

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

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EFFECT OF SOLAR PARTICLES ON LEO SATELLITES

Abstract

From the beginning of Space age, Solar Particles has been a major problem for space-crafts, probes, satellites and all other man-made equipments. The orbital environment is a major consideration in the design of any space system associated with various hazards to earth orbiting satellites since it can have critical effect on spacecraft operations. Variation in solar environment also impact thermospheric density levels. The solar cycle also plays an important role in mission planning and operations activities. Solar flares are a major contributor to overall radiation environment and can add to dose of accumulated radiation levels. From the experimental satellites like SCATHA, CRRES and DMSP investigated the radiation environment of the inner and outer radiation belts and measured the state-of-art microelectronics devices. These hazards include differential charging, internal charging and surface charging which can damage the spacecraft electronics. Solar storms and increased ultraviolet emissions heat earth's upper atmosphere causing it to expand, the heated air rises and density at the orbit of satellite increases significantly up to about 1000 kms. This results in increase in drag causing satellite to slow down and change orbit slightly by as much as 30 kilometers, LEO satellite are not repeatedly boosted to higher orbits slightly fall and will eventually burn up. During storms the number and energy of electrons and ions increases. When the satellite travel through this energized environment the charged particle striking the spacecraft, will differentially charge the portion of spacecraft. Discharges can arc across the spacecraft components, harming and possibly disabling them. If the sufficient charge accumulates in any one component, it may attempt to neutralize by discharging to other components. This discharge is hazardous to satellite electronic systems. This paper will discuss these cumulative effects on LEO satellites.