



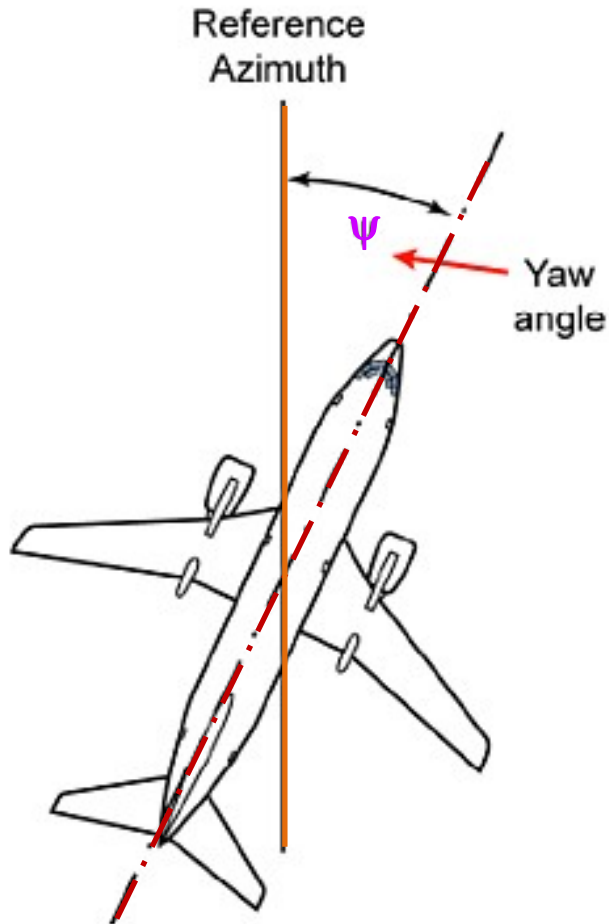
ESTABILIDAD ESTÁTICA DIRECCIONAL



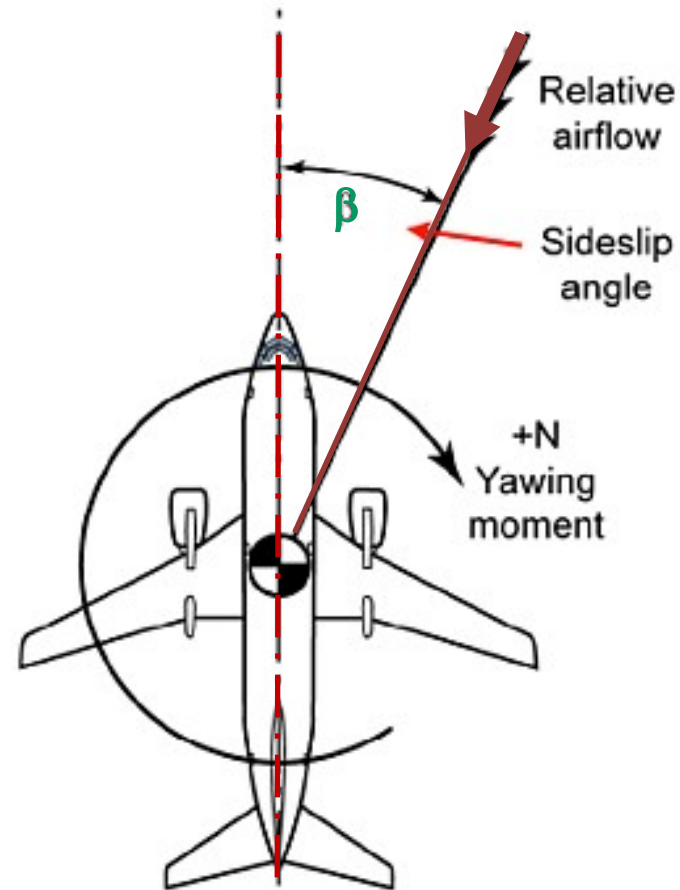
Primary Control Surface	Airplane Movement	Axes of Rotation	Type of Stability
Rudder	Yaw	Vertical	Directional

ESTABILIDAD ESTÁTICA DIRECCIONAL

El ángulo de guiñada Ψ es el que forma el eje longitudinal del avión con una determinada línea azimutal tomada como referencia.



El ángulo que formará el eje longitudinal del avión con el viento relativo se denomina ángulo de resbalamiento β .



ESTABILIDAD ESTÁTICA DIRECCIONAL

MOMENTO DE GUIÑADA:

$$N = C_n \cdot q \cdot S \cdot b$$

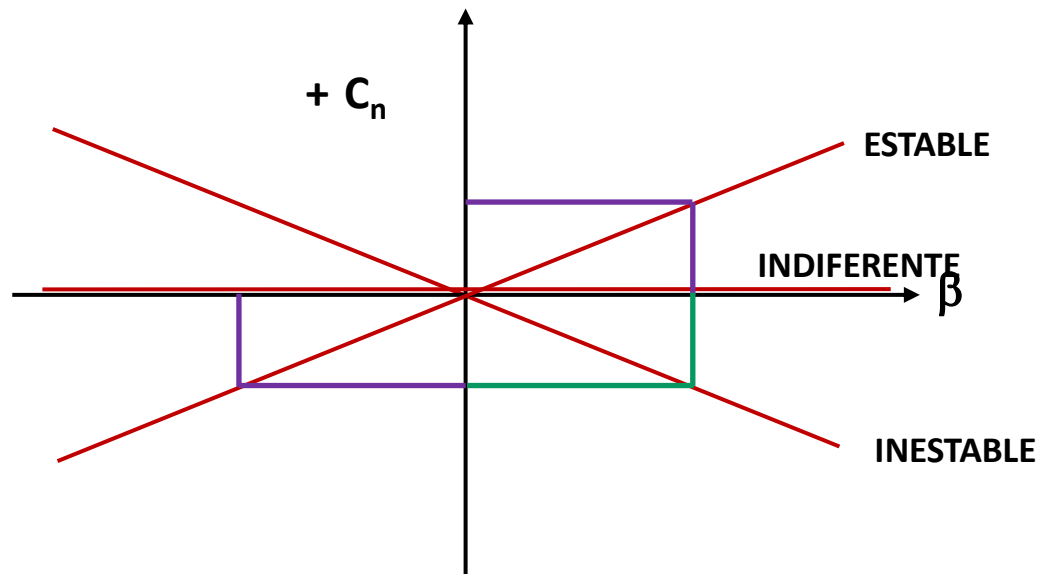
N = MOMENTO DE GUIÑADA

C_n = COEFICIENTE DE MOMENTO DE GUIÑADA

q = PRESIÓN DINÁMICA

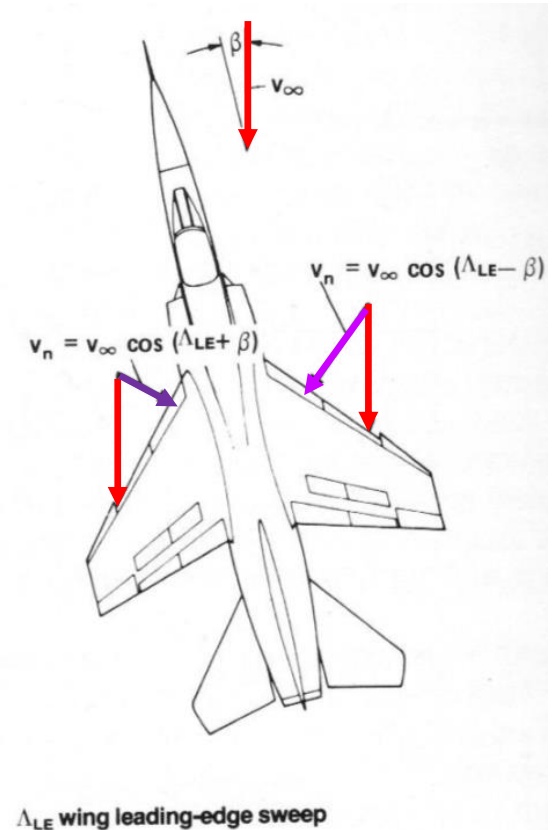
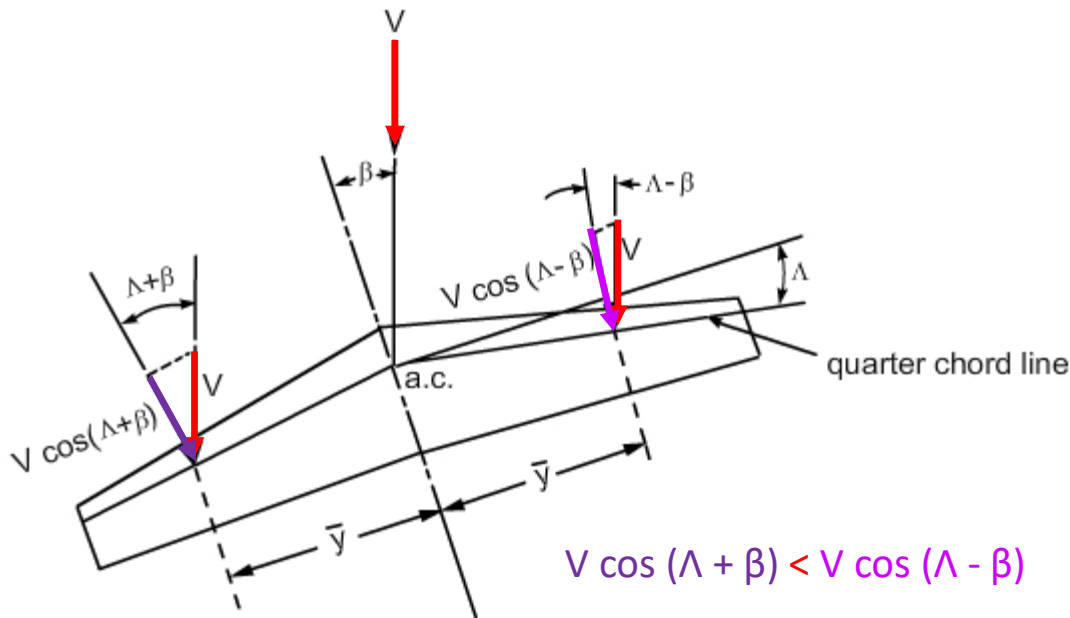
S = SUPERFICIE ALAR

b = ENVERGADURA



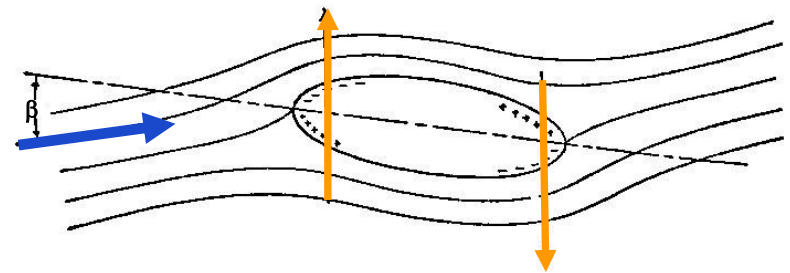
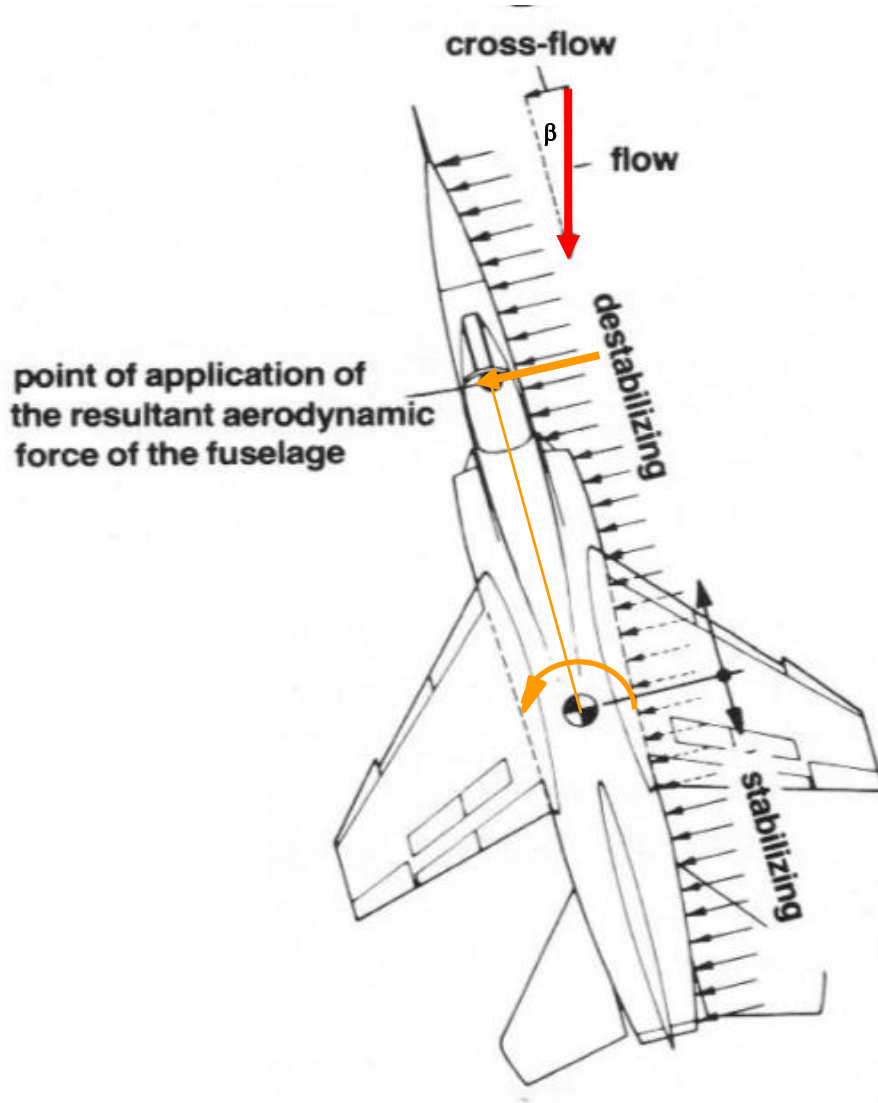
CONTRIBUCIÓN DEL ALA:

Cuando un ala con ángulo de flecha Λ está sujeta a deslizamiento lateral β , los componentes de la velocidad de la corriente libre que son normales a la línea del 25% de cuerda en las dos semialas serán desiguales, es decir, $V \cos(\Lambda - \beta)$ en el ala derecha y $V \cos(\Lambda + \beta)$ en el ala izquierda. En consecuencia, incluso si las dos semialas están con el mismo ángulo de ataque, experimentarían las presiones dinámicas efectivas desiguales y sus resistencias serán diferentes causando un momento de guiñada. Dependiendo del ángulo de flecha Λ , la contribución podrá ser: indiferente ($\Lambda = 0$), estable ($\Lambda > 0$), inestable ($\Lambda < 0$).



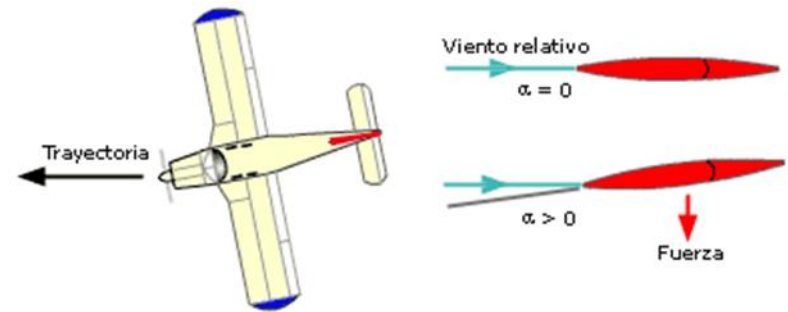
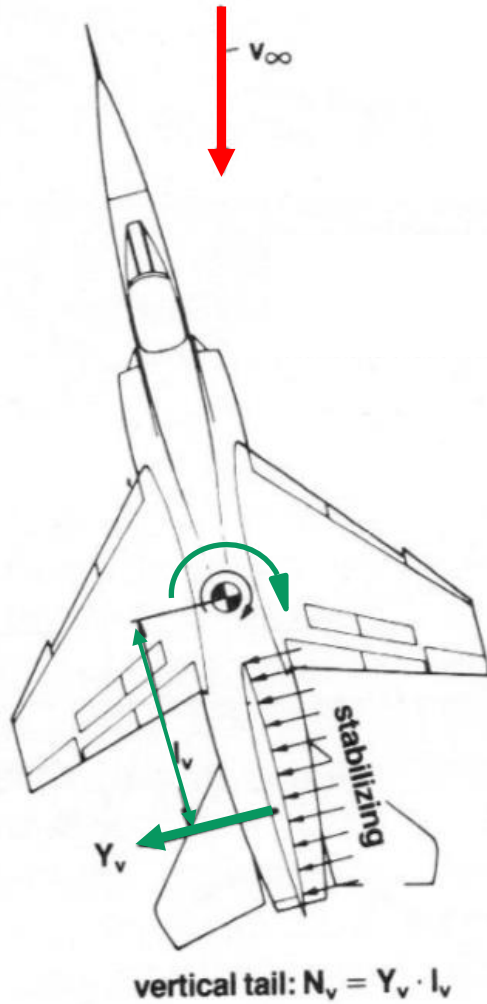
ESTABILIDAD ESTÁTICA DIRECCIONAL

CONTRIBUCIÓN DEL FUSELAJE: siempre desestabilizante.



