

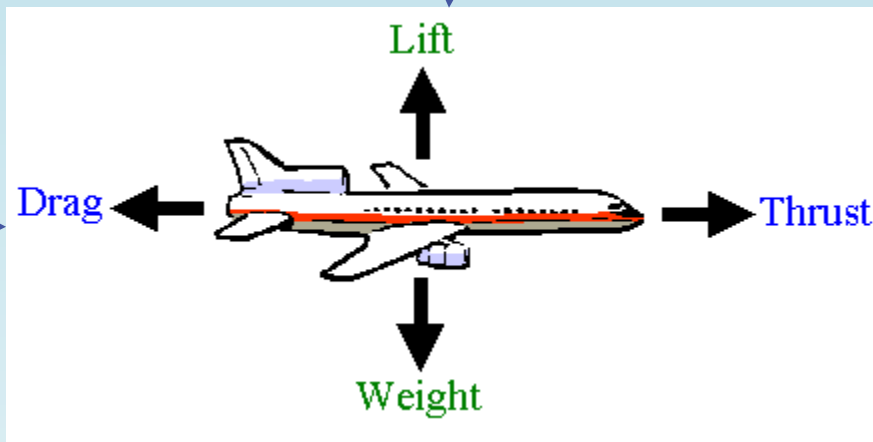
# Drag and Lift

MATERI VII

# Drag, Lift, Weight, Thrust

Gaya yang bekerja dalam arah horizontal dan berlawanan arah dengan arah gerak maju kendaraan (Thrust)

Gaya angkat yang berlawanan dengan gaya gravitasi bumi (Weight)



Gaya yang bekerja berlawanan dengan gaya hambat (Drag)

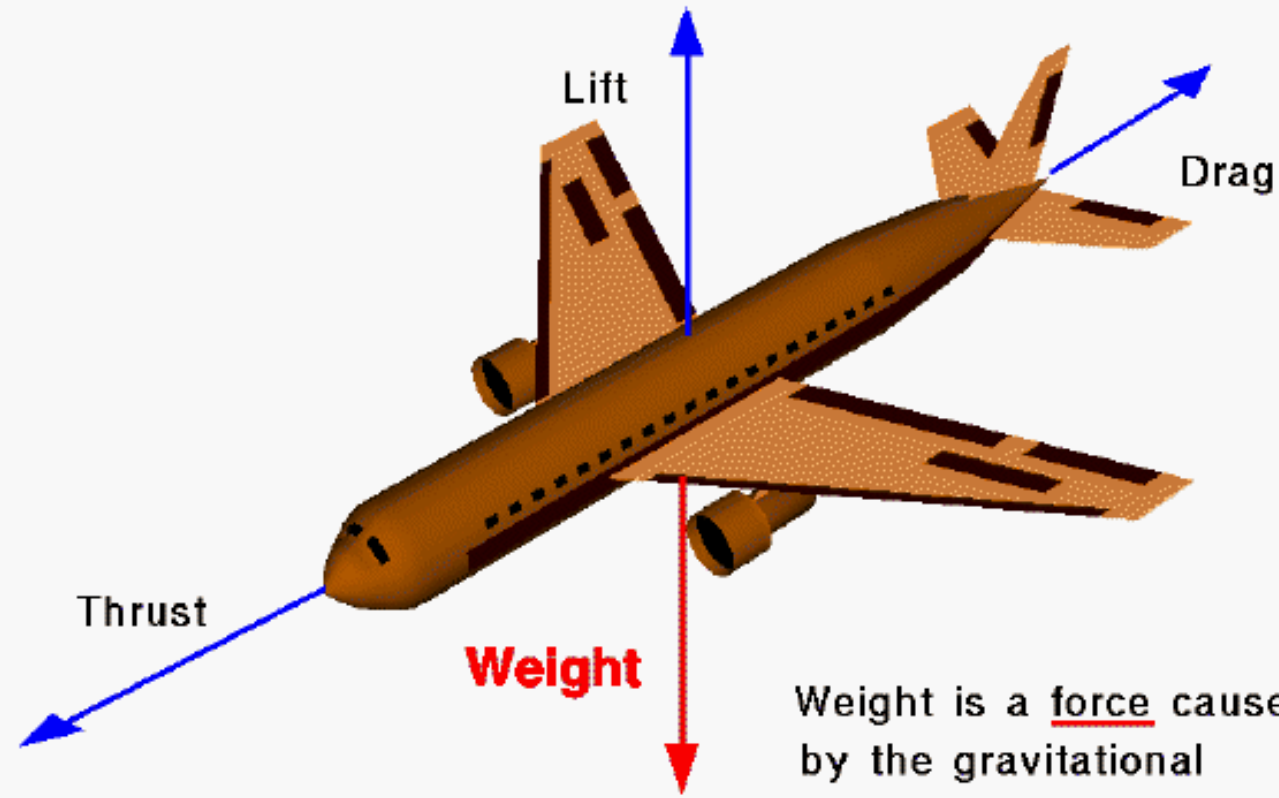
Gaya berat benda yang dipengaruhi oleh gaya gravitasi bumi

# Weight



## *What is Weight?*

Glenn  
Research  
Center



Weight is a force caused by the gravitational attraction of the Earth.

