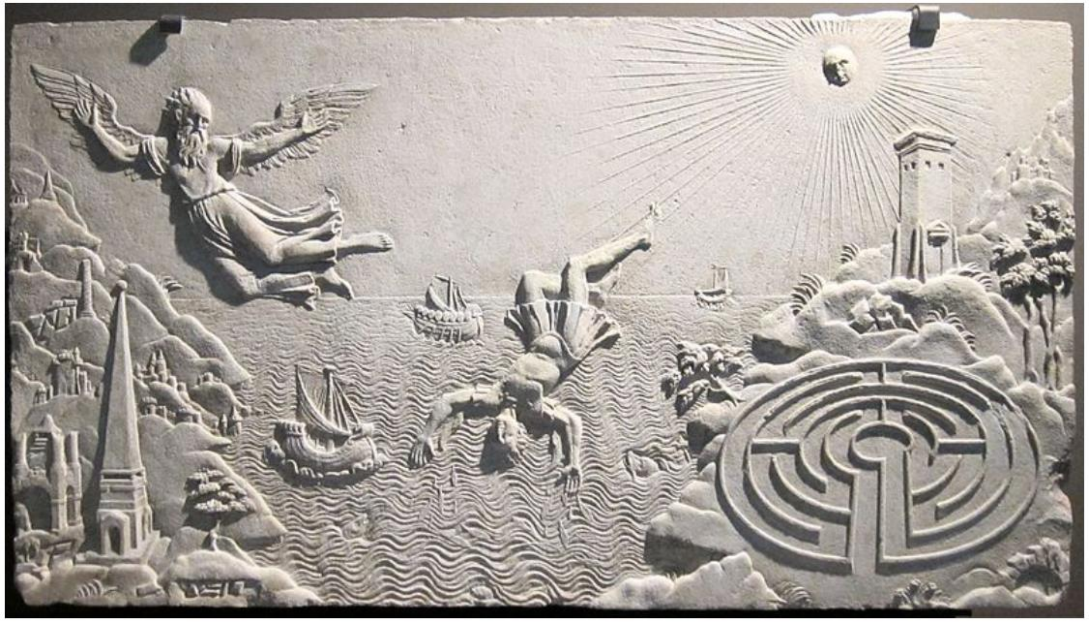
Introduction to aeronautics

Part 1. The pre-Wright era

1.1 The ancient inventions

- **For thousands of years, the dream of flying like birds stayed in the heart of the man kind**



The Fall of Icarus

1.1 The ancient inventions

- **For thousands of years, the dream of flying like birds stayed in the heart of the man kind**

