



# 2015

## **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](http://www.nesdi.navy.mil).





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## A Word From Our Program Manager

# Welcome to the Navy Environmental Sustainability Development to Integration (NESDI) program's Fiscal Year 2015 Year in Review report.



**Ken Kaempffe**

Reflecting on the past year, we have accomplished many great things in the NESDI program in spite of severe financial challenges. As most of you know, the NESDI budget—at \$3.7 million in fiscal year

(FY) 2015—was the lowest since the inception of the program. It is challenging, to say the least, to meet all of the Navy's outstanding needs for technology demonstration and validation at this level of funding. We had to make difficult decisions and actually cease work on a few important projects. We dealt effectively with yet another continuing resolution and the resulting uncertainty in funding flows.

As you read about the many successes in this Year in Review report, you will see that our Principal Investigators persisted throughout the current fiscal crisis to continue and, in many cases, complete their important work for the Navy. The ongoing gyrations in the budget process most severely impact those who execute NESDI projects. This Year in Review report is a testament to the hard work and dedication of our outstanding team of engineers and scientists from the performing organizations across the nation. With that, I would like to thank those who actually work on our projects and make the program a success.

Next, I would like to thank our governing board, the Technology Development Working Group (TDWG). It is my privilege to chair the TDWG. This group of dedicated individuals has done a fantastic job ensuring that the technologies we fund meet the needs of Navy installations and the operating Fleet. We work together to ensure that our portfolio of nearly 50 active projects is executed in a scientifically defensible manner, meets the needs of our customers, while at the same time ensuring that funds are obligated and expended to meet financial benchmarks. Particularly in FY15, the TDWG endured several drills to prepare for three possible FY16 budget scenarios—What would you do if your budget was reduced 50 percent from planned levels? How would such a reduction impact your ability to meet the mission? This is one FY16 scenario we had to plan for in FY15. The good news is that Congress did eventually pass a FY16 budget and the NESDI program will be funded at \$5.604M. This number is relatively robust compared with recent years, so we look forward to addressing our backlog of projects.

Program funding has been restored to near historical levels due to the successful efforts of our colleagues from our resource sponsor—the Chief of Naval Operations Energy and Environmental Readiness Division (OPNAV N45). I rely heavily on these folks, who have their finger on the pulse of the budgeting process at the Pentagon, to guide our responses to various data calls and budget drills. I am confident that there is a direct correlation between the advice and counsel I get from N45 managers and staff and the upward trajectory of the NESDI program budget in FY16 and beyond.





## A Word From Our Program Manager

This Year in Review report documents the needs we collected, the proposals we evaluated in FY15, and the new projects we will launch in FY16. You'll also find updates on progress made by individual projects, and accomplishments of the projects that closed out this past year.

Whether you're interested in how the NESDI process works or how you might leverage some of our solutions, I hope you'll find this Year in Review report useful in gaining new insights. And please feel free to contact me or any member of the TDWG if you have ideas on how we can improve the program.

### What's in Store for 2016

I have a number of things in mind for FY16 and beyond. We will continue to optimize NESDI processes and ensure that we invest as wisely as possible. In addition to the new projects that we will initiate next fiscal year, we will evaluate enhancements to our needs process. We have plans to convene a special meeting to address shipyard environmental Research, Development, Test and Evaluation (RDT&E) needs. We also plan to issue additional guidance to improve the technology transition process, including requirements for written transition agreements.

I will also continue to focus on accountability, which includes the requirement for detailed management plans at the onset of each of our new projects and monitoring the ongoing status of all of our active projects to ensure that project expenditures stay on track and the program's obligation and expenditure benchmarks are met.

### How You Can Participate

We need the most help to identify environmental requirements and implement 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 web site ([www.nesdi.navy.mil](http://www.nesdi.navy.mil)).

And 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 the TDWG.

I hope you find this Year in Review report useful in gaining the insights you need into the operation and success of our program in FY15.

**Ken Kaempffe, Program Manager**  
[ken.kaempffe@navy.mil](mailto:ken.kaempffe@navy.mil)



## The Mission of the NESDI Program



## 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, and 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 6.4 RDT&E program. The NESDI technology demonstration and validation program is sponsored by 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

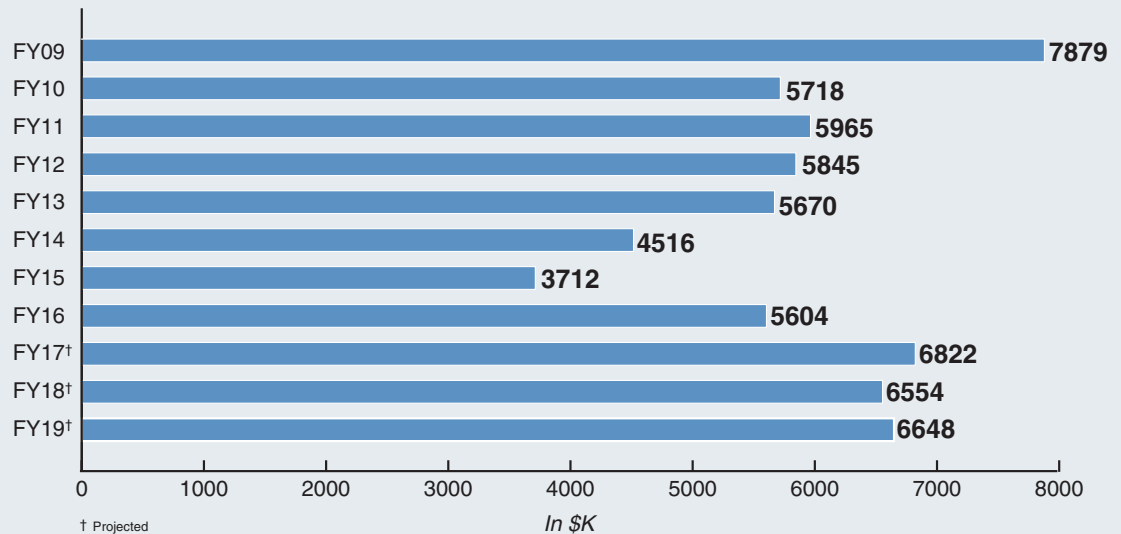
As always, the NESDI program establishes its investments based on the requirements identified by its end users in the Fleet and potential risk to the Navy mission.



## Financial Highlights

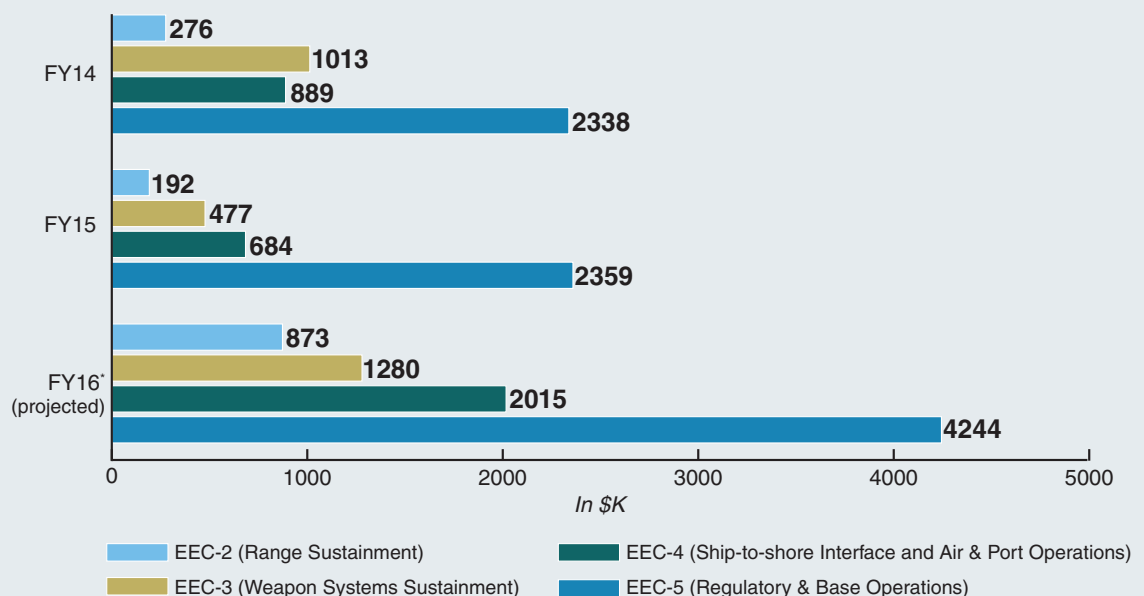
The following graphic summarizes program funding trends with actual amounts from FY09 to FY16 and projected amounts through FY19.

### Program Funding Trends (FY09-FY19)



The following graphic summarizes program funding trends by Environmental Enabling Capabilities (EEC). Details about each of these EECs are provided on pages 11, 21, 43 and 45.

### Program Funding (FY14-FY16)







## **The NESDI Program Process**

The NESDI program executes the same four-phased process each year. This management process ensures 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 at-sea testing and training activities. The four phases of that process are summarized on the following pages.



## The NESDI Program Process

### 1. Collect, Validate & Rank Needs

During this first phase of the process, our management team—the Technology Development Working Group (TDWG)—solicits environmental needs from across the Navy’s shore community. 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.

### 2. Collect, Evaluate & Rank Proposals

During this phase, the TDWG collects project proposals that address the needs collected in the first phase of the program process. In particular, the TDWG requests, collects, and reviews short pre-proposals and the subsequent detailed, full-length project proposals, and 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—through initial planning, ongoing reporting and management oversight—ensures that the projects remain properly focused on the needs they were intending to address.

### 4. Integrate Solutions

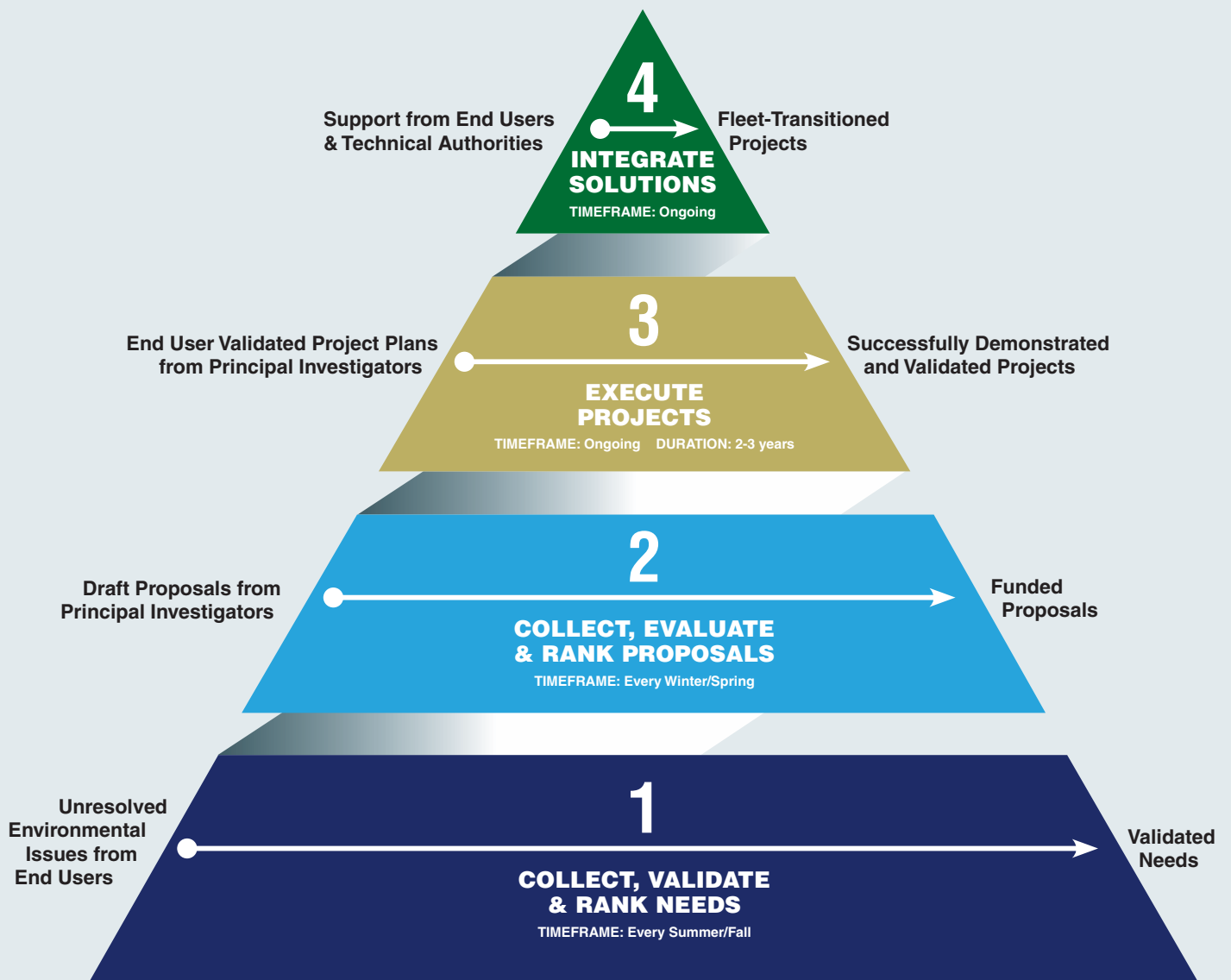
Throughout the project lifecycle, the NESDI program concentrates on moving the demonstrated technologies and other solutions out of the laboratories and demonstration sites and into the appropriate operational environment. During this fourth and final phase of the NESDI program process, the TDWG, Principal Investigators and technology integration specialists 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 it was executed throughout FY15 are discussed in the following sections of this report.



