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Conceptualizing Space Elevators and Tethered Satellites (3)

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PROPOSALS FOR GROWING SPACE ELEVATOR TRL BY OPERATION OF DEMONSTRATOR SYSTEMS

Abstract

Construction of a Space Elevator (SE) system on the Earth will have many challenges, not least being the ability to demonstrate an adequate Technology Readiness Level (TRL). This paper will discuss some methods of growing the TRL, and will specifically outline possible smaller-scale demonstrator systems : these would rehearse construction and dynamic control techniques whilst building long-duration reliability and durability experience on climber and material designs.

The paper will argue that, whilst limited 'pathfinder' demonstrations could be undertaken in the near-Earth locale, more valuable experience could then be gained on suitable asteroids : these could be selected to align with asteroid mining ventures, simplifying logistic issues and providing a bonus reduced-propellant shipping method for mined material. The results of a simple analysis for at least two asteroids will be included, proposing tether length, material and apex anchor mass requirements. A final demonstrator SE will be proposed for Mars, with a description of a system using Deimos material for the Apex anchor and active Phobos avoidance : this would prove the viability of SE construction and control techniques whilst also supporting projected human colonisation plans. A lunar elevator will be discussed but not proposed as an essential method of building TRL. It will be concluded that extended operation of these precursor demonstration systems will be essential to grow the Space Elevator TRL to that required before the go-ahead for construction of an Earth system.