29th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Interactive Presentations - 29th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

Author: Mr. Thorben Löffler
IRS, University of Stuttgart, Germany, loeffler@irs.uni-stuttgart.de

Mr. Jonas Burgdorf
IRS, University of Stuttgart, Germany, burgdorf@irs.uni-stuttgart.de
Mr. Jérôme Hildebrandt
IRS, University of Stuttgart, Germany, jhildebrandt@irs.uni-stuttgart.de
Mr. Alexandros Vikas
IRS, University of Stuttgart, Germany, vikasa@irs.uni-stuttgart.de
Mrs. Susann Pätschke
Institute of Space Systems, University of Stuttgart, Germany, paetschke@irs.uni-stuttgart.de
Mrs. Lena Bötsch-Zavřel
IRS, University of Stuttgart, Germany, lena.boetsch-zavrel@irs.uni-stuttgart.de
Mr. Cedric Holeczek
KSat e.V., Germany, holeczek@ksat-stuttgart.de
Mr. Patrick Largent
University of Stuttgart, Germany, patrick@largent.de
Ms. Marlin Kanzow
University of Stuttgart, Germany, kanzowm@irs.uni-stuttgart.de
Mr. Jona Petri
Institute of Space Systems, University of Stuttgart, Germany, petri@irs.uni-stuttgart.de
Dr. Michael Lengowski
Institute of Space Systems, University of Stuttgart, Germany, lengowsk@irs.uni-stuttgart.de
Prof. Sabine Klinkner
IRS, University of Stuttgart, Germany, klinkner@irs.uni-stuttgart.de

PRELIMINARY DESIGN OF THE RADIATION PROTECTION FOR THE SMALL SATELLITE ROMEO IN THE LOWER MEDIUM EARTH ORBIT

Abstract

The Medium Earth Orbit regimes, characterized by harsh radiation environments, are a target of the University of Stuttgart's Institute of Space Systems satellite "Research and Observation in Medium Earth Orbit" ROMEO. The aim of the ROMEO mission is to demonstrate a cost-efficient solution to access and operate in the lower MEO. Utilizing MEO can help to reduce the growing density of LEO spacecraft. Additionally, satellites in higher orbits achieve prolonged visibility times over targets and ground-stations, which lowers the overall number of satellites necessary in constellations. However, in contrast to the relatively protected lower Earth orbits, the MEO environment is particularly dangerous for electronic components, because of high-energetic protons and electrons, which are trapped in the Van Allen Radiation Belts. In comparison to LEO missions, this leads to a multiple of the annual Total Ionizing Dose (TID) levels received, and a significant higher probability of Single Event Effects (SEE). As the demonstration spacecraft's apogee will be raised up to 3000 km altitude, the platform has the chance to demonstrate radiation tolerant systems including commercial off-the-shelf (COTS) and NewSpace com-

ponents. This paper sums up the radiation mitigation strategies used for the small satellite platform on mission-, system-, and component-level. The goal of those strategies is to increase the reliability of the satellite bus. Suitable NewSpace components with increased radiation protection are selected by a market study. Additionally, a budget for shielding mass is analysed. This paper suggests a system design with single failure tolerance and independent redundant power distribution systems.