

**System of Systems Engineering and Integration  
Statement of Work**

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## **Statement of Work**

### **1 Introduction**

This Statement of Work (SOW) specifies the tasks that the Contractor shall perform for the Program Executive Office for Air, Space and Missile Defense (PEO ASMD) in executing the U.S. Army ASMD System of Systems (SoS) Engineering Support Program.

The PEO ASMD mission is to provide the nation with a horizontally and vertically integrated, responsive Air, Space and Missile Defense capability that protects the force and high value assets against the full spectrum of the air and missile threats. To satisfy this mission the PEO is transforming the way it acquires ASMD capabilities from a system-centric, stove-piped acquisition approach to an integrated, component-based SoS acquisition approach. This latter approach will provide the warfighter with a component-based, dynamically tailorable force consisting of sensors and shooters integrated together through a common ASMD BMC4I to be deployed as integrated components in a netted and distributed architecture. This architecture provides the capability for these components to be integrated to form combat organizations to perform specified warfighting missions to effectively and efficiently achieve the desired level of force protection. The SoS will be a spiral development program that involves fielding capabilities incrementally, closely associated with the user's incremental timelines for required capabilities. The approach is designed to allow for work to be accomplished supporting each of the three initial increments simultaneously, while ensuring that each increment builds on the previous. The first increment will focus on providing a potential SoS emergency operational capability (EOC) in the fiscal year (FY) 07 timeframe. The second increment (first increment fielded with a Common BMC4I) of the SoS will occur in the FY 10 time frame, with subsequent increments following approximately every four years. Existing and emerging programs which will be incorporated into the SoS include: the Combined Aggregate Program (CAP) consisting of the PATRIOT Air and Missile Defense System and the Medium Extended Air Defense System (MEADS); the Surface Launched Advanced Medium Range Air-to-Air Missile (SLAMRAAM) System; the Terminal High Altitude Area Defense (THAAD) system; Sentinel; the Joint Land Attack Cruise Missile Defense Elevated Netted Sensors (JLENS) system; and the Multimission Mobile Processor (M3P) upgrades to the Joint Tactical Ground Station (JTAGS).

A fully integrated ASMD SoS capability requires the development of a common ASMD BMC4I as the primary integrating element. The common ASMD BMC4I: Provides the "plug and fight" capabilities required for dynamic force tailoring; Provides the integrated fire control capabilities required to respond to emerging stressing threats; Provides a cost-effective means for integrating emerging joint functionality, such as the Single Integrated Air Picture (SIAP) Integrated Architecture Behavior Model (IABM); Reduces the ASMD Logistics footprint; and Reduces the acquisition and life cycle costs for ASMD BMC4I systems/components. The ASMD BMC4I component will be common and modular in both its hardware and software implementations.

The contractor shall accomplish the requirements of this Statement of Work (SOW) by integrating into the SoS Integrated Product Team (IPT) structure to develop SoS deliverables as described herein. The contractor shall co-chair the SoS IPT and working IPTs (WIPT) below the Integrating IPT (IIPT) and Overarching IPT (OIPT), which are chaired by the PEO ASMD. The PEO ASMD will be the overall Technical Manager for all efforts under this contract. The Technical Manager's contractual role is described in more detail in Section H of the contract.

The focus of this contract effort is to provide program management, engineering, integration, test and logistics analysis support to the government-led SoS IPT structure to develop SoS level program documentation to be flowed down through the PEO ASMD to the project offices for implementation. The contractor shall effect coordination with ASMD component system prime contractors to ensure SoS program executability within cost estimates and schedules.

## **2 Specific Scope**

### **2.1 Program Management**

The PEO ASMD provides overall management for the ASMD SoS Program and actively participates within the SoS IPT process. The PEO ASMD retains total systems performance responsibility for the SoS. The Contractor shall lead development of SoS deliverables through the SoS IPT process with the concurrence and approval of the PEO ASMD.

