
The Strategy of Responsive Space: Assured Access to Space Revisited

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Outline

- Overview
- The Strategy of Responsive Space
- Space Capabilities
 - Commercial
 - Military
 - Homeland Security
- Strategy
 - Sun Tzu
 - Mahan & Corbett
 - Boyd
- Bring it together / Determining what is needed
- Summary

Strategy of Responsive Space

- **Responsive Space** is the ability to put a satellite payload into orbit shortly after making the decision to launch. It includes the ability to replace failed satellites quickly, to re-attempt a launch after an aborted try, and to respond to operational requirements to satisfy national security interests.

Strategy of Responsive Space (2)

- **Make space systems less vulnerable**
 - **Not from harder systems or active countermeasures, but through ubiquity.**
 - **Push satellites to become less expensive and lighter**
 - **Launch services become more versatile and responsive**
 - **Satellite operations become faster and more flexible.**
 - **Satellites also become less vulnerable because damage or shortfalls can be replaced on short notice**
 - **Supplementary capability is always available.**

Strategy of Responsive Space (3)

Enabled capabilities:

- **Rapid and continuous battlefield intelligence**
 - **Quick replacement of failed or damaged satellites/restoration of services**
 - **Supplemental communications to handle short-term overload**
 - **Ground-based, rather than space-based spares for communications constellations**
 - **Scientific observation of transient phenomena**
 - **Educational payloads launched while the student is still a student**
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Critical Infrastructure

- *So vital that their incapacity or destruction would have a debilitating impact on our defense and economic security*
- *Foundation for creating the wealth of our nation and our quality of life*
- *Fundamental to development and projection of the military power*

NOT IRREPLACEABLE, BUT COSTLY AND NEED LOTS OF TIME TO REPLACE

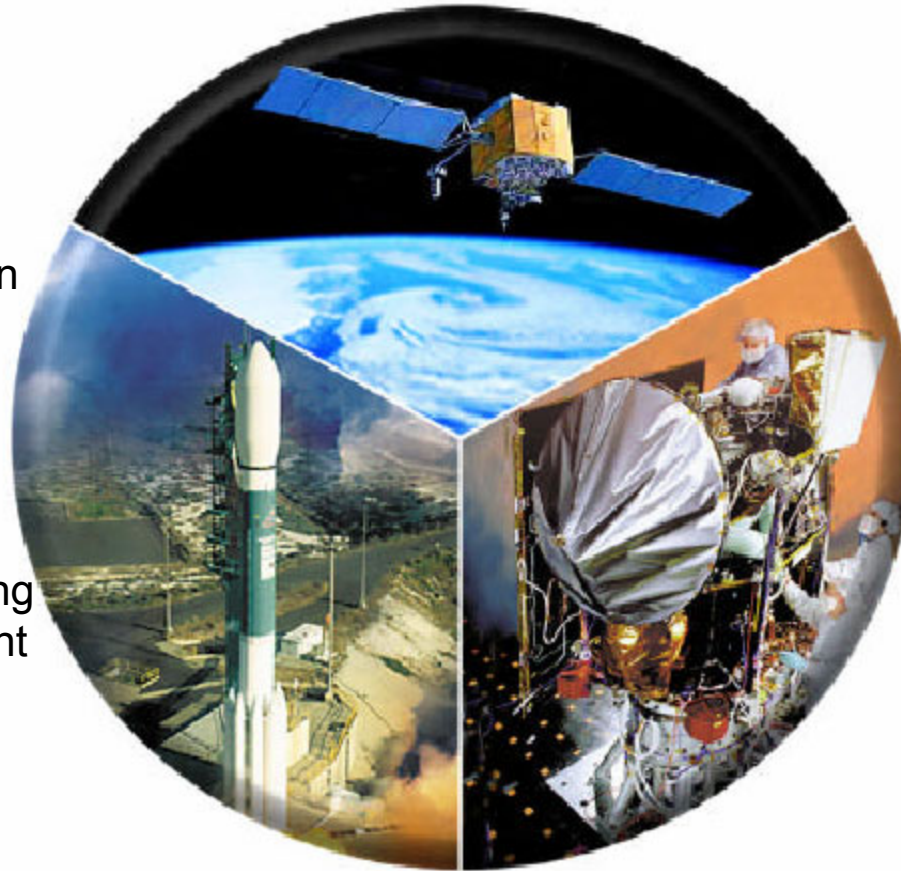
Satellite Industry Capabilities*

Communications

- Wireless Networks
- Telephony
- Messaging
- Satellite Phones
- Internet Backbone
- VSATs
- Credit Card Validation
- National Communications System

