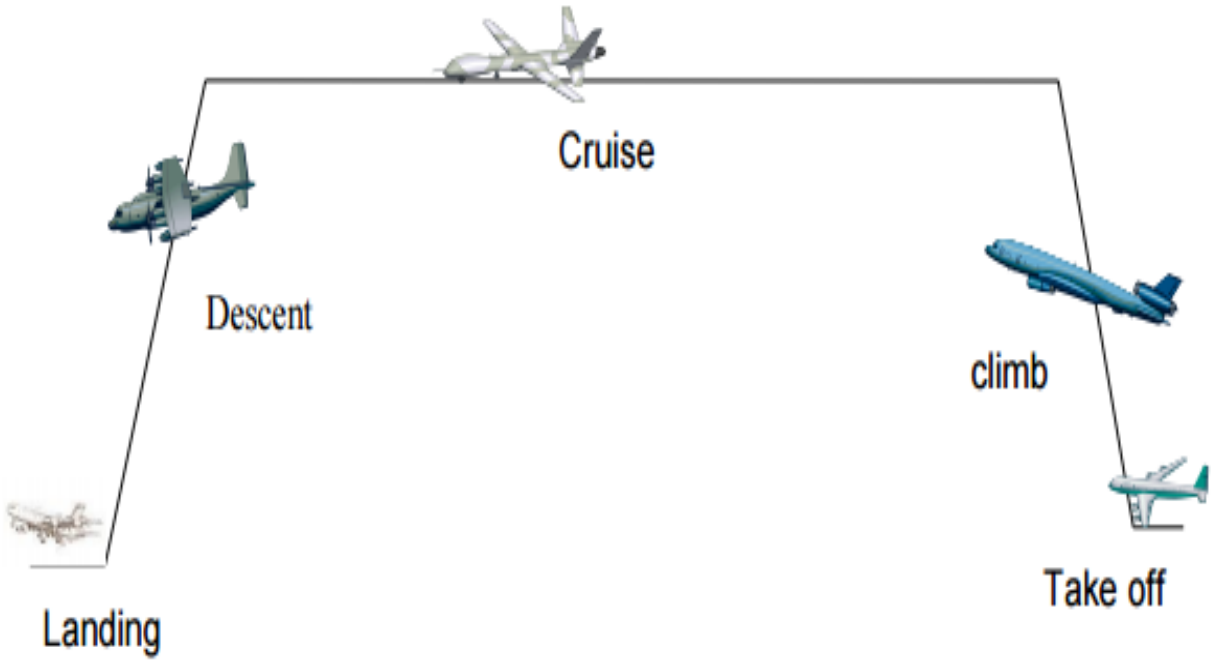
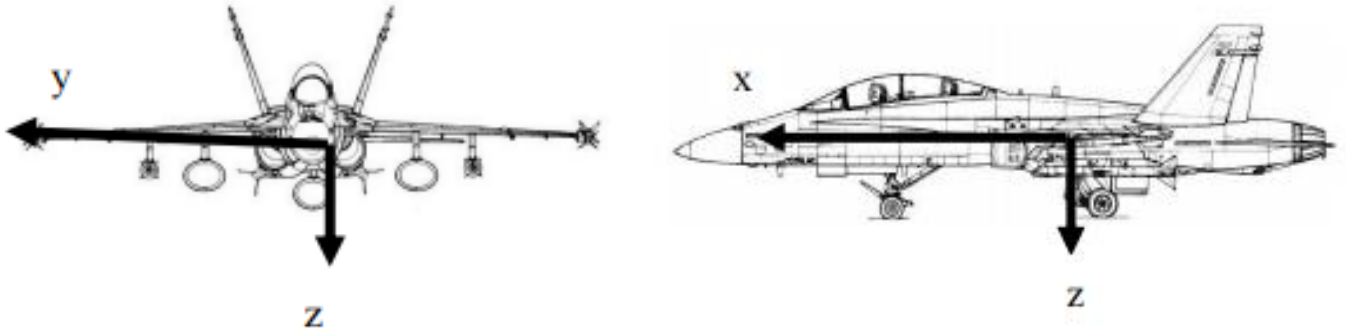

Aircraft
AIR-BERLIN
KKS/ZDMT

The flight phases of a simple flight mission



- Drag force (D) variations versus velocity (V) is fitted with a parabolic curve.

