Technology Investment Plan for Research Announcement 19-01

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1.0 INTRODUCTION

The National Shipbuilding Research Program Advanced Shipbuilding Enterprise (NSRP ASE) conducted a Technology Investment Plan (TIP) workshop on 13 and 14 February 2018 to identify high priority issues and current industry challenges where research proposals to address them would be of particular interest to the program. The NSRP ASE program goal is to reduce the cost of building and maintaining ships for 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 ship acquisition and life-cycle costs.

The TIP workshop was composed of a cross section of highly experienced shipbuilders from the member shipyards, along with senior government representatives from the Navy's Program Executive Offices and NAVSEA headquarters staff. The result of this effort was to identify specific topics by NSRP Major Initiative area where the group consensus was that proposals submitted to address them should receive the highest possible consideration by the Executive Control Board (ECB). However, while this document will address preferred topics of interest, the ECB wishes to 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 TIP workshop.

2.0 RESEARCH AND DEVELOPMENT AREAS OF INTEREST

NSRP has promulgated a Strategic Investment Plan (SIP), which was last updated in 2016. The SIP and the TIP are related documents. The SIP is the more enduring document and broader in scope, while the TIP attempts to identify research areas of particular interest in the current solicitation cycle, to foster the Strategic Objectives of the program delineated in the SIP and excerpted below.

Proposals for research, development and implementation of best practices in the U.S. shipbuilding and repair enterprise should look to 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

Over time and several iterations, the SIP has identified Focus Areas for the Strategic Objectives and Sub-initiatives for each Major Initiative Area. The SIP also identified "Potential Avenues for Implementation" for each Focus Area under each Major Initiative Area. In the future, the NSRP Program will perform a deliberate validation of all the variables identified in the SIP and ensure the TIP aligns to the revised SIP framework.

For this year's iteration, the TIP workshop identified specific topics by Major Initiative area. While this document addresses preferred topics of interest, other proposed project ideas having alignment with the SIP will be considered.

3.0 PROJECT TOPICS BY MAJOR INITIATIVE AREA

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:

- Enhance Digital Environment for Design, Production and Repair with a focus on Drawing-less, Paperless and Standardized Electronic Work Instructions
- Develop solutions for Enhanced Corrosion Prevention
  - Application of composite and corrosion resistant materials
  - Design concepts that support improved coating and insulation applications
  - Corrosion resistant fastening and support systems
  - Standard approach to use of corrosion resistant materials
  - Improved technologies for bi-metallic bonding
- Develop Practical Tools for Weld Distortion and Shrinkage Prediction and Standard Mitigation Approaches
- Develop Design Solutions for Reduced Complexity and Impact of New or Future Equipment Installations and Upgrades that Support Fleet Modernization
  - Modularity Concepts
  - Flexible Infrastructure

  - Hatch-able Racks/Enclosures
  - Below deck equipment access (BERP/WERP/Doors)
  - Integrated Enclosures
  - Equipment Interfaces
- Increase the Use of Cross-Platform Standard Design
  - Modules
  - Components
  - Specific compartments and spaces
- Facilitate Military Specification Relief and Increase Use of Commercial Technologies
  - Expansion of Commercial Materials Qualification
  - Cost/Benefit to Support Risk Analysis of Reduced Design Requirements and Specs
- Validate Cost Predictive Tools for Engineers and Designers
  - Benchmark existing tools and methodologies
  - Integration with existing design processes and tools
  - Improve the fidelity of cost estimates
- Cross-cut Initiatives
  - Rules Based Design
  - Commonality

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 that will advance flexible, mobile, and adaptive technologies:

- Welding and Allied Processes (Structural and Pipe)
  - Improve joint preparation accuracy (cut, bevel, grind)
  - Simplify robotic programming (user friendly/self-programming)
  - Increase deposition welding/cutting/grinding rates
  - Develop universal adaptive fill algorithms
  - Improve first-time process quality
  - Reduce weld-induced distortion

- Surface Preparation and Coatings
  - Increase surface preparation rates
  - Increase coating application rates
  - Reduce material consumption
  - Reduce hazardous waste
  - Reduce environmental impact
- Inspection
  - Reduce manual inspection/testing (HM&E)
  - Reduce data handling processes
  - Develop real-time, in-process solutions
  - Develop solutions for next generation power and control systems
- Warehousing and Materials Conveyance
  - Decrease material wait times
  - Increase material availability
  - Investigate purpose-designed storage
  - Investigate purpose-designed handling and manipulating equipment
- Next Generation Shipyard/Shipboard Electrical Systems
  - Power Systems
    - Installation methods and technology developments
  - Improve installation of shipboard networks and combat systems
  - Workforce Training
- Advanced Manufacturing
  - Modeling and simulation
  - Sensor technologies
  - Additive manufacturing
- Data Analytics and Integration
  - Improve efficiency metrics and projections
  - Improve accuracy controls
  - Condition-based maintenance
  - Cybersecurity

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 commercial shipbuilding. The BPIT group identified the following suggested project ideas:

- Digital Twin (Simulation)
  - Develop enhanced capabilities to forecast operational and maintenance impacts to improve planning and production efficiency with a digital twin

