

**FY2006 Environmental Quality Awards Program
Pollution Prevention
Team Nomination**

1. Abstract

A significant Pollution Prevention milestone for the U.S. Navy was achieved on 30 September 2006. Naval Sea Systems Command Environmental Protection Systems Division (SEA 05M4), in close partnership with key personnel from the Chief of Naval Operations (CNO), Program Executive Offices (PEOs), Naval Surface Warfare Center (NSWC), Carderock Division (Bethesda and Philadelphia), Mid-Atlantic Regional Maintenance Center (MARMC), the Southwest Regional Maintenance Center (SWRMC), the Naval Air Systems Command (NAVAIR), and Industry successfully reached the completion point in the development, acquisition and Fleetwide installation of the Pollution Prevention Afloat (P2A) equipment. The installation of P2A equipment introduced a totally new shipboard and Fleet capability, and over the next 10 years will provide \$118M in cost savings for waste disposal, \$15M in cost avoidance for procurement of consumables and a reduction of 5 million labor hours for maintenance.

Surveys of Navy homeports revealed that as much as 70% of the Hazardous Material (HM) handled by the Public Works Centers was used and excess HM offloaded from Navy ships. This important discovery led to the establishment of the P2A Program, combining the resources and talents of the ship and shore communities to integrate pollution prevention practices into afloat maintenance processes. A carefully structured program identifying the sources, processes, and materials that were generating the greatest amounts of used and excess HM aboard surface ships was implemented. The challenge for the SEA 05M4's team was clear; identify Commercial-off-the-shelf (COTS) solutions, test and evaluate (T&E) opportunities in the Fleet, conduct return on investment (ROI) analyses and install via backfit nearly 18,000 pieces of pollution prevention equipment on 20 different classes of U.S. Navy ships.

To speed the transfer of the COTS technologies, the team utilized a unique approach. Following the initial market surveys, a suite of P2 equipment and best management practices was assembled and proposed to a group of test ships. A total of 9 platforms representing the AOE, CG, CVN, DD, DDG, FFG, LHA and LHD ship classes participated in the tests. The ships chose the opportunities they were interested in to T&E. Following the T&E period, the test ships reported on their experiences and indicated which initiatives they would recommend for the ships similar to their class.

The ships' recommendations resulted in the development of P2A suites comprised of as many as 18 pieces of equipment provided in appropriate quantities based upon the ship class, mission and waste generation rates. The resultant matrix of ship classes and equipment was developed into the P2A Ship Alteration (SHIPALT) Program sponsored by CNO N452 and executed under the technical authority of NAVSEA 05M4. Overall installation program management was conducted by NSWC - Carderock, Code 634 with equipment procurement and installation accomplished by Naval Air Warfare Center Aircraft Division Lakehurst Code 117190 and NSWC - Philadelphia, Code 915, respectively. Crew hands-on training was completed by NSWC - Philadelphia, Code 635. As a result of the installation of the Pollution

Prevention equipment, large decks ships have reduced their HM disposal by 9,635 lbs per year per ship and small deck ships have reduced their HM disposal by 2,757 lbs per year per ship.

SEA 05M4 and its teammates successfully planned, programmed, budgeted and administered nearly \$35 million to support U.S. Navy environmental compliance and achieve a return on investment through executing the Pollution Prevention Afloat Program. This acquisition team has made a considerable contribution in reducing a significant element of the U. S. Navy's actual and potential environmental liabilities.

2. Introduction.

A significant Pollution Prevention milestone for the U.S. Navy was achieved on 30 September 2006. The men and women of the Naval Sea Systems Command Environmental Protection Systems Division (SEA 05M4), in close partnership with key personnel from the Chief of Naval Operations (CNO), Program Executive Offices (PEOs), Naval Surface Warfare Center (NSWC), Carderock Division (Bethesda and Philadelphia), Mid-Atlantic Regional Maintenance Center (MARMC), the Southwest Regional Maintenance Center (SWRMC), the Naval Air Systems Command (NAVAIR), the Naval Shipyards and Industry successfully reached the completion point in the development, acquisition and Fleetwide installation of the Pollution Prevention Afloat equipment.