Steady-State Trim Equations



Picture 1 - Aircraft coordinate system

The Newton's second law: $\overline{F} = m\bar{a} = m\frac{d\bar{v}}{dt}$,

$$\sum F_x = ma_x$$

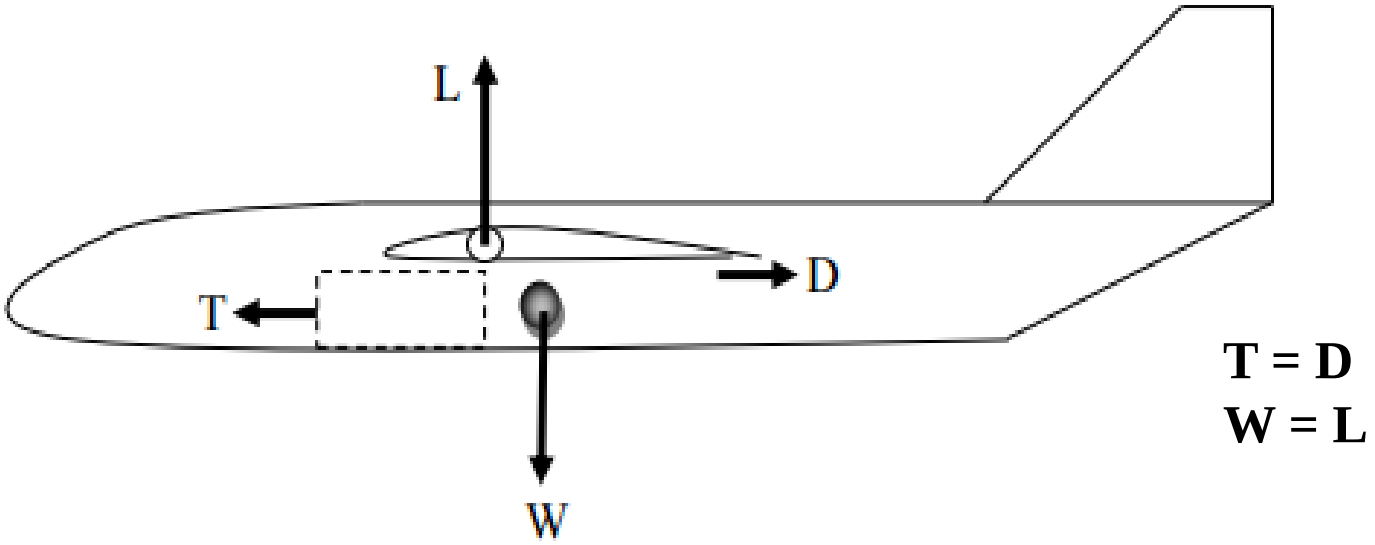
$$\sum F_y = 0$$

$$\sum F_z = 0$$

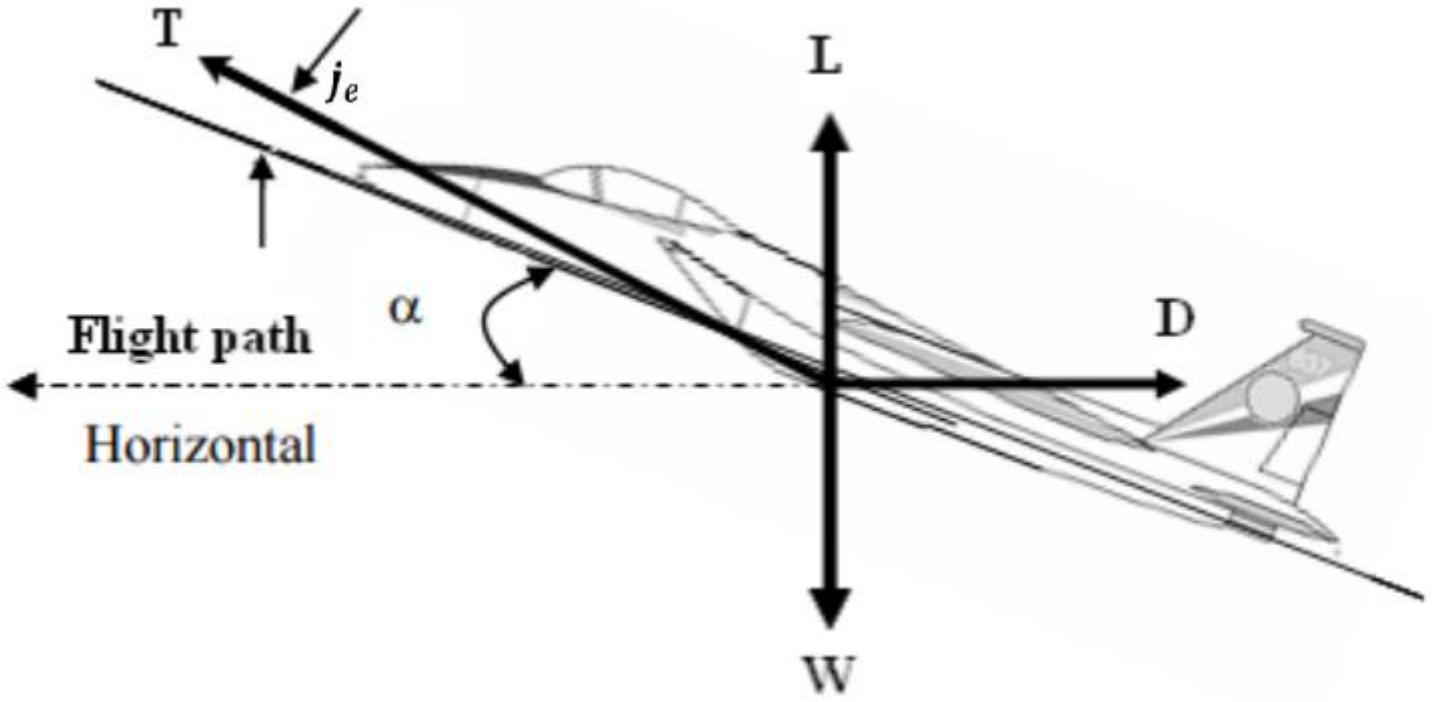
$$\Rightarrow \quad \sum F_x = ma_x \qquad \sum F_z = 0 \quad \Rightarrow \quad \sum F_x = 0 \qquad \sum F_z = 0$$

