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Space Elevator and Tethers (3)

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THE SPACE ELEVATOR TOWER

Abstract

The construction of a space elevator still awaits the availability of a material strong and light enough to reach down from the altitude of a geosynchronous orbit (35,850 km) to the Earth's surface. Materials are available that can do part of the job, and every year there are encouraging reports of new or improved materials. Zylon can reach down to an altitude of about 12,000 km on reasonable assumptions about the mass of the tether. Short lengths of carbon nanotubes have been made and reported with strengths three or more times that of Zylon. If a long tether can be built from materials of such strength, it could reach down to about 4000 km altitude.

One way to address this situation is to look at other means of bridging the gap by building up from the Earth's surface. A technology called High Stage One has been proposed to deal with the challenges of Earth's turbulent atmosphere. It rises to an altitude of 40 km or more so that the space elevator tether is above most of the atmosphere. High Stage One is a development of the Space Cable, which was itself developed from the Launch Loop. The Launch Loop uses the momentum of fast travelling objects inside evacuated tubes to support the structure. Magnetic levitation is used to keep friction very low. The main forces are supplied by permanent magnets, which consume no power. A small amount of power is consumed by electromagnets, which are needed for stabilization under electronic control.

The new proposal is the Space Elevator Tower, which is a vertical version of High Stage One capable of reaching as high as 12,000 km, bridging the gap between the Earth and a tether using today's materials. No new materials are needed for the Space Elevator Tower. Much of the research done for High Stage One can be reused in it. The weight of the tower is supported at the Earth's surface; it is built upwards to meet the tether, which is lowered from geosynchronous altitude.

The tower has the potential to lead to the construction of the first space elevator within a relatively short time. As stronger materials become available, the height of tower required will become correspondingly lower.