S8.2-5 (Increment 6) Preliminary Design Review (PDR) Execution

Task Order 0017

8 February 2018, Rev 6

Table of Contents

THE FOLLOWING TASK ORDER (TO), NUMBER 0017, SHALL BE PERFORMED BY THE CONTRACTOR AS A TO UNDER MISSILE DEFENSE AGENCY (MDA) INDEFINITE DELIVERY/INDEFINITE QUANTITY (IDIQ) CONTRACT HQ0147-12-D-0003. IN CASE OF CONFLICT BETWEEN THIS STATEMENT OF WORK (SOW) AND THE BASIC IDIQ CONTRACT IN EFFECT AT TIME OF AWARD OF THIS TO, THE BASIC IDIQ HAS PRECEDENCE.

1.0 <u>Task Description</u>

The purpose of this TO is to assess changes required to Command and Control, Battle Management and Communications (C2BMC) Spiral 8.2 (S8.2) for Increment 6 to include: sensor management of the Long Range Discrimination Radar (LRDR); provide system track and discrimination data to Ground-Based Midcourse Defense (GMD); design and prototype initial algorithms; provide engineering support of the Government-provided interface definition for LRDR management and system track data to GMD (including development-lab to development-lab testing); and execution of a successful Preliminary Design Review (PDR) for C2BMC Spiral 8.2-5 (S8.2-5).

2.0 <u>Background</u>

The MDA is developing the Integrated Ballistic Missile Defense System (BMDS) to defend the forces and territories of the United States, its Allies, and Friends against all categories of ballistic missile threats. The BMDS will accomplish this mission by providing an integrated layered defense that employs sensors for threat detection, tracking, discrimination, battle management aids for real-time decision making in accordance with (IAW) defined doctrine during mission planning cycles, and weapons to engage threat targets in all phases of their flight. MDA will be deploying the LRDR in FY21 to support PACOM/NORTHCOM operations. This radar will be included in the C2BMC integrated sensor management architecture. The radar will primarily provide surveillance and discrimination data to C2BMC for Homeland Defense support of GMD. C2BMC will provide Ballistic Missile Defense (BMD) System Track (BST) data to GMD to include LRDR and new discrimination features and to include the results of any third party capabilities incorporated into this spiral as well as interface with GMD to support accurate LRDR tasking. The C2BMC Increment 6 Capability (S8.2-5) will be designed and developed IAW the Government-approved C2BMC Element Specification (CES). Major capabilities are summarized:

- Initial Integration of Long Range Discrimination Radar
- C2BMC Generation of BMD System Track (with System Level Discrimination Data Integration) for GMD Homeland Defense Engagements

- Active Sensor Bias Monitoring and Reporting Initial GMD Redesigned Kill Vehicle Integration
- Retain Existing Sensor Data Interfaces and Provide LRDR Data for Risk Reduction until directed to stop these interfaces
- Sea Based X-Band (SBX) Radar Forward-Based Discrimination
- Space Situational Awareness (SSA).

3.0 Program Management

The Contractor shall provide Program Management services to enable planning, developing, controlling, directing, monitoring, reporting, and managing in a manner consistent with TO requirements. Overall associated Program Management services are addressed under a separate task order.

All documentation created and maintained in a database or storage medium associated with this contract shall be delivered to the Government's Contracting Officer IAW the various Contract Deliverables Requirements List (CDRLs) associated with this contract. The Contractor shall submit all CDRL deliverables to the Government's Contracting Officer electronically, unless otherwise stated, with distribution method to the Government to be determined by the C2BMC Program Management Office. Therefore, all such data shall be in compliance with the terms and conditions of the contract.

3.1 Integrated Process and Product Development (IPPD)

The Contractor shall apply an IPPD approach in all technical/functional disciplines and requirements in a coordinated manner to meet established financial management, resource, cost, schedule, performance, and supportability requirements for the C2BMC system.

3.2 Contractor Integrated Performance Management

The Contractor shall prepare and use an integrated performance management system. The Contractor shall use a Department of Defense (DoD) validated Earned Value Management System (EVMS) that is linked to, and supported by, the Contractor's management processes and systems to include the Integrated Master Schedule (IMS), Contract Work Breakdown Structure (CWBS), change management, material management, procurement, cost estimating, and accounting.

3.3 Integrated Baseline Reviews (IBRs)

The Contractor shall support the Government Program Manager, Contracting Officer and his/her representatives in IBRs to evaluate the risks inherent in the performance measurement baseline for this TO. The totality of the baseline

will be reviewed and evaluated no less than annually by the Government. Each IBR will verify that the Contractor is using a reliable performance measurement baseline (to include the entire contract scope of work for this TO), is consistent with contract schedule requirements, and has adequate resources assigned.

3.4 Process Control

The Contractor shall maintain a set of operating documentation that provides management direction, policies and procedures, per established Contractor tools and procedures IAW existing Government processes.

3.5 Program Reviews

The Contractor shall support the planning, preparation, conduct, and preparation of minutes of program reviews. The Contractor shall support the IBR, quarterly Program Management Reviews (PMRs), Government-led Internal Configuration Control Board (ICCB), Operational Capability Baseline Working Group, System Engineering & Integration Council (SEIC), Integration Synchronization Group (ISG)/Integration Synchronization Center (ISC), Program Change Board (PCB), bi-weekly Joint Business Reviews, bi-weekly C2BMC S8.2-5 Product Integration Team (PIT), Interoperability Technical Analysis Group, Algorithm Collaboration Team (ACT), and other relevant meetings as requested by the Government and agreed to by the Contractor. The Contractor shall support C2BMC component immersion reviews with the Government to facilitate understanding and agreement with implementation approaches used for chosen technical efforts. The Contractor shall update program documentation based on the outcome of the reviews. The Contractor shall provide progress reports to the Government in monthly C2BMC Cost/Schedule Executive Round Table (C/SERTs). The Contractor shall support the Communications Connectivity Task Force to coordinate, implement and execute the BMDS end-to-end communications architecture.

3.6 Bill of Material (BOM)

The Contractor shall manage the BOM and control changes IAW program configuration control procedures for this TO.