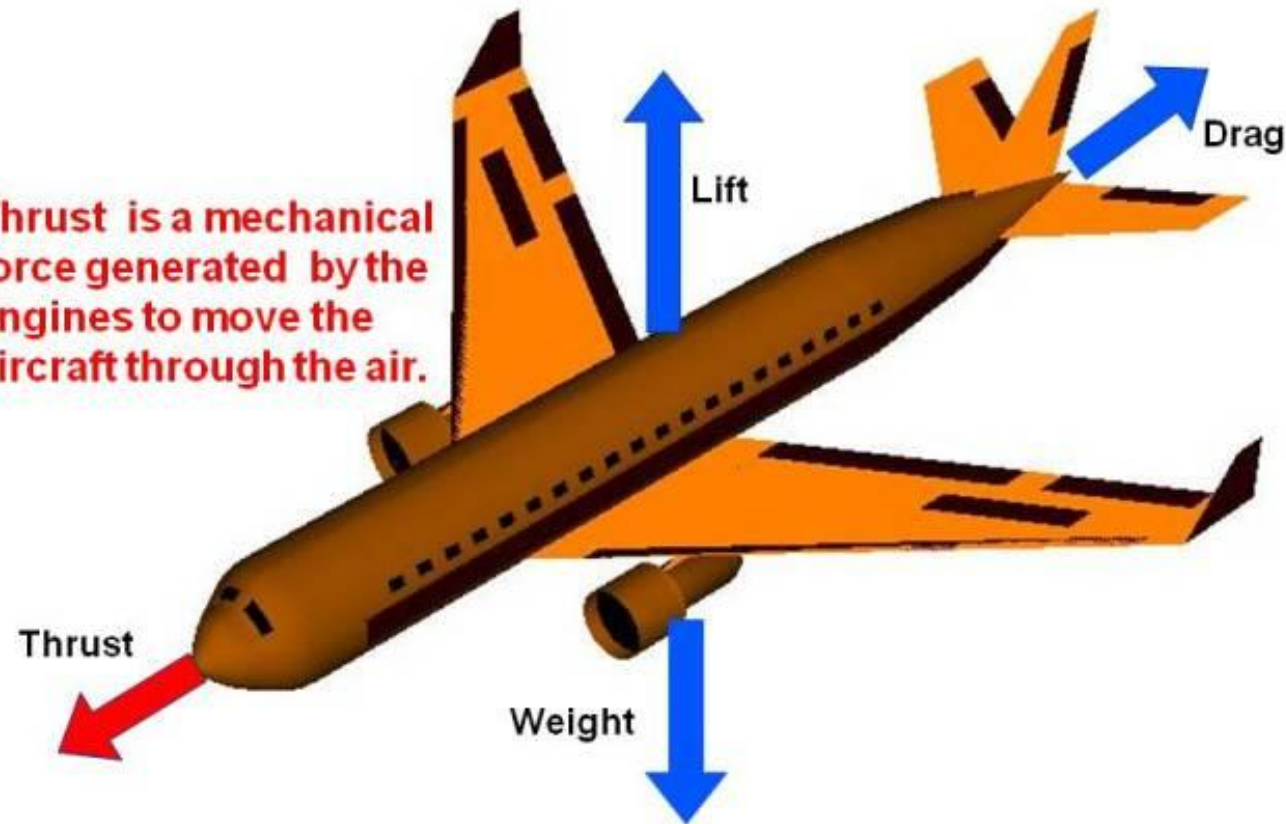
# Thrust

National Aeronautics and Space Administration



## What is Thrust ?

**Thrust is a mechanical force generated by the engines to move the aircraft through the air.**



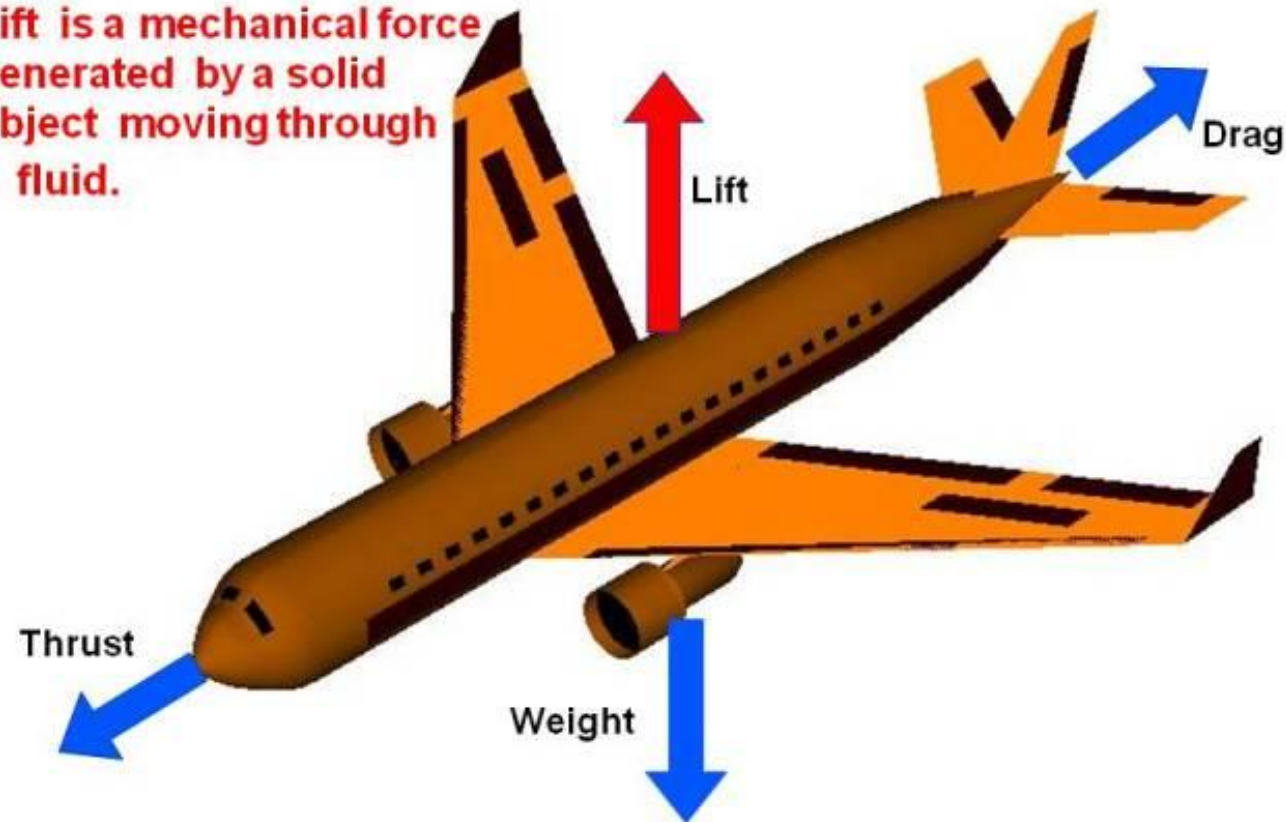
# Lift

National Aeronautics and Space Administration



