

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

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CONTRIBUTION OF ARIANE H-10 FRAGMENTATIONS TO THE GTO DEBRIS ENVIRONMENT

**Abstract**

The current paper is an excerpt from the doctoral thesis "Multi-Layer Insulation as Contribution to Orbital Debris" written at the Institute of Aerospace Systems of the Technische Universität of Braunschweig. The aim of the thesis is the modeling of multi-layer insulation (MLI) as a potential source for space debris. The validation of the simulated debris population is based on comparison to measurement data of the GEO and GTO debris environment obtained by the Astronomical Institute of the University of Bern (AIUB) using ESA's Space Debris Telescope (ESASDT), the 1-m Zeiss telescope located at the Optical Ground Station (OGS) at the Teide Observatory at Tenerife, Spain. The validation revealed that fragments from the explosion of Ariane H-10 upper stages between the years 1984 and 2002 may previously have been under-predicted significantly. The observations performed in the year 2001 specifically contain a feature which could be matched to the debris cloud of the Ariane upper stage with the international designator 1989-006B. Previously, this feature had been thought to belong to unconfirmed GEO fragmentations.

This paper discusses the contribution of the fragments from explosions of the Ariane H-10 upper stage to the GEO and GTO debris environment. Initially, an overview is given of the known explosion events of the unpassivated version of this type of upper stage. The assumptions are presented which are used to estimate the number of detectable fragments in these events. The ESA Program for Radar and Optical Observation Forecasting (PROOF) is used to simulate the GEO and GTO observation campaigns of the ESASDT based on the simulated debris environment. The results from the comparison of the simulated detections to the measured tracklets are presented. Finally, the contribution of the debris from the explosion of Ariane H-10 upper stages on GTO to the overall debris environment is discussed.