

STATEMENT OF WORK (SOW)

for

JHU/APL Support to USASMDC/ARSTRAT

in the areas of

Space Science, Systems Engineering, and Applied Science

SW-SMDC-11-08

01 February 2010

1.0 Background

To fulfill its mission, and realize its vision of ensuring and maintaining America's Space Superiority the Space and Missile Defense Command (herein after referred to as SMDC), and Army Forces Strategic Command (herein referred to as ARSTRAT) SMDC/ARSTRAT requires space system engineering expertise support from trusted sources. The Johns Hopkins University Applied Physics Laboratory (herein after referred to as JHU/APL) is one of a small number of organizations, which possess unique capabilities essential to our national defense; and, therefore, have been designated by the Department of Defense (DoD) as University Affiliated Research Centers (UARCs).

The DoD relies upon JHU/APL's core disciplines to provide engineering, research, development, and test and evaluation capabilities. Each of these core disciplines are determined to be essential to the support of a variety of programs managed by different technical sponsor organizations. Critical DoD areas supported by JHU/APL include missiles, radar, sonar, space, undersea warfare, command, control and communication (C3), anti-air warfare, strike warfare, information warfare, complex combat systems, and the characteristics and limitations unique to the operating environment of DoD systems. These core disciplines have been established and maintained at JHU/APL and are determined essential to the DoD's needs in the context of FAR 6.302-3(b)(2), as listed below:

- 1. Space Science and Engineering.** Design, develop, and build prototype space systems and instruments, conduct critical space experiments, analysis and evaluation of space systems and space-related data, and conduct research and development of systems that provide precision tracking, location, navigation, remote sensing, communication, characterization of the space environment, situational awareness, accurate discrimination, and targeting of threat objects.
- 2. Strategic Systems Test and Evaluation.** Independent quantitative performance evaluations of complex operational systems including ballistic and guided missile systems, strategic and tactical C3 systems, and other related combat and weapon systems; evaluation of alternative and modified systems; collection of requisite data; and development of instrumentation, as appropriate.
- 3. Simulation, Modeling and Operations Analysis.** Development, verification, validation and application of simulations, models, and operations analysis techniques to determine mission effectiveness and performance assessment of current, planned, and proposed systems; and coordination of employment of these systems.
- 4. Mission-Related Research and Development.** Mission-related and public-service-oriented research, technology development, test, evaluation, and system analysis (e.g., biomedicine, counter proliferation, environment, other topics of importance to DoD) through the application of the above core competencies, along with the complementary capabilities of other divisions of the University.

- 5. Information Technology (C4ISR/IW).** Research, development, and assessment of defense Command, Control, Communications, Computers, Intelligence, Sensors, Reconnaissance and Information Warfare (C4ISR/IW) technologies; application of these technologies to battlefield information management, intelligence systems and information warfare systems; operational evaluations and vulnerability assessments of current and planned systems; development of system architectures to improve intelligence systems and to improve the effectiveness and coordination and reduce vulnerability among forces; and demonstrations and testing of these systems.
- 6. Combat & Guided Missile Systems.** Detailed understanding of tactical combat systems and guided missile (including air defense and strike missiles) system design necessary for the independent evaluation of current and future systems, and the research and development of concepts and techniques for system improvements; development and maintenance of unique evaluation and development facilities; design and prototyping of systems; relating systems design to operational factors (e.g., targeting and mission planning); and conducting related analyses and tests, including full-scale experiments.
- 7. Theater Air Defense.** Research, development, and assessment of effective methods of coordinating warfare systems at the theater level by exploring system concepts, developing demonstration models, and conducting experiments; systems engineering and evaluation of electronic warfare and defense suppression systems; and assistance in planning and evaluation of C3 systems for attaining an integrated tactical and strategic system capability.
- 8. Submarine Security and Survivability.** Investigation and assessment of anti-submarine warfare, unmanned undersea vehicles, mine countermeasure technologies, and other aspects of undersea warfare with emphasis on the security, survivability, and operational effectiveness of submarines; instrumentation and oceanographic sensor development; and the execution of experiments and oceanographic research.

