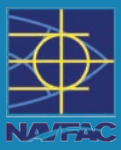
Accomplishments of the

NAVY ENVIRONMENTAL SUSTAINABILITY DEVELOPMENT TO INTEGRATION PROGRAM

2020 YEAR IN REVIEW REPORT



AVAILABLE FOR DOWNLOAD AT:
HTTPS://EPL.NAVFAC.NAVY.MIL/NESDI

CONTENTS

ADVANCING THROUGH ADVERSITY

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 and lethality. 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 Systems Command (NAVFAC). The program is the Navy's complement to the Environmental Security Technology Certification Program which demonstrates and validates technologies important to the Department of Defense tri-services and the Department of Energy.

A WORD FROM OUR PROGRAM MANAGER

Ken Kaempffe

Welcome to the Navy Environmental Sustainability Development to Integration (NESDI) program's fiscal year (FY) 2020 Year in Review report—*Advancing Through Adversity*.

This year's report highlights our efforts to manage the NESDI program in the midst of the unique challenges posed by the ongoing COVID-19 pandemic. Those challenges included limited access to Navy workspaces and laboratories as well as travel restrictions that prevented scheduled sampling and monitoring efforts, the installation of necessary equipment and the availability of the personnel necessary to conduct a successful demonstration.

Among the efforts that our various investigators made to advance their respective NESDI projects in a COVID-restricted world were the use of local personnel to conduct field efforts, changing planned demonstrations to sites where restrictions were less severe, anticipating and accommodating delays in the supply chain for necessary materials and equipment, substituting face-to-face meetings with numerous different teleconferencing capabilities, and adjusting project schedules to allow for whatever upfront analyses or bench scale testing could be conducted until COVID restrictions were lifted. Specific examples of our successful project "workarounds" are provided later in this report in the chapter entitled, "Advancing Through Adversity."

In addition to these project accomplishments, the program also met all of the obligation targets for fiscal year (FY) 19 and FY20 funds as established by the Assistant Secretary of the Navy (ASN) and nearly met the expenditure targets for FY20. Our expenditures for FY20 funds just missed the ASN expenditure benchmark by two percent (or $72,923).

The NESDI program also launched 14 new projects in FY20, including two efforts to help Navy water program managers maintain compliance with their strict National Pollutant Discharge Elimination System (NPDES) permit requirements. One project (no. 583) is validating a low profile and innovative stormwater best management practice (a pretreatment swale), whereas a second, related effort (project no. 585) is evaluating the performance of a specific filtration media for removing metals from various discharges and sources. All 14 "new start" projects are profiled later in this Year in Review report.

To subscribe to *NESDI News*—the NESDI program's quarterly electronic newsletter—visit https://epl.navfac.navy.mil/nesdi then select "Sign up for *NESDI News*."

Due to the travel restrictions put in place to mitigate the spread of the coronavirus, we "virtually" held three FY20 In-Progress Reviews (IPR) and one mid-year review in lieu of face-to-face meetings. These virtual IPRs relied on a number of teleconferencing tools, including Defense Collaboration Service (DCS), Microsoft™ Teams and conference calls. Over 80 people from across the Navy participated in our FY20 IPRs that highlighted progress being made by Principal Investigators assigned to NAVFAC EXWC in Port Hueneme, CA, various east coast Navy installations (including the Fleet Readiness Center Southeast in Jacksonville, FL, the Naval Air Warfare Center—Aircraft Division (NAWC-AD) Patuxent River, MD and NAWC-AD Lakehurst, NJ), as well as the Naval Information Warfare Center (NIWC) Pacific (formerly the Space and Naval Warfare Systems Command Pacific) in San Diego, CA. Though not optimal, we continued to have meaningful conversations with our Principal Investigators about their progress on NESDI-funded projects since our last face-to-face IPRs held in FY19.

This year's report highlights our efforts to manage the NESDI program in the midst of the unique challenges posed by the ongoing COVID-19 pandemic.

Each year, the NESDI program typically executes a four-phase process from the comprehensive collection of outstanding needs across the Navy through the successful transition of workable solutions into the Navy's shoreside operating environment and its range testing and training activities. Over the course of FY19 and FY20, we developed the following three "case studies" that demonstrate how this process evolves over the course of an actual NESDI project:

1. Project no. 514: Enhanced Trivalent Chromium Pretreatment for Improved Coloration and Corrosion Performance of Aluminum Substrates
2. Project no. 524: Innovative Hydrant Flushing
3. Project no. 540: Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting

The third case study about the validation of a smart electronic tool (a tablet) designed to improve the efficiency of environmental compliance field audits across the Navy is included in the "THE NESDI PROGRAM PROCESS: OVERVIEW & CASE STUDY" chapter of this Year in Review report.

While pandemic restrictions challenged our investigators and management personnel to innovate, it also provided our investigators, confined to their home offices, with more down time to complete the final reports associated with nearly two dozen legacy projects. See the "ADVANCING THROUGH ADVERSITY: Final Reports & Project Closeouts" sidebar for a list of those final reports.

Also in FY20, a recent NESDI pilot project led by Principal Investigator Todd Heintzelman from the Naval Supply Systems Command Weapons Systems Support (NAVSUP WSS) was designated as a Safer Choice Partner of the Year by the U.S. Environmental Protection Agency (EPA). Under Todd Heintzelman's guidance, this effort (NESDI project no. 556: Enterprise-wide Hazardous Material Standardization and Minimization of General Use Consumables) developed a process to standardize the procurement of consumable general use hazardous materials, create tools to guide end users of hazardous materials to procure less hazardous products, and ultimately advance the use of chemicals that meet Safer Choice criteria. Congratulations to Todd and his NAVSUP WSS team for this award and all their great work!

Over the course of FY21, I expect that we will renew our focus on generating project-level return on investment (ROI) metrics and initiate the development and adoption of program-based performance metrics. We now require that draft ROIs be generated using the program's Technology Integration and Cost Analysis (TICA) software and incorporated into full proposal submissions in FY21 and beyond. Our management team will also evaluate the metrics used by other RDT&E organizations and consider appyling those additional metrics to the NESDI program so that we can put in place program-level performance metrics sometime in late 2021.

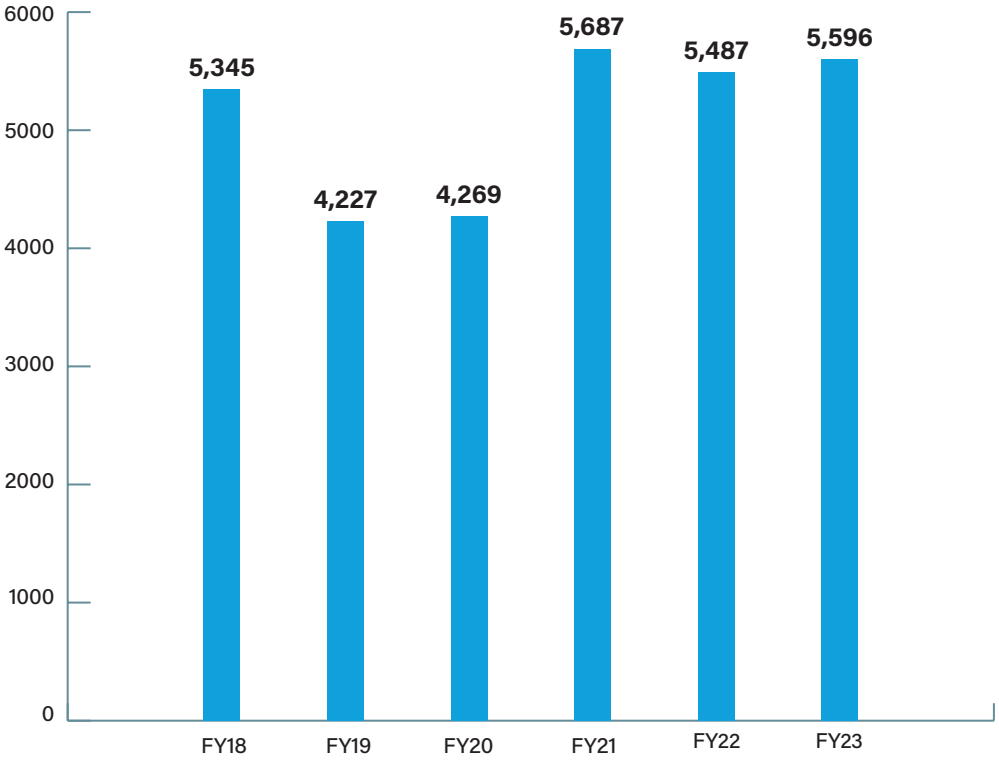
All of these efforts—especially in the middle of a global pandemic—would not have been achievable without the steady support and guidance that we receive from our resource sponsor, the Chief of Naval Operations Energy and Environmental Readiness Division (OPNAV N45), and members of our management team—the Technology Development Working Group (TDWG). The program maintains its relevancy and value because of the seasoned perspectives and assistance provided by N45 subject matter experts and members of our TDWG. I am grateful to you all. I hope you find this Year in Review report to be a reliable resource for additional insights into our projects and the overall operation and continued success of our program in FY21 and beyond.

Ken Kaempffe, Program Manager
ken.kaempffe@navy.mil

THE NUMBERS

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) 2018 through FY21, as well as the projected funding levels for FY22 and 23.

PROGRAM FUNDING (FY18 – FY23)



1. Funding in thousand dollars for PE 0603721N/Environmental Protection, 0817 Environmental Sustainability.
2. FY18 total includes Congressional Add of $598K.
3. Future year funding levels (in shaded box) are based on DON FY22 controls.

From 1994 to the present year, the NESDI program (and including its predecessor—the "0817" program) has been funded as high as $10,195K in one year (2003) to as low as $3,712K (in 2015). Future year funding is stable and planned at approximately $5,500K per year.

THE NESDI PROGRAM PROCESS:
Overview & Case Study

Each year, the NESDI program typically executes a four-phase process 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. 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:

Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting (project no. 540)

The four phases of the program's management process are described in the pages that follow and include the details behind an already-executed NESDI project to demonstrate how this process evolves over the course of an actual NESDI project (no. 540)—the validation of a smart electronic tool (a tablet) designed to improve the efficiency of environmental compliance field data collection across the Navy.

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 needs are received, the TDWG validates and ranks them based on a variety of criteria including 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 is not addressed.

The need for a smart electronic tool for improved efficiency of environmental compliance field data collection was first identified by Alicia Thompson (the compliance course director from the Civil Engineer Corps Officer School). The importance of the need was highlighted by Kevin Oshiro (NAVFAC Pacific) who identified a similar need for tablet-based software to allow for electronic data entry for environmental cross-connection surveys. Additionally, the U.S. Environmental Protection Agency (EPA) is aggressively pursuing a shift towards electronic reporting to make their reporting more efficient, accurate and complete, as well as help to better manage information and improve effectiveness and transparency. The Navy must investigate and adopt new smart electronic technologies to maintain an efficient approach to environmental compliance.

In 2015, Prakash Temkar (NAVFAC EXWC) submitted need no. N-1062-16: Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting on behalf of Alicia Thompson. Kevin Oshiro later submitted need no. N-1104-16: Tablet-based Software Tool to Facilitate Cross Connection Control Survey Data Collection and Reporting, which was then merged into need no. N-1062-16.

