SSP: Hearts and Minds

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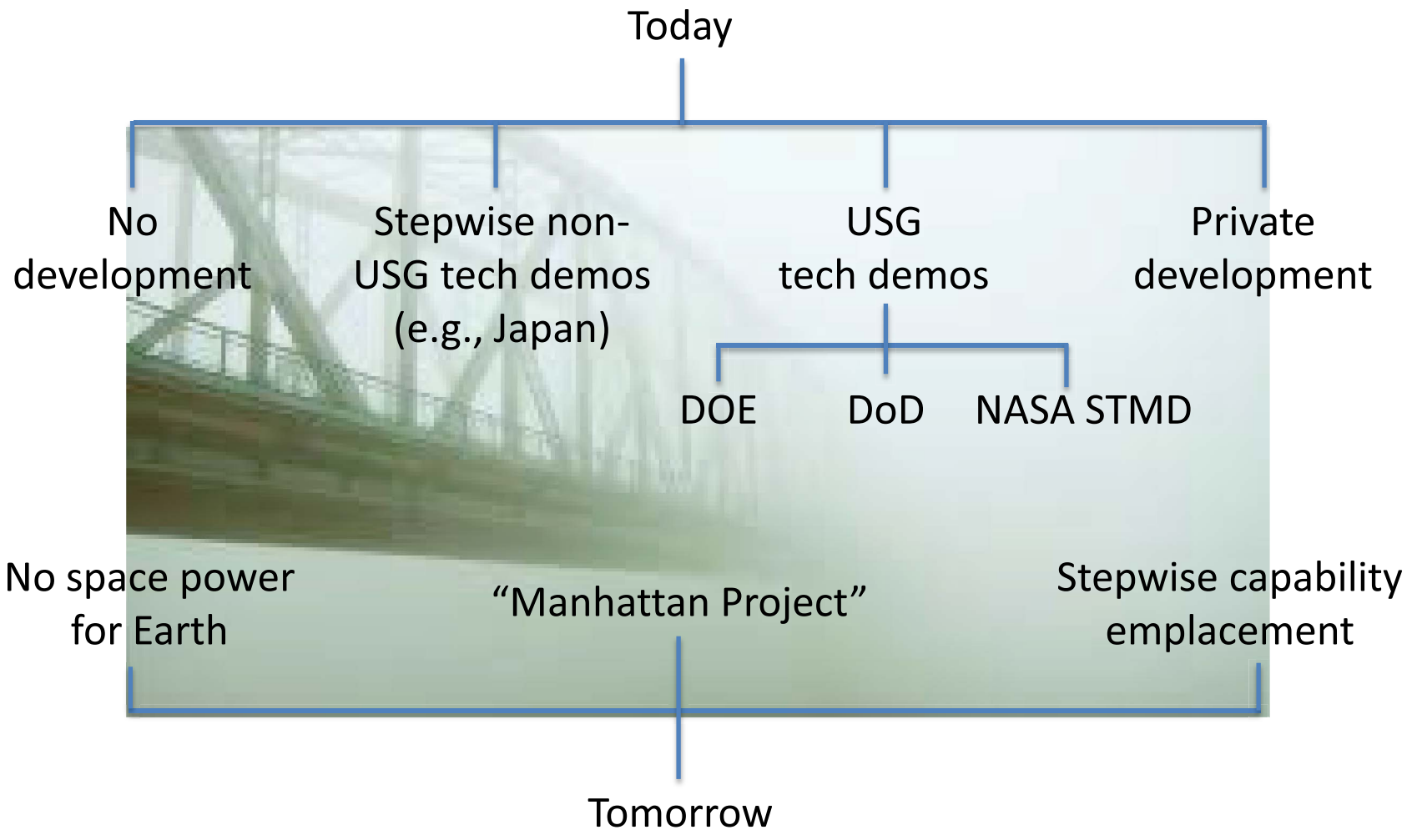
Three Generations of SSP Conception

1970s-1980s	Clever but not technically feasible
1990s-2000s	Increasingly feasible but not economically viable
Today	Economic non-viability beginning to be seen as diminishing, but…
	…neither on the "main sequence" of humankind's quest for renewable energy
	…nor of our 21st-century space agenda

Forks in the Fog



5-Point Framework for Changing the Conversation

1. Know the competition
2. Know the customer
3. Do our homework
4. Learn aikido
5. Start small

Know the competition

- Inertia
- Linear thinking
- Acceptable costs of delivering power
- Alternative visions about renewable energy
- Orthogonal visions about what space is good for

What is SSP really competing against?

