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

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SOME OPTIONS FOR LUNAR EXPLORATION UTILIZING THE EARTH-MOON L2 LIBRATION POINT

Abstract

The Moon is an attractive target for extending human exploration beyond low-Earth orbit. It is a logical next step for international cooperation following that for the International Space Station. Besides presenting a large nearby surface for testing techniques and equipment for exploring more distant Solar System objects, many scientific questions remain to be answered, especially about the unexplored lunar far side. Consequently, early crewed missions are likely to use orbits near the Earth-Moon L2 libration point, from which the Moon's back side can be studied remotely, and from which lunar rovers might be operated. The geologically intriguing South Pole-Aitken Basin (perhaps the largest and oldest impact basin in the Solar System), Tsiolkovsky crater, and the ice-rich lunar polar regions could be investigated in detail. We first present information about quick trajectories that loop over the back side for several days before returning to Earth, using powered swingbys at both lunar arrival and departure. Transfers to halo and Lissajous orbits about the Earth-Moon L2 point will be studied to provide longer exploration opportunities. Since periodic halo orbits are too large to provide good communications coverage of the most interesting areas of the lunar back side, we have investigated Lissajous orbits of different sizes in an attempt to quantify and minimize Earth occultation time while preserving links to interesting far-side areas. Possible use of these orbits as staging nodes for further lunar exploration will be described. Finally, we will present options for efficiently leaving Earth-Moon L2 Lissajous orbits, both for crew Earth-return emergencies and for entering the highly-elliptical "phasing orbits", the "inner loops" of double-lunar swingby orbits that are discussed in our other paper for astronaut rendezvous, operations, and lining up the line of apsides to reach departure asymptotes to more distant Solar System destinations.