Hosted Payload Lessons

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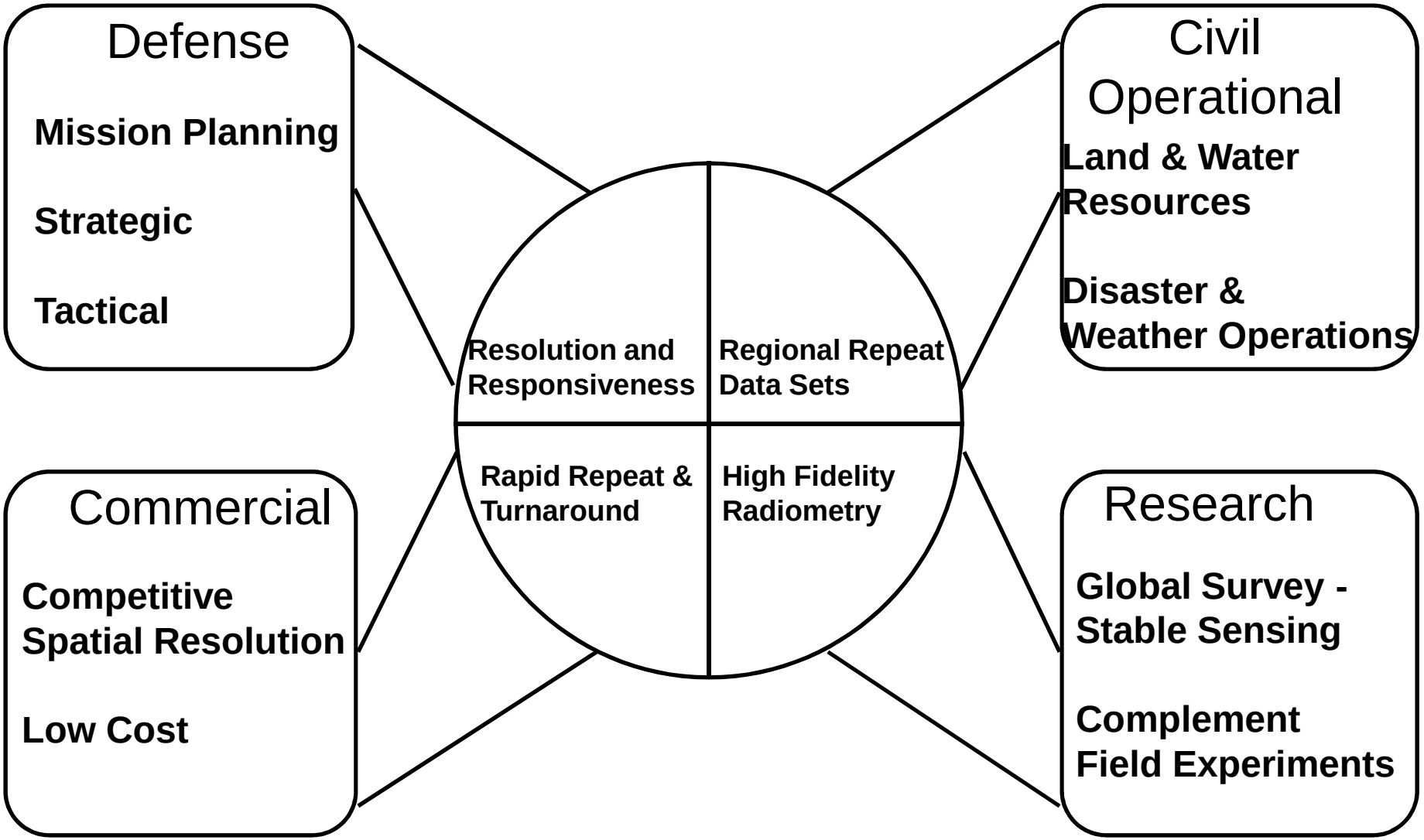
Abstract

- Commercial satellites can host remote sensing at dramatically lower cost than dedicated missions
- Air Force's Commercially Hosted Infrared Payload (CHIRP) to demonstrate commercially hosted geostationary remote-sensing this year*
- CHIRP, in S/C I&T, is confirming advantages of commercial hosting & providing lessons to mitigate real & perceived disadvantages relative to dedicated missions
- This poster focuses on hosted payload lessons

*Brinton, Turner, "Industry Banking on Market for Hosted Payloads," *Space News*, 6 October 2008

