

General Glider Performance

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SUMMARY

THE present paper presents the general formulas and charts for the determination of glider performance in terms of the fundamental parameters, the span and parasite loadings. With the use of the charts, the determination of all major glider performance is simple and rapid.

To obtain the performance at the minimum angle of glide and minimum sinking speed conditions, two separate charts are developed with the fundamental parameters as the independent variables. The performance at these conditions can be readily determined from these charts.

A generalized chart with the indicated speed as an independent variable is developed for determining the general performance. The sinking speeds due to parasite and span loadings can be obtained for any indicated speed. Also, the variation of performance due to a change in the design parameter can be seen from the chart.

INTRODUCTION

The present conflict has demonstrated the usefulness of gliders for transporting war materials, and it appears not impossible that gliders may be used even after the war to transport certain types of cargos. In designing gliders for the present and post-war uses, a simple, direct method for making a rapid performance estimation for preliminary design studies is lacking at the present time.^{4, 5, 6} Hence, general formulae and charts for obtaining glider performance are developed by applying Oswald's method¹ of performance analysis to gliders.

The analysis begins with the consideration of the power re-

quired expression for a glider in equilibrium flight. The equation is simplified by the use of a parabolic polar curve to represent the actual polar of the glider. It is simplified still further by the introduction of fundamental parameters, the span and

parasite loadings. The general expression for the sinking speed is obtained by dividing the equation for power required by the weight of the glider. The resultant sinking speed is the sum of sinking speeds due to parasite and induced drags. Simple formulas for these two speeds are obtained and plotted as functions of parasite and span loadings.

From the above formulas, a general performance

chart with the indicated gliding speed as an independent

variable is developed. This chart shows the indicated

sinking speeds due to parasite and span loadings for

any particular indicated speed. To the designer this

chart is very useful because it shows the effect of changes

of the fundamental parameters upon performance. For

an assumed indicated gliding speed, the indicated sinking

speed and the angle of glide can be obtained.

Similar charts for the conditions of minimum gli-

ding angle and minimum sinking speed are developed

from the general formulas with the basic parameters as

independent variables. If the parameters are known,

the sinking speed, gliding speed, and angle of glide can

be obtained for the above conditions. At the end of

the paper a procedure for determining the glider per-

formance from the general charts is given, and an ex-

ample is calculated to illustrate the method.

NOTATIONS

W = total weight of the glider (lbs.)

S = wing area (sq. ft.)

b = wing span (ft.)

$AR = \frac{b^2}{S}$ = geometric aspect ratio

$AR_e = eAR$ = effective aspect ratio

e = airplane efficiency factor (Oswald)

P_r = power required

L = lift

D = total drag

V = air speed

$V_i = \sqrt{\sigma} V$ = indicated air speed

$()_i$ = indicated quantities

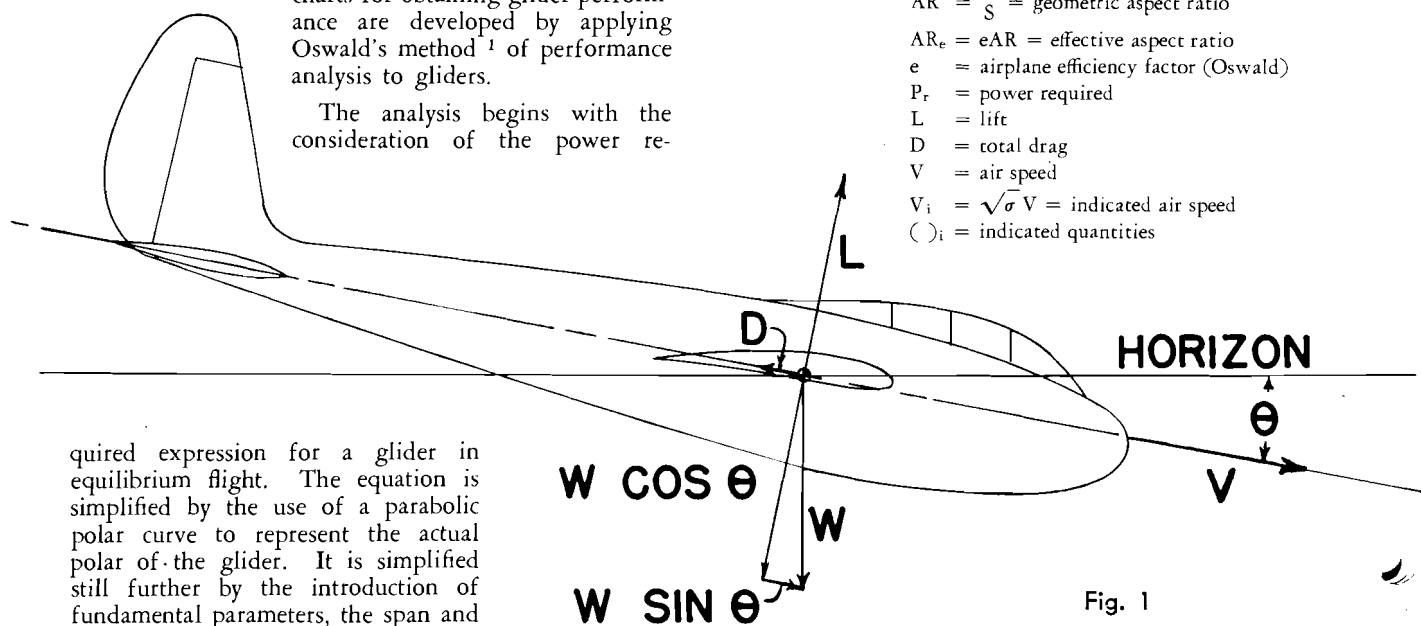


Fig. 1