ESTABILIDAD ESTÁTICA DIRECCIONAL

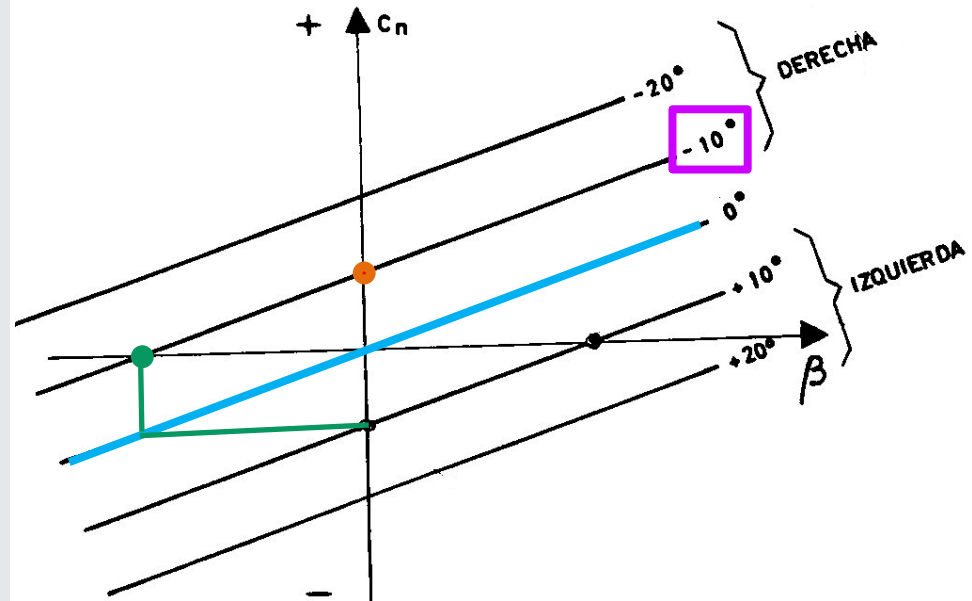
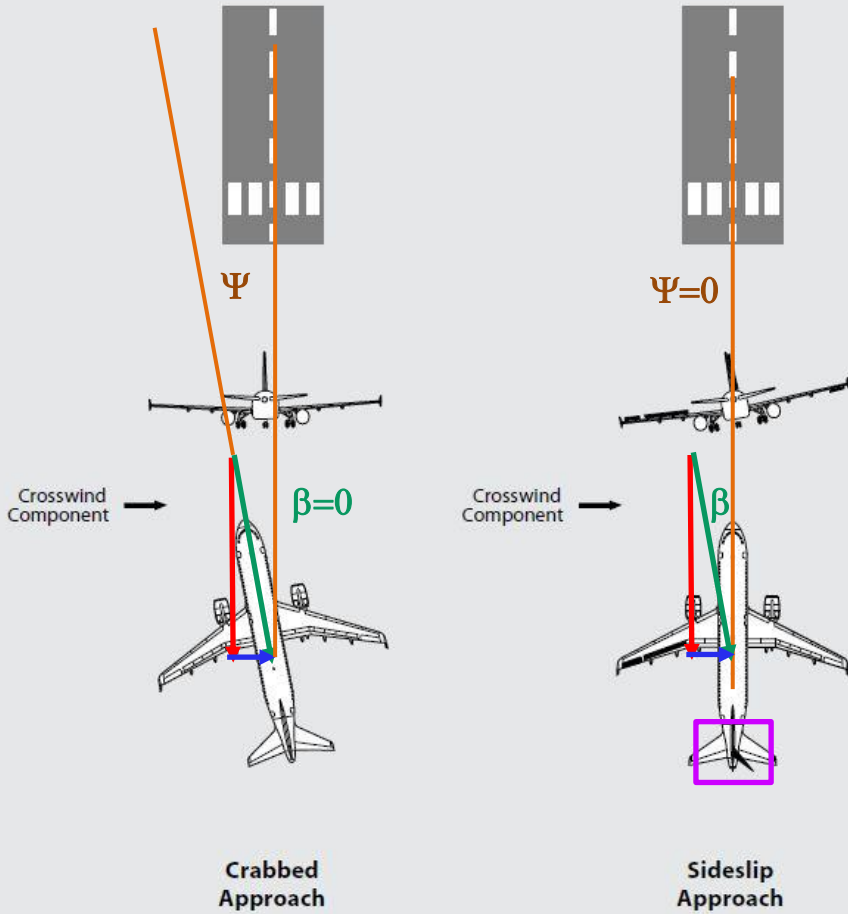
CONTRIBUCIÓN DEL EMPENAJE VERTICAL: siempre estabilizante.



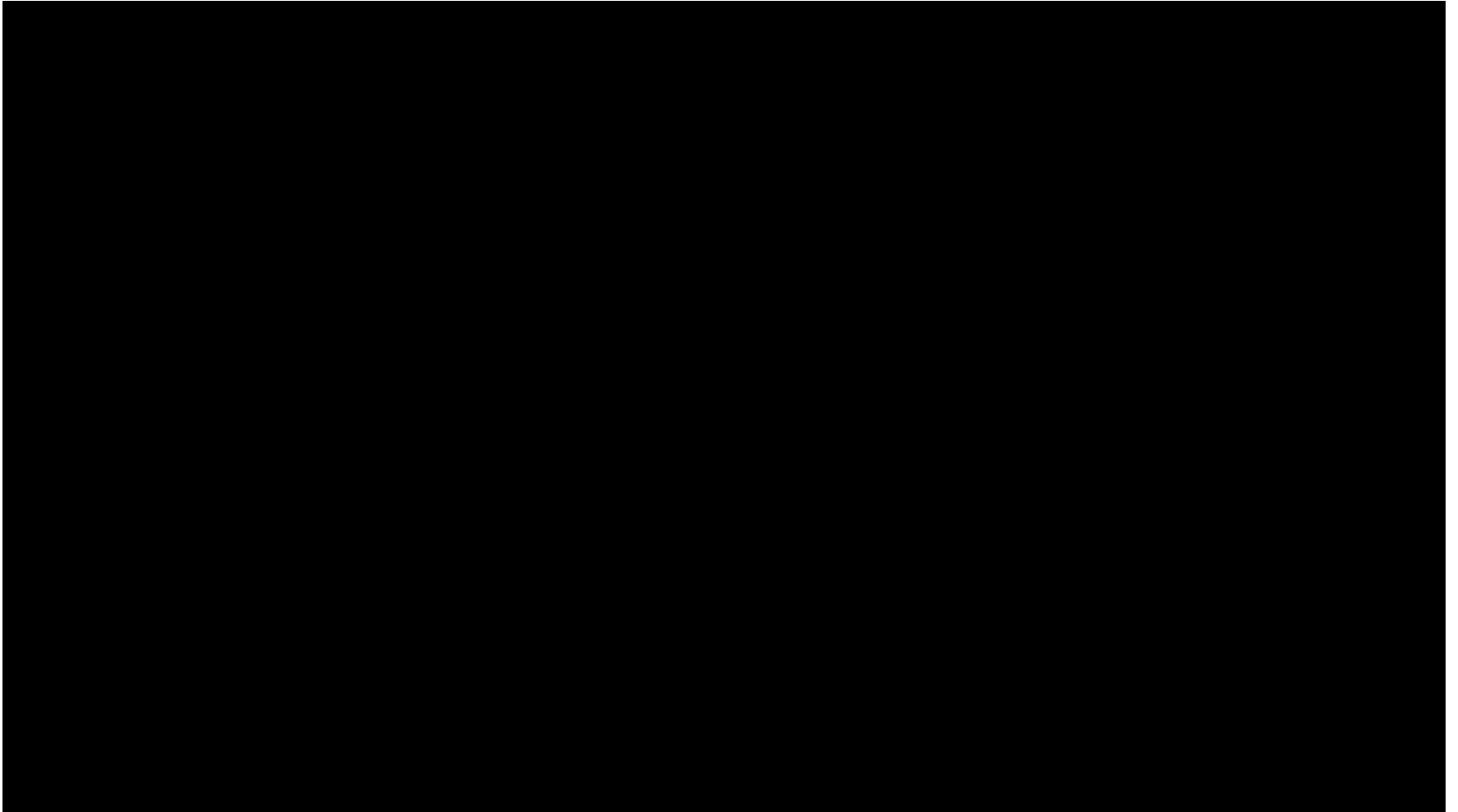
Efecto veleta del empenaje vertical de cola.

