

NESDI & ONR Sponsor Technology to Control Paint Overspray in Shipyards

Enclosure Prevents Paint Contaminants from Reaching Air & Water

ENGINEERS FROM THE Naval Surface Warfare Center, Carderock Division's (NSWCCD) Environmental Quality Division have developed and tested a means to capture the overspray generated during hull painting operations—the Motion Assisted Environmental Enclosure (MAEE).

dry dock floor and surrounding areas where they may be discharged into nearby waterways.

In an effort to address this challenge, NSWCCD, in conjunction with NORX, LLC and Concurrent Technologies Corporation, developed MAEE technology to mitigate the

tive, contact-free seal with the hull to prevent the overspray from escaping. The seal around the shroud is a pressurized zone created by a flow of air similar to an air curtain. Blowers on the enclosure clear paint overspray and fumes away from the periphery and the painter and deposit them

The more efficient the hull coating is, the greater the fuel economy of the vessel, and the less future maintenance will be required.

The hull coating process is critical to the preservation of a ship's hull. The more efficient the hull coating is, the greater the fuel economy of the vessel, and the less future maintenance will be required—resulting in less time in dry dock and reduced ownership costs. For these reasons, anti-fouling coatings, which contain copper and zinc, are utilized.

During the spray paint application process, some of the paint does not adhere to the surface of the ship. This “overspray” carries heavy metals and other hazardous materials onto the

release of these paint contaminants into the environment.

MAEE is a portable, lightweight, inexpensive enclosure that attaches to a standard aerial work platform (AWP). The MAEE enclosure allows a painter to apply coatings to a ship's hull with standard shipyard spray equipment. The rectangular containment unit, or shroud, which covers approximately 60 square feet of the hull, allows an operator to access the surface to be painted, draws and circulates air from within the enclosure to contain the overspray, and generates a posi-

onto the enclosure's filters. (Note: A patent for the MAEE has been granted to the developer of the enclosure—NORX, LLC (U.S. Patent 8,499,716).)

Using the MAEE system's micro-computer, the operator specifies a desired direction (up, down or steady) and a speed based on their particular level of expertise and proficiency with the application of the coating (paint). A system of sensors and computers on the MAEE's work platform detect the position of the hull as well as the positions of the aerial work platform's joints. The control system's micro-

computer converts the operator's instructions into commands that follow the hull's surface at a fixed standoff distance of four to six inches. As the paint is applied, the shroud constantly moves along the surface, exposing more of the surface to be painted. The painter simultaneously paints while the system moves along the surface of the ship. The painter only needs to periodically stop and relocate the basket once a full pass is complete. This eliminates a designated platform operator from the process.

To reduce system costs and improve safety, the MAEE controller does not require any significant or permanent modifications to the boomlift.

Modifications are easily assembled and can be completed in about an hour. The boomlift is then readily deployable for other shipyard activities or may be returned to a rental company without incurring any additional charges. The boomlift's integral safety systems remain fully intact and functional.

MAEE Development

Though more broadly capable, MAEE is designed to be used on the hulls of submarines and surface ships. The MAEE system consists of two components:

1. Motion Assistance Component

This component, which can be used independently of other system components, coordinates the motion of the MAEE platform's actuators, allowing it to follow a hull surface without direct input from the operator.

2. Tool Component

This environmental enclosure is a lightweight structural framework with a positive air pressure seal configured around the perimeter that directs air to entrain and direct paint overspray particles onto replaceable filters within the enclosure.



A painter operates an earlier MAEE prototype during testing at BAE Systems in Jacksonville, FL.
Naval Surface Warfare Center, Carderock Division

The maturing MAEE enclosure technology has been tested and evaluated in a series of progressive shipyard operational assessments conducted by shipyard and research and development personnel under representative hull painting conditions. Following each test, prototype modifications and refinements were made based on recommendations from operators trained on the system and shipyard process management personnel.

Advanced prototype development must reconcile increased performance with requirements for expanded system functionality on curved surfaces with safety requirements, limits on overall enclosure weight, and requirements for structural sturdiness.

