

$$a) V_{\max \text{ range}} = \left[4 \left(\frac{W}{S} \right)^2 \frac{1}{\rho^2} \frac{1}{C_{D0}} \left(\frac{1}{\pi e AR} \right) \right]^{1/4}$$

$$\frac{W}{S} \approx \frac{9.8 \text{oz}}{\text{ft}^2} = 14 \frac{\text{N}}{\text{m}^2}$$

$$C_{D0} \approx 0.3 \quad (\text{per Coleman})$$

$$e \approx 0.96$$

ALL PER COLEMAN

$$\rho = 1.2 \text{ kg/m}^3$$

$$AR \approx 5.12$$

$$W \approx 150 \text{oz} = 42 \text{N}$$

$$V_{\max \text{ range}} \approx 3.3 \text{ m/s}$$

$$b) V_{\max \text{ endurance}} = 3^{-1/4} (V_{\max \text{ range}}) = 2.5 \text{ m/s}$$

(= min power)

c) ASSUME THE AIRPLANE IS BEING FLOWN AT MAX ENDURANCE CONDITIONS

$$\text{POWER REQUIRED} = D_{\text{MIN POWER}} \cdot V_{\text{MIN POWER}}$$

$$D_{\text{MIN POWER}} = W \left[\frac{16 C_{D0}}{3 \pi e AR} \right]^{1/2} = 1.34 \text{ N}$$

$$\text{POWER REQD} = D_{\text{min power}} V_{\text{min power}} = 3.4 \text{ W} = 34 \text{ J/s}$$

$$\text{FLIGHT TIME} = 15 \text{ min} = 900 \text{ s} \quad \therefore \text{ENERGY}$$

$$\therefore \text{ENERGY} = \text{TIME (POWER REQD)} \times \frac{1}{\eta_0} = 30.6 \text{ kJ}$$

NOTE: PROF. COLEMAN

$$\text{CALCULATED } E = 18.1 \text{ kJ}_{\text{batt.}}$$

SO PERHAPS η_0 IS BETTER THAN 0.1!

$$\left(\begin{array}{l} 600 \text{ mA-hr} = 2150 \text{ A-s} \quad 8.4 \text{ Volts} = \frac{W}{A} \\ E = 8.4 \cdot 2150 \text{ W}\cdot\text{s} = \text{J/s} \cdot \text{s} = \text{J} = 18144 \end{array} \right)$$