Guidance for Implementation of Large-Scale Additive Manufacturing in Shipbuilding

PROJECT INFORMATION

Prime/Lead: American Bureau of Shipping (ABS)

Team Members: NSRP and non-NSRP yards, industry AM centers

Government Participants: TBD

Academic Member: (potential) Penn State Applied Research Laboratory (PSU-ARL)

Duration: 12 Months

DELIVERABLES/BENEFITS/ROI

Deliverables: Tangible output of this project will be:

- ABS Advisory publication on the feasibility, industry capability and business case for large-scale AM technology application, including demonstration case studies that Government fleet owners and the shipbuilding and repair industry can reference
- ABS webinar for government and industry on the ABS guidance publication
- Final report documenting the project activities

Benefits: The initial benefit of this Panel Project is to provide awareness of the opportunities and business case of large-scale additive manufacturing. Additionally, we envision the following benefits for industry and the agencies:

- Shipbuilding and Repair industry will benefit from clarity on additional considerations (tooling, industrial scaling, processes) beyond those of small-scale AM applications that uniquely apply to large-scale AM applications so that yards and supply chains can optimize their production processes to meet the requirements
- Agencies will benefit from contributing to effective guidance that provides an incentive for yards and supply chains to consider adopting large-scale AM technology to positively impact shipbuilding and repair costs, as well as offering mitigations to Diminishing Manufacturing Sources and Material Shortages (DMSMS) challenges.

ROI: available on request to NSRP members

ISSUE / OBJECTIVE

Additive manufacturing techniques provide valuable new opportunities for producing parts with a variety of materials in both ship construction and ship sustainment, saving time and money while also reducing construction and maintenance times that affect mission availability for assets. However, to date, the use of additive manufacturing has largely been applied only to small-scale maritime parts and components. The next logical step in capturing the cost and time savings benefits of additive manufacturing technology is to expand the application to larger metallic ship parts and components.

Project Goals and Objectives: The project goals will be to produce the following:

- Publication of an ABS guidance publication on large-scale additive manufacturing experience, lessons learned, and assessment of industry benefits.
- ABS webinar for government and industry on the ABS guidance publication.
- Final report documenting the research process and the demonstrations.

Business Objectives:

- To understand feasibility and business case information for developing large-scale AM capabilities
- To leverage additive manufacturing for shipbuilding and ship repair for cost and schedule advantages
- To provide clarity and establish guidance and standards for the shipbuilding industry

Technology Objectives:

- To identify and leverage best AM practices from industry participants
- To increase knowledge of AM capability and applications

The team is focused on identifying opportunities to drive efficiency in shipbuilding and ship repair through the use of additive manufacturing, while establishing guidance that industry and the agencies can use to further enable AM technology in shipbuilding.

Cost Share: TBD

Pathways for Emissions Reduction in Ship Construction and Sustainment

PROJECT INFORMATION

Prime/Lead: American Bureau of Shipping (ABS)

Team Members: NSRP and non-NSRP yards

Government Participants: TBD, public yards

Academic Member: TBD

Duration: 9-12 Months

DELIVERABLES/BENEFITS/ROI

Deliverables: Tangible output of this project will be:

- An ABS produced guidance document on GHG emissions in yards.
- A Paper/presentation at an NSRP event and/or other events.
- A Final report on project activities.
- A roll-out webinar training session for government & industry yards (tech transfer).

Benefits: Provide a better understanding of the GHG emissions produced by shipyards and the tools to best reduce emissions and accommodate rising standards.

1. Directly lead to a better understanding of GHG emissions and improvement options for the participating shipyard by:
   - Completing yard major GHG emissions review.
   - Development of a prioritized action plan addressing significant improvement opportunities.
2. Customized implementation guide for yards to conduct their own GHG emissions inventories and develop emission reduction plans by:
   - Implementing GHG emissions assessment in at least 5 other yards within 2 years.
3. Sharing lessons learned with the industry through genericized emission reduction opportunities and process implementation experience with the industry by:
   - Reporting on lessons learned throughout the study.
   - Presenting at NSRP or other industry events.

ROI: available on request to NSRP members – anticipate >10x ROI over 5 years

ISSUE / OBJECTIVE

Project Goals and Objectives: This project will produce customized guidance for shipyards to evaluate their GHG emissions and identify key next step opportunities for reducing GHG Emissions.

- Provide a guide to shipyards in the effort to reduce emissions across the industry:
  1. Using ABS emissions tools to evaluate current emissions and room for improvement.
  2. Identify successful practices and implement changes.
  3. Present best practices to the industry.

Business Objectives:

- To better understand GHG emissions and improvement opportunities for the participating shipyards to facilitate scope emission reductions
- Preparation for future regulations and remaining competitive to ship owners/operators

Technology Objectives:

- Customized implementation guide for yards to conduct their own GHG emissions inventories and develop emission reduction plans, encouraging other yards to implement assessments.
- Lessons learned sharing of genericized emission reduction opportunities and process implementation experience with the industry.

Cost Share: TBD

Pathways for Reducing Emissions of Government Fleet Operations

PROJECT INFORMATION

Prime/Lead: American Bureau of Shipping (ABS)

Team Members: NSRP and non-NSRP yards, OEM(s), design firm(s)

Government Participants: TBD

Academic Member: TBD

Duration: 9-12 Months

DELIVERABLES/BENEFITS/ROI

Deliverables:
- An ABS produced document identifying opportunities to achieve energy efficiency fleet operations objectives.
- A Paper/presentation at an NSRP event and/or other events.
- A Final report on project activities.
- A roll-out webinar training session for government & industry yards (tech transfer).

