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

Author: Dr. Frank Schäfer
Fraunhofer EMI, Germany

Mr. Martin Schimmerohn
Fraunhofer EMI, Germany
Mr. Vladimir Babyshkin
Russian Federation
Mr. Ilya Lomakin
Russian Federation
Mr. Philip Willemsen
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany

# 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 exoeriment 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 differen physical parameters of the impact: (1) ultrasonic transduces 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.