

# Joint Space Operations Center (JSpOC) Mission System (JMS)

## Executive Summary

- The Air Force has yet to conduct any OT&E for Joint Space Operations Center (JSpOC) Mission System (JMS) Increment 2, but conducted significant development and developmental testing for JMS Increment 2, Service Packs (SP) 9 and 11 in 2016, including three phases of functional developmental testing for SP9 and developmental cybersecurity assessments.
- The Air Force completed a Critical Change review for JMS Increment 2 in August 2016 due to both schedule and cost increases, and consequently descoped Increment 2 capabilities and deferred final delivery from July 2016 to May 2019. Descoped capabilities no longer being delivered with JMS Increment 2 include the Special Access Program (SAP)-level enclave, automated high-priority tasking, advanced space order of battle tools, and the capability to ingest and process data from non-traditional space situational awareness (SSA) sensors.
- The Air Force is planning an Operational Utility Evaluation (OUE) of JMS Increment 2, SP9 in 2017, following an integrated test and evaluation (IT&E) period, and the developmental testing campaign, which is in progress.
- The Air Force is finalizing a revision to the JMS Test and Evaluation Master Plan (TEMP) to reflect program schedule and content changes, including OT&E for SP11, necessitated by the addition of functional capabilities.
- Delayed interoperability testing between JMS and Space Fence Increment 1 adds risk to cost and delivery schedule for both programs.

## System

- JMS is a net-centric, service-oriented architecture of hardware, software, data, and network connectivity that will process, integrate, store, and allow for the compilation, exploitation, sharing, and visualization of SSA sensor data and analysis to support command and control tasking and battle-management decisions for space forces.
- Operational JMS hardware strings and infrastructure are installed at Vandenberg AFB, California, and will be installed at a backup site at Naval Support Facility Dahlgren, Virginia. Additional non-operational instances and partial-instances of JMS are installed for development and developmental testing purposes at a multitude of other sites, including Vandenberg AFB, California, and Space and Naval Warfare Systems Center Pacific at the Point Loma Annex of Naval Support Center San Diego, California.
- JMS net-centric enterprise services, including data visualization, mission applications, and functional queries, are accessible to worldwide users running JMS client software on



- non-JMS workstations connected through the Secret Internet Protocol Router Network (SIPRNET) and the Joint Worldwide Intelligence Communication System (JWICS) Network.
- JMS will replace legacy Space Defense Operations Center (SPADOC) and space specific portions of the Correlation, Analysis, and Verification of Ephemerides Network (CAVENet) systems.
- The Air Force is developing JMS in two increments.
  - Increment 1 delivered an initial service-oriented architecture infrastructure and user tools, including a client workstation-accessible User Defined Operational Picture that allows access to and analysis of data from legacy systems, integrated collaboration/messaging/data sharing tools, and space order of battle processing.
  - Increment 2 is being developed to deliver mission functionality in three SPs.
    - SP7 delivered updates and additions to Increment 1-delivered hardware and software infrastructure, including servers, space surveillance network (SSN) communications services connectivity, system security and message processing capabilities, and limited space surveillance data processing and visualization tools. SP7 was not operationally tested because it will not replace legacy SPADOC and CAVENet systems nor be used for mission critical functions.
    - SP9 is intended to update and expand JMS hardware and software to perform functions currently performed by SPADOC and CAVENet, with improved accuracy, efficiency, and responsiveness. Those functions include administration and maintenance of the space catalog, orbit determination for resident space objects (RSOs), assessment of conjunctions (collision risk) between

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RSOs, and high-accuracy tasking of sensors for orbital safety, threat modeling, and operational decisions.

- SP11 is intended to complete Increment 2 functionality on the Top Secret enclave. SP11 is intended to include the ability to ingest and integrate more highly-classified data, support routine Space Object Identification tasking, and support processing for critical events such as RSO Closely Spaced Operations, breakups, re-entries and de-orbits, launch processing, and processing of uncorrelated tracks. SP11 is also intended to encompass test, training, and exercise capabilities and availability and reliability improvements which had been planned for delivery in the descoped SP13.

## Mission

The JSpOC uses JMS to enable the coordination, planning, synchronization, and execution of continuous, integrated space operations in response to tasking from the Commander, Joint Functional Component Command for Space (CDR JFCC SPACE), a component of U.S. Strategic Command, in support of national and Combatant Commander objectives. JSpOC will use JMS to provide the CDR JFCC SPACE with the ability to task

sensors and process sensor data to monitor the space domain, predict, detect, and respond to space events, maintain, analyze, visualize, and disseminate SSA data, and collaborate with other forces.