Historically, field data for environmental compliance activities is manually collected via pen and paper, then later copied into the

appropriate digital format for analysis and reporting. Comprehensive field surveys of Navy installations may cover hundreds of facilities over a fixed period of time and require several teams of surveyors, each having varying degrees of experience, note taking habits and penmanship, along with very limited time to survey and document findings at each facility. Compilation and interpretation of field notes, manual tabulation of data and consistency checks for hundreds of buildings following the comprehensive cross-connection surveys require significant amounts of time to complete.

An alternative method would be to use a smart device (tablet) and associated software to help Navy personnel better collect, compile, analyze and report field data. This would allow for quicker and more complete field notes at each facility and eliminate the need to convert the notes into digital format upon returning to the office — facilitating more efficient analysis of the field data.

Each year, the NESDI program solicits and then ranks environmental needs from across the Navy's shore community.

Once the need was submitted, the program's management committee – the TDWG – convened to validate and rank it along with the other needs submitted during the 2015 solicitation period with a ranking of high, medium or low. Once the screening was complete, the TDWG set the ranking of need no. N-1062-16 as 'medium.'

This and other ranked needs were sent along to the NESDI program's resource sponsor – the Chief of Naval Operations Energy and Environmental Readiness Division (OPNAV N45) — for approval. Upon receiving approval from OPNAV N45 for this need, the TDWG included it as a priority need in its 2015 requests for pre-proposals.

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 proposals. The TDWG then recommends to the program's resource sponsor (OPNAV N45) which proposals should receive program support.

As a response to address the challenges presented in need no. N-1062-16, Edwin Chiang from NAVFAC EXWC submitted a brief (2-page) pre-proposal (no. 247: Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting). Like all NESDI pre-proposals, this pre-proposal included a discussion of the problem to be addressed, a brief description of the solution (technology) to be demonstrated and validated, an estimate of the associated

costs, an explicit statement of the intended benefits to the Navy as well as a proposed approach to successfully transition this technology beyond the original proposed demonstration sites (NBVC Port Hueneme and NAVFAC Pacific).

During its review of the pre-proposal, it was determined that all members of the TDWG were supportive of the need to evaluate capable smart electronic tools for environmental reporting. The TDWG requested a follow-on full proposal as an Initiation Decision Report (IDR) consisting of a market technology study.

In response to the TDWG's request, Prakash Temkar submitted full proposal no. 166. In addition to the information included in the pre-proposal, NESDI full proposals include more details about the proposed technology to be demonstrated and validated, including a discussion of the technical objective(s) to be achieved, a discussion of the technology's maturity level, and a detailed proposed technical approach, as well as a discussion of the potential risks and associated mitigation strategies. Finally, the full proposal includes a schedule of milestones and funding required from the performer for each fiscal year of the proposed effort.

This NESDI project is validating the use of a tablet to improve the efficiency of environmental compliance field data collection across the Navy.
(Photo Credit: Itzel Godinez)

3

EXECUTE PROJECTS

Once proposals have been selected and funded, the NESDI program ensures during this third phase of its annual management process that the "new start" projects are effectively launched and remain properly focused on the needs they were intending to address through initial planning, ongoing reporting and management oversight. As part of this oversight, NESDI program managers require project investigators to submit quarterly status reports, justify monthly project expenditures, adjust execution schedules as required and make other timely modifications to the project's management plan that may be necessary as the project evolves over time.

The first step toward execution of any NESDI project is the completion of the program's Project Management Plan (PMP). PMPs contain four chapters, including a summary of problem statement, a detailed description of the project itself, an execution approach which includes a discussion of performance objectives, a cost assessment, risks and associated mitigation strategies, and a summary of the project schedule,milestones, funding and staffing.

Prakash Temkar prepared and submitted the original draft PMP in FY17 for review. Itzel Godinez (NAVFAC EXWC) later assumed responsibility for the project and submitted a revised PMP to the TDWG in March 2018. Itzel's revisions included procuring tablets for the demonstration through the Navy's wireless contract and narrowing the scope of the project towards specific objectives, such as using tablets with data service plans and EMSWeb for internal and external audits.

Once the plan was reviewed and approved, Itzel initiated her efforts by performing market research and obtaining user feedback on potential commercially available technologies and obtaining wireless service guidance from NAVFAC EXWC on the use of the Navy wireless contract to procure the mobile devices.

One of the major hindrances towards implementing smart electronic tools is obtaining Navy Marine Corps Intranet (NMCI) certification for both the devices and associated software. The selected technology will need to meet all NMCI requirements and a Statement of Work (SOW) document outlining how to procure the devices with NMCI approval will be necessary. When completed, the SOW will allow for any organization to acquire and implement the smart technology into their own processes.

The iPad Pro tablets were identified to meet the needs of the project because they could accommodate Common Access Card (CAC) readers, were capable of using cellular data and were NMCI certifiable. Itzel worked with Christy Bixler, the then-EMS and External Audit Program Manager at NAVFAC Headquarters, to procure four tablets and associated data service plans. The requirements package for procurement through the Navy Wireless contract was submitted in FY17. Before the procurement was approved, the NAVFAC Headquarters Telecommunications Manager requested additional information regarding funding to pay for the tablets and service plan, location(s) where the tablets will be used and names of personnel that will use the tablets.

EMSWeb software is used to document and manage environmental data from audits and inspections.
(Photo Credit: iStock)

The use of the Navy Wireless contract instead of the standard information technology (IT) procurement method created unique challenges for this project. A major delay resulted when the existing contract vendor (Verizon) offered a newer model of the tablets rather than the requested, older version. The tablets were purchased but could not be used because the newer models had yet to be NMCI tested and certified. Obtaining the necessary NMCI certification took much longer than anticipated and delayed the project over a year (until late FY18) due to funding and communication issues with NMCI personnel.

Another unique challenge was discovered while using the Navy Wireless contract. Anytime the contract service provider changes, subscriber identity module (SIM) cards in cellular devices must be updated to accommodate the new vendors. In 2018, the contractor switched from Verizon to AT&T after Itzel had already obtained the tablets. Itzel worked with CIO to switch the SIM cards on the tablets, causing additional delays in starting the demonstrations.

EMSWeb was selected as the auditing software because it is hosted by the Navy's Environmental Portal (EPRWeb), is already NMCI approved and requires user registration and a CAC for log in. Part of the EMSWeb software's capability is that it can be used to document and manage environmental data from audits and inspections, as well as any additional findings or deficiencies. All installations have access to EMSWeb. For installations not compliant with EMSWeb use, Microsoft Office 365 subscriptions can be purchased to enable the tablets with Excel and other Microsoft Office functionality.

Itzel broke the project into three phases:

1. Phase I: Proof of Concept
2. Phase II: Perform Internal Audits
3. Phase III: Perform External Audits

Phase I consisted of using EMSWeb with tablets in a test/beta environment as a proof of concept that the hardware and software are viable solutions.

Itzel worked with Eugene Wang from NAVFAC EXWC on redesigning the EMSWeb interface to be more tablet friendly to navigate and allow for downloading checklists to complete without internet access and re-upload the checklist and other substantiating evidence, such as photos, to EMSWeb at a later time.

In FY2019, Itzel began to execute phases II and III of this project, which consisted of internal audit demonstrations at Naval Base Ventura County (NBVC), NWS Seal Beach and NAVFAC Washington, followed by external audit demonstrations at NBVC and Naval Base Point Loma.

Project Management Plan (PMP)

1. Summary of project statement
2. Description of project
3. Discussion of performance objectives, cost assesssment, risks and mitigation strategies
4. Summary of the project schedule, milestones, funding and staffing.

The NESDI PMP defines the problem to be addressed and documents the scope, methodology, and milestones required to develop the appropriate solution.

The NBVC and NWS Seal Beach internal audit demonstrations in FY2019 did not use EMSWeb for their Hazardous Waste Program and Tier II Multi-Media Compliance Inspections respectively. Instead, they completed checklists in PDF, Word and Excel formats. External audits using EMSWeb were later conducted at NBVC and Naval Base Point Loma, and user feedback was collected and evaluated.

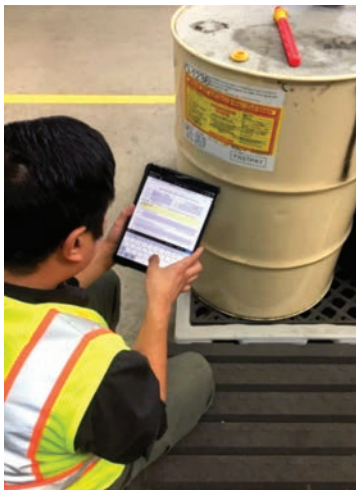
FY2020 involved more field testing of tablets with NAVFAC Washington PWD, this time using EMSWeb for their EMS Tier 1 Audit Program rather than Microsoft Office 365 applications. After the testing, it was determined that overall user experience was much more positive when using EMSWeb as compared to the Office 365 applications. With the positive feedback for using EMSWeb in combination with the tablets, Itzel reached out to NAVFAC Atlantic and Midlant to discuss testing the tablets for EMS Tier 2 inspections at Naval Station Norfolk. The capabilities of the system are constantly updating, and the Tier II demonstration is also planned to include use of the tablet's GPS to map and record findings with GIS data. Due to COVID-19 delays, the planned demonstration was postponed until the spring of 2021.

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.

The long term-goal is to transition Navy environmental audits and reports to electronic data collection via the tablets. Itzel is working towards preparing a Statement of Work (SoW) procedure that documents the routes to take in order to procure the tablets and obtain NMCI certification at the installation level. The SoW will allow for organizations to independently adopt the technology without additional input from NAVFAC EXWC. The SoW also covers



Using a tablet can save the Navy $6,000 of an auditor's time to conduct individual Tier 2 audits.
(Photo Credit: Itzel Godinez)

procuring software access to Microsoft Office 365 subscriptions if the installations choose not to use EMSWeb. YouTube training videos are also planned to be produced that will show how to use EMSWeb with the tablets.

This project currently benefits NAVFAC Headquarters, Public Works, the NAVFAC Media Field Teams (MFT), and other customers who use EMSWeb, but the potential for Office 365 integration could allow the technology to benefit several more groups Navy-wide.

An additional demonstration is tentatively planned for Norfolk, VA, as soon as COVID-related travel restrictions have been lifted. Itzel will submit a final report for this project sometime thereafter, hopefully by the end of the summer of FY21.

RETURN ON INVESTMENT

Using the NESDI program's TICA software, Itzel was able to generate an ROI for the use of tablets to conduct field audits versus the transitional "pen and paper" approach. The NESDI program created this software to enable Principal Investigators to generate economic analyses by site or scenario, quantify intangible benefits and calculate ROI and payback years per site/scenario, among other factors. The TICA software is available to all program investigators via the NESDI website.

Each Tier 2 audit using the traditional approach takes 18 working days (144 hours) to complete. Using the tablets, an auditor can successfully complete an audit in 12 working days (96 hours). Assuming a GS-12 field auditor with an estimated hourly rate of approximately $125.00, one traditional audit costs the Navy $18,000.00 to complete, whereas using the tablets costs the Navy only $12,000.00 of an auditor's time—a savings of $6,000.00 per audit.

