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Space Resources, the Enabler of the Earth-Moon Econosphere (5)

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ARAMIS PROJECT - DESIGN FRAMEWORK OF AN ADVANCED REUSABLE AUTONOMOUS MOON ICE SHUTTLE ALLOWING WATER-BASED PROPELLANT IN-(GEO)ORBIT SUPPLY

Abstract

This paper focuses on the feasibility study of a transport mission from the Moon to Geostationary Earth Orbit (GEO), acting as a relay station intended for in-orbit refueling and life extension services. The work demonstrates the design complexity and costs analysis to safely carry 10 tons of ice extracted from the Moon over a 20-year service life. The mission is a precursor for the future solar system explorations. Our focus is the preliminary design of a reusable unmanned cargo vehicle. The delivery requirement is a maximum of one month delay for each shuttling flight . The mission involves in-orbit maintenance of the station and rendezvous procedure facilitated by a third-party spacecraft. The latter provides replacement modules, post-assembly checks and assistance in ground operations such as liquid water flow analysis, fuel transfer in microgravity conditions and pressure and temperature stability. A priority list of the required critical technologies is identified. This paper addresses limitations of the current technologies such as high-capacity cryogenic fuel storage, long-term storage (15 days), multi-reignition throttling cryogenic LO2/LH2 engine to perform autonomous trajectory control, safe landing (ΔV=3500m/s of per trip) as well as the difficulty of in-orbit refueling.