## The NESDI Program Process





Collect, Validate  
& Rank Needs

Unresolved  
Environmental  
Issues from  
End Users

1

**COLLECT, VALIDATE  
& RANK NEEDS**

TIMEFRAME: Every Summer/Fall

Validated  
Needs

## Collect, Validate & Rank Needs

In this section of the FY15 NESDI Year in Review report, we discuss the process that was followed and the output that was generated through the execution of the first phase of our annual process—the collection, validation and ranking of needs, as in the previous illustration.



## Priority Investment Areas: EEC-2

**The NESDI program makes its primary investments in four Environmental Enabling Capabilities (EEC) areas. Here's a look at one of those EECs, Range Sustainment.**

### **Range Sustainment (EEC-2)**

In this area, the NESDI program invests in innovations that address environmental impacts and restrictions to ensure that naval training ranges and munitions testing/manufacturing ranges are fully available and efficiently utilized. Example projects in this area are:

- a. *Innovative Drilling Process to Vent Full Scale Non-explosive Practice Munitions.* Typically, composition C4 explosives have been used to defuse practice bombs. However, C4 has the potential to leach into the soil under some conditions and may migrate offsite. This project successfully demonstrated a remote-controlled bomb drill that defuses these bombs without explosives.
- b. *Multi-Sensor Weapons Impact Detection and Location System.* Thousands of practice bombs are expended annually at Navy bombing ranges. To locate munitions that may have landed offsite, this project is demonstrating

seismic-acoustic sensor technology, which senses both the impact shock of the weapon through the ground strata (seismic) as well as the sound wave propagation through the air (acoustic).

- c. *Demonstration of Passive Samplers for Assessing Environmentally Realistic Concentrations of Munitions Constituents at Underwater Unexploded Ordnance Sites.* This project team conducted a controlled field validation of passive sampler technology with Composition B explosive and verified the ability

of samplers to detect ultra-trace levels of munitions constituents such as RDX (cyclotrimethylene-trinitramine) and TNT (2,4,6-trinitrotoluene). (Read more about this project on page 33.)

- d. *Remotely Operated Vehicle Mounted Ultra-High Pressure Waterjet Cutter Tool for Underwater Munitions Breaching.* In order to minimize diver risk, this project is developing a remotely operated waterjet cutter system for breaching underwater munitions in shallow water environments.



**Examples of munitions debris in nearshore environment.** U.S. Army Corps of Engineers



## Collect, Validate & Rank Needs

### Process Overview

The first step is for the TDWG to solicit 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.

### Summary of Needs Collected, Validated & Ranked in FY15

For FY15, the NESDI program's needs collection process yielded 53 submittals from across the Navy. After a thorough review by program personnel, a solicitation for proposals was executed to address 22 needs determined to be priorities by personnel from the TDWG and our resource sponsor, the Chief of Naval Operations Energy and Environmental Readiness Division (OPNAV N45). Successful proposals will result in new projects beginning in FY16 and beyond.

Once needs were compiled, the TDWG met to consider all of the needs — determining whether

a need was valid (within the scope of the NESDI program, not already being addressed by the program, etc.).

The TDWG then ranked those needs based on the program's investment priorities. Once the TDWG had completed its rankings, those preliminary rankings were passed along to the appropriate Subject Matter Experts (SME) at OPNAV N45. After a thorough review by the TDWG and approval by OPNAV N45 SMEs, the following 22 priority Fleet operational needs (with environmental solutions) were selected as the basis for pre-proposal submittals.



**An F/A-18A Hornet drops two inert general purpose bombs. An ongoing NESDI project is using seismic-acoustic technology to track off-target bombs at training ranges.**

U.S. Navy photo by Photographer's Mate Airman Kristopher Wilson



**Collect, Validate  
& Rank Needs**

### FY15 Validated Needs

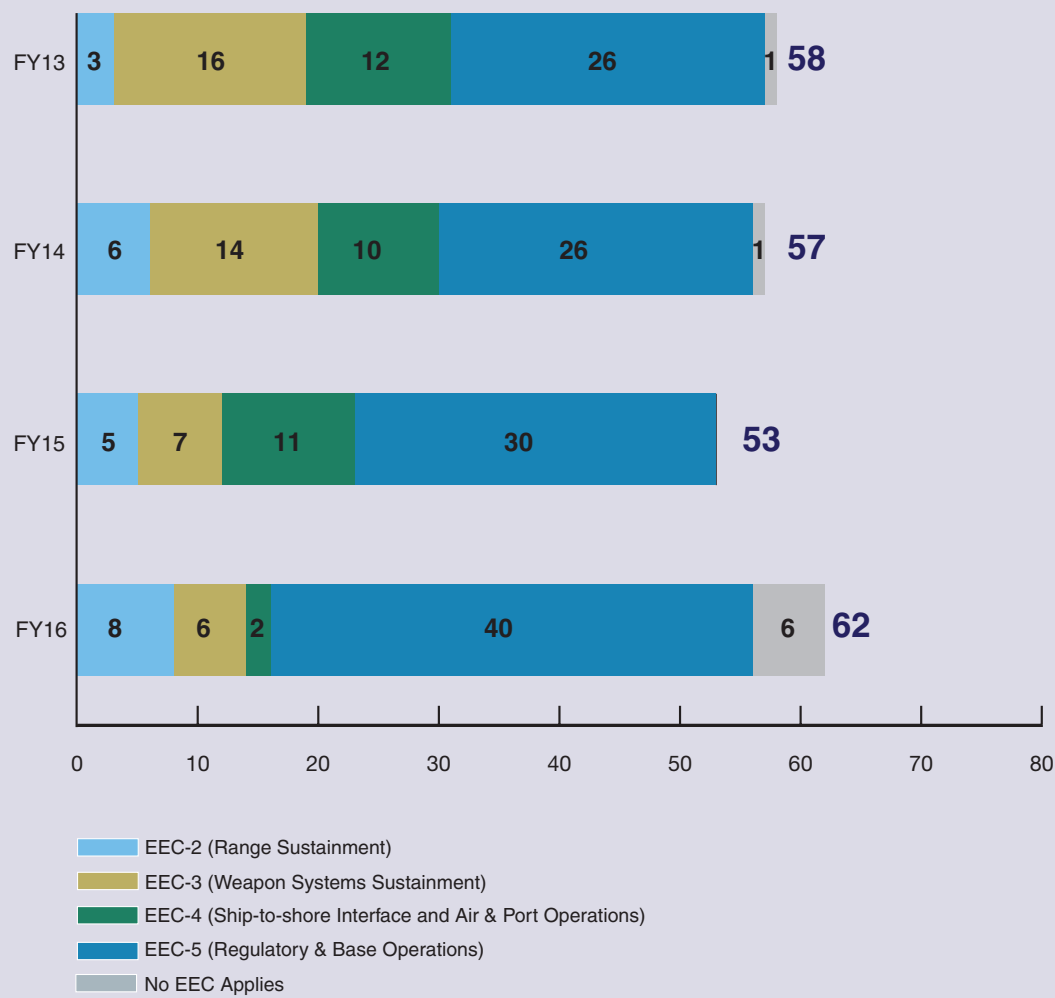
No.	Need	EEC	Command	Title
1.	N-0994-15	3	NAVAIR	Aqueous Cleaner Recycling System Demonstrate/Validate
2.	N-0996-15	5	NAVFAC	Application of Natural Abundance Radiocarbon for Determining Organic Contaminant Degradation Rates at Multiple Chlorinated Solvent Sites
3.	N-0997-15	5	NAVFAC	Alternative Hydrant Flushing to Maintain Chlorine Residual
4.	N-0999-15	5	NAVFAC	Passive Sampling for Stormwater Sampling and Illicit Discharge Investigations
5.	N-1001-15	3	NAVAIR	Non-Isocyanate Topcoat Aviation Systems
6.	N-1004-15	4	NAVSEA	Quantify Polychlorinated Biphenyls (PCB) Volatilization from Coatings at Elevated Temperatures
7.	N-1007-15	5	NAVFAC	Autonomous Benthic Ecology System
8.	N-1014-15	5	NAVFAC	Minimize Zinc Leaching from Galvanized Building Components
9.	N-1015-15	5	NAVFAC	Evaluation of Effectiveness of Habitat Enhancing Shoreline Stabilization Technologies
10.	N-1017-15	5	NAVFAC	Evaluation of Alternative Groundwater Supply Sources from a Safe Drinking Water Act Viewpoint
11.	N-1018-15	2	NAVFAC	Challenges in the Navy's Munitions Response Program
12.	N-1019-15	5	NAVFAC	Use of Phase Change Material to Reduce Thermal Loading to Ambient Waters
13.	N-1021-15	2	NAVFAC	Target Disposal
14.	N-1022-15	5	NAVFAC	Use of Floating Treatment Wetlands as an Effective Treatment Technology of Stormwater
15.	N-1023-15	3	NAVSEA	Multifunctional Surface Preparation Technology for Reducing Hazardous Waste and Cumbersome Work Practices
16.	N-1029-15	4	NAVFAC	Development of Regulated Solid Waste Management Best Practices and Standard Operating Procedures
17.	N-1030-15	5	NAVFAC	Development of Conceptual Site Models to Support Assessment of Perfluorochemicals Fate and Transport at Navy and Marine Corps Sites
18.	N-1031-15	5	NAVFAC	Validation of Promising Disinfectant for Drinking Water System Compliance
19.	N-1032-15	4	NAVFAC	Cost Effective Sediment Management Approaches
20.	N-1034-15	5	NAVFAC	Management Tools for Radiological Compounds in Environmental Media
21.	N-1036-15	3	NAVAIR	Cold Spray as a Hard Chromium Electroplating Alternative
22.	N-1042-15	5	NAVFAC	Compliance Impacts of Water Conservation Measures on Water and Wastewater Infrastructure



Collect, Validate  
& Rank Needs

**FY13 – FY16 Needs Collected**

Distribution of needs collected by the NESDI program has been relatively consistent for the past four years —most needs being collected in Regulatory & Base Operations (EEC-5).







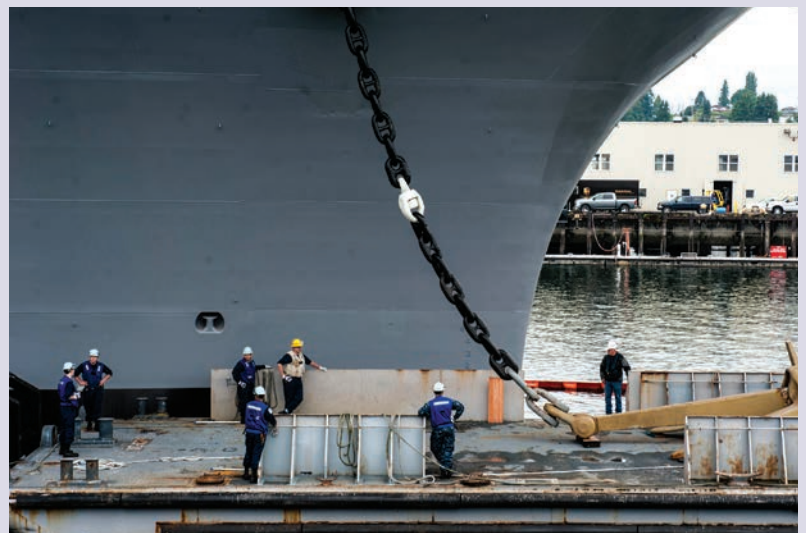
**Collect, Validate  
& Rank Needs**

### Trendspotting: Summary of FY12 – FY16 Needs

	2012	2013	2014	2015	2016
Total Number of Needs Submitted	65	58	57	53	62
Number of Needs for Which Pre-proposals Requested	25	23	17	22	27
Percentage of Needs for Which Pre-proposals Requested	38.5	39.7	29.8	41.5	43.5
EEC 2: Range Sustainment	5	3	6	5	8
EEC 3: Weapons System Sustainment	16	16	14	7	6
EEC 4: Ship-to-shore Interface and Air & Port Operations	10	12	10	11	2
EEC 5: Regulatory & Base Operations	33	26	26	30	40
No EEC Applies	1	1	1	0	6
HIGH	2	4	1	4	7
MEDIUM	31	27	19	17	16
LOW	13	13	6	10	3



**A ship in drydock.** U.S. Navy photo by Michael F. Laley



**A ship arrives for maintenance at Puget Sound Naval Shipyard & Intermediate Maintenance Facility.** U.S. Navy photo by MC Specialist Seaman Apprentice Christopher Frost



Collect, Evaluate  
& Rank Proposals

Draft Proposals  
from Principal  
Investigators

2

## COLLECT, EVALUATE & RANK PROPOSALS

TIMEFRAME: Every Winter/Spring

Funded  
Proposals

## Collect, Evaluate & Rank Proposals

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 pages) 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 support the overall environmental readiness of the Fleet and Navy acquisition communities.



