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EARTH-MOON LOGISTICAL OPERATIONS UTILIZING CISLUNAR PERIODIC ORBITS

Abstract

The world is in the midst of the second Space Age. The continued development and support of NASA's Artemis program and similar international efforts has made frequent Earth-Moon travel more likely than ever in the coming decades. With this surge in traffic, it is paramount to establish common cislunar routes and celestial highways for managing the flow of space travel and logistical operations between the highly chaotic zone connecting the Earth and Moon. One class of orbits, identified herein as cislunar periodic orbits, may act as an efficient means of establishing these common routes whilst utilizing natural perturbations to minimize fuel consumption. Cislunar periodic orbits are defined as orbits which periodically return to their initial conditions while they traverse the expanse of cislunar space, or the spherical volume of space extending from geostationary orbit to and including the Earth-Moon Lagrange points. Such orbits could provide support for a wide swatch of logistical missions to include re-supply, personnel transport, and space-based infrastructure development. In particular, cislunar periodic orbits which feature close proximity passes of both the Earth and Moon, identified herein as cycler orbits, may be extremely useful for such mission sets. As with any new system or policy, legislation for common regulations will be forthcoming as implementation comes to fruition and plans are set for establishment. With the anticipation for the need of common celestial highways, space faring nations have a vested interest in research focused on implementation and law surrounding these orbits. In this work, orbit feasibility, logistical challenges, patentability and rights of orbits, and international space law and policy will be explored to investigate the practicability of establishing these international routes using various forms of shared cislunar periodic orbits.