



Evaluating Prospects for Space- Based Solar Power

Study Overview for ISDC2022

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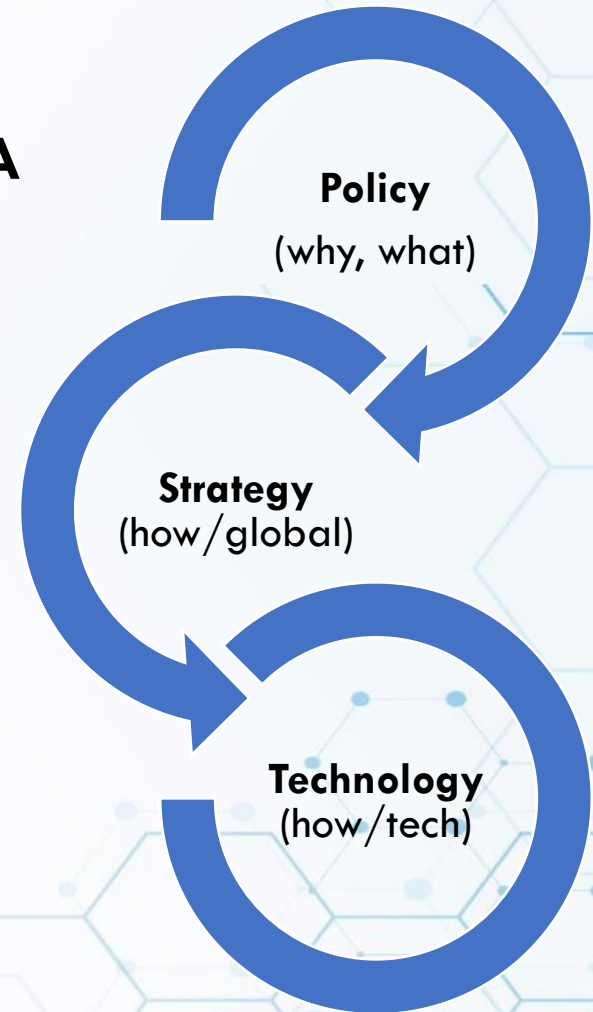
Office of Technology, Policy and Strategy (OTPS)

Overarching Goal – Help Support the *Why, What, and How* of NASA

Working in collaboration across NASA and the broader space community...

...Provide NASA leadership with data- and evidence-driven advice to develop and shape

- policy (what NASA should do and why),
- strategy (how should NASA do what it does), and
- technology (how to best develop/leverage the right technology)





Provide NASA leadership with data- and evidence-driven advice to develop and shape policy, strategy, technology



Provide **Day-to-Day Support** on Ongoing/Emerging Technology, Policy and Strategy Issue



Conduct Analyses to Support NASA Leadership's and Administration's **Overarching and Strategic Priorities**



Develop and Conduct Preliminary Exploration of **New Ideas** for Consideration by NASA leadership



Conduct **Ad Hoc Analyses** on Topics Directed by NASA Leadership



Evaluating Prospects for Space-Based Solar Power

- OTPS
 - Space Infrastructure and Logistics
 - SBSP

The feasibility of SBSP is both a *technical* and *policy* question, bound to a realizable *strategy*.

(But no answers or promises yet)

