2017

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 https://epl.navfac.navy.mil/nesdi.

Cover photo by Mass Communication Specialist 3rd Class Nathan T. Beard.

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 Navy readiness. The program seeks to accomplish this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

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

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WELCOME

Ken Kaempffe

Welcome to the Navy Environmental Sustainability Development to Integration (NESDI) program's fiscal year (FY) 2017 Year in Review Report. This report summarizes the accomplishments of our many NESDI team members from across the Navy. I'd like to thank everyone who contributed to making the NESDI program a success yet again in 2017.

As has been the case in recent years, one of the greatest challenges facing the NESDI program is budgetary uncertainty. Unfortunately, the Continuing Resolution (CR) has become "business as usual." It is nearly impossible to anticipate and mitigate all of the impacts associated with CRs but, for the most part, we have been able to address those impacts by delaying some of our projects and scaling back on others. In FY17, the NESDI program was funded at $5.6M—on the high end of the range over the past five years. In FY17, we expect funding for the program to be reduced to $4.8M in FY18 and $4.3M in FY19.

In the second half of FY17, we completed our standard needs collection process. A total of 57 unique field-level needs were collected, screened, evaluated and ranked using our established process. At the end of FY17, our resource sponsor (OPNAV N45) approved seven of those needs for possible proposal solicitation. However, due to planned budget reductions in FY18 and FY19, we were not able to request proposals for these approved needs. This means that we will not run our normal pre-proposal and full-proposal processes in FY18 and we do not anticipate awarding any "new start" projects in FY19.

I'd like to thank everyone who contributed to making the NESDI program a success yet again in 2017.

In FY17, the NESDI program successfully completed two In-Progress Reviews (IPR)—one at the Fleet Readiness Center (FRC) Southeast in Jacksonville, Florida on 28-30 March 2017 and a second IPR at the Naval Postgraduate School (NPS) in Monterey, California on 9-11 May 2017. Principal Investigators briefed me and our management team (the Technology Development Working Group (TDWG)) on the status of all of our active projects.

The FRC Southeast IPR included a tour of a local maintenance facility where we were able to see several successful NESDI projects in use by fleet personnel. Projects led by our colleagues from the Naval Air Systems Command (NAVAIR) often have the most direct impact on Navy readiness.

A Word From Our Program Manager

Our project, Advanced Anodizing using Process Control Technology (project no. 330), successfully demonstrated a hexavalent chromium-free anodizing technology for use at all Navy FRCs. In FY17, full production capability was achieved for the advance anodize line at FRC Southeast. The upgrade was funded with capital improvement money. During the same IPR, we were able to observe a field demonstration of another important project which is still underway, Naval Air Systems Command Solutions for Engine Washing (project no. 542). The new system produces deionized water for the engine wash cycle. Effluent from each wash is collected, the contaminants are removed via the system's integrated treatment process and the water is then reused. Additionally, the new system is much faster than the legacy engine wash process. Once successfully demonstrated and transitioned, the new process will dramatically improve the engine wash process. At the NPS IPR, we investigated possibilities for further collaboration and NPS is now a team member on one of our "new start" projects (Business Processes and Requirements Enabling Technology Integration (project no. 567)). Two NPS graduate students will analyze our current technology integration process and propose improvements in their theses for their master's degrees.

Investing in Critical Topic Areas

The NESDI program continues to invest in methods to optimize the restoration of sites containing historical contamination from perfluorochemicals. We have recently launched a project that will address the use of these compounds in materials such as firefighting foam. In fact, the NESDI program has four active projects that will enhance the Navy's response to potential risks posed by perfluorochemicals:

1. Structure-function Relationship and Environmental Behavior of Per- and Polyfluorochemicals from Aqueous Film-forming Foams (project no. 527)
2. Technology Evaluation and Sampling for Treatment of Perfluorochemicals (project no. 534)
3. Study of Waste Management and Minimization for AFFF Wastewater (project no. 553)
4. Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater (project no. 555)

You can read more about these and other projects by selecting the projects tab on our website at http://navysustainability.dodlive.mil/environment/nesdi (our public website) and https://epl.navfac.navy.mil/nesdi (our restricted site which requires a Common Access Card). As the Navy's 6.4 environmental technology demonstration and validation program, the NESDI program will continue to address the Navy's most difficult and persistent environmental challenges in FY18 and beyond.

Insights into Our "New Start" Projects

In this report, you can read about all of the efforts we initiated in FY17 including:

- Addressing Temporal Variability in Industrial Buildings during Vapor Intrusion Assessments (project no. 554)
- Background Analysis and Tracer Study to Identify Metal Contaminant Source Contributions to Stormwater Runoff (project no. 559)
- Biochar Adsorption for Dry Dock Effluent (project no. 560)
- Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal (project no. 561)

- Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers (project no. 562)
- Low-VOC Primers for Ground Support Equipment Application (project no. 563)
- Source Metal Particle Removal for Stormwater Compliance (project no. 566)

These are just a sample of NESDI projects that address difficult and persistent environmental compliance issues and also reduce the lifecycle cost of our ongoing operations. And all of these and other newly-launched NESDI projects are profiled later on in this report.

What's in Store for 2018

I have a number of things in mind for FY18 and the out-years. In FY18, we will continue to examine how we may better serve our shipyards. At the conclusion of FY17, several of us from the TDWG visited the Puget Sound Naval Shipyard to better understand how past and current NESDI projects are being integrated into operations. We have instituted process improvements that will help us better ensure shipyard projects are meeting their intended goal. We will hold one of our FY18 IPRs at Pearl Harbor that will focus on projects with the most direct impact on the operation of our shipyards. The shipyards have many challenges and the NESDI program will do its best to provide methods and technologies that help all of our shipyards meet their ever-challenging environmental compliance requirements.

With funding levels decreasing in FY18, we will place increased emphasis on closing out projects that are very near to the finish line. Closing out old projects increases our capacity to award new projects. We anticipate that we will return to our standard processes in FY19 including pre- and full proposal solicitations and "new start" project launches in FY20.

How You Can Participate

We need the most help identifying environmental requirements and implementing the results of our various projects into the ongoing operations of the Navy. 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 websites.

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

I hope you find this Year in Review report to be a valuable resource as you search for additional insights into our projects and the overall operation and continued success of our program in FY18 and beyond.

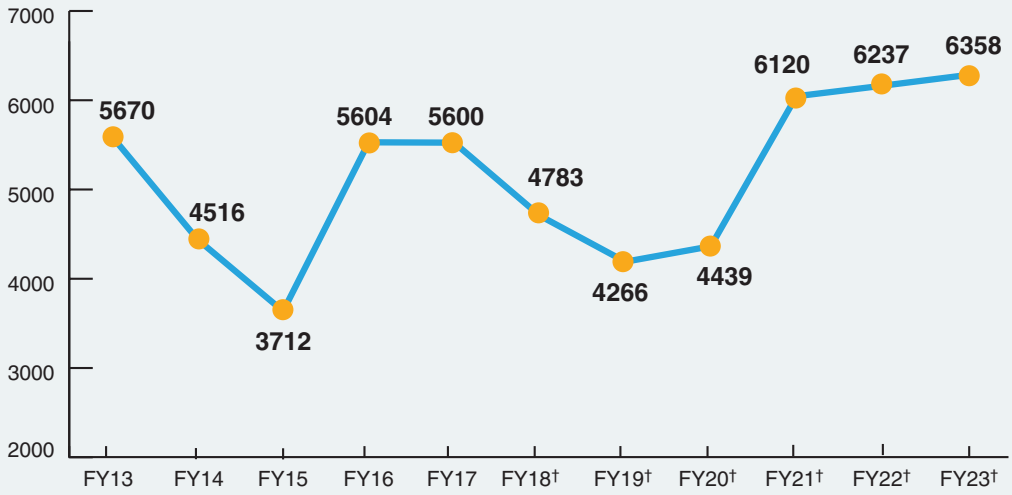
Ken Kaempffe
Program Manager
ken.kaempffe@navy.mil

Financial Highlights

Program Funding

Each year, the NESDI program establishes its investments based on the requirements identified by its end users from across the Navy and potential risk to the Navy mission. The chart below shows the evolution of the program's actual funding levels from fiscal year (FY) 2013 through FY17, as well as projected funding levels from FY18 through FY23.

Program Funding (FY13 – FY23)

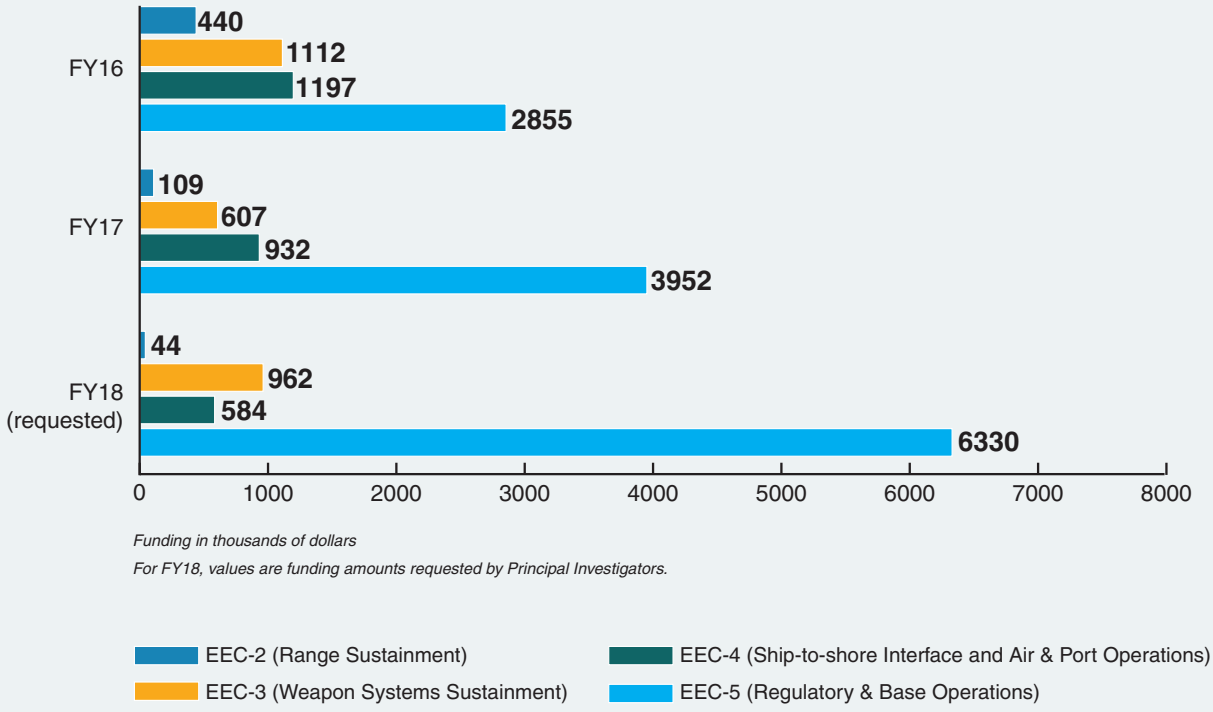


Funding in thousands of dollars

† Projected

The following graphic summarizes program funding trends from FY16 through FY18 by Environmental Enabling Capability (EEC).

Program Funding (FY16 - FY18)



Funding in thousands of dollars

For FY18, values are funding amounts requested by Principal Investigators.

For a description of each of these EECs, see page 67 in this report.

THE NESDI PROGRAM PROCESS

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

1 COLLECT, VALIDATE & RANK NEEDS

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

2 COLLECT, EVALUATE & RANK PROPOSALS

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

3 EXECUTE PROJECTS

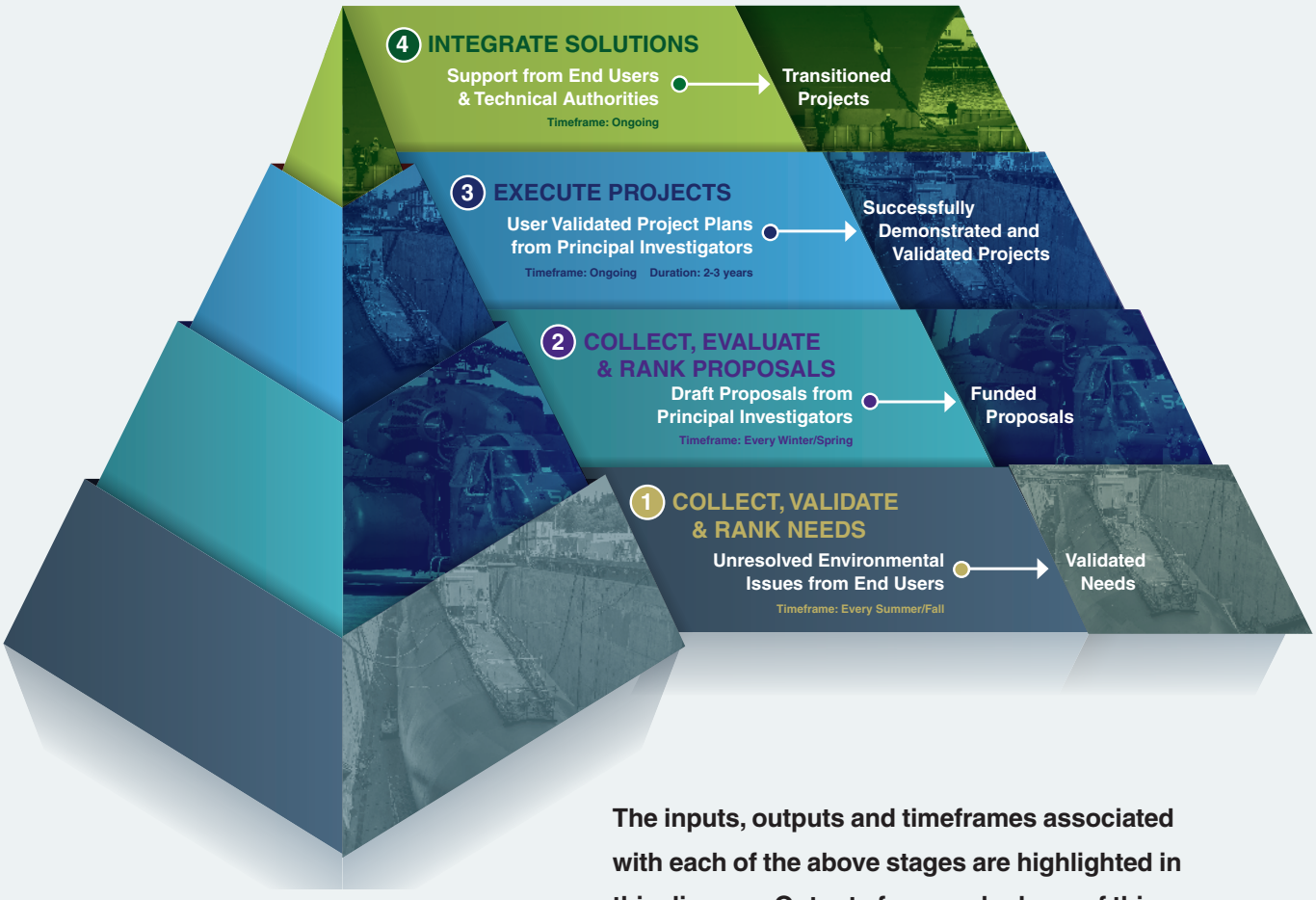
Once proposals have been selected and funded, the program ensures during this third phase of its annual management process that the projects remain properly focused on the needs they were intending to address through initial planning, ongoing reporting and management oversight.

