

$$P_{AVAIL} - P_{REQ} = \Delta P.E. + \Delta K.E.$$

$$TV - DV = W \frac{dh}{dt} + \frac{d}{dt} \left(\frac{1}{2} \frac{W}{g} V^2 \right)$$

CASE i) STEADY, NO CLIMB $T = D$ $L = nW = 5W$

$$\frac{T}{W} = \frac{D}{W} \quad D = \frac{1}{2} \rho V^2 S k C_L^2 + \frac{1}{2} \rho V^2 S C_{D0}$$

$$\frac{T}{W} = \frac{1}{2} \rho V^2 \left(\frac{1}{W/S} \right) k \frac{L^2}{\left(\frac{1}{2} \rho V^2 S \right)^2} + \frac{1}{2} \rho V^2 \left(\frac{1}{W/S} \right) C_{D0}$$

$$\frac{T}{W} = \frac{1}{2} \rho V^2 \left(\frac{1}{W/S} \right) k \frac{n^2 W^2}{\left(\frac{1}{2} \rho V^2 S \right)^2} + \frac{1}{2} \rho V^2 \left(\frac{1}{W/S} \right) C_{D0}$$

$$\frac{T}{W} = \frac{k n^2}{\frac{1}{2} \rho V^2} \left(\frac{W}{S} \right) + \frac{C_{D0}}{\left(\frac{W}{S} \right)} \frac{1}{2} \rho V^2$$

$$= 1.53 + 0.034$$

$$V = 0.9(295) = 265.5 \text{ m/s}$$

$$\rho = 0.34 \text{ kg/m}^3$$

$$k = 0.21$$

$$C_{D0} = 0.01$$

$$W/S = 3500$$

$$\boxed{\frac{T}{W} = 1.56}$$

CASE ii) $TV - DV = \frac{d}{dt} \left(\frac{1}{2} \frac{W}{g} V^2 \right) = \frac{1}{2} \frac{W}{g} 2V \frac{dV}{dt}$

$$\frac{T}{W} = \frac{D}{W} + \frac{1}{g} \frac{dV}{dt}$$

$$\frac{T}{W} = \underbrace{\frac{k n^2}{\frac{1}{2} \rho V^2} \left(\frac{W}{S} \right) + \frac{C_{D0}}{\left(\frac{W}{S} \right)} \frac{1}{2} \rho V^2}_{\text{from above (now } n=1)} + \frac{1}{g} \frac{(V_{\text{final}} - V_{\text{initial}})}{\Delta t}$$