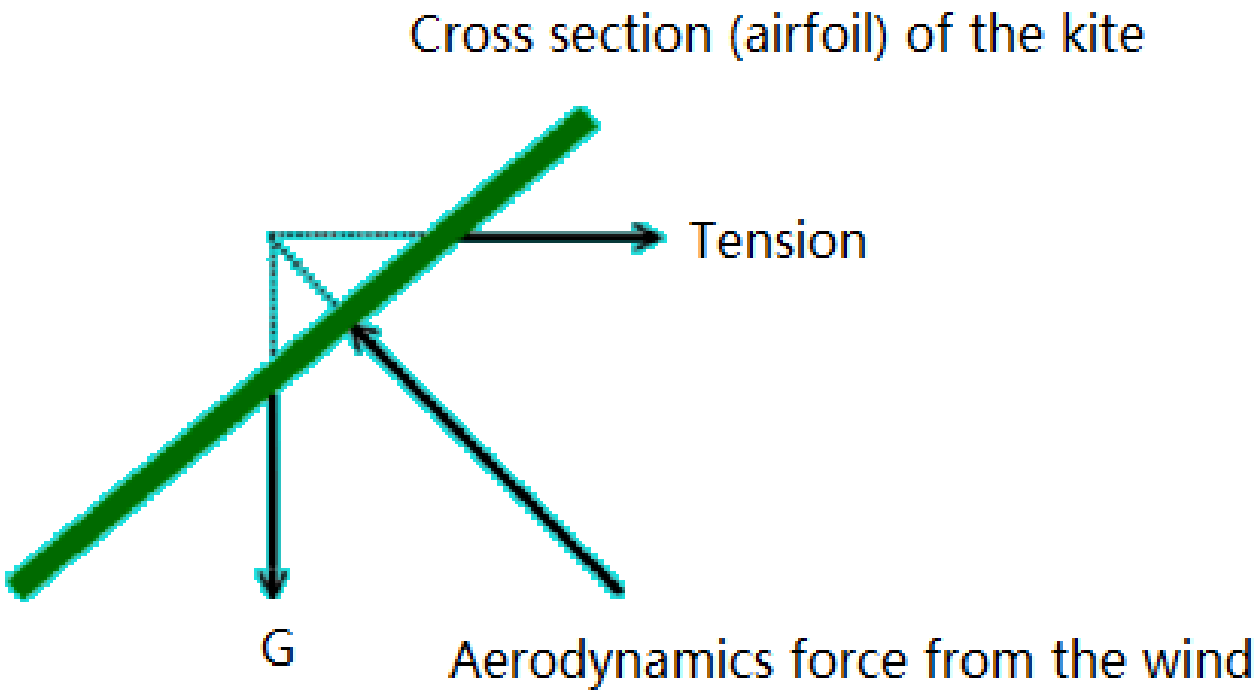
Chang'e

1.1 The ancient inventions

- **Kite**
  - A kite is a tethered aircraft

1.1 The ancient inventions

- **Kite**
  - How kite works

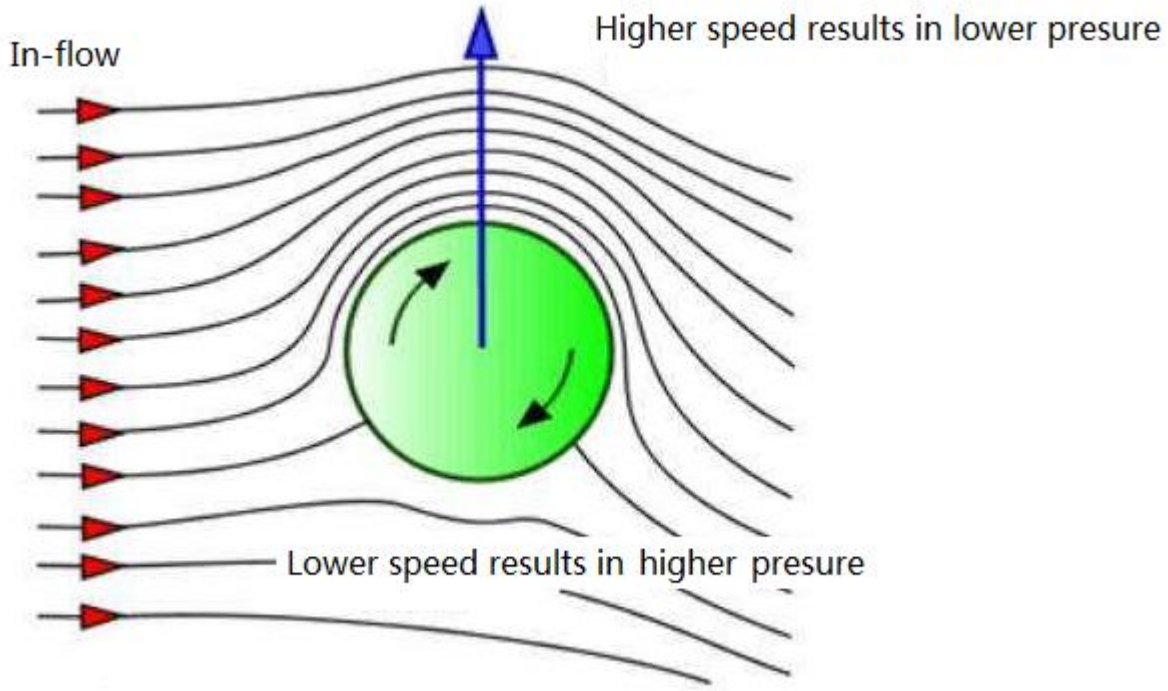


1.1 The ancient inventions

- **Bamboo dragonfly**
  - The bamboo-copter or bamboo dragonfly is a toy propeller that flies up when its shaft is rapidly spun

