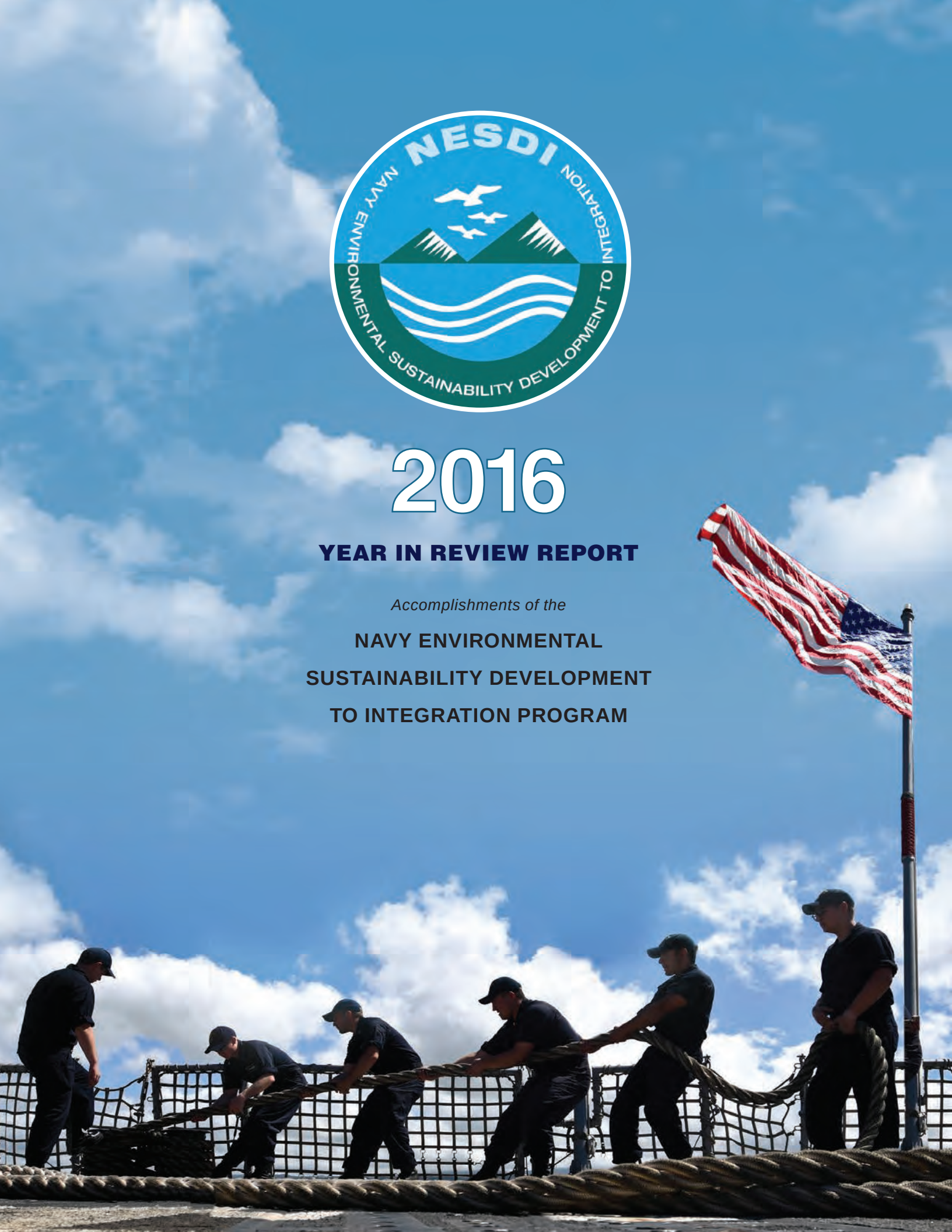
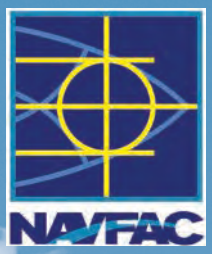
2016

YEAR IN REVIEW REPORT

Accomplishments of the

NAVY ENVIRONMENTAL SUSTAINABILITY DEVELOPMENT TO INTEGRATION PROGRAM





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For more information about the NESDI program visit www.nesdi.navy.mil.

Cover photo by Mass Communication Specialist 2nd Class Holly L. Herline

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A Word From Our Program Manager

Welcome to the Navy Environmental Sustainability Development to Integration (NESDI) program's Fiscal Year 2016 Year in Review report.

Ken Kaempffe

This report summarizes the accomplishments of our many NESDI team members from across the Navy. The success of the program can be directly attributed, in particular, to the ingenuity and hard work of our Principal Investigators—our dedicated subject matter experts who are civilian engineers and scientists at our warfare centers, Fleet Readiness Centers and other Navy organizations. Our team of experts also includes many contractors and university partners. I'd like to thank everyone who contributed to making the NESDI program a success yet again in 2016!

A Markedly Improved Year for the Program

Reflecting on the past several years, FY16 was a markedly improved year for the NESDI program. Our program funding level (at $5.604M) was the healthiest it has been in recent years. In fiscal years 2014 and 2015, program funding was significantly reduced. These reductions were so severe, in fact, that we were forced to delay or stop work on several of our projects. Thanks to a more sustainable funding level in FY16, we were able to partially address our backlog of deferred work. In addition to our many technical project accomplishments, for both fiscal years 2015 and 2016, we met or exceeded all of the Assistant Secretary of the Navy's financial benchmarks for research, development, testing and evaluation (RDT&E) funds. Meeting our financial benchmarks demonstrates that there is a strong demand for the work that the program continues to accomplish year after year.

Leveraging Resources with Other Programs

With each subsequent year, the NESDI program receives more field-generated, end user needs than can be addressed given our current budget limitations. In FY16, we received a total of 62 needs. Of these, we were ultimately able to make awards for 15 "new start" projects (highlighted later on in this report). In addition to strong field-level demand for our technology demonstration and validation services, another indicator of the health of the program is the amount of leveraged funding that our projects have been able to secure. These funds come from a variety of sources including other Department of Defense (DoD) RDT&E programs such as the Environmental Security Technology Certification Program (ESTCP). In FY16, NESDI projects leveraged a total of $2.084M in additional resources that were made available to our Principal Investigators. This demonstrates that other programs understand the value that we bring to the table. So much so that they are willing to share resources to address common objectives. I expect all of this to continue throughout the coming years.

I would like to give special thanks to our NESDI team for being exceedingly resilient over the past several years. Even though our FY16 budget was at a more robust level

than years past, we still had to contend with a Continuing Resolution and the uncertainty regarding the level and timing of the resources that would be made available to fund our efforts. Once again, the NESDI team including our management committee—the Technology Development Working Group (TDWG)—and our Principal Investigators from across the nation were able to effectively weather this uncertainty. I would also like to thank the managers and staff at our resource sponsor—the Chief of Naval Operations Energy and Environmental Readiness Division—who participate in our review process and help us to continually justify and defend our budget. Their support is critical to ensure the ongoing health of the program.

Investing in Critical Topic Areas

In FY16, the NESDI program invested in a number of critical topic areas including increased knowledge of the fate and transport of perfluorochemicals and reductions in the use of toxic metals such as hexavalent chromium and cadmium during the maintenance of many of our aircraft platforms. The NESDI program has two active projects that will allow the Navy to optimize our response to the potential risks posed by perfluorochemicals—*Structure-function Relationship and Environmental Behavior of Per- and Polyfluorochemicals from Aqueous Film-forming Foams* (project no. 527) and *Technology Evaluation and Sampling for Treatment of Perfluorochemicals* (project no. 534). Our projects led by our colleagues from the Naval Air Systems Command often have the most direct impact on Fleet readiness. One of our more successful efforts in this area is our *Nanocrystalline Cobalt Phosphorous Electroplating as a Hard Chrome Alternative* (project no. 348)—a project that was heavily leveraged by ESTCP. You can read more about these and other projects by selecting the projects tab on our website at www.nesdi.navy.mil. As the Navy's 6.4 environmental technology demonstration and validation program, the NESDI program will continue to address the Navy's most difficult and persistent environmental challenges in FY17 and beyond.

Insights Into Our "New Start" Projects

In this report, you can read about the efforts we initiated in FY16 such as our *Forward Looking Infrared (FLIR) for Advanced Discharge Characterization* project (project no. 539) which will provide a more accurate means to characterize contaminant concentrations and toxicity at outfall mixing zones pier side or near shore using a FLIR camera. This technology will be another tool that will help the Navy meet stringent National Pollutant Discharge Elimination System requirements in San Diego Bay, Pearl Harbor, Puget Sound and elsewhere. NESDI project no. 542 (*Naval Air Systems Command Solutions for Engine Washing*) will validate an aircraft engine washing system that uses heated, deionized, atomized water and custom manifolds. It is anticipated that once demonstrated and deployed throughout the Fleet, the improved aircraft engine wash process will save a tremendous amount of time per wash cycle and will also decrease hazardous waste generation. NESDI project no. 545 (*In Situ Treatment of 1,4-dioxane using Enhanced Biodegradation*) will demonstrate a new, cost-effective treatment method for 1,4-dioxane. It is estimated that the Navy has over 100 sites with measureable concentrations

of 1,4-dioxane however existing treatment methods are cost prohibitive. These are just a sample of NESDI projects that address difficult and persistent environmental compliance issues and also reduce the lifecycle cost of our ongoing operations.

What's in Store for 2017

I have a number of things in mind for FY17 and the outyears. First, we will continue to clear out the backlog of tasks that resulted from the budget reductions we incurred in FY14 and FY15. At the time of this printing, our FY17 budget was still uncertain. I expect it to settle in somewhere between $5.6M (as is proposed in the House of Representatives budget) and $6.822M (as is proposed in the Senate budget). Then, after two years of a more reasonable budget, funding for the NESDI program is expected to be reduced to $4.727M in FY18. This reduction may require us to reorder our efforts to ensure that our highest priority projects continue without interruption. I will continue to place a high priority on accountability to ensure that the NESDI program continues to deliver results regardless of our funding limitations.

How You Can Participate

We need the most help identifying environmental requirements and implementing the results of our various projects into the ongoing operations of the Fleet. So, whenever you can, find a way to use the technologies we demonstrate and the research that we sponsor.

Specifically, you can participate in our process and play a vital role by doing any or all of the following:

1. Submitting and validating an environmental need.
2. Reviewing the technologies already under development.
3. Supporting the integration of our products in your organization or at your installation.
4. Serving as a Principal Investigator on one of our projects.
5. Providing a demonstration site for one of our projects.
6. Staying up-to-date on our program by visiting our website (www.nesdi.navy.mil).

We're always looking for ways to do things better and more efficiently. So if you've got some ideas for us, please contact me or the appropriate member of our TDWG.

I hope you find this Year in Review report to be a valuable resource as you search for additional insights into our projects and the overall operation and continued success of our program in FY16.

Ken Kaempffe
Program Manager
ken.kaempffe@navy.mil

The Mission of the NESDI Program

The mission of the NESDI program is to provide solutions by demonstrating, validating, and integrating innovative technologies, processes and materials; and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program seeks to accomplish this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The NESDI program is the Navy's environmental shoreside Research, Development, Test & Evaluation (6.4) program. The NESDI technology demonstration and validation program is sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division (OPNAV N45) and managed by the Naval Facilities Engineering Command (NAVFAC). The program is the Navy's complement to the Environmental Security Technology Certification Program which demonstrates and validates technologies important to the Tri-Services, U.S. Environmental Protection Agency and the Department of Energy.

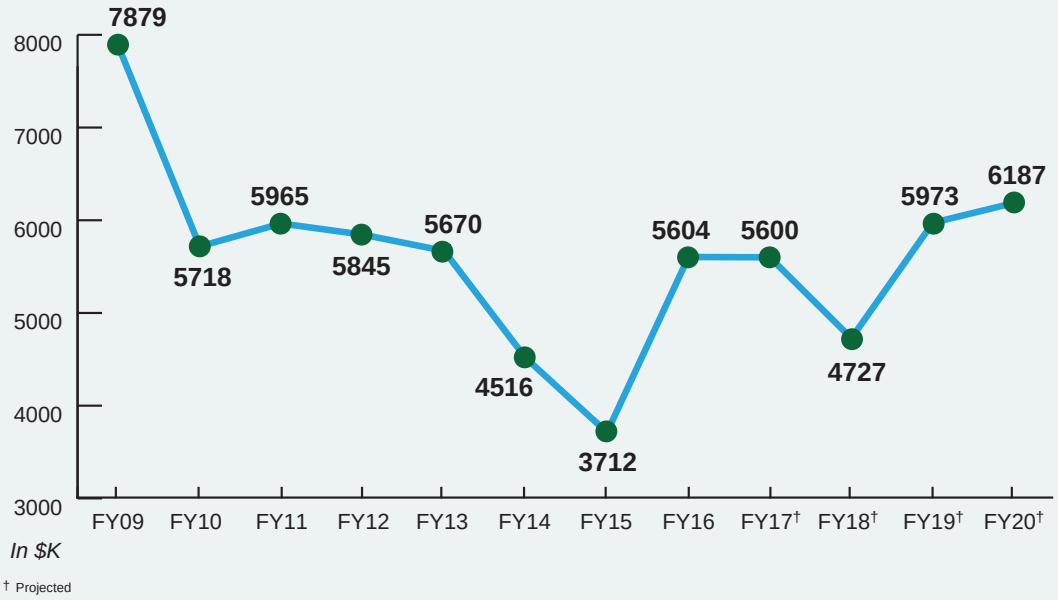
Financial Highlights

Program Funding

Each year, the NESDI program establishes its investments based on the requirements identified by its end users in the Fleet and potential risk to the Navy mission.

The chart below shows the evolution of the program's actual funding levels from fiscal year 2009 (FY09) through FY16, as well as projected funding levels from FY17 through FY20.

