SPACE DEBRIS SYMPOSIUM (A6)
Modelling and Orbit Determination (9)

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REEVALUATION OF THE MASTER-2009 MLI AND H-10 DEBRIS MODELING

Abstract

The current paper is an excerpt from the doctor thesis "Multi-Layer Insulation as Contribution to Orbital Debris" written at the Institute of Aerospace Systems of the Technische Universität of Braunschweig. The Multi-Layer Insulation (MLI) population included in ESA's MASTER-2009 (Meteoroid and Space-Debris Terrestrial Environment Reference) software is based on models for two mechanisms: one model simulates the release of MLI debris during fragmentation events (fragmentation sources model) while another estimates the continuous release of larger MLI pieces (continuous source model) due to aging related deterioration of the material. Since spacecraft in GEO or in a GEO graveyard orbit typically remain in that orbital region unless actively removed, they pose a large reservoir for MLI debris. In a business-as-usual scenario the models predict a drastic increase in the MLI population after 2009 so that in the year 2060 a total of 40,000 MLI objects which are larger than 10 cm would be in orbit. This is about the same as all other debris sources combined. The aim of the thesis was to determine the reliability of these results.

The current paper starts out with a brief description of the MLI model structure. The updates which were performed on the MLI source models are detailed succinctly. Observations of the debris environment for the years 2001 to 2007 which were performed by the Astronomical Institute of the University of Bern using ESA's Space Debris Telescope (ESASDT) have been simulated using ESA's Program for Radar and Optical Observation Forecasting (PROOF) based on the updated MLI population as well as all other known debris sources and TLE objects. ESA's Space Debris Telescope (ESASDT) is a 1-m Zeiss telescope which is located at the Optical Ground Station (OGS) at the Teide Observatory at Tenerife, Spain. Comparison of the simulated observations to the actual measurements from the ESASDT shows that MLI may cover a much smaller portion of the observed objects than previously published. The paper closes with a description of the MLI population between 1957 and 2060 resulting from the updated modeling approach.