Remote Sensing

- Oil Pipeline Monitoring
- Railroad Management
- Land Management
- Environmental Monitoring
- Urban Planning
- Infrastructure Management
- Flood & Storm Warning



Satellite Navigation

- Positioning
- Time Synchronization
- Mapping
- Search & Rescue
- Air Traffic Control
- Asset Tracking
- Automated Farming

Broadband

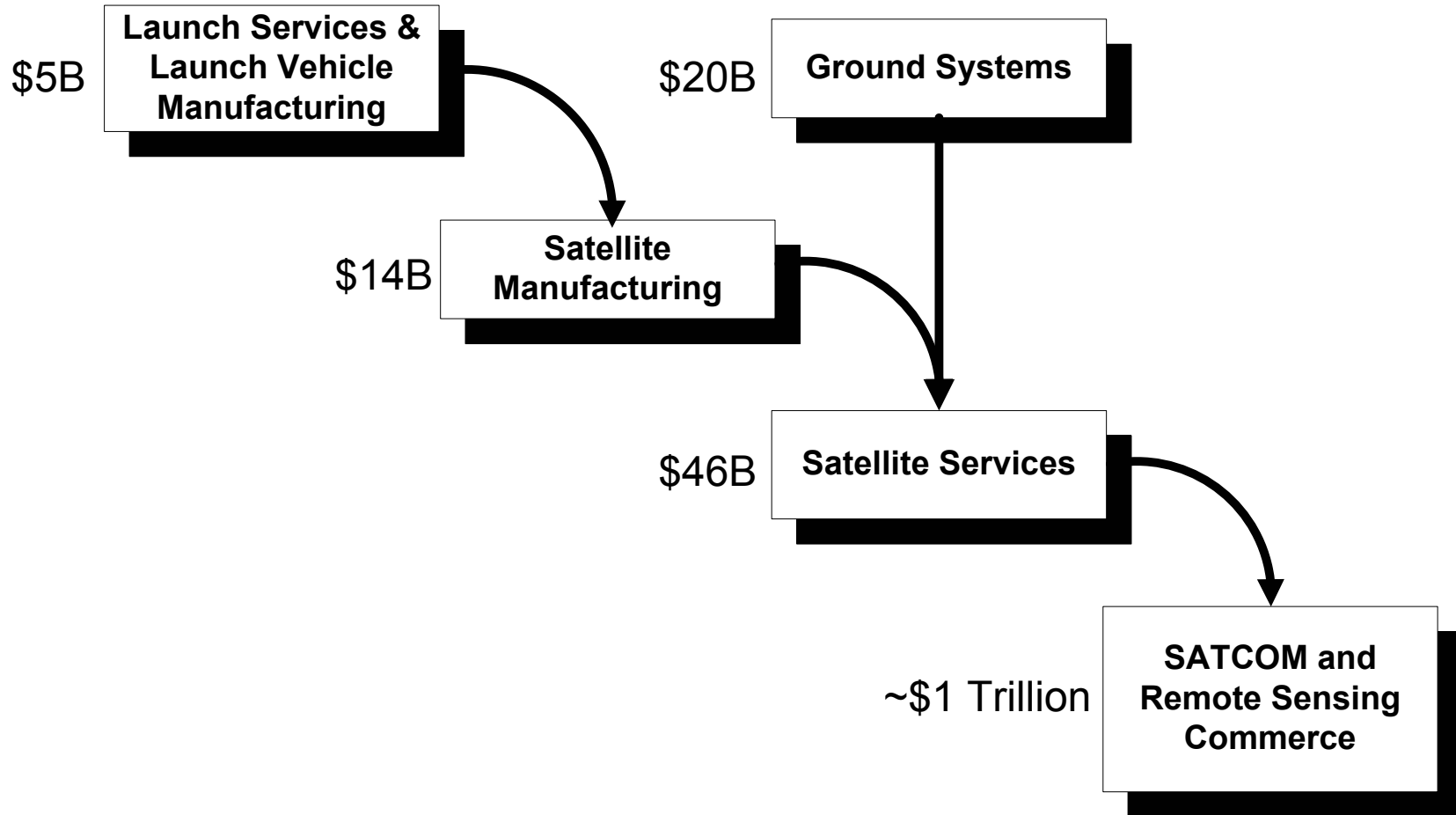
- Telemedicine
- Distance Learning
- Internet
- Videoconferencing

