Program Update

Business Technologies Panel Project Idea Presentation Meeting

July 30th, 2020

Virtual

Agenda

Time	Presentation	Speaker
10:00	**Convene Meeting**	
10:00	Introductions and Panel Business	Virgel Smith, Ingalls Shipbuilding Patrick Roberts, SSI USA Jamie Breakfield, Ingalls Shipbuilding
10:10	NSRP Brief & Update	Nick Laney, ATI
10:20	Panel Project Idea Quad Presentations	
11:55	Additional Idea Discussion	
~12:30	**Adjourn**	

NSRP Mission

The mission of the National Shipbuilding Research Program is to reduce the total ownership cost and improve the capabilities of both United States Government and U. S.-flag commercial ships.

The Program accomplishes this mission by providing a collaborative framework to manage, focus, develop and share research & development, and leverage best practices in shipbuilding and ship repair.

NSRP Collaboration

Anti-Trust Rules

- Regarding your company's and/or your competitor's **product & services**:
  - Do not discuss current or future prices.
  - Do not discuss any increase or decrease in price.
  - Do not discuss pricing procedures.
  - Do not discuss standardizing or stabilizing prices.
  - Do not discuss controlling sales or allocating markets for any product.
  - Do not discuss future design or marketing strategies.

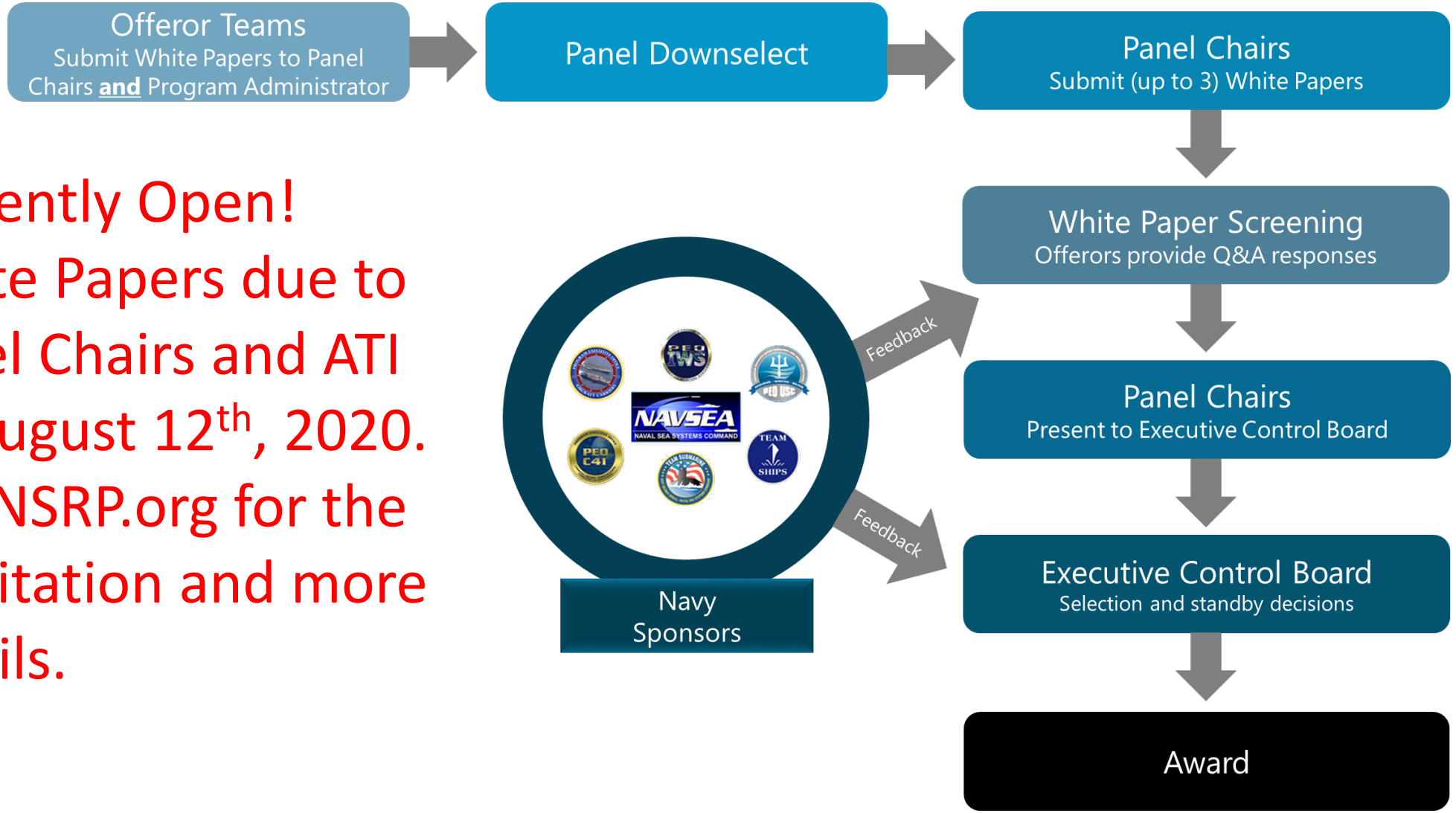
Anti-Trust Rules

- Regarding your company's and/or your competitors' selection of their **supplier companies**:
  - Do not discuss refusing to deal with a company because of its pricing or distribution practices.
  - Do not discuss strategies or plans to award business to remove business from a specific company.

- Regarding your company's and/or competitors' **trade secrets**:
  - Do not discuss trade secrets or confidential information of your company or any other participant.

Panel Project Proposal Process

Currently Open!
White Papers due to Panel Chairs and ATI by August 12th, 2020.
See NSRP.org for the solicitation and more details.



