Lateral Stability and Tail Sizing

Lecture 11

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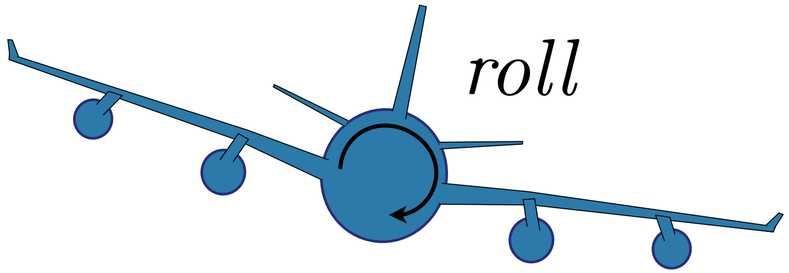
Lateral Stability

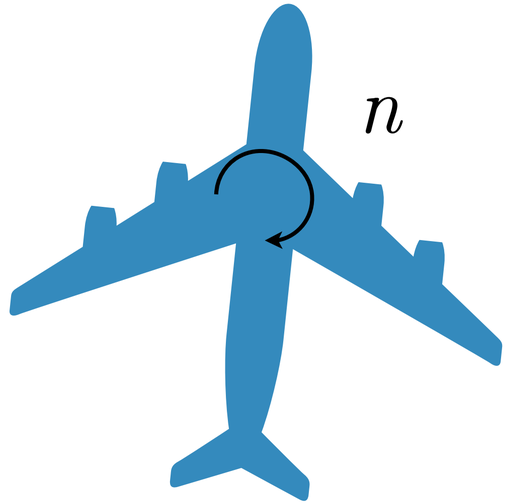
Coefficients (moments)

$$c_{roll} = \frac{roll}{q_\infty S_w b_w}$$

$$c_l = \frac{l}{q_\infty S_w b_w}$$

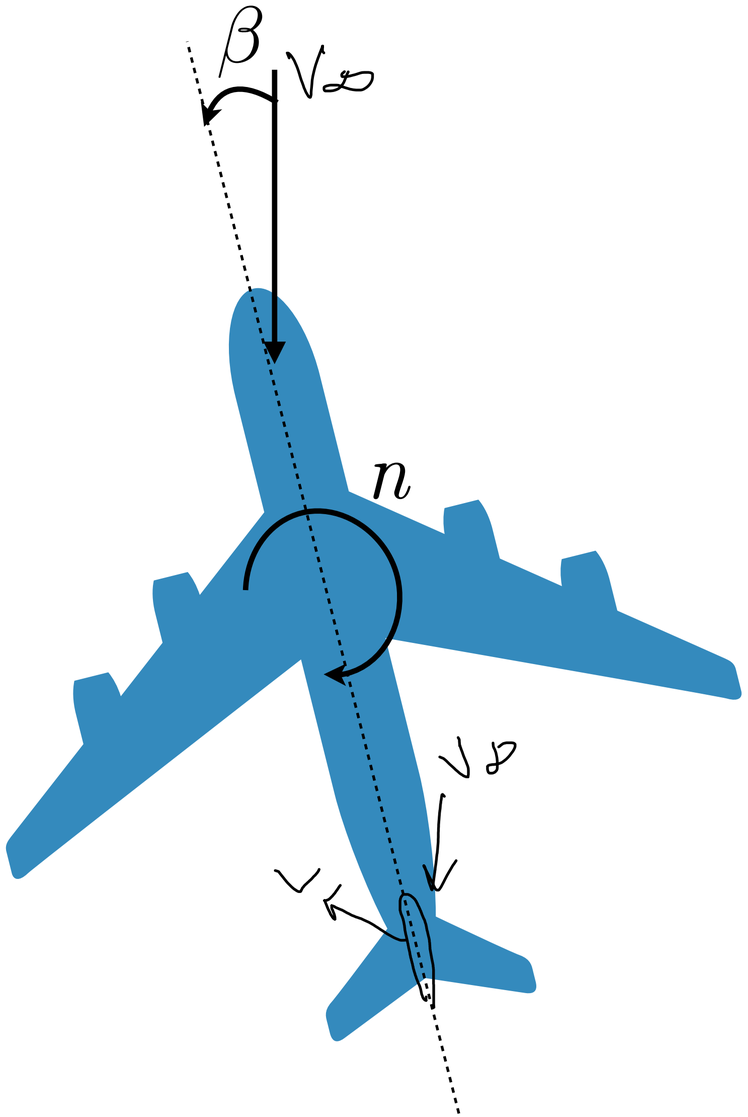
$$c_n = \frac{n}{q_\infty S_w b_w}$$





(yaw)

