

THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE

Currents

fall 2011

Pacific Fleet Targets

Shipboard Power Use with Meter Technology

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THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE
Currents

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The U.S. Pacific Fleet has launched an ambitious effort to establish continuous monitoring of energy use by its ships, both pierside and underway, to conserve fuel and control costs.

All ships images on our cover were found at www.navy.mil.

Pacific Fleet Targets Shipboard Power Use with Meter Technology

Continuous Monitoring Maximizes Energy Efficiency

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Secretary Mabus Provides Insights Into Goals & Ongoing Efforts to Increase Our Energy Independence

FOR EVERY 50 supply convoys in Afghanistan, a U.S. Marine dies or is wounded. And with water, fuel is the largest commodity we import into Afghanistan. A ship is rarely more vulnerable than when it is refueling, as the USS Cole was in 2000 when it was attacked in the Yemeni port of Aden. Every time the cost of a barrel of oil goes up a dollar, it costs the U.S. Navy \$31 million in additional fuel costs. Recent political unrest in Libya led to an increase in oil prices that ultimately cost the U.S. Navy \$1.5 billion. We rely too much on fossil fuel that comes from actually and potentially volatile places.

While we would never allow some of the nations that sell us oil to build our ships, aircraft, or ground vehicles, through our dependence on their oil, we give them a say in whether our ships sail, our aircraft fly, or our ground vehicles operate.

To help address these strategic and tactical vulnerabilities, I announced five goals for the Navy and Marine Corps in an effort to increase our energy independence and to save lives. The broadest goal is that, by no later than 2020, the Navy and Marine Corps both afloat and ashore will produce at least half of its energy from non-fossil-fuel sources.

fuel.” Modern warfare has changed significantly since World War II, but our sources of energy have not. Changing the kinds of fuels we use and the way we use them is critical to assuring the Navy and Marine Corps remain the most formidable expeditionary fighting force the world has ever known.



The sound tactical reasons for change are not limited to the Navy. Just think of the resources expended in transporting one gallon of gasoline to a Marine unit in Helmand province in Afghanistan. That gallon must first cross either the Atlantic or the Pacific Ocean and then travel by convoy over land, north through Pakistan or south through the Northern Distribution Network, crossing the Hindu Kush mountain range or the Amu Darya River to reach that Forward Operating Base. The Marines who guard these convoys are taken away from doing what Marines were sent to Afghanistan to do, which is to fight, to engage and to rebuild.

Changing the kinds of fuels we use and the way we use them is critical to assuring the Navy and Marine Corps remain the most formidable expeditionary fighting force the world has ever known.

Countries, governments, and militaries across the world have long recognized the strategic and tactical importance of energy sources. In his new book about the Navy's role in the Guadalcanal campaign of 1942, *Neptune's Inferno*, author James Hornfischer commented on the energy challenges the Americans and the Japanese faced in that battle, “when ships were more powerful than they had ever been before, but were effectively tethered to bases by their insatiable need for

Transitioning to alternative fuel sources is a significant part of the Department's overall strategy to strengthen our energy security. Over Labor Day weekend, for the first time ever, the U.S. Navy's Blue Angels flew all six of their F/A-18s on a 50/50 mix of conventional aviation gasoline and advanced biofuels. The first F/A-18 Hornet tested on drop-in biofuels, dubbed the Green Hornet, went 1.7 times the speed of sound on a mixture of camelina and aviation gas. In August 2011, we tested the T-45 trainer and the Marine

V-22 Osprey—the tilt rotor aircraft—on advanced biofuels. We are in the process of testing all our aircraft and surface ships to use advanced, drop-in biofuels. By the end of the fall, we will have certified biofuels for every single aircraft in the Navy and Marine Corps inventory. And, at President Obama’s direction, we have partnered with the Departments of Agriculture and Energy to assist in the development of a domestic biofuels manufacturing base which will be able to meet the Navy’s demand for biofuels and at the same time create new jobs here in America.

We are also developing other alternative sources of energy like solar and geothermal power. In the midst of a tough fight in the town of Sangin in Afghanistan, the 3rd Battalion 5th Marines reduced their need to be resupplied with batteries by using solar blankets to power their radios and Global Positioning Systems. Last year, the Navy and Marine Corps tripled the amount of solar power produced on our installations, and this year we will double that amount again. China Lake, our naval base in California, is now producing through geothermal energy more energy than it uses. By 2020, at least half of all our land bases will run an energy surplus.

How energy is expended is one of the ways we’ll work toward becoming better stewards of our valuable resources. We are also studying ways to make energy a determination in all our new contracts. These efficiency measures will save money and increase our energy independence, but most importantly, they will save the lives of Marines, of Sailors, of soldiers, and of airmen.

Throughout the history of the U.S. Navy and Marine Corps, we have been at the forefront of technological change. In the middle of the 19th century, we moved from sail to coal-fired steam power; fifty years later we moved from coal to oil; and then we added nuclear power to the Fleet in the 1950s. With each transition, there were naysayers who said such far-reaching changes could not—or should not—be done. They were wrong then, and they will be wrong this time as we move to make our nation more secure and save the lives of Sailors



By the end of the fall, we will have certified biofuels for every single aircraft in the Navy and Marine Corps inventory.

In addition to developing alternative sources of energy, we are seeking ways to use fuel more efficiently. We have installed a hybrid electric drive on the USS Makin Island that allows the ship to operate on full power with regular diesel, but rely on cheaper electric power when it is cruising at lower speeds. In its maiden voyage, that hybrid power system saved about \$2 million in fuel costs and over the life of the ship, will save an estimated \$250 million—and that is at 2010 prices. In today’s constricted budget environment, it only makes sense to retrofit many of our ships with the same type of drive and put that savings toward giving our Marines and Sailors the tools they need to do their jobs defending our country.

With over three million acres of land, 72,000 buildings, and over 50,000 non-combat vehicles, the Navy and Marine Corps can recoup significant energy savings on our installations with more efficient fuel use. Installing smart power

and Marines. This is what the U.S. Navy and Marine Corps has done for 235 years: adapt, innovate, create and come out the other side victorious.

I could not be more proud to be leading this department during such a critical time for our department and our country. October is National Energy Awareness month, so it is entirely appropriate that *Currents* dedicates this issue to energy security and independence. I count on each of you to incorporate into your mission ways to contribute to these energy goals. Work with your chain of command to find ways to be more energy effective and efficient. The Department of the Navy is leading the way, creating a new way of operating that will make our Sailors and Marines safer, our country more independent from outside influences, and our economy more self sustaining and stable. You must be a part of that future. 📌

Secretary Ray Mabus



Pacific Fleet Targets **Shipboard Power Use** with Meter Technology

Continuous Monitoring Maximizes Energy Efficiency

It's impossible to maximize energy efficiency if you don't know how, where and when energy is being used. That's why the U.S. Pacific Fleet (PACFLT) has launched an ambitious effort to establish continuous monitoring of energy use by its ships, both pierside and underway.

Like a typical homeowner, the fleet has seen its energy bills rising steadily in recent years, and is striving for ways to reduce consumption as a means to control costs. Unlike members of a typical family, energy consumption by the fleet's components can vary greatly, as operational needs and conditions change. Energy use by the Navy also involves a far broader spectrum of activities, from buildings to industrial applications to "hotel services" provided to ships tied up at a Navy pier.







Like a typical homeowner, the fleet has seen its energy bills rising steadily in recent years and is striving for ways to reduce consumption.

Worldwide, about 75 percent of the Navy’s energy use is tactical—primarily ships and aircraft, as opposed to 25 percent for shore use. In the Pacific, the split is 95 percent tactical, 5 percent shore because of “the tyranny of distance.” When oil prices spiked in 2008, Navy energy bills skyrocketed. Since then, PACFLT has developed a pioneering integrated energy strategy that examines energy use and alternatives at sea and ashore.

“Real-time, remote monitoring is one of more than 25 initiatives that are part of our Pacific Fleet integrated sea/shore energy strategy,” says Capt. Dan McNair, PACFLT deputy civil engineer and one of the officers charged with implementing the strategy.

To explore energy-saving opportunities, PACFLT hired Matthew Cohen in January 2009, a certified energy manager who brought more than 30 years of experience to the job.



Sailors man the rails aboard the guided-missile destroyer USS PAUL HAMILTON (DDG 60). PAUL HAMILTON was one of several ships to participate in PACFLT’s ongoing energy monitoring efforts.

MC2 Mark Logico

One of Cohen's primary goals was to examine usage and trends to determine exactly how much power is consumed by vessels in port for varying durations.

"He helped us recognize that the traditional practice of manually reading pierside electrical meters once a month leaves far too much room for guesswork," says McNair. "The fleet requires real-time visibility of daily load profiles to effectively understand how energy is being used on specific ships to effectively implement technological system changes and conservation measures."

In San Diego a few years ago, the Naval Facilities Engineering Command (NAVFAC) Southwest began using an existing supervisory control and data acquisition (SCADA) system to take readings of energy use by ships in port every 15 minutes. Resource managers analyzed the data and worked with individual ships to reduce their electrical load.

The improvements were noteworthy. However, the San Diego SCADA system was already in place and not available at most fleet concentration areas, including Pearl Harbor, home of the Commander, U.S. Pacific Fleet.

With the enthusiastic support of the environmental, fleet maintenance and finance sections of the Pearl Harbor staff, the energy team launched a plan to automatically acquire and communicate electrical use data from existing power meters. Fifteen cellular phone system-based data acquisition units, which provide electrical consumption data in real time, have been installed into electrical substations servicing the Pearl



Remote utility data transmitters like these enable PACFLT to monitor the shore power being drawn by ships at Pearl Harbor.

Mark Matsunaga



U.S. Pacific Fleet's **Integrated Energy Strategy**

WITH ITS VAST expanses of sea and sky, widely scattered bases and extended operational demands, PACFLT expects to burn about 11 million barrels of fuel in its ships and aircraft this year.

To conserve fuel—and taxpayer dollars—PACFLT has developed an integrated sea/shore energy strategy that combines ongoing and future energy conservation and alternative energy programs on the shore with energy conservation initiatives being implemented aboard ships and aircraft.

Developed over the last two years under the leadership of PACFLT Commander Adm. Patrick M. Walsh, this ground-breaking strategy moves all energy stakeholders and partners toward achieving energy security goals set by Secretary of the Navy (SECNAV) Ray Mabus and mandated through Federal

Executive Orders over the last several years. In fact, Walsh has made SECNAV's energy security policy one of his top 10 strategic goals.

"The key is synergism," says McNair. "Integrating the sea and shore aspects of energy use and getting everyone involved is essential to getting the most out of every dollar we spend on energy."

The PACFLT energy strategy is supported by Commander, NAVFAC, Naval Sea Systems (NAVSEA) and Naval Air Systems Command.

More than 25 separate initiatives are being implemented across shore commands, aboard ships, and aircraft and all of them have been integrated to move the Navy toward achieving energy security goals.



It might be as simple as modifying behavior to turn off power to lighting in unused spaces, or as complex as determining that seawater-cooled condensers are fouled.

Harbor Naval Station and the Submarine Base piers. The data are transmitted and displayed continuously on a user-friendly, password-protected web site providing all users and stakeholders visibility of consumption. In addition to kilowatts and kilowatt hours (kWh), the web site provides the means to visually compare electrical use by a ship to its own historical use or to other ships in its class. The software also has the capability to detect and communicate out-of-spec conditions.

“The monitoring improvements are a vital part of our integrated sea/shore energy program,” says McNair, who has partnered with Capt. Steve Reimers to lead the shipboard energy conservation program as well as other operational energy conservation initiatives under the strategy.

“These data sets provide the fleet with the means to communicate to the ship how much (shore power) it’s using and how much it costs, which is critical to making on-the-spot changes to optimize energy use by ship’s crew,” says Reimers, PACFLT maintenance officer, who is leading the at-sea implementation of the energy strategy.

Results of data are available to each ship’s commanding officer and chief engineer, who are responsible for addressing on-board energy consumption issues.

Baseline energy use is unique to each vessel, and will vary with its location, age, readiness status and adherence to established maintenance procedures.

Ultimately, measurements allow PACFLT to record degrees of predictability resulting from air conditioning, lighting, water pump, weapons and radar systems operation. That information can then be used to identify specific consumption-reducing opportunities. For example, assume Destroyer A consumes an average of 40,000 kWh of electricity pierside in Pearl Harbor each day, while Destroyer B of the same squadron consumes an average of 35,000 kWh. Pinpointing the reasons for the difference can help save energy. It might be as simple as modifying behavior to turn off power to lighting in unused spaces, or as complex as determining that seawater-cooled condensers are fouled, causing the air-conditioning plants to use more kilowatts for each ton of cooling.

U.S. Pacific Fleet’s Other Participating Ships

A NUMBER OF Pearl Harbor-based ships homeported in Hawaii participated in PACFLT’s power monitoring initiatives. Those include the 11 combatant ships assigned to Surface Group Mid-Pacific as well as other ships that tie up and draw shore power from Pearl Harbor’s Bravo Piers 22 through 26 and Mike Piers 1 through 4. Monitoring capabilities will be expanded to include submarine berthing spaces at Pearl Harbor in the future. Surface Group Mid-Pacific consists of the following ships:

Cruisers

- USS CHOSIN (CG 65)
- USS PORT ROYAL (CG 73)
- USS LAKE ERIE (CG 70)

Destroyers

- USS O’KANE (DDG 77)
- USS CHUNG-HOON (DDG 93)
- USS CHAFEE (DDG 90)
- USS RUSSELL (DDG 59)
- USS HOPPER (DDG 70)
- USS PAUL HAMILTON (DDG 60)

Frigates

- USS REUBEN JAMES (FFG 57)
- USS CROMMELIN (FFG 37)



USS PAUL HAMILTON, pierside at Pearl Harbor, is connected to cables that carry shore power from the turtleback at left onto the ship.

Mark Matsunaga

Today, throughout its worldwide footprint, the Navy maintains tens of thousands of conventional electric meters. They are being replaced with advanced Ethernet-enabled meters. This new Advanced Meter Infrastructure (AMI) program eventually will provide more and more granular electric meter data to the NAVFAC utilities department. The AMI system design can provide daily load profiles, but will be delayed by at least four hours. To maintain PACFLT access to real-time data, NAVFAC will connect the cell phone-based data units to the new AMI meters as they are installed.

“Our vision is to provide all Navy ports with pierside meter monitoring systems that can provide visibility to

actionable energy information in real time,” says Reimers.

What about ships at sea? When they’re not drawing shore power, Navy ships produce their own electricity with on-board generators. PACFLT is working with NAVSEA and the Naval Ship Systems Engineering Station to adapt what’s called the Integrated Component Assessment System (ICAS) to acquire and analyze electrical data.

ICAS provides real-time remote monitoring of subsystems aboard a ship. Originally designed to detect and diagnose equipment faults, ICAS capability is being expanded and exploited to optimize energy use.

ICAS: Monitor from Shore to Shore

ON A STANDARD naval vessel, there are about 10,000 data points collected from sensors in the ship’s systems. These sensors give feedback regarding equipment status and provide the ship’s chief engineer with measurements including voltage, amperage, pressure, temperature, fuel flow, status and other critical parameters. Of those thousands of sensors, about 1,500 are connected to ICAS for the purpose of detecting system faults and out-of-specification conditions.

The Navy is outfitting new ships (and retrofitting existing ships) with ICAS technology to identify

equipment problems before they fail or become inefficient. Operational both in port and at sea, this technology transfers packets of data containing energy information in four-hour intervals to a centrally located server, from wherever the ship is located.