Panel Project Requirements

- Official requirements can be found in the Panel Project Solicitation and the Panel Project Guide Vol 1 located at https://www.nsrp.org/resource-library/:
- Deadline for Offerors to submit white papers to Panel Chairs ***and*** ATI is 12:00 p.m. (noon) ET on **August 12, 2020**.
- Deadline for Panel Chairs to submit top three white papers and any joint panel papers to ATI is 12:00 p.m. (noon) ET on **September 9, 2020.** Panel Chairs shall submit white paper(s), using the White Paper Submission Module.
- Deadline for Offerors whose white paper is one of the panel's top three to submit to ATI the Supporting Cost Data Table, required by the Panel Project Guide Vol 1 – Offerors Rev. T, is **September 9, 2020**.
- **NOTE: White paper submitters are reminded that each Panel Chair will have interim due dates to accommodate their panel's down-select process prior to submission to ATI. Please regularly check the NSRP website for those dates.**
- *Any questions can be directed to Ryan Schneider (ryan.schneider@ati.org) or Sarah H. Swain (sarah.swain@ati.org).*

Panel Project Requirements

- NSRP Executive Control Board member shipyards and panel members (as defined by individual panel membership by-laws) may submit white papers.
- No more than $150K in program-funded costs (Note: Fee or profit is not allowed)
- No more than 12 months in duration
- At least one member shipyard should be a project participant – ***multiple shipyard participation is strongly encouraged.*** An endorsement email for each participating member shipyard, specifically, an email from that yard's NSRP Shipyard Delegate (NSD) must be attached. These endorsement pages do not count toward the three page limit.
- If a Government organization will participate in the project, provide the name and contact information for the government point of contact who agreed to participate. If there is any issue with obtaining this information, offerors should contact the NAVSEA NSRP Program Engineer, Mr. Howard Franklin, at howard.l.franklin@navy.mil or (202) 781-2171 for early coordination.

Panel Project Requirements

- Offerors shall submit white papers directly to the appropriate Panel Chair and ATI (nsrp@ati.org).
- Any proposed prime contractor shall ensure all subcontractors will agree to the terms and conditions of NSRP's standard Base Task Order Agreement prior to submission of a white paper.

Panel Universal By-laws

- At minimum, panel voting membership will include all of the member shipyards.
- Each organization gets only ONE vote. If an organization has a qualified voting member in a NSRP leadership position (Panel Chair, Panel Vice Chair, or Major Initiative Team Leader) the organization will have an additional vote (not to exceed two votes).
- Except for member shipyards, organizations must meet panel membership requirements, as defined in the individual panel by-laws, to propose a panel project or vote in panel voting activities.

BT Whitepaper Schedule

- 06/11/2020 – Panel Project Solicitation Announced
- 07/30/2020 – Panel Membership Present White Paper Ideas
- ***08/12/2020 – White Papers Due to Panel Chair***
- 08/24/2020 – White Paper Voting Begins (Dependent on Panel Chair review)
- 09/02/2020 – White Paper Voting Ends
- ***09/09/2020 – White Paper Submit to ATI***

Digital Twin Maturity Model Framework (Next Generation Capabilities)

DRAFT 07-14-2020 by MDD

Digital Twin definition: A digital twin is a virtual, computer-based representation of an asset or of a process. It is used to analyze and specify requirements, optimize the asset, understand its behavior, manage the asset's configuration, interface with the physical design and forecast future performance. The digital twin can exist in all phases of the digital thread – Design, Build, or Sustain.

Issue

The Defense Industry lacks consistent documentation for "Digital Twins" categorization (macro to micro level), usage, maturity level, and value/benefit as well as for their development and maintenance and configuration management costs.

Proposed Solution

Develop a framework which addresses types, uses, and costs for defining Digital Twin implementation strategies.

This project would concentrate on the:

- Development a Defense/Shipbuilding Industry reference document for the use of Digital Twins. This would also serve to create a single ontology around digital twin terms and their usage.
- Provide a framework to evaluate the Digital Twin maturity levels necessary to meet specified use-cases, capabilities, and requirements for Design and Operational DT's.
- Develop a ROI evaluation tool based on Digital Twin capabilities, complexity, and maturity levels.

Benefits/Justification

- The Digital Twin is a bridge between the digital world and the physical world. Its core use is to optimize business performance, through the analysis of data and the monitoring of systems to prevent issues before they occur and prevent downtime.
- This project will provide relevant information and documentation necessary to categorize, evaluate benefits, and the most effective use of Digital Twins.
- Provide the Shipbuilding Industry standardized definitions for Digital Twins.
- Provide a strategy for the planning and development of Digital Twins and their usage across the Design /Build /Sustain spectrum.
- Provide insight on the software, data, and system integration necessary to develop and support a Digital Twin.
- This project addresses the direction laid out in the NSRP 2020 Strategic Investment Plan & Technology Investment Plan.

Major Deliverables

1. Functional categorization documentation of Digital Twins.
2. Framework for Digital Twin Readiness to consider:
    - 3D Geometric Model
    - Digital Data
    - Sensor requirements
    - Technical Experience
    - Configuration Management – Governance
    - Fidelity/Performance of Functional Models
    - Hardware/Software, Security – Environment integration
    - Physical Asset
3. Framework for Digital Twin cross reference between capability, maturity level and benefit.
4. Final report for the use and evaluation of Digital Twins.

Schedule / Cost & Savings

- Investment = $150K
- Return: 10,000 man-hours on new design
- Return on Investment (ROI) = 8.0
- Project Schedule = 12 months
- Team members: TBD US Shipyards, Consultants, NIST, Navy

Model Based Requirements Management (Next Generation Capabilities)

DRAFT 07-14-2020 by MDD

Issue

Requirements and Target management is an essential part of successful systems engineering. Requirements define what must be accomplished in both functionality and performance and they lay the foundation for design and verification of the requirements.

With Digital Transformation well under way for Design/Build/Sustain processes, how do we manage end-to-end requirements for a ship as well as a ship class? How do we assure users that this information is accurate, up to date, and readily available throughout the ship's life?

Proposed Solution

This project would form a collaborative team of Shipbuilders, Government, and Industry to develop a framework which defines Requirements and Target Management processes for a ships lifecycle.

- Develop a future state “use-cases and capabilities” document for digital requirements management. (Requirement categories & product verification use with digital traceability)
- Evaluate selected COTS software applications which will integrate with PLM/CAD/ERP environments to provide a digital thread traceability capabilities for requirements management..

Benefits/Justification

- Delivers future state for requirements management use-case and capabilities document, along with an end-to-end data architecture map, will provide shipbuilders a framework for application and process digital transformation planning.
- Reduce risk using interdependent analysis capabilities that consider the technical, build, operational and economic requirements of the system.
- Identifies high impact requirement categories that previously had been to difficult to provide direct traceability, (Inspection, Build)
- This project will provide relevant maturity level evaluation results for COTS digital requirements managements applications.
- Future state will significantly improve access to, and quality of data for both direct and derived requirements management.
- This project addresses the direction laid out in the NSRP 2020 Strategic Investment Plan & Technology Investment Plan.

