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

Author: Mr. Sven Kevin Flegel
Technische Universität Braunschweig, Germany, sven.flegel@fhr.fraunhofer.de

Mr. Sebastian Stabroth
Technical University of Braunschweig, Germany, s.stabroth@tu-bs.de
Dr. Carsten Wiedemann
Technical University of Braunschweig, Germany, c.wiedemann@tu-braunschweig.de
Mr. Detlef Alwes
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, detlef.alwes@dlr.de
Dr. Jörg Bendisch
Germany, bendisch@aerodata.de
Prof. Peter Voersmann
Technische Universität Braunschweig, Germany, *(email is not specified)*

FUTURE SATELLITE FAILURE RISK DUE TO HYPERVELOCITY IMPACTS

Abstract

The failure risk of selected satellite missions due to hypervelocity impacts from space debris is estimated for the years 2005 and 2055. Impacts from space debris objects can lead to mission operation anomalies or the total loss of a satellite. The spatial object density at the mission altitude is a driving factor for the occurrence of a hypervelocity impact on a satellite. For the year 2005, the space debris environment as given by ESA's MASTER-2005 (Meteoroid and Space Debris Terrestrial Environment Reference) model is used. The future evolution of the spatial density is predicted for a business-as-usual scenario which is based on the launch activity in the years preceding 2005. Generation of the space debris population data for the years 2005 to 2055 is performed with LUCA (Long Term Utility for Collision Analysis) which is developed at the Institute of Aerospace Systems of the Technische Universität Braunschweig. Explosion and collision events are simulated using the NASA Breakup Model. The predicted evolution of the space debris environment is discussed in terms of object sources and orbit altitudes. The risk of failure of a satellite as a result of a hypervelocity impact is estimated by combining the impact probability with a vulnerability model. The vulnerability model is based on current satellite designs for the arrangement of critical components and wall configuration. The analysis shows that an increase in the failure risk of satellites is likely. This should be taken into account during planning of future satellite missions.