**Collect, Evaluate  
& Rank Proposals**

## Summary of Pre-proposals Requested & Received

In FY15, the NESDI program collected a total of 29 pre-proposals for needs that were collected 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, full proposals were requested for the following:

No.	Pre-proposal	Command	Title
1.	212	NAVAIR	Nanowell Plasmonic Crystals for the Quantitative Detection of Volatized PCBs
2.	213	NAVSEA	Shipboard and Shoreside Regulated Garbage Management
3.	214	NAVFAC	X-ray Inspection System to Demilitarize Targets
4.	215	NAVFAC	Understanding the Impact of Low Water Flows on Sewer Systems and Wastewater Treatment Plants
5.	217	NAVFAC	Innovative Hydrant Flushing
6.	218	NAVFAC	Multifunctional Surface Preparation Technology for Reducing Hazardous Waste and Cumbersome Work Practices Demonstration
7.	219	NAVFAC	Initiation Decision Report (IDR) Passive Sampling for Stormwater
8.	220	NAVSEA	Multi-Functional Surface Preparation Technology for Maintenance Painting
9.	221	NAVSEA	Quantification of PCB Paint Volatilization
10.	222	SPAWAR	Autonomous Benthic Ecology System
11.	223	NRL	Natural Abundance Radiocarbon for Determining Chlorinated Contaminant Degradation Rates at the Naval Support Facility Indian Head
12.	224	NAVAIR	Aqueous Cleaner Recycling System Demonstration and Validation
13.	225	NAVFAC	Technologies for Biofilm Control in Drinking Water Distribution System
14.	226	NAVFAC	Evaluation of Alternative Groundwater Supply Sources from a Safe Drinking Water Act Viewpoint

*(continued on the next page)*



### Summary of Pre-proposals Requested & Received *(continued)*

No.	Pre-proposal	Command	Title
15.	227	SPAWAR	Demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites
16.	228	NAVFAC	Management Tools Decision Document for Radiological Compounds in Environmental Media
17.	229	NAVFAC	Analysis of the Long-Term Fate of Munitions Constituents from UXO and Discarded Military Munitions (DMM) on Terrestrial Sites
18.	230	SPAWAR	Diver-less Deployment System for In-Situ Sediment Samplers
19.	231	NAVFAC	Encasement of Munitions of Explosive Concern (MEC) on the Seafloor
20.	232	NAVFAC	Treatment of Stormwater Runoff Using Floating Treatment Wetlands
21.	233	NAVFAC	Structure-Function Relationship and Environmental Behavior of Perfluorochemicals (PFC) from Aqueous Film-Forming Foams (AFFF) at Department of Defense (DoD) Sites for Conceptual Site Model Development
22.	234	NAVFAC	Technology Evaluation and Sampling for Treatment of PFCs
23.	235	NAVFAC	Improved Dewatering of Dredged Sediment
24.	236	NAVAIR	Cold Spray as a Hard Chrome Electroplating Alternative
25.	237	SPAWAR	Integrated Diagnostic Stormwater Monitoring with Passive Sampling
26.	238	SPAWAR	Shoreline Stabilization Technologies with Habitat Enhancement
27.	239	SPAWAR	Determination of In-Water Construction Noise Levels and Noise Attenuation Near Navy Facilities and Shallow Ranges
28.	240	NAVAIR	Non-Isocyanate Topcoat
29.	242	NAVFAC	Impacts of Water Conservation Measures on Potential Safe Drinking Water Act Violations in Navy Water Supply Systems

If a pre-proposal is determined to be sufficiently focused on a viable solution to the targeted need, a more detailed, full proposal (three to five pages) is solicited from the Principal Investigator who submitted the pre-proposal. The full proposal defines quantifiable performance

metrics to evaluate the ultimate success of the project and presents baseline data for later comparison to post-integration conditions.

Proposals that address the high priority needs and are judged to be well structured and feasible to implement receive the highest consideration.





**Collect, Evaluate  
& Rank Proposals**

### Summary of Full Proposals Requested & Received

From the 29 pre-proposals submitted, the program requested the following full proposals:

No.	Full Proposal	Command	Title
1.	139	NAVFAC	Understanding the Impact of Low Water Flows on Sewer Systems and Wastewater Treatment Plants
2.	140	NAVFAC	Management Tools for Radiological Compounds in Environmental Media
3.	141	NAVFAC	Analysis of the Long-Term Fate of Munitions Constituents from UXO and DMM on Terrestrial Sites
4.	142	NAVSEA	Multi-Functional Surface Preparation Technology for Maintenance Painting
5.	143	NAVSEA	Quantification of PCB Paint Volatilization
6.	144	SPAWAR	Diver-less Deployment System for In-Situ Sediment Samplers
7.	145	SPAWAR	Autonomous Benthic Ecology System
8.	146	SPAWAR	Demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites
9.	147	SPAWAR	Integrated Diagnostic Stormwater Monitoring with Passive Sampling
10.	148	SPAWAR	Shoreline Stabilization Technologies with Habitat Enhancement
11.	149	NRL	Natural Abundance Radiocarbon for Determining Chlorinated Contaminant Degradation Rates at the Naval Support Facility Indian Head
12.	150	NAVFAC	Encasement and Anchoring of MEC on the Seafloor
13.	151	NAVFAC	Innovative Hydrant Flushing
14.	152	NAVAIR	Non-Isocyanate Polyurethane-Free Coatings for Aircraft and Support Equipment
15.	153	NAVFAC	X-ray Inspection System to Demilitarize Targets
16.	154	NAVFAC	Improved Dewatering of Dredged Sediment
17.	155	NAVSEA	Analysis of Shipboard and Shoreside Regulated Garbage Management Processes to Ensure Efficient Compliance with United States Department of Agriculture Animal and Plant Health Inspection Service Regulations
18.	156	NAVFAC	Technology Evaluation and Sampling for Treatment of PFCs
19.	157	NAVFAC	Structure-Function Relationship & Environmental Behavior of PFCs from AFFF at DoD Sites for Conceptual Site Model Development
20.	158	NAVFAC	Treatment of Stormwater Runoff Using Floating Treatment Wetlands
21.	159	NAVFAC	Evaluation of Alternative Groundwater Supply Sources from a Safe Drinking Water Act Viewpoint
22.	160	NAVFAC	IDR Passive Sampling for Stormwater
23.	162	NAVFAC	Impacts of Water Conservation Measures on Safe Drinking Water in Navy Water Supply Systems



### Summary of “New Start” Projects for FY16

We then turned our attention to reviewing the full proposals received. This review often involves communication with the proposal submitter if additional insights, details, and/or clarification are warranted. At the end of this review of full proposals, the TDWG generated a ranked list of recommended project “new starts” and sent it to OPNAV N45 for their final review and approval. The full proposal review process in FY15 resulted in the following 11 recommended project “new starts” for FY16 and beyond.

No.	ID	Title	Principal Investigator
1.	527	Structure-Function Relationship and Environmental Behavior of PFCs from AFFFs for Conceptual Site Model Development	John Kornuc
2.	526	X-ray Inspection System to Demilitarize Targets	Joey Trotsky
3.	525	Non-Isocyanate Polyurethane-Free Formulation Coatings for Aircraft and Support Equipment	Jennifer Nunez
4.	524	Innovative Hydrant Flushing	Edwin Chiang
5.	523	Integrated Diagnostic Stormwater Monitoring with Passive Sampling	Gunther Rosen
6.	522	Demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites	Victoria Kirtay
7.	521	Autonomous Benthic Ecology System	Cheryl Cooke
8.	520	Quantification of PCB Paint Volatilization	Patrick Morrow
9.	519	Analysis of the Long-Term Fate of Munitions Constituents from UXO and DMM on Terrestrial Sites	Jim Austreng
10.	518	Understanding the Impact of Low Water Flows on Sewer Systems and Wastewater Treatment Plants	Tami Relph
11.	528	Impacts of Water Conservation Measures on Safe Drinking Water in Navy Water Supply Systems	Prakash Temkar

Highlights of these projects can be found starting on page 22 in this report.

## Priority Investment Areas: EEC-3

**The NESDI program makes its primary investments in four Environmental Enabling Capabilities (EEC) areas. Here's a look at one of those EECs, Weapons Systems Sustainment.**

### **Weapon Systems Sustainment (EEC-3)**

Here, the program invests in solutions to reduce the cost of compliance and increase readiness for Fleet maintenance personnel. Example projects include:

- a. *Low-Volatile Organic Compound (VOC) and Low-Hazardous Air Pollutant (HAP) Wipe Solvent and Paint Thinner Demonstration/Validation.* This team plans to demonstrate and validate that a low-VOC and low-HAP solvent can serve as a “drop-in” solution to the environmental issues associated with the current products used in naval aviation coatings and solvent cleaning applications.
- b. *Demonstration of Non-Chromated Adhesive Bond Primer for Metal Repair Bonding.* Historically, the most effective bond primers used in aircraft maintenance have contained hexavalent chromium,

a known carcinogen and strictly regulated chemical. This project seeks to verify the performance of a hexavalent chromium-free primer against a standard chromium product in the laboratory and in the field.

- c. *Investigation of Improved Epi-seal Materials for Use in General Purpose Bombs.* This project was formed to investigate the widespread problem of sealant leakage in general purpose bombs. The team first characterized

the ingredients used in the current sealant and plans to recommend and test a reformulated product.

- d. *Demonstrate/Validate Alternatives to Methylene Chloride-based Chemical Paint Strippers.* The purpose of this project was to identify and test a thixotropic paint stripper to replace the current methylene-chloride based product. (For more on this project, see page 55.)

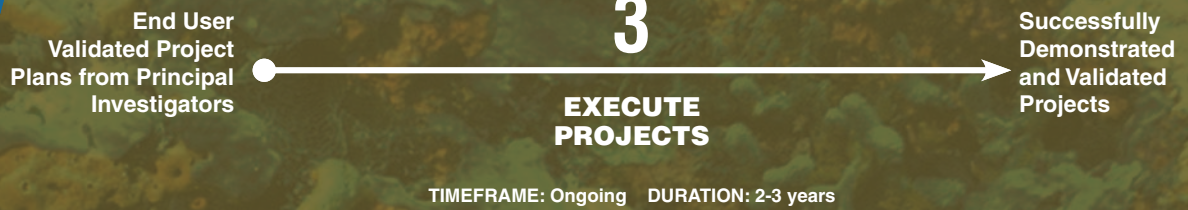


**Worker applies new low-VOC solution.** Photo by Luc Doan





## Execute Projects



## Execute Projects

Once proposals have been selected and funded, the program—through initial planning, ongoing reporting and management oversight—ensures that the projects remain properly focused on the needs they were intending to address.



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## FY16 “New Start” Projects

The program will initiate the following 11 new projects in FY16 that seek to better understand the potential impacts of water conservation measures on Navy water supply systems, investigate the volatilization rate of paint containing polychlorinated biphenyls (PCB), and validate non-isocyanate polyurethane-free coatings for aircraft and support equipment among other objectives.



1. Understanding the Impact of Low Water Flows on Sewer Systems and Wastewater Treatment Plants (no. 518)



7. Innovative Hydrant Flushing (no. 524)



2. Analysis of the Long-Term Fate of Munitions Constituents from Unexploded Ordnance and Discarded Military Munitions on Terrestrial Sites (no. 519)



8. Non-Isocyanate Polyurethane-Free Formulation Coatings for Aircraft and Support Equipment (no. 525)



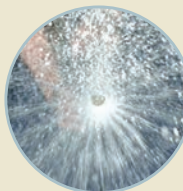
3. Quantification of Polychlorinated Biphenyls Paint Volatilization (no. 520)



9. X-ray Inspection System to Demilitarize Targets (no. 526)



4. Autonomous Benthic Ecology System (no. 521)



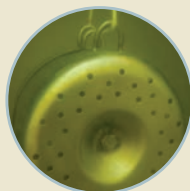
10. Structure-Function Relationship and Environmental Behavior of Perfluorochemicals from Aqueous Film-Forming Foams for Conceptual Site Model Development (no. 527)



5. Demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites (no. 522)



11. Impacts of Water Conservation Measures on Safe Drinking Water in Navy Water Supply Systems (no. 528)



6. Integrated Diagnostic Stormwater Monitoring with Passive Sampling (no. 523)

**Read on for more details on each of these newly funded projects. To keep up-to-date on these and all NESDI projects as the year progresses, visit [www.nesdi.navy.mil](http://www.nesdi.navy.mil), select “Current Projects,” and search by project number or keyword.**





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## 2016 New Starts *(continued)*

PROJECT NO. 518

### Studying the Potential Effects of Low Flow Devices on Collection & Distribution Systems

Effort Will Focus on Assessing Impacts & Recommending Corrective Measures

Increased use of low flow devices (toilets, showers, etc.) and widespread mandated water conservation measures have resulted in reduced and concentrated flow through wastewater collection systems. As technology improves and water conservation requirements tighten in the future, flow rates will be even further reduced. Currently, little is known about the impact of low wastewater flow on installation collection and distribution systems which were designed for much higher flow rates.

*Little is known about the impact of low wastewater flow on installation collection and distribution systems which were designed for much higher flow rates.*

Potential problems could arise such as increased corrosion in lines, elevated levels of hydrogen sulfide (a threat to sanitation workers in confined spaces), more frequent blockages, and increased concentrations of unhealthy contaminants.

This project was formed to determine whether such impacts are occurring, and if so, to recommend measures to overcome them.

The first phase of this project will include data collection from a significant portion of the Navy-operated systems and a select number of similar municipal systems, along with de-



This wastewater treatment plant is designed for an average daily flow of 107,000 gallons per day. This image was taken during a time of low flow into the plant and shows the incoming sewage flowing through two bar screens, and finally into a Parshall flume where the flowmeter records the flowrate of the influent wastewater. Photo by Tami Relph

tailed investigations of problem systems. The team will ask for data on flow rates, total suspended solids, nitrogen, Biological Oxygen Demand, and sulfur concentrations. These data are regularly collected for other purposes and therefore should be readily available. The project team will also collect data on Notices



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**Outfall for the same wastewater treatment plant. The treated wastewater effluent discharges into a combined sewer line after chlorination.**

Photo by Tami Relph

of Violation as well as qualitative information from installation water program managers and the Water Media Field Team. This would include such data as increased odor, lift station blockages, higher hydraulic detention times, increased grit loads after heavy rain due to low flow periods, etc. Once these data are collected, they will be compiled into a spreadsheet to help identify problem issues that correlate with low flow conditions.