Major Deliverables

- Documentation for future state requirements management use-case and capabilities.
- Architecture diagram depicting requirements integration (systems & data) across ship Design/Build/Sustain phases.
- Document containing COTS software application evaluation results and application maturity levels.
- Strategic whitepaper on requirements management current state, next steps to support digital transformation, and implementation recommendations.

Schedule / Cost & Savings

- Investment = $150,000
- Return: Digital traceability to requirements, validation & verification
- Return on Investment (ROI): TBD Core for Digital Transformation
  - Future State efficiency
- Project Schedule = 12 months
- Team members: TBD US Shipyards, Software vendors, Consultants

Implementing SMART Technology for Digital Twin Development in New Construction Programs

Project Lead Organization: American Bureau of Shipping (ABS)
Project Team members: Partners Yards, NSWC Carderock (Digital Twin Team), NSWC Philadelphia, NAVSEA 05D, USCG SFLC

Concept/Idea

Issue: The Navy and other Government vessel owner/operators are rapidly adopting Digital Twin technology for ships, especially for structural and machinery health monitoring over the life of their assets. However, building models and retrofitting existing ships for this purpose can be prohibitively expensive. The industry recognizes the optimal time to implement SMART technology for Digital Twin functionality is during design and construction, but Government agencies and shipyards do not have standard methods and tools for such implementations.

Proposed Solution(s): Engage stakeholders in developing guidance and example implementation specifications that can be used across the shipbuilding community to specify and deliver ships with effective Digital Twin technology for structural and machinery health monitoring (and other performance monitoring).

Benefits/Justification

Benefits of the project

- Standardized framework and scope (not specification of individual technical methods and tools) agreed upon by the industry that the Government can include (by incorporation or by reference) into requirements for newbuild projects
- Stakeholder consensus on a framework that ABS can develop into an open source Guide/Standard for the industry
- Acceleration in the use of Digital Twin technology for Government ships

Project Approach

High level statement of work

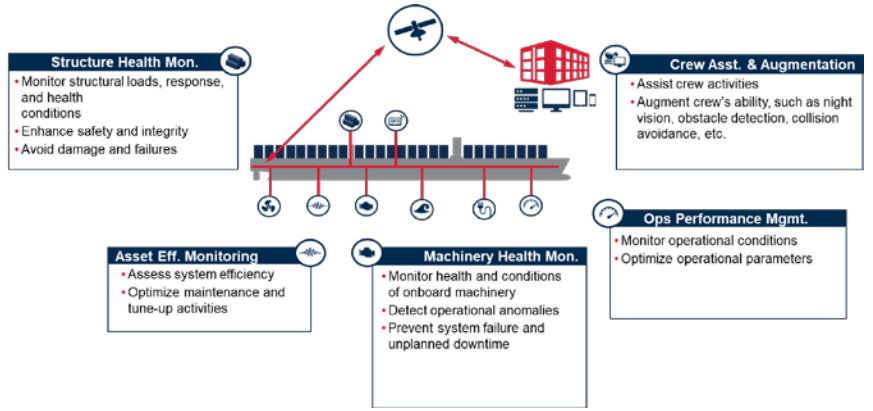
- Joint Workshops on SMART/Digital Twin Technology Implementation in Design and Construction Programs
- Standardized Framework and Scope for Government Use (suitable for follow-on development of ABS Guides/Standards that can be referenced in new build program specifications)

Metric(s) of Success

- Incorporation or Reference of the Standardized Framework (or resulting ABS Guides/Standards) in Government newbuild specifications

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000



Utilizing Ship Product Model Information for Corrosion Control and Coatings

Project Lead Organization: Ingalls Shipbuilding
Project Team members: TBD

Concept/Idea

Issue: Ship product models typically do not include information on corrosion control and specific coatings. The data that is pulled from the model for corrosion control and coating applications is duplicated and modified in other programs and excel

Proposed Solution(s): Develop processes to reduce the amount of manual input and handling of ship product model data for corrosion control and coatings applications

Benefits/Justification

Benefits of the project

- Improved quality of coverage area assessments for coatings applications
- Reduced rework due to incorrect and missed corrosion control applications

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Project Approach

High level statement of work

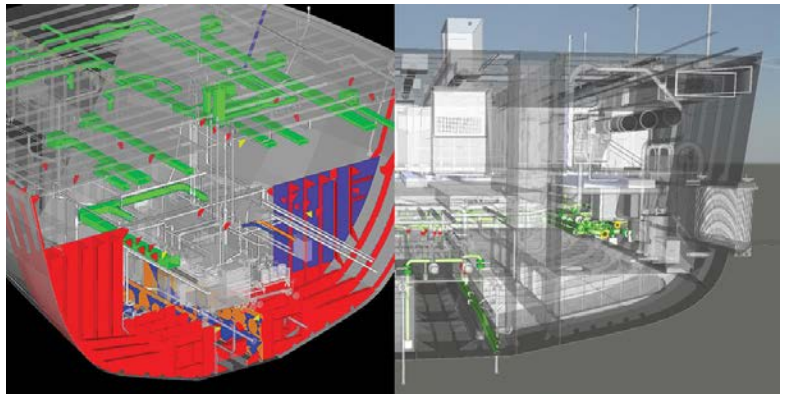
- Define the process that utilize ship product model data for corrosion control and coatings
- Develop modifications required to reduce the amount of manual input and handling of model data for each process
- Develop a plan to implement modified corrosion control and coatings processes

Metric(s) of Success

- Demo of process which achieves the benefits described

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000



State of Digital Drawing Delivery

Project Lead Organization: SSI USA
Project Team members: Design Automation Associates, Inc.

Concept/Idea

Issue: With the digital transformation of shipbuilding the next natural evolution is providing "digital drawing" engineering information to production. However there are many possible solutions and no good guide or reference for pros/cons of various approaches.

Proposed Solution(s): Provide a report+website to document the current state of hardware solutions and software solutions (data formats) for possible implementation and pros/cons of each.