The external forces that include:

- T – engine thrust
- D – drag
- W – aircraft weight
- L - lift



Picture 2 - Forces on an aircraft in straight line level flight



Picture 3 - Equilibrium of forces in a straight level flight

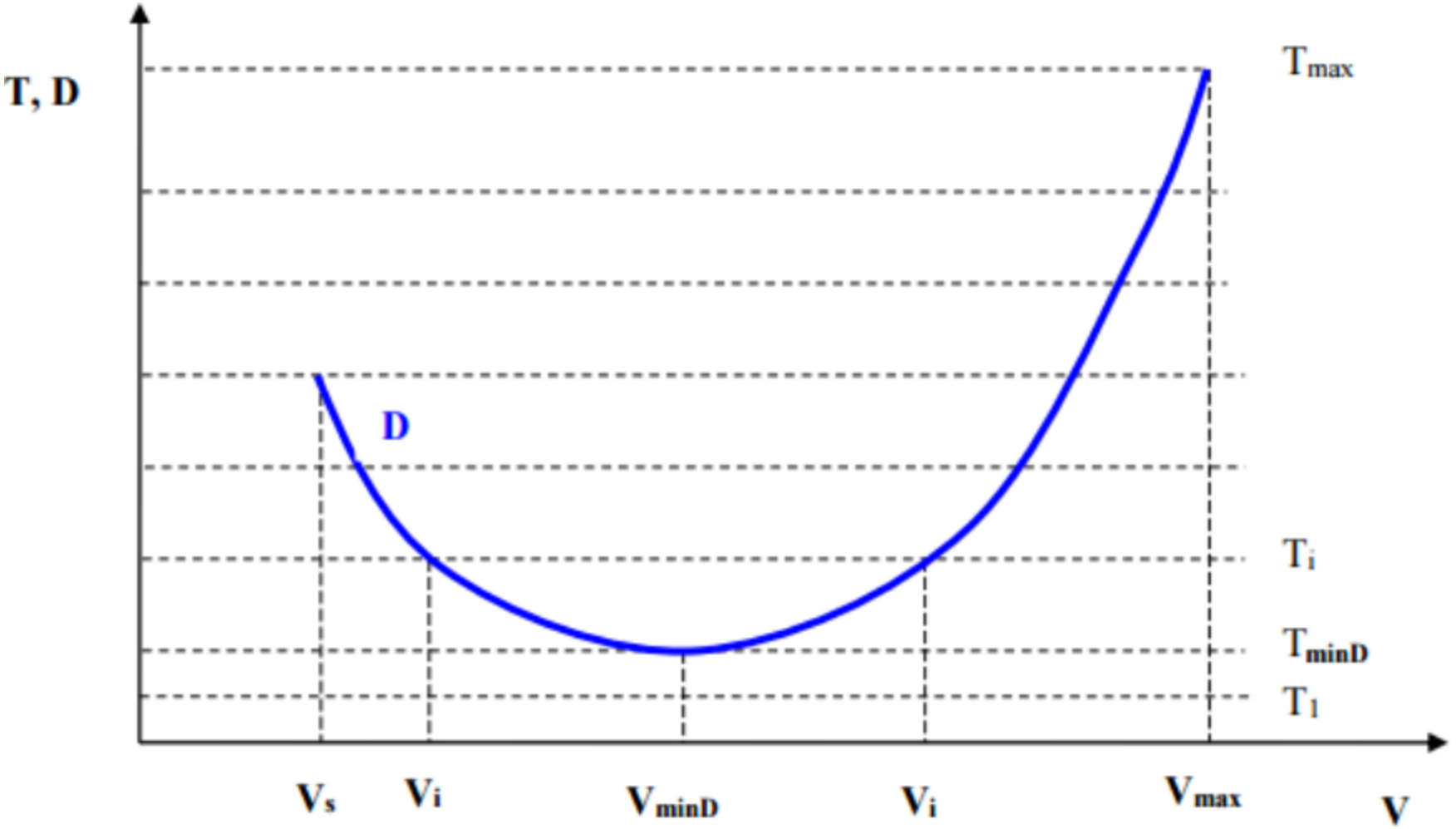
$$D = T \cos(\alpha + j_e)$$

$$W = L + T \sin(\alpha + j_e)$$

symplified calculation: $j_e = 0$

$$D = T \cos \alpha$$

$$W = L + T \sin \alpha$$



Picture 4 - Variations of drag and thrust as functions of velocity

Newton's formula F = m.a

At start D = D1 = we calculate from the formula for D.

then T1 = D1

T2 = 1,2 T1

then (T2 - D1) = m . a => a

D2 = T2

D2 => v

Thank you for your attention