- Mobile Technologies
  - Reduce non-value added time locating resources (i.e. personnel, material, equipment, data) to increase efficiencies in safety, staging, and decision making through the application of geolocation systems (sensors and software)
- Rules-Based Design, Planning, and Manufacturing
  - Increase quality of products and reduce errors (rework) that incur cost, through automated analysis and application of rules and standards by developing rules engines and real-time, interactive, feedback interfaces
- Real Time Data (Smart Factory)
  - Identify best practices and develop processes and tools for enabling implementation of Internet of Things (IOT) in the shop for decision making related to operational analysis, manufacturing, planning, and other related business decisions.
- Augmented Reality/Virtual Reality
  - Identify best practices to facilitate the creation of standards for health, safety, and use of AR/VR in the shipbuilding environment.
- Scanning Technologies
  - Continue the development of scanning technologies that facilitate the integration of as-built and as-designed model data for real time configuration analysis.
- Additive Manufacturing
  - Identify best practices in Design, Planning, and Production workflows.
  - Investigate current design simulation software and develop gap analysis for shipyards concerning skills, application, and development.
  - Identify opportunities to integrate data requirements of Additive Manufacturing software with shipyard product modeling software for data transfer.
- Data Governance
  - Increase efficiency of data access and reuse through technologies and methodologies that align data using standards and rules.
- Cybersecurity
  - Reduce cyber risk of proposed software solutions by identifying and applying current security standards and best practices for both traditional client/server and cloud environments.

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:

- Health and Safety
  - Improve injury rates (TRIR/TCIR)
  - Reduce overhead crane use
  - Improve control technologies (PPE, ventilation)
  - Evaluate emerging technologies
  - Investigate noise cancelation or abatement technologies (PP)
  - Improve ventilation and fume control for deep spaces within the ship
  - Reduce vapors and dust particles from shipyard operations (weld grind, paint)
  - Investigate the health effects of AR/VR and mobile technology
- Environmental
  - Investigate energy reduction in facility HVAC opportunities in shipyards
  - Investigate energy reduction in facility re-lamping opportunities in shipyards
  - Reduce heavy metals from dry dock effluents
  - Investigate the effects of lanthanated vs thoriated tungsten
  - Improve weld emissions
  - Research catalog blasting emission factors for shipbuilding
  - Mitigate the amount of unused paint/reduce hazardous materials
  - Geo-locate hazardous materials and catalog metadata
- Risk Management
  - Mitigate legal liabilities
    - Standardize the structure for managing subcontractor and contingent worker liabilities
  - Reduce workers' compensation
- Workforce Development
  - Develop smart PPE technology
    - Practical, durable, affordable, and comfortable
  - Evaluate cost effectiveness of implementing US Department of Labor apprenticeship/pre-apprenticeship model in shipyards
  - Standardize weld qualifications to a portable industry and Navy-recognized credential

4.0 OVERVIEW OF RESEARCH ANNOUNCEMENT PROCESS

The next NSRP solicitation will open when the Research Announcement (RA) is posted on Federal Business Opportunities (FedBizOpps) and NSRP program websites. It 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 RAs that merit specific attention, particularly the need for a strong business case that can and will be supported by project metrics. Readers are urged to review further details provided in the RA and the NSRP Proposal Preparation Kit.

Figure 1 outlines the RA proposal submission and selection process, which includes technical review of all Summary Proposals by a panel of third-party subject matter experts, followed by a review and project portfolio development by a panel of industry experts. The ECB conducts a final review, approves, and awards the NSRP RA project portfolio.

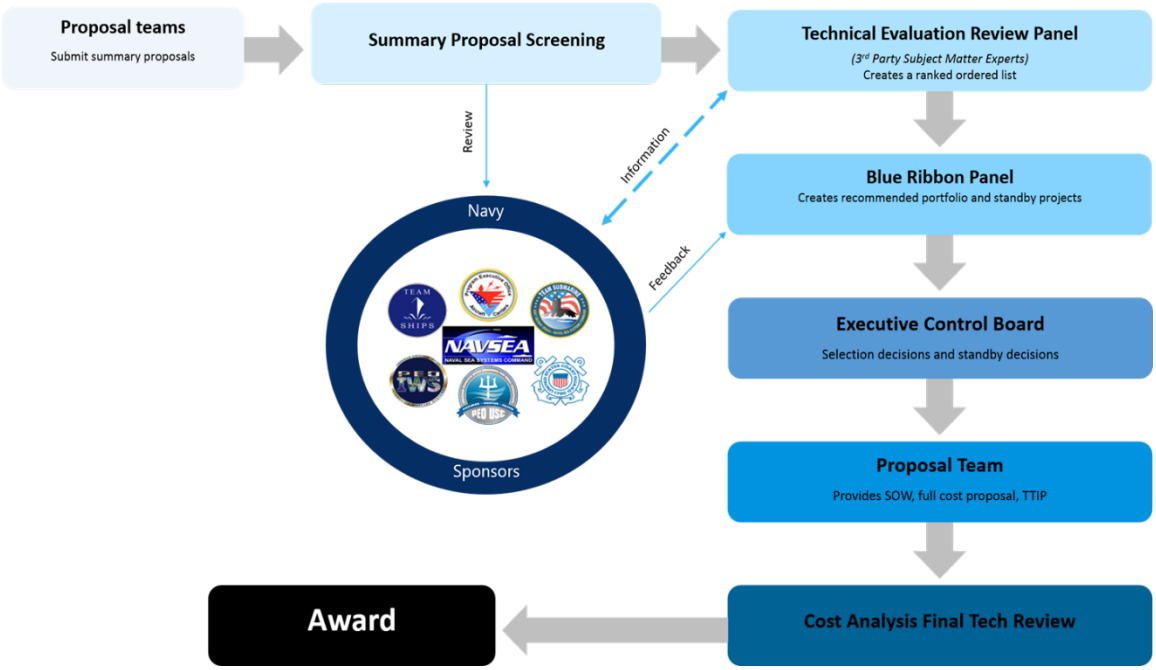

Figure 1 - NSRP RA Proposal Submission and Selection Process

5.0 POINT OF CONTACT

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