4 INTEGRATE SOLUTIONS

Throughout the project lifecycle, the NESDI program concentrates on moving the demonstrated technologies and other solutions out of the laboratories and demonstration sites and into the appropriate operational environment. During this fourth and final phase of the NESDI program process, the TDWG, Principal Investigators and end users work together to ensure that various solutions are successfully integrated into Navy operations 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 NESDI PROGRAM PROCESS



The inputs, outputs and timeframes associated with each of the above stages are highlighted in this diagram. Outputs from each phase of this process as executed throughout FY17 are discussed in the subsequent sections of this report.

1 COLLECT, VALIDATE & RANK NEEDS

Process Overview

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

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

Collect, Validate & Rank Needs

Results of FY17 Needs Solicitation, Screening & Ranking

The program collected a total of 62 needs via our FY17 solicitation. After a thorough review by program personnel including the TDWG and the program's resource sponsor (OPNAV N45), the following 29 needs were determined to be worthy of further attention by the program.

1. Alternatives to SF6 Switchgear (need no. N-1115-17)
2. Addressing Temporal Variability in Industrial Buildings during Vapor Intrusion Assessments (need no. N-1120-17)
3. Propane Burner Flashing for Certifying Safe Large-Scale Materials Potentially Presenting an Explosive Hazard (need no. N-1123-17)
4. Low-VOC Ground Support Primer(s) (need no. N-1124-17)
5. Need Alternative Process to Manage Downgraded Fuel from Aircraft Fuel Facility (need no. N-1127-17)
6. Eliminating Barriers that Prevent Technology Integration (need no. N-1131-17)
7. Heavy Metals Reduction in Surface Finishing Processes (need no. N-1132-17)
8. Industrial Waste Management of Spent AFFF Solution (need no. N-1134-17)
9. Caisson Ballast Water Treatment/Containment System Study & Field Testing (need no. N-1135-17)
10. Navy Enterprise-wide Hazardous Material Standardization, Minimization and Substitution of General Use Consumables (need no. N-1138-17)
11. New Treatment Technologies are Needed to Treat Groundwater and Surface Waters Impacted by Polyfluoroalkyl and Perfluoroalkyl Substances (need no. N-1143-17)
12. Climate Change Vulnerability Screening Tool for Environmental Restoration Sites (need no. N-1144-17)
13. Navy Installation Solid Waste Diversion Technology, Process Knowledge and Capability (need no. N-1145-17)
14. Automatic Stormwater Sampling in Locations with Tidal Influence (need no. N-1148-17)
15. Source Metal Particle Removal for Stormwater Compliance (need no. N-1150-17)
16. Automated Cleaning of Potable Water Tanks (need no. N-1152-17)

(continued)

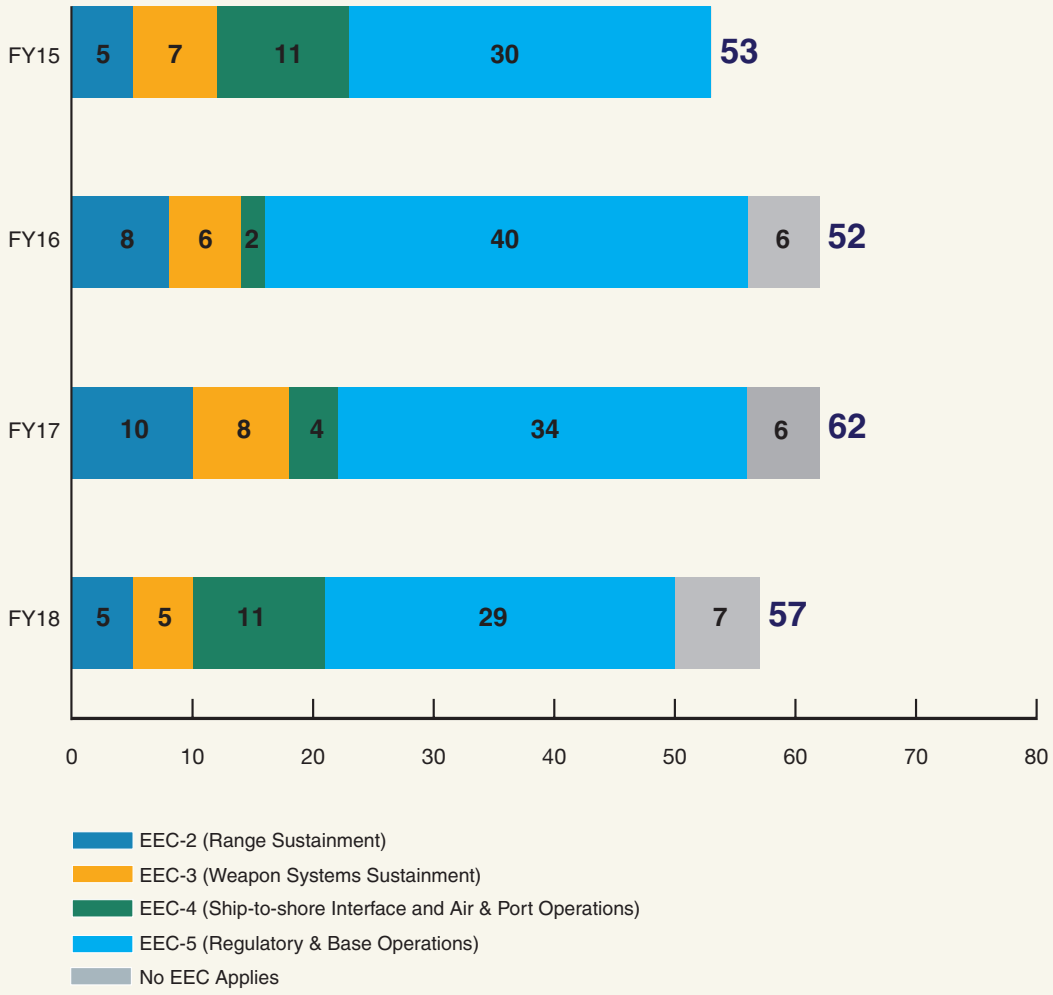
17. New Technologies for Turbidity Removal of Surface Water Drinking Water Sources (need no. N-1153-17)
18. Alternative Treatment Technology to Open Burning Open Detonation of Waste Military Munitions (need no. N-1154-17)
19. Dissolved Sulfides Treatment Alternatives for Oil/Water Separator Discharges (need no. N-1155-17)
20. Reduction of Clinical Laboratory Waste by Solvent Recovery (need no. N-1156-17)
21. Flame Resistant Oil Spill Containment Boom (need no. N-1158-17)
22. Coating Removal of Naval Aircraft Components: Alternative to Chemical/Mechanical Removal Technology IDR (need no. N-1159-17)
23. Mitigation of Blast Effects from Underwater Blow-In-Place of Unexploded Ordnance (need no. N-1160-17)
24. Clean Water Act Climate Change Vulnerability Assessment (need no. N-1162-17)
25. Guidance on Implementing the Aquatic Life Ambient Estuarine/ Marine Water Quality Criteria for Copper (need no. N-1164-17)
26. Sustainable Mitigation of Metals and Nutrients from Dry Dock Discharges (need no. N-1165-17)
27. Assessment of Uncontrolled Stormwater Pollutants (need no. N-1172-17)
28. Development of a Portable Temporary Brown Treesnake Barrier to Facilitate Equipment and Cargo Inspections (need no. N-1173-17)
29. Cold Spray as a Hard Chromium Electroplating Alternative (need no. N-1174-17)

As a result, the program solicited proposals to address these priority needs.

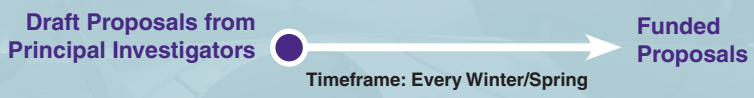
A summary of the number of needs collected by EEC from FY15 through FY18 is provided in the chart that follows.

FY15 – FY18 Needs Collected

The chart below distributes the number of needs collected by the NESDI program in FY15 through FY18.



2 COLLECT, EVALUATE & RANK PROPOSALS



Process Overview

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

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

Collect, Evaluate & Rank Proposals

Summary of Proposals Requested & Received

In FY17, we collected a total of 44 pre-proposals to address the priority needs that resulted from our FY17 needs solicitation process. The next significant milestone on the NESDI program schedule is the review of full proposals. 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 Navy operations. This was followed by a final evaluation that determined which pre-proposals will proceed to full proposal development. These results were provided to anyone who submitted a pre-proposal shortly after the evaluation period ended.

The following 16 full proposals were requested for those pre-proposals that met the evaluation criteria and addressed the explicit requirements stated in the targeted need.

1. Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal (full proposal no. 188)
2. Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Naval Fleet Readiness Centers (full proposal no.189)
3. Business Processes and Requirements Enabling Technology Integration (full proposal no. 191)
4. Addressing Temporal Variability in Industrial Buildings during Vapor Intrusion Assessments (full proposal no. 192)
5. Navy Enterprise-wide Hazardous Material Standardization and Minimization of General Use Consumables (full proposal no. 193)
6. Metal and Nutrient Contamination Mitigation (full proposal no. 194)
7. In-Situ Automatic Stormwater Sampling Device for Use at Tidally Impacted Sampling Locations (full proposal no. 195)
8. Source Metal Particle Removal for Stormwater Compliance (full proposal no. 196)
9. Study of Waste Management and Minimization for AFFF Wastewater (full proposal no. 197)
10. Background Analysis and Tracer Study to Identify Metal Contaminant Source Contributions to Stormwater Runoff (full proposal no. 198)
11. Implementation of Biotic Ligand Model-Based Water Quality Standards for Copper at Navy Sites (full proposal no. 199)
12. Low VOC Primers for Ground Support Equipment Application (full proposal no. 200)
13. Biochar Adsorption for Dry Dock Effluent (full proposal no. 201)
14. Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater (full proposal no. 202)
15. Initiation Decision Report of Laser Coating Removal on Naval Aircraft Components (full proposal no. 203)
16. Non-chromate Deoxidizer for Resistance Spot Weld Cleaning (full proposal no. 204)

3 EXECUTE PROJECTS

End UserValidated Project Plans from Principal Investigators

Timeframe: Ongoing
Duration: 2-3 years

Successfully Demonstrated and Validated Projects

Process Overview

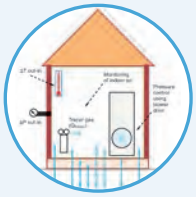
Once proposals have been selected and funded, the program ensures that the resultant projects are properly launched with the right objectives in mind and remain properly focused on their original objectives and on the needs they were intending to address.

FY17 "New Start" Projects

Each year, the NESDI program collects environmental needs from across the Navy's shore community. Based on selected needs, project teams are formed to demonstrate, validate and integrate innovative technologies, processes and materials into Navy operations. From the full proposals received in FY17, the program gave the green light to the following 14 "new start" projects listed below. These projects range from a study of improved methods to manage and minimize the wastewater associated with firefighting aqueous film forming foam to the validation of an affordable in-situ device to automatically sample stormwater at tidally impacted locations.

