OPTIMUM SAILPLANE DESIGN

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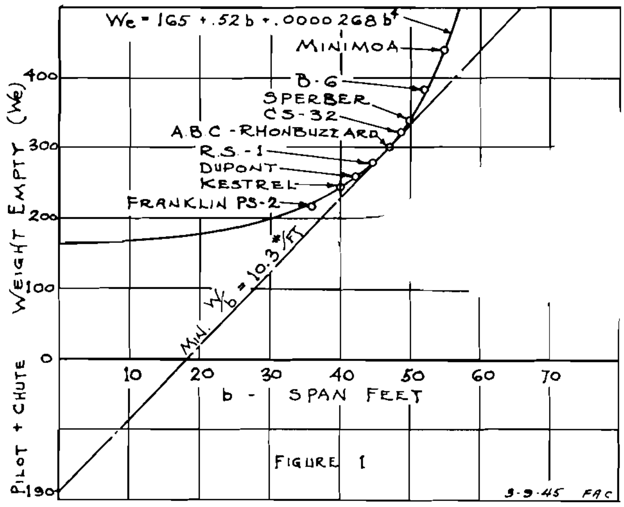
THE formulae and data presented herein have been developed with the idea of establishing a rational approach to preliminary sailplane and glider design. These data are based on existing weight information and aerodynamic relationships between weight, area, and span which will produce optimum performance for the sailplane designer.

Referring to Figure 1, the weights of several sailplanes and gliders were plotted against span and a curve drawn through them. Originally there were many more points which did not fall on this curve but these were eliminated because they were either twoplace designs having high empty weights, or the data used was not considered reliable. It is admitted that not all gliders or sailplanes will fall on the curve but since so many of them do, and for the lack of more exacting weight-span relationships, this curve is used as the basis for the analysis.

Leaving Figure 1 for the time being, refer to Figures 2 through 6 and note that the curves plotted are the



solutions for the relationship of minimum sinking speed (V_Z), aspect ratio (R), wing loading (w/s) and total profile drag coefficient (C_{D_0}).

The relationship has been evolved as follows from the classical formula:

$$V_Z = \frac{C_D}{C_L^{3/2}}\sqrt{\frac{2W}{\rho S}}$$

By expanding this relationship the sinking speed may be expressed as a function of C_{D_0}.

(1) $$C_D = C_{D_0} + C_{D_i}$$