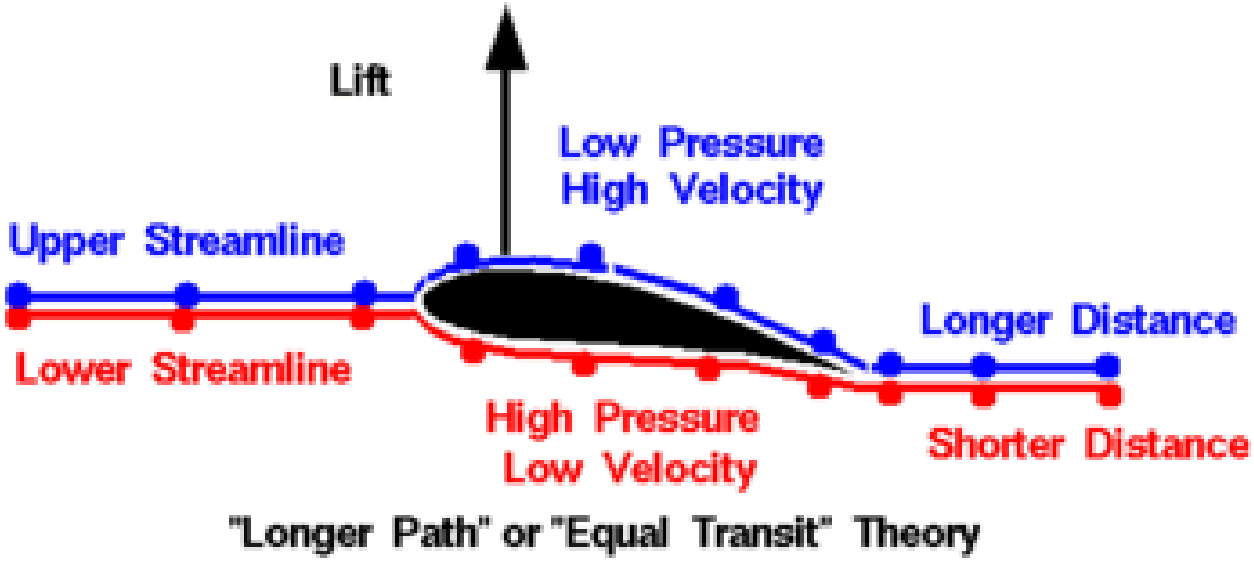
1.1 The ancient inventions

- **Bamboo dragonfly**
  - How the bamboo dragonfly works
    - The curved shot



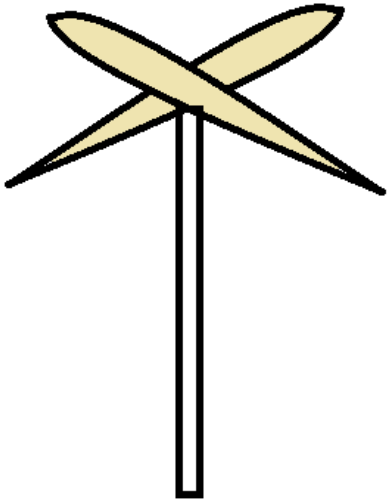
1.1 The ancient inventions

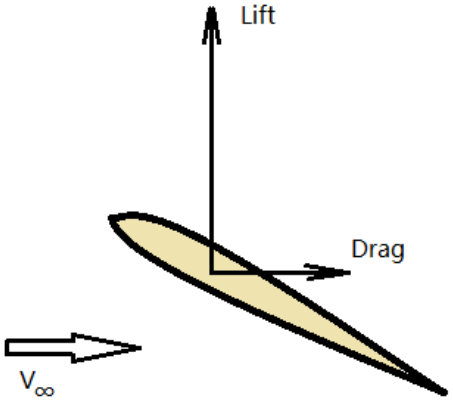
- **Bamboo dragonfly**
  - How the bamboo dragonfly works
    - The lift of the blade element/airfoil can be described by Bernoulli's principle



1.1 The ancient inventions

- **Bamboo dragonfly**
  - How the bamboo dragonfly works
    - It is actually a rotating wing
    - Each blade element , generates lift and drag simultaneously