Bottom line—the Navy saves 48 hours or $6,000.00 per audit using the tablet instead of "pen and paper."

Method	Working Days to Complete	Hours to Complete	Auditor Costs
Pen & Paper	18	144	$18,000.00
Tablet	12	96	$12,000.00


205
205

ADVANCING THROUGH ADVERSITY

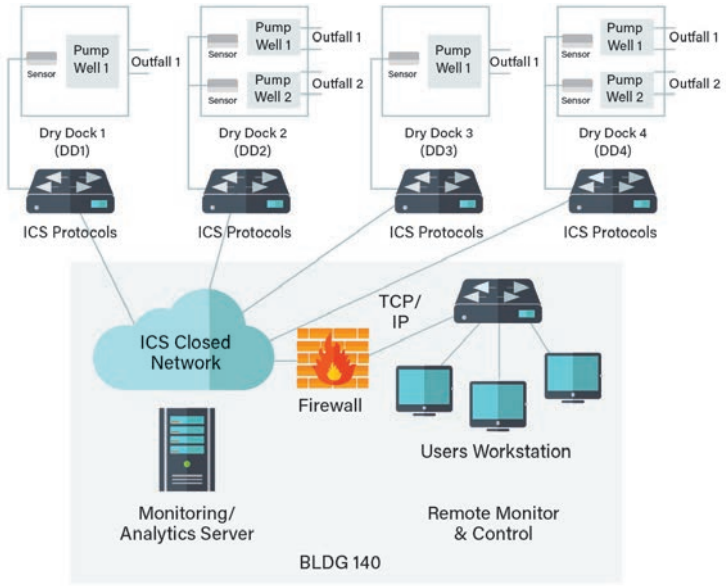
NOTEWORTHY PROJECT ACCOMPLISHMENTS & COVID WORKAROUNDS

In this chapter of the FY20 Year in Review report, we highlight those projects that had notable accomplishments over the course of this fiscal year and executed some innovative workarounds to advance individual project objectives despite the threats posed by a global pandemic. These innovations included efforts to use local personnel to conduct field work, changes in planned demonstration locations to sites where restrictions were less severe, anticipation and accommodation of delays in the supply chain for necessary materials and equipment, and project schedule adjustments to allow for whatever upfront analyses or bench-scale testing that could be conducted until COVID restrictions were lifted. Specific project workarounds and other noteworthy FY20 accomplishments are highlighted on the following pages.

ADVANCING THROUGH ADVERSITY

NOTEWORTHY PROJECT ACCOMPLISHMENTS & COVID WORKAROUNDS

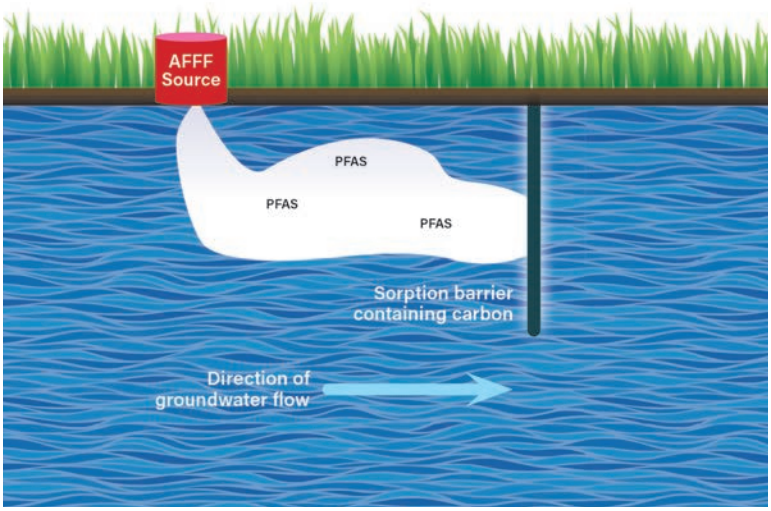
For NESDI project no. 582 (Sensor Interface and Infrastructure for Monitoring (SIIM)), Lewis Hsu and his colleagues anticipated slippage in shipping or manufacturer delivery dates to minimize the impact of COVID-related delays on overall project milestones. No significant slippage has occurred other than the availability of personnel for face-to-face meetings. Lewis Hsu also took advantage of some local personnel (at Pearl Harbor Naval Shipyard and the NIWC Pacific facility in Hawaii) to leverage for the development and testing of the SIIM network and hardware. SIIM network design has been completed, and cybersecurity configurations are being implemented and tested at the NIWC Pacific (Hawaii) facility. Pearl Harbor Naval Shipyard environmental program managers were briefed on the final architecture and initial versions of a graphical user interface and dashboard. Continuing work will focus on installation and starting up the SIIM network at the drydock locations. Ongoing COVID restrictions will be mitigated by utilizing Hawaii-based NIWC Pacific personnel (and leveraging Pearl Harbor Naval Shipyard personnel as needed) for onsite work and installation labor.



Conceptual framework for closed network monitoring solution with data analytics and user interface. (Schematic Credit: Henry Au)

Joe Marchica presented the progress being made under NESDI project no. 581 (Assessment of Cadmium Alternatives for Connector Applications) at the 2020 Advanced Surface Engineering Technologies for a Sustainable Defense (ASETSDefense) conference where the connector industry expressed real interest in the work on aluminum connector components coated with novel Zinc-Nickel finishes—efforts now being pursued under a Cooperative Research and Development Agreement (CRADA) between industry and NAVAIR. Joe also adjusted his project's implementation schedule to avert any

Degraded wires from the V-22 Osprey Full Authority Digital Engine Control (FADEC) and Flight Control Wiring. (Photo Credit: NAWC-AD Lakehurst Wiring Laboratory)



(Illustration Credit: Nancy Horvat)

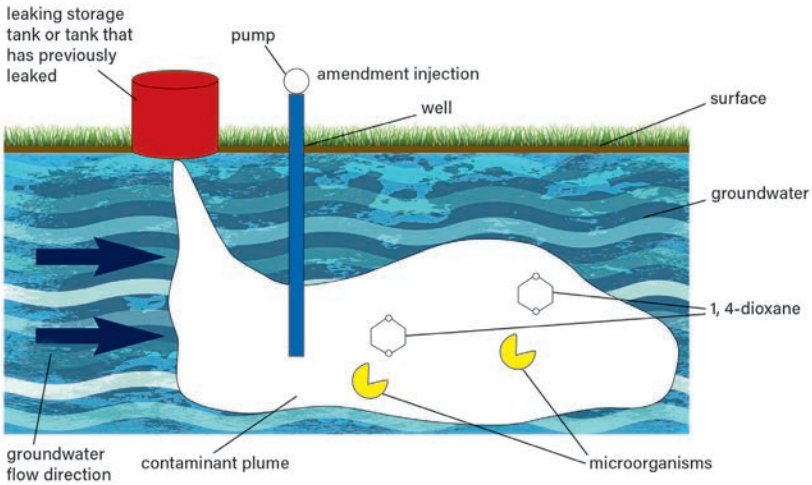
potential, significant delays in the supply chain that may have otherwise resulted from the COVID crisis.

As the selection of demonstration sites for both project nos. 569 (Field Demonstration of Colloidal Activated Carbon for In-situ Sequestration of Per- and Polyfluoroalkyl Substances) and 579 (In-situ Biodegradation of 1,4-Dioxane and Chlorinated Solvent Mixtures in Dilute Plumes) is essentially a desktop exercise, Tony Danko and his team were able to avoid any potential COVID-related delays by considering various demonstration sites.

Given that numerous sites have expressed interested in being part of the demonstration for project no. 569, the site selection process took a bit longer than anticipated.

A site has now been selected in the mid-Atlantic and work is moving forward to get out in the field as quickly as possible for site characterization efforts and core collection for laboratory tests.

For project no. 579, Tony was able to leverage the efforts from ESTCP project no. ER-201733 (Evaluation of A Novel Multiple Primary Substrate (MPS) Cometabolic Biosparging Technology for In Situ Bioremediation of 1,4-Dioxane and Chlorinated Solventsin Groundwater) and NESDI project no. 545 (In Situ Treatment of 1,4-Dioxane using Enhanced Biodegradation) to provide material for microcosm studies to the prime contractor (Oregon State University). Initial efforts are underway with the goal of determining the efficacy of different liquid amendments to drive bioremediation of comingled chlorinated volatile organic compounds (cVOC) and 1,4-dioxane. Some minor delays have been encountered due to analytical equipment issues and COVID-related delays of replacement parts, but the project is rapidly making strides in order to minimize schedule impacts.



This NESDI project is demonstrating a cost-effective treatment method for reducing or removing concentrations of 1,4-dioxane from groundwater at Navy sites. (Illustration Credit: Nancy Horvat)

Itzel Godinez and her team completed the construction of prototype barrier designs including this one to prevent brown treesnake dispersal.
(Photo Credit: Itzel Godinez)

Although some COVID-related and contractual delays impacted NESDI project no. 545, Principal Investigator Tony Danko via his prime contractor (GSI) was able to complete the initial phase of the push-pull efforts at Naval Air Station North Island, which were focused on assessing natural attenuation and biostimulation. The final phase of field efforts will be examining bioaugmentation and is expected to be completed in the spring of 2021. The project is anticipated to be finished in the fall of 2021.

Although the COVID pandemic temporarily interrupted momentum to complete the prototype barrier designs associated with NESDI project no. 561 (Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal), Itzel Godinez and her team requested and received authorization to enter the EXWC facilities in Port Hueneme, CA, to complete the construction of their prototype designs. Field testing of small-scale barrier prototypes will be conducted as soon as investigators are cleared to visit their Guam demonstration site.

As part of their efforts on NESDI project no. 540 (Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting) in FY20, Itzel and her team were able to complete more field testing of the tablets at NAVFAC Washington Public Works Department. This time, investigators used EMSWeb on the new tablet for their Environmental Management System (EMS) Tier 1 Audit Program rather than Microsoft Office. After this field testing, overall user experience was more positive when auditors used EMSWeb on the tablet compared to Microsoft Office 365. With the positive feedback for using EMSWeb in combination with the tablets, Itzel reached out to NAVFAC Atlantic and Midlant to discuss testing the tablets for the EMS Tier 2 inspections at Naval Station Norfolk. The capabilities of the system are constantly being updated and the Tier II demonstration is also planned to include use of the tablet's GPS function to map and record GIS data associated with audit findings.

Efforts by Steve Starnes and his colleagues on NESDI project no. 557 (Initiation Decision Report of Laser Coating Removal on Naval Aircraft Components) led to a subsequent Office of Naval Research (ONR) investment to qualify and transition a laser ablation process to remove coatings from Navy aircraft radomes, as well as an Office of the Secretary of Defense (OSD)

investment via the Foreign Comparative Testing (FCT) project, to qualify a portable, high-powered, directed-energy laser technology for ground support equipment and mobile maintenance facilities. These projects are now under contract with an investment of $1.4M and $1.5M, respectively.