3.7 Configuration Management (CM)

The Contractor shall ensure that controlled baselines are established, that changes to baselines are controlled, and that software, hardware, test tools, test software, databases, test data and documentation are consistent with the baseline. The Contractor shall ensure software and hardware CM activities in support of the C2BMC Program include identifying key software and hardware

components, controlling and tracking their progress, building software to the controlled baseline and maintaining controlled baselines, supporting Configuration Items through delivery, and making required updates. The Contractor shall minimize cost of baseline verification activities to the maximum extent possible through the use of remote and/or automated tools and regular on-site personnel. The Contractor shall limit on-site audits requiring travel to process improvement activities with demonstrated cost-saving impacts.

4.0 Tasks

The Contractor shall design algorithms for LRDR sensor management, BMD system track. The Contractor shall provide the engineering support for the Architecture and Systems Engineering development to support the LRDR and GMD BMDS Increment 6 capabilities with C2BMC. The Contractor shall perform all algorithm work and documentation IAW the BC Algorithm Readiness Level (ARL) Checklist.

4.1 System/Software Engineering

4.1.1 System Engineering

The Contractor shall apply standard Systems Engineering processes that comply with the Architecture and System Engineering Management Plan (ASEMP) and the MDA/C2BMC Program Office Systems Engineering Plan (SEP) v2.0 to develop, model, integrate, test, verify, evaluate, validate, document, and support updates to the C2BMC Element.

The Contractor, in conjunction with the Government, shall develop and execute a program-wide process for C2BMC Experimentation and Prototyping project definition, prioritization, approval, funding, execution, assessment and transition/insertion to development and implementation.

The Contactor shall support design discussions with MDA on LRDR integration and system track and discrimination data to GMD. The Contractor shall include the Government in the Contractor's system and software designs including, but not limited to:
- Architecture Design;
- Requirements analysis/refinement;
- Systems/software engineering and design;
- Initial human factors engineering and design;
- Other activities specifically identified in this SOW.

The Contractor shall update and maintain the C2BMC Architecture Model and Framework Description (CDRL A026) to include BMDS Increment-6 Capabilities.

The Contractor shall update and maintain the Operational Concept Description Document (CDRL A016).

4.1.1.1 Design/Readiness Reviews

The Contractor shall conduct and document two (2) Technical Review (S8.2-5 Element System Requirement Review 1 (ESRR 1); and S8.2-5 PDR), IAW the MDA/DE Engineering Technical Review Process (MDA Instruction 5000.20-INS, July 27, 2015) and the ASEMP as required during the period of performance for Increment 6 capability improvement updates.

At the ESRR 1 the Contractor shall baseline the requirements for the S8.2-5 system, the capabilities to be implemented, readiness to proceed with preliminary design, assessment of risks, and Government approval of C2BMC Spiral Specification (CSS).

The Contractor shall conduct a Requirements TIM. At the Requirements TIM, the Contractor shall present progress of Increment 6 requirements (to include CES v6.0 requirements and any associated SCNs as specified by the Government) development and allocations, technical adequacy, risk assessment and mitigation, and the Government will assess and approve readiness to continue preliminary design.

The Contractor shall conduct a Design TIM. At the Design TIM, the Contractor shall present progress of preliminary Hardware/software designs, requirement allocations, technical adequacy, risk assessment and mitigation, algorithm readiness level assessment, and the Government will assess and approve readiness to continue preliminary design.

At the PDR the Contractor shall review the Hardware/software designs, requirement allocations, technical adequacy, risk assessment and mitigation, algorithm readiness level assessment, and assess readiness to move into detailed design. Government approval at the conclusion of the C2BMC S8.2-5 PDR is required to proceed with detailed design.

Upon successful S8.2-5 PDR, the Contractor shall initiate preliminary activities to support S8.2-5 Critical Design Review (CDR).

4.1.1.2 C2BMC Element Specification (CES)

The Contractor shall use the Government Furnished CES v5.0 and C2BMC Specification Change Notices SCNs 0004/0005/0006 as the starting point to derive its spiral requirements for initial (ESRR 1) delivery. The Contractor shall use the Government Furnished CES v6.0 as the starting point to derive its spiral requirements for the Requirements TIM. If final CES v6.0 is not available by the need date required to support the TIM, then the Contractor shall instead use a Government recommended draft CES v6.0 provided in lieu of the final version, understanding that the final Government approved CES v6.0 will be the baseline version when available. The CES baseline for PDR1 includes ESRR1 content as well as updates for is CES v6.0, with the exception of CES-2123, CES-2682. Although not part of the ESRR1/PDR1 baseline and deliverables, the Contractor shall perform requirements analysis for development of updates to the Training Support System (TSS) and Distributed Training System (DTS) requirements for new and modified C2BMC Spiral 8.2-5 capabilities. The Contractor shall develop draft TSS and DTS updates to the Spiral 8.2-5 Operational Concept Description, use cases, and spiral requirements. The Contractor shall provide recommended changes to DTS Simulation/Stimulation (S/S) requirements to reflect the impacts of any changes to the S8.2-5 C2BMC capabilities.

(b)(3):10 U.S.C. § 130

The Contractor shall follow the ASEMP criteria for change requests. The Contractor shall present a plan to resolve all To Be Determined (TBD)/To Be Resolved (TBR) in the flow down to the CSS at the Design TIM or present evidence why one or more items cannot be sufficiently defined.

4.1.1.3 C2BMC S8.2-5 Spiral Specification (CSS)

The Contractor shall develop and maintain a CSS in Dynamic Object-Oriented Requirements System (DOORS) which is traceable to the Government-maintained CES and applicable System Interface Control Documents (SICDs). The Contractor shall identify all CSS requirements in DOORS as safety critical, safety related, or not applicable; and their associated verification plan method (inspection, test, analysis, demonstration) and verification phase (cycle 2 verification, cycle 5 verification, and/or regression testing). The Contractor shall make this identification via definition of a DOORS attribute designating the requirement as safety critical or safety related. The Contractor shall maintain traceability to the CES for changes to C2BMC documentation. The Contractor shall deliver all specifications and associated documentation, such as SCNs, to the Government (CDRL A015).

4.1.1.4 Interface Documentation

The Contractor shall participate in and support the development of the Part 1 System Interface Control Document (ICD) documents as defined in the BMDS Technical Baseline (TBL). The Contractor shall also establish and maintain Part 2 ICDs (CDRL A013) and Document Change Notices (DCNs) (CDRL A013), as required by the Government, and ensure traceability to the Part 1 ICDs and DCNs baselined upon award. If baselined Part 1s or Part 1 DCNs area not available, draft content will be used to support objective evidence deliveries for PDR as coordinated with the Government. The Contractor shall establish and maintain Interface Description Documents (IDD) and acceptable delivery of the IDDs shall be via the Data Accession List.

