

Technology Investment Plan for Research Announcement 20-01

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MISSION

- ❖ Manage and focus national shipbuilding and ship repair research and development funding on technologies that will reduce the cost of ships to the U.S. Navy, other national security customers and the commercial sector, and develop and leverage best commercial and naval practices to improve the efficiency of the U.S. shipbuilding and ship repair industry.
- ❖ Provide a collaborative framework to improve shipbuilding-related technical and business processes.



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1. INTRODUCTION

The National Shipbuilding Research Program Advanced Shipbuilding Enterprise (NSRP ASE) program goal is to reduce the cost of building and maintaining ships of the U.S. Navy, other national security customers, and the commercial sector. To accomplish this, NSRP ASE is focused on industry-wide implementation of solutions to common cost drivers – these solutions include leveraging of best commercial practices, use of new technologies and creation of industry-specific initiatives. Successful projects are generally those that incorporate aggressive technology transfer and implementation by multiple U.S. shipyards. Projects should demonstrate value through articulation of anticipated return-on-investment and clearly reduce total ownership costs with benefits that can be delivered by varied combinations of reductions in acquisition and fleet life-cycle costs.

The NSRP ASE conducted a Technology Investment Plan (TIP) workshop on 6 and 7 February 2019 to identify high priority issues and current industry challenges where research proposals would be of particular interest to the program. The workshop attendees included a cross section of highly experienced shipbuilders from the member shipyards, along with senior government representatives from the Navy's Program Executive Offices, Naval laboratories, and NAVSEA headquarters staff. The result was a list of specific topics arranged by NSRP Major Initiative Area. Proposals addressing these topics will receive strongest consideration by the Executive Control Board (ECB). However, the ECB wishes to clearly emphasize that this list should not be viewed as excluding any other ideas. The ECB will continue to encourage and fund those proposals which it feels best further the mission of the collaboration, whether or not they are the result of this workshop. The anticipated benefits of the proposed effort are far more important than whether the topic is included in the TIP. Successful proposals are generally those that incorporate aggressive technology transfer and implementation by multiple U.S. shipyards. Successful proposals demonstrate the value of the proposed solution by clearly describing its anticipated effects on ship acquisition and sustainment costs. The clearest method is to state the anticipated cost reductions that can be achieved through implementation.

The RA 20-01 solicitation will be opened when the Research Announcement (RA) is posted on the NSRP (www.nsrp.org) and Federal Business Opportunities (FedBizOpps) (www.fbo.gov) websites. The solicitation will be modified as necessary to reflect changes in government and/or industry priorities. Potential proposers are reminded that there are several requirements incorporated in NSRP Research Announcements that merit particular attention, particularly the need for a strong business case that can and will be supported by project metrics. Readers are strongly urged to review further details provided in the Research Announcement and the NSRP Proposal Preparation Kit.

This will be an unrestricted solicitation.

2. RESEARCH AND DEVELOPMENT AREAS OF PARTICULAR INTEREST

Generally speaking, proposals for research, development and implementation of best practices in the U.S. shipbuilding and repair enterprise should achieve one or more of the following Strategic Objectives:

- Reduced Total Ownership Cost of ships

- Improved quality in ship design, construction and repair through continuous improvement of advanced technologies, processes and data management applications
- Enhanced workforce excellence
 - Improved safety, wellness and environmental stewardship for shipyards and shipboard personnel
 - Recruitment, training, engagement and retention of shipbuilders through collaboration, knowledge sharing and attitude management during change
- Reduced cost associated with ship systems integration during ship design, construction, modernization and maintenance
- Increased materials and process commonality across the shipbuilding and ship repair enterprise to reduce cost
- Identification of best practices from all sources regarding cybersecurity technologies and their appropriate application to shipbuilding and repair systems and equipment

In support of those objectives, the following topics for proposals have been evaluated through the TIP workshop process as being of particular interest to the program:

A. Ship Design and Material Technologies (SDMT)

The SDMT Major Initiative Area focus is to implement cost reduction initiatives across the complete spectrum of design processes (conceptual to detail) and the use of advanced materials to support the rapid and efficient development, construction, sustainment, and disposal of the next generation of vessels. The SDMT group identified the following suggested project ideas:

Advanced Systems

Develop processes and technologies that accelerate the qualification and implementation of Additive Manufacturing (AM) for:

- Ship Alloys
- Ship Design
- Ship Building
- On Board Ship Applications
- Ship Repair

Data Management/Information Technologies

Develop a framework for transitioning ship model data to fleet for training and sustainment.

- Model Data should consider attributes, including but not limited to, the following:
 - Common Digital Platform
 - "Lightweight" Ship Model
 - Easily Accessible by Ship's Force

Materials and Design

Expand the qualifications and applications of Flexible Infrastructure for reconfigurable spaces.

