

A long time ago

In a building not far away....



TOWARDS A THEORY OF SPACEPOWER

*The Influence of
Spacepower on History
and
Implications for the Future*

April 25 - 26, 2007 **The Spacepower Team**



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The Power of Space

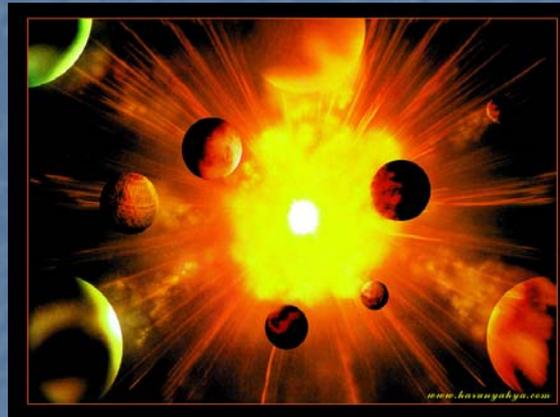


The awesome power of the universe....

Creation



Inspiration



Destruction



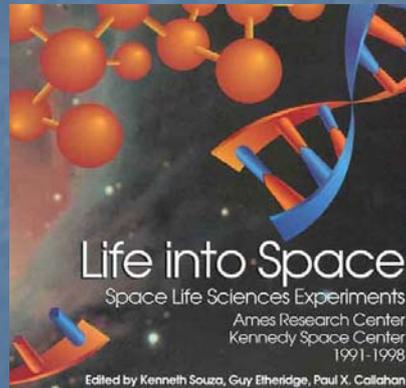
Human Activity in Space

Through space, humans have the power to:

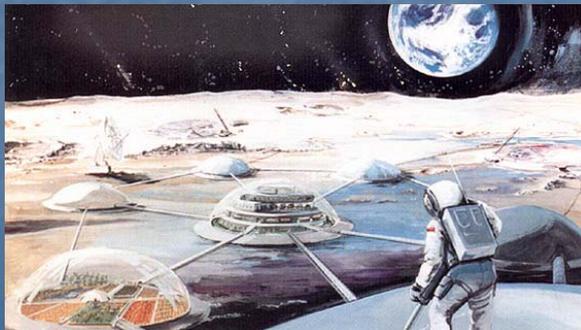
Create



Explore



Destroy



Survive



Prosper



A Theory of Spacepower

- Towards a Theory
- Defining Spacepower
- Describing Spacepower
- The Political Power of Space
- The Economic Power of Space
- Spacepower and the Common Welfare of Mankind
- Security and Spacepower
- Towards the Next Space Age
- Implications for the United States



Towards a Theory



Scope and Context

■ Scope:

- This is a theory, neither strategy nor policy
- Broader than a military theory
- Considers human activity in space for the next 50 years

■ Context:

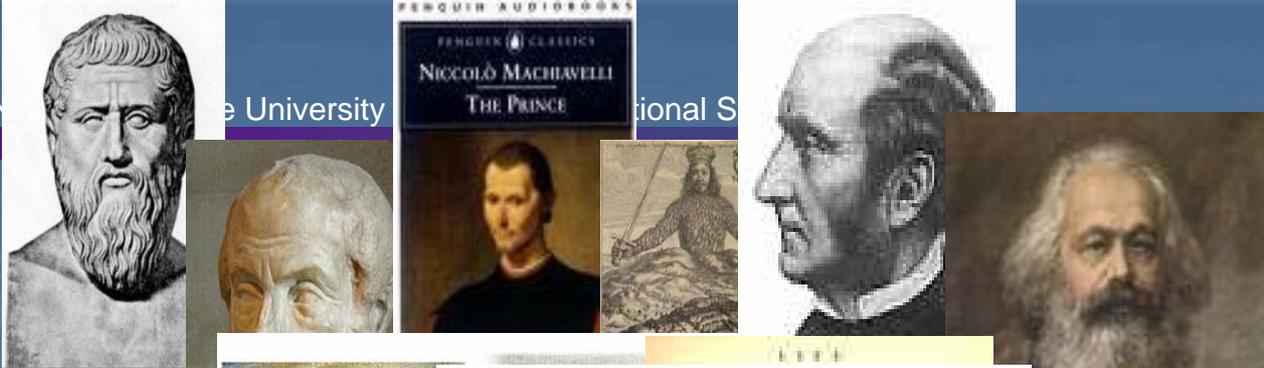
- U.S. is the preeminent space power in 2007
- Authors w/ military background
 - Continue to seek input from broader audience



Building Theory

Tools for building theory:

- **Assumptions:** Statements about the spacepower, or phenomena that affect spacepower, that are assumed to be true.
- **Principles:** Hypothetical statements derived from the evidentiary and historical base which have proven to be true in the past.
- **Propositions:** Debatable hypotheses that have been neither proven true nor false, and must be tested in a future context.