CONTROL DIRECCIONAL

Figure 1
Common Techniques for Crosswind landings

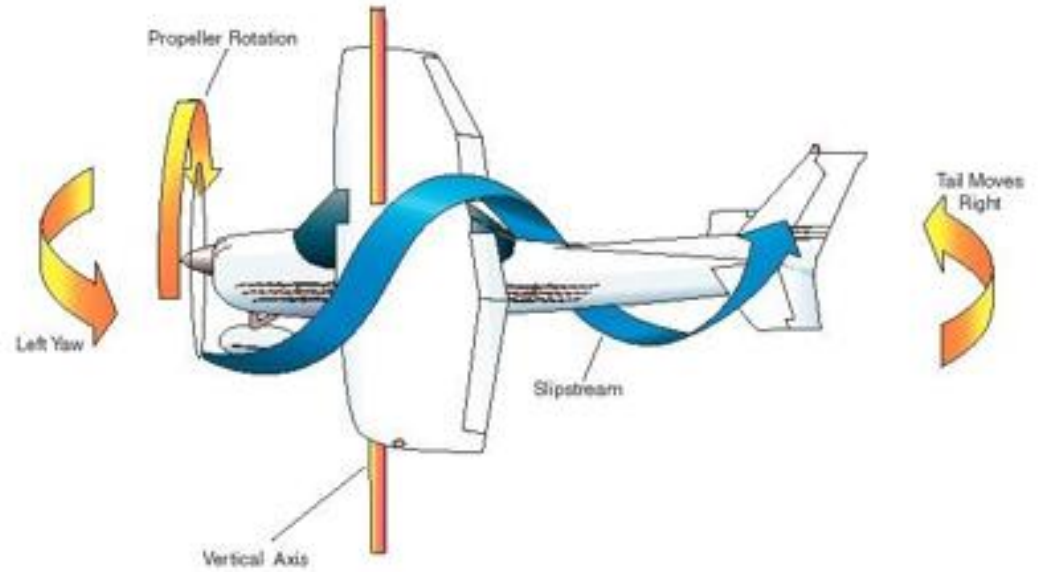
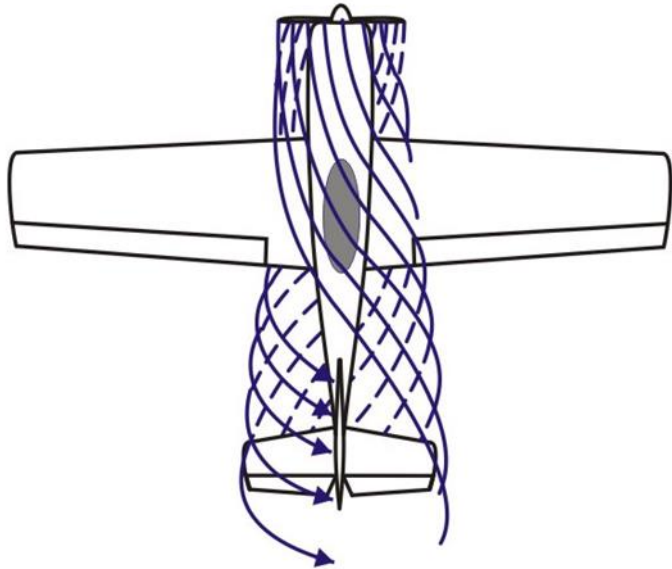


CONTROL DIRECCIONAL



ESTABILIDAD ESTÁTICA DIRECCIONAL

EFFECTOS DE LA POTENCIA

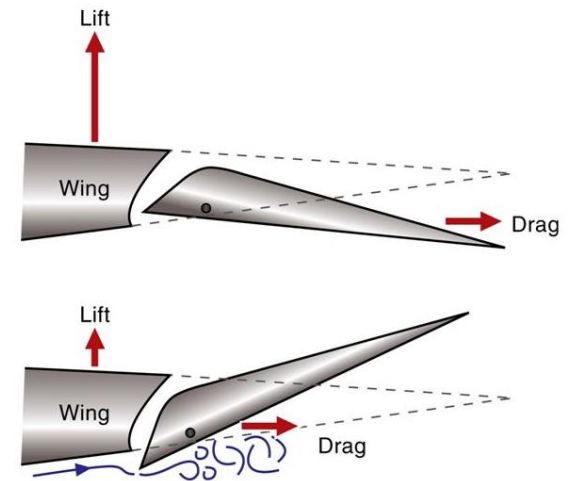


EFFECTOS DE LA POTENCIA

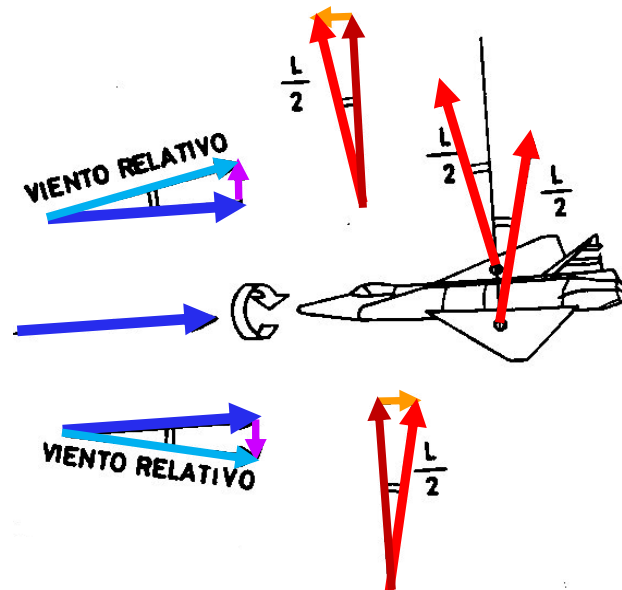


Observar desde minuto 1,40 previa al vuelo y en el minuto 2,05 el sentido de trim a izquierda del timón dirección por efecto direccional hélice y minuto 3,35 por movimiento timón de dirección a derecha para compensar guiñada a la izquierda por turbulencia hélice y rolido a izquierda del avión por torque motor .