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

1. Project no. 553:
   Study of Waste Management
   and Minimization for AFFF Wastewater



2. Project no. 554:
   Addressing Temporal Variability
   in Industrial Buildings during
   Vapor Intrusion Assessments

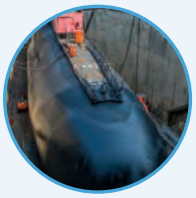
3. Project no. 555:
   Demonstrating the Effectiveness of
   Novel Treatment Technologies for the
   Removal of Poly- and Perfluoroalkyl
   Substances from Groundwater

4. Project no. 556:
   Enterprise-wide Hazardous Material
   Standardization and Minimization
   of General Use Consumables

5. Project no. 557: Initiation Decision Report of Laser Coating Removal on Naval Aircraft Components

6. Project no. 558: In-situ Automatic Stormwater Sampling Device for Use at Tidally Impacted Sampling Locations

7. Project no. 559: Background Analysis and Tracer Study to Identify Metal Contaminant Source Contributions to Stormwater Runoff

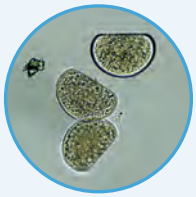


8. Project no. 560: Biochar Adsorption for Dry Dock Effluent

9. Project no. 561: Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal

10. Project no. 562: Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers

11. Project no. 563: Low VOC Primers for Ground Support Equipment Application



12. Project no. 564: Implementation of Biotic Ligand Model-Based Water Quality Standards for Copper at Navy Sites

13. Project no. 566: Source Metal Particle Removal for Stormwater Compliance

14. Project no. 567: Business Processes and Requirements Enabling Technology Integration

2017 New Starts

PROJECT NO. 553

Study of Waste Management and Minimization for AFFF Wastewater

Exploring Ways to Better Manage Firefighting Foam Residue

Aqueous film forming foam (AFFF) fire suppression systems are in place at numerous installations Navy-wide. Whenever these systems are installed, upgraded or tested, large amounts of AFFF-contaminated wastewater are generated. Each test event (recommended once every two years) generates 20,000 to 80,000 gallons of wastewater. Startup testing for a new system generates 80,000 gallons of wastewater. Because this water contains perfluorooctanoic acid (PFOA) and perfluorooctyl sulfonate (PFOS), off-site disposal by incineration is costly.

To address this problem, this project team will first perform a literature review of existing and emerging technologies and management procedures for handling AFFF wastewater. This will include a review of current disposal practices for AFFF wastewater (composed of approximately three percent AFFF concentrate to water) at commercial, private and government sectors. Site visits will be conducted as needed for information gathering and performance evaluation of both commercially applied and developing technologies and management methods. Technologies and methodologies will be evaluated based on performance in treatment or reduction of AFFF waste, cost efficiency for implementation and compliance with applicable standards, regulations and guidance documents.

This study will quantify rinsing efficiency and residual contamination on an aircraft rescue and firefighting vehicle and AFFF hangar system.

Secondly, a pilot study will be conducted to test the effectiveness of triple rinsing legacy concentrates, which no longer meet the current military specifications (mil-spec) for PFOS and PFOA content. This study will quantify rinsing efficiency and residual contamination on an aircraft rescue and firefighting vehicle and AFFF hangar system. This task would produce information and

AFFF system. (Photo Credit: Daniel Edwards)

Sailors conducting a firefighting exercise. (Photo Credit: Mass Communication Specialist 3rd Class Alex Perlman)

strategies for AFFF system rinsing and cleaning, research considerations associated with alternative concentrate replacement and issues associated with potential future removal of AFFF from systems.

At the conclusion of the project, an Initiation Decision Report (IDR) will be produced, containing the results of the literature review, evaluation of specific treatment methods (both mechanical and chemical) and future phase-out considerations and provide potential solutions which can aid in developing guidance on overall AFFF management. The results of the pilot study on triple rinsing will also be utilized in system concentrate replacement planning and execution.

Starting in February 2018, samples from existing equipment are being collected at the pilot test site. These data will be used to select a cleanout target. In addition, there is an opportunity to sample an aircraft rescue and firefighting vehicle which was loaded with legacy material then emptied and filled with newer mil-spec approved concentrate. This sampling event will provide insight into residual concentrations without rinsing. A report on the sampling and the results from the re-filled equipment residual level will be completed in late FY18. For comparison purposes, the pilot rinse out of another system was conducted in the late spring. The final report is expected to be completed near the end of calendar year 2018 although interim reports on the sampling and rinse out results will be issued as necessary and provided to stakeholders prior to the completion of the final report.

The primary customers for the IDR and pilot study report include all Navy facilities that utilize AFFF for fire suppression and have similar fire suppression systems. The study will break down applicable actions for a wide range of potential stakeholders.

Principal Investigator:
Daniel Edwards
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-3734
daniel.m.edwards1@navy.mil

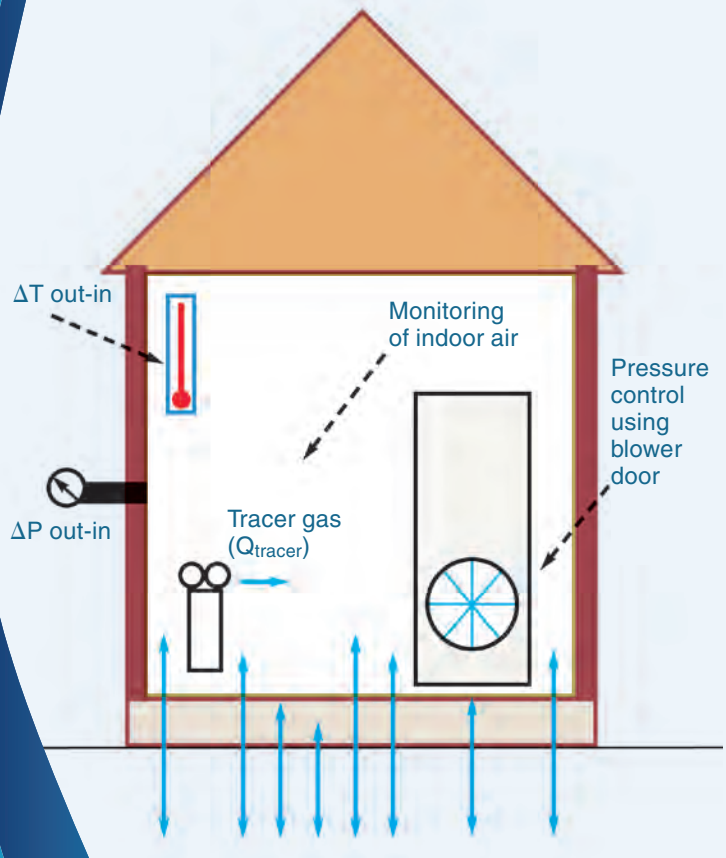
2017 New Starts *(continued)*

PROJECT NO. 554

Temporal Variability Vapor Intrusion Assessments

Strengthening the Vapor Intrusion Decision Framework

The goal of the project is to validate and strengthen the vapor intrusion (VI) decision framework initiated under a previous NESDI project (no. 476: A Quantitative Decision Framework for Assessing Navy Vapor Intrusion Sites) by addressing the data gaps that still exist regarding temporal and spatial variability of VI.



Measuring the temporal variability of vapor intrusion in industrial buildings.

VI is a form of indoor air pollution caused by the migration of chemical vapors from contaminated soil and groundwater into buildings. VI assessments are required at all Environmental Restoration sites and Base Realignment and Closure sites where subsurface volatile organic compounds (VOC) are present. This currently affects over 500 sites. Current regulatory guidance assumes that temporal variability in indoor air concentrations of VOCs at industrial/commercial buildings is similar to that of single family homes, requiring multiple sampling events at different locations within a site. However, investigators utilizing a NESDI-sponsored VI decision framework have collected data that suggests this may not be the best approach, and that indoor air concentrations may be significantly less temporally variable at many Navy industrial buildings than previously supposed. Additionally, the data suggest that attenuation factors (ratio of indoor air to sub-slab soil gas concentrations) in these buildings are much lower than at single family residences.

Using the current regulatory guidance has led to high costs, long timeframes in implementing a solution and continued monitoring of buildings that may have very low VI potential.

A year-long demonstration will be conducted at a selected VI-affected site with sub-surface contamination with a chlorinated solvent. Four zones within the building will be selected based on variables such as ventilation, indoor/outdoor air differentials and the presence of VI pathways. Investigators will utilize a pressure cycling methodology that is currently being fine-tuned under the Environmental Security Technology Certification Program

(ESTCP). Data from the ESTCP project will be shared on an ongoing basis. The results will be used to evaluate the hypothesis that VI potential of buildings/zones can be identified under reasonable worst case depressurization conditions with a relatively short sampling effort.

The results will be used to evaluate the hypothesis that VI potential of buildings/zones can be identified under reasonable worst case depressurization conditions with a relatively short sampling effort.

The final report will include a summary of relevant data collected during field studies, results of data evaluation, an improved VI decision framework and a streamlined approach for conducting VI assessments at industrial buildings. Department of Defense (DoD) VI guidance documents such as the Tri-Service Vapor Intrusion Handbook will also be updated. Presentations will be given at Navy and DoD workgroups and training events.

While Navy Remedial Program Managers (RPM) and contractors are the first and primary target audience, regulatory acceptance of this technology is critical to success and will be aided by inclusion of U.S. Environmental Protection Agency (EPA) representatives on the project team.

Principal Investigator:
Patricia Venable
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1411
patricia.venable@navy.mil

PROJECT NO. 555

Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater

Testing New Options to Treat A Persistent Contaminant

Polyfluoroalkyl substances (PFAS) are chemicals historically found in many consumer products across the globe. Although the use of PFAS is on the decline, these chemicals are persistent in soil and water, and repeated cumulative exposure to PFASs can cause detrimental effects on humans and on wildlife.

There are over 300 Navy sites that have been potentially impacted by PFASs due to the use, storage and treatment of PFAS-containing materials such as AFFF, electroplating mist suppressants and wastewater. The most immediate concern is PFAS contamination of groundwater used as a drinking water source.

Of the 300 affected sites, over 50 are located within one mile of a drinking water well.

Of the 300 affected sites, over 50 are located within one mile of a drinking water well, resulting in significant human health risk, and therefore may require treatment of groundwater for PFASs. Since many PFASs are highly resistant to chemical, biological and photolytic degradation, the most-used treatment approach for groundwater is pump-and-treat using granular activated carbon (GAC) and, more recently, anion exchange (AIX) resins.

2017 New Starts *(continued)*

However, both of these sorbents currently have significant performance limitations, are costly to use and have stringent clean-up levels. In addition, as regulatory levels are driven even lower and other PFASs are added to the regulatory list, performance limitations of standard GAC and AIX become more critical and costly, and incremental differences in performance between products and methods become increasingly important due to the frequent change-outs of adsorbents required. EPA has issued Lifetime Health Advisories for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA)—two common PFAS components. Other PFASs are being considered for regulation and some states have already promulgated values for other PFASs and may further lower PFOS/PFOA cleanup levels.

Due to the low binding capability of GAC and AIX with PFAS components, these media require frequent change-out. Due to the extreme stability of many PFASs, destructive technologies have been largely restricted to high temperature incineration.

New adsorbent and destructive technologies have recently been developed (or are in the late stages of development) for the treatment of PFASs. Due to the varied composition of PFASs and site-specific conditions such as toxin content, ionic strength, natural organic matter and other factors, rigorous testing of new technologies under controlled, but real-world conditions are needed.

This project will investigate PFAS treatments available from vendors and/or

Sailors fight a simulated fire at the Firefighting Damage Control School at Naval Base San Diego. Fire suppression systems such as these contain PFOS and PFOA.

(Photo Credit: Mass Communication Specialist Seaman Brandon Cyr)

those developed at universities. Treatments will be studied using batch and column adsorption tests, soil columns and destructive technologies including electrochemical methods. From these, the best two or three technologies will be demonstrated on a field pilot scale. Adsorbents tested will include GACs, modified activated carbons and related materials such as bone char, synthetic adsorbents including cyclodextrins and ion exchange resins. The criteria to meet the main objective of determining the best available technologies will include cost/performance in terms of treatment of groundwater to: a) current EPA health advisories for PFOS and PFOA, b) other PFASs regulated by states and c) other PFASs detectable by EPA Method 537 (for the analysis of PFOA).

There are a number of ongoing NESDI-sponsored projects studying the characterization and treatment of PFAS in the environment. This project will incorporate any ongoing knowledge gained through these projects as well.

A final report detailing all findings will be given to RPMs at sites containing PFAS plumes. Some of the most affected sites will also receive site visits from the team. In addition, demonstration results will be discussed in appropriate workgroups and presentations will take place at major conferences.

Principal Investigator:
John Kornuc
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1615
john.kornuc@navy.mil

PROJECT NO. 556

Enterprise-wide Hazardous Material Standardization and Minimization of General Use Consumables

Making the Green Choice Easier

Navy units ashore use a variety of hazardous materials such as paints and cleaners. (Items that have mil-specs are not included in general use hazardous materials.) Approximately 24 percent of products procured Navy-wide contain one or more chemicals of concern listed on Systems Command Avoidance Lists and/or the National Aerospace Standard 411 Hazardous Materials Target List.

For most applications, each facility has a choice of which hazardous material to use. The number of commercially available, general use hazardous material products grows each year, as manufacturers reformulate existing products and add new ones, resulting in 1,000 new products entering the Navy inventory each month. For each new product, health, safety and environmental data must be entered into the Navy supply recordkeeping systems for the purpose of environmental reporting.

In summary, the current procurement process for Navy general use hazardous materials procurement has become unsustainable.

To improve and streamline the process, this project team plans to identify less hazardous or non-hazardous alternatives for general use hazardous materials. This will be achieved through a collaboration among Navy Supply Systems Command (NAVSUP), Navy facilities environmental and Navy safety and industrial hygiene personnel.

2017 New Starts *(continued)*

A CHRIMP center.

NAVSUP has access to extensive hazardous materials data which can be used to identify a comparable preferred product for many Local Stock Numbers (LSN) items. A hazardous materials substitution algorithm/program will be designed to augment the Chief of Naval Operations-mandated Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP) effectiveness.

National Stock Number (NSN) items purchased via the supply system feature environmental attribute codes (ENAC) to identify environmentally preferable products. The tool developed by this project team will include a way to identify "green" general use LSN items in the same way that the ENACs are used for products procured via supply system NSN items.

This project team will also identify opportunities and economies of scale through standardization of hazardous materials.

Providing end users access to a new decision tool will result in the reduction of local stock numbers, improved shelf life management and increased use of safer and "greener" substitutes.