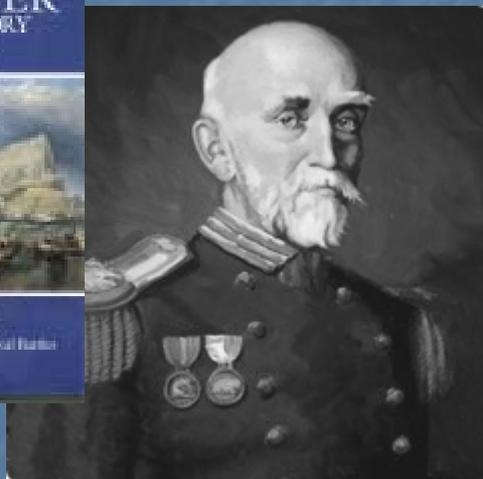
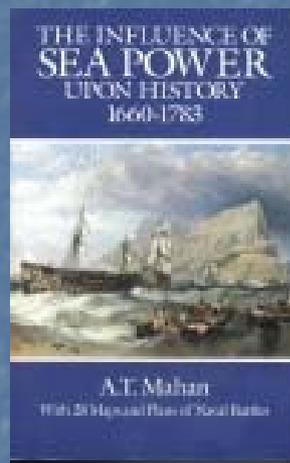
- **Relevance**
- **Political**
- **Historical**
- **Economic**
- **Geographical**
- **War**
- **Military**
- **Space**



A theory of spacepower is an extension of the body of knowledge that precedes it.



Mahan and his Influence on Spacepower Theory



Among all changes, the nature of man remains much the same.

-- A.T. Mahan



Defining Spacepower



Defining Spacepower

- **Power:** *The ability to effect the outcomes you want, and if necessary, to change the behavior of others to make this happen. (Nye)*
- **Spacepower:** *The ability to use space to get desired outcomes by influencing the environment and the behavior of others.*



DIPLOMACY

WORDS DON'T ALWAYS SOLVE PROBLEMS.
SOMETIMES YOU JUST HAVE TO PUNCH AN ALIEN IN THE FACE.



Defining Space

Astronautics | SPACE | ↑

Transverse Region
Where laws of Bernoulli, Archimedes, & Kepler cannot be exploited for practical operations

~93 miles: Lowest possible circularized orbit (already in decay)



50 miles: Astronaut wings

Aeronautics

Thin Air

~26 miles: Highest possible buoyant "flight"

Air

~16 miles: Highest manned aircraft (U-2)

Space begins at the lowest perigee of an orbiting satellite, about 93 miles beyond Earth's surface (Laymance).

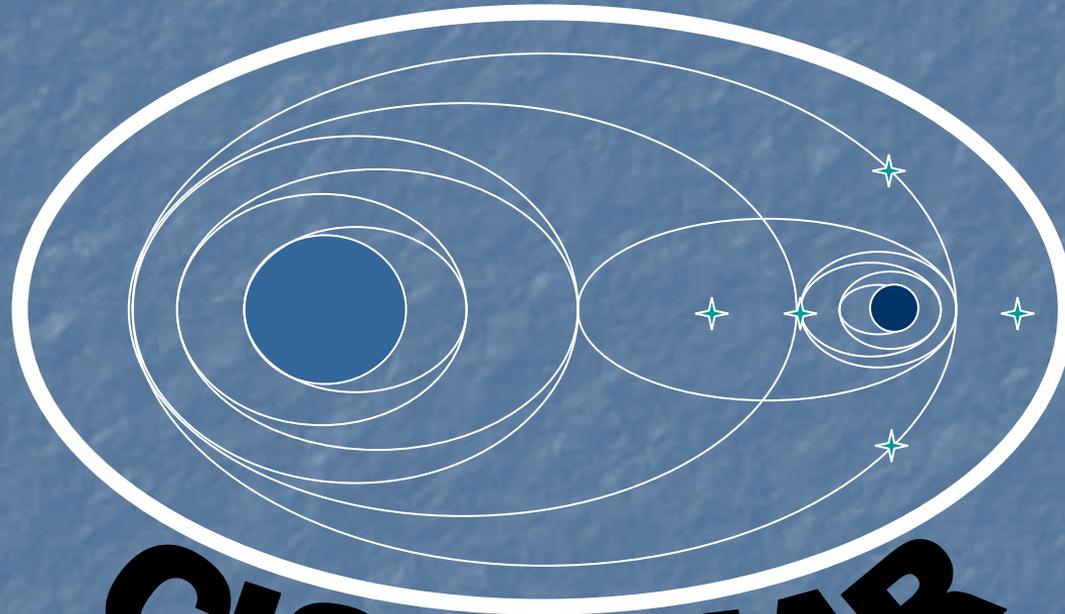


Spacefaring

- **Spacefaring:** *Doing something in space.*
 - **Spacefaring Activities:** *Those activities conducted in space*
 - **Spacefaring Actor:** *Any actor engaged in space activities; state, or non-state.*
 - **Space Industrial Base:** *Includes those elements of industry and education that contribute to spacefaring.” (NSSO)*



