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MISSION OPPORTUNITY SEARCH OF NEAR-EARTH ASTEROIDS ROUND-TRIP MISSIONS FROM LUNAR ORBITS

Abstract

NEAs accessibility of human and robotic missions has been analysed in several studies, such as NASA's NEO Human Space Flight Accessible Targets Study (NHATS), rendezvous delta-V evaluated by Lance Benner, low delta-V NEOs analysis by Elvis, analytic analysis of the feasibility of harvesting NEA material by Sanchez, etc. The previous studies were performed by assuming Earth departure and arrivals. However, the deployments of infrastructures on moon and moon orbits in the near future will provide us new mission opportunities. Therefore, this work performs a broad investigation analyse long stay-time round-trip mission opportunities from vicinity of moon to all existing Near-Earth Asteroids in the timeframe of 2030-2065. Moon based missions, where in-situ propellant production is possible, will allow more mass budget for crew and other scientific payloads to be launched from Earth. Meanwhile, the escape delta-V and the use of Earth flyby will also enable more mission opportunities, or even enable opportunities to NEAs which would otherwise inaccessible. On the other hand, to fully utilise these advantages, more complex cislunar astrodynamics needs to be constructed. In the cislunar space, 3-body dynamics will be established and missions from and to lunar periodic orbits, such as NRHO and other missions, will be designed. Since this work is proposing a broad investigation targeting all existing asteroid, high performance computing system will be used for parallel computation, the statistical results of NEAs' accessibilities from moon vicinity will be provided.