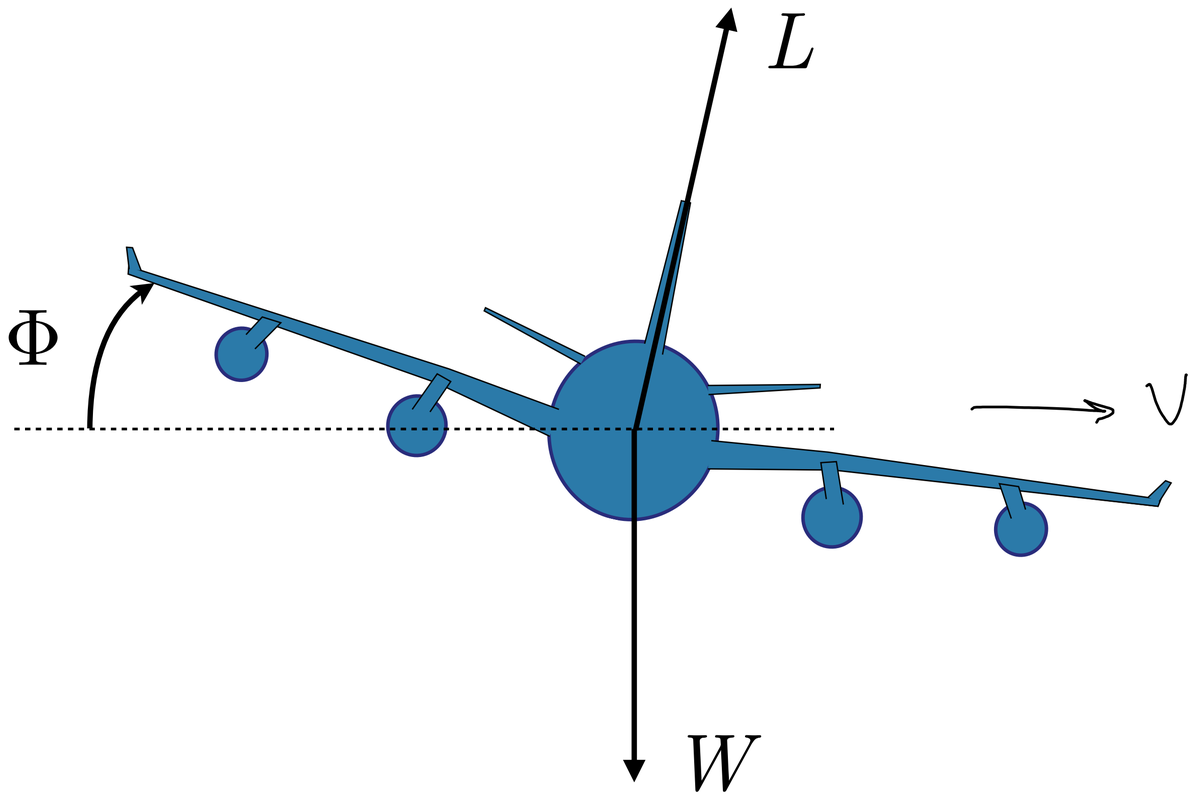
Yaw Stability (directional stability)



