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NTP Lunar Design Reference Missions

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Abstract. As NASA refocuses human exploration efforts toward lunar missions, there becomes a need for a transportation architecture that can deliver both cargo and crew to the Gateway and the lunar surface. Nuclear Thermal Propulsion (NTP) has shown that it can be an enabling technology to establish sustainable permanent human outposts at Mars and can be an enhancing technology for the exploration and habitation of the Moon. Due to the increased specific impulse of NTP (two times the best cryogenic propellant combinations), vehicle systems can be smaller, provide reduced transfer time, or provide increased payload capability. Aerojet Rocketdyne (AR) is working with NASA and other industry to improve the design and reduce the cost of NTP engine systems, while also examining potential architectures where NTP can be applied. By leveraging AR's current Mars Point-of-Departure (POD) vehicle design, several lunar Design Reference Missions (DRMs) were created to cover a wide range of payloads, destinations, and trajectory options. For the delivery of assets to the Gateway in Near Rectilinear Halo Orbit (NRHO), fast-transfer ballistic and Weak Stability Boundary (WSB) transfers can be utilized, providing assets at a rapid pace or at a low cost. NTP's high performance also allows for transfers between the Gateway and Low Lunar Orbit (LLO) at several inclinations, transfer times, and departure states, while maintaining the ability to perform multiple trips without refueling. Having the ability to perform both fast-transfer, high-cost and slow-transfer, low-cost missions demonstrates the robustness of a NTP Transfer Vehicle for missions in cislunar space.

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