- Auxiliary Vessels
- Commercial Vessels
- Aluminum/Non-Steel Vessels
- Compliant Spaces
- Modernizations

Develop methods for rapid material/component qualifications with NAVSEA and other regulatory bodies.

- Enhancing Material Properties Within Existing Specifications
- Incorporating Integrated Computational Materials Engineering (IMCE)
- Incorporating Design of Experiments (DOE)
- Consider Other Regulatory Bodies

Develop design guidelines and best practices for the application of automation in shipbuilding.

- Considerations for Robotic Implementations
- Order of Operations
- Consideration of Types of Compartments and Spaces
- Environmental/Safety Concerns

Benchmarking

Benchmark/leverage commercial (foreign/domestic) industry practices for potential improvements for shipbuilding applications.

- Outsourcing
- Vendor Certification
- Production Engineering
- Warehousing
- Material Logistics
- Design Methodologies

B. Ship Production Technologies (SPT)

The SPT Major Initiative Area focus is to address the fabrication and assembly phases of ship production, including the planning and organizational structure (facilities) that support those phases. During the TIP workshop, the SPT group focused on potential projects to quickly and efficiently achieve a 355-ship Navy. The high mix/low volume nature of shipbuilding and ship repair inhibits the implementation of traditional automated solutions. The SPT group identified the following suggested project ideas:

Automation

Greater utilization of automation and robotics is needed to meet safety, quality, schedule, and cost objectives.

- Identify best practices in industries outside of shipbuilding and ship repair
- Develop common, holistic strategies for accelerated insertion of automation that include considerations for design, infrastructure, capital procurement, applications, robust/flexible system designs, control of upstream production process and workforce training
- Develop simple, general purpose mechanical aids
- Develop technology to allow for utilization of human augmentation in automation control
- Develop design rules for automation
- Develop novel sensor technologies and control algorithms that enable adaptive automation
- Integrate predictive analyses into off-line robotic programming and ship design software programs

Surface Preparation and Coatings (SP&C)

SP&C processes in support of a 355-fleet Navy through construction, maintenance, and repair are impacted by current coatings requirements, a lack of skilled workforce personnel, and a lack of innovation within this value stream.

- Invest in streamlining, clarifying, and standardizing coatings specifications and requirements, especially relative to new construction submarine and carrier programs
- Increase the number of skilled craftsmen through recruitment, training, certification, and experience – this is applicable to new and existing member of SP&C workforce
- Obtain greater utilization of automation and robotics – gaining an understanding of automation beyond the Naval coatings community
 - Processes – Surface Prep and Coatings, Decking Systems, Documentation
 - Tools and Equipment – Instrumentation, gauges, tablets on the deck plate

Welding

Need to reduce the cost of welding and allied processes.

- Improve traditional welding processes and investigate/develop new processes for increasing productivity and deposition rates
- Enable technologies that improve first-time quality
- Investigate the use of digital transmission of welding information and requirements to the welder
- Improve welder proficiency and accelerate new welder development

Electrical

Develop technologies which ease installation, upgrade and repair, reduce costs, and improve the performance of current and next-generation shipboard electrical systems.

- Technologies to support implementation of medium voltage direct current (MVDC) systems:
 - DC breaker technologies
 - DC electrical system protection methodologies
- Improved power distribution technologies such as advanced modularity and cabling concepts (e.g. bus pipe)
- Energy storage maintenance reduction and new technology integration
- Improve power converter integration methods
- Technologies to support improved energy efficiency
- Improvements in fiber optic cable, connector and testing methodologies

Modularity

Increase use of modular technology to alleviate the difficulty of implementing upgrades and installing new technologies.

- Develop design standard sections/components that can be manufactured off-hull (plug and play)
- Utilize modularity during ship construction to optimize installation sequences and reduce equipment care and protection efforts
- Standardize access to high change spaces to aid in upgrade and repair activities
- Facilitate design of "hatchable" equipment

Vendor Base

Address inadequacy of vendor base to meet the growing shipbuilding and ship repair demand.

- Evaluate shipyards core/non-core processes in support of determining efficient outsourcing opportunities and maximize shipyards capacity and capabilities
- Identify barriers inhibiting potential suppliers from entering the shipbuilding; construction, maintenance, and repair, market and provide solutions to improve suppliers' entry-qualification

C. Business Processes and Information Technologies (BPIT)

The BPIT Major Initiative Area focus is to address current technologies and processes for improvement as well as emerging technologies that increase value to the U.S. Navy, other national security customers, and the commercial sector. The BPIT group identified the following suggested project ideas:

Data Management/Information Technologies

Define technologies and processes that provide actionable data at point-of-use to make real time decisions.