The identification of pollution prevention opportunities, commercial-off-the-shelf (COTS) technologies and Fleet implementation of the equipment and processes required the teaming of talented personnel, new or improved equipment designs, and other resources drawn from diverse groups and expertise within American Industry, Academia and the U.S. Navy. The installation of Pollution Prevention Afloat (P2A) equipment introduced a totally new shipboard and Fleet capability, and over the next ten years will provide \$118M in cost savings for waste disposal, \$15M in cost avoidance for procurement of consumables and a reduction of 5 million labor hours for maintenance. The Fleetwide installation and deployment of nearly 18,000 Pollution Prevention equipment pieces on 152 ships persuasively demonstrated this team's commitment to the mission of Pollution Prevention, and to Environmental Quality systems research, development and acquisition. Twenty five percent of the installations occurred during the past two years. This was a monumental accomplishment for the cohesive team facing myriad of ship scheduling and availability issues requiring skill in balancing programming, planning, budgeting and installations at a time when the Fleet is supporting the war in Iraq.

The Naval Sea Systems Command Environmental Protection Systems Division, and its U.S. Navy Afloat and Ashore Systems Command, Laboratory and U.S. Industry Pollution Prevention Afloat Program partners, exhibited superior leadership, management and environmental stewardship while pursuing their difficult and aggressive installation goal. The comprehensive acquisition approach developed was rigorously tailored to cost-effectively meet or exceed the technical and performance needs of the U.S. Navy. Acting as a cohesive pollution prevention team, they successfully carried out this environmentally significant system development, acquisition, installation and deployment plan within budget.

3. Background.

Surveys of Navy homeports revealed that as much as 70% of the Hazardous Material (HM) handled by the Public Works Centers was used and excess HM offloaded from Navy ships. This important discovery led to the establishment of the P2A Program, combining the resources and talents of the ship and shore communities to integrate pollution prevention practices into afloat maintenance processes.

The Environmental Protection Systems Division (SEA 05M4) is the keystone of a core team drawn from CNO, NSWCCD, NAVAIR, MARMC, SWRMC, Naval Shipyards, and Industry. A key element of SEA 05M4's near-term shipboard waste management mission is the successful identification, Fleetwide installation and deployment of the Pollution Prevention equipment.



Figure 1: Ship's Force cleaning a cable without a Pollution Prevention Device



Figure 2: Ship's Force cleaning a cable with a Pollution Prevention Device

The U.S. Navy began its search for an acceptable solution to ultimately reduce the amount of HM procured and offloaded by Navy ships. Alternatives to the use of HM were evaluated and opportunities for source-reduction in the amount of HM used in the operation and maintenance of the Fleet were explored and initiated. A carefully structured program identifying the sources, processes, and materials that were generating the greatest amounts of used and excess HM aboard surface ships was implemented. The team utilized a standardized Research, Development, Test & Evaluation (RDT&E) approach to survey the commercial sector for solutions that were transferable to the Navy and would facilitate achieving the desired goal of reducing the Navy's shipboard HM problems. Solutions were sought that would address the problem by process improvement, material elimination or substitution of a less hazardous material for the required task, introduction of COTS solutions employed by industry, and better management practices. Using the team's strategy, candidate COTS technologies to be transferred to the Fleet were rapidly identified, tested and implemented. Figures 1 and 2 provide an example of a process, cable cleaning and lubricating, without and with the use of a Pollution Prevention Device.

To enhance and speed the transfer of the COTS technologies, the team utilized a unique approach in the P2A Program. Because the COTS pollution prevention equipment was readily available and to expedite Fleet use, the laboratory evaluation of the equipment was bypassed.