What makes ICAS so important is it enables fleet and NAVSEA engineers to look at an individual ship or at the entire fleet remotely. While pier-side energy monitoring has been steadily improving, PACFLT’s use of ICAS produces data from ships at sea that were previously unavailable, opening up a new realm of energy management and potential savings.



PACFLT is conducting an investment-grade energy study of destroyers and dock landing ships to measure electrical use throughout the ships.



Sample dashboard shows real time energy use, load profile, daily consumption in a month and target levels for a shore power meter at Pearl Harbor. *Greenview Energy Management Systems*

financial and physical applicability. In addition, these studies are expected to identify additional data points that will be added to the ICAS system.

The ability of ICAS to provide a continuous stream of data no matter where a ship is located raises great possibilities for improving energy efficiency.

“Destroyers, cruisers and aircraft carriers are floating buildings with

PACFLT is conducting an investment-grade energy study of destroyers and dock landing ships. The study will measure electrical use throughout the ships under all states of mission readiness. Energy conservation opportunities will be identified, quantified, and analyzed for

complex, energy intensive chilled water systems that must keep mission-critical weapons systems cool,” Reimers says. “ICAS can detect and communicate the need for corrective action before equipment capability falls below specifications.”

Department of the Navy Energy Goals

IN OCTOBER 2009, Secretary Mabus announced the following energy goals for the Department of the Navy (DON):

1. By 2020, 50 percent of total DON energy consumption will come from alternative energy sources.
2. By 2020, DON will produce at least 50 percent of shore-based energy requirements from alternative sources; 50 percent of DON installations will be net-zero.
3. DON will demonstrate a Green Strike Group in local operations by 2012 and sail it by 2016.
4. By 2015, DON will reduce petroleum use in the commercial vehicle fleet by 50 percent.
5. Evaluation of energy factors will be mandatory when awarding contracts for systems and buildings.



LEFT: Each capable of handling 400 amps, cables connect a ship to a "turtle back" shore-power source at Pearl Harbor.

ABOVE: PACFLT energy leaders, from left, Capt. Steve Reimers, Matthew Cohen and Capt. Dan McNair check on the shore power being drawn by USS PAUL HAMILTON (DDG 60) pierside at Pearl Harbor.

MC2 Mark Logico

Eventually, ICAS could also be used to cross check and verify pier-side shore power meter readings. That capability is unlikely to become a reality for several years, however. Meanwhile, PACFLT will continue working with the Navy's ships technical engineers at NAVSEA to upgrade ICAS and other technologies to

improve the data and help the Navy make the best use of the energy it consumes. 

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The Basics About **U.S. Pacific Fleet**

PACFLT, THE WORLD'S largest fleet command, encompasses 100 million square miles, more than half the Earth's surface, from the west coast of the United States into the Indian Ocean. PACFLT consists of approximately 180 ships, nearly 2,000 aircraft and 125,000 Sailors, Marines and civilians.

Adm. Patrick M. Walsh is the current PACFLT commander. He is the 32nd Navy officer to command PACFLT since it was established in February 1941 with headquarters at Pearl Harbor, Hawaii. Past commanders of PACFLT include such naval giants as Fleet Admiral Chester Nimitz and Admiral Raymond Spruance.

The Navy's history in the Pacific actually spans more than a century and a half. Through the years, the

PACFLT commander's vision, mission and guiding principles have evolved as its challenges have changed. But many Navy customs and traditions have continued over the years, making the Navy unique among the services.

Under the current organization and command structure, the PACFLT staff reports administratively to the Chief of Naval Operations and operationally to the U.S. Pacific Command, whose headquarters are at nearby Camp H.M. Smith. Commands that fall directly under PACFLT include "type" commands for surface ships, submarines and aircraft as well as Navy construction. Operational commands that report directly to PACFLT include Third Fleet in the Eastern Pacific and Seventh Fleet in the Western Pacific and Indian Ocean.



Dr. Arun Majumdar, ARPA-E Director, Talks About Our Nation's Energy Future



i

IN THE SPOTLIGHT for this issue of *Currents* is Dr. Arun Majumdar, Director of the Advanced Research Projects Agency—Energy (ARPA-E). On 12 August 2011, Kenneth Hess from the public affairs staff at the Chief of Naval Operations Energy and Environmental Readiness Division (N45) conducted this interview with Dr. Majumdar as he spoke about ARPA-E's top priorities, current work, and interactions with the Navy and Department of Defense (DoD).

CURRENTS: Thank you for taking time to talk to us today. Could you tell us a little bit about your background?

DR. MAJUMDAR: Before I came to the Department of Energy (DoE) and ARPA-E, I was a professor of mechanical engineering and materials science and engineering at University of California Berkeley. My Ph.D. is in mechanical engineering and engineering in general. I was also head of the Environmental Energy Technologies Division at the Berkeley National Laboratory.

Our vision is to change the world, and make
the U.S. globally competitive in energy technology.

I have been very fortunate to receive funding from the Navy during my research career. I was involved with two Multi-disciplinary University Research Initiatives (MURI) that were funded by the Office of Naval Research.

My background spans the physical sciences, engineering and energy. I've worked in the biological sciences on projects that were funded by the National Institutes of Health. So my science and engineering research and development background includes a lot of areas—more recently the area of nanoscale science and engineering. The last 30 years of my career has concentrated on power systems, power/energy generation, energy and efficiency. I am also a member of the National Academy of Engineering.



CURRENTS: Tell us about ARPA-E. What is your organization's mission and vision?

MAJUMDAR: Our mission is to focus on research and development for transformational technologies, to translate science into breakthrough technologies that will provide the energy and economic security for the nation and protect our technological lead. We seek to reduce greenhouse gas emissions and increase the efficiency of our entire energy sector, as well as reduce our imports of energy. Our vision is to change the world, and make the U.S. globally competitive in energy technology.

ARPA-E is in many ways operationally modeled after the Defense Advanced Research Projects Agency (DARPA). If you recall the history of DARPA, it was created in 1958 in response to the launch of Sputnik when it was felt that the U.S. was losing its technological lead to the Soviets. At that point, we needed some quantum leaps in technology and a group that would take high risks with the potential for high reward. And of course, as we know, out of this came many interesting technologies including stealth technologies. So, as the president said, we are in a Sputnik-like moment right now and that has to do with our clean energy future. We are in a globally competitive landscape. Other nations are playing by our playbook and taking the lead. ARPA-E's role is to "out innovate." That's what we are doing.

ARPA-E's role is to "out innovate."
That's what we are doing.

CURRENTS: Talk about some of your priorities for ARPA-E.

MAJUMDAR: Well, we are still relatively new—just two years old. Our number one priority right now is to recruit talent. It is extremely important that we have the right kind of people here, to get the right value system in this organization so that we can achieve excellence in everything we do. We need to invest in ideas that are potentially transformational, to take enough risks, and in many cases, celebrate some failures. It's actually a good thing sometimes to fail and quickly learn from it.

The value system that we are creating in the energy sector is very different from the value system in the defense sector. And that's the difference between ARPA-E and DARPA. We are very closely connected to the private sector, because that's where the energy economies are huge. We want to create value for the nation, the private sector, and the military. So bringing in really talented people is very important. We need to create a culture to generate ideas that are not shy, not conservative. We are interested in taking the risky approach—not just for the sake of risk, but for a potentially high impact. That's what's going into creating this organization, in many ways from scratch, and having it connect with all the stakeholders in the right places including Congress and the White House.

CURRENTS: Let's talk about some of the ARPA-E projects that you see as having potential for transforming our nation's use of energy.



MAJUMDAR: That's like asking which of my children I like the best. It's very hard to do. But let me just say a few things that perhaps would be relevant for the Navy. We have invested a lot in storage—I'm talking about quantum leaps in battery technology—both mobile batteries, where weight is really important, as well as stationary battery systems that can store large amounts of energy for a long time in stationary systems (like the electrical grid). This has many implications for reducing our fuel consumption,

Non-photosynthetic fuel production is potentially a quantum leap in fuel synthesis.

whether it's generating electricity or changing how we use our energy. Storage turns out to be a really important factor in saving energy. Hybridization is an example, as we see in hybrid vehicles. Hybridization really increases the mileage and reduces fuel consumption.

Storage is a basic technology where there is a lot of room for improvement in both performance and reducing costs. Cost is a very important aspect in what we do. Our goal is to create technologies that make clean energy cheaper than traditional forms of energy. We often don't invest in technologies that are seemingly wonderful but just too expensive. It wouldn't matter in the real world.



We're also looking at new ways of synthesizing fuel. Today, most of the biofuels that we know of are photosynthetic-based—plant-based or algae-based—converting light into some sort of chemical bond using photosynthesis.

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The Basics about ARPA-E

RECOGNIZING THE NEED to reevaluate the way the United States spurs innovation, the National Academies of Sciences (NAS) released a 2006 report, "Rising Above the Gathering Storm," that included the recommendation to establish ARPA-E within DoE. The America Creating Opportunities to Meaningfully Promote Excellence in Technology (America COMPETES) Act, signed into law in August of 2007, codified many of the recommendations in the NAS report. Authorized but without an initial budget, ARPA-E received \$400 million funding in April 2009 through the American Recovery and Reinvestment Act. In December 2010, Congress reauthorized the America COMPETES Act. ARPA-E is modeled after DARPA—the agency responsible for technological innovations such as the Internet and the stealth technology found in the F117A and other modern fighter aircraft. Specifically, ARPA-E was established and charged with the following objectives:

1. To bring a freshness, excitement, and sense of mission to energy research that will attract many of the U.S.'s best and brightest minds—those of experienced scientists and engineers, and, especially, those of students and young researchers, including persons in the entrepreneurial world
2. To focus on creative "out-of-the-box" transformational energy research that industry by itself cannot or will not support due to its high risk but where success would provide dramatic benefits for the nation
3. To utilize an ARPA-like organization that is flat, nimble, and sparse, capable of sustaining for long periods of time those projects whose promise remains real, while phasing out programs that do not prove to be as promising as anticipated
4. To create a new tool to bridge the gap between basic energy research and development/industrial innovation



For more information about ARPA-E, visit <http://arpa-e.energy.gov>.

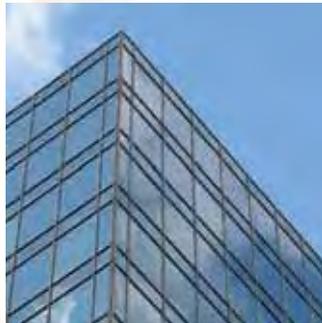
More Insights Into ARPA-E's Programs

ARPA-E PROGRAMS EXPLORE creative “outside-the-box” technologies that promise genuine transformation in the ways we generate, store and utilize energy. Unlike conventional DoE research, ARPA-E funds concepts that industry alone cannot support, but whose success would dramatically benefit the nation. Its high risk, high reward programs aim to substantially reduce foreign energy imports; cut energy-related greenhouse gas emissions; and improve efficiency across the energy spectrum.

ARPA-E is making investments in the following six program areas:

Better Energy Efficiency Through Innovative Thermodevices (BEETIT)

Residential and commercial buildings currently consume 40 percent of the primary energy consumed in the U.S., and they produce roughly 39 percent of total U.S. carbon dioxide emissions. Cooling is one of the major uses of energy in buildings, yet the basic approaches used for cooling have not changed in decades. New, more efficient methods of cooling represent a great opportunity to reduce energy consumption, especially from traditional refrigerants, from buildings. The 16 projects funded through the BEETIT program focus on developing new approaches and technologies for cooling equipment used in heating, ventilating, and air conditioning (HVAC) systems in our buildings, as well as in refrigeration. These projects aim to drastically improve energy efficiency in buildings at a cost comparable to current technologies. The technologies undergoing development in these projects are suitable for new building construction and can also be retrofitted into the existing cooling systems of legacy buildings, which will enable the U.S. to leverage its existing infrastructure.



Electrofuels

Liquid fuels are a ubiquitous component of the Nation's energy landscape. According to the U.S. Energy Information Administration, the U.S. will continue to rely on liquid fuels at a constant level for the next 20 years, even with the increased deployment of plug-in hybrids and electric vehicles. The U.S. transportation sector is almost exclusively reliant upon



petroleum-derived liquid fuels, and this dependency comes with a large and increasing economic cost.

Domestically-produced biofuels increase the Nation's energy security, but there remains considerable need for next-generation renewable fuels that can be integrated into the Nation's current fuel refining and distribution infrastructure. Most of the methods for producing biofuels that are currently under development involve converting biomass or waste, or directly producing fuels from sunlight and carbon dioxide, but overall efficiencies from these approaches remain low. The 13 projects that comprise the Electrofuels program intend to explore new paradigms for the production of renewable liquid fuels that are compatible with today's infrastructure—using microorganisms to harness chemical or electrical energy to convert carbon dioxide into liquid fuels, without using petroleum or biomass.

Grid-scale Rampable Intermittent Dispatchable Storage (GRIDS)

The ability to store electricity and shift the power in time is becoming significantly more important as the U.S.

increases its use of more eco-friendly renewable power. Renewable electricity generation is most commonly associated with wind and solar power, which when the sun stops shining or the wind stops blowing, is an intermittent and sometimes unreliable and undispachable source of power. Storage allows energy producers, such as utility companies, to send excess electricity to storage devices. When wind and solar power ramps from available to unavailable or when electricity demand increases, energy can be taken from the storage devices and delivered to users that need it.



Today's electricity grid, the interconnected network that delivers electricity from suppliers to consumers, has virtually no storage. Those storage facilities that do exist use pumped hydropower, a system that pumps water uphill to a reservoir when excess electricity is available and then lets the water flow downhill through turbines to generate electricity when it is needed. While pumped hydropower storage works well on a cost effective basis in many cases, it can only be located in very limited areas of the country. The 12 projects that make up the GRIDS program seek to develop new energy storage technologies that are comparable in reliability and cost to pumped hydropower, and additionally, that are modular and can be deployed in any location in the country. These new technologies will enable the storage of electricity anywhere on the electricity grid

across the U.S., allowing extra energy to be transmitted to geographies that need it the most at any given time. This ability to store and dispatch electricity on a reliable basis will be a key enabler of renewable electricity generation at high penetration while maintaining high reliability in electric supply.

Batteries for Electrical Energy Storage in Transportation (BEEST)

The U.S. transportation sector is almost exclusively reliant upon petroleum-based fuels and this dependency comes with a large and increasing economic cost. The transportation sector is a major contributor to U.S. reliance on foreign oil and air pollution. One way to reduce the impact of these



factors is for more people to drive cars that use electricity instead of gasoline, where the electricity is stored in large on-board rechargeable batteries. A major roadblock to realizing this goal is the battery itself. Batteries for plug-in hybrid electric vehicles (PHEV) and electric vehicles (EV) are currently limited to a range of fewer than 100 miles for normal light duty vehicles. This limitation causes “range anxiety” among many Americans and will likely slow EV adoption due to a fear that EVs cannot take them everywhere they want, when they want.

The ten projects that make up the BEEST program are developing batteries for PHEVs and EVs that can make a 300- to 500-mile-range electric car a reality. Successful development of these types of batteries will make PHEVs and EVs valuable to more people and could significantly reduce dependency on foreign oil for transportation. In this program, ARPA-E supports game-changing technologies that range from devices to double the minimum range of today’s EV cars, to high risk lithium-air batteries that could allow a car to travel up to 500-miles on a single charge.

