THE SPACE ELEVATOR
A revolutionary earth-to-space transportation system.
The space elevator is a real possibility that researchers are considering today as a far out space transportation system for the next century. The space elevator would consist of a cable attached to the surface reaching outwards into space. By positioning it so that the total centrifugal force exceeds the total gravity, either by extending the cable or attaching a counterweight, the elevator would stay in place.

The space elevator is essentially a long cable extending from our planet's surface into space with its center of mass at geosynchronous orbit (GEO), 35,786 km in altitude. Electromagnetic vehicles traveling along the cable could serve as a mass transportation system for moving people, payloads, and power between earth and space.
Base Station

**Mobile**
- Large ocean going vessels
- Able to maneuver
- Can avoid bad weather

**Stationary**
- Located in high altitude areas.
- Access to cheaper and more reliable power sources
- Require a shorter cable
CABLE

- The cable will be made of a material with a very high tensile strength / density ratio— the limit to which a material can be stretched, without irreversibly deforming divided by its density.
- The space elevator can actually be made very economically if a cable with a density similar to graphite, with a tensile strength of 60-120 Gpa can be produced in bulk at a reasonable price.
- By comparison most steel has a tensile strength of under 1 Gpa, and the strongest steels no more than 5 Gpa, but steel is way too heavy. The much lighter material Kevlar has a tensile strength of 2.6-4.1 Gpa, while quartz fiber can reach upwards of 20 Gpa.
- The discovery of carbon nanotubes puts us well within the tensile strength range needed for space elevator structures because they can reach well over 120 Gpa tensile strength.
- There are still a few problems. For instance in practice 63 Gpa is the highest tensile strength observed in single walled tubes and it averages breaking at 30-50 Gpa. Further research on purity and different types of nanotubes will hopefully improve this number.
- Another downside is that carbon nanotubes have a higher price than gold at $100/gram. But the good news is the price is decreasing rapidly and mass production will make it even further.
Climbers

- A Space elevator cannot be an elevator in a typical sense (with moving cables).
- Cable must be tapered due to its enormous length.
- Much wider at the center.
Cable taper
NOTE: Not drawn to scale
Beam it up with laser power!
Counterweight

- One method is to capture an asteroid or use a heavy object past GEO.
- Or extend the cable itself way past GEO.
- The idea of extending the cable has gained support over the years due to the simplicity of the task and the ability of the payload to be flung off as far as Saturn.
Launching into outer space

- As payload is lifted up the elevator it gains altitude and angular momentum.
- Angular momentum is taken from earth's own rotation.
- For higher velocities, the cargo can be electromagnetically accelerated, or the cable could be extended, although that would require additional strength in the cable.
Extraterrestrial Elevators

- A space elevator could be constructed on some of the other planets or moons.
- Can use existing engineering materials
- Gravity much lower
- definitely not impossible an impossible proposal and something cool to think about
One possible event that would destroy the elevator ribbon would be a lightning strike.

Lightning has sufficient current and voltage potential to heat and destroy and composite we have been considering.
Meteors

- Come in very fast and from all directions.
- Minimal damage from micrometeorites
- Catastrophic damage for large meteors at any angle of impact.
Other factors posing a threat to the elevator:

- Low-Earth-Orbit Objects or space debris
- Wind
- Atomic Oxygen
- Electromagnetic Fields
- Radiation Damage
- Induced Oscillations also known as vibrations
- Discharging the Ionosphere
**Severed Ribbons**

- If the ribbon is severed the lower segment will fall back to earth while the upper portion floats outward.
- Don't worry if the ribbon falls it will be designed to burn up in the atmosphere.
- Also Ribbon is very light and will be slowed to “terminal velocity.”