GEO Addresses Requirements

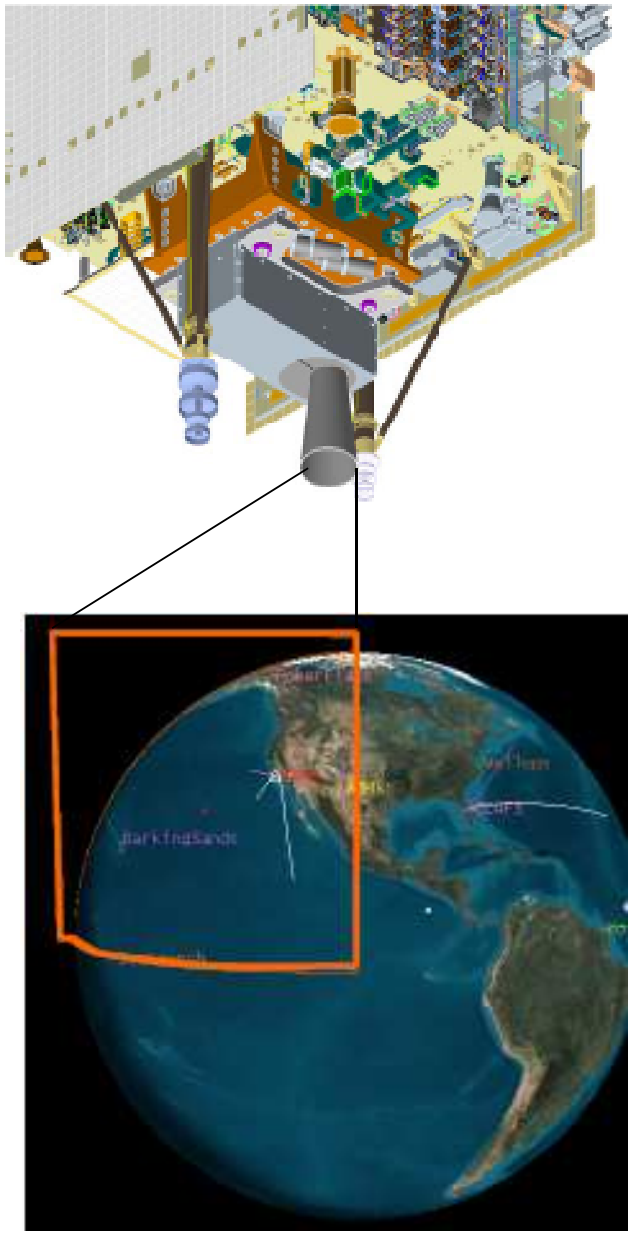


Many GEO Hosted Payload Applications

- Inter-Satellite Communication Links
- Military UHF SATCOM Augmentation
- Missile Warning
- Prototype Technology Demonstrations
- Space Environmental Sensors
- Space Situation Awareness
- Science Experiments
- Weather Sensors

CHIRP Example

- **Commercially Hosted Infrared Payload (CHIRP), US Air Force experiment CY-2011**
- **Gary Payton, USAF, Oct 2008 (Brinton): "The deal…was fantastic…a fourth-of-world view at geo & a year…of data…for less than the cost of a launch vehicle."**
- **US DOC Office of Space Commercialization (http://www.space.commerce.gov/general/commercialpurchase/hostedpayloads.shtml): "Air Force expects…major cost savings... They estimate…$500M to launch a dedicated free flyer to satisfy 100% of technical questions...hosted payload ended up costing $65M & should satisfy 80% of technical questions."**