Agile Delivery of Electrical Power Technology (ADEPT)

The Office of Electricity Delivery and Energy Reliability, part of DOE, estimates that within the next two decades, 80 percent of the electricity used in the U.S. will flow through power electronics. Power electronics modify the form of electrical energy (i.e., change its voltage, current or frequency) and can be found in applications as diverse as solid-



state lighting, intelligent motors, electric vehicles, and a smarter electricity grid. Deploying advanced power electronics could reduce electricity consumption up to 30 percent, or 12 percent of total U.S. energy use. Innovations in power electronics could significantly reduce costs, which would promote U.S. businesses through technological leadership.

ARPA-E’s ADEPT program is focused primarily in two areas—creating the world’s first kilovolt-scale integrated circuits, and developing transistor switches operating at grid-level voltages that would exceed 13 kilovolts. Bringing the integrated circuit revolution to power applications can improve the performance of nearly every type of electrical component while simultaneously redefining the manufacturing platform for power systems. The development of grid-scale discrete transistors has the potential to create an actively controlled electric power grid where transformers can be reconfigured dynamically. The 14 projects that make up the ADEPT program strive to reinvent the basic building blocks of circuits from transistors, inductors, transformers to capacitors for a broad spectrum of power applications.

Innovative Materials & Processes for Advanced Carbon Capture Technologies (IMPACCT)

Coal-fired power plants generate approximately 45 percent of electricity for the United States. While coal is a cheap and abundant natural resource, continued use of coal as an energy source will lead to increasing levels of greenhouse gases as carbon dioxide is released into the atmosphere. Capturing the emitted carbon dioxide and storing it would enable the continued use of domestic coal resources while reducing greenhouse gas emissions into the atmosphere. The primary challenge is the current cost of capturing carbon dioxide from a coal power plant, which is unacceptably high.



The IMPACCT program seeks to reduce the cost of carbon capture significantly through a combination of new materials, improvements to existing processes, and demonstration of new capture processes. Fifteen high-risk, high-reward projects are underway among a group of universities, businesses, and national laboratories. IMPACCT is pushing the boundaries of carbon capture research through technologies such as new liquid chemistries that dissolve carbon dioxide and a capture system inspired by jet engines that transforms carbon dioxide from a gas into pellets of dry ice. If successful, the IMPACCT program will provide options for the use of America’s existing infrastructure without further increases in harmful greenhouse gas emissions.

For specific projects being funded in each of the above program areas, visit <http://arpa-e.energy.gov/ProgramsProjects/Programs.aspx>.

CONTINUED FROM PAGE 17

We have invested in techniques that are non-photosynthetic—that are still using biology. This is a completely new route for making oil, and may be much more efficient than the photosynthetic approach. Efficiency is cost in this context. This is potentially a quantum leap in fuel synthesis.

CURRENTS: That is exciting. Give us an example of something that you're exploring in that regard.

MAJUMDAR: Sure. There are microbes that live in the deep vents in the ocean which do not have light but still survive. They use different kinds of energy. They grab energy from ions of magnesium or calcium or iron. They use energy from the electrons. They use energy from waste products of oil and natural gas like hydrogen sulfide. Hydrogen sulfide is the “sour” part of “sour crude.” It's a waste product, but there's energy stored in the bonds. So if you can convert electricity from wind or nuclear into a liquid fuel for transportation, it doesn't need photosynthesis. There are microbes that live on electrodes. And so we are programming them to make oil.

We have had interactions with many parts of DoD, but our interactions with the Navy have been particularly strong.

There's some basic infrastructure in energy that could use some improvement. For example, power conversion. Electricity is moving at 300 kilovolts or 765 kilovolts, but the outlet in people's homes are at 110. That voltage conversion is very important, including the voltage conversion to go from 110 to AC or DC for our personal computers. There's a lot of opportunity in power efficiency using new kinds of power electronics that are missing from the landscape.

Today, all the transformers we buy for our grid are made overseas. These transformers are not that different from

the first transformers invented by Nicola Tesla way back in the late 1800s. I think we can take a quantum leap in that technology. Energy efficiency in air conditioning also has not changed much since the days of Willis Carrier. (Note: Mr. Carrier is credited with inventing air conditioning in the early 1900s.) It has improved, but there's a lot of room for improvement. We have taken some very interesting, radical ideas. I think some of them might work out. Some will not. Some of them will potentially reduce the energy consumption of air conditioning by 50 percent—that is a big deal.

CURRENTS: You have definitely covered some technologies that would be of use to the Navy. That's going to be interesting to our readers. Are there any specific types of collaborations between ARPA-E and the Navy going on now, or areas you see as ripe for collaboration in the near future?



MC2 Cayman Santoro

MAJUMDAR: We have worked very closely with the Navy and DoD to develop some partnerships. One of my mentors in ARPA-E and DoE as a whole is the former Secretary of Defense William (Bill) Perry. He has seen it all in DoD since the days when DARPA was created. He is also the Chair of the Advisory Board for the Secretary of Energy. He has deeper involvement than just ARPA-E. He has enabled many interactions, not just with DoE but also with DoD. We

have had interactions with many parts of DoD, but our interactions with the Navy have been particularly strong.

We have a big summit every year. At this year's summit in March, Secretary Mabus—on behalf of DoD—announced a partnership on a project known as the Hybrid Energy Storage Module. The idea is that if you have power generation, whether it's a ship or a forward operating base, you have fuel being consumed to generate electricity. But if you were able to store the electricity, you could use your generator in a much more optimal way and increase efficiency and reduce fuel consumption. You can size the engine in the right way. So instead of using a big engine because you have a peak of electricity that you need only for a few minutes, you use a smaller engine so you use less fuel—and you use the battery to generate the extra power when you need it. That has implications not only in reducing fuel consumption but also in providing you a sudden burst of electricity when you need it—and you all could think about where that could be applicable.

I think we could be of value to the Navy in many ways, in making your applications much more energy-efficient and giving you new capabilities that perhaps you didn't have. At the same time, it helps us integrate the different components we are investing in—the breakthrough technologies in power electronics, generators. This partnership gives us a way to integrate those technologies into systems and deliver performance and capability. That is very useful to us. So I'm really looking forward to this partnership with DoD in general and the Navy in particular.

Innovations in energy are at the foundation for our national security.

CURRENTS: That's a piece our office focuses on quite strictly—combat capability. We want to do the right thing for energy efficiency, but it has to help the warfighter become more capable.

MAJUMDAR: Innovations in energy are at the foundation for our national security—our national security, our economic security and prosperity, and our environmental security. We want to develop technologies that can address all three, or at least two out of three. These are not mutu-

ally exclusive. In fact, they're mutually inclusive. The national security part is very important, which is part of the reason for our engagement with DoD.

CURRENTS: As a director of a federal agency focused on energy solutions, do you have any suggestions for the Navy on the best way to solve our energy challenges? For example, what are we doing right and what can be improved?

MAJUMDAR: It's very hard for me to speak for the Navy. But I think our partnerships so far have been absolutely wonderful. I've had several discussions with Admiral Cullom. I know he's very focused on the energy issue. I've had the honor of interacting with Secretary Mabus as well. Partnerships are something I wanted to build right from the beginning of ARPA-E. It should be part of the DNA of the organization, because national security is one of our goals. I hope that the discussions we're having and the partnerships we are creating together are just the first step in a longer relationship for these two institutions. I'll be long gone after awhile, but the institutions need to live together and that's what I'm really looking forward to. To build a sort of connective tissue now.



Dr. Ely Sachs, 1366 Technologies
Chief Technology Officer, Dr. Majumdar
and Dr. Steven Chu, U.S. Secretary of Energy.

CURRENTS: Anything else you'd like *Currents* readers to know?

MAJUMDAR: Well, I just want to thank the people in uniform and their families for all the sacrifices they're making and for protecting us. Our goal is to find solutions to make them more capable and bring them home safely. ⚓

Navy's Biosensor System Provides for Rapid, Cost Effective Toxicity Screening

QwikLite Demonstrates Versatility & Effectiveness in the Field

THE QWIKLITE BIOSENSOR

System™ is a toxicity testing procedure that was developed at the Space and Naval Warfare Systems Center Pacific (SSC Pacific) in the late 1990s, with support from what is now the Navy Environmental Sustainability Development to Integration (NESDI) program. The QwikLite System is a tool for rapid and cost effective screening of water or sediment samples to help direct environmental decision making at Navy facilities. Since its development, the prototype device has been extensively demonstrated and validated, patented, approved by the American Society for Testing and Materials, and licensed for commercial use. The commercial unit has demonstrated its effectiveness in a variety of applications.

The QwikLite test utilizes the natural phenomenon of light producing, single-celled, photosynthetic algae, known as dinoflagellates, as an indicator of toxicity in a variety of water sample types. This biologically produced light is commonly known as bioluminescence, and can be seen at night along coasts during large algal blooms, or red tides. The dinoflagellate species used in the commercial QwikLite test is known

as *Pyrocystis lunula*. The light emitted by the cells is captured, measured, and recorded by the optics and electronics of the QwikLite instrument, following a controlled exposure to samples (usually 24 hours).

Significantly lower light production in test samples relative to clean “control” seawater is a measure of the potential toxicity of the water sample to marine life. Examples of sample types appro-

priate for the test include stormwater and industrial discharges, ambient marine and estuarine waters receiving those discharges, sediment elutriates (created from mixtures of sediment and water), and sediment porewater (water between sediment grains).

The commercial version of QwikLite is small, simple to use, portable, and rugged enough for use in the field or onboard survey vessels. With NESDI



The QwikLite Biosensor System.
Assure Controls, Inc.

program support and by leveraging other projects, SSC Pacific personnel undertook an effort to expand the technology transfer and integration of the commercial test system. The commercial unit was used to focus remediation efforts funded by the Strategic Environmental Research and Development Program (SERDP) in the Bayou Grande estuary near Naval Air Station (NAS) Pensacola in Pensacola Bay, FL. Personnel were also able to coordinate with an ambient monitoring program for monitoring potential effluent toxicity from industrial discharges from the Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) and adjacent receiving waters of Sinclair Inlet, WA. In a third effort, QwikLite was employed in assessing the bioavailability and toxicity of oil and dispersants released during the British Petroleum (BP) Deep Water Horizon oil well disaster in the Gulf of Mexico.

Sediment Quality Testing at NAS Pensacola

At NAS Pensacola, the QwikLite system was used to identify possible contaminant sources during a study of the NAS Pensacola Yacht Basin, located at the mouth of Bayou Grande, an estuary that connects with Pensacola Bay on the Florida panhandle. The QwikLite bioassay tests were used to evaluate samples from areas of the estuary where there was concern whether contaminated sediment and/or groundwater could be causing impacts to the estuary. In the study, porewater samples were extracted from 26 different locations within the estuary and adjacent wetlands using another SSC Pacific tool—the Trident Probe. The samples were then tested with



Bioluminescence along shoreline in eastern Australia.
Phil Hart

The NESDI Program

THE NESDI PROGRAM is the Navy's environmental shoreside 6.4 Research, Development, Test and Evaluation (RDT&E) program. The program provides solutions by demonstrating, validating and integrating innovative technologies, processes, materials and filling knowledge gaps to minimize operational environmental risks, constraints and costs while supporting Fleet readiness. For more information, visit the program's web site at www.nesdi.navy.mil.



Bioluminescent dinoflagellate, *Pyrocystis lunula* (actual size approximately 0.1 mm).
Photo Sharing PhotoPost



SSC Pacific sampling team at NAS Pensacola Yacht Basin.
Gunther Rosen

the QwikLite system to determine whether toxic levels of contaminants were present in the porewater. The results helped identify which areas of the estuary should be the focus of further investigation using additional chemical and biological measurements. The data assisted in delineating wetland areas where no further action was recommended.

Discharge & Ambient Water Quality Monitoring at PSNS

For the past two years, the QwikLite Biosensor System has also been routinely employed by SSC Pacific in a comprehensive study for the PSNS & IMF, located in Bremerton, WA on Sinclair Inlet within the Puget Sound. The study is being conducted to characterize environmental conditions,

assess potential impacts, and establish environmental quality trends within the Inlet. Water, sediment, and biota monitoring locations were selected that were co-located near suspected sources (industrial, waste water, and stormwater outfalls; marinas, stream mouths, and others) and locations that were representative of ambient marine and nearshore conditions for seasonal sampling. The study is being conducted to inform the National Pollutant Discharge Elimination System (NPDES) permit process for the shipyard. A battery of toxicity tests and chemical analyses are being used in this program to characterize environmental quality of the samples. In addition to QwikLite 24 hour bioluminescent response, effluent and water column toxicity tests include mysid shrimp (*Americamysis bahia*) 96 hour survival, purple sea urchin (*Strongylocentrotus purpuratus*) 96 hour embryo development, mussel (*Mytilus sp.*) 48 hour larvae survival and development, and kelp (*Macrocystis pyrifera*) 48 hour growth and germination. The QwikLite test has provided an important line of evidence for assessing the potential



Porewater samples awaiting testing at NAS Pensacola.
Gunther Rosen



University of South Florida researcher Jenny Delaney assessing QwikLite data on the research vessel Weatherbird II in the Gulf of Mexico.

Bryan Bjorndahl

effects of discharges and receiving water conditions in concert with the other tests, which are more laborious and costly. Overall the toxicity tests results show minimal or no toxicity in the discharge samples. However, the tests have identified the presence of toxicity in ambient samples with high concentrations of toxic algae from episodic blooms (red tides) that commonly occur within the Puget Sound.

In addition to the seasonal monitoring at PSNS & IMF, a pilot study was conducted during August and September 2010 that involved weekly QwikLite toxicity testing and chemical analyses of samples from industrial processes and effluents in the shipyard. For this work, SSC Pacific personnel trained shipyard staff to conduct the testing using portable incubators and testing equipment set up in temporary laboratory space on site at the shipyard. The ability for personnel unfamiliar with the equipment to set up quickly in temporary laboratory space and to easily learn how to conduct the tests and meet the various quality assurance and quality control requirements was a testament to the portability, simplicity, and user-friendliness of the QwikLite system. The pilot study showed that the QwikLite system was versatile, reproducible, sensitive, and capable of providing rapid (within 24 hours) information on the potential presence or absence of toxicity in the samples tested.

Gulf Oil Spill Studies with QwikLite

Assure Controls, Inc., exclusively licensed to commercialize the QwikLite system, has also been busy promoting the technology in a number of different applications. Their team provided technical assistance for toxicity testing that

was conducted onboard the research vessel Weatherbird II during the BP Deepwater Horizon oil well disaster in the Gulf of Mexico last year. Led by researchers at the University of South Florida, several toxicity endpoints, including QwikLite, were used to help understand the potential bioavailability and toxicity of both crude oil and dispersants at varying distances from the well head, and near delicate habitats along the Gulf Coast. These QwikLite studies have received television coverage on the National Geographic Channel and Public Broadcast Service programs. The field portability, simplicity, and ecological relevance of the test (i.e. bioluminescent dinoflagellate species are an important component of the Gulf of Mexico food web) also led the

U.S. Environmental Protection Agency (EPA) Region 6 Houston, Texas laboratory to experiment with the QwikLite test as a screening tool for anticipated long term monitoring studies along the Gulf Coast.

