



# **Operationally Responsive Space Now Is The Time to Step-Out Smartly**

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**National Security Space Office**  
**2 February 2007**



# The Convergence of Many Forces

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- **Growing US Need for Responsiveness**
- **TACSAT Programs**
- **Back-to-Basics Acquisition Approach**
- **High Rate of Change of Technology**
- **Responsive Space Operations Architecture**
- **Congressional Interest**
- **Emerging threats (e.g. Chinese ASAT Testing)**



# Operationally Responsive Space: Four Ideas with the Same Name\*

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## “Operational Level of War vs. Strategic Mission”

- (OPERATIONALLY responsive space (Ors))
- Put combatant commanders in charge



## “Change the economics of space”

- (operationally RESPONSIVE space (oRs))
- Smaller and simpler satellites in shorter timeframes

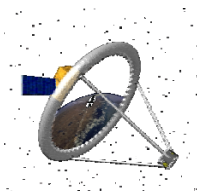


## “Surge and Replenish”

- (operationally responsive spaceLIFT (ors-L))
- Requires responsive launch and spacecraft

\* From Dr. S. Huybrechts, OASD(NII),  
“Thoughts on Space Power in the 21<sup>st</sup> Century”

## “Technology Push”



- (operationally responsive SPACE (orS))
- Use small satellites to drive technology insertion



# Operationally Responsive Space Goals

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## CONNECT SPACE TO THE USER:

- Make space capabilities more relevant to joint force commanders and more adaptable to future joint force needs

## RESPOND TO THE URGENT NEED:

- Deliver effects to joint warfare in response to an urgent or previously unanticipated need

## REDUCE DEVELOPMENT/DEPLOYMENT TIME AND COST:

- Complement NSS architecture with an element focused on increased value and timely delivery

## CAPITALIZE UPON EMERGING/INNOVATIVE CAPABILITIES:

- Motivate and adopt new capabilities from advanced technologies, innovative operational concepts, and benefits from data integration, information sharing, and net-centricity



# Potential Responsive Space Applications

## Missions

- **Battlefield ISR (hyper-spectral imaging, etc.)**
- **Communications**
- **Blue Force Tracking**
- **Position Navigation & Timing (PNT)**
- **Weather**
- **Space Superiority**

## Payload Capabilities

- **Imagery**
  - Synthetic aperture radar
  - Panchromatic, Multi-spectral, Hyper-spectral, Infrared
- **Communications**
  - Standard, Covert, Store and Forward
  - RF transmit, broadcast, relay, UAV support
- **Radio Frequency**
  - ELINT, battlefield geolocation
  - SIGINT, real-time detect radars
  - RF scan, detect new targets
- **Weapon Support**
  - PNT / GPS augmentation
  - Non-imaging infrared

**Feasible  
Applications  
Exist**



# Operational Experimentation

- **UK TopSat**

- Conducting operational experiments with UK's low cost imaging spacecraft already on orbit



TopSat

- **TacSat-1 (Lead: NRL for OSD/OFT)**

- Dual-mode target identification using Specific Emitter Intelligence (SEI)
- Estimated launch April 07 Space-X Falcon-I



TacSat-1

- **TacSat-2 (Lead: AFRL/VS)**

- Provides enhanced SEI & Automatic Identification Systems and ~1m resolution imagery, tactical tasking & data dissemination
- Proposed launch 16 Dec 2006



TacSat-2

- **TacSat-3 (Lead: AFRL/VS)**

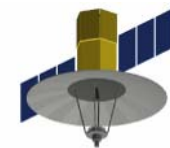
- Hyper-spectral and panchromatic imagery directly to tactical user or to CONUS data center, On-board data processing
- Estimated launch Fall 2007



