18th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Modeling and Risk Analysis (2)

Author: Dr. Carsten Wiedemann
TU Braunschweig, Institute of Space Systems, Germany

Mr. Andre Horstmann
TU Braunschweig, Germany
Mr. Sebastian Hesselbach
Technische Universität Braunschweig, Institute of Space Systems, Germany
Dr. Vitali Braun
IMS Space Consultancy, Germany
Dr. Holger Krag
European Space Agency (ESA), Germany
Mr. Sven Kevin Flegel
European Space Agency (ESA), Germany
Dr. Michael Oswald
EADS Astrium, Germany
Prof. Enrico Stoll
TU Braunschweig, Institute of Space Systems, Germany

IMPROVEMENTS AND UPDATES IN MASTER-8

Abstract

In this paper, the new version of the ESA MASTER model in its version 8.0 is introduced. The development of MASTER-8 is completed and the release was on March 19, 2019. A selection of the most important update work on the model is given. MASTER-8 was developed by the Institute of Space Systems of the TU Braunschweig, commissioned by ESA, to establish the successor of MASTER-2009. The model is made available to users by ESA. The most important improvements on the new reference population include the number of fragmentation events, solid rocket motor firings and NaK release. These are the main driver for the accuracy of MASTER. Significant revisions include completing the list of all events that generated space debris. Since the previous version, there have been numerous new release events that are taken into account in the new version. It is shown which additional single fragmentation events need to be considered. Therefore, one of the most important steps of the update was to integrate all previously unrecognized events and the newly added events into the model since the last release and to align the resulting new population with both historical and current measurements. Furthermore, some historical contributions have been revised and partially reinterpreted. A completely new historical population was developed, which is validated up to a reference period in November 2016. Whereas the generation of the debris is modeled statistically, its spatial distribution is modeled scientifically based on orbital mechanics. The improvements and additions as well as significant differences to the previous version of the model are shown in an overview.