GUIÑADA ADVERSA

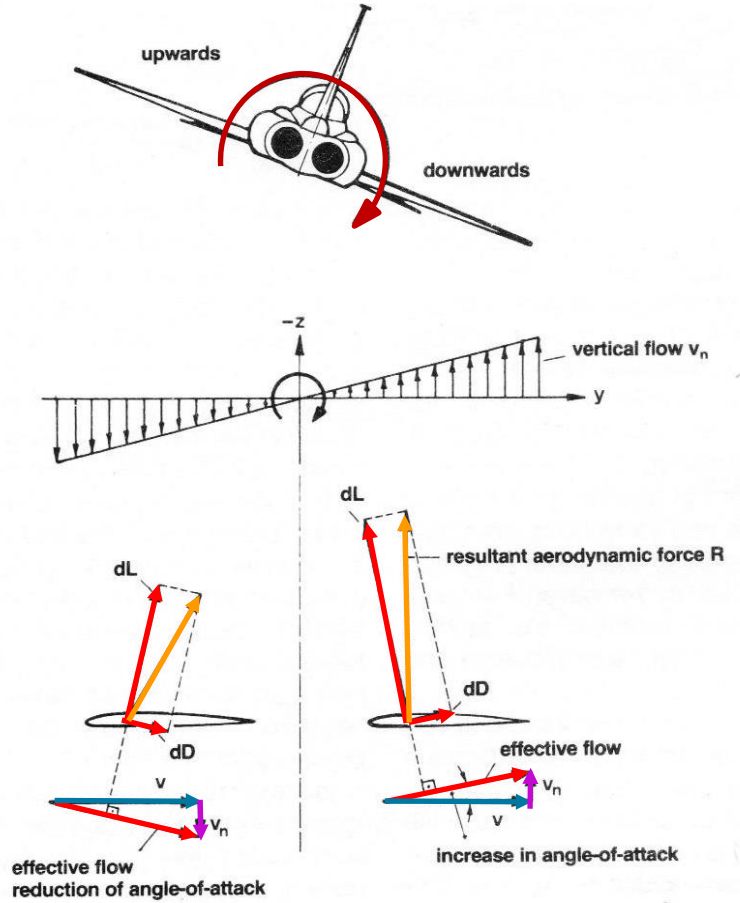
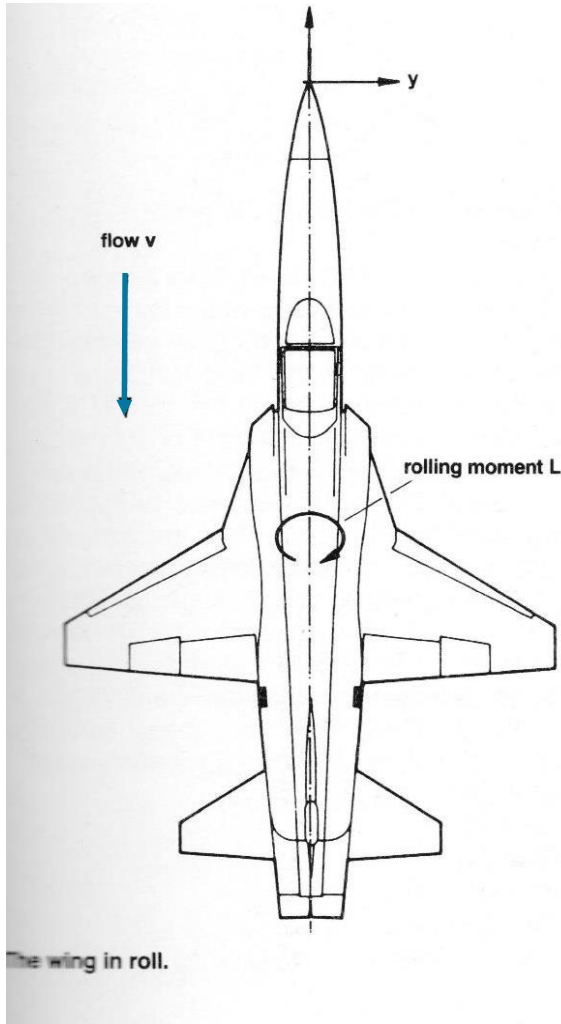


Frise-type ailerons equalize aileron drag and reduce adverse yaw.



ESTABILIDAD ESTÁTICA DIRECCIONAL

GUIÑADA ADVERSA



ESTABILIDAD ESTÁTICA LATERAL



Primary Control Surface	Airplane Movement	Axes of Rotation	Type of Stability
Aileron	Roll	Longitudinal	Lateral

ESTABILIDAD ESTÁTICA LATERAL

MOMENTO DE ROLIDO:

$$L_{roll} = C_l \cdot q \cdot S \cdot b$$

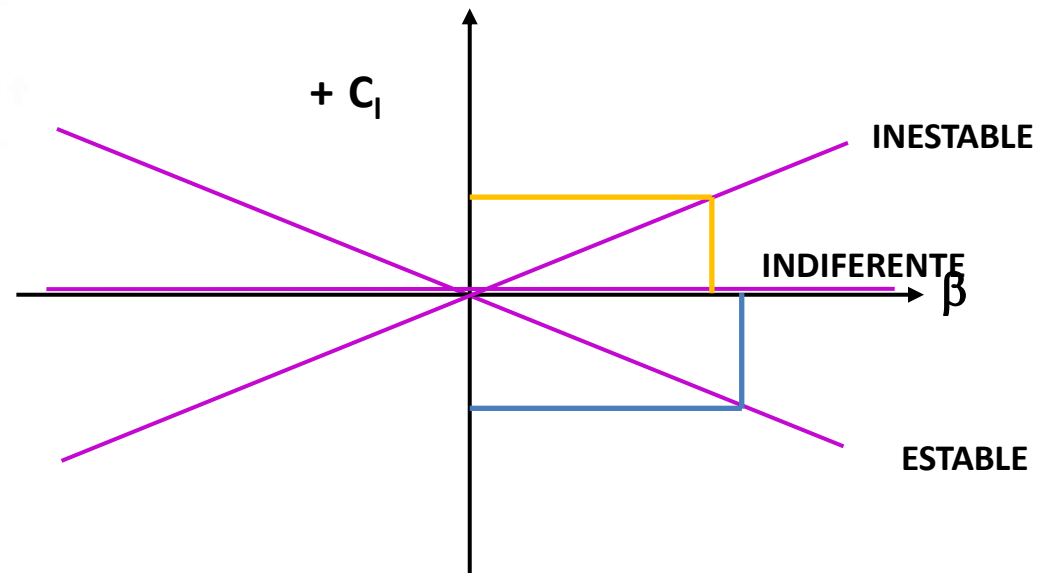
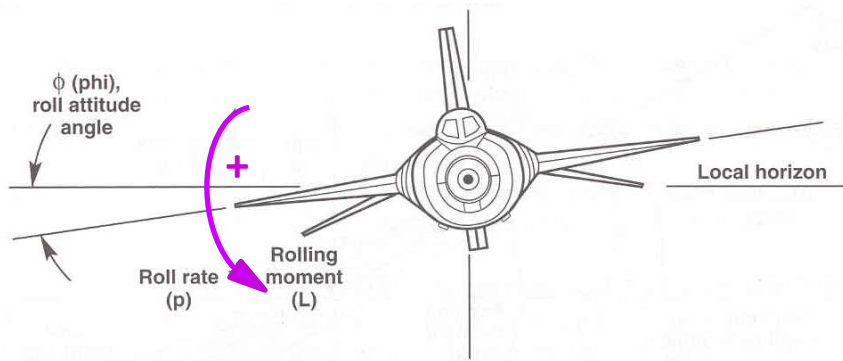
L_{roll} = MOMENTO DE ROLIDO

