THE NAVY'S ENVIRONMENTAL MAGAZINE

Currents

spring 2010

Spotlight on the Endangered Species coalition

Brock Evans, President, Discusses the State of the Conservation Movement

Rocket Science Unlocking Secrets of Cuvier's Beaked Whale

Partnership Restores Historic Marsh in Northwest

Demolitions Clear the Way for Fleet Readiness & Quality of Life at Pearl Harbor

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cover

In the spotlight for this issue of *Currents* is Brock Evans, President of the Endangered Species Coalition (ESC). Founded in 1982, ESC is a national network of hundreds of conservation, scientific, outdoor recreation, business and community organizations working to protect the nation's threatened wildlife, such as the Northern Spotted Owl, and last remaining wild places. Much of the coalition's efforts are directed toward safeguarding the Endangered Species Act.

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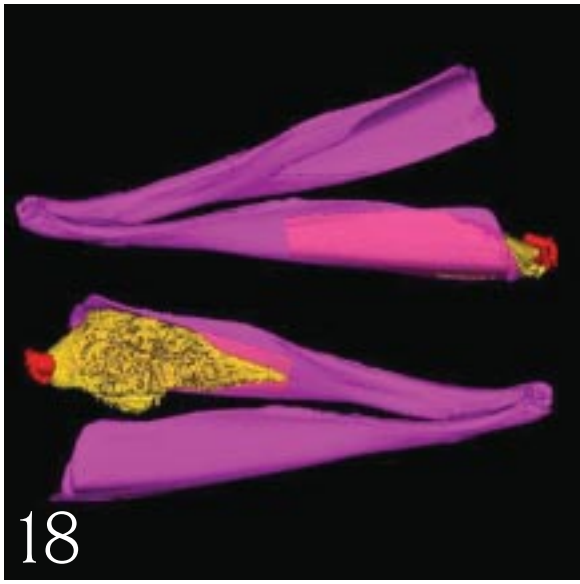

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N45 Deputy Director Discusses Efforts to Enhance Awareness, "Green" the Acquisition Process & Keep Environmental Planning on Track

WELCOME TO THE spring 2010 issue of *Currents*, the Navy's award-winning environmental quarterly magazine. In this column I'd like to address three important focus areas in the Navy environmental program:

1. Enhancing awareness of Navy environmental stewardship,
2. Environmental readiness in acquisition, and
3. The future direction of environmental planning for training and testing at sea.

Enhancing Awareness of Navy Environmental Stewardship

This issue of *Currents* features an interview with Mr. Brock Evans, President of the Endangered Species Coalition. We are delighted to share Brock's message with *Currents* readers, as part of the Navy's continuing efforts to build understanding and forge alliances with the environmental non-governmental organization (NGO) community. The military services and organizations like the Endangered Species Coalition share many common interests. This partnership offers tremendous opportunities for cooperation in protecting both national security and America's magnificent environment. Acreage devoted to military training or to buffer zones around military installations is often far more hospitable to wildlife than it would be if subject to development. Integrated Natural Resource Management Plans developed by military installations are concrete examples of how an appropriate balance of military and environmental interests can be achieved.

As part of the overall strategy to enhance awareness of Navy environmental stewardship, we continue to reach out to a variety of stakeholders. The Navy Active Sonar Action Plan, signed in early March 2010 by Vice Admiral Mike Loose, Deputy Chief of Naval Operations for Fleet Readiness and Logistics (OPNAV N4), reaffirmed the need for strategic communication with stakeholders about Navy environmental performance.

The first-ever Navy Environmental Forum with substantial participation by NGOs and the regulatory community was held in late March 2010. In April 2010, we made available to NGO and other stakeholders an overview of the Navy marine mammal research program, and took input on future directions. In cooperation with the Navy Secretariat, proactive outreach efforts to Congress, federal agencies, academia and other stakeholders will continue, with a view toward coordination of such outreach efforts throughout the Navy. The understanding and synergy developed through these contacts will help us be more effective and efficient in our environmental mission, while reducing the likelihood of litigation, which could impede our national defense mission.

