**MMSOC GSA:
Standards and Architecture
Enabling
Multi-Mission Interoperability**

Introduction. Historically, Air Force Space Command (AFSPC) has had limited success in operationally exploiting new space technologies and concepts developed by Department of Defense research laboratories. Significant changes in worldwide threats are rapidly evolving military needs and increasing demands for flexible and responsive space operations. To address this call, the Space and Missile Systems Center's (SMC) Space Development and Test Wing (SDTW) was issued a **mandate:** To fly various one-of-a-kind technology demonstrations and other space-based missions for Research, Development, Test and Evaluation (RDT&E) and responsive space operational communities.

In response, SDTW is developing the Multi-Mission Satellite Operations Center (MMSOC) Ground System Architecture (GSA) to provide a common system meeting this broad spectrum of operational requirements. The MMSOC GSA will consolidate satellite operations by providing an agile, flexible overarching ground segment architecture for one-of-a-kind technology demonstrations and responsive space operations. The mandate was accompanied by a **challenge**: To execute the mandate using limited personnel while lowering development and sustainment costs and reducing schedule without increasing technical risk.

This presentation will discuss the SDTW-developed MMSOC GSA architecture and demonstrate those aspects of the design that support different mission classes while providing the opportunity to reduce the readiness timeline, cost of mission transition, unique training requirements, and sustainment costs.

Background. MMSOC GSA is structured to meet the requirements of multiple programs. Each of these programs operate RDT&E or technically unique satellites with shorter life cycles. It is also important to understand that the MMSOC GSA architecture is not a "point" solution, continuous planned upgrades are necessary to maintain currency. Plans are currently in place to host missions from each of the following categories on the MMSOC GSA.

- DoD experimental and demonstration satellites are typically one-of-a-kind missions with a 1-year experimental operations phase. The MMSOC GSA architecture is structured to support all aspects of the RDT&E mission: planning, training, readiness activities, launch & early orbit operations, normal operations, data collection and processing, and vehicle health and safety.
- Some missions end the experimental phase with a determined residual COCOM capability. MMSOC GSA supports all aspects of this residual activity. The

MMSOC GSA vision provides a collaborative environment facilitating an efficient transfer of RDT&E satellites with residual COCOM capability to the warfighter providing rapid access to new battlefield effects.

- The Operationally Responsive Space (ORS) office is tasked to demonstrate an initial capability for operationally responsive access to and use of space to support national security requirements. ORS exists as both complementary to current space capabilities and as a means by which to implement new capabilities. ORS provides the capacity to respond to unexpected loss or degradation of selected capabilities, and/or provide timely availability of tailored or new capabilities. The MMSOC GSA architecture has been designated as the primary satellite C2 capability for the ORS office and is designed to facilitate rapid transition of assigned missions.

Meeting the challenge of flexible operations at reduced cost requires more than just a materiel **solution**; process and business rules must also be addressed. The MMSOC GSA architecture provides a collaborative environment to rapidly address RDT&E and operational needs for satellite operations. This new approach to acquisition, operations and maintenance is intended to organize the personnel, processes, and resources necessary to develop and field one-of-a-kind missions, whether intended for technology demonstration (RDT&E) operations or quick response missions (ORS).

Approach. Development and implementation of the MMSOC GSA capability is being managed by the Responsive Satellite Command and Control Division (RS C2) of SDTW. RS C2, working with its prime contractor, Lockheed Martin, has developed a strategy for the implementation of a robust, open system ground C2 segment focused on a published, to-be architecture. The strategy employs an evolutionary model guided by an Open Systems Management Plan (OSMP) with interfaces controlled by MMSOC GSA Services Catalogue and External Interface Control Document (ICD). Standards and the OSMP are expected to be valuable in facilitating both modifications and mission integration. Development activities to date have been methodical with very promising results.

