



WARR Space Elevator

European Space Elevator Challenge 2018

Handbook Summary

VESTNER
AUFZÜGE
ELEVATING PEOPLE

WARR e.V.
Wissenschaftliche
Arbeitsgemeinschaft
für Raketentechnik
und Raumfahrt

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1. General Information

The challenge is to design and build a climber structure in compliance with predetermined requirements, keeping in mind the idea of a real space elevator.

1.1. Levels

- For the 2018 challenge we decided to allow participants with a lower scientific or technical background to compete in a second level with lower requirements (Beginners' Level).
- We suggest for university teams to aim for participating in the Advanced Level and for high school teams to participate in the Beginners' Level.

1.2. Rope/Tether

- Rope properties:
 - Diameter: 10 mm
 - Material: Aramid sheath, polyamid core
- Tether properties:
 - Width: 38 mm
 - Thickness: 2 mm
 - Material: Aramid

1.3. Important dates

1. Team registration until **April 30th**
2. Rough climber concept until **June 30th**
3. Video of the working climber until **August 31st**
4. Competition week from **September 17th to 20th**

Further information can be found in the more detailed handbook at <http://euspec.warr.de/downloads>.

2. Beginners' Level

2.1. The participation includes:

1. A short presentation about the climber.
2. The drive of the climber.

2.2. Drive

- The climber has to drive up 20 m vertically on a round rope or flat tether.
- The climber has to operate fully autonomously during the drive.
- The climber has to be mounted on the rope/tether without disassembly of the latter.
- The climber does not have to carry a payload.

2.3. Climber dimensions & materials

- The dimensions of the climber must not exceed 0.5 m x 0.5 m x 1 m.
- The climber must not weigh more than 10 kg.
- The climber structure can be made from any material, including LEGO® or fischertechnik®, but also steel, aluminium or carbon fiber.

2.4. Power

- The climber has to be powered by pre-charged batteries only.

2.5. Safety

- The climber has to fulfill basic safety requirements for protection of operators.
- The climber will be deemed safe or unsafe to drive by EUSPEC technical staff.

2.6. Scoring

The score is determined by the following formula using speed and weight of the climber:

$$Score = \frac{v_{avg}}{m_{climber}}$$

2.7. Prizes

- There will be prizes for the best three teams and a special award for innovation/technology.

3. Advanced Level

3.1. The participation includes:

1. The submission of a paper about the development process of the climber.
2. A short presentation about the climber.
3. The drive of the climber.

3.2. Drive

- The climber has to drive up and down 100 m vertically on a round rope or flat tether.
- The climber has to operate fully autonomously during the drive.
- The climber has to be mounted on the rope/tether without disassembly of the latter.

3.3. Climber dimensions & materials

- The dimensions of the climber (including payload) must not exceed 1 m x 1 m x 2 m.
- The climber (including payload) must not weigh more than 20 kg.
- The climber structure should be made from proper engineering materials.

3.4. Power

- The climber should mainly be powered by pre-charged batteries.
- Additional power sources and energy recuperation are permitted but not required.

3.5. Payload

- Standardized payload cubes (10 x 10 x 10 cm) are provided by EUSPEC organizers.
- Each cube weighs approximately 1.1 kg.
- The payload must not be required for the functional capability of the climber.

3.6. Safety

- The climber has to fulfill certain safety requirements like engineering standards and design specifications to prevent water ingress and for protection of operators.
- The payload cubes have to be attached safely to the climber structure.
- The climber will be deemed safe or unsafe to drive by EUSPEC technical staff.

3.7. Scoring

$$Score = \left(\frac{m_{pl}}{m_{tot}} \right) \cdot 100 + \left(\frac{E_{pot}}{E_{bat}} \right) \cdot 100 + v_{avg}$$

- A measurement board to record power consumption will be attached to the climber by EUSPEC technical staff for which appropriate connectors have to be provided.

3.8. Prizes

- There will be prizes for the best three teams and special awards for Safety, Innovation and Construction Quality.