Cislunar Region

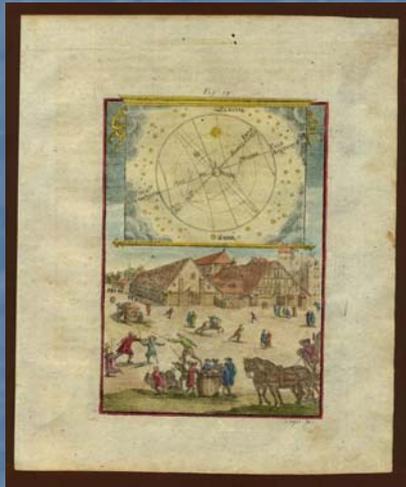


CISLUNAR

This theory focuses primarily on the earth-moon system in a 50 year time frame...it does not preclude consideration of deep space activities.

Cosmography

Describing the Earth



Describing the Heavens



Fig. 194.—Whale-Fishing.—Fac-simile of a Woodcut in the "Cosmographie Universelle" or Thevet, in folio: Paris, 1574.

Describing human activity



Defining Spacepower

- **Space:** *Space begins at the lowest perigee of an orbiting satellite, about 93 miles beyond Earth's surface. (Laymance)*
- **Power:** *The ability to effect the outcomes you want, and if necessary, to change the behavior of others to make this happen. (Nye)*
- **Spacepower:** *The ability to use space to get desired outcomes by influencing the environment and the behavior of others.*
- **Spacefaring Actor:** *Any actor engaged in space activities; state, or non-state.*
- **Cislunar Region:** *The region in space encompassing the Earth-Moon system.*
- **Cosmography:** *A general description of the world or of the universe.*

Spacepower has its own grammar, but not its own logic (Gray). The vocabulary of spacepower will grow and evolve with experience over time.



Describing Spacepower



Spacepower is shaped by:

- ***Physical properties:*** Cosmography, astrodynamics, and astrophysics
- ***Technology:*** Financial, material, and industrial resources
- ***Culture :*** Popular support, well educated technical culture, strategic culture or national style
- ***Politics:*** Long term political will, external motivation, security needs
- ***Governance:*** Treaties, laws (domestic and international), regimes, partnerships etc...



A variety of perspectives

- **Space exploration**: Destiny focused
- **Space science**: Discovery focused
- **Space security**: Threat focused
- **Space economics**: Profit focused
- **Environmental security**: Survival focused
- **Search for life intelligence**: Awareness focused