At this point in the project, a go/no go decision point will be inserted. If no significant problems are identified, a final report will be prepared and the project will be terminated. If problems are found, the project team will gather additional information on the issues (such as additional laboratory analysis not normally performed by the Public Works staff) and will identify potential Best Management Practices (BMP) to address those issues. If an appropriate technology is identified that addresses a key problem with reduced flow rates in sewers or treatment plants, a limited duration demonstration may be recommended for future NESDI funding.

At the conclusion of this task, a final report will be published. If BMPs are developed, they will be posted on the Naval Facilities Engineering Command (NAVFAC) portal. This document would be formatted similarly to the existing collection of BMPs for stormwater management. The project team will employ the Technology Implementation Team at the Naval Facilities Engineering and Expeditionary Warfare Center's environmental department to provide all applicable Navy wastewater program managers with a copy of the final report and the link to any BMPs posted on the NAVFAC portal. This will ensure that all applicable Navy wastewater program managers are aware of any BMPs to address problems associated with low wastewater flows.

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## 2016 New Starts *(continued)*

### PROJECT NO. 519

#### **Analysis of the Long-Term Fate of Munitions Constituents on Terrestrial Sites**

##### **Effort Will Study Fate & Transport of Lesser Known Munitions Constituents**

The Navy has approximately 325 terrestrial munition response sites where munitions or munitions constituents (MC) from unexploded ordnance and discarded military munitions are found and need to be remediated. While the fate and transport of the more common MCs such as TNT (2,4,6-trinitrotoluene) and RDX (cyclotrimethylene-trinitramine) in the environment are relatively well known, there are many associated degradation products and compounds (e.g., picramic acid) for which the fate, transport, and toxicity characteristics are unclear. This hampers the development of viable risk assessments at impacted sites.

While site managers may be able to find some of the necessary information through literature searches, there is no one easy reference that captures this information in a concise format. This project was formed to identify, research, and summarize the current knowledge about the fate, transport, and toxicity characteristics of MC and associated degradation products found at terrestrial munition response sites.

As a first step, the project team will develop a list of degradation compounds associated with each targeted MC. Factors such as fate (degradation behavior), transport (chemical and physical properties), and toxicity data for each compound will be covered as well as regulatory limits for the MC and degradation compounds, and a discussion of applicable remediation technologies. These data will be compiled into an Initiation Decision Report (IDR) that will identify gaps in the data as well as critical assessments of those gaps to aid in developing a remediation strategy.



**Discarded military munitions.** Photo by Joey Trotsky



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## PROJECT NO. 520

The IDR will be available to Navy decision makers including Remedial Project Managers (RPM) via various channels such as the Remedial Innovative Technology Seminar (RITS), postings on web sites, webinars, etc. The report will enable them to survey the current state of knowledge about the fate, transport, and toxicity of MCs and to understand how specific targeted investments could enhance capabilities to respond to the associated risks. The summaries and assessments in the IDR may later be transferred to end users with similar responsibilities for other armed service branches.

*The IDR will identify gaps in the data as well as critical assessments of those gaps to aid in developing a remediation strategy for munitions constituents.*

The data in the IDR appendix can be used by RPMs, contractors, and operational range personnel for addressing regulatory concerns about MCs and MC degradation products at terrestrial munition response sites and operational ranges. Distribution of the appendix content via the Naval Facilities Engineering Command's Munitions Response Working Group will allow access to those personnel who deal with munitions response issues on a daily basis.

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## Ensuring the Safe Removal of Legacy Paints During Shipbreaking

Study Will Reveal PCB Volatility  
at Critical Temperatures



This NESDI project will investigate the volatilization rate of PCB-containing legacy paints on Navy ships.

U.S. Navy photo by Mass Communication Specialist Seaman Apprentice Robert Robbins

The use and manufacture of paint containing PCBs has been prohibited for decades. Some Navy ships still have PCB-containing paint that was applied before use of this type of paint was prohibited. Because PCBs are known to become volatile (airborne) when heated, special measures must be taken when these ships arrive at the shipyard for welding and cutting operations. Current procedure requires the removal of PCB-containing paint up to a radius of 24 inches when performing work that has the potential to heat the steel in excess of 200 degrees Fahrenheit. However, there is a lack of data showing the quantity of specific PCB components volatilized as a function of temperature, and these controls may well be over-conservative.



## Execute Projects

### 2016 New Starts *(continued)*

This 24-inch removal requirement results in increases in time and cost to perform the required work, and generates a large volume of waste that needs to be safely disposed of. Additionally, the risk of safety issues for employees, as well as injuries from chronic exposure to noise and vibration, is elevated.

Currently, this problem is of great importance at Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS&IMF) due to the large volume of current and planned inactivation and recycling of Navy vessels. Other shipyards and maintenance facilities performing work on ships with legacy paint systems could also be impacted.

This project will investigate the volatilization rate of paint containing PCBs in order to generate a defensible, environmentally and fiscally responsible work process for the removal of paints containing these compounds.

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***The team will perform a thorough quantification study to relate steel temperature to volatilization of PCBs.***

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The team will perform a thorough quantification study to relate steel temperature to volatilization of PCBs within various paint systems. The study is based on standard U.S. Environmental Protection Agency (EPA) test methods, and will be carried out by accredited laboratory facilities. Samples of PCB-containing paint will be taken from a ship at PSNS&IMF and heated to a range of temperatures up to 400 degrees Fahrenheit in a controlled environment. The vapor phase during this heating process will be collected on low-volume polyurethane foam (PUF) in accordance with EPA method TO-10A. This vapor phase testing will be conducted by scientists at Naval Air Warfare Center China Lake, and the resulting PCB-bearing PUF samples will be sent to an outside laboratory



**Some older Navy ships have been painted with PCB-containing coatings.**

U.S. Navy photo by Wendy Hallmark

competent in PCB extraction and analysis. The results of this analysis will show the total loading of PCBs resulting from exposure at different temperature levels. Those data can then be correlated to available steel heating profiles developed at PSNS&IMF, enabling informed decision making, and the appropriate modification of current work processes.

The final product of this demonstration will be a work process that relates the paint removal requirements with paint type, thickness, and task to be completed. This process will be based on a statistically valid correlation of the loading of PCBs released into the atmosphere as a result of heating the paint to various temperatures corresponding with cutting and welding operations. The process will be gathered into a final report and posted to the NESDI and other web sites for other shipyards and maintenance facilities to utilize.

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## PROJECT NO. 521

### Monitoring Endangered Corals With a Remote Vehicle

#### Project Could Replace Challenging Diver Surveys

In order to comply with environmental directives, such as the National Environmental Policy Act (NEPA), the Navy requires the ability to conduct close, high-resolution monitoring of threatened and endangered species within coral reef communities and other benthic (seabed) ecosystems. This need became even more urgent in 2014 with the addition of 20 coral species to the Endangered Species List.

One way to effectively survey these areas is to create a photomosaic, or a collection of individual high-resolution images of each ecosystem. The current approach to conducting these types of surveys is to hire contract divers for months at a time to assess these areas in small sections at a time, or to assess small random areas and overestimate ecological metrics with statistical analyses. This is very costly and time consuming, and the data generated may not meet regulatory compliance under NEPA. Additionally, these surveys are currently conducted by various methods and entities, making data usability and comparability difficult.

***These vehicles can travel into areas that are difficult or dangerous for divers to access.***

Utilizing a remotely operated vehicle (ROV) to conduct underwater surveys would present a complete picture of the benthic community because these vehicles can travel into areas that are inaccessible, such as vertical structures, or dangerous for divers to access, such as areas with suspected unexploded ordnance.



**The project leverages a previously developed ROV which was demonstrated to the Fifth Fleet for identification of waterborne improvised explosive devices.**

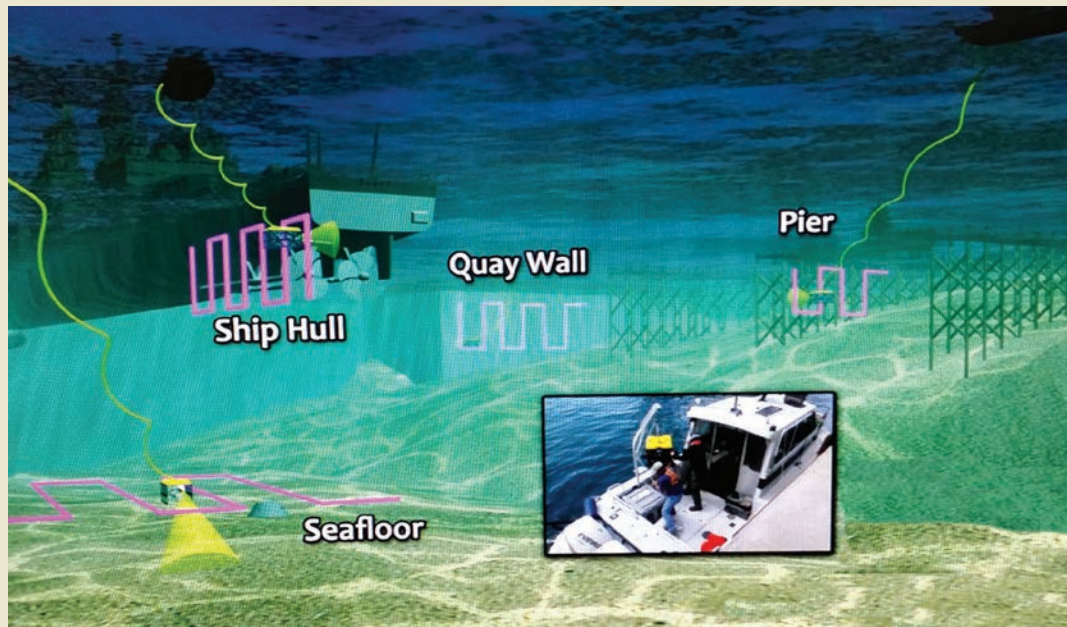
U.S. Navy photo by Mass Communication Specialist 1st Class Daniel Gay

This project will develop and test an Automated Benthic Ecology System (ABES) for the purpose of conducting such surveys at sea ranges, vessel homeports and weapons test and evaluation centers. The system will leverage a previously developed sensor-based stabilized ROV which has been demonstrated for identification of waterborne improvised explosive devices. This ROV will be equipped with photomosaicing cameras as well as other sensors to capture pH, salinity, temperature, etc. The ABES will be able to traverse vertical structures such as piers and quay walls, and can safely survey areas with known or suspected unexploded ordnance. The vehicle will also prove useful in examining underwater surfaces for cracks or damage, including piers and ship's hulls.



## Execute Projects

### 2016 New Starts *(continued)*



Conceptual image of the Autonomous Benthic Ecology System.

In the first year of the project, the ROV will be equipped with the cameras and sensors. Next, the team will conduct tests to verify the vehicle's stability and agility, the accuracy of the results, and the kind of environmental disturbances the vehicle can handle. In year two, the team will test the integrated system in the ocean environment at a pier on San Clemente Island. This site offers a plethora of benthic environments to assess, including piers covered with fauna.

The final test will be a field study at Naval Air Station Key West. Two seawalls and a coral reef will be surveyed, and photomosaics of the pier wall will be made in the San Diego laboratory. This will determine whether or not the ABES is effective in extracting the data required by the Florida Keys National Marine Sanctuary, and to a greater extent, whether the system will be viable for compliance purposes at other sites.

A report will be generated documenting the suitability of the photomosaicing technology for

compliance documentation. The report will contain the results of the field testing along with Graphical Information Systems maps for easy incorporation into environmental compliance documents of all types. The project team will use the Reef Assessment and Data Integration Center, available to Navy users on the Space and Naval Warfare Systems Center Pacific web site to transition ABES. A Department of Defense (DoD) Wiki Page and public Facebook page will list field deployments and background information about this technology. The final report will also be available on the Marine Resources Support Group web site and the Chief of Naval Operations Environmental Planning Library.

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## PROJECT NO. 522

### Seeking a Better Solution to Sediment Remediation

#### Enhanced Natural Recovery Shows Great Promise

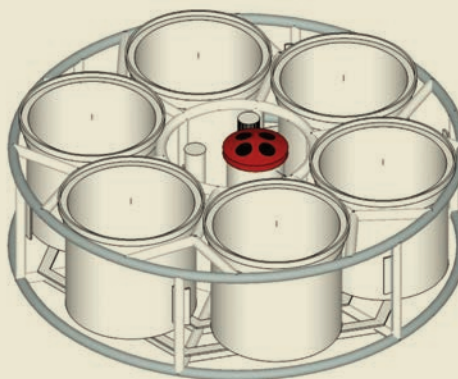
Contaminated sediment in the Navy's harbors is anticipated to become a one billion dollar problem over time, more if potential natural resource damages are factored in. The most common remediation techniques currently are dredging, capping and natural recovery. Dredging contaminated sediment is very costly and may result in collateral impacts to aquatic biota, along with resuspension and resettling of contaminants. Capping, which involves covering submerged contaminated sediments with layers of sediment, gravel, and/or synthetic materials, is relatively less costly, but is not always possible in harbors with substantial ship traffic. Monitored natural recovery, while cost-effective, is not always acceptable to regulators and public stakeholders. Driven by a lack of suitable options and the increasingly apparent limitations of existing technologies over time, there is a need to develop more nuanced technologies and risk assessment methods.