#### **2.1.1 PEO ASMD/Industry Integrated Process/Product Teams**

The Contractor will be a key participant in the PEO ASMD/industry SoS IPT process. As part of the SoS IPT, the contractor shall co-chair the SoS IPT and each of its subordinate WIPTs with the government. The Contractor shall propose a Chief Engineer for the SoS Engineering Support Program who will also serve as a member of the PEO ASMD chaired SoS IIPT. The Contractor's proposed Chief Engineer and IPT/WIPT industry co-chairs will be approved by the PEO ASMD and will be designated as key personnel in the contract. The Contractor's designated Program Manager will be invited to serve as an advisor to the SoS OIPT. The Contractor shall execute the SoS IPT process for the PEO ASMD and utilize the collaborative team's resources in the development of SoS deliverables. Participation in the SoS IPT structure includes the responsibility for assessing and recommending adjustments to the IPT structure as well as the roles and responsibilities for the individual WIPTs and members. As a working member of the IPT structure the contractor will be responsive to the direction of the SoS IIPT and the OIPT. All contract tasks and all deliverables (other than CDRL 21, Performance and Cost Report) are subject to the technical guidance and direction of the PEO ASMD as Technical Manager and, as specifically noted herein, the SoS IPT process. No such technical guidance/direction shall be construed as authorizing a change to the terms, conditions, funding or price structure of the contract. Only the contracting officer is authorized to change the contract.

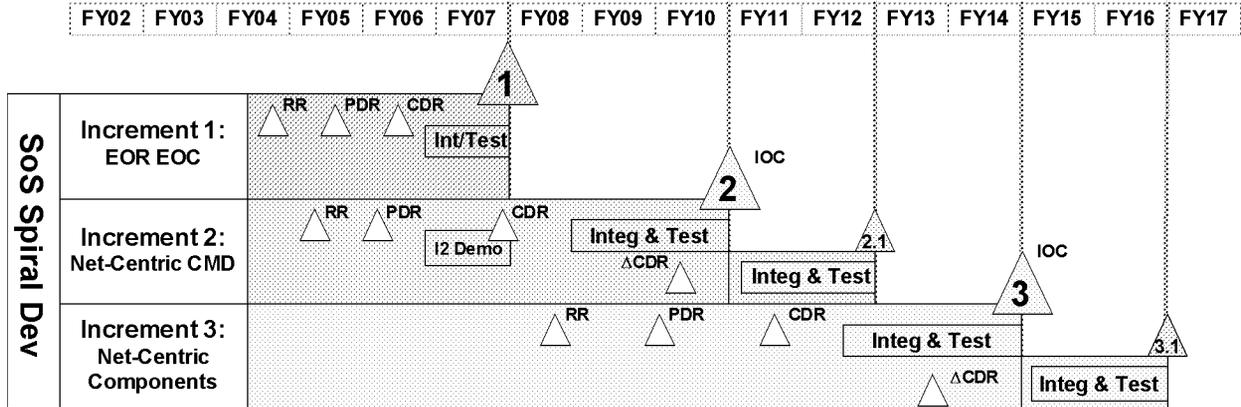
Within 30 days of contract award, the Contractor shall submit a Technical Report to the SoS IIPT providing contractor recommendations, if any, for modifying the SoS WIPT structure and/or roles and responsibilities. This technical report will also identify the Contractor's recommended key personnel co-chairs for the SoS IPT and each of the WIPTs.

**Deliverables:** Technical Reports (CDRL 18)

#### **2.1.2 SoS Engineering Support Program Management**

The Contractor shall lead the development and maintenance of the SoS Program Management Plan, Work Breakdown Structure, Integrated Master Plan and Integrated Master Schedule through the SoS Programmatic WIPT.

The Contractor shall develop the Baseline SoS IMS to support the SoS Program Schedule presented below. The Contractor's IMS shall include the schedule for all contract deliverables in support of the SoS Program Schedule, unless otherwise specified in Section 3 of this SOW. The Contractor shall recommend adjustments to key supporting program milestones such as SoS Requirements Reviews (SRR), Preliminary Design Reviews (PDR) and Critical Design Reviews (CDR) as necessary to synchronize with corresponding ASMD system technical reviews in order to effectively influence the requirements and design of these systems/components.



**Deliverables:** SoS Engineering Support Program Management Plan (CDRL 01), SoS Engineering Support Program Work Breakdown Structure (CDRL 02), SoS Engineering Support Program Integrated Master Plan (CDRL 03), SoS Engineering Support Program Integrated Master Schedule (CDRL 04)

### 2.1.3 SoS Configuration Management

The contractor shall develop and maintain a formal configuration management (CM) process for the ASMD SoS and will support configuration management activities with the Ballistic Missile Defense System (BMDS) as required. The CM process will leverage the existing SoS IPT structure. The PEO ASMD retains responsibility as the SoS Configuration Manager.

