THE SPACE ELEVATOR

Presented by
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The Space Elevator

- Geosynchronous orbit
- Magnetopause during day
- Earth
- Cable
- Counterweight

Acceleration (m/s²)

Acceleration of an object above a fixed point on Earth

Radius (1000's km)
Aspects of a Space Elevator:

1. Cable fabrication
   A. Nanotubes
   B. Basic cable design

2. Deployment of the Space Elevator
   A. Initial cable deployment
   B. Climber design
   C. Schedule

3. Utilization stage
   A. Alternatives
   B. Exploration

4. Challenges
   A. Micrometeorite impacts on cable
   B. Low-earth orbit spacecraft impacts on cable
   C. Radiation and atomic O damage of cable
   D. Cable heating by induced electrical currents
   E. Natural frequency and oscillations in the cable
   F. Deployment locations
      i. Power beaming
      ii. Jet streams and cyclones
      iii. Lightning
      iv. Active avoidance
      v. Optimal locations
   G. Risks of severed cables and malfunctioning climbers
The Space Elevator

Minimum Length of individual nanotubes

5 cm

Micrometeorite damage

Epoxy/nanotube composite section

Bare nanotube section

Epoxy/nanotube composite section
Initial Climber: 528 kg

Motors:
- 75 kg
- 91.7% efficient
- 42 kW of mech. power

Cable:
- 316 kg
- 0.7mm wide
- 8 kg lift capacity

Power receiver:
- 21 or 33 kg
- 3 m diameter
- tuned photocells or rectennas

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Climbing rollers

Variable speed transmission

Structures

Power control
Speed control
Diagnostics
CPU

Cable splicing & epoxying
Challenges

- Micrometeorite impacts on cable
- Low-earth orbit spacecraft impacts on cable
- Radiation and atomic O damage of cable
- Cable heating by induced electrical currents
- Natural frequency and oscillations in the cable
- Deployment locations
  i. Power beaming
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  iv. Active avoidance
  v. Optimal locations
- Risks of severed cables and malfunctioning climbers
Summary

- The Space Elevator is certainly fun to read about in science fiction (Fountains of Paradise, Red Mars, Green Mars, Blue Mars,...)
- The challenges to bring the Space Elevator to reality are substantial.
- A realistic scenario can be presented for construction of a Space Elevator.
- Technology is advancing quickly enough to conceive of building the Space Elevator in our lifetimes.
- The Space Elevator is no longer only in the realm of science fiction.