

SPACE DEBRIS SYMPOSIUM (A6)
Modelling and Risk Analysis (2)

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VALIDATION OF THE ESA-MASTER-2009 SPACE DEBRIS POPULATION

Abstract

MASTER-2009 will be the new orbital debris reference model of the European Space Agency. It was developed by the Institute of Aerospace Systems at the Technische Universität of Braunschweig. The model is based on the simulation of events and processes through which orbital debris is created. The majority of the debris generation mechanisms implemented in MASTER have been reviewed in the course of the project. Also a new model to consider objects with very high area-to-mass ratios has been implemented. The validation for debris objects larger than 1 mm was based on observation data gathered by the TIRA, EISCAT, Goldstone, and Haystack radars and the ESA Space Debris Telescope (ESA-SDT). The PROOF validation tool (Program for Radar and Optical Observation Forecasting) has been used to simulate detections of orbital debris based on the analysis of geometrical and instrument parameters. The simulations were performed based on the observation scenarios of the actual surveys and the results were compared with survey results. In this paper, the results of this population generation mechanism will be presented. New ESA-SDT data was used to further refine the simulation of the GEO object population. In MASTER-2005, in addition to the known fragmentations of the Ekran-2 satellite and the Titan 3C Transtage, 8 artificial breakups had been introduced in order to accomplish an agreement of PROOF simulations with measurement data. These artificial events have been reviewed since the release of MASTER-2005 and have been updated for MASTER-2009. Also the LEO event list has been reviewed and additional events have been introduced (e.g. Feng-Yun) and existing ones have been updated. Small particle validation was performed based on returned space hardware impact data. The solar arrays of the Hubble Space Telescope returned by the Space Shuttle on missions STS-61 and STS-109, the EURECA satellite, and the Long Duration Exposure Facility are sources for impact data.