The tool developed by this project team will include a way to identify "green" general use LSN items.

In addition, the team will determine the technical and economic feasibility of replacing target hazardous materials on a large scale. The procurement tool/process will be piloted at two Hazardous Materials Supply Centers prior to full scale implementation. It is the goal of this project to achieve a 50 percent increase in sustainable products selected and a 25 percent reduction in the number of new environmental record builds for conventional products.

The hazardous materials standardization, procurement process and the substitution

tools and methods will be demonstrated and proofed at two Hazardous Materials Supply Centers. Lessons learned and recommendations for additional refinement will be promulgated to all Hazardous Material Supply Centers in the continental United States. The NAVSUP Weapons Systems Support Pollution Prevention team and NAVSUP headquarters will revise its hazardous materials management publication to ensure that tools and methods developed as a result of this study are promoted across the Navy.

Principal Investigator:
Renata Laing
Navy Supply Systems Command
717-605-7777
renata.laing@navy.mil

PROJECT NO. 557

Initiation Decision Report of Laser Coating Removal on Naval Aircraft Components

Removing Paint with Lasers Reduces Risk, Saves Time

The depainting processes performed on Navy aircraft generate significant quantities of primary and secondary hazardous waste, resulting in substantial wastewater treatment and hazardous material disposal costs. At the Fleet Readiness Center Southeast (FRC-SE) the current wastewater treatment facilities are antiquated and commercially available off-the-shelf products to upgrade these facilities are unable to process the current wastewater due to high levels of organic compounds.

In addition, the conventional chemical and abrasive depainting processes employed at FRC-SE may pose significant safety and health risks to production artisans. Despite safety precautions, workers are routinely exposed to VOCs and hazardous air pollutants. These operations also cause repetitive motion-related injuries and muscle strain. The existing process may pose a risk to delivering aircraft on time.

One operation that is particularly problematic is the removal of coatings on the radar dome (radome) located on the nose of the aircraft. Since aircraft radar is situated in this area, a protective film known as a radome boot is applied. Currently, these radome boots are removed via sanding (mechanical) operations. These operations generate waste and dust and may result in damage to the underlining composite structure. The repair of damage caused by mechanical coating removal contributes to long lead times on these in-demand components—approximately eight hours to remove the radome and 24 hours for a full re-work. In addition, current workload for aircraft and component coating removal is significant at FRC-SE and is expected to increase.

In recent years, the laser paint stripping process has undergone dramatic improvements. Unlike mechanical techniques, paint stripping by laser is fast, efficient and safe for workers.

Unlike mechanical techniques, paint stripping by laser is fast, efficient and safe for workers.

In laser stripping, paint is heated by lasers and vaporized, followed by immediate combustion as it leaves the surface and encounters oxygen in the air.

2017 New Starts *(continued)*

Typical radome with boot. (Photo Credit: Stephen Starnes)

Several different laser depainting systems are available, ranging from simple hand-held laser equipment to fully automated systems capable of coating removal from an entire aircraft. The Ogden Air Logistics Center at Hill Air Force Base is currently using the Laser Automated De-coating System (LADS) II for coatings removal on F-16 Fighting Falcon and C-130 Hercules radomes. This system has significantly reduced coating removal time, reduced hazardous waste generation by over 99 percent, eliminated worker exposure to hazardous de-coating chemicals and repetitive motion-related injuries and eliminated damage to the radomes caused during de-coating.

This NESDI project will survey various existing technologies to determine the potential effectiveness of these technologies for use at FRCs. Differences in Navy and Air Force radomes and coatings will be identified to determine what type of additional testing is required. If the technology meets the project team's acceptance criteria, the results of this IDR could lead to additional needs for the testing of laser depainting equipment on naval coatings and substrates.

The project's final report will detail advantages and limitations of the identified technology including level of development and applicability (i.e., substrate and coating compatibility) and will specify required testing protocols to compare current hand sanding method and laser depainting techniques.

The successful application of this process on radomes will likely scale up for future full aircraft coatings removal, further reducing costs and human health risks, saving time andrequiring minimal facility modification.

Principal Investigator:
Stephen Starnes
Fleet Readiness Center Southeast
904-790-6410
stephen.starnes@navy.mil

PROJECT NO. 558

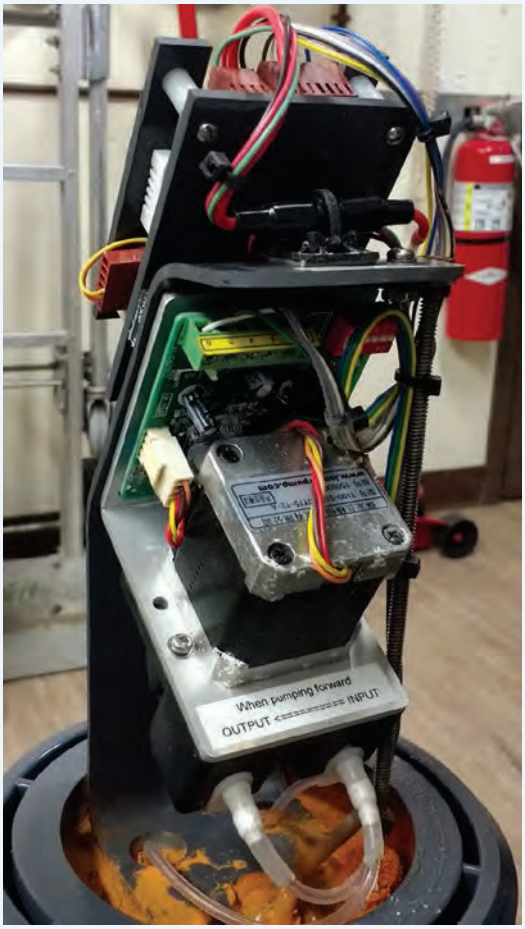
In-situ Automatic Stormwater Sampling Device for Use at Tidally Impacted Sampling Locations

Designing a Cost-Effective Way to Sample Stormwater in Tidal Zones

To meet National Pollutant Discharge Elimination System (NPDES) permit requirements, most industrial stormwater permits, including the majority of Navy facilities, require control measures to minimize or eliminate pollutants in stormwater. These measures generally include monitoring (i.e., sampling) of specified discharges. Stormwater sampling determines pollutant concentrations in runoff and also indicates the effectiveness of the overall stormwater management program.

Navy facilities in coastal areas are presented with the particular problem of tidally impacted stormwater discharge sampling locations. Storm events that coincide with tidal intrusion at sampling sites can result in stormwater/seawater mixing. Sample collection is invalidated due to seawater contaminated samples for chemical and biological evaluation (toxicity assays). Manual sampling during storm events can be difficult to achieve successfully due to manpower and resource constraints, facility constraints and scheduling logistics.

There are automated sampling systems available with complex programming and high-power requirements. However, these are generally cost-prohibitive for smaller-scale monitoring requirements or opportunistic sampling. Per-sample costs to collect a non-tidally impacted sample with these systems can run into the thousands of dollars.



The PAWS system electronics and pump.
(Photo Credit: Ernie Arias)

This project team will design and develop a handheld device with onboard sensing capabilities that can detect the presence of non-tidally impacted stormwater in a stormwater conveyance or discharge sampling location.

This project team will design and develop a handheld device with onboard sensing capabilities that can detect the presence of non-tidally impacted stormwater.

The device will combine elements of a Niskin bottle—a simple, commonplace sampling device used in oceanographic research—and a Programmable Automatic Water

2017 New Starts *(continued)*

Sampler (PAWS) system, such as that recently evaluated by personnel from the Space and Naval Warfare Systems Center Pacific (SSC Pacific) for stormwater discharge particulate tracking.

The PAWS system at SSC Pacific has been deployed in San Diego Bay and Pearl Harbor during storm events over the past year. The PAWS was programmed to sample according to pre-set parameters for conductivity (an indication whether salinity is present). Evaluation of the system proved that the programmable pumping mechanism in an ocean environment was able to collect samples as programmed.

The first technical objective of this effort will be to develop a sensor system that will appropriately trigger stormwater sample collection when conditions are appropriate. Conditions for sampling will occur when the presence of water in the conveyance is detected and measurement of conductivity below a threshold value indicates that water is non-tidal (non-saline). The goal is to create a simple system with low power requirements that can operate autonomously.

The second technical objective is successful sampling and sample retrieval once the device is triggered. The device will be placed at the sampling location, a high-energy coastal area, in a confined space that may be of limited access. Complications arising from physical placement will be addressed and multiple design characteristics will be evaluated.

The demonstration results including description of the technology and its application and cost savings validation will be distributed to facility water managers for their consideration. Commercialization partners will also be sought, including stormwater instrumentation vendors and oceanographic and environmental equipment manufacturers. If a contractor/vendor is selected to provide design and construction support for this effort, they will be recruited at project inception for commercialization.

Principal Investigator:
Ernie Arias
Space and Naval Warfare Systems Center Pacific
619-553-3579
ernie.arias@navy.mil

PROJECT NO. 559

Background Analysis and Tracer Study to Identify Metal Contaminant Source Contributions to Stormwater Runoff

Determining the Actual Source of Contaminants

Urban watersheds contain numerous sources of metals that can ultimately find their way into stormwater runoff. To develop a stormwater management plan, it is important to differentiate the general source types of metal runoff and to differentiate them from naturally occurring background levels. Recent stormwater data in Navy Region Southwest show exceedances of numeric action limit benchmarks for several metals such as iron, aluminum and magnesium—elements that have relatively high abundances in the Earth's crust. Navy Region Southwest is developing best management practices (BMP) to mitigate these constituents, even if they may be naturally occurring or if they occur at generally higher levels in the watershed as a whole.

Green particle tracer moving downstream away from its source. (Photo Credit: Kevin Black)

Current approaches for stormwater management often rely on collecting samples for metals analysis at the "end of pipe" and comparing any measured metals concentrations to benchmarks for action. These benchmarks are typically overly conservative and fail to consider natural background levels or whether these benchmark levels are even obtainable in typical urban watersheds.

This team will characterize and quantify general urban watershed sources, background abundances and Navy-generated source materials to address their relative contribution to the Navy's stormwater runoff. The effort will use two approaches to assess this:

1. A forensic approach that looks at statistical and geochemical distributions of metal contaminants to differentiate source types, and
2. A novel tracer technique that uses fluorescently dyed magnetic particles to identify Navy-generated source locations.

Utilizing the Navy background guidance developed for soils, sediments and groundwater, the project team will employ both statistical and geochemical steps to determine if site particles contain metal concentrations that are considered natural background or whether they are elevated above these levels. Background comparisons will be made among Navy sites and surrounding urban sites with similar types of usage (e.g., shopping areas, industrial sites, residential areas) and urban sites that are not likely to generate their own contaminants (e.g., parks). These comparisons will determine which Navy sites act as background and elevated metal source areas and show how these Navy areas compare to similar non-Navy source areas.

In the tracer study, a tracer substance will be released at sites that are characterized as having elevated metal levels above

2017 New Starts *(continued)*

background or the nearby urban watershed. This tracer material has both fluorescent and paramagnetic properties, meaning that particles can be visually identified and can be collected and separated from other particles using magnets.

Determining the origins of metals in stormwater runoff will prevent stormwater managers from enacting needless BMPs for metal constituents that originate off-site and/or naturally and will inform management decisions regarding specific metal constituents that are found to originate on base.

Determining the origins of metals in stormwater runoff will prevent stormwater managers from enacting needless BMPs.

The project team will continuously involve regulators and stakeholders (e.g., regional water quality board, City of San Diego) so that their inputs can be incorporated into the study design. First Navy users will be at Naval Base San Diego, where the tracer study will be performed with additional sites in San Diego Bay. Effective case study examples, along with regulator involvement, will open the door for regulatory buy-in.

Principal Investigator:
Jim Leather
Space and Naval Warfare Systems Center Pacific
619-553-6240
jim.leather@navy.mil

PROJECT NO. 560

Biochar Adsorption for Dry Dock Effluent

A New Possibility for Reducing Metals Loading

Navy shipyard dry docks generate industrial process water that may contain metal particulates as well as nutrients from stormwater runoff, non-contact cooling systems, and other activities that are regulated under the NPDES program. NPDES permit requirements at Navy shipyards are becoming increasingly more restrictive—particularly with respect to the concentrations of metals and nutrients allowed in point source discharges.

Due to these stringent limits, and the limited capacity to treat large-volume continuous flows, shipyards may be at risk for exceeding NPDES permit limitations for metals such as copper, zinc and aluminum among others.

There are four dry docks at Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility (PHNSY&IMF), six dry docks at Puget Sound Naval Shipyard and additional docks at other Washington State and California installations with similarly restrictive permit levels.

The State of Hawaii is aware of the significant challenges imposed by NPDES permit limitations and has granted PHNSY&IMF a Schedule of Compliance and interim permit limits for pollutants such as copper. Although PHNSY&IMF can consistently attain its current interim limit for copper, the facility continues to struggle to meet the final permit limitations which will go into effect by October 2022. BMPs have

helped to significantly lower metal and nutrient concentrations from the end-of-pipe discharge but do not appear adequate to meet long-term goals.

Recent testing has indicated that the use of biochar can be an effective means of removing metals and nutrients from stormwater and process water streams. A carbonaceous byproduct of bioenergy production, biochar is an inexpensive, highly porous filtration media with high contaminant retention rates.

Recent testing has indicated that the use of biochar can be an effective means of removing metals and nutrients from stormwater and process water streams.

This project team will place weirs within existing dry dock drainage troughs which will result in the temporary pooling of process water. This water will then be forced to flow up through a biochar device to provide adequate contact time and sequestration of contaminants. Lessons learned from previous studies indicate that rinsing the biochar prior to use increases the contaminant holding capacity, and this practice will be implemented during the demonstration.