The Promise

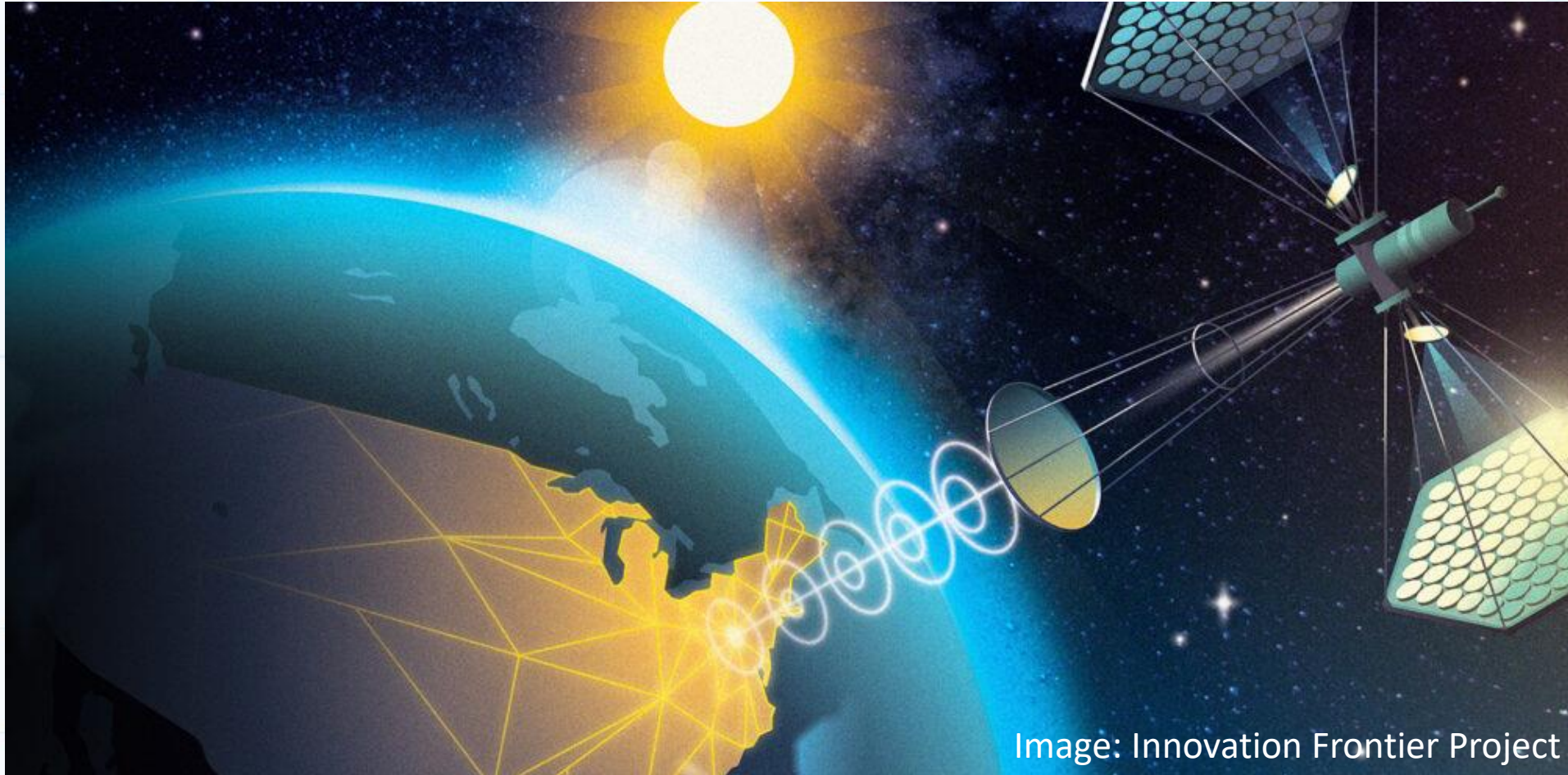