**Deliverables:** SoS Configuration Management Plan (CDRL 16)

### 2.1.4 SoS Risk Management

The contractor shall develop and maintain a formal risk management process for the ASMD SoS. The risk management process will leverage the existing SoS IPT structure, with the SoS IIPT serving as the PEO's Risk Management Board.

**Deliverables:** SoS Risk Management Plan (CDRL 17)

## 2.2 SoS Transformation Strategy

The Contractor shall develop and support the execution of an achievable, incremental strategy for acquiring ASMD components and integrating them into incremental SoS capabilities. The Contractor shall fully utilize their unique access to the evolving ASMD components (cost, performance, and schedule) to develop plans and assess impacts to existing programs. The transformation strategy must be consistent with the user's needs as currently defined in The United States Army Air and Missile Defense Operational and Organizational Concept for the Future Force (the AMD O&O) and other imperatives specified by the PEO ASMD. The transformation strategy shall be updated upon approval of the AMD SoS Initial Capabilities Document (ICD) and Capability Development Document (CDD).

### 2.2.1 JV-SoS Contractor Relationships

The Contractor shall establish cooperative working relationships with prime contractors of existing and emerging ASMD component systems as well as other Joint air and missile defense (AMD) systems/components in order to obtain their cooperation, knowledge, expertise, and data (proprietary and otherwise) in developing and designing a fully coordinated, integrated and effective ASMD SoS. Special emphasis shall be placed upon the Contractor's relationship to MEADS International (MI) as the

prime developer for the MEADS program. Other specific prime contractors with whom such working relationships will be necessary are [REDACTED] (PATRIOT, SLAMRAAM, Sentinel and JLENS), [REDACTED] (THAAD, M3P upgrades to JTAGS, PAC-3, PAC-3 Missile Segment Enhancements (MSE) and related ground systems), [REDACTED] (JTAGS) and [REDACTED] (Ballistic Missile Defense System (BMDS) and Future Combat System (FCS)).

The Contractor shall submit a plan for establishing cooperative working relationships with other contractors. In this plan, the contractor shall consider adding these other contractors to the JV as partners or entering into subcontracts or associate contractor agreements with them as necessary to optimize the SE&I effort under this contract.

**Deliverables:** Cooperation Plan Report (CDRL 20)

### **2.2.2 SoS Transformation**

The Contractor shall conduct analyses to recommend an executable strategy for incrementally fielding capabilities to evolve the current system-centric AMD architecture into a network-centric SoS architecture. This analytically supported recommendation shall detail a development and acquisition plan in order to obtain a realistic, achievable, affordable SoS capability in terms of cost, schedule, performance, and technology maturity. Strategy recommendations shall address the balancing or rebalancing of system requirements in order to make the SoS more efficient and effective. The recommendation shall address how the current system- and staff-centric BM/C4I architectures will migrate to a common BM/C4I architecture as the nerve center of the SoS architecture.

**Deliverables:** SoS Transformation Strategy Report (CDRL 5)

### **2.2.3 Program Impact Analysis**

The Contractor shall conduct analyses in cooperation with the ASMD component system prime contractors IAW the plan developed in task 2.2.1 above to estimate cost and schedule impacts when compared to current planned program efforts to achieve balanced/rebalanced SoS capabilities with common BM/C4I elements to implement the SoS Transformation Strategy.

**Deliverables:** Technical Report (CDRL 18)

### **2.2.4 CAP Transformation Strategy**

The CAP envisions the incorporation and integration of selected SoS developed (to include MEADS-developed) capabilities into the fielded PATRIOT force over time. The CAP program must balance the ongoing recapitalization of the PATRIOT program with capability insertion from SoS and MEADS development to ensure PATRIOT retains requisite operational availability while advancing SoS operational capabilities.

The Contractor shall conduct analyses in cooperation with Raytheon and other ASMD component system prime contractors as appropriate to develop recommendations for cost-effective improvements under the CAP to affect the timely transition from PATRIOT to MEADS capabilities, while improving the overall warfighter capabilities across a PATRIOT-supported SoS. This analysis will include evaluations of connectivity among Increment 1 components, effective SoS footprints and battle space effectiveness measurement plots, MTTR, MTBF, MTBCF and life cycle cost measurements. The analysis will also assess Increment 1 CAP/SoS ability to resolve Operation Iraqi Freedom (OIF) lessons learned issues. An overall assessment will be made of benefits from any reduced transport, savings in minimum first engagement capability, and increased defense area coverage from postulated air threats. Emphasis shall be on early fielding of MEADS capabilities and other appropriate SoS-emerging capabilities into the PATRIOT system. The Contractor shall recommend an affordable, efficient, and effective CAP through submission of a Transformation Strategy Report.