## What is Lift ?

**Lift is a mechanical force generated by a solid object moving through a fluid.**

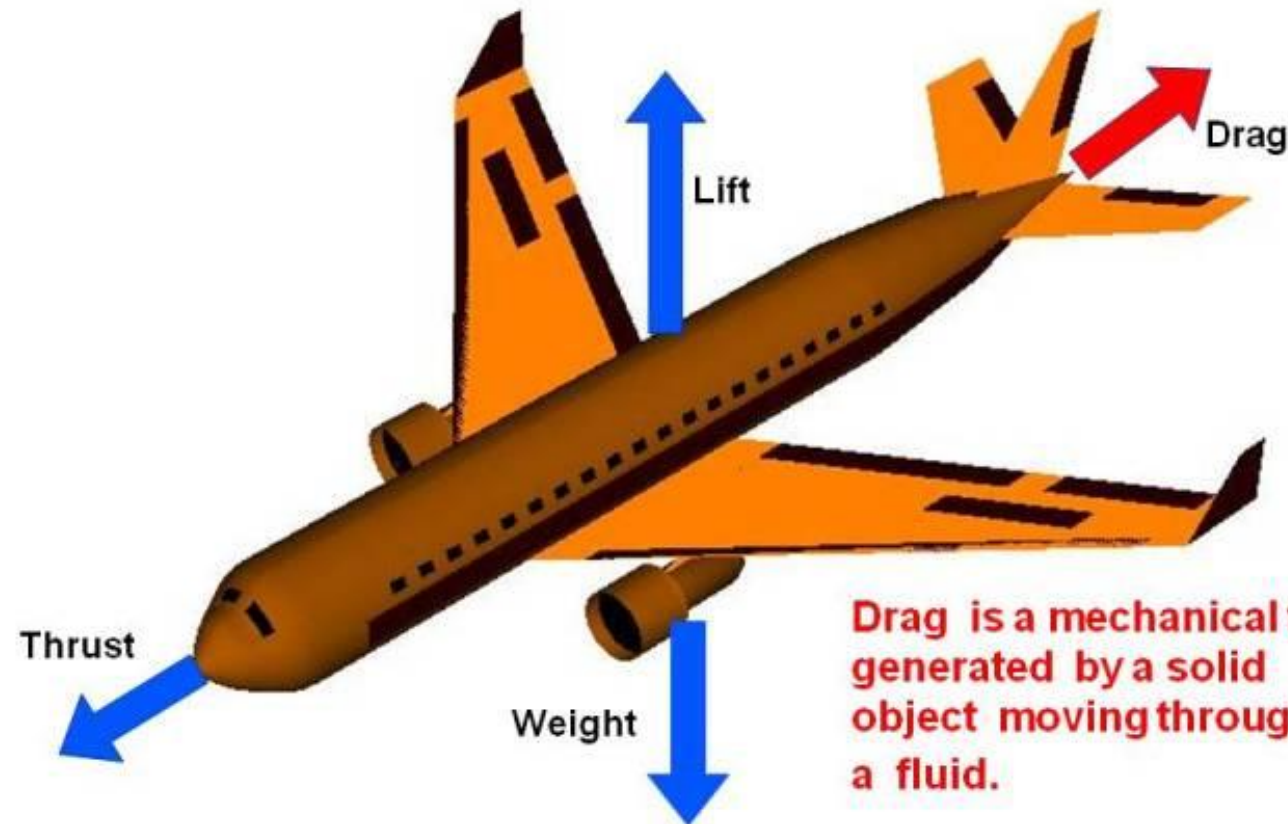


# Drag

National Aeronautics and Space Administration

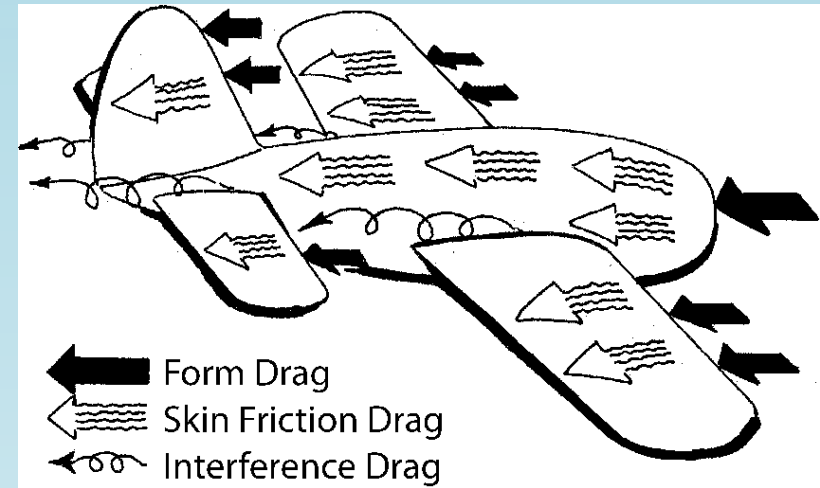