Space as a place

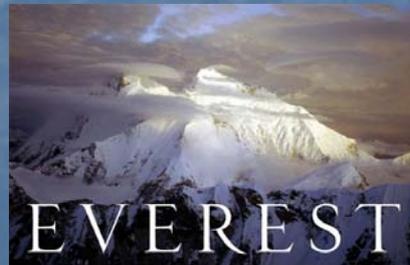
Scott Pace's Organizing Questions

**Not
commercially
sustainable**



**We can live off
the land**

**We can't live
off the land**



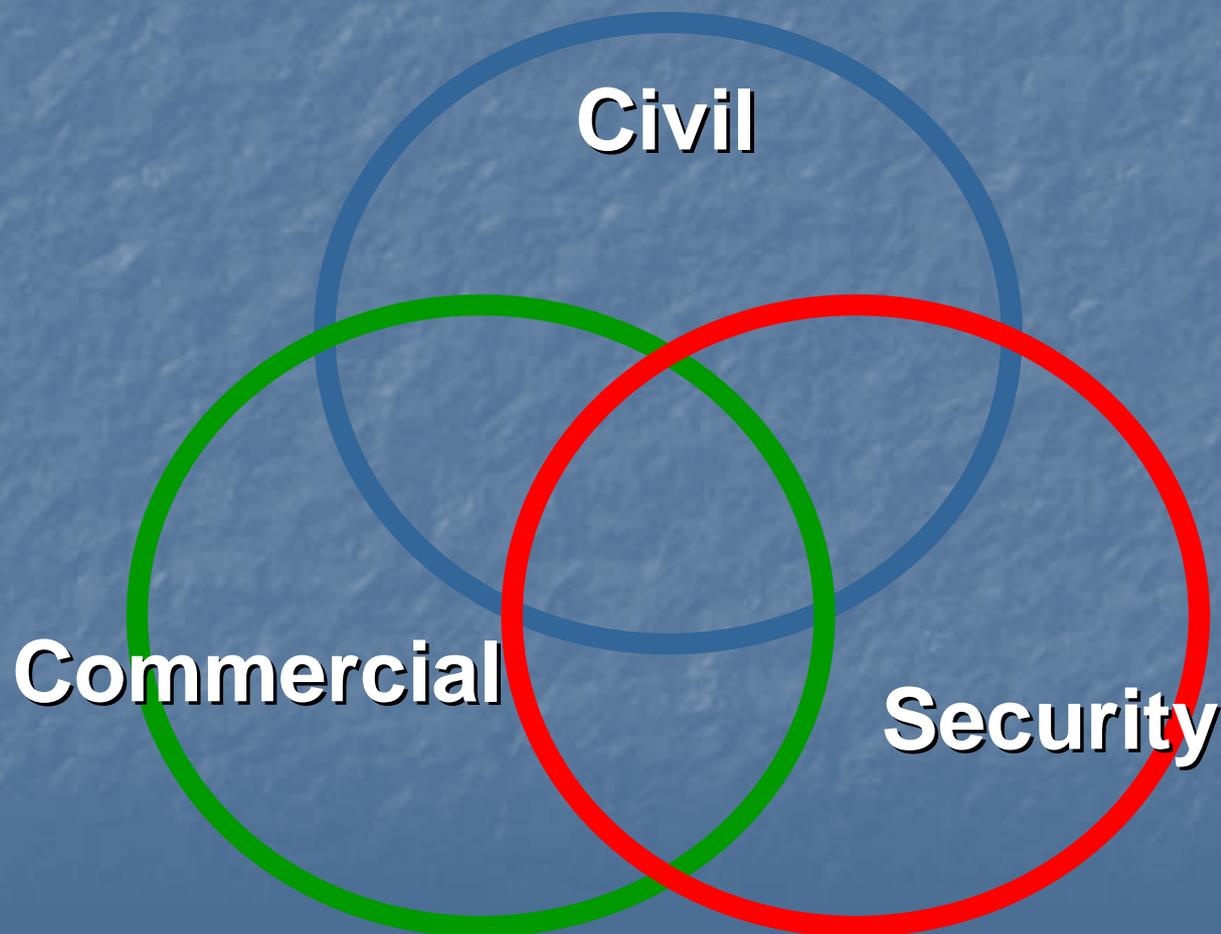
**Commercially
sustainable**





Building Blocks of Spacepower

Space Sectors

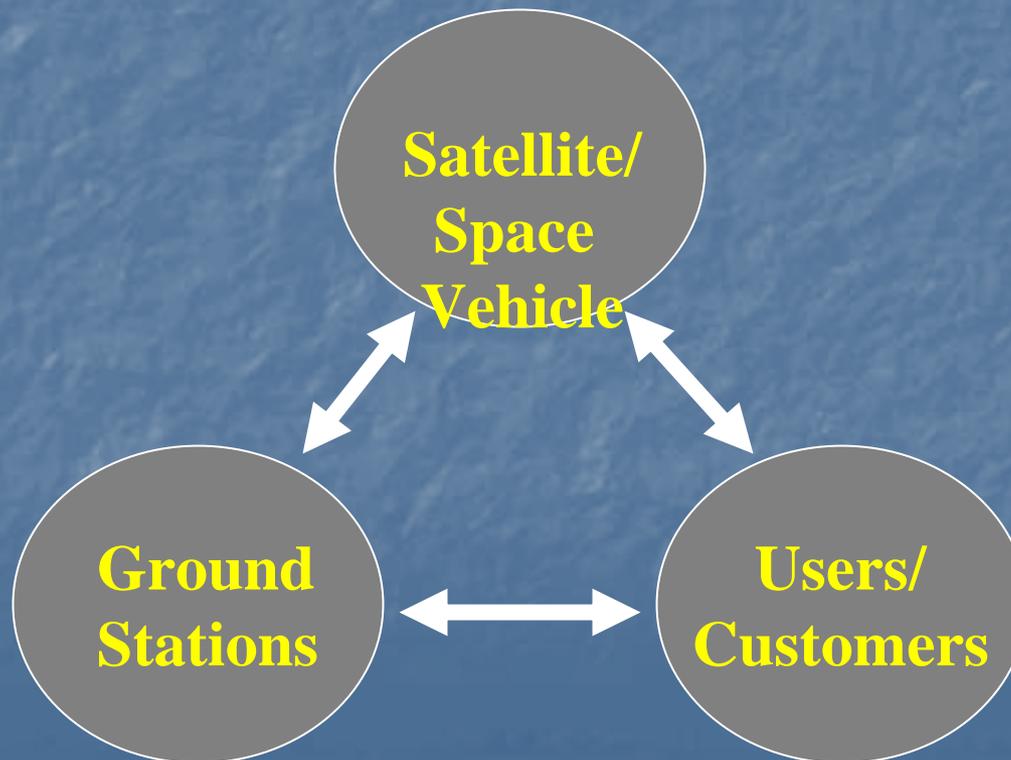




Building Blocks of Spacepower

Space System Segments

- No satellites = no spacepower
- No users = no spacepower
- No spectrum = no spacepower *today*





Describing Spacepower

ASSUMPTION:

Space is a unique operating environment

PRINCIPLES:

1. Spacepower may be distinct from power derived in other media
2. Spacepower is contextual, but some elements are universal
3. Spacepower is shaped by physical properties, technology, culture, politics, and governance
4. All terrestrial actors can be influenced by events in space

PROPOSITIONS:

1. Spacefaring actors have a distinct style toward spacepower
2. The importance of spacepower will grow over time

Actors have reasons for going to space and conditions that shape their choices



The Political Power of Space



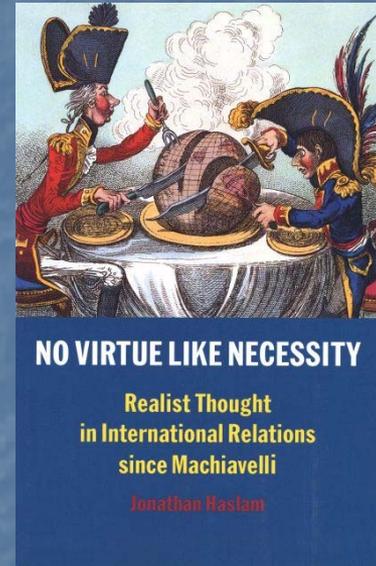
Perspectives in the International System



Liberal
Internationalism



Constructivism



Realism



Cooperation, Competition and Conflict

- **Socio-cultural**: Improving the human condition
 - **Cooperation**, Competition, Conflict

- **Economic**: Generating wealth
 - Cooperation, **Competition**, Conflict

- **Military**: Providing security
 - Cooperation, Competition, **Conflict**

Cooperation, competition and conflict exist in varying degrees in every context of human activity.



The Politics of Spacepower

ASSUMPTIONS:

1. Nation-states will remain the primary actors in the international system, but power will diffuse to a growing and diverse set of non-state actors.

PRINCIPLES:

1. Spacefaring actors primarily pursue their own interests in space.
2. Spacepower enables both hard and soft power.
3. Space activity reflects both human aspirations and needs.

PROPOSITIONS:

1. Actors will compete in space to gain advantage.
2. Nations, societies and groups will use space to advance their culture and values.

Spacepower incorporates an evolving set of cultural, political, and economic relationships among terrestrial and spacefaring actors.



The Economic Power of Space



Thomas Friedman: *Globalization is “the overarching international system shaping the domestic politics and foreign relations of virtually every country”*

Robert Reich: *“Technology and globalization are often discussed as separate trends, but they are becoming one and the same.”*

Space applications are fundamental, though often transparent, in a globalizing world
– Jim Vedda



Economic Activity in the Current Age

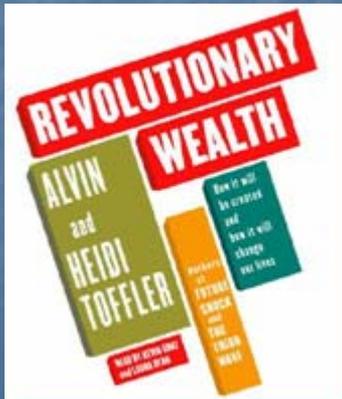
- **Key characteristics of spacefaring activity:** R&D and the mastery of new technology; economies of scope; dual nature of technology; long gestation and durability of space assets; long value-added chain; economies of scale downstream
- **Commercial space segments:**
 - **Upstream (space providers):** Launchers and launching services; satellite manufacturing; ground segments; space insurance
 - **Downstream (space users):** Satellite telecommunications; Global positioning and navigation; earth observation
- **Trends and Obstacles to future economic development**
 - **Merchants and Guardians:** Security concerns
 - **Market retrenchment:** Exits from industry; consolidation; tapping new markets; restructuring downstream
 - **Institutional and regulatory obstacles:** Market access restrictions; procurement policies; export control and investment restrictions; spectrum allocation problems; government investment; legal and regulatory constraints; measurement problems



Creating Wealth in the Next Space Age

- **Extensions of current applications:** Telecommunications; earth observation; position, navigation, and timing (PNT)
- **New applications**
 - **Space production:** In-orbit servicing; in-orbit manufacturing; energy; extraterrestrial mining
 - **Space tourism/adventure**

“What will be remembered about our lifetime one thousand years from today? They will look at our society as primitive and stupid and ignorant. **But one thing they will remember is that we are the first society in human history to create wealth beyond our planet.** I believe the next generation or two will see enormous increases in human activities in space. Combined with other changes, you will have a Fourth Wave society.”



-- Alvin Toffler



The Economic Power of Space

ASSUMPTIONS:

1. Globalization will continue, although major disruptions could retard its progress.
2. Open markets will remain the dominant feature of the global economic system.

PRINCIPLES:

1. Spacepower enables globalization
2. Spacepower provides access to new markets & resources and increases the speed of transactions
3. Spacepower provides direct and indirect economic benefits to non-spacefaring actors as well as spacefaring actors

PROPOSITIONS:

1. Technological advances will lower the costs of spacefaring over time
2. Space will become a venue for economic competition
3. Space will provide maximal economic benefit to those who exploit it first (and compete best)

Economic factors will be the dominant driver of the next space age.