DBS/DARS

- Satellite TV & Radio
- Broadcast & Cable Relay
- Emergency Broadcast System

*Source: Satellite Industry Association's 2001-2002 Satellite Industry Indicators Survey

Satellite Related Revenues*



*Revenue Figures for CY2001

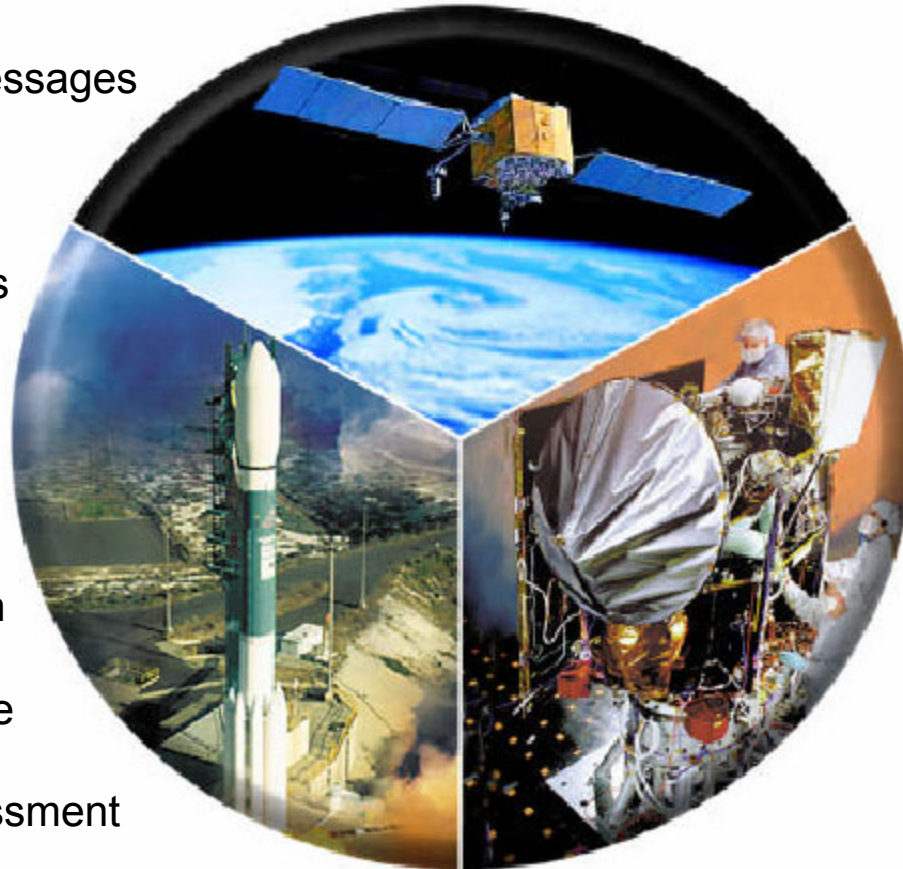
Military Satellite Capabilities

Communications

- Emergency Action Messages
- Command & Control
- UAV
- GBS
- Fleet Communications
- Tactical Comm

ISR

- Intelligence Collection
- Treaty Monitoring
- Enemy Order of Battle
- Target Identification
- Bomb Damage Assessment



Satellite Navigation

- Positioning
- Time Synchronization
- Mapping
- Blue Force Tracking
- Search & Rescue
- Air Traffic Control

