

# A 2000 tonne per day Space Elevator

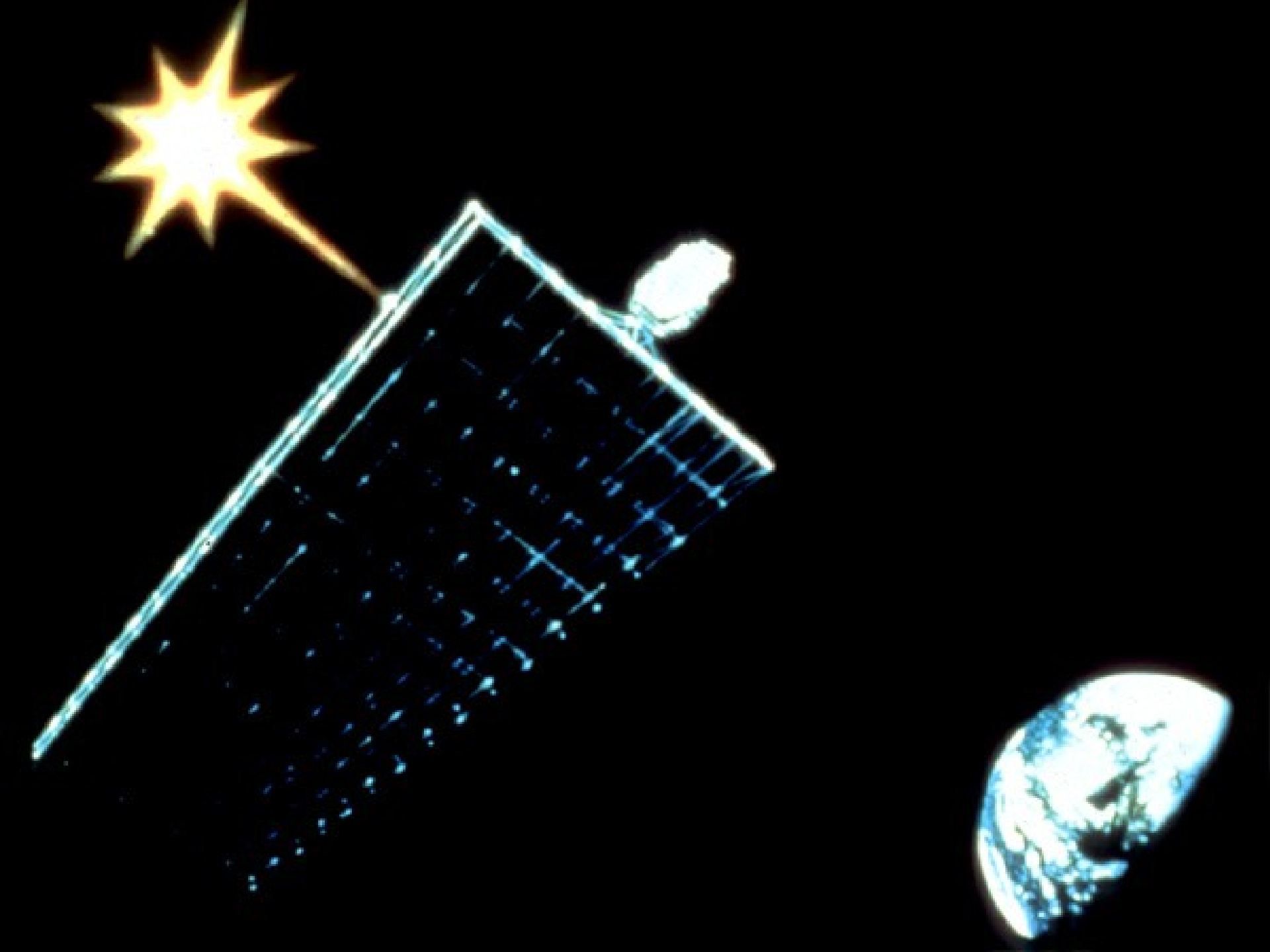
Or: How the US could meet  
the Kyoto protocol by 2028  
and make a tonne of money.

# How big is the problem?

- The US has about 300 Gw of coal fired generation currently.
- To size the problem, consider the task of displacing 300 Gw of coal generation in a year with

