→ for cruise cond^n

Power required $= DV$

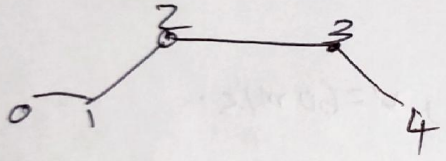
$$= \frac{1}{2}\rho V^2 S\left[C_{D_0} + KC_L^2\right] \cdot V$$

$$P_{req.} = \frac{1}{2}\rho S C_{D_0} V^3 + \frac{2KW^2}{\rho S}\cdot\frac{1}{V}$$

$$= (0.1708)\rho V^3 + \frac{0.63\,W^2}{\rho V}$$

$\left| \text{for } \left(C_L^2 = \frac{2W}{\rho V^2 S}\right) \right.$

- Consider W_{MC} = mid cruise weight.



$$W_{MC} = W_2 - \frac{(W_2 - W_3)}{2}$$

$$\frac{W_{MC}}{W_2} = \left(1 + \frac{W_3}{W_2}\right)\frac{1}{2}$$

$$= (1 + 0.90)\frac{1}{2}$$

$$= 0.95$$

(recall that $\frac{W_3}{W_2} = 0.9$ from Perf. calc)

$$\frac{W_2}{W_0} = \frac{W_1}{W_0}\cdot\frac{W_2}{W_1}$$

$$= (0.97)(0.98) = 0.9506.$$

$$\therefore W_{MC} = (0.95)W_2 = (0.95)(0.9506)W_0$$

$$W_{MC} = (0.903)W_0$$

$$\therefore \boxed{W_{MC} = 1323.44\ kg}$$

eg. P_{req} @ 10 km, $V = 60$ m/s

$$P_{req} = (0.1708)(0.4135)(60)^3 + \frac{0.63\,(1323.44)^2}{(0.4135)(60)}$$

$$= 70952.99\ W$$

$$= 95.15\ hp.$$

$$\frac{P_{av} - P_{req}}{w} = ROC$$

$P_{av} = (ROC \cdot w) + P_{req}$ or $P_{av} = P_{req}$ from engine.

→ for $ROC = 10$ m/s at $h = 0$, $V = 60$ m/s.

$P_{req\ from\ engine} = (10)(1465.5)(9.8) + P_{req}$ (@ $h = 0$, 60 m/s)

~~$= 230,276.09$ W~~

~~$= 308.80$ hp.~~

$P_{req\ from\ engine} = 277.88$ hp.

for $ROC = 8$ m/s at $h = 1$ km, $V = 60$ m/s.

$P_{req\ from\ engine} = (8)(1465.5)(9.8) + P_{req}$ (@ $h = 1$ km, 60 m/s)

$= 236.28$ hp.

for $ROC = 5$ m/s at $h = 2$ km, $V = 60$ m/s.

$P_{req\ from\ engine} = (5)(1465.5)(9.8) + P_{req}$ (@ $h = 2$ km / 60 m/s)

$= 176.14$ hp.

for $ROC = 3$ m/s at $h = 3$ km, $V = 60$ m/s.

$P_{req\ from\ engine} = (3)(1465.5)(9.8) + P_{req}$ (@ $h = 3$ km, 60 m/s)

$= 136.01$ hp.