A 2000 tonne per day Space Elevator

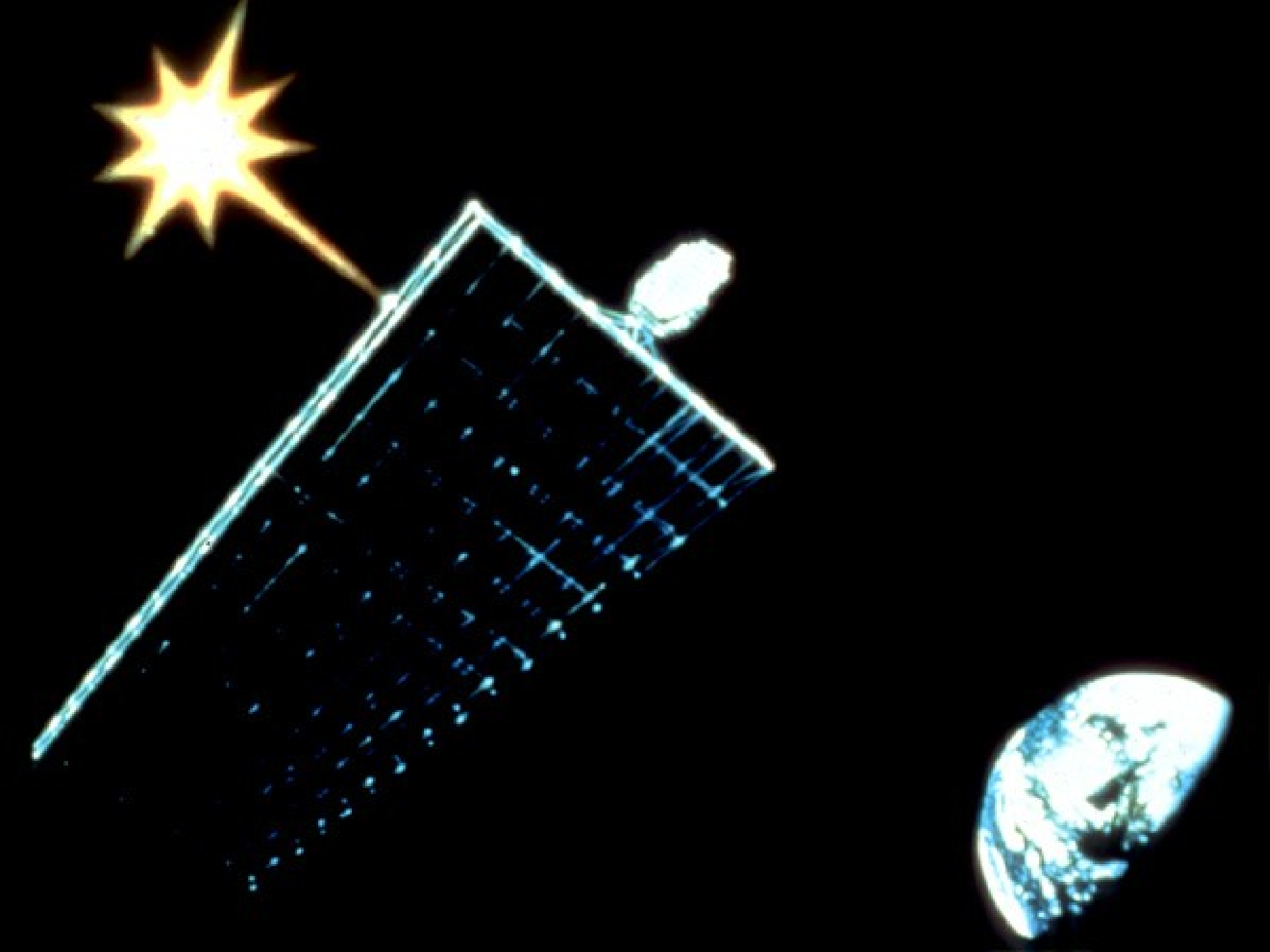
Or: How the US could meet the Kyoto protocol by 2028 and make a tonne of money.