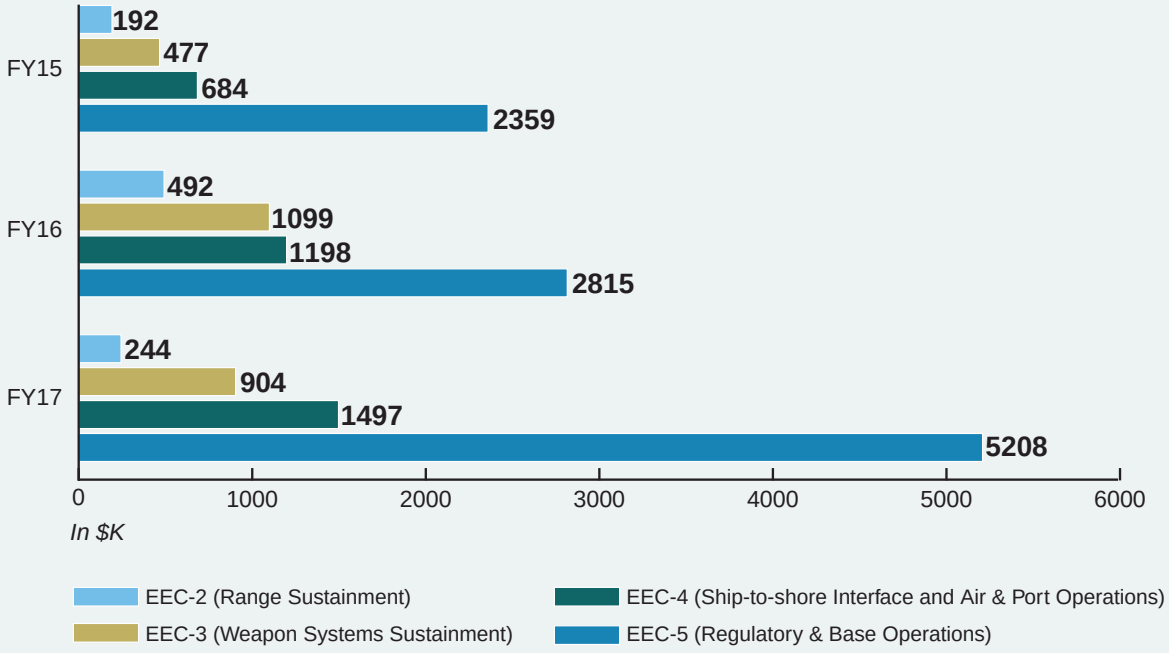
Program Funding (FY09 – FY20)



† Projected

The following graphic summarizes program funding trends from FY15 through FY17 by Environmental Enabling Capability (EEC).

Program Funding (FY15 - FY17)



For FY17, values are funding amounts requested by Principal Investigators.

The NESDI Program Process

The NESDI program executes the same four-phased process each year that helps ensure the comprehensive collection of outstanding needs from the Fleet through the successful transition of workable solutions into the Navy's shoreside operating environment and its range testing and training activities.

The four phases of that process are summarized on the following pages.

1. Collect, Validate & Rank Needs

During this first phase of the annual management process executed by the NESDI program, our management team—the Technology Development Working Group (TDWG)—solicits environmental needs from across the Navy's shore community. Once these are received, the TDWG validates and ranks them based on a variety of criteria including whether the need falls within one of the program's priority investment areas, how pervasive the problem is in the Navy, the extent and severity of the associated compliance risk and the potential impacts on the mission of the Fleet if the need isn't addressed.

2. Collect, Evaluate & Rank Proposals

During this second phase of the program's annual management process, the TDWG collects project proposals that address the needs collected in the first phase of the process. In particular, the TDWG first requests, collects and reviews short pre-proposals, and then requests more detailed, full-length project proposals. The TDWG then recommends to the program's resource sponsor (OPNAV N45) which projects should receive program support.

3. Execute Projects

Once proposals have been selected and funded, the program ensures during this third phase of its annual management process that the projects remain properly focused on the needs they were intending to address through initial planning, ongoing reporting and management oversight.

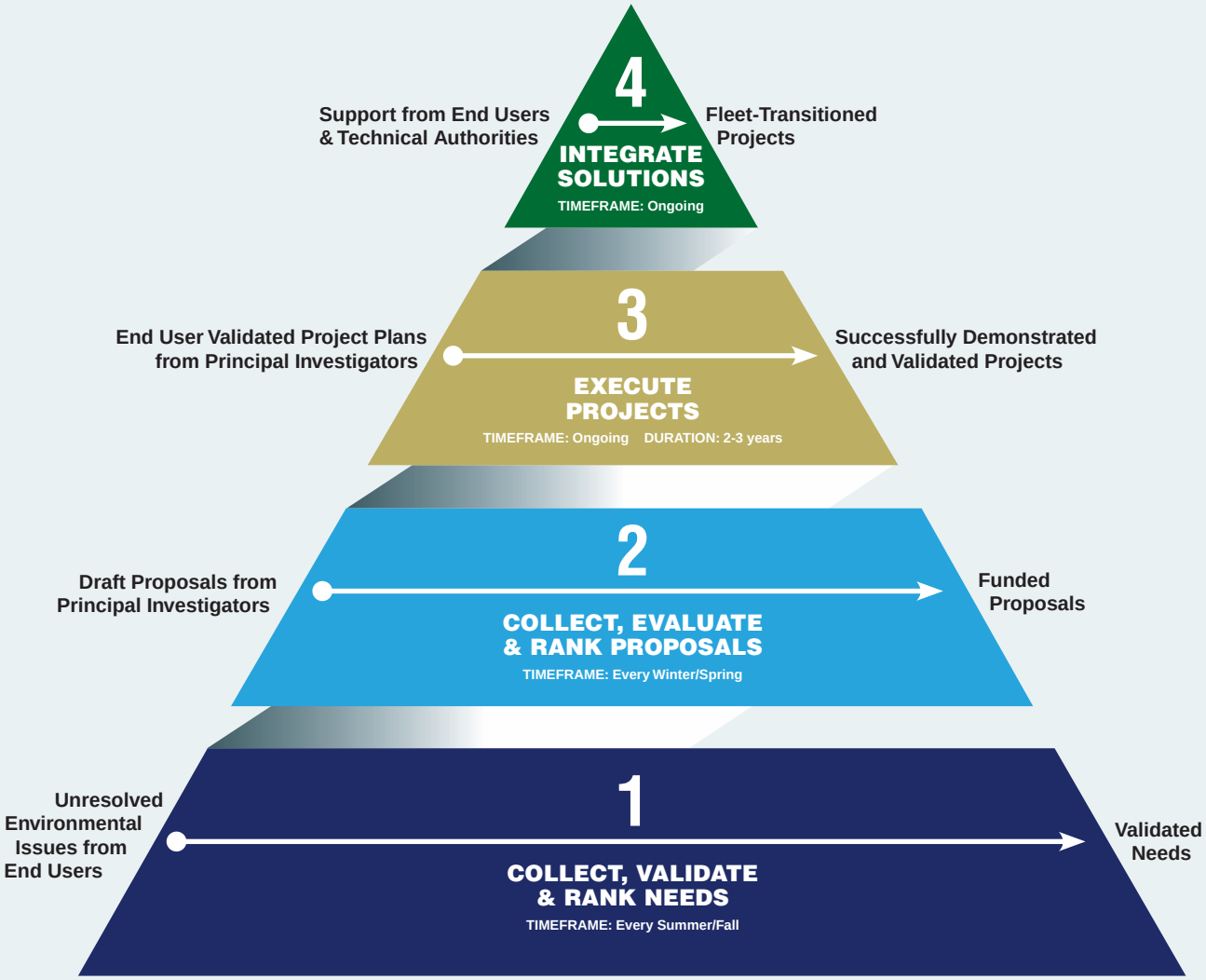
4. Integrate Solutions

Throughout the project lifecycle, the NESDI program concentrates on moving the demonstrated technologies and other solutions out of the laboratories and demonstration sites and into the appropriate operational environment. During this fourth and final phase of the NESDI program process, the TDWG, Principal Investigators and end users work together to ensure that various solutions are successfully integrated into the Fleet and weapons system acquisition programs and verify that the solutions provide the anticipated benefits.

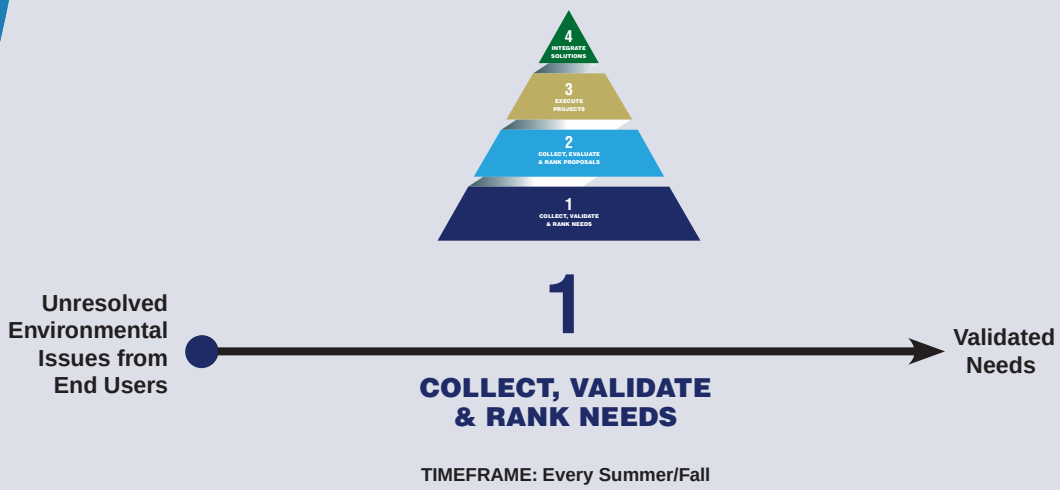
Throughout this process, the program's targeted customers—including need submitters, end users, technical authorities and other stakeholders—provide valuable input to develop meaningful needs, support the ongoing execution of individual projects, and help to ensure the successful integration of products and other solutions.

The inputs, outputs and timeframes associated with each of the above stages are highlighted in the following diagram. Outputs from each phase of this process as executed throughout FY16 are discussed in the subsequent sections of this report.

The NESDI Program Process



Collect, Validate & Rank Needs



Process Overview

In the first step, the TDWG solicits environmental needs from the Navy's shore community. This is done through the program's formal needs solicitation process as well as direct communication among TDWG members, end users and environmental liaisons.

Once received, the TDWG then validates and ranks those needs based on a variety of criteria including whether the need falls within one of the program's priority investment areas, the pervasiveness of the problem across the Navy, the extent and severity of the associated compliance risk, and the potential impacts on the mission of the Fleet if the need isn't addressed.

Results of FY16 Needs Solicitation, Screening & Ranking

The program collected a total of 62 needs via its FY16 solicitation. After a thorough review by program personnel including the TDWG and the program's resource sponsor (OPNAV N45), 27 needs were determined to be worthy of further attention by the program. As a result, the program solicited proposals to address the following priority needs.

1. Technologies for Certifying Safe Materials Potentially Presenting an Explosive Hazard (need no. N-1048-16)
2. Future Sustainability and Readiness of Naval Assets — A Strategic Response to the Impacts of U.S. Environmental Protection Agency Rule 20 and the Future Phase-out of Hydrofluorocarbon Chemicals (need no. N-1055-16)
3. Naval Air System Command Solutions for Engine Washing (need no. N-1057-16)
4. Impact of Propeller Wash on Performance of Sediment Remediation Options in Navy Harbors (need no. N-1059-16)
5. Advanced Discharge Characterization (need no. N-1060-16)
6. Comprehensive Sewer Gas Elimination Options for Navy Installations (need no. N-1061-16)
7. Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting (need no. N-1062-16)
8. New In-Situ Methods to Quantitatively Determine the Role of Monitored Natural Attenuation of RDX in Groundwater Remediation (need no. N-1063-16)
9. Contaminated Silt Management in Navy Harbors (need no. N-1065-16)
10. Cost-Effective Treatment Options for 1,4-Dioxane in Groundwater (need no. N-1066-16)
11. Low-Volatile Organic Containing Ground Support Equipment Primer(s) (need no. N-1067-16)
12. Development of an Optional Propane Burner for Fast Cook-Off Testing (need no. N-1069-16)
13. Metal Corrosion Prevention in High Saline Marine Environments (need no. N-1071-16)
14. Navy Installation Solid Waste Diversion Technology, Process Knowledge and Capability (need no. N-1079-16)
15. Intertidal Zone Polychlorinated Biphenyl Removal (need no. N-1080-16)
16. Utility Vault Water Contaminant Removal (need no. N-1081-16)

(continued)

Results of FY16 Needs Solicitation, Screening & Ranking (continued)

