14th ICCRTS
"C2 and Agility"

Paper ID # 075
Topic 2: Networks and Networking

Virtual Mission Operations Center: Transforming the conduct of space based operations

Omar Medina - Naval Research Laboratory

Christine W. Balisle – SAIC

Kimberly A. Holloman, Ph.D. – SAIC

Eric Miller – General Dynamics

Point of Contact:

Christine Balisle - SAIC

Topics

- Operationally Responsive Space (ORS)
- Virtual Mission Operations Center (VMOC)
- VMOC Operational Experimentation
- VMOC Support to Tactical Satellite Four (TacSat-4) Operational Experimentation
- VMCO Support to Operations: ORS Sat-1
- VMOC Status and Transition
- VMOC Way Ahead
- Conclusion

Operationally Responsive Space

- **ORS is defined "broadly as assured space power focused on timely satisfaction of Joint Force Commanders' needs"**
- **ORS provides a known capability, but does so in a completely new way**
- **This approach requires exploration of new concepts of operations through enabling technologies**
  - **Allows technology to mature alongside emerging concepts of operations**
- **ORS Timeline:**
  - **2003: OSD instructs DOD to create new business model for developing and employing space systems**
  - **2003: OSD Office of Force Transformation (OFT) begins ORS effort**
  - **2005: U.S. Space Transportation Policy makes ORS an explicit objective, and states an ORS initial capability be developed by 2010**
  - **2006: Congress requests that DOD prepare a plan for ORS**
  - **April 2007: DOD delivers *Plan for Operationally Responsive Space***
  - **May 2007: ORS Office stood up at Kirtland Air Force Base, NM**

Virtual Mission Operations Center (VMOC)

- **VMOC began as a platform to incubate, mature, and transition new and relevant technologies and concepts of operations relevant to tiered sensors and operationally responsive space**

- **VMOC is a pathfinder that explores, documents, and helps to articulate the needs of the community in the following areas:**
  - **Technology (pathfind, mature, and transition enabling elements)**
  - **Organization (experiment and document emerging CONOPS/TTPs)**
  - **Policy (identification, application, and possibly modification of policies concerning ORS)**

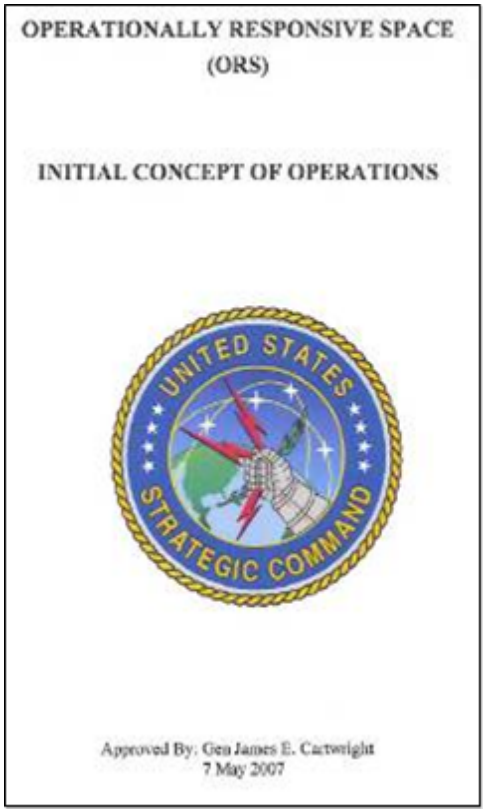
- **Specifically for ORS, VMOC is now transitioning to an operational role of tasking, managing and apportioning space vehicle sensors in support of actual operations**

VMOC Supports ORS CONOPS and Needs

- **Tactical: Enable the Users**
  - **1.A.(7) "…ORS capabilities will be net-centric and net-enabled"**
  - **1.A.(8) "…information from and operations of ORS capabilities are generally expected to be classified at the collateral SECRET level…"**
  - **4.A.1.(A) "… example of [new space capabilities] include dynamic ip-based tasking and data dissemination approaches which hold potential for enhancing the effectiveness of existing space system CONOPS."**
  - **4.A.(B).3 "[tier-2] on-orbit activities are characterized by rapid initialization and checkout, and real-time, dynamic internet protocol (ip)-based tasking and data flow focused on the user.**

