

Technical Note on Cruising

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By assuming the weight W varies as a linear function of distance x , $W=Ax+B$, where A and B are expressed in terms of α , β , W_F , W_0 , x_c , and x_d , and by minimizing the thrust-to-velocity ratio, T_R/V_∞ , two approximate relations between V_c and V_d can be determined as follows:

(1) Medium-altitudes $V_d = \{V_c^4 - \frac{32}{\rho^2 S^2 C_{D,0} \pi e A R} [(1/2) A^2 (x_d^2 - x_c^2) + AB(x_d - x_c)]\}^{1/4}$

(2) High-altitudes $V_d = V_c \{(x_d+B/A) / (x_c+B/A)\}^{2/3}$

To determine the corresponding maximum range and the equilibrium velocity during the flight, the following equation next to be satisfied:

$$\int_{W_c}^{W_d} -dW = \int_{x_c}^{x_d} C_t \{T_R/V_\infty\} dx$$

where C_t is the fuel consumption rate.