The original MAEE enclosure design distributed numerous blowers around the perimeter on a metal plenum (chamber) with rigid vanes to direct the air towards the hull surface.

The new design uses fewer blowers to feed air into a lightweight, tube-shaped perimeter plenum. The new plenum directs the air towards the surface through a series of openings in flexible tube. It is lighter and simpler and



Paint capture testing of the new MAEE plenum being conducted at the OT Neighoff paint facility in Glen Burnie, MD. Naval Surface Warfare Center, Carderock Division

other shipyard activities or may be returned to the rental company. The AWP's integral safety systems remain fully intact and functional, as required by American National Standard ANSI/SIA A92.5—2006 "Boom Supported Elevating Work Platforms."

Some tasks remain to ensure the successful transition of MAEE technology into shipyard operations. The first is to receive additional acknowledgement from JLG Industries (the original equipment manufacturer of the AWP) for extended testing and evaluation of the AWP by Navy shipyard users. This extended testing is needed to evaluate reliability and harden the system before MAEE can become a commercial product. Secondly, the system must also receive approval from the Occupational, Safety and Health Administration before a production-ready MAEE can be made available to all Navy and commercial shipyards by either purchase or lease agreement.

The MAEE project team is also considering additional project funding efforts through the National Shipbuilding Research Program (NSRP) via a Fiscal Year (FY) 2014 research announcement, and the Office of Naval Research's (ONR) Rapid Innovation Fund via a FY14 white paper.

The primary benefits of the MAEE are as follows:

requires a less elaborate support structure and fewer components. This design approach has the potential to meet the weight restrictions imposed by shipyard requirements that will enable use of the system within the unrestricted work zone of existing AWP's.

Paint capture testing of the new plenum has shown that a peripheral air seal enclosure is light enough to be carried on a standard AWP, can be successfully configured and operated to block the discharge of overspray into the environment. The latest test results indicate that the new plenum captures 98 percent of overspray along a flat surface.

To ensure the safety of the AWP, MAEE's motion controller does not require significant or permanent modifications to the AWP. Once disassembled, the AWP is then ready for

1. Virtually eliminates paint overspray and associated contaminants such as heavy metals into the atmosphere and water.
2. Enhances environmental compliance and reduces associated risk and liability associated with potential permit requirements and burden associated with by-product waste generation and management.
3. Reduces total ownership cost as a simple, sustainable, inexpensive and versatile production enhancement that is interchangeable and synergistic with existing coatings application systems and processes.
4. Maximizes use of existing shipyard assets, expertise and work flow characteristics to increase industrial productivity and enhance compliance with existing environmental requirements.



One of the MAEE's system evaluations was conducted on the amphibious transport dock ship USS Arlington (LPD 24) at the Huntington Ingalls Shipyard in Pascagoula, MS. *Northrop Grumman Shipbuilding*



MCS2 Nick Scott

- Does not alter existing shipyard equipment functionality or safety features. Is designed to be a quick on/off assembly to an AWP.

Project Support

Primary funding for this project was provided by the Chief of Naval Operation Energy and Environmental Readiness Division's Navy Environmental Sustainability Development to Integration (NESDI) program to address mature system configuration, demonstration, validation and initial integra-

tion efforts. (For more information about the NESDI program, visit www.nesdi.navy.mil.) ONR has also provided resources to develop effective perforated tube and sensor technology and to reduce enclosure weight while maintaining strength.

Continued advocacy and support for information exchange and further shipyard review and assessment for developing MAEE technology has been provided by Navy and commercial sources including the Naval Sea Systems Command 04XP (shipyard

industrial/technology insertion), 04RE (environmental), and 04RS (safety) offices, as well as the NSRP via their Surface Preparation and Coating and Environmental Technologies Panels. [↴](#)

CONTACT

Jim Howell
 Naval Surface Warfare Center, Carderock Division
 301-227-5178
 DSN: 287-5178
james.e.howell1@navy.mil