- **Mission: Manage the Sensors**
  - **4.C.(3).(C) "in the desired net-centric architecture, the requesting JFC will have direct tasking capability via the global information grid (GIG) and will receive satellite mission products directly via the GIG."**
  - **4.A.(2).(A).4 "A key enabler of tier-1 efforts will be the transformation to a data-centric/net-centric philosophy in which expanded data access and data movement will yield increased access to existing space products."**

- **Apportionment: Establish the Rules**
  - **4.C.(3).(C) "for ISR capabilities, JFCC ISR will coordinate user requests to ensure efficient allocation, collection, processing, [and] dissemination."**



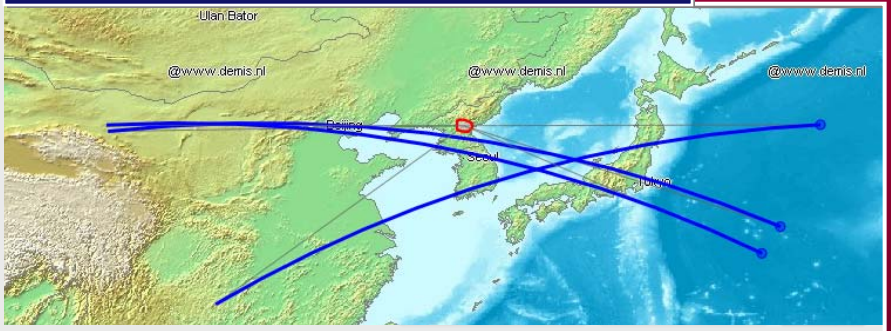
VMOC System: Components and User Groups

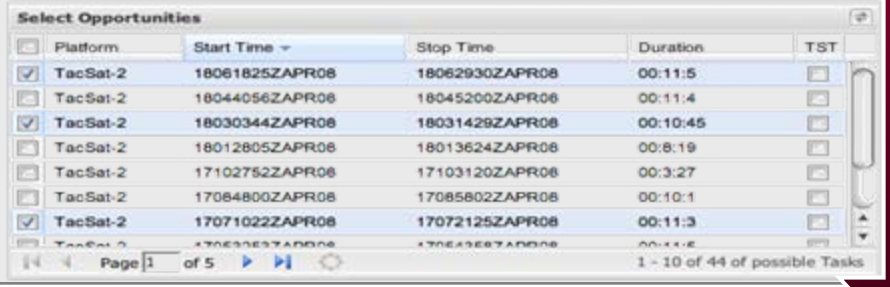
VMOC Component Capabilities		Users
• **Tactical** **Enable Diverse Users**	⟷	• **Operational & Tactical Users** • **Beginner to Advanced** • **Wide Range of Equipment**
• **Mission** **Manage the Sensors**	⟷	• **MOC/SOC Operators**
• **Apportionment** **Establish the Rules**	⟷	• **STRATCOM, JFCC Space, JSpOC**

VMOC System: Component View

Tactical: Enable Diverse Users

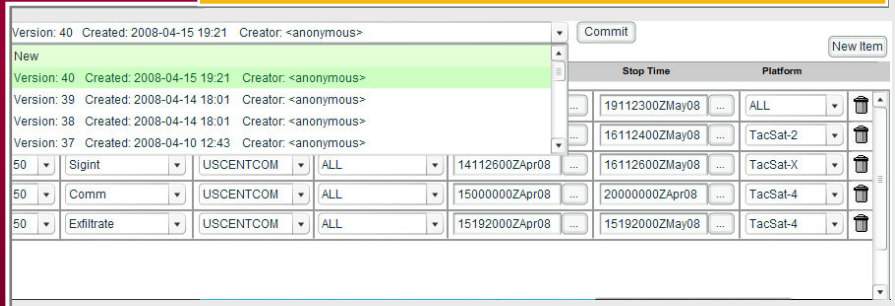
Intuitive User Interface in Explorer to Task & View Resulting Schedules