- Research infrastructures that deliver time sensitive data across the Digital Thread
- Develop data governance solutions that are scalable across different enterprises to reduce disparate data formats:
 - Identify shipyard data structures/tools/formats
 - Consider “open” standards for data portability
 - Investigate data exchange, delivery, interoperability, intra-operability

Define architectural elements required for a fully Digital Shipyard with close integration with our Navy and commercial customers.

- Identify and research Digital Shipbuilding data strategies, architectures and infrastructures to enable the digital thread; extending to the ship and its lifecycle
- Develop the processes for maintenance and implementation of digital data and technology insertion
- Expand shipbuilding informatics (data analytics, applications, reporting)

Need time-sensitive configuration management solutions throughout platform lifecycles to enable the Digital Twin.

- Define and/or develop a configuration control strategy which is suitable for product model architectures, is efficient to maintain, and provides hull-specific data for the user to maximize the use of the digital twin
- Develop processes to provide a current state Digital Twin (virtual and physical alignment) to address changes in ship operational configurations
- Define requirements to advance Model Based Enterprise (MBE) at the shipyards to enable the digital thread

Provide sufficient shipyard-specific tools for enabling end-to-end integrated digital processes.

- Develop advanced laser scanning capabilities to meet shipbuilding needs for improved object recognition and CAD part replacement, automatic registry into the digital twin, and penetration through insulations
- Provide data necessary to support Additive Manufacturing capabilities across the lifecycle
- Define areas of cost-effective use for Augmented Reality/Virtual Reality capabilities
- Architect Internet of Things (IOT); including mobile devices, and embedded sensors, to integrate Model Based Enterprise (MBE) and Digital Twin to enable:
 - “Smart Buyer” (design, acquisition data)
 - “Smart Yard/Factory” (product model and machine data)
 - “Smart Operator and Maintainer” (product model and IOT)

Address complex cybersecurity requirements to meet government requirements and certification.

- Review industry best practices and standards; assess and disseminate to the shipbuilding and repair industry
- Identify and apply current security standards and best practices for both traditional client/server and cloud environments to reduce cyber risk of proposed software solutions (Internal)
- Identify and apply current security standards and best practices for sharing and transfer of data between the Navy and shipyards (External)
- Develop a roadmap for software and data qualifications, implementation concerns and Navy future state

D. Infrastructure and Support (IS)

The IS Major Initiative Area focus is to drive and support shipbuilding and repair processes to achieve a safe, high quality, environmentally responsible and productive workforce. The IS group identified the following suggested project ideas:

Environmental

With increased regulatory scrutiny, innovative technologies/processes are needed to ensure compliance and to avoid potential liabilities.

- Identify technologies/processes to reduce pollutants from dry dock, storm water, and industrial effluents
- Investigate real time environmental monitoring equipment for regulatory compliance and emissions reduction
- Investigate alternative environmentally friendly technologies for cadmium and chromium processes to minimize exposures to employees and to reduce hazardous waste disposal costs
- Develop dredging best practices and improve the framework, training, and strategies to minimize dredging costs and constraints
- Research best practices for repair contractor waste management and develop a model to minimize the economic impact on the ship owner customer base, which ultimately bears the cost of this activity

Risk Management

Occupational safety and health solutions are needed to improve health and safety of shipyard workers.

- Research wellness programs to increase productivity and reduce liabilities to the shipbuilding and repair industry
- Develop organizational change management solutions to reduce injuries in shipbuilding and repair industry through habit based learning

- Research previous work related to wearable technology and human augmentation, including other industries, for implementation in shipbuilding and repair industry

Need system for identifying per diem inconsistencies and enforcing compliance for contract labor.

- Standardize the structure for managing subcontractor and contingent worker liabilities

Workforce Development

Need a comprehensive talent management and workforce development solution for both trades and technical/professional roles.

- Define and build talent management solutions for all hard-to-fill/high demand jobs in the industry
 - Identify, design, and develop talent pipelines critical to shipbuilding and repair industry
 - Develop career pathways specific to shipbuilding and repair via skill/ability matrix
 - Develop portable credentials for training and link to shipyard jobs
 - Develop knowledge retention and succession/workforce planning solutions for the shipbuilding and repair industry
- Specific to Technical Professional
 - Research processes and systems for developing skill/ability matrix to define job requirement to better forecast and plan shipyard workforce demand and job overlap
 - Specific areas include: Project management, Project controls, Supply chain, Production planning, Design for production/maintenance awareness training for engineers and designers, Cyber security, Data analytics, Dimensional and quality control, Production and process engineering, Pre-erection outfitting, outfit installation and module building

Address the short supply of talent to sustain process improvements in the shipbuilding and repair industry.