On NESDI project no. 514 (Enhanced Trivalent Chromium Pretreatment for Improved Coloration and Corrosion Performance of Aluminum Substrates), Peter Sheridan and his NAVAIR colleagues finalized the Qualified Products List (QPL) testing of Chemeon Surface Technology's enhanced trivalent chromium pretreatment (eTCP) conversion coating and recommended that the product be placed on the MIL-DTL-81706 QPL for all conversion coating applications within the Navy with the exception of Method D (application via applicator pen or pre-saturated applicator device).

Spray application of eTCP ready-to-use at FRC Southeast to an aluminum panel. Production environment and panel orientation mimic spray conversion coating on aircraft as it is performed at FRC Southeast. (Photo Credit: Sjon Westre)

Although the original full demonstration site target for project no. 572 (Flexible Under Pier Sediment Assessment) had to be changed due to COVID-19, the project has been able to pivot and execute locally at Naval Base San Diego (NBSD), avoiding problems and uncertainty associated with travel restrictions. COVID-19 caused additional delays to the start of the field demonstration, because of both concerns earlier in the pandemic before safe protocols were developed for teams to work together and supply-chain problems with vendors. The latter impacted the team's ability to purchase necessary equipment required for providing location data for the remote-controlled bathymetric survey vessel when it is underneath piers. To keep the project moving forward, Jessica Carilli and her team worked to test alternative methods to track the vessel location using existing equipment, which ultimately proved successful.

Despite early challenges, the project is now well underway and on track to complete field efforts in the spring and summer of 2021.

The NIWC "Z-boat" is key to this effort to develop a simple and cost-effective solution to ascertain the potential magnitude of recontamination occurring from unremediated underpier sediments slumping into dredged and/or remediated areas between piers. (Photo Credit: Chuck Katz)

Bathymetric surveys have been completed at all five target piers at NBSD. Jessica was able to obtain initial bathymetric data from NAVFAC Southwest earlier in 2020. COVID impacts had prevented her team from collecting the data they needed from the same time period.

The team has also finished identifying methods to collect sediment cores underneath the piers at NBSD and successfully tested the approach at NIWC Pacific. NAVFAC Southwest has provided leveraged funds to hire contractors to scan for potential munitions ahead of sample collection. Sediment sampling for the project is expected to begin soon.

As COVID restrictions prevented Eric Winchell and his NIWC Pacific team (in San Diego, CA) from conducting any site visits over the course of their work on project no. 574 (Developing Lines of Evidence to Support Nutrient Compliance), they were able to leverage local NIWC personnel in Norfolk, VA, to select monitoring wells that are accessible and usable for the purposes of this project.

Through his efforts on project no. 527 (Structure-function Relationship and Environmental Behavior of Per- and Polyfluorochemicals from Aqueous Film-forming Foams), John Kornuc and his team determined spatial trends for per- and polyfluoroalkyl substances (PFAS) associated with aqueous film-forming foam (AFFF) use at Navy sites, including perfluoroalkyl acids and precursors, to gain a better understanding of PFAS composition, transport and transformation. The results of this study provide insight into the type of information needed to produce accurate conceptual site models (CSM) at PFAS-impacted sites to design better site investigations, determine risk, mitigate PFAS if necessary and make other informed site management decisions. Key findings in this project's FY20 final report were in the following areas:

1. Mass distribution and transformation of precursors
2. Retention of PFAS mass by low-permeability zones

3. Primary source of PFAS
4. Evidence for vertical transport of PFAS
5. Evidence for differential downgradient transport
6. Evidence for mass retention and/or matrix diffusion
7. Evidence for biotransformation of precursors
8. Relationships between soil and groundwater data

This project was leveraged by ESTCP project no. ER-201633 (Characterization of the Nature and Extent of Per- and Polyfluoroalkyl Substances in Environmental Media at DoD Sites for Informed Decision-Making), as well as congressional plus-up funding.

As COVID-19 safety protocols required a 14-day Restriction of Movement (ROM) for off-island (Hawaii) visitors, Lewis Hsu was able to use local personnel from Pearl City to finish the inserts associated with his project no. 560 (Biochar Adsorption for Dry Dock Effluent) in August 2020.

In addition to these COVID-19 "workarounds," two other NESDI projects had significant accomplishments in FY20 as described below.

Based on a NESDI pilot project (no. 556: Enterprise-wide Hazardous Material Standardization and Minimization of General Use Consumables) led by Principal Investigator Todd Heintzelman, Naval Supply Systems Command Weapons Systems Support (NAVSUP WSS) was designated as a Safer Choice Partner of the Year by the U.S. Environmental Protection Agency (EPA). Under Todd's guidance, this effort is developing a process to standardize the procurement of consumable general use hazardous materials, create tools to guide end users of hazardous materials to procure less hazardous products, and ultimately advance the use of chemicals that meet Safer Choice criteria. The project demonstrated that the Navy can increase the purchase of sustainable products, decrease the amount of new hazardous materials added to the Authorized Use List and make hazardous materials request procedures more efficient by leveraging web-based supply tools.

The objective of NESDI project no. 523 (Integrated Diagnostic Stormwater Monitoring with Passive Sampling) was to incorporate and demonstrate the value of passive sampling devices into an integrated stormwater monitoring strategy to improve the quality of data collected and achieve effective stormwater management. By the end of this project in FY20, Gunther Rosen and his NIWC Pacific team submitted a NESDI final report and published the following three peer-reviewed journal articles:

1. Strivens J, Hayman NT, Rosen G, Myers-Pigg A, 2020. Toward validation of toxicological interpretation of Diffusive Gradients in Thin Films in marine waters impacted by copper. *Environmental Toxicology and Chemistry*. 39:873-881.
2. Hayman NT, Rosen G, Strivens JE, 2019. Evaluating the efficacy of DGT to quantify copper in stormwater at end-of-pipe. *Chemosphere:* 235:1125-1133.
3. Strivens J, Hayman N, Johnston R, Rosen G, 2019. Effects of dissolved organic carbon on copper toxicity to embryos of M. galloprovincialis as measured by diffusive gradient in thin-films. *Environmental Toxicology and Chemistry* 38 (5): 1029-1034.

The investigators have also submitted a FY21 proposal (led by Nick Hayman at NIWC Pacific) to ESTCP with a focus on further demonstration and regulatory acceptance of these passive samplers.

RESULTS OF OUR FY20 NEEDS SOLICITATION

Our formal needs collection process for potential FY20 "new start" projects ran from June 3 until August 1, 2019. Overall, 34 needs were submitted by personnel from across the Navy and Marine Corps. Through the program's annual needs solicitation, screening and ranking process, the program's management committee (the TDWG), advanced 18 needs (approximately half of the total received) to the program's resource sponsor (OPNAV N45) so that their subject matter experts (SME) could review and then approve (or reject) the TDWG's recommendations and/or rankings. All of these needs were ultimately validated by OPNAV N45 SMEs who also made some suggestions and adjusted some of the original TDWG rankings. These needs (listed in the table below) were incorporated into the program's solicitation for pre-proposals.

No.	Need	Title	Submitter
1.	N-1307-20	Low-VOC, non-HAP Rapid Cure Aerospace Primer	Jack Benfer (NAVAIR)
2.	N-1308-20	Reducing Regulatory Requirements When Conducting Pier Operations	Alfred Dumaual (NAVFAC)
3.	N-1310-20	Rapid Pathogen Detection in Drinking Water	Len Sinfield (NAVFAC)
4.	N-1311-20	Event-Based Sediment Deposition Sampler	Jessica Palmer (NAVFAC)
5.	N-1314-20	Opportunity Assessment for Stormwater BMPs at Navy Shipyards	Brook Zeller (NAVSEA)
6.	N-1319-20	Demonstration to Determine and Evaluate the Effect of Radiological Sources in Sediment on Marine Biota	Melanie Kito (NAVFAC)
7.	N-1321-20	Technologies that Sequester Comingled Contaminants in Sediment Including Heavy Metals and Organics	Jason Speicher (NAVFAC)
8.	N-1325-20	Development and Implementation of Metal Removal Technologies that Achieves Water Body Concentrations at/below Permitted Compliance Levels	Trevor Richardson (NAVSEA)
9.	N-1326-20	Electromagnetic Interference Shielding Tape (EMIST)	Jacob Deeb (NAVAIR)
10.	N-1327-20	Rapidly Curable Sealants	Jacob Deeb (NAVAIR)
11.	N-1328-20	Rapid, Sensitive Screening Method for PFAS in Soil	Malcom Gander (NAVFAC)
12.	N-1329-20	Development of an Integrated Analytical Approach to Transition from Active to Passive Treatments at Munition Constituent's Contaminated Sites	Malcom Gander (NAVFAC)
13.	N-1332-20	Aircraft Paint Removal Alternatives to Plastic Media Blast	Ray Paulson (NAVAIR)
14.	N-1333-20	Hexavalent Chromium-Free Conversion Coating for Anodize Coating Repairs and Touch Up Conversion Coating Application	Jacob Deeb (NAVAIR)
15.	N-1334-20	Rapid Monitoring of Contaminant Concentrations in Drydock Effluent	Edward Drielak (NAVSEA)
16.	N-1335-20	Rapid PFAS/PFOA Detection and Treatment of Oily Wastewater from Ships (D-TOWS)	CDR Antonio Matos (CNIC)
17.	N-1336-20	Mitigation of Blast Effects from Underwater Blow-In-Place	Karla Harre (NAVFAC)
18.	N-1337-20	Identification and Measurement of Groundwater Seeps Emerging into Surface Water	Karla Harre (NAVFAC)

OUR FOURTEEN FY20 "NEW START" PROJECTS

Over the course of FY20, the NESDI program launched 14 new projects including two efforts to help Navy water program managers maintain compliance with their strict NPDES permit requirements. One project (no. 583) is validating a low profile and innovative stormwater best management practice (a pretreatment swale) for installations to use to meet NPDES permit effluent limits whereas a second related effort (project no. 585) is evaluating the performance of a specific filtration media for removing metals from various discharges and sources, including stormwater runoff and other shipyard activities.

Other FY20 "new start" projects include an initiative to develop and validate an effective methodology to detect and treat PFAS chemicals in bilge and oily wastewater as it is transferred from Navy vessels to collection barges (project no. 587), as well as an effort to test and evaluate rapid-cure, low-VOC and chromate-free solvent-based primers that provide adequate corrosion protection on Navy aircraft platforms (project no. 586). A complete list of these and all other FY20 "new start" projects is provided below.

