Space & Missile Systems Center

Challenges for Systems of Systems / Mission Engineering in a Space Acquisition Environment

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Overview

- Space Acquisition Pivot
- SMC Strategic Outcomes
- SMC Acquisition Framework
- 2030 Space Enterprise Architecture
- Space Enterprise Focus Areas
- Portfolio Sys of Sys Engineering Construct
- Use Case: Cross-Mission Integration (Concept for Ground)

Space Acquisition Pivot

In order to achieve Joint, all-domain objectives, deliver an open space architecture, able to rapidly on-board organic, Allied, commercial & mission partner capabilities and advanced technologies at the speed required to outpace the threat.

The future resilient space architecture must:

- Enable decision & weaponeering speed across joint, all-domain operations to achieve & maintain the initiative for the joint commander
- Enhance resilience of capabilities w/multi-layer architectures, partnerships & protection strategies
- Enhance rate of production via development, partnership & business practice improvements
- Create more opportunities for operator innovation, experimentation & feedback

AFSPC and SMC implementing architecting, acquisition and partnership actions to evolve the architecture, enhance production & capability integration to deliver the resilient space enterprise.

SMC Strategic Outcomes

Strategic Outcomes

Dominate

Deliver

Drive

Enterprise

- **Shared vision and strategy** of an integrated portfolio across programs
- **Resilient, multi-layered architectures** and infrastructure services that leverage economies of scale for all programs
- Ability to **dynamically reallocate resources** based on priorities and promote collaboration and knowledge sharing

Partnerships

- A **wide network of suppliers** including both traditional contractors and innovative start-ups
- **Collaboration with Inter-government and International allies** to share costs, technologies and solutions to move faster and improve capabilities

Innovation

- Encourage **fast-failure and fast-learning** by maximizing use of prototyping, experimentation and rapid demonstration/feedback
- **Balanced portfolio** of S&T, R&D and fielded capabilities providing incremental improvements and opportunities for innovation
- Make **Strategic innovative investment** in high pay-off technologies and game changing capabilities (Space Control, Rapid Orbital Mobility, Info Agility)

Culture

- **Mission focused**, motivated, knowledgeable, and empowered workforce
- A culture of **risk-taking and continuous improvement** that enables creative problem solving
- **Talent management system** designed to develop leaders, empower teams, and reward performance

Speed

- **Increase decision-making velocity** with flatter organization and delegated decision authorities
- **Streamlined processes, documentation and reviews** tailored for the acquisition strategy

SMC Acquisition Framework

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CAT: Capability Area Team

The "Verticals"

Enduring Mission Capabilities

(What Missions We Deliver)

- Create dynamic requirements framework capable of rapidly allocating mission/requirements to a family of systems

The "Field"

Enterprise Environment

(Why it exists and Where it lives)