## What is Drag ?

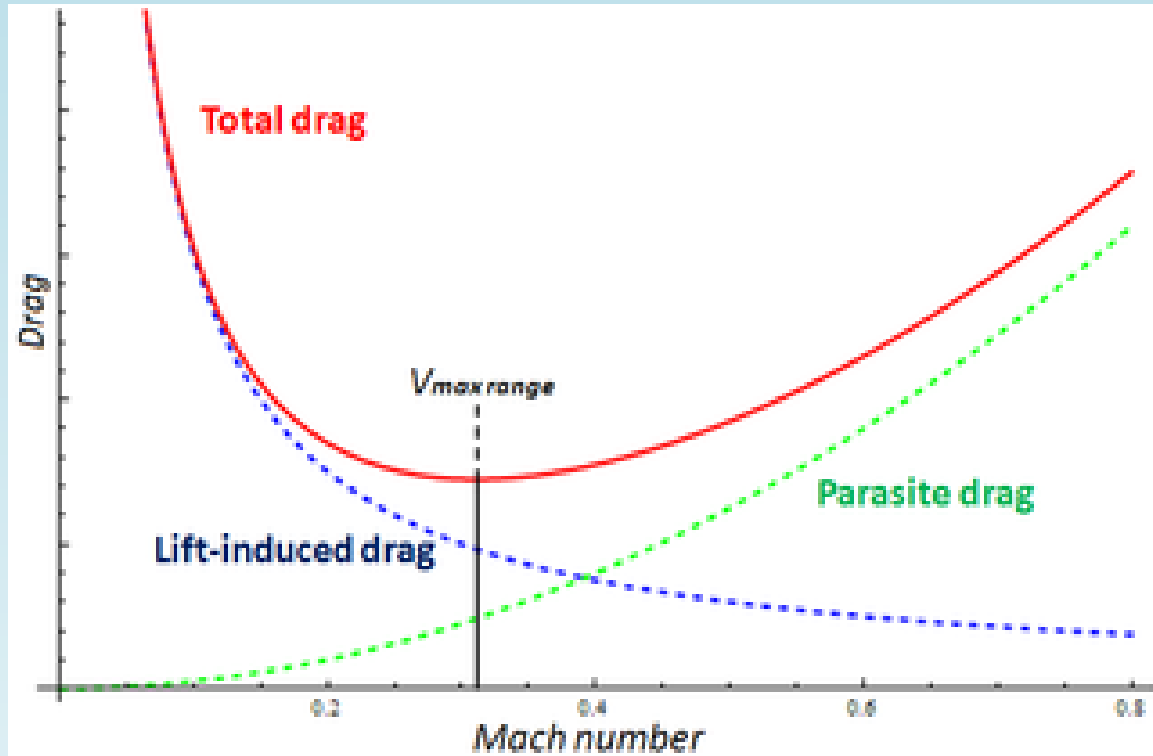


**Drag is a mechanical force generated by a solid object moving through a fluid.**

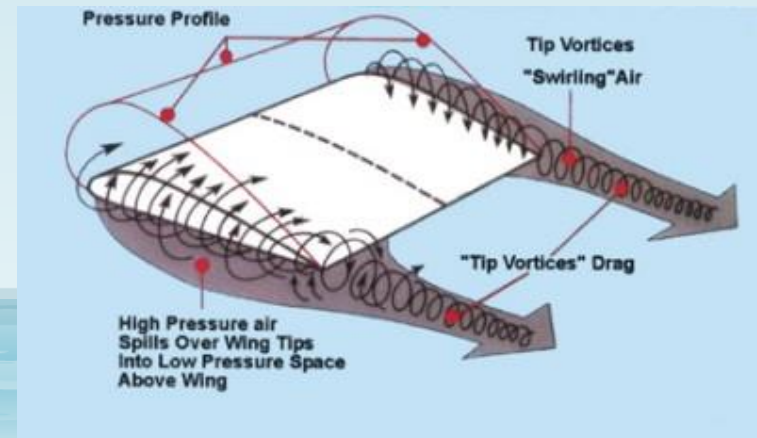
# Jenis Drag



Parasite Drag



Grafik Total Drag



Induced Drag

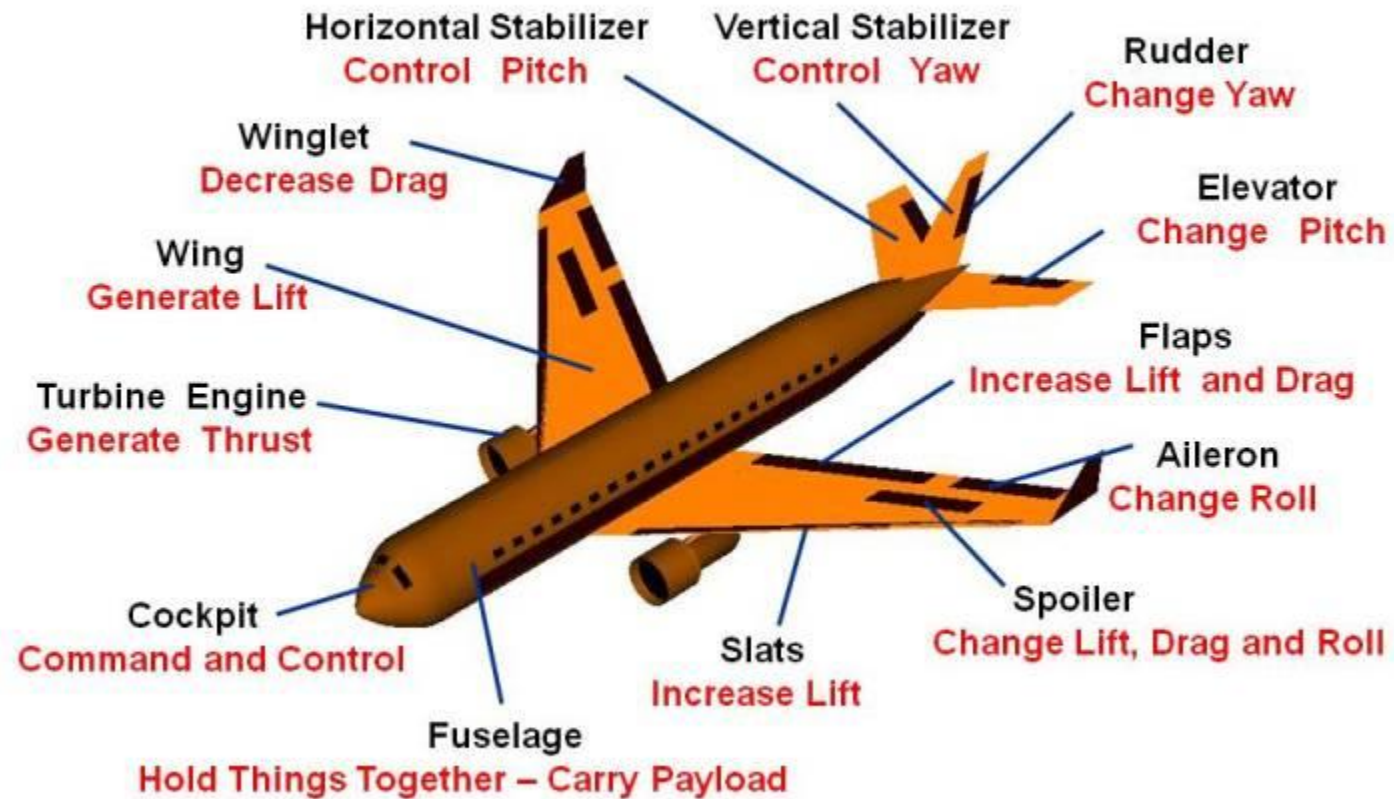


