HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Lunar Exploration (1)

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PROPOSED ORBITS FOR HUMAN MISSONS TO THE EARTH-MOON L2 REGION

Abstract

Lockheed Martin has previously articulated a plan for a sequence of human exploration missions dubbed Stepping Stones. This would begin with the EFT-1 Orion re-entry test flight in 2014, and continue with incrementally more challenging missions to explore the lunar farside from the Earth Moon L2 (EM-L2) region, asteroids, and eventually the moons of Mars. Each mission develops technologies and demonstrates capabilities which enable subsequent missions. This paper describes proposed mission design for the 'Fastnet' missions in which astronauts would teleoperate rovers on the lunar farside from a halo orbit in the vicinity of EM-L2. First, trajectories with low post-launch delta-V are detailed that use two powered lunar swingbys to spend at least 9 days over the lunar far side with total mission durations of 18 to 35 days. Delta-V margins to achieve large launch windows are shown, as well as the delta V budget to enable numerous abort options during the outbound transfer or from the halo orbit. We compare multiple options for halo or Lissajous orbits in the vicinity of L2 including optimization of the Lissajous parameters to minimize Earth occultations by the Moon, yet providing virtually constant communications coverage to the most interesting areas on the lunar far side. Longer missions that could spend anywhere from one to six months in such orbits. Orbital options will be described for maintaining a sizeable habitat in an EM-L2 orbit for long durations (perhaps a few years) that could be used as a staging node for astronauts travelling in smaller vehicles to the habitat, then either to low lunar orbit, to the lunar surface, or for later missions to near-Earth asteroids.