1. Low-profile Integrated Porous Pretreatment Swale (LIPPS) for Metals Treatment in Industrial Areas (project no. 583)
   James Pilkington (NAVFAC EXWC)
2. Real-Time Multi-Contaminant Detection System (RMDS) (project no. 584)
   Autumn Resto (NAVFAC EXWC)
3. High Efficiency Media for Metals Removal in NPDES Discharges (project no. 585)
   Brandon Swope (NIWC Pacific)
4. Chrome-Free, Low-VOC and Fast Drying Single- and Two-Component Primers (project no. 586)
   Erick Iezzi (NRL)
5. Detection Methodology and Treatment Train Technology for PFAS Removal in Bilge and Oily Wastewater (project no. 587)
   Itzel Godinez (NAVFAC EXWC)
6. Effluent Copper Quantification by Flow-Through Optical Detection (project no. 588)
   Ron Gauthier (NIWC Pacific)
7. Rapid Pathogen Detection in Drinking and Surface Waters (project no. 589)
   Rob George (NIWC Pacific)
8. Dry Ice Paint Removal and Cleaning (project no. 590)
   Kami Carter (NAVAIR FRCSE)
9. Locating and Quantifying Groundwater Surface Water Connections Using Distributed Temperature Sensing (project no. 591)
   Joey Trotsky (NAVFAC EXWC)
10. Demonstration of the Robust Caisson Structure to Reduce Blast Effects from Underwater Blow-In-Place (project no. 592)
    Joey Trotsky (NAVFAC EXWC)
11. Evaluating Potential Effects to Marine Biota from Small-Scale, Legacy Radioactive Objects (project no. 593)
    Jovan Popovich (NAVFAC EXWC)
12. Demonstration and Application of Amendments Targeting Comingled Organics and Metals in Sediments (project no. 594)
    Gunther Rosen (NIWC Pacific)
13. Demonstration of a Signal Activated Bottom Lander Trap (project no. 595)
    Molly Colvin (NIWC Pacific)
14. Integrated Analytical Approach to Transition from Active to Passive Treatments at Munitions Sites (project no. 596)
    Tony Danko (NAVFAC EXWC)

Brief introductions to all of these efforts can be found on the following pages of this report.

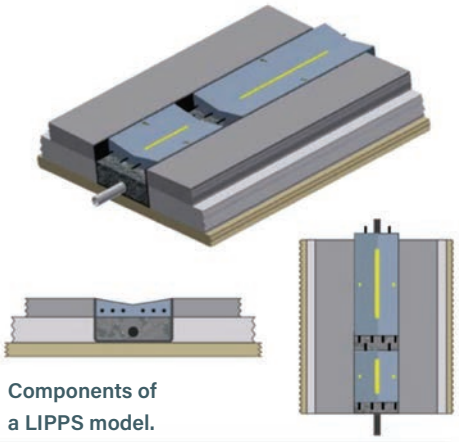
OUR FOURTEEN FY20 "NEW START" PROJECTS

1 Low-profile Integrated Porous Pretreatment Swale (LIPPS) for Metals Treatment in Industrial Areas (project no. 583)

James Pilkington (NAVFAC EXWC)

The Navy may face fines, regulatory action and operational impacts due to NPDES and industrial stormwater permit exceedances. Facilities are struggling to meet current limits, and some face permit renewals with even more stringent effluent limits. There is a need for a new technology that efficiently removes more metal particulates from stormwater runoff and is robust enough to handle the active industrial environments and tidal influences found at Navy shipyards.

The objective of this effort is to provide a low profile and innovative stormwater best management practice (LIPPS) for installations to use to meet strict NPDES permit effluent limits. This technology allows users to target specific pollutants of concern and is modular to accommodate different flowrates, allowing it to operate in multiple platforms across the Navy and private industry.

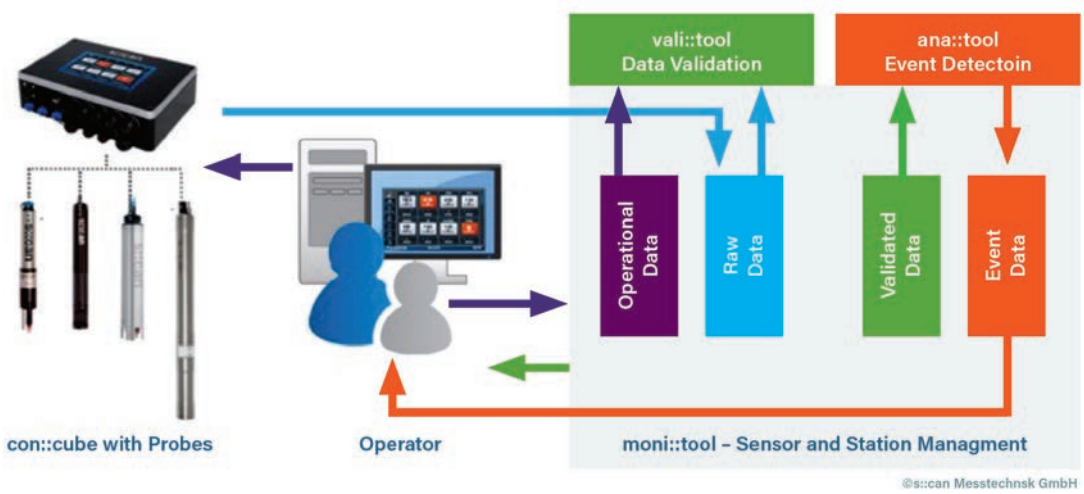


Components of a LIPPS model.
(Schematic Credit: Dennis How)

2 Real-Time Multi-Contaminant Detection System (RMDS) (project no. 584)

Autumn Resto (NAVFAC EXWC)

Environmental program managers need real-time monitoring of high priority constituents such as nutrients, copper and other heavy metals in drydocks to adequately implement required mitigating actions or sample collection and permit compliance. Current infrastructure and monitoring equipment are either lacking or obsolete and represent a notable risk to continued operations. Current methods



RMDS sensing system flow. (Diagram Credit: Autumn Resto)

for metal sensing involve grab samples sent to laboratories with long turnaround times and results of any violations are often sent too late for immediate compliance. A more efficient approach is needed to utilize standard protocols and updated infrastructure to enable a near real-time solution.

This project proposes to develop an integrative and innovative approach that will allow, as near as possible, a system for real-time constituents monitoring and detection that will provide the necessary and timely detection, notification, analytics and data visualization of sensor data from drydocks and other effluent-generating operations.

3 High Efficiency Media for Metals Removal in NPDES Discharges (project no. 585)

Brandon Swope (NIWC Pacific)

There is a longstanding issue in meeting NPDES permit requirements for metals from various discharges and sources, including shipyard activities and stormwater runoff. The need exists for technologies to remove metals from these discharge streams down to permit compliance levels. This project team is evaluating the performance of one specific filtration media (MetalZorb®) for removing metals from various discharges and sources, including stormwater runoff and other shipyard activities, to help maintain regulatory permit compliance. The team also aims to expedite field deployment of the media during the first year of the effort.

MetalZorb is a high-capacity sponge filtration media that effectively absorbs and reduces dissolved heavy metals, including copper, zinc, lead and mercury found in stormwater and industrial process water discharges. This media has been previously identified (in a Naval Base San Diego project) and undergone initial bench scale testing (under NESDI project no. 576: In-Pipe Stormwater Treatment System). Results indicated that MetalZorb performs better than established media such as bone char, zeolite, etc., with good metals removal efficiency under short exposure/treatment durations.

This project team will build upon previous laboratory work and evaluate the metal removal capacity of the media over longer exposure durations (several minutes) and with larger volumes of water (greater than 50 gallons). This project will target two primary field deployment settings. The first will be identifying best management practices (BMP) that currently use some type of media for a 1:1 replacement with MetalZorb. The second will be identifying novel BMP options to include MetalZorb as part of the treatment process. The project will consider testing and evaluation across multiple geographic areas, including regional Navy bases in San Diego, Puget Sound Naval Shipyard and Pearl Harbor Naval Shipyard.

The MetalZorb filtration media.
(Photo Credit: Brandon Swope)

4 Chrome-Free, Low-VOC and Fast Drying Single- and Two-Component Primers (project no. 586)

Erick Iezzi (NRL)

The anticorrosive primers most commonly used on Navy aircraft are two-component products that contain VOCs, including toxic hexavalent chromium as the active corrosion inhibitor. Hexavalent chromium is a carcinogen and therefore poses a human health risk, and as a hazardous waste, there can be significant monetary costs associated with the monitoring and disposal of hexavalent chromium. In addition, these efforts are in line with an April 2009 Office of the Secretary of Defense memo restricting the use of hexavalent chromium when cost-effective alternatives with satisfactory performance become available.

Water-based primers have come into use in recent years due to their shorter drying time, which enables application of a polyurethane topcoat within an 8-hour work shift. However, these water-based primers don't provide the same corrosion protection as solvent-based primers, and ultimately result in repeated cycles of maintenance. A low-VOC alternative primer that provides adequate corrosion protection is needed.

The objective of this project is to test and evaluate rapid-cure, chromate-free, and low-VOC solvent-based primers that meet the requirements for use on tactical Navy aircraft, such as the F/A-18 Hornet jet fighter, the AV-8 Harrier ground-attack aircraft, the UH-1Y Venom utility helicopter and the AH-1Z Viper reconnaissance helicopter.

This project team is exploring the use of two alternative solvent-based primers: a single-component formula and a two-component formula. The goal is to qualify these to the performance requirements associated with MIL-PRF-23377 (PRIMER COATINGS: EPOXY, HIGH-SOLIDS, Type I/II Class N (non-chrome)), which will allow for their use at Navy aircraft maintenance facilities.

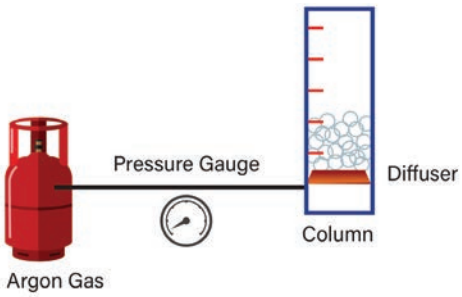
This F/A-18E Super Hornet on the flight deck of the USS Ronald Reagan (CVN 76) is among the platforms targeted by the rapid-cure, low-VOC and chromate-free solvent-based primers being evaluated as part of this NESDI project.
(Photo Credit: Mass Communication Specialist 2nd Class Samantha Jetzer)

5 Detection Methodology and Treatment Train Technology for PFAS Removal in Bilge and Oily Wastewater (project no. 587)

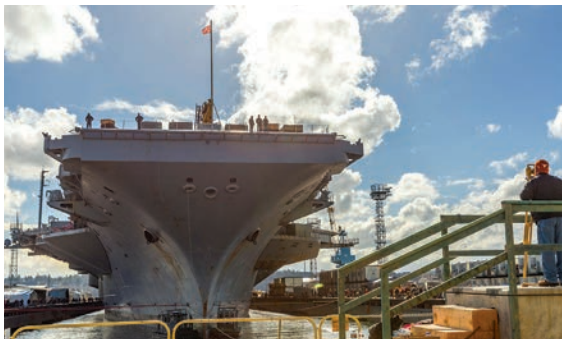
Itzel Godinez (NAVFAC EXWC)

PFASs consist of a large class of substances with unique chemical and physical properties that make them particularly persistent and mobile in the environment. In Japan, current practices dictate that bilge and oily wastewater (BOW) transferred from Navy vessels to collection barges needs to be sampled for the presence of PFAS. The current turnaround time to analyze BOW samples is up to 35 days. While waiting for results, barges are placed offline, which disturbs normal operations at ports. In some cases, U.S. Fleet activities have been forced to rent commercial barges for several times the cost of a government barge because there were no available barges to service Navy vessels coming to port. Furthermore, if the analytical results indicate the presence of PFAS chemicals, U.S. Fleet activities must contract for the disposal and incineration of BOW and the decontamination of the barge. The latter actions can result in considerable costs to the Department of the Navy (DON). There is a critical need for prompt and cost-effective methodologies and technologies capable of detecting and treating PFAS in BOW in accordance with Navy policies.