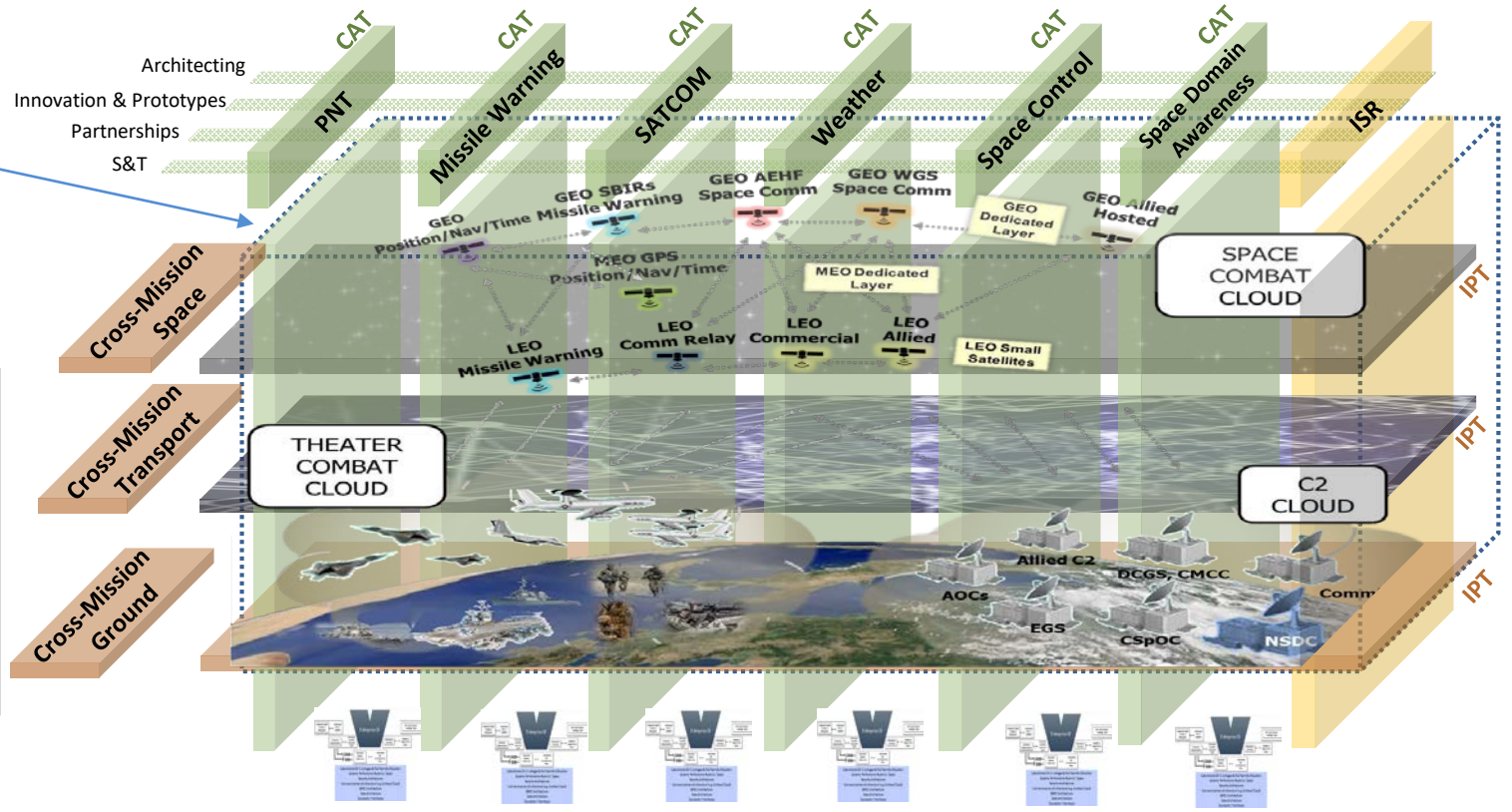
- Strategic architectural LOE

The "Horizontals"

Common Functions

(Ensuring Enterprise Delivery)