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

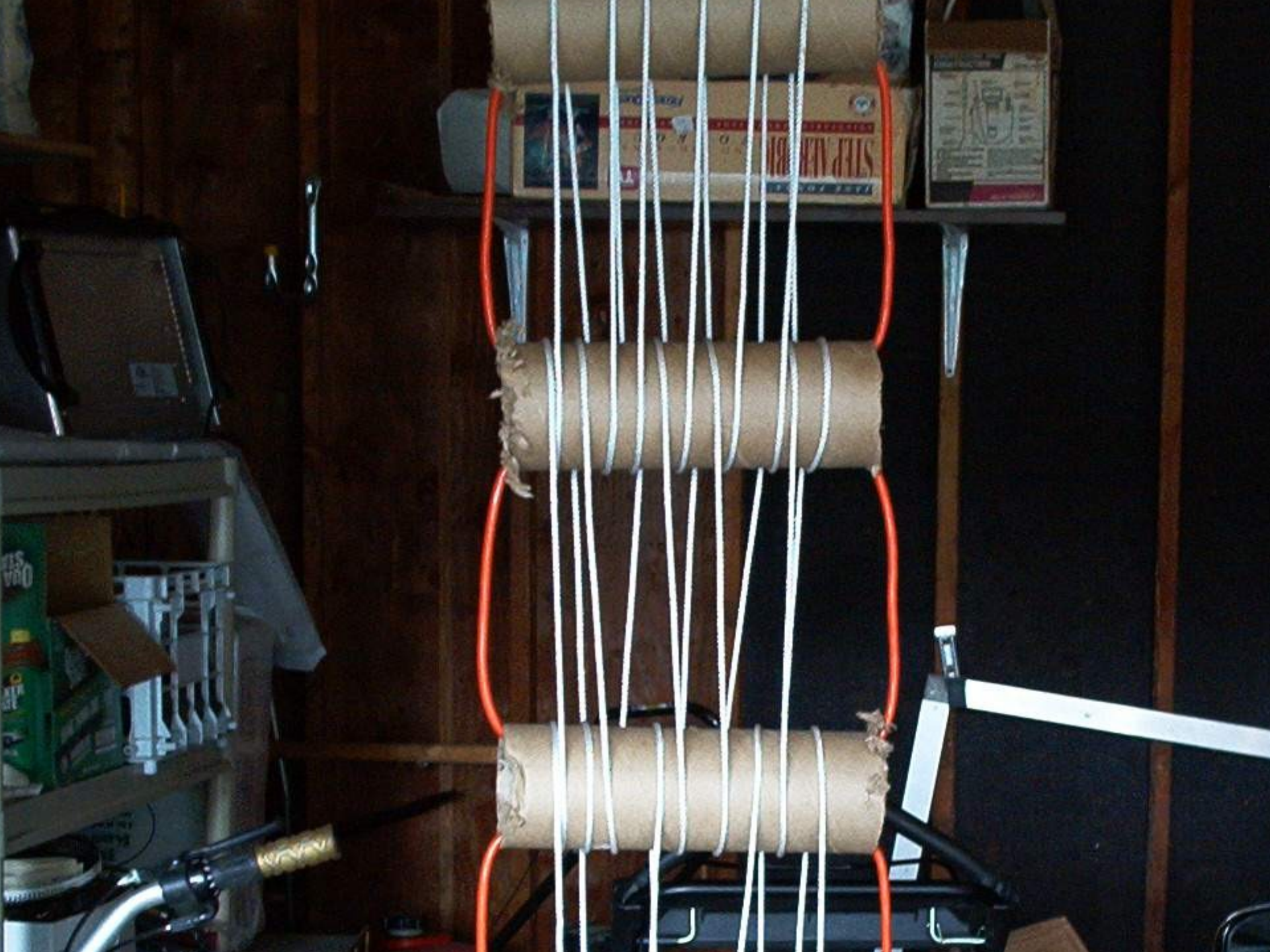
Solar Power Satellites

- 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