As a UARC, JHU/APL has the following important characteristics, as well as essential capabilities in space science and engineering, that make it an excellent choice for providing comprehensive space system engineering and applied science support to SMDC/ARSTRAT:

- a) it is affiliated with a university and, therefore, is a not-for-profit organization dedicated to the public good
- b) it provides or maintains DoD essential engineering, research, and/or development capabilities defined as core and, therefore, it may receive sole source (non-competitive) contract funding from DoD sponsors under the authority of 10 U.S.C. 2304(c)(3)(B).

- c) it maintains a strategic relationship with its DoD sponsors having the following attributes:
 - 1) responsiveness to evolving sponsor's requirements
 - 2) comprehensive knowledge of sponsor's requirements and problems
 - 3) broad access to information including industry proprietary data
 - 4) broad corporate knowledge
 - 5) independence and objectivity
 - 6) quick response capability
 - 7) current operational experience
 - 8) freedom from real and/or perceived conflicts of interest

The objective of this Statement of Work is to define the scope of work JHU/APL may be requested to perform to support SMDC/ARSTRAT in the evaluation and development of new technologies, the performance of risk reduction efforts, the design, development, and fielding of operational demonstrations/systems, and the augmenting of their own internal capabilities in productive and synergistic ways by employing JHU/APL's essential capabilities in space system engineering and applied science in the broadest and most flexible manner.

2.0 Scope of Work

The scope of the relationship with JHU/APL would encompass their unique capability of participating in the development of complex technical programs, from concept to operational deployment, to include a key characteristic of JHU/APL's strategic relationship with DoD - quick response capability. Specifically: under this contract, JHU/APL shall provide space science applications, engineering, analysis, design and development support to SMDC as specified in each task order.

Implicit in all of the task statements that may be included in this SOW is the fact that JHU/APL works at the direction of the government sponsor as a trusted technical advisor and that all of JHU/APL's recommendations and deliverables are subject to approval and acceptance by the government.

This Statement of Work describes the space science applications, engineering, analysis, design and development support to be provided by JHU/APL to SMDC/ARSTRAT at the unclassified and classified levels (potential multiple levels of classification involved).

JHU/APL shall provide on- and/or off-site support as required; including multidisciplinary analyses, planning, engineering and space science applications support pursuant to individual Task Orders issued by the SMDC contracting officer. JHU/APL shall furnish the necessary facilities, materials, and professional engineering and technical personnel, together with adequate support and management personnel, for both on- and/or off-site support as required by the Task Orders issued by the SMDC contracting officer. Task orders may cover any of the above core disciplines and may include, but are NOT limited to the following areas of related support:

1. Planning and analyses

2. Science and technology (S&T) evaluation and assessment
3. Application of space science and technology to new system concepts and operational needs
4. Technology transfer
5. Space system architectures
6. System performance and cost
7. Development engineering
8. Systems engineering
9. Rapid prototyping (hardware and software)
10. Systems integration
11. Wargaming/exercise/demonstration
12. Hardware and software design engineering
13. Classified and unclassified experimentation
14. Modeling, Simulation, and Analysis (MS&A) development, support, execution, and analysis
15. Test and evaluation of new and emerging technologies
16. Instantiating enabling concepts (from breadboards to spacecraft)
17. Capability Review and Risk Assessment (CRRA) process
18. Analysis of Alternatives (AoA)
19. Integration of existing and planned aerospace force elements and infrastructures
20. Military Utility Assessments (MUAs)
21. Special studies

Specific tasks to be performed under this contract may be in any of the core disciplines in Paragraph 1.0. or tasks may be in one or more of the general areas listed above (items 1-21) as long as tasks in these general areas are related to the core disciplines in Paragraph 1.0. In the event a task cannot be specifically categorized into the areas identified herein, the USASMDC/ARSTRAT contracting officer shall determine if the tasks to be performed or services to be acquired are within scope of the basic contract.

2.1 Systems Engineering and Integration

JHU/APL shall assist SMDC/ARSTRAT in identifying requirements and opportunities for integrating new and emerging national, DoD, civil, and commercial surface, air, and space technologies and capabilities into military applications. JHU/APL shall articulate SMDC/ARSTRAT mission needs and derive top-level requirements in a manner and format that shall permit effective use by acquisition, Research and Development, and Science and Technology organizations. JHU/APL shall recommend concepts and architectures for material solutions for military applications to support advanced planning processes.