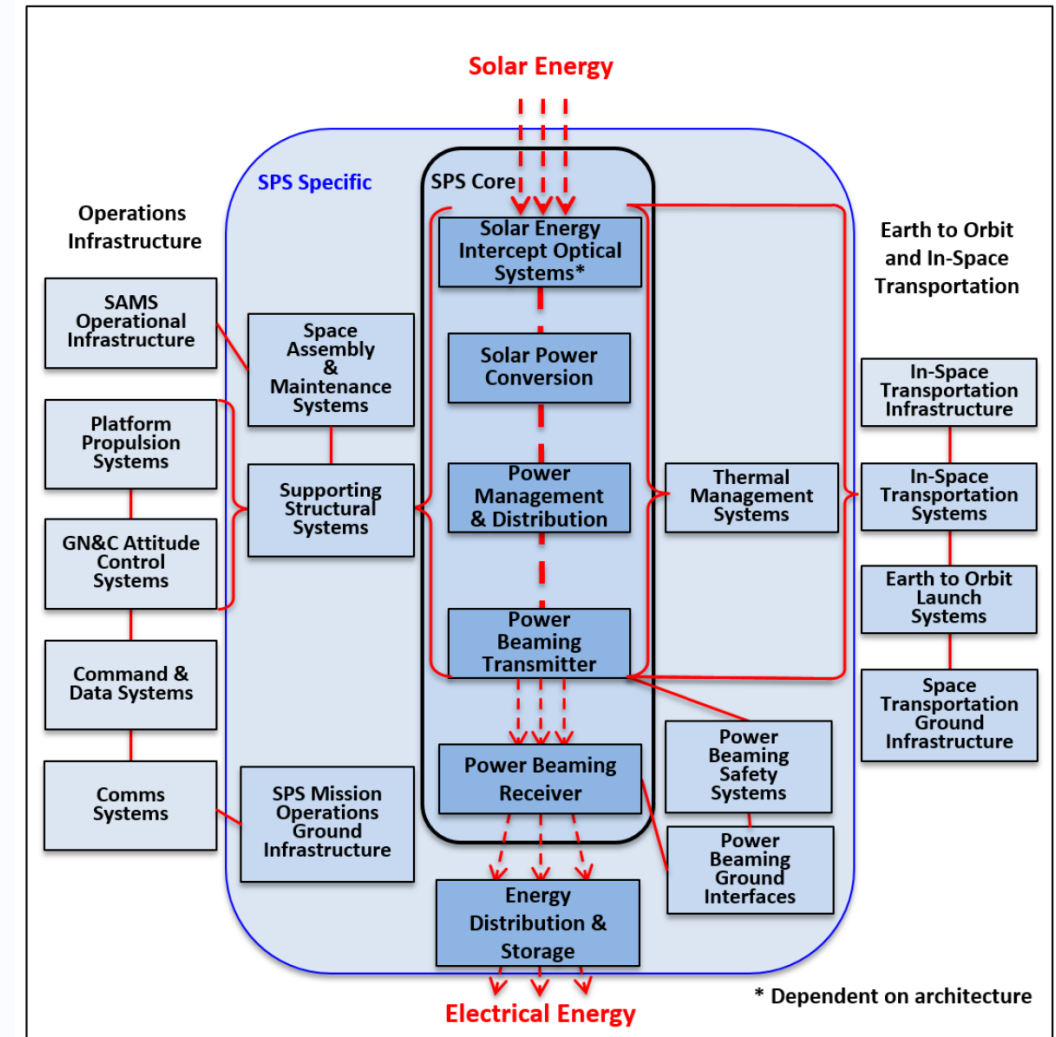


