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Conceptualizing Space Elevators and Tethered Satellites (3)

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THERMAL STUDY FOR THE STARS-E CLIMBER'S MISSION

Abstract

The Space Elevator, an alternative to rockets, has been proven feasible by both Dr. Bradley Edwards and the IAA. This system can be divided into three main parts, the space station, tether and climber. Ourselves included, many groups have been developing prototype climbers. Each year there is a Space Elevator Challenge (SPEC), and many skills and techniques have been developed through these climbs. The highest vertical climb height achieved to date is 1km. However, each of these climb tests were performed from the ground up, and no testing has been done in space. Furthermore, whether a climber will function properly in space while moving along a tether; what effect it has on the space station and tether itself, has never been demonstrated. That is why we are planning this project (STARS-E), to test a climber in a space environment. For this mission, a climber will move between two tethered satellites. Since the main satellite needs to contain a climber, the 50cm-class of satellite has been chosen. After separating into an upper and lower section, the climber will move out along the tether. By logging the motion of the satellites as the climber moves, it will be possible to measure the effect the climber has on the tethered satellite system. Recently we completed the third Bread Board Model(BBM) and succeeded in moving along a tether. The next step is to begin development of the Engineering Model(EM) that will be used in space.

This paper's aim is to investigate the heat generated while the Climber moves, as well as the thermal shock from outside influences. STARS-E uses a low earth orbit (LEO) to perform its mission; the orbit selected will allow the satellite to make one revolution of the earth in 90 minutes, while the external temperature will change from 0 to 200 degrees centigrade. It is necessary to design the Climber so that it can withstand the external thermal shock. When externally applied thermal shock is applied, we need to confirm that the motor and communication parts operate normally, and design motors and communication equipment suitable for the climber's mission as an elevator. We also examine the possibility of using heat generated by the motor and communication equipment, which can be heat sources, near the battery to be utilized as a substitute for a heater.