## Major Contractors

- Government prime contractor:
  - Air Force Space and Missile Systems Center – Los Angeles AFB, California
- System Integrator, Increments 1 and 2:
  - Space and Naval Warfare Systems Command – San Diego, California
- Increment 1 sub-contractors:
  - Intelligent Software Solutions, Inc. – Colorado Springs, Colorado
  - The Design Knowledge Company – Fairborn, Ohio
- Increment 2 sub-contractors:
  - Analytical Graphics Incorporated – Exton, Pennsylvania
  - Artificial Intelligence Solutions – Lanham, Maryland
  - Intelligent Software Solutions, Inc. – Colorado Springs, Colorado
  - The Design Knowledge Company – Fairborn, Ohio

## Activity

- The Air Force has yet to conduct any OT&E for JMS Increment 2, but conducted significant development and developmental testing for JMS Increment 2, SP9 and 11 in 2016, including:
  - Three phases of functional developmental testing for SP9 between May and October 2016
  - Developmental cybersecurity assessment from February to March 2016 and testing of partial representations of JMS Increment 2 at the National Cyber Range as part of a continuum of cybersecurity assessment incorporated by the Program Office into the JMS development effort
- The Air Force Operational Test and Evaluation Center is planning an OUE of JMS Increment 2, SP9 following an IT&E period, and the developmental testing campaign, which is in progress.
- The Air Force completed a Critical Change review for JMS Increment 2 in August 2016, due to both schedule and cost increases. As a result of the review, the Air Force descoped JMS Increment 2, with a new final delivery date of May 2019 (originally July 2016). Descoped capabilities no longer being delivered with JMS Increment 2 include the majority of planned SP13 content, including a SAP-level enclave, automated high-priority tasking, advanced space order of battle tools, and the capability to ingest and process data from non-traditional SSA sensors.
- The Air Force is finalizing development of a revision to the JMS TEMP, to reflect program schedule and content changes, including the addition of OT&E for SP11, necessitated by the addition of functional capabilities.

## Assessment

- As the Air Force has not conducted any OT&E for JMS Increment 2, there are no operational test data available.
- SP9 will require at least one more developmental testing phase than the three currently planned by the Air Force. The Program Office plans to reassess the SP9 and broader Increment 2 schedule at the completion of each developmental testing phase. DOT&E expects OT&E for SP9 to begin no earlier than June 2017.
- Delays in JMS Increment 2 capability delivery increase risk of late discovery of interoperability deficiencies between JMS and Space Fence Increment 1, and data processing capacity adequacy for JMS. Space Fence Increment 1 is currently in development, and a sub-scale Integration Test Bed representation of Space Fence is available for testing but is not connected nor prepared to connect to JMS. The deferral of Space Fence interoperability functionality to SP11 and the non-availability of JMS for interoperability testing between JMS and Space Fence will delay deficiency discovery and resolution for both JMS and Space Fence, and require the simulation of Space Fence-imposed workload in JMS testing, likely increasing cost and delivery schedule for both.
- The Air Force has deferred capability requirements from the validated JMS Capability Development Document, which were planned for delivery in SP13 and not included in SP11, to an undefined increment. The increment may overlap an as-yet-undefined program of record being planned to equip the new Joint Interagency Combined Space Operations Center (JICSPOC).

## Recommendations

- Status of Previous Recommendations. The Air Force resolved one of the seven previous recommendations when it completed the planned technology refresh for Increment 1 equipment and continued acquisition, development, testing, and fielding of JMS Increment 2. The Air Force still needs to:
  1. Develop an acquisition strategy for delivery of capabilities post-Increment 2, including facilities and capabilities to support continuity of operations. This recommendation remains valid, given the restructure of Increment 2 and the nascent planning for a JICSPOC program of record.
  2. Investigate and resolve problems with external data source consistency, external interfaces, and support networks that will otherwise impede JMS end-to-end mission performance. The Air Force has made substantial progress in planning and assessing data source and external interface connectivity and interoperability, with the significant exception of JMS-Space Fence interoperability, as described above.
  3. Assess new Increment 2 capabilities and reassess JMS User Defined Operational Picture and net-centric capabilities to verify full JMS functionality. This is in progress and should be completed with SP11 OT&E.
  4. Develop and validate modeling and simulation tools to support evaluation of system capacity under high-user loading and evaluation of JMS high-accuracy catalog size and accuracy. This is in progress.
- 5. Develop operationally-relevant measures to assess JMS system performance degradation due to cyber-attack. Provide capabilities to allow system administrators to monitor performance and take appropriate actions to mitigate operational impacts based on these measures. This recommendation remains valid and some progress has been made due to the Program Office's significant focus on cybersecurity assessment and hardening. Additional work remains to ensure JMS provides monitoring and insight sufficient to enable active cyber defense.
- 6. Conduct independent, non-cooperative, threat representative penetration testing to assess protect, detect, react, and restore components of cybersecurity for Increment 2. This testing is planned for SP9 and SP11.
- FY16 Recommendation.
  1. The Air Force should commit resources to ensure interoperability testing between JMS and Space Fence Increment 1 in 2017, including dedicated schedule periods and use of partial- and full-hardware and software instances.

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