

Moon and Mars Orbiting Spinning Tether Transport (MMOSTT)

ROBERT P. HOYT

Tethers Unlimited, Inc.

Systems of rotating momentum-exchange tether facilities can repeatedly transport payloads between low Earth orbit, geostationary orbit, the Moon, and Mars with minimal propellant expenditure. The Phase I effort developed a design for a Cislunar Tether Transport System that uses one tether in elliptical, equatorial Earth orbit and one tether in low lunar orbit. Numerical modeling verified that this system could provide round-trip travel between LEO and the surface of the Moon with near-zero propellant requirements. Using currently available tether materials, such a system would require a total mass of less than 28 times the mass of the payloads it can handle. Because a rocket-based system would require a propellant mass of at least 16 times the payload mass to perform the same job, the fully-reusable tether system would be competitive from a perspective after only two trips, and would provide large cost savings for frequent round-trip travel. The Phase I effort also developed a conceptual design for a tether system for rapid Earth-Mars travels. In the Phase II effort, we will combine and improve these system designs to develop a tether transportation architecture that can combine and improve these system designs to develop a tether transportation architecture that can provide low-cost transport to the Moon, Mars, and elsewhere in the solar system. In order to determine specific requirements for the hardware and technologies needed for tether transport systems, we will investigate concepts for enabling payload capsules to rendezvous with rotating tether systems, we will investigate concepts for enabling payload capsules to rendezvous with rotating tether facilities, and develop methods to minimize propellant requirements and maximize rendezvous windows. We will then develop a detailed design for a low-cost flight experiment to begin demonstrating the momentum-exchange tether technologies needed to create tether transport systems.