Other deployment strategies to be tested include the use of biochar as a treatment step within the dry dock sand trap and utilizing clarifying inserts being developed under another NESDI project (project no. 543: Preventative Management of Contaminated Silt). In this case, biochar will be a drop-in media filtration component in the clarifying inserts. Remedy effectiveness will be laboratory tested via EPA-approved methods.

The data from this demonstration will be made available to end users to determine if this technology is a good fit at their respective sites. If so, the passive filtration fixtures used may be fabricated by shipyard tradespeople or contractors using commercially available biochar. Coordination with shipyard personnel and commercial biochar manufacturers will aid in the integration of this technology and provide an effective means of deploying it. A final

A submarine awaits repair in dry dock. (Photo Credit: Mass Communication Specialist 1st Class Amanda R. Gray)

Biochar media. (Photo Credit: Lewis Hsu)

2017 New Starts *(continued)*

report including recommended testing and design criteria will be prepared.

Regulators will have access to the data from this demonstration as evidence of BMP improvement efforts targeting permit violation reductions. If successful, this technology will be included in future updates to BMPs found in shipyard Dry Dock Water Pollution Control Plans and future NPDES permits if applicable.

Principal Investigator:
Lewis Hsu
Space and Naval Warfare Systems Center Pacific
619-553-4934
lewis.hsu1@navy.mil

PROJECT NO. 561

Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal

Simple Solution Aims to Save Time, Maintain Control

The brown treesnake (*Boiga irregularis*) is an invasive species with the largest current and potential impact to Department of Defense (DoD) activities in the Pacific. Since the late 1940s, the brown treesnake (BTS) has caused the extinction or extirpation of many endemic species on Guam, including 10 of 12 forest birds. Were the treesnake to successfully invade other locations, particularly the Commonwealth of the Northern Mariana Islands (CNMI) and Hawaii, it could wreak both biological and economic havoc. Given the increased military activities in the region and military construction on Guam from the Guam and CNMI military relocation, there is a high risk of the treesnake being dispersed into these areas through the DoD transportation network.

Currently, the DoD spends millions of dollars a year on the management and control of the BTS. Much of this funding goes toward inspecting all outbound cargo and equipment for BTS stowaways. (Inspection of cargo at inbound locations may also be required, depending on the location.) The primary BTS inspection method is canine inspection followed by human visual inspection. Cargo is inspected when it arrives at the outbound site and then daily until it is loaded onto a departing vessel.

Cargo is inspected when it arrives at the outbound site and then daily until it is loaded onto a departing vessel.

The speed at which cargo and equipment can be loaded and unloaded is limited by the number of canine teams and the time it takes for them to inspect each piece of cargo. If the canine teams fall behind, this can delay cargo and equipment transport and military missions.

This project team plans to use portable, temporary barriers to prevent the movement of BTS. Cargo and equipment that have passed an initial canine inspection can be stored within these barriers until the day of loading or transport, where they can undergo a final canine inspection before being moved. Such a barrier can also be used as a rapid response tool during the inspection process at a receiving jurisdiction when a canine alerts inspectors to a particular piece of cargo, but the BTS is not immediately visible.

Brown treesnake.

The barrier would serve as a quarantine structure until the BTS can be found and removed.

While some barriers are currently in use by the DoD, existing designs require ground penetration or disturbance (e.g., posts, walls, rebar) in order to withstand local environmental conditions. This is problematic on Guam and the CNMI due to unexploded munition and cultural resource issues.

Utilizing some of the design elements of other temporary barriers, the team will design and test a new prototype barrier under controlled conditions. The successful design will then be field tested on Guam to determine its effectiveness against BTS and its ability to withstand environmental conditions. Following the successful deployment of these tasks, a full-size barrier will be built and utilized in realistic transportation situations.

The team will transition this technology to a variety of audiences (e.g., end-users, DoD personnel, regulators). For long-term technology transition, the Naval Facilities Engineering Command Marianas team member will transition this technology within the DoD, at transportation venues and with regulators on Guam, CNMI and Hawaii.

The team will also produce a guidance document on how to use the barrier, as well as in-person training and a training video.

Principal Investigator:
Jean Pan
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-6084
jean.pan@navy.mil

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PROJECT NO. 562

Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers

Color Changing Chemistry Will Aid Alternative Process Assessment

Metal finishing processes, including conversion coatings, are performed at all major Navy FRCs. Conversion coatings are thin films applied to alloys to provide some measure of corrosion protection and to promote adhesion between the alloy and subsequent surface treatments. These coatings are generated by reaction between the metal and a chemical solution. While process specifications vary among FRCs, all current processes for applying conversion coatings to magnesium alloys use hexavalent chromium (hex chrome) -based chemistries, long established as both toxic and carcinogenic.

At the FRCs responsible for processing magnesium parts, the total magnesium conversion process tank volume exceeds 3,200 gallons, meaning that at any given time there is over 3,200 gallons of solution containing some level of hex chrome. At a single FRC, the cost associated with cleaning to limit heavy metal exposure to personnel exceeds $1 million per year. Similar costs are borne across other FRCs—and this does not even include the further costs associated with management of the hazardous waste. Elimination of hex chrome from magnesium finishing processes would be of great benefit toward the Navy's goal of reducing heavy metal usage.

Components of the H-53 and other helicopters are target applications for a non-hex chrome conversion coating process. (Photo Credit: Ismael Ortega)

Several hex chrome-free conversion coating formulations were evaluated by the Navy in the past for use on magnesium alloys and laboratory results showed comparable performance to the hex chrome-based formulas. Attempts to transition these technologies for use on magnesium alloys were not successful for various reasons; one of which is the lack of an observable color change. The presence of hex chrome conversion coatings is readily apparent due to their characteristic iridescent gold color, making it simple for artisans to assess the efficacy of a coating process. In contrast, none of the hex chrome-free coatings were observable, making process assessment very challenging.

All current processes for applying conversion coatings to magnesium alloys use hex chrome-based chemistries.

The project team will first compare the processes in place at each FRC such that any new process at minimum meets existing requirements. Next, extensive laboratory tests will be conducted using metrics such as coating weight/thickness and appearance to identify two to three potential candidates. The evaluation of color additives will be an integral part of this process. These candidates will be subjected to corrosion resistance testing. If successful, a pilot process line will be established at a suitable FRC using the chosen formulation. Corrosion/adhesion performance will remain the primary metric, but effectiveness of the color additive will also be a critical metric in assessing the process.

To be successful, replacement coatings need to perform at least comparably to the current coatings and exhibit similar process characteristics. If successful, demonstration at a second FRC will begin at the beginning of year three. A secondary goal is to generate sufficient data and know-how for the possible future development of a detail specification for a non-hex chrome conversion coating process with the aim of aligning processes across FRCs.

If demonstration/validation work proves successful, implementation will begin at the demonstration site(s) immediately, before transitioning to other FRCs. This technology could be of value to other services, in particular the Army. Army engineers have expressed interest in the proposed program and possible future collaboration.

Principal Investigator:
Alan Grieve
Naval Air Warfare Center–
Aircraft Division
Patuxent River, MD
301-342-6807
alan.grieve@navy.mil

PROJECT NO. 563

Low-VOC Primers for Ground Support Equipment Application

Validating Primers to Keep Pace with Rigorous Environmental Regulations

There is a push both at the federal and local levels for the continual reduction of VOCs and hazardous air pollutants (HAP) associated with painting operations. Many of the mil-spec primers have not changed significantly, whereas local and federal environmental regulations are continually changing. Two of these local regulations, in the state of Maryland and Ventura County (California), have the most stringent regulations in the

2017 New Starts *(continued)*

Primer is applied to GSE such as this mid-range tow tractor (left) and fire truck (right).

(Photo Credit: Atish Gupta)

nation with a primer maximum VOC limit of 250 gallons per liter (2.1 pounds per gallon). The current mil-specs for aircraft ground support equipment (GSE) primers have a maximum VOC requirement of 340 gallons per liter (2.8 pounds per gallon), meaning they are out of compliance with these current regulations.

While these rules currently affect only two jurisdictions (Maryland and Ventura County), environmental regulations are traditionally broadly adopted and likely to be adopted elsewhere. The effects on the Maryland jurisdiction is significant because the primary overhaul facility for aviation support equipment is located in Solomons Island, MD.

Failure to identify low-VOC primer alternatives can adversely affect Navy GSE coatings operations and increase the compliance cost of current and future local and EPA environmental legislations.

According to the Naval Air Systems Command, the preferred primer for GSE are products qualified to the Army-maintained MIL-PRF-53022 specification. Acceptable alternate primers are products qualified to MIL-PRF-23377 Class N (the mil-spec for the non-chrome class of primers). This effort will identify, test and qualify GSE-acceptable primers to the MIL-PRF-23377 specification that are both HAP-free and VOC-compliant. Modified low-VOC formulations of qualified MIL-PRF-23377 non-chrome primers will be evaluated, as will metal-rich primer technologies and other potential low-VOC primers.

Failure to identify low-VOC primer alternatives can adversely affect Navy GSE coatings operations and increase the compliance cost of current and future local and EPA environmental legislations.

Laboratory testing will be performed on both steel and aluminum substrates with pre-treatments and surface preparations that will capture the varying requirements of MIL-PRF-23377 and MIL-DTL-53022 and the capabilities of the GSE rework locations. Testing will include but not be limited to viscosity, spraying properties, pot life, dry time, adhesion, corrosion resistance, flexibility, fluid resistance, strippability as well as compatibility to qualified topcoats.

Upon successful laboratory testing, demonstration and validation of the low-VOC primers is anticipated to occur at FRCs in North Island, CA and Solomons Island, MD. The low-VOC primers will be applied on both land-based and shipboard GSE. The coating(s) will be evaluated for application characteristics and user friendliness. The durability of the new coating systems will be evaluated by photo documentation and direct visual inspection. Land-based evaluation intervals will be every six months for a total of two years. Shipboard GSE will similarly be evaluated as close to the six-month interval as ship schedules permit.

The proposed primers must pass the rigorous performance requirements that are currently asked of MIL-PRF-23377 products and perform satisfactorily to many of the performance requirements of MIL-DTL-53022.

Upon successful laboratory testing and field demonstration, MIL-PRF-23377 will be revised and the Qualified Products List will be populated with low-VOC and HAP-free products. If an acceptable primer(s) is identified that satisfies both GSE and aerospace requirements, the "Cleaning and Corrosion Control" manual (NAVAIR 01-1A-509) and the "Airborne Weapons and Associated Equipment" manual (NAVAIR 01-1A-75) will be updated at their next revision or Interim Rapid Action Changes will be generated.

Principal Investigator:
Michael Brindza
Naval Air Warfare Center–
Aircraft Division,
Patuxent River, MD
301-995-3897
michael.brindza@navy.mil

PROJECT NO. 564

Implementation of Biotic Ligand Model-Based Water Quality Standards for Copper at Navy Sites

Closing Data Gaps with Regulators on Copper Water Quality Standards

Copper is a ubiquitous contaminant in and around Navy-relevant water bodies. Currently, states use national water quality criteria (WQC) to establish standards by which to regulate copper discharges under NPDES permits. Navy managers are required to either use the default national WQC or conduct and approve costly site-specific studies involving extensive toxicity testing, chemical analyses and rulemaking.

This project will provide scientific contributions towards finalizing EPA's saltwater copper criterion document.

The EPA recently released a draft criterion document that incorporates a simple, scientifically defensible Biotic Ligand Model (BLM) towards calculation of water-body-specific water quality standards without the need to conduct costly laboratory-based studies. Based on comments by nearly four dozen stakeholders nationwide, including the Navy, the consensus was that the document included overly high levels of conservatism, improper assumptions and incorrect use of peer reviewed data available, potentially making compliance with a BLM-based standard more challenging than intended.

Concerns expressed by the stakeholders are currently being evaluated by EPA with the expectation that issues will be addressed and Navy compliance will improve if the concerns are incorporated. However, if

2017 New Starts *(continued)*

Mussel larvae are among the most sensitive toxicity endpoints used for EPA water quality criteria derivation for copper.

the finalized BLM-based standard is overly stringent, it will not improve copper compliance at Navy facilities, and the Navy will likely be required to continue down a path of uncertain and costly means of achieving compliance.

This project will provide scientific contributions towards finalizing EPA's saltwater copper criterion document and provide examples based on historical and ongoing data collection regarding whether or not the new criterion should be used as a regulatory tool for environmental compliance at Navy sites.

The BLM is a metal bioavailability model that uses receiving water body characteristics and monitoring data to develop site-specific WQC. The BLM for copper has already been developed and validated for protection of the most sensitive EPA-accepted test mechanisms (e.g., *Mytilus galloprovincialis* mussel embryos).

The first task of this project will be the consultation and closure of data gaps with key personnel (EPA headquarters) regarding their remaining concerns associated with the draft final criterion document. As soon as EPA releases the final WQC document, the project team will collect any available historical data sets for affected Navy sites and run them through the BLM to determine whether the Navy would be expected to be compliant.

In addition to EPA concurrence of the saltwater BLM for copper, objectives of this work include development of a Navy document that will guide end users towards integration of an overdue update to copper compliance in marine environments. This will occur based on consultation with the Copper Development Association and International Copper Association which have been working on implementation of the freshwater BLM for copper and continue to support this need for saltwater. The freshwater BLM has been implemented in multiple states and provides examples towards implementation of the marine BLM.

The consolidated technical document will be geared towards implementation by states and permit writers. This document will be shared through webinars directed to Navy end users summarizing the findings, which will be in part developed through peer review and participation in at least one high visibility national technical conference.