One of these methods is Enhanced Monitored Natural Recovery (EMNR). In this approach, thin caps (10-30 centimeters) of clean sediment are placed atop contaminated sediment to enhance ongoing natural recovery processes. In contrast to the thicker layers of sediment used in traditional isolation capping, thin caps used for EMNR are not intended to provide a complete seal over the contaminated sediment. Instead, they simulate an accelerated natural deposition of clean sediment, resulting in a surface layer of cleaner sediment and an immediate reduction in surface contaminant concentrations.

This facilitates the reestablishment of benthic (bottom dwelling) organisms, and accelerates the processes of natural binding and physical isolation that would occur over time. True EMNR also lends itself well to beneficial reuse of clean dredge materials, and it is cost-effective. However there are few examples of true EMNR implementation in the U.S.

Previous EMNR efforts have used sand as the capping layer instead of local sediments or sediments with an appreciable organic content, and therefore have little or no binding capability. The key focus of this project is the development of standardized procedures for applying EMNR using natural sediments at moderately contaminated DoD and Navy sites.

Currently the project team is defining key EMNR parameters and protocols to ensure that the methodology can be replicated elsewhere. Then a range of natural sediments will be field tested using a Remedy And Recontamination Assessment (RARA) array that the project team is developing under a Strategic Environmental Research and Development Program (SERDP) project. Next, the team plans to take the field



Sediments will be tested using a RARA array that is being developed for a SERDP project. This diagram shows an isometric view of the RARA with sediment trays and instruments installed.





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## 2016 New Starts *(continued)*



**This project team plans to apply its field testing results at pilot scale at a Navy harbor in Puget Sound.**

U.S. Navy photo by Mass Communications Specialist Seaman Apprentice William Bleas

testing results to application at pilot scale at a Puget Sound Navy site. This effort will include application of the protocols developed under this project, and potentially, integration with opportunistic beneficial reuse of clean dredged sediments. The scale of the demonstration will be tailored to the specific conditions and requirements of the chosen site, and constrained by the available funding. Performance and cost metrics will be captured for comparison to current capping methods and other sediment remedies.

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***Cost effectiveness could also be significantly enhanced by integrating EMNR with opportunistic beneficial reuse of clean dredge sediments.***

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EMNR technology, when implemented with natural sediments, promises to be both more successful and more cost effective than current approaches. Cost effectiveness could

also be significantly enhanced by integrating EMNR with opportunistic beneficial reuse of clean dredge sediments.

It is expected that the first Navy users are likely to be RPMs at active Navy sediment sites. End products of the project will include a final technical report which will include standardized procedures for applying EMNR using natural sediments along with cost and performance information and technical publications describing the technology and protocols.

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## PROJECT NO. 523

### Passive Sampling May Offer Another Solution for Stormwater Monitoring

#### Samplers Produce Useful, Time-Weighted Results

Currently, stormwater monitoring is labor intensive, expensive, and not optimal for meeting regulatory requirements at Navy facilities. For a variety of reasons, neither manual grab nor automated composite sampling methods have succeeded in consistently providing the information needed to identify sources of contamination and evaluate the effectiveness of BMPs. This project will evaluate the effectiveness of using passive sampling devices (PSD) to assess the impacts of stormwater runoff and improve stormwater management at Navy facilities.

Regulatory agencies are currently requiring an arbitrary monitoring schedule (monthly or seasonally) that ignores the driving forces within the watershed such as hydrology (e.g. flow duration and magnitude), and contaminant loading to the receiving waters. The result is expensive data collection efforts that

provide little information on the impact to the receiving waters. Additionally, when these limits are exceeded, the violations invariably require the implementation of BMPs that may not be effective or even appropriate. Passive sampling, as part of an integrated monitoring plan, shows great potential to provide the needed data.

Typically, stormwater monitoring consists of many components (e.g. identifying representative sampling locations; establishing telemetry and data sensors for flow, conductivity/salinity, turbidity; installing rain gauge stations; and collecting manual grab and automated composite samples at specified locations). However, these data are unable to provide information about pulsed inputs of contaminants into the receiving waters.

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*PSDs can provide meaningful data which are more representative of the potential for biological effects.*

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Since the PSDs used in this project consistently sample over time, they automatically provide a time-integrated measure of contamination without extensive sampling and analysis costs. PSDs can provide meaningful data which are more representative of the potential for biological effects, because they will record time-varying exposure of contaminants released over time.



A Polar Organic Chemical Integrative Sampler (POCIS). Photo by Gunther Rosen

The project team will work with partners at Naval Base Kitsap (NBK), Naval Facilities Engineering Command Northwest, and PSNS&IMF to integrate PSDs into their current stormwater monitoring efforts. Representative drainage basins will be selected that cover the range of land-use/land-cover and industrial activities present at NBK. Priority will be given to basins slated for installation of BMPs or





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### 2016 New Starts *(continued)*

other stormwater improvement projects so that before/after effectiveness can be evaluated.

This project will demonstrate two different types of passive samplers:

1. Diffusive Gradients in Thin Film (DGT) for metals
2. POCIS for contaminants including compounds that occur in human waste and wastewater

Over 300 chemicals have been calibrated for quantification by POCIS. This project will measure selected organic marker chemicals found in human waste and wastewater including pharmaceuticals, hand sanitizers, fragrances, and others. Indicators of human waste to be sampled by POCIS will be selected based on site expectations to improve detectability near expected waste sources and to decrease false positives due to alternative sources that may be present on site (i.e. bird fecal material).

The DGTs will be deployed for multiple time points (days, weeks, months) to characterize the pulsed nature of metal exposure during storm events, and spatially to verify mixing of stormwater with the receiving environment.

Performance will be evaluated based on the cost and ability for the PSDs to provide meaningful data with which to quantify the effectiveness of BMPs and stormwater management programs.

This project will be conducted in coordination and collaboration with the Puget Sound Ecosystem Monitoring Program (PSEMP) Stormwater Work Group which is working with local, state and federal jurisdictions to develop a regional stormwater monitoring program, and the PSEMP Toxics Work Group which is assessing the impact of toxics on



**A POCIS alongside a more traditional sampling method, oysters.** Photo by Gunther Rosen

the Puget Sound ecosystem. The work will help expand the PSEMP's effort to include Navy facilities regulated by the U.S. EPA and address monitoring and BMPs for industrial sites. Successful completion of this project will make a major contribution to the watershed-based approach for stormwater management recommended by the National Research Council and assure that the Navy is adequately represented within the stakeholder groups.

A user's guide, articles in newsletters, peer-reviewed journal articles, and symposia will help to disseminate the results and open the door for regulatory buy-in.

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## PROJECT NO. 524

### Tackling Nitrification in Drinking Water

#### Team to Demonstrate a Truck-mounted Solution with Zero Water Waste

Navy and Marine Corps installations worldwide are required to maintain a disinfectant residual in their drinking water systems. The chlorine or chloramine residual prevents bacteriological growth in the drinking water and is required under the Safe Drinking Water Act (SDWA) and associated Chief of Naval Operations Energy and Environmental Readiness Division instructions. However, this chlorine residue tends to be “consumed” by a buildup of biofilms and sediment in most water systems. Additionally, nitrification or trihalomethanes (THM) may also build up in the water distribution system. (Nitrification increases nitrite and nitrate levels, and promotes bacterial regrowth.) To maintain compliance, Naval bases flush hydrants with millions of gallons of potable water to eradicate stagnant water, clean the pipes, increase the disinfection residual in the pipes, and flush out the nitrates and THMs.

At many locations, including Naval Base Ventura County (NBVC) Port Hueneme and Naval Air Station Lemoore, California, the effective scouring velocity cannot be achieved by traditional hydrant flushing. At these bases, water lines are repeatedly flushed weekly—but even this procedure fails to remove all the biofilm, so nitrification continues to occur.

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*The flushing process wastes a tremendous amount of water—over a million gallons of water per year for one hydrant.*

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In addition, the flushing process wastes a tremendous amount of water—over a million gallons of water per year for one hydrant. These California bases (and likely others) need an efficient way to maintain disinfectant residual without utilizing large amounts of water in the midst of a severe and ongoing drought.

This project will demonstrate and evaluate one promising solution—a truck-mounted potable water distribution system which has been used effectively in over 50 municipalities to date.



The NO-DES truck. Photo courtesy of the Low Impact Development Center



## Execute Projects

### 2016 New Starts *(continued)*

To effectively clean pipes, a scouring velocity of five cubic feet per second needs to be achieved. In conventional hydrant flushing, the velocity is only one to three cubic feet per second. Also, conventional flushing cleans pipes randomly, and there is no control in directing “dirty” water away from already cleaned pipes.

The high-velocity truck-mounted system chosen for this demonstration can provide on-the-spot water treatment and analysis by creating a temporary connection into the water distribution line through existing fire hydrants. The Neutral Output Discharge Elimination System (NO-DES) connects between two fire hydrants or between a fire hydrant and a fully open blow-off valve. The water from the hydrant is run through a filter system mounted on the truck in order to remove biofilm and clean out the line. The water is disinfected and returned to the water system, resulting in zero water waste.

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*The water is disinfected and returned to the water system, resulting in zero water waste.*

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In this demonstration of the NO-DES system, the drinking water system at the NBVC Port Hueneme base will be flushed. Prior to this flushing, water quality parameters will be collected to establish a baseline. The same parameters will be collected during and after flushing to determine the system’s effectiveness. Additionally, the base will be monitored for nitrification and chloramines for one year. At the end of this period, an economic analysis will be conducted to compare the costs of purchasing the equipment versus contracting for the flushing as a service as a better option to conventional hydrant flushing.

At the conclusion of the project, the Naval Facilities Engineering Command’s Water Media Field Team will be invited to a demon-

stration of the NO-DES system so they can recommend this technology to their regional bases if appropriate. The team will also prepare a video of the NO-DES system in use, so that Navy public works directors can see the ease with which the system is set up and utilized. Datasheets, which will include associated capital and contracting costs, will be produced and distributed to all Navy public works offices. A final report will also be prepared and made available via the NESDI web site.

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#### **PROJECT NO. 525**

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### **Finding a Safe, Effective Alternative to Isocyanate Aircraft Coatings**

**Team Leveraging Formulation  
Developed by Naval Research Laboratory**

For many years, polyurethane topcoat materials have been used for maintenance of military aircraft because of their superior abrasion-, stain-, and chemical-resistant properties. However, these products contain isocyanate compounds, which are regulated by the U.S. EPA as a hazardous air pollutant and a hazardous waste. Because they pose a threat to human health, painters are required to wear personal protective equipment (PPE) and undergo medical monitoring when applying these formulations. Additionally, regulations require that the entire aircraft



## Execute Projects

be roped off during spray applications of polyurethanes, thereby preventing concurrent work in nearby areas.

This project was formed to find a non-isocyanate formulation so that the Navy can minimize or eliminate the environmental hazards and health risks associated with currently used polyurethane products.

The Naval Research Laboratory (NRL) has recently developed two siloxane-based topcoats for Navy surface ships. Siloxane (also referred to as polysiloxane) polymers offer several advantages over organic-based isocyanate compounds, such as those used in polyurethane topcoats, due to the inherent chemistry of the materials. Siloxane materials have greater exterior durability (e.g., color stability) and thermal stability due to an increased resistance to UV/sunlight and heat. And because siloxane-based polymers are lower in viscosity, less solvent is needed to formulate

a coating product. Siloxane is used in many consumer products and is relatively non-toxic and non-flammable.

The novel one-component and two-component siloxane products developed by the NRL are undergoing demonstration and qualification on two Navy surface ships and both are currently outperforming all qualified ship topside coatings. A concurrent Environmental Security Technology Certification Program project is developing aircraft topcoats based on polymers used in the NRL coating formulations.

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*The focus of this project is to validate mature products for both touch-up and full aircraft application.*

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The focus of this project is to validate mature products for both touch-up (single component) and full aircraft application (two-component). Products will be tested for compatibility with existing aircraft finishing materials and non-



Worker applying polyurethane coating to an F/A-18 aircraft. Photo by Jennifer Nunez





## Execute Projects

### 2016 New Starts *(continued)*

chromate containing primer systems. Following compatibility testing, the coatings will be performance tested for adhesion, gloss, weatherability, flexibility, fluid resistance and heat resistance. Strippability studies will also be performed to ensure siloxane systems can be fully integrated into Fleet Readiness Centers (FRC) overhaul cycles. These tests will be performed at laboratory scale utilizing materials, equipment and facilities representative of industrial environments at Naval Air System Command (NAVAIR) FRCs. The criterion for success will be performance equal to or better than traditional polyurethane coatings qualified to military specifications MIL-PRF-81352 and MIL-PRF-85285. Due to the level of maturity, single component validation will occur first. Two-component systems will be validated within three years of project start.

Implementation of the new product(s) will occur through development of engineering documents to include use of siloxane coating for aircraft and components. Demonstration results will enable adoption of the technology throughout FRCs through NAVAIR authorization and the development of Local Process Specifications that control processing requirements, materials utilized and quality conformance inspection. In addition, the siloxane coating technology will be added to the Authorized Use List at

each paint shop in the desired application. FRC artisan training will also be provided based on the application optimization results.

