



WARR

Wissenschaftliche
Arbeitsgemeinschaft für
Raketentechnik und Raumfahrt

Overview

The Team: History of the WARR and the SpaceElevator group

Our Concept: Comparison of our Japan-Climber and the EuSEC-Climber

Components: Overview of different parts of our System

Sponsors: enabling students to build high-tech machines

History of the WARR

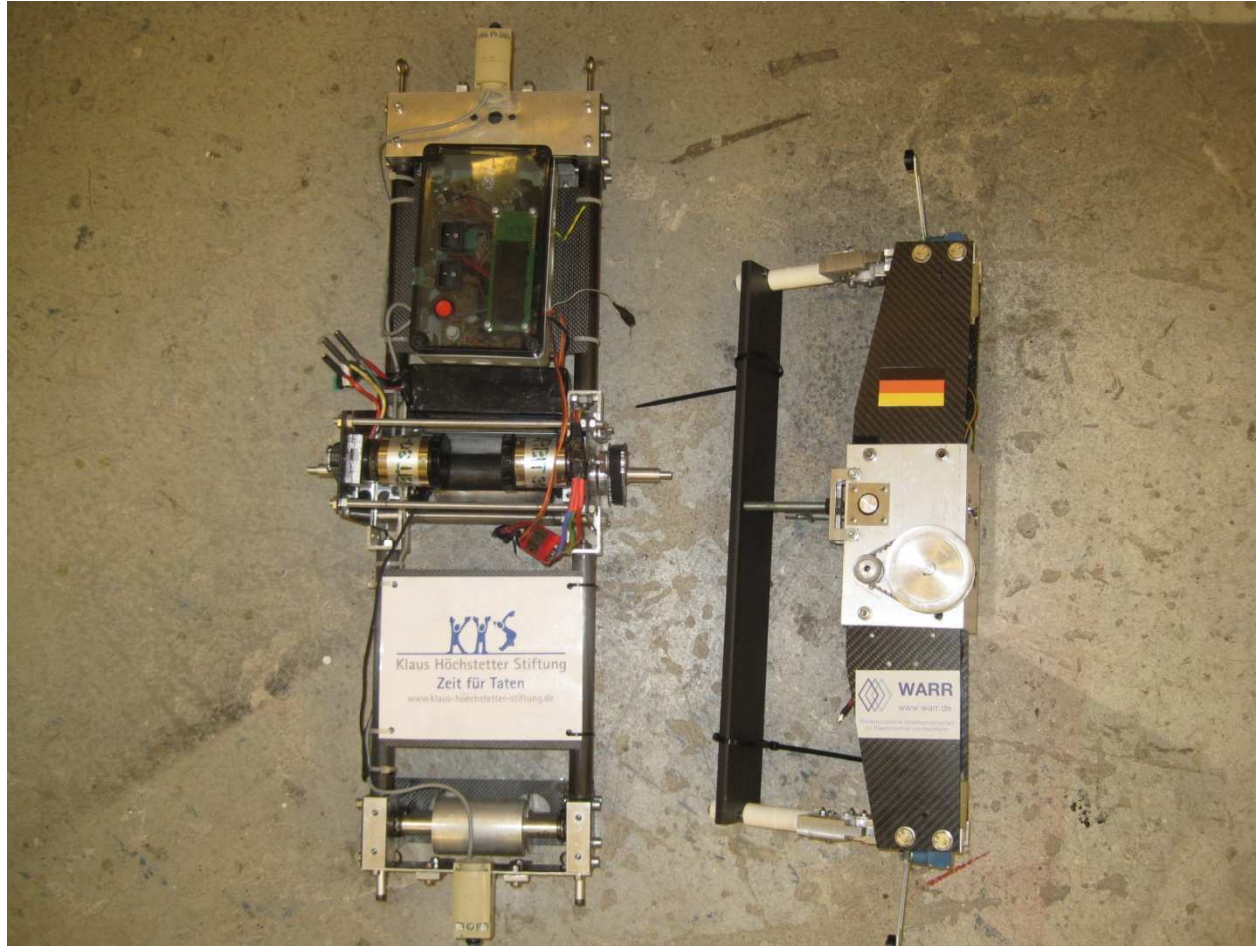
- WARR – „Wissenschaftliche Arbeitsgemeinschaft für Raketentechnik und Raumfahrt“
- Founded in 1962 by a student at TU Munich
- Highlight in 1968: Launch of the first German hybrid rocket BARBARELLA
- Today the WARR consists of 3 divisions: Rocketry, Space Elevator and Interstellar Space Flight
- Currently about 50 active members
- Future: Cube Sats ~2015