**Deliverables:** CAP Transformation Strategy Report (CDRL 6)

## 2.3 SoS Specification Development

The PEO ASMD has established a collaborative systems engineering process that is managed through the PEO's SoS Systems Engineering WIPT. The contractor shall fully participate in the collaborative engineering environment designed to include all legacy and developmental efforts within the ASMD SoS arena. The contractor will become an integral member of this process by designating a co-chair for the SE WIPT.

The Contractor shall develop and maintain SoS Requirements Specifications for each SoS Capability Increment. These specifications shall be developed under the direction of the SoS Systems Engineering WIPT. The Contractor shall ensure that specified SoS requirements are supported by rigorous systems engineering underpinnings and are achievable within the Increment timeframes. The Contractor's systems engineering approach shall be documented in the SoS Engineering Support Program Management Plan (SOW Section 2.1.2).

The Contractor shall lead the development of the SoS Increment 1 Specification through the SE WIPT. The SoS Increment 1 Specification will be a single, simplified specification, reflecting the requirements and modifications that are achievable by the FY07 timeframe. The Contractor's key role in the development of the SoS Increment 1 Specification is ensuring that specified requirements are achievable (cost, schedule and performance) in the target systems/components.

The Contractor shall develop and maintain a family of specifications for SoS Increments 2 and 3, under the direction of the SE WIPT. The Contractor will work within the SE WIPT to define the SoS specification tree. Subject to technical guidance and direction from the PEO ASMD, the Contractor shall develop an overarching SoS Specification for each increment with subordinate specifications for SoS Sensors, SoS Weapons, Common ASMD BMC4I, and SoS Interfaces. The Contractor shall apply a rigorous systems engineering methodology to support the SE WIPT in balancing or rebalancing SoS Requirements across the SoS. The Contractor shall ensure that the interface specifications include interoperability with the evolving Future Combat Systems, and Joint, Inter-Agency and Multi-National (JIM) systems/networks. The Contractor shall apply their unique knowledge of the SoS component development programs to ensure that the specified SoS requirements will result in the required capabilities being delivered within identified cost and schedule.

The Contractor shall prepare draft specifications prior to the conduct of scheduled technical reviews, and shall support the SE WIPT as required during the conduct of the formal technical reviews for each increment. Technical reviews shall be conducted at the PEO ASMD and shall include an Increment SRR, Increment PDR and Increment CDR. The Contractor shall prepare supporting DoD Architecture Framework compliant system views as required to convey the SoS Increment Architecture to the Joint community. These system views will be included as an annex to the SoS Increment Specifications.

**Deliverables:** SoS Increment Specifications (CDRL 7), Common ASMD BMC4I Specification (CDRL 8), SoS Weapon Specifications (CDRL 9), SoS Sensor Specifications (CDRL 10), SoS Interface Specifications (CDRL 11), Technical Reports (CDRL 18)

## 2.4 ASMD SoS Architecture Trades

The Contractor shall lead the conduct of trade studies in the SE WIPT to define the SoS architecture. The SoS architecture will be scalable and extensible and implemented in a time-phased approach consistent with SoS Increment 1, Increment 2 and Increment 3. Architecture definitions shall include capability descriptions and architectural views at the component level to include functional descriptions, quantities and availability dates. The Contractor shall participate in the development of the incremental, time-phased SoS Architectures to satisfy user's needs as currently defined in the AMD O&O, the SE WIPT developed ASMD Component-Based SoS Technical Implementation Concept, and other imperatives specified by the PEO ASMD. The architecture definitions shall clearly describe the relationship between the ASMD SoS and the evolving Future Combat Systems, and Joint, Inter-Agency and Multi-National (JIM) capabilities. The architecture assessments shall be updated upon approval of

the AMD SoS CDD. The Contractor shall formulate and evaluate system of systems architecture strategies to determine the most cost effective implementation approach for incremental improvements to meet the PEO ASMD vision.

The Contractor shall lead an effort to refine the SoS Increment 1 architecture to effectively integrate currently planned capabilities with achievable modifications in order to achieve an emergency operational capability (EOC) in the FY07 timeframe. The SoS Increment 1 architecture should show progress toward development of SoS Increment 2 to specifically include measurable progress toward achieving the required Common ASMD BMC4I.

