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From Earth Missions to Deep Space Exploration (05)
Cis-Lunar Outposts and other Exploration Missions (5)

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THE ROLE OF CIS-LUNAR SPACE IN FUTURE GLOBAL SPACE EXPLORATION

Abstract

Cis-Lunar space offers affordable near-term opportunities to help pave the way for future global human exploration of deep space, serving as a bridge between present missions and future deep space missions. While missions in cis-lunar space have value unto themselves, they can also play an important role in enabling and reducing risk for future human missions to the Moon, Near-Earth Asteroids (NEAs), Mars, and other deep space destinations. The Cis-Lunar Destination Team of NASA's Human Spaceflight Architecture Team (HAT) has been analyzing cis-lunar destination activities and developing notional missions (or "destination Design Reference Missions" [DRMs]) for cis-lunar locations to inform roadmap and architecture development, transportation and destination elements definition, operations, and strategic knowledge gaps.

The cis-lunar domain is defined as that area of deep space under the gravitational influence of the earth-moon system and includes a set of orbital locations (e.g., low earth orbit/LEO and geosynchronous earth orbit/GEO) and earth-moon libration or "Lagrange" points (EML1 through EML5, and in particular, EML1 and EML2), and low lunar orbit (LLO). To explore this large mission space, we identified a set of potential cis-lunar missions in the form of a mission tree, defined by four parameters: mission duration, pre-deployment, type of mission, and cis-lunar location. The mission tree provides an overall analytical context for our development of cis-lunar destination DRMs, which are then used to inform HAT exploration capabilities, operations, and architectures.

With the mission tree as context, we will briefly describe two cis-lunar DRMs (servicing an asset in LEO and GEO) that we developed within the framework of the present HAT architecture. We will then describe our recent work in defining mission activities that could be conducted with a deep space EML1/L2 facility. This work is the emphasis of our paper, motivated in part by the identification of such a facility within the International Space Exploration Coordination Group (ISECG) Global Exploration Roadmap (GER) "Asteroid Next" scenario (ISECG, September 2011) and interest in such a facility at the recent "Human Exploration Community Workshop on the GER."

The Global Exploration Roadmap. International Space Exploration Coordination Group. (September, 2011). http://www.nasa.gov/exploration/about/isecg/