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IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
In-Space Transportation Solutions and Space Logistics (8)

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THE PHYSICS OF SPACE LOGISTICS

Abstract

A methodology combining the rocket equation, orbital mechanics, and satellite propulsion engineering is presented and is used to provide a cursory look of logistics in space from a fundamental perspective. This paper will use these three elements to produce system mass fractions based in fundamental physics and state of the art propulsion system capabilities for a variety of logistical activities commonly discussed by the In-space Servicing, Assembly, and Manufacturing (ISAM) community as well as being developed and fielded for operational use by commercial and governmental entities globally. These capabilities include active debris disposal in Low Earth Orbit (LEO), LEO or GEO Transfer Orbit (GTO) to GEO tugging, in GEO servicing operations (life extension, refueling, etc.), GEO disposal, and cis-lunar tugging and servicing operations. Results can be used to estimate capabilities of single use and reusable Orbit Transfer Vehicles (OTVs), debris disposal systems, servicing systems, and the supply chain realities for commodity delivery to higher energy orbits like the Geosynchronous Earth Orbit (GEO) for refueling or upgrade and repair capabilities. These results will be limited to the set of reference missions and technologies identified by the authors, but the methodology can be extensible to any mission.