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Conceptualizing Space Elevators and Tethered Satellites (3)

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# THE EFFECTS OF PAYLOAD TRANSPORTATION ON THE TETHERED SYSTEMS IN LOW EARTH ORBIT

**Abstract**

Due to the demands of the expanding space industry, various plans are being made concerning the commercial use of nanosatellites. This has increased the demand for small satellite launches, resulting in the development of very small launch vehicles that meet these demands. Currently, the rocket system of launching from earth's surface is the most widely accepted, and inclement weather conditions, in no small part, cause delays. Conversely, an air launch system using an aircraft is little affected by weather conditions, and is not dependant on a launch site's latitude, allowing for the optimum conditions to reach a specific orbit; the system is also easily adapted. However, if higher altitudes are desired, the main craft must be of larger construction, which creates higher maintenance costs. Therefore, we propose the use of a tethered system between earth and LEO for space transportation. For this system, a payload will be launched via an air launch rocket to an altitude of 100km, following which it will dock with a slave satellite, situated at the bottom of the tethered system, after which a climber which travels along the tether will carry it to the specified orbit. In this study, an investigation into the consequences of the payload-carrying climber on the entire tethered system as it moves will aim to identify the feasibility of such a system. For the study, the motion of the tethered satellite system is examined when the master satellite draws an ellipse as it moves in an orbit around the earth. A model developed by considering the master satellite, located at the tip of the tethered satellite system, the climber which moves along the tether, the slave satellite located at the bottom of the system, and the tether itself, is used with the equation of motion of the system to identify the vibration in the system. Various patterns of movement for the climber were prepared, and along with investigating the feasibility of such a system for space transportation, we looked at which type of climber movement was the most stable.