FAR FUTURE (D4)
Space Elevators and Tethers (2)

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LEO-BASED SPACE-ELEVATOR DEVELOPMENT USING AVAILABLE MATERIALS AND TECHNOLOGIES

Abstract

A technical-feasibility study of a rotovator-based space-elevator system called "Sling-on-a-ring" was presented last year (IAC-08-D4.1.5). Although conceptually analogous to the HASTOL (Hypersonic Airplane Space Tether Orbital Launch) system, the proposed Sling-on-a-ring system, using readily-available subsonic aircraft, bypasses the need for hypersonic aircraft. It also can be implemented and tested at an initial stage with high-tensile-strength materials presently available. Hence, the development of the Sling-on-a-ring (SOR) system can start today. Even if super-strength carbon-nanotube (CNT) fibers of the appropriate length (required for non-HASTOL type systems) are not available in the expected time-frame, a fully-operational (proto-flight) SOR system could still be tested, albeit with limited mass-lifting capability. The advent of stronger fibers (especially the CNT fibers) would allow massive-scale mass-lifting capability with efficiencies similar to that proposed for HASTOL, but independent of any hypersonic-aircraft development.

The successful deployment of such a space-elevator system with full capabilities would enable millions of tons of payload to be transferred to Low-Earth-Orbit (and beyond) at greatly-reduced costs per ton. Such a capability would have far-reaching consequences for humanity. Several concepts, which are technologically and economically not feasible using present-day launch capabilities, would become a reality with the advent of Sling-on-a-ring. These include: deployment of solar shades, blocking a fraction of insolation to mitigate global warming; growth of solar farms, beaming unlimited and clean power for other space applications and to the earth; storage of energy in space, using circum-terra rings and electrodynamic tethers; suppression of the Van-Allen radiation belts; mitigation of space debris; and, thus, the eventual growth of human-colonies and industries in LEO.

In order to motivate more investment for further research and development of such a system, it is important to repeatedly emphasize its world-altering applications to the scientific community, to industry, to governments, and to other funding sources. This "push" to provide alternative and timely solutions to some of the gravest problems haunting humanity today may be critical to its tomorrow.

This paper provides an analysis of the above applications as associated with Sling-on-a-ring, since they are financially- and technically-dependent concepts. They are all of such a large scale that, individually, they may not appear cost effective. However, collectively, they are much more valuable than the sum of their individual contributions. There will be particular emphasis on the principal financial drivers (Solar-Shades and Solar-Power farms), their associated system analysis, and the trade-offs with respect to the sling-on-a-ring system.