IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Radiation Fields, Effects and Risks in Human Space Missions (5)

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MAPPING HIGH ENERGY PARTICLE POPULATION IN THE BOUNDARY REGIONS OF EARTH'S MAGNETOSPHERE USING NEW DATA FROM MMS

Abstract

Penetrating Ionizing Radiation (PIR) is presently one of the greatest hazards to human space transportation in cis-lunar space. With construction of the Lunar Orbital Platform Gateway and plans of human presence on the lunar surface already in 2024, humans will increasingly travel to the Moon's vicinity and surface in the coming decades.

Beyond the protective magnetic field of Earth, the highly energetic particle background flux from the galaxy and solar activity driven events are dominating. Thus monitoring and modelling this radiation for the entire cis-lunar space is imperative, for enabling safe and efficient human space transportation beyond the well-studied region below GEO orbit.

The NASA Magnetospheric Multiscale (MMS) mission, launched on March 12, 2015, consists of four spinning spacecraft (MMS observatories). Each MMS observatory is equipped with a Micro Advanced Stellar Compass (μASC) Star Tracker System (STS) provided by the Technical University of Denmark (DTU). These μASC are, besides their primary function of attitude determination, capable of detecting and monitoring PIR. The highly elliptical equatorial orbits of MMS, ranging from a perigee of Re=1.2 to apogee Re=29.34 (i.e. almost halfway to the Moon), provides for a continuous scan of the region of interest to human cis-lunar travel. MMS data thus enables detailed spatiotemporal mapping of PIR, and provides a direct link between the deep-space and trapped high energy particle populations.

We present processes and analysis of the high energy radiation data obtained from the Micro Advanced Stellar Compass (μASC) on board MMS, from May 2017 to summer 2020, and present the first ever

detailed high energy flux map in cis-lunar space.