$$\frac{dC_n}{d\beta} > 0 \qquad C_{n,\beta} > 0$$


AIR FORCE

Roll Stability



$$\frac{dC_{roll}}{d\beta} < 0$$

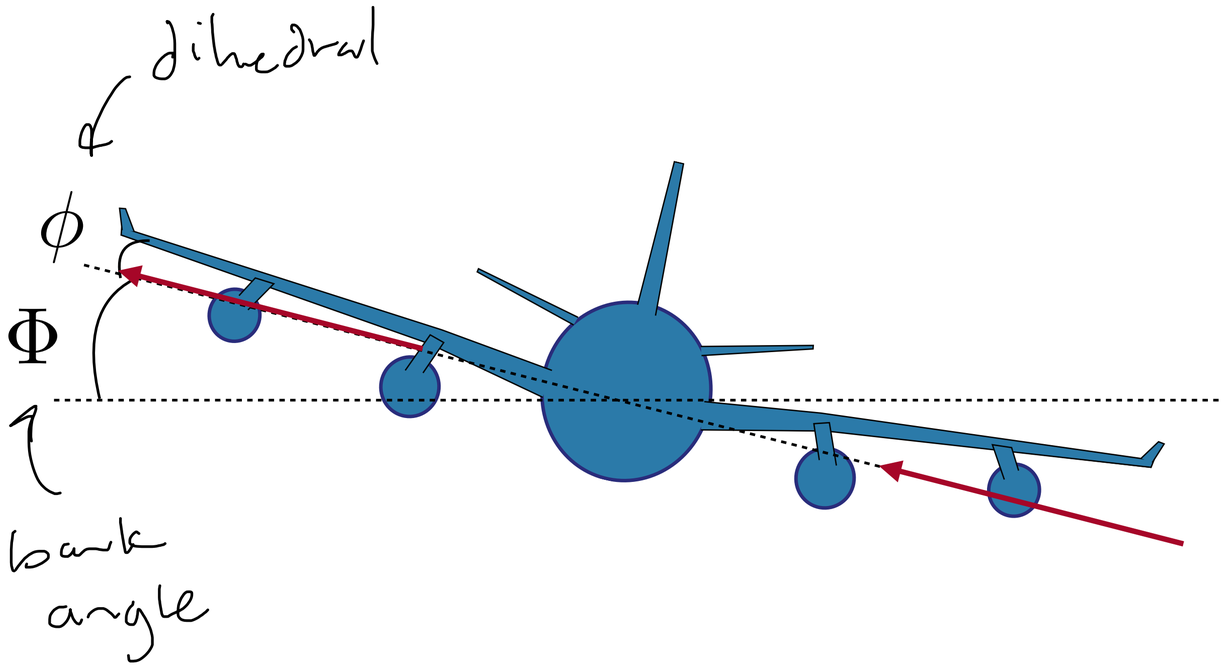
$$C_{roll,\beta} < 0$$

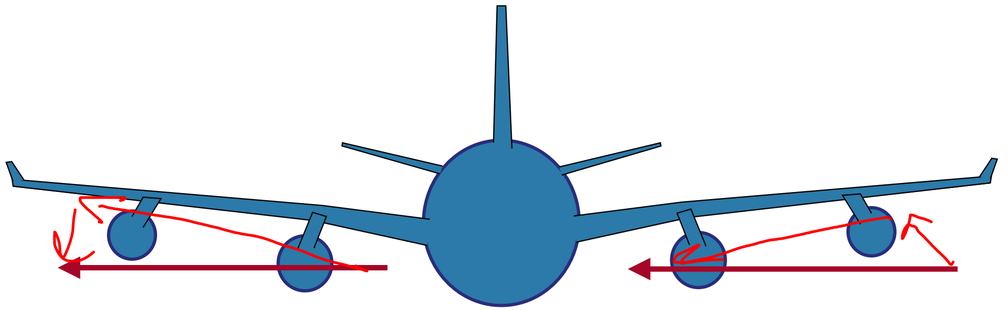
"effective dihedral"

