



WARR Space Elevator

## European Space Elevator Challenge 2018

*Handbook Summary*



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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 30<sup>th</sup>**
2. Rough climber concept until **June 30<sup>th</sup>**
3. Video of the working climber until **August 31<sup>st</sup>**
4. Competition week from **September 17<sup>th</sup> to 20<sup>th</sup>**

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:

$$Score = \frac{v_{avg}}{m_{climber}} \quad \begin{array}{l} \text{in m/s} \\ \text{in kg} \end{array}$$

### 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 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 16 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

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

- 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.