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ADDRESSING SPACE DEBRIS MITIGATION IN SATELLITE MISSION DESIGN

Abstract

The past decade saw many countries establishing a national regulatory regime to tackle space debris mitigation, and many others are currently following similar steps. Such regimes generally involve the adoption of already existing and widely accepted standards and international guidelines, such as ISO 24113, but those standards and guidelines evolved likewise in the past few years, reflecting the changes in the dynamic space debris environment.

In order to support the verification of the compliance with existing recommendations, guidelines or even national laws, the European Space Agency (ESA) has been developing the Debris Risk Assessment and Mitigation Analysis (DRAMA) software tool suite since 2004. This software has now become an essential part in satellite mission design and subsequent compliance verification by ESA, and is also used by about 2000 users world-wide from industry, academia and agencies.

Reflecting on how space debris mitigation is addressed today, by taking into account the maturity in the related standards, seeing the many different needs from a diverse community of engineers, manufacturers, operators, regulators, etc., and based on many years of experience, ESA has begun developing the Debris Mitigation Framework (DMF).

This paper will describe the DMF in detail. Its core element is a software framework bundling the major tools that have been used in the past in the space debris mitigation context, which are essentially DRAMA and MASTER (Meteoroid And Space debris Terrestrial Environment Reference). Those tools are fed with mission design parameters, following a model-based engineering approach, and then processed to result in an assessment mission designers could use to document their space debris mitigation plan. The key advantage by the DMF is that users so far had to work with all the individual tools, collect the required input, provide it in very different formats, before processing and then collecting outputs, again, in different formats. This will be overcome by the DMF in linking all those tools together and specifically addressing space debris mitigation requirements. But the DMF is not limited to the software alone: a community approach, which entails a discussion forum, a knowledge base for key methodologies and algorithms related to space debris mitigation, and the open-source nature with the options to extend the framework with custom code, are all part of the vision to provide a solution on what has been learned in the past in the area of space debris mitigation and compliance verification.