- Develop a workforce development solution via high velocity learning to emphasize and educate on the value of sustaining process improvements to business functions
- Develop formal leadership training programs
 - Identify, design, and develop a talent management solution to aid in onboarding and integration
 - Pilot a performance and development solution using data analytics
 - Identify, design, and implement a leadership development solution via high velocity learning
 - Research best global practices of front line production worker involvement in waste, problem or innovation identification, evaluation and implementation. Survey

participating shipyards to develop metrics and case studies that compare global best practices to current shipyard practices. When possible, design recommended coaching instruction and delivery to correct weaknesses

- Research metrics and practices of global heavy manufacturing plants to determine best practices in coaching for performance in preparing and coaching supervisors. Compare global best practices to USA shipyard practices to identify performance gaps then develop tools and methods to close gaps as needed

3. OVERVIEW OF RESEARCH ANNOUNCEMENT PROCESS

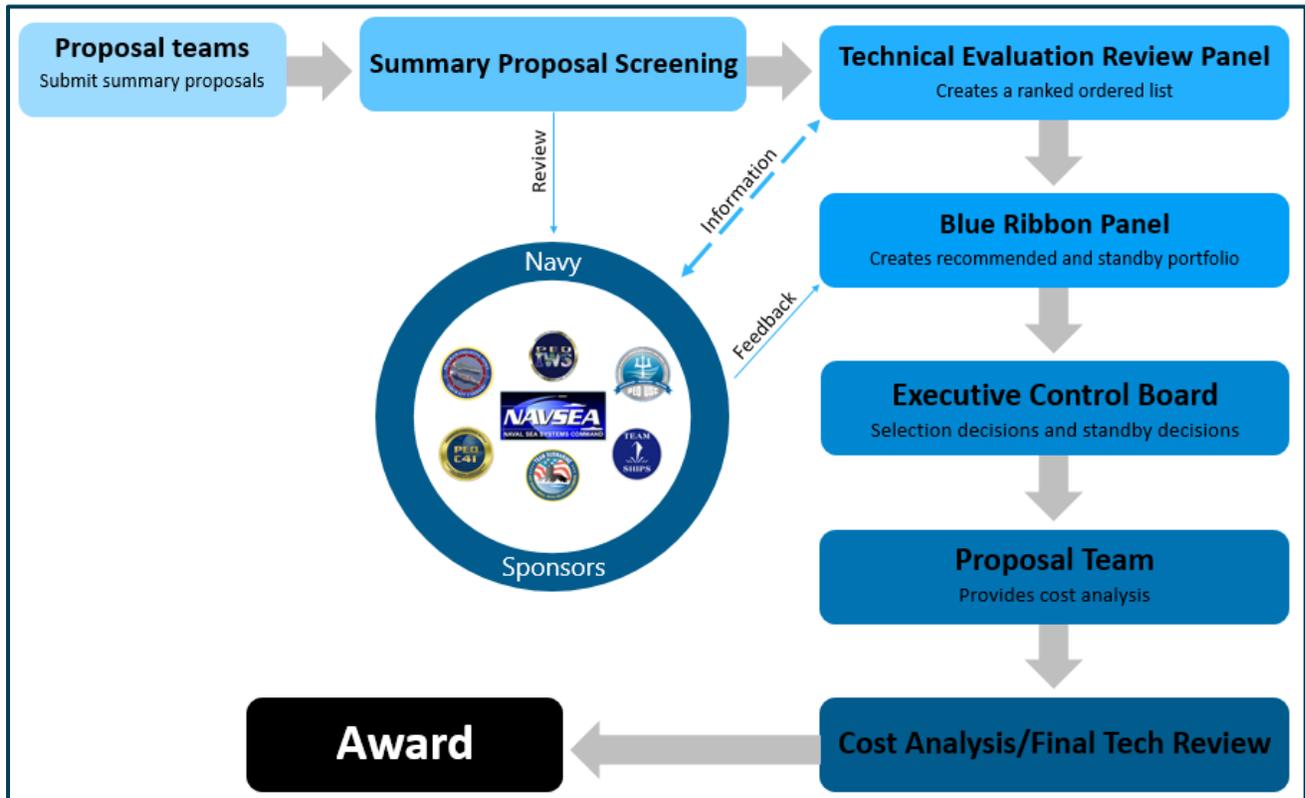


Figure 1 – NSRP RA Selection Process

4. PROPOSERS' CONFERENCE

For this solicitation cycle, NSRP anticipates that it will hold a Proposers' Conference within the first month of the release of the solicitation itself, which will be available via virtual attendance. The Proposers' Conference will provide an overview of the Program and explain proposal requirements and the submission and selection process. It will also provide an opportunity for attendees to explore teaming opportunities.

5. POINT OF CONTACT

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