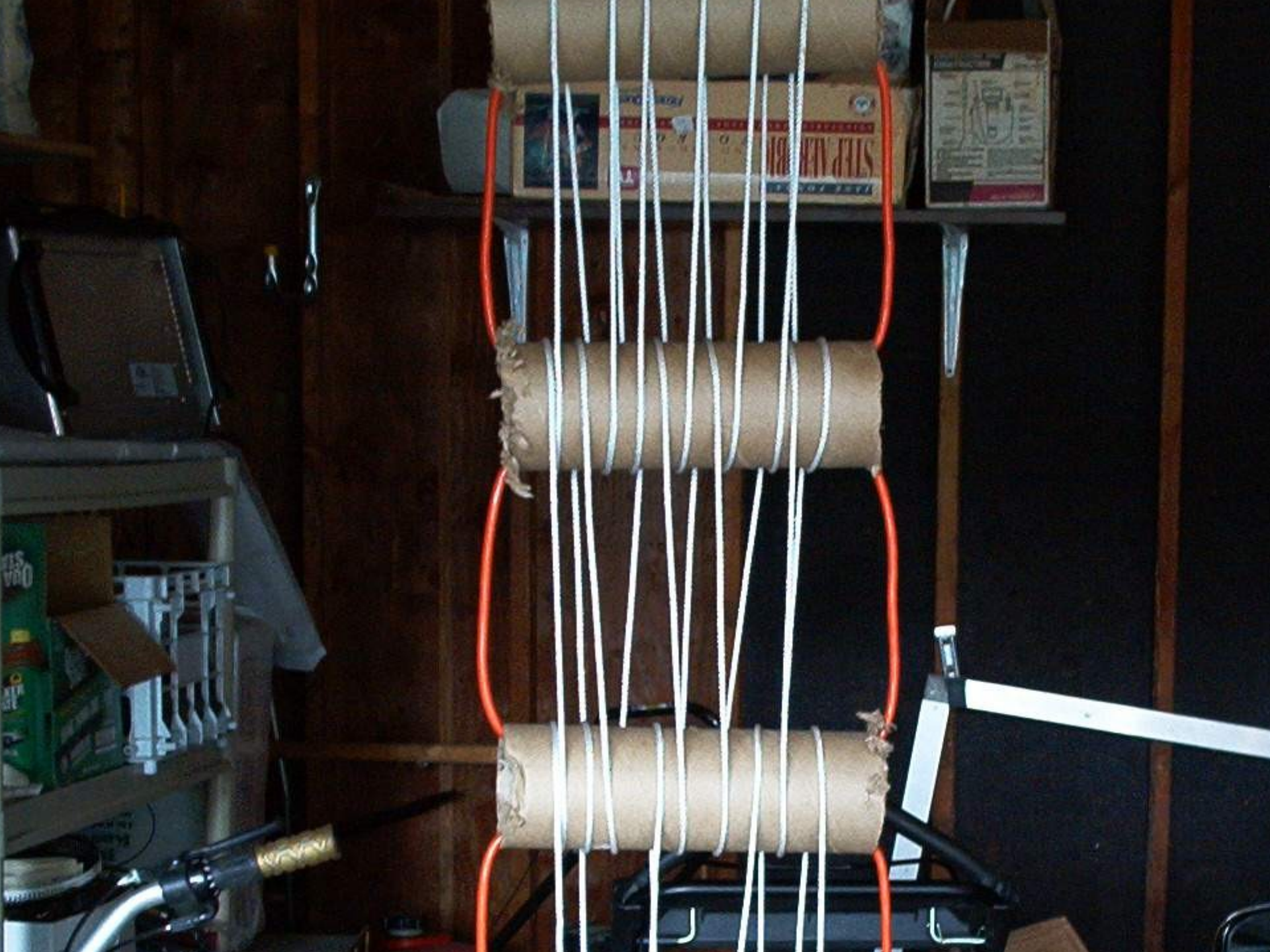
# Solar Power Satellites

- Idea is 38 years old.
- Technical problems are well understood.
- Economic difficulty is the lift to GEO or the complexity of using extra terrestrial resources.



# Sizing an Elevator, 300 Gw/yr

- Rockets are energy inefficient.
- Elevators with climbers are not much better.
- Mechanical lift is close to 100%.
- Taper is a problem below 63 Gpa, 15 looks more likely
- Perhaps step taper is the answer.



