THE NAVY'S ENVIRONMENTAL MAGAZINE

Currents

winter 2011

from seed to supersonic

How Camelina Powered the Navy's Premier Fighter Jet

Navy Fuels *Great Green Fleet* Vision

Spotlight on the Natural Resources Defense Council

Navy Moves Forward on Compliance Strategy for Training & Testing at Sea

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Currents

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cover

On Earth Day 2010, for the first time ever, the F/A 18 E/F Green Hornet–the Navy's premier fighter jet–flew faster than the speed of sound on a 50/50 blend of camelina-based and petroleum-based fuel.

Courtesy of Sustainable Oils, Inc.

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How Camelina Powered the Navy's Premier Fighter Jet

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Currents (ISSN 1544-6603) is the official environmental magazine of the U.S. Navy, Chief of Naval Operations Energy and Environmental Readiness Division (N45). Participating Commands include the Naval Facilities Engineering Command (NAVFAC), the Naval Air Systems Command (NAVAIR), the Naval Sea Systems Command (NAVSEA) and the Naval Supply Systems Command (NAVSUP).

This magazine is an authorized publication for members of the Department of Defense. Statements made in the N45 Outlook column reflect the official environmental policy of the Navy. The contents in the remainder of the magazine are not necessarily the official views of, or endorsed by, the U.S. Government, the Department of Defense, or the United States Navy. Inclusion of any product or service in any *Currents* feature article does not constitute an endorsement by the Navy. The Navy encourages all readers to check with the appropriate supervising authority prior to using any product or service mentioned in the magazine.

Article submissions should be submitted through the appropriate Command representative or directly to *Currents*' Managing Editor, Bruce McCaffrey, using the *Currents* article template. Command representatives are Jill Lomeli (NAVFAC) at jill.lomeli@navy.mil, Bob Hicks (NAVAIR) at robert.hicks@navy.mil, Deborah Verderame (NAVSEA) at deborah.verderame@navy.mil and Chuck Curry (NAVSUP) at charles.j.curry@navy.mil.

A public affairs review must be completed before *Currents* management can consider an article for publication.

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Ensuring National & Natural Security

OVER THE PAST six months I have had the privilege of leading both the Navy Energy Program and the Navy Environmental Program. In the Energy Program, the Navy's goal is to enhance national security by reducing warfighter dependence on vulnerable fuel supplies while simultaneously ensuring we have available sustainable energy for the future. We have had many early successes. In the Environmental Program, the Navy is also a leader. By minimizing releases to air, land and water, and ensuring effective protection of sensitive places and threatened/endangered species in all Navy activities, we ensure security of another kind, natural security.

It is no accident that I draw a parallel between these two American values of national security and natural security. As a maritime nation, our way of life depends heavily on our Navy's ability to assure the free flow of commerce over the world's oceans and, where necessary, project power ashore anywhere in the world to protect our national security. As we look to the future, our quality of life is equally dependent upon how we preserve the natural resources vital to the nation, from water to air to flora and fauna, and how we find ways to mitigate threats like climate change.

Executive Director of the Natural Resources Defense Council (NRDC). NRDC has long been an influential voice in the national discussion of environmental, energy, and sustainability issues. I am sure *Currents* readers will find his comments most interesting.

Looking forward to the New Year, there will be no shortage of opportunities and challenges. We hope to complete Phase I environmental planning for 14 training ranges and operating areas at sea, while simultaneously developing the follow-on Phase II documents that will cover the period 2014 through 2020. Our environmental restoration (ER) and munitions response (MR) efforts will continue according to plan, with the goal of achieving remedy-in-place or remedy complete by 2014, for ER sites, and 2020 for the MR sites.

> The Navy's goal is to enhance national security by reducing warfighter dependence on vulnerable fuel supplies.

This is why we have chosen to pursue both security requirements through a future fleet of fuel-efficient ships and aircraft powered by sustainable, non-petroleum-based fuels made in America from renewable resources. The development of plant and algae-based fuels is rapidly making this national security future a reality for the U.S. Navy. In 2010 the Navy demonstrated that tactical aircraft and riverine command vessels can operate to full performance parameters using these "home-grown" biofuels, which account for far lower carbon emissions than petroleum-based fuels. As the Navy moves in the biofuel direction, our natural security is enhanced at the same time.

Part of the success of the Navy's Energy and Environmental Programs is due to strong collaboration with other federal agencies, industry, academia and non-governmental organizations (NGO). In this vein, I am happy to welcome to the pages of *Currents* Mr. Peter Lehner,

Through implementation of conservation and alternative fuel efforts ashore, we will progress toward achievement of a 34 percent reduction in Scope 1 and 2 greenhouse gas emissions by 2020. We will continue to collaborate with regulators, other agencies, industry, academia, and NGOs in carrying out a world class marine mammal research program with emphasis on understanding behavioral effects of anthropogenic sound on marine species. In partnership with federal and state regulators, the Navy will do its part to achieve a clean and vibrant Chesapeake Bay. We will face increasing fiscal challenges in all these efforts, as the federal government moves to address longstanding budgetary issues. More than ever we must work together to ensure that every dollar spent, and every man-hour devoted to an issue, returns good value to our ultimate objectives of national and natural security. ⚓

Rear Admiral Philip H. Cullom
Director, Energy and Environmental Readiness

NAVY EARTH DAY 2011: PARTNERING FOR A GREENER FUTURE

Navy Earth Day will take place this year on 22 April 2011. Navy and Marine Corps commands worldwide will participate in activities on and around that date to celebrate and educate people about the Earth-friendly projects we manage daily as we perform our national security mission. The 2011 theme, "Partnering for a Greener Future," highlights our collaborations with local communities, industry, government agencies and science institutions as we seek solutions for reducing our ecological footprint and optimizing energy use while increasing combat capability for the warfighter.

GET FREE PRESS

Tell *Currents* what activities your command is doing for Earth Day. We'll help you spread the word via our social media presence on Facebook (search for "U.S. Navy Currents Magazine" and "like" us) and Twitter (www.twitter.com/navycurrents). You can contact us on our social media sites, or reach Chris Dettmar via e-mail at chris_dettmar@urscorp.com or by phone at 703-418-3017.

GET FREE STUFF

If you need posters, factsheets, and other materials to hand out at your Earth Day event, send an e-mail to Chris Dettmar (contact information below). Let Chris know:

1. The type of event
2. The planned date(s)
3. How many people you expect, and
4. The mix of adults & children

In turn, Chris will send you a customized package of outreach materials to support your event.

SPREAD THE GOOD WORD

Whether it's a school visit, recycling contest, tree planting, beach cleanup, invasive species removal, or other creative team activity, Earth Day is a perfect opportunity to work with your community and showcase the ways in which the Navy and Marine Corps make the environment a priority.

TELL US ABOUT YOUR PLANS TO CELEBRATE!

Contact Chris Dettmar, URS Corporation
703-418-3017, chris_dettmar@urscorp.com

from seed

to supersonic

How Camelina Powered the Navy's Premier Fighter Jet

on 22 april,

Earth Day 2010, what appeared to be a routine flight of a Green Hornet—the F/A 18 E/F, the Navy's premier fighter jet—attracted hundreds of onlookers, including Secretary of the Navy Ray Mabus. This time, for the first time, the jet was powered with a 50/50 blend of biofuel and petroleum-based fuel. The flight, one of a series of test flights held in early 2010 at the Naval Air Station (NAS) in Patuxent River, MD (Pax River), marked the first time ever that an aircraft has flown faster than the speed of sound on a fuel mix that is 50 percent biomassed derived. And this is how it happened.

the basics about the Navy Fuels Team

THE NAVY FUELS TEAM IS part of the Naval Fuels and Lubricants Cross Function Team. The team is comprised of technical experts from across the Navy. Officially chartered in 1999, the team includes representation from the aviation, ship, logistics, research and operational communities. The Team's mission is to provide a single source of fuels-related technical expertise, guidance and solutions to all levels of the Navy.

The road to the series of test flights started back in 2008 when the Navy Fuels Team began to test small quantities of biofuels in its Pax River laboratory. Based on this testing, a procurement specification for the jet propulsion 5 (JP-5) biofuel was developed and the team was on the road to the testing of the F/A-18 fighter jet, also known as the Green Hornet. Secretary Mabus's announcement of the Navy's energy goals, designed to lessen the Navy's dependence on foreign oil, spurred the team on and they accelerated their efforts in October of 2009.

The Navy's Procurement Specification for a Biofuel

"The Navy Fuels Team has the job of taking the fuels that various manufacturers and refiners are producing and getting them approved," stated Rick Kamin of the Navy Fuels Team.

"We wrote a procurement specification that specified the performance properties for the biological component of the aviation fuel blend," he continued. The biomass component of the new fuel had to meet the following requirements:

1. It had to be a drop-in replacement for the petroleum-based fuel.
2. It must meet or exceed the performance requirements of the petroleum-based fuel. (There must be no notable operational differences.)
3. The biofuel must be able to be successfully mixed or alternated with petroleum fuel.
4. The biofuel must require no modifications or enhancements to the configuration of the aircraft or ship.
5. The biofuel must require no modifications or enhancements to the Navy's existing fuel storage or transfer infrastructure.

"Although, we were looking for a sustainable plant—and/or algae-derived oil—that was not competitive with food crops, we did not specify that it needed to be a camelina-based fuel," explained Kamin. But camelina seemed to be a logical choice.

Kamin sent the procurement specification for JP-5 jet fuel to the Defense Logistics Agency (DLA) Energy (formally known as the Defense Energy Support Center), which has the responsibility of purchasing fuel for the Department of Defense (DoD). (For more information about DLA Energy, see our sidebar entitled, "The Basics About the Defense Logistics Agency Energy.") An open solicitation

was put forth to the energy industry to develop and produce a suitable fuel, and in 2009, a contract for almost 600,000 gallons of biofuel (190,000 gallons for the Navy and 400,000 gallons for the Air Force) was awarded to Sustainable Oils, Inc.

Because the procurement specification stipulated that the biological component of the blend must not compete with food crops, traditional materials or "feedstocks" such as corn or soy were not appropriate. Because it is a dedicated energy feedstock, camelina met the requirement.

This Thing Called Camelina

The oils that come from crushing the camelina (*Camelina sativa*) seed (a type of mustard plant) are structurally more similar to petroleum than other bio-based products. Used by the ancient Romans as lamp oil, camelina oil was produced in Europe and Asia throughout the 19th century for a variety of mostly industrial applications. After World War II, however, the crop fell out of favor and has since been largely regarded as a minor non-food crop in Europe and a weed in North America.

Camelina moved to the forefront of the renewable fuels scene only two years ago. Its advantages include the fact that it is best grown in rotation with dryland wheat during the part of the cycle where the land would otherwise lie fallow (uncultivated). As a result, camelina does not compete with

Camelina sativa.

USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. *Charles Scribner's Sons, New York. Vol. 2: 157. Courtesy of Kentucky Native Plant Society.*

An F/A-18 Super Hornet strike fighter, dubbed the "Green Hornet," conducts a supersonic test flight. The aircraft is fueled with a 50/50 blend of biofuel and conventional fuel. The test, conducted at NAS Patuxent River, drew hundreds of onlookers, including Secretary of the Navy Ray Mabus, who has made research, development, and increased use of alternative fuels a priority for the Department of the Navy.

Liz Goettee

the basics about the Defense Logistics Agency Energy

WITH HEADQUARTERS IN FORT BELVOIR, VA, DLA Energy exercises procurement and sales responsibility for crude oil for the Department of Energy's Strategic Petroleum Reserve, a program used to store crude oil as a buffer against potential national energy emergencies.

DLA Energy's mission is to provide DoD and other government agencies with comprehensive energy support in the most effective and economical manner possible. DLA Energy directs the DoD organization responsible for purchasing and managing all petroleum resources used by the U.S. military. In addition, DLA Energy guides the growing mission of total energy support by developing strategies to buy and sell deregulated electricity and natural gas to DoD and other federal agency customers. DLA Energy also directly supports DoD's initiative to privatize the military base infrastructure that distributes those utilities (in addition to lighting, heating, air conditioning and water/wastewater systems).

Camelina seeds.
Courtesy of Sustainable Oils, Inc.

RIGHT: Camelina (early stage shown here) requires less fertilizer and herbicides than traditional crops, is an excellent rotation crop with wheat, and can also grow on marginal land.
Courtesy of Sustainable Oils, Inc.

food crops, and requires little irrigation. It has even been shown to enhance the yield of subsequent crops by up to 15 percent. In addition, the oil it produces is more cold-tolerant than other biofuel feedstocks. (Note: For more information about camelina, see the Energy Daily web site at www.energydaily.com/reports/Camelina_Biodiesel_A_Reality_999.html.)

In the words of John Williams, spokesman for Sustainable Oils, "Camelina is the world's first dedicated energy feedstock."

Turning Mustard Seed into Jet Fuel

Early on, Sustainable Oils recognized the potential that camelina oil had as a feedstock for biofuel. The company, a joint venture between Seattle-based Targeted Growth (a biosciences company) and Houston-based Green Earth Fuels (a biodiesel production facility), researched and pioneered the seed's use for producing biodiesel.

As scientists and engineers from Targeted Growth were trying to figure out ways to increase the yield of crops that were used for both food and fuel (crops such as corn and soy), a team of their researchers decided to look at the problem in reverse. According to John Williams, Targeted Growth's researchers realized, "There's no doubt that agriculture and biology can play a role here. But we've been looking at this the wrong way. Instead of looking at what we're already growing, we should be looking at the desired end product and figure out what we should be growing."

Camelina is the world's first dedicated energy feedstock.
John Williams

Camelina seeds typically contain more than 35 percent oil and are high in omega three fatty acids. This makes the energy crop a good fit for jet fuel (as well as biodiesel), but the meal is also a valuable co-product as a good option for livestock feed.
Courtesy of Sustainable Oils, Inc.

Targeted Growth's scientists looked at a variety of different raw materials for feedstocks for producing biofuel including switchgrass, sorghum, different types of corn, and camelina. They settled on camelina because it doesn't compete with food crops and it is easy to cultivate (with existing equipment) as well as other factors. "We joke that camelina is the meaner, older brother of canola," says Williams. "Camelina oil is very high in omega three fatty acids. But for all its productive qualities, it doesn't taste very good. That's why it's never entered the agricultural mainstream." The "meal" from camelina, however, can be cycled back into the food chain as a feed for livestock and poultry once the oil is extracted.

Because camelina fits so well into crop rotation, "It offers farmers a way to make some money during a time when they would leave their land fallow or planted with a cover crop that doesn't generate significant revenue," stated Williams.

Navy & Other Federal Agency *energy goals*

THERE HAS BEEN NO SHORTAGE of new federal energy policy in recent years. The Energy Policy Act of 2005, The Energy Independence and Security Act of 2007, Executive Order 13423, renewable energy provisions in the National Defense Authorization Act of 2007 and the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding all contributed substantial new requirements. The policies invoke wide-ranging and aggressive energy and water initiatives, such as:

- Reducing installation energy consumption per square foot 30 percent by 2015 relative to 2003.
- Reducing installation water consumption per square foot 16 percent by 2015 relative to 2007.
- Requiring Leadership in Energy and Environmental Design Silver or higher certification for new facilities.
- Constructing new facilities 30 percent more energy efficient than American Society of Heating, Refrigerating and Air-Conditioning Engineers standards.
- Reducing fossil fuel use in new and renovated buildings by 55 percent by 2010 and 100 percent by 2030.
- Metering all facilities with advanced time-of-use electrical meters.
- Purchasing Energy Star or Federal Energy Management Program-designated equipment—written justification required to deviate.
- Generating/Procuring renewable energy equal to 25 percent of electrical energy consumed by 2025.

At the October 2009 Navy Energy Forum, Secretary Mabus announced the following 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.

Farmers harvest a field of camelina on the northern Great Plains near Great Falls, Montana.
Courtesy of Sustainable Oils, Inc.

Targeted Growth proceeded to research the seed, conducting non-genetic breeding techniques to produce an "elite" camelina seed—one that produces more oil per acre, requires less fertilizer, and performs better under extreme temperature variations than the original seed. The "elite" seed was introduced to Montana in 2007.

Since Targeted Growth was not in the business of producing biofuels, they realized that they needed to establish a second company to take the "elite" camelina seed that they had engineered and get it into production. For this task, the company joined with Green Earth Fuels to form Sustainable Oils as the marketing arm for the new seed.

Producing Camelina Oil

Camelina seeds are crushed using existing equipment and technology, and are converted through the same refinery process used for soybean and canola oils. Called transesterification, this process combines natural feedstocks such as vegetable oils or animal fats with a short chain alcohol in the presence of a catalyst.

Targeted Growth's original intended purpose for the camelina oil was for use in vehicle diesel engines but not jet engines. To re-purpose the oil, they turned to Honeywell's UOP for the knowledge and technologies necessary to process oils into jet fuels.

The Honeywell/UOP Connection

UOP, LLC—a Honeywell company—develops and licenses processing technologies to the refining, gas processing, and petrochemical production industries.

UOP had already established a track record in the biofuel industry. Its green division, formed in 2006, worked with European energy company Eni, to develop a process to convert vegetable oils and waste into a green diesel fuel.

Working with the camelina oil provided by Sustainable Oils, animal fats from Cargill, and algae from Solazyme

Camelina oil is very high in omega three fatty acids.

John Williams

This particular F/A18F, commanded by Lieutenant Commander Tom Weaver, successfully tested a 50/50 blend of camelina-based and petroleum-based fuel on Earth Day 2010.

(among others), UOP engineers designed a process that utilizes traditional refinery hydroprocessing technology—a process that could easily be adopted by American refineries using existing equipment.

Refining the Oil

The refining process for camelina and other plant-based oils works as follows:

First, the oils are cleaned to remove impurities using standard oil cleaning procedures. The oils are then converted to the shorter chain diesel-range paraffins (chemical compounds that consist of hydrocarbon and hydrogen) using UOP's Green Jet Fuel Production Process. This hydroprocessing process (called Deoxygenation) converts natural oils by removing oxygen molecules from the oil and converting any olefins to paraffins by reaction with hydrogen. The removal of the oxygen atoms raises the heat of combustion of the fuel and the removal of the olefins increases the thermal and oxidative stability of the fuel. A second reaction, called Selective Hydrocracking, then isomerizes and cracks the diesel range paraffins, breaking them down into smaller paraffins with carbon numbers in the jet range. The third and final Product Separation phase separates the products of the hydrocracking process into end products—light fuels, green jet fuels and green diesel.

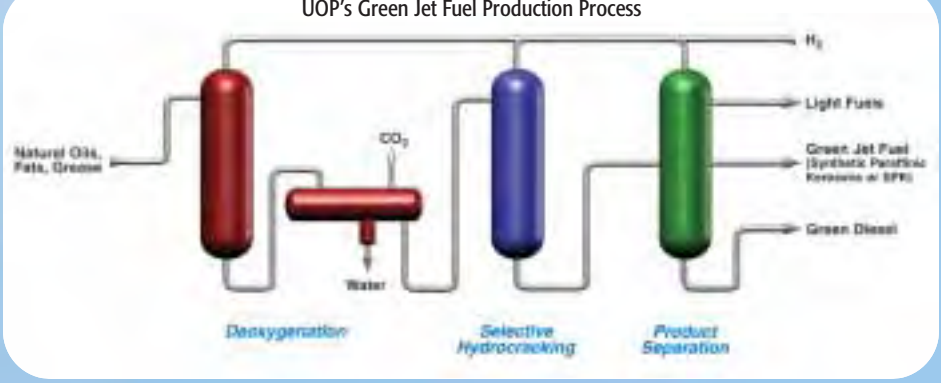
The end product is a synthetic paraffinic kerosene fuel that contains the same types of molecules that are typically found in conventional petroleum-based jet fuel.

"Green jet fuel is able to address several requirements," said Jim Rekoske, Vice President & General Manager of Renewable Energy & Chemicals for Honeywell's UOP. "First, the fuel had to meet the Navy's flight specifications. Secondly, the fuel could not require any changes to the engine or airframe. Finally, the formula had to be generated from a sustainable, non-food feedstock."

