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ORBITAL 'SLING' FOR LEO TO GEO MASS TRANSFER

Abstract

The Sling-on-a-Ring concept, for moving mass from atmospheric aircraft (30-40,000 ft) to a Low-Earth-Orbit, Circum-Terra Ring has previously been modeled and described in detail. This paper extends the concept to examine the pros and cons of using the same system for direct or indirect transfer on out to other orbits, including Geostationary-Earth Orbit. Just as there is no direct 'single-burn' path from the earth to GEO, an unpowered sling transfer would be unable to provide more than a 'transfer' orbit from which an apogee motor would have to insert the payload into GEO. While lifting mass without having to move propellant mass at the same time is a clear benefit for getting into LEO, the need of an apogee stage for insertion into higher orbits will still reduce the payload capability of the sling system. The ability to lift payload and apogee motor to LEO on separate pickups would have a significant impact on the size of payloads that could be delivered to outer orbits. However, until in infrastructure is far along, integration of payload and apogee motor on orbit would be an undesirable option. On the other hand, a linear mass accelerator, as the probable choice for establishing the upper level transfer orbit, would be more accurate than a sling and would be capable of directing the payload off ecliptic of the LEO ring. Unfortunately, the development of such a capability would be further down the timeline and that would perhaps undermine one of the primary advantages of the LEO-sling system over the GEO-based, space-elevator system. Various options and the resultant trade-space will be explored for getting payloads to GEO and beyond.