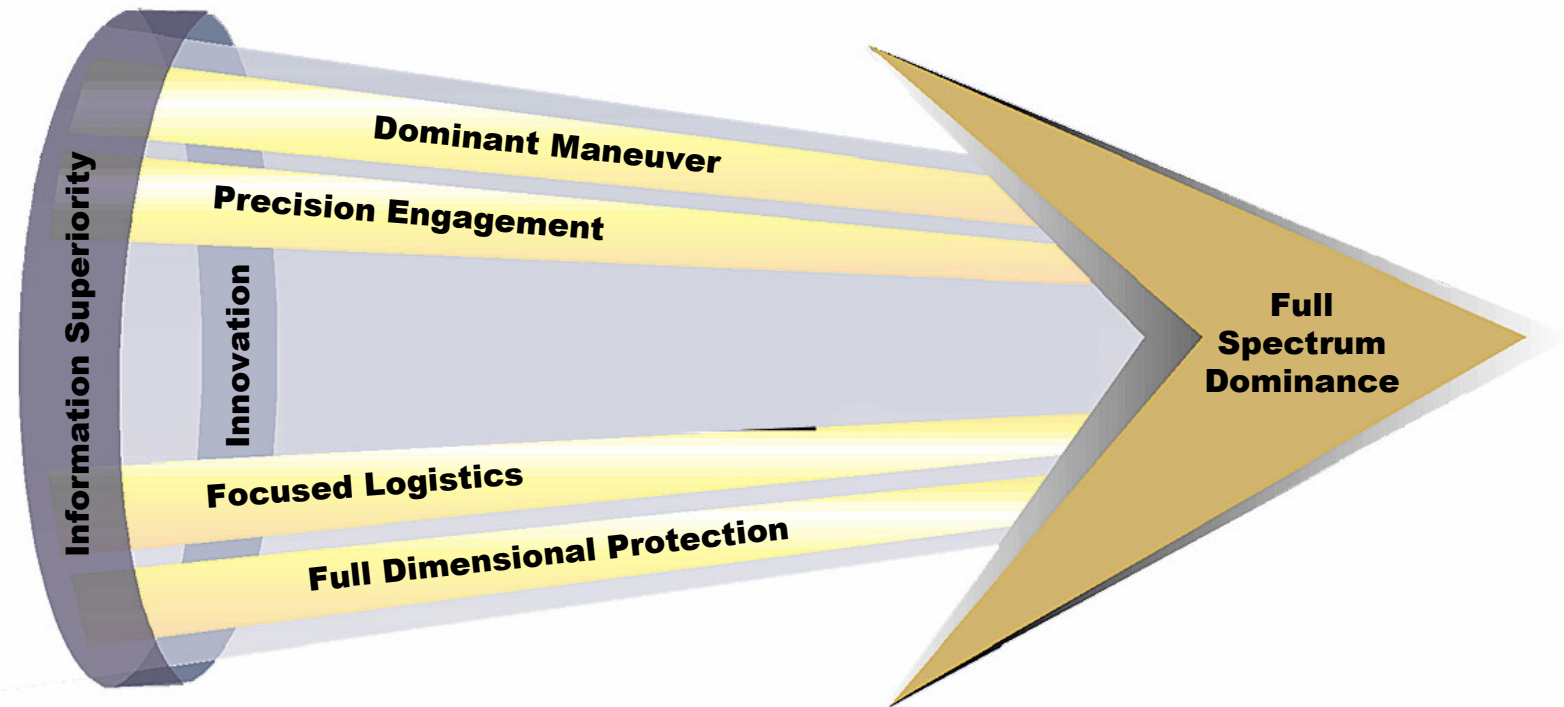
Meteorology

- Battlespace Conditions

Missile Warning

- Attack Warning
- Tracking and Cueing
- Launch site location
- Impact location

Joint Vision 2020



Dedicated individuals and innovative organizations transforming the joint force for the 21st Century to achieve **full spectrum dominance** :

