The M. I. T. SAILPLANE

by James Kendricks

With our present knowledge of sailplane operation, certain specifications may be described for the machine which will satisfy the needs of a soaring enthusiast for sport or record performance. To arrive at the most satisfactory design, we should bear in mind the varied weather conditions under which a sailplane must operate on a normal flight. Take-off conditions may be ideal with numerous thermal currents and cumuli available. Under such conditions, low sinking speed is not essential, but good gliding angle at a high speed is important in order to traverse in a minimum time the spaces between up-currents. For cloud soaring the craft must be structurally sound and possess good stability characteristics. Under poor conditions minimum sinking speed and low flying speed are of great importance. For satisfactory operation in small thermals, the craft should be easily maneuvered in tight spirals in order to remain within an up-current. Add to the above requirements, the need for adequate comfort and visibility; ease of ground handling; ease of assembly and disassembly; and low cost. We then have a basis for the design of a modern sailplane.

With these factors in mind, members of the Aeronautical Engineering Society of the Massachusetts Institute of Technology (AES of MIT, for short) have carried out the design and are now in the process of constructing a sailplane for the use of its members in future soaring practice and contests. Originally designed in 1934 as a thesis by the author and his colleague, Mr. Ray Holland, the work has been continued by the Society as the first all-Tech soaring plane project.

In order to best fulfill the above general specifications, a careful study was made of the performance of previous sailplanes, to find the dimensions and characteristics of the most successful models. Our analysis of existing designs, and conclusions as to the most desirable features, agree in general with the judgment of members of the ISTUS Congress, who in 1938 started a design competition to establish a Standard Sailplane to be flown by contestants in the 1940 Olympic Games. The specifications of the winner, the "Meise," of the Deutsche Forschungsanstalt fur Segelflug (D. F. S.) are surprisingly similar to the M. I. T. Sailplane, designed four years earlier.

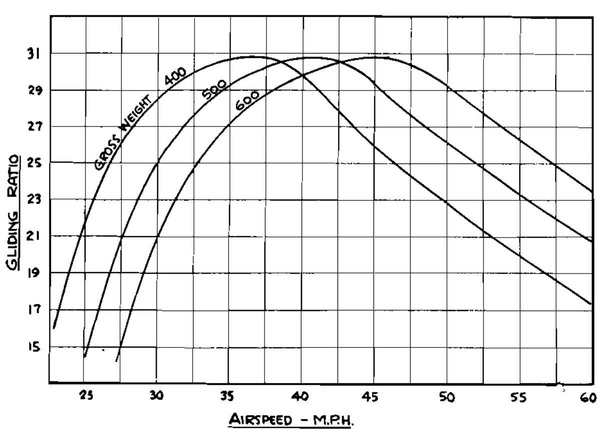

Fig. 1. Variation of gliding ratio with air speed.

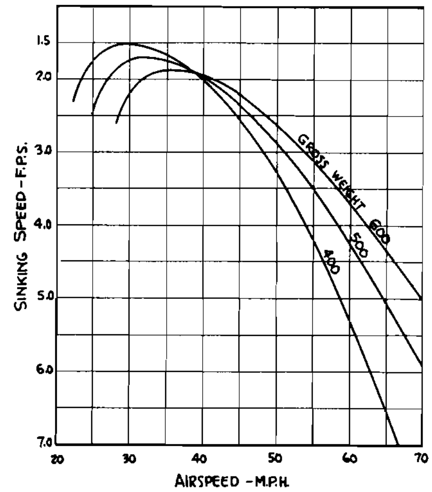

Fig. 2. Variation in sinking speed with air speed.

Sailplane Design Factors

The gliding angle of an airplane depends upon the ratio of lift to drag. As discussed in the general specifications, it is desirable to have a maximum gliding angle at a relatively high speed in order to permit the plane to fly across the country with a minimum loss of time. Figure 1 shows the variation in gliding angle with speed and airplane weight. It will be noted that for a given airplane, loaded to various gross weights, the maximum gliding angle at a relatively high speed in order to permit the plane to fly across country with a minimum loss of time. Figure 1 shows the variation in gliding angle with speed and airplane weight. It will be noted that for a given airplane, loaded to various gross weights, the maximum gliding angle is independent of the weight. However, the gliding angle at high speed is considerably better for a heavily loaded machine than for a lightly loaded one.

The sinking speed varies with the ratio (lift/drag) 3/2. In this case, it is somewhat more important to have a low gross weight for obtaining a minimum sinking speed than in the case of gliding angle. However, at high speed the effect of high wing loading is again important to the attainment of low sinking speed. (See Figure 2.)

The specification that our sailplane should, in certain cases, have a low sinking speed at a low flying speed, in order to maneuver in small thermals, prevents us from designing for high speeds only. However, the consequent reduction to high speed performance may be minimized if proper design methods are used, as described later.

Selection of the span is the most fundamental decision, for other dimensions of the craft as well as weights will be determined thereby. For adequate performance the span should not be too small. For good maneuverability, excessive span is undesirable. We chose 52.5 (16m.) for the MIT design. For stability reasons, a sailplane should have a tail length, from C. G. to tail post, of at least 30

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