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Development of a New Type Sensor for Micrometeoroid and Space Debris In-Situ Measurement at JAXA

Y. KITAZAWA (1,2,3), A. SAKURAI (4), T. YASAKA (4,5), K. FUNAKOSHI (4), T. HANADA (5), and H. MATSUMOTO (2)

(1) IHI Corporation (IHI), Tokyo, Japan (kitazawa@planeta.sci.isas.jaxa.jp, +81 36204 8799), (2) Japan Aerospace Exploration Agency (JAXA), Tsukuba, Japan, (3) National Institute of Information and Communications Technology (NiCT), Tokyo, Japan, (4) Institute for Q-shu Pioneers of Space, Inc. (iQPS), Fukuoka, Japan, (5) Kyushu University, Fukuoka, Japan

Several sensor systems are being designed to monitor large (larger than 100 μm) hypervelocity particles in space. Because of the low spatial density of these large particles, the candidate sensor systems must have a large detection area, while the constraints of a space environment deployment require that these systems be low in mass, low in power, robust and low telemetry requirements. On the other hand importance of measurement of these large particles has been increased especially in engineering viewpoints (e.g. space system design and operations). The in-situ measurement data are useful for; 1) verifications of meteoroid and debris environment models, 2) verifications of meteoroid and debris environment evolution models, 3) real time detection of unexpected events, such as explosions on an orbit (Ex. ASAT: Anti Satellite Test). JAXA has been developing a simple in-situ sensor to detect dust particles ranging from a hundred micrometers to several millimeters. Multitudes of thin, conductive strips 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 (easy to make a large-size sensor and no restrictions of size and/or form), 4) No need to perform many hypervelocity impact experiments (Calibration shots), 5) Measurement of change of the usable area of a sensor is possible correctly, 6) Low weight, low power and low cost, 7) Excellent extendibility for measure additional parameters (the impact location, the impact velocity and direction of the particle).