# Komponen Pesawat Terbang

National Aeronautics and Space Administration




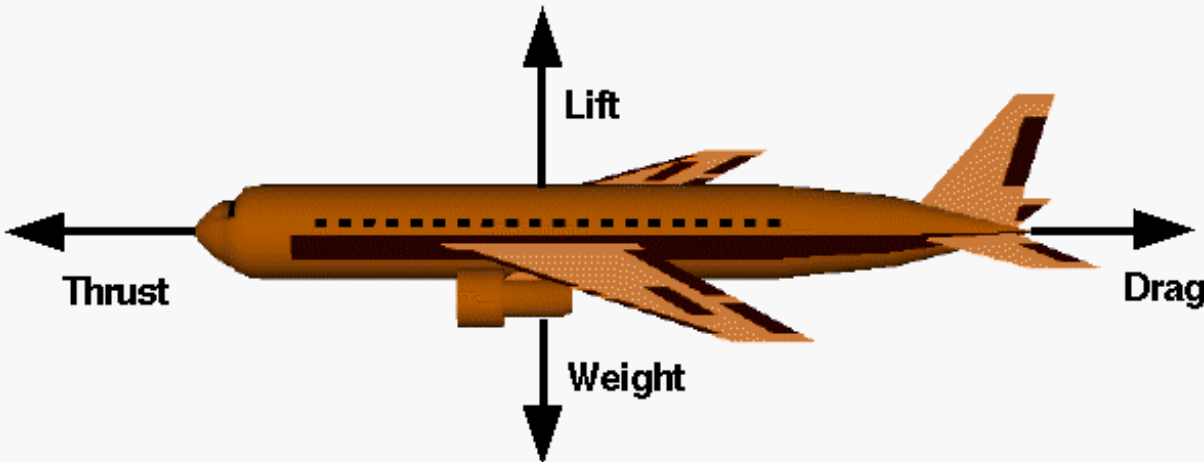
## Airplane Parts and Function





# Gerakan Pesawat Terbang

 **Simplified Aircraft Motion**  
*Unbalanced Forces* Glenn Research Center



The diagram shows a brown aircraft with four