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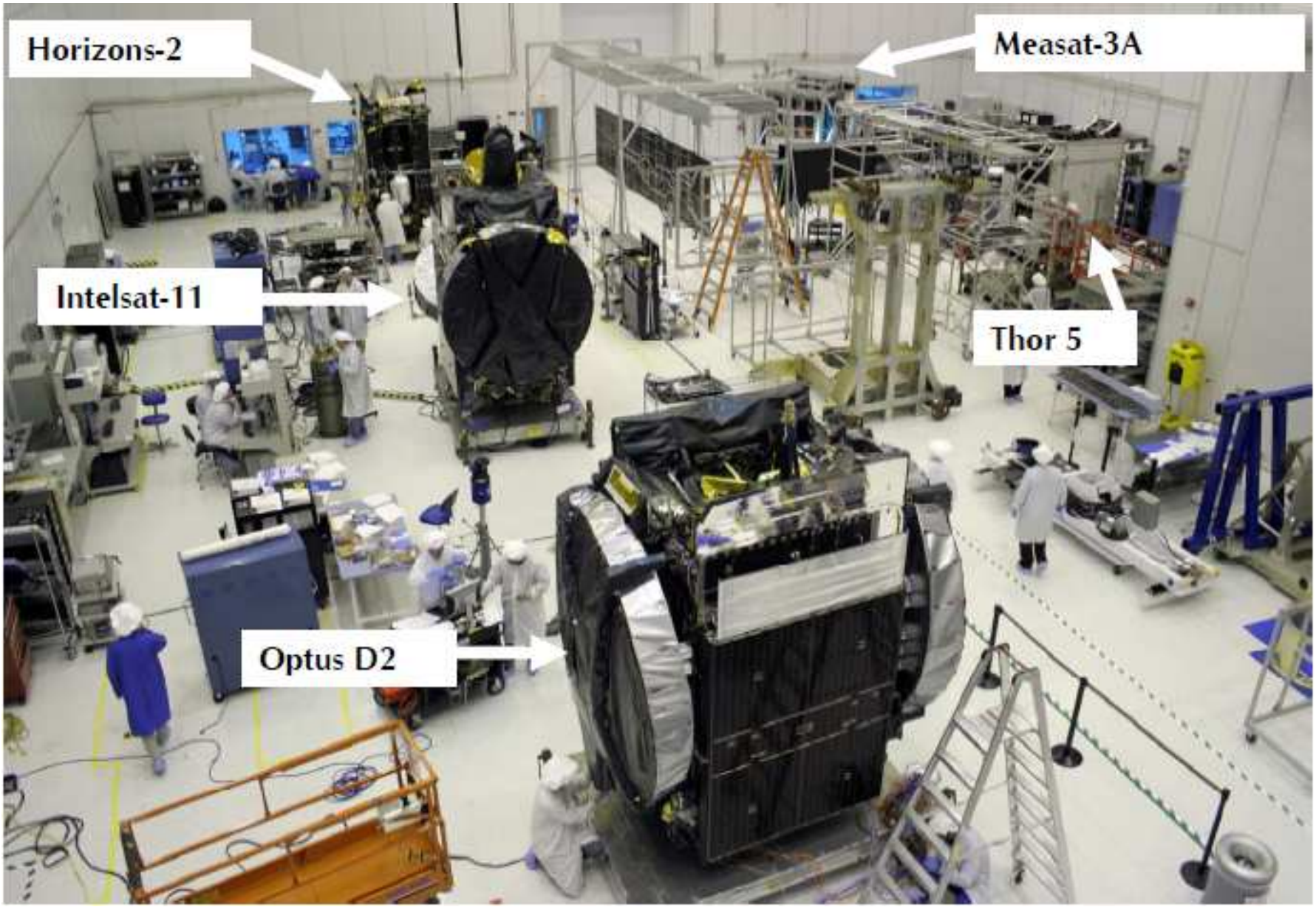
Orbital GEO Satellite Factory Flow