- persuasive in peace
- decisive in war
- preeminent in any form of conflict

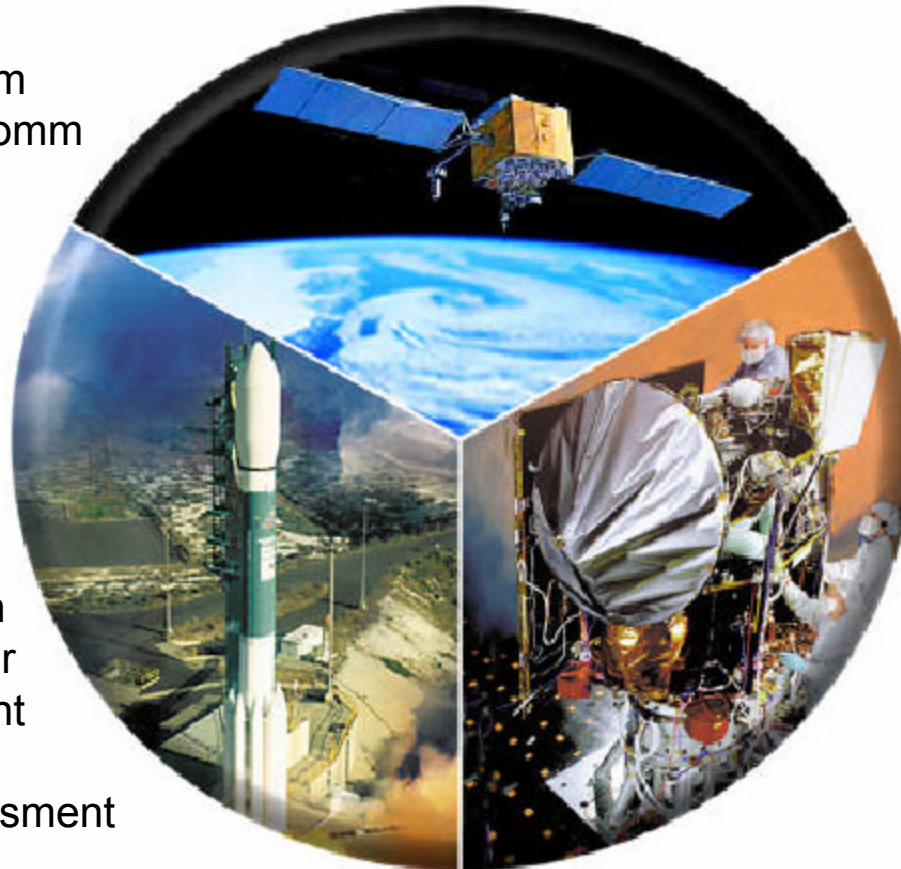
Homeland Security Capabilities (emerging)

Communications

- First Responder Comm
- Disaster Response Comm
- Air Traffic Control

ISR

- Intelligence Collection
- Flood/Natural Disaster Prediction/Assessment
- Threat Tracking
- Crisis Damage Assessment



Satellite Navigation

- Positioning
- Time Synchronization
- Mapping
- Asset Tracking
- Search & Rescue

Meteorology

- Flood/Natural Disaster Analysis

Strategy – Sun Tzu

- Difficult Ground

"Ground to which access is constricted, where the way out is tortuous, and where a small enemy force can strike my larger one is called *encircled*."

