Reduction of Trapped Energetic Particle Fluxes in Earth & Jovian Radiation Belts
Robert Hoyt, Tethers Unlimited, Inc.

The energetic radiation particles trapped by the strong magnetic fields of the Earth, Jupiter, and other planets present a tremendous challenge for human and robotic exploration and development of space. These energetic particles cause biological damage in humans and constant degradation in electronics and other materials used in spacecraft. The current methods for dealing with the orbital radiation environment are to limit long-duration manned missions to low-altitude orbits below the intense regions of the Van Allen belts, to protect orbital facilities with heavy shielding materials, to minimize the duration of extravehicular activities of personnel outside the shielding of orbital facilities, and to utilize heavy, expensive, and low-performance electronics and other components in spacecraft systems. These measures, however, are insufficient to ensure the safety and performance of human and robotic components of a sustained program of exploration and development of space. The proposed effort will evaluate the feasibility of actively reducing the fluxes of energetic particles trapped by the magnetic fields of Earth and Jupiter utilizing high voltage orbiting structures. Recent analyses of scattering of energetic electrons by high voltage structures have indicated that a technically and economically feasible system could rapidly reduce particle fluxes in man-made radiation belts. This project will investigate application of this concept to elimination of the naturally-occurring Van Allen belts. Remediation of the Van Allen belts could dramatically reduce the risks and costs associated with long-duration manned missions in Earth and Jovian space. Additionally, by reducing the rate of degradation of solar panels and electronics in these regions, it could significantly improve the performance and economic viability of systems such as solar-electric propulsion tugs for lunar missions and solar power satellites. The proposed effort will develop system concepts for Earth and Jovian radiation belt remediation, investigate the potential environmental effects of such an effort to reduce the natural radiation belts, and develop strategies and designs for validating the concept feasibility through experimentation and simulation.

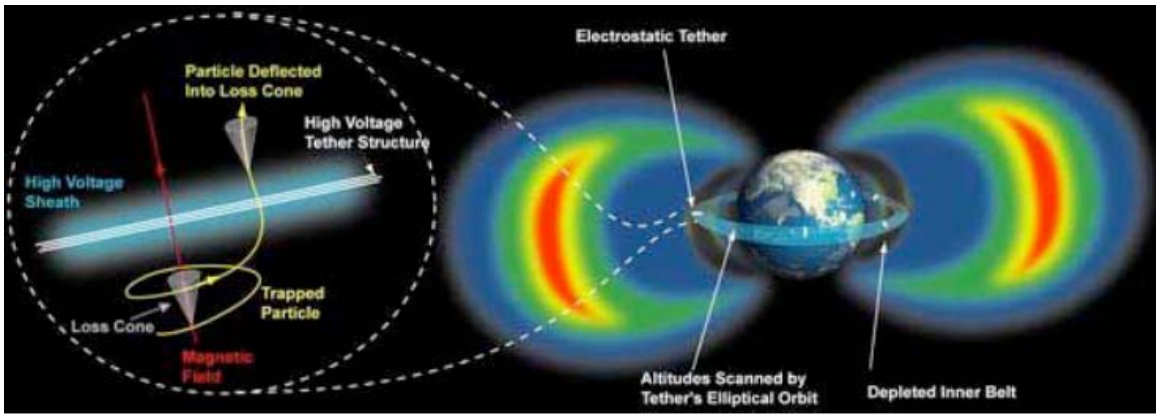

Figure: Concept of operations of an electrostatic system deployed to reduce radiation fluxes in the inner electron Van Allen belt.