.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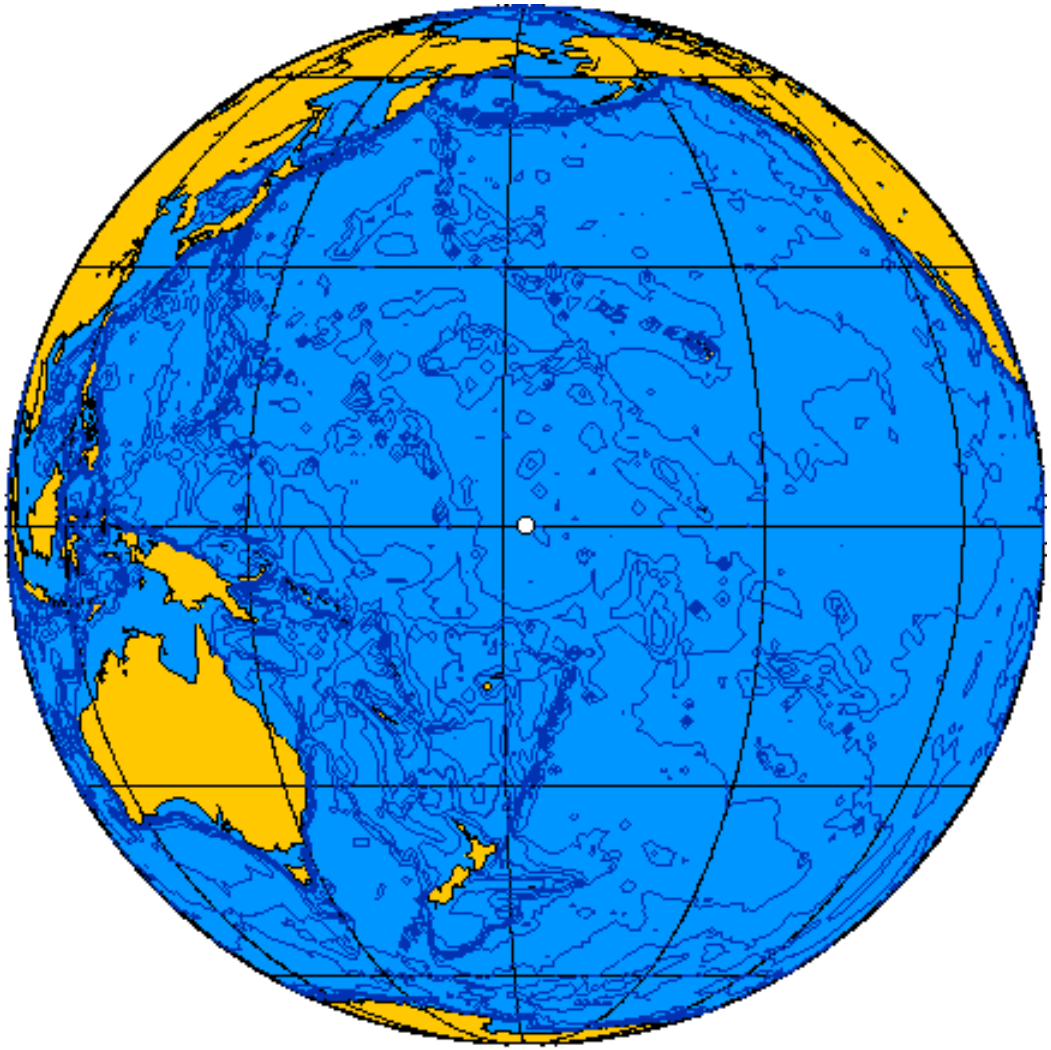
Where to put the anchor point?