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#### PROJECT NO. 526

### Certifying Boat Targets as Safe for Disposal

#### Project Demonstrates Timesaving X-ray Device

The Navy has significantly increased training exercises that use small boat targets. Trainees

*Boat targets are often stockpiled until they can be inspected, taking up valuable space and interfering with day-to-day operations.*



**Because of health hazards, workers must wear PPE when applying polyurethane coatings.**

Photo by Jennifer Nunez

fire tracer rounds at these targets, some of which become lodged in the targets themselves. When training is concluded, all targets are regarded as Material Potentially Presenting an Explosive Hazard (MPPEH) and must be inert certified before disposal. This means the target must be free from all projectiles and be visually inspected by an Unexploded Ordnance Technician to certify it is Material Documented As Safe (MDAS) before it can be disposed of. Currently, this is a time-consuming process, and boat targets are often stockpiled until they can be inspected, taking up valuable space and interfering with day-to-day operations.





## Execute Projects

The NAVAIR Seaborne Targets program has an urgent need for a means to clear its targets as safe for repair and disposal following live fire operations.

To serve this need, this project team is demonstrating a hand-held X-ray device that would allow inspectors to determine whether or not boat targets contain MPPEH. These machines have been recently developed for use in the dental and medical fields; as well as for law enforcement to use on suspicious bags and vehicles. These hand-held systems produce an easy-to-read image of the scanned object. If no projectile is found, the target can be immediately classified as MDAS. If MPPEH is found, minimal cutting and digging can be conducted to certify the material as safe for disposal.

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***These hand-held systems produce an easy-to-read image of the scanned object.***

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Two different machines will be demonstrated at the NAVAIR Seaborne Targets Facility in Port Hueneme, California. Evaluation of the technology will include determining if the X-ray image will accurately show the locations of projectiles, the amount of time needed for a complete scan of the target, and the ease of use.

The new technology will be immediately available for use at the Seaborne Targets Facility once it is successfully demonstrated. The ability for onsite personnel to classify a target as MPPEH-free will allow the prompt removal of the object to the Defense Utilization and Reissue Office, freeing up valuable storage space.

A final technical report, including guidance on how to use the technology, will be also be prepared. This report will incorporate com-



**Small boat targets such as this one are often used in training.**

Photo by NAVAIR Seaborne Targets



**A boat target with mannequin.** Photo by NAVAIR Seaborne Targets

ments received from the NESDI and range communities, and will be distributed to Navy range managers.

### **PRINCIPAL INVESTIGATOR:**

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## 2016 New Starts *(continued)*

### PROJECT NO. 527

#### **Understanding an Emerging Contaminant**

##### **Decision Tool Will Help Manage PFAS Risk Assessment**

Perfluorchemicals and polyfluorinated alkyl substances (PFAS) are chemicals that have been widely used for decades, both in consumer products and industrial processes. PFASs are unique in that they possess both hydrophobic (water-repelling) and oleophobic (oil-repelling) properties, making them especially useful in fighting fuel fires. The Navy and the other DoD services have used significant quantities of PFASs in the form of aqueous film-forming foams (AFFF) for fighting petroleum fires since the 1960s.

Despite their effectiveness, PFASs are defined as an emerging contaminant by the DoD. PFASs have been shown to cause developmental problems, have been implicated as immune-suppressants, endocrine disruptors, and some are classified as probable carcinogens. In addition, they are environmentally persistent due to their strong fluorine-carbon bond, are bioaccumulative, and have been detected in environmental samples long after a release was reported.

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***AFFFs and their PFAS components represent one of the greatest emerging contaminant challenges facing the Navy's environmental restoration program.***

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AFFFs are stockpiled and used in regular training exercises and emergency responses by fire departments throughout the DoD. AFFFs and their PFAS components represent one of the greatest emerging contaminant challenges facing the Navy's environmental

restoration program, partly because the current understanding of their fate and transport in soil and groundwater is limited.

This project was formed to develop a robust and accurate conceptual site model for Navy sites impacted by PFASs from various sources, especially AFFF.

PFASs are based on hydrocarbon chemicals where the hydrogen atoms in the carbon-hydrogen bond have been completely (perfluorinated) or partly (polyfluorinated) replaced by fluorine atoms. There are hundreds of PFASs, and analytical methods have only recently become available to accurately measure the major PFAS compounds of AFFF formulations used by the DoD. As a result, it has only recently become possible to conduct a full characterization of PFASs associated with AFFF use, and identify the various compounds and their behaviors/presence across a site.

This project will begin by reviewing available data from 15 Navy and Base Realignment and Closure (BRAC) sites impacted by PFASs. The PFAS data will be closely inspected to identify preliminary trends and behavioral indicators. Factors such as nature of sources, distance of plume migration from its source, hydrogeology, and potential receptors will be compiled. This information will be combined with a literature review to develop preliminary indicators of fate and transport of the chemicals.

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***It has only recently become possible to conduct a full characterization of PFASs associated with AFFF use.***

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In the second phase of the project, three sites will be selected that have likely source zone areas and/or a plume that has migrated to potential surface water receptors. The au-



**Execute  
Projects**

thors will perform multi-level sampling at these sites, including sampling of surface sediment and benthic invertebrates. Utilizing this information, the project team will develop a decision tool with the ability to inform site managers and RPMs and to enable them to make effective site management decisions when PFASs are present at their sites.

Once the decision tool is ready, the authors will first transition it to the Risk Assessment Workgroup within NAVFAC. The workgroup will, in turn, channel the report to the environmental restoration managers at the NAVFAC Field Engineering Commands and to the NAVFAC and BRAC program RPMs.

**PRINCIPAL INVESTIGATOR:**

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**PROJECT NO. 528**

**Studying Drinking  
Water Quality in the Age  
of Water Conservation**

**Reduced Volume & Flow May  
Impact Compliance Status**

Widespread water conservation measures across the DoD often result in less water moving through distribution and storage systems. When this happens, the system can be at increased risk for violations of the SDWA.

Navy installations commonly struggle to maintain residual chlorine levels in their water distribution and storage systems without exceeding the total trihalomethane standard at the far reaches of those systems. The levels of trihalomethanes and other byproducts of chlorination tend to increase with the amount of time water remains in a system.

To date, there has been no comprehensive trend analysis that demonstrates how water conservation efforts may contribute to the deterioration of drinking water quality. It is the goal of the project to assess a representative



**This project is studying the potential impacts of water conservation measures on Navy drinking water systems.**

U.S. Navy photo by Photographer's Mate 1st Class Bart A. Bauer



## Execute Projects

### 2016 New Starts *(continued)*

sample of drinking water systems to gain a better understanding of the impact of declining consumption from these systems.

There are a number of fundamental characteristics of drinking water supply systems common to many Navy facilities that may impact SDWA compliance:

- Low density land use planning strategies can lead to relatively long distribution runs between the supply system complex and the buildings it is designed to supply.
- Declining staffing levels can lead to reductions in total water demand.
- The capacity of aging water systems that were originally oversized to provide for fire flows can provide space for water to stagnate.
- The roughness of existing piping materials can allow for and even encourage development of biofilms (biomass).
- Aggressive water conservation strategies can reduce both facility and irrigation consumption rates.
- Regulatory standards that address water quality within the distribution system are becoming increasingly more rigorous.

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#### ***Aggressive water conservation strategies can reduce both facility and irrigation consumption rates.***

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To meet water quality compliance standards, the Navy often relies on flushing and cleaning pipe networks, which tends to defeat water conservation goals, and doesn't always solve the problem. Though this project will concentrate on the impacts of water conservation efforts, it will also identify operational, systemic or long-term policy changes that would minimize compliance problems. Additionally, the project team will assess trends in an attempt to more accurately evaluate future regulatory challenges that should be considered by drinking water system planners.

In the first phase of this project, the team will gather a representative sample of drinking water system characteristics, examine Notices of Violation, identify system problems, and define the current state of the practice. Representative case studies will be developed based on observed "real world" systems and problems.

Next, the project team will engage a group of Navy drinking water system experts to analyze specific systems and problems and recommend alternative strategies to address these problems. The team will then conduct a table top analysis of existing system designs including current water consumption rates and associated water conservation efforts.

Finally, the team will analyze specific recommended strategies based on anticipated benefit, cost, and potential risks. The team will also attempt to identify and evaluate operational BMPs, low-cost structural BMPs, and systemic (long-term) BMPs.

A final report, in the form of a guidance manual, will be prepared for use by Navy water program managers. The guidance manual will include examples of "real world" applications of the identified strategies including the tools, techniques and management practices to effectively control water quality problems in distribution systems and meet SDWA regulations.

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Execute  
Projects

## Priority Investment Areas: EEC-4

The NESDI program makes its primary investments in four Environmental Enabling Capabilities (EEC) areas. Here's a look at one of those EECs, Ship-to-Shore Interface and Air and Port Operations.

### Ship-to-shore Interface and Air and Port Operations (EEC-4)

In this area, the NESDI program invests in innovative techniques to manage ship hazardous material/waste offload to shore facilities as well as approaches for addressing issues pertaining to air and port operations that ensure Fleet readiness. Example projects in this investment area are:

a. *Dry Dock Sediment Management.*

This effort tested a commercial off-the-shelf vehicle for cleaning drydock floors in an effort to reduce runoff and meet National Pollutant Discharge Elimination System requirements. This effort also determined that there was no need to regularly allocate funds/labor for cleaning out discharge tunnels as cleaning practices prevent sediment from entering them.

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

When a ship enters drydock for maintenance or lay-up, it discharges millions of gallons of cooling water daily. These once-through cooling waters generally contain heavy metals such as copper. This project was formed to research the issue and compile an IDR to guide investments in this area.

c. *Radiant Cooling for Closed-loop Water Containment.*

This project is also addressing the problem of ship cooling water discharge by studying the potential use of radiant cooling technology. Using the principles of radiant heating in reverse,

this technology would channel ship's cooling water through underground pipes allowing the ground to act as a heat reservoir.

d. *Evaluation and Implementation of Compliance Options for Intake Structures at Existing Facilities.*

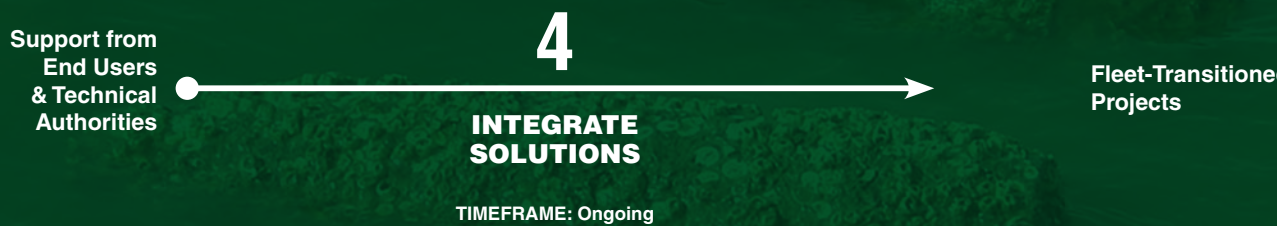
A new rule signed by the U.S. Environmental Protection Agency (EPA) is poised to affect cooling water intake structures at Navy shipyards. This project reviewed and evaluated existing cooling water intake systems at three Navy sites that will be impacted by this rule, then suggested a modification to the intake structure which has been accepted by the EPA. (For more, see page 58.)



A submarine entering drydock. U.S. Navy photo by Brian Nokell



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## **Integrate Solutions**

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 Technology Development Working Group, Principal Investigators and technology integration specialists (for NAVFAC-led projects) 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.

## Priority Investment Areas: EEC-5

**The NESDI program makes its primary investments in four Environmental Enabling Capabilities (EEC) areas. Here's a look at one of those EECs, Regulatory and Base Operations.**

### **Regulatory and Base Operations (EEC-5)**

Most of our projects traditionally tend to fall under this category. This area explores cost-effective methods for identifying, analyzing, and managing environmental constraints related to current and projected regulatory impacts. Example projects include:

- a. *Develop an Automated Real-time Opacity Monitor for Use in Determining the Opacity of Fugitive Emissions.*  
The oxygen/fuel cutting torches used for ship dismantling at Puget Sound Naval Shipyard generate plumes of smoke and metal fumes with the potential to exceed the Visible Emission Standard of 20 percent opacity. However, it is very difficult to assure that emissions are within these limits when utilizing the standard protocol defined by the U.S. Environmental Protection Agency. This effort identified a laser technology (known as Light Detection and Ranging (LiDAR)) that

is capable of providing real-time opacity determination.

- b. *Demonstration of an Improved Method for Quantifying Algal Biomass to Meet Nutrient Numeric Endpoint Compliance.*  
An excess of nutrients, particularly nitrogen and phosphorus, can result in excessive algal growth known as biomass in subtidal environments. This project is demonstrating and validating an accurate, cost-effective method for measuring benthic algal biomass in order to maintain clean water compliance.
- c. *Capacitive Deionization Water Treatment System.*  
This project is improving on the application of Capacitive Deionization (CDI) for the

treatment of drinking water at small or remote locations. CDI is an electrochemical water treatment method that will work with near energy-neutral requirements. It is expected to perform comparably to a reverse osmosis system at significantly less cost.

- d. *Evaluation of Low Impact Development Implementation.*  
Low Impact Development (LID) is a land planning and engineering design approach to minimizing the potential effects of stormwater runoff. This project is demonstrating the effectiveness of LID technology in reducing flow, contaminant loads, and toxicity in stormwater at non-industrial Navy sites.



**This bioretention planter helps minimize stormwater runoff.**





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## **2015 Project Closeouts**

Principal Investigators for eleven NESDI projects completed their work in FY15 by documenting the results of their efforts and alerting the appropriate members of the Navy environmental community of those results. Principal Investigators were also encouraged to post their final reports and other project documentation on the appropriate web sites (including the NESDI web site) to promote the awareness and leveraging of their work. All efforts on the following projects listed and highlighted below were completed in FY15.