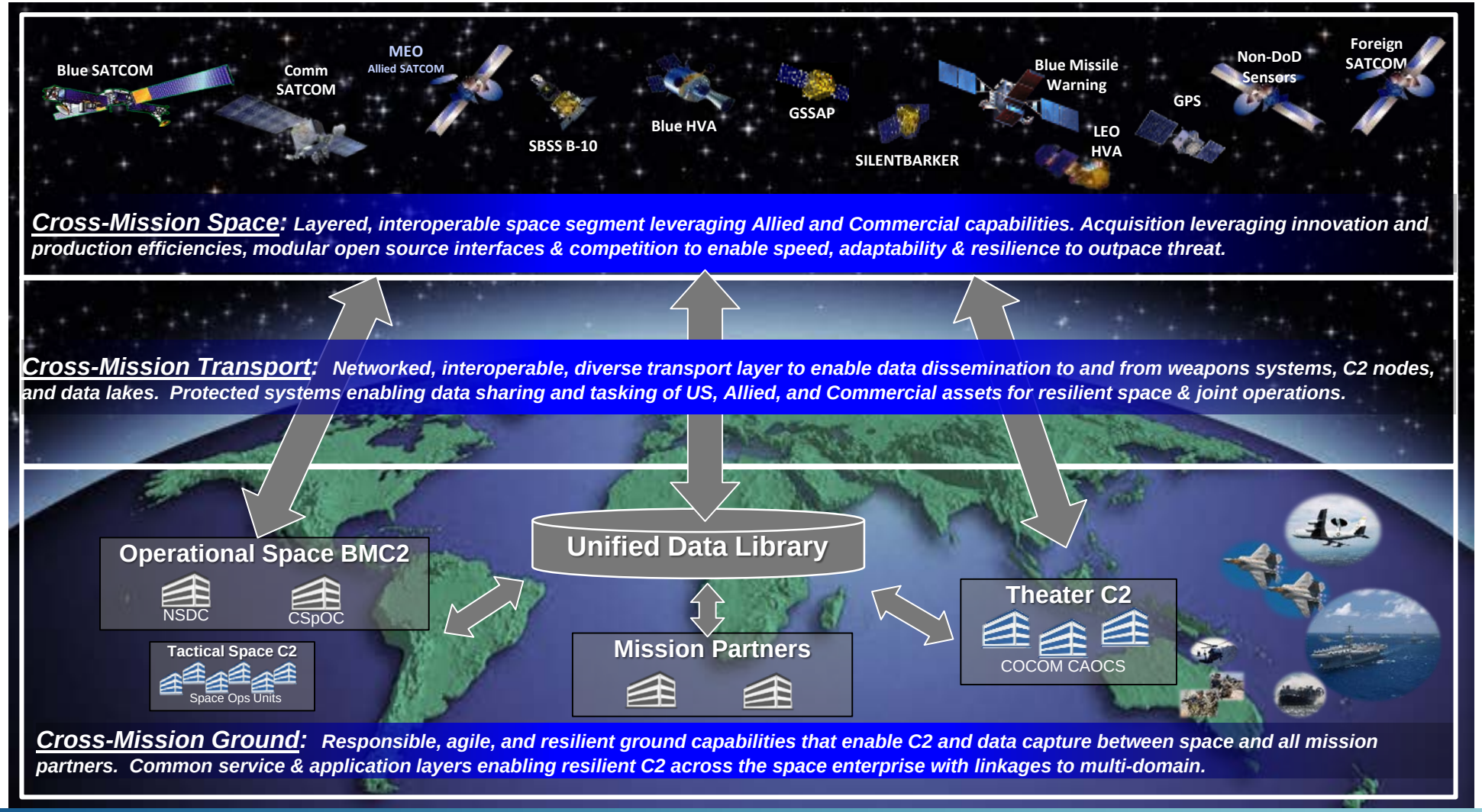
- Derived capabilities to meet enterprise objectives
- System of Systems Engineering



We are creating the Enterprise Processes & Products to Simultaneously Evolve the "Verticals" and "Horizontals"

2030 Space Enterprise Architecture

(AFSPC Key Lines of Effort)



Space Enterprise Focus Areas

Cross-Mission Space

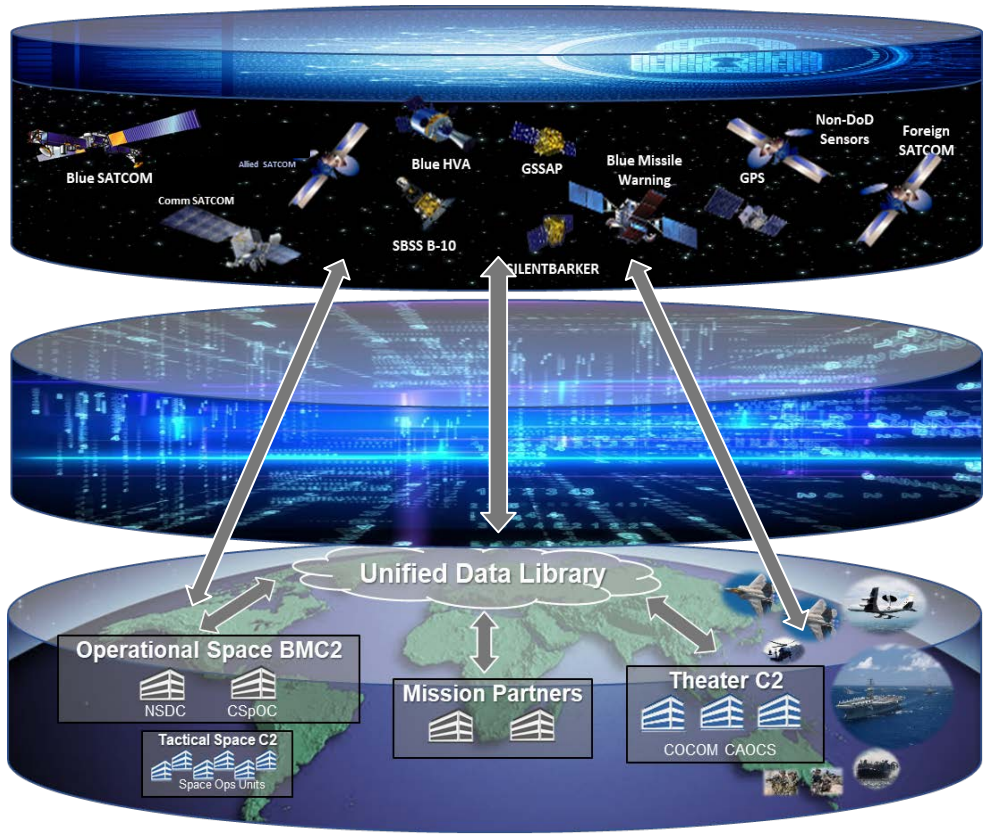
- Enhance production for space-layer (Continuous Product Agility)
- Partnership & Capture cells,
- High-rate payloads (PNT, EM, SSA)
- MBSE/Digital Twins