Since the Gulf Oil Spill, Assure Controls has continued to identify a variety of unique applications for the QwikLite technology. In addition to traditional applications for sediment quality assessment and NPDES monitoring of industrial discharges, the company has identified promising applications for shipboard monitoring of ballast water discharges, water quality assessments of freshwater wells potentially impacted by natural gas drilling, and monitoring of private drinking water wells near Superfund sites. By keeping costs and labor well below that of traditional bioassays and providing rapid turnaround of time critical samples while maintaining contaminant sensitivity and reproducibility, the commercial QwikLite Biosensor System has proven itself well suited for determining whether water and sediment samples are toxic. [↴](#)

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SOME OF MY Best Shots



After hiking a few miles of the Pupukea Trail and a round of Golf at Turtle Bay, I was on my way home to Waikiki when my girlfriend convinced me to swing by Puaena Point Beach Park just north of Haleiwa Town on the North Shore of Oahu. To our surprise, we saw two green sea turtles (*Chelonia mydas*) feeding on the green algae growing on the rocks on the beach. The tide was high allowing both turtles to feed comfortably while remaining submerged in about two to three feet of ocean water, coming up to breathe every few minutes or so. Occasionally, the surf was large enough to push them onto the rocks. After about 45 minutes or so, the turtles finished their dinner and made their way out to deeper water.

Green sea turtles, in spite of their population numbers around the Hawaiian Islands, remain listed as a threatened species under the Endangered Species Act. All four species of sea turtles, known in Hawaiian as "honu," remain in a state of some fragility. Ships' logs from the 18th century cruises of Pacific exploration tell of sailors being sent ashore by their captains to collect turtles to replenish the depleted fresh meat stocks. The turtles could be put on their backs in the ship's hold and kept alive for an extended time. Today, on some remote

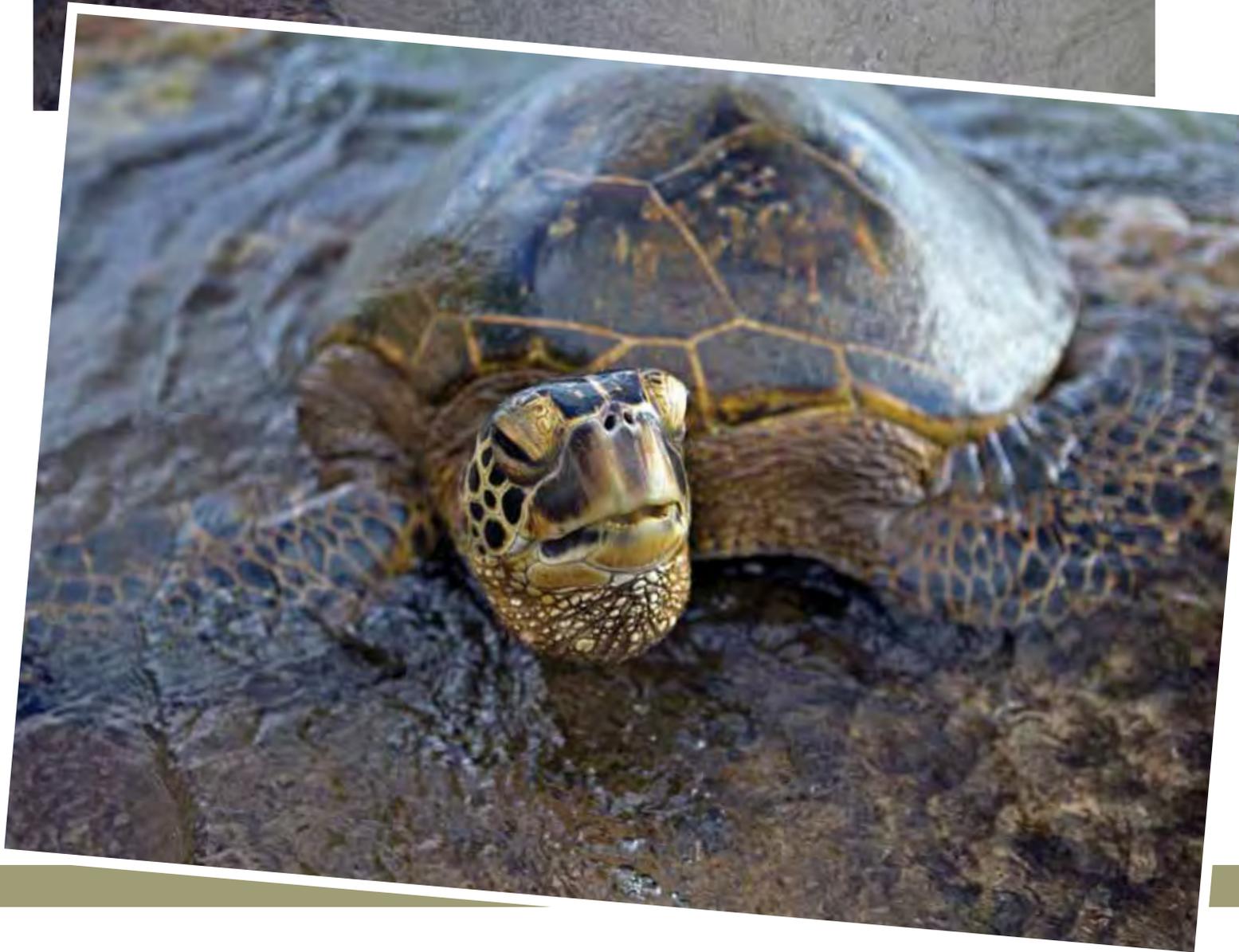
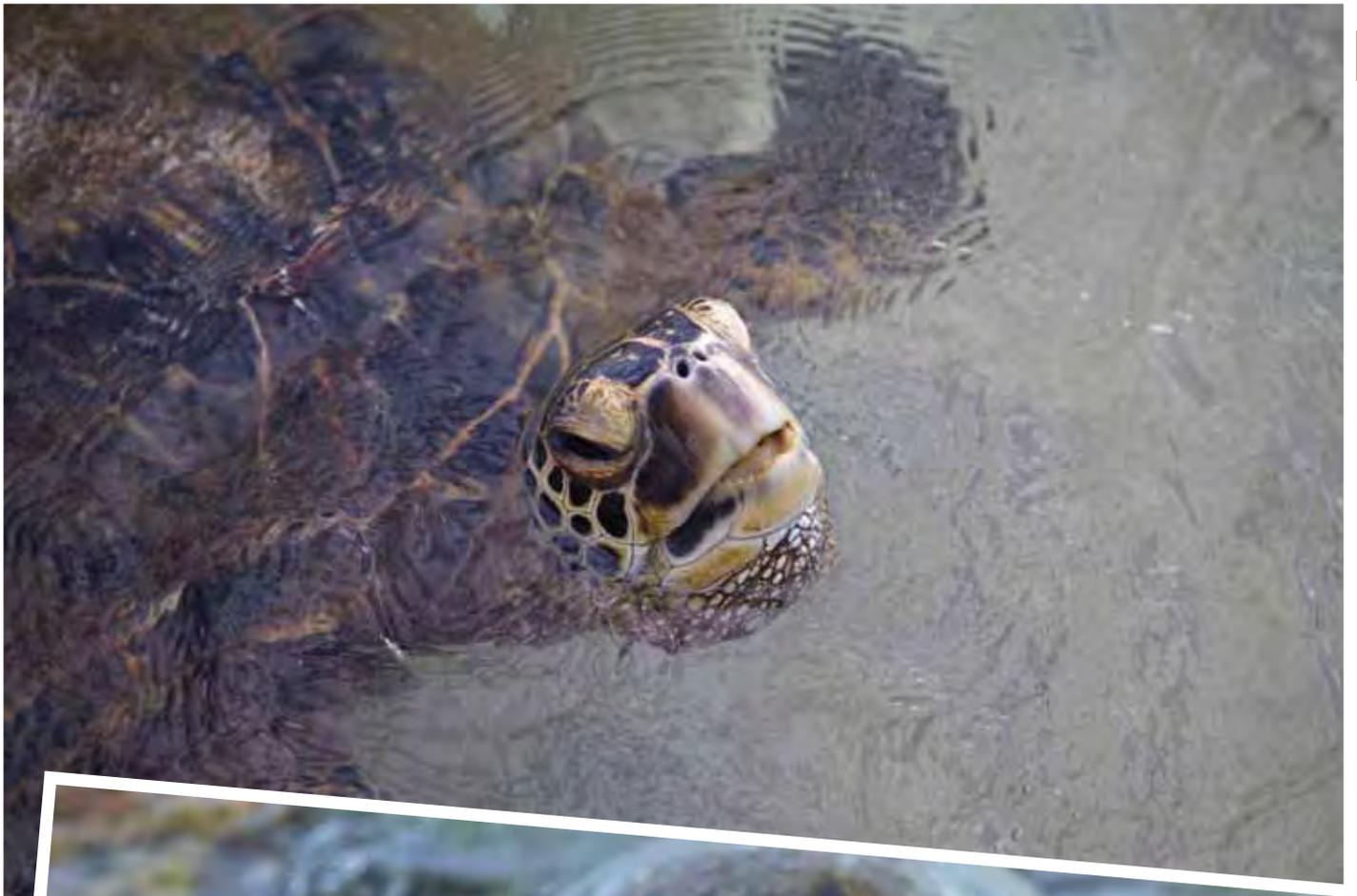
Pacific islands, sea turtles are consumed. Under United States' law, they are protected from harm. In addition to threats of being consumed by humans, sea turtles are threatened by entanglement with fishing gear and marine debris, habitat disturbances, and shark attacks.

When proposing any activity that occurs in areas known to be occupied by sea turtles, the Navy considers the potential for impact on this important member of our marine and nearshore ecosystem and modifies the proposal to avoid them.

These pictures were taken with a Canon EOS 5D Mark II body equipped with a Canon EF 24-70mm f/2.8 L USM Lens and a B+W 72mm Circular Polarizer Filter.

Lieutenant Erik Molina ● Navy Region Hawaii/Naval Surface Group Middle Pacific ● erik.molina@navy.mil

Submit your own Best Shot to Bruce McCaffrey, *Currents'* managing editor, at brucemccaffrey@sbcglobal.net.



N45 Offers EPCRA Reporting Resources

Information is Critical for Accurate Program Assessment

WITH AN EYE towards next year's Emergency Planning and Community Right-to-Know Act (EPCRA) reporting cycle, there are many resources at your disposal for additional guidance and assistance with reporting efforts.

Form R Review Service

The Form R review service is a free service offered by the Chief of Naval Operations, Energy and Environmental Readiness Division (N45). Navy facilities submitting Form Rs are strongly encouraged to utilize this service. The Form R review provides a technical review of completed draft Form Rs prior to submittal, ensuring any calculation errors are identified and applicable exemptions are applied.

There are many resources at your disposal for additional guidance and assistance with reporting efforts.

First, the review examines how the Form R is completed. For example, the reviewer will ensure the facility name is in the correct format; the releases reported correspond with the toxic chemical. (Are there air emissions reported for a volatile organic chemical? Are their land releases for lead on a range? Are whole numbers reported for non-Persistent Bioaccumulative Toxic chemicals?)

Next, the review briefly examines activities that triggered reporting and releases included in the Form R release estimates to ensure the Form R is completed correctly. For example, many installations "otherwise use" naphthalene in non-exempt activities and "manufacture" naphthalene as a product of combustion from the burning of fuels in equipment. These activities alert the Form R reviewer to look for point source and fugitive air emissions from storage tanks and fuel dispensing respectively, to question pathways for releases to water, and to examine spills and transfers off-site.

The voluntary Form R technical review service is available through the Navy's EPCRA Helpline (NavyEPCRA@

urscorp.com) for each reporting cycle. An announcement is distributed to the Navy EPCRA e-mail group each spring. Draft Form Rs are requested by mid-May with reviewer comments provided as soon as possible after receiving the draft. Following the review, a detailed e-mail is provided for installation documentation which documents the items identified and recommended changes to the Form Rs.

The Form R review service not only provides compliance support for installation's EPCRA reporting responsibilities, but also assists in promoting consistent and correct reporting Navy-wide. For example, the review this past reporting cycle identified instances where wastes generated from exempt activities were incorrectly included on the Form R. As another example, Navy installations using the same specialized material in the same process were reporting different releases. The review identified the correct release pathways and amounts to be reported on the Form R.

Training

The Naval Civil Engineer Corps Officer School (CECOS) will be offering full EPCRA training and refresher courses, in the form of web conferences in preparation for reporting year 2011 reporting (reports due in 2012 for calendar year 2011). These courses are instrumental for those individuals responsible for completing and complying with EPCRA reporting requirements. The CECOS EPCRA no-cost, no-travel web conferences provide the latest EPCRA information from EPCRA experts.

Upcoming EPCRA Course Offerings

EPCRA and TRI Reporting	31 October to 3 November 2011 28 November to 1 December 2011
Section 311/312 Refresher Course	12 January 2012
Section 313 Refresher Course	15 and 16 February 2012

The EPCRA and Toxic Release Inventory (TRI) Reporting is a four-day course (approximately six hours per day) essential for those with EPCRA compliance responsibilities. This course provides an introduction to EPCRA, emphasizing emergency planning, emergency release notification, material safety data sheets reporting requirements, Tier I/Tier II reporting requirements, toxic chemical release reporting, and information required for EPCRA compli-

ance. The upcoming course offerings are 31 October to 3 November 2011 and 28 November to 1 December 2011.

Refresher courses provide a review of the regulations with a focus on Department of Defense (DoD) and Navy-specific scenarios. The upcoming course offerings include Section 311/312 refresher course on 12 January 2012 (one day for approximately five hours) and Section 313 refresher course on 15 and 16 February 2012 (two days for approximately six hours per day).

All upcoming EPCRA course offerings are listed on the CECOS web site at <https://www.netc.navy.mil/centers/csfe/cecos/> under the “Courses” tab.

Guidance Materials

The OPNAV N45 EPCRA guidebook entitled “Getting Started with the Emergency Planning and Community Right-to-Know Act (EPCRA): A Primer for Navy Facilities” (May 2009) provides Navy environmental personnel with practical guidance on EPCRA reporting requirements. The document encompasses all applicable EPCRA reporting requirements including emergency planning (Section 302), emergency release notification (Section 304), hazardous chemical inventory reporting (Sections 312/313), and toxic chemical release reporting (Section 313). Key topics include:

- Summary of EPCRA requirements
- Quick reference for each EPCRA section
- Sample calculations
- Flow diagrams of reporting requirements
- Sample forms and letters
- Compliance checklist

OPNAV N45 has developed and provided additional detailed guidance on the following topics:

- How to Consider Batteries (February 2010)
- How to Consider Fuel Thresholds (June 2010)
- How to Consider Munitions and Range Activities (March 2011)
- How to Consider Nitrate Compounds (release pending)

Each guidance document includes an Excel™ template spreadsheet for calculation and documentation assistance. Copies of *Getting Started with EPCRA* and all available calculation manuals and templates are available at:

- The Naval Facilities Engineering Command’s Enterprise Document Library (https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_docs_pp)

- The CECOS training materials web site (<http://www.cecosweb.com/handouts/EPCRA>)
- The TRI Data Delivery System web page (<https://dod-triggs.org/tri-web>) (login required)

New calculation manual appendices will be announced via the Navy EPCRA e-mail group. To become a member, e-mail the helpline at NavyEPCRA@urscorp.com.

Send in Your Success Stories

DO YOU HAVE a toxic chemical release reduction success story? Send your success story to your Echelon II Command. Your story could be published in the Defense Environmental Programs Annual Report to Congress, Strategic Sustainability Performance Plan, *Currents*, or could become a Navy-wide best management practice. In addition, consider including your success story in the narrative portion of your N45 environmental awards nomination submission.

