Maritime Sustainment Technology and Innovation Concepts

The Naval Surface Warfare Center, Philadelphia Division (NSWCPD) requires innovative technological warfare sustainment solutions to address current and future security threats to our nation, our warfighters, and our allies in maritime environments. The maritime space is a unique and complex environment, and has specific challenges relative to the security threats and solutions.

NSWCPD has a number of maritime programs with requirements for prototyping that further the objectives of each individual program mission. Constant changes to technology and the rapid commercial-off-the-shelf (COTS) insertion process demand expeditious technology development and prototyping efforts.

NSWCPD has a continuing, significant demand for programmatic prototype projects that involve:

- Advanced concept demonstrations;
- Risk reduction prototyping projects/processes;
- Technology demonstrations; and
- Development of pre-production prototypes.

Current program requirements dictate a need to identify transition paths to use a diverse toolset to provide rapid obsolescence mitigation, improved equipment design, and deployment of new parts and technologies to the Fleet. This involves integrating a model-based approach to current operations. This integration involves many tasks including the development of capabilities to support a model-driven system engineering process (SEP) that leverages 3D data as an authoritative source of truth that can be used across the acquisition lifecycle. This project includes developing tools to enhance current rapid prototyping and reverse engineering capabilities to explore novel methods of generating, manipulating, presenting, and interacting with 3D source data as well as investigating advanced manufacturing technologies capable of leveraging the digital eco-system to improve engineering practices.

Current maritime sustainment technology and innovation requirements relative to prototyping that may be executed under the new Agreement include the following. The technologies listed are only examples of technologies and are not limiting in scope. The intent is to ensure as new technological developments occur, Sustainment projects will be able to achieve rapid access to state-of-the-art advancements. Therefore, the Maritime Sustainment Technology and Innovation Concepts Attachment Document will evolve and change over the term of the agreement.

MARITIME SUSTAINMENT TECHNOLOGY AND INNOVATION CONCEPTS

1.0 COTS Obsolescence and Tech Refresh Product Development

Design, develop, prototype, and demonstrate COTS devices at the leading edge with commercial partners to address obsolescence and tech refresh that meet current future DoD needs at commercial cost and timelines and that improve the performance, reliability, or

availability of shipboard systems. Eliminating the legacy supply chain risks and deliver a future proof technology without having to upgrade software systems. Tasking related to this project concept may include:

1. Digital engineering technologies in support of reverse engineering and parts obsolescence
2. Hardware Component design and development to create a form, fit functional replacement
3. Data analysis and modeling to support business case analyses for parts sparing, procurements, life-of-type buys, and strategies on system obsolescence issues

2.0 Data Transformation

Develop and demonstrate technologies and solutions to store, process, synthesize and operationalize sustainment data.

1. Design and Development of Data Systems that store, process, and synthesize sustainment data.
2. Associated ship installation drawing, development, and shipcheck for prototype installation onboard a maritime vessel.
3. Associated prototype Technical data package development (Tech Manual, Preventive Maintenance Schedule (PMS), Allowable Parts List (APL)) to meet prototype shipboard installation requirements.
4. Ship's force training package development for the prototype system.
5. Rapid development of analytical models in support of maintenance and reliability studies, test site reliability engineering efforts, and prognostics for condition-based-maintenance.
6. Development, demonstration, and exploitation of technologies, algorithms, and methods that expands the ability and/or improves predictive and prognostic maintenance decisions in support of condition based maintenance and availability decisions/planning in support of on time delivery of ships.
7. Develop and demonstrate virtual prototype models to support the component, system, engagement, and mission level. Includes prototypes that allow the interconnection of hardware in the loop with computer models and/or the use of virtual and augmented reality, in support of In-service Engineering Agent (ISEA) of the Future.

3.0 Cyber

1. Development of additional cyber risk models to balance operational and cyber risks in planning and emergent situations.
2. Prototype software and hardware assurance tools as well as security features and secure design environments.
3. Develop cyber hardened COTS solutions to address system vulnerabilities and provide for compliance with security controls frameworks.
4. Develop standards and practices to foster commercial development of secure, trusted, and assured parts and supply chains.
5. Document and promulgate security-enhancing design practices across Government, Industry, and academia in the areas of standard program outreach material; standard

training material; Government and Industry standards and best practices; and self-service libraries of standards and best practices.
6. Document and promulgate DevOps and other Agile working practices across Government, Industry, and academia.
7. Development of policies, software, and hardware technologies to support cyber security related incident response.