Benefits/Justification

Benefits of the project

- Comprehensive, objective reporting on the current state of technology to support "digital drawing" delivery to communicate engineering data
- Reference website with supporting information and citations for further study
- Website/document able to be updated as technology progresses.

Project Approach

High level statement of work

- Identify business process and data requirements
- Identify available technologies and maturity levels
- Identify working implementations and feasibility/results

Metric(s) of Success

- Identification of current state-of-the-art for hardware/software options
- Website created and living document created with pros/cons/results

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

In this space, include pictures, other relevant information, if applicable

Design - Build for Test

Project Lead Organization: SSI USA
Project Team members:

Concept/Idea

Issue: Eliminate the current research effort by those outside of engineering regarding distributive systems test criteria.

Proposed Solution(s): Provide distributive system testing particulars within the 3D detail design model associated to each specific system allowing engineering's testing requirements readily available to others

Benefits/Justification

Benefits of the project

- Allows distributive system testing information from the engineers to be centrally located within the 3D detail design model for ease of access and accuracy by other departments such as Test, QA, Planning
- Supports the reuse of the engineering digital data, in this case information supporting distributive system testing, to those that require it; thereby eliminating the time for independent research which could be in error and the rework associated with retesting in accordance with the previously approved requirements.

Project Approach

High level statement of work

- Ensure field exist within the 3D detail design model to contain distributive system testing requirements
- Develop a workflow to enter test requirements into the model
- Develop a workflow for others to access said test information

Metric(s) of Success

- Successful test of test requirement data management "in" and "out" of the 3D detail design model.

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

In this space, include pictures, other relevant information, if applicable

Delivering CyberReady Ships in Alignment with Navy RMF Requirements

Project Lead Organization: ABS
Project Team Members: Participating Shipyards, MSC, NAVSEA 05Q, PEO Ships, PMS 385, PMS 325

Concept/Idea

Issue: The Navy's Technical Authority (TA) for cybersecurity (NAVSEA 05Q) recognizes multiple combinations of methods/tools for demonstrating RMF compliance; however, the burden of implementation and gaining Navy TA approval can be quite large and varies among approaches. The ABS CyberSafety process is one of the acceptable approaches, and it is proving to be an efficient and cost-effective approach for addressing cybersecurity on certain Government vessels (primarily auxiliary shipbuilding programs) to RMF requirements.

Proposed Solution(s): The publication *ABS CyberSafety Guide for Government Vessels* is a process for addressing cybersecurity and documenting compliance with Navy RMF requirements with cost-effective, time-efficient deliverables and an ABS **CyberReady** certification. The **CyberReady** certification focuses on the inherent cybersecurity of the ship systems and equipment.

Benefits/Justification

Benefits of the project

- Increased Government and industry awareness and use of the ABS **CyberReady** certification option as a best-in-class value approach for demonstrating cybersecurity and documenting compliance with Navy RMF requirements for Navy auxiliary shipbuilding programs
- Framework for third-party cybersecurity certifications at the system (**CS-System**) and component/product design level (**CS-PDA**) that shipyards can require of suppliers to streamline shipyard cybersecurity demonstration activities
- Decreased workload on shipyards in demonstrating RMF compliance using an industry standard approach rather than custom approaches
- Ability for Government to specify and for industry to deliver ships with clear requirements for a third-party **CyberReady** certification, which can be included as a Notation with ABS Class certificates (if desired) and can be expanded with the Government owner/operator for full operational cybersecurity certification by ABS using the ABS **CS-G** Notation/Certification

Project Approach

High level statement of work

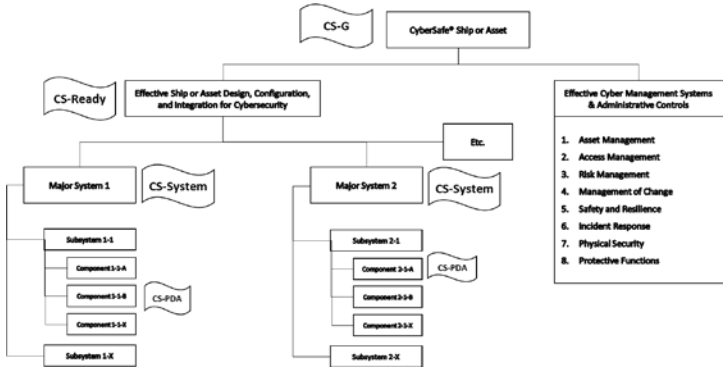
- Side-by-side comparative analysis of the ABS CyberSafety process for achieving **CyberReady** certification with approaches that shipyards have recently used (or are considering) for auxiliary shipbuilding programs
- Documentation of strength, weaknesses, required timeline, implementation cost, and ultimately Navy acceptance of current approaches with comparison to the ABS **CyberReady** requirements
- Documentation of industry-wide benefits and costs of consensus use of the *ABS CyberSafety Guide for Government Vessels* and its Cyber Ready certification

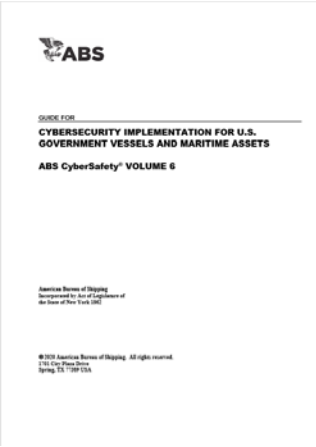
Metric(s) of Success

- Savings (time and cost) from use of the ABS CyberSafety process for Government Vessels compared to custom approaches currently being implemented for auxiliary shipbuilding programs

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000




ABS

GUIDE FOR

CYBERSECURITY IMPLEMENTATION FOR U.S. GOVERNMENT VESSELS AND MARITIME ASSETS

ABS CyberSafety® VOLUME 6

Platform Cybersecurity Suitability

Project Lead Organization: HII-Ingalls Shipbuilding
Project Team members: HII, TSD, Sperry/LM

Concept/Idea

Issue: The complexity of determining the Cybersecurity status of an operational system is more challenging as threats emerge.