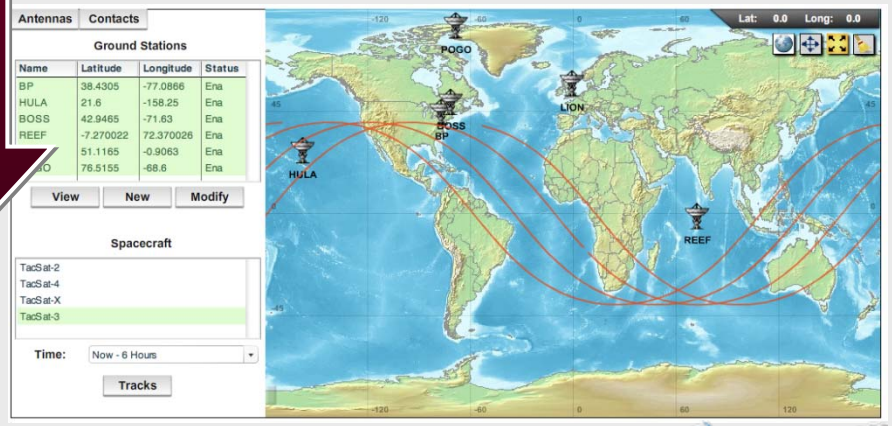


Apportionment: Establish the Rules

Apportion Assets with Automation & Visibility



Mission: Manage the Sensors



BP/MMSOC

Mission Receives Rules from Apportionment, User Requests from Tactical, and Applies Modeled Sensor/Vehicle Engineering Constraints Automatically to Provide Schedules to MOC/SOC

Featured Capabilities

- **Web Based System**
  - IE 6.0 Baseline
  - Flash Plug-In for Select Features
  - Low Foot Print at Organizations
  - Low Barrier of Entry
- **Modular System**
  - Modular Construction
    - Able to Change out Components as Technologies Change
  - APIs to External System Capable
    - Web Service Enabled
- **Scalable Architecture**
  - Not a point solution for one specific mission
- **Multi-Level Task Prioritization**
  - Global and Regional Prioritization Fidelity
  - Dynamic and Asynchronous
- **Multi-Mission Management**
  - Effects based user tasking
  - Scalable to accommodate multiple assets
  - Automated processes
- **Transparency in the Process**
  - "Fed-Ex" style tracking of user tasks from request to data available
  - Prioritization Schema and Mission Schedule Visible
- **Intuitive User Interface for Ease of Use**
  - Supports beginner to expert users for access to space capabilities
  - Capable of Expanding User Base to Non Traditional Players

*Tasking here is referred to as a user request for satellite payload scheduling

Operational Experimentation Overview

- **Operational experimentation**
  - **A co-evolutionary process in which a new capability is developed and utilized in a realistic operational context so that the impact of the emerging capability on users can be evaluated and improved in a rapid manner**
- **Assessment in operational experimentation**
  - **A process by which the operational performance and effectiveness of a new and emerging capability is estimated and evaluated and needed modifications in the capability are identified**
  - **Provides rapid feedback to developers**
  - **Matures ORS capabilities (CONOPS, TTPs, technologies)**
- **User Support**
  - **Operational focus: CONOPS, TTP development**
  - **Training and user manuals**
  - **Socializing VMOC and ORS concepts and capabilities with user groups**
    - **Disadvantaged users**
    - **Non-space savvy users**