This team plans to develop and validate a detection methodology for PFAS chemicals in BOW and to demonstrate and validate a two-part treatment technology.



Experimental set-up for detection methodology column tests. (Schematic Credit: Itzel Godinez)



A ship enters drydock at Puget Sound Naval Shipyard (PSNS) and Intermediate Maintenance Facility (IMF). PSNS&IMF must monitor the levels of copper and other contaminants in shipyard effluent. (Photo Credit: Thiep Van Nguyen II)

6 Effluent Copper Quantification by Flow-Through Optical Detection (project no. 588)

Ron Gauthier (NIWC Pacific)

To maintain compliance with NPDES limits, U.S. Navy shipyards must monitor the levels of copper (and other contaminants) in shipyard effluent (discharge water). The EPA has set the limit at 3.1 micrograms per liter (µg/L). This measurement is based on total copper concentration, which includes all forms of copper (particulate, total and dissolved). Most copper in shipyard discharges is in the form of the less bioavailable particulate phase, rather than the bioavailable, and toxic, aqueous (dissolved) form.

To satisfy NPDES compliance, there is a need for a fast, easy-to-use tool to differentiate between forms of copper in shipyard effluent. The goal of this project is to demonstrate a methodology for rapid quantification of copper in seawater using an optical detection system. This project team will explore an innovative technology that uses fluorescence and a laser system for copper quantification. Light-reflecting copper complexes are illuminated when fluorescently activated copper ions pass through a green laser diode, producing an optical signal that corresponds to the copper concentration.

7 Rapid Pathogen Detection in Drinking and Surface Waters (project no. 589)

Rob George (NIWC Pacific)

Current approaches for detecting pathogens in drinking and surface waters from military installations are slow, cumbersome, labor-intensive and prone to false positives. A portable, real-time (or near real-time) tool is required to evaluate whether drinking water supplies and/or surface and drainage waters contain biological contaminants of concern that could be a threat to human health or the environment.

Currently, the most common method for detecting pathogens for drinking water monitoring and environmental monitoring is a culture assay conducted in the laboratory. This type of analysis identifies a group of bacteria known as coliforms in the water. However, these drinking water analyses, approved by the EPA, are subject to false positives from field sampling errors, transportation issues and lab cross-contamination. Furthermore, both this type of testing and the more recent EPA-approved rapid assessment method for testing water detects total coliforms, which in some cases are harmless bacteria present in the environment.

Gathering water samples is typically slow, cumbersome and labor-intensive. (Photo Credit: Lance Cpl. Jacob Bertram)

The goal of this effort is to leverage existing biological detection technologies to create a portable tool that will rapidly detect and quantify targeted biological pathogens of concern in drinking and surface water.

8 Dry Ice Paint Removal and Cleaning (project no. 590)

Kami Carter (NAVAIR FRCSE)

Plastic media blasting (PMB), a type of sandblasting, is the primary blast method for paint and coating removal at Fleet Readiness Centers East, Southeast and Southwest (FRCE, FRCSE and FRCSW). The waste generated from these processes is classified as hazardous waste. At FRCSE alone more than 100,000 pounds of contaminated blast media is disposed of annually, costing the facility more than $185,000 in disposal fees. Glass bead and aluminum oxide media used in mechanical cleaning operations also generate a significant amount of hazardous waste. There is a current need for effective, environmentally friendly, cleaning and stripping processes that create minimal hazardous waste.

The objective of this investigation is to evaluate whether dry ice (carbon dioxide (CO_2)) can be utilized at Fleet Readiness Centers as an effective, environmentally friendly alternative to the use of PMB for cleaning and organic coating removal. Dry ice can be used in a dry and thermal cleaning process that does not create residual blasting media (secondary hazardous waste). At extremely low temperatures, CO_2 changes directly from a solid to a gas in a process called sublimation. When CO_2 pellets are shot from a compressed air source, the combination of kinetic energy and sublimation produces a sandblasting effect.

For this project, two methods will be investigated, both of which utilize the same commercial-off-the-shelf system—the Cold Jet Aero 80. This system offers a variety of pressures and nozzles to optimize dry ice blasting and can

Fleet Readiness Center East is one of the facilities that would benefit from CO_2 blasting processes during the maintenance of the F-35 Lightning and other Navy aircraft programs. (Photo Credit: Heather Wilburn)

be retrofitted with accessories for the purposes of mixed media blasting. The use of dry ice blasting reduces the level of dust and secondary waste generated in traditional blast operations because the blast media itself will evaporate.

9 Locating and Quantifying Groundwater Surface Water Connections Using Distributed Temperature Sensing (project no. 591)

Joey Trotsky (NAVFAC EXWC)

The identification and migration of contaminated groundwater into surface water is a priority among Remedial Program Managers (RPM). Traditional sampling methods to identify and quantify groundwater seepage involve measurements at a few discrete locations. These methods provide limited information because seepage may occur to varying degrees over a large area. Better methods that provide data that are more complete are needed to improve the characterization of groundwater movement and associated contaminant transport in order to support decision-making for potential remedial actions.

The objective of this study is to demonstrate the capability of a distributed temperature sensing (DTS) system to provide high resolution identification of seepage locations at a relevant Navy site. Temperature differences have been used extensively as tracers to track groundwater-to-surface water discharge—areas of lower temperature indicate groundwater discharge zones. Fiber optic DTS technology uses the relationship between temperature and scattered light in a fiber optic cable to measure temperatures continuously. The cable may be several kilometers in length, allowing continuous measurement at thousands of locations.

Analytical tools allow for the processing of these data into a detailed view of temperature differential (representing groundwater seepage) over time, including variations with tide level, precipitation events and/or pumping.

Deployment of the distributed temperature sensing system. (Photo Credit: Joey Trotsky)

10 Demonstration of the Robust Caisson Structure to Reduce Blast Effects from Underwater Blow-In-Place (project no. 592)

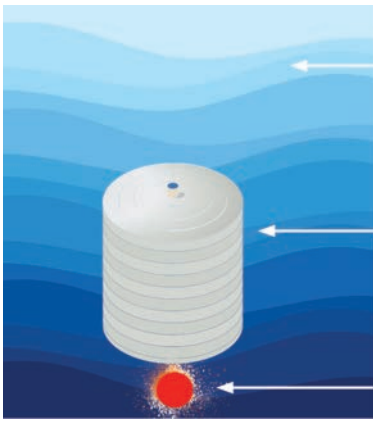
Joey Trotsky (NAVFAC EXWC)

Underwater munitions represent a significant threat due to potential incidental contact with recreational users. Current procedures, known as blow-in-place, detonate the underwater munition, which can result in blast pressures

that are detrimental to nearby structures and marine life. Technologies are needed to cost effectively and safely recover munitions in the underwater environment. This project is field testing the effectiveness of a robust caisson structure to reduce blast effects from underwater explosions.

A caisson is a secure, watertight chamber usually used for underwater construction. The chamber is made waterproof through the addition of compressed air. The use of a caisson as a blast shield was studied under a Strategic Environmental Research and Development Program (SERDP) project no. MR-2648 "Modeling a Robust Caisson Structure to Resist Effects from Blow-In-Place of Underwater Unexploded Ordnance." Computer simulations found that the robust caisson structure (RCS) model developed by the SERDP team was able to significantly reduce the effects of underwater explosions.

The innovative design of the RCS splits the total blast wave energy into multiple smaller, weaker shock waves that travel at different speeds, resulting in much lower blast peak pressures and impulses. This project was formed to fabricate and demonstrate a full-scale RCS based on the original SERDP design.



This NESDI project will field test the effectiveness of a robust caisson structure to reduce blast effects from underwater explosions. (Diagram Credit: Joey Trotsky)

11 Evaluating Potential Effects to Marine Biota from Small-Scale, Legacy Radioactive Objects (project no. 593)

Jovan Popovich (NAVFAC EXWC)

Discrete radioactive particles are small, usually microscopic, radioactive particles that are sometimes found in the marine environment at Department of Navy locations. These particles were usually lost from Navy ships, such as radium painted dials or paint chips, prior to the present day understanding and control of radiological materials. Though the effects of discrete radioactive material (RAM) are not well understood, such particles can become lodged in living tissue and have the potential to affect the food chain.

Current practices to remediate sites with discrete RAM involve removal of the material, which can incur significant costs and project delays. Knowledge regarding the detrimental effects of discrete RAM on the marine biota is a necessary first step toward informed remediation. This project was formed to evaluate the potential for detrimental effects on marine biota of small-scale objects containing radioactive material relevant to the U.S. Navy.

Radium painted dials like the one on this ship's clock can contain small, usually microscopic, radioactive particles and are sometimes found in the marine environment at Department of Navy locations. (Photo Credit: Compliments of *Currents* magazine)

12 Demonstration and Application of Amendments Targeting Comingled Organics and Metals in Sediments (project no. 594)

Gunther Rosen (NIWC Pacific)

Contaminated sediment remediation represents a $2 billion liability for the Navy. Though activated carbon has proven effective as an in situ amendment for addressing sediments with organic contaminants, a remedy that addresses comingled organics and metals contamination is needed.

Several amendments for addressing metal-contaminated sediments are emerging, including various metal oxides and clays. Metal oxide-modified activated carbon is a promising treatment for addressing sediments contaminated with comingled metals and organics. However, none of these remedies have been field tested in real-world environments similar to Navy sites. The objective of this work is to demonstrate and validate performance, placement and stability following placement of reactive amendments for in situ treatment of comingled organic and metal contaminated sediments at Navy facilities.

AquaGate+ amendments being deployed at a Navy site. (Photo Credit: Courtesy of ESTCP project no. ER-201131)

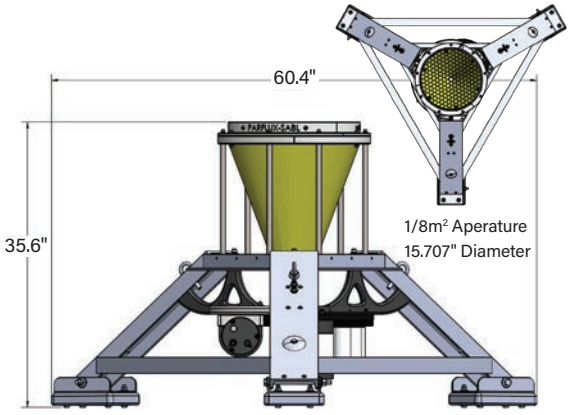
AquaGate+ reactive amendment media. (Photo Credit: Scott Collins)

13 Demonstration of a Signal Activated Bottom Lander Trap (project no. 595)

Molly Colvin (NIWC Pacific)

Determining the sources of sediment contamination in Navy harbors is a complicated endeavor. In addition, sites that have been identified for remediation often become recontaminated over time due to various environmental factors. Most contaminated sediment sites currently use sediment trap technology: passive, diver-deployed, cylindrical traps that capture particles as they settle to the seafloor. As these traps are passive and always open to the environment, they cannot distinguish between actual depositions associated with specific temporal particle discharge events (such as storms, dredging projects, ship activities, etc.) versus local resuspension that might be associated with bottom erosion (i.e., tidal influences).