Benefits: Provide a better understanding of technology readiness projects and implementation and adoption strategies to achieve energy efficiency goals, maintain mission readiness, and inform future ship designs and construction programs.

1. Directly lead to a better understanding of energy efficiency options for the participating government participants by:
    - Completing industry best practices review
    - Development of a prioritized action plan addressing significant improvement opportunities.
2. Customized implementation guide for industry and government owners to reference in fleet lifecycle planning.
3. Sharing lessons learned with the industry through genericized pathways and strategies for achieving energy efficiency goals.

ROI: available on request to NSRP members

ISSUE / OBJECTIVE

The military services have focused on achieving energy efficient fleet operations. The initial goals target land-based operations and energy efficiency; however, pathways for efficient vessel operations (especially with non-combatants) will be a growing area of interest. This project will examine the most credible emission reduction pathways and timelines for government fleet vessels, especially around design and construction planning to achieve future emission goals.

Project Goals and Objectives: This project will produce implementation pathways and strategies for government agencies and industry to use for achieving energy efficient fleet operations.

- Provide a guide to government fleet owners and operators in the effort to reduce energy use and emissions across the industry:
    1. Using ABS energy measurement methods in collaboration with team member data, evaluate current energy consumption and areas for improvement.
    2. Identify successful practices and implementation options.
    3. Present practices to the industry.

Business Objectives:
- To better understand energy efficiency opportunities for fleet operators
- Understand potential energy cost savings through strategy implementations

Technology Objectives:
- Customized implementation guide identifying opportunities and strategies for developing energy efficiency improvement plans.
- Lessons learned sharing of genericized pathways and strategies for achieving energy efficiency goals with the industry.

Cost Share: TBD

Workforce Training on Ship Inspection/Survey Using MetaShips

PROJECT INFORMATION

Prime/Lead: American Bureau of Shipping (ABS)

Team Members: NSRP and non-NSRP yards, OEM(s), design firm(s)

Government Participants: TBD

Academic Member: TBD

Duration: 12 Months

DELIVERABLES/BENEFITS/ROI

Deliverables:

- Virtual application and tool for government fleet vessels for defect identification training.
- A Paper/presentation at an NSRP event and/or other events.
- A Final report on project activities.
- A roll-out webinar training session for government & industry yards (tech transfer).

Benefits: Provide a professional development virtual training tool and platform for defect and discrepancy identification for government fleet vessels.

1. Directly lead to increased exposure to maintenance standards and material readiness inspection processes for government fleet maintainers and new construction overseers by:
    - Building a virtual environment in accordance with ships construction and maintenance inspection procedures and requirements.
2. Shipyards can use tool for in-service ships or even ships under construction to (1) measure effectiveness in finding important defect conditions and (2) improve performance in identifying and resolving defects.
3. Training that can lead to more defect identification and resolution exposure to inform fleet maintenance planning

ROI: available on request to NSRP members

ISSUE / OBJECTIVE

Government fleet vessels require meticulous maintenance identification to maintain rigorous mission readiness levels. Maintenance and sustainment training is largely conducted on-the-job. ABS has developed metaships for a number of commercial vessel types and embedded "game-like simulations" at multiple levels of difficulty for inspectors/surveyors to identify defect conditions.

Project Goals and Objectives: This project would leverage this existing "metaship" technology to build similar applications for government fleet vessels types, covering a wide range of common systems and associated defect conditions. The simulations include physical examinations of ship equipment, records/data reviews, and interviews with virtual crew members to identify, diagnose, and initiate action on defects.

Business Objectives:

- Supports workforce development (new hire and continuous learning) and organizational training objectives
- Supports continuous cost-effective organizational quality improvement objectives

Technology Objectives:

- Customized metaship technology training tool available on demand

Cost Share: TBD

Shipyard Safety Culture Assessment & Improvement Playbook

PROJECT INFORMATION

Prime/Lead: American Bureau of Shipping (ABS)

Team Members: NSRP and non-NSRP yards

Government Participants: public yards

Academic Member: TBD

Duration: 12 Months

DELIVERABLES/BENEFITS/ROI

Deliverables:
- An ABS produced guide for shipyard safety performance.
- A Paper/presentation at an NSRP event and/or other events.
- A Final report on project activities.
- A roll-out webinar training session for government & industry yards (tech transfer).

Benefits: Directly lead to increased safety culture and performance by:
1. Identifying best industry practices and tools for implementing safety culture
2. Sharing lessons learned with the industry through genericized pathways and strategies for achieving high safety performance.

ROI: available on request to NSRP members

ISSUE / OBJECTIVE

Shipyard safety remains a high priority for industry and government. Shipyard safety is strongly influenced by the underlying Safety Culture in the yard (and within the overall organization).

Project Goals and Objectives: This project would develop a recommended set of tools and guidance for assessing/monitoring and improving safety culture in a yard.

- Provide a guide to private and public yards:
    1. Present practices to the industry.
    2. Identify successful practices and implementation options.
    3. Identify successful continuous assessment and measurement metrics.

Business Objectives:
- Improved safety performance in construction and sustainment of government fleet vessels

Technology Objectives:
- Identify and install/implement safety technologies

Cost Share: TBD