The Contractor shall provide new and updated ICDs and IDDs, using the current baseline version as a starting point, for the S8.2-5 build, including the development of new and updated Part 2 DCNs, as determined by the Government, to fully document the system design. The Part 2 ICDs and IDDs identified (by function title) for maintenance and update by the Contractor consist of the following and those driven by CES v6.0 and associated SCNs as specified by the Government and provided upon award:

Part 2 ICDs:
- Volume 1: General and Link 16 Formatted Data;
- Volume 2: C2BMC to GMD;

- Volume 3: C2BMC and X-Band Radar (Army/Navy Transportable Radar Surveillance (AN/TPY-2)) (no deliverable on this TO);
- Volume 4: C2BMC to BMDS Overhead Persistent Infrared (OPIR) Architecture (BOA);
- Volume 5: C2BMC and LRDR;
- BMDS External Command Center Systems (ECCS);
- C2BMC to Joint Space Operation Center (JSpOC) Mission System (JMS);
- C2BMC Releasable Client ICD;

Interface Description Documents (IDDs):

- 8.2 Net-Centric Command and Control (NC2) IDD - C2BMC with Defense Information Systems Agency (DISA) Enterprise Management (EM);
- Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS) to C2BMC Planner;
- Air Defense System Integrator (ADSI) IDD;
- Adaptable Toolkit for Open Message Service (ATOMS) IDD to the results of any third party capabilities incorporated into this spiral, if applicable;
- C2BMC Planner Internal Third Party IDD;
- C2BMC to National Sensor Integration Node (NSIN).

The Contractor shall support reviews and coordination of these External Interface Documents:

- Air and Missile Defense Workstation (AMDWS) to C2BMC Planner;
- C2BMC to NATO (Non Real-Time (Planner));
- C2BMC to Increment 2 Space-Based Infrared System (SBIRS);
- (b)(3):10 U.S.C. § 130
- Air Force IAMD Planner to C2BMC Planner;
- C2BMC to Real-time Transfer Service (RTS);
- Overhead Persistent GEOINT Architecture (OPGA) Definition Description Document.

4.1.1.5 Dynamic Object-Oriented Requirements System (DOORS)

The Contractor shall maintain all data associated with the S8.2-5 CSS, part 2 ICDs and SCNs/DCNs in the Contractor's DOORS database (as required, some interfaces documents will be

developed in Word versus DOORS to facilitate interface maturity and data sharing). The Contractor shall maintain CES requirements traceability to the CSS in the Contractor's DOORS database. The Contractor shall publish periodic reports in a DOORS format as specified by the Government, and make available those reports in the searchable repository. The Contractor shall mark the reports with proper Department of Defense Federal Acquisition Regulation Supplement (DFARS) marking and have no proprietary markings. The Contractor shall maintain transportability of partitions between the Government and Contractor maintained DOORS databases. The Contractor shall provide a copy of DOORS specifications, part 2 ICDs, and SCNs/DCNs Partition, after the Contractor has received formal approval by the Government of ICDs or SCNs/DCNs, or as requested by the Government. The Contractor shall provide access to DOORS at each Contractor facility. The Contractor shall provide technical assistance with the DOORS tool, modules, and partitions as well as information from DOORs (e.g. reports, trace information, verification methods) as needed to support the Government Configuration Control Board (CCB).

4.1.2 Software Engineering

The Contractor shall use the software development process documented within PL-DV-0001 C2BMC Software Development Plan (SDP) that complies with the Institute of Electrical and Electronics Engineers (IEEE) 12207 Software Life Cycle Processes, IEEE 15288 System and Software Engineering, MDA Assurance Provisions (MDA-QS-001-MAP-Rev A), and MDA Assurance Provisions Requirements Allocation Matrix (SP-PM-C2BMC S8.2 RAM).

The Contractor shall participate in system level ESRRs and conduct the associated software preliminary level Requirements and Design TIM.

4.1.2.1 Software Development Plan (SDP)

The Contractor shall use the C2BMC SDP as the basis for Software engineering activities of S8.2-5.

4.1.2.2 Development Lab Support

4.1.2.2.1 Lab Analysis and Integration for LRDR

The Contractor shall establish and maintain (b)(3):10 U.S.C. § 130 (b)(3):10 U.S.C. § 130 connectivity

to perform interface prototyping activities and pairwise testing, for LRDR interfaces.

4.1.2.2.2 Lab Analysis and Integration for GMD

The Contractor shall establish and maintain a C2BMC Development Lab to perform interface prototyping activities to inform preliminary design decisions for the C2BMC-GFC interface.

4.1.2.3 COTS, GOTS, and Maintenance

The Contractor shall assess and report on the need for upgrades to the S8.2-5 software baseline (CDRL A021). The Contractor shall update the development lab environments (Development, Cybersecurity,) with representative hardware and software, as needed to support completion of preliminary design, as approved by the Government.

4.1.3 Integrated Engineering

The Contractor shall translate CSS requirements into configuration controlled software through a systematic approach to integrated design. The Contractor shall integrate all technical requirements and disciplines into a coordinated effort to meet cost, schedule, performance, affordability, quality, reliability, producibility, and supportability requirements IAW the ASEMP. The Contractor shall consider and involve software quality assurance in all phases and reviews of the software development lifecycle to include planning, requirements, design, coding, test, implementation, and release. The Contractor shall continuously monitor and report on all software development activities and processes and work to improve the efficiency of these processes from project initiation through delivery.

4.1.4 C2BMC Algorithm Engineering

The Contractor shall develop, document, and manage the algorithm baseline, Algorithm Description Documents (ADDs), reference implementations, algorithm system engineering documents and reports, and architectures IAW IEEE 12207 "Systems and software engineering - Software lifecycle processes", MDA Assurance Provisions (MDA-QS-001-MAP-Rev A), and MDA Assurance Provisions Requirements Allocation Matrix (SP-PM-C2BMC S8.2 MAP RAM). The Contractor shall participate in the Government's Integrated Product Team (IPT) process via the ACT and BMDS System Assessment Team (BSAT).

The Contractor shall support the MDA/BC BSAT with documentation (e.g., draft ADD and AIP) and presentation material to support a detailed review and assessment process of proposed changes to C2BMC algorithms and associated engineering products.