There is an ongoing need for technologies that would more accurately evaluate sources of particulate deposition to better evaluate potential contamination and recontamination of sediments.



This NESDI project is developing and demonstrating an automated technology (a signal-activated bottom lander) that can aid sediment remediation efforts by targeting specific particle discharge or resuspension events.
(Schematic Credit: Courtesy of McLane Research Laboratories)

The objective of this project is to develop and demonstrate an automated technology that can aid sediment remediation efforts by targeting specific particle discharge or resuspension events.

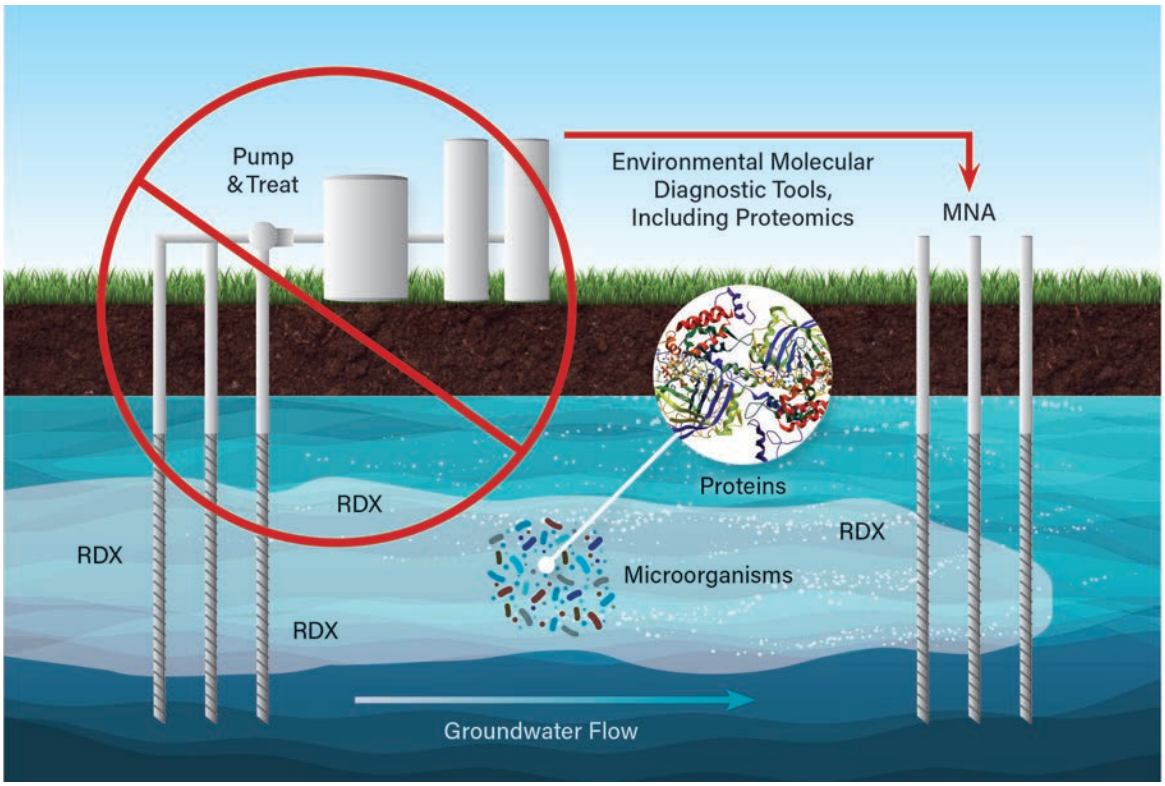
14 Integrated Analytical Approach to Transition from Active to Passive Treatments at Munitions Sites (project no. 596)

Tony Danko (NAVFAC EXWC)

The Navy has over 400 sites in need of remediation due to remnants of munitions (munitions constituents). Approximately 70 of these sites are currently being treated with pump and treat systems, which means that contaminated groundwater is pumped out of the soil and treated aboveground. Remedial program managers (RPM) need a formalized framework to determine when pump and treat activities (active remediation) can be ceased and the next phase (passive remediation) begun.

This project is developing a protocol to ease transition from active to passive remediation at Navy sites contaminated with munitions constituents.

This project team is combining compound-specific isotopic analysis (CSIA) with molecular biological tools to identify degradation potential of munitions constituents at Naval Base Kitsap – Bangor, which is an active remediation site. The resultant protocols can be transferred to a variety of environmental contaminants, including RDX. The process will be incorporated into Naval Base Kitsap – Bangor's adaptive management plan, which will formalize a versatile cleanup strategy developed in conjunction with regional representatives from the EPA.



(Diagram Credit: Nancy Horvat)

OUR FY21 SCHEDULE

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

What	When
Request Pre-proposals	2 November 2020
Pre-proposals DUE	15 December 2020
Make Pre-proposals Assignments to FWGs	8 January 2021
Evaluate Pre-proposals	11 – 15 January 2021
TDWG & FWG Comments on Pre-proposals DUE	15 January 2021
Request Full Proposals	22 January 2021
Conduct OPNAV N45 Virtual Programmatic Review	26 & 27 January 2021
Full Proposals DUE	11 March 2021
Screen Full Proposals	29 March – 2 April 2021
Principal Investigator Answers to Full Proposal Screening Questions DUE	23 April 2021
Conduct First FY22 Virtual In-Progress Review	27 – 29 April 2021
Conduct Second FY22 Virtual In-Progress Review	4 – 5 May 2021
FWG & TDWG Comments on Full Proposals DUE	14 May 2021
Announce FY22 Needs Solicitation	1 June 2021
Conduct Third FY22 Virtual In-Progress Review	8-9 June 2021
Complete Evaluation of Full Proposals	21 May 2021
Obtain Sponsor Review & Approval of Full Proposals	5 June – 13 August 2021
Close FY22 Needs Solicitation	2 August 2021
Announce FY22 New Starts	16 August 2021
Screen FY22 Needs	16 – 20 August 2021
Evaluate & Rank Needs	13 – 17 September 2021
Obtain Sponsor Review & Approval of Needs	20 September – 22 October 2021
Quarterly Status Reports Due	5 October 2020 4 January 2021 5 April 2021 6 July 2021

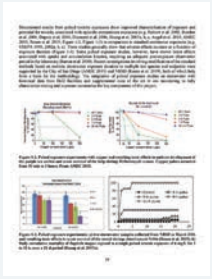
Check out the NESDI website (https://epl.navfac.navy.mil/nesdi) for the latest version of our program schedule.

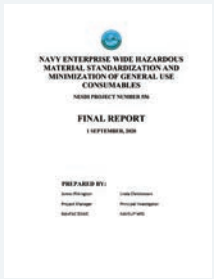
ADVANCING THROUGH ADVERSITY

FINAL REPORTS & PROJECT CLOSEOUTS

COVID-related travel restrictions provided many of our investigators with the "quiet time" necessary to write and complete their project final reports. Nearly two dozen final reports were completed in FY20 and the first quarter of FY21. The entire list is provided in the table below.

No.	ID	TITLE	Investigator	SYSCOM
1.	433	User Friendly Oxygen Cleaning Alternatives to Navy Oxygen Cleaner	Kami Downey	NAVAIR
2.	500	Demonstration of Non-Chromated Adhesive Bond Primer for Metal Repair Bonding	Justin Massey	NAVAIR
3.	503	Dry Dock Sediment Management	Patrick Morrow	NAVSEA
4.	511	Demonstration of an Improved Method for Quantifying Algal Biomass to Meet Nutrient Numeric Endpoint Compliance	Kara Sorensen	NIWC
5.	516	Automated Monitor to Determine the Opacity of Fugitive Emissions	Patrick Morrow	NAVSEA
6.	520	Quantification of Polychlorinated Biphenyls Paint Volatilization	Patrick Morrow	NAVSEA
7.	521	Autonomous Benthic Ecology System	Cheryl Cooke	NIWC
8.	522	Demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites	Gunther Rosen	NIWC
9.	523	Integrated Diagnostic Stormwater Monitoring with Passive Sampling Active Project	Gunther Rosen	NIWC
10.	527	Structure-function Relationship and Environmental Behavior of Per- and Polyfluorochemicals from Aqueous Film-forming Foams	John Kornuc	NAVFAC
11.	533	Analysis of Regulated Garbage Management Processes to Ensure Compliance with Animal and Plant Health Inspection Service Regulations	Tracy Carole	NAVSEA
12.	534	Technology Evaluation and Sampling for Treatment of Perfluorochemicals	John Kornuc	NAVFAC
13.	539	Using a Forward-Looking Infrared Camera for Advanced Discharge Characterization	Brandon Swope	NIWC
14.	541	Utility Vault Water Treatment	Patrick Morrow	NAVSEA
15.	542	Naval Air Systems Command Solutions for Engine Washing Active Project Technology Replacement	Keiko Sapp	NAVAIR
16.	544	Using Stable-Isotope Labeled Tracers to Validate Natural Attenuation of RDX in Groundwater	Jovan Popovic	NAVFAC
17.	546	NPDES Copper Effluent Control System	Iryna Dzieciuch	NIWC
18.	547	Demonstration of Improved Toxicity Methodology to Link Stormwater Discharges to Receiving Water Impacts	Molly Colvin	NIWC
19.	548	Sewer Gas Elimination Technology	Steve Fann	NAVFAC
20.	556	Enterprise-wide Hazardous Material Standardization and Minimization of General Use Consumables	Todd Heintzelman	NAVSUP
21.	566	Source Metal Particle Removal for Stormwater Compliance	Jim Howell	NAVSEA
22.	567	Business Processes and Requirements Enabling Technology Integration	Marty McMorrow	NAVFAC





To find these and other final reports, visit the NESDI program's public website at https://epl.navfac.navy.mil/NESDI (no log-in necessary or Common Access Card required). Choose the 'Projects' tab and in the filter for "More Information" choose "Final Reports." There will be a link to the project's final report (and fact sheet if available) under the "More Information" column.

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

NESDI BY THE NUMBERS

PROGRAM

663: Program participants
16: Commands supporting the program
36: Activities supporting the program

NEEDS

933: Needs submitted
295: Needs approved
32: Percentage of needs approved
10: Commands submitting needs

PROPOSALS

415: Pre-proposals submitted
255: Pre-proposals approved
61: Percentage of pre-proposals advanced to full proposal stage
8: Commands submitting pre-proposals
247: Full proposals submitted
174: Full proposals approved
70: Percentage of full proposals approved
6: Commands submitting full proposals

PROJECTS

173: Projects launched
89: Participating Principal Investigators
6: Commands participating in projects
12: Activities participating in projects
9: Completed projects (in FY20)

OTHER

3: Program Managers (Scott Mauro, Leslie Karr, Ken Kaempffe)
11: Journal articles/Conference presentations (in FY20)
261: Current active website users
419: Website users since 2007

(Note: These numbers were compiled in February 2021 from data available on the NESDI website since 2007.)

