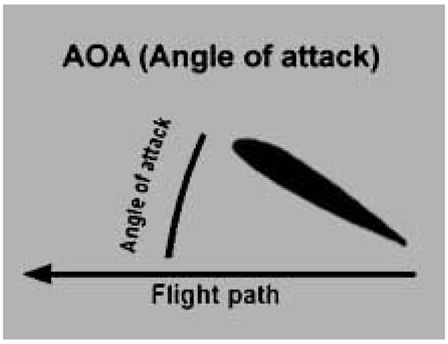
Chapter 4 Stalling

The Stall



- In normal flight a wing meets the oncoming air at a small angle of attack, with the air flowing smoothly and continuously over and under the wing.
- The more the pilot **increases the angle of attack,** the **more lift there will be**, until an angle of about 15°.

Stalling Angle

The **critical angle of attack** (the stalling angle) varies from one type of wing to another, as it depends upon the shape and general design of the wing. For most conventional aircraft, the stalling angle is around **15°.**

Stalling Speed

For every type of aircraft there is a booklet called '**Pilot's Notes**' which gives facts and figures about performance, including the aircraft's various stalling speeds for certain flight conditions.

Factors affecting stalling speed are:

a. **Weight**. Extra weight (for example, carrying more cargo) increases the stalling speed
b. **Power**. The higher the power used, the lower the stalling speed.
c. **Flaps**. With flaps lowered (which in improves the wing shape for low-speed flight) the stalling speed is reduced.
d. **Ice**. An accumulation of ice adversely alters the designed shape of the wing section, thereby **reducing the lift** and **increasing the stalling speed**.
e. **Damaged Wings**. Damage to a wing can similarly reduce the lift and so increase the stalling speed.
f. **Manoeuvres**. Most manoeuvres affect the stalling speed. In a turn the wings are banked, so the lift force is no longer vertical; this means that only part of it is available to support the weight of the aircraft, increasing the stalling speed. The steeper the turn, the higher the stalling speed.

Attitude and the Stall

- An aircraft can stall in any attitude
- The crucial factor in determining when a wing will stall is the angle of attack.

Chapter 5 Gliding

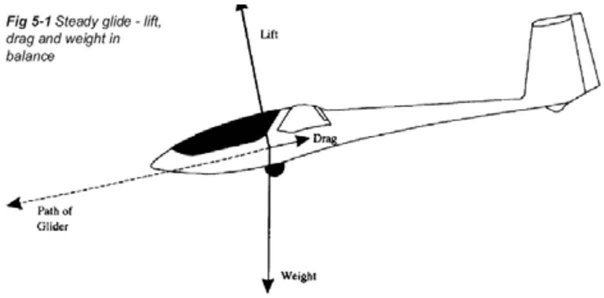


Fig 5-1 Steady glide - lift, drag and weight in balance

Introduction

- For a powered aircraft flying straight and level at a constant speed, there are four forces acting - lift, weight, thrust and drag - all in balance.
- If the engine is switched off (i.e. all thrust is removed), the only way the pilot can maintain a steady airspeed is to pitch the nose down a little and descend.
- Using **gravity** - that is, the **weight force** - to maintain a flying speed sufficient to control and manoeuvre the aircraft - known as **gliding**.

Speed

- In a car you can 'coast' down hill with its engine switched off, due to the pull of **gravity**. In a glider you can fall, in a controlled way from a set height.
- As the glider descends, the **air flow** over its wings **produces lift.** This lift reduces the rate of descent so that the glider can return to the ground safely.
- If the pilot wishes to **increase the airspeed**, the **nose of the glider is lowered** and the aircraft descends faster.
- Reducing the airspeed too much however, could result in losing so much lift that the aircraft will **stall**.

How Far Will a Glider Travel?

- This depends upon the **gliding angle**.
- The smaller this angle, the further the glider will travel over the ground.
- It can be expressed as a ratio, e.g. **1:38** so for **every 1km the glider falls** it will travel **38km along the ground**

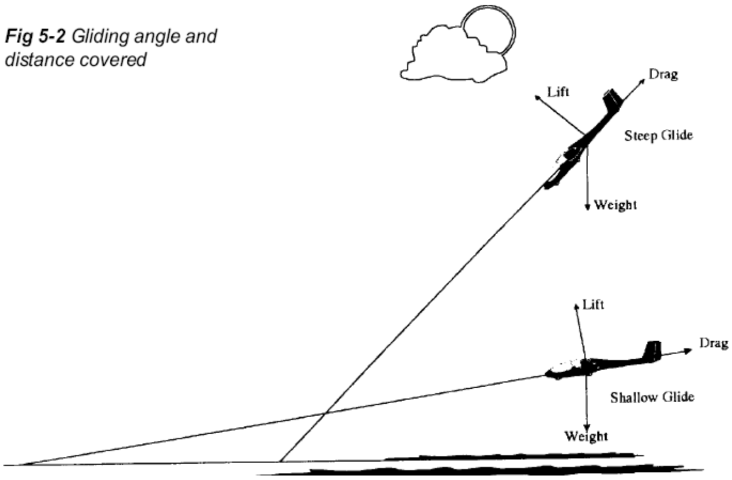


Fig 5-2 Gliding angle and distance covered

Wind

A glider travelling **downwind** will cover a **greater distance** over the ground than a glider travelling into wind. The pilot will fly at the same indicated airspeed in both cases, and the glider's angle of attack and its gliding angle relative to the air will be the same in both cases.

Airbrakes

Most gliders do not have flaps, but instead are fitted with **airbrakes**.
They come up at **90° to the wing surfaces**, where they interfere with the smooth airflow, **increasing the drag** considerably.