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# HIGH EARTH ORBIT: THE PRIME LOCATION FOR PROCESSING AND DISTRIBUTING ASTEROID RESOURCES

**Abstract**

Incoming resources from near Earth asteroids will necessarily enter an initial capture orbit with an apogee of perhaps hundreds of thousands of km. Rather than spending propellant to reduce this Highly Eccentric Earth Orbit (HEEO) to a lower level, asteroid miners may establish HEEO as the preferred location for processing and distribution of NEA resources. For outbound expeditions to the Mars system, adding propellant in HEEO provides the maximum additional delta-V potential compared to acquiring it in lower orbits. The high value it provides to customers will be matched with the lowest cost of production by asteroid miners, compared to transporting it to lower orbits. If the HEEO perigee is set a few hundred km above geosynchronous orbit (GEO), then products can be economically delivered both to GEO and GEO transfer orbit. The raw materials remain in HEEO, and only the refined end products are transferred to their marketplaces. This can provide ample benefits to GEO communications and sensing satellites released in GTO. More than two tonnes of a five-tonne satellite can be the propellant needed to complete the journey to GEO. A HEEO-based transfer vehicle can reach GTO with an expenditure of less than 900 m/s, place the cargo into GEO, and return to HEEO for refueling and reuse. Satellites designed for this architecture can launch with far more transponders and larger solar arrays, increasing their productivity.

The HEEO processing facility also will be able to fabricate ultra-large aperture antennas and giant solar arrays from the raw NEA resources. Designs can be straightforward, without the extreme packaging tricks now required to fit into limited payload fairings, and without the extra mass required to counter the stress of Earth launch. Again, only the finished products are transported from the HEEO processing facility down to customer orbits.

NASA Design Reference Architecture 5.0 examined four orbits for assembly of crewed expeditions to the Mars system. EM-1/EM-2 and the Distant Retrograde Lunar Orbit were down-rated due to their higher delta-V requirements. Assembly in Low Earth Orbit required three 100-ton Reboost Modules to keep early elements of the Mars armada from reentering due to drag – requiring 1.5 SLS vehicles for this task alone. Marshaling the elements in HEEO requires no Reboost Modules, and the outgoing vehicles can be refueled so they can deliver more dry mass, for greater systems redundancy and more effective radiation shielding (from asteroid-derived plastics).