The mechanics of flight non-engine gliding

Konstantinos P. Anastasiadis

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Abstract

First we will exlain some of the principles that govern a flight in the atmosphere.Secondly we will try to lood at the managing factors affecting the duration of a non-engine flight glide. The lifting ability of helium is approximately 1 gram per liter

1 Introduction

Mechanics of flight is not a very complicated field, but it is a complex field.

$$ratio = \frac{Lift}{Drag} \tag{1}$$

1.1 Lift to drag ratio [2]

In aerodynamics, the lift-to-drag ratio, or L/D ratio, is the amount of lift generated by a wing or vehicle, divided by the aerodynamic drag it creates by moving through the air. A higher or more favorable L/D ratio is typically one of the major goals in aircraft design; since a particular aircraft's required lift is set

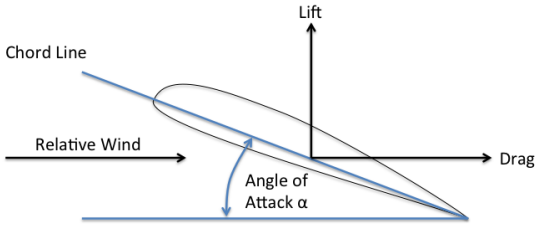

Figure 1: Lift and drag forces on a wing

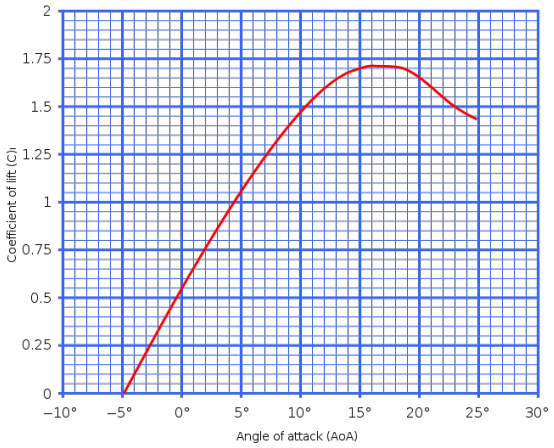

Figure 2: Lift to angle of attack, plot

by its weight, delivering that lift with lower drag leads directly to better fuel economy in aircraft, climb performance, and glide ratio.

The term is calculated for any particular airspeed by measuring the lift generated, then dividing by the drag at that speed. These vary with speed, so the results are typically plotted on a 2D graph. In almost all cases the graph forms a U-shape, due to the two main components of drag.

1.2 Lift

We can increase lift force if we increase the angle of attack, until the critical angle. At that point the "stall angle of attack" the lift stops increasing, follows a straight line segment and then drops down as in figure 1.2.

$$L = \frac{1}{2}\rho v^2 C_L A \tag{2}$$

Where
L is the **lift force**.
$\boldsymbol{\rho}$ is the density of the fluid.
$\boldsymbol{v}$ is the speed of the object relative to the fluid.
A is the cross sectional area
$\mathbf{C_L}$ is the lift coefficient/

1.3 Drag force-drag equation

$$\boldsymbol{F_D = \frac{1}{2}\rho v^2 C_D A} \tag{3}$$

Where
$\mathbf{F_p}$ is the **drag force**.