The new fuel succeeds on all three fronts:

1. It meets and in some cases exceeds the Navy's procurement specification.
2. The 50/50 blend (renewable product to petroleum) provides the necessary aromatics required in today's jet engines.

UOP's Green Jet Fuel Production Process



3. The process can be utilized to convert a wide range of non-food feedstocks including camelina, jatropha and algae.

"The camelina used for the Navy flight is only one feedstock option," says Rekoske. "It's available in the U.S. now, but oils extracted from various other sources such as algae and jatropha [a plant that grows well in tropical climates] can also be used as feedstock for biofuel production. The process is feedstock-agnostic, meaning that producers can select the ideal feedstock depending on their location, availability or cost."

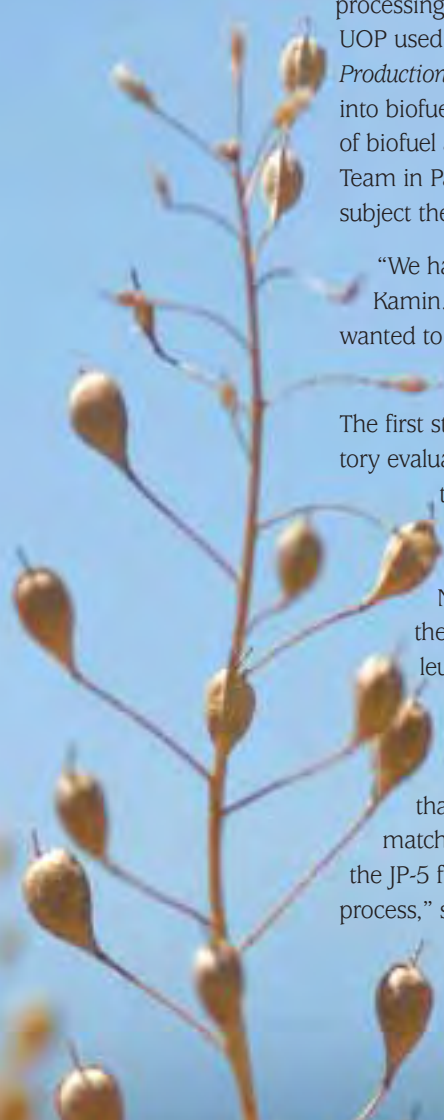
Rekoske also stated that although the initial formula requires 50 percent petroleum-based fuel, there is a possibility of a 100 percent sustainable biofuel in the future—technology could be available as soon as 2014.

The Testing Begins

Per the biofuel procurement specification developed by the Navy Fuels Team, Sustainable Oils produced the necessary amount of camelina oil and shipped it to UOP's seed processing plant in Bayport, TX. In turn, UOP used their patented *Green Jet Fuel Production Process* to refine the camelina oil into biofuel. UOP produced 40,000 gallons of biofuel and delivered it to the Navy Fuels Team in Pax River. Then, it was time to subject the biofuel to rigorous testing.

"We had a very ambitious timeline," said Kamin. "From the receipt of the fuel, we wanted to complete testing in the Green Hornet in less than six months."

The first step was to conduct a full laboratory evaluation to compare the biofuel with the performance parameters outlined in the procurement specification. Navy chemists blended the biofuel with the petroleum-based JP-5, then initiated a series of chemistry and property analysis tests to validate that the blended fuel matched the performance of the JP-5 fuel. "This is a two-part process," stated Kamin, "First you need to conduct 'performance to specification' tests and then 'fit for purpose' tests."



The 'fit for purpose' properties testing involved 20 to 30 different tests that analyzed properties and chemistries that are outside the limits of the specification. "These 'fit for purpose' tests are critical since all of the Navy's systems have been designed around petroleum," Kamin explained. "There are a number of properties that are inherent to petroleum-based fuels for which we don't regularly test during procurement. It is those properties, not explicitly referenced in our biofuel procurement specification, that we needed to test under the 'fit for purpose' mantle. These tests would cover the entire range of purposes for which the fuel may reasonably be used and provide the fuels chemists and engineers with the confidence that the fuels will perform as expected when used in subsequent component and system tests."

"We wanted to make sure that the biofuel had the same properties that we have come to expect of petroleum-based fuels," Kamin continued. "For example, the dielectric constant of the biofuel is important for the purposes of tank gauging". The F-18 uses a capacitance gauging system

There is a possibility of a 100 percent sustainable biofuel in the future—technology could be available as soon as 2014.

Jim Rekoske

Liz Goettee

which is calibrated for the dielectric properties of petroleum-based jet fuels. If the dielectric constant of the biofuel is not the same as petroleum-based jet fuel, the F/A-18's tank gauging systems will provide incorrect fuel quantity readings to the pilot.

After laboratory tests were completed, testing of individual components and the jet's engine began. At this stage, the Navy team expanded to include engine experts, fuel control experts and combustion experts among others. "As you move away from the laboratory and closer to the aircraft, the composition and size of your team expands," said Kamin. Two component tests and one of the two engine tests were performed at General Electric—the manufacturer of the F/A-18's F414 engine.

"We conducted a 500-hour test of the fuel control unit to see if the biofuel had any impact on any of the materials contained in the unit," said Kamin. "This unit is a complex series of valves and orifices that meter and control the flow of fuel to the engine. This system ensures that the right amount of fuel is sent to the engine based on the throttle settings set by the pilot," he explained.

The other component that was tested was the combuster. This is where the

The Green Hornet's *green initiatives*

AS THE PREMIERE TACTICAL AIRCRAFT of the U.S. Navy, the F/A-18 Green Hornet is the focal point of various energy and environmental initiatives. For years, the team has focused on reducing or eliminating hazardous materials, identifying material reduction and recycling opportunities, and identifying and addressing environmental health and safety concerns.

New technologies are at work to make the F414 engine more efficient. Testing of some engine efficiency upgrades (an advanced aerodynamic compressor and high pressure turbine, ceramic matrix composite turbine blades, and performance seeking engine controls) was conducted in November 2010. Air emission and fuel consumption reductions are the goal of the trapped vortex combustor technology. This technology initiative supported by PMA265 has demonstrated reductions in greenhouse gases (carbon monoxide, nitrogen oxides [42 percent reduction], and unburned hydrocarbons [17 percent reduction]) with no loss in engine performance. Other efforts to reduce energy consumption include minimized hot pit refueling at NAS Lemoore and Fallon, and enhanced simulation capabilities. Mike Rudy estimated, "The Green Hornet's carbon footprint will be reduced from all of these energy initiatives. We expect fuel consumption reduction by 27 million gallons per year and greenhouse gas emission reductions by 300,000 metric tons annually." The use of the camelina biofuel reduces conventional aviation fuel use by 50 percent and reduces carbon emissions by 80 percent on a lifecycle basis.

For more insights into the Green Hornet's other green initiatives, see our cover story entitled "Green Hornet Team Achieves Environmental Breakthroughs: Program Office Implements Green Technologies Without Compromising Aircraft Performance" from the spring 2007 issue of *Currents*. To subscribe to the magazine or browse the *Currents* archives, visit the Naval Air Systems Command's environmental web site at www.enviro-navair.navy.mil/currents.

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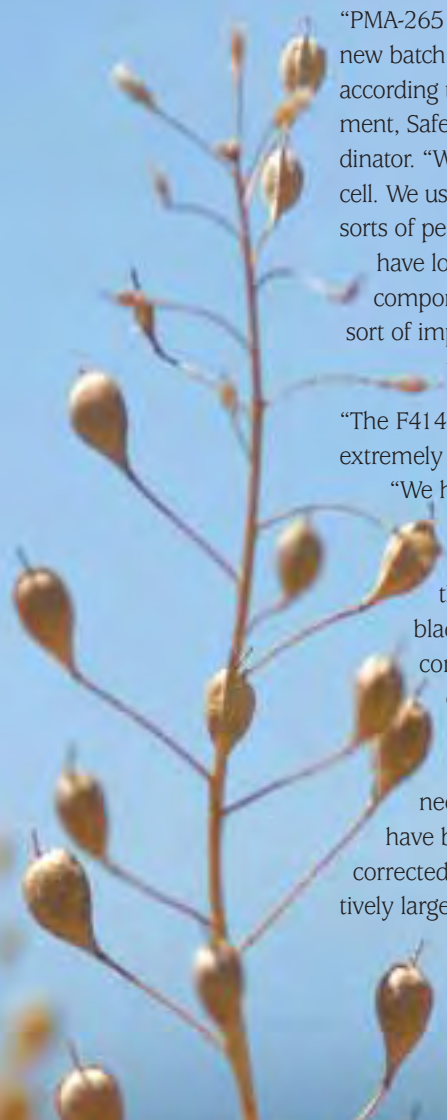
fuel is atomized and burned providing the energy to propel the aircraft.

The component and engine tests confirmed the initial results from the laboratory tests. The components and engines didn't "know" the difference between the petroleum- and bio-based fuels. "The performance of the bio-based fuel was well within the tolerance that was expected. Everything operated exactly as we expected," said Kamin.

A flight clearance package was prepared that summarized all of the technical data that was collected during laboratory, component and engine testing. The performance monitors need to be confident based on the results of the testing and data contained in the flight clearance package, that the aircraft won't be exposed to any undue risk.

Once flight clearance was obtained, the effort was turned over to the VX-23 squadron and the Naval Air Systems Command's Flight Test Team who were responsible for conducting the flight test.

Why the Green Hornet Program?



"PMA-265 was a logical program to test this new batch of camelina-based biofuel," according to Mike Rudy, PMA265's Environment, Safety and Occupational Health Coordinator. "We have our own jet engine test cell. We use it to run our engines through all sorts of performance parameters. We also have lot of experience studying the components of the engine to see what sort of impact there might have been during the course of the tests," said Rudy.

"The F414 series engine is also known to be extremely reliable," explained Rudy. "We have a large database of tests on this engine, including things like the rotors, the turbine blades and the combustor—those components have been analyzed and reworked where necessary. Any problems have been analyzed then corrected. We also have a relatively large number of test

aircraft here at Pax River. And our Green Hornet team is located here at Pax River and has a recognized environmental track record. So it made perfect sense for us to test the camelina-based biofuel."

The Earth Day demonstration flight at Pax River on 22 April 2010 was one of 16 test flights conducted on the F/A-18E/F that demonstrated the performance of the biofuel blend over the entire aircraft flight envelope. The event drew hundreds of onlookers, including Secretary Mabus, who observed the flight from a Project Engineering Station at the air station's Atlantic Test Range. After the jet landed, he met the pilot, Lieutenant Commander Tom Weaver, of Billerica, MA.

"The aircraft flew exactly as we expected—no surprises," said Weaver, in a Navy announcement. "The fuel works so well, all I needed to do was fly the plane."

"We observed no operational difference with the biofuel," confirmed Mike Rudy. "It accelerated properly, it decelerated properly. There were no flame-outs. All functional checks were nominal [normal]."

> Our Navy, alongside industry, the other services and federal agency partners, will continue to be an early adopter of alternative energy sources.
>
> *Secretary Ray Mabus*

Courtesy of Sustainable Oils, Inc.

"The alternative fuels test program is a significant milestone in the certification and ultimate operational use of biofuels by the Navy and Marine Corps," remarked Secretary Mabus. "It's important to emphasize the Navy's commitment to reducing dependence on foreign oil as well as safeguarding our environment. Our Navy, alongside industry, the other services and federal agency partners, will continue to be an early adopter of alternative energy sources."

The flight test report is currently in final review so it would be premature to quote results. However, all the data analyzed to date have shown that the 50/50 biofuel JP-5 blend operated no differently in the aircraft than 100 percent petroleum-based JP-5.

The Future

The program's goal is to incorporate the 50/50 blend into the Navy's JP-5 aviation specification by early 2012. Planning is already underway to expand testing to a number of other Navy and Marine Corps tactical systems. MH-60 Seahawk helicopter testing was conducted in November 2010 with tests on the V-22 Osprey tiltrotor aircraft and other systems in the works for 2011.

"The plan is to qualify JP-5 for all programs," states Rudy. "These programs will be qualified to use the 50/50 blend and will eventually move to 100 percent biofuel when it becomes available," Rudy continued.

Energy & Environmental Benefits

Though the impetus for the development of the new biofuel was to lessen the Navy's dependence on foreign oil, the new fuel has environmental benefits as well.

"Camelina fuel has been demonstrated to reduce carbon emissions by 80 percent," stated John Williams. These emission reductions will be realized over the long run, due to the fact that biomass sources absorb carbon dioxide while growing and can have higher energy content than fossil-based fuel. The use of use biomass sources as aviation biofuel could potentially save millions of tons of aviation greenhouse gas emissions.

The Big Picture

Now that camelina and other sources have been successfully tested in the F/A-18 as well as other commercial and military aircraft, the industry has a challenge to produce enough renewable fuel to support the eventual demand for the 50/50 blend.

"Camelina is the first of the biofuel stepping stones," says Rudy. "It is scalable today and has been proven. In the future, other feedstocks, such as algae, will complement production to efficient levels. "

At the present time, there is no commercial scale production infrastructure in place. All the fuel procured for testing to date was produced in pilot scale operations, which, as in all new technology, resulted in higher costs. Currently the Department of Energy, Department of Agriculture, Defense Advanced Research Projects Agency, and industry are aggressively working to commercialize the technology and drive the economies of scale to enable these fuels of the future to be produced in quantities sufficient to make them competitive with petroleum.

Even more so than camelina, algae can be grown in the most hostile of regions such as deserts, so it doesn't infringe on land set aside for food crops. It doesn't require fresh water to flourish, and can thrive in salt water or even wastewater.

The Navy's Vision

"The Navy has always led in energy change," Mabus said, noting that it switched from sails to coal-fired power in the 1850s, from coal to oil in the early 1900s and from oil to nuclear in some vessels in the 1950s. "Every single time we did that, there were people who said we were taking proven technology and trading it for an unproven one, and (putting the operations at risk). Every single time they were wrong." (Source: The Billings Gazette web site at www.billingsgazette.com/news/state-and-regional/montana/article_c32a96a2-4cce-11df-ab60-001cc4c03286.html. Used with permission.) ⚓

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Navy Fuels *Great Green Fleet* Vision

Latest Milestone on the Road to Energy Security

ON 22 OCTOBER 2010, in the waters off Naval Station Norfolk, the Navy reached another milestone on the road toward energy security. Conducting a full power demonstration of an alternative fuel-powered riverine boat, the Riverine Command Boat - Experimental (RCB-X) ran on a 50/50 blend of algae biofuel and petroleum, achieving a top speed of 44.5 knots (about 52 miles per hour). The demonstration marked an important step toward meeting Secretary of the Navy Ray Mabus' goal of fueling half the Navy's energy consumption through alternative fuels by 2020.

"Running the RCB-X at its maximum power throughout this test of a 2nd generation marine biofuel was a Wright Brothers moment for the Navy," stated Rear Admiral Philip Cullom, director of the Energy and Environmental Readiness Division on the Chief of Naval Operations staff, which leads the Navy's Task Force Energy.[1] It was the first time a naval surface vessel from any nation has ever been driven at full power on biofuel, let alone one derived from algae.

The successful RCB-X demonstration came almost one year to the day after Mabus laid out his energy goals for the Navy and Marine Corps. The Naval Sea Systems Command's advanced fuels program office is leading the testing and demonstration program in coordination with the Task Force Energy Maritime Working Group. The riverine demonstration is just one of a series of progressively larger scale tests and evaluations scheduled through 2012. These exhibitions will culminate in 2012 with a Green Strike Group of U.S. Navy ships and aircraft operating locally and in 2016, with deployment of a Great Green Fleet of ships and tactical aircraft, all powered by alternative fuels.

The demonstration marked an important step toward meeting Secretary of the Navy Ray Mabus' goal of fueling half the Navy's energy consumption through alternative fuels by 2020.

The Great Green Fleet

The *Great Green Fleet* is of course a takeoff from the *Great White Fleet*, a group of naval vessels that sailed around the world between 1907 and 1909. The purpose of the *Great White Fleet's* "world tour" was principally to showcase the Navy's capabilities and U. S. seapower, though coincidentally, like the *Great Green Fleet*, it was meant to provide an operational evaluation of innovative energy efficiencies. *The Great Green Fleet* will experiment with hybrid electric drive and other energy saving technologies, but the main purpose behind this journey will be to demonstrate the Navy's commitment to achieving energy security, enhancing combat capability, and reducing greenhouse gases.

"Going green is about combat capability and assuring the Navy's mobility," said Cullom. "By having reliable and abundant alternate sources of energy, we will no longer be held hostage by any one source of energy, such as petroleum."[2]

Tom Hicks, Deputy Assistant Secretary to the Navy (Energy), agrees.

On 22 October 2010, the Navy conducted a full power demonstration of this alternative fuel-powered RCB-X running on a blend of 50 percent algae-based and 50 percent petroleum-based fuel, achieving a speed topping 44 knots (about 52 miles per hour).

"Alternative fuels really give the Navy a chance to divest a bit from petroleum to provide some increased insulation from a pretty volatile petroleum market."[3]

Why Algae?

Algae are attracting attention as a fuel source because the strains can potentially produce at least ten times more fuel per acre than the corn used to make ethanol or the soybeans used to make biodiesel. Moreover, algae can be grown on virtually any type of land, using brackish water, meaning that fuel production would not compete with food production.[4] Another advantage of biofuels is that fuels made from biomass burn cleaner than fossil fuels and require no drilling to acquire, which means fewer greenhouse gas emissions throughout the fuel's lifecycle. According to Solazyme, the company from which the Navy acquired its algae-based oil, this type of fuel results in up to 85 percent less greenhouse gas emissions than fossil fuels.

Solazyme is one of several companies working to engineer the "perfect" strain of algae for biofuel production. Jonathan Wolfson, the company's Chief Executive Officer and co-founder says, "Our unique microbial conversion technology process allows algae to produce oil in standard industrial fermentation facilities quickly, efficiently and at commercial scale."[5]

Presently, the company grows algae in tanks inside a Pennsylvania warehouse. Fed by sugar beets, switch grass or a host of other plants, the algae is cut and dried into pebbles that resemble couscous. It is then shipped to Iowa, where the oil is extracted. After the oil is extracted it is sent to refineries in Texas, where it is blended with traditional diesel.

In September 2010, the U.S. Navy ordered more than 150,000 gallons of ship and jet fuel from Solazyme. The company received a $21.8 million grant from the U.S. Department of Energy in 2009 to build a new refinery in Riverside, Pennsylvania, to help push production to commercial levels.

Don't Call it Biodiesel

The algae-based fuel used by the Navy is known as hydro-processed renewable diesel (HR-D). Unlike biodiesel, HR-D does not include water; which is incompatible with shipboard fuel systems. HR-D is a drop-in

Rear Admiral Philip Cullom shows off a container of the algae-petroleum fuel blend.

replacement for traditional fuel, meaning that the fuel system's integrity is not compromised, and there are no performance or maintenance issues. The RCB-X demonstration provided further evidence of this. "The boat's performance was indistinguishable from what it would have been using standard diesel fuel," said Cullom.[4]

The RCB-X is a 49-foot boat which the Navy one day hopes to use for patrols in rivers and bays. Cullom said it was an ideal place for the team to begin alternative fuels testing. "It's always best, of course, when you're doing testing like this to start small. We'll be able to extrapolate the performance that we see here into the next series of tests," he said.[1]

What About Cost?

Because the market is still in its infancy, the fuel is not yet cost-competitive with petroleum. Initial supplies of the experimental renewable diesel fuel cost around $400 per gallon, but with time, that price has dropped to around $60 per barrel, according to Cullom.[1]

Tom Hicks explains some of the reasons for the high cost. "The quantities we are buying today, there's research and development that is factored into that—there's a lot of testing and certification that we are buying, and these are very small batches. As the Navy, we purchase roughly 32 million barrels of fuel per year, so that's 1.2 or 1.3 billion gallons of fuel. The quantities you are talking about here are pretty small—20,000, 50,000, 100,000 gallons of experimental biodiesel fuel, which is pretty small relative to that. To an extent, you pay for that lack of economy of scale at this point."[3]

Cullom feels that the Navy initiative, by increasing demand for such products, will help drive prices down over time.

