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Conceptualizing Space Elevators and Tethered Satellites (3)

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**Abstract**

The idea of a space elevator to transport crew and payloads was first proposed by Konstantin Tsiolkovsky in 1895. Since then, several different concepts have been suggested to realise an operational space elevator on Earth. These present numerous advantages and cost savings over traditional launch approaches but limitations of current materials, and foreseen operational and engineering complications question the feasibility of such designs in the near future. The Moon, however, may be the ideal place to realise the first space elevator, with its reduced gravity, and potentially resource rich environment. This paper is the culmination of six months of project work completed by a multidisciplinary team of 27 graduate students, from 10 different countries, as part of the ninth edition of the 'SpacE Exploration and Development Systems' (SEEDS) Master's programme. The research activities of this paper relate to the post-2025 timeframe, where the architecture of a future cislunar station is known and has been derived by students from previous editions of the SEEDS programme and industry studies. Presented is an analysis of the design and utilisation of a lunar space elevator for payload and cargo transfers from a lunar surface base to the cislunar station. Detailed are trade off analyses, between traditional transportation systems and the lunar elevator concept, to clarify the necessity of such proposals to support the station's maintenance and evolution. The building blocks of a conceptual lunar elevator architecture are proposed. Additionally, an analysis is presented regarding the elevator's construction and operations, and the potential use of lunar resources to support its development. Finally, a technology roadmap is defined focused on the realisation of the lunar space elevator in the near future.