SPACE DEBRIS SYMPOSIUM (A6)
Measurements and Space Surveillance (1)

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DEVELOPMENT OF A NEW TYPE SENSOR FOR IN-SITU SPACE DEBRIS MEASUREMENT

Abstract

Space debris environment models are used for debris impact risk assessments for spacecraft. The comparison of representative models revealed that there is large difference in the flux value of the size range from a hundred micrometers to several millimeters. The uncertainty of models is caused by the lack of measurement data. Although the large size objects (larger than several cm) can be detected by grand based observations, and small size debris (smaller than hundred micrometers) is measured by spacecraft surface inspections, the size range of hundred micrometers to several millimeters cannot be detected by ground observations and cannot get enough data from spacecraft surface inspections. On the other hand, importance of measurement of these large particles has been increased especially in the engineering viewpoints (e.g. space system design and operations). The in-situ measurement data are useful for; 1) verifications of space debris environment models, 2) verifications of space debris environment evolution models, 3) real time detection and evaluation of the influences on space environment by unexpected events, such as explosions on an orbit (ex. ASAT (Anti-Satellite Test) and satellites collisions). Authors have been developing the in-situ measurement sensor to detect dust particles ranging from a hundred micrometers to several millimeters. Since spatial density of this size range of debris is low, the sensor must have a large detection area, while the sensor is required to be low in mass, low in power, robust, and low in telemetry requirements. The sensor consists of multitudes of thin and conductive strips which are formed with fine pitch on a thin film of nonconductive material. A dust particle impact is detected when one or more strips are severed by the impact hole. It is simple to produce and use and requires almost no calibration as it is essentially a digital system. Features of the sensor are; 1) Simple mechanism, 2) High reliability (sensing ability), 3) Flexible configuration, 4) Measurement of change of the usable area of a sensor is possible correctly, 5) Low weight, low power and low cost, 6) Excellent extendability for measure additional parameters (the impact location, the impact velocity and direction of the particle). Authors report the sensor development, hypervelocity impact experiments on the preliminary models of the sensor, and mission plans which use the sensors.