Image: Innovation Frontier Project

Reality

- Each subsystem is a microcosm of technologies NASA and others have invested in
- Constant technology improvement means this is an evolving system
- SBSP is a good strawman for studying mega projects
 - Serves large societal need
 - Requires massive effort
 - Development spans years
 - High strategic value to output
 - Many disciplines interacting
 - Many constituencies and interests
- Emerging as candidate for space development program to meet global emissions goals.



Source: adapted from Mankins, 2014



SBSP Study

Goal

To assess the degree to which NASA should support the development of SBSP. This requires first assessing whether SBSP is a worthy target of investment, which can be determined by performing an analysis that does the following:

- Enumerates the potential use cases of SBSP;
- Identifies other technologies that may satisfy the same use cases in the future;
- Makes an apples-to-apples comparison between future SBSP and other future technologies for each use case to demonstrate the potential efficacy of SBSP.
- This analysis will focus on the potential for SBSP to reduce green house gas (GHG) emissions.
- Identify current performance characteristics of various designs and costs while exploring benefits to our current and projected circumstances.



SBSP Study

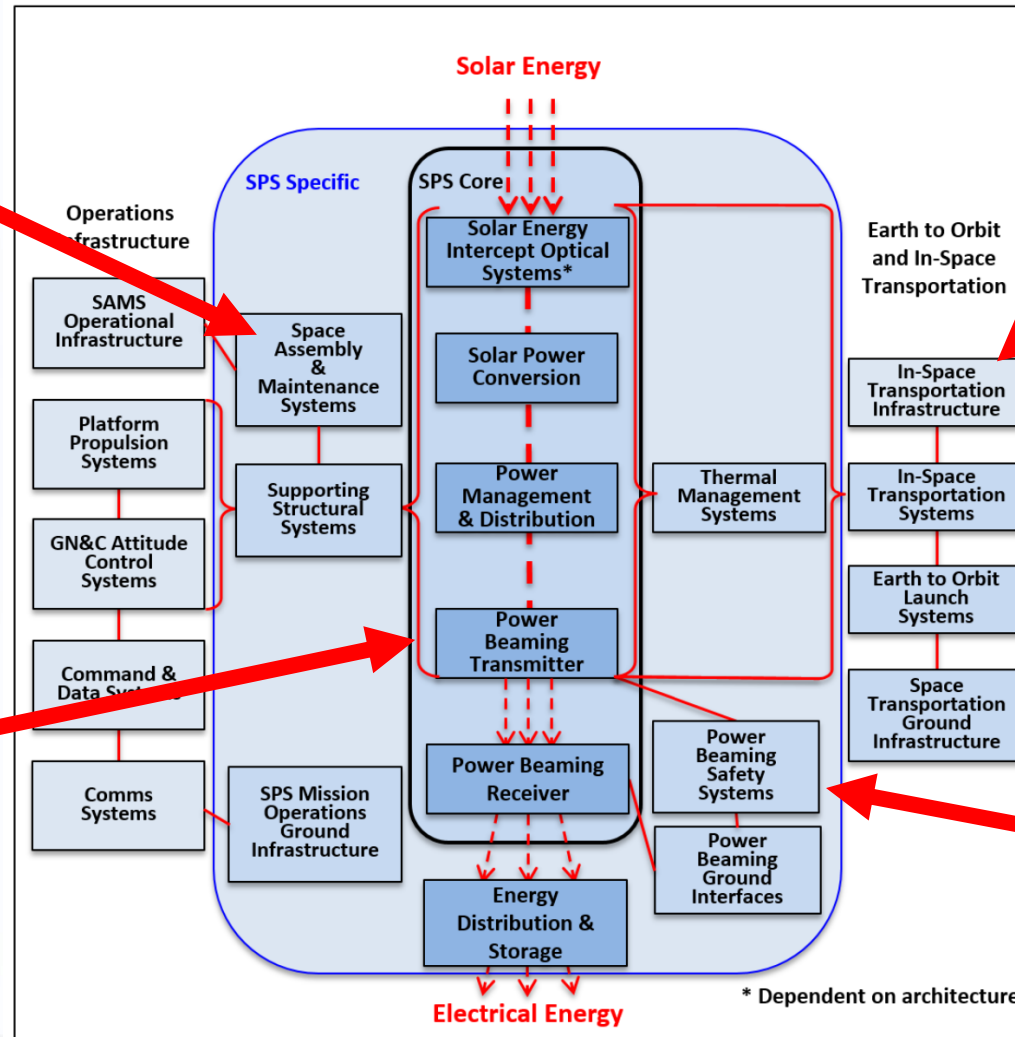
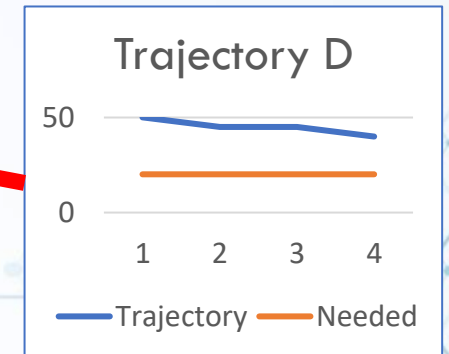
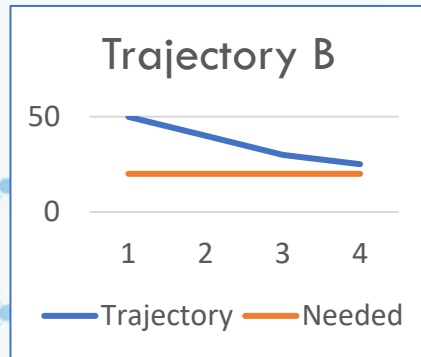
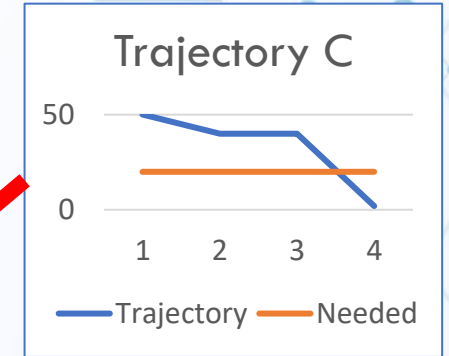
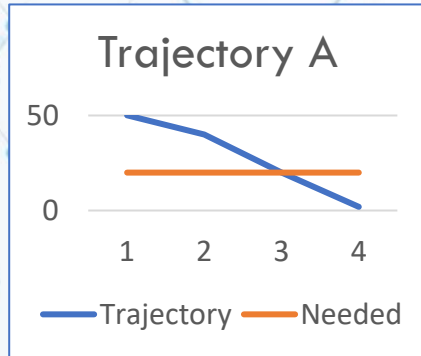
Approach