> This partnership (with the Endangered Species Coalition) offers tremendous opportunities for cooperation in protecting both national security and America's magnificent environment.

Environmental Readiness in Acquisition

Environmental Readiness in Acquisition means the ability of new systems to be used in realistic training and exercises, in full compliance with environmental requirements, upon delivery to the Fleets. First addressed in the winter 2009 issue of *Currents*, we've made a lot of progress in this area over the past year.

In June 2009, the Center for Naval Analysis (CNA) published a study concluding that existing acquisition regulations and practices did not sufficiently incentivize

acquisition program officials to ensure environmental readiness in acquisition. The CNA study made several recommendations for policy and practice changes, which OPNAV N4 and Deputy Assistant Secretary of the Navy (Acquisition and Logistics Management) shared with acquisition Program Executive Officers (PEO) and the naval research community. One immediate effect was to more fully involve PEOs and the Office of Naval Research in environmental planning for the five-year renewals of range and operating area environmental impact statements (EIS). This will help ensure that systems reaching Initial Operational Capability (IOC) when the renewal EISs will be in effect, the period from 2014 through 2020, will be environmentally ready.

N45 spearheaded the inclusion of two significant changes in Navy acquisition regulations.

Building on the CNA report, we here at the Chief of Naval Operations Environmental Readiness Division (N45) spearheaded the inclusion of two significant changes in Navy acquisition regulations. First, an environmental review will be incorporated into the Analysis of Alternatives, a step that occurs early in the requirements development process. Second, Gate Reviews will include enhanced environmental oversight to ensure that end users of systems have factored the new system into ongoing and planned environmental analysis. When fully implemented, these process improvements will ensure that new systems are designed, built and delivered with appropriate consideration of lifecycle environmental compliance requirements.

Environmental Planning at Sea

Environmental compliance in training and testing at sea remains the number one environmental challenge to Navy readiness. As of the spring of 2010, we have completed environmental planning, permitting and consultations for eight training, testing and operating areas at sea, with another six to be completed within the next year. Once completed, however, these efforts will mark only the beginning of a continuous cycle of high stakes environmental planning work. Under current regulatory practice, annual renewals will be required for continued training and testing in each area, supported by extensive reporting and consultation requirements.

Sustained environmental planning for training and testing at sea, and extension of environmental coverage for activities beyond training ranges and operating areas, is a daunting challenge. It calls not only for an unprecedented commitment of Navy resources, but for similar commitments by regulatory agencies. Any glitch in this continuous environmental planning process could result in suspension of critical Navy training and testing at sea if renewals are not completed on time, as occurred in the Hawaii Range Complex in January 2010. Fleet and systems command action proponents, along with N45 and the Navy Secretariat, are acutely aware of the need for timely completion of these requirements. N45 and higher OPNAV and Secretary of the Navy authority are continuously engaged with the regulatory community in an effort to keep things on track. Over time, this intensive environmental planning process should become smoother, as Navy and the regulatory community adapt to the "new normal" in terms of planning workload.

Environmental compliance in training and testing at sea remains the number one environmental challenge to Navy readiness.

Conclusion

The months and years ahead will be interesting and busy in the Navy environmental arena. While sonar has been the principal focus over the past several years, other significant challenges are emerging, such as carbon footprint reduction and coastal and marine spatial planning. I'm confident that the men and women of the Navy's environmental programs will lead the way to ensure continued environmental stewardship as we carry out our national defense mission. Thanks for all you do. ⚓

All the best,
John Quinn, Deputy Director
Environmental Readiness Division

Spotlight on the Endangered Species coalition

Brock Evans, President, Discusses the State of the Conservation Movement

IN THE SPOTLIGHT for this issue of *Currents* is Brock Evans, President of the Endangered Species Coalition (ESC). Founded in 1982, ESC is a national network of hundreds of conservation, scientific, outdoor recreation, business and community organizations working to protect the nation's threatened wildlife and last remaining wild places. Much of the coalition's efforts are directed toward safeguarding the Endangered Species Act (ESA).