TacSat-3

- **TacSat-4 (Lead: NRL)**

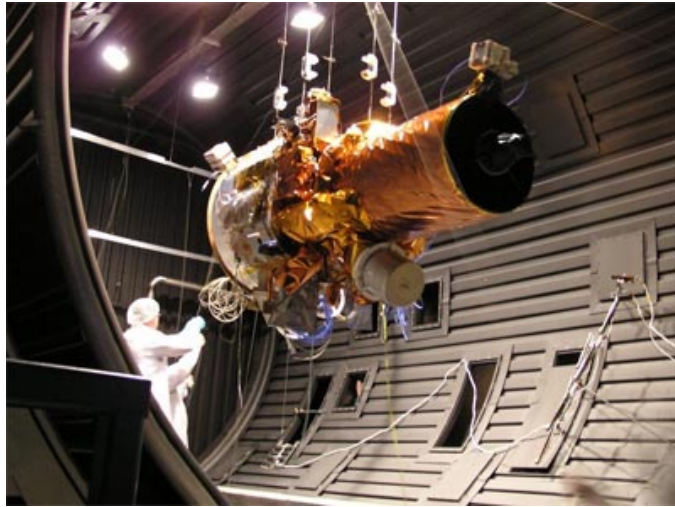
- “Comm on the Move”, Data Exfiltration and Blue Force tracking
- Launch ready 2008



TacSat-4



# Tactical Satellite (TacSat)-2 Experiment



**Successful Launch,  
16 Dec 06, Orbital  
Minotaur**



**Ground Terminal –  
China Lake**

## **Capability:**

- Field tasking/data downlink in same pass
- One meter tactical imagery
- Specific emitter ID & geolocation
- Dynamic retasking, cooperative with EP-3
- Autonomous tasking/checkout/on-orbit maintenance, on-board data processing
- Total mission cost w/ launch ~\$63M

## **Status:**

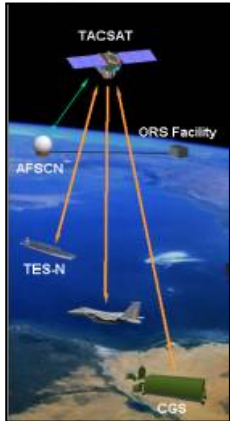
- First of TACSAT series on-orbit
- 18 month development to launch cycle
- Utilized the Minotaur launch vehicle
- Launched from Wallops Island Facility 16 Dec 2006
- Successfully commanded spacecraft from China Lake ground station



# Responsive Satellite Enabling Technology

## • Tactical Operations and Data Dissemination:

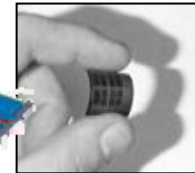
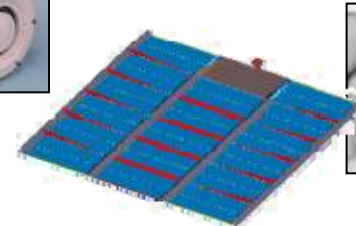
- Integrated with existing ISR C2
- Must fit into existing warfighting architecture
- Decision quality data to the warfighter



- Responsive
- Affordable
- Employable
- Integrated

## • Advanced Small / Microsat Technologies:

- Lightweight, low cost apertures
- Advanced power
- Efficient propulsion
- Low cost rad-tolerant components

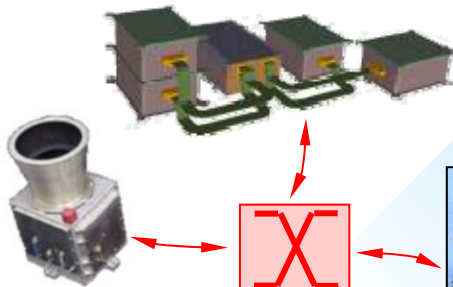


## • Rapid Deployment & Ops:

- Mission planning tools / tailored orbits
- Fast assembly and test
- Rapid autonomous deployment and operations