force vectors: Lift (upward arrow), Weight (downward arrow), Thrust (leftward arrow), and Drag (rightward arrow).

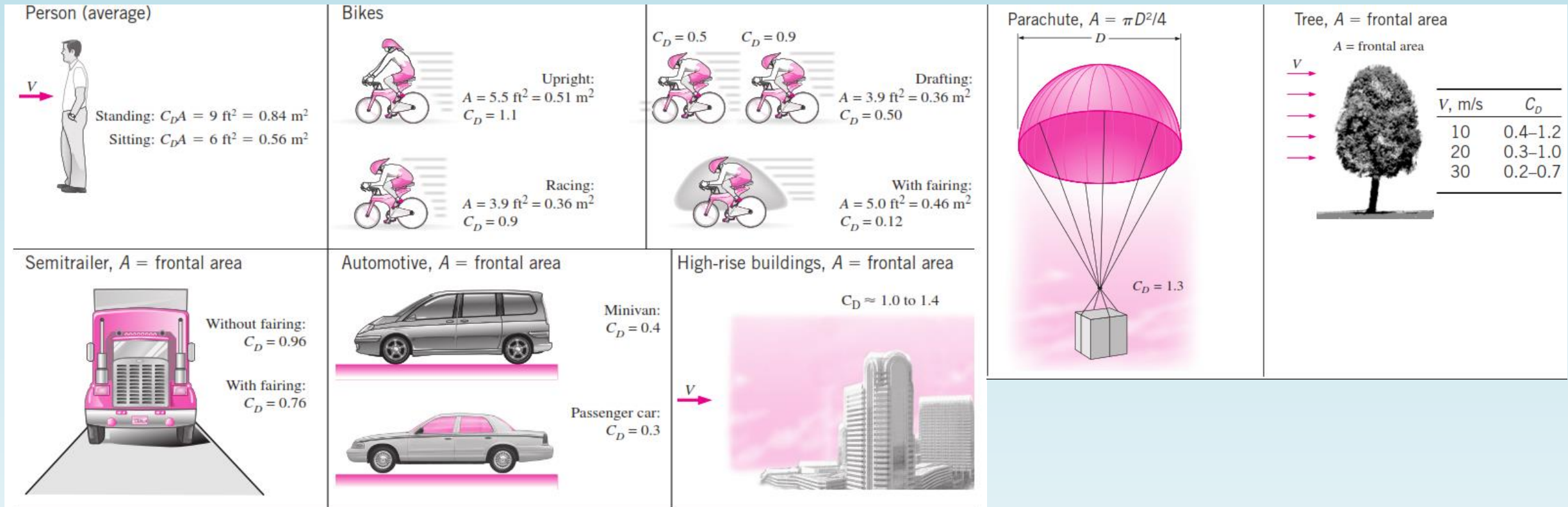
Flight Condition	Effect
Lift > Weight	Plane Rises
Weight > Lift	Plane Falls
Drag > Thrust	Plane Slows
Thrust > Drag	Plane Accelerates

