SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

Author: Dr. Yukihito Kitazawa
IHI Corporation, Japan, kitazawa@planeta.sci.isas.jaxa.jp

Mr. Haruhisa Matsumoto
Japan Aerospace Exploration Agency (JAXA), Japan, matsumoto.haruhisa@jaxa.jp
Prof. Toshiya Hanada
Kyushu University, Japan, hanada.toshiya.293@m.kyushu-u.ac.jp
Dr. Toshifumi Yanagisawa
Japan Aerospace Exploration Agency (JAXA), Japan, tyanagi@chofu.jaxa.jp
Mr. Atsushi Karaki
IHI Corporation, Japan, atsushi_karaki@ihi.co.jp
Prof. Akira Sakurai
Institute for Q-shu Pioneer of Space, Inc. (iQPS), Japan, sakurai@i-qps.com
Mr. Funakoshi Kunihiro
Institute for Q-shu Pioneer of Space, Inc. (iQPS), Japan, funakoshi@i-qps.com
Prof. Tetsuo Yasaka
QPS Institute, Japan, tyasaka@nifty.com
Dr. Sunao Hasegawa
Japan Aerospace Exploration Agency (JAXA), ISAS, Japan, hasehase@isas.jaxa.jp

DEVELOPMENT OF IN-SITU MICRO-DEBRIS MEASUREMENT SYSTEM

Abstract

JAXA has been developing in-situ debris measurement system. The objective of the system is to measure small size debris (between 100 μm and several cm) . The distribution and flux of the debris of the size range are not well understood. The size range is difficult to measure from the ground observation, although the impact risk evaluation on space system caused by the size range is important. For the measurement system on the size range, combination of an optical sensor and a dust detector is under studying by JAXA with JAXA's collaborators. The in-situ measurement of the size range is 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 and/or collisions on an orbit. In present status, in-situ optical observation system is under conceptual study and a dust sensor is already in BBM (Bread Board Model) phase. This paper reports the study results of measurement system and describes details of the development of dust sensor. The dust sensor especially to monitor the size range 100 μm to a few mm, 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 have low telemetry requirements. 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 (material: copper) are formed with fine pitch (pitch: 100 μm) on a thin film of nonconductive material (thickness: 12.5 μm, material: polyimide). A dust particle impact is detected when one or more strips are severed by the perforation hole. The sensor is simple to produce and use and requires almost no calibration as it is essentially a digital system. BBM model was manufactured successfully with applying printed wiring board product technology. The sensor area of BBM is 35 cm x 35 cm, and thermal-strain

experiments and hypervelocity impact experiments on the BBM model were performed. This paper reports manufacturing and experiments results, and the development plan of flight model.