5.2 $\quad T(h,P) + P = \text{Const} \rightarrow T = \text{Const.}$

$$T - \frac{1}{2} C_{D_0} \rho S_w V^2 - \frac{2KW^2}{\rho S_w V^2} = 0$$

$$\frac{1}{2} C_{D_0} \rho^2 S_w^2 V^4 - T \rho S_w V^2 + 2K W^2 = 0$$

$$V^2 = \frac{T}{C_{D_0} \rho S_w} \left[1 + \sqrt{1 - 4 C_{D_0} K \frac{W^2}{T^2}} \right]$$ using the high-speed solution (+)

$$\frac{1}{C_{D_0}} = 2 \frac{E^*}{C_L^*} \qquad 4 C_{D_0} K = \frac{1}{E^{*2}}$$

$$V^2 = \frac{2 T E^*}{\rho S_w C_L^*} \left[1 + \sqrt{1 - \left(\frac{W}{TE^*} \right)^2} \right]$$

$$\frac{dx}{dW} = -\frac{V}{cT} \qquad x_f - x_0 = \int_{W_f}^{W_0} \frac{V}{cT} \, dW$$

$$x_f - x_0 = \frac{1}{cT} \sqrt{\frac{2TE^*}{\rho S_w C_L^*}} \int_{W_f}^{W_0} \sqrt{1 + \sqrt{1 - \left(\frac{W}{TE^*} \right)^2}} \, dW \; \frac{TE^*}{TE^*}$$

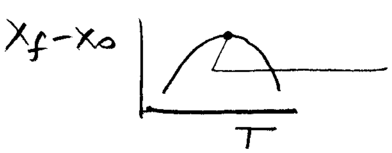
$$\mu = \frac{W}{TE^*} \qquad x_f - x_0 = \frac{E^*}{C} \sqrt{\frac{2TE^*}{\rho S_w C_L^*}} \int_{\mu_f}^{\mu_0} \sqrt{1 + \sqrt{1-\mu^2}} \, d\mu$$

$$z = \sqrt{1-\mu^2} \qquad \mu = \sqrt{1-z^2} \qquad d\mu = -\frac{z\,dz}{\sqrt{1-z^2}}$$

$$\text{Integral} = -\int_{z_f}^{z_0} \frac{z\,dz}{\sqrt{1-z}} = -\frac{2}{(-1)^2} \left[\frac{(1-z)^{3/2}}{3} - (1-z)^{1/2} \right]_{z_f}^{z_0}$$

$$= \frac{2}{3} \left[\sqrt{1-z}\,(2+z) \right]_{z_f}^{z_0} = \frac{2}{3} \left[\sqrt{1-\sqrt{1-\mu^2}} \left(2 + \sqrt{1-\mu^2} \right) \right]_{\mu_f}^{\mu_0}$$

$$x_f - x_0 = \frac{2}{3} \frac{E^*}{C} \sqrt{\frac{2TE^*}{\rho S_w C_L^*}} \left[A(W_0) - A(W_f) \right] \qquad A = \sqrt{1 - \sqrt{1 - \left(\frac{W}{E^*T} \right)^2}} \left[2 + \sqrt{1 - \left(\frac{W}{E^*T} \right)^2} \right]$$



best distance in P = Const Cruise