C_l = COEFICIENTE DE MOMENTO DE ROLIDO

q = PRESIÓN DINÁMICA

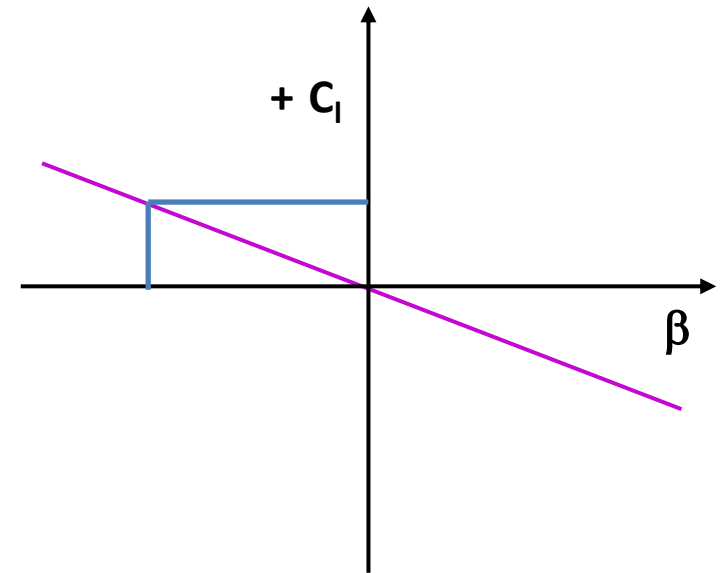
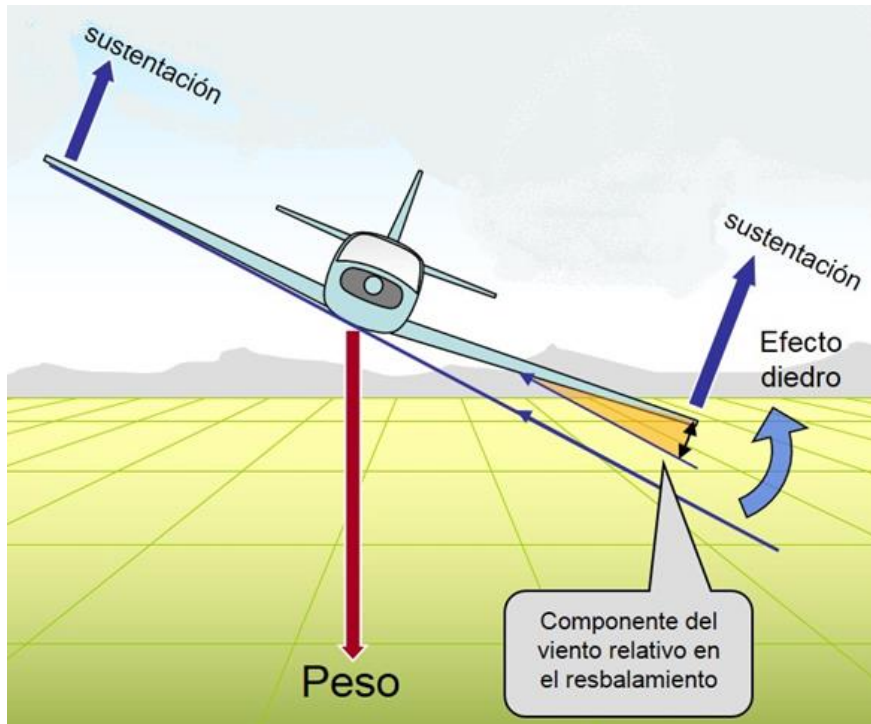
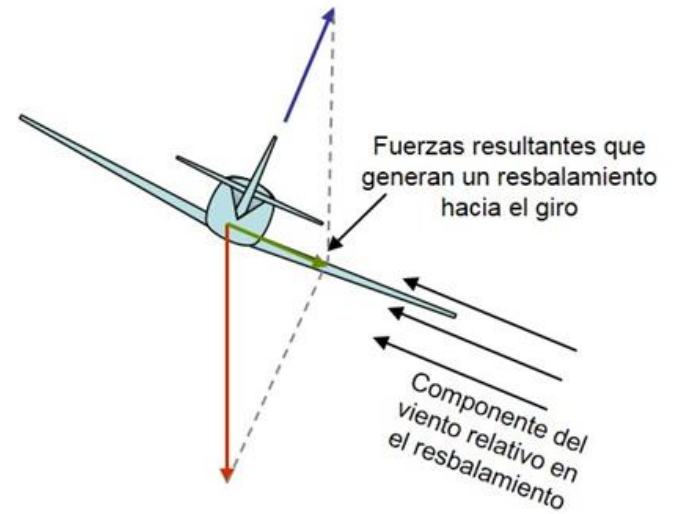
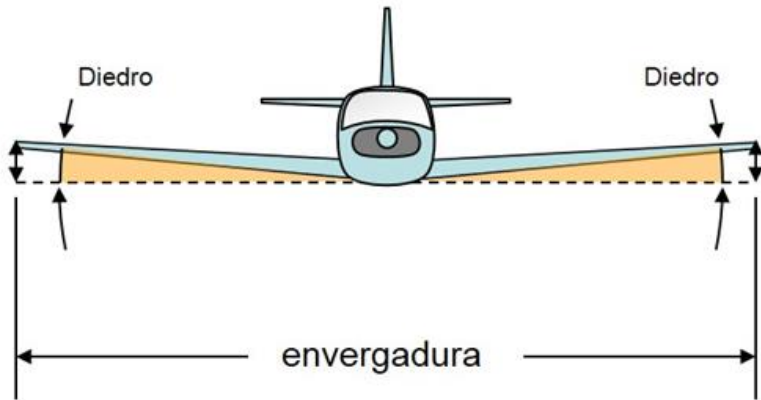
S = SUPERFICIE ALAR

b = ENVERGADURA



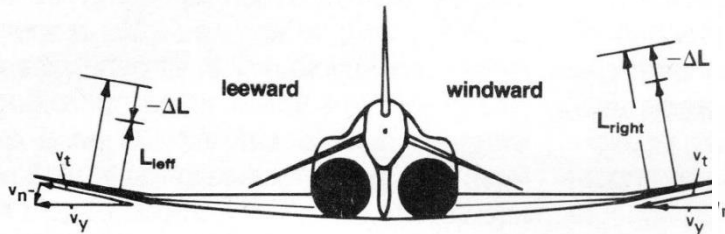
ESTABILIDAD ESTÁTICA LATERAL

EFEECTO DIEDRO

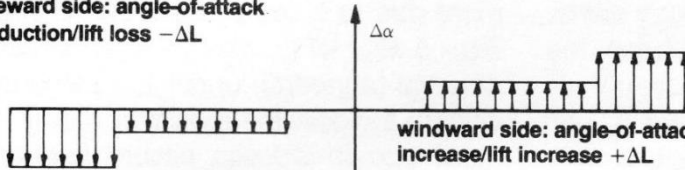


ESTABILIDAD ESTÁTICA LATERAL

stabilizing rolling moment through positive dihedral (F-4)

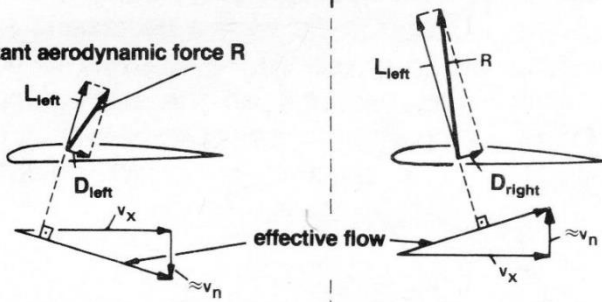


leeward side: angle-of-attack reduction/lift loss $-\Delta L$

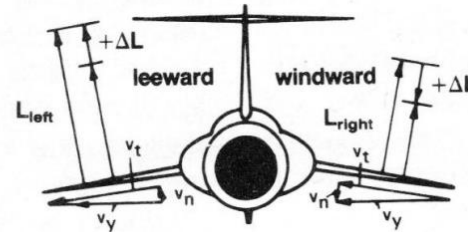


windward side: angle-of-attack increase/lift increase $+\Delta L$

resultant aerodynamic force R



destabilizing rolling moment through negative dihedral (F-104)

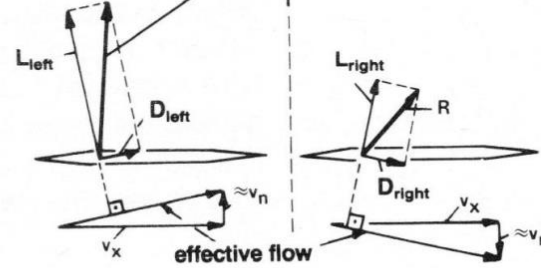


leeward: angle-of-attack increase

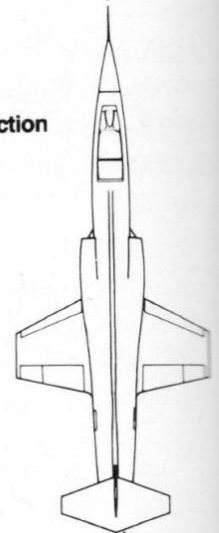
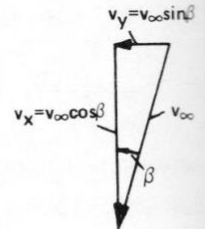