Proposed Solution(s): Improve the deployed Cybersecurity personnel's Situational Awareness to mitigate against the potential schedule and mission impact of Cyber incidents. Create a virtual environment where the research effort can determine critical system Cybersecurity functions. Once the functions are identified further research into a viable methodology for users to make effective evaluations of the platforms Cybersecurity status. The General Hosts (GHOSTS) framework would be used in conjunction with a test platform, e.g. LHA Machinery Control system (MCS) to generate accidental and purposeful operator actions triggering Cyber effects. Using the known Cyber effects and the user interface data on the targeted system, an evaluation of HMI available data will be gathered and summarized.

Benefits/Justification

Benefits of the project

- Improved Cyber incident recognition
- Accelerated incident resolution timeline
- Minimize Cyber Incident's impact to the platform
- Improve on False Positive Incident identification

Project Approach

High level statement of work

- System Virtualization
- Integration on Virtual Platform
- Scenario Generation
- Test
- Demonstration

Metric(s) of Success

- Delivery of System
- Operational Capability of Virtual Systems
- Anticipated effectiveness of scenarios created
- Actual effectiveness of scenarios tested
- Demonstration approval

Cost/Images/Relevant Information

- **Project Estimated Cost:** $ 150K
  - Development of a virtual system architecture
  - Configuration and integration of General Hosts (GHOSTS) Framework in the virtual environment
  - Scenario development and test
  - Demonstration

Modern Shipbuilding Design Course 3

Project Lead Organization: SSI USA
Project Team members: Fincantieri Marinette Marine, Conrad

Concept/Idea

Issue: There aren't any marine-specific training opportunities that address marine design in general. There was a previous NSRP project to create this coursework but it's over 10 years old.

Proposed Solution(s): Update and document the Marine Design Course NSRP project results to use new software with latest updates and capabilities and document the results for anyone to deploy. Coordinate with learning centers to identify requirements to be able to offer the courses on site and determine what's involved to migrate the coursework to an Online Training Center.

Benefits/Justification

Benefits of the project

- Shipbuilding-specific designer course available
- On-line version of course
- All course material available on website (for teaching)
- Off-load costs to designers (less OJT required)

Project Approach

High level statement of work

- Update prior NSRP Modern Shipbuilding Design coursework
- Produce website with updated material
- Engage local training facilities
- Produce online training

Metric(s) of Success

- New material produced and published
- Website running w/ material
- Online training and/or local training being offered

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

In this space, include pictures, other relevant information, if applicable

Automated Detail Planning and Instant Earned Value Control

Project Lead Organization: SSI USA
Project Team members: Austal USA

Concept/Idea

Issue: Project planning tools are broadly applied to production and lack a high level of integrated granularity. Multiple department-focused legacy systems attempt to track various levels of planning but lack integrated mechanisms for other shipyard systems.

Proposed Solution(s): Provide integration between the 3D production design model with the Floorganise *Floor2Plan* detailed production shop floor planning tool. Track and assess production planning gains and predictability of operations.

Benefits/Justification

Benefits of the project

- Automation of data integration with 3D production design model and detailed production planning tool
- Increase in production performance through more predictable behavior
- Multiple efficiency gains across production from much more detailed and granular planning and EVMS results tracking

Project Approach

High level statement of work

- Identify business process and data requirements
- Provide data exchange mechanism with 3D model
- Automated detailed planning for a block of construction
- Track and report

Metric(s) of Success

- Installation of COTS software solution from Floorganise
- Data exchange between ShipConstructor and *Floor2Plan*
- Positive results of automated detail planning vs. baseline

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

In this space, include pictures, other relevant information, if applicable

Digital Scan Management

Project Lead Organization: SSI USA
Project Team members:

Concept/Idea

Issue: 3D Scanned data files, how to organize the numerous files of various file types and file naming conventions.

Proposed Solution(s): Determine shipyard requirements for easy saving, naming, sorting 3D scanned files for hull, scan date, vessel area, scan resolution, to name a few. Develop a matrix of the requirements ranking them through surveys. Develop a list of off the self products and staking them with cost information against the requirements.

Benefits/Justification

Benefits of the project

- Research shipyard issues with storing 3D scanned files and develop a requirements matrix to search for off the shelf products
- Provide a list of COTS software products with cost ranked against the requirements
- Faster and easier recall of past data – being able to logically search data with multiple parameters
- Digital Data reuse – save time and money of additional scans because one cannot locate and existing scan file

Project Approach

High level statement of work

- Engage shipyard engineers, and designers
- Develop requirements through surveys
- Research COTS software products
- Rank products based on cost and requirements
- Test (if feasible) the top ranked products

Metric(s) of Success

- Products vs Requirements matrix provided to industry
- Demo / Test top ranked COTS software products with results provided to industry

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

In this space, include pictures, other relevant information, if applicable

Automated Label Plate Generation

Project Lead Organization: SSI USA
Project Team members:

Concept/Idea

Issue: Reduce the rework and cost associated with label plates due to label plates scheduled at the end of the project where many design changes are often overlooked.

Proposed Solution(s): Develop an automated workflow where label plate information is kept in the 3D detail design model with other systems using the same data which is kept current as the model us updated with changes.

Benefits/Justification

Benefits of the project

- Having label plate data contained within the 3D model where engineering can keep the data updated as the detail design evolves allows for efficient label plate configuration management
- Effective label plate configuration management will drastically reduce incorrect label plates being procured and / or installed; thereby eliminating rework and expediting replacements
- Will provide a central label plate repository supporting the needs of planning, scheduling, purchasing, QA, production, estimating, change control management, and engineering

Project Approach

High level statement of work

- Develop a field for label plate information within the 3D detail design model
- Develop a workflow to enter and to access label plate data
- Develop workflow tracking label plate changes and placing label plates "on-hold"

Metric(s) of Success

- Label plate data is efficiently entered and accessed from the 3D detail design model
- Label plate workflow is generic for any shipyard to incorporate into their workflow

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

In this space, include pictures, other relevant information, if applicable

Optimized Weld Records

Project Lead Organization: TruQC
Project Team Members: EWI, Vigor

Concept/Idea

Problem:

- Welding processes require input from multiple individuals, documents and specifications, making proper management a challenge
- Quality Assurance (QA) procedures can be expensive, inefficient, and difficult to administer

Proposed Solution:

- TruQC, a commercial off the shelf (COTS) software, will be configured to manage welding requirements and records
- TruQC will be a single access point to the data needed to complete and document welds for engineers, inspectors, supervisors and welders