Cross-mission Transport

- Create open networked architecture
- Enable agile C3I operations (network management and path diverse comm)
- Enable machine-to-machine for cross-cueing & hand-off

Cross-mission Ground

- Enhance cross-mission DevSecOps ecosystem
- Enhance common development
- Enable C2 of hybrid architectures
- Create ops beachheads for rapid on-boarding



Space/Cyber

- Life-cycle cyber protection
- Cross-mission cyber security (ground, systems, network & data)

Space Maneuver/Logistics

- Alternative orbits/cis-lunar
- Agile Launch
- Dynamic Logistics--enhanced maneuver & 0n-orbits servicing

Cross-mission Data

- Create cross-mission data ecosystem
- Enable cross-mission data analytics
- Enhance access to traditional/non-traditional analytic teams
- Tools/Apps for C2/weapons/sensors

Multi-domain Ops Integration

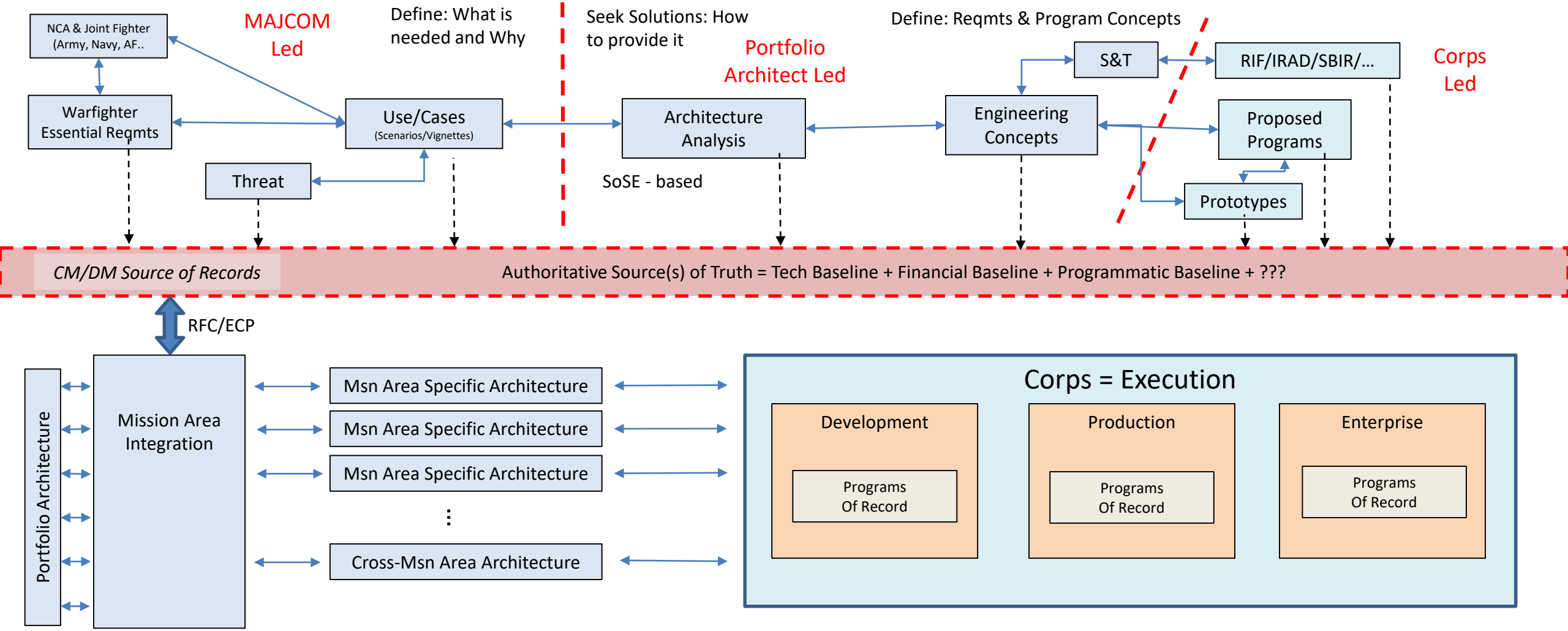
- Direct inject to theater C2/weapons
- Theater experimentation (ACC/PACAF/USAFE)
- Ensure seamless cross-mission multi-domain integration (C2, comm, network, data)

