

SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

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A BALLISTIC LIMIT ANALYSIS PROGRAM FOR SHIELDING AGAINST MICROMETEORIODS
AND ORBITAL DEBRIS

Abstract

Ballistic Limit Equations (BLEs) lie at the heart of Micrometeoroid and Orbital Debris (MMOD) risk assessments, yet are often unpublished, loosely validated, or simply open to misinterpretation through insufficient documentation. Furthermore, for common MMOD shields, multiple competing BLEs often exist, each with their own underlying assumptions and predictive biases. In order to provide a more user-friendly means to perform preliminary shield sizing, performance evaluations, and parametric studies, a simple software program has been developed by the Hypervelocity Impact Technology Facility (HITF) at NASA Johnson Space Center. The program is written in Visual Basic for Applications (VBA), and is intended to be freely distributed as an add-in to Microsoft Excel [®]. BLEs are provided for single wall, dual wall, triple wall, and advanced shield types, along with common thermal protection systems (TPS) and transparent materials. The effects of multi-layer insulation and projectile shape (ellipsoid only) can also be included in the evaluation. In the case of configurations for which multiple approaches exist, e.g. metallic Whipple shield, a competitive evaluation has been performed using a compilation of over 440 experimental data points to identify the most accurate. The software is distributed together with a user manual which documents, and provides validity bounds, for each of the program's underlying equations.