The EPCRA Helpline

The Navy’s EPCRA Helpline (NavyEPCRA@urscorp.com) is available to answer your EPCRA questions. Helpline personnel have extensive knowledge of DoD and Navy EPCRA policy and significant, current experience supporting Navy installations with EPCRA compliance. EPCRA questions may be e-mailed to the Helpline at any time and a response will be sent no later than the next business day.

How-To Close Reporting Year (RY) 2010 Reporting

The following checklist provides helpful hints on completing RY 2010 efforts.

1. Compile Your Documentation
 - Reporting forms and any associated notes
 - Proofs of delivery
 - Section 313 Facility Data Profile
 - TRI-Made Easy web site (TRI-MEweb) username and password in a secure location
 - Communication with EPCRA authorities
2. Record Your Data Collection Methods
 - How were data collected?
 - Where/what exemptions were applied?
 - Were assumptions made? If so, what were they?

3. Document Your Calculations

- What calculation approaches were used?
- What calculation tools were used?
- What were the release estimates and what sources/contributors were included?

4. Report Up

- Report data up the chain-of-command.

Improvements in Tracking Progress

Navy installations have been working to continually improve the accuracy of TRI reporting and the quality of release estimates reported on the Form R. These efforts have improved the Navy's and DoD's ability to track and assess progress toward meeting toxic chemical release reduction goals.

N45 Wants Your Feedback

- Do you find the guidance documents helpful?
- Is there information you would like to see added to the existing guidance documents?
- Do you have an idea for future guidance materials?

Please send your comments on existing guidance and ideas for new EPCRA guidance materials to the Navy EPCRA e-mail helpline at NavyEPCRA@urscorp.com. 

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NAS Pensacola Moves Closer to Energy Compliance with Electric Cars

Seven New Vehicles Help to Meet SECNAV Energy Mandates

SEVEN NEW ELECTRIC vehicles were delivered to Naval Air Station Pensacola (NASP) 11 July, bolstering the NASP Public Works Department (PWD) Transportation Center motor pool's electric fleet and helping bring the

installation closer to meeting the Secretary of the Navy's (SECNAV) energy mandates.

Secretary of the Navy Ray Mabus laid out five aggressive energy goals in October 2009 to improve the Navy's energy security and efficiency, increase energy independence, and help lead the nation toward a clean energy economy. This initiative assists in achieving the energy goal of increasing alternative energy afloat and ashore where by 2020, the Department of the Navy (DON) will produce at least 50 percent of shore-based energy requirements from alternative sources and 50 percent of DON installations will be net-zero.



Vantage Vehicle International GreenVans are unloaded at NASP on 15 July.

Mike O'Connor

The Vantage Vehicle International GreenVan EVP1000s are undergoing preparation for use. These electric passenger-carrying vans are charged using a conventional-style power cord but also feature solar panels on the vehicle's roof to help charge the battery while in use.

"These vehicles are to replace some of the gas-powered vehicles already in the pool that the customers are already using," said William Clowe, Naval Facilities Engineering Command Southeast (NAVFAC SE) transportation director. "The good thing about these vehicles is that they already have a third row seat for passengers."

The GreenVan EVC1000s currently in inventory are sliding-door models, which are primarily cargo carriers. These electric vehicles, in a class known as slow-moving vehicles, cannot go out on the highways; their top speeds don't allow that. But they fill a valuable on-base role for mail runs, administrative purposes and as people-movers in general.



PWD had in existing inventory 15 electric vehicles—eight Vantage electric pickup trucks and cargo-style vans, and seven older Global Electronics Motorcars passenger cars. NASP received its first Vantage Vehicle International electrics last year and they have been well received, according to Clowe.

"Ever since they've gone out to the customers, we haven't had any complaints," he said. "Customers like them. They're keeping them and that's good news."

Two of the vehicles are going to Supervisor of Shipbuilding, Conversion & Repair Gulf Coast in Pascagoula, MS. The PWD Transportation Center leases out vehicles to government customers as well as NASP tenant commands, including some as far away as Eglin Air Force Base. Internal customers for the electrics include NASP Corry Station, Naval Hospital Pensacola and Naval Air Training Technical Center.

As NAVFAC SE moves to meet SECNAV instruction to reduce petroleum usage 50 percent by 2015, the plan includes putting 215 Vantage Vehicle International electrics in place across the southeast region. Among the significant advantages of going green—cost savings.

"You could get two of these for the price of one van," Clowe noted. "The cost of a lease (to an internal customer) is about half of a conventional gas-powered vehicle." 📍

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Register Now for Annual SERDP & ESTCP Symposium

Program Includes Technical Sessions & Training Opportunities

THE PARTNERS IN Environmental Technology Technical Symposium and Workshop, sponsored by the Strategic Environmental



Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP), will be held 29 November to 1 December 2011, at the Washington Hilton in Washington, D.C.

Plenary Session

The symposium and workshop will commence with presentations by three distinguished plenary session speakers:

1. Dr. John Holdren, Assistant to the President for Science and Technology in the White House Office of Science and Technology Policy
2. The Honorable Terry Yonkers, Assistant Secretary of the Air Force for Installations, Environment and Logistics
3. Dr. Naomi Oreskes, Professor of History and Science Studies at the University of California, San Diego and Adjunct Professor of Geosciences at Scripps Institution of Oceanography

They will discuss emerging environmental challenges facing the Department of Defense (DoD) and solutions for a sustainable future. Also, as part of the plenary session, SERDP and ESTCP principal investigators who have helped DoD achieve its mission while improving its environmental performance will be honored as the SERDP and ESTCP Project-of-the-Year Awards are announced.

Technical Program

A comprehensive technical program consisting of concurrent technical sessions and short courses covering a variety of scientific and technical topics will follow the plenary session.

Technical Sessions

Fifteen technical sessions will highlight research and innovative technologies that improve DoD's environmental

performance, reduce costs, and enhance mission capabilities. Following are this year's topics:

1. Energy Management and Technologies for DoD Buildings
2. Renewable Energy on DoD Installations
3. Microgrids for Energy Security on DoD Installations
4. Challenges to Military Readiness Posed by Climate Change
5. Pacific Island Restoration Challenges
6. Role of Fire in the Carbon Cycle under Climate Change
7. Incorporating Innovative Technologies to Meet DoD Restoration Goals from Remedy in Place to Response Complete
8. Environmental Molecular Diagnostic Tools: Innovations and Applications
9. Improving Our Understanding of the Impact of Contaminants Stored in Low Permeability Zones
10. Best Management Practices for Controlling Munitions Constituents on Operational Ranges
11. Classification Applied to Munitions Response—Development
12. Classification Applied to Munitions Response—Production Applications
13. Next Generation Energetic Materials—Striking a Balance between Performance, Insensitivity, and Environmental Sustainability
14. National and International Regulatory Impacts on DoD Operations: Refining the Goals of DoD's Strategic Plan for 'REACH'
15. Impact of Particulate Emissions from Gas Turbine Powered Aircraft

To view the lineup of speakers and their topics for each technical session, visit www.serdp-estcp.org/symposium.

Short Courses

Short courses will offer unique training opportunities on emerging technologies and methods in environmental restoration and munitions response. Professional development hours will be offered for participation in short courses. Attendance for these short courses will be limited, and advanced registration for each short course is required. Following are this year's short course topics:

- Implementing Classification on a Munitions Response Project
- Estimating Dense Nonaqueous Phase Liquid Source Zone Natural Attenuation
- Thermal Treatment Technologies: Lessons Learned
- Field Methods to Distinguish between Vapor Intrusion and Indoor Sources of Volatile Organic Compounds

To view the agendas for each short course or to pre-register, visit www.serdp-estcp.org/symposium.

Funding Opportunities Briefing

On the last day of the symposium, the Executive Director of SERDP and ESTCP will present a funding opportunities briefing and hold a Q&A session afterwards. During this briefing, attendees will receive an overview of SERDP and ESTCP investment strategies, funding levels, and areas of emphasis as well as a summary of opportunities to conduct research and technology demonstrations. This “how to play” briefing will offer valuable information on the solicitation processes for those who would like to understand how to submit proposals for upcoming funding opportunities.

Other Symposium Highlights

Attendees will have numerous opportunities to tour more than 450 posters and exhibit booths and network with approximately 1,200 environmental professionals. Technical exchange networking receptions will be held both Tuesday and Wednesday evening.

Solicitations to Be Released Beginning in October 2011

SERDP is DoD’s environmental science and technology program, executed in partnership with the Department of Energy and the U.S. Environmental Protection Agency. SERDP invests in basic and applied research and advanced development. ESTCP is DoD’s environmental technology

demonstration and validation program. The program’s goal is to identify and demonstrate cost-effective technologies that address DoD’s highest priority environmental requirements. Both programs address DoD environmental needs in the Energy and Water, Environmental Restoration, Munitions Response, Resource Conservation and Climate Change, and Weapons Systems and Platforms areas.

ESTCP will be seeking proposals in response to its FY 2013 solicitation, scheduled to be released in late October 2011. Projects will be selected through a competitive process that is open to both Federal and non-Federal submissions. Upon release of the solicitation, detailed instructions and the Statements of Need will be available at www.serdp-estcp.org under “Funding Opportunities.”

The FY 2013 ESTCP Environmental Technologies solicitation will be released in early January 2012. The FY 2013 ESTCP Installation Energy solicitation will be released in early February 2012. Technology demonstrations are open to both the Federal and non-Federal sectors, and projects will

be selected through a competitive process. Information about the solicitation process is available at www.serdp-estcp.org under “Funding Opportunities.”



For More Information

For additional information about the symposium, visit www.serdp-estcp.org/symposium, send an e-mail to partners@hgl.com, or call the contact line at 703-736-4548. For information about the SERDP or ESTCP solicitations, visit www.serdp-estcp.org. [↕](#)

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NAVFAC Southwest Renewable Energy Contract May Serve as Model

Groundbreaking Celebrates Renewable Energy Contract for MCAS Miramar

THE NAVAL FACILITIES Engineering Command (NAVFAC) Southwest awarded a \$42.7 million contract on 12 July to purchase renewable energy that will supply Marine Corps Air Station (MCAS) Miramar with up to half of its daily power over a 15 year period and may serve as a model for future Department of Defense long term power purchase agreements.

“This project, which is one of many the Department of the Navy is pursuing in the Southwest region of the country, is the first project in the entire Department of Defense to use special legislation established to allow the long term, 10 to 30 year, business arrangements necessary to accomplish these types of power purchase agreements,” said Capt. Keith Hamilton, NAVFAC Southwest commanding officer.

The special legislation is Section 2922a of U.S. Code Title 10 “Contracts for energy or fuel for military installations” which Congress enacted in July 1982.

Miramar Energy LLC, a wholly-owned subsidiary of Fortistar Methane Group of White Plains, NY will build a 3.2 megawatt power plant powered by methane gas at the city of San Diego Miramar landfill. The city of San Diego landfill is on leased land from the U.S. Navy and adjacent to MCAS Miramar. Minnesota Methane, a subsidiary of Fortistar Methane Group, currently manages a power plant that collects methane gas at the landfill to generate electricity for landfill operations. The plant’s renewable energy is also sold to the city of San Diego.

NAVFAC Southwest, MCAS Miramar, city of San Diego, Fortistar Methane Group and its subsidiary Miramar Energy LLC participated in a groundbreaking ceremony after the award. Members of the official party included city of San Diego Mayor Jerry Sanders, MCAS Miramar Commanding Officer Col. Frank Richie, NAVFAC Southwest Commanding Officer Capt. Keith Hamilton, and Fortistar President Mark Comora.

“This project is a very important early success on the path towards accomplishing Secretary of the Navy Mabus’ energy strategy to improve our energy security, efficiency, and independence by obtaining or producing at least 50

percent of our total ashore energy requirement from clean, renewable or alternative sources by 2020,” said Hamilton, during remarks at the groundbreaking ceremony.

The project also has an American Recovery and Reinvestment Act of 2009 component. RQ-Berg JV of Carlsbad, CA was awarded a \$5.4 million Recovery Act funded contract in February 2011 to construct an electrical distribution system to supply renewable energy from the landfill power plant site to MCAS Miramar.

“Our team has been carefully working that project in parallel with the power plant agreements to ensure that the power lines will be ready to receive and distribute the power when this new plant is ready to go in service,” said Hamilton.

The project will also improve MCAS Miramar’s strategic energy security and economics.

This renewable energy will significantly reduce MCAS Miramar’s reliance on fossil fuels.

—Rose Araracap

“The contract will include a provision for “Black Start”—a technology that allows MCAS Miramar to maintain electrical operations in the event of an electrical grid failure,” said Rose Araracap, NAVFAC Southwest deputy assistant operations officer and technical expert for this renewable energy project. “This renewable energy will significantly reduce MCAS Miramar’s reliance on fossil fuels. The price is pre-established for price predictability and budgetary planning,” she continued.

Electricity generated from the landfill renewable power plant is scheduled for delivery by early 2012.

“I am extremely pleased that early next year I can flip on the switch and half of the power will be coming from San Diego’s trash,” said Col. Frank Richie, MCAS Miramar commanding officer. ↴

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NAS Jacksonville Solar-powered Vehicle Marks Two Years Off the Grid

Over 1,000 Miles Traveled

IN MARCH 2009, Naval Air Station (NAS) Jacksonville modified one of its electric vehicles with a solar cell power system for use by the environmental staff on the station. After installing three sets of 110-watt panels on the roof of a Global Electric Motors vehicle to charge six 12-volt batteries, the staff has traveled more than 1,000 miles in the last two years completely off the electric grid. While

traveling at a top speed of 24 miles per hour (mph), the panels continually recharge the batteries during the day.

The staff uses the vehicle for daily inspections, visitor tours and exhibits at the Florida Transportation Planning Organization Clean Cities, City of Jacksonville Environmental Symposium and Earth Day Celebration and station air show and energy conservation awareness events.

With electricity costs relatively low in Jacksonville, FL, the system cost of \$4,000 is currently not cost effective (10-year pay back), but demonstrates that a properly sized solar photovoltaic system can provide transportation power without connection to the power grid. The system included mounted panels (designed to withstand 60 mph winds), three voltage regulators and a separate inverter to convert solar energy to 110 volts.

As part of the test the solar panels have not been cleaned to better replicate normal operations. Only rain, wind and vehicle travel remove dust and dirt from the flat panels and, with two years off the grid, the panels continue to work to effectively recharge the batteries. ⚓

Aviation Maintenance Administrationman 1st Class Bridget Geigerpye of Patrol Squadron Eight displays the NAS Jacksonville solar-powered vehicle on the base flightline.

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BE PART OF OUR SPRING ISSUE

Submissions Are Due by 20 January

We're already planning our spring 2012 issue. And you can be a part of it! If you have a story that you want us to consider, you need to submit your final text and images by 20 January 2012.

The power of your experiences is even greater when you share them with our readers.

Your chances of being published in *Currents* are dramatically increased if you follow our article template. Simply request this easy-to-use template by sending an email to Bruce McCaffrey, our Managing Editor, at bruceMcCaffrey@sbcglobal.net. Bruce is available at 773-376-6200 if you have any questions or would like to discuss your story ideas.

We look forward to reading your stories about all the great work you're doing to optimize the Navy's energy use and serve as good stewards of the environment.