"Virtual" Warfare Center

- Create ecosystem to plan, test, train, exercise & wargame
- Shared access by developers & operators (prototypes & TTPs)
- Linked to adv development architectures (sims, MBSE, digital twins)
- Supports Red vs. Blue exercises

Aligned with AFSPC/CC's challenges that must be solved to field resilient space capabilities to joint operators

Portfolio Sys of Sys Engineering Construct



Use Case: Cross-Mission Integration (Concept for Ground)

HQ AFSPC/ESAO

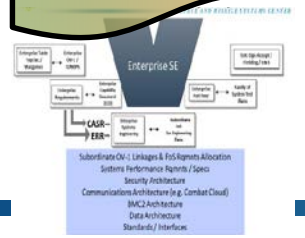
HQ AFSPC Guiding Documents from Phase 1 (Enabling Concept, OV-1, ERD, etc.)

AFSPC Guidance

SMC/ZA

SMC/ZA Guiding Documents (Acquisition, SoSE, standards, etc.)

Final Guiding and Draft Implementation Plans



XMS-G Integrator

XMS-G Director

Cross-Mission Ground IPT (XMS-G IPT)

XMS-G FFRDC

XMS-G SE&I (Document Development& Maintenance)

Industry Engagement & Feedback Forum

PMs

Msn Partners

Demos Prototypes

XMS-G Program Implementation (Roadmaps, Plans, SoSE specifics, etc.)

Mission Partners

XMS-G Program Implementation (Roadmaps, Plans, SoSE specifics, etc.)

Modifications, Issues

Cross-Mission Enterprise Review (XER)

Capability Board

PEO Council

SMC / AFSPC Resource Decision

Compliance

Architecture Updates

POM

Execution Updates

Questions

OV-1 Mohawk (US Army)

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Backup & Additional Information

HQ AFSPC
Commander's Strategic Intent

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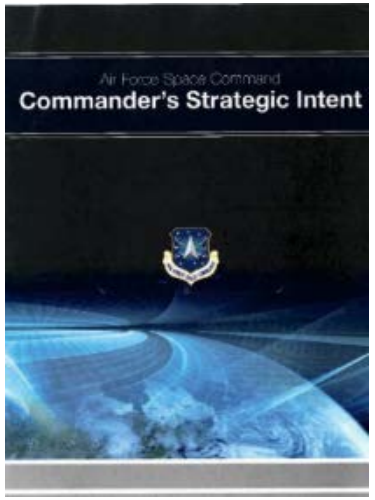
"Potential adversaries can threaten our use of space in many orbital regimes and will soon be able to threaten all US space capabilities in all orbital regimes." - AFSPC Commander's Strategic Intent



Priority 1: Build Combat Readiness & Lethality for the Contested Multi-Domain Fight

- **Pivot SSA to the threat**
- **Field and employ BMC2 capabilities**
- **Transition Ops Centers to address space as a warfighting domain**

Priority 2: Innovate and Accelerate to Win – Institutionalize Agility to Outpace Threat