- 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.



km
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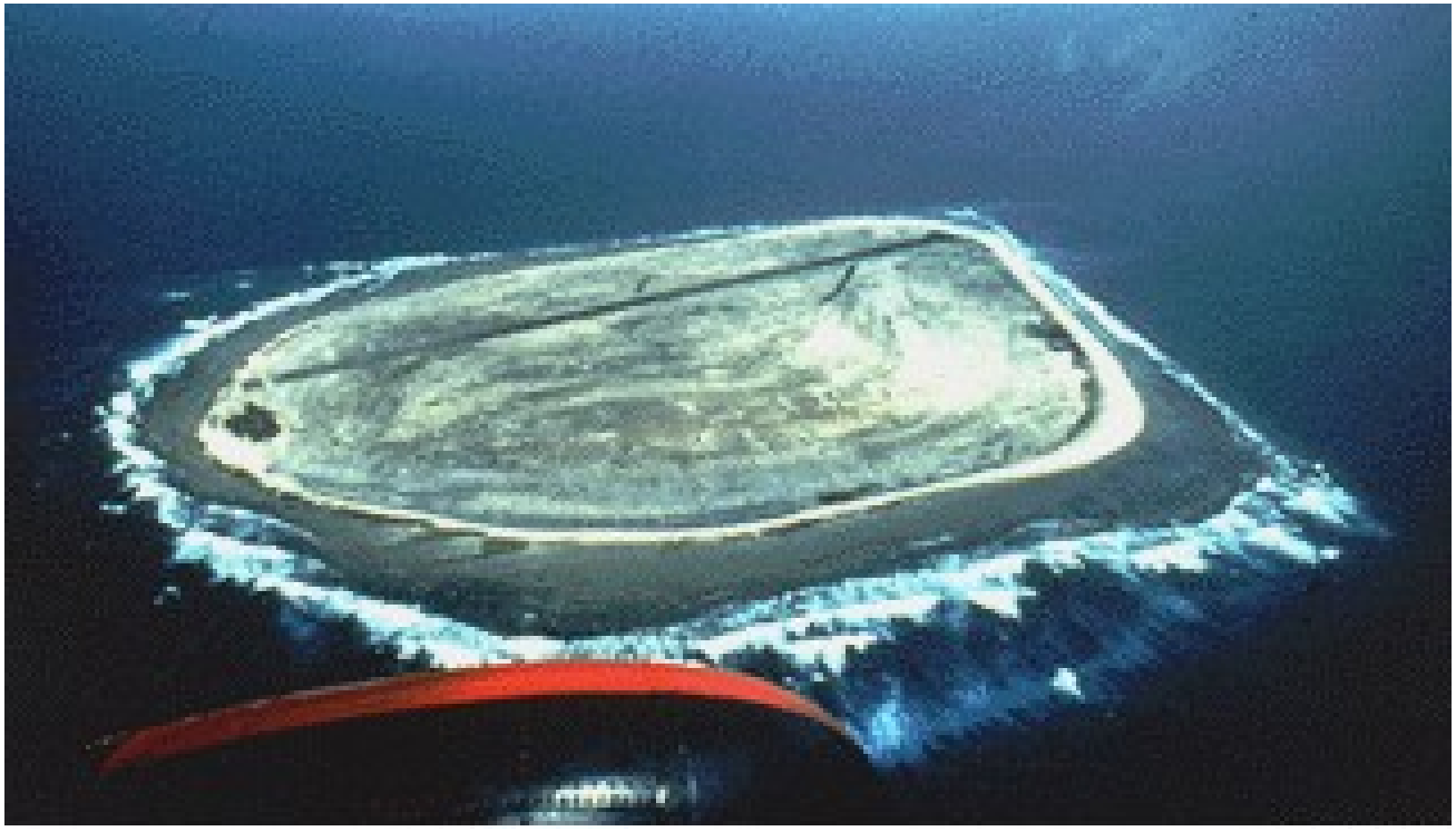
Baker Island



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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