Richard Nakka's *Experimental Rocketry* Web Site

Derivation of Selected Rocket Equations

Digging through my technical archives recently, I came across the derivation of various rocket related equations that I did some twenty years ago. These step-by-step derivations were performed in order to gain a better understanding of the fundamentals behind these well-known equations. Most are from Sutton's <u>Rocket Propulsion Elements</u>. I decided to scan them and put them on-line, to help others who also would like to gain a better understanding of the development of these important equations. As well, I have included more recent derivations of other important equations.

<u>Sutton, 4th Ed.</u>

Equation 3-19, weight flow through a nozzle

Equation 3-20, critical pressure at nozzle throat

Equation 3-24 , weight flow through critical section of a nozzle

Equation 3-25, area ratio to pressure ratio relationship in a nozzle

Equation 3-29 , ideal thrust equation

Equation 5-32 , energy requirement to place a unit mass into orbit

Miscellaneous

Isentropic exponent modified for 2-phase flow, alternate expression

Derivation of equation for rocket thrust using a control volume analogy

Conversion of Burn Rate Coefficient "a" from English units to Metric units

Last updated January 30, 2009