European Space Elevator Challenge 2016

Handbook Summary

Version 1.1b

VESTNER AUFZÜGE
ELEVATING PEOPLE

WARR e.V.
Wissenschaftliche
Arbeitsgemeinschaft
für Raketentechnik
und Raumfahrt

TUM
Lehrstuhl für Raumfahrttechnik
Boltzmannstraße 15
D-85748 Garching
www.warr.de

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

- The Beginners' Level is aimed at high school teams and first time participants with limited experience in the design of technical systems.

- The Advanced Level is aimed at university teams with advanced knowledge in CAD and electronics design.

1.2. Rope/Tether

- Rope properties:
    - Diameter: 10 mm
    - Material: Aramid sheath, polyamid core

- Tether properties:
    - Width: 30 to 40 mm
    - Thickness: 2 mm
    - Material: Aramid or Dyneema

1.3. Important dates

1. Team application in the Beginners' Level **extended** until **June 30th** if the rough climber concept is handed in together with the application
   Team application in the Advanced Level **on a waiting list** until **June 30th** if the rough climber concept is handed in together with the application
2. Rough climber concept until **June 30th**
3. Video of the working climber until **August 31st**
4. Competition week from **September 12th to 16th**

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. The design of a poster about the team and 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 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 will be determined by the jury as a combination of speed, weight and construction quality of the climber.

2.7. Prizes

- There will be prizes for the best three teams.

3. Advanced Level

3.1. The participation includes:

1. The design of a poster about the team and the climber.
2. A short presentation about the team and 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 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

$$Score = \left(\frac{m_{payload}}{m_{total}} \right) \cdot 100 + \left(\frac{E_{potential}}{E_{consumed}} \right) \cdot 200$$

- 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 technology, speed and safety.