What's Next?

The Navy isn't the only branch of the military testing alternative fuels. The Air Force has tested a biofuel blend in its C-17 Globemaster III cargo plane.

Cullom said that with the successful test of the RCB-X on biodiesel under their wing, the Navy will expand the test to larger ships of the fleet. But first, the Navy's Task Force Energy is turning its attention to testing the use of biofuels in one of its workhorse aircraft—the Sikorsky MH-60 Seahawk helicopter.

"Our goal, as a Navy, is to be an early adopter of new technologies that enhance national security in an environmentally sustainable way," said Cullom.[6]

For more insights into the Navy's demonstration of alternative fuels, see our cover story entitled "From Seed to Supersonic: How Camelina Powered the Navy's Premier Fighter Jet" in this issue of *Currents*. ⚓

[1] *Navy on Course to Meeting Energy Conservation on Ships—Interview by Max Cacas Reporter, Federal News Radio.*

[2] *Great Green Fleet—Navy News Service.*

[3] *The U.S. Navy and Biofuels—by Robert Rapier, Consumer Energy Report.*

[4] *New York Times, 26 July 2010.*

[5] *Navy Taps Solazyme for Bioengineered Algae Fuel by Jason Dearen, Associated Press and Navy Unveils Its 'Mean, Green Riverine Machine' In Norfolk by Bill Sizemore, Norfolk Virginian-Pilot.*

[6] *Navy to Fuel Half Its Vessels Alternatively By 2020 by Natalia Real, Fish Information and Services, 26 October 2010.*

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2011 Calendar Celebrates the Best of

Currents

If you think environmental work is just about birds and bunnies, think again. The *Currents* 2011 calendar reveals the depth and breadth of the Navy's environmental efforts—from finding new sources of fuel to fueling your competitive spirit via the Chief of Naval Operations (CNO) environmental awards. Ensuring mission readiness while protecting our environment takes research, engineering, hand-on work and community building. Some of the highlights include:

January: CNO Awards Recognize Exceptional Stewardship

March: New Protocol Helps Evaluate Risks to Frogs, Toads & Salamanders

August: Navy Region Northwest Partnering to Restore Habitats & Species

October: Biofuel Powers the Navy's Premier Fighter Jet

November: Navy Environmental Sustainability Development to Integration Program Demonstrates Technologies to Enhance Operational Readiness

As the Navy's official environmental magazine, *Currents* has the privilege to share the many ways the Navy's environmental personnel and Sailors work to find and implement the best techniques to achieve their goals. *Currents* provides a forum in which all of you can share your knowledge and successes with your colleagues.

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Thanks for all of your great work and we look forward to seeing more from you in the pages of *Currents*!

Peter Lehner once climbed the Cordillera Blanca (the White Range) in Peru. Climate change models show that the Andes mountains are experiencing one of the fastest rates of change.

Executive Director Peter Lehner Identifies Priorities & Future Opportunities for Collaboration with the Navy

ON 9 AUGUST 2010, Ken Hess from the public affairs staff at the Chief of Naval Operations Energy and Environmental Readiness Division (N45) and Bruce McCaffrey, managing editor of *Currents* magazine, traveled to New York City and interviewed Peter Lehner, executive director of the Natural Resources Defense Council (NRDC) as one in a series of *Currents* interviews with representatives from environmental non-governmental organizations. Mr. Lehner (pronounced LAY-ner) spoke about NRDC's top priorities, past interactions with the Navy and Department of Defense (DoD), and opportunities for future collaborations between NRDC and the Navy.

CURRENTS: Thanks for taking the time to speak with us today. Let's start with a discussion of your role at NRDC.

PETER LEHNER: In my role as Executive Director of NRDC, I manage more than 350 dedicated environmental advocates in seven offices and guide all of NRDC's policy positions and advocacy strategies.

NRDC is working to safeguard the planet and the plants, animals, people, and systems on which all life depends.

Matt Greenslade/ photo-nyc.com

Since I assumed this role in 2006, we have strengthened and rededicated our resources towards curbing global warming, building a clean energy future for America, reviving the world's oceans, saving endangered wild spaces and lands, stemming the tide of toxic chemicals, and accelerating the greening of China.

CURRENTS: What is the primary mission of the NRDC?

LEHNER: NRDC is working to safeguard the planet and the plants, animals, people, and systems on which all life depends. It is the connectedness of all of these systems that is so often forgotten that we are frequently focusing on. Right now our big priorities are clean energy and climate change.

NRDC is 40 years old this year. We are one of the country's oldest, most influential environmental organizations with 1.3 million members and

offices around this country and in China. We have members in every state and virtually every county.

We work through scientific and economic analysis, litigation, lobbying, and a lot of public education, mobilization and partnerships with companies and governments big and small including a number of partnerships with DoD.

CURRENTS: What are the primary challenges that NRDC is facing right now?

LEHNER: The biggest challenges we face right now are climate change and our energy system. NRDC is pushing very hard to move to a clean energy system that doesn't pollute our air and water, doesn't leave us at a trade deficit or a competitive jobs deficit, or endanger national security. We think that a clean energy future is possible, will provide jobs, will provide greater security and really is clean.

The oceans are acidifying, and a vast majority of the world's fisheries are overfished or exploited.

Another one of our big priorities is our *Reviving the Oceans* campaign. The oceans are acidifying, and a vast majority of the world's fisheries are overfished or exploited. So we're trying very hard to revive the oceans by advocating for the establishment of marine protected areas particularly off the coast of California.

The oceans are governed by about 120 different laws and administered by about 20 different agencies. This means that there isn't much of a coordinated presence, protection or plan for the oceans. We pushed very hard for and were delighted with the National Oceans Policy that President Obama recently released.

One of our biggest challenges is the fact that much of what we are tackling now is invisible. Climate change—you can't see it. It's not like the Cayahoga River catching fire. Ocean depletion—you don't see the depletion of fish stocks. You can read about how cod were once so plentiful you could scoop them up with a bucket in Boston Harbor. You don't see that. That's one of the real challenges we have. So many of the environmental issues are long-term, diffuse, and not very visible.

That's why we are delighted that the Navy is getting engaged. The Navy is an important voice, and people who might not listen to us might listen to you.

CURRENTS: How might NRDC's challenges evolve over the next five years?

LEHNER: We just completed a strategic planning process to establish our priorities for the next five years. So we'll be concentrating on them for a while. We looked at issues that were the most pressing to people and the planet, and issues where we could make a difference. We think we can make a difference with the oceans. We believe that the National Oceans Policy will lead to better management of the ocean in terms of areas that should be open to offshore drilling or wind or fisheries and other areas that are so special from a fisheries perspective that they should be protected. We're hopeful that this process will help to restore some of the fisheries and result in fewer destructive practices, including bottom trawling. I think we'll make progress on all of these fronts, although I doubt we'll be done in five years.

CURRENTS: Can you provide us with more insights into some of your priority initiatives?

LEHNER: Sure. Let's take global warming, which we refer to as the "evil twin" of ocean acidification. Our carbon dioxide emissions are vastly in excess of what the planet can absorb. The more one looks around—whether it be the drought here in the New York City metropolitan area, the flooding in other places, the wildfires in Russia—climate change is an issue that is really coming home to roost.

A lot of the wars around the world are fights over resources. As areas dry out, as areas flood, there will be more conflicts over limited resources. And the United States will be called in as the world's cop and peacekeeper. That's NOT an easy job.

I have always very much admired the military's willingness to speak out even when it was politically unpopular to do so.

CURRENTS: In November 2009, the Navy issued an Arctic Roadmap to guide strategy, policy, investments, and training activities now that reduced sea ice is making the Arctic more accessible to human activity.

We try to find, based on medical information, those chemicals for which we have safer, healthier alternatives.

LEHNER: The Arctic is one specific area we are interested in because it is one area that has been particularly hard hit by the changes brought on by global warming. Areas that used to be covered by ice half the year or all year are now open for commercial consideration—ironically, exploration for oil in areas that were unreachable before the ice melted—including the competing demands of the different countries as well as an extremely vibrant fishery. The same is the case in the Antarctic. The Antarctic krill fishery supports a vast portion of the world's fish and marine mammals. As these oceans change, we are going to face challenges all around the world.

We are also working very hard to advance clean energy. Right now, clean energy is competing against dirty energy. The benefits associated with clean energy aren't counted when it's compared to dirty energy, and the harms associated with dirty energy are not counted against or included in its price.

Here in New York, we're downwind from the mid-western coal plants, and during the Bush administration the U.S. Environmental Protection Agency estimated that 20,000 people per year were being killed by coal-fired power plant pollution. Think about the economic drag that creates on this country.

We also have a public health program we've started with the over 200 different dangerous chemicals inside our bodies. We try to find, based on medical information, those chemicals for which we have safer, healthier alternatives. We then develop strategies to take the worst chemicals out of commerce.

CURRENTS: Do you have a top ten list of sorts?

NRDC has had some success in banning the sale of elemental mercury in the United States.

LEHNER: Mercury. Lead—which has been a priority for quite some time. Sulfur from diesel fuel. The organophosphates in pesticides, which are nasty. Some recent additions include phthalates which are plasticizers (added to plastics to increase their flexibility). All of these chemicals are turning up, in varying levels, in our blood.

We have had some success in banning the sale of elemental mercury in the United States. The European Union has done the same, and they are negotiating a world-wide treaty to phase out mercury. That is really terrific.

We call this initiative *Protecting Our Health by Preventing Pollution*, and it is part of our *Partnership for the Earth* campaign.

We have two new priorities. One is water—a topic we've been litigating since 1971 when we were first founded—and the recognition that it is water quantity as well as water quality that is important.

In many parts of the world, it will be in water shortages where climate change will first be felt. I once climbed the Cordillera Blanca (the "White Range") in Peru. But the locals say that this range is not nearly as white as it once was—the glaciers have been melting fast. Climate change models show that the Andes mountains are experiencing one of the fastest rates of change. Those glaciers are the water supply, the reservoirs for those communities. So we are studying issues pertaining to water efficiency through a connection we call "green infrastructure." When it rains, very often the goal of the engineers and civic planners is to get rid of the stormwater as fast as possible. And yet stormwater is an extraordinarily valuable resource. We are promoting ways to capture rainwater and use it as a resource. We're not there yet, but we really do need a paradigm shift in how we think about stormwater.

Our last new priority is in the area of sustainable communities—recognizing that how we shape our existing communities in terms of infrastructure, design and urban planning drives how healthy we are and how clean our air and water are.

We've begun to collaborate with the Navy and other branches of the military on sustainable fuels.

As a simple matter, you have 80 percent of the economic engine of this country in 100 metropolitan areas. Most of those areas are crying out for more mass transit. It would be a great economic and environmental driver to meet the need for more mass transit. We've also seen an exodus to the suburbs where very limited mass transit options exist. According to the American Association of Retired Persons, there are 50 to 60 million Americans who are living in places where there is limited access to mass transit. Of course, there is a tremendous potential environmental benefit to using mass transit instead of our cars. And it offers a better quality of life.

CURRENTS: How would you characterize NRDC's interactions with the Navy?

LEHNER: NRDC has been working with, and sometimes against, the Navy for 10 to 15 years. We've had our ups and downs, but we are hopeful—particularly with a new administration—that we will be able to find common ground. We've had some litigation with the Navy over the use of low- and mid-frequency sonar. There are different types of sonar and different exercises in different parts of the country. But what's interesting is that in most areas, after a little pushing and shoving, we were able to resolve the issues. The Navy was able to do, as is appropriate, its training. We have no desire to, in any way, undermine national security and fully believe in the Navy's mission. On the other hand, with a little bit of thinking ahead, planning and flexibility, you can also protect the marine mammals.

An F/A-18F Super Hornet strike fighter is fueled with a 50/50 blend of biofuel and conventional fuel at Naval Air Station Patuxent River, MD.
Liz Goettee

We've…begun to collaborate with the Navy and other branches of the military on sustainable fuels. The energy density of fuel is such that I suspect ships and planes will probably be run on liquid fuels for quite a while. Shifting to sustainable biofuels for those purposes is an important issue which the military recognizes.

It is very important to look at biofuels throughout their life. If you clear land that had been forested to grow a feedstock to

For More Information

FOR MORE INFORMATION about EPA's National Renewable Fuel Standard, visit www.epa.gov/otaq/fuels/renewablefuels/index.htm and download the fact sheet entitled, *EPA Lifecycle Analysis of Greenhouse Gas Emissions from Renewable Fuels*.

make biofuel, you start with a large timber and soil carbon deficit. If you are growing the biofuel crop on land that is otherwise used to plant food crops, that's not optimal either. We have been working extensively with the U.S. Environmental Protection Agency (EPA) on the lifecycle analysis rules that they have just recently issued on renewable fuels.

The military is a major purchaser of biofuels. This sets a wonderful example that takes biofuels out of the realm of the treehuggers and into the realm of serious national security. This is a collaboration that we hope will result in the development of a good standard for what are truly sustainable biofuels.

NRDC also worked with DoD to resist the purchase of jet fuel made from tar sands. (Note: Tar sands are a combination of clay, sand, water, and bitumen—a heavy black viscous oil. Tar sands can be mined and processed to extract the oil-rich bitumen, which is then refined into oil.) Refining fuel from tar sands is an energy-intensive process. We want to make sure that the military resists pressure to purchase jet fuel made by processing the oil from tar sands.

CURRENTS: Can you talk about some particularly successful collaborations between the Navy and NRDC?

LEHNER: Sure. One successful collaboration resulted in the Navy adopting a set of mitigation measures that guided the use of sonar during their training exercises. These measures, devised by experts, allow the Navy to conduct their training and, at the same time, protect marine mammals. This is almost a text book "win-win." I hope that we can get to those types of resolutions more quickly than we have in the past.

I am hopeful that biofuels will be another area of successful collaboration with the Navy. In particular, I hope the Navy is able to look beyond the glib answers that some will encourage them to adopt, and instead consider a real lifecycle analysis of any particular biofuel. I suspect that the Navy will be pressured to adopt biofuels that are not truly sustainable if you look at the impact across their lifecycle.

We are finding that the "renewable" fuels industry is pushing for renewable fuels regardless of whether or not they are truly sustainable. Renewable fuels done badly can actually take us backwards.

The Basics About the Navy's Marine Mammal Mitigation Measures

THE NAVY EMPLOYS 29 protective measures to limit contact with marine mammals while training with active sonar. These measures include the following:

1. Marine mammal awareness training for key shipboard personnel;
2. Multiple lookouts aboard sonar-equipped ships during exercises;
3. Special operating procedures, including safety zones for reducing power or shutting off sonar at specified distances from marine mammals; and
4. Coordination and reporting requirements for marine mammal strandings, mortalities or unusual behavior.

The measures were developed in cooperation with the National Marine Fisheries Service, the regulatory agency that oversees the protection of marine life for U.S. entities. In addition, the Navy funds about half of the marine mammal research conducted world-wide. Much of the approximately $20 million the Navy spends annually (as of Fiscal Year 2009) goes toward studying the effects of sound on marine life.

The Navy is currently developing comprehensive environmental planning documentation for its training ranges and operating areas. As part of the environmental planning process, Navy researchers perform modeling of animal movements and acoustic exposure to ensure adequate assessment of the effects of active sonar and have conducted concurrent studies to ensure that sonar systems will not harm humans scuba diving in the ocean.

Peter Lehner (standing right) on a boat in Laguna San Ignacio as a gray whale approaches.
Jacob Scherr

Peter Lehner (left) touching a baby gray whale in Laguna San Ignacio, one of the last breeding grounds for Pacific gray whales, which NRDC fought to protect from industrialization and pollution.

I am hopeful that the Navy remains interested and wants to work together on sound renewable fuels issues.

CURRENTS: With regard to the mitigation measures that you discussed, can you explain what NRDC did to help get those measures in place?

LEHNER: Yes. Many of the mitigation measures are not that complex—having a spotter on the flight deck, not using sonar when whales are in the area, and so on. What we did is talk to a lot of marine experts so we had some idea of what measures were necessary to protect marine mammals. There is a strong consensus among these experts that

by far the most effective mitigation measure is geographic avoidance in training exercises—that is, avoiding areas of particular importance to marine mammals when they are present. We also increased public awareness of this issue so that there was some appreciation of why we were taking these actions. We also promoted a fact-based, scientifically-driven approach to this issue.

We were able to reach common ground with the Navy on training exercises in some areas, but other areas were tougher. But even before we went to the Supreme Court, there were six mitigation measures at issue. The Navy adopted four of them, which left only two as part of the Supreme Court case. And the court didn't say that the mitigation measures weren't scientifically based. In our view, the court's decision was much more a procedural decision about the role of the Navy and national security matters.

What we did is talk to a lot of marine experts so we had some idea of what measures were necessary to protect marine mammals.

CURRENTS: How would you like to see interactions between NRDC and the Navy change?

LEHNER: Generally, I'd like to see us resolve issues prior to litigation. The National Environmental Policy Act (NEPA) process gets to the essential information—information that you will want to have. Yes, sometimes it means you may have to change course. But that's what life is all about—learning, then adjusting to what you learn. Don't try to minimize it—jump into it, hear the voices and then make the best decision you can. It's much better to do that than to enter into litigation and be forced to modify your NEPA documentation. That entire process can be very messy and stressful. Do it up front. Do it early. You'll reach a much better decision.

CURRENTS: Are there other changes in the way the Navy does business that would be valuable for us to consider?

LEHNER: I don't say this just with regard to the Navy, but with other branches of government, I would encourage them to be as public as possible with their information. Keeping things secret slows the process, and ultimately is destructive. When people know something is going on but are not being informed, they assume the worst. So we encourage governments to be as open as they can be with scientific and other information. Obviously, the Navy has a lot of information that they cannot release for security reasons. But the Navy also has a tremendous amount of information on the marine environment. Making more of that information accessible to the general public would be terrific. We probably don't even appreciate all of the valuable information the Navy has.

CURRENTS: Can you characterize the type of projects where the Navy and NRDC might be well-suited as collaborators?

LEHNER: The oceans cover two-thirds of the planet and the Navy probably knows more than almost anybody else about the ocean environment. The ocean is one of our priority areas—an area where we would love to engage more with the Navy.

CURRENTS: How does public perception of environmental issues affect NRDC's efforts? How do you change those perceptions?

LEHNER: In a very fast-paced media world, people want drama. But as I said earlier, many of the challenges we face are literally invisible. And this is not dramatic. So the challenge is to educate people about important and real issues that are not necessarily visible or dramatic. That's where messengers and their stories become more important so that the issue "sounds right" to folks.

CURRENTS: So where do we go from here?

LEHNER: Biofuels are going to be a critical element of our energy future. We're going to be using liquid fuels for ships and planes for quite some time. It would be terrific if the Navy could lead the way on this front.

With regard to the acoustic environment in the ocean and the use of sonar, the Navy should use its knowledge and keep pushing the technology forward.

I think the National Oceans Policy that President Obama just signed, deepwater drilling, and the dramatic changes in the Arctic environment, provide the Navy with a great opportunity to be a strong voice of science and reason. The "land grab" that is going on in the Arctic is really frightening—where normally restrained nations are being much more aggressive. I think the Navy could make a really powerful statement by considering the Arctic as a very special place that should be largely off limits.

CURRENTS: From the Navy's perspective, we are a major funder of marine mammal research so that our policy and operational decisions can be based on real science. In terms of discussing issues, prior to litigation, how would you propose that those interactions happen?

LEHNER: What I found from my years working for the New York State government is that things can be going along at a relatively low level without any real careful, creative or broad thinking. Litigation is finally what bumps the discussion up the chain to

Navy & NRDC Participate in Environmental Entrepreneurs Summit

LEADERS FROM THE Navy and the NRDC participated in the Environmental Entrepreneurs (E2) Summit held in San Francisco on 28 October 2010.

