THE EFFECT OF AN ON-ORBIT NEAR ENCOUNTER ON THE NUMBER FLUX DENSITY OF MICRON SIZED PARTICLES

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Many materials and techniques have been developed by the authors to sample the flux of particles in Low Earth Orbit (LEO), and through regular *insitu* sampling of the flux in LEO, the materials and techniques have produced data which compliment the data now being amassed by the Long Duration Exposure Facility (LDEF) research activities. Several recent flight experiments have been conducted on the Space Shuttle as part of an ongoing program to develop an understanding of the Spatial Density as a function of size (mass) for particle sizes $1 \cdot 10^{-6}$ cm and larger. During the course of one of the missions, the Space Shuttle corrected its altitude to evade an upper stage. The results of this near encounter provided unexpected data.

Extensive research [1] has been conducted to characterize the effects on materials subjected to hypervelocity impacts by large masses. Even though the large mass impactors carry the highest probability of precipitating a catastrophic event, the number of large mass objects which might be encountered by an exposed surface in LEO is believed to be quite small. However, the size distribution of objects that will be encountered in LEO has not been adequately characterized; especially for that portion of the distribution which contains the largest number of objects, i.e., micron and sub-micron size.

Characterization of the orbital debris and micrometeoroid complex which any surface will encounter in LEO implies an implementation of several concurrent processes. Foremost, there should be a means to sample *insitu* , the flux with a frequency which can establish good statistics for multiple samples. There also should be access to that environment for an extended period so that the existence of any temporal fluctuations in that flux can be identified. The experiments flown can be passive sensors if the materials can be easily returned to Earth. In fact, the complete analysis of the LEO environment cannot be adequately conducted without repeated examinations of materials which have been exposed to the extremes of space. Hence, the experimental design which can provide a much needed investigation of small grains would be a passive sensor which could both detect and capture constituents of the orbital debris and micrometeoroid complex.

Recent flight experiments on STS-32, STS-44, STS-46 and STS-52 have been conducted to develop an understanding of the Spatial Density as a function of size (mass) for particle sizes $1 \cdot 10^{-6}$ cm and larger. In addition to the enumeration of particle impacts, it was also the intent of these experiments that hypervelocity particles be captured and returned intact. Measurements were performed post-flight to determine the flux density, diameters, and subsequent effects on various optical, thermal control and structural materials.

During the course of the STS-44 mission, the Space Shuttle corrected its altitude by 26 km to evade a spent upper stage. The results of this near encounter suggests that a cloud of micron sized particles exist in the vicinity of the object. Data also suggests that the flux density is nearly two (2) orders of magnitude higher than background flux. A comparison of the number flux density, along with microphotographs of the captured particles will be presented for the referenced shuttle flights.

REFERENCES. [1] Tanner, W. G. et al. An Examination of Hypervelocity Particle Penetration Parameters for Thin Films Flown in Space. HVIS 1992.

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