- **Prototype and experiment rapidly, with greater risk tolerance, to identify breakthrough technology**
- **Leverage industry (e.g. Catalyst Campus)**

Priority 3: Develop Space and Cyberspace Joint Warfighters

- **Recruit and retain the best; conduct broader outreach**
- **Space Mission Force: transition training from benign environment to a contested domain/threats**

Priority 4: Organize for Sustained Success

- **Build new Partnerships with Allies and Commercial Industry**
- **Build new Space RCO**
- **Re-architect SMC to manage as an enterprise**

"our current doctrine, force structure and acquisition processes have not evolved with the growing global threats…Yesterday's Command does not meet today's or tomorrow's challenges"

- General Raymond

Portfolio Architect

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1. Vision: Create the Space Enterprise strategy and framework that informs and prioritizes what SMC acquires to enable our Program Managers to "Buy the Right Things" at EPIC Speed!

2. Accomplishments:
- Established space architecting process with AFSPC
  - Capability Area Strategy Review
  - Enterprise Requirements Review
- Innovation - 460th Space Wing Demo Day
- International Partnerships – MDC2, SSA collaborations

3. Near Term Goals:
- Create AFSPC/SMC/AFRL integrated Enterprise Roadmaps
- Birth 3-5 prototypes/programs to be executed by the Corps via SpEC OT
- Create Govt/FFRDC Modeling & Simulation/Systems Engineering framework supported by SE&I and Industry Consortia
- Continue to synch Space Innovation with AF Innovation teams
- Continue Navy/Army Geographic COCOM experimentation

Director
Col Teehan

Deputy Director Ms. Eberhardt	Chief Architecting Officer Lt Col Kimbrough
Chief of System of Systems Engr Mr. Horejsi	Chief of Portfolio Integration Mr. Karns
Chief of Mission Innovation Lt Col McMillan	Chief Scientist Dr. Ewart
Chief Partnership Officer Ms. Ryals	Director of Mission Integration Mr. Becht

Abstract

Title

Challenges for Systems of Systems/Mission Engineering in a Space Acquisition Environment

Short Summary

The paradigm of how space systems are acquired has changed. In response the USAF Space and Missile Systems Center has begun applying Systems of Systems/Mission Engineering in a Space Acquisition Environment. Discussion on progress so far, challenges, and potential ways forward are discussed.

Text

For the last sixty years space has been considered to be an uncontested environment. However recent threats to the space commons have required a rethinking of this philosophy, thus necessitating a change of how the Air Force works in the space domain. As a result of this, on October 15, 2018 the USAF Space and Missile Systems Center (SMC) began transition to “SMC 2.0”. This was done in order to better respond to USAF Space Command’s mandate to acquire space systems more rapidly and with better agility. Also, space systems were previously acquired individually and designed as exquisite point solutions to capability needs, without regard to other systems being acquired by other program offices. As the result, the Space Portfolio lacked cohesion and coherence. Now SMC 2.0 requires that all systems primarily benefit the Space Enterprise, and that has required a shift in the paradigm from development of individual systems to the integration of a systems of systems to better benefit the warfighter. Additionally, the concept of Mission Engineering, in which the mission itself is the system, has taken also root at the Center. This paper summarizes progress to date by the SMC Portfolio Architect and the SMC Systems of Systems Engineer in meet this challenge within a DoD acquisition environment. Lessons learned, along with potential pathways for meeting the mandate are discussed.

Biography

Lt Col(s) Benjamin M. Bennett is the Deputy, Systems of Systems Engineering Division, Portfolio Architect, Space and Missile Systems Center (SMC), Los Angeles Air Force Base, El Segundo, California.

He holds a BSME from Utah State University and an MS in Systems Engineering from AFIT. Over his last 14 years he has broadened his leadership and technical capabilities by serving in 6 different Major Commands. Most notably he has worked on development testing of the RQ-4A Global Hawk, operational testing and evaluation of advanced communication packages, and software upgrades for the bomber fleet. He has also analyzed foreign aircraft systems and led a team in analysis of counterspace operations. He led and managed the Air Force Research Lab Materials and Manufacturing Installation Readiness Energy Working Group. Prior to his current position, he was the Deputy Chief for the SMC Independent Readiness Review Team.