4.1.4.1 C2BMC Algorithm Documentation, Reference Implementation, & Software

The Contractor shall develop and deliver system engineering documentation to describe the C2BMC algorithms to include algorithm logic description, reference implementation, and ADDs for each critical C2BMC algorithm.

4.1.4.2 Algorithm Design

The Contractor shall design C2BMC algorithm changes to support the Increment 6 capabilities to include C2BMC algorithm changes for LRDR source track forwarding and system track and discrimination reporting (to include boost phase cue and combining discrimination results from multiple sensors) to weapon systems, including GMD; and C2BMC algorithms to coordinate external sensor data needs (e.g., track accuracy, discrimination complete from multiple sensors) for supporting GMD weapon engagements. The Contractor shall stop source track forwarding upon direction.

For these algorithm changes, the Contractor shall deliver a Draft Algorithm Description Document, an algorithm prototype that supports the Benchmark framework, and a Draft Algorithm Integration Plan sufficient to support ARL 4 compliance IAW the BC ARL Checklist and not less than 60 days prior to the PDR.

4.1.5 User Interface Engineering

The Contractor shall execute a Human Factors Engineering (HFE) program to ensure effective integration of users and stakeholders (to include Warfighter communities) in the design of the system, and to ensure consideration of industry standard practices to ensure effective Human Machine Interface (HMI) development. The Contractor shall conduct a technical analysis to assess the impacts to the current C2BMC HMI due to functionalities and requirements (e.g., LRDR sensor management, BMD system track, MIL-STD-1472, MIL-STD-2525D) being implemented in support of all BMDS Increment 6 capabilities (CDRL A021). The Contractor shall include in this technical analysis

any meetings and Technical Interactions required with the User community to identify tasks and essential elements of information as well as user assessments of proposed displays. The Contractor shall include in this technical analysis impacts to the Planner and/or Training Systems (e.g., Distributed Training System (DTS), Training Support System (TSS)). The Contractor shall execute on-site reviews of planned/prototyped HMI designs and implementations to:

- gather feedback that can be used to influence the final HMI implementation;
- verify HFE Usability Goals;
- educate users on system capabilities and features; and
- gather information and evidence necessary to support future program milestones.

The Contractor shall support a user task analysis to determine Essential Elements of Information required for the system Graphical User Interface (GUI) to support User tasks and support the end user in determining manning requirements. The Contractor shall execute the HFE program IAW approval provided by the Government as established in the current version of the C2BMC HFE IPT Charter to update capability based on the changes required to support Increment 6 functionality. The Contractor shall present the HFE preliminary design progress at the Design TIM and preliminary design at the PDR.

4.1.6 C2BMC Architecture

The Contractor shall develop Increment 6 architecture products (use cases, activity diagrams, logic flows) (CDRL A026) in accordance with the ASEMP (PL-AS-0001) using Model Based System Engineering (MBSE) techniques and best practices. The Contractor shall modify the S8.2-3 System Architecture as necessary to realize the S8.2-5 capabilities. The Contractor shall describe the resulting S8.2-5 System Architecture by updating these S8.2-3 system architecture artifacts as appropriate:

- Architecture Overview
- Common Services Hardware Platform
- Design Constraints
- System Architecture Model
- Modes/States
- Top Level Architecture (Pony Blanket)
- Hardware Architecture

- Decomposition and Aggregators
- Transition Strategy
- SW/HW Configurations
- Use Cases
- Logical and Physical Transport Design
- Long Haul Architecture
- Physical Architecture
- Software Architecture.

The Contractor shall modify the System Architecture Model (logical, physical, and deployment views) to capture S8.2-5 related changes to the:

- Logical system composition, subsystem behaviors, message flows, and connections
- Physical hardware implementation patterns and software allocations to hardware
- Deployment designs of the hardware, software, and network infrastructure.

The Contractor's updates for Spiral 8.2-5 to the System Architecture Model shall include cross references to the key, authoritative ICDs, element spiral requirements, and CES as necessary to allow model diagrams to be traced to the appropriate driving specifications. The Contractor shall include the System Architecture Model in CDRL A026 as a Hyper-Text Markup Language (HTML) report that unambiguously identifies which diagrams compose the baseline being delivered by the CDRL. The Contractor shall ensure the System Architecture model is located in the C2BMC Searchable Repository. The Contractor shall make Architecture artifacts available for Government review at all peer reviews, technical interchanges, design reviews and other meetings as requested.

The Contractor shall develop and maintain interfaces with the other BMD elements and maintain ICDs as part of the system engineering process, and store them electronically in the C2BMC Searchable Repository as noted in section 4.1.1.4.

The Contractor shall present the following Architecture engineering artifacts at the C2BMC design milestone reviews in accordance with the entrance criteria for each event:

- C2BMC Architecture Concept
- Architecture diagrams for each BMDSS Capability, C2BMC Allocated Subsystem/Component, derived functional performance and information data exchange and data rate requirements (CDRL A026).

4.1.7 Third Party Technology Integration

The Contractor shall assess third-party integration technology for insertion into core spiral development and provide results and recommendations of this evaluation (CDRL A021) as directed by the Government. The Contractor shall present how selected capabilities will be integrated into the C2BMC architecture, design, development, and verification.

Third party technologies the Contractor shall consider for incorporation include, but are not limited to:

- (b)(3):10 U.S.C. § 130

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- Any other technologies the Prime Contractor would like to consider.

4.1.8 Analysis and Assessments

The Contractor shall perform analyses/assessments and trade studies supporting the BMDS Build and S8.2-5 evolution of the C2BMC Element addressing spiral content and growth planning, design trade-offs, algorithm development/effectiveness, capability specification, and performance prediction and assessment. The Contractor's analysis shall demonstrate that the requirements allocated to S8.2-5 are feasible and sufficient to achieve the specified performance within mandated latencies using standards-based interfaces for the C2BMC, and allow for ease of implementing future enhancements or updates per the open systems approach (CDRL A021). The Contractor shall present all trade studies to the Government for approval before work begins. The Contractor shall present these analyses/assessments at the S8.2-5 ESRR 1, Requirements TIM, Design TIM, and PDR.

The Contractor shall provide evidence for Government review and formal acceptance of ARLs 1-4. The Contractor shall support the independent assessments for ARL 5 through simulation runs and analysis as requested by the independent assessor on a schedule agreed to jointly

by the Contractor, the Government, and the independent evaluator. This is performed in preparations for PDR.

4.1.8.1 Technical Performance Measures/Special Interest Items (TPMs/SIIs)

The Contractor shall work with the Government to define the list of Government approved TPMs/SIIs (CDRL A019).

