POSSIBLE PERFORMANCE IMPROVEMENTS FOR 1-23 SERIES SAILPLANES

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When purchasing a sailplane, there are many factors to be considered. Sailplane performance, cost, type of construction, purpose of ownership and other factors enter into the selection. The principal items of consideration are, however, performance and price. And in many cases, there is an incompatibility between desired performance and available cash.

Consider first the probable performance requirements for those interested in doing well in national level competition. The probable performance requirements for those interested in doing well in national level competition can be determined by studying the maximum L/D of the sailplanes placing in the top 15 places in the last two National contests. The results indicate that to adequately compete it is very desirable to fly a ship with an L/D of 35 or better and there is not much hope for outstanding success if competing in a ship with an L/D of less than 30.

The next factor to be examined is cost. Cost is a function of performance and type of construction. The approximate cost, new, for various familiar sailplanes delivered to the Central United States, can be plotted as a function of the maximum L/D of the sailplane being considered. The results demonstrate a $1500 price differential of metal over wood construction, and the requirement for an expenditure of at least $4000 for a 30 to 1 sailplane, with the price going to $5500 if one prefers metal construction. Obtaining a ship in the "very desirable" performance bracket of 35 to 1 is rather difficult and very expensive.

It is believed that there is a hypothetical "cost barrier" beyond which many potential sailplane owners find it difficult to justify such an expenditure for pursuit of a hobby. It is, of course, a variable depending on individual circumstances. However, this barrier in many cases forces a purchaser to accept inferior performance or a different type construction than desired. Some, finding neither solution satisfactory, design and build their own sailplanes. In the particular case of the author, the "cost barrier" forced acceptance of a used sailplane, a Schweizer 1-23D, with performance considerably inferior to that desired. Therefore, a study was undertaken to determine the available gains in performance through improvement in the aerodynamic characteristics of the 1-23D. The following discussion presents the principal results of this brief examination.

To initiate the study, the 1-23D performance was assumed to be identical to the 1-23H-15 performance as published by Schweizer Aircraft Corp. The ships are almost identical in geometry. The assumed performance is illustrated in Figure 1, with Sisu 1 flight test performance shown as a comparison (to illustrate the desire for improvement).

To determine areas of possible improvement, it was necessary to determine the component parts of the 1-23D total drag. First, the airfoil profile drag was estimated at the flight Reynolds number occurring at 10,000 ft., for the 1-23D m.a.c. This was done using as a basis high Reynolds number data on the NACA 43012A airfoil presented in Reference 1, and basing the variation of profile drag with Reynolds number on the characteristics of the NACA 23012 airfoil presented in Reference 2. (This procedure, although crude, was necessary because of lack of low Reynolds number data on the 43012-A section.) The result, smooth airfoil drag vs. lift coefficient, is shown in Figure 2.

The induced drag component was determined by plotting the difference between total drag and smooth wing profile drag vs. lift coefficient squared. The slope of this curve defined the induced drag factor 1/(piARe). The span efficiency factor determined in this manner was 96 percent. The induced drag component is also shown in Figure 2.

The remaining drag component to be determined was the parasite drag, assumed here to be invariant with lift coefficient, and consisting of wing roughness drag, fuselage, and tail drag. The value of this component was computed by subtracting from the total drag the smooth wing profile drag zero lift coefficient. The

Figure 1. Performance comparisons.

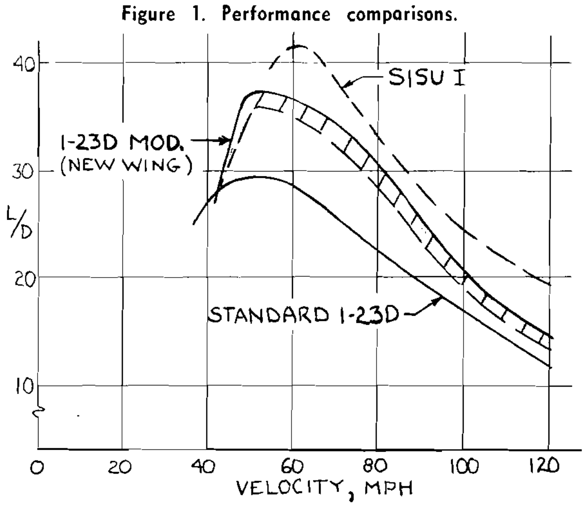

Figure 2. Breakdown of drag coefficient vs. lift coefficient for 1-23D sailplane.