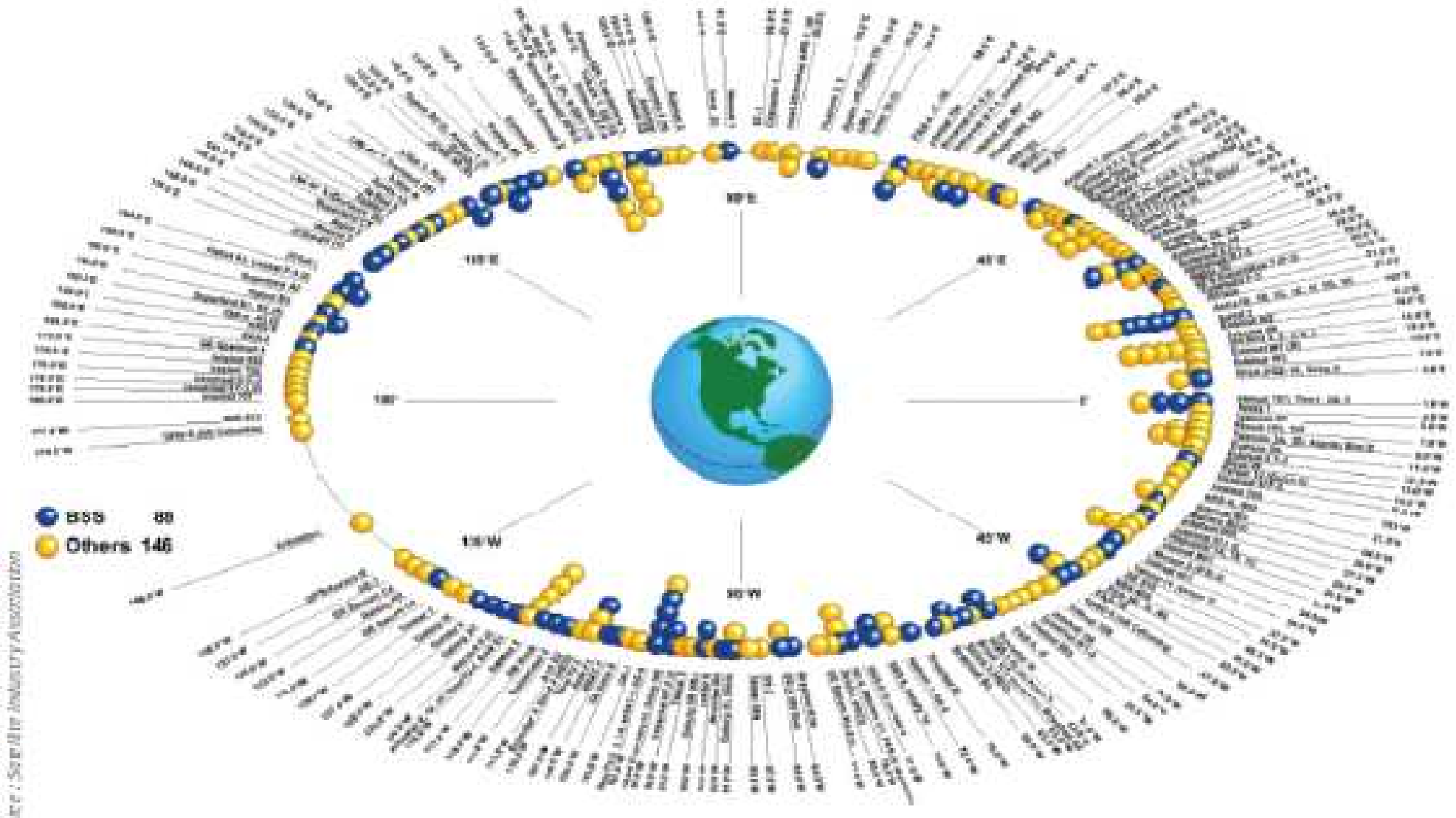
GEO Issues

- Commercial GEO operators seek more revenue
- Government agencies cannot satisfy GEO mission demand
- Increasing data rates

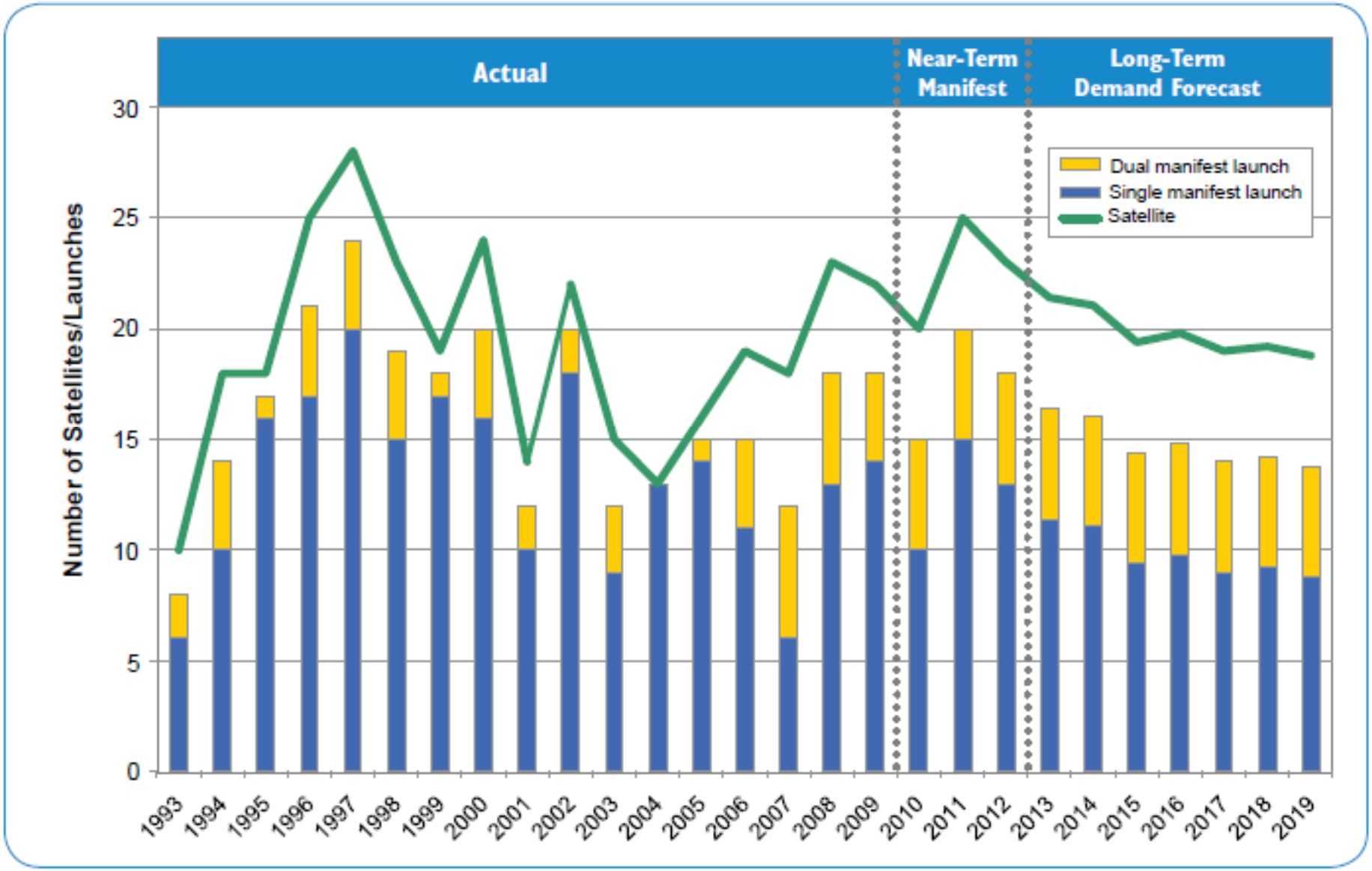
Commercially Hosted Payloads

- **Provide added revenue for satellite operators**
- **Dramatically cut cost to payload providers**
- **Offer almost unlimited bandwidth at reasonable cost**