Captain James L. Brown.

Captain James L. Brown, Director of the OPNAV N45 Energy Coordination Office and The Honorable Jackalyne Pfannenstiel, Assistant Secretary of the Navy (Energy, Installations, and Environment) participated in a panel called "The Department of Defense as a Market Maker." According to this year's summit organizers, the military has become one of the strongest advocates for clean, low carbon energy technologies to enhance energy independence and avert the national security risks of global warming. DoD and the Navy are already committing resources to develop technologies that might not otherwise survive in this economic climate, and could be a important customer for successful new technologies. This panel discussed DoD's potential role as one of the early adopters of clean technology. Panelists, including CAPT Brown, Ms. Pfannenstiel and clean technology entrepreneurs including the chairman of Solazyme, spoke about the promise of their emerging partnerships.

The Honorable Jackalyne Pfannenstiel.

E2, born out of NRDC, is a national community of business leaders who advocate for good environmental policy while building economic prosperity. Working with NRDC, E2 takes a reasoned, economically sound approach to environmental issues by relying on fact-based policy expertise. E2 is celebrating its tenth anniversary this year.

For more information about E2, visit www.e2.org.

Photos by Christine Luong

Military participants in an E2 Summit panel.

Victoria Bermel

someone who will be thinking more broadly about a particular issue. People think, "Now that we're being sued, maybe we should think about this a different way." It is the threat of litigation that often forces the discussions to be had at higher levels in the organization and in a more creative and thoughtful way. I'd like for us to have more conversations about marine mammals or other issues at higher levels in the Navy before litigation looms.

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

LEHNER: We had an interview on the use of sonar with James Taylor, one of our trustees, in a past issue of our *Nature's Voice* newsletter. His father was a Navy SEAL and he grew up believing that the Navy was there to solve the problems and protect us. From that real affection for the Navy, he was hoping that the Navy would find ways to work with NRDC constructively on issues like sonar. Like James, my father was also in the Navy. NRDC respects and values the mission of the Navy. And we often find that when all of us are willing to step back a bit and think more broadly about an issue, we can often reach mutually agreeable solutions—you can conduct your training AND protect marine mammals at the same time. But it does require some new thinking and sometimes that's hard. It's easy to dismiss people who disagree. But I hope we can get beyond that.

CURRENTS: Thanks for sitting down with us today, Peter.

LEHNER: Thank you. ⚓

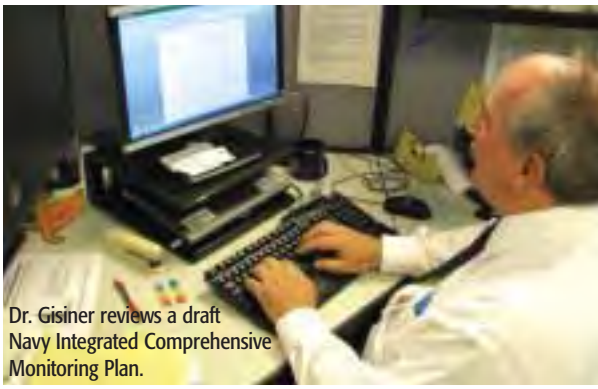
N45's Marine Mammal Expert Provides Insights into the Navy's Knowledge & Future Investments

ON 20 OCTOBER 2010, Ken Hess from the public affairs staff at the Chief of Naval Operations Energy and Environmental Readiness Division (N45) and Bruce McCaffrey, managing editor of Currents magazine, interviewed Bob Gisiner, who joined N45 in May 2010 as head of the marine science branch. Dr. Gisiner spoke about N45's past and future investments in understanding the behavior of various species of marine mammals and the potential impact of man-made sounds on those mammals.

CURRENTS: Tell us a little about your background.

BOB GISINER: I am a biologist by training, but a biologist with an unusual background. I had a professor, Ron Schusterman, who was a psychologist by training. I learned a great deal from him about how to ask experimental questions about animal behavior. This approach differed from that of my primary background in the field of natural behavior of wild animals and how ecology shapes behavior and social structures. My Ph.D. was on Steller sea lions and their social behavior. I did some work for the Navy training dolphins and pigeons, and then did my post-doctoral work with Schusterman on animal language learning, complex cognition and linguistics. Eventually, I went back to work with the Navy doing similar work on animal cognition and bioacoustics before coming to the Office of Naval Research (ONR) in 1994 to manage ONR's marine mammal science program.

I have an interest in seeing how science is applied to the practicalities of conservation and resource management.



Dr. Gisiner reviews a draft Navy Integrated Comprehensive Monitoring Plan.

I have an interest in seeing how science is applied to the practicalities of conservation and resource management. It's very difficult at times to understand how some scientific findings would actually be implemented in the day-to-day world of rules and regulations. The Marine Mammal Commission plays a very important role in that process. I left ONR in June 2007 to serve as the Commission's Scientific Program Director through May 2009. At the Commission, I was interested in a number of issues from fisheries interac-

tions to establishing goals for recovering species that have been depleted from commercial exploitation.

CURRENTS: What are your responsibilities at N45?

GISINER: I have two primary roles at N45. One is to know the subject matter. I've been involved with the science for a long time, and getting the science into the Navy's plan for marine stewardship is a very important issue to the Navy. So, they hired me to be their scientist.

There are challenging science issues, such as when behavioral effects from underwater sound become biologically meaningful. Cumulative effects assessment, space-based management in the oceans, biodiversity—these are all very interesting questions to me.

Dr. Gisiner chats with Linda Petitpas, N45 Ocean Acoustics Lead.

The other responsibility involves turning the science into environmental stewardship practices. How do we take our scientific knowledge and turn it into effective management and responsible behavior to minimize our impact on the natural world? That's another interesting and challenging question.

CURRENTS: What is the Navy doing with the science that ONR and N45 have been sponsoring to promote environmental stewardship?

GISINER: A major priority for the Navy is to develop science to inform our environmental planning as we work with the National Marine Fisheries Service to obtain permits for our at-sea training and testing. As part of the scientific process, we also encourage peer reviewed publication in public forums, presentations in meetings and peer review journals. The science is not just for us to use, it's for everybody to mull over and discuss how to use it. These are matters of interpretation. This science doesn't specifically say, "This is the right thing to do."

One of the first things we chose to focus on, which has become an integral part of risk assessment of underwater noise, is understanding Temporary Threshold Shift (TTS)—a common, recoverable partial hearing loss caused by overexerted cells. Understanding TTS for an animal tells you something about the likelihood of Permanent Threshold Shift (PTS), or permanent hearing loss, at least for the narrow bandwidth of frequencies to which the animal is being exposed.

Now, what to do with that information has been an ongoing debate, and will continue to be. TTS is not really an injury, but it's not simply a behavioral effect. It has a relationship to an injury. A partial loss of hearing capacity can result if you exceed the PTS. Is that loss sufficiently injurious to severely hamper the animal? It's difficult to say.

A major priority for the Navy is to develop science to inform our environmental planning.

These issues are regulated in some way under the Marine Mammal Protection Act (MMPA). Both behavioral and injurious effects are regulated. They are treated a little differently, but you can see that TTS and PTS are in a gray area. Where some people see TTS and PTS as definitely injurious or deleterious to the animal, others see them as minor. They may or may not have biological significance in the course of that animal's life, or in a population of individuals.

CURRENTS: Can you tell us how you see science playing a larger role in what the Navy does to protect the environment?

GISINER: We're approaching this from two different directions. One is to understand how animals respond to sound in general, and in particular, man-made sources of sound. There wasn't much man-made sound in the water until the industrial age. We're talking about an experience, in terms of the evolution of these animals, of 150 to 200 years. The question is, how do animals respond to these increasing ways in which we use sound, the increasing amount of sound as human populations grow, and the increasing use of the oceans? What are the deleterious effects versus the innocuous or even beneficial effects? How do we minimize the deleterious effects while balancing all the other factors that society balances when it makes decisions?

Digital data tag (D-TAG) attached to the back of a male Blainville's beaked whale.
Ari Friedlaender

Secondly, we don't really know much about the animals themselves. In many cases, we don't know how many there are, where they are, or what they need from the environment. When you talk about lions and tigers and elephants, people can tell you where they are and what they eat. For most marine mammals, we can't say that. If we went out to the Chesapeake Bay right now, I couldn't tell you what we might see. But if we hiked the Shenandoah Trail, I could tell you which mammals we'd expect to see with some degree of certainty.

Are marine mammals migrating? Are they feeding? Are they looking for food? It's very difficult for us to put the background in place. A lot of the work we do with tagging animals, surveys, and acoustic monitoring is simply to find out what's out there. If you know what's out there, then you can manage your activities accordingly.

CURRENTS: How has tagging and monitoring evolved?

GISINER: When I first started as a graduate student around 1973, I had the opportunity to put some tags on elephant seals. We put the devices on the animals and stood on a nearby hill with headphones on. We intended to listen to the seals as they meandered around the island and were eating fish just offshore. We were surprised and dismayed to lose the animals after about ten seconds. We never saw them again! Fast forward to 2010, and we now know that elephant seals go halfway out into the Pacific Ocean. Most of the time they are out there, they are 400 meters or more under the water.

The acoustic data logger tags on beaked whales have been astonishing.

Today's acoustic data logging tags have to withstand more than 200 atmospheres of pressure to be used on deep-diving animals like sperm whales and elephant seals. Cell phone technology has allowed us to miniaturize these things. While the original package was about the size of a cigar box, the current package is about the size of a cell phone. These devices capture roll, pitch, yaw (side-to-side movement), acceleration, temperature, pressure, as well as stereo broadband acoustics.

What we're really doing is reconstructing the animal's dive. If you have the pressure, temperature, acceleration, and direction, you can basically reconstruct a three-dimensional track from the place it started at the surface to where it finished. Now you know why the animal is making the sound it's making, and what it's doing at that time.

The acoustic data logger tags on beaked whales have been astonishing. We've taken an animal that we knew almost nothing about, known only from museum specimens, and now we know how they behave 1,000 feet below the surface of the water. We really wanted to focus on these animals, and the new technologies have enabled us to do that.

We complement those advances with advances in passive acoustics, listening to animals that are almost continuously vocally active when they are underwater. Most of the behaviors important to the animals—feeding, breeding, migrating, social interaction, avoiding predators, finding food—all of that takes place underwater. It's just not visually accessible. The combination of these two methods is relatively new and has opened up access to the underwater world.

CURRENTS: What progress are we making applying the data tags?

Dolphin hearing test at the Space and Naval Warfare Systems Command in San Diego, CA.

GISINER: We've tagged dozens and dozens of species. At this point, we have trouble tagging small dolphins (because of the size of tag we think they can safely carry). And attaching the tags is also a challenge. If you attach a tag with a suction cup, the tag is only going to stay on for a few hours, and that only tells you so much. If you attach tags that penetrate the skin, the tags will stay on for months. In some cases, they've stayed on for over a year. But we only feel comfortable doing that right now with larger whales. There are some new types of attachments—dart-type tags—that stay on for a few days. ONR has issued a Request for Proposals to look at new methods to attach tags.

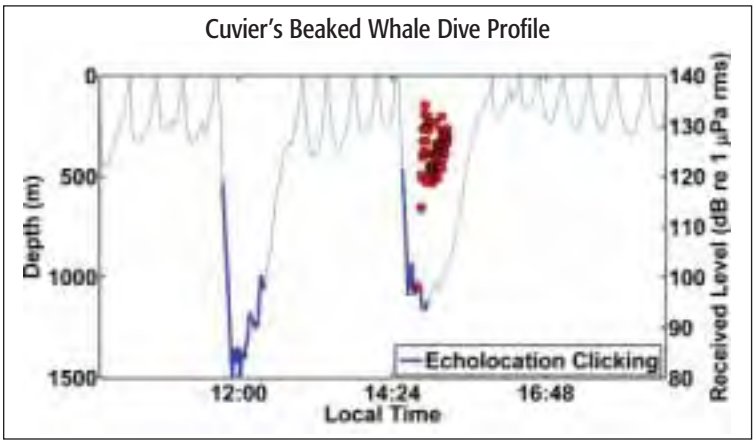
CURRENTS: What other efforts have we implemented to learn more about marine mammals?

GISINER: We've explored some things that have yet to work for us. We've looked at infrared as a possible technology, because the Germans have had some success using it in the Antarctic. It seems to work well with large whales blowing hot breath into cold, 20-below zero air.

A Duke University researcher attaches a D-TAG to an adult male pilot whale.
Brandon Southall

We've had less success using infrared to detect whales off the coast of Florida. We've tried using ship navigational radar to detect blows or the body of the whale. But there are false alarms—it's hard to distinguish whales from waves and other things. We've also tried using satellite imagery without much success.

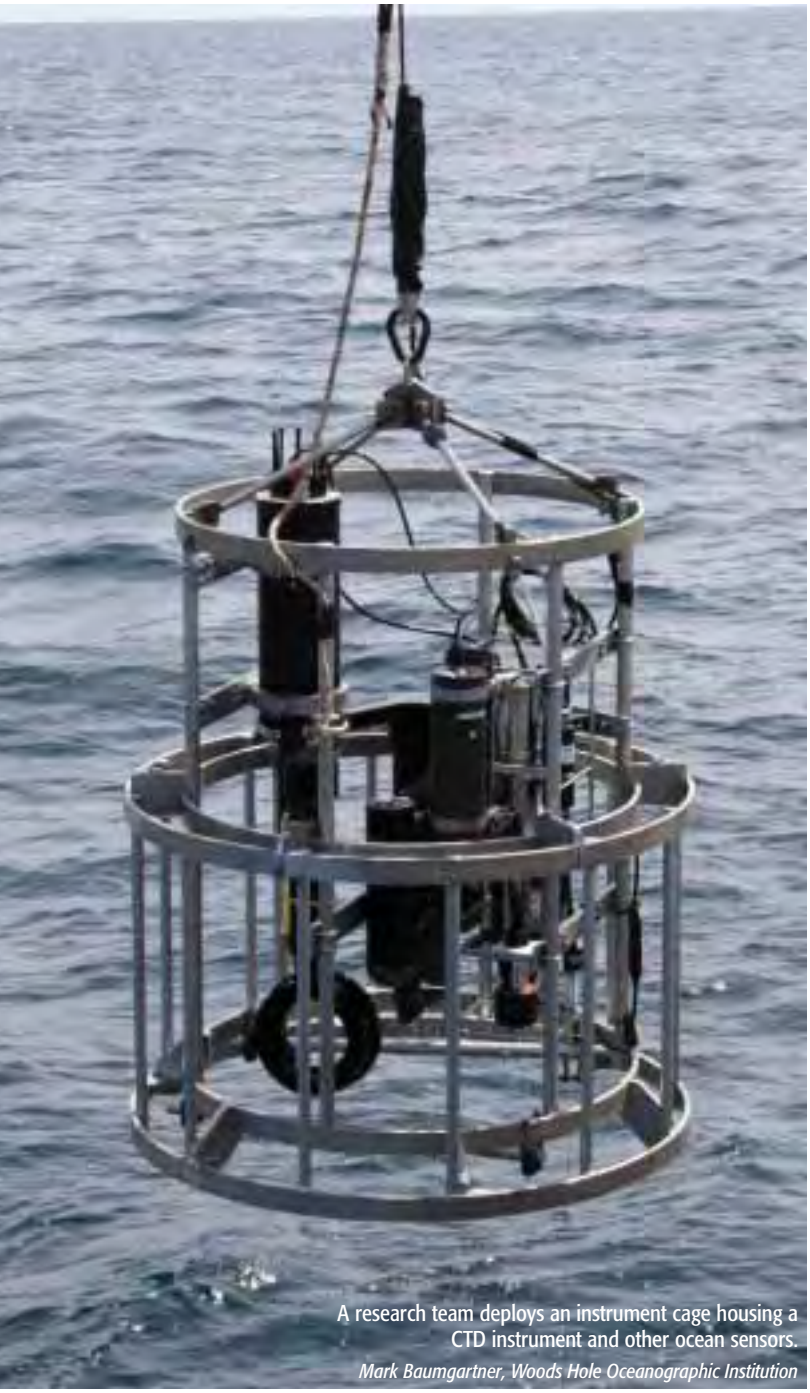
But there are things that are working really well. Advances in tag technology have been tremendous—and not just data loggers or video tags—but tags that do simple things like measure pressure, temperature and salinity at the same quality that an oceanographic Conductivity, Temperature, and Depth (CTD) device does. (Note: CTDs assess the essential physical properties of sea water.) These tags essentially turn the animals into oceanographers. We've actually supplied more and better oceanographic data from marine mammals in the last several years than we've accumulated from all the hydrographic surveys accumulated over the last 150 years.



Depth and duration of Cuvier's beaked whale dives (gray line) and echolocation clicks (blue line) over a seven-hour period during a controlled exposure experiment on the Southern California Range Complex. Lowest red dot shows when sonar-like sound source was turned on, and additional red dots represent receive levels of the sound based on the location of the beaked whale in the water column.

In addition to being highly effective from an oceanographic data gathering standpoint, tagging marine mammals for that purpose is also economical. A ship costs tens of thousands of dollars a day to operate, and you only have so many ships. But we can put 50 CTD tags on elephant seals and map the entire southern ocean boundary current.

A Global Positioning System (GPS) location gets the precision of localization down to a few meters, instead of a kilometer or more with the ARGOS system. (Note: Argos is a worldwide location and data collection system dedicated to the study and protection



A research team deploys an instrument cage housing a CTD instrument and other ocean sensors.
Mark Baumgartner, Woods Hole Oceanographic Institution

of the environment. For more information, visit www.argos-system.org.) The University of St. Andrews in Scotland figured out a way to do fast-lock GPS. It basically receives the signal from a GPS and then interpolates a location from the one-way communications path. It's not as accurate as a perfect two-way GPS fix, but it's pretty close.

One of the other successes we've had is with passive acoustics, or what the Navy would call passive sonar. It turns out the oceans are quite noisy. People generate noise as do fish, mammals, shrimp, and all kinds of other creatures. These noises are meaningful sounds to marine mammals. So passive acoustics can tell us something about the animals' environment and help to identify them.

Passive acoustics can tell us something about the animals' environment and help to identify them.

We've had a fair amount of success acoustically distinguishing one species of whale from another. We are able to tell the difference between a ziphius beaked whale and a mesoplodon beaked whale. We can distinguish a blue whale from a fin whale, a fin whale from a sei whale, a humpback whale from almost anything else.

Through sophisticated applications of multiple units of these technologies, we can start to answer questions about how many animals are in a given area and how they are using the area seasonally. One of the successful developments, which was kicked off by ONR but since driven by many other users, is the Marine Autonomous Recording Unit (MARU). This is the next generation of a device called a "pop-up" that was originally developed by Cornell University. Approximately 150 of these units are deployed around the world, from Madagascar to the Antarctic to the Pacific Ocean. The MARU is a broadband device that can listen across a wide range of frequencies. They are small and can be thrown over the side of a boat (attached to a buoy) with a weight attached, and will sit there for months. They have a lot of memory and can sample at any desired frequency. The devices are eventually pulled back to the surface where their data are downloaded. They are generating terabytes and terabytes of data, so the analysis, storage, and archiving of the data is becoming a major concern.

CURRENTS: Who is helping us solve the problem of collecting and archiving all this data?

GISINER: We have a whole parallel databasing effort going on, and that too is in the process of maturation. ONR partnered with the Sloan Foundation, a private foundation, on

something called the Census of Marine Life. We came up with a project called Sea Map, centered at Duke University to build a database of marine mammal sightings, surveys, tagging and acoustic data. (For more information about Sea Map, visit http://seamap.env.duke.edu.)

Researchers aboard North Atlantic Treaty Organization Research Vessel Alliance use passive acoustic arrays to monitor marine mammals.

We've got another group at the University of St. Andrews that does methodology for visual surveys that developed something called distant sampling. They are working on a project now to calibrate the acoustic data collection with a simultaneous standardized visual distance sampling survey. So you've got the gold standard of visual survey, do your passive acoustic survey at the same time, then calibrate one against the other.

