NSRP National Shipbuilding Research Program



Pacific Shipyards International (PSI), Port of Honolulu, Pier 24



AI/AR Knowledge Provisioning Project Welding Smart Camera In-The **Torch Project**

PPPF Panel Presentation – March 24, 2021 Mike Buelsing, Pacific Shipyards International (PSI)

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AI/AR Knowledge Provisioning

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Project Overview - Team

- Pacific Shipyards
- Conrad Shipyards
- Fincantieri Marine Systems, N.A.
- Auros Knowledge Systems
- D'Angelo Technologies
- Hepinstall Consulting Group



- NSRP Technical Manager
 Jim House, ATI
- NSRP Project Technical Representative
 - Shawn Wilkerson, HII-Ingalls

Overall Project Objective



Automate the provisioning of critical knowledge directly into the ship repair workflows using Artificial Intelligence (AI) and Augmented Reality (AR)

Value Proposition

- Al-assisted capture and packaging of critical knowledge/information
 - Customer requirements, Standards, Shipyard crowd-sourced knowledge
- Automated mapping of customer specifications and regulatory requirements into work control artifacts:
 - Estimating packages, Test and inspection plans, Planning work instructions, Job safety hazard notices, and Standard production work
- Augments ship repair workflow
 - Real-time viewing of reference materials while on ship
 - AR content persists for other users (Sticky Notes)
 - Virtual reference content (Designation nodes, animations)
 - Navigation feature assists in pathfinding to compartment
 - Remote Assistance feature provides live feedback from an SME via video chat

Applying AI and AR to Ship Repair



Accomplishments/Benefits to Date

- Document Ingestor Completed (Development Environment)
- ✓AI K-PAC Auto Classifier / Categorization of Specs Completed (Development Environment)
- ✓6,516 Ship Repair Knowledge Packets
- ✓Work Package imported and classified in 2 Days vs 21 Days
- ✓8 Major Workflows Completed or Under Development
- ✓AR User Interface and Auros Connector functionality for compartment-specific information delivery completed
- Integrated the Remote Assistance capability to connect remote supervisor or subject matter expert to see and interact with worker at job site. (Especially useful during COVID).

Pilot Project Highlights - PSI



- Standard Work Capture
- Shared Workflow with Roles and Responsibilities identified
- Provisioned Knowledge is utilized and evaluated.



Other Pilot Project Highlights

- Conrad Shipyard Customer Specification Compliance
- Fincantieri Marine Systems, NA (FMSNA)
 - Ship Service Generator Engines
 - Maintenance Procedures (Technical Manuals, Supplemental Procedures, Maintenance Repair Cards (MRC's)
- Delaware River Barge Authority (DRBA)
 - Assessments to Track Repair Specifications Progress & Issues

Phase 2 Plans (Feb 2021 – Oct 2021)

- Conduct shipyard pilots
- Measure effectiveness
- Upgrade/harden the application for Ship Repair
- Release AI/AR Knowledge
 Provisioning Application for Ship
 Repair
- Develop Implementation
 Offerings
- Disseminate results to industry

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Welding Smart Camera In-The Torch Project

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Team Introductions

- Pacific Shipyards
- Vigor Industrial
- EnergynTech
- D'Angelo Technologies
- Gatekey Engineering
- Hepinstall Consulting Group
- Miller Electric/Hobart Brothers



- NSRP Technical Manager
 Mark Smitherman, ATI
- NSRP Project Technical Representative
 - •Thresa Nelson, HII-NNS

Value Proposition



- Delivers a portable Smart Camera-Enabled Welding Torch System
 - Enables the welder to view the weld and welding parameters through the helmet without looking directly at the weld
 - Eliminates the need for mirror welding in inaccessible locations,
 - Significantly reduces eye injuries common across all shipyards,
 - Provide voltage and current information at point of use on the video screen during welding
 - Provides a digital recording of weld quality and process information to enable forensic analysis.

SMART Camera in the Torch Prototype

Torch Assembly

Torch Handle

- Trigger
- Joystick

Camera System

- **Camera In The Torch**
- Video Capture/Transmit

Electronic

Processing Module

- External Wireless Communications
- Software for Information Processing

Helmet/Headset Design Flip Up Screen



- Visor lifts, moving the screen, raspberry pi, and accessories out of the welder's view.
- Screen flips up out of the way for easy access to inspect the weld.
- Visor easily lifts with no wear and tear on wires.

Shipyard Benefits



- Will significantly improve the ability of the welder to weld inaccessible areas shipboard and in the shop.
- Will improve the first-time quality of welding and reduce rework and repair.
- Will provide information to the shipyard quality department to improve quality and provide real-time quality feedback to the welders.
- Will be able to capture information to measure usage and demonstrate improvement in productivity and quality of "mirror" welding.
- Will significantly reduce eye injuries associated with welding (Target 50%).

Phase 2 Plans (Mar 2021 – Aug 2021)

- Perform Shipyard Testing
- Harden Camera-enabled Torch System for Shipboard Use
- Shipyard Implementations
- Develop Weld Procedure
- Commercialize Product for Industry Use
- Disseminate Results to Industry