windward: angle-of-attack reduction

resultant aerodynamic force R

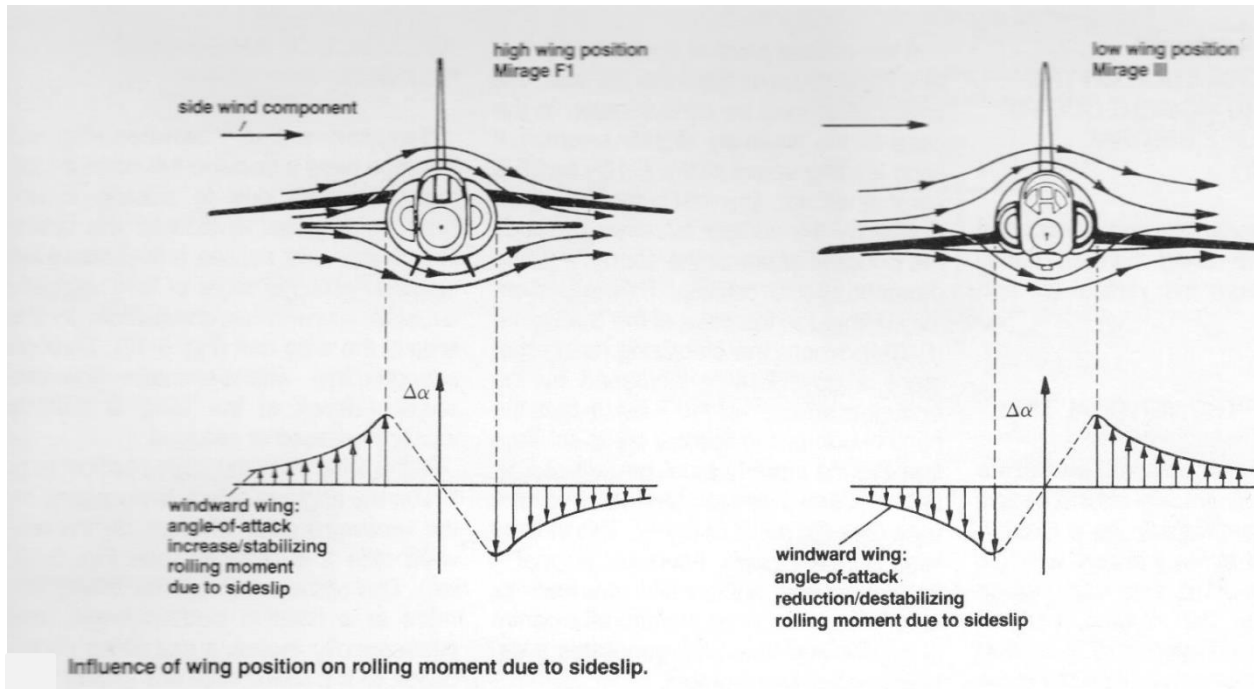
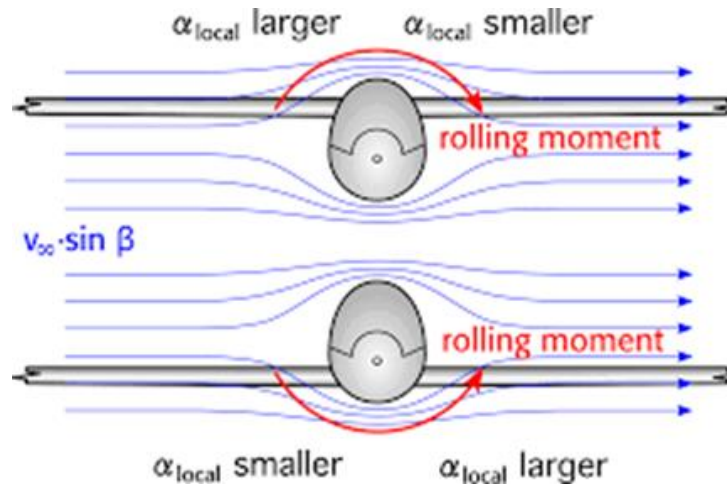


- v_∞ undisturbed flow
- v_y side-wind component
- v_x longitudinal flow component
- v_t tangential component



5-17 Effect of wing dihedral on the lateral motion.

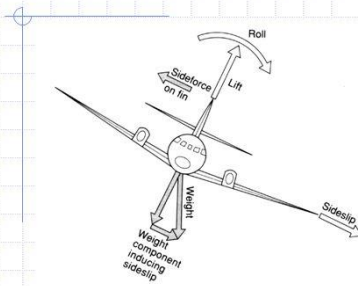
ESTABILIDAD ESTÁTICA LATERAL



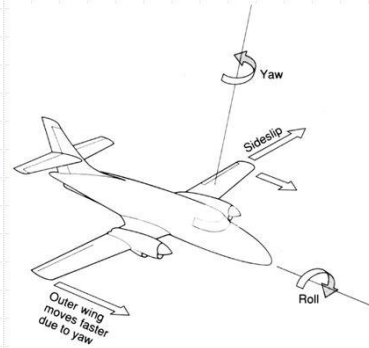
ESTABILIDAD ESTÁTICA DIRECCIONAL Y LATERAL

DIVERGENCIA ESPIRAL

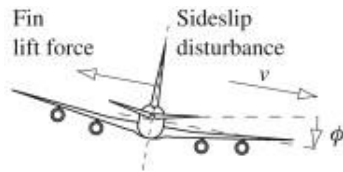
Spiral Divergence



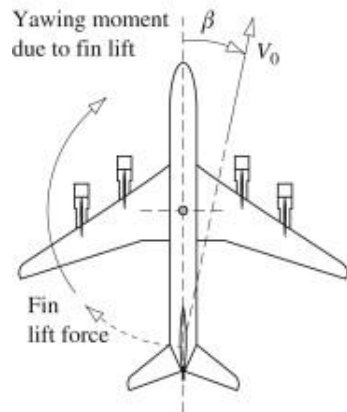
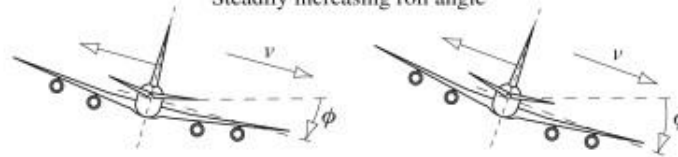
If an aircraft is disturbed in yaw then a side flow across the wing, fuselage and fin will result.



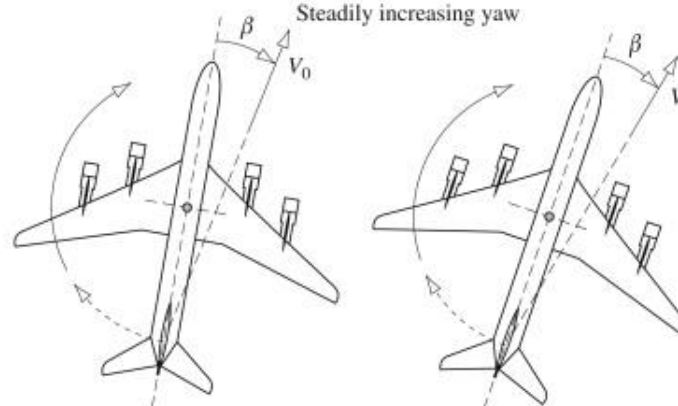
The sideslip will create a yawing motion through the change in the angle of attack on the fin.