The WARR Space Elevator Team

- Founded in 2005
- Successful participation at the “Japan Space Elevator Technical & Engineering Competition” in 2009 and 2010
- Currently about 20 active members
- Many first year students participating



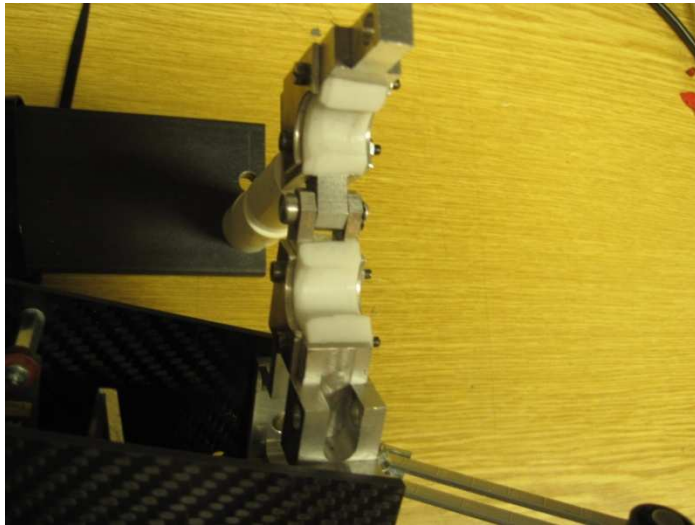
The Climber Concept



• Japan-Climber

EuSEC-Climber

Components – Guiding Unit



Hinge-mechanism for fast mounting on the rope

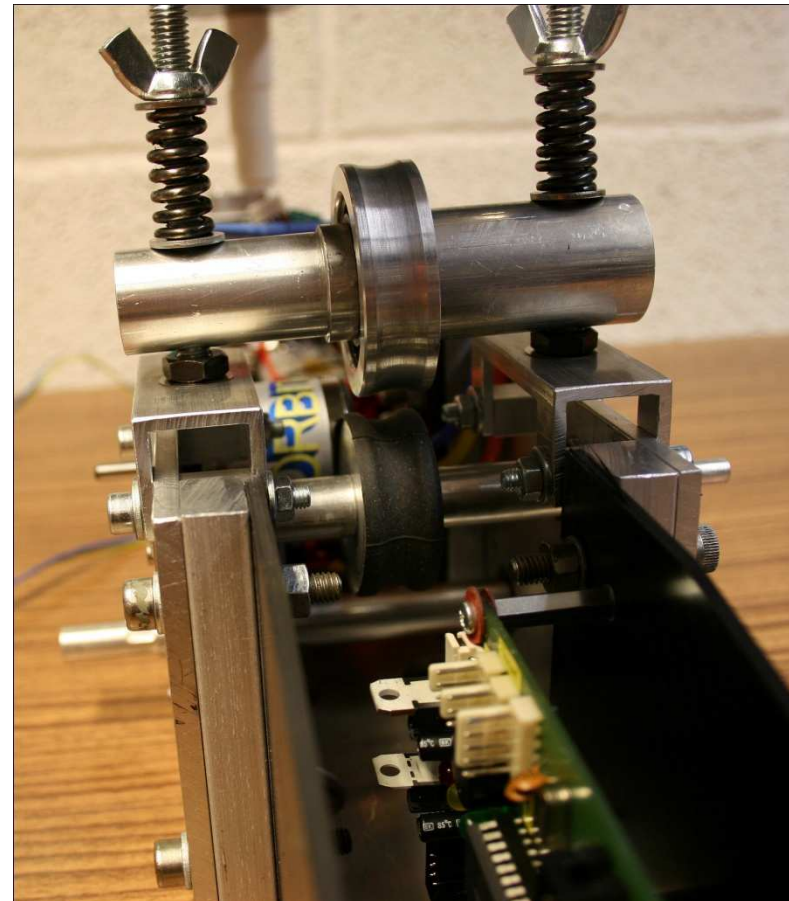
No moving parts

All rope-touching surfaces are made of PTFE for minimized friction

Two guiding blocks with high distance on opposing ends of the climber

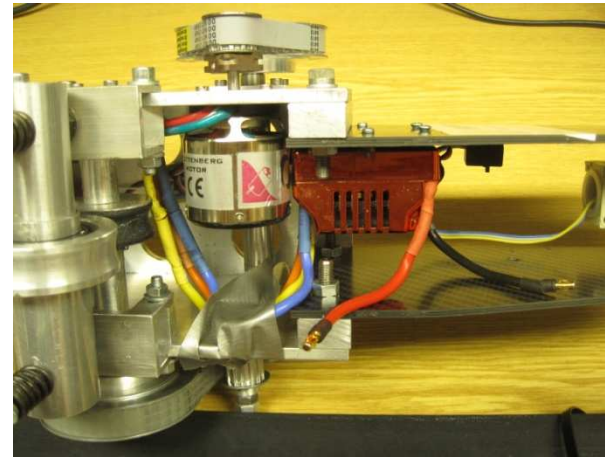
Components – Traction Unit

Spring mechanism for quick and easy pressure adjustment
Simple design with just two screws for fast mounting



Components – Motor and Energy Supply

Single 400W motor instead of two
Motors 1.5kW each



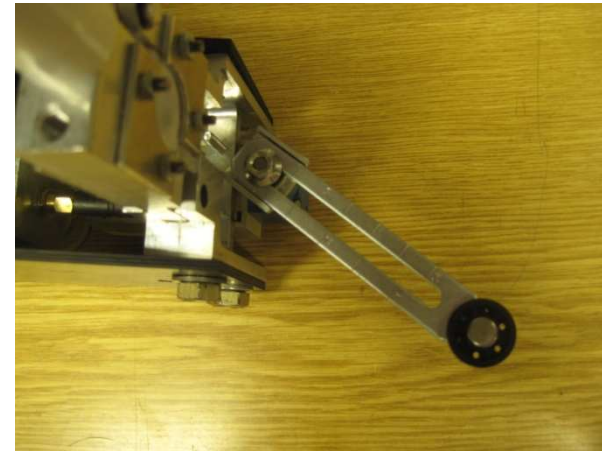
Battery Pack:
Lithium Polymer, 14V, 21000 mAh

Far lighter than Japan-Climber-
Equipment



Components - Sensors

- Evolved touch-sensors for detecting track-stoppers
- Independent barometric height sensors