PROMOTING OUR SUCCESSES

NEW: Project Case Studies

Each year, the NESDI program executes a four-phase process 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. Throughout this process, the program's 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. Over the course of FY20, we developed the following case studies to demonstrate how this process evolves over the course of three NESDI projects:

1 Project no. 514: Enhanced Trivalent Chromium Pretreatment for Improved Coloration and Corrosion Performance of Aluminum Substrates

Peter Sheridan

This project added color to a non-hexavalent chromium conversion coating (eTCP) that makes it easier for maintenance artisans to visually confirm that the desired coating has been thoroughly applied. This effort is in-line with other efforts across the U.S. Navy to eliminate the use of hexavalent chromium — a known carcinogen.

2 Project no. 524: Innovative Hydrant Flushing

Tami Relph

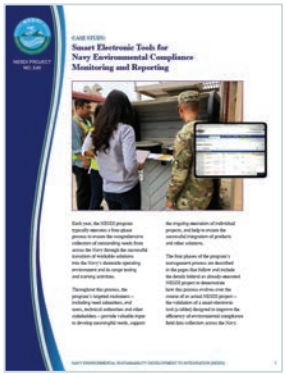
This project demonstrated and evaluated the effectiveness of a truck-mounted potable water distribution flushing system to prevent nitrification and maintain adequate free chlorine residual in Navy systems.

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

Itzel Godinez

This project is validating a smart electronic tool (tablet) to improve the efficiency of environmental compliance field data collection and audits across the Navy.

The actual case study for project no. 540 is included in the "THE NESDI PROGRAM PROCESS: Overview & Case Study" chapter of this Year in Review report.



Publications & Conference Presentations

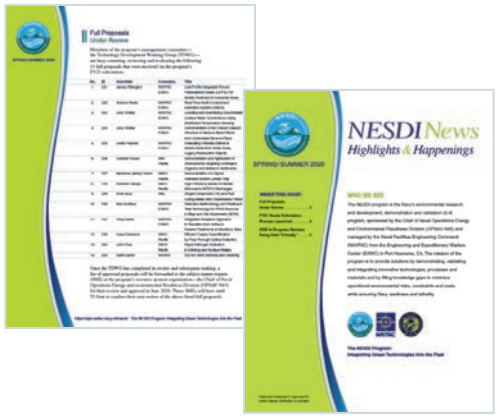
Over the course of FY20, a number of NESDI projects published the results of their efforts in a variety of peer-reviewed journals and other publications. They also presented those results in real-time at a number of virtual conferences and meetings. A list of those publications and presentations is provided below.

No.	Project Title	Publication
523	Integrated Diagnostic Stormwater Monitoring with Passive Sampling	▪ Strivens J, Hayman NT, Rosen G, Myers-Pigg A, 2020. Toward validation of toxicological interpretation of Diffusive Gradients in Thin Films in marine waters impacted by copper. Environmental Toxicology and Chemistry. 39:873-881. ▪ Hayman NT, Rosen G, Strivens JE, 2019. Evaluating the efficacy of DGT to quantify copper in stormwater at end-of-pipe. Chemosphere: 235:1125-1133. ▪ Strivens J, Hayman N, Johnston R, Rosen G, 2019. Effects of dissolved organic carbon on copper toxicity to embryos of M. *galloprovincialis* as measured by diffusive gradient in thin-films. Environmental Toxicology and Chemistry 38 (5): 1029-1034.
551	Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation Options	Navy Cooperative Research and Development Agreement (CRADA) between NIWC Pacific and DSI, Inc. to combine NIWC Pacific's propeller wash data with DSI's environmental modeling computer code to produce coupled near-field-far-field propeller wash analysis software. Fall 2020.
556	Enterprise-wide Hazardous Material Standardization and Minimization of General Use Consumables	▪ Presentation at the Navy Ashore Hazardous Material Managers Annual Working Group. 15 November 2019. ▪ Presentation at the Joint Safety and Environmental Professional Development Symposium. 7 April 2020.
576	In-Pipe Stormwater Treatment System	Patent pending for a best management practice (In-Pipe Stormwater Treatment System) for handling stormwater focusing on removing particles or contaminants from surface areas prior to a storm. This patent application is for a treatment system for filtering stormwater in an outfall pipe. Fall 2020.
578	Mesocosm Field Testing of In-situ PFAS Treatment Trains	Presented poster at North American Society of Environmental Toxicology and Chemistry (SETAC) conference.
549, 557 & 581	▪ Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents for Immersion Chemical Depainting ▪ Initiation Decision Report of Laser Coating Removal on Naval Aircraft Components ▪ Assessment of Cadmium Alternatives for Connector Applications	All presented at the Advanced Surface Engineering Technologies for a Sustainable Defense (ASETSDefense) conference. This conference is sponsored by SERDP and ESTCP to provide engineering resources and information to the defense industry and a database for testing, qualification and implementation. August 2020.
583	Low-profile Integrated Porous Pretreatment Swale (LIPPS) for Metals Treatment in Industrial Areas	▪ Presented technology at Young Moon Virtual Innovation Discovery Event. ▪ U.S. patent application was approved in the fall of 2020 for a low-profile and innovative stormwater management solution that will allow users to target specific pollutants of concern and operate in multiple platforms. 30 September 2020.

Enhancements to the Program's Website

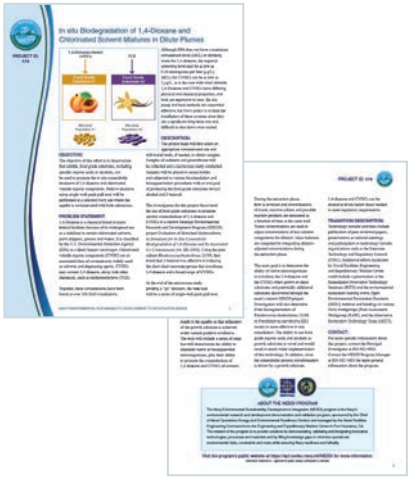
Each year, our webmaster (Eric Rasmussen) continues to improve the performance of our website. In particular and over the course of FY20, Eric implemented the following enhancements:

- Incorporated cost benefit elements/inputs for pre- and full proposal submissions. The program sponsor requested collection of more detailed cost analysis data to ensure sound investment decisions. This update provides principal investigators with the guidance and interface to capture the required data points.
- Improved data analytics through the expansion of filter options. More options are now available to drill down to specific query subsets for projects and proposals.
- Implemented multiple fixes/improvements based on feedback from program participants. These include the displays for quality assurance reports, display of project milestones, custom fact sheet display and handling of automated emails with attachments exceeding the email server limit.
- Improved security. Enhanced security by refining software processes that extract Common Access Card (CAC) certificate data for the identification and authenticate of users.



Quarterly "Electronic" Newsletters

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



Project Fact Sheets

In an ongoing effort to promote the program's investments, on-line fact sheets are developed that highlight "new start," ongoing and completed NESDI projects. In FY20, fact sheets for the program's 14 "new start" projects were developed. These and all other project fact sheets are available for download on the program's website at https://epl.navfac.navy.mil/nesdi.

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.

Kaempffe, Ken (Chair)
NAVFAC
805-982-4893
ken.kaempffe@navy.mil

Bixler, Christy
CNIC
202-685-9313
christy.bixler@navy.mil

Earley, Pat
NIWC
619-553-2768
earl@spawar.navy.mil

Harre, Karla
NAVFAC
805-982-2636
karla.harre@navy.mil

Henning, Jeff
NAVSUP
717-605-2861
jeffrey.a.henning@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

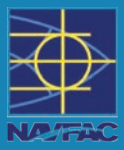
Rasmussen, Eric
NAVAIR
732-323-7481
eric.rasmussen@navy.mil

Webb, Tom
NAVFAC
805-982-2574
thomas.h.webb@navy.mil

Webber, Cindy
NAVAIR
760-939-2060
cynthia.webber@navy.mil

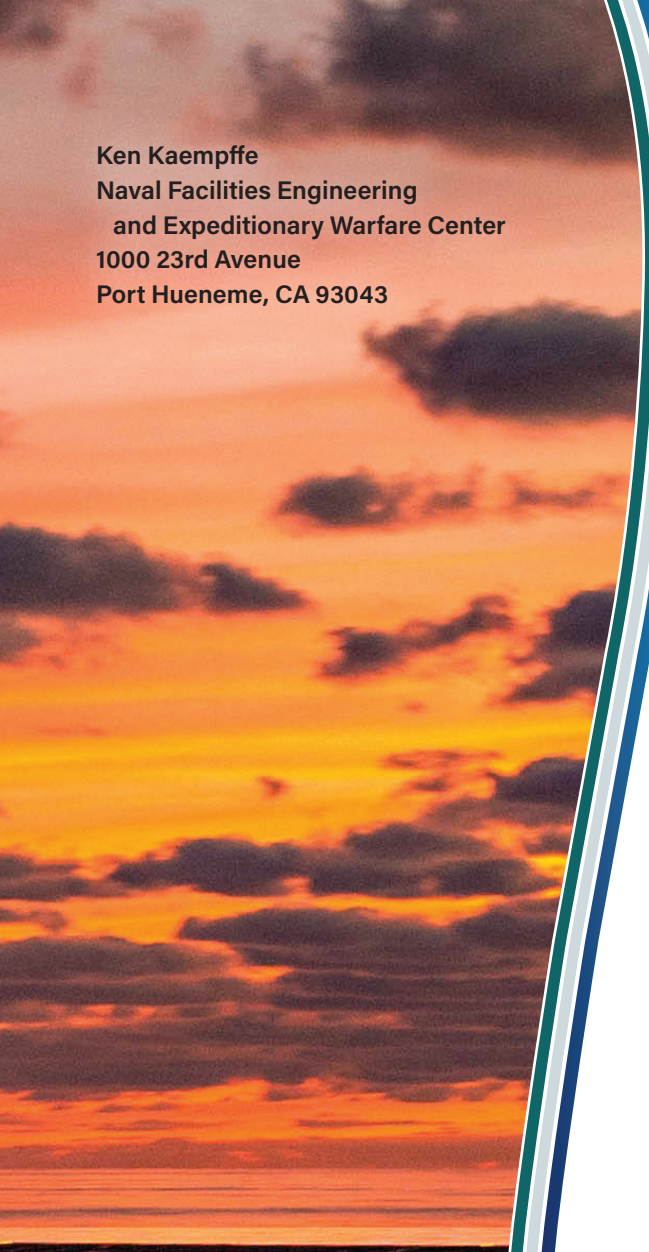
Youngers, Luzmarie
NAVAIR
904-790-6382
luzmarie.youngers@navy.mil

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



AVAILABLE FOR DOWNLOAD AT:
HTTPS://EPL.NAVFAC.NAVY.MIL/NESDI

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



Accomplishments of the

NAVY ENVIRONMENTAL SUSTAINABILITY DEVELOPMENT TO INTEGRATION PROGRAM

2020 YEAR IN REVIEW REPORT

Available for download at:
https://epl.navfac.navy.mil/nesdi