4.0 Fleet Introduction Technologies

1. Develop new technology prototypes that can be implemented broadly to address warfighter needs. New technology prototypes may be hardware, virtual, process-based, or a combination of demonstrations (such as hardware in the loop computer models, rapid prototyping, or augmented reality distance support).
2. Establish new technology qualification standards and approaches that reduce prototype development cycle time, reduce cost, and lower the risk of developing failing products.
3. Perform testing of developed technologies and processes. Testing shall be done to gather information about final products/processes and their behaviors as early as possible. Testing may be done to support system validation, shipboard integration, environmental qualification, and other assessments as required.
4. Develop and evaluate standardized business and technical practices for new Fleet technologies across Government, Industry, and academia. Standardized practices shall consist of engineering design practices, systems integration processes, specification and standards development methods, training and outreach material, general best practices guides, and self-service libraries.

5.0 Waterfront Industrial Support Operations

1. Optimization of industrial waterfront process and process automation to enhance capabilities and improve efficiencies. Development of robust implementation techniques of these automations to operationalize critical system enhancements and improvements.
2. Prototype system design, detailed design, technical package (Technical manual, preventive maintenance, and allowable parts list) and training package including Phase II Ship Change Document development, alterations, and prototype shipboard installation.
3. Material procurement and installation services to support prototype installation for shipboard test and evaluation purposes.
4. Research, design, development, and demonstration of Program Management tools to include cost, schedule and risk management with development of analytical tools for performance-to-plan metrics.
5. Development of Quality Assurance process prototypes that increase efficiency and reduce cost to the customer.
6. Develop improvements/innovations in methods, materials, and procedures for installing prototype equipment onboard maritime vessels or test sites.

6.0 Develop Asset Fabrication, Revitalization (Remanufacturing) and Packaging Innovations

1. Develop new and innovative asset fabrication, revitalization, and packaging methods for systems down to the Line Replaceable Unit (LRU) level.
2. New fabrication methods may target any phase of fabrication innovation from concept development through material/hardware implementation. New fabrication methods shall demonstrate advancements that reduce cost or process time, increase component quality, and de-risk obsolescence. Fabrication methods can be physical and/or abstract (process) improvements.
3. New machinery systems revitalization (remanufacturing) methods may address system/component handling and marking, inspection techniques, test methods, cleaning and sanitizing, restoration of components to their original condition, upgrades, storage improvements, material recycling, and disposal. Revitalization methods shall not be limited to component functionality. They may target component cosmetics, operator usability and comfort, or remanufacturing process improvements.
4. New packaging methods shall demonstrate improvements in component marking and labeling, handling, extended preservation, non-destructive inspection methods, bulk packaging automation, and environmental impact reductions. Improvements of security and traceability of packaged goods in the supply chain shall also be demonstrated. Packaging methods may consider any packaging medium such as glass packaging, wood packaging, anti-corrosive packaging, pharma packaging, plastics packaging, and any other means of flexible packaging. Methods to utilize zero-waste packaging shall be evaluated whenever possible.

7.0 Logistic and Supply Chain Management

1. Research, develop, and demonstrate component and part-centric supply chain management processes and tools that would provide for more informed decision making on the selection of components for system design.
2. Design and develop a Logistics Data Model that has the capability to analyze and integrate existing and future logistics products.
3. System Supportability and Sustainability Logistics

8.0 Research and Development

Work with Government, academia, and Industry to identify and evaluate innovative and cutting edge technologies through the development and test of prototype equipment that improves system functionality, supports future mission capabilities, and improves maintainability, sustainability, operability, and safety. The interest areas of equipment R&D include, but are not limited to:

R & D Technology Areas

- Cybersecurity
- Controls

Maritime Sustainment Technology and Innovation Concepts

- Networked Communications
- Encryption
- Neural Network/Machine Learning
- Artificial Intelligence
- Virtual Reality
- AC Power Generation
- Fault Protection
- Power Distribution
- Power Conversion
- Harmonic Filtering
- EMI Hardening & Filtering
- Conductors
- Power System Modeling & Simulation
- MVDC Components and systems
- Motors
- Motor Controllers
- Energy Storage (batteries, capacitors)
- Electric Actuators
- Shaft Seals
- Air Handling (Fans, blowers, dampers, ducting, etc.)
- Pumps
- Reverse Osmosis
- Breathing Air Purification
- Air Conditioning & Refrigeration
- Gas Turbines
- Fuel Cells
- High Temperature Superconductivity
- 3D Printing/Additive Manufacturing
- Laser Scanning
- Parametric Scaling Software & Tools