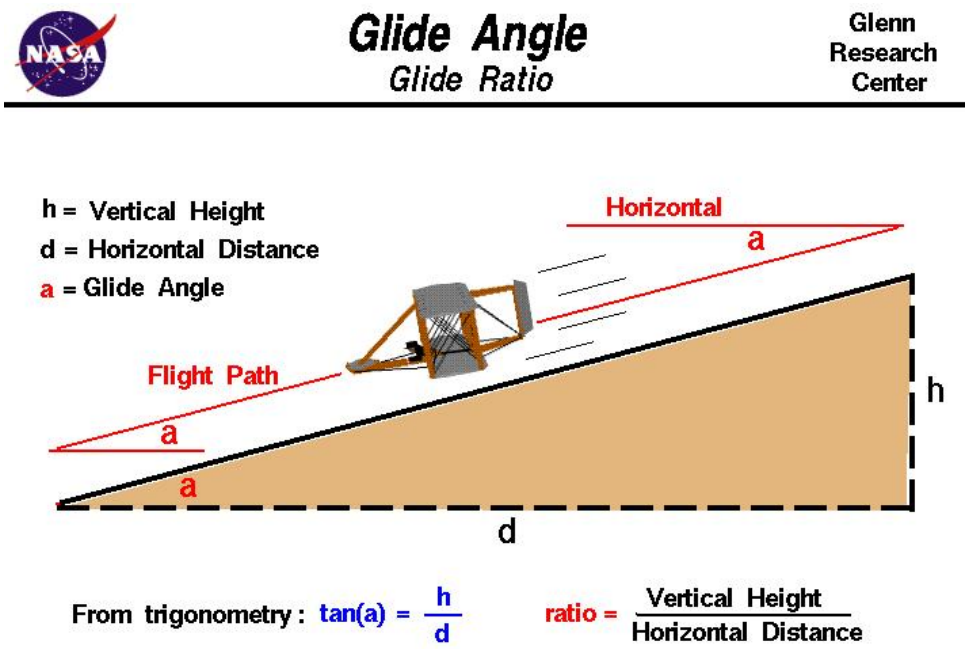

Figure 3: NASA:Gliding angle[3]

$\boldsymbol{\rho}$ is the density of the fluid.
$\boldsymbol{\upsilon}$ is the speed of the object relative to the fluid.
$\mathbf{A}$ is the cross sectional area
$\mathbf{C_D}$ is the drag coefficient/

1.4 Glide ratio

Glide ratio is the ratio of the drop in height to the horizontal distance travelled as illustrated in figure 3. Glide ration is equal to the tangent of the opposite to drop angle.

1.5 Aspect ratio of the wings

Wing span is the length of the straight line connecting the 2 edges of the wings as illustrated in figure 4 if the chord has a length of c then the ratio:
$\boldsymbol{AR = \frac{c}{AB}}$
is called wing aspect ratio.

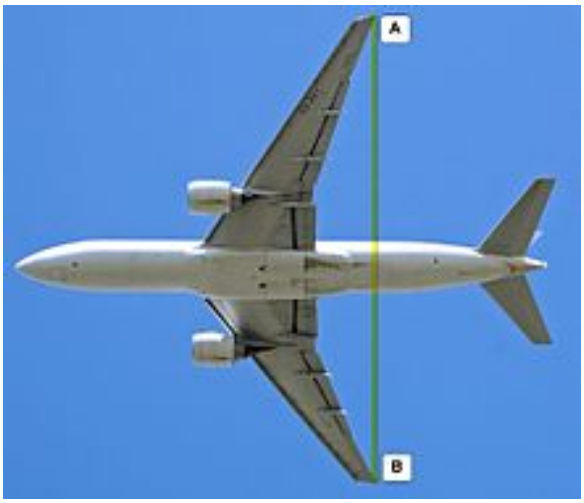

Figure 4: The distance A to B is the wingspan[4]

1.6 Critical angle of attack

$$C_L = 2 * \ pi * a \tag{4}$$

The critical angle of attack is the angle of attack which produces maximum lift coefficient.

$$C_{Lmax} = \frac{W}{A * \rho * V_s^2} \tag{5}$$

Where:
W is the weight and load.
A is the wing area.
ρ is the density of the air at that height.
V_S is the stall velocity

1.7 Zero lift drag coefficient

1.8 Lift-drag relation to angle of attack

1.9 Helium

Helium in the atmoshpere is coming from the radio active radiation, alpha.Natural gas contains 7% of helium. Helium is about 80% lighter than air, which mostly contains Nitrogen.

1.10 Avogadro's number

Like a football team which is a group of 11 people, a mole is Avogadro's number of things.
How many?
$\mathbf{6.0221415X10^{23}}$ things.

References

[1] Wikipedia *https://en.wikipedia.org/wiki/Drag_equation*
Drag equation

[2] Wikipedia *https://en.wikipedia.org/wiki/Lift-to-drag_ratio*
Lift to Drag ratio

[3] Wikipedia *https://www.grc.nasa.gov/www/k-12/airplane/glidang.html*Glide Angle

[4] Wikipedia *https://en.wikipedia.org/wiki/Wingspan*Wing span