GEO Fleets Require Continuous Replenishment



~20 Annual GEO Host Opportunities

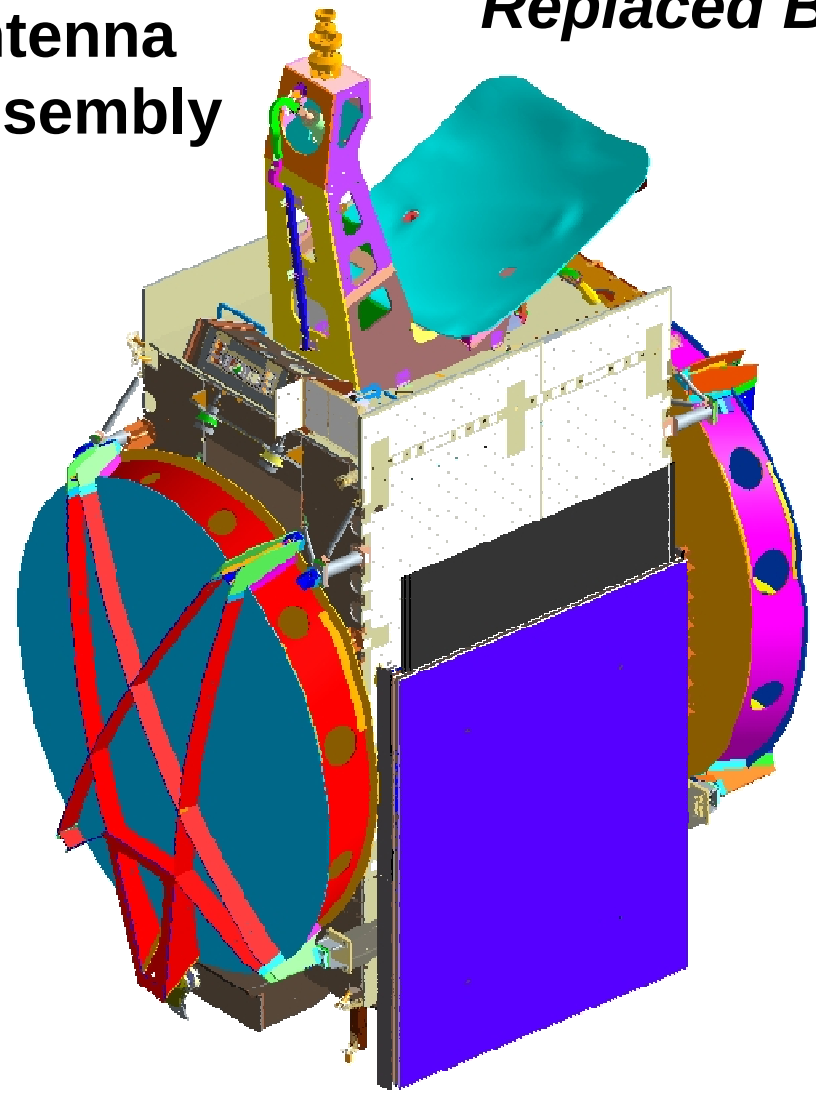


Federal Aviation Administration (FAA):
May 2010 Commercial Space Transportation Forecasts
October 2010 Semi-Annual Launch Report