The Contractor shall provide and maintain a recommended schedule for reporting the status of C2BMC TPMs/SIIs to the Government at key program milestones and technical reviews in conjunction with S8.2-5 performance reports and assessments. The Contractor shall document the reporting period of each TPM/SII in CDRL A019 for Government approval.

4.1.8.2 Knowledge Points (KPs)

The Contractor shall work with the Government to define the list of KPs for Government approval.

The Contractor shall provide a recommended schedule for reporting the status of C2BMC KPs at key program milestones and technical reviews in conjunction with S8.2-5 performance reports and assessments for Government approval.

4.1.8.3 Early Learning Prototyping, Integration and Development Testing

The Contractor shall support early prototype integration activities concurrent with C2BMC development to reduce risk of integrating in Ground Tests. The Contractor shall use C2BMC prototypes from the development cycles to integrate with GMD and LRDR prototypes and simulations. The Contractor shall perform developmental testing with the respective prime contractors to cooperatively support mutual developments. This exercise will provide tools to support early assessment of BST integration, reduce risks by providing feedback throughout the development phase, and will span both non-real-time assessments.

The Contractor shall integrate the non-real-time (event-based) C2BMC prototypes with S8.2-5 functionality and functional interface into BMD Benchmark to support periodic assessment activities coordinated by the Government per the baseline IMS. The Contractor shall perform software design, coding, unit testing,

and cycle integration and testing of the C2BMC S8.2-5 prototypes to provide non-real-time representations of C2BMC S8.2-5 functionality for early prototyping and assessments of maturing capabilities.

The Contractor shall update the Government regularly (e.g., S8.2-5 PIT meetings) on the status, Plan of Action and Milestones (POAM) and issues/watch items of the non-real-time prototypes. The Contractor shall prepare a description for each C2BMC prototype to include a summary of each prototype's functionality, details of each prototype's interface(s) with other element models as appropriate and any capability caveats and/or limitations to the Government via the DAL prior to the associated assessment analysis.

Interface Prototyping and Pairwise Testing

The Contractor shall conduct interface prototyping and initial pairwise testing of the LRDR interface, and interface prototyping of the GFC interface (b)(3):10 U.S.C. § 130 The Contractor shall support the LRDR pairwise tasks with:

- Develop Test Information Sheets documenting at a minimum test title, test dates, test objectives, test participants, test configuration of all participants sequence of events, test simulation or test data and success criteria;
- Validate C2BMC Element interfaces;
- Update and maintain ICDs;
- Execute a minimum of three (3) pairwise test events for LRDR and C2BMC or equivalent offline data exchange/processing if live network connectivity to LRDR is not available.

4.1.9 Technical Baseline Management

The Contractor shall manage the technical baseline configuration IAW the ASEMP approved by the Government. The Contractor shall provide technical assistance and information to support the Government CCB that will manage the technical baseline.

The Contractor shall receive written Government approval for changes to documents under Government control at contract award before implementation of modifications, Requests for Deviation (RFD), or Requests for Waiver (RFW). The Contractor shall make this documentation available via searchable repository (CDRL A048).

The Contractor shall prepare schedule reports that include identification, status, and traceability for all technical and cost/schedule program documentation and staff supporting the S8.2-5 delivery.

4.1.10 Advanced Concepts & Technology Evaluation – X-Lab

The Contractor shall continue to use the C2BMC Experimentation Laboratory (X Lab) to perform experimentation activities as agreed to and directed by the Government, specifically

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development of advanced threat characterization capabilities. The Contractor shall provide the Government and other Contractor Functional Areas with semi-annual reviews on the purpose, design, and approach for X-Lab experiments.

4.2 C2BMC Planner

The Contractor shall design the algorithms, define and document the requirements and preliminary design required to update the current S8.2-3 planner to support integration and update/verify the Red/Blue force while maintaining the C2BMC Planner subsystem support of the C2BMC initialization of the Mission Suite, Unified Client displays, and Operations Capability (OPSCAP) functionality.

The Contractor shall support Red/Blue force validation activities to include data logging requirements, test tools for batch analysis, development and analysis of test cases.

The Contractor shall present progress of this design update at the S8.2-5 Design TIM and preliminary design at PDR.

4.2.1 Continued Red/Blue Force Update

The Contractor shall perform all of the activities necessary for the preliminary design to continue this ongoing activity to improve the quality and quantity of the blue force and red force representations in the C2BMC Planner subsystem, ensuring that the representations are up-to-date with the BMD Elements, as approved by the appropriate MDA/BC board and produce reliable results for force level planning purposes. The Contractor shall work with the BMDS Elements to compare analysis results, update Characteristics and Performance data to improve the fidelity of the C2BMC Planner results, identify and implement algorithm improvements. The Contractor shall work with MDA and the Intelligence Centers to update the C2BMC Planner threat representations

using the latest Adversary Data Package, based on prioritized Warfighter requirements provided by JFCC-IMD through the C2BMC Program Office.

The Contractor shall design and document modifications to the C2BMC Defense Planner framework to allow for the incorporation of Government-furnished federated models from third party developers in order to provide analysis results directly into the defense planning tools (e.g. Defended Area Analysis, Operating Area Analysis, Scenario Analysis, etc.). The Contractor shall support technical interface exchange meetings and shall develop the Application Program Interfaces (APIs) necessary for product integration. The Contractor shall document and deliver the API design documentation.

4.2.2   IAMD Battle Command System (IBCS) Update

The Contractor shall design and document modifications to the C2BMC Planner to integrate with the IBCS IDD Enhanced Operational Capability providing planning interoperability with Army Integrated Air and Missile Defense Planning. The Contractor shall design the modifications of the existing C2BMC Planner subsystem necessary for updated IBCS components/capabilities in defense designs and analysis of defense designs (e.g. Engagement Operation Centers, updated PATRIOT laydown).

4.2.3   Support & Improvements to Existing External Interfaces

The Contractor shall provide support for the improvement and testing of both existing and new AMDWS, IBCS, Air Force IAMD Planner, and NATO Planning Systems, Modernized Integrated Database (MIDB) and Common Integrated Air and Missile Defense Extensible Markup Language (XML) Schema (CIXS) interfaces. The Contractor shall provide for test support for the migration of the interfaces

(b)(3):10 U.S.C. § 130

4.2.4   Engagement on Remote (EoR) Planning update in the C2BMC Planner

The Contractor shall design and document modifications to the C2BMC Planner subsystem to improve the analysis capability plan for initial EoR. The C2BMC Planner shall determine EoR engagement opportunities and provide the appropriate engagement tasking where possible. The Contractor shall modify the C2BMC Planner to provide the Selectable Quality of Service (SqoS) bins to be provided to the Navy

planner system located in the Mobile Operations Control Center (MOCC) and Aegis Mission Planning systems.

