MICROMETEOROID AND ORBITAL DEBRIS RISK ASSESSMENT WITH BUMPER 3

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The Bumper 3 computer code is the primary tool used by NASA for micrometeoroid and orbital debris (MMOD) risk analysis. Bumper 3 (and its predecessors) have been used to analyze a variety of manned and unmanned spacecraft. The code uses NASA's latest micrometeoroid (MEM-R2) and orbital debris (ORDEM 3.0) environment definition models and is updated frequently with ballistic limit equations that describe the hypervelocity impact performance of spacecraft materials. The Bumper 3 program uses these inputs along with a finite element representation of spacecraft geometry to provide a deterministic calculation of the expected number of failures. The Bumper 3 software is configuration controlled by the NASA/JSC Hypervelocity Impact Technology (HVIT) Group.

This paper will demonstrate MMOD risk assessment techniques with Bumper 3 used by NASA's HVIT Group. The Permanent Multipurpose Module (PMM) was added to the International Space Station in 2011. A Bumper 3 MMOD risk assessment of this module will show techniques used to create the input model and assign the property IDs. The methodology used to optimize the MMOD shielding for minimum mass while still meeting structural penetration requirements will also be demonstrated.