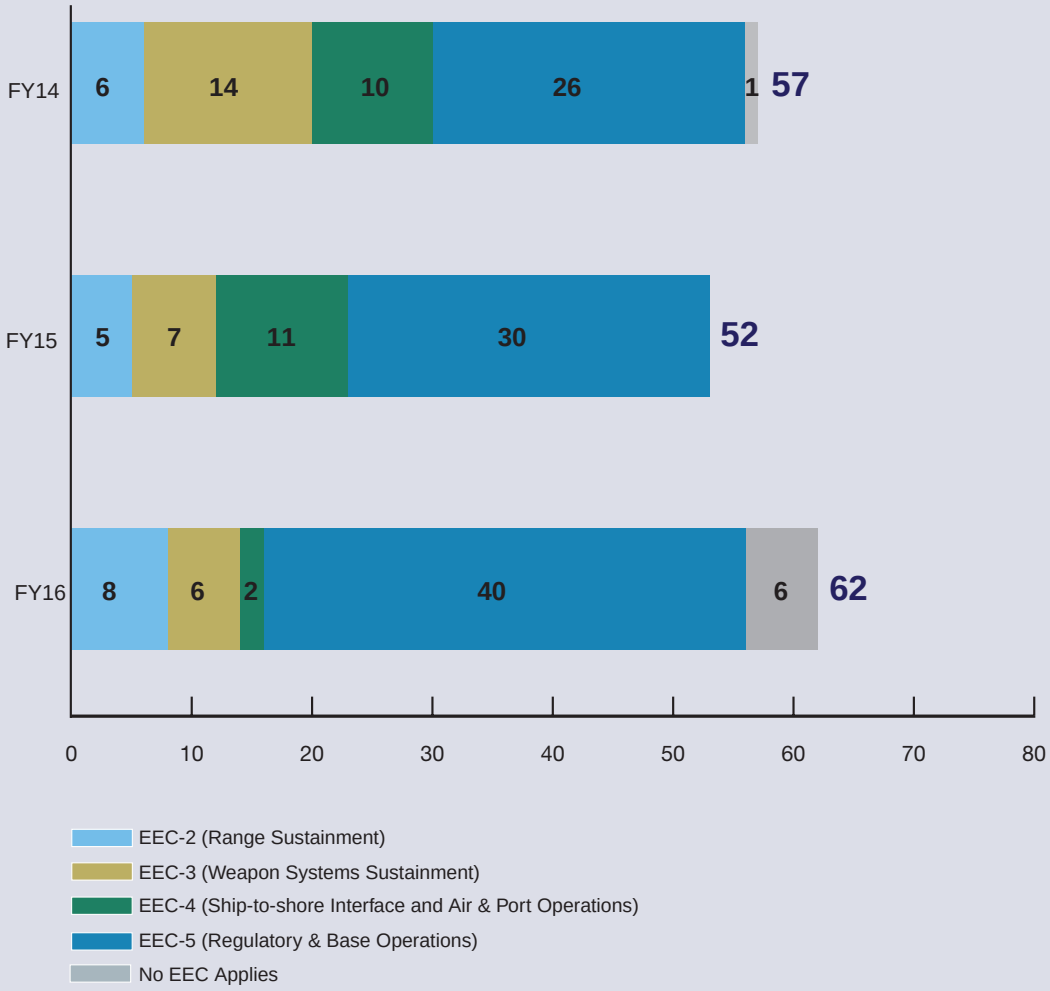
17. Industrial Pier Area Testing of Best Stormwater Pollutant Reduction Measures (need no. N-1082-16)
18. Assessment of Uncontrolled Stormwater Pollutants (need no. N-1083-16)
19. Integration of Green Energy and Stormwater Requirements (need no. N-1084-16)
20. Linking Receiving Water Impacts to Navy Stormwater Discharges (need no. N-1087-16)
21. Development of Analytical Detection Method and Review of Treatment Technologies for Insensitive Munitions (need no. N-1090-16)
22. System for Containment and Recovery of Depainting and Painting Wastes from Small Vessel Hull Repair (need no. N-1092-16)
23. Assessment and Transition of Hexavalent Chromium Reduction Technology at Fleet Readiness Centers (need no. N-1093-16)
24. Demonstration-Validation of non-N-Methyl-2-pyrrolidone Immersion Paint Stripper (need no. N-1094-16)
25. Advanced and Cost Effective Sediment Management Approaches (need no. N-1100-16)
26. New Methods to Address Copper in National Pollutant Discharge Elimination System Effluents at Shipyards and Drydocks (need no. N-1103-16)
27. Demonstration of Toxic Release Inventory Reduction Technologies (need no. N-1106-16)

Collecting effluent for a new engine washing procedure. See page 25.

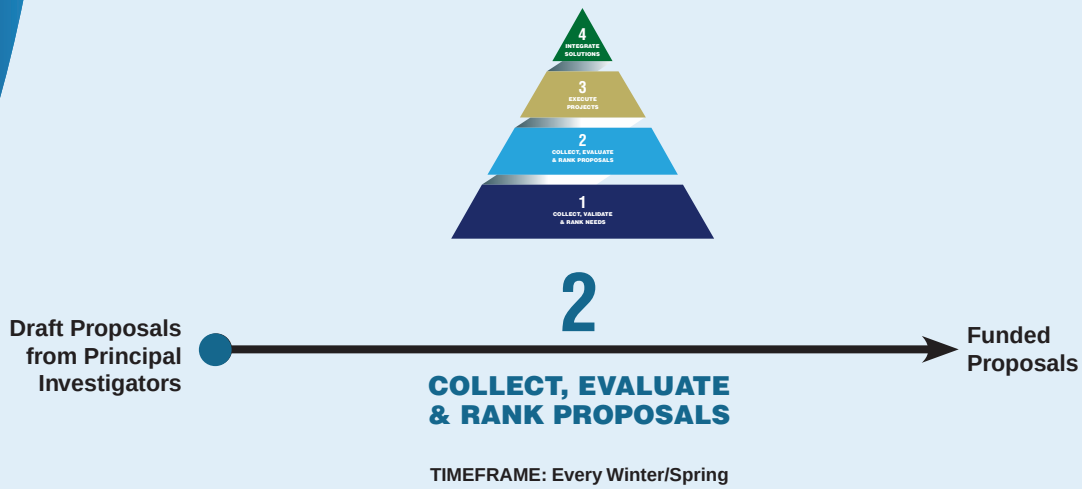
(Photo Credit: David Marriott)

FY14 – FY16 Needs Collected

The chart below distributes the number of needs collected by the NESDI program in FY14, FY15 and FY16.



Collect, Evaluate & Rank Proposals



Process Overview

During this second phase of the NESDI program process, the TDWG collects project proposals that address the needs that were collected in the first phase of the program process.

The program first requests, collects and reviews short (one– to two– page) pre-proposals to ensure that the proposed project adequately addresses the subject requirements. We concentrate on technologies that are sufficiently mature for demonstration and validation, and also support the overall environmental readiness of the Fleet and Navy acquisition communities.

Summary of Pre-proposals Requested & Received

In FY16, the NESDI program collected a total of 41 pre-proposals for needs that were submitted via the program's needs solicitation process. Once all pre-proposals were collected, NESDI program management reviewed and ranked them using established criteria including how the proposed effort addresses the need, how executable the project is, if the proposed effort is ready for demonstration and validation and how feasible it will be to integrate the solution into ongoing Fleet operations. This was followed by a final evaluation that determines which pre-proposals will proceed to full proposal development.

Of the pre-proposals that were received in FY16, full proposals were requested for the following 25 efforts:

1. Validation Testing of an Optional, Large Scale Sustainable Liquid Propane Fast Cook-off Burner
2. Development of Advanced Primer and Superhydrophobic Topcoat for Corrosion Resistance and Leachate Impedance
3. Forward Looking Infrared (FLIR) for Advanced Discharge Characterization
4. Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting
5. Zinc-free Inorganic Primer Coatings for Active Corrosion Protection
6. Microfluidic Paper-based Sampling and Capillary Electrophoresis Detection for Rapid Preconcentration/Separation of Insensitive Munitions Explosives
7. Utility Vault Water Treatment
8. Hexavalent Chromium Reduction Technology at Navy Fleet Readiness Centers
9. Naval Air Systems Command Solutions for Engine Washing
10. Preventative Management of Contaminated Silt
11. Plasma Enhanced Melter (PEM) to Reduce Hazardous Wastes and Generate Energy
12. Stable Carbon Isotopes for Tracing in situ RDX Remediation
13. Stable-Isotope Labeled Tracers, an Innovative Way to Validate Natural Attenuation of RDX in Groundwater
14. In Situ Treatment of 1,4-Dioxane Using Enhanced Biodegradation
15. National Pollutant Discharge Elimination System Copper Effluent Control System
16. Background Analysis and Tracer Study to Identify Metal Contaminant Source Contributions to Stormwater Runoff
17. Demonstration of Improved Toxicity Methodology to Link Stormwater Discharges to Receiving Water Impacts at Navy Sites
18. Sewer Gas Elimination Technology
19. Industrial Pier Area Testing of Best Stormwater Pollutant Reduction Measures
20. Demonstrate and Validate Acceptable Ground Support Equipment Primers
21. Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents for Immersion Chemical Depainting
22. Technologies, Process Knowledge & Capabilities that Increase Waste Plastics Diversion
23. A Comprehensive Analysis and Strategy for Contaminated Sediment Management
24. Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation Options
25. A Methodology for Assessment and Removal of Storm Conveyance and Intertidal Zone Polychlorinated Biphenyls

Execute Projects

End User Validated Project Plans from Principal Investigators

3

EXECUTE PROJECTS

Successfully Demonstrated and Validated Projects

TIMEFRAME: Ongoing DURATION: 2-3 years

Process Overview

Once proposals have been selected and funded, the program ensures that the resultant projects are properly launched with the right objectives in mind and remain properly focused on their original objectives and on the needs they were intending to address.

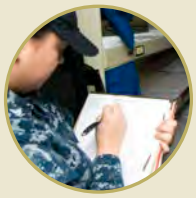
"New Start" Projects

From the 25 full proposals received in FY16, the program decided to initiate the following 15 new projects. These projects seek, among other objectives, to demonstrate a new engine washing procedure for use across the Naval Air Systems Command and develop a comprehensive investment strategy for contaminated sediment management.

1. Project no. 537: Stable Carbon Isotopes for Tracing In Situ RDX Remediation

2. Project no. 538: Development of Advanced Primer and Superhydrophobic Topcoat for Corrosion Resistance and Leachate Impedance

3. Project no. 539: Forward Looking Infrared (FLIR) for Advanced Discharge Characterization



4. Project no. 540: Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting

5. Project no. 541: Utility Vault Water Treatment

6. Project no. 542: Naval Air Systems Command Solutions for Engine Washing

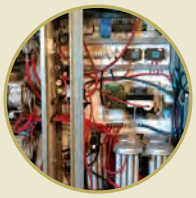
7. Project no. 543: Preventative Management of Contaminated Silt

8. Project no. 544: Stable-Isotope Labeled Tracers, an Innovative Way to Validate Natural Attenuation of RDX in Groundwater

9. Project no. 545: In Situ Treatment of 1,4-Dioxane Using Enhanced Biodegradation

10. Project no. 546: National Pollutant Discharge Elimination System (NPDES) Copper Effluent Control System

11. Project no. 547: Demonstration of Improved Toxicity Methodology to Link Stormwater Discharges to Receiving Water Impacts at Navy Sites



12. Project no. 548: Sewer Gas Elimination Technology

13. Project no. 549: Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents for Immersion Chemical Depainting

14. Project no. 550: A Comprehensive Analysis and Strategy for Contaminated Sediment Management

15. Project no. 551: Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation Options

Highlights of these projects can be found on the following pages.

2016 New Starts

PROJECT NO. 537

Stable Carbon Isotopes for Tracing In Situ RDX Remediation

RDX to Carbon Dioxide: Seeking the Truth About Degradation

Munitions explosives contamination continues to concern Department of Defense (DoD) facilities, requiring considerable resources in time and money for assessment, cleanup, monitoring and site closure. Acceptable limits of RDX (cyclotrimethylene-trinitramine) are very low, making accurate contaminant degradation measurements a high priority for site managers. If provided with a scientific method for determining RDX degradation rates over site-specific spatial and temporal scales, site managers could more confidently implement successful remediation approaches.

Most assessment methods for degradation rate estimation are based on indirect measures. These "lines of evidence" approaches are expensive and have little forecast capability. They fail to conclusively determine which of many factors and conditions are responsible for the degradation of RDX into its desired end product—carbon dioxide (CO_2).

The goal of this project, Stable Carbon Isotopes for Tracing in situ RDX Remediation, is to differentiate contaminant-derived CO_2 from CO_2 produced by the soil's natural respiration processes. The general approach is to target the contaminant's carbon backbone using isotopic analyses—the most common being stable carbon analysis. This type of analysis has been employed by the Naval Research Laboratory to detect chlorohydrocarbons and munitions constituents in contaminated plumes at other DoD sites.

Carbon-13-labeled RDX will be released as a tracer into the groundwater at a U.S. Navy site (or sites). RDX with Carbon-13 is traceable into soil gas CO_2 and methane, under

Munitions residue is an ongoing problem across the DoD.

both aerobic and anaerobic conditions. Preliminary discussions have identified a site at Naval Base Kitsap-Bremerton Washington. This site meets many of the conditions that make it appropriate for a demonstration, and the site has regulator approval to release small amounts of RDX.

A natural abundance isotope ratio mass spectrometer (IRMS)—designed to work at per mil (1 in 1,000) resolution—will detect shifts in the CO_2 and CH_4 stable isotope ratios as RDX is degraded to these end-products. Sampling will be conducted seasonally and spatially for dissolved inorganic carbon (CO_2), dissolved methane (CH_4) and bacterial biomolecules in groundwater and if possible, soil. The sum of these measurements can determine the total degradation of RDX by natural methods (attenuation).

If provided with a scientific method for determining RDX degradation rates over site-specific spatial and temporal scales, site managers could more confidently implement successful remediation approaches.

The end result of this project will be a protocol usable at sites with either engineered or natural attenuation remediation programs currently in effect. The team will develop a seminar to highlight the results of this project and resultant methodology and deliver it to affected Remedial Project Managers, regulators and other stakeholders.

Principal Investigator:
Thomas Boyd
Naval Research Laboratory
202-404-6424
thomas.boyd@nrl.navy.mil

PROJECT NO. 538

Development of Advanced Primer and Superhydrophobic Topcoat for Corrosion Resistance and Leachate Impedance

Two New Weapons Against Corrosion & Leachate

Galvanized metal is commonly used at Navy installations. This metal is also one of the main sources for zinc in stormwater discharges, and one of the primary reasons for potential regulatory compliance issues. Both the Navy and the Electronic Harbor Security Systems (EHSS) program have a stake in protecting these galvanized structures and reducing zinc in stormwater runoff.