Following the initial market surveys, a suite of P2 equipment and best management practices was assembled and proposed to a group of test ships for their consideration. A total of nine platforms representing the AOE, CG, CVN, DD, DDG, FFG, LHA and LHD ship classes participated in the tests. The ships chose the opportunities they were interested in to test and evaluate (T&E) over a six to nine month period inclusive of an overseas deployment. Following the T&E period, the test ships reported on their experiences and indicated which initiatives they would recommend for the ships similar to their class. Following the T&E portion of the program, a careful analysis of the old and new processes was conducted and a return on investment (ROI) analysis was conducted. The ROI analysis calculated savings in waste disposal costs, maintenance labor hours and consumables, and was completed for each individual pollution prevention opportunity. ROI analysis outcomes resulted in the deletion of several initiatives due to the lack of a positive return on investment within the program's established goal of a three-year payback period. In other instances, the T&E results led to further re-engineering of the opportunity in concert with the commercial vendor, and then re-testing. The ultimate acceptable solution had to be practical, affordable, extremely rugged, easy to use and effective. SEA 05M4's team considered many environmental issues associated with system design, test, evaluation, manufacturing, operations, logistics support, system disposal and system life cycle costs. The Pollution Prevention Equipment Suites were conceived out of this rigorous, cooperative effort.

The ships' recommendations resulted in the development of P2A suites comprised of as many as 18 pieces of equipment or management practices provided in appropriate quantities based upon the ship class, mission and waste generation rates. The resultant matrix of ship classes and equipment, including items from 15 different manufacturers, was developed into the formal Pollution Prevention Afloat Ship Alteration (SHIPALT) Program sponsored by CNO N452 and executed under the technical authority of NAVSEA 05M4. Overall installation program management was conducted by Naval Surface Warfare Center - Carderock, Code 634 with equipment procurement and installation accomplished by Naval Air Warfare Center Aircraft Division Lakehurst Code 117190 and Naval Surface Warfare Center - Philadelphia, Code 915, respectively. Crew hands-on training was completed by Naval Surface Warfare Center - Philadelphia, Code 635.

Team Members:

Naval Sea Systems Command:

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Mary Jo Bieberich	Drew Jackson	Rita Schuh
Claudia Covell	Martin Cohen	Thomas Luchay
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3. Program Summary

NAVSEA 05M4’s team, composed of government and industry organizations, conducted an analysis of the HM offloaded from ships. The analysis indicated there was a direct correlation to amount and type of HM generated to the ship’s operations. The team characterized the HM offloaded by conducting a waste audit: 25% of offloaded HM was paint related, 13% was oily/greasy rags, 7% was oils, greases and related material, 7% was hydraulic fluid, 1% was mercuric nitrate solutions and 1% was related to batteries. SEA 05M4 and its teammates initiated a market survey to identify possible COTS solutions targeted towards reducing the waste streams identified during the waste audit. The team evaluated thousands of COTS solutions that could potentially meet the Navy’s needs and used the following criteria to down select candidates: (1) Meet a break even point of 3 years or less based upon a 10 year service life, (2) Reduce HM procurement, (3) Provide HM offload savings, (4) Provide sailors with improved safety, health and quality of life and (5) Receive positive Fleet feedback.

The team identified paint-related pollution prevention COTS technologies, such as paint dispensers, paint mixers, paint brush holders, vacuum sanding systems and backpack vacuums. Rag reduction opportunities included the use of an automated cable cleaner/lubricator, pneumatic wet/dry vacuums, explosion proof vacuums and pressure washers. To assist in managing the HM, hand pumps and spray bottles, drum level indicators and hand wipes kits were identified. To reduce the volume of solvents used for parts cleaning, large aqueous parts washers and top-loading aqueous parts washer were included. Other items such as mercury ion exchange cartridge systems, maintenance free batteries and reciprocating saws were also included to eliminate shipboard HM generated. Table 1 provides an overview of some of the P2 opportunities, and ROI results.

P2 Opportunity	Data Source	10-Year Cost Savings	Labor Reduction	Break-Even Point (YRS)
Large Aqueous Parts Washer	USS CARL VINSON	\$93,430	90%	1.95
Small Aqueous Parts Washer	USS JOHN HANCOCK	\$130,090	74%	0.55
Cable Cleaner/Lubricator	USS ARCTIC	\$652,320	75%	0.1
Mercury Ion Exchange Cartridge	P2 Fleet	\$13,120	N/A	0.96
Maintenance-Free Batteries	USS CARL VINSON	\$14,194	89%	0.3
Paint Dispensing System	USS ARCTIC	\$214,050	76%	1.4
HVLP Paint Guns (3)	USS KEARSARGE	\$248,440	50%	0.02
Paint Gun Cleaning Station	USS CARL VINSON	\$31,880	44%	2.7
Paint Brush Holder (5)	USS ARCTIC	60,970	N/A	0.085