Spacepower and the Common Welfare of Mankind

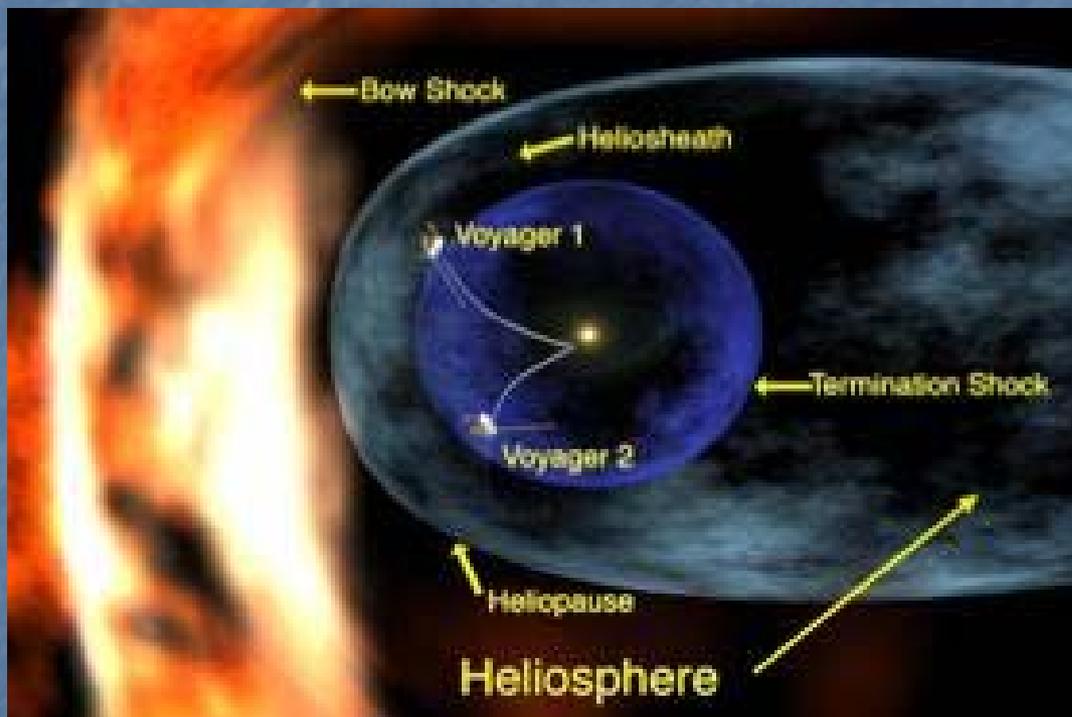


Societal Benefits of Space Activity

- Environmental and ecological
- Energy and resources
- Technology spin-offs

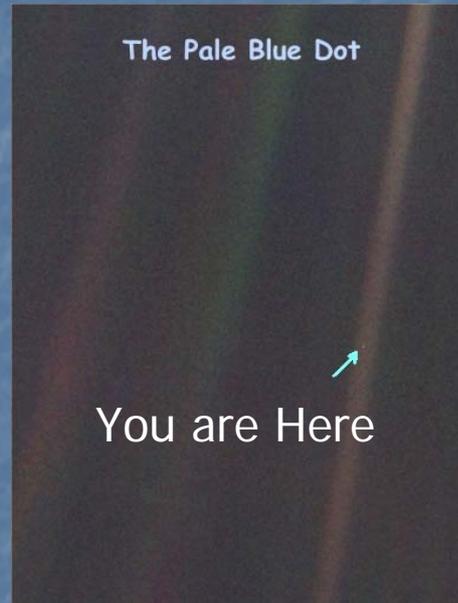


The Final Frontier?





The Frail Blue Dot



Since, in the long run, every planetary society will be endangered by impacts from space, every surviving civilization is obliged to become spacefaring—not because of exploratory or romantic zeal, but for the most practical reason imaginable: staying alive.

Carl Sagan



Space and Human Welfare

ASSUMPTIONS:

1. Global and societal challenges will increase, and individual states will be unable to address them on their own.
2. The Earth will eventually be destroyed.
3. The ultimate human motivation is survival of the species.

PRINCIPLES:

1. Spacepower provides benefits for all of mankind.
2. Spacefaring provides an opportunity for the survival of the human race.

PROPOSITIONS:

1. State and non-state actors will cooperate in space to address global problems

**Cooperation among spacefaring actors provides
common benefit to all of mankind**



Space and Security



Beware of Metaphors

- Is space like:

Airpower?



Seapower?



Landpower?



Security spacepower is not in its infancy, it is simply evolving into something different than air, land and seapower.