4.2.5 Automatic Engagement Support Task (EST) Generation in the C2BMC Planner

The Contractor shall design and document modifications to the C2BMC Planner subsystem to automatically provide a list of the possible ESTs that are possible within a specific defense design. The Contractor shall include the provision of visual aids in the design to allow the operator to easily discern the kill chains resident in a particular plan. The C2BMC Planner shall allow the operator the capability to plan in each of the Sensor Resource Management (SRM) operational modes.

4.2.6 Human Factors Improvements in the C2BMC Planner

The Contractor shall design and document modifications to the C2BMC Planner subsystem to improve and enhance the graphical user interface to increase usability and reduce training time requirements. The Contractor will use findings from the Government contracted HFE reports from claiming events 1 and 2, as guidance. The Contractor shall coordinate HMI improvements with the Defense Planner Government point of contact to ensure alignment with Warfighter feedback.

4.2.7 LRDR Planning Update in the C2BMC Planner

The Contractor shall design the algorithms, define and document the requirements and preliminary design required to modify the C2BMC Planner subsystem to enable the capability to develop custom radar locations with approximate mission-specific search sectors to include the newly developed LRDR sensor representations for planning and analysis.

4.3 Battle Management

4.3.1 Sensor Resource Management (SRM) of LRDR for GMD Engagements

The Contractor shall develop the preliminary design for C2BMC control and tasking of LRDR for collection and development of track, feature, and discrimination data. The Contractor shall define the interface between C2BMC and LRDR required to support radar tasking for threat acquisition and receipt of the resulting radar data. The Contractor shall create the preliminary design to generate and schedule LRDR objective tasking to support GMD engagement timelines with the necessary track priorities and track quality-of-service (QoS), including accuracy and

discrimination results, for GMD to achieve their required probability of engagement success. The Contractor shall also design the interface with GMD to obtain the engagement timelines and track QoS required to support objective tasking of LRDR.

(b)(3):10 U.S.C. § 130

4.3.2 SRM of LRDR for Space Situational Awareness (SSA)

4.3.2.1 Threshold SSA Metric Observation Capabilities

The Contractor shall develop the preliminary design for C2BMC control and tasking of LRDR for SSA. SSA requirements are defined in JP 3-14 as well as USSTRATCOM Instruction 534-9 and include the ability to detect, track and identify space objects and events, threat warning and assessment, and characterization. The Contractor shall update and document the interface between C2BMC and the Joint Space Operations Center (JSpOC) Mission System (JMS)

(b)(3):10 U.S.C. § 130

The Contractor shall update and document the interface between C2BMC and LRDR required to support radar tasking for the SSA mission, to include the sending of all updated satellite catalog entries to LRDR, and dissemination of SSA information through C2BMC.

(b)(3):10 U.S.C. § 130

The Contractor shall update C2BMC to include the tasking message ID in the response messages.

4.3.3 BMD System Track (BST) Processing and Reporting

The Contractor shall develop the preliminary design for BST based on C2BMC System Track processing enhancements that provide new functionality to support GMD engagements. The Contractor shall collaborate with the Government through the ACT and jointly identify and select the updates for this new capability.

The Contractor shall develop algorithms to provide combined conventional and advanced discrimination results into a singular discrimination result and provide it to GFC via the BMD System Track.

4.3.3.1 Initial Detailed Design and Development of BMD System Track (BST) Processing and Reporting

The Contractor shall initiate detailed design and software development of the Spiral 8.2-5 Track Processing and Track Reporting capabilities for implementation of BST generation and reporting based on C2BMC System Track processing and reporting enhancements to support GMD engagements in order to reduce cost and to mitigate schedule risks in completing Detailed Design for CDR and development by the Test Readiness Review conducted under the next Spiral 8.2-5 Development Task Order.

4.3.4 Net-Centric Command and Control (NC2)

The Contractor shall develop the preliminary design of updates for NC2, to include the exposure of new or modified C2BMC capabilities, such as LRDR source tracks. The Contractor shall update the Global Sensor Integration on Networks (GSIN) XML Schema for approval by the GSIN COI CCB.

4.3.5 Adaptable Toolkit for Open Message Service (ATOMS) Interface Definition Language (IDL)

The Contractor shall create a preliminary design that will maintain the ATOMS-IDL. The Contractor shall use the ATOMS-IDL to define all internal C2BMC messages and services. The Contractor shall design any new ATOMS messages related to BMDS data required for the proper operations of C2BMC with regard to the addition of the new radar. The Contractor preliminary design shall maintain the ATOMS Messaging Engine (ME) to provide point-to-point and publish/subscribe messaging interfaces. The Contractor shall assess the need for any changes to support S8.2-5 capabilities to the ATOMS-IDL and the ATOMS interface (CDRL A021). The Contractor shall obtain

Government Program Manager's approval of these changes through the system design review process.

4.3.6 Interface Change Proposals (ICPs)

The Contractor shall create the preliminary C2BMC design to support Increment 6 Link-16 ICPs as defined in the CES.

4.3.7 Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS)

The Contractor shall support all aspects of planning and design to support interoperability with the U.S. Army's IBCS. The IBCS interface shall be based upon MIL-STD-6016.

4.3.8 BOA 7.0 Integration

The Contractor shall design the system to interface and integrate with the BOA Element of the BMDS as a sensor source to C2BMC for system track development. The Contractor shall design for the full use of BOA tracking information in system track generation from launch to impact when available. (b)(3):10 U.S.C. § 130

- (b)(3):10 U.S.C. § 130

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4.4   Modeling and Simulation (M&S)

The Contractor shall collect, define, and track BMDS M&S capabilities and requirements consistent with the S8.2-5 capabilities and the need to support S8.2-5 development, integration, and test. The Contractor shall ensure that all plans associated with model acquisition are consistent with and complementary to the C2BMC Government Program Plan (PP) and the Program IMS. The Contractor shall comply with all DoD 8500 Cybersecurity policies when writing plans associated with model acquisition to support BMDS events.