The Contractor shall conduct trade studies through the SE WIPT to define the SoS Increment 2 and Increment 3 architectures. Definition of the SoS Increment 2 and Increment 3 architectures shall be supported by rigorous architecture trades and studies. The SoS Increment 2 architecture will at a minimum satisfy the PEO's commitment to provide an effective Cruise Missile Defense capability, and the SoS Increment 3 Architecture will satisfy all SoS requirements (to be definitized following approval of the SoS CDD).

**Deliverables:** Architecture Trades Assessments (CDRL 19), Technical Reports (CDRL 18)

## **2.5 ASMD SoS Test and Evaluation (T&E)**

The Contractor, under the direction of the SoS T&E WIPT, shall develop and document a SoS test and evaluation strategy. This strategy shall leverage the test and evaluation strategies of the component systems to the maximum extent feasible to reduce overall test and evaluation cost and schedule impacts. This strategy shall leverage Government and contractor hardware-in-the-loop, software-in-the-loop, and man-in-the-loop test beds, such as that available at the Software Engineering Directorate (SED), AMCOM to reduce cost, schedule, and equipment resourcing issues of conducting a comprehensive test and evaluation program. The contractor shall be responsible for drafting and maintaining a SoS Test and Evaluation Master Plan (TEMP) and submitting to the T&E WIPT for coordination and approval. The Contractor shall coordinate with ASMD component system prime contractors to develop recommendations, cost estimates, and schedule impacts of recommending changes to system-level test and evaluation strategies that will reduce the burden and cost of conducting unique or additional SoS-level testing. Recommendations for such changes to system-level testing shall be submitted using Technical Reports. The Contractor shall support execution of Developmental and Operational Testing of the SoS, submitting test reports and documentation using Technical Reports.

The Contractor shall coordinate deliverables and configuration management of System Software Elements from SoS component system prime and subcontractors in support of System Integration and Test. The Contractor shall develop a validation plan, noting most effective approaches involving integration/testing of selected SoS components/modules in support of overall effectiveness and evaluation assessments. The Contractor shall perform ground testing on specific SoS prototype components to support assessments. The Contractor shall provide recommendations to PEO ASMD for test adjustments in existing / evolving programs that promote SoS architecture assessments.

**Deliverables:** Test and Evaluation Master Plan (CDRL 12), Technical Reports (CDRL 18)

## **2.6 ASMD Modeling, Simulation and HWIL**

### **2.6.1 ASMD SoS Integration Laboratory**

Subject to the technical guidance and direction of the PEO ASMD, the Contractor shall provide analysis and recommendations with regard to the planning and implementation of a System Integration Laboratory (SIL) to support SoS integration / testing activities, maximizing existing government, contractor and PEO ASMD program infrastructure. The Contractor shall assess existing capabilities and propose the most cost effective approach that meets the requirements. This facility will be used to

demonstrate and test the interoperability of the SoS software elements and compatibility with the SoS architecture to incorporate other weapons, sensors, and Common ASMD BMC4I components.

**Deliverables:** SoS Integration Lab Plan (CDRL 13)

### **2.6.2 Integration and Use of Existing ASMD SoS Modeling and Simulation**

The Contractor shall utilize and integrate existing ASMD models and simulations to evaluate the effectiveness of each SoS architecture strategy. In supporting requirement effectiveness as it pertains to performance gains, the Contractor shall perform detailed simulations, utilizing existing program simulations products. The Contractor shall leverage and operate existing models and simulations to assess performance of various architecture recommendations. These models and simulations shall support trade studies required to further define SoS increments. The contractor shall integrate existing government and contractor maintained and operated simulations to create end-to-end simulation capabilities supporting the entire range of SoS architecture options to be evaluated. The contractor shall utilize existing cost model capabilities found with government or ASMD component system prime contractors and modify and/or integrate those to provide SoS level cost analysis capabilities to include life cycle cost modeling. Assessment results shall be provided in Technical Reports.

**Deliverables:** Technical Reports (CDRL 18)

### **2.6.3 ASMD SoS Modeling and Simulation Development**

If required, the Contractor shall develop new models and simulation capabilities to support the efforts defined in Section 2.6.2 above. If requested by the PEO ASMD, the contractor shall develop a Modeling and Simulation Development Plan detailing the deficiencies in existing capabilities, and the Contractor's plan for resolving these deficiencies. The Modeling and Simulation Development Plan shall be coordinated through the appropriate WIPT to ensure that existing capabilities are not being overlooked.

