

THE USE OF TETHERED SATELLITES FOR THE COLLECTION OF COSMIC DUST AND THE SAMPLING OF MAN MADE ORBITAL DEBRIS FAR FROM THE SPACE STATION

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All attempts to collect samples of the smallest micron and sub micron sized cosmic dust particles in space with collectors on board the space shuttle, the Long Duration Exposure Facility (LDEF), and the Space Station are subject to two main difficulties:

- 1) Contamination by orbital debris associated with the shuttle, the space station or other satellites (rocket exhaust, paint flecks, outgassing, etc.)
- 2) Hypervelocity impact speed of tens of km/sec. resulting in the destruction of the smallest particles with only small amounts of chemically fractionated impact debris remaining.

The use of a tethered subsatellite employed downward into the earth's upper atmosphere to an altitude of about 110 km. above the earth would eliminate the orbital contamination problem while at the same time affording a measure of atmospheric braking to reduce the velocities of many particles to where they may be captured intact or nearly so with properly designed collectors (1,2).

The same technique could also be used to monitor the flux of all types of man made orbital debris out to a distance of more than a hundred kilometers in any direction from the space station (3). In this way the build up of any debris belt orbiting earth could be determined.

The actual collecting elements used for both purposes could be of several different materials and designs so as to optimize the collection of different types of particles with different densities. Stacks of foils, films, plastics, and foams, as well as simple capture cells would be mounted in clusters around the outside of a tethered satellite and protected by iris covers until the tether had been fully deployed. Before retrieval the covers would be closed and the collectors returned to earth for study. If the orientation history of the satellite were known the direction of the incoming material could be inferred. A chief advantage in deploying such tethered collectors from the Space Station instead of from the shuttle is the ability to maintain deployment of the tether for days instead of hours resulting in much greater yields of intact particles and impact debris.

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The first test of the tethered satellite facility being developed by the Marshall Space Flight Center for the acquisition of upper atmospheric data will employ a tether which is 30 km. long. Eventually tethers which are 100 or more km. long will be deployed. It should be noted that cosmic dust collectors could be easily added to the outside of any satellites designed for upper atmospheric studies. Such collectors, with little or no power requirements, would add little to the cost of a planned mission but would yield important information on the composition and flux of micron and submicron cosmic dust particles.

- 1) Corso, G.C. (1983) J. Brit. Int. Soc., V. 36, p.403
- 2) Corso, G.C. (1984) Lunar and Planetary Science Conv. XV,
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- 3) Corso, G.C. (1985) ACTA ASTRONAUTICA, Vol. 12, p. 265