Currents Deadlines

- Spring 2012 Issue: Friday, 20 January 2012
- Summer 2012 Issue: Friday, 20 April 2012
- Fall 2012 Issue: Friday, 20 July 2012
- Winter 2013 Issue: Friday, 19 October 2012

You can also refer to your *Currents* calendar for reminders about these deadlines.

Taking on Storm Water

NESDI Program Addressing Immediate Needs, Testing Solutions & Gathering Knowledge

NAVY STORM WATER managers are taking on the removal of pollutants found in storm water generated at industrial installations. Runoff from industrial areas contains heavy metals, suspended solids, and oil and grease at levels that can exceed National Pollutant Discharge Elimination System (NPDES) permit limits and benchmarks. These pollutants are known to impair our nation's water bodies.

Runoff from industrial galvanized roofs and copper gutter systems add to the problem. Permit requirements vary by receiving water body and state, with some being more stringent than others. Storm water managers might have as many as 100 or more storm water outfalls to address. Space, slope and water table constraints can limit structural treatment solutions available to meet the NPDES requirements.

The U.S. Environmental Protection Agency (EPA) has initiated a national rulemaking to strengthen its stormwater program. EPA intends to propose a rule in September 2011 and take final action by November 2012. It is anticipated that the rule could result in lower storm water permits

limits to which compliance will become an increasing challenge within the Navy.

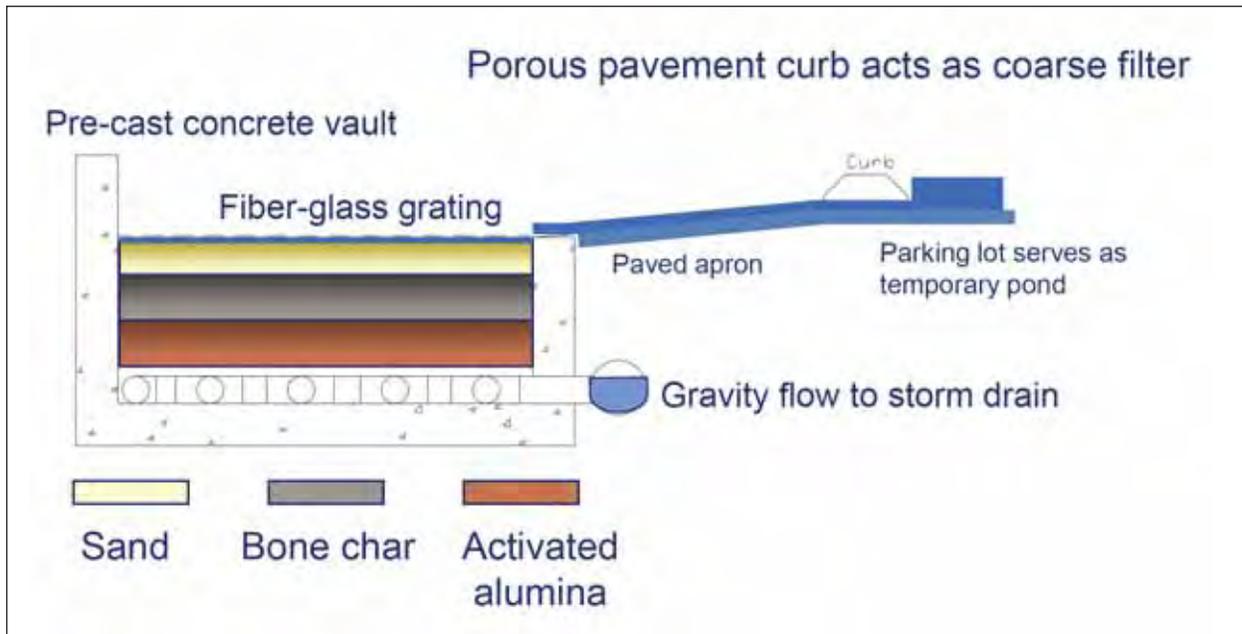
The Navy Environmental Sustainability Development to Integration (NESDI) program receives multiple requests each year to help storm water managers improve storm water compliance. To address these challenges, the NESDI program has provided resources to personnel from the Naval Facilities Engineering Command Engineering Service Center (NAVFAC ESC) and other organizations to demonstrate and validate commercially available systems and new systems as possible Best Management Practices (BMP) to maintain pollutant concentrations below permitted levels. Recent projects include the demonstration of a below grade dual media filtration system, a roof runoff BMP, and an above grade linear treatment known as the Linear Treatment System (LTS). NAVFAC ESC has also evaluated over 25 absorbent media aimed at removing copper and zinc, which are known to be toxic at low concentration to some marine organisms. In addition to evaluating above and below ground systems, the NESDI program has supported

efforts to evaluate non-structural or administrative techniques, optimize existing BMPs and develop a web-based tool to assist water program managers in selecting the most appropriate BMP.

The recent demonstration of the LTS at the Naval Regional Recycling Center (NRRC), San Diego, CA, offers insights into the NESDI program's expedient approach to addressing current needs while concurrently testing for broader applications. One of the objectives of the LTS project was to improve the performance and the maintainability of the existing, below-grade BMP by reducing the sediment load that tends to plug the absorbent media. A broader objective was to determine if the above-ground LTS could be used to control dissolved metal contaminants found in sheet flow (i.e., non-point) storm water runoff.

Background

All industrial activities, including those operated by the Navy, are under increasing pressure from EPA, state regulators and local communities to reduce the concentration of pollutants found in storm water runoff from being discharged into harbors, bays,



Cross-section of Storm Water Runoff Treatment System.



elevated metal concentrations in storm water runoff from Navy industrial sites can be attributed to outdoor metal working processes such as cutting and grinding, outdoor storage of metal objects and use of metal bearing materials such as corrosion inhibiting and anti-fouling paints. Suspended solids are usually fine particles of soil deposited on the watershed by wind or erosion. Dust created by industrial processes (such as media blasting) is another source of fine particles. Organic material can often be attributed to small leaks of motor oil, hydraulic fluid and antifreeze.

Recognizing that Navy industrial sites typically have limited land area for storm water BMPs, as well as limited resources, the NESDI program's ideal storm water treatment system concepts strive to meet the following criteria:

- Low capital cost
- Easy installation
- Minimum land area requirements
- Low maintenance frequencies and costs
- Site-specific permit requirements compliance.

Some of the previously demonstrated technologies, funded by the NESDI program, include:

- Full scale dual media storm water treatment trench BMP

lakes and streams. Contaminated sediments can pose a substantial threat to aquatic life, wildlife, fisheries and human health. Fish and bottom-dwelling creatures suffer disease, death, reproductive failure or impaired growth upon exposure. Trace metals (e.g., copper, mercury, zinc) in the sediments are harmful particularly because they persist in the marine environment and bio-accumulate up the food chain, traveling from marine organisms to fish then to humans.

Storm water runoff from Navy industrial operations can be roughly characterized as having elevated metals content, moderate suspended solids and organic content, and low nutrient and bacteria content. The

- Full scale roof runoff BMP
- Storm Water BMP Decision Support Tool web site to assist storm water managers in selecting optimal BMPs to meet NPDES permit limits.

Dual-media Filtration System

This filtration system is a below-grade structural BMP, designed to remove dissolved copper and zinc from storm water runoff at NRRC. The NRRC was required to meet California Regional Water Quality Control Board (CRWQCB) requirements to pass a 96-hour acute toxicity test, reduce copper discharges to less than 63 micrograms per liter ($\mu\text{g/l}$), and reduce zinc discharges to less than 117 $\mu\text{g/l}$. At this project's initiation, Commercial Off-the-Shelf (COTS) technologies were expensive, costing approximately \$57,000 or more per acre of drainage. The existing COTS technologies also were not reliably passing required toxicity tests.

The NESDI program sponsored the development and integration of a lower cost innovative two-stage filter process that utilizes filtering and adsorption media (bone char and activated alumina) to filter out solids and metals. The installed system had a significantly lower capital cost (\$20,000 per acre of drainage), low operational cost and required little land area. For more information about this system, see our article entitled "Treatment of Storm Water Runoff from Military Industrial Activities: NFESC Demonstrates Advanced Storm Water Runoff Treatment System" in the winter 2006 issue of *Currents*.

Roof-top/Downspout Filtration System

Roof-top runoff from Building V-88 on Naval Base Norfolk appeared to be contributing elevated copper and

zinc concentrations in storm water samples. The building has a galvanized metal roof and copper gutters and downspouts.

Drawing from the successful implementation of the dual media BMP, NAVFAC ESC incorporated components into a new BMP technology to address roof-top runoff in Norfolk, VA. The BMP is a 200-gallon barrel filled with bone char layered over activated alumina, with geofabric and an internal drain system, to capture heavy metals in the Building V-88 downspout runoff. The BMP removed enough copper and zinc from the storm water to meet the Virginia



Roof-top Runoff BMP.

The Basics About the NESDI Program

THE NESDI PROGRAM seeks to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program accomplishes 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 6.4 Research, Development, Test and Evaluation program. The NESDI technology demonstration and validation program is sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division (N45) and managed by NAVFAC. The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at www.nesdi.navy.mil or contact Leslie Karr, the NESDI Program Manager at 805-982-1618, DSN: 551-1618 or leslie.karr@navy.mil.



SUMMARY OF PERFORMANCE OBJECTIVES

Performance Objective	Metric	Data Requirements	Success Criteria	Actual Performance Objective Met?
Quantitative Performance Objectives				
Reduce TSS	EPA 2540.D test method	Influent and effluent TSS concentration	80% reduction	No
Reduce Dissolved Copper and Zinc	EPA 200.8 test method	Influent and effluent metals concentration	75% reduction	Yes
Maximize Hydraulic Capability	Flow conductivity	Bench scale testing at constant head, gallons per minute (gpm)	2–4 gpm per linear foot	Yes
Qualitative Performance Objectives				
Lower O&M Cost	Annual maintenance cost Replacement/disposal cost	Replacement cost and cleanup man-hours	< Below grade COTS and O&M costs	Yes
Minimize Degradation	BMP durability	Qualitative observation of rips, clogs, and undesirable movement	Minimum of one year's performance	Yes

storm water screening criteria of 33 µg/l copper and 180 µg/l zinc.

The Roof-top Runoff BMP provides Naval Base Norfolk with a lower cost decentralized method of meeting their Virginia Pollutant Discharge Elimination System storm water discharge requirements. The BMP sampling results indicate that several small-scale structural BMPs can be deployed at building downspouts (and other point sources of copper and zinc) in lieu of larger, centralized treatment systems for storm water runoff.

The Storm Water BMP Decision Support Tool Web Site

The NAVFAC ESC also developed a web-based expert system, the Storm Water BMP Decision Support Tool, which is designed to help users identify the most cost effective storm water BMPs to address storm water run-off requirements at Department of Defense (DoD) installations and activities. The BMP website is based on a review of proven BMPs and lessons learned from past and ongoing BMP projects performed by

the DoD, government and the private sector. The website ties BMPs to Navy specific industrial operations, site conditions and discharge limits. The BMP website address is: www.p2sustainabilitylibrary.mil/stormwaterbmp/hm.html

Experiments with a Linear Treatment System

When the NRRC storm water BMP was showing signs of reduced flow, the NAVFAC ESC team looked for an expedient approach that would offer a quick response to an immediate need while also offering an opportunity to test additional non-structural BMPs for potential as stand-alone, above grade use.

The NRRC is one of the Navy's recycling centers that accepts used and scrap materials, such as metals, paper, cardboard and plastic, for recycling and resale. The center currently uses a full scale, structural dual media filtration system to remove toxic metals from the storm water runoff. Although the system is working, fine particle solids (silt) are prematurely plugging the filtration system, which

leads to increased maintenance and reduced effectiveness. Some method of pre-treatment was needed to optimize the existing system. The site also offered other advantages for conducting tests, including on-site sampling equipment and nearby power to run the equipment.

The NAVFAC ESC team looked for existing BMP techniques that might be adapted to this need. One BMP technique often used at new construction sites is to place straw wattles (rolls) to capture suspended solids in storm water runoff. Working with this concept, the NAVFAC ESC team developed a bench-scale apparatus to evaluate multiple combinations of adsorptive media within fiber rolls. Each combination was tested for Total Suspended Solids (TSS) filtration and dissolved metals removal efficiencies, as well as the hydraulic capabilities. Qualitative measures included operation and maintenance costs and system durability. (See table above.) The test performance objectives were based on NPDES standards for discharge to San Diego Bay.

CANDIDATE MEDIA TYPES

Organic Materials	Active Materials	Inert Minerals	Proprietary Materials	Other
Loose peat moss	Activated alumina	Perlite	Forager sponge cubes	Iron chips and filings
Hardwood chips	Iron Coated activated alumina	Washed plaster's sand	Dynaphore granules	Sodium alginate beads
Bone char	Zeolite (chabasite)	Washed concrete sand	Ancor M-20/80 zero valence iron	Geotextile
Anthracite	Zeolite (glauconite)	Washed well- packing gravel	Stormwater Management Metal Rx	Ecology Mix
Sulphonated peat moss	Ilmanite		Environmental H ₂ O, LLC White Karbon	

The table above lists media considered for preliminary testing.

The laboratory scale apparatus and set-up schematic are shown in Figures 1 and 2.

In this testing, each media type was tested in a wattle (or roll) for both hydraulic capabilities and TSS and dissolved metals removal efficiencies. Both are important to overall success.



FIGURE 1: Laboratory scale test bed.

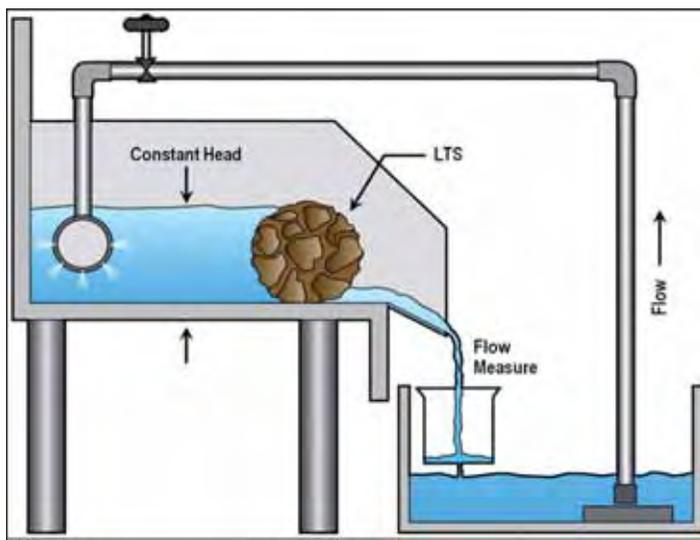


FIGURE 2: Schematic of laboratory scale testing.

The hydraulic capability of a LTS is dependent upon the characteristics of the internal filter media. The important characteristics include: particle size, particle shape, particle gradation, hydrophobicity and the degree of compaction.

Figure 2 displays the hydraulic capability test setup. Wattle hydraulic capabilities were measured for each test candidate by regulating flow with a control valve until a constant head steady state flow was achieved. The test results could then be compared on a flow rate per inch of head relationship, and also be expressed as gallons per minute (gpm) per linear foot of LTS.

The TSS and dissolved metals removal efficiencies were then measured by moving the sump pump shown in Figure 2 to a separate tank with a known influent concentration of TSS, copper and zinc. Influent concentrations of copper and zinc were chosen using historical storm water characterization data from previous NAVFAC ESC projects conducted at the NRRC site.