1.1 The ancient inventions

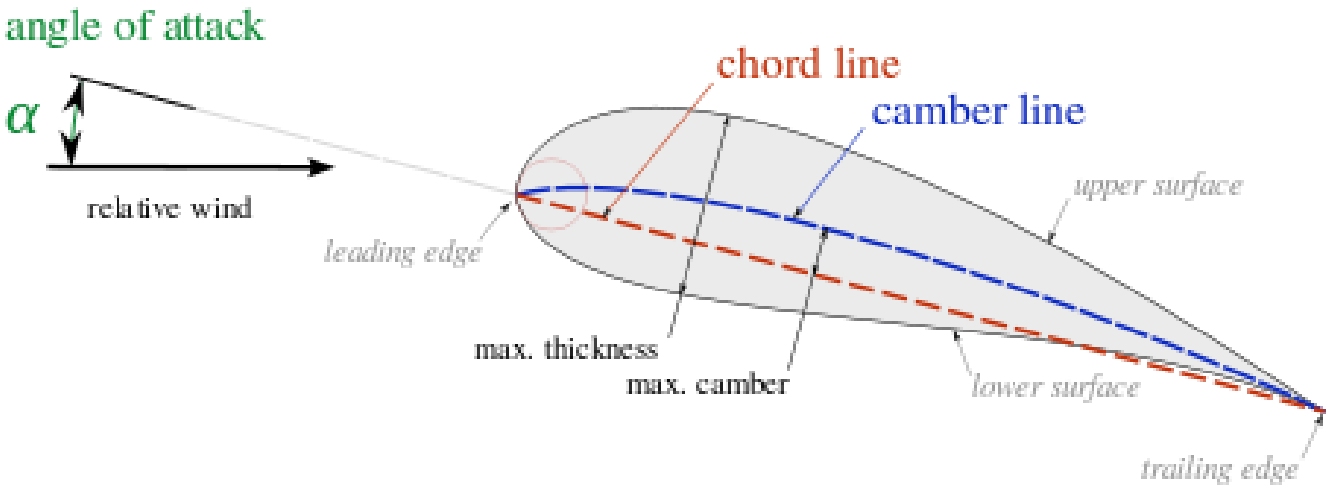
- **Bamboo dragonfly**
  - How the bamboo dragonfly works
    - The lift of the lade element/airfoil can be described by Bernoulli's principle
      - An increase in the speed of the fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy

1.1 The ancient inventions

- **Bamboo dragonfly**
  - How the bamboo dragonfly works
    - The lift of the lade element/airfoil can be described by Bernoulli's principle

1.1 The ancient inventions

- **Bamboo dragonfly**
  - How the bamboo dragonfly works
    - The airfoil nomenclature