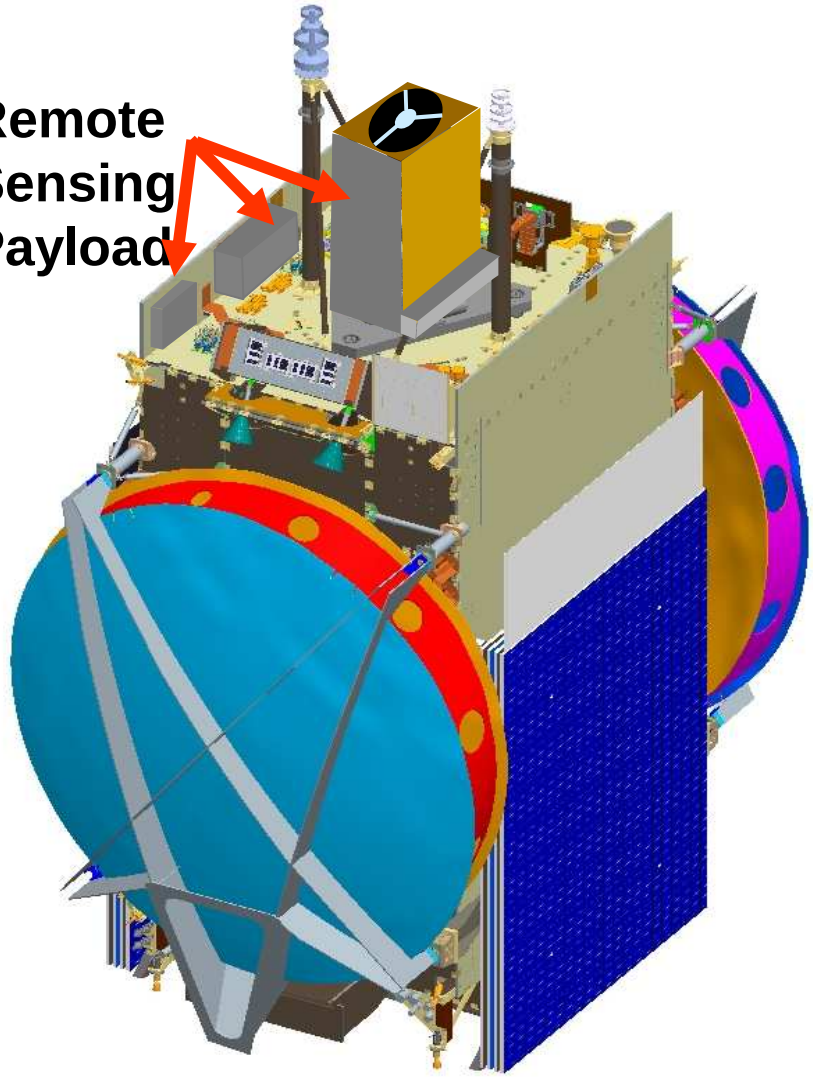
Hosted Payload Approach

Typical Nadir Antenna Assembly

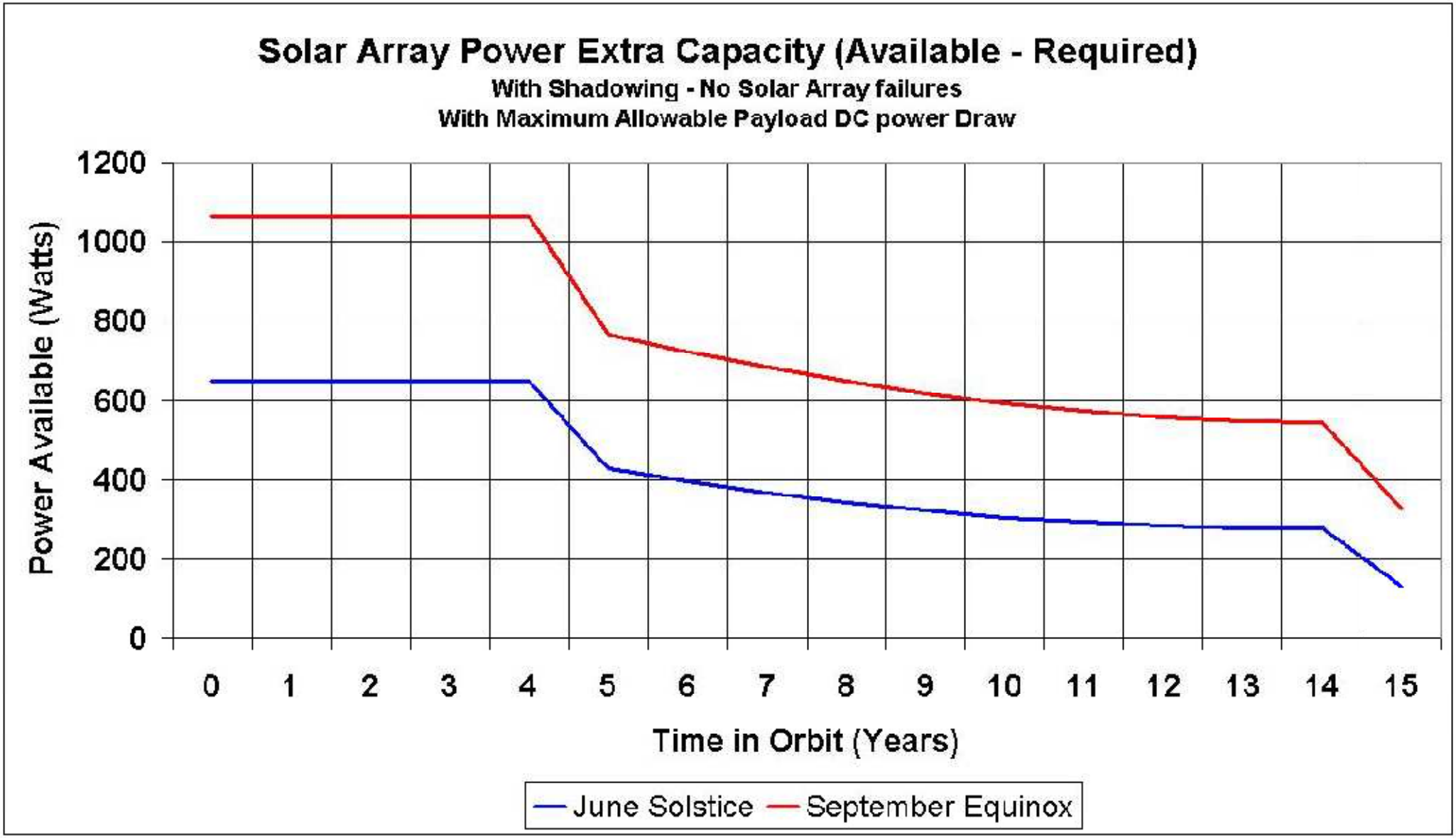
Replaced By



Remote Sensing Payload



Plenty of Power



Stable Commercial GEO S/C

Orbital

- For Payload Sensor Integration Time = 2 Seconds

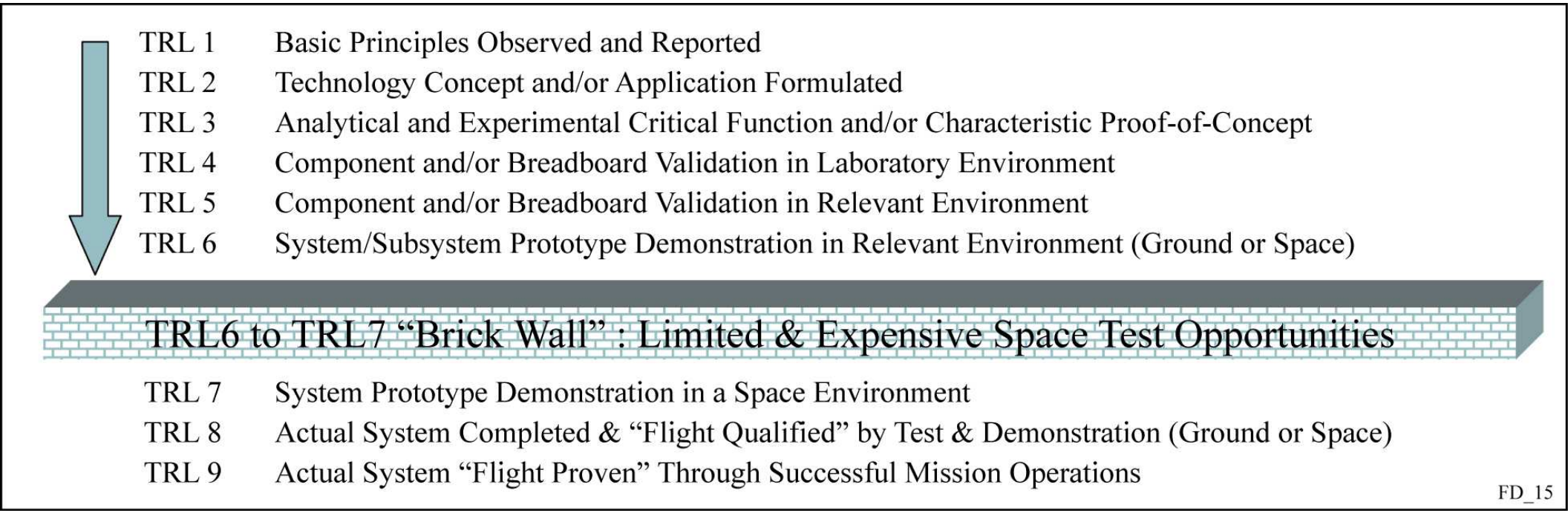
ACS Measure of Performance	STAR-2.2M Performance
Attitude Control	16 Arc-Sec (3σ)
Attitude Knowledge	16 Arc-Sec (3σ)
Low Frequency Jitter (0.1 – 0.5 Hz)	0.93 Arc-Sec (3σ) or 1.86 Arc-Sec (3σ) peak-to-peak
High Frequency Jitter (> 0.5 Hz)	0.55 Arc-Sec (3σ) or 1.1 Arc-Sec (3σ) peak-to-peak

- For Payload Sensor Integration Time = 0.5 Seconds

ACS Measure of Performance	STAR-2.2M Performance
Attitude Control	16 Arc-Sec (3σ)
Attitude Knowledge	16 Arc-Sec (3σ)
Low Frequency Jitter (0.4 – 2.0 Hz)	0.55 Arc-Sec (3σ) or 1.1 Arc-Sec (3σ) peak-to-peak
High Frequency Jitter (> 2.0 Hz)	0.2 Arc-Sec (3σ) or 0.4 Arc-Sec (3σ) peak-to-peak

