SPACE DEBRIS SYMPOSIUM (A6)
Mitigation and Standards (4)

Author: Mr. Claude Cougnet
EADS Astrium, France

Mrs. Laure Brooker Lizon-Tati
Airbus Defence and Space SAS, France
Mr. Matthieu David
EADS Astrium, Germany
Mr. bernard Gergonne
EADS Astrium, France
Mr. Robin Putzar
Fraunhofer - Institute for High-Speed Dynamics, Germany
Dr. Hedley Stokes
PHS Space Ltd, United Kingdom
Mr. Paul Bourke
Tencate Advanced Armour, United Kingdom

PROTECTING THE LEO SPACE SYSTEMS AGAINST SMALL DEBRIS PARTICLES

Abstract

The presence of debris represents an increasing risk for the survivability of space assets in low Earth orbit (LEO). A European FP7 project, entitled ReVuS, aims to define design solutions that will reduce the vulnerability of future LEO satellites to small- and medium-sized debris (typically 1mm to 5 cm). Indeed, these debris cannot be tracked, but remain a significant threat. An assessment of the vulnerability of current LEO satellites to these types of debris has been carried out on two representative satellites. It has allowed to evaluate the failure probability for the entire satellite, and to identify the critical areas and equipment on the satellites. It appears that the most significant contribution to this probability of failure comes from the debris in the range 2 to 5mm. Potential solutions to minimise the vulnerability of the satellite have been identified, both at system and architecture levels. The use of shielding protection is one of the main solutions at architecture level. The aim is to protect the critical equipment, possibly the critical areas. However, different layouts of the critical equipment can be considered, each having its own constraints. Thus, several shielding configurations have been identified for each of these equipment. They are based on shielding bricks that have been defined in the field of reinforced MLI, reinforced sandwich panel, reinforced equipment box and intermediate layers. Successive steps of tests are being performed in order to evaluate at first the characteristics of these shielding bricks and then the performances of a set of shielding configurations. The first step of tests is now almost completed, allowing an evaluation of the various options of shielding bricks in each field. In parallel, other possible solutions at architecture level have been analysed. An assessment of the proposed solutions is on-going, to evaluate their gain in terms of vulnerability, but also their impacts on the satellite. The paper will provide an overview of the results of the vulnerability analysis, of the selected solutions and of the shielding aspects.