The Contractor shall define the Federated Model and Scenarios to be used during the C2BMC S8.2-5 engineering, development, integration and testing activities including review of C2BMC requirements, ICDs, and assessment needs to determine drivers for component models and playback data, and

scenarios. The Contractor shall conduct early assessment of BMDSS representative threats and create S8.2-5 Scenarios to support System Engineering and algorithm assessment.

The Contractor shall update and maintain the development plan for the BMDS C2BMC Model (BCM) with the required S8.2-5 capabilities and present a preliminary design update at the S8.2-5 Design TIM and the design at PDR.

4.5 Network Communication Services

(b)(3):10 U.S.C. § 130

(b)(3):10 U.S.C. § 130 The BMDS Networks Operations & Security Center provides capabilities to detect intrusion threats and filter data.

4.5.1 Network Concepts & Requirements

4.5.1.1 Network Requirements

4.5.1.1.1 LRDR Network Interface

The Contractor shall provide a network gateway at the LRDR (b)(3):10 U.S.C. § 130

(b)(3):10 U.S.C. § 130 The Contractor shall maintain an activity separation for safety within the network until interfacing with the first C2BMC Network Interface Processor (CNIP). The Contractor shall design the capability to, at the radar location, allow for

(b)(3):10 U.S.C. § 130

The Contractor shall design the capability to, at the corresponding element node, include safety separation until transition to ATOMs within the element node. The Contractor shall design the new (b)(3):10 U.S.C. § 130 gateway to be extensible to future (b)(3):10 U.S.C. § 130 BMDS element interfaces.

4.5.1.2 Network Design

The Contractor shall update the Network design to meet requirements identified in this task order and C2BMC Element Specification. The Contractor shall also develop preliminary design artifacts, which fully describe the network configuration

The Contractor shall participate in a system level design reviews and conduct the associated Network level Requirements and Design TIMs and design reviews.

4.6 Cybersecurity

The Contractor shall conduct Cybersecurity Design to ensure all architectures include appropriate Cybersecurity requirements and are approved by the C2BMC ISSM, AWG, the C2BMC ICCB, and the C2BMC Program Office, and are subsequently incorporated into the C2BMC system design. The Contractor shall incorporate all applicable Cybersecurity controls listed in National Institute of Standards and Technology (NIST) Special Publications 800-53 and Committee on National Security Systems Instruction (CNSSI) 1253, USCYBERCOM and MDA/CERT Communications Task Order (CTO), Operations Order (OPORD), Warning Order (WARNORD), Execution Order (EXORD), and Security Technical Implementation Guide (STIGs) /IAVMs (Information Assurance Vulnerability Management) into the system design or have approved mitigations. The Contractor shall provide use cases and test plans.

(b)(3):10 U.S.C. § 130

5.0 Special Studies / Special Emphasis Projects

The Contractor shall execute special emphasis tasks as requested through Requests for Task Instructions that include implementation of technical study results or recommendations; analyses, assessments, and reports; issue resolutions for C2BMC; procurement of material; and software updates/engineering releases. The Contractor shall deliver results to the Government IAW instructions in the Task Instruction(s).

6.0 Period of Performance

From award through April 30, 2018.

7.0 Travel

The Contractor shall travel as required to participate in meetings, conferences, program reviews, technical interchanges, and test events to accomplish the work described in this TO. The Contractor shall ensure costs associated to travel are IAW Federal Acquisition Regulation (FAR) Part 31.205-46.

8.0 Government Furnished and Contractor Acquired Property

All Government Furnished Items (GFx) associated to this TO are identified in "Attachment 4 – Government Furnished Information/Services/Facilities/Property" and "Attachment 9 – Master Government Property List" of the basic contract.

In addition to the Compliance Documents listed in the basic IDIQ Contract, these compliance documents are called out as applicable to this TO:

- BC ARL Checklist, May 25, 2016, Version 1
- MDA Instruction 5000.20-INS (MDA/DE Engineering Technical Review Process)
- C2BMC Element Specification (CES), date TBD, Versions 6.0 and SCNs 0007 and 0008
- IEEE 12207, Software Lifecycle Processes, April 15, 2011
- C2BMC HFE IPT Charter November 20, 2012

9.0 Critical Milestones

Milestone	Purpose	Date
Element System Requirements Review #1 (ESRR 1)	Government review and approval of the CSS	3QFY17
Requirements TIM	Government review of the Contractor's status of the new Increment 6 requirements	1QFY18
Design TIM	Government review and concurrence with path forward	1QFY18
PDR	Government review and approval prior to major development	3QFY18

10.0 Deliverables

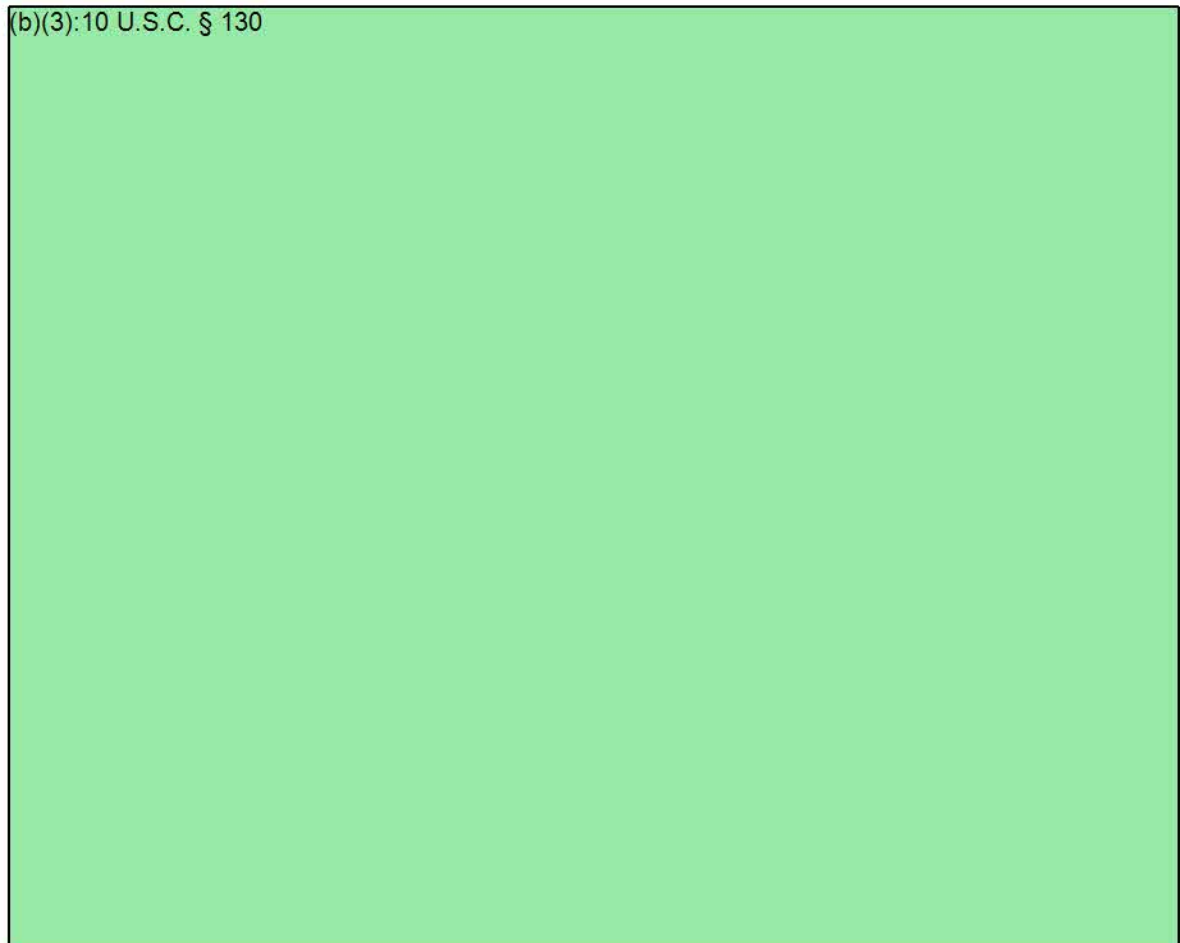The following table identifies the required CDRL deliverables associated with this TO.