This is the fifth in a series of interviews with representatives of environmental non-governmental organizations (NGO) intended to broaden our understanding of the NGO community and to enhance Navy-NGO environmental cooperation and partnerships.

This interview was conducted on 24 February 2010 in the Washington, D.C. offices of the Defenders of Wildlife (one of ESC's member organizations) by Tracey Moriarty, Director of Environmental Outreach for the Chief of Naval Operations Environmental Readiness Division, and Bruce McCaffrey, Managing Editor, *Currents*.

Currents: Let's start with a discussion of your background.

Brock Evans: I am now President of the ESC, which I joined in 1997 as its Executive Director. Prior to assuming leadership of the ESC, I served as Vice President for National Issues for the National Audubon Society for 15 years. Earlier, I had served for eight years as Director (head lobbyist) of the Sierra Club's Washington, D.C. office, and for six more as the Club's Northwest Representative, responsible for its interests from the North Pole to California. I have also done scholarly work at the Environmental Law Institute in Washington, as a Fellow at Harvard's Institute of Politics and I've taught in Israel at the Arava Institute for Environmental Studies.

Currents: Tell us about your service in the United States Marine Corps.

Evans: It was the depths of the Cold War—1959. I graduated from college and came home to find my draft notice waiting for me. That was something every American male faced in those days. Your choices were to enlist, seek a deferment or get drafted. So I enlisted. I figured if I was gonna be a soldier I might as well be the best soldier I could be so I joined the Marines.

I went through boot camp at Parris Island, did advanced infantry training at Camp Lejeune, then went into the Reserves in Michigan. By this time I was going to law school at the University of Michigan and was finding it almost impossible to make the weekend meetings, so in 1961 I transferred to the local Army Reserve. But in my mind, I'll always be a Marine.

I learned a lot from my service. Nothing could ever be harder, and I carried this attitude with me into my environmental career.

Currents: How so?

Evans: In the Marines—in training—they make you do things that you know you can't possibly do. But your peers are following you around, making sure you do it. If you're going to lead the assault infantry, you can't think you can't do it.

Well, the whole story of the conservation movement is small bands of people fighting to save the places they love. When I was with the Sierra Club, what I saw over and over again was that small bands of people who had the courage to stand up and fight for what they love can win. It's surprising how often we win. The history of the conservation movement is in turning hopelessly lost causes into stunning victories.

Pull out a map some time and look at all the green places—the wilderness areas and national parks. Almost each one of those places was put there by small bands of people who so loved their land that they were willing to fight for it however long it took.

Currents: What made you interested in environmentalism in the first place?

Evans: I moved to Seattle to be a mountain climber. I loved the wilderness there with its magnificent forests eight feet thick and 200 feet high—some of them older than Charlemagne. And one year, one trail after another was destroyed—trails that I had hiked one summer, dreamed about all winter and couldn't wait to go back to the following summer. That's when I got angry. I was determined to do something about it, but it all seemed hopeless. It was the government doing all of these things. The timber industry was running the politics in the northwest states. I became passionate about saving my beloved Northwest.

I was a lawyer at the time and that's when I joined the Sierra Club. That was the time that the environmental movement—they called it the conservation movement then—was blossoming across the entire country. And I started getting involved in lots of causes.

I made a vow to myself one night when I came across one timber sale too many—"I don't know if we're going to win or lose, but it won't be because I didn't give it everything I had." We're not just destroying trees that are eight feet thick and 200 feet high, but we're destroying whole habitats and ecosystems. We're destroying water filtration and clean air too. Someone has to stand up and do something.

Currents: On our way over here, we were talking about an article that appeared recently in the New York Times (NYT) regarding the fact that a lot of endangered species are migrating onto military bases because they're some of the last areas of undeveloped land available to them. (See "Pentagon Making Room for Wildlife at Military Bases" on the NYT's web site at http://www.nytimes.com.) Do you want to talk to us about some of your own initiatives—ESC's "Mending the Net" campaign that seeks to repair the damage done to the ESA by the Bush administration?

The history of the conservation movement is in turning hopelessly lost causes into stunning victories.

