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DRAMA 3.0 - UPGRADE OF ESA'S DEBRIS RISK ASSESSMENT AND MITIGATION ANALYSIS TOOL SUITE

Abstract

In recent years some countries have established national regulation related to space debris mitigation, while many others are currently considering to follow similar steps. In general, this involves the adoption of already existing and widely accepted standards and international guidelines, such as ISO 24113 or the UN Space Debris Mitigation Guidelines. In order to support the verification of the compliance with existing recommendations, guidelines or even national laws, ESA has been developing the Debris Risk Assessment and Mitigation Analysis (DRAMA) software tool suite. Since 2014, when an ESA instruction came into force rendering space debris mitigation requirements applicable for any ESA satellite mission, DRAMA is being an essential part in mission design and subsequent compliance verification by the Agency. Today more than 1000 users world-wide from industry, academia and agencies are working with the software to address issues such as the remaining orbital lifetime of the spacecraft after disposal or the associated on-ground risk for an uncontrolled re-entry. The recent upgrade to DRAMA 3.0 entails the incorporation of the latest Meteoroid And Space debris Terrestrial Environment Reference (MASTER) model, evolving from MASTER-2009 to MASTER-8; an extensive analysis of Conjunction Data Messages (CDM) which serve as the crucial input to estimate annual collision avoidance manoeuvre rates; a dedicated Python framework to run parametric analyses; and a significant extension of SARA, the tool used for the assessment of on-ground risk upon atmospheric re-entry. The latter includes improvements in the materials database, the aerothermodynamics and aerodynamics as well as an update of the world's population model. In this paper, the improvements in DRAMA 3.0 are introduced with a focus on showing instructive examples of how the new DRAMA software is being used in the context of verifying compliance with respect to space debris mitigation requirements.