# Rumus Drag and Lift

$$C_D = \frac{F_D}{\frac{1}{2}\rho V^2 A}$$

$$C_L = \frac{F_L}{\frac{1}{2}\rho V^2 A}$$

# Koefisien Drag and Lift

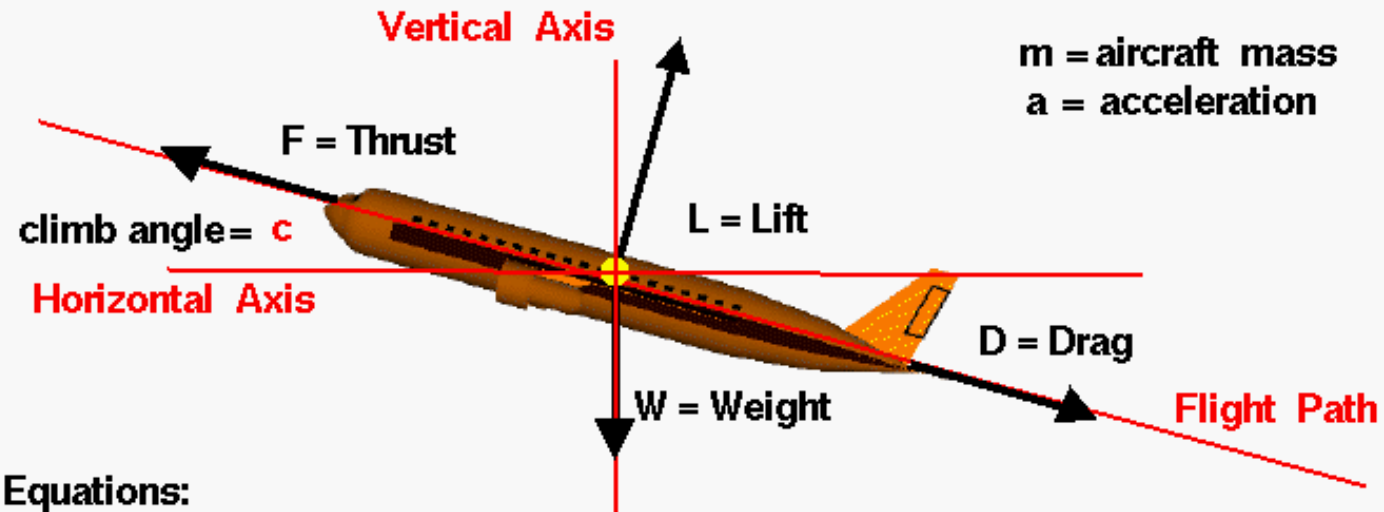


# Gaya Angkat Pesawat



## Forces in a Climb

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$m$  = aircraft mass  
 $a$  = acceleration

Equations:

Vertical  $F \sin(c) - D \sin(c) + L \cos(c) - W = m a_v$

Horizontal  $F \cos(c) - D \cos(c) - L \sin(c) = m a_h$

Definition of Excess Thrust:  $F - D = F_{ex}$

Vertical  $F_{ex} \sin(c) + L \cos(c) - W = m a_v$

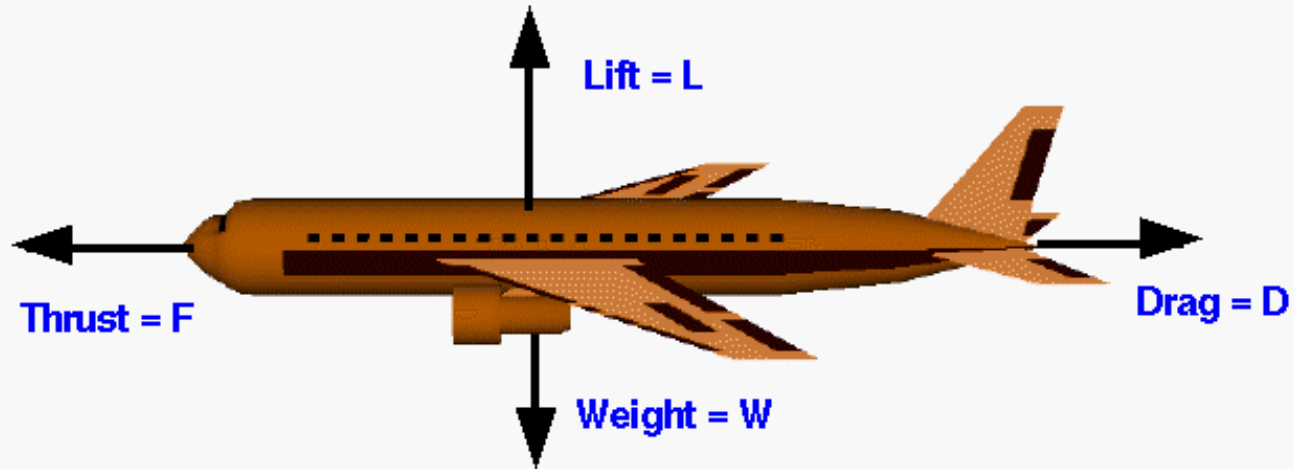
Horizontal  $F_{ex} \cos(c) - L \sin(c) = m a_h$

