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## A Space Elevator Between the Earth and the Moon! A Dream or Reality?

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The hope for constructing an elevator from the earth to the moon was reinforced soon after the discovery of carbon nanotubes (CNTs) in the 1990s. Recently, researchers have developed a technology for fabricating extraordinary firm ropes 1 cm of which can bear the weight of about 160 elephants! However, the main question is how much this idea is likely to be commercialized in a scale of the distance between the earth and the moon.

The idea of constructing an elevator from the earth to the moon was proposed in the 1960s but did not attract much attention due to the lack of required technologies. Nevertheless, practical ways were suggested for constructing such a structure. For example, in a paper published in Science in 1966, John Isaacs proposed the idea of thin and at the same time, highly strong ropes that can bear structures at space stations in a suspended condition. This plan received almost no serious attention and got forgotten very soon.

Three decades later, a momentous event revitalized the idea of super-strong ropes. After the discovery of [CNTs](#) in 1991 in [Japan](#), the proposal of fabricating ropes using this new material with surprising properties acquired new momentum. Consequently, the scientific community paid attention to potential applications of CNTs in the fabricating ropes with extraordinary mechanical properties.

For realizing the idea of the space elevator, CNTs have to be woven in such a way that a firm rope can be fabricated. However, simulations by a research team from Hong Kong showed that weaving CNTs decreases their mechanical strength. Theoretical studies suggest that the tensile strength of CNTs amounts to 100 GPa, but the simulation by the mentioned team showed that if CNTs are woven for fabricating a huge rope, the strength of the final structure would be just about 1 GPa. The main causes of this considerable decrease in mechanical properties are structural deficiencies and the existence of a kind of chirality in the walls of CNTs. Weaving CNTs together increases this chirality and leads to the decline of the tensile strength.

Several efforts were made for proposing other strategies with the goal of using CNTs for fabricating ropes. In 2013, a research team at the University of Tsinghua found an optimum condition for the growth of long CNTs. This procedure led to the fabrication of tubes with about 0.5 m lengths. In a more recent step, researchers in this university fabricated a super-strong CNT rope 1 cm of which can bear the weight of 160 elephants which amounts to 800 tons while the weight of the rope is just 1.6 g. Fibers with such an extraordinary mechanical property may be used for constructing the space elevator.

The idea of constructing such an elevator appeared as a science-fiction in the 1960s. However, given the achievements in recent decades, the realization of this dream has been made more likely. NASA initiated a competition for constructing a space elevator in 2005 and different companies began their activities with this aim. For example, Obayashi Company in [Japan](#) has declared that it has a program for constructing the elevator by 2050. The objective of this plan is to construct a CNT cable with the capacity of transporting 30 persons with a speed of 200 km per hour. The power of the system will be supplied by magnetic motors and solar panels.

Another considerable project is being pursued by LiftPort Group. This company began a series of experiments with CNTs ribbons in 2004 and one year later, constructed an elevator with a height of 300 m using this material. In 2011, the company announced that it had launched a program for constructing space elevators and will fund research plans in this field. The final goal is to construct an elevator from the earth to the moon in the following years.

Despite research teams and companies' efforts and spending vast amounts of money, the envisaged elevator between the earth and the moon or space stations has not been constructed yet. Nevertheless, undeniable achievements made in the field may make the dream of an elevator for traveling the moon (at the distance of more than 385,000 km) realizable in the near future.