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THE POLAR REEL, A NOVEL APPROACH FOR IMPLEMENTING A SPACE ELEVATOR

Abstract

The idea of using a space elevator to reach space is almost as old as the Eiffel Tower, which inspired Konstantin Tsiolkovsky in 1895. All implementation scenarios that have been imagined since that time are based on the assumption that the first deployment of the tether will be performed downwards, starting from the geostationary orbit. We propose a radically different approach where the tether is extended from the Earth surface using a 'polar reel' located at the South Pole. Once the required length has been extended, the anchor location is moved to an equatorial site. Then, the operational configuration is similar to 'classical' designs. As a first step, it is necessary to extend about 25.000 km of tether with a rotation period of 8 hours relative to the Earth. This would be achieved by launching, from a site located in Antarctica, a Soyouz or ARIANE 6 class launcher to which the tether would be attached. The other end of the tether would be fixed to the rotating polar base and the tether itself would be sustained by a combination of planes and stratospheric balloons during the launch mission. Once the tether is rotating, it can be gently extended from the polar tower which will act as a reel. Up to an altitude of a few tens of kilometers, the tether will be sustained by propelled stratospheric balloons. Once the requested length of tether has been extended, the rotation relative to the Earth is cancelled and the lower part of the tether can be transferred to the equatorial location where the elevator will be operated. In the paper, we will demonstrate that this scenario is feasible with current technologies: polar base and logistics, launcher, balloons, tether material, rotating architecture, transoceanic cables... We will not provide any cost figure but a Technological Readiness Level for the key features of this approach.