JHU/APL shall perform and/or review all elements of the SMDC/ARSTRAT system engineering process including concept and mission analysis, requirements gathering, requirements analysis, functional requirements analysis and allocation, system synthesis and design, trade studies, system partitioning, requirements allocation and balancing, prototyping, and performance verifications for potential new or existing programs and

projects. JHU/APL shall also perform specialty systems engineering activities including technical performance measurement, performance analysis, reliability, maintainability and availability analysis, systems safety analysis, and security systems analysis.

JHU/APL shall develop and evaluate needs and requirements associated with the SMDC/ARSTRAT missions and assess current capabilities relative to their ability to meet those needs. JHU/APL shall develop and maintain system requirements' traceability from the user command's Initial Capabilities Documents (ICDs) into system Technical Requirements Documents (TRDs).

JHU/APL shall assist SMDC/ARSTRAT in identifying critical capability gaps and shall assist in the development of innovative system concepts to narrow or close those gaps. Concept mission performance analysis shall be performed to characterize the overall system performance of candidate innovative system solutions.

JHU/APL shall perform or assist the SMDC/ARSTRAT in monitoring and evaluating the technical progress of system development efforts, as well as performing or participating in system integration, testing, validation, and acceptance test. JHU/APL shall provide technical and project management support to the SMDC/ARSTRAT throughout all lifecycle phases of the systems development effort.

2.2 Technology Assessment

As requested by SMDC, JHU/APL shall assist SMDC in identifying promising new technology with application to national security systems and transferring that technology into SMDC programs or out to industry where appropriate.

JHU/APL shall apply its expertise in space science and technology to support the development of new or transformational system concepts and/or to provide new predictive or diagnostic capabilities that support operational needs. JHU/APL shall evaluate current and evolving science and technology relevant to SMDC programs and responsibilities, assess the potential for application to current and/or future systems, and disseminate the results to appropriate SMDC staff and U.S. Government stakeholders.

2.3 Space Systems Design / Prototyping

JHU/APL shall provide rapid prototyping of material solutions to military requirements including, but not limited to, design, development, fabrication, installation, integration, test and demonstration of prototype systems in order to assess the viability of new surface, air, and space system concepts for utility. This shall include development of both hardware and software systems and integration across a broad spectrum of surface, air, and space systems to include man portable, surface vehicles, facilities, and manned and unmanned air and space assets. This shall also include evaluation of system constraints and capabilities resulting from a given transition approach. The JHU/APL shall document development efforts in accordance with requirements identified in the

Task Order. JHU/APL shall provide cradle to grave acquisition support to SMDC experimentation and demonstration efforts.

2.4 Concept Development

JHU/APL shall develop, evaluate, analyze, and recommend new or modernization changes to surface, air, and space system concepts, mission concepts, system of systems concepts, mission area plans, mission need statements, system requirements, system and technical roadmaps, architecture studies, and operational requirements and analyses. Studies may include concepts from national (to include the National Reconnaissance Office [NRO], and the Space Architect), DoD, service agencies, civil agencies (to include NASA), and industry.

JHU/APL shall perform assessments of, and recommend changes to, candidate surface, air, near space (High Altitude), and space missions including, but not limited to, considerations of:

- a) surface, air, near space, and space integration
- b) system of systems factors which include joint or shared accomplishment of certain missions
- c) system vulnerability and survivability
- d) system commonality such as shared, distributed, or common ground infrastructures or shared, distributed on-orbit infrastructures
- e) enhancements and/or new technologies to improve system performance and/or utility trades
- f) commercialization of space initiatives
- g) cost effectiveness, performance, and utility
- h) mission assurance process improvement

JHU/APL shall assist SMDC/ARSTRAT in defining specific guidance for selected technologies, equipment, and systems. JHU/APL shall assist SMDC/ARSTRAT in identifying mission interoperability needs and requirements and shall perform technology assessments and/or concept development that lead to enhanced mission interoperability. Where necessary, JHU/APL shall assist in the evaluation of exercises and/or drills and provide recommendations for improvements in capabilities across the command. Emphasis shall be placed on gathering and understanding the entire system domain, including the needs of the warfighter and the evaluation and integration of User Equipment into the system architecture.

2.5 Sensor Design / Development

As requested by SMDC, JHU/APL shall apply its expertise in sensor technology to support the analysis, design, prototyping, and operational prototype deployment and assessment of new sensors in support of SMDC mission needs. Sensor Design / Development support shall conform to, and include, the process steps identified in the SMDC systems engineering process handbook.