Getting on the space radar

Option	Purpose	Myth	Needs (+ 10^{11} over 40 yr)	Yields	2050 Space Population
Explore Mars	Extend direct human experience as far as possible	Hero (Lewis and Clark)	Public commitment sustained over several decades	Cultural achievement: setting foot on Mars	Six international civil servants
Settle the Moon	Establish humanity as a two-planet species	Pioneer (Heinlein)	• Routine heavy traffic to lunar surface • Use of lunar resources	"Living off the land" in space	10^3 citizens raising families off-world
Accelerate space passenger travel	Create new travel-related industries	Jet set (Branson)	"Four 9s" reliability launch and entry	• Highly reliable, reusable space vehicles • 1-hr intercontinental travel	10^3 crew + 10^5 citizens in LEO every year
Enable space solar power for Earth	Prepare for post-petroleum age with minimal disruption	Green	Public-private and inter-Agency partnerships	• Energy-abundant future • Economical heavy-lift launch	10^2 skilled workers in GEO

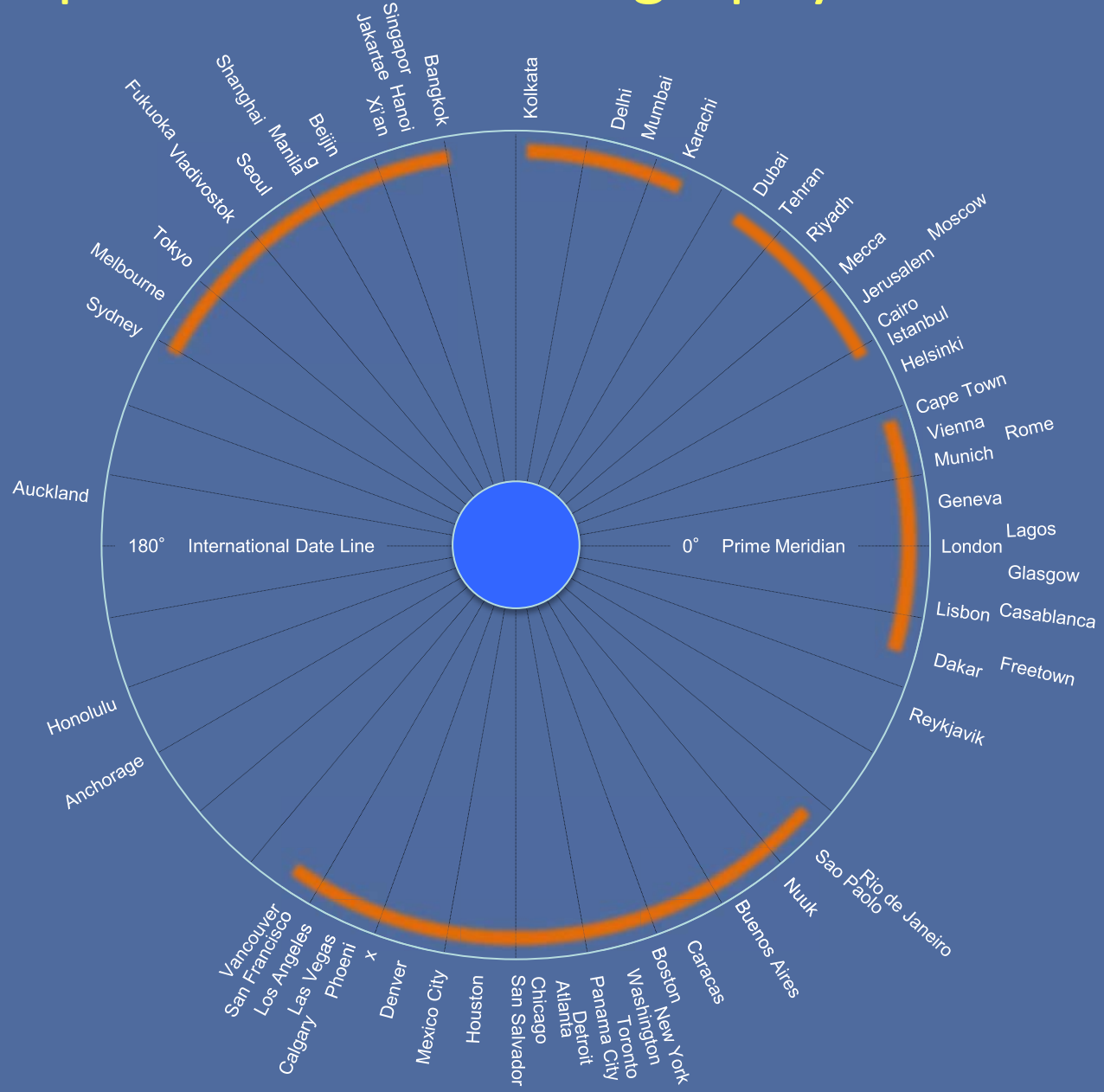
Sherwood, B., "Comparing Future Options for Human Space Flight," *Acta Astronautica* 69, 2011, pp. 346–353

