Paper ID: 76283
oral

21st IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Modern Day Space Elevators Customer Design Drivers (3)

Author: Mr. Peter Robinson
International Space Elevator Consortium, United Kingdom

THE SPACE ELEVATOR PAYLOAD JOURNEY BEYOND GEO : CLIMBER CONCEPT AND OPTIONS

Abstract

The paper makes use of a spreadsheet-based analysis of the motion of a climber ascending an Earth space elevator tether. A basic spreadsheet tool (previously described in paper IAC-22,D4,3,8,x68299 "Space Elevator Climber Dynamics Analysis and Climb Frequency Optimisation") has been extended to cover climber motion between GEO and the Apex Anchor. The analysis output includes the required climber braking power, braking being necessary as centrifugal force exceeds the gravity force beyond GEO. After calculating the climber velocity with no braking the analysis assessed the impact of limiting parameters such as the maximum climber speed and maximum braking power : for each parameter value the journey time to the Apex was also calculated. The effect of these variables on tether tension and consequential actions required at the Apex Anchor was also determined, presented and discussed. Consideration was then given to the climber configuration changes required for the journey beyond GEO, based on the climber configuration for the ascent to GEO described in the 2021-2023 ISEC Study Report "The Climber-Tether Interface of the Space Elevator". It was concluded that there was little benefit from using the multiple smaller climbers recommended previously : the combination of smaller climber modules into fewer larger assemblies would have minor detrimental impact and would permit heavier discreet payloads to be carried from GEO to the Apex. These larger climbers would each need fewer motors and drive wheels than for the ascent from Earth to GEO, but dissipation of the braking energy might require a new high-temperature heat rejection system. The climber ascent time to the Apex is likely to be in excess of 14 days, prompting review of alternative options for shipping of payload to destinations beyond the Apex : these alternatives include spacecraft departing from the GEO node (thus avoiding the journey to the Apex) using conventional rockets, current and proposed high specific impulse drives and speculated systems such as a magnetic sail. This review concluded that existing systems such as ion drives do not yet have adequate performance, but systems may become available in the timescale of Space Elevator construction to offer an alternative to the climber journey to the Apex.