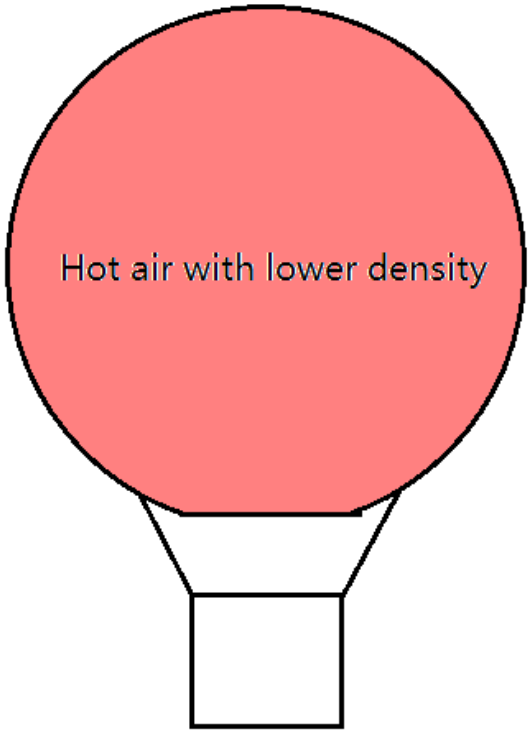


1.1 The ancient inventions

- **Kongming lantern**
  - **The ancient hot air balloon**

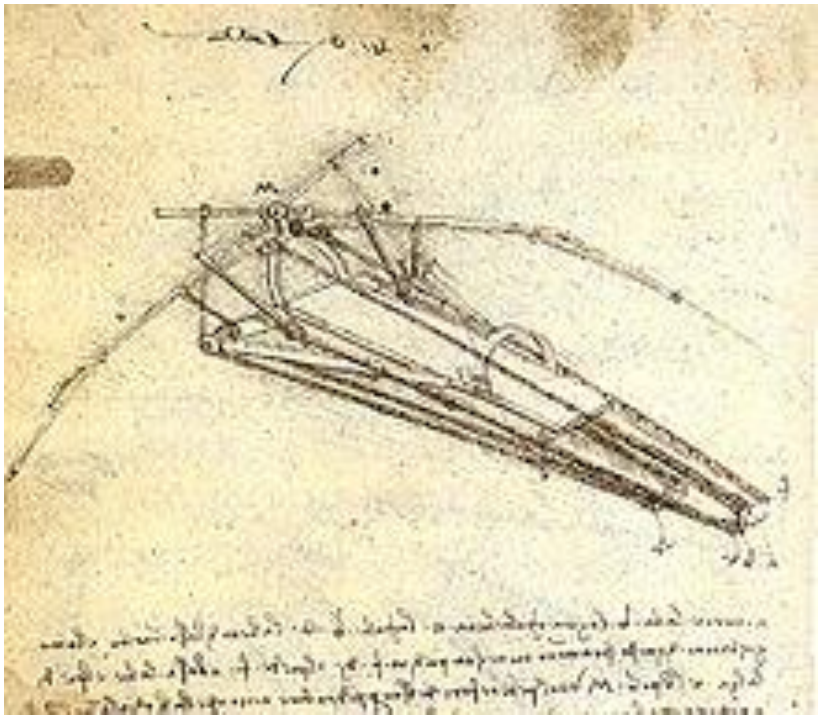
1.1 The ancient inventions

- **The hot-air balloon**
  - **How the hot air balloon works**



1.2 The attemps of human carrying flight

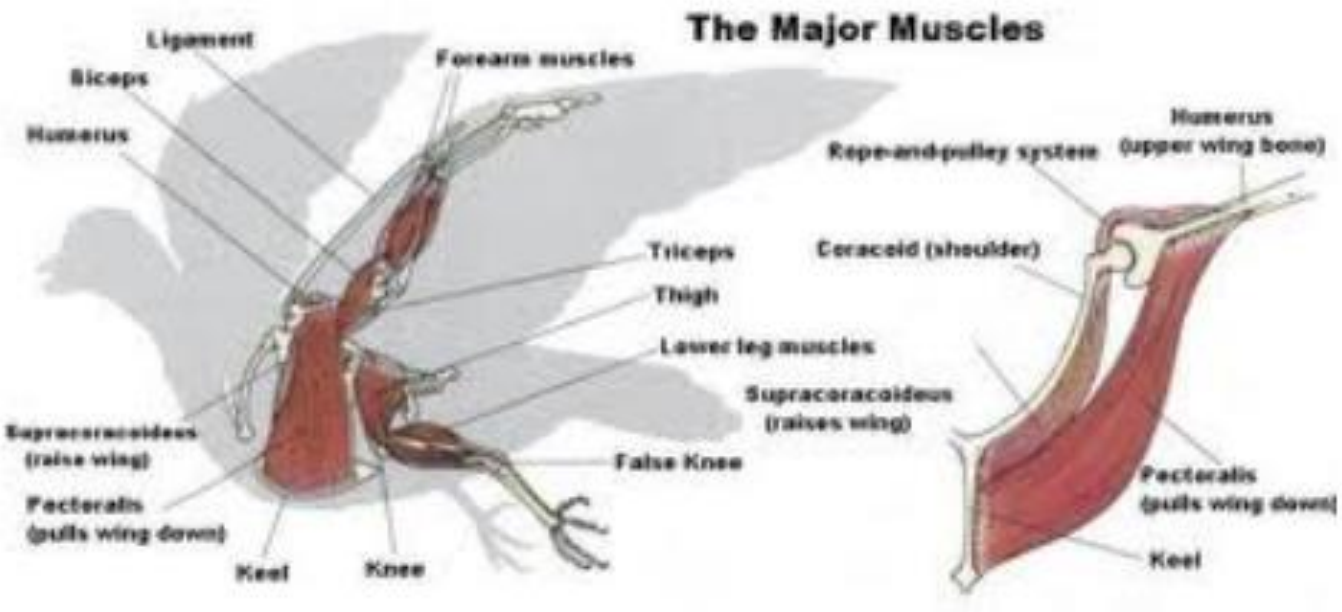
- **The ornithopters**
  - **To mimic the birds is the most straight forward approach to flight**



