Week 8 Quiz

Givens:

Weight: 74,335 lb

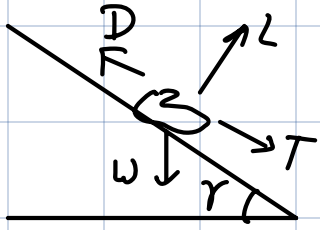
S: 947 ft²

Vind: 143 KIAS

$C_{D_{clean}}$: 0.05

$\Delta C_{D_{gear}}$: 0.031

Thrust: 0



Increase in flight path angle when gear released?

$$D_{clean} = C_{D_{clean}} \cdot q \cdot S$$

$$= 0.05 \cdot \tfrac{1}{2}\left(0.00238 \tfrac{slug}{ft^3}\right)(143 \text{ knots} \cdot 1.69)^2 \cdot 947 ft^2$$

$$= 3286.7 \text{ lb}$$

$$D_{gear\,down} = (C_{D\,clean} + \Delta C_{D_{gear}})\, q\, S$$

$$= (0.05 + 0.031) \cdot \tfrac{1}{2}\left(0.00238 \tfrac{slugs}{ft^3}\right)(143 \text{ knots} \cdot 1.69)^2 \cdot 947 ft^2$$

$$= 5324.5 \text{ lb}$$

if thrust = 0, $W \sin\gamma = D$

so $\gamma_{clean} = \sin^{-1}\left(\frac{D_{clean}}{W}\right) = \sin^{-1}\left(\frac{3286.7 \text{ lb}}{74335 \text{ lb}}\right)$

$= 2.53°$

$\gamma_{gear\,down} = \sin^{-1}\left(\frac{D_{gear\,down}}{W}\right) = \sin^{-1}\left(\frac{5324.5 \text{ lb}}{74335 \text{ lb}}\right)$

$= 4.11°$

so $\Delta\gamma = 4.11° - 2.53° = \underline{1.57°}$

2. Givens: Standard Sea level atmosphere

$V_{REF} = 1.3\, V_{stall}$

$W = 52\,446\ lb$

$S = 1431\ ft^2$

$s_g = 6067\ ft$

$a_{0.7V_2} = 2\ ft^2/s$

$C_{L_{max}}$?

$$s_g = V_{REF}^2 / 2 \cdot a_{0.7V_{REF}} \quad \& \quad V_{REF} = 1.3\, V_{stall}$$

$$V_{stall} = \sqrt{\frac{2W}{\rho S C_{L_{max}}}} \quad \text{thus,}$$

$$\frac{\sqrt{s_g \cdot 2 \cdot a_{0.7V_{REF}}}}{1.3} = V_{stall} = \frac{\sqrt{(6067ft)\cdot 2 \cdot 2\frac{ft}{s^2}}}{1.2}$$

$$= 119.8\ ft/s$$

$$\text{then } C_{L_{max}} = \frac{2(52446lb)}{(0.00238\frac{slug}{ft^3})(1431ft^2)(119.8\ ft/s)^2}$$

$$= \underline{2.14}$$

3. Givens: $W/S = 110\ lb/ft^2$

$C_{L\max} = 1.9$

$n = 3.3$

Sea level conditions

$$\frac{L}{W} = n$$

so $$W = \frac{\frac{1}{2}\rho V_{stall}^2 C_{L\max} S}{n}$$

- or -

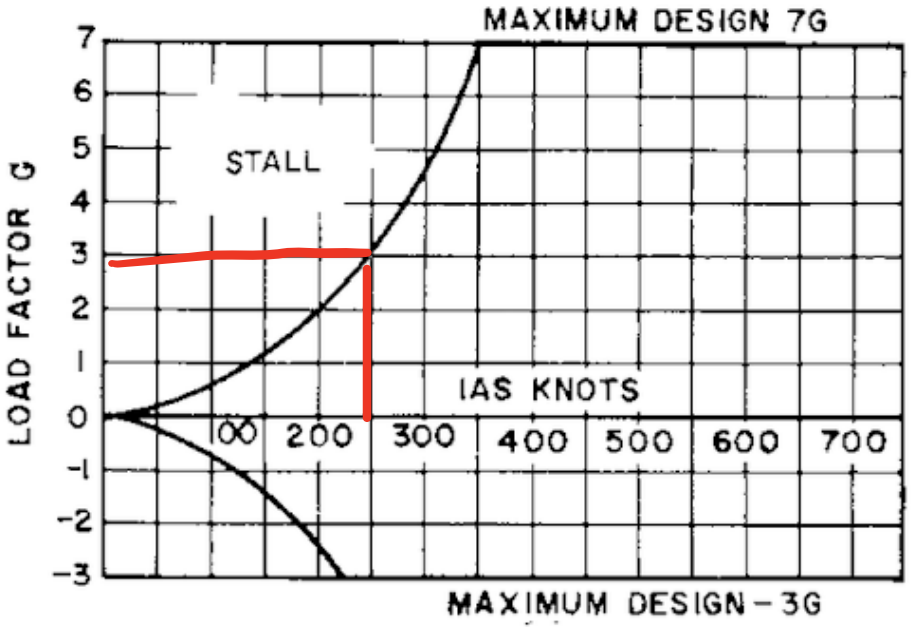
$$V_{stall} = \sqrt{\frac{2 \cdot n \cdot W}{\rho C_{L\max} S}}$$

$$= \sqrt{\frac{2 \cdot 3.3 \cdot 110 \frac{lb}{ft^2}}{(0.00238 \frac{slug}{ft^3})(1.9)}}$$

$$= 400.9 \frac{ft}{s}$$

$$= 237 \text{ knots}$$

4.



use V-n diagram only
(ie don't need to consider $n_{thrust\ constraint}$)

@ 250 knots, want largest as possible load factor for min turn Radius

thus, $n = 3$ due to stall constraint @ 250 knots