National Security Space

- ***Soft Power - Security through:***
 - *Transparency:* Intelligence and warning from space
 - *Stability:* Deterrence and dissuasion from space
 - *Cooperative Activities*

- ***Hard power – Military Uses of Space***
 - Enabler of terrestrial warfare
 - Defensive aspects of spacepower (protection)
 - Offensive aspects of spacepower (negation)
 - The missions of military spacepower
 - Military space forces

Global war prevention and worldwide force enabler



The Mission of Security Space

- Space assets have become an economic, cultural, and military *center of gravity*—more so for technocentric societies.
- Space capabilities demand protection commensurate with the degree of reliance upon them.
- The primary mission of security spacepower is **to prevent wars and global conflict.**
 - Soft power
 - Shared transparency & confidence building
 - Broad cooperative partnerships
 - Close space support of diplomacy
 - Hard power
 - Dissuasion/Deterrence calculus
 - Increase cost to benefit ratio for rogues



Security Spacepower



General Carl Von Clausewitz

- Security spacepower is one more set of tools for policy
- “War is a unity” that requires full integration of tools
- But the classical theorists limited their discussion only to war
- *Peace is a unity, too*



Protecting Space Capabilities

- On Orbit Defenses
 - Passive
 - Encryption
 - Hardening
 - Redundancy
 - Maneuver
 - Active (on-board or off)
 - KEW
 - DEW
 - Decoys
 - Chaff
 - Flares
 - Kites
 - Towed
- Terrestrial infrastructure & network defenses



- **Survivable**
- **Endurable**
- **Recoverable**
- **Non-Recoverable**

Best Defensive Strategy:

- **Broad partnering on space systems**
- **Widely sharing data**
- **Distributed small satellite architectures**

Ubiquitous and interdependent

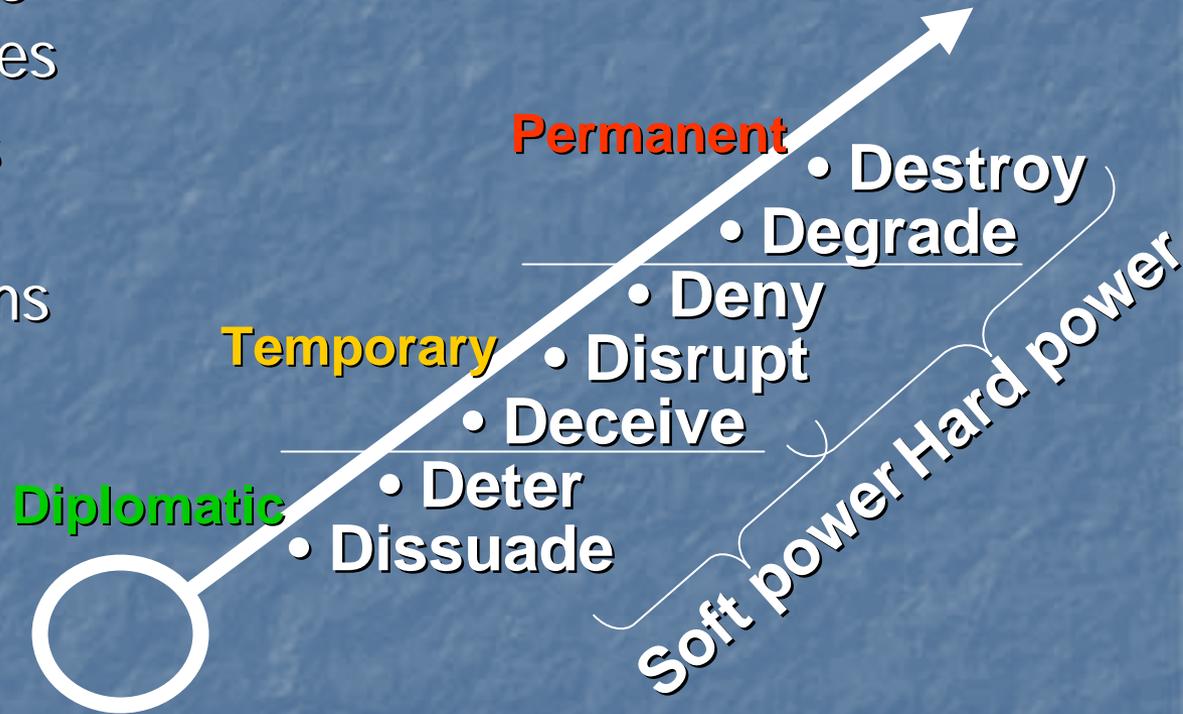


Negating Space Capabilities

- Easier to negate than to protect space capabilities
- Spacefaring near-peers will seek to negate adversary space systems ASAP and keep them down—increase fog & friction

Negation Methods:

- Jamming
- Permanent Negation
- Reversible Negation





Space Superiority?

- **Space superiority** is the relative ability to **protect freedom of action** in space (defend satellites), but it also requires the ability to **deny freedom of action** in space to hostile actors who would exploit space for military purpose (attack satellites).
- All with a sense of proportionality and IAW Article V's stance on an inherent right of self defense



Security Spacepower in Conflict

Should conflict prevention fail, the **priority mission** of security spacepower becomes **securing relative space superiority** over hostile foes so it can **provide close space support** to terrestrial forces engaged in theater combat—*all the while sustaining its global mission of war and conflict prevention everywhere else on the globe.*

Critical Proposition: If true, has great implications for a nation's spacepower strategy and development of its capabilities



Weapons in Space?