Principal Investigator:
Gunther Rosen
Space and Naval Warfare Systems Center Pacific
619-553-0886
gunther.rosen@navy.mil

PROJECT NO. 566

Source Metal Particle Removal for Stormwater Compliance

Cleaning Vehicle Offers Viable Option to Address Increasing Compliance Challenge

Metal particles (such as copper, zinc, nickel and iron) in stormwater can lead to violations or exceedances for Navy facility stormwater discharges related to Clean Water Act and NPDES permits. This can be a serious issue for industrial areas such as metal processing/reworking facilities, metal storage facilities, recycling yards and pier areas where paint stripping and sand blasting activities occur.

San Diego area Navy installations (Naval Base San Diego (NBSD), Naval Base Coronado (NBC) and Naval Base Point Loma) are having an increasingly difficult time meeting new California metal benchmarks/ Numerical Action Limits (NAL) for their storm-water discharges, which are now at 33.2 parts per billion (ppb) for copper and 260 ppb for zinc. Between 2011 and 2014, NBC had 87 copper and 221 zinc benchmark exceedances as well as 96 exceedances for acute toxicity.

These installations employ BMPs directed at reducing source metal particles from pier and metal processing areas; however, these practices are ineffective in meeting the new limits. Recent discharge sampling data (from December 2016) show NAL

The Municipal Cleaning Vehicle. (Photo Courtesy of Triverus)

2017 New Starts *(continued)*

exceedances for copper and zinc at all three installations. Sustained, high concentrations of these pollutants in industrial stormwater discharges are elevating acute toxicity levels beyond permit limits at an increasing rate.

San Diego metro Navy installations spend over three million dollars a year on stormwater compliance monitoring and reporting including expensive phased studies that are required under new NPDES permit requirements when discharges exceed benchmarks. In addition to these costs, exceeding benchmarks on a regular basis increases the potential for lawsuits from non-governmental agencies.

Sustained, high concentrations of these pollutants in industrial stormwater discharges are elevating acute toxicity levels beyond permit limits at an increasing rate.

This project was formed to evaluate a new surface cleaning technology—the Municipal Cleaning Vehicle (MCV). This multi-purpose surface cleaning vehicle is based on the Mobile Cleaning, Recovery and Recycling System developed by Naval Surface Warfare Center Carderock Division (NSWCCD). The MCV vehicle is a closed-loop, surface power washing, filtration, recovery and recycling system that can recover ferrous and non-ferrous solids ranging in size from sub-micron to two inches and can clean up to 10,000 square feet of surface area per hour. The system provides total suspended solids control and a physical barrier to larger particles. It leaves no discernable solids residue, and its performance exceeds the individual cleaning capabilities of pressure washing, vacuuming and sweeping.

After initial discussions with NBSD, NSWCCD has identified numerous high-risk outfall locations that are exceeding benchmark limits. Two outfalls at Naval Amphibious Base (NAB) Coronado, will be the site for the technology demonstration. The MCV will be deployed for a period of approximately three months, during which time training of the vehicle and its systems will be conducted, along with the actual surface cleaning and sampling at the targeted outfalls.

NSWCCD has already made a site visit to the targeted hot-spot areas at NAB Coronado and will soon be working with NAVFAC Southwest and San Diego metro installation representatives to develop a test and sampling plan that will best show the effectiveness of the MCV technology. If it is shown to be effective in removing problematic metal particulate, then San Diego metro representatives can work with their in-house departments to procure MCV platform(s) as desired.

NBSD/NBC environmental offices and stormwater/surface cleaning operations personnel will be part of the testing and evaluation process as well as any technology transfer follow-up actions.

Principal Investigator:
James Howell
Naval Surface Warfare Center Carderock Division
301-227-5178
james.e.howell1@navy.mil

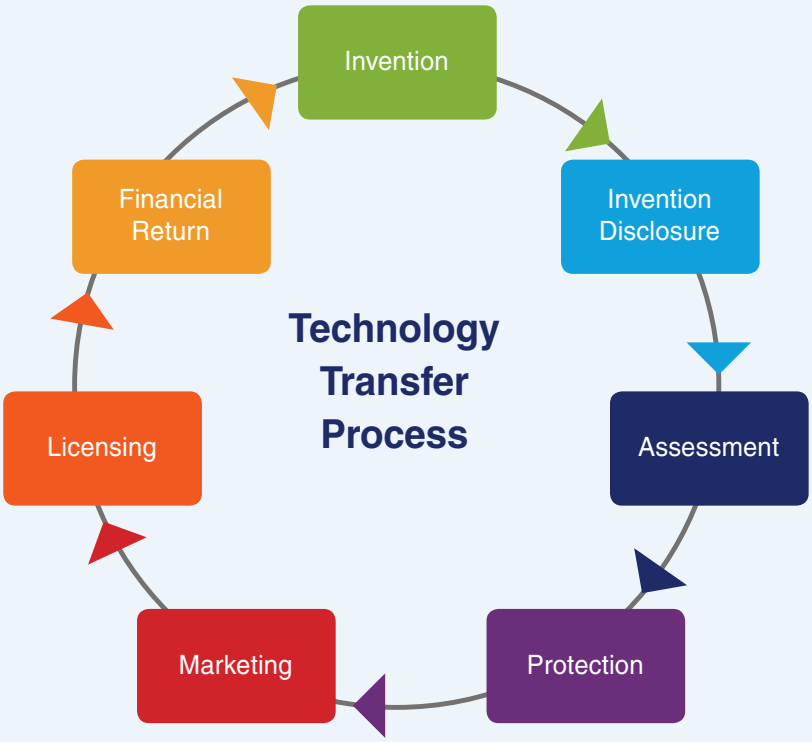
PROJECT NO. 567

Business Processes and Requirements Enabling Technology Integration

Formalizing and Customizing the Technology Transfer Process

Navy facility commands need a framework that allows facility or installation stakeholders and technology advocates to collaborate and advance cost-effective solutions to their environmental challenges. When a technology, techniques and tools (TTT) solution has been validated through the NESDI and other programs, the conventional approach to technology integration has focused only on advertising the technical data and fact sheets related to that technology and seeking to sell the TTT as a package that presumably fits with every Systems Command. While this approach reflects a genuine desire for integrating technologies, it neglects a more holistic business plan and strategy for customizing TTT solutions for different installations and stakeholders. What's needed is an enduring system of actions and activities that enable the successful integration of TTT solutions, as well as a method for identifying where additional needs for a particular technology exist.

This project will utilize a systems engineering process (a sequence of events that functions together to produce the capability that satisfies a particular need) to enable effective and efficient technology integration across NAVFAC.



A basic technology transfer process.

2017 New Starts *(continued)*

Technology transition programs for weapons systems and platforms have formal processes to smooth and speed the path to operational adoption. Examples include the Navy Shore Energy Technology Transition and Integration (NSETTI) program and the Energy Systems Technology Evaluation Program (ESTEP). Each of these programs has a multi-gate project review process to ensure early consideration of stakeholder needs and administrative processes. It is the intention of this project team to create a similar system for Navy facilities use.

What's needed is an enduring system of actions and activities that enable the successful integration of technology, techniques and tools.

The system engineering process and accompanying manual will be based on the Shore Facilities Planning System and Office of the Chief of Naval Operations (OPNAV) instructions, along with information acquired from internet literature searches addressing stakeholder engagement business practices. A case study analysis of completed and/or ongoing approved real property work will be conducted in accordance with the framework to validate the process and associated manual.

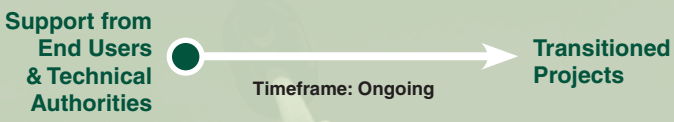
A guide for potential stakeholders/users of TTT solutions and backup documentation required by stakeholders will be produced. Methods will include mining environmental Notices of Violation and military construction databases. To ease the transition, the team will determine what data (i.e., cost estimates, analysis of alternatives) stakeholders will need.

The process and manual will be transitioned as follows:

- Provided to the Naval Civil Engineers Corps Officer School for insertion and use as a training module during environmental training and other courses.
- Distributed throughout the NAVFAC enterprise via each of the NAVFAC businesses participating and contributing in development of the final deliverable and posted on the NAVFAC portal.
- Offered to other Systems Commands for guidance and implementation.
- Presented during annual NAVFAC business line specific workshops/conferences
- Incorporated into NPS curriculum.

Principal Investigator:
Martin McMorrow
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-2669
martin.v.mcmorrow@navy.mil

4 INTEGRATE SOLUTIONS



Process Overview

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

Integrate Solutions

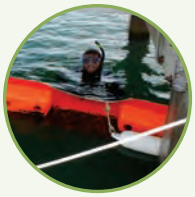
2017 Project Transitions

The following six NESDI projects were successfully transitioned in FY17:

1. Project No. 330: Advanced Anodizing using Process Control Technology

4. Project No. 465: Demonstration of Passive Samplers for Assessing Environmentally Realistic Concentrations of Munitions Constituents at Underwater UXO Sites

2. Project No. 416: Mobile Surface Cleaning



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

3. Project No. 450: Cadmium Tank Electroplating Alternative

6. Clean Sampling Techniques

These transitions occurred in FY17 even though some of these projects were closed out in previous years.

PROJECT NO. 330

Advanced Anodizing using Process Control Technology

PRINCIPAL INVESTIGATOR:
RUBEN PRADO

This project successfully demonstrated a hexavalent chromium-free anodizing technology for use at Fleet Readiness Centers (FRC) with resources provided by the NESDI program and completed in FY11. In FY17, full production capability was achieved for the advance anodizing line at FRC Southeast in Jacksonville, FL. The upgrade was funded with capital improvement money.

A shop artisan anodizing an EA-6B main landing gear in the modified anodizing tank at FRC Southeast. (Photo Credit: Ruben Prado)

PROJECT NO. 416

Mobile Surface Cleaning

PRINCIPAL INVESTIGATOR:
BILL HERTEL

This team successfully demonstrated a Mobile Cleaning, Recovery and Recycling System (MCRRS) unit as an improved tool for surface cleaning as compared to conventional technologies such as brush/vacuum equipment. The MCRRS was established as an acquisition Program of Record in FY17. NAVSEA is leading the transition of this technology to all amphibious assault ships and aircraft carriers. Four low rate initial production units are currently deployed. Full rate production acquisition is underway for an additional 43 units in FY18 through FY22 via an Abbreviated Acquisition Program. This project's last year of NESDI program funding was FY08.

A Mobile Cleaning, Recovery and Recycling System unit. (Photo Courtesy of Triverus)

2017 Project Transitions *(continued)*

PROJECT NO. 450

Cadmium Tank Electroplating Alternative

PRINCIPAL INVESTIGATOR: LUZMARIE YOUNGERS

This project demonstrated and validated an alkaline zinc-nickel alloy electroplating process (DIPSOL IZ-C17+) as an alternative to cadmium in the tanks that perform the electroplating (commonly known as "cadmium tank electroplating") on high-strength steel at FRCs. In FY17, the process line was installed at FRC Southeast with resources provided by the Small Business Innovation Research program. A similar process line is underway at the FRC East in Cherry Point, NC.

Process line designed for zinc-nickel electroplating. (Photo Credit: Ruben Prado)

PROJECT NO. 465

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

PRINCIPAL INVESTIGATOR: GUNTHER ROSEN

Even though the last year of NESDI funding was received in FY14, there was a full-scale field validation of these passive samplers in FY17 at the former Naval Training Range in Vieques, Puerto Rico. The validation was funded by the Environmental Security Technology Certification Program, with in-kind support from Naval Facilities Engineering Command Atlantic. Site managers were very pleased with the results of the validation. The results will be incorporated into a Strategic Environmental Research and Development Program Underwater Military Munitions Eco-Risk Workshop led by project Principal Investigators in FY18. In addition, a technical guidance document for Navy and Department of Defense end users was published.

One of the samplers validated at the former Naval Training Range in Vieques, Puerto Rico.

(Photo Credit: Gunther Rosen)

PROJECT NO. 489

Oil Boom Biofouling Control by Mechanical Intervention and Material Technologies

PRINCIPAL INVESTIGATOR:
MATT NAIMAN

This project demonstrated the use of an environmentally friendly non-stick coating in conjunction with in-water cleaning to reduce the biofouling of oil booms. It was determined that impregnating the oil boom fabric with the selected coating caused a decrease in strength, making the NESDI project marginally successful. However, the investigation of foul release solutions continues as the project transitioned to the Office of Naval Research for the investigation of alternative primers, tie coats and surface preparation for coating existing booms.

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

PROJECT

Clean Sampling Techniques

PRINCIPAL INVESTIGATORS:
IGNACIO RIVERA, PAT EARLEY

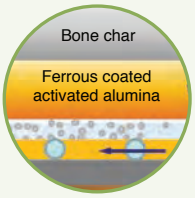
This FY14 NESDI project established policy and guidelines for the application of clean sampling techniques to trace metal sampling at U.S. Environmental Protection Agency water-quality criteria levels required by the Clean Water Act. In FY17, these techniques and instructions were published in the Naval Sea Systems Command's Environmental Protection, Occupational Safety and Health Control Manual for Naval shipyards. Training was also rolled out to Naval Base Kitsap- Bangor during this period and will continue.

Clean sampling techniques are used to avoid contamination of the sample by other particles in the environment.

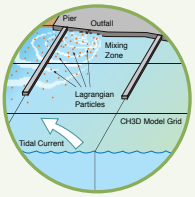
Integrate Solutions

2017 Project Accomplishments

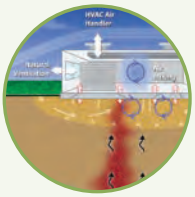
Nearly two dozen NESDI projects were particularly successful in FY17. These notable efforts are listed below and highlighted on the following pages.



