

Technical Comments

Comment on "Cost Minimization of a Space System by Multiple Launchings"

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IN a recent engineering note, Allen¹ examined the desirability of multiple launchings for placing a desired payload mass in space, as opposed to single launchings. Examination of his Eqs. (1) and (2) shows that his expression for losses due to unreliability must be

$$\text{losses} = w_P p(1 + p + p^2 + p^3 + \dots p^n) \quad (1)$$

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where n is the number of launchings required to place an accumulation of W_{PD} lb-mass of payload in space w_P lb-mass at a time, with a probability of failure p for each launch. Clearly, the expected losses should be given by

$$\text{losses} = npw_P \quad (2)$$

Errors arising from the difference between Eqs. (1) and (2) can be relatively great. For example, if n and p have values of 10 and 0.2, respectively, Eq. (1) understates losses relative to Eq. (2) by a factor of approximately 8. The degree of understatement of losses increases with an increasing value for n .

Reference

¹ Allen, R. W., "Cost minimization of a space system by multiple launchings," *J. Spacecraft Rockets* 1, 112-113 (1964).

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