MAR12-2011-000497

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Mitigation of Space Radiation Effects

WILLIAM ATWELL[1], The Boeing Company

During low earth orbit and deep space missions, humans and spacecraft systems are exposed to high energy particles emanating from basically three sources: geomagnetically-trapped protons and electrons (Van Allen Belts), extremely high energy galactic cosmic radiation (GCR), and solar proton events (SPEs). The particles can have deleterious effects if not properly shielded. For humans, there can be a multitude of harmful effects depending on the degree of exposure. For spacecraft systems, especially electronics, the effects can range from single event upsets (SEUs) to catastrophic effects such as latchup and burnout. In addition, some materials, radio-sensitive experiments, and scientific payloads are subject to harmful effects. To date, other methods have been proposed such as electrostatic and electromagnetic shielding, but these approaches have not proven feasible due to cost, weight, and safety issues. The only method that has merit and has been effective is bulk or parasitic shielding. In this paper, we discuss in detail the sources of the space radiation environment, spacecraft, human, and onboard systems modeling methodologies, transport of these particles through shielding materials, and the calculation of the dose effects. In addition, a review of the space missions to date and a discussion of the space radiation mitigation challenges for lunar and deep space missions such as lunar outposts and human missions to Mars are presented.

[1]Boeing Research & Technology 13100 Space Center Blvd., MS: HB 2-30 Houston, TX 77058 cell #: 281/804-3673