The laboratory-scale testing showed one of the linear treatment systems was capable of removing significant levels of total suspended solids and dissolved copper and zinc from a synthetic storm water solution. The linear treatment system had 79 percent removal efficiency for total suspended solids and dissolved copper and zinc. The laboratory scale results exceeded the 75 percent dissolved metals quantitative performance objective, and were just one percentage point below the 80 percent TSS quantitative performance objective.

The hydraulic capacities of the most promising adsorption medium, however, were inadequate for the NRCC site. Flow rates less than the two gpm per linear foot threshold would likely cause excessive flooding at the site. Efforts to optimize the hydraulic capacity resulted in reduced removal efficiencies.

How to Submit a Need to the NESDI Program

FOR THE NESDI program, a “need” defines a requirement to eliminate or reduce an environmental constraint that:

- Addresses a Fleet operational challenge
- Identifies an existing gap in knowledge, technology, and/or capability
- Is associated with an environmental constraint or regulatory driver

Needs are the fundamental basis of the NESDI program as all of its technology investments are based on recommended solutions to the need.

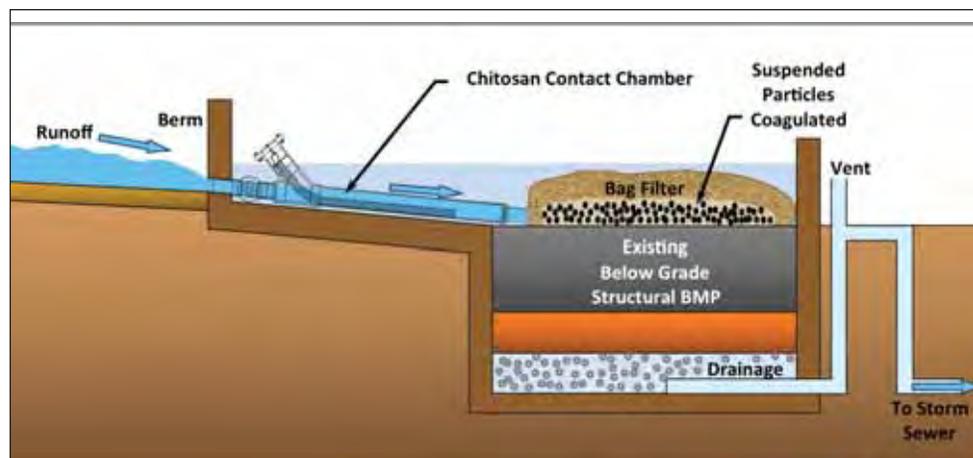
To submit your need, visit the “Environmental Needs” section on the NESDI web site then click on the “Submit A Need Now” button. This will take you to the “NESDI Environmental Needs Submission Form.” Use this on-line form to characterize your need. Then click on the “Submit Need” button to complete the process.

Once you submit your need, technical experts assembled by NESDI program management will assess, validate, and rank it. You will be notified about the ultimate status of your need once this ranking process is complete. For more information, download the *Reference Guide: Submitting and Evaluating Needs* by visiting the NESDI web site at www.nesdi.mil then clicking on the “Environmental Needs” button.

Although none of the LTS combinations could simultaneously meet all performance objectives for a stand-alone BMP using the stringent standards required for San Diego Bay, the high metals removal efficiencies of selected materials show promise for other applications and possibly for other locations. Other industrial sites might be able to

use the filter wattle depending on site-specific permit requirements and hydraulic conditions.

Using results from this LTS demonstration, the NESDI program initiated a subsequent project to develop a low maintenance retrofit to the existing below-grade BMP to improve its performance. The objective of the new project is to include a pre-filtering system to remove particularly fine suspended solids from industrial site storm water runoff. These types of solids have



Schematic of filtration BMP for optimizing a dual media system.

increased maintenance demands and diminished the system’s performance reliability for meeting permit requirements.

The current project, *Optimization of the Storm Water Dual Media Filtration System at NRRC San Diego*, will test the effectiveness of a low-maintenance filter sock mesh containing flocculating material placed immediately upstream of the structural BMP.

Such a filtration add-on could enhance the performance of any below-grade

structural BMP. If successful, this technology will significantly decrease the frequency of labor-intensive maintenance while allowing industrial facilities to consistently meet NPDES permit requirements. ⚓

Photos by Gary Anguiano

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Navy Region Hawaii Participates in Multi-Agency Oil Spill Drill

Navy, Private Sector, Local Government Exercise Creates Partnering Opportunities

IMAGINE THOUSANDS OF gallons of sticky, smelly, and toxic crude oil heading directly for Waikiki Beach or Ko Olina, killing sea birds, turtles and seals along the way and filling the tropical air with sickening vapors. To prevent such a disaster, Navy Region Hawaii conducted intense training last spring. Dozens of Sailors, Navy civilians and other responders participated in a series of joint multi-agency and private sector field and functional exercises to see if they could stop a simulated catastrophic oil spill such as this in its tracks. These activities were conducted under the National Preparedness for Response Exercise Program (NPREP) to test the Hawaii Area, Navy and Tesoro Corporation Contingency Plans.

Navy Region Hawaii recognized that a joint exercise with Tesoro would fulfill its own triennial exercise requirement for a worst case discharge scenario as well as gain invaluable experience by working with the private sector and other response agencies. Over a year of intense planning culminated in a highly charged series of exercises which included the following events over a two month period:

- Shoreline cleanup assessment training
- Equipment deployment to simulate oil dispersant application
- Aerial observer training
- Open-ocean and near shore spill response equipment deployments
- Advanced and position specific Incident Command System (ICS) training
- One day functional exercise

Several personnel from the Navy Region Hawaii Spill Management Team (SMT) attended a three-day training course on shoreline cleanup assessment that was conducted by the National Oceanic and Atmospheric Administration. This involved classroom work on the science of oil spills and standardized assessment methodologies. The students then practiced their observational and data-recording skills at two locations along Oahu's shoreline.

The off-shore equipment deployments involved the Navy's Supervisor of Salvage and Diving (SUPSALV) and the

Military Sealift Command vessel USNS NAVAJO (T-ATF 169). The ship was outfitted with the Ocean Buster skimming system and practiced various booming maneuvers and response tactics alongside the private sector response vessel Clean Islands. This was an excellent opportunity for both Navy and private sector responders to work together and become familiar with each other's capabilities. SUPSALV also placed their mobile command and repair shop vans dockside as static displays for the deployment observers.

This off-shore event also served as training for the aerial observers who flew overhead in a chartered helicopter. The aerial observers practiced techniques in following the simulated oil slick, using computerized tracking software, and operating the Clean Islands Council's unique multi-function communications system. Using the software that was connected to a Global Positioning System device, the observers were able to record the complete flight path as well as perform other tasks, such as providing the exact location of the spill and its boundaries, thus presenting the inci-



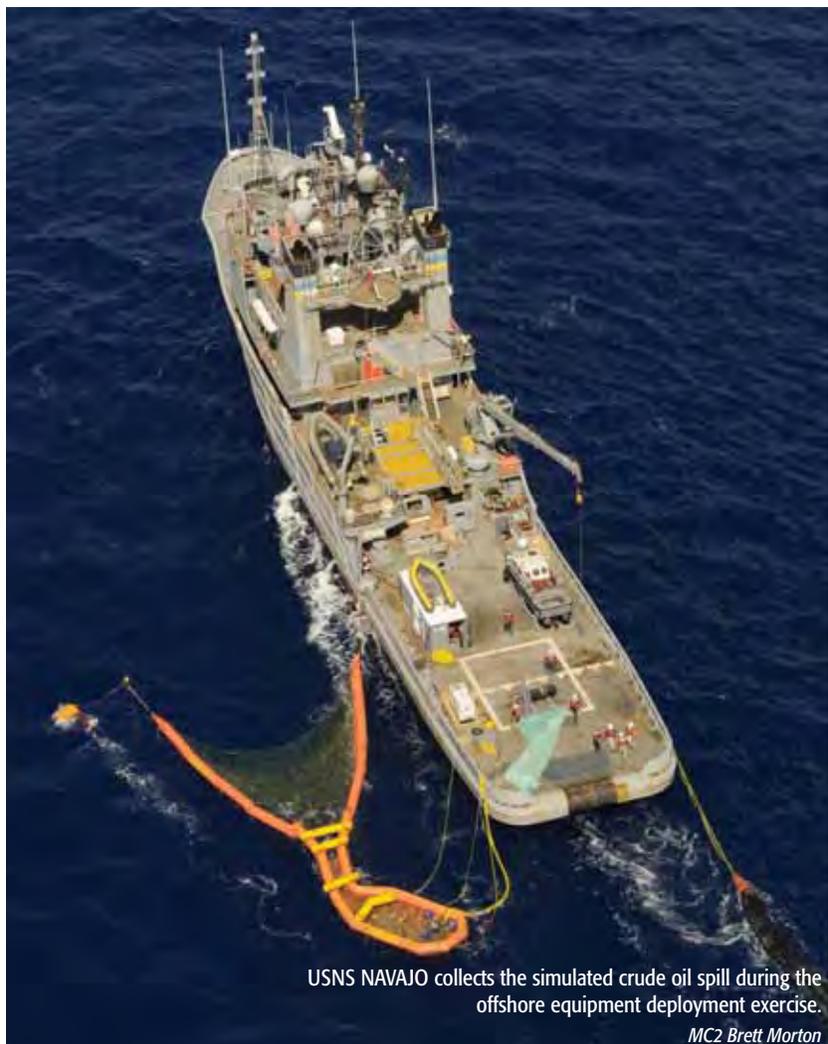
Navy aerial observer trainees receive a safety brief before boarding the helicopter that will take them to the offshore equipment deployment exercise.

Terry Corpus

dent command post with a clearer understanding of the spill area of coverage and volume. Three Navy Region Hawaii SMT members participated in this aerial observer training. They joined an elite group of less than a dozen trained oil spill aerial observers in Hawaii.

In addition, a separate equipment deployment exercise was conducted within Pearl Harbor. Vessels from Joint Base Pearl Harbor—Hickam's Facility Response Team and Clean Islands Council practiced near-shore booming and oil skimming techniques. An on-shore weir skimmer deployment exercise was also conducted at Kilo Pier by Fuel Department personnel from Naval Supply Systems Command Fleet Logistics Center Pearl Harbor.

Navy Region Hawaii drew upon trained individuals from various commands within its area of responsibility to serve in the ICS-based SMT. Team members received extensive training on ICS and oil spill response in the weeks prior to the exercise. Courses included Group and Division



USNS NAVAJO collects the simulated crude oil spill during the offshore equipment deployment exercise.

MC2 Brett Morton

Supervisors, an advanced planning process workshop, Situation and Resource Unit Leaders, Unified Command, Joint Information Center, and Liaison Officer. Training was also conducted on emergency operations center coordination and the relationship with the incident command post.

many other Federal and State agencies worked shoulder to shoulder at the Hawaii Oil Spill Response Center to develop plans, processes and procedures in this worst case discharge scenario.

The first steps were to begin organizing the various ICS sections and

refinery's off-shore mooring, Rear Adm. Dixon Smith, Commander, Navy Region Hawaii and Naval Surface Group Middle Pacific, served as the NOSC, and Dan Carlson of Tesoro served as the Potential Responsible Party. Representing the FOSC was Capt. Joanna Nunan, USCG Captain of

The problem-solving skills of all parties were tested, and issues were quickly resolved based on the wide range of personal experience and organizational procedures represented.

The functional exercise started early in the morning of 14 April 2011 with actual notification calls made to the National Response Center, U.S. Coast Guard (USCG) Sector Honolulu and others. By 0800, more than 180 people from Navy Region Hawaii, SUPSALV, Tesoro, Clean Islands Council, USCG, State of Hawaii, and

gathering information about the incident. The unified command was quickly established and was composed of the Federal On-Scene Coordinator (FOSC), State of Hawaii On-Scene Coordinator (SOSC), Navy On-Scene Coordinator (NOSC) and the Responsible Party. Since the scenario included a Navy vessel and a local

the Port. Curtis Martin from the State of Hawaii Department of Health served as the SOSC.

The joint public and private sector SMT prepared detailed oil recovery and environment protection plans throughout the day using the various contingency plans and ICS procedures. During this



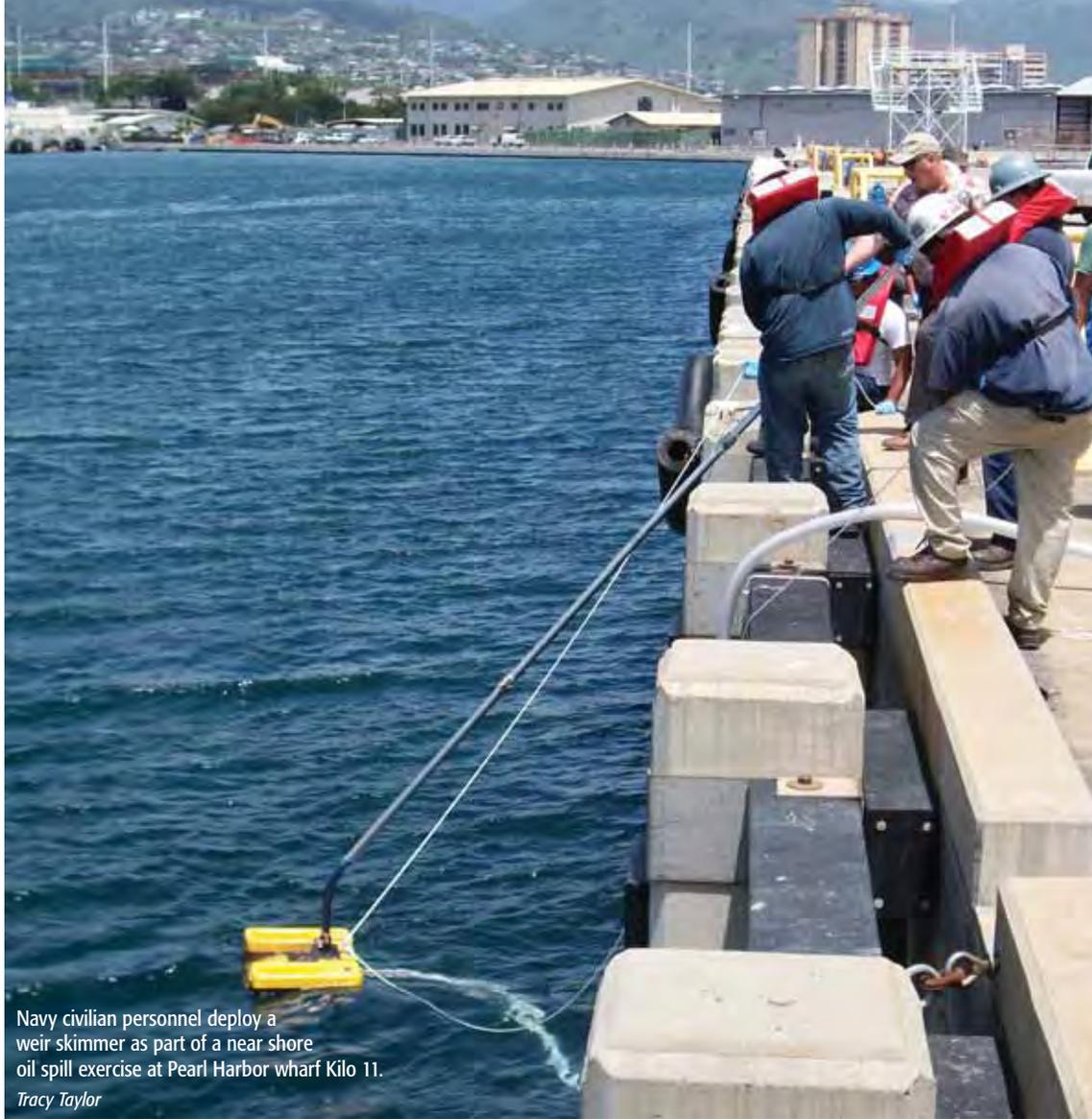
Personnel from the Navy, other federal agencies, and industry partners develop response strategies and environmental protection plans during the functional exercise.