CDRL #	CDRL Title
A013	Interface Control Documents
A015	C2BMC Spiral Specification
A016	OPSCON Document (Operational Concept Description)
A019	TPM Management Plan
A021	Assessment Reports/ Analysis Reports
A026	DoD Architecture Framework Documentation
A048	Requests for Waivers and Deviations

The following deliverables require Government acceptance through Wide Area Work Flow (WAWF) Receiving Reports:

- C2BMC Spiral Specifications, IAW CDRL A015
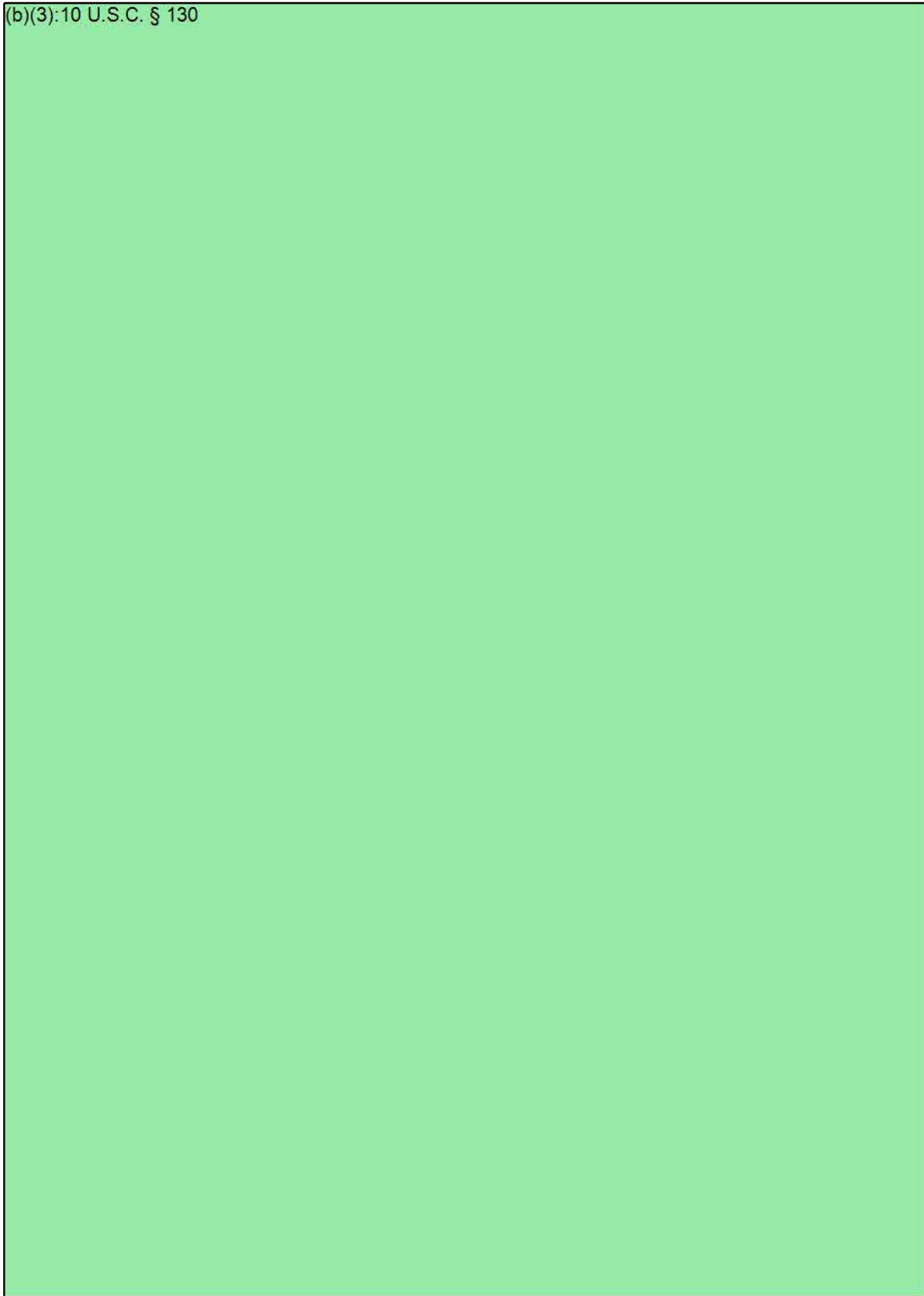- OPSCON Document, IAW CDRL A016

11.0 Acronym List

(b)(3):10 U.S.C. § 130

(b)(3):10 U.S.C. § 130

(b)(3):10 U.S.C. § 130

(b)(3):10 U.S.C. § 130