Know the customer

- Those who are used to easy electrical power
- Those who provide it today
- Those who could make a fortune providing it tomorrow
- Those who could change the world – and make a fortune – by using electrical power in new ways

Who should (or will…) care about SSP,
and what motivates them?

Geopolitics: Urban Geography from GEO



Do our homework

- Understand the practical alternatives to SSP
  - Advocate them, too
- Acknowledge the enormity of the SSP undertaking
  - Describe it in relatable terms
- Study side-effects of vast quantities of cargo launch
  - Differentially advocate the most sensible option(s)
- Benchmark public and environmental safety
  - Expose, analyze, validate, and become definitive about it
- Know the terrestrial side – land use, regional integration
  - Show people what they will actually see

A simple calculation

World electricity energy usage in 2010[1] = 18.5 (10^{12}) kWhr

World power average consumption = $\frac{18.5\ (10^{12})\ \text{kWhr}}{24\ \text{hr/d} \bullet 365\ \text{d/yr}}$ = 2.1 (10^{9}) kW = 2.1 TW

Assume ~50x today's power demand: 100 TW

- Neutral demand growth in the west due to conservation
- 3rd world rises to 1st-world standards
- Electricity to desalinate sea water for potable supply
- Electricity to crack water for hydrogen mobile fuel

Assume end-to-end SSP efficiency = 1%

- Losses from PV conversion, µwave xmitter, free-air xmission, atmospheric absorption, rectenna spill, inversion, etc.)

Implementing SSP would be a mega-project…
but not one beyond our comprehension, practicality, or experience

GEO collector area = $\frac{100\ \text{TW}}{1400\ \text{W/m}^2\ (0.01)}$ = 7.14 (10^{12}) m^2 = 7140 km^2

For comparison: U.S. National Highway System[2] = 259 (10^{3}) km long, and cost ~ 425 (10^{9}) B$2006

Assume average paving width ~ 10 m = 10^{-2} km → Total paved area = 2590 km^2

[1] U.S. Energy Information Administration
[2] Wikipedia, 21 Sep 2013

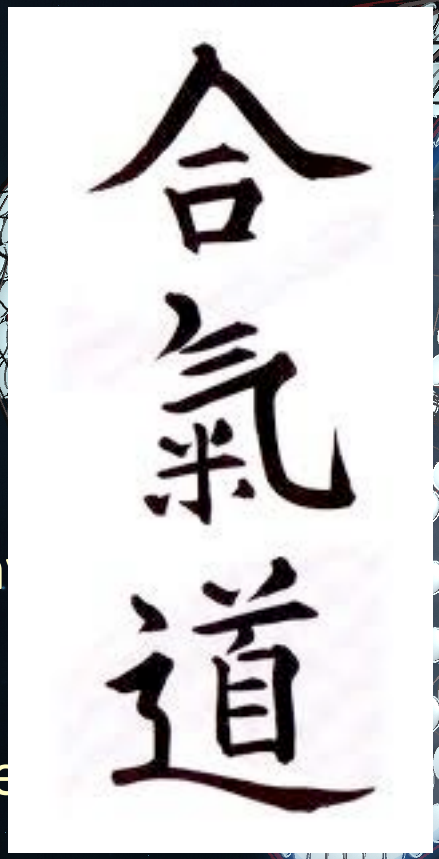
Learn aikido

Price at the pump

Balance of trade

Capitalism

Harmony



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Energy

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Path

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Potable wate

Environmental stewardship

Potable water

Start small

- 10^{11} infrastructure project
- Creation of a new federal agency
- Fully robotic assembly and maintenance
- …or, an O'Neill colony of construction families
- …mining the Moon for construction materials