The EHSS has responsibility for over 60 sites worldwide with galvanized metal structures that are regularly subject to heavy salt spray which results in rapid corrosion. This can cause both zinc leaching and discharge, increased structural repair due to corrosion, potential damage to security equipment and potential downtime.

This project, Advanced Primer and Superhydrophobic Topcoat for Corrosion Resistance and Leachate Impedance, was formed as a partnership between EHSS, the Naval Air Warfare Center (NAWC) in Patuxent River, Maryland and the Space and Naval Warfare Systems Center Pacific (SSC Pacific) in San Diego, California. The team will investigate two potential solutions to this problem—superhydrophobic coatings and inorganic zinc-free primers.

Volumetric superhydrophobic coatings are water-repelling coatings first developed by the oil industry. These coatings have

2016 New Starts (continued)

undergone preliminary testing for their anti-corrosion properties and showed no leaching whatsoever, making them far superior to any other coatings currently or previously in use. Superhydrophobic coatings are also considered a "green" technology because they're not biocidal and virtually eliminate zinc leaching.

These coatings have undergone preliminary testing for their anti-corrosion properties and showed no leaching whatsoever.

Metal-rich coatings have proven to be highly effective in preventing corrosion in aggressive corrosion environments. Most of these products contain a zinc pigment, which leaches out into the environment. This type of pollution in estuaries and bays is a problem that can affect marine life. Zinc-free alternative coatings have been developed by personnel from the Naval Air Systems Command. These inorganic coatings have produced good results in accelerated testing and may provide an alternative to zinc-based corrosion prevention schemes while limiting heavy metal discharge.

Laboratory testing of the two products will be conducted at NAWC Patuxent River and SSC Pacific. After a suitable formula has been identified, field-deployed test panels will then be sent to various EHSS testing sites (based on operational availability) where high levels of corrosion occur, and assessed for corrosion in these environments over time. Additionally, scaffolding material will be coated and field deployed in an industrial shipyard setting

End users at EHSS will be involved with the demonstration of the product, and if successful, they will adopt the technology worldwide. Additionally, Navy facilities with permitting issues related to zinc leachate will be engaged during the project with the end goal being to include the product in future contractor requirements to apply these new coatings during the maintenance of galvanized structures.

Galvanized metal is one of the major sources for zinc runoff in stormwater. (Photo Credit: Chuck Katz)

Principal Investigators:
Brandon Swope
Space and Naval Warfare Systems Center Pacific
619-553-2761
brandon.swope@navy.mil

Alan Grieve
Naval Air Warfare Center Patuxent River
301-342-6807
alan.grieve@navy.mil

PROJECT NO. 539

Forward Looking Infrared (FLIR) for Advanced Discharge Characterization

What's Really Happening in the Mixing Zone?

A mixing zone is an area in a water body immediately adjacent to a discharge outfall. Discharges may result from stormwater or other industrial activities such as cooling water. A mixing zone is defined by the U.S. Environmental Protection Agency (EPA) as an "allocated impact zone where numeric water quality criteria may be exceeded as long as acutely toxic conditions are prevented." Put simply, higher levels of metals and other contaminants are allowed in this zone, with the assumption that they will become diluted within the larger water body.

Hydrodynamic models have been developed to characterize the potential concentrations of contaminants and toxicity of these mixing zones; however they are not designed to address the issues of dynamic mixing for pierside/nearshore surface discharges (e.g., stormwater mixing).

A FLIR camera can provide thermal imaging of the environment which can aid in developing highly accurate data associated with outfall discharges.

It is the goal of this project, Forward Looking Infrared (FLIR) for Advanced Discharge Characterization, to provide a means to better and more easily quantify and characterize a dynamic mixing zone as well as provide more data for these models through the use of a new technology. This will allow for the better linking of small and large scale hydrodynamic models.

Stormwater outfall.

2016 New Starts (continued)

A FLIR camera can provide thermal imaging of the environment, which can aid in developing highly accurate data associated with outfall discharges. FLIR cameras are currently used for a wide variety of applications, including crop analysis, animal physiology and law enforcement.

The camera records temperature differences between the discharge and ambient water, and its fine scale data resolution can adequately record the mixing patterns in structurally complex pierside regions. A validated model utilizing this technology will enable advanced discharge characterization at Navy facilities to meet National Pollutant Discharge Elimination System requirements.

After calibrating the FLIR camera, the project team will demonstrate the utility of FLIR cameras to capture the dynamics of multiple shoreline discharges, and will incorporate FLIR data into three current hydrodynamic models.

EPA supports the use of advanced discharge models that integrate the concepts utilized in this project. Adding additional capabilities to the suite of hydrodynamic models currently used by the Navy (Curvilinear-grid Hydrodynamics 3D (CH3D), CORMIX mixing zone, and Dynamic Mixing Zone models) will strengthen support for and adoption of these models.

Principal Investigator:
Brandon Swope
Space and Naval Warfare Systems Center Pacific
619-553-2761
brandon.swope@navy.mil

PROJECT NO. 540

Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting

Simplifying Environmental Field Data Collection: One Team Looks at the Options

The Department of the Navy is required by the U.S. Environmental Protection Agency to perform compliance monitoring of Navy activities for 44 programs, including stormwater discharge and spill response. Establishing an efficient compliance program requires collection of massive amounts of data. Comprehensive field surveys of Navy installations require several teams of surveyors, each having varying degrees of experience, note-taking habits, penmanship and very limited time. For example, cross connection surveys (surveys of points where potable and non-potable water sources meet) involve labor-intensive activities including field collection of data, review and manual tabulation of data into spreadsheet or database format, resolving discrepancies in identification of hazard types and identifying corrective actions

Most field surveys in the Navy are done with pen and paper. (Photo Credit: Mass Communication Specialist Seaman Daniel P. Jackson Norgart)

required. Compilation and interpretation of field notes, manual tabulation of data and consistency checks for hundreds of buildings following these surveys are time-consuming tasks. In addition, handwritten data has to be transferred into a digital format.

Many commercial-off-the-shelf technologies exist that assist Public Works Departments in collecting data digitally in the field and transferring it to the work station. However, there is an information gap on what electronic devices are acceptable and compatible with the Navy Marine Corps Intranet (NMCI). This project, Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting, was formed to identify a user-friendly electronic device and software that are currently NMCI-compatible, or could be certified to be NMCI-compatible.

Although integrating a new technology into the NMCI network can be burdensome and time-consuming, this hurdle should not immediately exclude this project. If the technology is successfully integrated into NMCI, end users would reap the benefits indefinitely.

If the technology is successfully integrated into NMCI, end users would reap the benefits indefinitely.

The project team will first seek feedback from the public works department at Naval Base Ventura County (NBVC) in Port Hueneme, California to determine the needs of the user community. Then a market technology survey will be undertaken, and the top two technologies will be delivered to NBVC for feedback. The technology with the most potential will be demonstrated on a small scale at the base. If the demonstration is successful, a statement of work (SOW) will be completed that includes the technology specifications and cost information. The SOW can be then used by any public works department to acquire the technology.

Principal Investigator:
Itzel Godinez
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-5864
itzel.godinez@navy.mil

PROJECT NO. 541

Utility Vault Water Treatment

A Better Way to Dewater Utility Vaults

All Navy shoreside facilities have a system of underground vaults which provide access to utility systems. These vaults accumulate rainwater and groundwater, which can be contaminated through surface runoff, or through contact with lubricants, oils and rust within the vaults themselves. The accumulated water in these tunnels must be removed if it interferes with maintenance work, and occasionally, to prevent discharge to surrounding waters. Under the NPDES program, this contaminated water is subject to the facility's permit, which requires the installations to generate and comply with a Pollution Prevention (P2) plan. Naval Base Coronado's (NBC) P2 plan includes measures to route pumps and hoses to the local sewer service for manual dewatering, requiring extensive labor and logistical support to set up. Dewatering a utility vault and discharging the accumulated water to the sanitary sewer requires the use of a network of portable pumps or a vacuum truck, resulting in delays when this equipment is not readily available.

2016 New Starts (continued)

A typical utility vault onboard a Navy installation.

This project, Utility Vault Water Treatment, will demonstrate a Hydrocarbon and Contaminants Removal (HCOR) device which has been developed specifically for utility vault dewatering. The HCOR is a compact filter installed on the outflow of the vault's sump pump prior to discharge. The HCOR device utilizes fine-grain media for hydrocarbon and suspended solids removal. While much of the total contamination will be removed through this filtration media, more robust, chemically reactive measures will be added to reduce the fraction of dissolved metals even more. Additionally, other metal-specific adsorbents will be evaluated for suitability as a finishing or "polishing" step in this process. The combination of these technologies can ultimately prolong the life of the ion exchange media, and meet increasingly stringent discharge requirements.

The demonstration will include the evaluation of the HCOR filtration device along with polishing steps during normal dewatering of the utility vaults located at NBC. This demonstration will include appropriate sampling and analysis to determine the improvement in effluent quality resulting from the use of the following:

1. The stock HCOR device on its own.
2. The HCOR device with the addition of enhanced metals removal.
3. The HCOR device coupled with adsorbent media as an alternative solution to remove metals.

The HCOR device has been developed specifically for utility vault dewatering.

Once these technologies have been evaluated, the most cost-effective option that meets discharge criteria will be made available to Navy sites, along with full operating instructions.

Principal Investigator:
Pat Morrow
Naval Surface Warfare Center, Carderock Division
301-227-5176
patrick.r.morrow@navy.mil

PROJECT NO. 542

Naval Air Systems Command Solutions for Engine Washing

Rethinking Aircraft Engine Washing: There IS a Better Way

Naval Air Systems Command (NAVAIR) maintenance operations require engine washing as a routine part of scheduled maintenance. Current engine washing procedures require the use of a gas path cleaner, which requires thorough rinsing. Occasionally, the rinsing process is insufficient, and dried residual cleaning solution remains in and on the engine. This attracts dirt and contaminants, and can lead to bearing pitting/corrosion, and water migration into the oil—all of which require subsequent maintenance.

The EcoPower system produces better results, in less time, with greater efficiency, without the associated hazardous waste disposal issues.

The equipment and processes used at Fleet Readiness Centers (FRC), Naval Air Stations, and other maintenance facilities lead to excessive amounts of water usage and insufficient cleaning. In addition, these systems use osmosis water purifiers in combination with mixed bed deionizers. Workers—particularly outside the U.S.—often do not have access to water of sufficient quality; instead using locally available potable water, which rarely meets requirements. Without deionized water, engine washing quality is compromised. Inefficient engine washing operations potentially lead to hazardous waste generation and greater hazardous air pollutant emissions due to excess fuel burning and excess fuel consumption.

This project, Naval Air Systems Command Solutions for Engine Washing, plans to demonstrate EcoPower™—a cleaning technology that uses heated, deionized, atomized water along with custom manifolds for specific aircraft/engine types to clean the engine. EcoPower is used extensively worldwide in the commercial aviation industry.

This technology works by delivering high-pressure water through a manifold in a droplet size tailored to the engine type. The system deionizes the input water, so any fresh water source is acceptable. At the end of the cleaning process, the effluent is captured, recycled, and cleaned of metal contaminants in a nearly closed-loop system. Recycled water can be analyzed and monitored for contamination buildup to determine when it should be disposed.

Detergent is not required for this system, thus eliminating the challenges associated with detergent buildup, as well as purchasing costs and handling/storage concerns. Additionally, the proposed technology takes about 40 to

This NESDI project is demonstrating a new engine washing procedure for use across NAVAIR. Shown here is an H-53 helicopter engine wash demonstration with the EcoPower small wash unit and effluent collecting kit in place.

(Photo Credit: David Marriott)

2016 New Starts (continued)

60 minutes per aircraft to complete, as opposed to roughly 4–8 hours per aircraft for the current procedure.

In short, the EcoPower system produces better results, in less time, with greater efficiency, without the associated hazardous waste disposal issues and no need for a deionized water supply. The initial phase of this project involves customizing the system for various aircraft platforms including the V-22 Osprey tiltrotor aircraft, H-53 Sea Stallion helicopter, AV-8 Harrier vertical/short takeoff and landing jet aircraft, P-8 Poseidon military patrol aircraft and C-130 Hercules military transport aircraft. This will be followed by demonstration, performance testing (including an estimation of the hazardous material and hazardous waste handling costs), industrial validation and integration into existing operations.

After successful execution at land-based activities, additional demonstrations will be conducted in a shipboard environment. Then, the appropriate technical maintenance manuals including the Cleaning and Corrosion Control Manual (NAVAIR 01-1A-509) and the Maintenance Instructions (Organizational and Intermediate Level) Support Equipment Cleaning, Preservation, and Corrosion Control Manual (NAVAIR 17-1-125) will be revised.

Principal Investigators:
Keiko Sapp
Fleet Readiness Center East
252-464-5259
keiko.sapp@navy.mil

Kami Downey
Fleet Readiness Center Southeast
904-790-6395
kami.downey@navy.mil

PROJECT NO. 543

Preventative Management of Contaminated Silt

A Common Sense Solution to Shipyard Silt Contamination

Sediment contamination in the waterways surrounding Navy facilities may require costly cleanup efforts and operational disruption. Sediment containing contaminants may be found in drydock discharge and process streams. Once this sediment is introduced into the process stream—through the intake of seawater during docking operations—it is managed through cleaning efforts requiring extensive labor and potential delays to industrial work on the ship in dock. Current methods of managing contaminated sediment before reaching the drydock in surrounding waterways are limited to techniques such as dredging and capping, which are expensive and can be operationally and environmentally disruptive.

These clarifiers can be inserted in the traps to capture and retain sediment during drydock flooding and dewatering.

This project, Preventative Management of Contaminated Silt, will demonstrate passive sediment collection and dewatering devices that will trap contaminated sediment before it is deposited on the drydock floor, thereby reducing the contaminant waste stream as well as the time and effort needed for drydock cleaning. The devices will be demonstrated at the Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS & IMF).