# Rasio Thrust to Weight



## Thrust to Weight Ratio

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$$\text{ratio} = \frac{F}{W} = \frac{\text{Thrust}}{\text{Weight}} = \frac{m a}{m g} = \frac{a}{g}$$

**a** = acceleration

**g** = gravitational acceleration

**m** = aircraft mass

High  $F/W$  = High Acceleration = High Climb Rate

$F/W > 1.0$  can accelerate vertically.

# Rasio Lift to Drag



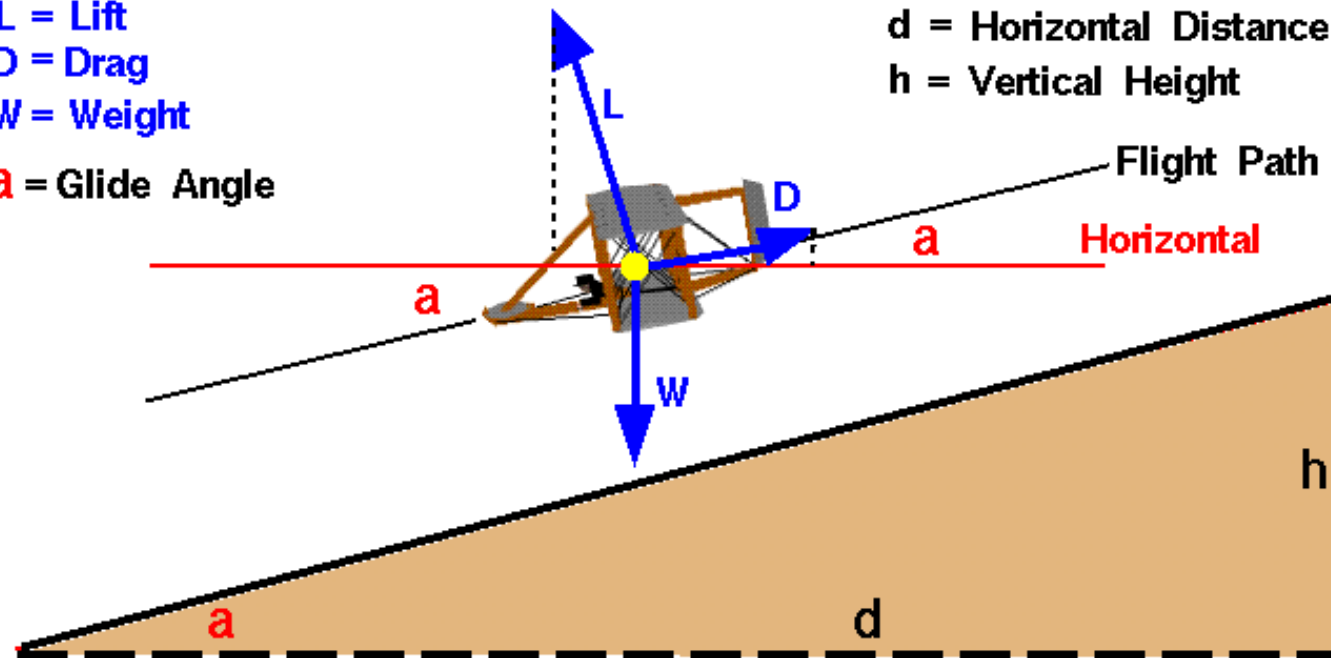
## Lift to Drag Ratio (L/D Ratio)

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L = Lift  
D = Drag  
W = Weight

a = Glide Angle

d = Horizontal Distance  
h = Vertical Height



Horizontal Force Equation:  $L \sin(a) = D \cos(a)$

$$\text{ratio} = \frac{\text{Lift}}{\text{Drag}} = \frac{L}{D} = \frac{cl}{cd} = \frac{1}{\tan(a)} = \frac{d}{h} = \frac{\text{distance}}{\text{height}}$$