VMOC Operational Experimentation Objectives

- **Facilitate the development of ORS technologies, CONOPS and TTPs**
- **Evaluate the performance and value-added of VMOC as a maturing ORS capability**
- **Expand the ORS and VMOC community of users and create opportunities to expose new users to ORS concepts and assets**
- **Evaluate the performance and utility of VMOC tasking, apportionment and mission capabilities**
- **Evaluate the appropriateness, functionality and usability of the evolving VMOC 2015 Architecture**

VMOC Operational Experimentation Constraints

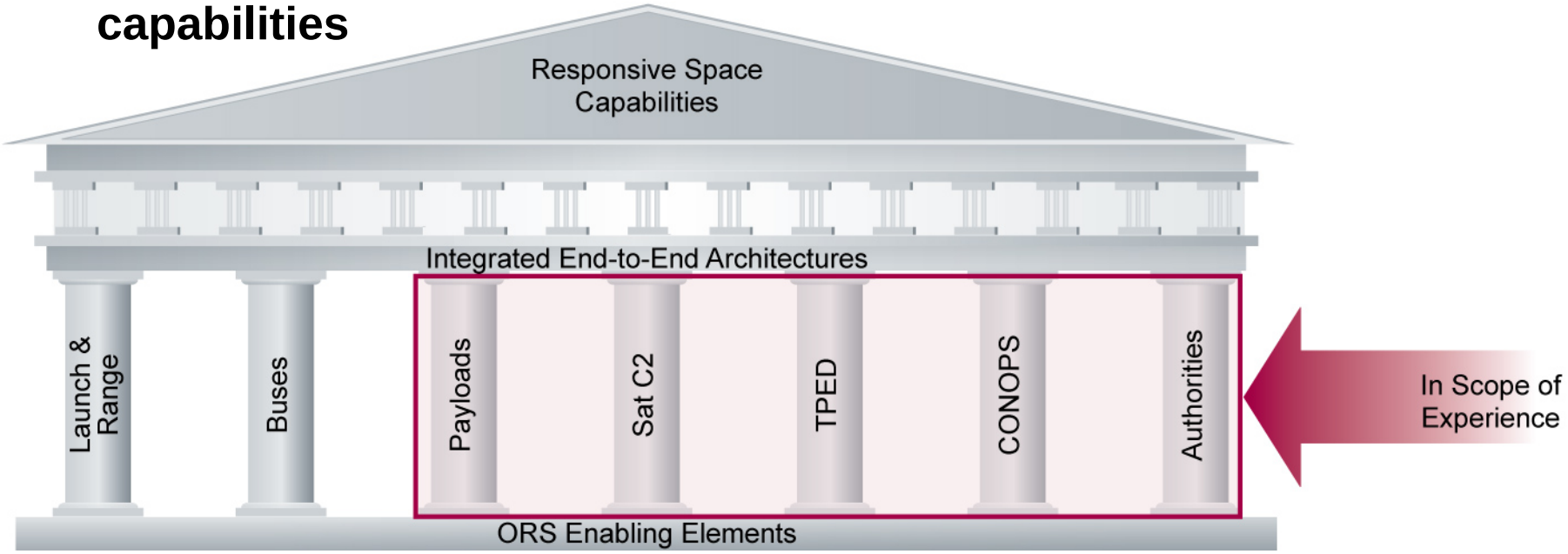
- **Focused on:**
  - **Evaluation of the operational utility of VMOC as a tactical space C2 capability supporting the development of ORS related tasking, CONOPS, policies and authorities – and tasking, processing, exploitation and dissemination (TPED) processes when appropriate**
  - **Selected evaluation of the operational utility of TacSats to warfighters**
- **Not intended to replace a formal joint military utility assessment (JMUA) or T&E of particular systems**
  - **OP EXP efforts augment formal JMUA of VMOC/TacSats**
- **The OP EXP assessment approach utilized is consistent with the DoD's practical operating guidelines for evaluation of Joint Capability Technology Demonstrations (JCTD)**

