Jack O'Neill
AE 5222
HW#1

1) $L = W = \frac{1}{2}\rho V^2 S C_L \qquad D = \frac{1}{2}\rho V^2 S (C_{D_0} + K C_L^2)$

Constraint: $C_L = \frac{2W}{\rho V^2 S}$

$$\frac{L}{D} = \frac{\rho V^2 S C_L}{\rho V^2 S (C_{D_0} + K C_L^2)} = \frac{\rho V^2 S \left(\frac{2W}{\rho V^2 S}\right)}{\rho V^2 S \left(C_{D_0} + K\left[\frac{2W}{\rho V^2 S}\right]^2\right)}$$

$$\frac{L}{D} = \frac{2W}{\rho V^2 S \left(C_{D_0} + K\left[\frac{2W}{\rho V^2 S}\right]^2\right)} \rightarrow \frac{\partial \frac{L}{D}}{\partial V}(V^*) = 0 = -\frac{2W\rho V^* S \left(2\rho^2 V^{*4} C_{D_0} - 8W^2 K\right)}{\left(\rho^2 V^{*4} S^2 C_{D_0} + 4W^2 K\right)^2}$$

$$\frac{L}{D}(V^*) = \frac{2W}{\rho V^{*2} S \left(C_{D_0} + K\left(\frac{2W}{\rho V^{*2} S}\right)^2\right)}$$

$$\boxed{V^* = 695.087 \text{ ft/s}}$$

Plot is on the next page