Architecture Development:

The RS C2 Division developed and published an initial “to-be” architecture, one that addressed both the acquire (process) and employ (system) aspects of the enterprise. The first instance of the employ side (MMSOC GSA Block I) will be used to support STPSat-2 in early 2010. Block I will also be installed at SOC-11 at Schriever AFB, Colorado Springs to support the first ORS mission, ORSSat-1, scheduled for launch in late 2010. The published architecture can be accessed at the following web location: https://wwwd.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EA-AF-SP-18-2-21-9&Filter=OO-EA-AF-SP

Solution Identification:

Working closely with the developers, MMSOC GSA is leveraging both commercially-based and newly-developed satellite C2 systems using an incremental process. Currently, AFSPC satellite C2 systems are developed under the traditional acquisition methodology where an extended period of time elapses between system requirements definition and the fielding of the required capability. The MMSOC GSA strategy breaks this paradigm.

The MMSOC GSA is an open system, COTS and NDI-based Telemetry, Tracking & Control capability. Primary capabilities are provided by Horizon (Lockheed Martin), SAGES, and STK.

The C2 system will be developed and initially fielded within SDTW. Once proven, the systems will be deployed into operational and support components and undergo operational acceptance testing. Operator evaluations of these systems will provide feedback between the operational and development communities and lead to a continuous loop of overall system improvement.

Open System Management Plan, External ICD, and Services Catalogue Development:
RS C2, in conjunction with the development contractor, identified the need for an Open System Management Plan (OSMP). The MMSOC GSA OSMP was developed based on fundamental open system principles: Establish Business and Technical Enabling Environments; Employ Modular Concepts; Employ Business and Technical Patterns; Designate Key Interfaces; and, Use Open Standards for Key Interface Certification and Conformance.

These principles, combined with the identification of standards (particularly for data and interface control) and an established list of services, will allow the program to work with potential missions reducing unique mission support requirements. Further, a mission portfolio and GSA specific cost model are being developed to assist in managing the new mission developments.

Upgrade/Improvement Cycle Initiation:
The RS C2 Division will plan the system evolution taking into account technical needs and projected resources. Based on current and projected needs, the program will develop optimization capacity and capability to meet designated targets while maintaining system availability. MMSOC GSA will also be improved and modernized to enhance cost effectiveness, ensure sustainability and prevent system obsolescence.

Since the architecture is meant to be continually enhanced as well as sustained, the RS C2 has planned for a new block upgrade each year. This process is designed to maintain currency and prevent complete replacement due to obsolescence while providing a continuous operational capability. A 6-month planning cycle, used to evaluate current shortfalls, requirement priorities and the technology roadmap weighed against funding profiles will overlap with completion of the existing build. A twelve month development window will then complete with the acceptance of the new build. The Block II study phase was recently initiated in accordance with this process.

The RS C2 Division needs to expand the “acquire” side of the architecture. Additionally, a target mission was needed to test the expected benefits of the published interfaces and services guide. A Navy satellite system, GFO-2, will make the External ICD and

Services Guide part of the source selection package. By identifying and controlling ground system expectations early and properly linking the ground system development schedule to overall mission milestones, it is expected that cost and schedule risks can be more effectively controlled and reduced. The Block II study phase has identified modifications to both the "acquire" and "employ" sides of the enterprise architecture. Specifically, the need for a GSA compatible Integration, Assembly and Test (AI&T) system was identified as a mechanism to reduce cost, schedule and integration risks. It is expected that by allowing the vehicle developers to interact with this AI&T, not only will database and screen development activities be reduced but continual testing during the vehicle development phase will reduce overall risk of unexpected ground system behaviors. GFO-2 will be the initial implementer of the GSA-compatible AI&T GSE.

Conclusion. A fielded MMSOC GSA will institutionalize AFSPC's ability to exploit emerging technologies on a significantly reduced timeline and funding profile. The flexibility and responsiveness of the architecture is the key enabler to achieve the operations concept. The common architecture leverages efficiencies in both training and maintenance, minimizing funding requirements in these areas. Likewise, transition of missions and remote backup of operations between similar Satellite Operations Centers (SOC) becomes more straightforward.

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