## • Modular Design:

- Plug 'n play architecture
- Standard, open architecture interfaces



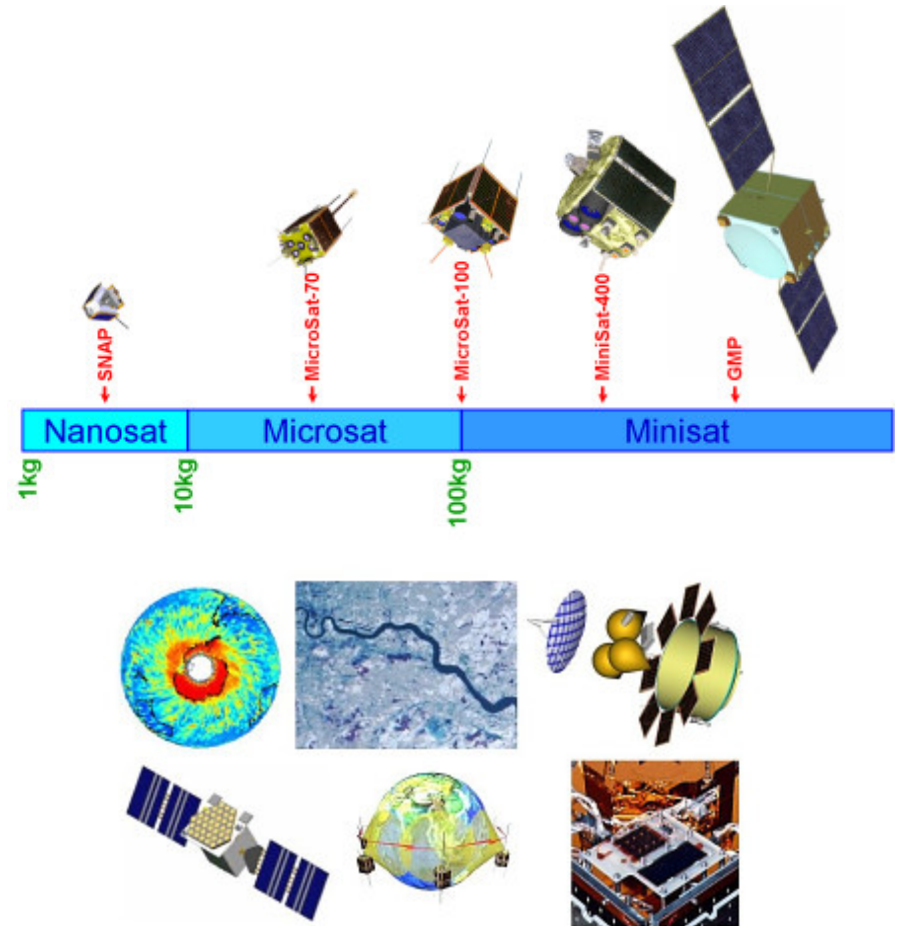
**Investments Being Made Across ORS Enterprise**