VMOC Experimentation Efforts

- Twelve operational experimentation events conducted to date
  - Across a variety of operational contexts: PACOM, USCG, STRATCOM, others
  - Focused on different functional areas: Tactical, Apportionment, and Mission
- Specific Events
  - Air Force CIO Demonstration (2004)
  - TERMINAL FURY 05, 06, 07 (2005-2007)
  - Space Apportionment for Effect (2006)
  - Multi Use Ground Station (2006)
  - Cap Archer (2006)
  - Space Operations Responsiveness Demo (2007)
  - Project Spotlight (2007)
  - Valiant Shield (2007)
  - Talisman Saber (2007)
  - VMOC Demonstration (2008)
  - TacSat-4 (2009-2010)

TacSat Experimentation

- **ORS Office has identified seven enabling elements required in order to develop and mature responsive space capabilities**
- **Development of each of the elements, in the pillars below, contributes to an end-to-end ORS architecture**
- **Each TacSat experiment is designed to further the ORS effort and cumulatively will facilitate the development of ORS capabilities**



VMOC Support to TacSat-4 Experimentation

- **TacSat-4:**
  - **Will provide military users with communications on the move (COTM), data from unmanned sensors (Data X-Filtration and Ocean Data Telemetry Microsatellite Link) and Friendly Force Tracking (FFT) support**
  - **Intended to enhance the ORS effort by developing and maturing relevant technologies, policies and objectives, CONOPS and TTPs**
- **VMOC:**
  - **Will provide tasking, apportionment and mission planning and scheduling capabilities to TacSat-4 users**
  - **Intended to enhance the ORS effort by maturing VMOC capabilities and providing 'risk reduction' for VMOC support to operations**
- **Operational Experimentation will evaluate**
  - **Operational utility of TacSat-4's payloads**
  - **Impact of using VMOC to support TacSat-4 operations**
  - **Development of related tasking processes, CONOPS, policies and authorities**

VMOC Support to Operations: ORS Sat-1

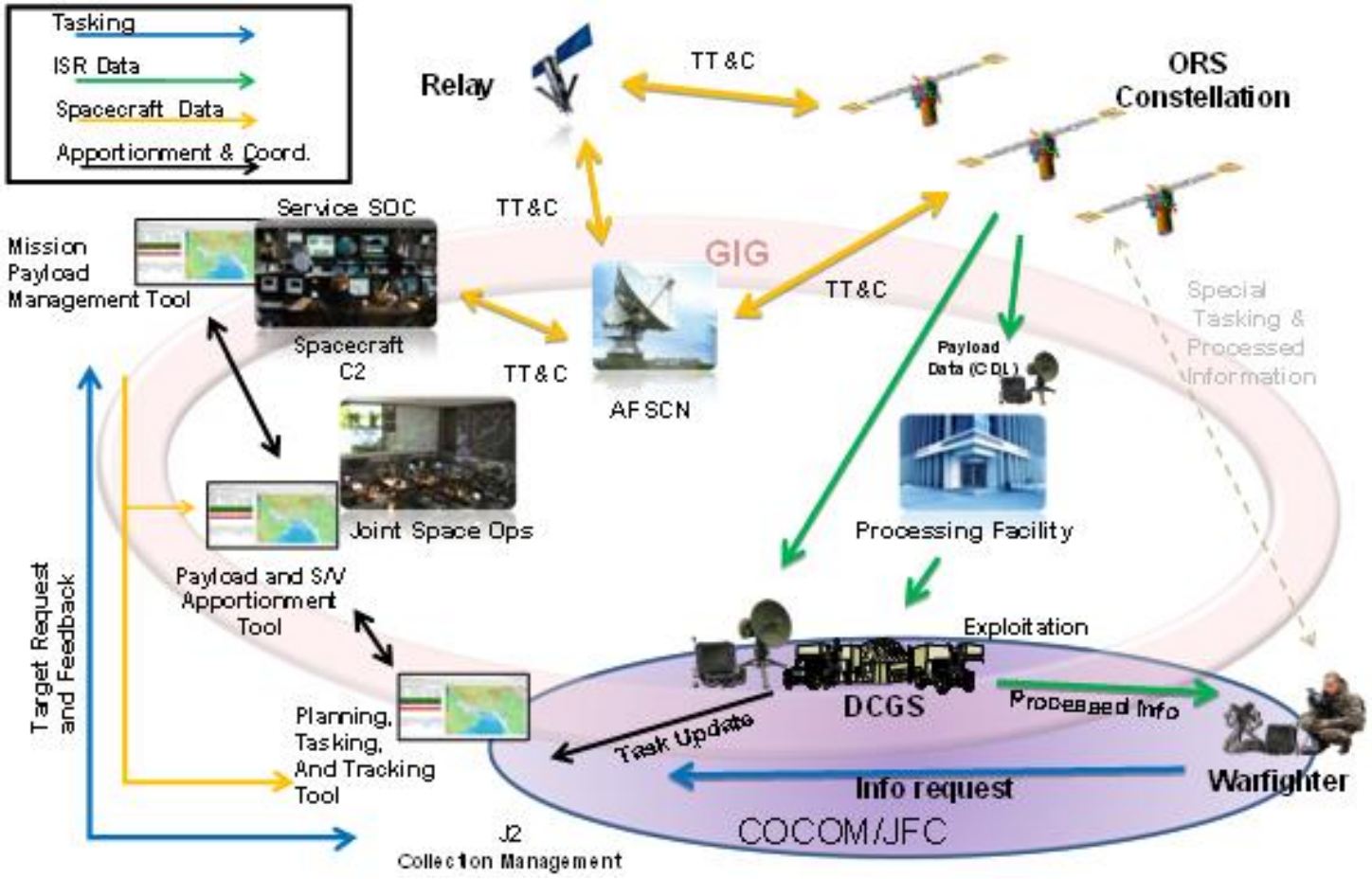
- **First operational mission being conducted by the ORS Office**
- **Designed to meet critical quick-response intelligence, surveillance and reconnaissance (ISR) needs**
- **VMOC will interface with existing TPED systems in a timely process to meet user needs and successfully conduct the mission**