Benefits/Justification

- More access to welding requirements and records will improve efficiency of planning, process improvement, and troubleshooting
- Expedite decision-making, reducing analysis costs and associated downtime
- Automated document organization for easier audits
- Consolidates data for re-work tracking with weld specific information
- Minimize or eliminate delays associated with adjudication of out of spec items
- Reduce inspection costs
- Eliminate costs incurred to re-create history of assessments
- Increase transparency of inspection to the welding process

Project Approach

High Level Statement of Work:

- TruQC will develop a weld requirement and record specific solution that connects resources and documents
- TruQC will work with EWI and Vigor to test and introduce the solution to shipyard personnel

Metrics of Success:

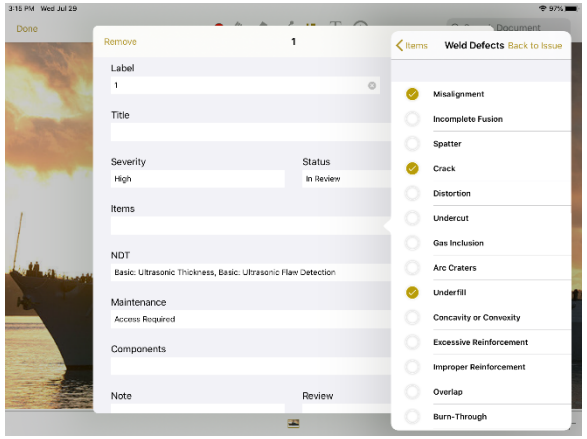
- TruQC solution for creating weld requirement documents, collecting weld record data and limited deployment to shipyard personnel for buy-in development
- Compare digitalized weld lifecycle process using TruQC to the traditional paper method previously used

Cost/Images/Relevant Information

Project Estimated Cost:

$150,000

- TruQC will work with partner shipyards to create and administer a survey to shipyard personnel to examine current weld requirements, record management and NDT requirements with plans to grow this into an RA project



Artificial Intelligence (AI) Developed CAD Models (Next Generation Capabilities)

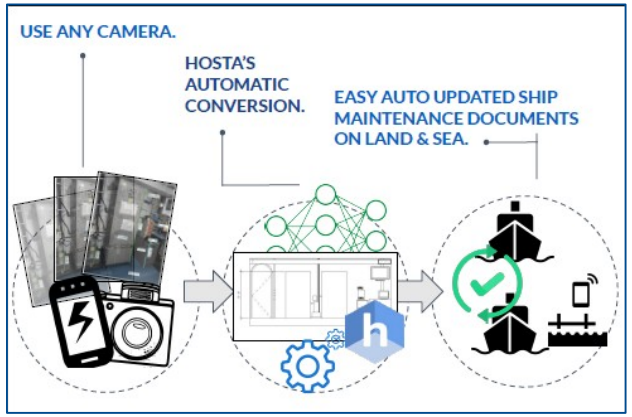
DRAFT 07-20-2020 by MDD

Issue

There is no automated process for creating CAD models from mobile device laser scan files.

Proposed Solution:

Evaluate software developed by Hosta Labs' A.I. which converts images of interior spaces/compartments into data and data into models, plans, and insights. It does this by assigning each pixel of an image to an object and adding properties to that object to enable contextual understanding *(i.e. a window belongs to a wall that has a 6 inch partition and a 2hr fire rating)*.



Benefits/Justification

Hosta Labs enables a significant efficiency increase in ship maintenance by:

- Automated CAD model generation from a simple image without any expert intervention
- Device-agnostic
- Full-digitization of ship maintenance data to allow for predictive maintenance & VR-supported maintenance enabling remote tracking of changes made on water with just a simple image (a ship maintenance officer can be equipped with a small device and track all changes onsite),
- Automatically creating product models from simple images or 2D drawings (no need to fly-in onshore teams)
- Providing bill of material data with timestamps as well as models of spaces or potentially parts for predictive maintenance, VR-maintenance solutions, and 3D printing.

Sample output can be found here: modler.io/n/ship_sample.pdf

Consideration for a cross BT & SDMT panel project.

Major Deliverables

- Documentation for evaluation use-case and capabilities.
- Document containing COTS software application evaluation results and application maturity levels.
- Strategic whitepaper on laser scan to CAD utilizing AI technology current state, next steps to support digital transformation, and implementation recommendations.

Schedule / Cost & Savings

- Investment = $150,000
- Return: Automation of manual processes by using AI
- Return on Investment (ROI): TBD Core for Digital Transformation - Future State efficiency
- Project Schedule = 12 months
- Team members: Hosta Labs TBD: US Shipyards, Consultants

Using AI to Simplify Provisioning of Navy Standard Rqmts

Project Lead Organization: Auros, LLC

Project Team members: NAVSEA - TBD, Shipyards - TBD, Hepinstall Consulting Group

Concept/Idea

Issue: Navy Standards are available to shipyards in PDF, Word, and other "dumb" file formats, which include scanned in images. As a result, these "dumb" files require significant manual effort to parse and organize for provisioning and compliance tracking. In addition to the inefficiency of manually developing and updating check sheets, there is significant risk of human error to overlook or miss some standards.

Proposed Solution(s): Use Artificial Intelligence / Machine Learning to digitize the Navy Standard Rqmts by automatically parsing the standards files into logical individual rules and categorize each rule for provisioning into the shipyard workflow as required. This will avoid the need to manually develop check sheets and eliminate the risk of missing some standards due to human error. Through this approach, compliance can be captured through generated assessments.