The devices chosen for demonstration are clarifying inserts which can be placed into the existing sand traps to capture and retain

Cleaning underway at a Navy drydock.

sediment during drydock flooding and dewatering. A sloped or conical bottom shape coupled with piping connections will allow the inserts to be quickly and effectively flushed out for removal and disposal of silt.

Part two of this demonstration will be the collection of sediment from the area of accumulation outside the drydock apron. This process will precede drydock flooding, reducing the amount of silt that would otherwise flow into the dock when the caisson is removed. Following an initial feasibility study and proof of concept testing, it is expected that this will be accomplished through targeted high solids pumping and recovery devices similar to those used in dredging, but on a much smaller scale.

These two targeted methods of sediment retention bridge the gap between disruptive, expensive, large-scale dredging and capping projects and the time-consuming, inefficient ground crew cleanup that occurs between docking completion and commencement of industrial work.

Once a successful design of the dewatering and sediment removal equipment is demonstrated, additional facilities and additional drydocks at PSNS & IMF will be addressed. The design will allow for the customization of equipment needed for each PSNS & IMF drydock and other Navy drydocks.

Principal Investigator:
Pat Morrow
Naval Surface Warfare Center,
Carderock Division
301-227-5176
patrick.r.morrow@navy.mil

2016 New Starts (continued)

PROJECT NO. 544

Stable-Isotope Labeled Tracers, an Innovative Way to Validate Natural Attenuation of RDX in Groundwater

Tracing RDX to Support Natural Attenuation

The Navy has multiple sites impacted by munitions explosives contamination. Acceptable limits of RDX (cyclotrimethylene-trinitramine)—the main contaminant of concern—are very low, making site closure difficult to attain when sites have to meet strict cleanup goals. Many Navy installations with RDX groundwater have active remedies in place, such as pump and treat systems, to mitigate any risks associated with these plumes. Active remediation systems tend to have high operating and maintenance costs, and the persistence of RDX tends to limit their overall effectiveness. Often, sites rely on natural attenuation processes to achieve the site-specific remediation goals; however, it is difficult to demonstrate that natural attenuation really is occurring and at what rate.

This project, Using Stable-Isotope Labeled Tracers to Validate Natural Attenuation of RDX in Groundwater, will conduct a field demonstration based on a technology developed under the Strategic Environmental Research and Development Program. This approach uses a stable isotope method for tracking RDX in situ to validate that natural attenuation is occurring and at what rates.

Small natural variations in the composition of isotopes (atoms with small but detectable variations in mass) have proven useful for examining contaminant sources, transport and processing, particularly in groundwater environments for a variety of contaminants. However, because natural variations in isotopes are small and can arise for several reasons, this method can be an ambiguous tool to attribute sources or calculate transformation rates. In contrast to relying on natural variations in isotopic enrichment, adding an isotope to a contaminant (known

The proposed demonstration site at Naval Base Kitsap Bangor.

as isotope labelling) provides clear source tracking. This technique can uniquely identify the products of RDX degradation, whether they are organic derivatives or true products of complete mineralization—the latter constituting natural attenuation.

This technique can uniquely identify the products of RDX degradation.

This project team will introduce a stable isotope-labeled contaminant (RDX) into an existing RDX plume to trace the fate of the parent RDX in the environment.

The demonstration is proposed to take place at Naval Base Kitsap Bangor. The well-established "push-pull" technique will be used to introduce stable isotope-labeled ^{15}N-RDX into the RDX plume. The plume will be monitored for production of RDX mineralization products containing the ^{15}N tracer. Natural attenuation rates will then be calculated from these measurements. This demonstration will provide substantial data that can be utilized to transition sites from active to passive remediation with regulator acceptance.

The project's final report will be distributed to Remedial Project Managers for those sites impacted by RDX. Results of the project will also be discussed with relevant working groups and presented at major conferences.

Principal Investigator:
Jennifer Segura
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1793
jennifer.segura@navy.mil

PROJECT NO. 545

In Situ Treatment of 1,4-Dioxane Using Enhanced Biodegradation

Enhanced Biodegradation: A Solution to 1,4-dioxane Contamination?

The Department of Defense has over 100 sites with measureable concentrations of 1,4-dioxane in their groundwater, and many of these have high enough concentrations to require treatment. Although a number of potential remedies have been examined, these all tend to be either prohibitively expensive or ineffective, and the Navy does not have a cost-effective solution that can be implemented immediately.

Propane is injected into the saturated zone to increase the biological activity of the indigenous microorganisms.

The objective of this project, In Situ Treatment of 1,4-dioxane Using Enhanced Biodegradation, is to demonstrate a new, cost-effective treatment method for reducing or removing concentrations of 1,4-dioxane from groundwater at Navy sites.

Enhanced in situ aerobic bioremediation is the process of stimulating indigenous oxygen-dependent microorganisms to degrade contaminants in groundwater and in the aquifer matrix. Bacteria with the capacity to biodegrade 1,4-dioxane are augmented with auxiliary substrates to induce the required enzymes and support co-metabolic degradation.

Preliminary studies have revealed propane biosparging to be effective for bioremediation of 1,4-dioxane. Biosparging technology uses indigenous microorganisms to biodegrade organic constituents. In this process, propane

2016 New Starts (continued)

is injected into the saturated zone to increase the biological activity of the indigenous microorganisms. If necessary, oxygen and nutrients are also injected to make for ideal conditions for biodegradation.

This project team plans to leverage the results of treatability studies conducted at Rice University in a separate project sponsored by the Naval Facilities Engineering Command. The most promising bacteria strains identified in these studies will be fermented and characterized by their suitability for production scale-up.

The project will then move into the pilot test phase. The design of the pilot test will be tailored to meet the characteristics of the selected test site. The general structure of the pilot test will involve the injection of an amendment solution consisting of a tracer plus a co-metabolic substrate into a well or wells. At a nearby well(s), an amendment solution consisting of a tracer, co-metabolic substrate and a bioaugmentation culture will be injected. Consequently, this design will provide data to compare biostimulation with bioaugmentation. Post-injection monitoring will occur periodically through a series of groundwater extractions from test well(s).

Real-time multi-level monitoring of remedial amendment injection. (Photo Credit: GSI Environmental, Inc.)

The success of the demonstration will be tied to decreasing concentrations of 1,4-dioxane, and the transformation capacity and rates which will help determine the feasibility of designing a full-scale in situ biostimulation system.

Principal Investigator:
Anthony Danko
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-4805
anthony.danko@navy.mil

PROJECT NO. 546

National Pollutant Discharge Elimination System (NPDES) Copper Effluent Control System

The Navy Copper Analyzer: A New & Improved Weapon for Maintaining Compliance

Over the past several years, regulatory levels for copper in stormwater runoff have become more stringent across the country. Meeting these requirements is particularly problematic at Navy shipyards and drydocks where multiple point and non-point sources of copper exist. In addition, effluent levels vary temporally, and are especially sensitive to rain events, which triple effluent concentrations. NPDES program-regulated copper concentrations are based on total copper, which includes all forms (dissolved and bound). Most copper in runoff is in the form of the bound or particulate forms, which are less bioavailable and less toxic than the aqueous (dissolved) form. Conversion of the more toxic forms of copper to the less toxic forms can be environmentally protec-

tive, but its regulatory utility has not yet been adopted in some Navy locations.

The ability to measure all forms of copper and demonstrate how much of the metal is bioavailable will aid with analysis of NPDES levels.

As each shipyard has its own unique conditions, no single treatment technology will be able to cost effectively clean all shipyard and drydock effluents. This project, NPDES Copper Effluent Control System, plans to demonstrate an automated approach to selecting appropriate technologies and monitoring their effectiveness.

The Navy Copper Analyzer (NCA) is the latest generation of automated real-time copper analyzers developed at the Space and Naval Warfare Systems Center Pacific and demonstrated under the NESDI program and the Environmental Security Technology Certification Program. The NCA is the only instrument capable of measuring all three forms of copper (whole, dissolved and bound) in effluents, in situ and in near real-time at environmentally-relevant concentrations.

The NCA is the only instrument capable of measuring all three forms of copper (whole, dissolved and bound) in effluents, in situ, in near real-time.

This precise real-time control system is also capable of diverting copper-laden runoff to the appropriate coordinated treatment systems, without impeding the flow of effluents that are in compliance with regulations. This would result in a significant reduction in treatment technology footprint, and operational cost savings versus treating all effluent with a single technology. This system will also be capable of measuring and controlling the diversion of stormwater, cooling water, or wastewater in drydocks, treatment plants, or receiving waters.

The Navy Copper Analyzer. (Photo Credit: Mike Putnam)

The NCA will be laboratory tested and field tested at Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility, where the regulatory level is many times lower than current discharge levels. Grab samples will be collected and measured using approved EPA methods. These results will be compared with the field readings of the NCA.

Principal Investigator:
Iryna Dzieciuch
Space and Naval Warfare Systems Center Pacific
619-553-2793
iryna.dzieciuch@navy.mil

2016 New Starts (continued)

PROJECT NO. 547

Demonstration of Improved Toxicity Methodology to Link Stormwater Discharges to Receiving Water Impacts at Navy Sites

Moving Away from End-of-pipe Monitoring

The Navy is required to comply with increasingly stringent water quality requirements associated with industrial stormwater discharges. These requirements generally specify end-of-pipe monitoring. However, this type of monitoring—measuring contaminants at the outfall point—is problematic because the exposure conditions at the end-of-pipe are not static. Also, this type of monitoring does not account for the changing magnitude and extent of exposure when contaminants mix in the larger body of water.

The use of pulsed (intermittent) toxicity exposures has been documented in several studies as an effective way to characterize toxicity in water bodies.

One commonly used test method, Whole Effluent Toxicity (WET) testing, was developed to provide a better picture of continuous point source discharges by taking into account factors such as contaminant bioavailability, and some of the complex effects associated with exposure to multiple contaminants, many of which may not be monitored. However, WET methodologies still assume continuous discharges, likely overestimating the toxicity associated with the infrequent and episodic nature of stormwater discharges.

This project, Demonstration of Improved Toxicity Methodology for Stormwater Discharges, plans to identify a more environmentally relevant approach to assessing stormwater toxicity by taking into account actual exposure conditions both at the end-of-pipe and in the receiving water.

The use of pulsed (intermittent) toxicity exposures has been documented in several studies as an effective way to characterize toxicity in water bodies, in part because pulsed exposures are more characteristic of real-world conditions.

The team will leverage work already sponsored by the NESDI program and others to gather historical data on rainfall and mixing zone dynamics at several Department of Defense facilities. These data, and the results of other pulsed toxicity studies, will be used to conduct laboratory testing using relevant contaminants of concern and permit-relevant species.

Concurrent end-of-pipe monitoring and in situ water body monitoring will then be initiated, using passive Sediment Ecotoxicity Assessment (SEA) ring samplers. Using the data gathered in the first two steps as a guide, exposures will be varied by time and concentration. The goal is to paint a more accurate, scientifically defensible picture of real-world stormwater discharges and their impact on the water body.

At the end of the project, a user's guide will be produced for permit writers and Navy water quality managers. The development of a final report will also be coordinated with the San Diego Regional Water Quality Control Board to seek regulator acceptance of the technology.

Principal Investigator:
Marienne Colvin
Space and Naval Warfare Systems Center Pacific
619-553-2788
marienne.colvin@navy.mil

Stormwater discharge at the onset of a rain event (top) and less than 24 hours later (bottom) showing episodic nature of events at end-of-pipe and in the receiving environment. This NESDI project will demonstrate and validate a more accurate exposure design for laboratory toxicity testing to support improved stormwater discharge monitoring at this and many other outfalls on Navy installations.

(Photo Credit: Chris Stransky)

2016 New Starts (continued)

PROJECT NO. 548

Sewer Gas Elimination Technology

Noxious Gases in the Sewer: Getting to the Root of the Problem

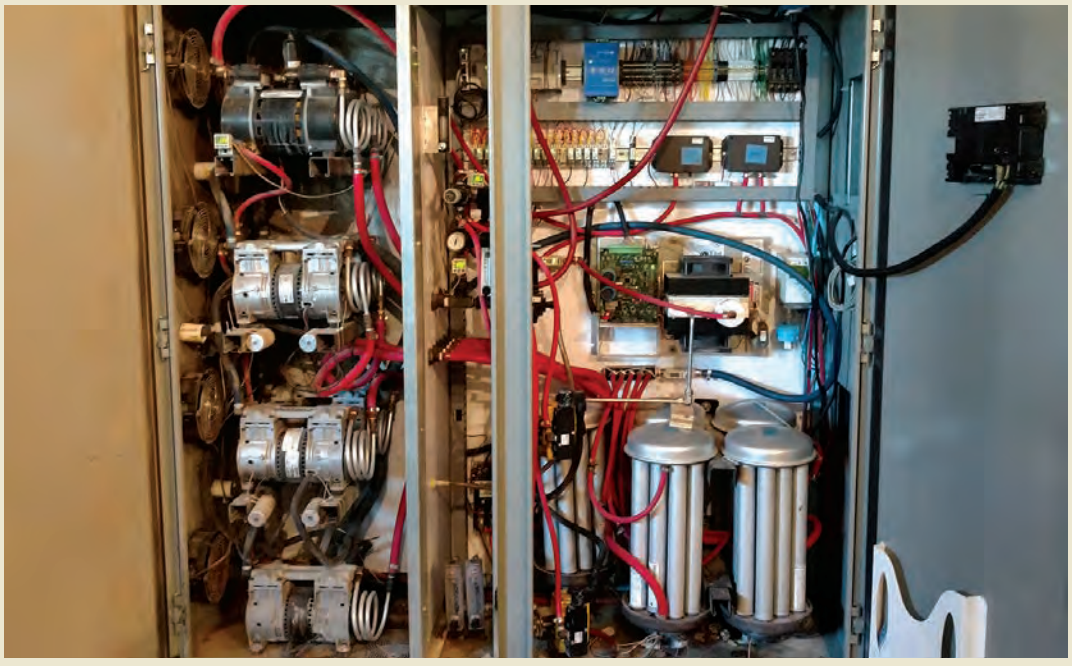
The wastewater infrastructures at many Navy installations have been beset with sewer gas problems for decades without an effective remedy. Sewer gas often contains hydrogen sulfide (H_2S), methane, and other noxious gases. H_2S can cause corrosion of concrete sewers and pump station infrastructure, and can be lethal to humans at concentrations ranging from 100 to 500 parts per million (ppm).