- Reduced complexity for saving weight



Electronics - Radio transmission

- Criteria:
 - Reliability
 - Full duplex
 - Licence free/low cost
- Modules:
 - Reference: RFM12 433MHz
 - ZigBit™ 700/800/900 MHz Wireless Module
 - ZigBit™ 2.4 GHz Amplified Wireless Module

Electronics - Reliability

- Specified range > 100m
- Data link layer (data integrity)

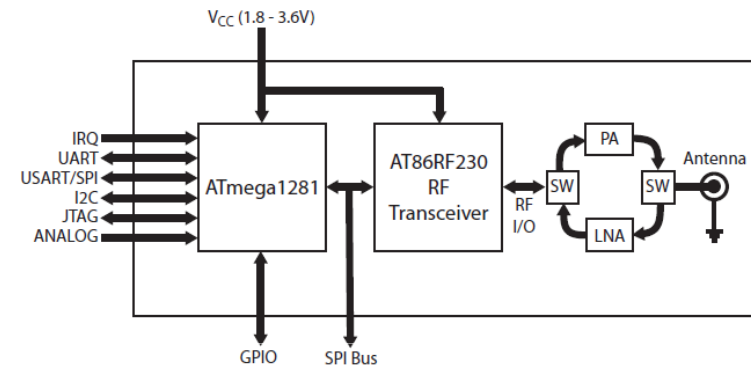
- RFM12 433MHz
 - Range: 100m, Community “support”
- ZigBit™ 700/800/900 MHz Wireless Module
 - Range: 6000m, comes with zigbee protocol
- ZigBit™ 2.4 GHz Amplified Wireless Module
 - Range: 4000m, comes with zigbee protocol



Electronics - Components

- Complete system
 - Microcontroller
 - RF Transceiver
 - Antenna port
 - Software library
- Data integrity ?

Figure 2-1. ATZB-A24-UFL/UN Block Diagram



Electronics - Data link layer

- Develop a streamlined, custom protocol
 - Multiple devices
 - Reliable
- Packets:
 - ASM, Source, Destination, Command, Data, CRC
 - Future Improvement: Tolerate packet loss
 - ➔ Data integrity ensured

Sponsors

- The Klaus Höchstetter Stiftung
- Plettenberg Electric Motors
- Ebiz
- FILL

Thank you!