CURRENTS: You've also invested quite a bit of time and resources in acoustic signal processing.

GISINER: Yes. You get the (acoustic signal) data back, and it's just wind noise, bubbles, ship sounds, electronic noise from the gear itself, snapping shrimp, fish, etc. It comes in a stream as a raw electronic signal, and you've got to pick out the dolphin or whale sounds of interest. A lot of investment goes into automating that process so that it is reliable. We need a low false alarm rate, and a high probability of detection.

CURRENTS: This is quite a multi-faceted science, from collecting the data to compiling the results.

GISINER: You can see that a number of different efforts have come together—building devices to record the sounds in the first place, getting them out there and getting the data back, managing the data and archiving it, developing algorithms to process the data, and then doing these paired calibration studies to interpret the meaning of the analyzed data. These are all taking place in parallel by multiple organizations, including research organizations, the U. S. Navy, other government agencies, and the oil industry.

We are working to understand injuries associated with stranded beaked whales.

CURRENTS: Is there a goal for what we are trying to do with this science?

GISINER: A lot of the science we're working on right now has to do with the behavioral effects of sound. But we remain most concerned about are the things that could kill or injure animals. So we look at the levels of sound that are likely to produce harm. We are working to understand injuries associated with stranded beaked whales. We're not sure if the injuries to these animals are a product of the stranding, or the fleeing from sound. There have been hypotheses that the sound could produce bubbles in the bloodstream, but bubbles are pretty common in mammalian circulation in general. In these deep-diving mammals, we don't really know how they manage these bubbles. Is it a normal healthy part of being a marine mammal, or is it pathological? These are all very open questions, and difficult to address with an experiment or a study.

What we are finding in the sound exposure studies—the playback studies in the Bahamas, Mediterranean, and now in Southern California—is that beaked whales are unusual in how aversive they find sound in general, particularly sonar. They will flee from sounds more so than other species of marine mammals in the area. We look at big whales, pilot whales, dolphins and other things we've tagged, and they do not react as strongly as beaked whales. We don't know why that is; it's an interesting result.

Navy and Sonoma State University researchers test a live elephant seal's hearing.

In the Bahamas and Southern California, we can now see this taking place regularly with Navy exercises. The ships move through doing anti-submarine exercises with their sonar on, and the beaked whales clear out. If we have tags on the animals, we actually see them move away from the source. Within 24 to 48 hours, they are back again, and we don't know what they do during this time away.

So we're still working on this. If there's a behavioral response, what does it mean? What does it take for that behavioral response to cross some tipping point where the animals actually go up on the beach?

CURRENTS: Have you studied other comparably-sized mammals as well?

GISINER: We have a lot of data for elephant seals, and we think that when they dive they go into a state that is similar to hibernation. Their heart rate slows to something like one beat per minute. They have selective blood shunts that route the blood away from organs they are not going to use when diving. They go completely catatonic, drift down 1,000 feet, saving oxygen, and then do the same thing coming back up. Now, if the sound interrupts that routine, and that routine is physiologically necessary, disrupting the routine can cause physiological problems.

It has to do with animals pushing themselves to their physiological limits to exploit a very specialized but successful niche—they are the only warm blooded animal at 1,000 feet below the surface. The cold-blooded animals down there are in the oxygen minimum zone, and the water temperature is two to three degrees above freezing. Then, here come these big-brained, fast predators, and they just clean up down there.

We will continue to work on ways to detect marine mammals. One of the things we're working on is platforms. We've got good sensors, so how do you get them out there where the animals are and survey the information? We're very interested in unmanned platforms, both

aerial and underwater. They are a good spin off from tactical, military applications. Unmanned vehicles have been very successful in the Middle East, and a lot of funding is coming into companies to build them. As the technology gets better and easier to use, the price goes down. An additional advantage is that we don't subject our researchers to the risks associated with field studies in the open ocean.

CURRENTS: What is the potential to use and share all of this information?

When the Natural Resources Defense Council and others raise issues, we can discover commonalities and shared points of view.

GISINER: We intend to make all of this information accessible to the general public. It gets published in peer reviewed journals, and there's some extra effort to digest the information and put it in presentable form. All of the data we are generating right now, as a condition of the permits, is reported annually to the National Oceanic and Atmospheric Administration. Everything we saw, everything we did is reported and accessible.

One of the ways to make this information most accessible is the Ocean Biogeographic Information System (OBIS). (For more information about OBIS, visit www.iobis.org.) It makes sense to me that, when we're talking about ecosystem-based management for the oceans, you have to have an inventory of what's out there to make wise management decisions.

CURRENTS: Are there other initiatives out there that might make this information more digestible?

GISINER: I think there are others out there, and plenty of partnership opportunities. This is an opportunity for groups to say what it is they need, and what form they need it in, and then for us to work on it. There will always be aspects of military activities that will be classified for national security reasons, but most of what we're doing here is publicly accessible and available to be shared.

CURRENTS: Why is the Navy funding research on marine mammals?

Autonomous underwater glider funded by Woods Hole Oceanographic Institution and ONR.

GISINER: Our primary responsibility is national security—the defense of our nation. But consistent with that, we will also be good stewards of our marine environment. That is part of the mission of every Sailor on every ship. We have the same stewardship responsibilities for our land holdings—Camp Pendleton or China Lake and all of our other installations. Nobody questions the idea that we have to keep those pieces of property in good shape, because it belongs to the American people. The same is true of the marine environment.

CURRENTS: Are there any areas that come to mind that are open to potential improvement?

GISINER: The dialogue is important. So when the Natural Resources Defense Council and others raise issues, we can discover commonalities and shared points of view. That's one of the most important things we've got to work on. ⚓

Environment in a (High-Tech) Box

Navy Model Simulates Undersea Sound Fields & Marine Mammal Locations to Plan Training & Testing Activities

IN COMPLIANCE WITH environmental regulations, the Navy strives to protect the ocean environment as its personnel train and conduct testing in support of its national security mission. To accomplish this, Navy personnel work closely with the National Marine Fisheries Service (NMFS) and other government agencies responsible for wildlife and habitat conservation to conduct environmental planning. (For more insights, see our article entitled "Navy Moves Forward on Compliance Strategy for Training & Testing at Sea: The Latest on Phase I & II Environmental Planning Efforts" on page 44 of this issue of *Currents*.)

As part of the environmental planning process, the Navy and regulatory agencies require scientifically relevant information about the locations of marine mammals at sea and the likelihood of the animals being affected by manmade underwater sound sources. Because marine mammals are difficult to detect in real time and have varied behaviors based on species, geographic location and time of year, the Navy and NMFS depend on mathematical modeling to estimate the number of marine mammals that may be affected by specific training and testing activities.

The Navy has been modeling acoustic effects on marine mammals since 1997, using acoustic propagation models merged with other methods of estimating marine mammal locations within the water column. In simple terms, an effects analysis is the result of merging a three-dimensional (3-D) acoustic sound field with a 3-D profile of diving animals to estimate sound exposures on animals from individual sound sources. The model input shows energy accumulated by the marine mammals compared to a predefined threshold.

Over the years, the effects analysis process has evolved to more accurately represent animal placement. A NMFS Center for Independent Experts review of the various approaches to Navy effects analysis suggested refinements that led to the current effects analysis version, known as the Navy Acoustic Effects Model (NAEMO).

NAEMO is a single model now being used to analyze the effects of proposed Navy actions on marine mammals. The model has standardized input parameters (e.g., environments, animal density, source parameters) and more closely reflects marine mammal placement within the water column.

NAEMO: A Technical Look

The NAEMO model is comprised of five basic components: 1) Scenario Builder, 2) Environment Builder, 3) Acoustic Builder, 4) Marine Mammal Distribution, and 5) Scenario Simulator.

1. Scenario Builder module

A graphic user interface (GUI)-based tool that defines where an operation is taking place, the time of the action, what is occurring and what units are participating. Once a platform is chosen to be included in a scenario, all the sound sources typically associated with it are displayed. This provides standardization and repeatability in the process of entering data. Platforms can be moved through the operating area in either a defined track or random simulation.

2. Environment Builder module

A user interface that extracts all of the oceanographic environmental data required for a scenario simulation. Based on the geographic area, information on bathymetry, average sound velocity profiles, wind speeds and bottom properties are extracted from an array of points across the region, using Oceanographic and Atmospheric Master Library (OAML) databases.

Members of NUWC Newport's MSMT gather data to run analyses for various training and testing scenarios.

3. Acoustic Builder module

A GUI for generating acoustic propagation analysis data. This module reads the scenario file, defines analysis points for propagation software, and exports the results. The propagation models utilized are Comprehensive Acoustic Simulation System/Gaussian Ray Bundle (CASS/GRAB), Range-dependent Acoustic Model (RAM), and Reflection and Refraction Multi-Layered Ocean/Ocean Bottoms with Shear Wave Effects (REFMS), depending on the specific application.

4. Marine Mammal Distribution module

Creates a GUI 3-D field of marine mammals, by species and by season (when available) for the specific geographic region.

5. Scenario Simulator module

Combines module numbers three and four above to execute a simulation to determine the maximum sound pressure level received by each marine mammal in the exposed area. This module incorporates the scenario, sound propagation data and marine mammal distribution data, ultimately providing raw data output for each simulation. The majority of Navy scenarios are four to 12 hour segments. Some scenarios are broken down by platform (e.g., ship, submarine, helicopter, other source), while others involve multiple platforms. Scenarios can be evaluated in multiple locations within a single range complex. Computation of estimated exposures is based upon the entire scenario, which may include several weeks of daily training operations. Once the simulation is completed, exposures of marine mammals are calculated by species. This allows users to introduce changes to the harassment criteria or sound sources within a scenario without having to re-run the entire simulation.

The Post Processor provides a means to look at the output from a simulation or series of simulations. Data are presented in a series of tables and graphs. Raw output from NAEMO is written to a text file. Output from multiple simulations can be combined, and data from individual sound sources can be added or subtracted from the exposure calculations.

Naval Undersea Warfare Center (NUWC) Division Newport is overseeing development, upgrades and maintenance of the Navy's single model. NUWC has put together a Marine Species Modeling Team (MSMT) that consists of approximately 25 biologists, engineers and modelers who collaborate to develop the software codes, input data and produce the exposure estimates. There are twenty desktop workstations being utilized for the modeling. Sixteen of those systems have two quad core Central Processing Units (CPU) containing 24 gigabytes of memory. The other four have dual core CPUs with 12 gigabytes. Over 6,000 simulations will be run, requiring 50,000 CPU hours. So far, more than 55,000 propagation runs have been made for proposed Navy training and testing activities, generating four terabytes of data. The initial round of modeling covering Atlantic and Eastern Pacific operating areas will be completed in the spring of 2011, with additional geographic areas to be addressed afterwards.

By mid-2011, a version of the Navy's single model should be available for use by organizations doing Navy-specific work. Thereafter, NUWC, the Chief of Naval Operations Energy and Environmental Readiness Division and the Office of Naval Research plan to release an additional version for general unclassified use. ⚓

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Navy Moves Forward on Compliance Strategy for Training & Testing at Sea

The Latest on Phase I & II Environmental Planning Efforts

THE NAVY'S AT sea compliance strategy is to produce environmental planning documents under the National Environmental Policy Act (NEPA) and/or Executive Order (EO) 12114 "Environmental Effects Abroad"; consult under the Endangered Species Act (ESA); and seek Marine Mammal Protection Act (MMPA) authorizations for at sea training and testing that is subject to these requirements.

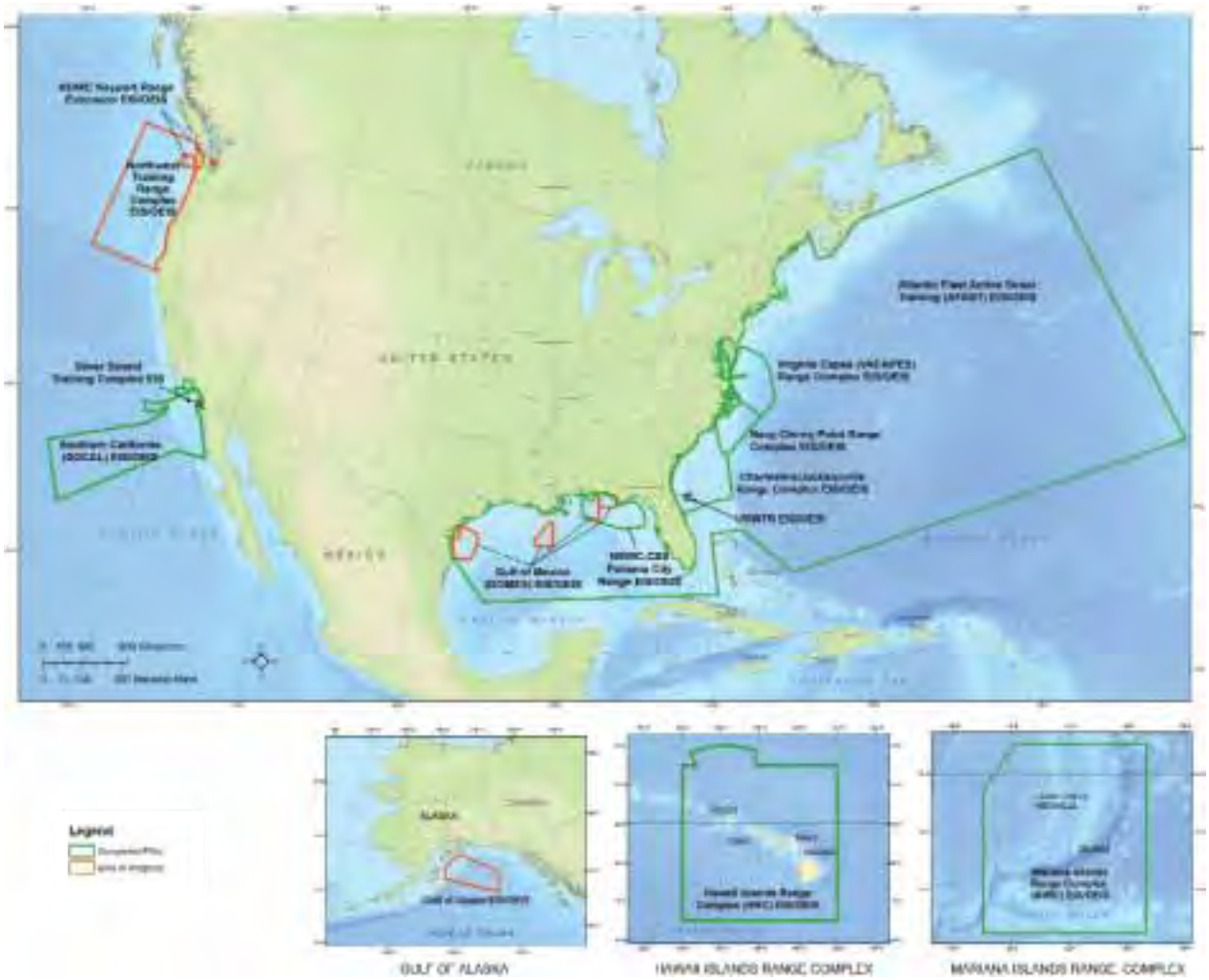
NEPA requires Federal agencies to examine the environmental effects of their proposed actions that have the potential to significantly affect the environment. NEPA's objective is to ensure that pertinent environmental information for major Federal actions is available to decision-makers and the public. Similarly, EO 12114 requires federal agencies to identify, document and consider environmental effects of their proposed actions. The Navy often addresses NEPA and EO 12114 in the same document. Under the MMPA, no "takes" of marine mammals by harassment, injury or mortality can occur unless exempt or authorized under a permit. Under the ESA, the Navy must consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (NMFS) on any proposed action that "may affect" listed species or designated critical habitat. As part of the analysis prepared to meet NEPA, ESA and MMPA requirements, the Navy conducts an effects analysis that predicts the number of animals exposed to a NMFS-defined acoustic threshold.

In 2004, the Navy initiated long range comprehensive environmental impact statements (EIS) for 12 ranges and operating areas (OPAREA), adding the Gulf of Alaska and the Silver Strand Training Complex near San Diego to the scope in 2007 and 2008, respectively. Over the past six years, the Navy has been proactively engaged in permitting actions and consultations with various federal wildlife agencies regarding testing and training activities on all of its sea ranges and OPAREAs.

"So far, the Navy has completed its environmental planning, permitting, and consultation requirements for ten of its sea ranges and OPAREAs," said Karen Foskey, lead environmental planner for the Chief of Naval Operations Energy and Environmental Readiness Division (N45). "The Navy expects to have initial environmental documents completed for its remaining four ranges and OPAREAs in late 2010 and early 2011," said Foskey.

> It's critical to the mission that we complete these efforts on time, and we will.
>
> *–John Quinn*

Collectively, the initial 14 EISs and associated regulatory processes are often referred to within the Navy environmental planning community as "Phase I." Although the Navy has been training at sea for decades, Phase I represents the first time the



Navy has conducted comprehensive, long-term environmental analyses for its sea ranges and OPAREAs. Prior to Phase I, Navy environmental planning for activities at sea was done piecemeal, covering single exercises or tests. From a workload perspective, Phase I is a massive undertaking by the Navy, as well as for NMFS, the regulatory agency that provides oversight to most of the Navy's at sea environmental planning efforts.

"Environmental planning for all Navy training, testing and research at sea, covering activities far in the future and over large geographic areas, is a daunting challenge," said John Quinn, N45's deputy director. "It's critical to the mission that we complete these efforts on time, and we will."

This workload is expected to increase for the Navy and NMFS in 2014, when the original authorizations issued under the MMPA and ESA begin to expire and new environmental analyses, permits, and consultations are required.

Way Forward for Navy Environmental Planning & Compliance

The next phase of environmental planning, "Phase II," will cover maritime activities including but not limited to Fleet training; Fleet and System Commands pierside maintenance locations where sonar testing of hull mounted active sonar systems occurs; at sea acquisition-related research, development, test and evaluation activities sponsored by Program Executive Offices, such as service weapons tests and sea trials of new construction vessels; testing of new systems; and Office of Naval Research-(ONR) and Space and Naval Warfare Systems Command-sponsored science and technology activities. Phase II documentation is anticipated to:

The USS ABRAHAM LINCOLN prepares for flight operations in the Gulf of Alaska as part of joint training exercise Northern Edge.
Photographer's Mate 3rd Class Kittie VandenBosch

We have made significant investments to better understand the behavior of marine mammals and protect them from potential impacts of Navy training activities.

–John Quinn

- Incorporate sea areas that were covered in Phase I environmental planning and compliance documentation, including expanded areas as needed for transit routes, pierside locations, etc.
- Cover areas within the Mediterranean Sea where Navy conducts testing and training
- Include other ocean areas where the Navy has historically trained and/or conducted tests outside of recognized Foreign Exclusive Economic Zones.

Phase II environmental planning will also incorporate lessons learned from the analyses conducted for the initial ranges and OPAREAs. "The Navy is committed to incorporating advances in scientific research into its effect analysis process as appropriate" said Linda Petitpas, N45's ocean acoustics technical lead. For example, ONR developed the Effects of Sound on the Marine Environment (ESME) conceptual model as a research tool for studying anthropogenic sound effects in the marine environment. We have evaluated individual portions of ESME and incorporated them into the new Phase II effects analysis." said Petitpas. The Phase II effects analysis has been updated to incorporate standardization of model input parameters such as environment, animal density, and source parameters as well as placement of the marine mammals in the water column to more closely reflect their natural dive profiles. (For more insights, read our article entitled "Environment in a (High-Tech) Box: Navy's Single Effects Analysis Model Simulates Undersea Sound Fields & Marine Mammal Locations to Plan Training & Testing Activities" on page 42 of this issue of *Currents*.) The Navy intends to put the Phase II effects analysis process through a vigorous verification, validation, and accreditation process both internal and external to the Navy. In addition,

The guided missile destroyer USS WINSTON S. CHURCHILL (DDG 81) fires its MK-45 Mod 4 lightweight gun mount during an exercise in the Virginia Capes operating area.
LTJG Caleb Swigart

An MV-22 Osprey flies over the Gulf of Mexico during a two-week exercise that allows aircrew members to train and navigate in an unfamiliar environment.
Senior Airman Andy M. Kin

the Navy is exploring the possibility of a National Research Council/National Academy of Sciences review of the process used to determine the effects of the Navy's proposed actions and publish the results in a National Academies Press document. With each five year increment of permits, the Navy will reevaluate the current state of science and update the effects analysis process as appropriate.