(positive sideslip)

flying into page

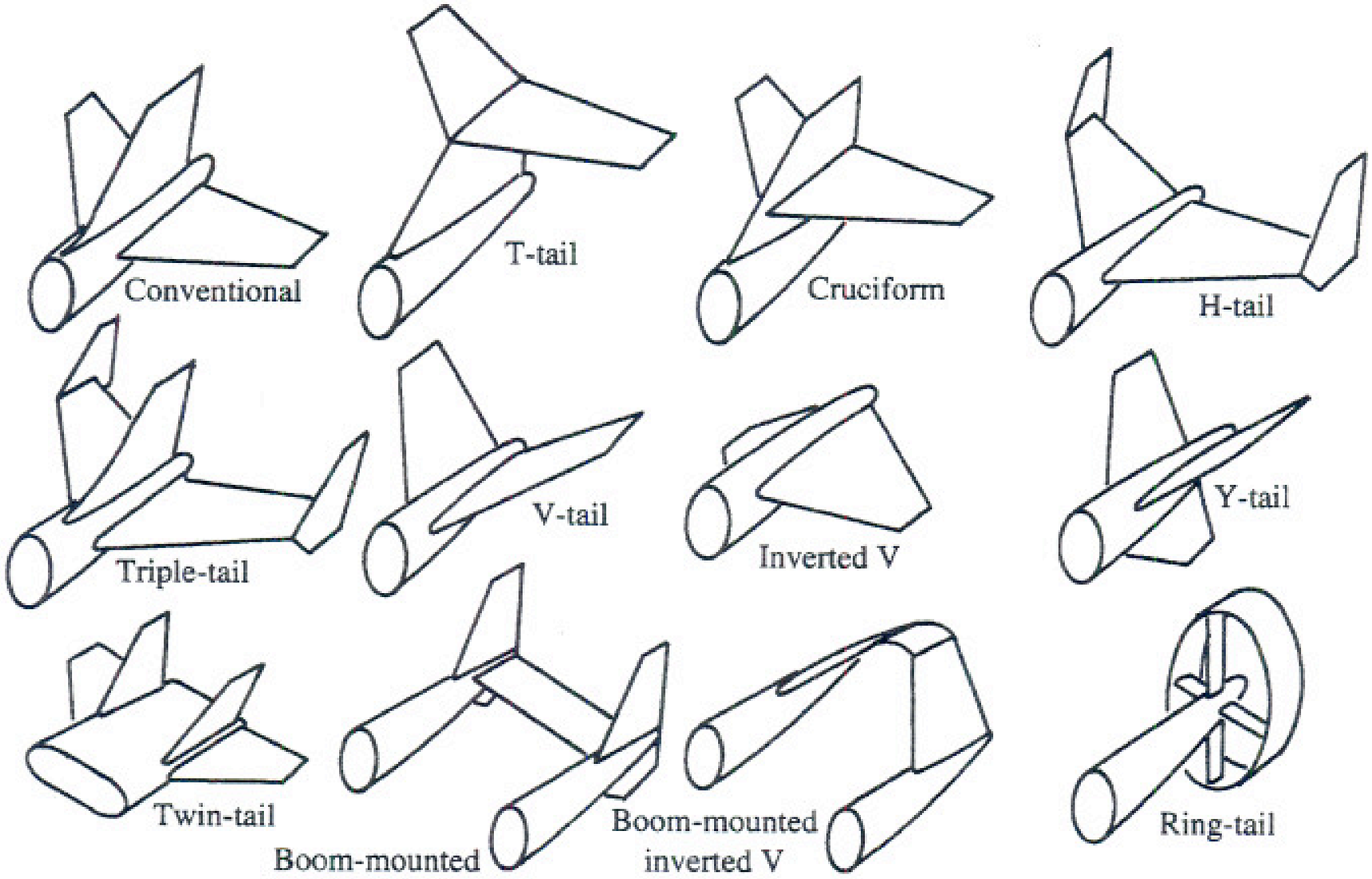
Dihedral



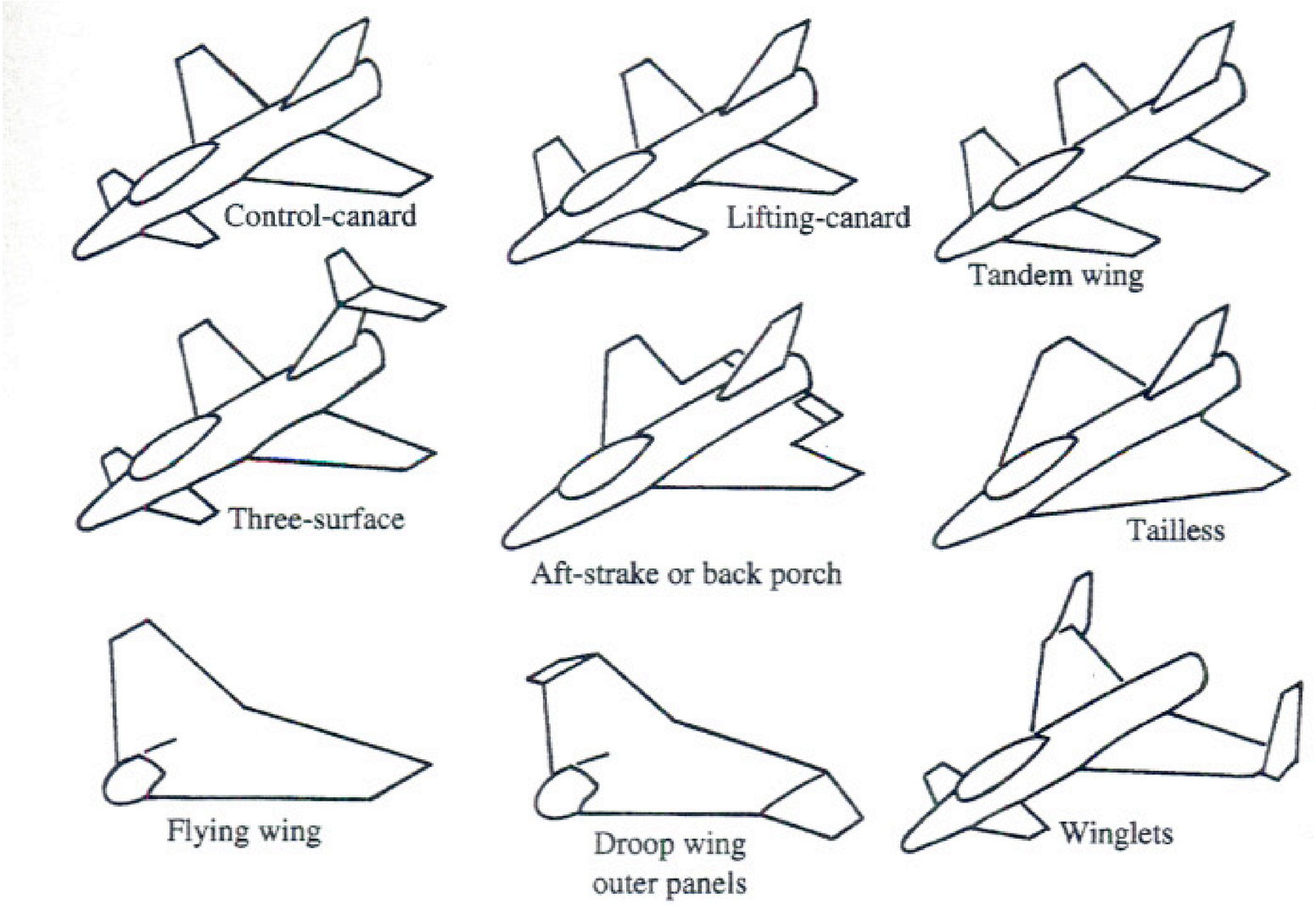


Statistical Tail Sizing

Tail Types



Raymer, Aircraft Design



Raymer, Aircraft Design

Statistical Tail Sizing

$$V_H = \frac{l_H S_H}{c_w S_w}$$

horizontal tail volume coefficient

$$V_V = \frac{l_V S_V}{b_w S_w}$$

vertical tail volume coefficient.