# Surrey Satellite Technology Limited (SSTL)

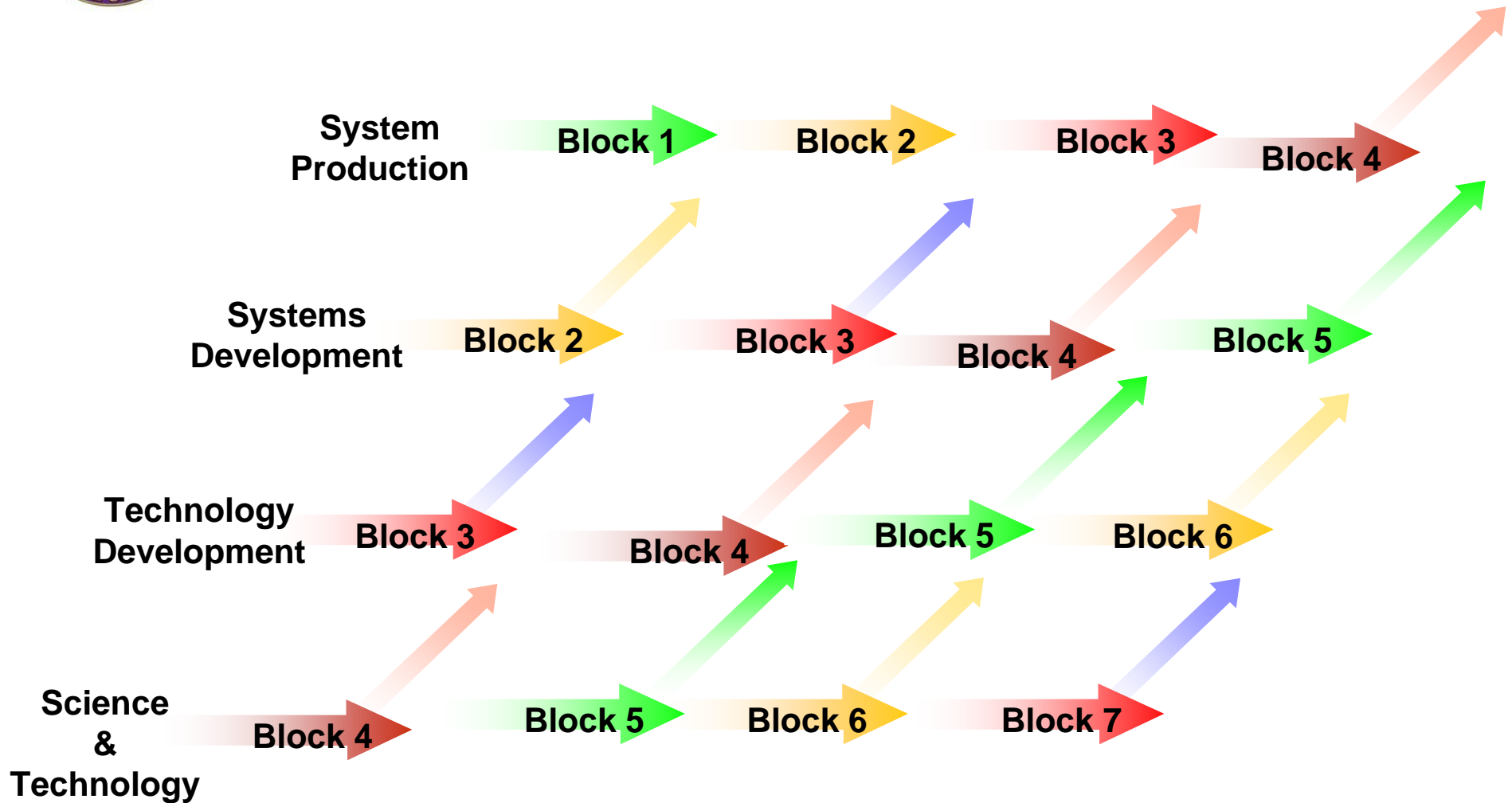
Mission	Year	Launch	Platform	Programme
BEIJING-1	2005	Cosmos	<a href="#">Bespoke</a>	Turnkey
TopSat	2005	Cosmos	<a href="#">Bespoke</a>	Turnkey
UK-DMC	2003	Cosmos	<a href="#">MicroSat-100</a> ↔	Turnkey
NigeriaSat-1	2003	Cosmos	<a href="#">MicroSat-100</a>	<a href="#">Knowhow Transfer</a>
BILSAT-1	2003	Cosmos	<a href="#">MicroSat-100</a>	<a href="#">Knowhow Transfer</a>
AISAT-1	2002	Cosmos	<a href="#">MicroSat-100</a>	<a href="#">Knowhow Transfer</a>
PICOSat	2001	Athena	<a href="#">MicroSat-70</a>	Turnkey
Tsinghua-1	2000	Cosmos	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
SNAP-1	2000	Cosmos	<a href="#">SNAP</a> nanosat	R&D
TiungSat-1	2000	Dnepr	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
UoSAT-12	1999	Dnepr	<a href="#">MiniSat-400</a>	R&D
Clementine	1999	Ariane	<a href="#">MicroSat-70</a>	Turnkey
FASat-B	1998	Zenit	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
Thai-Paht	1998	Zenit	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
CERISE	1995	Ariane	<a href="#">MicroSat-70</a>	Turnkey
FASat-A	1995	Tsyklon	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
HealthSat-2	1993	Ariane	<a href="#">MicroSat-70</a>	Turnkey
PoSAT-1	1993	Ariane	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
KITSAT-1	1992	Ariane	<a href="#">MicroSat-70</a>	<a href="#">Knowhow Transfer</a>
S80/T	1992	Ariane	<a href="#">MicroSat-70</a>	Turnkey
UoSAT-5	1991	Ariane	<a href="#">MicroSat-70</a>	R&D
UoSAT-3	1990	Ariane	<a href="#">MicroSat-70</a>	R&D
UoSAT-4	1990	Ariane	<a href="#">MicroSat-70</a>	R&D
UoSAT-2	1984	Delta	microsat	R&D
UoSAT-1	1981	Delta	microsat	R&D