1. **Optimization of the Stormwater Dual Media Filtration System at Navy Regional Recycling Center in San Diego (no. 454)**
2. **Modeling Tool for Navy Facilities to Quantify Sources, Loads, and Mitigation Actions of Metals in Stormwater Discharges (no. 455)**
3. **Hull Maintenance Shroud (no. 456)**
4. **Demonstration and Validation of Sediment Ecotoxicity Assessment Ring Technology for Improved Assessment of Ecological Exposure and Effects (no. 459)**
5. **Tertiary Treatment and Recycling of Waste Water (no. 464)**
6. **Low Cost Selective Polymer and Laser Interferometer Real Time Sensors for Detection of Solvents in Contaminated Groundwater Plumes (no. 468)**
7. **Demonstration/Validation of a Surface Cleaning Control Practice to Mitigate Stormwater Metal Contaminants (no. 469)**
8. **Qualification of Type 8 Plastic Media Blast (PMB) as a Replacement for Chemical-based Strippers and Type 5/7 PMB (no. 486)**
9. **Implementation Strategy for Coral Reef Transplantation Methods (no. 491)**
10. **Low Impact Development for Industrial Areas (no. 493)**
11. **Successful Municipal Separate Storm Sewer System Programs Implemented in the Navy (no. 494)**





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#### PROJECT NO. 454

### **Optimization of the Stormwater Dual Media Filtration System at Navy Regional Recycling Center in San Diego**

#### **PRINCIPAL INVESTIGATOR:**

**Gary Anguiano**

This project team optimized performance of the Navy-developed dual media filtration system by retrofitting it so that the system was able to operate at 200 gallons per minute. The team also demonstrated a new low-maintenance Best Management Practice (BMP) that reduced the copper concentration by 96 percent, zinc concentration by 90 percent and total suspended solids concentration to non-detect levels—all are well within permit limits.



**The dual media filtration system. Dual media chambers are shown on the left and float valves are shown on the right.** Photo by Gary Anguiano

#### PROJECT NO. 455

### **Modeling Tool for Navy Facilities to Quantify Sources, Loads, and Mitigation Actions of Metals in Stormwater Discharges**

#### **PRINCIPAL INVESTIGATOR:**

**Chuck Katz**

The purpose of this effort was to demonstrate and validate the Source Loading and Management Model for Windows (WinSLAMM), a stormwater management model for Navy facilities managers. The model was demonstrated at St. Julien's Creek Annex with a site characterization. A final report and spreadsheet tools were created and posted to the NESDI web site and the Defense Technical Information Center web site. Additionally, an article was published in *Currents* magazine.



**Galvanized metal contributes to metals loading in stormwater runoff.** Photo by Chuck Katz



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## 2015 Project Closeouts *(continued)*

### PROJECT NO. 456

#### Hull Maintenance Shroud

##### PRINCIPAL INVESTIGATOR:

Pat Earley

This team developed and demonstrated an easy, inexpensive shroud that collects the hazardous waste generated during the in-port maintenance of surface ship hulls. A guide to making the shroud was produced, and the project was publicized in *Currents* and *Naval Engineers' Journal* as well as during a briefing at the Occupational Safety, Health and Environment Shipyard Directors meeting.



Shroud in use during demonstration on USS San Diego. Photo by Pat Earley

### PROJECT NO. 459

#### Demonstration and Validation of Sediment Ecotoxicity Assessment (SEA) Ring Technology for Improved Assessment of Ecological Exposure and Effects

##### PRINCIPAL INVESTIGATOR:

Gunther Rosen

This project accomplished its goal of demonstrating and validating an in situ bioassessment tool, the SEA Ring, developed under a Strategic Environmental Research and Development Program (SERDP) project. The team improved upon the original design, and procured several modified units which demonstrated multiple advantages over previous versions. The device was transitioned to the Puget Sound Naval Shipyard, Naval Base San Diego, and Marine Corps Base Quantico, where the technology is supporting sediment remediation efforts.



Water column deployment of first generation SEA Ring near Scripps Institution of Oceanography.

Photo by Rolf Schottle

## PROJECT NO. 464

### **Tertiary Treatment and Recycling of Waste Water**

#### **PRINCIPAL INVESTIGATOR:**

**Sonny Maga**

This project team developed a manmade wetland for onsite reclamation and reuse of wastewater. They received an operating permit from the state of California allowing use of the treated water for subterranean irrigation at Marine Corps Recruit Depot San Diego. In FY15, they produced a final report and produced a video (available at [navfac.navy.mil](http://navfac.navy.mil), search for Tidal Wetland System).



The manmade wetland. Photo by Sonny Maga

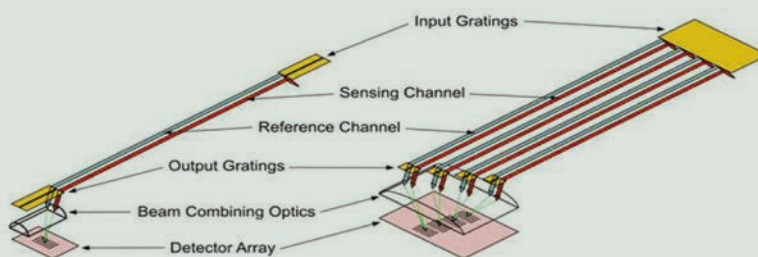
## PROJECT NO. 468

### **Low Cost Selective Polymer and Laser Interferometer Real Time Sensors for Detection of Solvents in Contaminated Groundwater Plumes**

#### **PRINCIPAL INVESTIGATOR:**

**Issis Long**

The objective of this project was to demonstrate and validate optical sensor technology to detect groundwater contaminants in real time and to enable remote access to these data. Field testing in FY15 revealed that the sensor works as expected. However, housing design modifications were suggested to the manufacturer. A technical memo, still under preparation, will suggest a path forward.



Single and multi-channel interferometer.



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## **2015 Project Closeouts** *(continued)*

### **PROJECT NO. 469**

#### **Demonstration/Validation of a Surface Cleaning Control Practice to Mitigate Stormwater Metal Contaminants**

##### **PRINCIPAL INVESTIGATORS:**

**Chuck Katz, Brandon Swope**

This team validated a BMP for cleaning impervious surfaces on three San Diego piers. In FY14, the team validated that the power vacuuming/high-pressure washing technique reduced average loading of copper and zinc by 75 percent and 40 percent, respectively. In FY15, the team sent the final report to 29 potential end users worldwide. An article was also published in the spring 2015 issue of *Currents* magazine.



**Power washing technology at work.**

Photo by Chuck Katz

### **PROJECT NO. 491**

#### **Implementation Strategy for Coral Reef Transplantation Methods**

##### **PRINCIPAL INVESTIGATOR:**

**Cheryl Cooke**

This project was formed to describe, review and prioritize potential transplant technologies that could be used to mitigate impacts to coral reefs. The team prepared a final implementation strategy that was used to support the X-Ray Wharf Coral Translocation project in Guam. This document will be published as a Space and Naval Warfare Systems Center Pacific technical document and posted to the NESDI and other web sites. The team also produced a project video that will be posted to the NESDI web site.



***Acropora cervicornis* nursery in Florida.**

Photo courtesy of the Rosentiel School of Marine and Atmospheric Sciences, University of Miami





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## PROJECT NO. 493

### Low Impact Development for Industrial Areas

#### PRINCIPAL INVESTIGATOR:

Edwin Chiang

This project was formed to identify, evaluate, and provide guidance on Low Impact Development (LID) practices capable of removing pollutants and reducing volume from stormwater runoff in industrial areas. In FY15, the team published a decision support system to help managers choose the appropriate LID measures, and a final report detailing the effectiveness of various BMPs. A final literature review was also published.



The compost mat shown here is designed to reduce the metal loading associated with stormwater runoff.

Photo courtesy of the Low Impact Development Center

## Web Site Enhancements

In FY15, we made a number of improvements to the NESDI web site:

- Redesigned the public side of the site for a cleaner look and feel
- Streamlined the processes for evaluating needs and full proposals
- Improved public access to project information by updating “fact sheets” on all our active projects.



Visit us at [www.nesdi.navy.mil](http://www.nesdi.navy.mil).



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## 2015 Project Accomplishments

A number of ongoing NESDI projects were particularly successful in FY15. Some notable successes are highlighted on the following pages:

### PROJECT NO. 440

#### **Surface Cleaning of Drydock Floors**

##### **PRINCIPAL INVESTIGATOR:**

**Jim Howell**

Drydock cleaning is labor-intensive and has limited effectiveness for reducing metals runoff. This project selected and tested a cleaning vehicle that demonstrated 90 percent effectiveness at removing primary contaminants during a sampling event. The vehicle is currently being evaluated during regular operations at Puget Sound Naval Shipyard.



**The cleaning vehicle.** Photo by Jim Howell

### PROJECT NO. 457

#### **Compliance with the Emerging Requirements of the Stage II Disinfectant and Disinfection Byproduct Rule**

##### **PRINCIPAL INVESTIGATOR:**

**Steve Fann**

According to the U.S. Environmental Protection Agency (EPA), the byproducts of drinking water disinfection are considered a contaminant. To meet the Navy's unique needs, this team successfully lab tested a new type of ceramic membrane filtration. The pilot membrane technology has been shipped to Naval Air Station Lemoore where it awaits demonstration.



**The pilot unit at Naval Air Station Lemoore.**

Photo by Steve Fann

## 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. In FY15, a letter of authorization was signed for a non-chromate Type I primer. In addition, non-chromate Type II primers have been applied to numerous F-A/18, P-3 and H-53 aircraft.



**Painter working on a P-3C.**

Photo by Naval Air Station Jacksonville

## PROJECT NO. 465

### **Demonstration of Passive Samplers for Assessing Environmentally Realistic Concentrations of Munitions Constituents at Underwater UXO Sites**

#### **PRINCIPAL INVESTIGATOR:**

**Gunther Rosen**

In FY15, this project field tested two types of passive samplers for assessing the presence of munitions constituents in the marine environment. One type, the polar organic chemical integrative sampler (POCIS) was found to detect ultra-low levels of constituents of concern at low cost with more accuracy than any previous system. Two articles detailing results of the testing were published, and a follow-on Environmental Security Technology Certification Program project was initiated.



**The POCIS encased in its canister.**

Photo by Gunther Rosen





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## 2015 Project Accomplishments *(continued)*

### PROJECT NO. 466

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

##### **PRINCIPAL INVESTIGATOR:**

**John Kornuc**

The objective of this project is to demonstrate an improved process for separating and recovering munitions and explosives of concern (MEC) from freshly dredged (wet) material using mechanical screens. Initial testing using MEC-free sediment revealed that the target material was moving through the screen, but was rapidly covered with sediment. The testing process is being refined.



**Dewatered excavated dredged material being screened for MEC.** Photo by Fred Goetz

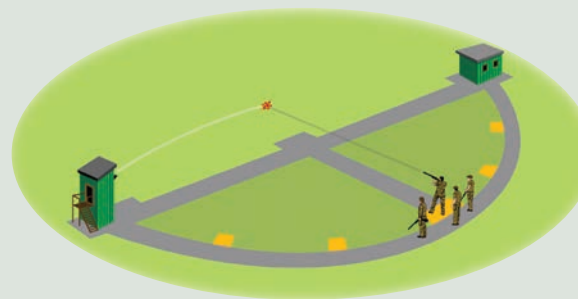
### PROJECT NO. 474

#### **Toxicity Associated with PAHs 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. It is the goal of this project to determine the health threat from PAHs found in clay targets used on Navy skeet ranges. In FY15, the team obtained consistent extraction test calibration data run results and is currently performing minor adjustments to improve overall percentage recovery and aid in the analysis during the correlation to in vivo work. U.S. Army Corps of Engineers and SERDP feeding trials were also completed during this time period.



**Skeet shooting range.** Diagram by John Lambert



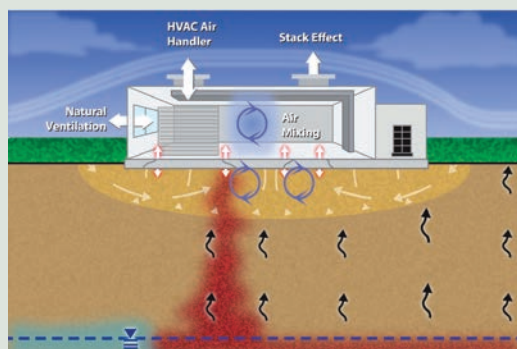
## PROJECT NO. 476

### **A Quantitative Decision Framework for Assessing Navy Vapor Intrusion Sites**

#### **PRINCIPAL INVESTIGATOR:**

**Trish Venable**

Vapor Intrusion (VI) occurs when vapor-phase contaminants migrate from subsurface sources into buildings. This project team has developed a decision framework to help the Navy evaluate VI risk and expedite site management decisions. The final report is in final review, and database, data analysis results and the decision framework scoring system were presented at a poster session attended by regulators, contractors and other VI field professionals.



**Industrial building vapor intrusion scenario.**

Diagram by John Lambert

## PROJECT NO. 485

### **Demonstrate and Validate Alternatives to Methylene Chloride-based Chemical Paint Strippers**

#### **PRINCIPAL INVESTIGATOR:**

**Luc Doan**

The purpose of this project was to identify and test a thixotropic paint stripper to replace the current methylene-chloride based product. In FY15, the team successfully completed its final demonstration/validation: testing on aluminum and fiberglass sections of an E-2 Hawkeye rotodome. A draft military specification is now underway.