Steadily increasing roll angle



Steadily increasing yaw

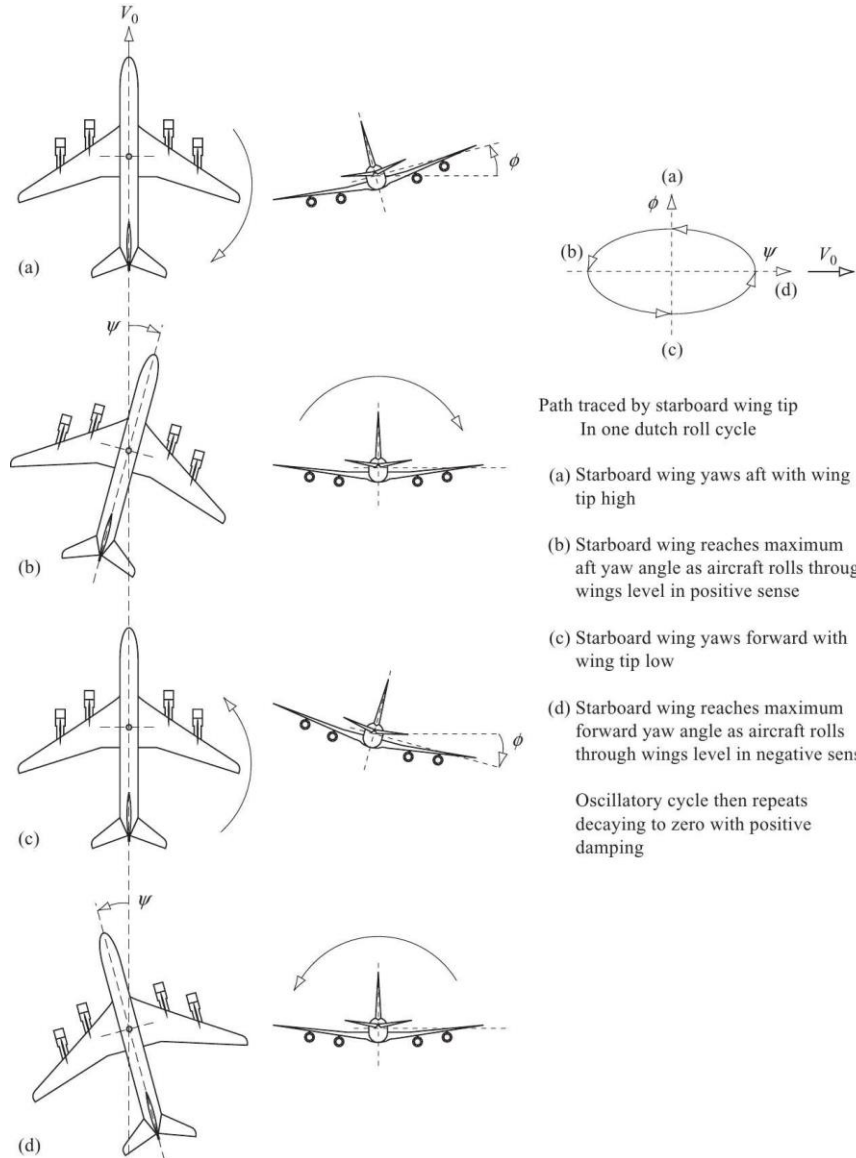


(a)

(b)

(c)

ROLIDO HOLANDÉS



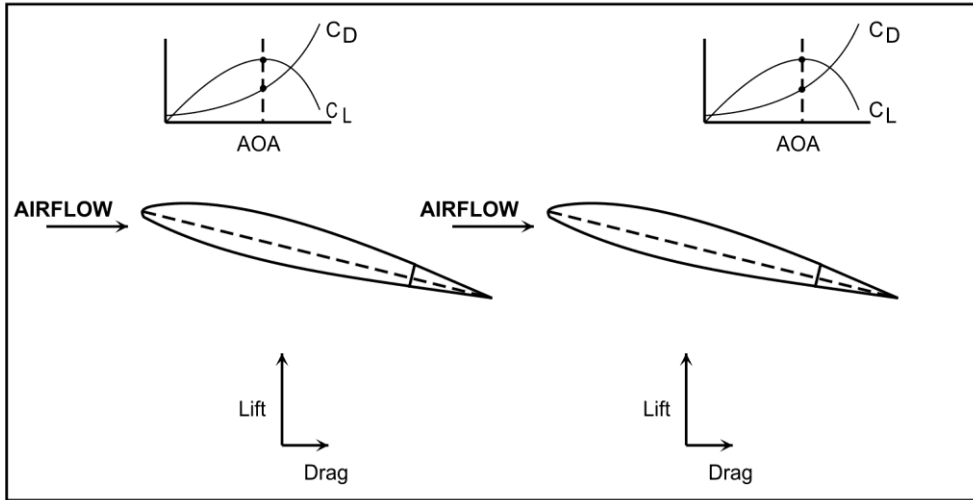
ROLIDO HOLANDÉS



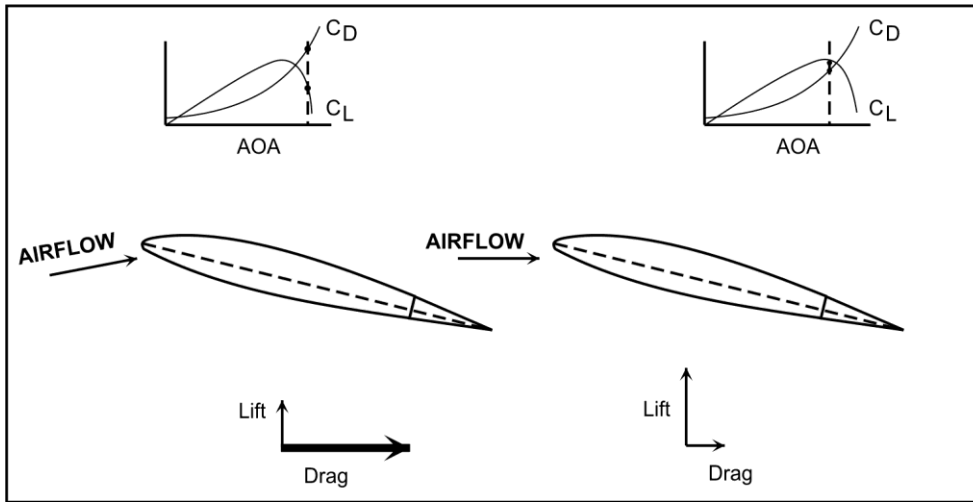
ESTABILIDAD ESTÁTICA DIRECCIONAL Y LATERAL

BARRENA

NORMAL FLIGHT

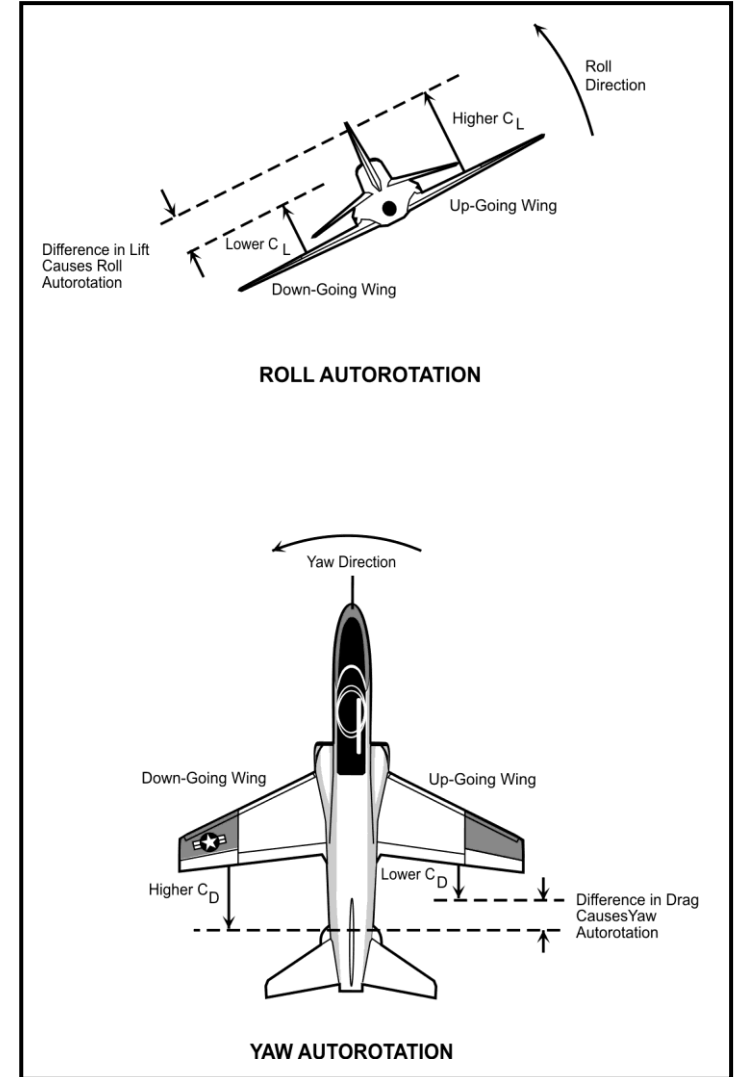


SPINNING FLIGHT



DOWN-GOING WING

UP-GOING WING



ESTABILIDAD ESTÁTICA DIRECCIONAL Y LATERAL

BARRENA