Benefits/Justification

Benefits of the project

- Simplify Navy Standard Requirements compliance
- Automate provisioning and compliance tracking of Navy Standards through digitization
- Increased visibility and traceability
- Reduce risk of overlooking or missing some Navy Standards
- Reduce preparation time for new ship design cycle
- Provide foundation for Knowledge Operating System (KOS)

Project Approach

High level statement of work

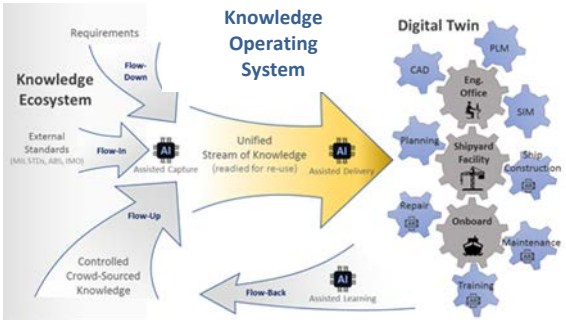
- Identify Use Case and relevant Navy Standard Rqmts
- Software Requirements to Integrate OCR capability with Document Ingestor
- Develop and integrate OCR capability to extract scanned in images through Document Ingestor
- Perform Pilot

Metric(s) of Success

- Reduced cycle time / labor to identify and apply Navy Standards
- Improved first time quality through compliance tracking and Mgmt overview
- Provide closed loop process to capture learnings from design process

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000



This project leverages capabilities developed in the ABS Compliance Simplification project and the AI / AR for Ship Repair project, extending the AI capability to address the unique features of Mil Stds, such as digitizing scanned images, to build on the foundation of a Knowledge Operating System.

Knowledge Provisioning to Simplify Preliminary Design

Project Lead Organization: Auros Knowledge Systems
Project Team members: Express Marine, Shipyards - TBD

Concept/Idea

Issue: A significant percentage of a ship's cost is locked-in during the concept and preliminary design phase, before the functional design of a vessel even starts. The ability to quickly develop compliant designs, incorporating lean design and DFP concepts, and perform rapid trade-off studies to obtain the least cost option, has the potential to make a big impact on ship cost.

Proposed Solution(s): This project will build on the successes of previous knowledge provisioning projects (with SSI and ABS) and the SSI/Express Marine Integration project, to seamlessly connect knowledge throughout the structural design phases from concept design through detail and production design. The key deliverables will be an ability to connect Express Marine to the Auros Knowledge Systems to complete the integration of knowledge provisioning into the structural design process as well as provide documentation of the future state process to promote widespread future implementation.

Benefits/Justification

Benefits of the project

- Knowledge is provisioned into seamlessly connected design tools
- Simplified ABS / Owner Requirements compliance
- Allows for rapid change by use of parametric / rule-based configurations
- Early application of lean design and DFP best practices
- Early application of shipyard's design guidelines and lessons learned
- Active approach to knowledge management and provisioning

Project Approach

High level statement of work

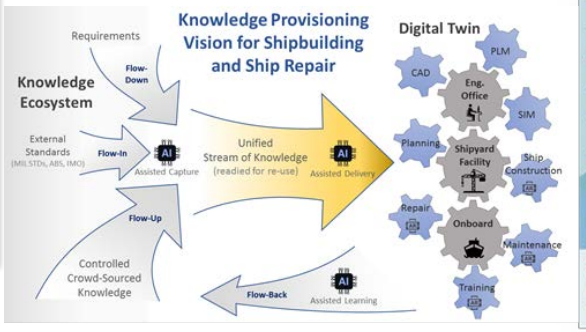
- Technology Transfer / Software Integration Requirements
- Develop Connector between Auros and Express Marine
- Structural Design Pilot Project
- Future State Process from Concept Design through Design/Production Design

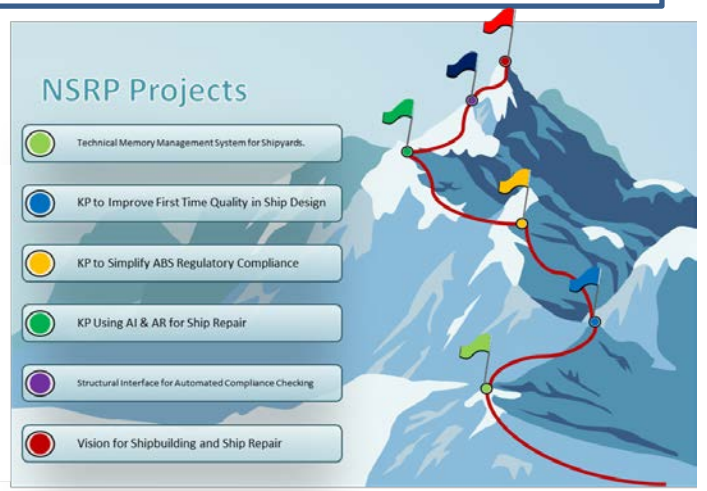
Metric(s) of Success

- Reduced cycle time / man-hours for structural design
- Improved first time quality of concept / preliminary design
- Reduced checking time

Cost/Images/Relevant Information

- **Project Estimated Cost:**
  $150,000





Equipment Validation Through Scanning

Project Lead Organization: SSI USA
Project Team members: Austal USA

Concept/Idea

Issue: Received equipment that does not match form/fit expected by engineering is disruptive and costly to deal with.

Proposed Solution(s): Provide an inexpensive and intuitive 3D scanner to receiving personnel to scan equipment as it is delivered and compare the scan to the expected 3D model provided by engineering. Mismatches can be identified directly on the handheld scanner and flagged for action before it gets warehoused or delivered to production.

Benefits/Justification

Benefits of the project

- Identify mismatched equipment items (for form/fit) before being fully received and warehoused (or delivered to production)
- Lower cost due to disruptions of engineering personnel to very component suitability.
- Lower cost due to improper components delivered all the way through production

Project Approach

High level statement of work

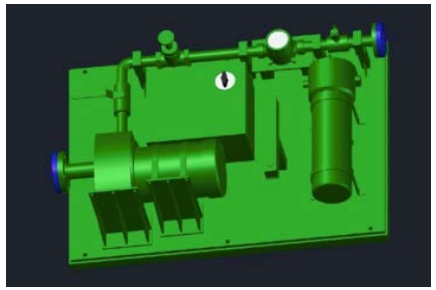
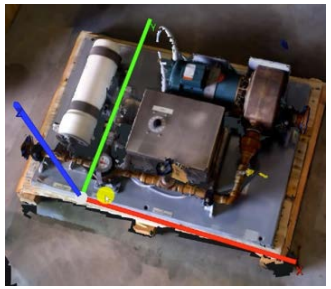
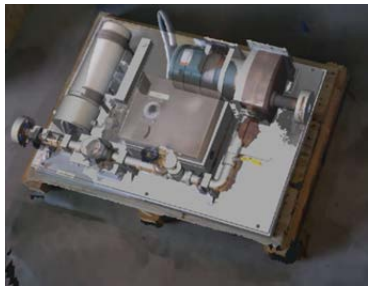
- Identify receiving processes and candidate equipment
- Provide and train 3D scanning hardware and processes
- Provide data exchange process from 3D models to scanner
- Scan, test, report

