

WRMISS ABSTRACT – Artemis 1 Radiation Modeling and Analysis Using Operational Methods

Abstract

The successful completion of the Artemis 1 mission has provided NASA with a significant volume of space radiation dosimetry data that can be used to verify the accuracy of current operational SRAG dose computation models and methods for Beyond LEO missions. High-Fidelity CAD models of the Artemis 1 MPCV Orion were raytraced in 10,000 directions per sensor location, including the location of Artemis HERA sensors, Artemis RAMs (TLDs), and the crew active dosimetry (CADs). The full Artemis 1 mission was modelled using the as-flown trajectory, Ap9-Ae9 IRENE providing the VAB trapped proton and electron environment, and the Badhwar-O'Neill 2020 model providing the freespace GCR environment. IGRF 12 was used to compute cutoff rigidities for the GCR environment in LEO. 1DHZETRN was used to estimate point doses at each sensor position. Computed RAM doses were within 5% of measured values. The computed VAB transit and freespace GCR dose rates showed good qualitative agreement with measured HERA values. An estimate of normalized mean effective dose for a hypothetical male crew member on Artemis 1 using current standard operational methods was computed to be 22.3 mSv.

Keywords: Artemis 1, radiation models, Van Allen radiation belts, space radiation environment, GCR, NSCR, effective dose