

An Aerodynamic Performance Figure of Merit for Sailplanes

By Nicholas Goodhart

The comparison of the cross-country abilities of different sailplanes is limited by the fact that they are designed for operation under varying thermal strengths and hence the performance curves cannot be directly compared. This article proposes a single figure of merit which may be used as a general indication of the cross-country performance of all sailplanes, under a variety of conditions, though naturally the best sailplane under any particular thermal conditions is not necessarily the one with the best figure of merit, since it may have been designed for thermals of entirely different strength.

Calculation of the figure of merit

Fig. 1 shows the standard construction used to obtain values of achieved cross-country speed against achieved rate-of-climb.

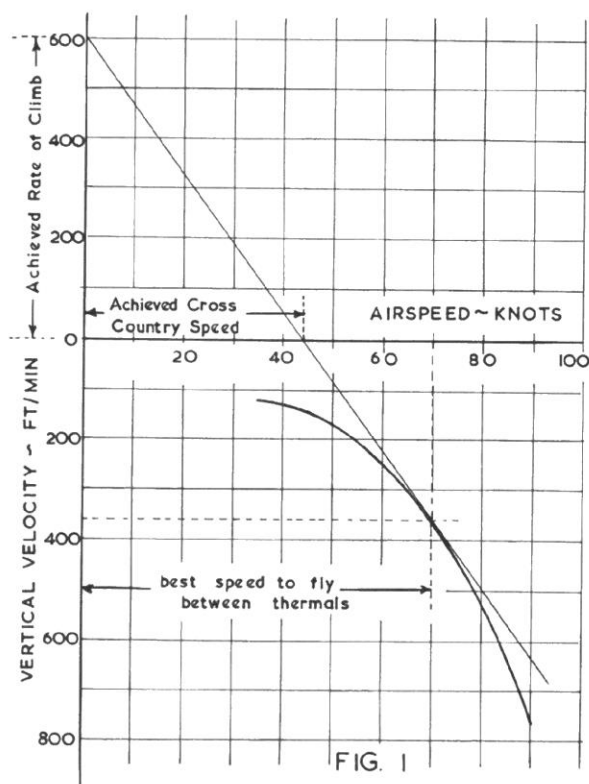


FIG. 1

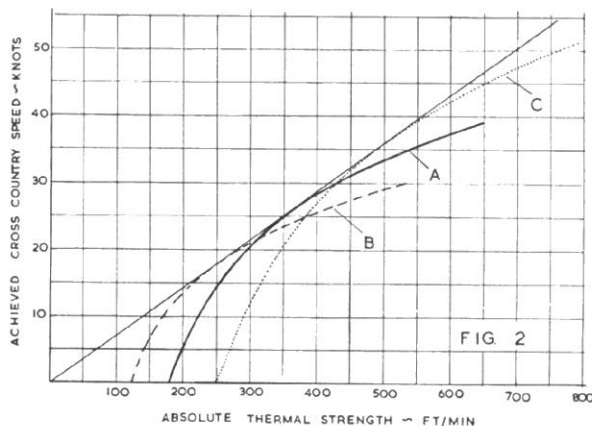


Fig. 2 (curve A) shows a plot of achieved cross-country speed against absolute thermal strength. The absolute thermal strength has been obtained by adding $1.5 \times$ minimum sinking speed to the achieved rate-of-climb. The value of 1.5 is purely arbitrary and is my guess of a likely value of achieved sink relative to the air when thermalling.

It must now be imagined that the weight of this sailplane can be varied up or down to a large degree without any alteration in its aerodynamic form. The effect of this will be to produce new curves of cross-country achieved speed. Curves B and C in Fig. 2 show the curves for flying at half normal weight and twice normal weight.

The significant point to note is that a straight line from the origin is a tangent to all these curves and therefore represents the ultimate performance of the design regardless of weight (wing loading). Since both scales are in speed units, the slope of this line is obtained by picking any point on it and dividing achieved cross-country speed by absolute thermal strength after both have been converted to the same units. The figure obtained (7.28 in this case) is the figure of merit for this particular sailplane.

It should be noted that there is no need to draw the achieved cross-country speed curves for more than one weight and is therefore a unique curve for each type of the curve at any one weight to ensure that a tangent can be drawn.

Insufficient data is held to determine this figure for the machines of other countries, but it would be very interesting if figures could be obtained for such machines as the RJ-5, Meteor and Elfe-M.