

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

Author: Dr. Frank Schäfer
Fraunhofer EMI, Germany, frank.schaefer@emi.fraunhofer.de

Mr. Martin Schimmerohn
Fraunhofer EMI, Germany, martin.schimmerohn@emi.fraunhofer.de

Mr. Vladimir Babyshkin
Russian Federation, Vladimir.Babyshkin@laspace.ru

Mr. Ilya Lomakin
Russian Federation, ilya_lomakin@laspace.ru

Mr. Philip Willemsen
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, philip.willemsen@dlr.de

IMPACT SENSING SYSTEMS AND ESTIMATED IMPACT RATES OF THE UPCOMING
METEOROID AND SPACE DEBRIS DETECTOR EXPERIMENT (MDD3) ONBOARD RUSSIAN
SPEKTR-R SATELLITE

Abstract

MDD3 is a Meteoroid and Space Debris Detector experiment, supported by the German Aerospace Center, which will be flown onboard Russian Spektr-R satellite with a planned launch for end of 2009. The MDD3 flight experiment has two goals: First, the in-orbit verification of the impact-detector technology and second, the monitoring of hypervelocity impacts from space debris and meteoroids on the ca. 0.12 m² surface area of the detector.

The detector has three different impact sensing systems that monitor different physical parameters of the impact: (1) ultrasonic transducers for monitoring the acoustic emission from the impact in the detector plate, (2) optical detectors for monitoring the light that is emitted from the impact plasma, and (3) a radiofrequency (RF) coil that is intended to monitor the transient magnetic field generated in the impact plasma. A hypervelocity impact event will be assumed to have occurred if all three detection systems are triggered synchronously. The special character of the Spektr-R mission is that the satellite is operated in a highly elliptical orbit, which encounters the Earth orbit environment from 600 km perigee altitude up to 330000 km apogee altitude. Hence, MDD3 allows for in-situ measurement of space debris and micro-meteoroid impacts in various Earth orbit particle environments, which has never been done before.

This paper gives an overview of the Spektr-R mission, describes the impact sensing system of the MDD3 and provides a first estimate of the predicted impact rates of the MDD3 during one orbit of Spektr-R based on meteoroid and debris flux model calculations.