National Space Society

National Space Society &
A Framework for Architecting the Future of Space

Fifty-Ninth Session of the Scientific and Technical Subcommittee
of the Committee on the Peaceful Uses of Outer Space

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http://space.nss.org

National Space Society (NSS)

- **NSS is an international non-governmental organization:** in consultative status with the United Nations Economic and Social Council since 1996, permanent observer status with COPUOS, and ongoing participant in both the COPUOS Science and Technical as well as Legal Subcommittees.
- **NSS Vision:** "People living and working in thriving communities beyond the Earth, and the use of the vast resources of space for the dramatic betterment of humanity."
- **NSS Mission:** "to promote social, economic, technological, and political change in order to expand civilization beyond Earth, to settle space and to use the resulting resources to build a hopeful and prosperous future for humanity."
- **NSS Reach:** over 700,000 members, affiliates, donors, Ad Astra magazine subscribers, web & social media followers, conference/chapter/fora participants, and students in programs & contests.

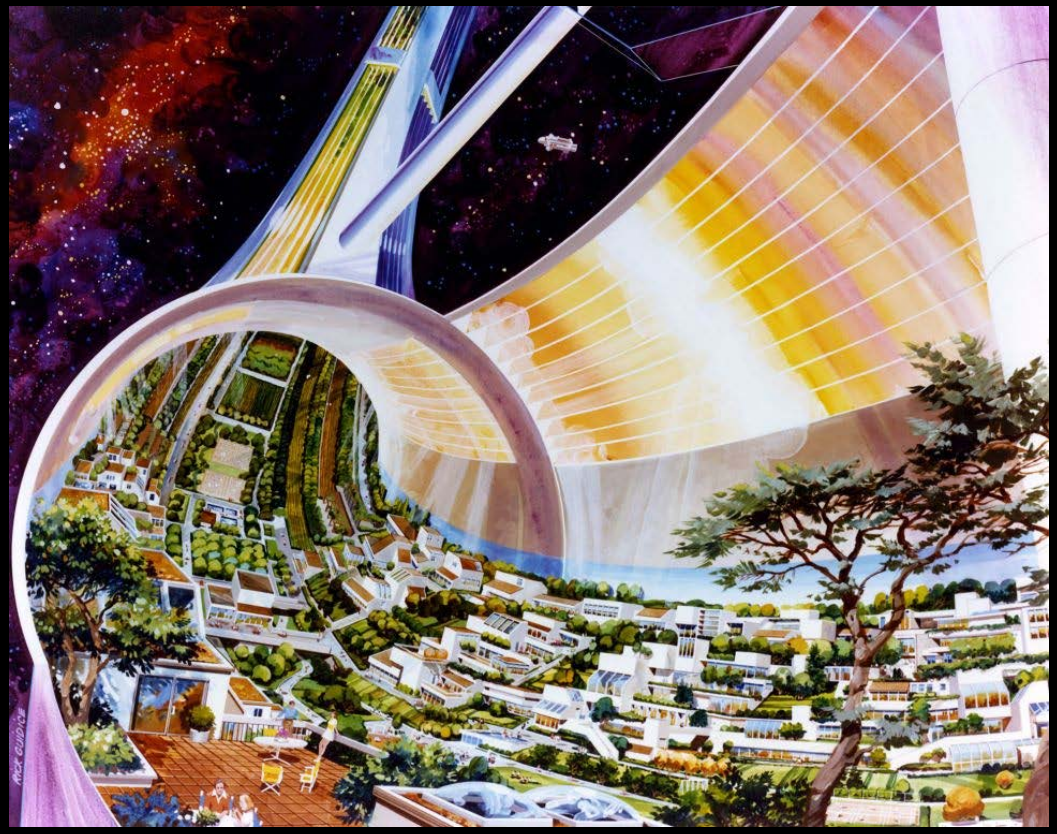

Image Credit: Rick Guidice

Why Architect the Future of Space? (1)

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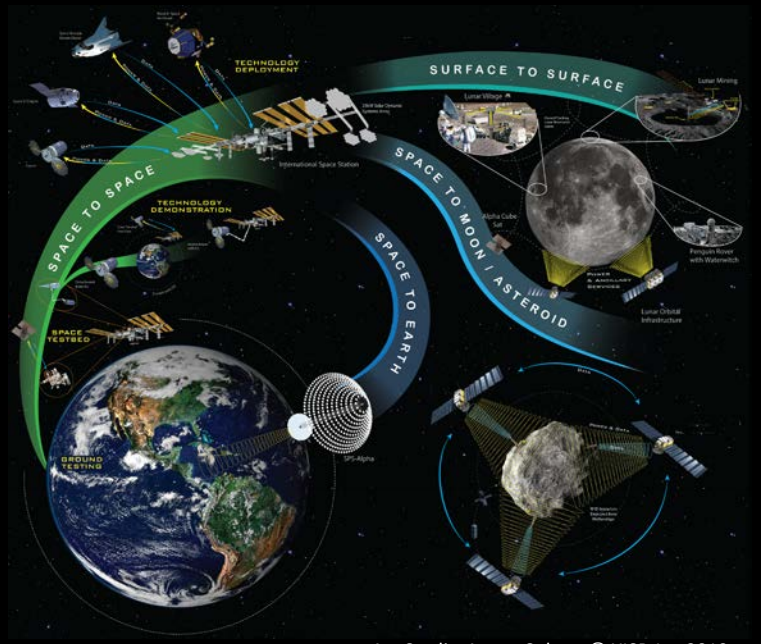
What you can learn to do really does matter . . .

