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Technical Note on Cruising Actions 10/16/2023

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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, xc, 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 $\mathrm{Vd} = \{\mathrm{Vc}^4 - \frac{32}{\rho^2 S^2 C_{D,0} \pi e A R} [(1/2)\,\mathrm{A}^2\ (\mathrm{xd}^2 - \mathrm{xc}^2) + \mathrm{AB}(\mathrm{xd} - \mathrm{xc}]\}^{1/4}$

(2) High altitudes $\mathrm{V_d} = \mathrm{V_c}\{(\mathrm{xd}+\mathrm{B/A}) / (\mathrm{xc}+\mathrm{B/A})\}^{2/3}$

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

$\int_{\mathrm{Wc}}^{\mathrm{Wd}} -\mathrm{dW} = \int_{\mathrm{xc}}^{\mathrm{xd}} \mathrm{Ct}\,\{\mathrm{T_R}/\mathrm{V_\infty}\}\,\mathrm{dx}$

where Ct is the fuel consumption rate.