Table 1: Select P2 Opportunity ROI Results

The challenge for the SEA 05M4's team was clear; identify COTS solutions, T&E opportunities in the Fleet, conduct ROI analyses and install via backfit nearly 18,000 pieces of pollution prevention equipment on a U.S. Navy fleet comprised of 20 classes of ships. The installations occurred from 1 September 2000 to 30 September 2006 at sites located worldwide.

4. Accomplishments.

SEA 05M4 and its teammates successfully planned, programmed, budgeted and administered nearly \$35 million to support U.S. Navy environmental compliance and achieve a return on investment through executing the Pollution Prevention Afloat Program. This acquisition team has made a considerable contribution in reducing a significant element of the U. S. Navy's actual and potential environmental liabilities. As a result of the use of the Pollution Prevention equipment, large decks ships have reduced their HM disposal by 9,635 lbs per year per ship and small deck ships have reduced their HM disposal by 2,757 lbs per year per ship.

The Fleetwide installation of a completely new family of waste reduction equipments comprised of nearly 18,000 pieces of equipment in this unusually short timeframe is itself a remarkable achievement. This team formulated a number of tailored and forward thinking program management and technical initiatives based on the Navy's Plastics Waste Processor Program that contributed to this success. These initiatives include early program coordination with CNO and the Fleet, extensive analysis of COTS candidate equipments, working with industry to develop Navy solutions and implementing solutions within the Fleet. U.S. Industry has been relied on to provide logistical and technical support, and was an essential member of the team.

U.S. Industry played a key role in design, analysis, manufacturing and life cycle support of the pollution prevention equipment suite. Research and development engineering support contractors, marine engineers and architects, original equipment manufacturers and management support contractors worked in close partnership with U. S. Navy counterparts.

A complete Integrated Logistics Support (ILS) Package was developed. This included the development of appropriate training materials, Maintenance Requirement Cards (MRCs), Maintenance Index Pages (MIPs), Allowance Parts Lists (APLs), and Technical Manuals (TMs). Through the acquisition process, and in collaboration with Navy engineers, the commercial TMs were significantly augmented, rewritten, and reformatted into a product that met the needs of U.S. Navy shipboard use.

The P2A SHIPALTs included delivery of the complete ILS package to the ships at the time of installation, as well as crew training on all the equipments and processes installed. To facilitate retention of the knowledge and hands-on training provided by the P2A Program at the time of installation, all ILS documents, including four equipment specific training videos, were placed on a compact disk (CD). Copies of this CD were provided to every ship to facilitate knowledge retention following Sailor turnover in the various work centers.

Various outreach initiatives tailored to the Fleet and other internal and external customers worldwide have been developed. The Shipboard Environmental Information Clearinghouse

website was established (screen view shown below as Figure 3) and is continuously refined to present a broad range of relevant information and data on U.S. Navy progress in this area and other areas of the Shipboard Environmental Protection Program. Videotapes entitled: “Paint Dispensing System”, “Top Loading Aqueous Parts Washer”, Mercury Ion Exchange Cartridge System”, and “Cable Cleaner/Lubricator System” were distributed within the Fleet and are available for download from the website. All ILS information, Equipment Fact Sheets for each piece of equipment and Program POCs are available for download from the website.



Figure 3: Home Page of the Shipboard Environmental Information Clearinghouse (https://navyseic.dt.navy.mil)

The bottom line is that the Pollution Prevention Equipment provides an entirely new Fleet capability for the avoidance and reduction of HM related pollution generated at sea while enhancing Sailor’s quality of life by limiting their exposure to potentially hazardous materials and reducing maintenance requirements. The fact that the system is legally compliant, deployed, logistically supported, and within budget is especially noteworthy. The challenges to any publicly financed and annually appropriated large-scale pollution prevention and environmental quality initiative impacting complex warships and military operations are legion. The installation of the Pollution Prevention Equipment in U.S. Navy ships is an important milestone.