Metric(s) of Success

- Receiving personnel trained in use of 3D scanner
- Successful test of scanning candidate items and matching to 3D model
- Implementation processes

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000

Data Fusion for Performance Prediction of AM Parts

Project Lead Organization: ATA Engineering
Project Team members: HII-Ingalls Shipbuilding, Sandia National Laboratories

Concept/Idea

Issue: Widespread implementation of AM faces several major data challenges

- No satisfactory way to connect AM parameters, process, and performance, making print parameter selection a costly trial-and-error process
- No clear application for the terabytes of data that can come from a single print, making it a challenge to define a minimum AM data package for Digital Thread
- No clear way to visualize or organize data to gain design insights

Proposed Solution(s): A prototype machine learning (ML) framework capable of fusing AM data from a variety of sources (simulation, print monitoring, inspection, testing) to train an ML surrogate model able to efficiently predict part stress/strain response and visualize parameters-to-performance mappings

Benefits/Justification

Benefits of the project

- Once trained, an ML surrogate model can perform thousands of predictions of part performance in minutes to rapidly explore the parameter selection space and eliminate a trial-and-error approach to print parameter selection
- Visualization and data mining tools can identify key performance drivers
- This approach is adaptable to a variety of AM processes and materials
- ATA will seek to adapt simulation methods developed in our current NSRP panel project to a wire-fed arc DED AM process and partner with Sandia to generate experimental data aligned with work being done on the robotic AM RA project.
- ATA will again seek feedback from NAVSEA 05 to align on methods developed
- Prototype tools can be delivered to government and shipyard partners at no cost

Project Approach

High level statement of work

- Generate simulation, in-situ monitoring, ex-situ inspection, and test data
- Compress and fuse data into a single stream to train a predictor neural network
- Validate performance predictions with new part builds and testing

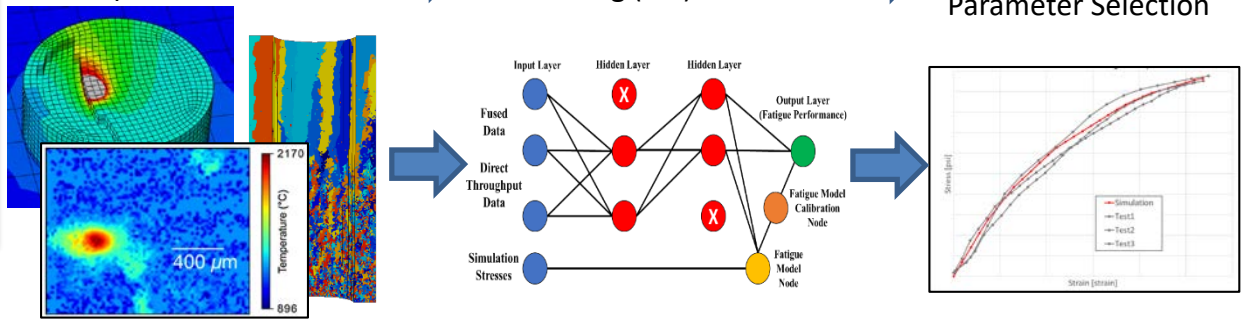
Metric(s) of Success

- Number and types of data streams fused
- Workflow computational cost
- Accuracy of model predictions for part strength
- Intuitiveness of visual mappings between parameters and performance

Cost/Images/Relevant Information

- **Project Estimated Cost: $150,000**

Part Simulation and Experimental Data → Training of a Machine Learning (ML) Model → Low-Cost Performance Predictions Based on Parameter Selection



Title: Digital Tracking and Analysis of Human Shipbuilding Activities

Project Lead Organization: ESAB (Christopher Hsu) (chris.hsu@esab.com, 301-503-3148)
Project Team members: University of Kentucky, Austal USA (TBD) and Bath Iron Works (TBD)

Concept/Idea

Issue: Each US shipyard employs thousands of workers to build ships. There are various types of production processes done by skilled trades, e.g. welder, pipefitter, electrician, carpenter etc. Each worker may spend a small fraction of shift time on trade activity – e.g. 5% arc-on time, and non-trade activities dominate OEE. Management lacks data collection to track activities outside the assigned trade (95%) for value stream mapping, quantify and eliminate wastes and improve overall productivity.

Proposed Solution(s): Similar Fitbit and Apple Watch, operators wear smart gloves PPE with motion sensors to track activities that can be logged into database together with IOT equipped machine tool data for analysis. The objective is to use machine learning on the glove motion to classify operator activities, ultimately a new data-driven modality to systematically eliminate waste in shipbuilding production as driver for continuous and sustainable improvement.

Benefits/Justification

Benefits of the project

- Analyze worker's time distribution for optimization in causes of delays, workflow stagnation and bottleneck, and improve the work efficiency
- Analyze if the worker has followed the procedure (e.g. weld sequence and weld speed) and alert for possible issues at early stage
- Monitor and analyze welder's productivity above and beyond "arc on time" or machine utilization, e.g. pre-weld activities and post-weld activities
- Provide the data for automatically monitoring the progress of shipbuilding in the next phase of the project that integrate data from all workers.

Project Approach

High level statement of work

- Build prototype or use COTS VR glove for worker to wear during operation
- Process the data to detect the type of the production activities, initially linear welding, pipe welding, cutting, material handling and idle time; its time periods and locations and compare with arc-on data from welding/cutting equipment
- Store the data and provide the analysis and statistics of daily operation for management to review

Metric(s) of Success

- Operator activities provide insight to the production control and supervisors.
- Identify and eliminate non value-added activities
- Identify and eliminate production bottleneck and improve workflow

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150K

The University of Kentucky has used the proposed sensor to monitor the travel speed in manual FCAW and achieved good accuracy and has used the monitored speed from this sensor to control a pipe welding process. This project will build upon the previous work and offer insight beyond welding to understand activities around welding and cutting (most of the operator time) to improve OEE with digital solutions. It can be extended beyond welding, to other skilled trades, such as fitters, electricians, painters, and other fabrication in shipbuilding.