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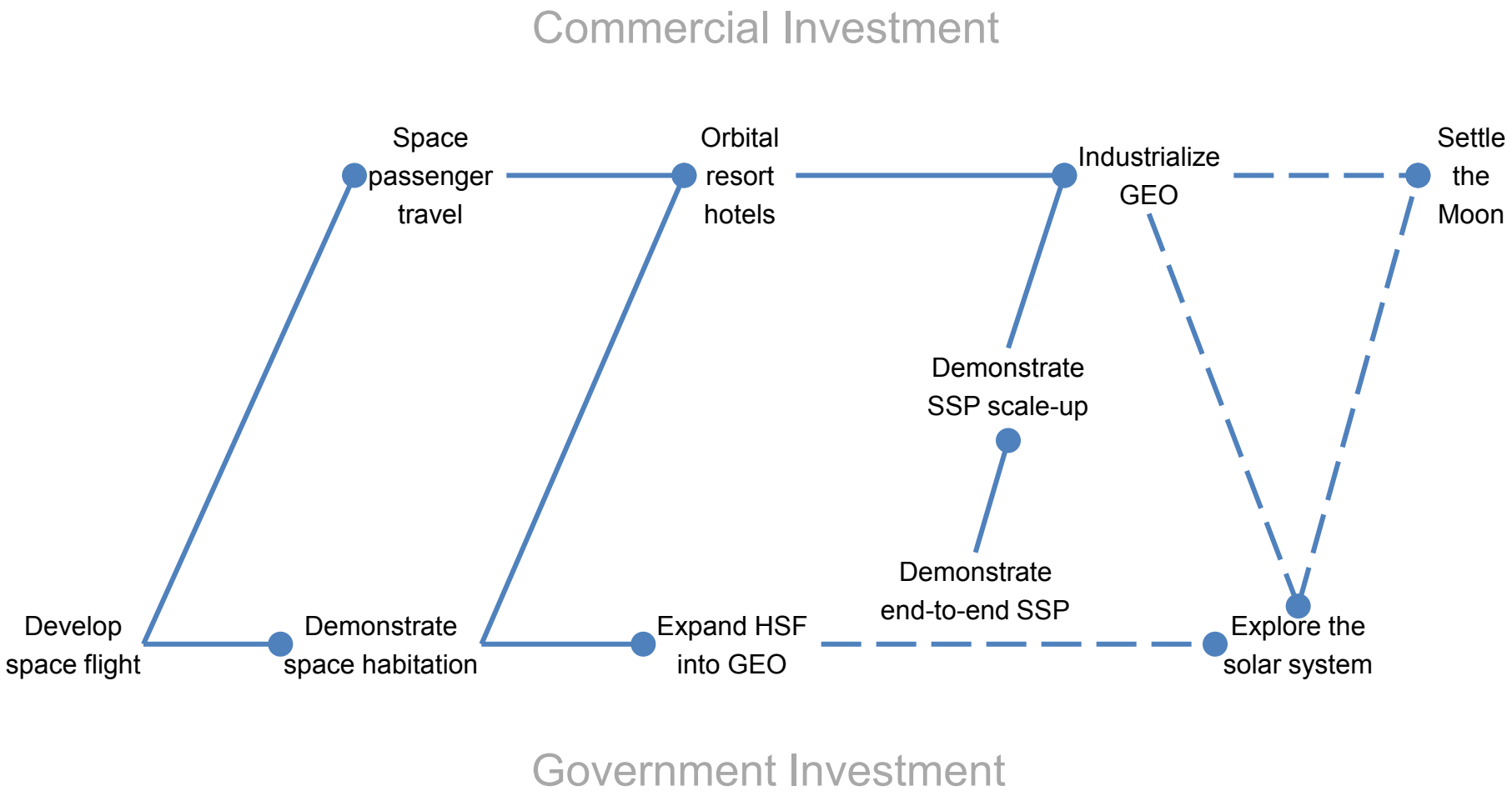
Some of something is better than all of nothing

“When you come to a fork in the road…”



Our limited world is just a soccer ball held at arms' length…as viewed from tomorrow's source of energy