**Deliverables:** Modeling and Simulation Development Plan (CDRL 14), Modeling and Simulation Software (CDRL 22)

## **2.7 ASMD SoS Logistics**

The Contractor, under the direction of the SoS IPT structure, shall conduct logistics, supportability and sustainment analyses with the objective of reducing the logistics support footprint and the operations and sustainment cost for the SoS. Emphasis shall be placed on commonality of components and repair parts, common maintenance and logistics approaches, common repair parts modules, and common tools and diagnostic equipment across systems and components comprising the SoS. The Contractor shall conduct cost and impact analyses cooperatively with ASMD component system prime contractors to estimate cost savings and avoidance benefits and schedule impacts of modifying system logistics support plans and concepts to enable more synergistic and cost efficient operations and sustainment while reducing the deployed sustainment footprint for the SoS. Findings, conclusions and recommendations of these analyses shall be provided in Technical Reports.

**Deliverables:** Technical Reports (CDRL 18)

## **2.8 Common ASMD BMC4I Standards Development**

The Contractor shall support PEO ASMD initiatives to develop a Common ASMD BMC4I capability as the cornerstone of the ASMD SoS. The Contractor shall leverage previously performed Army ASMD RDT&E efforts in developing recommended hardware and software standards for a Common ASMD BMC4I component. Common hardware standards include shelters, computers, displays, communications equipment and other hardware. The key aspect of the common software standards is the identification of an open, modular software architecture. Other relevant software standards shall

also be defined. In order to facilitate implementation of other Army and Joint solutions, the Contractor shall ensure compatibility of the Common ASMD BMC4I software architecture and standards with the evolving Future Combat Systems, Missile Defense Agency C2BM, Navy Open Architecture and SIAP IABM software architectures. The SoS Common ASMD BMC4I Standards is a standalone document that supports the SoS Increment Common BMC4I Specifications. The intent of the SoS Common ASMD BMC4I Standards is to provide an early specification of the Common ASMD BMC4I vision to guide near-term development of Common ASMD BMC4I capabilities and support coordination of the Army ASMD approach with FCS and JIM capabilities.

**Deliverables:** SoS Common ASMD BMC4I Standards (CDRL 15)

### 3 Contract Deliverables

All deliverables (except CDRLs 20 & 21) are developed and maintained under the direction of the SoS IPT or one of its subordinate WIPTs. Deliverable schedules, unless otherwise specified below or in the DD Form 1423 CDRL, will be developed/coordinated through the programmatic WIPT. Section H of the contract includes negotiated special provisions addressing copyrights and technical data/software rights pertaining to these deliverables. The contractor shall provide all deliverables in paper and electronic form.

1. SoS Engineering Support Program Management Plan – 30 Days After Contract Award
2. SoS Engineering Support Program WBS – 30 Days After Contract Award
3. SoS Engineering Support Program Integrated Master Plan – Baseline Due 60 Days After Contract Award
4. SoS Engineering Support Program Integrated Master Schedule – Baseline submitted with Contractor's Proposal, updated Quarterly or as required to support SoS Program Milestones
5. SoS Transformation Strategy – Specified by Contractor in Baseline IMS
6. CAP Transformation Strategy – Specified by Contractor in Baseline IMS
7. SoS Increment Specification– Specified by Contractor in Baseline IMS
8. SoS Common ASMD BMC4I Specification – Specified by Contractor in Baseline IMS
9. SoS Weapon Specification – Specified by Contractor in Baseline IMS
10. SoS Sensor Specifications – Specified by Contractor in Baseline IMS
11. SoS Interface Specifications – Specified by Contractor in Baseline IMS
12. SoS TEMP – Specified by Contractor in Baseline IMS
13. SoS Integration Lab Plan - 60 Days After Contract Award, Semi-Annual Updates
14. Modeling & Simulation Development Plan – As Required
15. Common ASMD BMC4I Standards (HW and SW) - 90 Days After Contract Award
16. SoS Configuration Management Plan – Specified by Contractor in Baseline IMS
17. SoS Risk Management Plan 180 Days After Contract Award, Semi-Annual Updates
18. Technical Reports (white papers, briefings, reports, flow charts, etc as required by the government will be provided in contractor format)
19. SoS Architecture Trades Assessment Reports – Specified by Contractor in Baseline IMS
20. JV Cooperation Plan – Submit Baseline with Proposal. Update as Necessary During Contract Performance (Early emphasis on MI relationship)
21. Performance and Cost Report - Monthly
22. Modeling and Simulation Software – As Required