- **Defending Earth against Asteroids and Comets**
  - See https://space.nss.org/planetary-defense/
- **Space Development**
  - e.g. Space Solar Power, LEO commercialization, lunar In Situ Resource Utilization (ISRU), to benefit everyone on Earth
- **Space Settlements**
  - Space settlement is the general process of developing and living in space.
  - A space settlement is a specific place in space where people live, work, and raise families.



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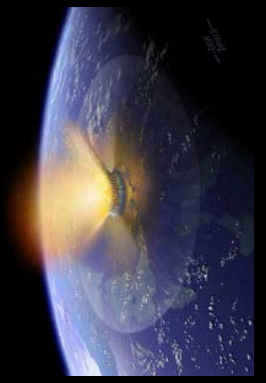

Image Credit Don Davis

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Why Architect the Future of Space? (2)

Why your doing it can matter just as much if not more . . .

- *The consequences of extinction level events are irreconcilable.*
- *Bringing new resources (energy, material resources, and habitable area) to the table for use in space and on Earth for the dramatic betterment of humanity provides options for a positive future.*
- *Understanding how to build and maintain viable space settlements is a microcosm of providing for all life as we know it.*

Arcs of Opportunity

Multiple Venues

Ground,
Space-to-space
Surface-to-surface
Space-to-Moon/
Asteroid
Space-to-Earth

Work Vectors

Technology Development, Demonstration, and Deployment

Art Credit: Aaron Cohen, © XISP-Inc 2019

Flows of People, Material, Energy & Information

Stake Holders

Government
Commercial
Non-Profit
Educational
Individuals

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In Search of a Framework

- How do you accomplish the systems engineering of something you have never built before?
- An excellent place to start is by lending your efforts to understanding both the problem space and the potential solution space.
- From there you need to identify some number of threads that can be used as lenses to look at each aspect of the work that is proposed and as it is being executed.
- You could think of these threads as "Outcome elements".

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Critical Outcome Elements

To provide a framework for space development we need to identify the critical outcome elements

- **Global Energy Market**
  - Competition, Diversity, Robustness, Resiliency, Interoperability, Switching, Dispatchability
- **Climate Change**
  - Energy generation alternatives such as Space Solar Power, Greenhouse gas balance
- **Economic Development**
  - Break out of the perceived and actual zero-sum game mindsets, generate opportunities for new real wealth
- **Regulatory Evolution to Achieve a Level Playing Field**
  - Rational, fair markets, Dynamic Stochastic Optimal Power Flow, Frequency Allocations, Land Use
- **Situational Awareness**
  - Information interchange, interoperable network communication architectures, management operations control applications, information integrity, autonomous navigation
- **Open Standards and Interfaces**
  - Interoperability, Freedom from backdoors (S/W & H/W), quantum tech as a foundation for security
- **Long Term Sustainability**
  - Implementation of the 21 adopted LTS guidelines, improvement thereof through LTS 2.0 working group, and related capacity building to best ensure safe and sustainable civil activities is essential

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Reverse Engineering "Outcomes"

- **Requires knowledge of both objectives and processes . . .**
- **Knowing where you are trying to go makes it a whole lot easier to get there**
  - **the alternatives this can lead to a massive squandering of resources**
- **End-to-end systems engineering is essential**
  - **piecewise engineering is insufficient in and of itself**
- **Understanding the economics is critical to understanding the viability of any solution**
  - **history is replete with examples that have proven this out time, and time again**
- **Fostering markets**
  - **exercising the available societal levers to stimulate ecosystems of innovation**
- **Providing for security**
  - **without it we will plummet down Maslow's Hierarchy of needs despite the best of intentions**

Our Technical Session presentation offers an update on space solar power development within the context of this framework.

Example Next Steps for Space Solar Power

Mars

Asteroids

Moon

Starship

Art Credit
SpaceX/Elon Musk

Orion MRCV

Art Credit NASA

OOSA & COPUOS Delegations Can Engage With . . .

- *IAA Permanent Committee on Space Solar Power (approved December 2021)*
- *Space Solar Power Symposium at the NSS International Space Development Conference 2022, 26-27 May 2022*
- *Participation in the proposed IAC 2022 Space Solar Power Special Session 18 – 22 September 2022*

Space is our future

Let's not wait for it, let's build it!

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