The Navy initiated Phase II in summer 2010, publishing Notices of Intent and conducting public scoping meetings to identify community concerns and issues relating to the Atlantic Fleet Training and Testing Environmental Impact Statement/ Overseas Environmental Statement (EIS/OEIS) and the Hawaii Southern California Training and Testing EIS/OEIS. Although Phase I and

Engineman 2nd Class Kpaku Palay serves as aft lookout during a simulated escort of high value asset USNS HENRY J. KAISER (T-AO 187) in San Diego Bay.
Mass Communication Specialist 1st Class R. Jason Brunson

Phase II documentation addresses a majority of training and testing each year, at sea environmental planning is a long-term proposition required to support military readiness.

Marine Mammal Protection

A key focus of the Navy's environmental stewardship at sea is the protection of marine species, including marine mammals. "We understand and share the public's concern for marine mammals. Our Sailors and Marines have the amazing opportunity to share the natural environment with marine mammals in a way that many Americans do not," said Quinn. "Because of our collaborative efforts with regulatory agencies, academia, and non-governmental organizations, we have improved our conservation efforts. We have made significant investments to better understand the behavior of marine mammals and protect them from potential impacts of Navy training activities," said Quinn.

The air boss aboard the USS NASSAU (LHA 4) radios commands to aircraft handlers during deck landing qualifications for V-22 Osprey and AH-1 Cobra aircraft.
Mass Communication Specialist 1st Class James R. Stilipec

In partnership with NMFS, the Navy develops and implements appropriate science-based monitoring and mitigation measures to protect marine mammals during testing and training activities at sea. In addition to area-specific mitigation measures for ranges and OPAREAs with

Sailors assigned to Strike Fighter Squadron (VFA) 213 remove ordnance from an F/A-18F Super Hornet aboard the USS GEORGE H.W. BUSH (CVN 77) during training in the Atlantic Ocean.
Naval Air Crewman 3rd Class Joshua K. Horton

permits, the Navy employs protective measures worldwide to ensure the least practicable effects on the marine environment. Examples include marine species awareness training for shipboard lookouts, using all available sensor systems to aid in marine mammal detection prior to sonar use, and ceasing sonar transmissions if marine mammals are sighted within a specified range of ships using sonar.

In support of its environmental stewardship goals, the Navy has long supported a robust program of marine mammal research. The Navy's marine mammal research program has historically been funded approximately $20 million annually, making it one of the largest single contributors to marine mammal research globally. The Navy's marine mammal research program invests in research on the potential effects of sound on marine mammals and develops scientific information that supports the Navy's preparation of EISs and associated regulatory processes under the MMPA, ESA and other statutes. The research program also goes beyond compliance requirements to support the development of improved marine mammal monitoring and detection technology and overall knowledge about marine mammals.

"The Navy takes its environmental stewardship responsibilities very seriously. We understand that national security, like all aspects of life on Earth, requires a healthy ocean environment," said Dr. Robert Gisiner, N45's senior marine biologist.

Finally, Navy ships, aircraft and installations have long assisted in the rescue and/or study of stranded marine mammals by reporting animal locations and providing assistance to NMFS' stranding response network. These cooperative efforts with NMFS will be enhanced in 2011 with the signing of a Navy-NMFS Memorandum of Understanding that is currently under development. Once signed, the memorandum will establish a national framework that allows the Navy to assist NMFS in investigations of stranding events that occur on and around Navy ranges during major training exercises and in certain other circumstances. ⚓

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Shoreline Project Establishes Healthy Ecosystem in Chesapeake Bay Watershed

Stabilization Protects Mission Critical Infrastructure & Enhances Habitat

NAVAL SUPPORT FACILITY (NSF) Indian Head, MD, is near completion of the second phase of a four-phased shoreline stabilization project designed to protect mission critical infrastructure, as well as enhance aquatic and terrestrial wildlife habitat and improve water quality by reducing sediment loading to the Chesapeake Bay watershed. The second phase began in March 2010 and installation of the stabilization structures was completed in November 2010.

The Navy partnered with the Southern Maryland Resource Conservation and Development Board, the Charles County Soil Conservation District, Coastal Design, and Coastline Design to conduct this project while reducing

Close up of barge work on the first sill spur.

Sediment fill in place behind the first sill structure. Work in distance is on the cobble beach area.

Sediment fill approaching final grade behind sill.

costs to the Navy and ensuring that shoreline stabilization expertise is provided through the use of a cooperative agreement. The total awarded funding for this cooperative agreement was $5 million.

The project goals were met by installing sills and breakwaters approximately 55 to 70 feet offshore and filling in behind the structures with sediment to create intertidal wetland and riparian floodplain habitats along approximately 5,400 linear feet of the eastern shore of the Potomac River and the confluence of the Mattawoman Creek and Potomac River.

The sills were designed with windows to facilitate the movement of flora and fauna from open water to the fill areas behind the structures. The currently slumping shoreline banks will now be able to reach equilibrium and naturally revegetate as they are protected from the continuous wave activity on the Potomac River, fueled by a four-mile fetch in some locations and northeasterly winds.

Approximately 600 linear feet of sills will be installed in the Mattawoman Creek. As a result, NSF Indian Head has pulled these sill structures landward to mean high water to

For More Insights

FOR MORE INSIGHTS into the first phases of this shoreline restoration initiative, read our articles entitled "Navy Initiates Potomac Shoreline Stabilization: Off-shore Breakwaters & Sills Will Prevent Erosion at NSF Indian Head" and "Conservation Groups Partner in NSF Indian Head Shoreline Planting: Stabilization Project is Largest in Chesapeake Bay Watershed" from the summer 2008 and spring 2009 issues of *Currents*. The entire *Currents* archive is available on-line at www.enviro-navair.navy.mil/currents.

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reduce impacts to existing submerged aquatic vegetation beds and anadramous fish spawning areas. These 600 linear feet will only have riparian floodplain habitat created behind the structure as a result of the landward movement. A cobble beach is also being installed within the 5,400 linear feet in an area that receives a large quantity of groundwater seepage to reduce erosion associated with the seepage and add variety in the design of the project for wildlife purposes.

LEFT TO RIGHT: Glenn Gass, Charles Soil Conservation District; CDR Dennis Quick, Naval Support Activity South Potomac Executive Officer; Robert Summers, Deputy Secretary of the Maryland Department of the Environment and Seth Berry, NSF Indian Head Natural Resources Program Manager discussing the shoreline project and planting efforts.

Volunteers work to plant trees in the riparian floodplain habitat created during the shoreline stabilization project.

In October 2010, the National Aquarium in Baltimore recruited volunteers from the AmeriCorps, Maryland Conservation Corps, Charles County Master Gardeners, Aquarium Conservation Team, local community and Navy military and civilian personnel to support the planting of trees, shrubs and grasses in the riparian floodplain areas. The Aquarium staff and volunteers plan to return in May 2011 to plant native wetland plants in the intertidal wetland areas and replace damaged or dead trees and shrubs from the fall planting effort.

Currently, the design for the final two phases is in progress and installation of these two phases is anticipated in late 2011 or early 2012. The final two phases will concentrate stabilization efforts at NSF Indian Head's Stump Neck Annex along the confluence of the Mattawoman Creek and Potomac River, and at several locations along the eastern shore of the Potomac River where eroding shoreline banks have begun to compromise the integrity of mission critical infrastructure.

The design of the final two phases will remain the same as the previous two phases, however, several areas will require bank grading to stabilize banks below buildings and groundwater discharge will be intercepted and transported to the toe of the sill or breakwater structure. The total awarded funding for the final two phases is $10 million. ⚓

Photos by Seth Berry

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Developments of Interest: July 2010 through September 2010

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

In September 2010, the U.S. Environmental Protection Agency (EPA) released a draft Total Maximum Daily Load (TMDL) addressing sediment and nutrients for the Chesapeake Bay watershed.

As the largest estuary in North America and formerly a fantastically productive commercial fishery, the Chesapeake Bay has been a prominent test case for whether the Clean Water Act (CWA) "fishable and swimmable" goals could be realized. The effort of trying to attain these goals is providing additional impetus for environmental changes ranging from better control of oxides of nitrogen from power plants to requiring low impact development (i.e., stormwater management that emphasizes infiltration to reduce runoff) in public and private sector development. Already mandatory for federal agencies, low impact development is being explored as a future requirement for private sector construction and renovation. Executive Order 13508 in May 2009 tasked federal agencies with multiple actions to protect and restore the Chesapeake Bay, including strengthening stormwater management.

The watershed draining to the Chesapeake Bay covers more than 64,000 square miles, encompassing parts of Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia, and the entire District of Columbia. The Chesapeake Bay TMDL allocates to each portion (segment) of the watershed an allowable daily contribution of nutrients and sediment. The draft TMDL will contain at minimum 92 segment specific point (wasteload) and non-point (load) allocations for nitrogen, phosphorous and sediment that will assure the attainment and maintenance of all applicable water quality standards for each of the 92 segments. EPA has worked with Bay jurisdictions, to assist them in developing individual jurisdiction-specific Watershed Implementation Plans that identify specific nutrient and sediment reduction targets and actions that the jurisdictions will take to achieve these reductions.

As an example, the State of Maryland Watershed Implementation Plan addresses nutrient management plans on farms, upgrades to large wastewater treatment plants and air pollution controls on coal fired power plants to reduce nitrogen emissions, and nutrient removal technology for new and failing septic systems located within 1,000 feet of the Bay. The state requires site design to reduce storm-

Easy Access

FOR EASY AND direct access to many of the web addresses included in this regulatory summary, select the "Digital Currents" button from the *Currents* page on the Naval Air Systems Command's environmental web site at www.enviro-navair.navy.mil/currents.

water runoff on all new development, and stringent MS-4 permitting Best Management Practices. The state is sponsoring trading programs, including between point and non-point sources. Links to watershed implementation plans, and other information are available at http://www.epa.gov/chesapeakebaytmdl.

The Chesapeake Bay TMDL, along with EPA efforts in Florida, is a prominent pilot for nutrient control efforts in United States waters. The hypoxic zone that appears annually in the Gulf of Mexico near the Mississippi delta suggests the extent and significance of excessive nutrients in our aquatic ecosystems. Because excessive nutrients and sediments are the most common causes identified for impairment of waters throughout the nation, the types of regulatory controls that are being applied in the Chesapeake Bay and in Florida will establish patterns likely to be copied to protect other estuaries and water bodies.

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Atmospheric nitrogen deposition may contribute 30 percent of total nitrogen loadings in the Chesapeake Bay. The secondary National Ambient Air Quality Standards (NAAQS) for nitrogen oxides (NOx) are currently under review and EPA documents suggest that the secondary NAAQS may be tightened—which if it occurred would, for NOx, set the secondary NAAQS—which protect the environment—at lower values than the primary NAAQS which protect human health. For more information, visit http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid = 198220.

Additional regulatory and environmental news items of interest (26 June 2010 through 30 September 2010) include:

Air

Reviews of the Secondary NAAQS for NOx and Sulfur Oxides—Notice (21-September-10)
http://edocket.access.gpo.gov/2010/2010-23540.htm

National Emission Standard for Hazardous Air Pollutants for Reciprocal Internal Combustion Engines—Final Rule (20-August-10)
http://edocket.access.gpo.gov/2010/2010-20298.htm

Water

Ninth Circuit Court Rules Runoff from Logging Roads Requires National Pollutant Discharge Elimination System (NPDES) Permitting (17-August-10)
http://www.sfgate.com/cgi-bin/article.cgi?f = /c/a/2010/08/18/BAMV1EVF36.DTL&feed = rss.bayarea

NPDES Electronic Reporting (01-July-10)
http://edocket.access.gpo.gov/2010/2010-15885.htm

Guidelines Establishing Test Procedures for the Analysis of Pollutants under the CWA (23-September-10)
http://edocket.access.gpo.gov/2010/2010-20018.htm

Water Quality Standards for the State of Florida's Lakes and Flowing Water (03-August-10)
http://edocket.access.gpo.gov/2010/2010-19140.htm

Pesticide NPDES General Permit (02-June-10)
http://cfpub.epa.gov/npdes/home.cfm?program_id = 410

Energy

External Power Adapters No Longer Available for EPA's Energy Star Label—Notice (17-September-10)
http://yosemite.epa.gov/opa/admpress.nsf/0/C1D81E1692F0771E852577A10048E953

Health & Safety

Occupational Safety and Health Administration Cranes and Derricks in Construction Standard—Final Rule (09-August-10)
http://edocket.access.gpo.gov/2010/2010-17818.htm

Presidential Memo on Protecting Our Workers and Ensuring Reemployment; POWER Initiative (22-July-10)
http://edocket.access.gpo.gov/2010/2010-18176.htm

Materials

Best Management Practices for Unused Pharmaceuticals at Health Care Facilities—EPA Guidance (08-September-10)
http://edocket.access.gpo.gov/2010/2010-22325.htm

Navy Guidance on Pharmaceutical Waste Management
http://www-nehc.med.navy.mil/environmental_health/environ_qualdocuments_backup.aspx

Revisions to the Total Coliform Rule—Proposed Rule (14-July-10)
http://edocket.access.gpo.gov/2010/2010-15205.htm

Multi-Walled and Single-Walled Carbon Nanotubes; Significant New Use Rules—Final Rule (7-September-10)
http://edocket.access.gpo.gov/2010/2010-23321.htm

Formaldehyde Standards for Composite Wood Products Act—Public Law (07-July-10)
http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname = 111_cong_bills&docid = f:s1660enr.txt.pdf

http://www.whitehouse.gov/the-press-office/president-obama-expands-greenhouse-gas-reduction-target-federal-operations

Federal Greenhouse Gas Accounting and Reporting Guidance for EO 13514—Council on Environmental Quality Notice and Request for Comments (16-July-10)
http://edocket.access.gpo.gov/2010/2010-17352.htm

Greenhouse Gas Reporting of Scope 3 Vendor and Contractor Emissions EO 13514 GSA Recommendations—Notice (01-April-10)
http://www.gsa.gov/graphics/admin/GSA_Section13_FinalReport_040510_v2.pdf

Other

Navy Electronic Signature Policy Released—Notice (30-August-10)
http://www.doncio.navy.mil/Download.aspx?AttachID = 1343

Emergency Response Guidebook—Notice and Request for Comments (23-July-10)
http://edocket.access.gpo.gov/2010/2010-18134.htm

To subscribe or unsubscribe, contact NFESCRegulatorySupportDesk@navy.mil or 805-982-2640.

Greenhouse Gas Reduction & Sustainability

EPA's Role in Advancing Sustainable Products—Notice and Request for Comments (16-September-10)
http://edocket.access.gpo.gov/2010/2010-23123.htm

Strategic Sustainability Performance Plans per Executive Order (EO) 13514—Notice (10-September-10)
http://www.whitehouse.gov/administration/eop/ceq/sustainability/plans

Recommendations on Sustainable Siting for Federal Facilities—Notice (26-May-10)
http://www.fedcenter.gov/_kd/Items/actions.cfm?action = Show&item_id = 15263&destination = ShowItem

General Services Administration (GSA) Supplier Greenhouse Gas Emissions Inventory Pilot—Notice (20-September-10)
http://edocket.access.gpo.gov/2010/2010-23391.htm

Greenhouse Gas Reduction Target Established for Federal Scope 3 Indirect Emissions—Presidential Memo or Proclamation (20-July-10)

Stewardship of the Ocean, Our Coasts, and the Great Lakes—EO 13547 (22-July-10)
http://edocket.access.gpo.gov/2010/2010-18169.htm

Interagency Ocean Policy Task Force; Interim Framework for Effective Coastal and Marine Spatial Planning—Notice (03-August-10)
http://edocket.access.gpo.gov/2010/2010-18950.htm

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NESDI & ONR Sponsor Technology to Control Paint Overspray

MAEE Helps to Prevent Contaminants from Reaching the Air & Water

ENGINEERS FROM THE Naval Surface Warfare Center, Carderock Division (NSWCCD) have introduced a new prototype device—the Motion Assisted Environmental Enclosure (MAEE)—to mitigate the release of contaminants into the environment during ship hull painting operations.

The hull coating process is critical to the preservation of the ship's hull. The more efficient the hull coating is, the greater the fuel economy of the vessel, and the less future maintenance will be required—resulting in less time in dry dock and reduced ownership costs. For these reasons, anti-fouling coatings containing copper and zinc are utilized.

Unfortunately, some of these heavy metals are released during the painting process through overspray and paint waste. Current commercial painting methods can result in greater than 30 percent (by weight) of the applied paint going to waste through overspray. This overspray can settle onto the dry dock floor and surrounding areas, where it has the potential to be incorporated in dry dock industrial operations or discharges associated with flooding or storm water runoff into nearby waterways.

In an effort to address these challenge, NSWCCD in conjunction with Concurrent Technologies Corporation (CTC) and NORX, LLC, has developed the MAEE prototype to capture paint overspray.

MAEE's Predecessor

In some regards, the MAEE concept is the second generation solution developed by the Navy for overspray containment. In 1997, NSWCCD personnel began the development of an Automated Paint Application, Containment and Treatment System (APACTS). The technology was designed to apply paint robotically to hull surfaces and to capture and retain the overspray emissions.

APACTS, a predecessor of the MAEE, was designed to be an automated system using an integrated dome-covered nozzle and vacuum technology to help minimize overspray at its source.

The MAEE control system's micro-computer converts the operator's instructions into precise commands that follow along the ship's hull.

APACTS was designed to be an automated system utilizing an integrated dome-covered nozzle and vacuum technology to help minimize overspray at its source. The system, while technically innovative, particularly in its ability to increase paint transfer efficiency and mitigate the release of overspray, was costly due to hardware and software complexities associated with the robotic control platform and treatment system components of the system. A subset of the motion control technology developed for APACTS has been incorporated into the overall MAEE system development. MAEE technology is designed to be a much simpler, significantly lower cost adaptation of APACTS that retains a painter in the operating loop.

MAEE technology is a portable, light weight, inexpensive enclosure that allows a painter to manually or semi-autonomously apply coatings with conventional spray equipment, on a boomlift or man lift with little or no overspray. The containment unit, or shroud, covers a small portion of the hull, allows operator access to the surface to be painted, draws and circulates air from within the enclosure to contain the overspray, and generates a positive, contact-free seal with the hull to prevent the overspray from escaping. The seal around the shroud is a pressurized zone created by a flow of air similar to an air curtain. Blowers on each side of the operator window clear paint overspray and fumes away from the painter and deposit them into the enclosure's filters.

The operator commands a desired direction (up, down or steady) and a speed based on their particular expertise and coating application capability. A system of sensors and computers on the work platform detect the position of the hull as well as the positions of the aerial work platforms' joints. The control system's micro-computer converts the operator's instructions into precise commands that follow the hull's surface at a fixed standoff distance of four to six inches. As the paint is applied, the shroud constantly moves along the surface, exposing more of the surface to be painted. The painter simultaneously paints and relocates the basket, thereby eliminating a platform operator from the process.

MAEE Development

MAEE was designed to be used on submarines and the hulls of surface ships.

The maturing MAEE enclosure technology has been tested and evaluated in a series of four, progressive shipyard operational assessments conducted by shipyard and research and development personnel under representative production conditions. The evaluations began in March of 2009 at Atlantic Marine Shipyard (now BAE Systems Southeast) in Jacksonville, Florida.

Following each test, prototype modifications and refinements were made based upon recommendations from operators trained on the system and shipyard process management personnel. Blotter tests and high definition video were used to determine capture efficiency as well as overall system performance. Capture efficiency assessments conducted to date indicate that efficiencies

The MAEE can be assembled on a conventional boom lift in about an hour.

on the order of 90 percent can be achieved. The targeted goal is to capture more than 95 percent of the paint overspray.