**Non-methylene chloride based chemical**

**paint remover used on fiberglass.** Photo by Luc Doan



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## 2015 Project Accomplishments *(continued)*

### PROJECT NO. 487

#### Use of Mixed Metal Electrodes for Water Treatment

##### PRINCIPAL INVESTIGATOR:

Nancy Ruiz

The purpose of this project was to demonstrate a mixed metal oxide electrochemical water treatment system for drinking water at remote locations. A six-month field demonstration in FY15 resulted in a 99 to 99.9 percent removal of bacteria. Disinfection byproducts were not generated above regulatory levels, and the treatment was shown to slightly mitigate the formation of total trihalomethanes upon subsequent exposure to hypochlorite. The results of the project have been published in the *Chemical Engineering Journal*.



Skid-mounted mixed-metal treatment field unit at NAS Lemoore. Photo courtesy of CB&I Federal Services

### PROJECT NO. 489

#### Oil Boom Biofouling Control by Mechanical Intervention and Material Technologies

##### PRINCIPAL INVESTIGATOR:

Matt Naiman

This team validated the use of an environmentally friendly non-stick coating in conjunction with in-water cleaning to reduce the biofouling of oil containment booms. In FY15 tests, the team determined that the new stock required 50 percent less cleaning time for out-of-water cleaning. Initial tests indicate that in-water cleaning is also practical, which would yield significant labor savings. In addition, first season biofouling rates indicate that intervals between cleanings could be doubled.



Boom segments as deployed prior to cleaning at Port Canaveral. Photo courtesy of Abe Stephens, Florida

Institute of Technology Center for Corrosion and Biofouling Control



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## PROJECT NO. 492

### **Capacitive Deionization (CDI) Water Treatment System**

#### **PRINCIPAL INVESTIGATOR:**

**Ignacio Rivera**

The goal of this project was to challenge-test and improve upon the application of Capacitive Deionization (CDI) for the treatment of drinking water at small facilities. The prototype system reduced copper from 1,500 parts per billion (ppb) to 400 ppb, below the EPA standard of 500 ppb. The system also successfully treated water spiked to about 400 ppb with total trihalo-methanes. Estimates indicate that a CDI system with 15 cells, each with 10 pairs of electrodes should be able to treat 1,000 gallons per day.



**CDI holds promise as a more  
cost-effective option for the treatment  
of drinking water at small facilities.**

U.S. Navy photo by Mass Communication Specialist

1st Class Eric Dietrich

## PROJECT NO. 495

### **Radioactive Material Permit Generation, Management, and Tracking System**

#### **PRINCIPAL INVESTIGATOR:**

**Eric Friedl**

This project team completed development of a database that will streamline Radiological Affairs Support Office (RASO) operations and ensure compliance with environmental rules and regulations. The tool is currently in use at RASO and the software is being transitioned to the maintenance phase.



**Sailors inspecting Navy aircraft components  
with beta/gamma detector equipment.**

U.S. Navy photo by Mass Communication Specialist

1st Class Jose Lopez Jr.



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## 2015 Project Accomplishments *(continued)*

### PROJECT NO. 498

#### **Emissions Capture Technology for OxyFuel Hull Cutting Operations**

##### **PRINCIPAL INVESTIGATOR:**

**Jim Howell**

This project team designed a containment shroud to help eliminate, reduce or control point-of-generation emissions and opacity during shipbreaking operations. Two rounds of hot cut testing were completed to determine optimal heat-resistant materials/coatings and filtration and air recovery blower requirements. Subsequently, due to rescheduling, the focus is now on using the enclosure for submarine dismantling, and the prototype is undergoing design modifications.



The prototype capture system. Photo by Jim Howell

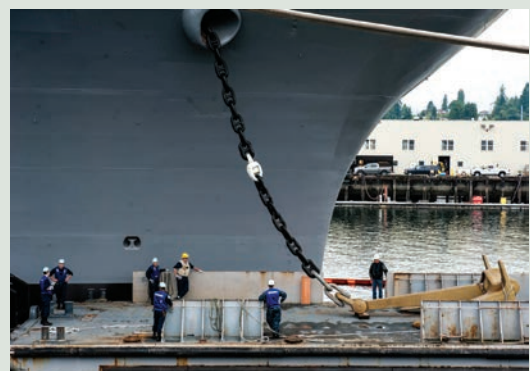
### PROJECT NO. 506

#### **Evaluation and Implementation of Compliance Options for NPDES Cooling Water Intake Structures at Existing Facilities**

##### **PRINCIPAL INVESTIGATOR:**

**P.F. Wang**

The use of water for vessel cooling at the volumes and rates required at Naval shipyards has the potential to entrain and impinge large numbers of fish eggs and larvae. A new rule signed by the EPA is poised to affect cooling water intake structures at these facilities. This project team held a meeting with EPA and the Naval Sea Systems Command to interpret the rule, then conducted an onsite review of existing cooling water structures. The team suggested modification to the intake mouth pipe, which was accepted by EPA.



**A ship arrives at Puget Sound Naval Shipyard &  
Intermediate Maintenance Facility for maintenance.**

U.S. Navy photo by Mass Communication Specialist

Seaman Apprentice Christopher Frost





**Integrate  
Solutions**

## PROJECT NO. 509

### **Enterprise NAVFAC Hazardous Waste Application**

#### **PRINCIPAL INVESTIGATOR:**

**Matt Hawkins**

The goal of this project is the development of a secure, web-enabled hazardous waste application that can be used by Naval Facilities Engineering Command installations worldwide. In FY15, software buildout and beta testing was conducted for a select number of users.



**Barrels of hazardous waste stored aboard ship.**

U.S. Navy photo by Mass Communication Specialist

3rd Class Dean M. Cates

## PROJECT NO. 510

### **Pierside In-situ Discharge Monitoring for Collection and Holding Tank (CHT) Contaminants**

#### **PRINCIPAL INVESTIGATOR:**

**Rachel Jacobs**

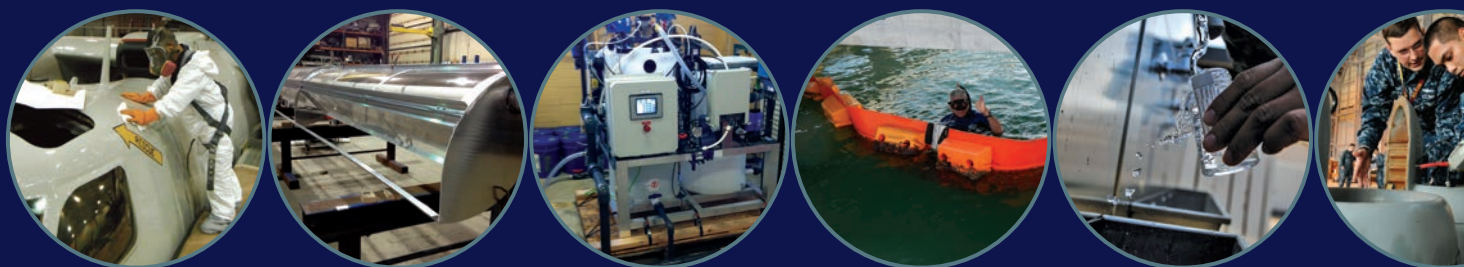
This project was formed to select, demonstrate and validate a sensor for use at Naval Station Mayport that will identify whether ships are discharging constituents that could harm a downstream wastewater treatment plant. The team met with Mayport staff to determine technical parameters for the sensors, initiated the sensor selection process, and met with the fabrication shop to discuss project parameters and contract requirements.



**Sailors disconnect a CHT system from shore**

**drainage.** U.S. Navy photo by Mass Communication Specialist

3rd Class Scott Pittman



## Looking Forward

As FY16 begins, we have 55 active projects with 12 set to close out at the end of the fiscal year. Our renewed focus on accountability will extend into FY16 and beyond and include detailed management plans at the onset of our new projects and monitoring the status of our active projects to ensure that project expenditures stay on track and program obligation and expenditure benchmarks are met.

We will also continue to push for the integration of our validated technologies, processes and materials into the ongoing operation of the Fleet. Leveraging a number of Navy working groups (including the Water Media Field Team, Alternative Restoration Technologies Team, and Corrosion Fleet Focus Team) will help during the validation process and as we move toward integration. Also during FY16, the NESDI program will continue to leverage its efforts with the research being sponsored by ESTCP including research on minimizing the use of cadmium and hexavalent chromium.

These focus areas of accountability, integration and leveraging will be underscored during the site visits that have already been scheduled to accompany our In-Progress Reviews (IPR) in FY16.

Visit our web site at [www.nesdi.navy.mil](http://www.nesdi.navy.mil) to get the latest information about the program over the course of the year.



**Looking  
Forward**

## Our FY16 Schedule

No.	What	When
1.	Pre-proposals DUE	18 November 2015
2.	Make Pre-proposals Assignments to FWGs	1 December 2015
3.	TDWG & FWG Comments on Pre-proposals DUE	16 December 2015
4.	Evaluate Pre-proposals	11-15 January 2016
5.	Request Full Proposals	20 January 2016
6.	Conduct West Coast In-Progress Review	8-10 March 2016 (China Lake, CA)
7.	Full Proposals DUE	16 March 2016
8.	TDWG & FWG Comments on Full Proposals DUE	1 April 2016
9.	Screen Full Proposals	4-8 April 2016
10.	Principal Investigator Answers to Full Proposal Screening Questions DUE	2 May 2016
11.	Conduct East Coast In-Progress Review	3-5 May 2016 (Washington Navy Yard, DC)
12.	Evaluate Full Proposals	16-20 May 2016
13.	Announce FY17 Needs Solicitation	1 June 2016
14.	Obtain Sponsor Review & Approval of Full Proposals	10 June 2016
15.	Announce FY17 New Starts	29 July 2016
16.	Close FY17 Needs Solicitation	1 August 2016
17.	Screen Needs	8-11 August 2016
18.	Evaluate & Rank Needs	12-16 September 2016
19.	Obtain Sponsor Review & Approval of Needs	19 September - 7 October 2016
20.	Request Pre-proposals	14 October 2016
21.	Conduct OPNAV N45 Programmatic Review	November 2016
22.	Quarterly Status Reports Due	4 January 2016 4 April 2016 5 July 2016 3 October 2016

Check out our web site ([www.nesdi.navy.mil](http://www.nesdi.navy.mil)) for the latest version of our program schedule.



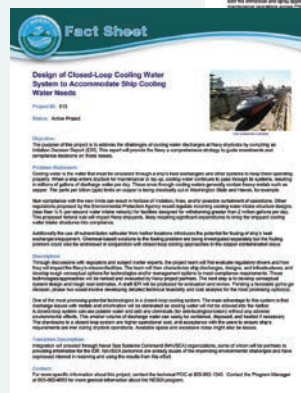
Promoting  
Our Successes

## Promoting Our Successes

Successful NESDI projects were promoted throughout FY15 in a variety of print and online publications. In addition to this Year in Review report, an annual programmatic review, and the program's web site, 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. The program has also generated several videos to promote the results of some of our more successful projects—all available via the NESDI web site.

### Quarterly Newsletters

*NESDI News: Highlights and Happenings*—the program's quarterly 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 four issues of our newsletter in FY15.



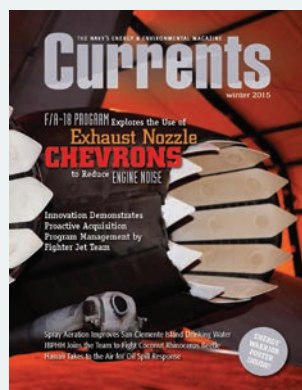
### Fact Sheets

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.





Promoting  
Our Successes



## 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. SPAWAR Validates New Tool for Quantifying Copper and Zinc in Stormwater: WinSLAMM Use Supports Development of Control Practices to Reduce Metal Concentrations
2. NESDI Project Studies Pier Cleaning to Reduce Toxicity in Stormwater: Technique Combines Power Vacuuming & High-Pressure Washing
3. SPAWAR Validates Sampler for Underwater Detection of Munitions Constituents: Polar Organic Chemical Integrative Samplers Deemed More Effective Than Other Methods
4. Carderock Targets Monitoring & Control of Emissions from Puget Shipbreaking: New Technologies Target Thermal Cutting Operations & Fugitive Emissions
5. Carderock Testing New Oil Boom Fouling Release Material: New Material Reduces Biofouling, Simplifies Cleaning
6. ESTCP Explores Innovations to Maintain Shipboard Heat Exchangers: Initial Study Focuses on the Use of Iodine Bubble to Reduce the Rate of Fouling
7. CNO Environmental Research & Development Programs Release Annual Reports: First-ever LMR Report Joins Latest NESDI Year In Review Report

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>.



For More  
Information

## For More Information

For more information about the operation of the NESDI program, contact Ken Kaempffe or members of the program's TDWG at the following phone numbers and email addresses:

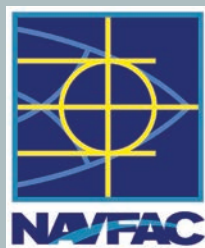
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7.	McCaffrey, Bruce	Consultant	773-376-6200	brucemccaffrey@sbcglobal.net
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12.	Youngers, Luzmarie	NAVAIR	904-790-6382	luzmarie.youngers@navy.mil

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](http://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](mailto:ljwass@outlook.com) or 207-384-5249.



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



*Accomplishments of the*

**NAVY ENVIRONMENTAL  
SUSTAINABILITY DEVELOPMENT  
TO INTEGRATION PROGRAM**

For more information about the NESDI program  
visit [www.nesdi.navy.mil](http://www.nesdi.navy.mil).

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# 2015

## YEAR IN REVIEW REPORT

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