1. Project No. 454: Optimization of the Stormwater Dual Media Filtration System

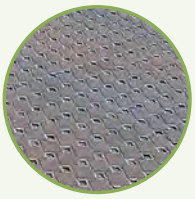


2. Project No. 473: Dynamic Mixing Zone Modeling



3. Project No. 476: A Quantitative Decision Framework for Assessing Navy Vapor Intrusion Sites

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



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

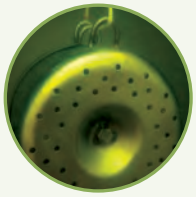
6. Project No. 503: Dry Dock Sediment Management

7. Project No. 504: Low-VOC and Low-HAP Wipe Solvent and Paint Thinner Demonstration /Validation

8. Project No. 506: Evaluation and Implementation of Compliance Options for NPDES Cooling Water Intake Structures at Existing Facilities

9. Project No. 520: Quantification of Polychlorinated Biphenyls Paint Volatilization

10. Project No. 521: Autonomous Benthic Ecology System



11. Project No. 523: Integrated Diagnostic Stormwater Monitoring with Passive Sampling

12. Project No. 524:
Innovative
Hydrant Flushing

17. Project No. 540:
Smart Electronic Tools for
Navy Environmental Compliance
Monitoring and Reporting

13. Project No. 527:
Structure-function
Relationship and Environmental
Behavior of Per- and
Polyfluorochemicals from
Aqueous Film-forming Foams

18. Project No. 542:
Naval Air Systems
Command Solutions
for Engine Washing

14. Project No. 529:
Diver-less Deployment
System for In-Situ
Sediment Samplers

19. Project No. 553:
Study of Waste Management
and Minimization for
AFFF Wastewater

15. Project No. 534:
Technology Evaluation
and Sampling for Treatment
of Perfluorochemicals

20. Project No. 555:
Demonstrating the Effectiveness
of Novel Treatment Technologies
for the Removal of Poly- and
Perfluoroalkyl Substances
from Groundwater

16. Project No. 539:
Using a Forward Looking
Infrared Camera for Advanced
Discharge Characterization

21. Project No. 567:
Business Processes and
Requirements Enabling
Technology Integration

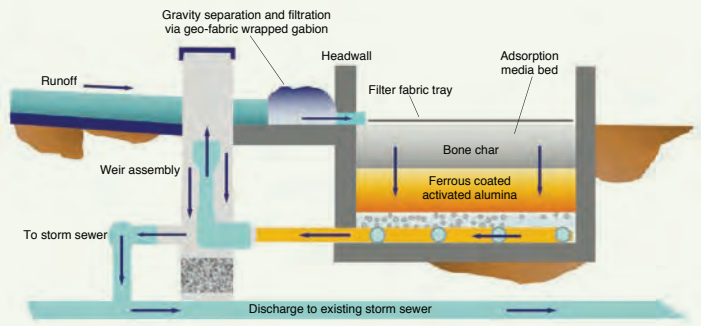
2017 Project Accomplishments *(continued)*

PROJECT NO. 454

Optimization of the Stormwater Dual Media Filtration System

PRINCIPAL INVESTIGATOR:
GARY ANGUIANO

The goal of this project was to optimize performance of the Navy-developed dual media filtration system installed at the Naval Base San Diego Recycling Center, which had become clogged by suspended solids over the years. This project team optimized a best management practice (BMP) that retrofitted the deficient design elements of the existing system and demonstrated it at the facility. The retrofitted system con-sistently passed maximum daily effluent concentration acute toxicity tests. Under Environmental Security Technology Certification Program (ESTCP) funding, the team is installing a similar system at Naval Base Point Loma's Fleet Recycling Center.



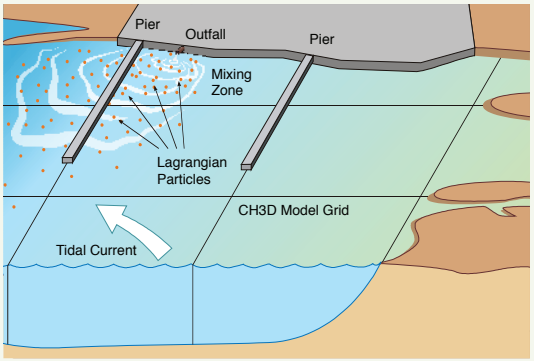
Elevation view of the dual media filtration system. (Illustration Credit: Victoria Bermel)

PROJECT NO. 473

Dynamic Mixing Zone Modeling

PRINCIPAL INVESTIGATOR:
PEI-FANG WANG

In order to comply with National Pollutant Discharge Elimination System (NPDES) permit requirements, all stormwater discharges must meet water quality standards at the end of the pipe unless a mixing zone is granted. This project team established a scientific basis for designating mixing zones through the linkage of two predictive models—the hydrodynamic model, CH3D and the Lagrangian transport module within GNOME (a National Oceanic and Atmospheric Administration model). The linked model was validated and will be used in NPDES permit writing processes for Navy activities that discharge to Puget Sound, Pearl Harbor, San Diego Bay and elsewhere.



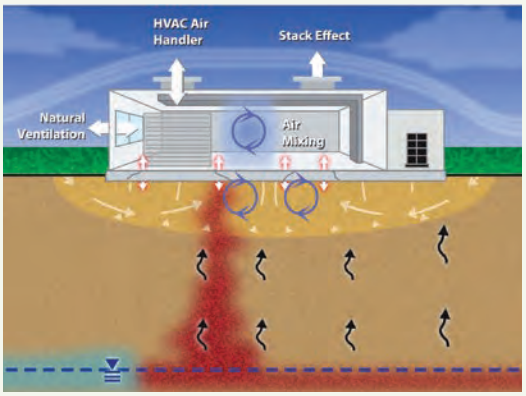
A conceptual mixing zone model for discharges near Navy piers and facilities.

PROJECT NO. 476

A Quantitative Decision Framework for Assessing Navy Vapor Intrusion Sites

PRINCIPAL INVESTIGATOR:
PATRICIA VENABLE

Vapor intrusion (VI) occurs when vapor-phase containments migrate from subsurface sources into buildings. This team developed a framework to improve site-management practices for VI at Environmental Restoration Program sites. The data and analysis gathered by the team has been adopted by the Department of Defense's (DoD) Environmental Data Quality Workgroup and is being incorporated into the development of a template for DoD VI investigations at industrial buildings. The Naval Sea Systems Command has funded 30 additional sites in the NESDI VI database and NAVFAC has provided funding for additional work on the database and user guide.



Industrial building vapor intrusion scenario.

PROJECT NO. 492

Capacitive Deionization Water Treatment System

PRINCIPAL INVESTIGATOR:
IGNACIO RIVERA

This project team developed an improved capacitive deionization (CDI) system which has the potential to produce clean, low-cost drinking water at small or forward operating bases. The technology was validated in the laboratory and field validation is underway at Naval Air Weapons Station China Lake with resources provided by the Office of Naval Research's Energy Systems Technology Evaluation Program (ESTEP) which is focusing on reducing the system's energy requirements. The NESDI program's partner (Ur-Water) is commercializing the technology under license from the Wisconsin Alumni Research Foundation, which holds the intellectual property on the CDI system.

The CDI system. (Photo Credit: Ramsey Kropp)

2017 Project Accomplishments *(continued)*

PROJECT NO. 497

Evaluation of Low Impact Development Implementation

PRINCIPAL INVESTIGATOR: CHUCK KATZ

The objective of this project was to validate the effectiveness of Low Impact Development (LID) BMPs to reduce storm-water metals in Navy commercial areas. Two demonstrations within the Navy Exchange complex onboard Naval Base San Diego resulted in average (area adjusted) metal loading reduction between 80 and 86 percent. The final report is currently in draft form. A technical report will also be generated and distributed.

The use of porous pavers is one example of low impact development. (Photo Credit: Chuck Katz)

PROJECT NO. 503

Dry Dock Sediment Management

PRINCIPAL INVESTIGATOR: PATRICK MORROW

This project team demonstrated a Municipal Cleaning Vehicle (MCV) as a means of improving the collection and removal of contaminant-laden sediment from dry dock areas. The demonstration, conducted at the Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS&IMF), met qualitative criteria. Post-demonstration, hazardous materials response personnel staged a simulated lube oil spill, during which they observed the ability of the MCV to recover free oil as well as granular oil adsorbent over multiple surface types. The hazardous materials team expressed interest in procurement of the MCV in con-junction with the Naval Surface Warfare Center Carderock Division.

A ship in dry dock. (Photo Credit: Michael F. Laley)

PROJECT NO. 504

Low-VOC and Low-HAP Wipe Solvent and Paint Thinner Demonstration / Validation

PRINCIPAL INVESTIGATOR: EDWARD LIPNICKAS

This project team demonstrated a more environmentally friendly paint thinner and wipe solvent for use at Naval Air Systems Command (NAVAIR) maintenance facilities. The low-volatile organic compound (VOC) and low-hazardous air pollutant (HAP) solvents were as effective as previously used hazardous compounds in demonstration/validation at the Fleet Readiness Centers (FRC) in Cherry Point, NC and Jacksonville, FL. A fleet-level demonstration/validation was also conducted at Point Mugu. All results were positive and each squadron was left with additional gallons of this solvent for further testing.

A worker applies a new low-VOC, low-HAP solvent.

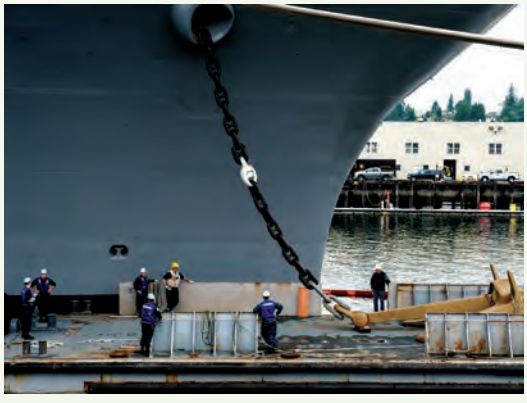
(Photo Credit: Luc Doan)

PROJECT NO. 506

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

PRINCIPAL INVESTIGATOR: PEI-FANG WANG

A new rule signed by the U.S. Environmental Protection Agency (EPA) may have an impact on the design and configuration of cooling water intake structures at U.S. Navy shipyards. This project team worked with two shipyards to evaluate compliance requirements for their NPDES permits, both set to expire in 2018. At Pearl Harbor Naval Shipyard, the team helped compile biological data and prepared a template for the shipyard's new permit. At Naval Base Kitsap Bangor, a new cooling water intake head design was tested using a computer model. Results indicate that the water flow velocities through the intake screens at both of these facilities will meet requirements of the new EPA rule.



Ship arriving at Puget Sound Naval Shipyard.

(Photo Credit: Mass Communication Specialist Seaman Apprentice Christopher Frost)

2017 Project Accomplishments *(continued)*

PROJECT NO. 520

Quantification of Polychlorinated Biphenyls Paint Volatilization

PRINCIPAL INVESTIGATOR: PATRICK MORROW

Some Navy ships still contain legacy paint containing polychlorinated biphenyls (PCB). 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. This project was formed to supply data on the quantity of specific PCB components volatilized as a function of temperature. Preliminary results indicate high volatilization rates of low-molecular weight PCB compounds and a higher variance in volatilization among different paint types versus among different temperatures. Remaining tests include trials at lower temperatures and possibly shorter heating durations.

This project is investigating the volatilization rate of PCB-containing legacy paints on Navy ships.

(Photo Credit: Mass Communication Specialist Seaman Apprentice Robert Robbins)

PROJECT NO. 521

Autonomous Benthic Ecology System

PRINCIPAL INVESTIGATOR: CHERYL COOKE

This project is developing and testing an Automated Benthic Ecology System (ABES) to monitor coral reef and benthic communities on Navy submerged lands. To date, the project team has finalized a field survey report for a pier at Naval Base San Diego. They have also analyzed photomosaic data collected at a pier at San Clemente Island. Fish assessments have also been conducted from this survey and a draft survey report is in progress. Other possible applications for this technology are also being investigated. This project will transition to ESTCP in 2018.

The Automated Benthic Ecology System deployed.

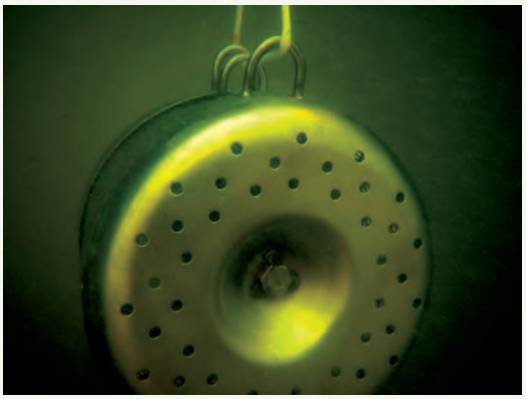
(Photo Credit: Cheryl Cooke)

PROJECT NO. 523

Integrated Diagnostic Stormwater Monitoring with Passive Sampling

PRINCIPAL INVESTIGATOR: GUNTHER ROSEN

This project was formed to evaluate the effectiveness of two different types of passive sampling devices to assess the impacts of stormwater runoff and improve stormwater management at Navy facilities. The Polar Organic Chemical Integrative Sampler (POCIS) was tested first. Over several sampling events at Navy installations in the Puget Sound area, the sampler showed very high sensitivity. The next phase is the development and demonstration of Diffusive Gradients in Thin Film samplers for end-of-pipe monitoring in both stormwater and tidally influenced discharges at Navy facilities.



The Polar Organic Chemical Integrative Sampler.