- Review design studies and identify the technical fulcrums in developing a large future system
- Identify the cost and performance levels necessary to make SBSP system that would be competitive within a future clean energy mix
- Assess the benefits of SBSP compared to other terrestrial power sources, focusing on the clean energy aspects
- Assess policy implications and challenges to implement a development and deployment program

Use results for a policy basis:

- If SBSP is worthwhile for NASA to pursue, produce a recommendation of how to proceed, with associated rationale.
- If SBSP is not, and won't be, worthwhile, document that and share with the community with rationale.
- Either way, we get an answer!

SBSP Study



Source: adapted from Mankins, 2014

(All figures notional)



3 Reasons to Develop SSP

1. SSP for energy

- a) SSP is persistent, clean, scalable, and functionally unlimited energy
- b) Deployable anywhere and insulated from price fluctuations
- c) Potential to replace all fossil fuel energy generation

2. SSP for space

- a) Combines every skill and industry already working on space
- b) Exists as the major driver for industrialization of space
- c) Enables unimaginable new possibilities for human development

3. SSP for the US

- a) Requires massive domestic manufacturing capacity
- b) Puts US on the path to lead the world in meeting climate obligations
- c) Opportunities for diplomacy through sharing and aid



What's Next?

- Big Questions Remain:
 - Technical
 - What do things really cost?
 - How do we build something so big?
 - How well do we understand the spectrum implications?
 - Policy
 - How do you develop intergovernmental efforts?
 - When do you hand it off?
 - How would SBSP interact with megaconstellations?
 - What about orbital debris?
 - Public perception
 - This isn't a death ray?
 - Are you sure it's not a death ray? It sounds like Goldeneye



Conclusion

- The idea of SBSP has been around for a long time.
- Given recent advances and changes to the market, does it make sense now?