**SSTL Leads the World in Small Satellite Mission Development**

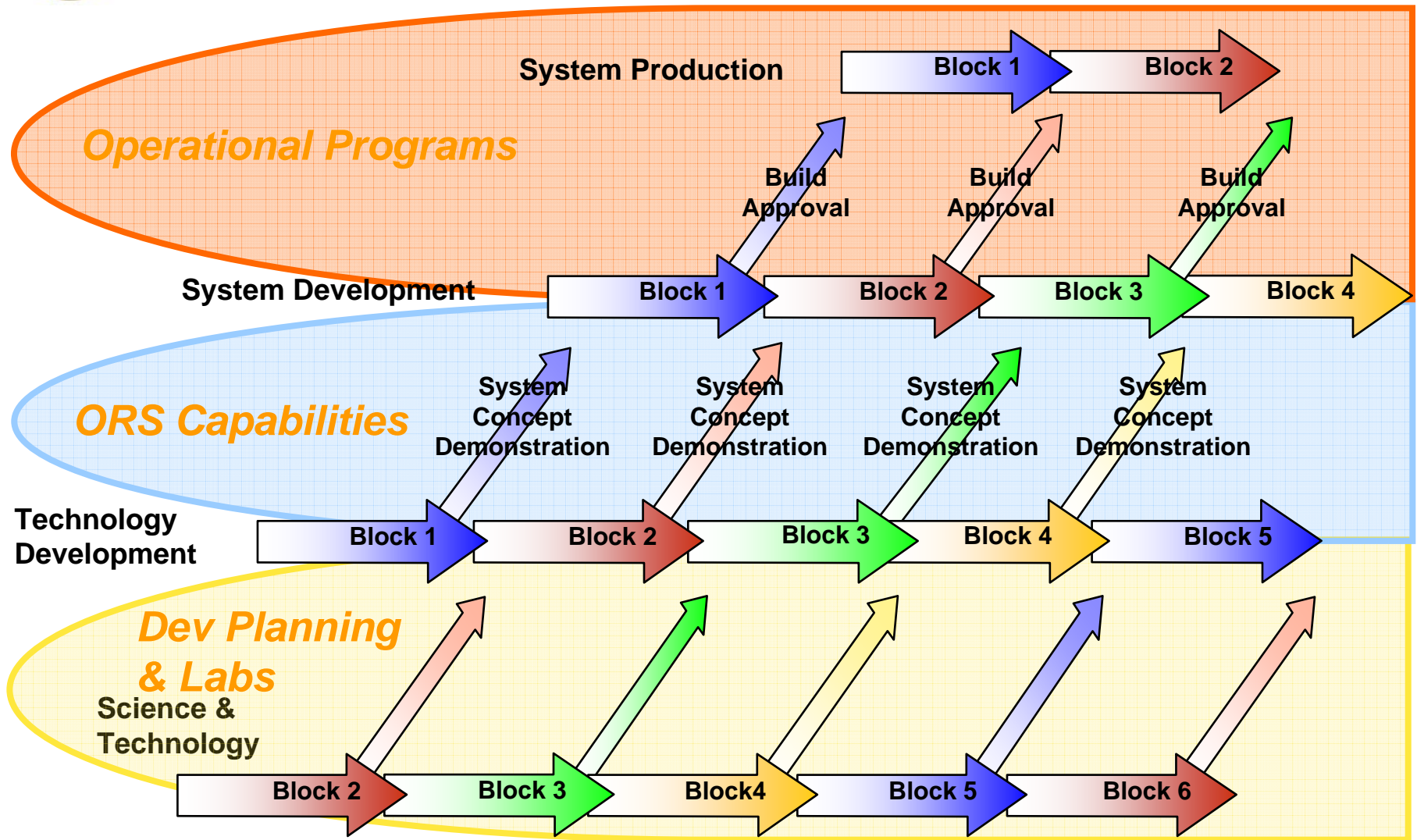


# Acquisition Stages--Block Approach





# ORS and the “Block” Acquisition Strategy





# Responsive Space Operations Architecture

## Responsive Reserves against Uncertainty

“It is thus an essential condition of strategic leadership that forces should be held in reserve according to the degree of strategic uncertainty.”