- Geographical and political considerations restricts choice of launch site

- Choice of site restricts operations, limits payload weight

Kennedy Space Center

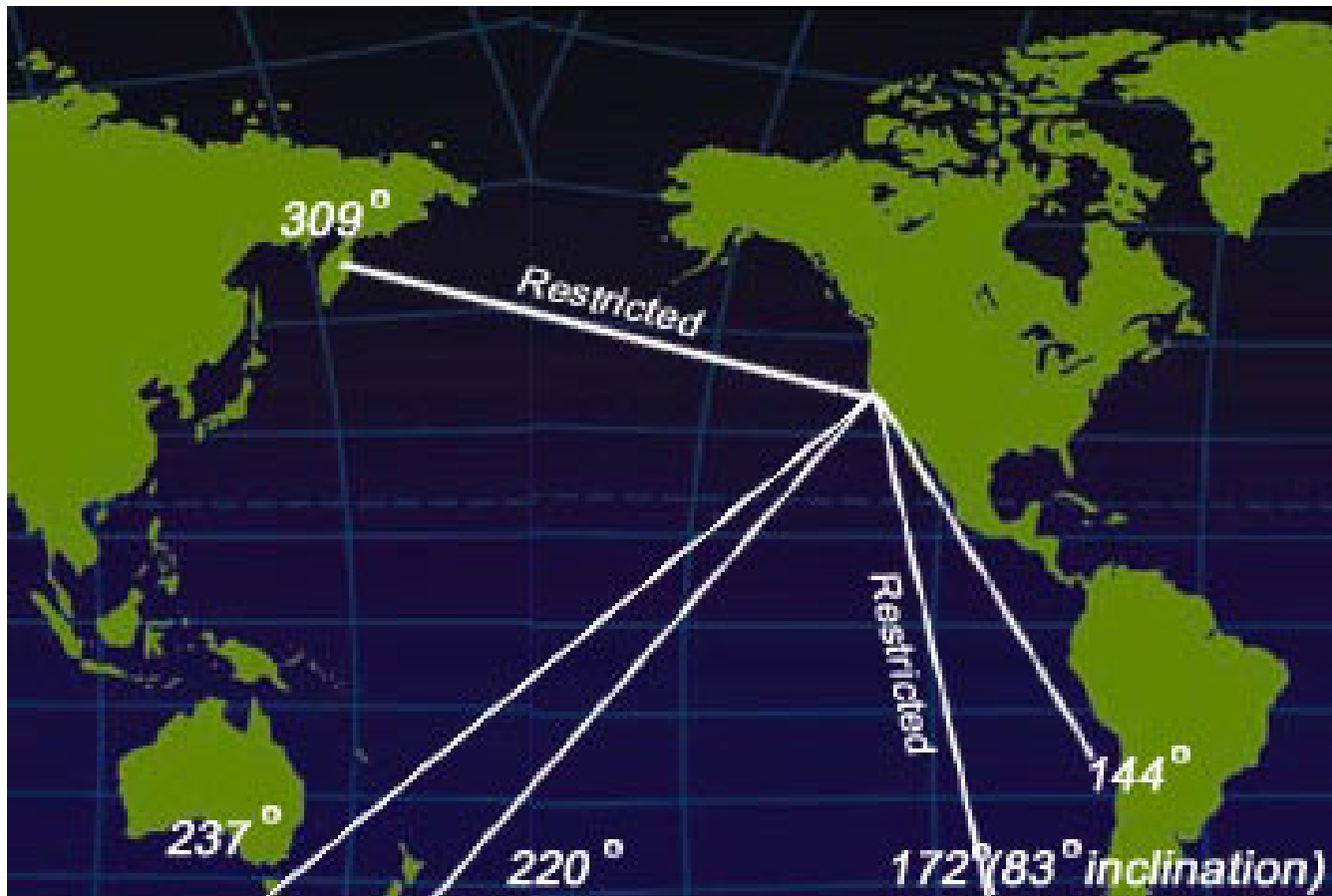
Azimuth Restrictions



Graphic courtesy of Courtney Semmes

Vandenberg AFB Launch Site

Azimuth Restrictions



Graphic courtesy of Courtney Semmes

Israel Launch Site Azimuth Restriction



Graphic courtesy of Dr Anthony Curtis and Space Today Online

Mahan and Corbett

- Both – ports and choke points are key to controlling the sea
- Mahan – Force a decisive battle and destroy the enemy fleet
- Corbett – Even total command of the sea doesn't provide total invulnerability
 - An enemy can achieve temporary, local command of the sea
 - Overcome attacks on commerce through economic strength; a robust and proliferated trading system ensures continued commerce and that any damage would be of minor importance

