Analysis of a Lunar Base Electrostatic Radiation Shield Concept

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The concept presented in this proposal is based on two recent but unrelated studies at the Kennedy Space Center (KSC) Applied Physics Laboratory and Electrostatics and Surface Physics Laboratory (ESPL): a multipole electrostatic radiation shield and an electrodynamic dust shield. Both advanced concepts are combined in this proposal for a lunar base radiation shield study.

The proposed radiation shield is composed of a cluster of charged conducting spheres, some positively charged and some negatively charged such that the total charge of the system may be equal to zero. The potential field of the cluster of spheres is configured so that in the far field, relative to the center of the cluster, the potential will be weakly negative over a range of distance toward the shield's center. In the near field, the potential is strongly positive. Incoming negatively charged radiation particles of a given energy spectra are scattered by the far-field negative potential created by the shield. Incoming positively charged radiation particles of a given energy spectra are then scattered by the positive potential near the center of the shield. This shielding strategy results in a volume near the center of the electrostatic sphere network, where radiation of a given energy spectra is eliminated or significantly reduced. The electrodynamic dust shield, previously investigated by the ESPL for removing dust from solar panels on the surface of Mars, will be studied as the basis of a solution to the problem of lunar dust collecting on the radiation shield conducting spheres.

This Phase I activity involves an in-depth mathematical analysis, modeling, and computer simulation of the lunar radiation shield concept. In addition to the NASA KSC laboratory resources, Field Precision (Albuquerque, NM) advanced radiation simulation software will be an available analytical resource.

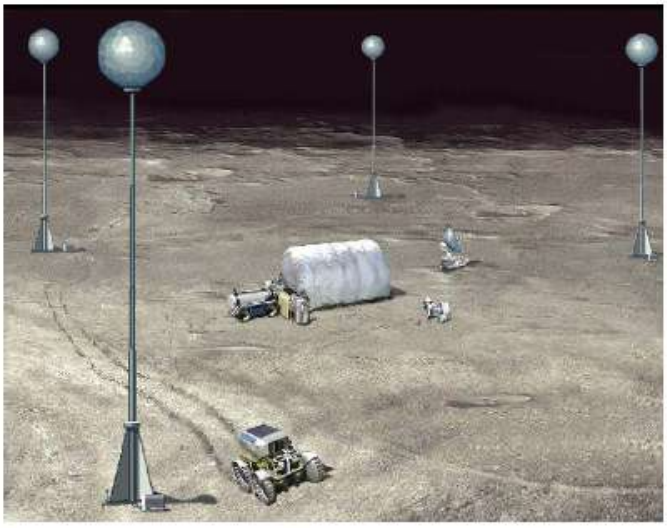

Figure 2. Artist's concept of a lunar base radiation shield. The electrostatic spheres are supported by telescoping poles and are powered by individual power supplies. *Art concept by Marvin Tatum.*