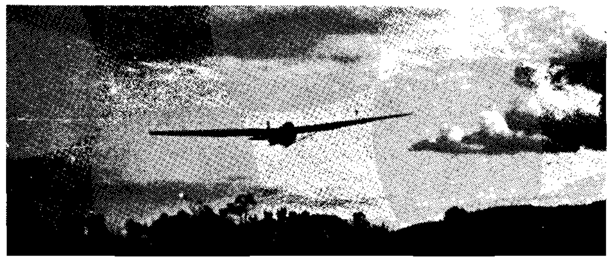
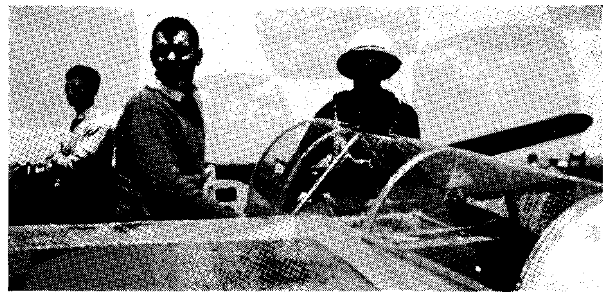
The SCHWEIZER TWO-PLACE ALL-PURPOSE SAILPLANE

by Paul and Ernest Schweizer



Coming in to land at Elmira



Close-up of cockpits with Ernest Schweizer, left, and Jack Brookhart *Alexis Dawydoff*

In designing this ship, our main aim was that it be an all-purpose sailplane within the reach of the average club. The requirements that we set for this all-purpose, two-place sailplane were:

1. That it be rugged enough and practical for routine airport training flights.
2. That it perform well enough so that soaring flights could be made from winch tow under ordinary conditions.
3. That it be easy to assemble and disassemble and easy to handle on the ground.
4. That its cross-country and general performance be good enough so that record attempts could be made under good conditions.
5. That its price be as low as possible so that it will be within the reach of clubs.

We chose all metal construction for this ship because experience gained in building and flying several all-metal gliders convinced us of the practicability and low production costs of this type of construction. Some of the many advantages of all-metal construction are: better corrosion and deterioration qualities than wood, greater structural efficiency, ease of recognizing set or failure in damaged parts, ease of repair, and adaptability to production methods. At present, due to small production, no great savings in manufacturing costs will be made, but, with increased production, substantial savings should result.

A shoulder wing type was chosen because it permitted unlimited up vision for cloud and thermal flying, and because technical reports showed that added efficiency could be obtained by using this type of wing fuselage combination. As ease of assembly and low cost were important, it was decided to have struts instead of cantilever wings. A deep fuselage section permitted enough angle on the strut so that it did not have to be inordinately heavy. Struts permitted the use of a 12% section, which would more than overcome the drag of the single streamline strut. So we reasoned that we might come out ahead using this arrangement.

In order to get sailplane performances, a large span seemed necessary, but cost of construction, handling and hangaring considerations dictated a small span. After much measuring and figuring, a compromise was reached and it was decided that a 52′ span was the largest practical for our case. With the span determined, it was a question of what wing loading and aspect ratio were desired, one being dependent on the other. Performance figures showed that increasing the wing loading made only a slight change in the minimum sinking speed, while an increase in aspect ratio yielded good results in added performance. The only disadvantage of higher loadings is a higher landing and stalling speed, but as the landing speed goes up as the square root of the wing loading, there is little increase in speed due to the slightly heavier loadings. Also, control and cross-country performance are improved with the higher loadings. So the heavier loadings were decided upon, resulting in an aspect ratio of 12.6 and an area of 214 sq. ft. This gave a two-place (full load) wing loading of 4.0 lb./sq. ft. and a single-place loading of 3.0 lb./sq. ft.

For ease of construction and simplicity, a plan form with straight center section and straight tapered tips was chosen. With a taper ratio of 2.5, it gave a root chord of 4 ft. and a tip chord of 2 ft. As this type of plan form approaches the ideal elliptical wing shape, performance should not suffer much from the use of straight tapers. There is a slight weight advantage, due to the straight taper. In order to take care of the taper and resulting tip stall, and for aileron effectiveness, a 4 degree twist was put in the tip section. This washout causes the root section to stall first and lets the aileron operate at a smaller angle of attack.

Many airfoils were investigated, especially those for which we had low Reynolds No. data. After considering most of the 12% sections, the NACA 4412 was chosen. At the Reynolds No. of this ship operation, this section has good maximum lift and a smooth peak of the lift curve. The minimum drag of the airfoil is low and the L/D is high. Also, the shape of the airfoil adapted itself to the type of construction that we were using. Fuselage-wing interference data that we had showed that this section gave good results in the shoulder wing position with the type of fuselage we had.

A straight dihedral was chosen instead of a "gull