(Photo Credit: Gunther Rosen)

PROJECT NO. 524

Innovative Hydrant Flushing

PRINCIPAL INVESTIGATOR: TAMI RELPH

To maintain compliance in drinking water systems, Naval bases flush their hydrants to eradicate stagnant water, clean distribution pipes, increase the disinfection residual in the pipes and flush out impurities. Traditional hydrant flushing is not adequate to effectively clean these systems and, in drought-prone areas, is a tremendous waste of water. This team performed two demonstrations of a high-velocity truck-mounted system that provides a scouring velocity of five cubic feet per second, effectively cleaning the pipes with virtually no wastewater. The final report is expected to be released in the summer of 2018.

The truck-mounted hydrant flushing system.

(Photo Credit: Courtesy of ValveTek)

2017 Project Accomplishments *(continued)*

PROJECT NO. 527

Structure-function Relationship and Environmental Behavior of Per- and Polyfluorochemicals from Aqueous Film-forming Foams

PRINCIPAL INVESTIGATOR:
JOHN KORNUC

One of the greatest emerging contaminant challenges facing the Navy's Environmental Restoration program is perfluorinated and polyfluorinated alkyl substances (PFAS), widely used in aqueous film-forming foams (AFFF) for fighting petroleum fires. This project was formed to gather information on the transport and exposure pathways of PFAS. Contaminated soil, biota and groundwater samples have been gathered at a former firefighting training area at Naval Air Station (NAS) Jacksonville. Additional samples are being gathered at NAS Fallon. Samples will be analyzed and a final report and decision tool is expected in late 2018.

Sailors man an AFFF hose during a fire drill. (Photo Credit: Mass Communication Specialist 2nd Class Timothy A. Hazel)

PROJECT NO. 529

Diver-less Deployment System for In-Situ Sediment Samplers

PRINCIPAL INVESTIGATOR:
JESSICA CARILLI

Recently, the Strategic Environmental Research and Development Program and ESTCP have developed a new family of passive sampling devices for sediment. Their use has been endorsed by EPA and ESTCP, but one of the key limitations to their use has been the ability to cost-effectively deploy and retrieve the devices. This team completed a full-scale demonstration of two deployment/retrieval systems in Pearl Harbor, with successful retrieval of 22 of the 24 samplers deployed. A second demonstration will be conducted in San Diego Bay incorporating the lessons learned from the Pearl Harbor demonstration.

The prototype passive sampling device for sediment. (Photo Credit: Bart Chadwick)

PROJECT NO. 534

Technology Evaluation and Sampling for Treatment of Perfluorochemicals

PRINCIPAL INVESTIGATOR:
JOHN KORNUC

PFCs and PFAS are persistent contaminants in industrial areas. Preliminary groundwater investigations conducted at Navy sites suggest that remediation methods applied to remove common co-contaminants may have resulted in increased levels of PFCs and PFAS. This project team is studying how the treatment of co-contaminants affects the degradation or persistence of these substances. During a leveraged ESTCP project, groundwater and soil samples were collected at NAS Jacksonville, a site which had undergone previous co-contaminant treatment and where high concentrations of PFAS are present. Samples are also being collected from NAS Yuma.

Column studies have been set up with PFC contaminated groundwater and soil from a PFC contaminated site.

PROJECT NO. 539

Using a Forward Looking Infrared Camera for Advanced Discharge Characterization

PRINCIPAL INVESTIGATOR:
BRANDON SWOPE

The goals of this project are to use a novel sensing technology—Forward Looking Infrared (FLIR)—to better define surface mixing adjacent to a discharge outfall and use these data to improve the capabilities of current hydrodynamic models. To date, the FLIR camera has been tested pierside at the Space and Naval Warfare Systems Command (SPAWAR) complex in San Diego, CA. Ongoing mathematical work is aimed at determining the effect that distance and camera angle has on apparent temperature.

The initial FLIR camera test. (Photo Credit: Brandon Swope)

2017 Project Accomplishments *(continued)*

PROJECT NO. 540

Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting

PRINCIPAL INVESTIGATOR:
ITZEL GODINEZ

Establishing an efficient compliance program requires the collection of massive amounts of data which must be entered, stored and evaluated. This team was formed to standardize the record-keeping process across hundreds of sites and multiple teams. The team has designed an Environmental Management System (EMS) web tool, obtained tablets to support the digital tool and are currently awaiting Navy Marine Corps Intranet (NMCI) hardware certification. When this is obtained, a NESDI field demonstration will be scheduled. Demonstrations for EMS external and internal audits have already been conducted.

Most field surveys are done with pen and paper.

(Photo Credit: Mass Communication Specialist Seaman Daniel P. Jackson)

PROJECT NO. 542

Naval Air Systems Command Solutions for Engine Washing

PRINCIPAL INVESTIGATOR:
KEIKO SAPP

Naval Air Systems Command maintenance facilities use jet engine control carts and spray units to wash and rinse aircraft engines. The design limitations of these carts lead to excessive amounts of water usage and insufficient cleaning. This project team has demonstrated the use of the EcoPower™ engine wash system—a cleaning technology that uses heated, deionized, atomized water along with custom manifolds for specific aircraft/engine types. A total of 25 P-8 Poseidon (anti-submarine warfare, anti-surface warfare military aircraft) engines and one T-34 Mentor (military training aircraft) engine have been successfully washed with the EcoPower system. Squadrons involved in these demonstrations have expressed interest in using this new system. A demonstration/validation report is being prepared for distribution.

An H-53 engine wash demonstration was performed using the EcoPower small wash unit and effluent collecting kit. (Photo Credit: David Marriott)

PROJECT NO. 553

Study of Waste Management and Minimization for AFFF Wastewater

PRINCIPAL INVESTIGATOR: DANIEL EDWARDS

The objective of this project is to develop economic costing factors, cleanout methods, treatment and disposal options in support of Navy facilities AFFF system cleanout and transition away from concentrates with environmentally deleterious materials. (For more information about this project, see page 20 in this report.) First steps will be to conduct initial sampling at NAS Meridian in early 2018. For this, an aircraft rescue and firefighting vehicle was loaded with legacy concentrate, then filled with newer military specification (mil-spec) approved concentrate which will give insight on residual concentrations without rinsing.

Sailors conduct firefighting exercises using AFFF during a drill aboard the aircraft carrier USS Theodore Roosevelt (CVN 71). (Photo Credit: Mass Communication Specialist 3rd Class Alex Perlman)

PROJECT NO. 555

Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater

PRINCIPAL INVESTIGATOR: JOHN KORNUC

There are over 300 Navy sites that have been potentially impacted by PFAS—a widespread contaminant that is persistent in the environment. This new start project is evaluating multiple treatments for removing PFAS from groundwater. To date, the team has acquired equipment for performing batch tests and testing groundwater bladder pumps to determine whether PFAS leach from the pumps. This is a concern since pumps are often moved from one location to another, and cross-contamination is possible. Funding for this project is leveraged with two ESTCP projects.

Sailors fight a simulated fire using AFFF—a PFAS-containing substance—at the Firefighting Damage Control School at Naval Base San Diego. (Photo Credit: Mass Communication Specialist Seaman Brandon Cyr)

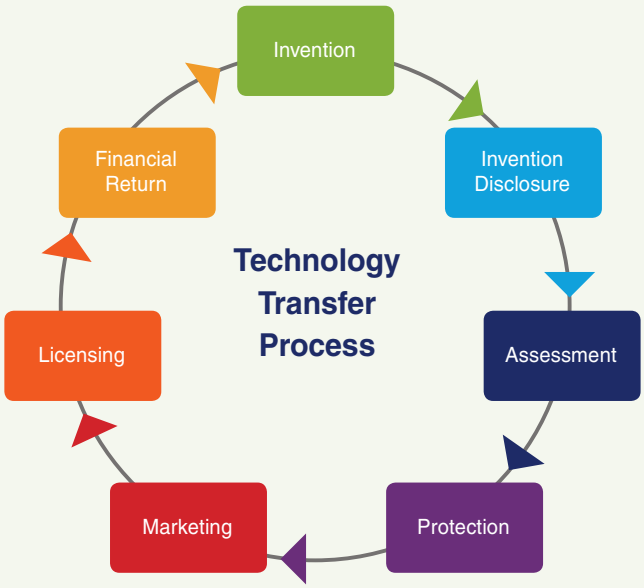
2017 Project Accomplishments *(continued)*

PROJECT NO. 567

Business Processes and Requirements Enabling Technology Integration

PRINCIPAL INVESTIGATOR:
MARTIN MCMORROW

In an effort to provide clarity on the actions and activities required for successful technology integration, this new start project is developing a clear and practical systems engineering approach and manual. The aim is to enable efficient and effective transfer of technology, techniques and tools across NAVFAC with an emphasis on shore facilities. The project team, which includes NPS professors and students, will conduct case studies using projects from the NESDI program as well as other research, development, test and evaluation programs. A draft management plan has recently been completed for this project. (For more information about this project, see page 43 in this report.)



A basic technology transfer process.

OUR FY18 SCHEDULE

Check out the NESDI website (https://epl.navfac.navy.mil/nesdi) for the latest version of our program schedule.

What	When
Conduct OPNAV N45 Programmatic Review	18 January 2018
Conduct First FY18 In-Progress Review	12-16 March 2018 (Pearl Harbor, HI)
Conduct Second FY18 In-Progress Review	30 April - 4 May 2018 (Port Hueneme, CA)
Announce FY19 Needs Solicitation	1 June 2018
Close FY19 Needs Solicitation	1 August 2018
Screen Needs	13-17 August 2018
Evaluate & Rank Needs	19-20 September 2018
Obtain Sponsor Review & Approval of Needs	21 September - 12 October 2018
Quarterly Status Reports Due	2 October 2017 8 January 2018 2 April 2018 2 July 2018

PROMOTING OUR SUCCESSES

Successful NESDI projects were promoted throughout FY17 in a variety of print and online publications. In addition to this Year in Review report, an annual programmatic review and the program's two websites, the NESDI program also sponsors an electronic newsletter, generates project fact sheets and regularly publishes stories in *Currents*—the Navy's energy and environmental magazine—all available via the NESDI website at https://epl.navfac.navy.mil/nesdi.

Websites

In FY17, we migrated our program's website to the NAVFAC Information Technology Center (NITC) at https://epl.navfac.navy.mil/nesdi (Common Access Card required). This move ensured the ongoing security and integrity of the site. Improvements were also made to increase the function and utility of the NITC site. In particular, we completed the migration to and testing of the new site (now in production), improved our ability to navigate through the process to perform subsequent software updates to the NITC site, reviewed and confirmed to numerous Security Technical Implementation Guides and completed the redesign of the site including a more current and improved user interface.

In addition to this website, the program also maintains a public presence via the Department of the Navy's Energy, Environment and Climate Change website at http://navysustainability.dodlive.mil/environment/nesdi.

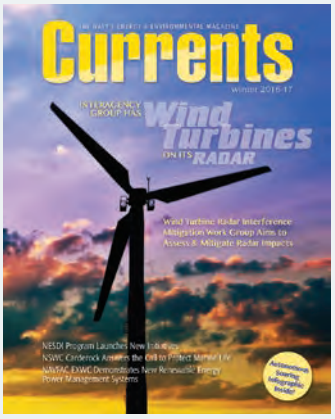
Electronic Newsletters

NESDI News: Highlights and Happenings—the program's regular electronic publication—brings recent technical achievements and regulatory concerns to the forefront, along with highlights on significant program events over the course of the year. We published four issues of our newsletter in FY17.
A history of program newsletters is available on-line at https://epl.navfac.navy.mil/nesdi.

Currents Articles

Throughout the year, our Principal Investigators worked with the managing editor of *Currents* magazine to have the following three articles about NESDI-related efforts published in 2017 issues of the magazine:

1. NESDI Program Launches New Initiatives: Notable Efforts Include Improved Aircraft Engine Washing & Contaminated Sediment Strategy (winter 2016-17 issue)
2. NAVFAC EXWC Tests Feasibility of Smart Water Conservation System: System May Significantly Reduce Potable Water Consumption (spring 2017 issue)
3. NESDI Program Releases FY16 Year in Review Report: Report Features Newly-Launched Initiatives (spring 2017 issue)



To read these and other NESDI-related articles and browse the entire *Currents* archives, visit http://navysustainability.dodlive.mil/currents-magazine.

Fact Sheets

In an ongoing effort to promote the program's active and completed projects, we developed over a dozen on-line fact sheets that highlight "new start," ongoing and completed NESDI projects. These fact sheets are also available at https://epl.navfac.navy.mil/nesdi.

Our Investment Areas

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

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

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

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

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

For More Information

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

FOR MORE INFORMATION

Name	Command	Phone	Email
Kaempffe, Ken (Chair)	NAVFAC	805-982-4893	ken.kaempffe@navy.mil
Bixler, Christy	NAVFAC/ CNIC	202-685-9313	christy.bixler@navy.mil
Earley, Pat	SPAWAR	619-553-2768	patrick.earley@navy.mil
Harre, Karla	NAVFAC	805-982-2636	karla.harre@navy.mil
Hertel, Bill	NAVSEA	301-227-5259	william.hertel@navy.mil
Kopack, David	NAVSEA	202-781-3247	david.kopack@navy.mil
McCaffrey, Bruce	Consultant	773-376-6200	brucemccaffrey@sbcglobal.net
Mukherjee, Sandi	NAVSUP	717-605-6854	sandi.mukherjee@navy.mil
Rasmussen, Eric	NAVAIR	732-323-7481	eric.rasmussen@navy.mil
Sugiyama, Barbara	NAVFAC	805-982-1668	barbara.sugiyama@navy.mil
Webber, Cindy	NAVAIR	760-939-2060	cynthia.webber@navy.mil
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 https://epl.navfac.navy.mil/nesdi.

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

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Accomplishments of the

NAVY ENVIRONMENTAL SUSTAINABILITY DEVELOPMENT TO INTEGRATION PROGRAM

For more information about the NESDI program visit https://epl.navfac.navy.mil/nesdi.

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

2017

YEAR IN REVIEW REPORT

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