- Clausewitz, *On War*

### Customer Reserves

Forward Deployed



30 days



90 days

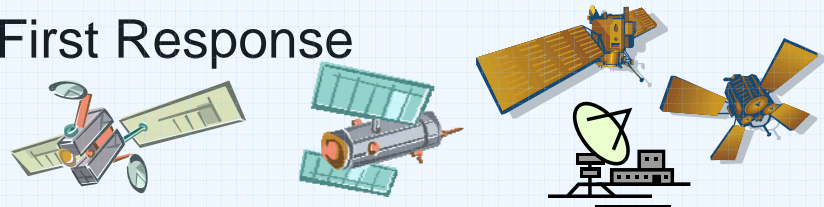


Maintenance and Construction

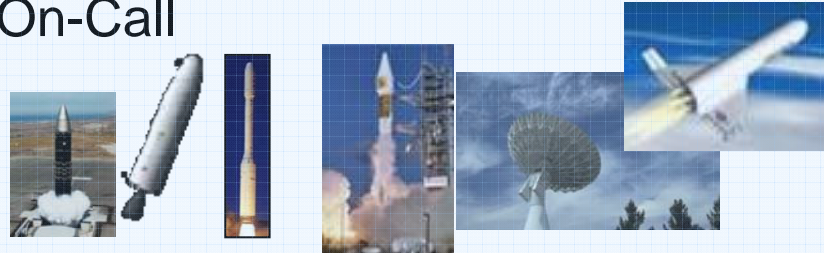


### Responsive Space Capabilities

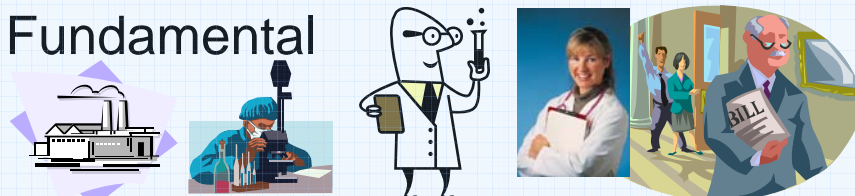
First Response



On-Call



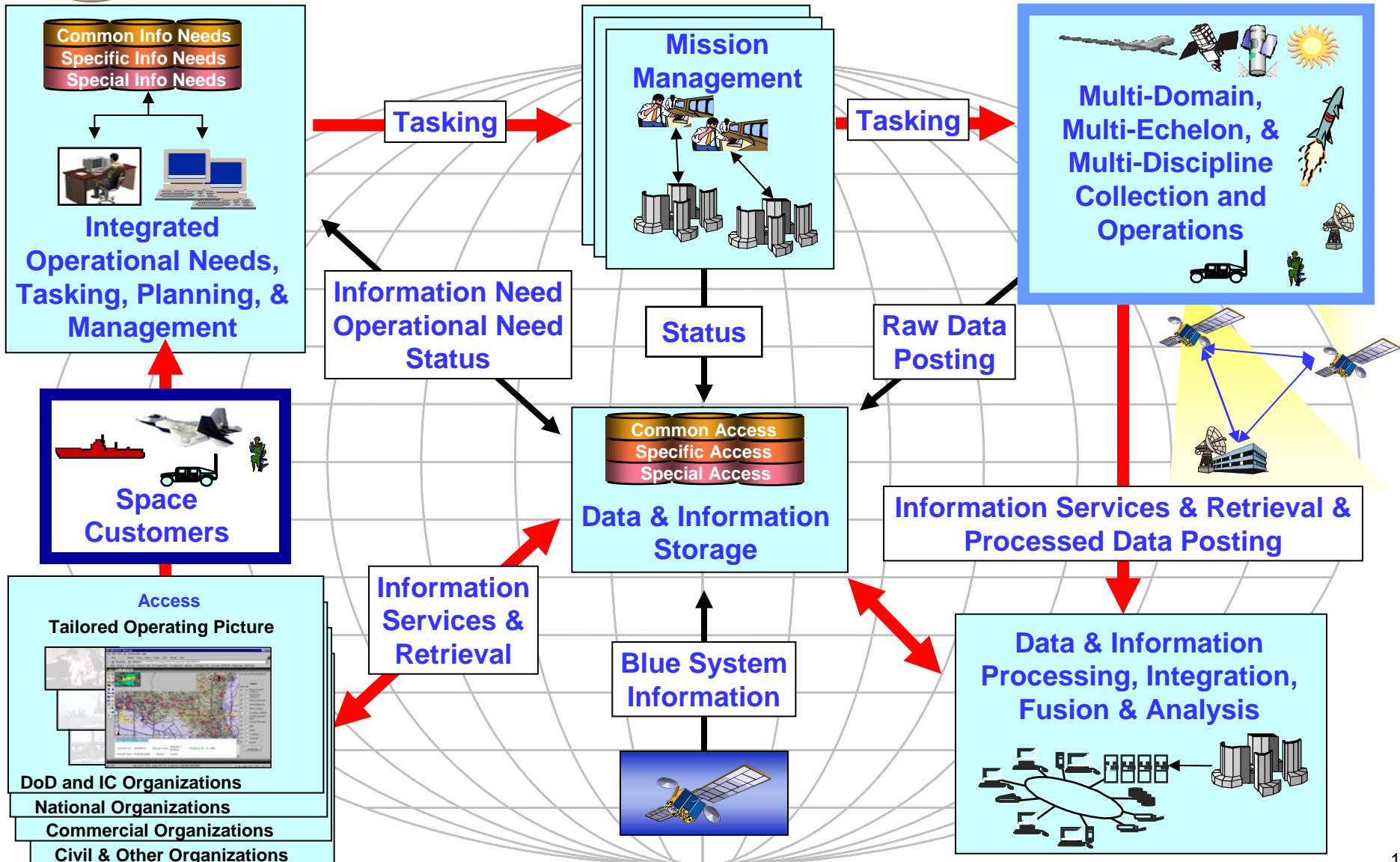
Fundamental





# RSO Architecture

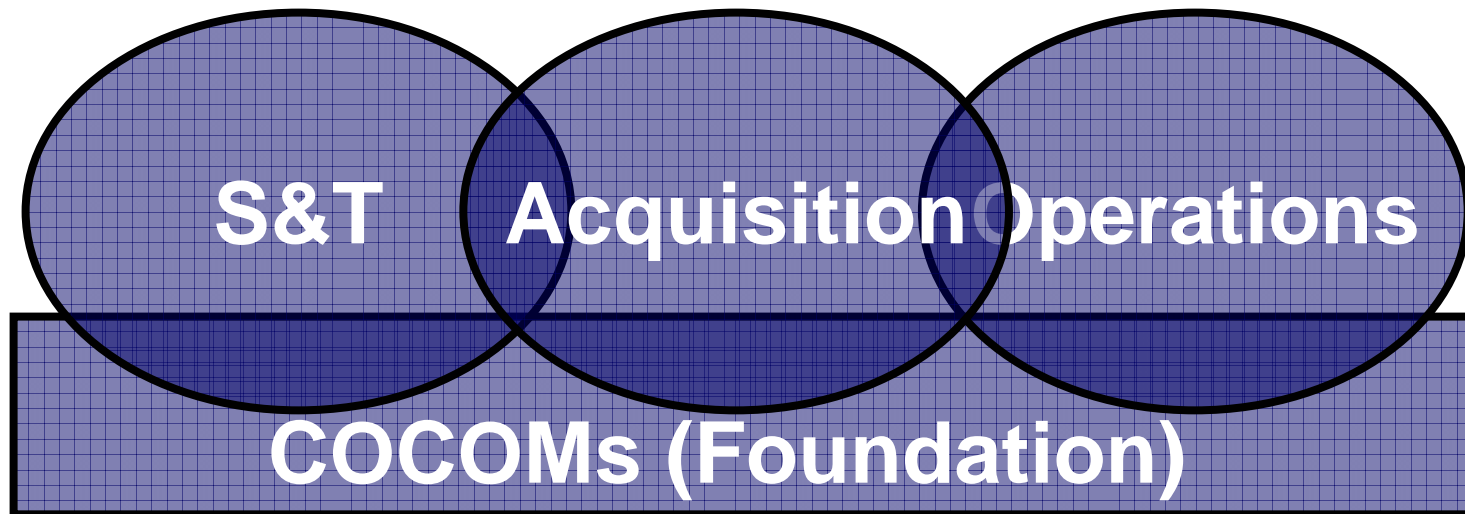
## End-To-End Responsiveness





## Mr. Hartman ORS Speech -- 17 Aug 2006

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- **COCOMs: Drivers, but need “interpreters” between each organization**
- **“Don’t wait for the perfect requirement” “Don’t overload projects with S&T”**
- **Near Term Focus: S&T; Tens of \$Ms, doled out by the “ORS HQ”**
- **AQ Office: Near Term – 10 people; setting up processes – IDIQs...**
- **Expects '07 to be OFT; '08 to have significant AF budget for ORS**



# Congressionally-Directed ORS Plan

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- **Who: SECDEF shall submit to the defense committees**