The sketch of an ornithopter by da Vinci

1.2 The attemps of human carrying flight

- **The ornithopters**
  - **The birds have extraordinarily strong pectoral muscles, which no pectoral muscle of man kind can match.**



1.2 The attemps of human carrying flight

- **The ornithopters**
  - **There are still many attempts for ornithopters**

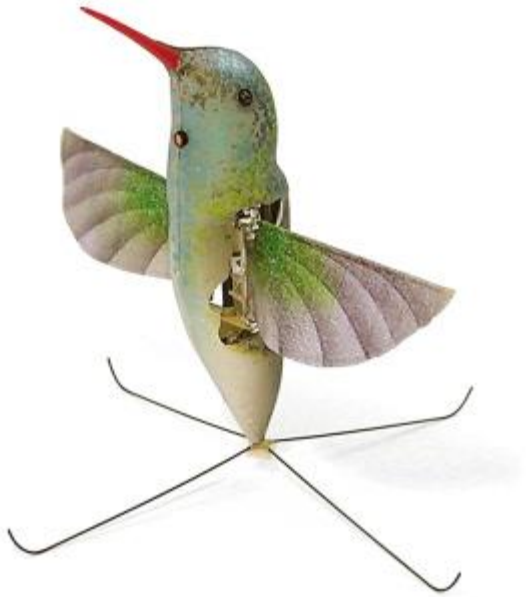
The ornithopter developped by University of Toronto

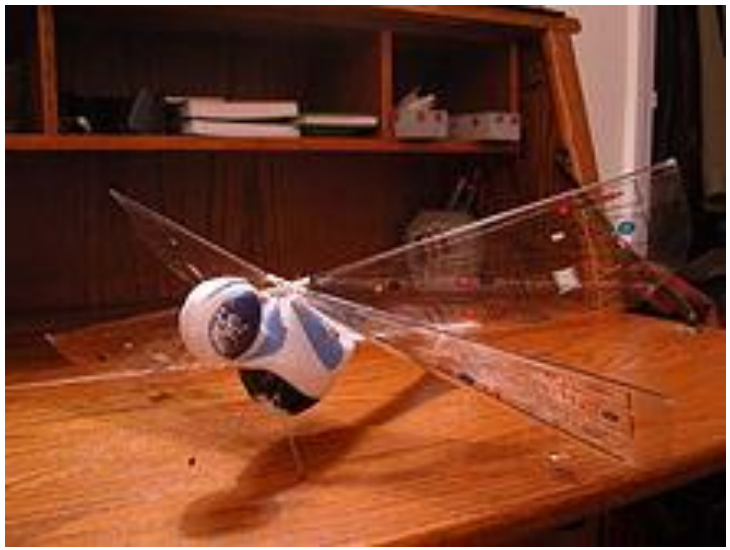
1.2 The attemps of human carrying flight