$V_H \sim 0.5 - 0.7$

$V_V \sim 0.02 - 0.04$

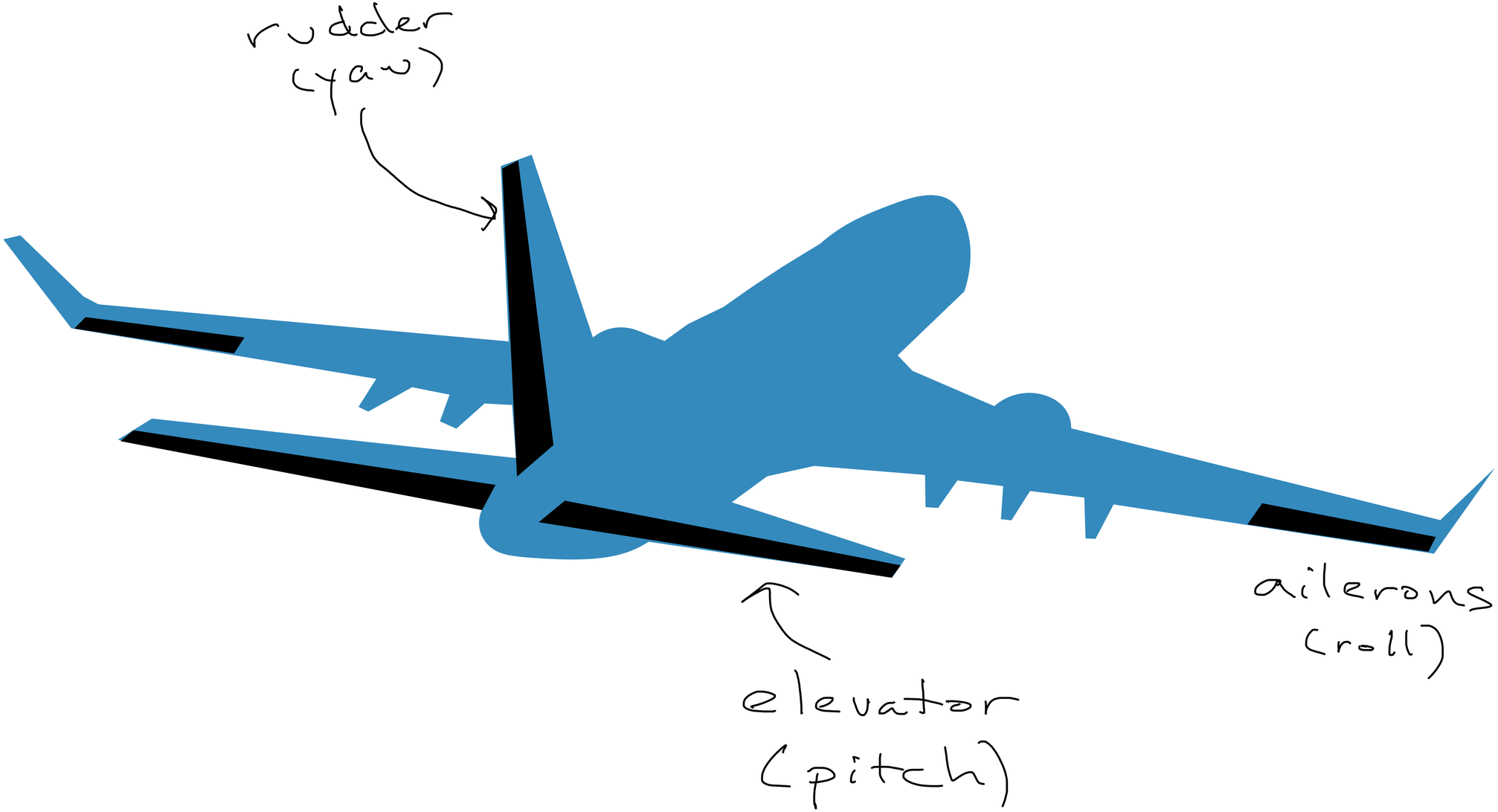
$AR_H \sim 3 - 5$

$AR_V \sim 1.3 - 2.0$

$\lambda \sim 0.4 - 0.6$

Control Surfaces

Flight Controls



Flight Controls