This project, Sewer Gas Elimination Technology, plans to demonstrate ozone injection technology as a way to mitigate the generation and release of noxious and toxic gases in sanitary sewers.

H_2S is generated when sulfates are converted to sulfides by sulfate-reducing bacteria. Sulfates are universally present in stormwater and water rich in decaying matter, such as wastewater. Under the anaerobic conditions prevalent in sewer systems, sulfate-reducing bacteria, and therefore, H_2S, can thrive. The low-flow velocities found in many sewer systems allow the settling of organic matter, and this can cause anaerobic conditions and exacerbate the growth of this bacteria.

The low-flow velocities found in many sewer systems can exacerbate the growth of this bacteria.

Additionally, the intermittent operation of pumps in pump stations results in the generation of high levels of H_2S gas. This gas may escape the system via manholes, drains, or malfunctioning sewer traps. This presents nuisance odor conditions, and health and safety risks, requiring increased expenditures for sewer infrastructure rehabilitation. Further, dissolved sulfides produced by bacterial reduction of sulfates present in wastewater



The oxygen and ozone generator. (Photo Credit: Alex Mathews)

can exceed local dissolved sulfide discharge limits, triggering permit violations.

Ozone inhibits the growth of sulfate-reducing bacteria, and thereby limits the generation of associated noxious gases. Ozone can be safely and simply generated from ambient air, providing an effective option that is more sustainable than conventional sewer gas elimination strategies.

Team members will demonstrate an ozone injection system at Naval Air Station Coronado. After a six month monitoring period to establish baseline conditions and quantify the extent of the problems, the team will dissolve ozone in water and apply it as a solution into the sewer. Gas levels will be monitored regularly, and the results of the demonstration will be compared with previous nitrate and ferrous salt injection demonstrations to develop a comprehensive method for the elimination or drastic reduction in emission of H_2S and other gases from sewers.

During project planning, the team will coordinate with the City of San Diego to gain acceptance of the technologies to be tested during this project. During the demonstration, the team will also invite interested parties from the Naval Facilities Engineering Command Southwest to the demonstration site for an overview off the technologies. The team also plans to work with end users via regional offices, and participate in Media Field Team meetings.

Principal Investigator:
Steven Fann
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1016
steven.fann@navy.mil

PROJECT NO. 549

Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents for Immersion Chemical Depainting

Seeking a New NMP-free Solvent for Immersion Chemical Depainting

All of the products currently qualified per the MIL-PRF-83936 specification (Remover, Paint, Tank Type, for Aircraft Wheels, Landing Gear Components, and Other Aircraft) contain n-Methyl-2-pyrrolidone (NMP), which is classified as a reprotoxin, due to its detrimental effects on the reproductive system. NMP is a reportable constituent on the Toxic Release Inventory. It is also regulated as a chemical under the California Office of Environmental Health Hazard Assessment and as a European Chemicals Agency Substance of Very High Concern. An alternative non-NMP paint remover is needed.

Efforts are underway through the Defense Logistics Agency's Hazard Minimization and Green Products Program to revise the specification and to perform an initial demonstration of alternative, non-NMP materials to demon-

The D-Zolve product without an oil seal, with a 200 milliliter (mL) oil seal, and with a 400 mL oil seal.

(Photo Credit: Joseph Santa Maria)

2016 New Starts (continued)

strate acceptable performance. One product (D-Zolve 1533 IM), showed promise in early trials, but raised several concerns: the product evaporated rapidly, was easily removed from the component part and emitted a strong odor. Through leveraged work with the Aircraft Equipment Reliability and Maintainability Improvement Program, the formulation is being optimized for the field application to correct these issues. The reformulated product will also enable the stripping bath temperature to be increased to improve stripping efficiency. Currently, the product is limited to operation at 120 to 125 degrees Fahrenheit because higher temperatures affect additional evaporative losses.

If the reformulated product is suitable, this project, Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents, will begin with a full demonstration/validation at a Fleet Readiness Center (FRC) to validate its performance and ensure its compatibility with existing infrastructure.

The reformulated product will also enable the stripping bath temperature to be increased to improve stripping efficiency.

Before the demonstration/validation can take place, the project team will perform coupon tests utilizing small squares or "coupons" of different substrates and various finish systems. The new formula will be compared to a control product that is currently qualified to MIL-PRF-83936. The product will be tested for paint removal performance, corrosion, strip rate, paint adhesion and hydrogen embrittlement. After the coupon testing, scale-up testing will take place at FRC Southeast to demonstrate and validate the new product for stability and maintainability, to establish process controls for quality improvement and to develop engineering documentation.

The non-NMP product will likely be a drop-in replacement for current products because the evaporation retardant will not likely affect the products' properties. In fiscal year 2018, the plan is to revise the applicable technical manuals, Local Process Specifications, general series manuals and/or Naval Air Systems Command authorization letters in accordance with the new specification qualifications to prescribe the use of the new chemical at other facilities.

Principal Investigator:
Joseph Santa Maria
Fleet Readiness Center Southeast
904-790-6393
joseph.santamaria@navy.mil

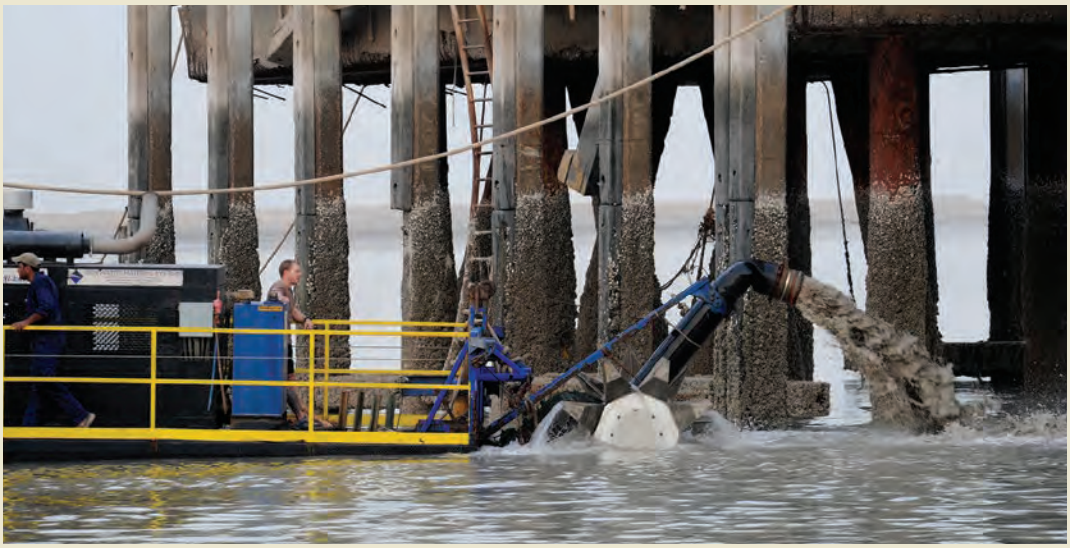
PROJECT NO. 550

A Comprehensive Analysis and Strategy for Contaminated Sediment Management

Seeking Technical Insights into Sediment Remediation

Contaminated sediment management is broadly estimated to be a one billion dollar problem for the Navy. The actual cost of managing these sites could be even higher, since costs often grow as a site progresses from feasibility study to Record of Decision (ROD) to remedy design, to implementation. A systematic review of how and why these costs grow is needed.

This project, A Comprehensive Analysis and Strategy for Contaminated Sediment Management, will prepare an Initiation



Dredging is one major contributor to the Navy's contaminated sediment management challenges.

(Photo Credit: Mass Communication Specialist 1st Class Peter D. Lawlor)

Decision Report (IDR) to guide investments in the sediment remediation area.

At most remediation sites, the understanding and tools for determining the nature and extent of the contamination, the limitations of existing characterization tools and the shortcomings of current remediation and performance monitoring technologies are still evolving, as is understanding of regulatory/stakeholder expectations. Therefore, decision making often occurs at every stage based on incomplete information.

Decision making often occurs at every stage based on incomplete information.

The IDR will provide technical insights into and analysis of the sediment marketplace, identifying information gaps and limiting factors, such as Navy or regulatory policies. The report will indicate where sediment research, development, test and evaluation investments should be made to fill these gaps, and which technologies are ready for demonstration/validation today.

The project team will gather broad input from Remedial Project Managers in the Navy as well as non-Navy stakeholders (including the EPA, Army Corps of Engineers, individual states and others). Recent remedial investigations, feasibility studies, and RODs will be examined to identify end user-driven research needs for possible future NESDI investments.

The IDR will be disseminated through multiple technology mechanisms. Discussion of IDR results will also be presented to the Naval Facilities Engineering Command's Contaminated Sediment Workgroup and Alternative Restoration Technology Team. The report may also be incorporated into additional training seminars.

Principal Investigator:
Joey Trotsky
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1258
joey.trotsky@navy.mil

2016 New Starts (continued)

PROJECT NO. 551

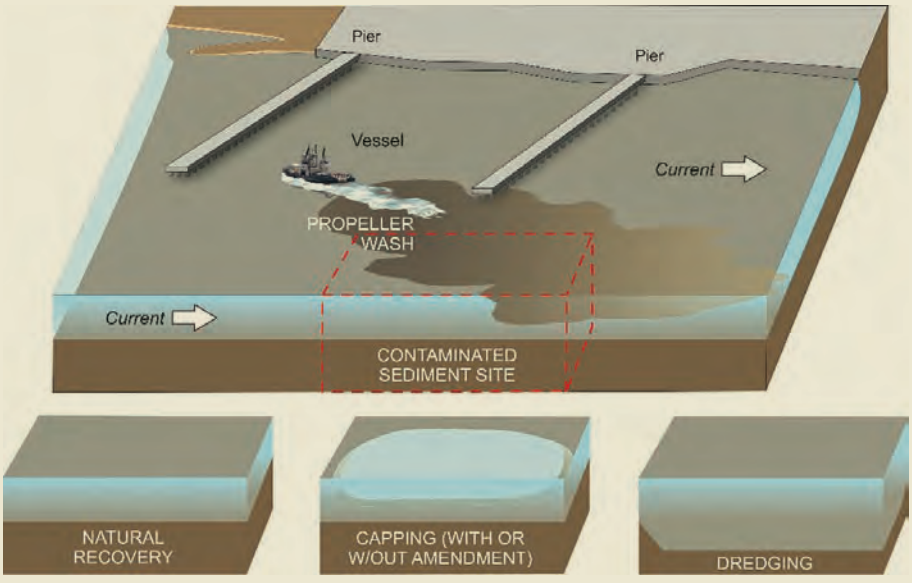
Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation Options

Sediment Remediation & its Real World Effects

While there has been significant progress toward both the identification and remediation of contaminated sediments at Department of Defense (DoD) harbors and waterways, there is a lack of understanding and public confidence on the effectiveness and permanence of these actions. Short-term remedial actions such as removal, and long-term actions such as capping and monitored natural recovery may be affected by site conditions such as propeller wash and wave action. This project, Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation, was formed to provide more information regarding the effectiveness of various sediment remediation methodologies under real world stressors.

Long-term actions such as capping and monitored natural recovery may be affected by site conditions such as propeller wash and wave action.

Sediment dynamics in harbors and shore regions are complex. The potential for resuspension of contaminated and remediated sediments, remigration of these suspended sediments to other areas, and recontamination of remediated areas by particles generated from other ongoing sources, complicate the performance of remedial actions. Under this project, a rigorous study will be conducted at Naval Base San Diego (NBSD) to examine the effect of sediment resuspension dynamics by propeller wash and shore sediment dynamics (wave action) on short- and long-term remedial options.



Propeller wash impact model. Processes include resuspension of contaminated sediment, near field mixing and re-deposition, far-field transport and re-deposition, and washing (with a portion of the sediment mass washed out of the harbor).

This NESDI project will examine the effect of sediment resuspension dynamics by propeller wash and shore sediment dynamics (wave action) on remedial options.

Issues covered will address how propeller wash may affect the stability and effectiveness of each remediation technique and how propeller wash and shore sediment dynamics may affect water quality and sediment recontamination.

Two protocols will be developed and demonstrated: one for the evaluation of the effect of resuspension events, the other for the evaluation of recontamination potential.

The protocols are based on data specific for the study site, for which numerical models have been previously validated. Existing estimates of daily tugboat activity at NBSD will be used to characterize and quantify resuspension by propeller wash. These data, in conjunction with baseline sediment chemical characteristics and calculations from the previously developed models, will help to determine the impact of propeller wash on each of the three sediment remediation options, including natural recovery, capping and dredging.

The knowledge and modeling tools to be developed will also be applied for intertidal shallow shoreline areas, where remediated sediment undergoes persistent and repetitive resuspension, migration and redeposition processes.

This project also leverages ongoing work sponsored by the Environmental Security Technology Certification Program and the Strategic Environmental Research and Development Program.

At the end of the project, the team will develop a report to help Navy Remedial Project Managers design and select remediation options for contaminated sediment sites where propeller wash and other factors may be an issue.

Principal Investigator:
Pei-fang Wang
Space and Naval Warfare Systems Center Pacific
619-553-9192
pei-fang.wang@navy.mil

Integrate Solutions

Support from End Users & Technical Authorities

4

INTEGRATE SOLUTIONS

Fleet-Transitioned Projects

TIMEFRAME: Ongoing

Process Overview

Throughout the project lifecycle, program personnel concentrate on moving the demonstrated technologies and other solutions out of the laboratories and demonstration sites and into the appropriate operational environment. During this fourth and final phase of the NESDI program process, the TDWG, Principal Investigators and technology integration specialists (for NAVFAC-led projects) work together to ensure that various solutions are successfully integrated into Fleet operations and weapons system acquisition programs and verify that the solutions provide the anticipated benefits.

