An Overview of NASA's Newest Engineering Model, ORDEM 4.0

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ABSTRACT

Since the mid-1990s, one of the most important products produced by the NASA Orbital Debris Program Office (ODPO) has been the Orbital Debris Engineering Model (ORDEM). This series of models distills down our knowledge of the orbital debris environment to compute debris fluxes on satellites in a given orbit. This information can be used by spacecraft and upper stage designers and operators to design missions for better protection against the debris environment. The current version of the model is ORDEM 3.2, but the ODPO is working on the next generation of ORDEM, to be designated ORDEM 4.0. ORDEM 4.0 will include many known features from previous models, such as the ability to input a spacecraft orbit and time and to compute the flux as a function of debris size, impact speed, impact direction, and debris material densities, as well as uncertainty information on the flux. ORDEM 4.0 will update debris populations using the most recent measurements, including radar observations by the Haystack Ultrawideband Satellite Imaging Radar (HUSIR), NASA's Goldstone radar, data from the new Space Surveillance Network Space Fence, and observations of Geosynchronous Earth Orbits (GEO) using the Eugene Stansbery-Meter Class Autonomous Telescope (ES-MCAT). The latest *in situ* impact data from returned hardware surfaces will be used. In addition, ORDEM 4.0 will introduce a parameterized debris shape model based on laboratory hypervelocity impact tests, such as DebriSat. This will allow analysts to implement shape characteristics in their damage equations and more accurately predict impact damage risk by debris of different shapes and orientations. This paper provides an overview of some of the new features forthcoming in ORDEM 4.0 and a status report on its development.