2.6 Modeling, Simulation, and Analysis (MS&A)

JHU/APL shall perform analysis to support development of concepts, associated technologies, military/mission utility, architecture and integration analysis, and cost assessments. JHU/APL shall conduct detailed trade studies, technical analysis, cost analysis, and simulation-based support pertaining to the effects on payload, operations, maintenance, logistics, training, technology, requirements, performance, and acquisition.

JHU/APL shall establish an MS&A implementation capability that includes the necessary equipment, processing capability, security, configuration control, display, and connectivity. JHU/APL shall ensure the integration of disparate modeling and simulation tools into a robust scenario generation capability. This MS&A effort may bridge to other government agency (national and civil) efforts and programs where appropriate.

JHU/APL shall participate with government and contractor organizations in developing, maintaining, and enhancing government and commercial models and simulations for use in developing, assessing, and integrating surface, air, and space elements. JHU/APL shall maintain configuration control, support user group meetings, and support data and model distribution for models. JHU/APL shall establish MS&A Independent Verification and Validation (IV&V) procedures for identified MS&A tools.

JHU/APL shall develop documentation supporting the development of MS&A. JHU/APL shall develop and conduct MS&A training.

2.7 Ground Segment

JHU/APL may be tasked with the conceptual development, systems design, integration, and prototype deployment of a space system ground segment. JHU/APL shall plan for exercises, wargames, developmental and operational tests, evaluations, demonstrations, and world wide contingency operations for both material and non-material solutions, and tactics, techniques, and procedures (TTPs) across a broad spectrum of test and operational environments to include laboratories, test ranges, surface, air, and space assets in the field and/or in-theater. JHU/APL shall facilitate technology sharing among other national, DoD, civil and commercial partners.

2.8 Integration and Test

JHU/APL shall perform, and/or assist the SMDC in the execution of system integration and test. Integration support shall include the planning, organization, executing, and monitoring of technical, personnel, and facility resources to conduct systems integration in classified and unclassified environments.

JHU/APL shall perform, and/or assist the SMDC in the performing system validation and verification. JHU/APL shall perform system validation through analysis, inspection, testing, demonstration, and/or process measurement.

JHU/APL shall perform, and/or assist the SMDC in the planning, organizing, developing, executing, and monitoring of integration, system, and acceptance test efforts. Test plans shall be created and approved by SMDC to ensure compliance to systems requirements.

JHU/APL shall provide system validation, verification, and test results documentation, as specified by task order.

2.9 User Equipment

JHU/APL may be tasked with the conceptual development, systems design, integration, and prototype deployment of ground- or platform-based User Equipment that might be a fundamental component of the total space system. As requested by SMDC, JHU/APL shall perform end-to-end systems engineering and development of User Equipment that integrate with existing and/or evolving systems. JHU/APL shall evaluate User Equipment effectiveness and make recommendations and/or implement system changes to include User and User Equipment requirements.

2.10 Special Studies

JHU/APL shall conduct, support, and/or participate in new or ongoing special studies. Study sponsors may include other SMDC directorates as well as external organizations.

2.11 Exercise, Wargaming, Test & Evaluation, Demonstration Support

JHU/APL shall deploy, support, and sustain prototype systems and architectures, apply new tactics, techniques, and procedures (TTPs), and provide communications capabilities necessary to support exercises, wargames, tests, evaluations and demonstrations, and worldwide contingency operations.

JHU/APL shall conduct analyses and reporting for test, demonstration, and worldwide contingency operations. Analyses and reporting shall emphasize integration of mission, architecture, and systems to ensure total system performance and sharing of assets. Analyses shall include use of MS&A tools and shall establish appropriate Measures of Effectiveness (MOEs) and/or other metrics. JHU/APL shall verify and validate the operational effectiveness of proposed solutions to tactical military operations. JHU/APL shall evaluate results and suggest recommendations for improvements and/or operational implementations.