- A **policy decision**, not a theoretical principle
- However:
 - Earth-to-Space weapons already exist
 - Surface-to surface weapons already travel through space (IRBMs and ICBMs)
 - Space-to-Earth weapons are unlikely due to cost, complexity, and vulnerability
 - Space-to-space weapons are most likely if space is weaponized



Limitations of Security Spacepower

- Fragility of space assets
- Cost
- Technology and physical limitations
- Vulnerability to detection
- Premature legal regimes
- Misunderstood by policy-makers



Space and National Security

ASSUMPTION:

The nature of military conflict will remain the same, however it will vary in form

PRINCIPLE:

The application of military spacepower has meaning only if serving the ends of policy

PROPOSITION:

1. Offense is the stronger form of warfare in space
2. Security spacefaring is driven by the security dilemma



Towards the Next Space Age



Towards the Next Space Age

The next space age can be anticipated in character...the timing cannot



The Evolution of the Space Ages

	FIRST SPACE AGE (COLD WAR)	SECOND SPACE AGE (Post COLD WAR – PRESENT)	THIRD SPACE AGE (SPECULATIVE)
SIGNALING EVENT	-Sputnik 1957	-Collapse of the USSR in 1991	-War extended to space? -Space arms race? -Settlements in space? -Harvesting space resources?
GEOPOLITICAL POLARITY	-Bi-polar	-Temporary U.S. hegemony -Rise of counter-balancing powers	-Multi-polar
SPACE-ENABLED ACTORS	-Few	-Many	-ALL
KEY SPACEFARERS	-US -USSR	-US -EU -Emerging China -Resurgent Russia -Commercial venders	-China -US -EU -Russia -India -Commercial venders



The Evolution of the Space Ages

	FIRST SPACE AGE (COLD WAR)	SECOND SPACE AGE (Post COLD WAR – PRESENT)	THIRD SPACE AGE (SPECULATIVE)
SATELLITE OWNERS	– Mostly single states	–Some single states –Some multi-national consortia	–Mostly multi-national consortia –Some single states
EMPHASIS ON SECTORS	<ol style="list-style-type: none"> 1. Civil 2. Security 3. Commercial 	<ol style="list-style-type: none"> 1. Security 2. Commercial 3. Civil 	<ol style="list-style-type: none"> 1. Commercial 2. Security 3. Civil
ARCHITECTURES	<ul style="list-style-type: none"> –A few large, single-purpose capital satellites –Single-purpose satellites 	<ul style="list-style-type: none"> –Large, multi-purpose capital satellites augmented by some smaller satellites 	<ul style="list-style-type: none"> –Larger, more distributed constellations of smaller satellites augmented by some larger satellites –Single-purpose satellites –Rapid reconstitution
STATE DRIVERS	–Geopolitical	–Geopolitical –Economic	–Cosmological –Economic



The Evolution of the Space Ages

	FIRST SPACE AGE (COLD WAR)	SECOND SPACE AGE (Post COLD WAR – PRESENT)	THIRD SPACE AGE (SPECULATIVE)
SECURITY SECTOR FOCUS	<ul style="list-style-type: none"> -Intelligence/ISR <ul style="list-style-type: none"> -Reduce fog -Increase transparency -Treaty compliance 	<ul style="list-style-type: none"> -The aforementioned -Force enhancement: <ul style="list-style-type: none"> -Reduce friction -Integrate terrestrial forces -Informationalization of warfare -Leverage off of commercial sector 	<ul style="list-style-type: none"> -The aforementioned -Force application? <ul style="list-style-type: none"> -Defensive systems -Offensive systems -Coercion including deterrence and compellance from space -Mercenary space forces?
COMMERCIAL SECTOR FOCUS	<ul style="list-style-type: none"> -Communications 	<ul style="list-style-type: none"> -Communications -ISR -Tourism on orbit 	<ul style="list-style-type: none"> -Communications -ISR -PNT -Resource harvesting -Tourism on Moon/Mars -Services to settlers
CIVIL SECTOR FOCUS	<ul style="list-style-type: none"> -Manned Exploration -Race to the Moon -Shuttle 	<ul style="list-style-type: none"> -Manned Research -Space Station -Renewed Interest in the Moon 	<ul style="list-style-type: none"> -Revisit the Moon -Robotic Exploration -Research to reduce commercial risk



Implications for the United States



Alternative Futures for Spacepower

- Future scenarios will be used to test the principles and propositions of the theory and derive implications for the United States:
 - **NIC 2020**: Mapping the Global Future
 - *Davos World*
 - *Pax Americana*
 - *Islamic Caliphate*
 - *Pervasive Insecurity*
 - **OECD 2030**
 - *Beggar thy Neighbor*: unilateralist U.S.
 - *Ad Astra*: multilateral approaches
 - *Eastern Star Rising*: China-centric



Concluding Thoughts



Why Do Humans Go To Space?

- *Peace and Stability*
- *Prestige*
- *Prosperity*
- *Preservation and Advancement of Mankind*