2016 Project Closeouts

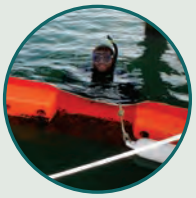
Principal Investigators for eight NESDI projects completed their work in FY16 by documenting the results of their efforts and alerting the appropriate members of the Navy environmental community of those results. Principal Investigators also posted their final reports and other project documentation on the appropriate websites (including the NESDI website) to promote the awareness and leveraging of their work. The projects listed and highlighted below were completed in FY16:

1. Project no. 440: Surface Cleaning of Drydock Floors

2. Project no. 466: Separation, Detection and Removal of MEC/UXO from Dredged Material Using Physical Separation Methods

3. Project no. 475: Portable Treatment for Ship Material Removal Processes

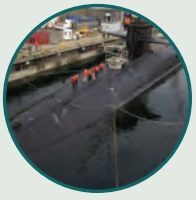
4. Project no. 485: Demonstrate/Validate Alternatives to Methylene Chloride-based Chemical Paint Strippers



5. Project no. 489: Oil Boom Biofouling Control by Mechanical Intervention and Material Technologies

6. Project no. 498: Emissions Capture Technology for Oxy-Fuel Hull Cutting Operations

7. Project no. 502: Biofouling Reduction of Ship Cooling Water Systems



8. Project no. 513: Design of Closed-Loop Cooling Water System to Accommodate Ship Cooling Water Needs

Highlights of these projects can be found on the following pages.

Integrate Solutions

2016 Project Closeouts

PROJECT NO. 440

Surface Cleaning of Drydock Floors

PRINCIPAL INVESTIGATOR:
JIM HOWELL

This project developed a shipyard-specific cleaning vehicle for removing hazardous wastes from drydock floors. Fabrication of a shipyard-specific cleaning vehicle was completed in FY16, and is expected to be delivered to the Naval Surface Warfare Center Carderock in early 2017. The lessons learned from this effort (regarding vehicle specifications and operating environment) have been applied to another ongoing NESDI project, Drydock Sediment Management (project no. 503).

The prototype cleaning vehicle.

(Photo Credit: Jim Howell)

PROJECT NO. 466

Separation, Detection and Removal of MEC/UXO from Dredged Material Using Physical Separation Methods

PRINCIPAL INVESTIGATOR:
JOHN KORNUC

Using mechanical screens, this team successfully demonstrated a pilot-scale process to detect and remove munitions of explosive concern (MEC) and unexploded ordnance from freshly dredged material prior to placement in a confined disposal facility. The next step is to develop and demonstrate a large scale system capable of processing 200 cubic yards an hour (similar to a commercial mining set-up).

Dewatered excavated dredged material being screened for MEC. (Photo Credit: Fred Goetz)

PROJECT NO. 475

Portable Treatment for Ship Material Removal Processes

PRINCIPAL INVESTIGATOR:
JIM HOWELL

This project team demonstrated a mobile system that recovers and treats the waste stream generated during ultra-high pressure (UHP) water blasting of vessels when in drydock. The system is installed at Puget Sound Naval Shipyard with final system hookup and verification scheduled before the end of 2016.

First stage testing of the Advanced Hull Cleaning System.

PROJECT NO. 485

Demonstrate/Validate Alternatives to Methylene Chloride-based Chemical Paint Strippers

PRINCIPAL INVESTIGATOR:
LUC DOAN

This project successfully demonstrated a non-methylene chloride alternative for MIL-R-81294 thixotropic paint stripping (remover, paint, epoxy, polysulfide, and polyurethane systems). This product is a drop-in replacement with no regulatory issues, and it reduces volatile organic compounds, hazardous air pollutants, hazardous waste disposal, material procurement and labor costs. The military specification was revised and the product has been implemented at Fleet Readiness Centers. It is also expected to transition to Aircraft Intermediate Maintenance Detachments and aircraft and helicopter squadrons.

Non-methylene chloride based chemical paint remover used on fiberglass. (Photo Credit: Luc Doan)

2016 Project Closeouts (continued)

PROJECT NO. 489

Oil Boom Biofouling Control by Mechanical Intervention and Material Technologies

PRINCIPAL INVESTIGATOR:
MATT NAIMAN

The objective of this project was to devise an environmentally friendly coating for oil booms that would cut cleaning and maintenance time in half and extend boom life. The team demonstrated a commercial-off-the-shelf boom with a nontoxic coating that significantly reduced biofouling. However, the boom did not meet tensile strength specifications, and the cost of the new boom was too high (estimated at four to five times the current boom). Naval Surface Warfare Center Carderock has submitted a proposal to the Office of Naval Research for a project that will address the basic materials issues identified by this project.

Boom segments as deployed prior to cleaning at Port Canaveral. (Photo Credit: Abe Stephens)

PROJECT NO. 498

Emissions Capture Technology for Oxy-Fuel Hull Cutting Operations

PRINCIPAL INVESTIGATOR:
JIM HOWELL

To address the issue of visible emissions created during ship dismantling, this team developed and demonstrated an enclosure/containment shroud that safely captures these emissions and deflects molten slag stream to the drydock floor. Final bench scale system testing was completed and a final report is being prepared.

The prototype capture system. (Photo Credit: Jim Howell)

PROJECT NO. 502

Biofouling Reduction of Ship Cooling Water Systems

PRINCIPAL INVESTIGATOR:
SONNY MAGA

This team investigated an innovative new iodine infusion technology as a means to significantly reduce the fouling rate and microbial corrosion (also called microbiologically influenced corrosion) within a shipboard water system during pier-side maintenance. After small-scale testing, it was determined that this technology was not effective at minimizing biofouling in cooling water systems.

During pier side maintenance, shipboard water systems are at risk for biofouling and corrosion

(Photo Credit: Journalist Seaman Joseph Caballero)

PROJECT NO. 513

Design of Closed-Loop Cooling Water System to Accommodate Ship Cooling Water Needs

PRINCIPAL INVESTIGATOR:
SONNY MAGA

When a ship enters drydock for maintenance or repair, it discharges millions of gallons of cooling water per day. In an effort to address the multiple challenges presented by this issue, this team produced an Initiation Decision Report, which concluded that a closed loop system is feasible. The final report, currently in draft form, will provide the Navy with a comprehensive strategy to guide investments and compliance decisions on these issues.

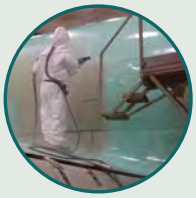
When a ship or submarine enters drydock for maintenance, cooling water continues to pass through its systems, which can result in millions of gallons of discharge water per day.

(Photo Credit: Brian Nokell)

Integrate Solutions

2016 Project Accomplishments

The following 11 NESDI projects were particularly successful in FY16:



1. Project no. 458: Advanced Non-Chromate Primers and Coatings

2. Project no. 470: Cyanide Waste Reduction of Electroplating and Stripping Processes

3. Project no. 474: Toxicity Associated with Polycyclic Aromatic Hydrocarbons Used in Clay Targets

4. Project no. 492: Capacitive Deionization Water Treatment System

5. Project no. 497: Evaluation of Low Impact Development Implementation

6. Project no. 499: Aerobic Bioaugmentation for Remediation of RDX-Contaminated Groundwater

7. Project no. 503: Drydock Sediment Management

8. Project no. 508: Multi-Sensor Weapons Impact Detection and Location System

9. Project no. 509: Enterprise Naval Facilities Engineering Command Hazardous Waste Application

10. Project no. 512: Investigation of Improved Epi-seal Materials for Use in General Purpose Bombs

11. Project no. 516: Automated Monitor to Determine the Opacity of Fugitive Emissions

These notable successes are highlighted on the following pages.

2016 Project Accomplishments

PROJECT NO. 458

Advanced Non-Chromate Primers and Coatings

PRINCIPAL INVESTIGATOR:
JULIA RUSSELL

This project identified and tested non-chromate primers for use in the marine environment. Type I primer (for use on gloss paint schemes) has been fully implemented at Naval Air Station (NAS) Kingsville, NAS Meridian and the Fleet Readiness Center Southeast. A Naval Air Systems Command authorization letter has been signed for Type I primer. Testing the Type II primer (for low infrared reflective pigments) is in progress, as additional aircraft need to log more service hours.

Additionally, a joint test report was drafted for a leveraged ESTCP demonstration project across the services. Eliminating hexavalent chrome from the waste stream has the potential to achieve significant cost savings from hazardous waste disposal and personnel monitoring.

Painter working on a P-3 Orion aircraft.

(Photo Credit: Naval Air Station Jacksonville)

PROJECT NO. 470

Cyanide Waste Reduction of Electroplating and Stripping Processes

PRINCIPAL INVESTIGATOR:
KAMI DOWNEY

This project devised non-cyanide silver electroplating and strip processes to remove cyanide from the waste stream. These processes have been implemented at the Fleet Readiness Center Southeast and Norfolk Naval Shipyard. The elimination of cyanide from the waste stream improves safety, and has resulted in a cost savings of approximately $1,200 per month. The process is a candidate for future transition to the Fleet Readiness Center East and Fleet Readiness Center Southwest via modifications to Local Process Specifications.

Under this NESDI project, Kami Downey (shown here) devised a silver electroplating and strip process that removed cyanide from the waste stream. (Photo Credit: Victor Pitts)

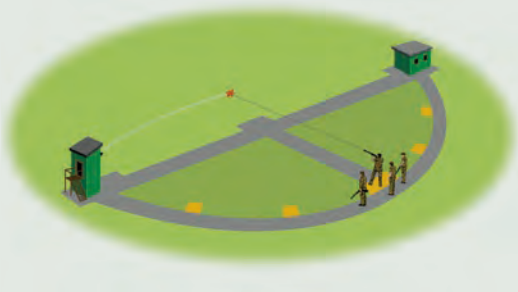
2016 Project Accomplishments (continued)

PROJECT NO. 474

Toxicity Associated with Polycyclic Aromatic Hydrocarbons Used in Clay Targets

PRINCIPAL INVESTIGATOR:
KARA SORENSEN

Polycyclic aromatic hydrocarbons (PAH) are widely found in the urban environment and are known carcinogens at certain levels. This project was formed to determine the health threat from PAHs found in clay targets used on Navy skeet ranges. In FY16, the team successfully completed development of an improved method to determine the relative bioavailability of PAH in soil. The team worked extensively with the Interstate Technology and Regulatory Council to pursue regulatory acceptance. This information can be used to negotiate lower risk-based clean-up costs, and is projected to save an estimated $200,000 to $600,000 per site.



Skeet shooting range. (Diagram: John Lambert)

PROJECT NO. 492

Capacitive Deionization Water Treatment System

PRINCIPAL INVESTIGATOR:
IGNACIO RIVERA

In the continuing search to find a safe, cost-effective way to treat drinking water at small facilities, this project installed a capacitive deionization (CDI) system at San Clemente Island Auxiliary Landing Field that is capable of treating 1,000 gallons per day.

In FY16, the team also prepared a list of sites that will benefit from the installation of this technology. The Naval Facilities Engineering Command Water Media Field Team will contact these sites to disseminate information about this technology.

CDI holds promise as a more cost-effective option for the treatment of drinking water at small facilities. (Photo Credit: Mass Communication Specialist First Class Eric Dietrich)

PROJECT NO. 497

Evaluation of Low Impact Development Implementation

PRINCIPAL INVESTIGATOR:
CHUCK KATZ

Low impact development (LID) is a land planning and engineering design approach to enhance the hydrologic regime of urban watersheds; thus minimizing the potential effects of stormwater runoff. In partnership with the Low Impact Development Center, a national research organization, this project team installed two LID configurations at the Navy Exchange area onboard Naval Base San Diego. The team also installed monitoring equipment to compare and contrast these solutions. Currently, the team is awaiting sufficient rainfall to continue with the demonstration.

A biofiltration fixture at the LID site.

(Photo Credit: Chuck Katz)

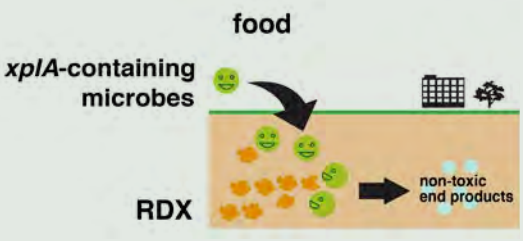
PROJECT NO. 499

Aerobic Bio-augmentation for Remediation of RDX-Contaminated Groundwater

PRINCIPAL INVESTIGATOR:
STEVE HAMMETT

RDX (cyclotrimethylene-trinitramine) explosives can be mobile and persistent in groundwater under the aerobic conditions present in many aquifers. In FY16, this team conducted a successful laboratory bench-scale demonstration of an innovative application known as bio-augmentation to tackle this problem. In bio-augmentation, selected microbial cultures are injected into an aquifer to increase numbers of organisms that efficiently degrade a particular contaminant; thereby enhancing in situ biodegradation rates.

The plan is to transition the method to full-scale at Naval Base Kitsap at Bangor, where the current pump and treat site efficiency is declining.



Bioaugmentation involves injection of select microbes to increase aquifer population of effective contaminant "degraders" thereby increasing in-situ degradation rates.

(Diagram: John Lambert)

2016 Project Accomplishments (continued)

PROJECT NO. 503

Drydock Sediment Management

PRINCIPAL INVESTIGATOR: PAT MORROW

This project team successfully demonstrated a modified commercial-off-the-shelf vehicle to capture contaminated drydock sediment at Puget Sound Naval Shipyard and Intermediate Maintenance Facility. This improved compliance with NPDES program requirements, while reducing labor costs significantly. Instead of taking six to eight workers an entire week to complete, the new process can be completed in two days with three or four workers. The next step is transitioning the device to other shipyards.