The most recent full scale test and evaluation of the MAEE unit was conducted on an active ship hull in August 2010 at the BAE Southeast Shipyard. This evaluation exercised four new integrated component technologies: a flat faced high efficiency filter, a bottom-mount basket mechanism, a cable driven tilt mechanism, and a modified blower distribution. The current unit mounts to the bottom of the boom-lift basket in order to enhance safety and to comply with lift manufacturer restrictions.

Results to date indicate that a peripheral air seal, light enough to be carried on a standard aerial work platform, can be successfully configured and operated to block the discharge of overspray into the environment during representative hull coating application on relatively flat hull surfaces.

Advanced prototype development is ongoing and must trade off goals for increased performance with requirements for expanded system functionality on curved surfaces while continuing to address safety requirements, limits on overall enclosure weight, and requirements for structural sturdiness.

MAEE technology will require more extensive shipyard testing on actual hull surfaces to further refine and harden the system by exposing it to the rigors and full breadth of production level operations needed for full demonstration, validation and integration.

The ultimate goal is to demonstrate a production-ready MAEE that is available to all Navy and commercial shipyards by either purchase or lease agreement.

Benefits

The primary benefits of MAEE are:

- Virtually eliminates paint overspray and associated contaminants such as heavy metals into the atmosphere and waterways
- Enhances environmental compliance and reduces associated risk and liability associated with potential permit requirements and burden associated with by-product waste generation and management
- Increases productivity and reduces total ownership cost as a simple, sustainable, inexpensive and versatile production enhancement that is interchangeable and synergistic with existing coatings application systems and processes
- Maximizes use of existing shipyard assets, expertise and work flow characteristics to increase industrial productivity and enhance compliance with existing environmental requirements
- Enables expanded capability and use within the greater shipbuilding and repair industry

The MAEE's modular design also supports alternative tool development. The enclosure concept has the potential to be modified and used for hull hydro-washing operations as well

The ultimate goal is to demonstrate a production-ready MAEE that is available to all Navy and commercial shipyards by either purchase or lease agreement.

as capturing smoke emissions during hull cutting and welding operations.

The MAEE system consists of three subsystems:

1. Integrated sensors and control software to semi-autonomously coordinate and control the motions of a boomlift
2. A portable, light weight air curtain frame or enclosure carried by the man lift that redirects and captures un-adhered paint spray from the painter
3. A means of communication between the enclosure and the boomlift controller.

To reduce system costs and improve safety, the controller does not require any significant or permanent modifications to the boomlift. Modifications are easily assembled and can be completed in approximately one hour. The boomlift is then readily deployable for other shipyard activities or it may be returned to a rental company without incurring any additional charges. The boomlift's intrinsic safety systems remain fully intact and functional.

Project Support

Primary funding for this project is provided by the Chief of Naval Operations Energy and Environmental Readiness Division's (N45) Navy Environmental Sustainability Development to Integration (NESDI) program to address mature system configuration, demonstration, validation and initial integration efforts.

The Office of Naval Research is funding research to better understand and optimize enclosure characteristics and to develop technology for achieving efficient operations over the breadth of curved surfaces likely to be encountered within the shipyard dry dock environment.

Initial interest and support for development of MAEE technology has been provided by Navy and commercial sources including the Naval Sea Systems Command 04XP and 04RE offices, as well as the National Shipbuilding Research Program via their Surface Preparation and Coating Panel and their Environmental Technologies Panel. ⚓

Photos by Naval Surface Warfare Center, Carderock Division

The Basics About the NESDI Program

THE MISSION OF the NESDI program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, and materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program seeks to accomplish this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities.

The NESDI program just released a manual which contains all of the documents essential to the timely and successful execution of demonstration/validation (Dem/Val) projects sponsored by the program and/or other projects leveraged with funding from other Dem/Val programs. This manual is intended to provide Principal Investigators and other program personnel with the necessary guidance and templates for completing the documentation required for each program project. For a hardcopy of the NESDI Program Manual, contact Barbara Sugiyama at barbara.sugiyama@navy.mil and 805-982-1668.

For more information, visit the program's web site at www.nesdi.navy.mil.

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Xeriscape Project at Pearl Harbor Navy Exchange Mall Complete

Second Phase Expands Planting to Nearly 200,000 Square Feet

NAVAL FACILITIES ENGINEERING Command (NAVFAC) Hawaii completed the second and final phase of a large-scale, drought-tolerant xeriscape project on 2 August 2010 for the Navy Exchange (NEX) at Pearl Harbor.

Xeriscape is a form of landscaping that conserves water through the choice of hardy, drought-resistant plants and creative landscaping. The combination of drought-tolerant plants, efficient irrigation, ground cover and balanced soil will produce a landscape that requires half (or less) the amount of water to maintain than traditional landscaping. Over 45,000 plants, ranging from crown of thorn shrubs to dwarf sugar cane, were planted.

Work officially began on Phase I of this project in April 2008. The first portion of the project included herbicide applications, the demolition of existing shrubs, weeds and ground cover, the replacement and repair of

An overhead view of the elaborately planned green space next to the Pearl Harbor Commissary that allows patrons to walk around and look at the different plants used in the water-saving design.

irrigation system heads, the replacement of a malfunctioning irrigation booster pump and rain sensing shut-off devices, tree pruning, soil preparation, and plant installation.

The second phase began in October 2009, and expands the approximately 96,000 square feet of work done in Phase I to nearly 200,000 square feet. "Phase II incorporates both the planting of a host of new, native plants, synthetic turf, and drought-resistant plants, as well as the removal and treatment of weeds and other undesirables," said Matt Flach, NAVFAC Hawaii landscape architect.

Over the past several years, aggressive federal mandates have been issued requiring federal agencies to reduce energy and water consumption. Beginning in fiscal year 2008, all federal agencies, including the Department of Navy, were required to reduce their water consumption by two percent annually through fiscal year 2015.

"Xeriscape landscaping is a practical water management tool that will help the Region attain federal water consumption goals," states Greg Gebhardt, energy and utilities services manager, NAVFAC Hawaii.

NAVFAC Hawaii awarded the $470,569 contract to Hawaii-based KN Lawn Service. The project was awarded and completed in two phases to allow the landscaping contractor enough time to gather the large quantity of plants from local nurseries and to repair and prepare areas before any work could begin.

"The contractor completed prep work on the soil prior to December 2009 to ensure that most of the weeds would be germinated for their removal in the summer and to allow time to grow enough plants for the

KN Lawn Service personnel talk with Matt Flach, a landscape architect at NAVFAC Hawaii, about planting Norma Crotons (*Codiaeum Varigatum* "Norma"), which provide instant color and height to the planter beds as well as help conserve water.

To Learn More

TO READ MORE about the initial phases of this project, read our cover story entitled "Pearl Harbor Navy Exchange Employs Practical Landscape Design: Xeriscaping to Help Region Meet Water Reduction Mandates" from the spring 2009 issue of *Currents*. The entire *Currents* archive is available on-line at www.enviro-navair.navy.mil/currents.

Over 20 different species of drought-tolerant plants make up an elaborately designed landscape which includes a walking path allowing patrons to take a closer look at the plants.

Bird of Paradise (*Strletzia Reginea*).

project," said Flach. "In addition, 12,000 square feet of synthetic turf was added into the design because it requires little maintenance and virtually no water, while preserving the look of real grass, saving time and money for the customer."

Native Hawaiian plants account for eight of the 20 different species used throughout the NEX complex, totaling about 22,000 plants. Their role in xeriscaping is essential to the project, because they are naturally accustomed to Hawaii's temperate climate and unpredictable weather patterns.

After completing the installation project, the contractor entered a mandatory 120-day maintenance period to guarantee the new plants mature and weeds stay at bay. During this time they will be fertilizing, weeding, watering, and maintaining the grounds until the final inspection in January 2011.

After the maintenance period is over, KN Lawn Service will resume its previously standing grounds maintenance contract with NAVFAC Hawaii to perform normal upkeep of the NEX's landscaping.

One of the 13 completed raised planter beds that fronts the NEX complex contains ground cover and a myriad of plants.

Red Dwarf Crown of Thorns (*Euphorbia mili 'Red'*) recently planted at the Radford Drive entrance to the NEX complex provide a vibrant red hue.

As with any new landscaping job, the new plants will require constant watering despite their drought-resistant qualities. However, NEX will begin to see water savings upwards of 50 percent once the plants have matured, contributing to the Navy-wide push to become environmentally responsible and energy efficient.

In addition to this project, design plans are being finalized for similar xeriscaping projects at Camp H.M. Smith and at the main gates to Joint Base Pearl Harbor-Hickam. ⚓

Photos by Thomas Obungen

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SOME OF MY Best Shots

Naval Radio Station (Transmitter) Jim Creek, outside of Arlington, Washington is one of those areas that seem to turn up the color volume in the fall. The Station consists of approximately 5,000 acres of mostly forested wildlife habitat, 250 of which are old growth forest. These pictures reveal the variety of colors and landscapes on Station in October and November. The Jim Creek wilderness area is designated for recreational use for Department of Defense personnel and has a lodge, cabins, recreational vehicle hookups, and camping areas.

I took these pictures with a Canon Power Shot SD 10 (4 megapixels), and a Canon Rebel SXi (10 megapixels).

Douglas Millison ◉ Naval Radio Station (T) Jim Creek ◉ 425-304-5374 ◉ douglas.millison@navy.mil

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

Trailblazing at Guantanamo

Volunteers Come Together to Restore Hiking Trails

A VOLUNTEER ORGANIZATION aboard Naval Station Guantanamo Bay, Cuba (GTMO) brings volunteers and hikers throughout the community together to revitalize the hiking trails, beaches and wildlife viewing areas in a summer restoration project. This group, known as the "Breakfast Club," was founded by personnel from Joint Task Force (JTF) —Guantanamo's Navy Expeditionary Guard Battalion's (NEGB) Volunteer Program, and the GTMO Naval Facilities Engineering Command (NAVFAC) Public Works Department (PWD) Self-Help and Environmental Offices.

Established in 1898, GTMO is the U.S. military's oldest overseas installation and is part of the West Indies and Greater Antilles island chains in the Caribbean. In December 1903, the United States began leasing GTMO's 45 square miles of land and water for use as a fueling station from the Cuban government. On 1 January 1959, access to Cuban territory outside the confines of the base was

Jose Montalvo

declared off limits to U.S. military personnel and civilians. Five years later, Cuba's government cut off water and supply sources to the base. Since then, GTMO has been self sufficient with its own energy and water sources. GTMO's isolation from the rest of Cuba is the reason it has an important wildlife sanctuary.

Outside the Naval Station's fence line, forested areas have been converted to pastureland and wildlife is hunted for food. In contrast, the Naval Station protects many of its animals in an "animal refuge" on much of GTMO's underdeveloped and primarily undisturbed land.

Conducting research on the flora and fauna of Cuba is almost impossible because U.S. travel sanctions and the Cuban government severely restrict research in the country. Instead, researchers gain access to those areas through the Naval Station. Several partnerships exist between organizations such as the Naval Station PWD's Environmental Office and the Toledo Zoo, the National Oceanic and Atmospheric Administration (NOAA), the Applied Conservation Division of the Zoological Society of San Diego and the United States Geological Survey (USGS). These partnerships advance research in plant and wildlife species under protected and isolated conditions which are not common elsewhere in the world. Dr. Peter Tolson, the Director of Conservation and Research at the Toledo Zoo, and his colleagues have been studying GTMO's wildlife for over ten years. Dr. Tolson was fundamental in establishing an integrated natural resource management plan (INRMP) for the base and holds annual wildlife seminars raising awareness of their importance within the GTMO community.

The Antillean nighthawk camouflages its nest in a bed of rocks. (Egg laying in nest.)

The Cuban rock iguana, one of the largest reptiles in the West Indies and belonging to one of the most endangered groups of lizard, makes up approximately five percent of the total population of Cuba.

Cuban Tody.
CSCS Carlos Rodriguez

Cuban Pygmy Owl.

Through the base's intricate trail system, hikers have access to see plants and wildlife many people in the West Indies cannot. On GTMO, 193 plant species have been identified—51 are endemic to Cuba, and four to the Naval Station itself, including an extremely rare and primitive cactus tree, Pereskia zinniiflora, of which only one single tree has been found. In addition, 167 species of birds reside on base including five that are endemic to the West Indies and five to Cuba. The Cuban rock iguana population, one of the largest reptiles in the West Indies and belonging to one of the most endangered groups of lizard, makes up a conservative estimate of five percent of the total population of Cuba. The estimate is considered a significant fact given the small footprint the base has on the island. Recently, Dr. Tolson was contracted by NAVFAC to conduct an iguana survey to verify population density and develop a management program to meet requirements of the INRMP. Other reptiles such as the Cuban boa can sometimes reach ten feet or more in length on base, a phenomenon that rarely occurs outside the fence line. Additionally, there are 24 other reptile species, four of which are sea turtles.

A keen observer might be able to spot some of the birds endemic to the area. Some birds seen are Cuba's rare bee hummingbird, the world's smallest bird, the Antillean nighthawk who camouflages its nest in a bed of rocks, the Cuban Pygmy Owl or the colorful Cuban Tody.

Most of the current trails are remnants of former "tank trails" from the Cold War era. Some of GTMO's trails were initially constructed as a means to get to observation posts in

the early 1900's when adjacent areas were used as firing ranges. Later they were used by military forces to defend GTMO from possible Cuban attack. Until the early 1990's, these trails were off-limits. Many of these trails remain closed due to operational requirements. In 2000, the Naval Station introduced the Ridgeline trail to the community, which helped the base achieve the Commander in Chief, U.S. Atlantic Fleet's 1999 Bronze Hammer award for a small activity's achievement in Self-Help with no Construction Battalion Unit in the area. In early 2009, the U.S. Coast Guard Port Security Unit 305 from Fort Eustis, Virginia conducted extensive work to build up a trail sign infrastructure to help hikers navigate the formerly restricted trails. Unfortunately, that infrastructure has degraded to the point where the trails have become confusing to navigate in some areas.

GTMO introduced the Ridgeline trail to the community in 2000.

This past summer, JTF NEGB troopers surveyed the trails, identified locations with excessive trash, missing or degraded signs and trail overgrowth. Some of the problems with the trails involved part of them being unrecognizable; hikers mistakenly traveling into off-limit areas and others are not aware of their existence.

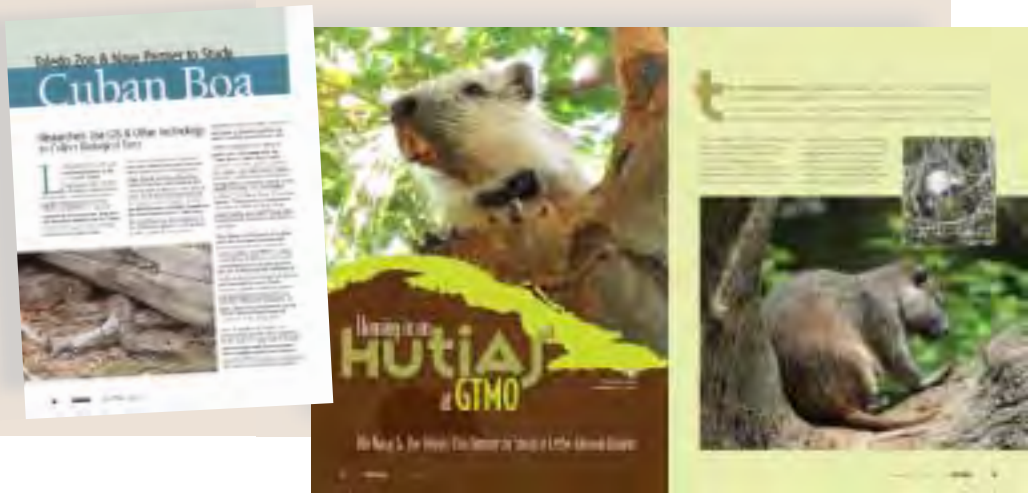
Revitalizing the Marina Nature Trail was the first project to tackle. The Marina Nature Trail is a quarter-mile stretch of coastline and mangroves. In the late 1950's, this location was called Deer Point Beach, but with the growth of several mangrove trees, over time the beach coastline disappeared and an interesting trail emerged. Eventually the trail became overgrown, forgotten, and cluttered with trash.

After meeting five mornings in a three-week period, 75 volunteers from ten commands all over the base came out to show their support for the project. The volunteers were a clear representation of the base's diverse community, ranging from civilians to officers throughout every branch of service, including a Seaman on his two weeks of reserve training, a park ranger, a teacher, an interpreter, dozens of JTF Troopers, Naval Station Sailors and several senior enlisted and commissioned leaders.

In the first two days, volunteers removed 60 bags of trash, in addition to several old boat batteries, fire extinguishers, a F-250 truck-bed full of brick, 10 dump truck loads of trees and brush, a

For More Insights

FOR MORE INSIGHTS into Peter Tolson's work with GTMO's Cuban boas and hutias, read our articles entitled "Toledo Zoo & Navy Partner to Study Cuban Boa: Researchers Use GIS & Other Technology to Collect Biological Data" and "Homing in on Hutias at GTMO: The Navy & The Toledo Zoo Partner to Study Little-known Rodent" as they appeared in the winter 2007 and summer 2008 issues of *Currents*. You can browse the entire *Currents* archives at www.enviro-navair.navy.mil/currents and "like" us on Facebook at www.facebook.com/navycurrents.



20-foot concrete slab, several oversized sewage pipes and other miscellaneous scrap metal. On the third day, volunteers from Naval Mobile Construction Battalion Twenty-Five (NMCB-25) brought in heavy equipment to haul away everything collected. They used heavy equipment to define the path and establish three picnic/rest areas along the trail. The remaining days were used to fine tune the trail's appearance. Volunteers found an oversized piece of driftwood they were able to reuse as an interesting bench alternative for one of the rest areas, and the local community donated two picnic tables.

Added benefits to the Marina Nature Trail project are the improvement of

In the late 1950's, this location was called Deer Point Beach, but with the growth of several mangrove trees, over time the beach coastline disappeared and an interesting trail emerged.

Navy Equipment Operator 2nd Class Battease from the Naval Station's PWD, Self-Help Leading Petty Officer, uses a chainsaw to fell a tree, opening a path for the volunteer working party to come in and remove the accumulated trash and overgrowth on a nature trail at GTMO on 1 June 2010.

EN1 Matthew Bodenner

soil quality and the proper disposal of hazardous materials. Any grooming of the trail's vegetation ensured that the roots were left in place to aid in erosion prevention and recruitment of mangroves. Mangroves act as a natural buffer to protect shorelines and improve the quality of water and wildlife habitat.

Regular and consistent grooming is recommended for any trail system. (Frequency and scope is dependent on your environment). Grooming consists of identification and removal of any garbage, invasive plants, safety hazards, and any infrastructure issues. Lack of trail maintenance and awareness can easily lead to trail abandonment and abuse. There are different ways to manage a trail system and the group chose to start from the ground up.