- **The ornithopters**
  - **There are still many attempts for ornithopters**

1.2 The attemps of human carrying flight

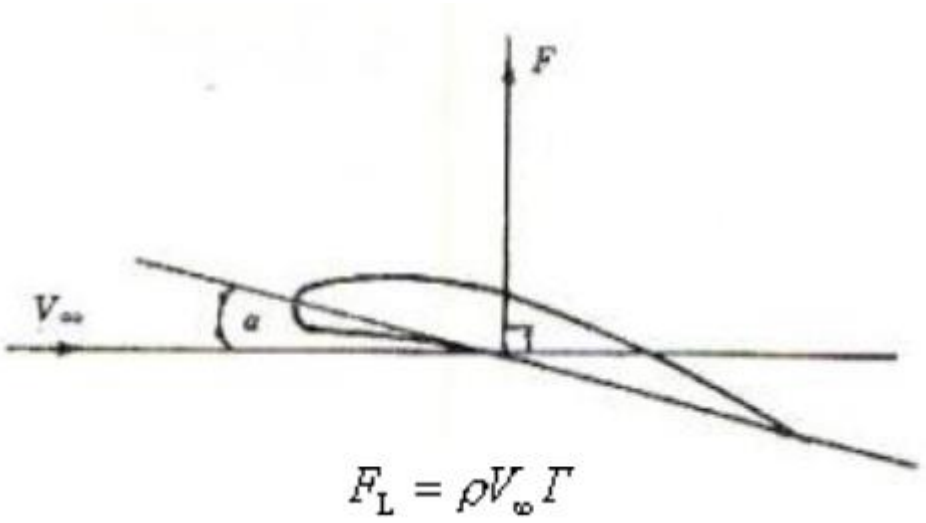
- **The ornithopters**
  - **Ornithopters/flapping wing aircraft could be a good choice for MAVs.**





1.2 The attemps of human carrying flight

- **The ornithopters**
  - **How ornithopters fly**



Kutta-joukowski theorem

1.2 The attemps of human carrying flight

- **The ornithopters**
  - **In general, ornithopters are not so successful as the fixed wing aircrafts and rotor aircrafts.**

1.2 The attemps of human carrying flight

- **The principle of the modern aircraft by Sir George Cayley**
  - **He conceived that the generation of the lift and thrust should be separated**

1.2 The attemps of human carrying flight

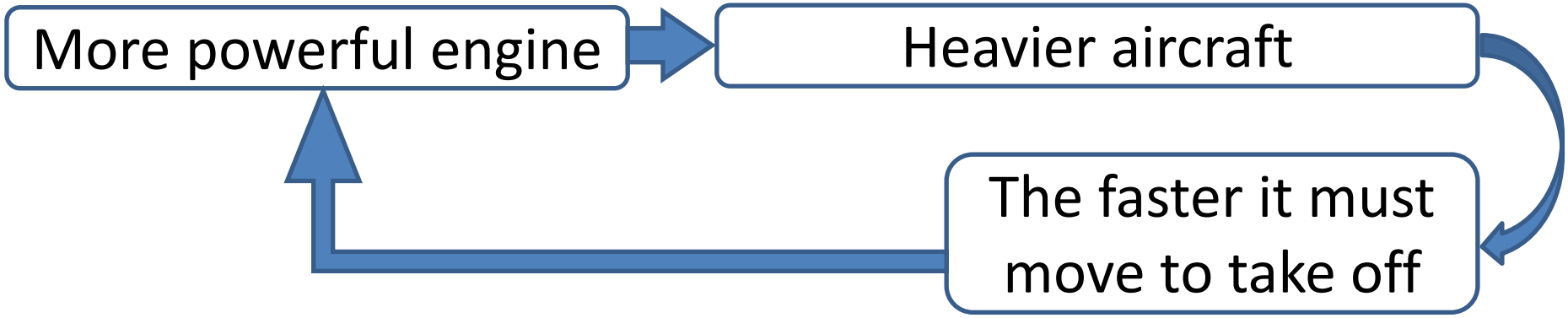
- **The principle of the modern aircraft by Sir George Cayley**
  - **The 19th century was full of abortive attempts to actually build and fly fixed-wing, powered, human carrying flying machines**

1.2 The attemps of human carrying flight

- **The principle of the modern aircraft by Sir George Cayley**
  - **The inventors were trying to equip the aircraft with powerful engine to accelerate aircraft to a velocity high enough to raise the machine off the ground and into the air**

1.2 The attemps of human carrying flight

- **The principle of the modern aircraft by Sir George Cayley**
  - **They suffered from the same circular argument:**



1.2 The attemps of human carrying flight

- The way out of the quandary is to build the engine with higher T/W （thrust to weight ratio）
- To accelerate the air craft, they need to increase the L/D （Lift to drag ratio）

1.2 The attemps of human carrying flight

- At that time，the inventors were obsessed with brute force.

- With enough power given, the aircraft could be wrestled into the air

1.2 The attemps of human carrying flight

- **The epitome of the chauffeurs was Sir Hiram Maxim**