A drydock is flooded in preparation for ship maintenance. (Photo Credit: John Whalen)

PROJECT NO. 508

Multi-Sensor Weapons Impact Detection and Location System

PRINCIPAL INVESTIGATOR: JOEY TROTSKY

This project utilized seismic-acoustic sensor technology to locate off-range training munitions. The system senses both the impact shock of the weapon through the ground strata (seismic) and the sound wave propagation through the air (acoustic).

This real-time detection and location system was successfully demonstrated, and will substantially improve the range clearance process. However, it was determined that the user interface needs further refining.

An F/A-18A Hornet drops two inert general purpose bombs. (Photo Credit: Photographer's Mate Airman Kristopher Wilson)

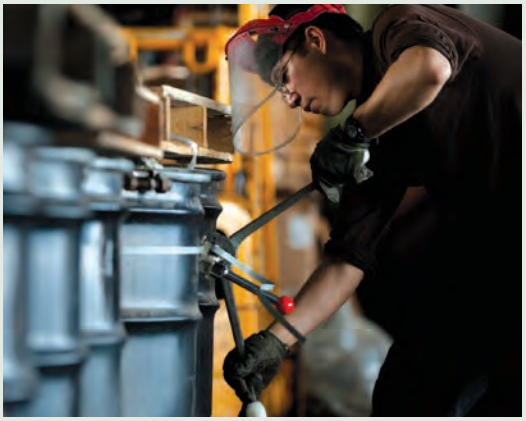
PROJECT NO. 509

Enterprise Naval Facilities Engineering Command Hazardous Waste Application

PRINCIPAL INVESTIGATOR:
MATT HAWKINS

This project team successfully developed a secure, web-enabled hazardous waste application to manage waste at the Naval Facilities Engineering Command and its installations worldwide. The new application provides improved analytical tools to better manage, track and understand hazardous waste at all levels, thereby improving compliance posture and reducing risk of Notices of Violation.

This system is being transitioned via the U.S. Navy Environmental Portal. The project team worked closely with the Naval Facilities Engineering Command Hazardous Waste Media Field Team and gleaned lessons learned from previous hazardous waste management database demonstrations. This solution is resulting in reduced labor and burden for completion of hazardous waste metrics and reporting.



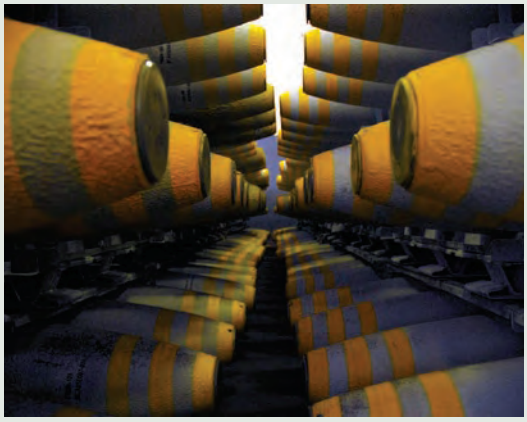
Aviation Structural Mechanic Airman Erickson Schafer bands barrels of hazardous waste. (Photo Credit: Mass Communication Specialist 2nd Class James R. Evans)

PROJECT NO. 512

Investigation of Improved Epi-seal Materials for Use in General Purpose Bombs

PRINCIPAL INVESTIGATORS:
JOHN RETTIG AND HANNAH MOODY

When a bomb is manufactured, a tail pad is applied to confine the explosive within the bomb casing as the explosive cures. The sealant used for this purpose is called Epi-seal™. Throughout the bomb's shelf life, this sealant tends to leak from the aft end of the bomb, contaminating the surface of the bomb and the surrounding areas of the storage facility. This project team devised a process modification that solved this problem. This team is drafting Standard Operating Procedures for this process, which will be transitioned to McAlester Army Ammunition Plant, where all general purpose bombs are assembled.



This project team devised a process modification to prevent Epi-seal sealant from leaking from general purpose bombs. (Photo Credit: Mass Communication Specialist 3rd Class Joseph Pol Sebastian Gocong)

2016 Project Accomplishments (continued)

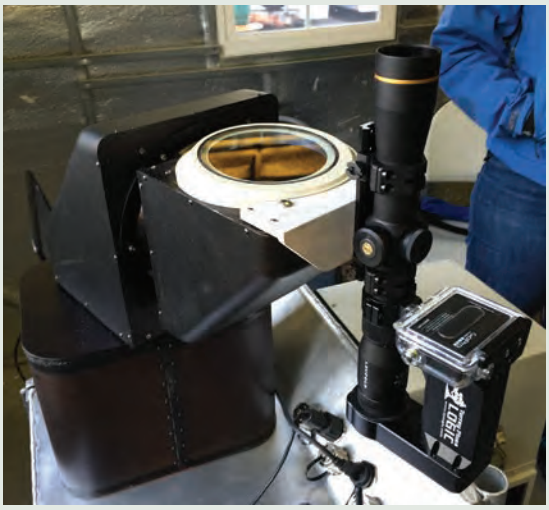
PROJECT NO. 516

Automated Monitor to Determine the Opacity of Fugitive Emissions

PRINCIPAL INVESTIGATOR:
PAT MORROW

During ship dismantling, workers routinely use oxygen/fuel cutting torches. This process, known as hot cutting, has the potential to exceed the EPA's Visible Emission Standard. Effectively monitoring these emissions has been time-consuming and problematic at Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS&IMF). This project identified and field-tested a modified Light Detection and Ranging (LiDAR) device to deliver real-time measurements of opacity.

In FY16, a support contract was awarded to the contractor for system installation at PSNS&IMF, user training, remote support, and software modifications as needed during the extended demonstration, which is scheduled to wrap up in early FY17. EPA Region 10 and the Puget Sound Clean Air Agency are supportive of this technology.



The system demonstrated over the course of this NESDI project consists of a laser, a 2-axis scanner for beam steering, a camera for co-registered screen capture, a weather station for surface observations and a Global Positioning System for location information.

The hot cutting process on a submarine hull sample. (Photo Credit: Jim Howell)

Our FY17 Schedule

No.	What	When
1.	Request Pre-proposals	18 October 2016
2.	Conduct OPNAV N45 Programmatic Review	26 October 2016
3.	Pre-proposals DUE	16 November 2016
4.	Make Pre-proposals Assignments to Functional Working Groups	2 December 2016
5.	TDWG & FWG Comments on Pre-proposals DUE	21 December 2016
6.	Evaluate Pre-proposals	9-13 January 2017
7.	Request Full Proposals	19 January 2017
8.	Full Proposals DUE	15 March 2017
9.	Conduct East Coast In-Progress Review	28-30 March 2017 Fleet Readiness Center Southeast, Jacksonville, FL
10.	TDWG & FWG Comments on Full Proposals DUE	31 March 2017
11.	Screen Full Proposals	3-7 April 2017
12.	Principal Investigator Answers to Full Proposal Screening Questions DUE	5 May 2017
13.	Conduct West Coast In-Progress Review	9-11 May 2017 Naval Postgraduate School, Monterey, CA
14.	Announce FY18 Needs Solicitation	1 June 2017
15.	Evaluate Full Proposals	by 8 June 2017
16.	Obtain Sponsor Review & Approval of Full Proposals DUE	29 June 2017
17.	Announce FY18 New Starts	31 July 2017
18.	Close FY18 Needs Solicitation	2 August 2017
19.	Screen Needs	7-11 August 2017
20.	Evaluate & Rank Needs	11-15 September 2017
21.	Obtain Sponsor Review & Approval of Needs	18 September - 6 October 2017
22.	Quarterly Status Reports Due	2 January 2017 3 April 2017 3 July 2017 2 October 2017

Check out the NESDI website (www.nesdi.navy.mil) for the latest version of our program schedule.

Promoting Our Successes

Successful NESDI projects were promoted throughout FY16 in a variety of print and online publications. In addition to this Year in Review report, an annual programmatic review and the program's website, the NESDI program also sponsors a quarterly newsletter, generates project fact sheets and regularly publishes stories in *Currents*—the Navy's energy and environmental magazine—all available via the NESDI website.

Website

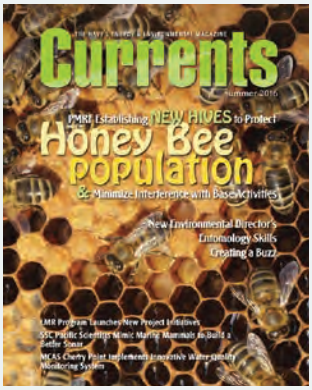
Improvements were made to increase the function and utility of the NESDI website including enhancing the quarterly project management process and initiating the redesign of the internal management site.

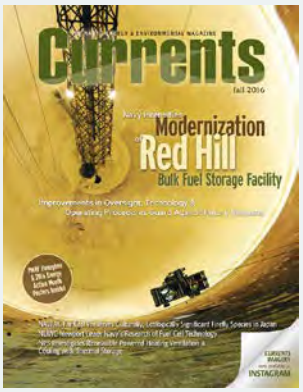
Quarterly Newsletters

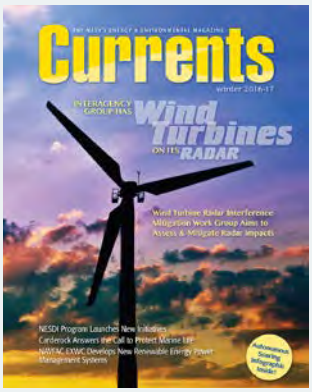
NESDI News: Highlights and Happenings—the program's regular electronic publication—brings recent technical achievements and regulatory concerns to the forefront, along with highlights on significant program events over the course of the year. We published three issues of our newsletter in FY16.

Fact Sheets

In an ongoing effort to promote the program's active and completed projects, we developed dozens of online fact sheets that highlight the objectives and latest progress made by ongoing NESDI projects and the accomplishments of completed projects.







Currents Articles

Throughout the year, many of our Principal Investigators worked with the managing editor of *Currents* to have a number of articles published about their NESDI projects in the magazine including the following:

1. Employing Shroud to Capture Particulate Emissions During Ship Touch-up: Do-it-yourself Solution is Easy & Cost Effective
2. NESDI Program Launches Eleven Technology Initiatives: Notable Efforts Target Water Conservation Challenges & Enhanced Stormwater Monitoring
3. CNO Environmental Research & Development Programs Release Annual Reports: LMR Program Report & NESDI Year In Review Report Now Available
4. New Methodology Quantifies Non-Point Sources of Metal Pollutants in Stormwater: NAVFAC EXWC Approach Includes Site Characterization & Importing Data into Management Tool

To browse the *Currents* archives, visit the Department of the Navy's Energy, Environment and Climate Change web site at http://greenfleet.dodlive.mil/currents-magazine.

Our Investment Areas

The NESDI program makes its primary investments in the following four Environmental Enabling Capabilities (EEC) areas:

1. **EEC 2: Maximize Training & Testing Requirements Within Environmental Constraints.** Investments in this area address environmental impacts and restrictions at Navy ranges to ensure that naval training ranges and munitions testing/manufacturing ranges are fully available and efficiently utilized.

2. **EEC 3: Platform Repair & Maintenance with Minimal Environmental Impact.** These investments focus on identifying systems and processes that minimize or eliminate environmental hazards in critical repair and maintenance operations both ashore and afloat.

3. **EEC 4: Support Shore Readiness within Environmental Constraints.** Investments in this area provide cost effective services at naval bases and air facilities in compliance with environmental regulations.

4. **EEC 5: Cost-Effective Management of Environmental Regulatory Requirements.** These investments provide cost-effective methods for identifying, analyzing, and managing environmental constraints related to current and projected regulatory impacts.

For More Information

For more information about the operation of the NESDI program, contact Ken Kaempffe, the NESDI program manager, or members of the TDWG.

No.	Name	Command	Phone	Email
1.	Kaempffe, Ken (Chair)	NAVFAC	805-982-4893	ken.kaempffe@navy.mil
2.	Bixler, Christy	NAVFAC/ CNIC	202-685-9313	christy.bixler@navy.mil
3.	Earley, Pat	SPAWAR	619-553-2768	patrick.earley@navy.mil
4.	Harre, Karla	NAVFAC	805-982-2636	karla.harre@navy.mil
5.	Hertel, Bill	NAVSEA	301-227-5259	william.hertel@navy.mil
6.	Kopack, David	NAVSEA	202-781-3247	david.kopack@navy.mil
7.	McCaffrey, Bruce	Consultant	773-376-6200	brucemccaffrey@sbcglobal.net
8.	Mukherjee, Sandi	NAVSUP	717-605-6854	sandi.mukherjee@navy.mil
9.	Rasmussen, Eric	NAVAIR	732-323-7481	eric.rasmussen@navy.mil
10.	Sugiyama, Barbara	NAVFAC	805-982-1668	barbara.sugiyama@navy.mil
11.	Webber, Cindy	NAVAIR	760-939-2060	cynthia.webber@navy.mil
12.	Youngers, Luzmarie	NAVAIR	904-790-6382	luzmarie.youngers@navy.mil

To get the latest information about the program, participate in the ongoing execution of our projects and download electronic copies of this and other Year in Review reports, visit the NESDI program web site at www.nesdi.navy.mil.

To subscribe to our quarterly newsletter, *NESDI News: Highlights and Happenings,* send your email address to Lorraine Wass at ljwass@outlook.com or 207-384-5249.

Accomplishments of the

NAVY ENVIRONMENTAL SUSTAINABILITY DEVELOPMENT TO INTEGRATION PROGRAM

For more information about the NESDI program visit www.nesdi.navy.mil.

Document preparation assistance and graphic design
services were provided by Bruce McCaffrey Consulting, Inc.

Ken Kaempffe
Naval Facilities Engineering
and Expeditionary Warfare Center
1000 23rd Avenue
Port Hueneme, CA 93043

2016

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