Terry Corpus

process, simulated calls to the participants were designed to test the various contingency plans. A press conference and an open house were conducted to provide outreach to the community. The exercise planners and evaluators acted as members of the public and media by raising questions during these events. This also tested the Joint Information Center's capability to create these events on short notice. The functional exercise concluded with the presentation of the incident action plan for the next operational period to the Unified Command.

The participation of the Navy in this exercise with government, community and industry responders provided many benefits. It

allowed personnel from these agencies and organizations to work together in a highly cooperative manner. The problem-solving skills of all parties were tested, and issues were quickly resolved based on the wide range of personal experience and organizational procedures represented. It provided the ability to learn best practices from each other and created strong relationships among the participants. Other Navy activities or regions should strongly consider such joint Navy-industry exercises as a means of increasing their arsenal of knowledge and available response resources. Further, it will enhance the relationship among the Navy and its neighbors by portraying the



Navy civilian personnel deploy a weir skimmer as part of a near shore oil spill exercise at Pearl Harbor wharf Kilo 11.
Tracy Taylor

Navy as a willing and capable steward of the environment.

Rear Adm. Smith stated, "We take our responsibility of environmental stewardship seriously. This training with our government and industry partners helps us all work together to protect the beautiful environment here in Hawaii. We learned a great deal about each other's strengths and capabilities. This exercise increased our confidence about the Region's expertise and readiness to respond." CAPT Nunan stated, "The exercise planners did a great job in designing and executing an extremely realistic scenario. I was very impressed by the teamwork of the Federal, State, and industry partners." Mr. Martin said, "Exercises such as this are especially

valuable in training new and old staff members for oil spill response and improving preparedness."

Oil spill prevention and response preparedness are a high priority at Navy Region Hawaii. Thus, a catastrophic spill is unlikely. However, should the unthinkable happen, training and exercises among Navy Region Hawaii and its partners in the local response community will ensure that the response will be timely, effective and well-coordinated. ⚓

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Developments of Interest— May through July 2011

THIS ARTICLE HIGHLIGHTS significant environmental regulatory changes and indicators suggesting future changes to the regulatory landscape.

Greening of federal procurement is pushing ahead with recent publication of several significant proposed and final rules and other developments. Highlights include:

- Federal Acquisition Regulations (FAR) requirements for sustainable acquisition with commitments to incorporate green procurement mandates into relevant contracts
- Proposed requirements for contractors to document their purchases of biobased products and supplies under federal contracts
- Department of Defense (DoD) policy making energy use a key consideration and requiring fully burdened lifecycle cost analysis of energy in the design and operation of weapons platforms
- A presidential directive emphasizing procurement of alternative fuel vehicles and use of alternative fuels
- New and expanded voluntary programs such as Energy Star that identify environmentally superior products

New green procurement items of interest since the last issue of *Currents* are as follows:

Federal Acquisition Regulation; Biobased Procurements— Proposed Rule (13 July 2011)

Would require prime contractors to report annually their biobased products procured under service and construction contracts.

<http://www.gpo.gov/fdsys/pkg/FR-2011-07-13/html/2011-17453.htm>

Easy Access

FOR EASY AND direct access to many of the web addresses included in this regulatory summary, select the “Digital Currents” link next to the “Regulatory Corner” link from *Currents*’ new home on the Internet—the Department of the Navy’s new Energy, Environment and Climate Change web site—at <http://greenfleet.dodlive.mil/currents-magazine>.

Additional Biobased Items Designated for Federal Procurement (22 July 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-07-22/html/2011-18478.htm>

Sustainable Acquisition, Federal Acquisition Regulation (31 May 2011)

Interim Rule implements Executive Orders 13514 and 13423. A ninety-five percent compliance goal has been established for contracts within the United States. The energy efficiency and environmental preferences apply only if the product in question meets agency requirements, is cost-competitive, and is available in a timely manner. Weapons systems are exempt from the requirements, and other agency exemptions are available.

<http://www.gpo.gov/fdsys/pkg/FR-2011-05-31/html/2011-12851.htm>

DoD Operational Energy Strategy (14 June 2011)

DoD components shall document actual and projected energy consumption in current and planned operations, analyze and report lessons learned, and apply to strategic and force planning, requirements, acquisition, and budgeting. DoD to incorporate energy considerations, including tools required by statute, such as the Fully Burdened Cost of Energy, in the requirements and acquisition processes for new vehicles, vessels, aircraft, weapons, and equipment.

<http://www.defense.gov/news/newsarticle.aspx?id=64318>

Federal Fleet Performance—Presidential Memorandum (24 May 2011)

The memo contains a number of vehicle and fleet efficiency, right-sizing and alternative fuel vehicle and fuel use mandates; electric and plug-in electric hybrid vehicles qualify as alternative fuel vehicles.

<http://www.whitehouse.gov/the-press-office/2011/05/24/presidential-memorandum-federal-fleet-performance>

Minimizing Use of Hexavalent Chromium (Defense FARS Case 2009-D004) (5 May 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-05-05/html/2011-10882.htm>

New Energy Star Initiative to Identify the Highest Energy Efficiency Products Within Energy Star Categories (14 July 2011)

<http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceac8525735900400c27/26e61b6a9a9d8c2d852578cd0057a2aa!OpenDocument>

Global Appliance Efficiency Award Competition for Televisions; Other Categories to Follow (23 June 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-06-23/html/2011-15693.htm>

Additional items of interest (May through July 2011) include the following:

Air

Stationary Compression Ignition & Spark Ignition Internal Combustion Engines—Standards of Performance (28 June 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-06-28/html/2011-15004.htm>

Plating and Polishing Area Source Facilities National Emission Standard for Hazardous Air Pollutants (20 June 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-06-20/html/2011-15274.htm>

Climate Change & Energy

American Society of Heating, Refrigerating and Air-Conditioning Engineers 50 Percent Advanced Energy Design Guide for Small to Medium Office Buildings (11 May 2011)

http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=530

Department of Energy, Energy Efficient Building Technology Database Under Consideration (26 May 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-05-26/html/2011-13096.htm>

General

Camp Lejeune Health Survey of Previous Active Duty Personnel Exposed to Contaminated Drinking Water (27 June 2011)

<http://www.atsdr.cdc.gov/sites/lejeune/>

Occupational Safety and Health Administration (OSHA)

Occupational Injury and Illness Recording and Reporting Requirements—Proposed Rule (22 June 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-06-22/html/2011-15277.htm>

OSHA Standards Improvement Project, Phase III—Final Rule (8 June 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-06-08/html/2011-13517.htm>

Occupational Exposure to Infectious Diseases—Meeting to Consider Rulemaking (5 July 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-07-05/html/2011-16742.htm>

Preventing Occupational Respiratory Disease from Dampness in Buildings—Notice and Request for Comment (18 May 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-05-18/html/2011-12166.htm>

Revisions to General Working Conditions in Shipyard Employment—Final Rule (2 May 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-05-02/html/2011-9567.htm>

Water

Stormwater Charges—DoD Legal Guidance on Payment of Reasonable Stormwater Charges (20 April 2011)

The relevant memorandums are posted at:

http://www.p2sustainabilitylibrary.mil/p2_documents/signed_memo_stormwater42011.pdf.

Toxic Substances

Petition Made to the U.S. Environmental Protection Agency to Prevent Navy Ship Disposal Under Sink Exercise (SINKEX) (12 July 2011)

http://www.ban.org/ban_news/2011/111205_environmental_groups_petition_epa_to_end_navy_ship_dumping_program.html

Underground Storage Tanks

Compatibility of Underground Storage Tank Systems with Biofuel Blends (5 July 2011)

<http://www.gpo.gov/fdsys/pkg/FR-2011-07-05/html/2011-16738.htm>

The Naval Facilities Engineering Service Center provides a free Weekly Federal Regulatory Summary that DoD personnel or contractors supporting DoD may receive by e-mail. To subscribe or unsubscribe, contact NFESCRRegulatorySupportDesk@navy.mil or 805-982-2640. [↕](#)

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SSC Pacific Farm Helps Restore Southern California Abalone Populations

U.S. Navy Supporting Conservation Efforts

SOUTHERN CALIFORNIA ABALONE populations have declined dramatically. The Endangered Species Act (ESA) designated the black abalone, *Haliotis cracherodii*, and the white abalone, *Haliotis sorenseni*, as endangered species. The National Marine Fisheries Services (NMFS) has also expressed concern that the green abalone, *Haliotis fulgens*, a species of concern (SOC), and various other species of southern California abalone are well on their way to be added to the list. But the U.S. Navy supports an ongoing southern California abalone conservation project in order to mitigate the southern California abalone population decline.

Background

In the 1990's, the Withering Foot Syndrome—a bacteria that causes abalone to atrophy and ultimately die—is one of the main reasons for the population decrease of the black abalone. Another factor leading to the increased mortality of southern California abalone is human impact—through poaching and coastal habitat destruction. This leads to stress on present coastal ecosystems which

southern California abalone inhabit. In light of the ESA, the Department of Defense (DoD) must act to alleviate the further decline of southern California abalone on U.S. Navy property. The Space and Naval Warfare Systems Center (SSC) Pacific Abalone Farm, located in Point Loma, San Diego, CA grows abalone solely for conservation and educational purposes.

David Lapota's passion and concern for the dwindling populations of southern California abalone drives the continued presence of the SSC Pacific Abalone Farm. Green and red abalone are cultured at SSC Pacific. Green abalone are the main focus of this effort, which acts to improve strategies to prevent green abalone from becoming listed as another endangered species. This includes spawning, settling, culturing, outplanting, and educational awareness strategies to aid in the restora-

tion of wild southern California abalone populations. The SSC Pacific Abalone Farm team believes by improving techniques for the green abalone, methods could be used for various restoration projects of other southern California abalone, such as black abalone, white abalone, and red abalone.

Taking Action

Spawning and culturing techniques of southern California abalone is crucial to reviving wild populations. Spawning is the act of female abalone releasing their eggs and male abalone releasing



Green abalone during spawning.



Red abalone cultured at the SSC Pacific Abalone Farm.

their sperm into the water, in hopes that the eggs will be fertilized. Culturing abalone must include increasing the settling and survival rate of newly hatched larvae within the laboratory. Increased numbers translate to more abalone for outplanting. During summer 2010, the SSC Pacific Abalone Farm experimented and modified spawning and culturing techniques in order to increase settlement of juvenile abalone with some success. They modified spawning techniques and culturing techniques by experimenting with an ultraviolet filtration system, antibiotics, and batch culturing. These techniques are crucial to restore southern California abalone populations—by increasing the population of cultured abalone, more abalone are available to outplant into wild populations.

In 2004, the SSC Pacific Abalone Farm and U.S. Navy divers outplanted 700 to 800 reproductive green

abalone off the coast of Point Loma, San Diego, CA. This area is in a Marine Protected Area, under the Marine Protection Act. Outplanting included placing reproductive, tagged green abalone into a suitable habitat to increase the reproductive success of wild populations. Outplanting is crucial to restoring populations of this SOC, for it increases the number of eggs to be fertilized and promotes genetic diversity of wild populations. Although the outplanting was successfully completed, a complete survey has yet to be conducted to determine the impacts of the successful outplanting.

The SSC Pacific Abalone Farm takes an added

interest in educational outreach regarding southern California abalone. Lapota has worked with various high schools around the United States. These high schools include Thomas Jefferson High School for Science and Technology, Alexandria, VA, High Tech High School, San Diego, CA, and Cesar Chavez High School, San Diego, CA. He provided students with the knowledge and materials to care for southern California abalone species, by helping



Tagged green abalone outplanted by U.S. Navy divers off Point Loma in 2004.



Red abalone.
David Lapota

students house red abalone in a classroom aquarium. He also helped perform research in the classroom with students. One research effort pertained to how diet affects the growth and coloration patterns of red abalone. The SSC Pacific Abalone team believes it is crucial to educate the community, especially the young generation, about southern California abalone conservation. In the future, students and the community would aim to minimize their human impact on the environment, and/or help support conservation efforts.

Future Plans

Future efforts for outplanting would include a thorough survey of the 2004 outplant, where U.S. Navy divers would visit each previous enclosure, and record the number of green abalone present. This number would be compared to the number of green abalone outplanted in 2004. The survey would also help improve conservation efforts of outplanting green abalone, and these improved outplanting methods would be used for outplanting other species (black abalone, white abalone, and red abalone). The SSC Pacific Abalone Farm will continue to perform future outplants to increase wild abalone stock.



A High Tech High School student feeding green abalone brood stock at the SSC Pacific Abalone Farm.

Black abalone is listed as endangered under the ESA, and SSC Pacific hopes to continue conservation efforts with this species. Because of this listing, it is necessary to include black abalone in the Navy's natural resources conservation program and ensure that DoD training, operations, and facility activities do not jeopardize the continued existence of the species. Factors affecting species growth and/or sustainability have been identified as key issues under the San Clemente Integrated Natural Resource Management Plan and the ESA. Both the black and white abalone are endangered species and found within the U.S. Navy's test ranges off southern California. Recent work on San Nicolas Island has tentatively identified black abalone populations which appear to be resistant to the Withering Foot Syndrome.

The future project would increase these populations out on the Channel Islands and coastal San Diego by providing methods to develop reproductive techniques for outplanting sufficient quantities of black abalone. Through appropriate conditioning of black abalone (diet, temperature regime), black abalone will be capable of successful spawning and rearing of larvae, for future outplanting activities. ⚓

Note: Melissa Blando, an SSC Pacific intern, made significant contributions to this article.

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Join Navy Leadership at the 2011 **NAVAL ENERGY FORUM**

Join the Secretary of the Navy, Chief of Naval Operations, and other Navy leaders at the 2011 Naval Energy Forum being held 13–14 October at the Ronald Reagan Center in Washington, D.C. This year's theme, *Creating Spartan Energy Warriors: Our Competitive Advantage*, emphasizes the importance of energy as a tactical advantage in the crucial pursuit of energy security and independence.

This forum will bring together the top leaders from the Department of the Navy, industry, and academia. Be there to hear the latest news from the subject matter experts themselves. Come visit the various displays and make new professional contacts. These are exciting times for those of us dealing with energy issues, and if that includes you, register today at www.ndia.org/meetings/2600/Pages/default.aspx.

DATE

13–14 October 2011

LOCATION

Ronald Reagan Building & International Trade Center
1300 Pennsylvania Ave. NW, Washington, DC 20004, 202-312-1300

METRO

The Federal Triangle Metro stop (orange and blue lines)
is connected to the Ronald Reagan Building by a covered passageway.

PARKING

Daily parking is available in an underground parking garage. Access is available via 13th Street (off Pennsylvania Avenue) and via two entrances on 14th Street from 5:00 am until 2:00 am.

AIRPORT

If traveling to the D.C. area, arrive at Ronald Reagan National Airport (DCA).

ATTIRE

Appropriate attire for the forum will be Navy Service Dress Blue or business attire for civilians.

CONTACTS

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