VMOC Status

- **Continuing ongoing research and development efforts**
  - **Recently merged disparate VMOC systems into one integrated system featuring three distinct components: tactical, mission and apportionment**
  - **Conducting operational evaluation in support of ORS objectives and other sponsor needs (such as ONR)**
- **Transitioning VMOC to operational system in support of ORS-1**
  - **Adhering to design requirements established for ORS-1**
  - **Participating in formal system review**
    - **Preliminary Design Review (March 2009)**
    - **Critical Design Review (June 2009)**
- **Beginning the transition path toward becoming a Program of Record (POR):**
  - **Discussions with Joint Space Operations Center (JSpOC) indicate interest in VMOC becoming a POR**

VMOC Way Ahead (1)

- **ORS 2015 Ground System Enterprise (GSE): Presents an integrated approach to ISR missions**



VMOC Way Ahead (2)

To support the ORS 2015 GSE -

- **VMOC is building a common mission planning, apportionment, and tasking interface**
  - **Interface is integrated with tasking tools currently used by Collection/Asset Managers and is being integrated into an overarching C2 TPED process**

- **The automated interface between the Tactical, Apportionment, and Mission VMOC components plays a key role in the GSE:**
  - **Allows scalable multi mission planning**
  - **Provides a "Fed-Ex" style tracking capability**

Conclusion

- **VMOC's path to space operations has been a multi-year process**
  - **Emerged from a need to make space capabilities more accessible to users and to dynamically manage responsive space systems**
  - **Matured through user experimentation and demonstrations**
- **Currently expanding the ORS community of users and establishing ORS CONOPS and TTPs**
  - **Supporting TacSat-4 operational experimentation**
  - **With the launch of ORS Sat-1, VMOC will transition from experimentation status to a fully operational program**
- **VMOC is a key element of the ORS GSE and will provide a scalable, dynamic, and flexible set of services to support and further the ORS vision**

Thank you!

Questions?