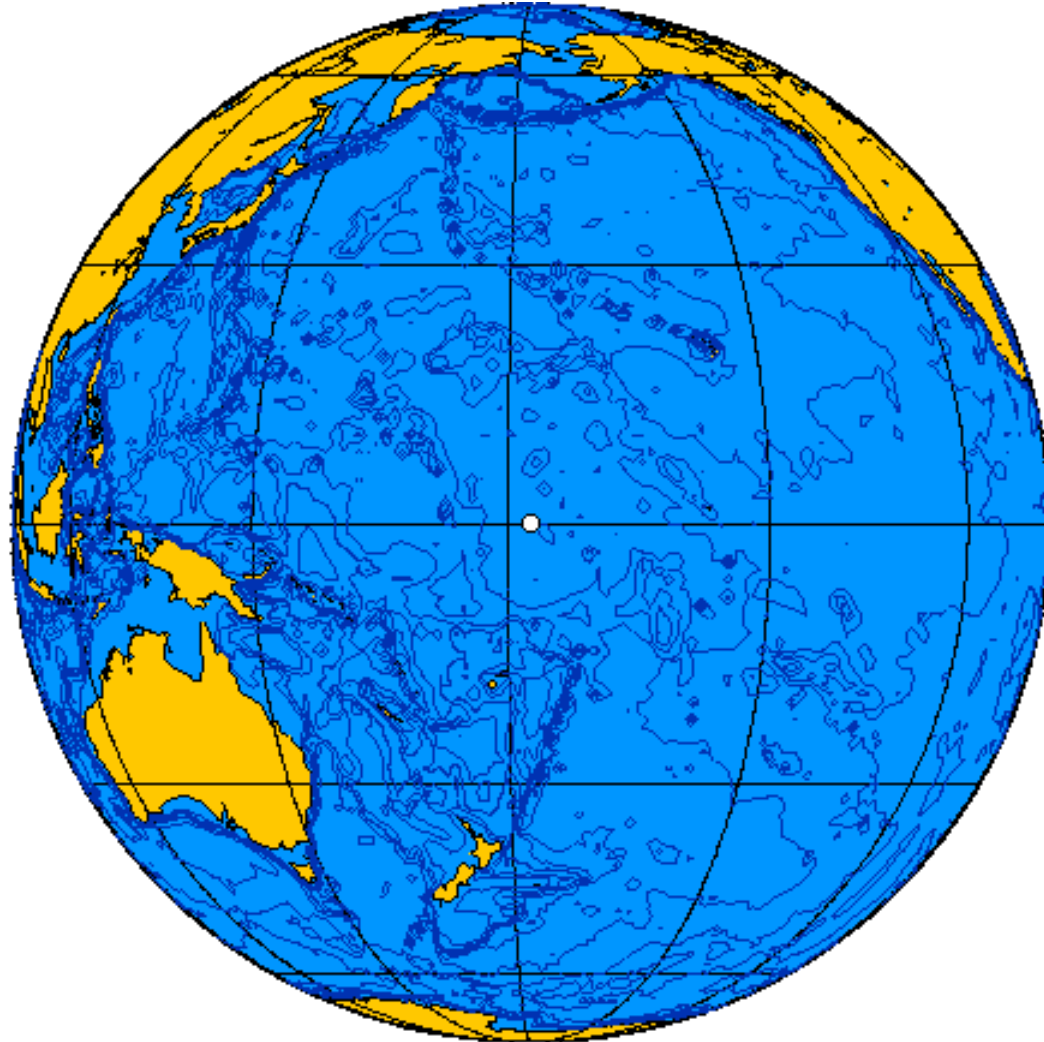
# Power Requirements to lift 300 Gw/yr.

- 5 Gw Power Sat at 2 kg/kw masses 10,000 tonnes.
- At one produced every 5 days that's 2,000 tonnes per day.
- Lift to GEO is close to a 3,200 km lift against 1 g.
- That requires mechanical power of 0.66 Gw.
- For scale the aircraft carrier Enterprise generates 0.21 Gw and could lift a few hundred tonnes a day.

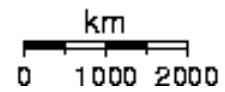


# Where to put the anchor point?

- Must be on or close to the Equator.
- Western Pacific has fewest storms.
- Perhaps on US territory.
- Baker Island is at 176 Deg. The equator is 1 mile south of 12 mile US territorial limit.



GMT 2006 Oct 31 04:27:46 ONC - Martin Weinet



# Baker Island



USFWS

View from the Northwest. The abandoned World War II runway is 1,665 meters long. 1.64 square km.

# How to power it?



The Enterprise is due to be decommissioned in 8 years

# Orbital cleaning

- 10,000 pieces of space junk, need to clean it out in a few years.
- 200 ion drive orbital tugs each removing 50 pieces over 5 years would clean it up.
- Push the junk out to GEO for needed counterweight mass.

# Aerodynamic considerations

- 1600 km/hr primary cable speed.
- Bare cable will probably be ok at that speed.
- Loads will not (too much drag).
- Variable speed cable in parallel for lowest 80 km. (Credit to Keith Lofstrom)
- At 10 cycles per hour for the VS cable, the loads will be about 14 tons each.

# Draining the Van Allen Belt

- Proposal to drain the inner belt,  
<http://www.tethers.com/HiVOLT.html>
- Total mass of the belts is a few kgs.
- Gas dumped into the belts would drain them. If dumped into retrograde orbits, the gas should also de-orbit the smallest pieces of space junk.

# Fabricating SPS surfaces

- Invar (to deal with eclipses)
- Sheet metal coils
- Roll formers and stretch to make ] beams
- Spot weld
- Two 5 km by 5 km “wings”
- 10,000 volts and 1,000,000 amps per wing

# Unaddressed Problems

- Cable for cents per kg (solvent process?)
- Vacuum degradation (Hard vacuum is an excellent insulator, but it doesn't take much gas for a flashover)
- “Man” rating the elevator
- Political/economic.

But if a very large scale space  
elevator-power satellite program  
can be done . . .

It solves the energy and carbon  
problems

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