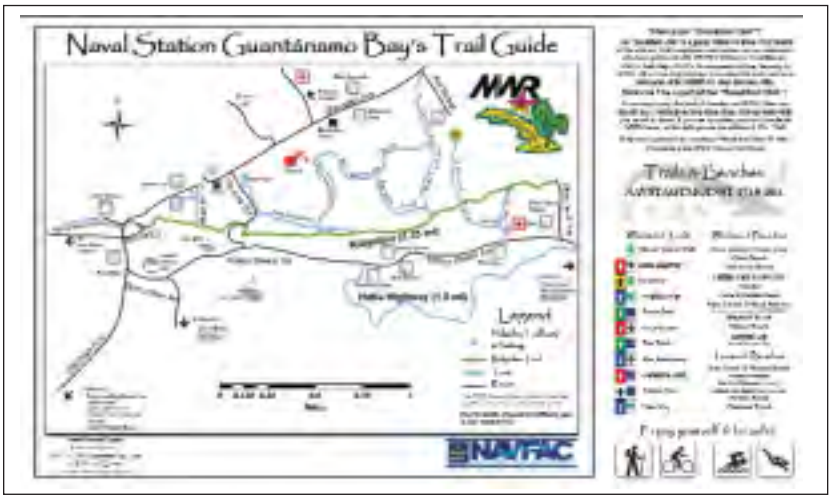
The Breakfast Club, in conjunction with the JTF's Joint Intelligence

Naval Station volunteers removed several tons of debris from the Marina Nature trail.
EN1 Matthew Bodenner

Navy Damage Controlman 2nd Class Joab Estrada, Army Master Sergeant Sheryl Mason, Navy Aviation Maintenance Administrationman 1st Class Ligia Velezquez, Aviation Maintenance Administrationman 2nd Class Andrew Roberts, and Fire Control Technician Christopher Hamilton, from JTF–Guantanamo's NEGB, haul away a truckload of bricks accumulated after the day of clean up from the Breakfast Club's inaugural event, revitalizing the quarter mile Marina Nature Trail at GTMO on 2 June 2010.
EN1 Matthew Bodenner

A Seabee from NMCB-25 uses heavy equipment to reestablish the Nature Trail as part of the "Breakfast Club" trail project.
EN1 Matthew Bodenner

Seabees from NMCB-7 make repairs to GTMO's hiking trails as part of the "Breakfast Club" trail project.
EN1 Matthew Bodenner



GTMO's hiking trail guide.

Group, accurately mapped the entire trail network using Global Positioning System (GPS) and Geographic Information System (GIS). Using a handheld GPS unit, the trail network was mapped out collecting hundreds of waypoints. Additional waypoints were collected, identifying existing trail signs, locations where repairs or needed signs would be placed, safety issues, trail overgrowth as well as locations with excess garbage. Interpretive sign locations were identified to raise community awareness on the importance of the local flora and fauna as well as the trail's historical value. These data were inserted into ArcGIS™, advanced mapping software, to produce a trail map with all the discrepancies mapped.

Once these locations were identified and mapped, volunteer events were scheduled throughout the summer to work through the list. Needed signs were available from the base's existing sign inventory, additional signs were identified and the base's Moral, Welfare and Recreation

ABOVE: The Marina Nature Trail before volunteers restored the trail.

RIGHT: The Marina Nature Trail after volunteers restored the trail. The Marina Nature Trail was called Deere Point Beach in the 1950's before mangroves covered the shoreline.

EN1 Matthew Bodenner

(MWR) Office is funding their purchase. The same map used to collect all the infrastructure data has been published through the MWR program to provide hikers in the community a comprehensive guide to the trails.

In an effort to provide a long-term solution preventing future degradation of the trails, there are plans to increase hiker awareness of authorized recreational trail routes and provide the community information needed to help protect and view this unique wildlife habitat. Several measures have been put into place, including establishing street level trail head locations with oversized maps and general trail safety information, implementing the new trail guide, and offering a monthly calendar with beach and trail clean-up events in addition to various outdoor recreation opportunities. ⚓

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Time to Get Ready for EPCRA Reporting

Reporting Deadlines Fast Approaching

THE EMERGENCY PLANNING and Community Right-to-Know Act (EPCRA) reporting deadlines are fast approaching. Emergency and Hazardous Chemical Inventory, Section 312, reporting is due in a few weeks and the Toxic Chemical Release (TRI), Section 313, Form R reporting deadline is right around the corner. If you haven't already, it is time to make sure you have the most current guidance from your state, the U.S. Environmental Protection Agency (EPA), and Navy for this reporting cycle.

Section 312 Tier II reporting is due 1 March 2011. Many states will send updated reporting packages to facilities that have reported in the past. These packages are available via e-mail and contain a link to the reporting web site. Alternatively, states often post the packages directly on their web sites. For submissions, states are following the lead of EPA and developing electronic reporting systems. Many states will accept the electronic files generated by EPA's Tier2 Submit software, have developed their own software based on Tier2 Submit, or have developed web portals into which their facilities enter data. See EPA's Tier II Chemical Inventory Reports/Tier2 Submit web site for further information at www.epa.gov/osweroe1/content/epcra/tier2.htm.

Reporting Year 2010 Section 313 Form Rs are due to EPA on 1 July 2011. Most states will be utilizing Toxics Release Inventory—Made Easy Web (TRI-MEweb). Navy installations in TRI-MEweb participating states will only have to submit the form(s) once via TRI-MEweb. TRI-MEweb will automatically forward the Form R(s) to the state (i.e., a separate submittal to the state is not needed or required). If your state does not participate in the TRI State Data Exchange, submitting via the Internet does not satisfy your state reporting requirements for your facility. In that case, a separate submittal to the state is needed and required. TRI-MEweb will assist your facility in preparing materials containing your TRI data and in the required format specified by your state (i.e., diskette, paper, etc.). Be certain you have your username and password for TRI-MEweb, keep EPA e-mail correspondence (e.g., the e-mail with the facility Access Key or other TRI-MEweb access information), and check to make sure your Certifying Official has not changed (and has their username and password for TRI-MEweb).

> It is time to make sure you have the most current guidance from your state, the U.S. Environmental Protection Agency, and Navy for this reporting cycle.

EPA Will Not Accept Uncertified Submissions via TRI-MEweb

When submitting your Form R(s) via TRI-MEweb, the facility's registered Certifying Official must electronically sign the submission before it can be entered into the TRI database. The

RY 2010 EPCRA REPORTING TIMELINE

Dec 2010–early Feb 2011
- Collect data of storage/amounts present on-site/usage data

Mid Feb 2011
- Complete Section 312 threshold determination

On or before 1 Mar 2011
- Submit Section 312 Tier II report to State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and local fire department.
- Update Section 311 list, if needed, and send to SERC, LEPC, and local fire department within 3 months.

Mar-Apr 2011
- Collect any additional data for Section 313 thresholds (e.g., coincidental manufacture, munitions)

May 2011
- Complete Section 313 threshold determination to identify toxic chemicals that trigger reporting.
- Collect additional data to estimate releases and complete a Form R for each toxic chemical that triggered reporting. For voluntary Form R review, submit draft via Navy's EPCRA Helpline.

On or before 1 Jul 2011
- Send TRI-MEweb Facility Access Key and list of Form Rs submitted to Budget Submitting Office (BSO) by mid July.
- Submit Section 313 Form R reports via TRI-MEweb to EPA and via required method to SERC.

Jul-Sep 2011
- Watch for TRI Facility Data Profile (FDP) and respond to any issues identified by EPA.
- Review Section 302 notification whenever a change is identified and submit update to SERC and LEPC, if required, within 30 days of change.

**Compile and complete all EPCRA documentation for the reporting year as soon as practicable following submittals.*

Form R must be certified on or before 1 July for the submittal to be considered on time and in compliance. EPA will not accept any uncertified submissions via TRI-MEweb. Be certain that your Certifying Official is approved within TRI-MEweb in time for the reporting deadline.

In the Facility Data Profile (FDP) that is sent to the technical contact given on the Form R, EPA will include a Notice of Significant Error (NOSE). A facility must respond to a NOSE within 21 days of receipt. Failure to respond within the initial 21-day requirement could result in the issuance of a Notice of Noncompliance (NON). A NON requires a facility to take corrective action within 30 days and respond to the Agency that correction action has been taken. Because a Navy installation is a Federal facility complying with an Executive Order, if an NON is received it should be forwarded up the chain of command for resolution between the Navy/Department of Defense and EPA. If a facility fails to respond to the NON within a required time period, the Agency may take further action. A NON is not included in a FDP but is mailed separately.

A facility must respond to a NOSE within 21 days of receipt.

TRI-DDS Updated

The Toxics Release Inventory Data Delivery System (TRI-DDS) web-based system for the calculation of Section 313 thresholds and releases from munitions and range activities has been updated and improved. There is a new user interface to allow for easier identification and execution of the

All About the Navy EPCRA Helpline

1. The Navy's EPCRA Helpline (NavyEPCRA@urscorp.com) is available to answer your EPCRA questions.
2. The Helpline is staffed by Naval Civil Engineer Corps Officers School (CECOS) Navy EPCRA training instructors from URS Corporation that have extensive knowledge of DoD and Navy EPCRA policy and much experience supporting Navy installations with EPCRA compliance.
3. EPCRA questions may be emailed to the Helpline at any time and a response will be sent the next business day.
4. The voluntary Form R technical review service is available through the Helpline. If interested, send an e-mail to the Helpline with the name, phone number, and e-mail address of the Form R contact at the installation and a list of expected Form Rs. Once a Form R is ready for review, send a notification e-mail to the Helpline. The reviewer will then contact you to discuss accessing the Form Rs in TRI-MEweb.

How to Consider Range & Munitions Activities Under EPCRA Section 313

THE CHIEF OF Naval Operations Energy and Environment Readiness Division is further expanding its "Getting Started with the Emergency Planning and Community Right-to-Know Act (EPCRA): A Primer for Navy Facilities" (May 2009) guidance with a new section on range and munitions activities specific to Section 313. This new section is expected to be released in early 2011.

The new section, titled "How to Consider Range and Munitions Activities under EPCRA Section 313," will provide detailed guidance on:

- Defining your facility when there are adjacent, contiguous, encompassed, or geographically separate ranges.
- Distinguishing between a range activity (that is reported on a separate Form R) and a munitions activity (that is reported on the installation Form R).
- Establishing areas in TRI-DDS to support separate range and munitions reporting.
- Collecting the necessary data for threshold determinations.
- Using TRI-DDS and the TRI Information Summary Report for threshold determinations.
- Collecting additional data needed for the Form R.
- Using TRI-DDS and the TRI Information Summary Report for release estimates on the Form R.
- Preparing and submitting EPCRA Section 313 reports for range and munitions activities.

Once available, an email will be sent using the Navy EPCRA e-mail list and the document and any spreadsheet files will be posted to:

- The TRI-DDS web site at https://dod-tridds.org/tri-web/ (login required)
- The Naval Facilities Engineering Command's Enterprise Document Library web site at https://portal.navfac.navy.mil/portal/page/portal/NAVFAC/NAVFAC_DOCS_PP
- The CECOS web site at http://www.cecosweb.com/handouts/EPCRA/FuelsUnderSection313.pdf

The TRI-DDS web-based system for the calculation of Section 313 thresholds and releases from munitions and range activities has been updated and improved.

needed functions. For example, functions for generating a report or importing/uploading data into TRI-DDS have been streamlined. In addition, close to 1,000 munitions items have been added to the system so be certain to confirm any munitions items where you needed to assign a substitute.

Upcoming EPCRA Training Opportunities and Resources

The CECOS EPCRA no-cost, no-travel web conferences are in progress. To help with the upcoming reporting deadlines of 1 March and 1 July, CECOS is again offering Sections 311/312 and Section 313 refresher courses. These refresher courses briefly review the regulations with a focus on DoD and Navy-specific scenarios. Course participants may submit facility-specific questions in advance of the training for discussion. Refresher courses for the EPCRA Sections 311/312 requirements are offered prior to the Section 312 reporting deadline of 1 March—one was conducted on 6 January 2011 and another will be held on 9 February 2011. Refresher courses for the EPCRA Section 313 reporting deadline of 1 July are scheduled for 8–9 and 29–30 March 2011. 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. ⚓

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Souda Bay, Naples, Oil Spill Response Capabilities Tested & Ready

Two-Day Oil Spill Exercise a Complete Success

Long before U.S. and world headlines were filled with images of the spill of national significance from the Deepwater Horizon oil drilling rig in the Gulf of Mexico, the U.S. Navy recognized the importance of developing robust, capable oil spill response capabilities for Navy facilities and vessels worldwide. Recently these capabilities were evaluated and exercised in the Mediterranean Sea when Commander, Navy Region Europe, Africa, Southwest Asia (CNREURAFSWA) conducted a Navy On-Scene Coordinator (NOSC) exercise in Souda Bay, Greece and in Naples, Italy.

The NOSC Exercise (NOSCEX) 2010 was a coordinated multi-level, two-day exercise that simulated the accidental discharge of over 50,000 gallons of distillate Diesel Fuel, Marine from a Military Sealift Command Combat Logistics Force replenishment vessel while pierside at the Marathi Pier Complex in Souda Bay, Greece. The scenario was designed to exercise the tiered transition of incident management roles and responsibilities from (1) the Port Operations' first responders, responsible for minor incidents on the waterfront, to (2) the Souda Bay Emergency Operations Center (EOC) for incidents that exceed the capabilities of Port Operations, to (3) the Regional Operations Center (ROC) in Naples when the simulated oil pollution moved from areas of Souda Bay within military control to civilian areas, greatly increasing the potential for negative impacts. This migration, involving sensitive areas, host nation civilian authorities, and a significant increase in resources required, escalated the scope of the response from local to regional. Key elements of the tiered transition are the integration of consistent oil spill guidance at each level of incident management, and connectivity among the various operations centers.

At the start of the exercise, Naval Support Activity (NSA) Souda Bay Port Operations immediately and effectively deployed its Tier I response equipment in an attempt to contain the simulated release, but it quickly became clear that the magnitude of the incident would exceed its capacity. The Souda Bay EOC was activated, and brought additional capabilities to bear including the assistance of Hellenic Navy assets, Naval Sea Systems Command's Office of the Supervisor of Salvage and Diving technical guidance, and

NSA Souda Bay on-water spill response team deployment at NOSCEX 2010.
MC3 John Martinez

For More Insights

FOR MORE INSIGHTS into the Navy's spill response capabilities and exercises, read our story entitled "Navy SUPSALV Participates in the Coast Guard's "Spill of National Significance" Exercise: Simulated Disaster Brings Together Nearly 600 Personnel" in the summer 2010 issue of *Currents*. The entire *Currents* archive can be found on-line at www.enviro-navair.navy.mil/currents.

contractor support. The volume of the simulated release, and the speed at which it spread to non-military areas outside of Souda Bay, led to the decision to activate the CNREURAFSWA ROC in Naples to manage Tier II response capabilities, supporting the local incident commander with appropriate, scaled regional resources. The exercise progressed seamlessly over two days from emergency operations to coordinated response, through the recovery phase, demonstrating the capabilities of organic Navy assets, Hellenic Navy support, and Greek environmental support contractors. Additionally, environmental representatives from in-theater installations participated and received training on required environmental unit tools such as shoreline clean-up assessment team operations and contingency waste management plan development, which are critical to a smooth transition to recovery. The CNREURAFSWA NOSCEX 2010 oil spill exercise was considered a success by all who participated, and the superb planning and organization for the event is viewed by the Chief of Naval Operations Energy and Environmental Readiness Division as a model for stateside and overseas NOSCs to emulate. ⚓

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CELEBRATING American Indian & Alaska Native

Commander, Navy Region Hawaii celebrated Native American Heritage in November 2010 by hosting a Native American presentation of dance, music and traditions. This year's theme was "Life is Sacred, Celebrate Healthy Native Communities."

In 1990, President George H. W. Bush designated November as National American Indian Heritage Month. Today, National American Indian and Alaska Native Heritage Month is celebrated to recognize the intertribal cultures of Native Americans and to inform the public of the rich heritage, history, and traditions of American Indian and Native American peoples.

Native Americans and Alaska Natives have served honorably in the United States Navy for more than 200 years and have made remarkable contributions to our naval history and the legacy of our nation.

Native American Dr. David Bevett performs a traditional inter-tribal dance during the Native American heritage observance at Lockwood Hall on Joint Base Pearl Harbor-Hickam.

Mass Communication Specialist 2nd Class Mark Logico

- Native American seamen served on Continental and state vessels during the War of Independence.
- During the Civil War, as many as 20,000 Native Americans contributed to Union and Confederate forces as auxiliary troops.
- More than 44,000 American Indians served during World War II, including Lt. Cmdr. Ernest Evans, of Cherokee and Creek ancestry, who was posthumously awarded the Medal of Honor for his actions during the Battle of Leyte Gulf. In the Pacific from 1942 to 1945, Navajo Code Talkers transmitted messages by telephone and radio in their native language, saving the lives of countless troops and helping win numerous island battles.

A showcase of American Indians and Alaska Natives from the Navy History and Heritage Command can be found at www.history.navy.mil.

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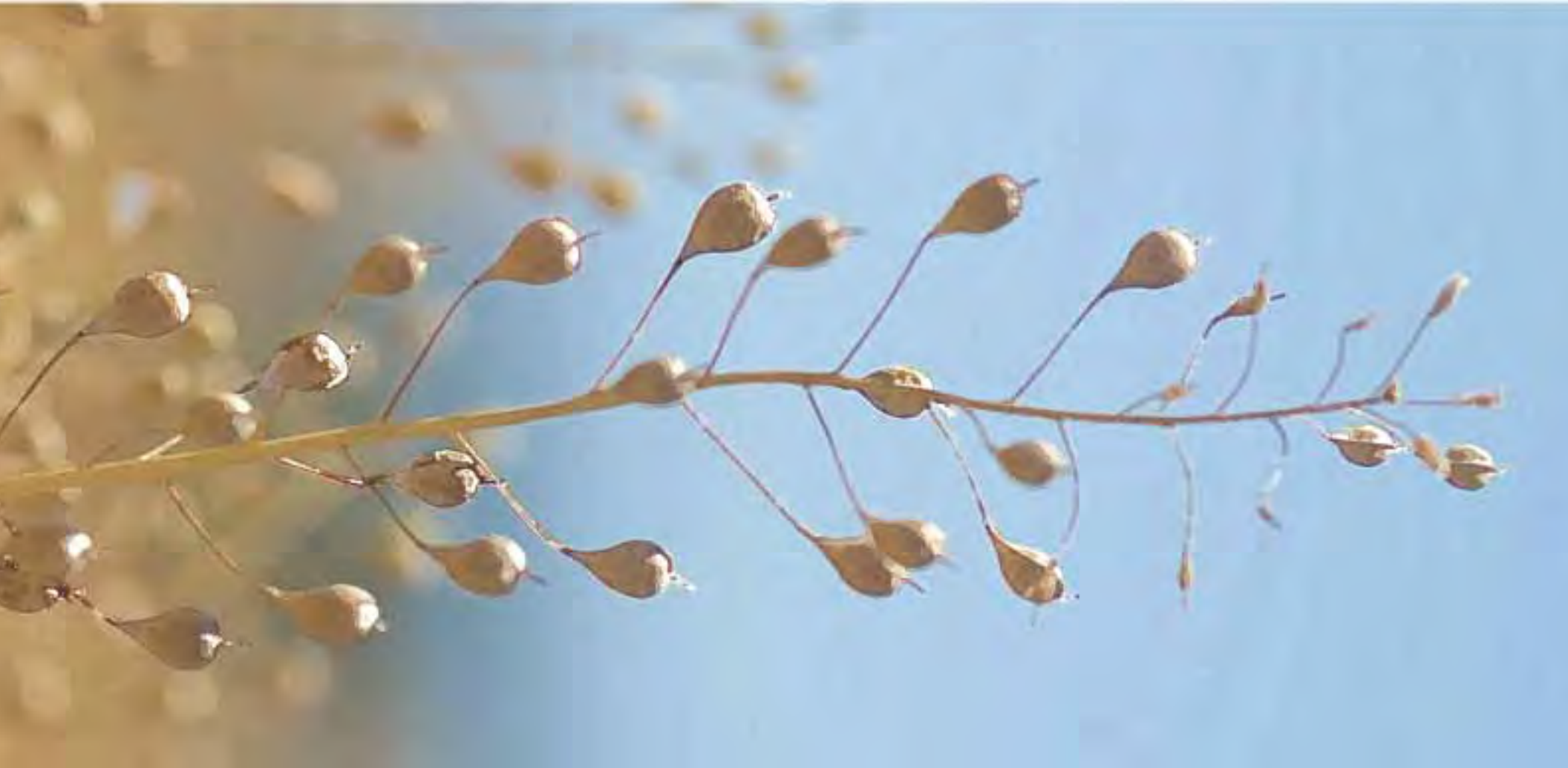
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