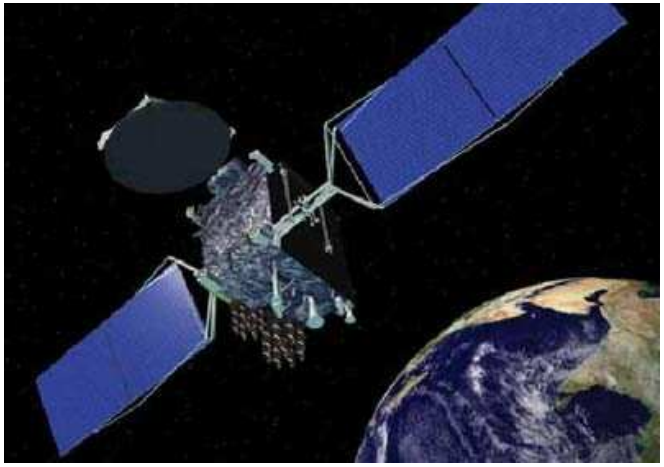
TRL7 Demos: Ideal Commercial Hosting Application

TRL 6 to 7 “Brick Wall” Hampers New Space Component Development:

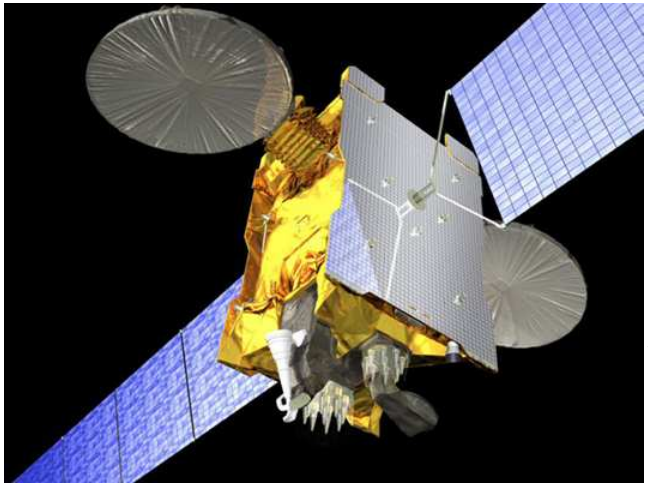


Commercially Hosted Payloads tear down TRL 6 to 7 Brick Wall!

In Orbit: Geostationary Communication & Control Segment (GCCS)



•Galaxy 15 Pan Am Sat, Bermuda
•Star 2.2 (Orbital)
•October 2005 Ariane



•Anik F1R Telesat Canada
•Eurostar 3000 (EADS-Astrium)
•September 2005 Proton

- **Foreign satellites *host* US government owned & operated payloads!**
- **Intelsat Galaxy 15 & Telesat Anik F1R host GCCS Wide Area Augmentation System (WAAS)**
  - **Operational payloads sponsored & operated by the US Federal Aviation Administration (FAA)**
  - **Essential to international aviation navigation, reliability & safety**
  - **Millions *depend* on these hosted payloads every day!**
  - **Launched by foreign rockets:**
    - **Galaxy 15 by Ariane 5GS**
    - **Anik F1R by Proton M – Briz M**

Not New! Examples Abound…

MISSION	Operator	Hosted Payload Type
Galaxy 15	Intelsat	Operational (FAA Navigation)
Anik F1R	Telesat	Operational (FAA - Navigation)
Intelsat 14	Intelsat	Technology Demonstration (Defense – Comm.)
GSAT-2	ISRO	Science (Solar and Space Physics)
GSAT-4	ISRO	Science (Astronomy - Navigation)
INSAT-2E	ISRO	Science & Operational (Meteorology)
INSAT-3A	ISRO	Science & Operational (Meteorology and Geology)
INSAT-4G	ISRO	Technology Demonstration (Navigation)
COMS1	KARI	Technology Demonstration (Oceanography, Meteorology)

Who Benefits & How

U.S. Government Organizations	Possible Mission Type
NOAA	Remote sensing/ observation instruments
NASA SMD	Remote sensing/ observation instruments
NASA/GSFC	Science, technology development, RS/EO instruments, communications
NASA ESMD	Various payload types
DOE/National Labs	Science and technology development
NSF	Science and technology development
NGA	Imaging, remote sensing
FAA Global Navigation Satellite Systems Group	WAAS transponders
DHS/USCG	AIS hosted
ORS Office	Various responsive payloads
USSTRATCOM	Communications, technology development
AFRL	Technology development
NRL	Technology development
DARPA	Technology development
MDA/SMC Missile Defense Space Systems Office	Detection, remote sensing, technology development
SMC/MILSATCOM Systems Wing	Communications, transponders
SMC/GPS Wing	Navigation, NUDET
SMC/Space Superiority Wing	Remote sensing, detection, counterspace
SMC/Development and Testing Wing & STP	Technology development/experiments
SMC/SBIRS Wing	IR sensors
NSSO	Various military payload types
NRO	Imaging, remote sensing, communications

Conclusion

- ***Mission success possible without Budget for launch or spacecraft!***
- You ***can*** have it all:
  - ***Fast access to space!***
  - ***Mission accomplishment!***
  - ***Low cost!***