2.12 Doctrine, Enabling Concepts, Tactics, Techniques, and Procedures

JHU/APL shall perform trade studies of candidate doctrine, enabling concepts, and TTPs against potential scenarios to determine efficacy of non-material solutions for tactical

military requirements. JHU/APL shall provide non-material solutions to support advanced planning processes. The trade studies shall consider factors that include, but are not limited to:

- a) Ongoing and planned government, and commercial initiatives
- b) Existing and planned national, DoD, civil, and commercial systems
- c) System of systems
- d) System vulnerability and survivability
- e) System commonality
- f) Extended performance and/or utility trades
- g) Cost effectiveness, performance worth, and utility worth

JHU/APL shall support development of new enabling concepts, doctrine, TTPs, and other non-material solutions for surface, air, and space integration. This support shall interface with national, DoD, civil, and other agencies, as required.

3.0 Project Management

3.1 Task orders

JHU/APL shall develop, generate, and execute work covered by this SOW pursuant to individual Task Orders issued by the SMDC contracting officer. JHU/APL shall provide task management plans, schedules, cost estimates, security administration, planning, and operational support. JHU/APL shall be responsible for executing all Task Orders and for supplying all of the personnel, facilities, and materials required to accomplish each of them, either directly or through appropriate purchases and subcontracts, or unless otherwise provided by the government as identified in the individual Task Order.

3.2 Program management reviews and coordination. As required JHU/APL shall:

- a) conduct Program Management Reviews (PMRs) at the Space and Missile Defense Command or at JHU/APL's Howard County, Maryland facility,
- b) host and participate in Task Management Reviews (TMRs), Integrated Product Team Meetings (IPTs), and Technical Interchange Meetings (TIMs),
- c) host and participate in other working groups with Government and contractor organizations, and
- d) prepare briefings, special technical reports, or papers as requested to support reviews and meetings.

JHU/APL shall provide progress and status inputs as required and shall show it is managing to performance via a set of specific measures (metrics) as identified by the individual Task Order.

3.3 Earned Value Management System

JHU/APL shall apply standard Earned Value Management System (EVMS) practices to provide the government cost, schedule, and performance information down to the Task and Sub-Task Order level, as specified by the individual Task Order.

3.4 Performance Cost Reports

JHU/APL shall provide Performance Cost Reports (PCRs) to the project task leads including sufficient information to monitor progress, identify significant problems, and implement corrective action as applicable. Report frequency, format and content for each individual Task Order shall be mutually agreed to by SMDC/ARSTRAT and JHU/APL.

3.5 Subcontractor Management

JHU/APL shall obtain subcontractor's cost, schedule, and performance data and incorporate this data into its PCR. JHU/APL shall provide a copy of the subcontractor's PCR to the project task lead as required or requested.

3.6 Electronic Data Interchange

JHU/APL shall use the common business practices for an Electronic Data Interchange (EDI) process (e.g. web-based, dial-in, or as specified by individual Task Order). This process shall support the exchange of cost, schedule and technical information to adequately manage a Task Order. JHU/APL shall provide the PCO, and designated representatives, visibility and real-time access to programmatic softcopy materials. This shall include Task Orders, IMSs, IMPs, Contract Data Requirements Lists (CDRLs), property management data, etc. Data shall be delivered in Microsoft Office 2007 format unless otherwise specified in the Task Order.

3.7 Task Management

JHU/APL shall use their existing management systems and tools for accomplishing all Task Order requirements. JHU/APL shall assign a Task Manager to oversee task order execution. The Task Manager shall be responsible for the completion of each assigned task, monthly reporting, supervision of the task team, and all other management functions necessary to accomplish the task's completion to high quality standards.

3.8 Quality Management

Unless otherwise specified in the individual Task Order, JHU/APL shall adhere to its own internal AS9100 based Quality Management System for all work performed under this contract.

4.0 Security Requirements

Access to classified national security information up to **Top Secret/SCI/SAP** is required in the performance of work under this contract. JHU/APL shall provide personnel with the appropriate clearances and security approved work and storage spaces to accomplish the classified work, if any, associated with each Task Order. DD 254's shall be issued at the Task Order level. SMDC/ARSTRAT shall provide or advocate for the required billets JHU/APL personnel shall need to perform work at SCI/SAP levels.

The government shall at no cost sponsor JHU/APL for access to the necessary secure networks, including JWICS, CWAN SIPRNET, and NSANET.

The government shall at no cost support JHU/APL interactions with external agencies as necessary to complete this work and shall provide endorsement and support for installation and access to the above IS system in conjunction with the execution of this contract.

The government shall at no cost provide support for the JHU/APL team supporting this contract to be granted a common access card to facilitate access to government facilities and websites under this contract.