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A JOURNEY OF STUDENT SPACE ELEVATOR DEVELOPMENT

Abstract

"We want to build a Space Elevator!" - With this idea in mind, a student group from Munich, Germany, has been developing Space Elevator concepts and climber prototypes since 2005, complementing ongoing theoretical work in the research community. This paper presents their technological milestones and documents a 14 year journey. It describes the technical details of their climber evolution, their success in competitions and their efforts in establishing an international Space Elevator competition in Europe.

The group was founded as part of the *Scientific Workgroup for Rocketry and Spaceflight* (German abbr.: WARR) when the *Power Beaming Challenge* was established as part of NASA's *Centennial Challenges*. The team targeted to achieve the required 1 m/s ascent rate with a light-weight climber design and microwave power beaming. Although all components proved to work in the end, an underestimation of time and budget prevented the team from participating.

Over the following years and driven by the challenges of NASA, JSEA and WARR's own, the group ran through a technical evolution: From the first LEGO prototype through five generations of rope and tether climbers towards today's highly integrated climbing module, mostly built from composite materials. Its drive assembly includes an 8 kW electrical motor to achieve a vertical speed of up to 35 m/s.

After several years of climber development and participating in international competitions, the group decided to establish a Space Elevator competition of their own: With a unique focus on energy efficiency

and payload carrying capability, the *European Space Elevator Challenge* (EUSPEC) was hosted at TUM in 2011, 2012, 2016 and 2018, with climbing heights of up to 100 m, in conjunction with the *EuroSpaceward Foundation*. Many unique concepts were presented by the participating teams and both design quality and climber performance improved over time, setting new targets for future competitions.