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Conceptualizing Space Elevators and Tethered Satellites (3)

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MEO TETHERED SPACE ELEVATOR SYSTEM ARCHITECTURE FEASIBILITY STUDY

Abstract

The average cost of launching into low Earth orbit (LEO) is around 22,000 USD/kg. With around one hundred global launches annually, it is essential that technology improves enough to lower launch costs. One approach to lowering these costs is to provide a reusable suborbital launching element in conjunction with an intelligent momentum exchanging space element. Such a space elevator architecture could permit substantially increased accessibility into space at significantly lower cost.

The system architecture of the geostationary Earth orbit (GEO) space elevator has been long studied and the dynamics are relatively well known. Other tether options exist, however. This paper identifies the technical feasibility of a medium Earth orbit (MEO) space elevator system architecture and its overall technology readiness level (TRL).

The system is divided into six subsystems: the orbiting control station, the tether design and materials, the climber mechanism, payload transfer interface, propulsion and re-boosting, and finally the hypersonic reusable suborbital launch vehicle (RSLV).

The methodology in which this study was performed was to take each of the subsystems and analyze the latest technological advances and determine the TRLs for each. Preliminary finding indicate that humanity is roughly 15 to 20 years away from having the technology needed to build a successful MEO tethered space elevator. Identifying the technology needs, we can focus more resources in increasing these TRLs and, with further advancements, we can bring a successful conclusion to the space elevator roadmap.