- **When: Due NLT 120 days after enactment: February 14th**
- **What: A plan for the acquisition by the DoD of capabilities for operationally responsive space to support military users and military operations**



# **Congressionally-Directed ORS Plan**

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- **Elements of the plan specified for inclusion:**
  - **Roles and missions**
  - **Identification of required capabilities**
  - **ORS Program Office\* chain of command and reporting structure**
  - **Classification of ORS-related information**
  - **Description of the acquisition policies and procedures applicable to ORS... and any legislative or administrative action necessary to provide any additional acquisition authority to carry out ORS responsibilities**
  - **Schedule to implement the Plan and...establishment of the ORS Program Office**
  - **Funding/personnel required to implement the plan within the FYDP**
  - **Additional authorities and programmatic, organizational, or other changes to ensure success**





# Senator Kyl on Chinese ASAT

## 29 Jan 2007

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**“The space threat posed by China is multifaceted. The painting in September of a U.S. satellite by a ground-based laser shows that the Chinese program includes a broad range of capabilities, from kinetic kill to directed energy. The January 11<sup>th</sup> test also show China’s ability to hit targets in low Earth orbit where most of American reconnaissance assets are deployed. But reports also suggest that they are seeking the ability to attack satellites in the medium and higher Earth orbit, such as GPS.”**



# Conclusions

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- **Congressional support sound**
- **Threat to US Space capabilities emerging**
- **DOD heavily investing**
- **Community-wide team charting way ahead**



**ORS will transform future space operations**  
**The Time is NOW**