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Author: Dr. Cristiano F. de Melo
Instituto Nacional de Pesquisas Espaciais (INPE), Brazil

Prof. Elbert E.N. Macau
Instituto Nacional de Pesquisas Espaciais (INPE), Brazil
Prof. Othon Winter
UNESP - Univ Estadual Paulista, Brazil

NATURAL WAYS TO HIGH INCLINATION LUNAR ORBITS

Abstract

The poles and some areas on the far side of the Moon are strong candidates to receive the future bases with permanent crews (NASA/ESAS 2005). Depending on the area near the poles, the Earth can stay for more than two weeks below the horizon. On the far side, it is not possible to establish a direct link with the Earth. In these two cases, communication with the Earth becomes unviable. The solution to this problem is in the maintenance of satellites or micro satellites constellations in lunar orbits with high inclinations to guarantee communication with the Earth (Ely and Lieb, 2005). In this work, we considered natural routes between LEOs and the lunar sphere of influence, through L1 and L2 (de Melo et al. 2007), to insert spaceships in lunar orbits with inclinations between 70 and 110 degrees at low costs. The transfer time varies between 8 and 16 days. These routes are formed by derived trajectories from the periodic orbits predicted by the restricted three-body problem Earth-Moon-particle and the complete four-body problem Sun-Earth-Moon-particle (de Melo et al. 2007). Methodology: the trajectories are naturally captured by Moon's gravitational field, and they stay like this, for some time, in eccentric orbits with high inclinations. During this time, transfer maneuvers to stable orbits with lower altitudes, but also with high inclinations, are accomplished starting from the proximities of the zero velocity surfaces, around 59,000km from the Moon. These two procedures provide considerable reductions in the VTotal requested for insertion and maintenance of satellite constellations around the Moon.

NASA, Exploration Systems and Architecture Study - ESAS, 2005. Ely T. A. and Lieb E., 2005, AAS/AIAA Astrodynamics Specialist Conference, AAS 05-343. de Melo et al., 2007, Adv. Space Res., 40, 83-95.