Thermal Analysis of NRHO Entry Lunar Flyby Maneuver

NASA’s Gateway will serve as a platform for sustained human lunar exploration and an opportunity to gain experience with long duration deep-space architectures. The first two Gateway modules, the Power and Propulsion Element (PPE) and the Habitation and Logistics Outpost (HALO) are scheduled to launch together as a Co-Manifested Vehicle (CMV) in 2024. To reach the destination Near-Rectilinear Halo Orbit (NRHO), the CMV will perform a low-thrust electric propulsion spiral and a final transfer maneuver that will include a low altitude flyby of the lunar surface. This flyby thermal environment is more adverse than that expected during the NRHO itself and risks temperature exceedances on various spacecraft components. The highly transient nature of the flyby also required a different approach than the typical worst-case dissipation margins used to size the spacecraft thermal control systems. This paper presents analyses on the relative severity of different minimum perilune altitudes and results of an integrated CMV thermal model built in Thermal Desktop.

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