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An Empirically Based Shaped Charge Jet Break-Up Model

ERNEST BAKER, JAMES PHAM, TAN VUONG, US Army ARDEC — This paper discusses an empirically based shaped charge jet break-up model based around Walsh's breakup theory and provides significant experimental confirmation over a broad range of velocity gradients. The parameters which affect jet length and breakup times are fairly well known, but there is some controversy over the exact nature of the dependencies. Walsh theorized that the dependence of jet length would take a particular form, based on his determination of a dimensionless parameter for the problem and numerical experiments in which initial perturbation strengths were varied. Walsh did not present comparisons with experimental results. Chou has presented a variety of different jet break-up models with some data comparisons. Mostert [3] has suggested that breakup time is proportional to $\left(\frac{\Delta m}{\Delta v}\right)^{1/3}$. It is shown here that the parameter $\left(\frac{\Delta m}{\Delta v}\right)^{1/3}$or $\left(\frac{dm}{dv}\right)^{1/3}$, closely related to Walsh's dimensionless parameter, whose values were obtained from either experiments or simulations correlates quite well with jet breakup times for a very wide variety of shaped charge devices. The values of Δm and Δv are respectively the jet mass and the velocity difference of the portion of jet in question. For a typical shaped charge $\frac{\Delta m}{\Delta v}$ is essentially invariant with respect to time. In this paper, we present the mathematical basis for an empirically based break-up model with a similar basis to Walsh and Mostert, as well as supporting empirical data for a broad range of shaped charge geometries.

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