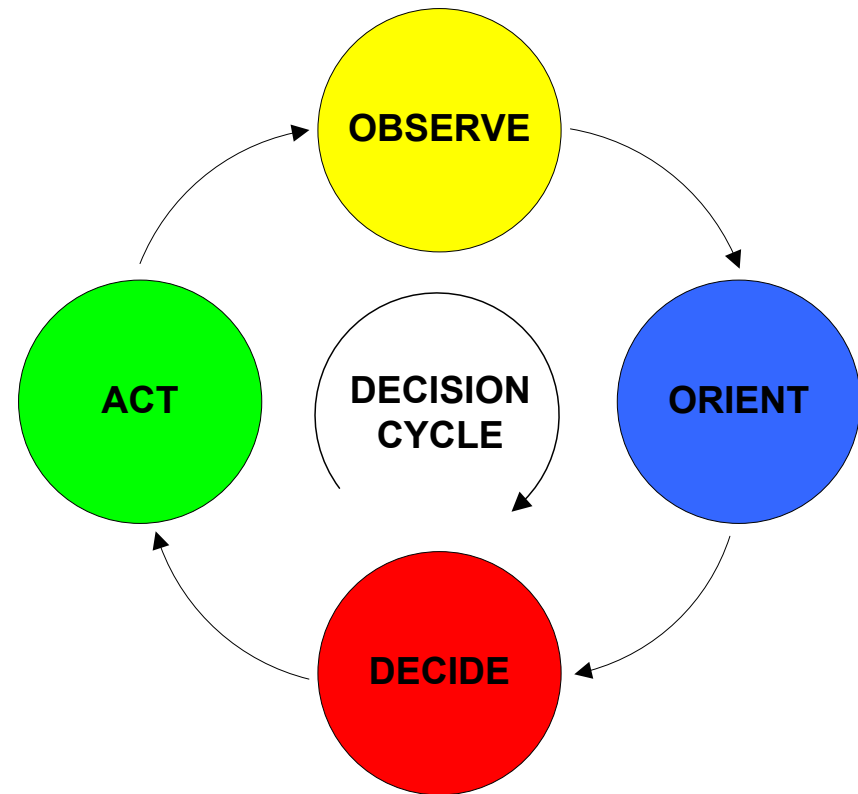
Launch and Antipode Choke Points



Graphic courtesy of Air & Space Power Journal

Boyd's OODA Loop

- Operating inside" an adversary's OODA loop or inside his decision cycle
"[g]enerate[s] uncertainty, confusion, disorder, panic, chaos ... Shatter[s] cohesion, produces paralysis and brings about collapse
- Satellites key to US' OODA s
- Portrays satellites as simply *another port or hub*.
- The "ship at sea" is the data transiting the satellite hub.
- View satellites as network



Bringing it together

- Critical Infrastructure vulnerable
 - In orbit
 - On the pad and going into orbit
 - Unexpected malfunctions/space debris/space weather
 - Commerce Raiding
 - Jamming/Nanosatellites
 - High Altitude Nuke
 - Short Term Losses
 - Longer Term Losses
 - Spares stay on the ground until needed, launched on demand
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Bringing it together (2)

Space Weapons

- Stay on ground until needed, remain in pristine condition and available for upgrades/maintenance
- Side steps weapons-in-space argument
- Space weapons stay on the ground until adversary violates “sanctity” of space
- Pursuit squadron or Coast Guard/Life Guard model

Determining what is needed

- Inexpensive launch – key to developing smaller ubiquitous spacecraft
 - Add additional emphasis to National Aerospace Initiative
 - Reusable and low cost launch
 - Launch infrastructure upgrades/modernization
 - Mobile launch operations – Pegasus, Sea Launch, Pioneer Rocketplane, etc
 - Small, inexpensive spacecraft – rapidly reconfigurable
 - Assembly line construction ala Motorola/Iridium
 - Rapid on-orbit checkout
 - Operational procedures, exercises
 - Respond to Corbett’s admonition: achieve invulnerability through economic strength - proliferated networked satellites reduce vulnerability of services
 - **Need emphasis and commitment to an accelerated NAI**
 - **Need policy and oversight focus in OSD – USD(SII)**
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Summary

- Responsive Space - “ensuring the delivery of the right equipment, supplies, and personnel in the right quantities, in the right place, and at the right time to support operational objectives
- Less expensive smaller launch vehicles and satellites
- Provides supplemental satellites and space control capabilities on the ground, not in orbit
- Need NAI sooner, more XSS type experiments, need reconfigurable satellites
- USD (SII)
- Ubiquity provides ability to overcome attacks on commerce through economic strength