Evans: Sure. But first I should mention that the Department of Defense (DoD) is entrusted with the management of some of the most pristine and incredible wild lands. Because of DoD's excellent stewardship of these lands, they are also some of the most pristine in terms of biological resources. For example, I know over 50 endangered species call Marine Corps installations home. I've had the pleasure of visiting many of these bases and talking with the dedicated scientists and officials in charge of environmental protection. These professionals have shown me how they have balanced land conservation with their efforts to make the base suitable for military training.

And they have had amazing success at protecting our nation's most endangered species. Marine Corps Base Camp Pendleton, CA alone supports 17 listed species. On the east coast, Marine Corps Base Quantico, VA supports the highest number of small whorled pogonia colonies in Virginia and Marine Corps Base Camp Lejeune, NC supports one of the few increasing populations of Red-cockaded Woodpeckers in coastal North Carolina.

However, development around these bases both hampers military readiness and threatens the natural habitat. The military and conservationists have a common mission to protect these critical buffer areas of open space around bases, both to keep the bases viable training centers and to protect vulnerable wildlife. We have been happy to form a partnership with DoD to protect these wild areas and keep America strong and vital.

Celebrate Endangered Species Day on 21 May 2010

ENDANGERED SPECIES DAY is an opportunity for people young and old to learn about the importance of protecting endangered species and everyday actions that people can take to help protect our nation's disappearing wildlife and last remaining open space. Protecting America's wildlife and plants today is a legacy we leave to our children and grandchildren, so that all Americans can experience the rich variety of native species that help to define our nation.

For more information, visit www.EndangeredSpeciesDay.org.

The Basics About Section 7 Consultations

SECTION 7 OF the ESA directs all federal agencies to use their existing authorities to conserve threatened and endangered species and to consult with the USFWS to ensure their actions do not jeopardize listed species or their habitats.

A crucial part of the endangered species program, Section 7 consultations are used to address threats that may result from federal agency programs and activities, and help identify ways to prevent such threats and/or to implement recovery.

If a Federal agency determines that a project is likely to adversely affect a listed species or designated critical habitat, the agency initiates formal consultation by providing information with regard to the nature of the anticipated effects.

The ESA requires that consultation be completed within 90 days, and the regulations allow an additional 45 days for the USFWS to prepare a biological opinion, which consists of an analysis of whether or not the proposed action is likely to jeopardize the species in question or its habitat. If a jeopardy or adverse modification determination is made, the biological opinion must identify any reasonable and prudent alternatives that could allow the project to move forward.

Consultations with Federal Agencies

Now to answer your question, under our "Mending the Net" campaign, ESC is working with the Obama administration to undo some of the damage done to the ESA by the previous administration. And we've already had some successes under Secretary of the Interior Ken Salazar.

One of the things that the Bush administration did was to try to remove the Section 7 consultation provision. In order to build a dam or a highway, developers under Section 7 of the ESA have to consult with biologists from the U.S. Fish and Wildlife Service (USFWS) regarding the potential impact of their project on threatened and endangered species. Far too often these construction projects have compromised the habitats that endangered species rely upon for survival. The Bush administration pushed through a change in the wording of the ESA to require "self-consultations," which means that the developer needs only to ask himself whether or not their proposed construction project will have an adverse impact on the surrounding ecosystem. When the new administration came in, we knew we had a chance to reverse this, and after a lot of hard work, we succeeded.

I should also say that it is very rare that a project is cancelled because of the consultation process. Between 1998 and 2001, the USFWS conducted more than 219,000 consultations and only required changes to 367 of them to reduce impacts on endangered species. Once small changes are made to protect the environment, most projects are allowed to move forward.

We have been happy to form a partnership with DoD to protect these wild areas and keep America strong and vital.

This was very important because one of the best defenses we have to protect these species once they're listed is through a Section 7 consultation. In our experience, over 90 percent of the time, once you consult, you can still build your project with some adjustments to your original plan.

Currents: So no one should be afraid of these consultations because they usually result in a solution that works for everybody?

Evans: The ultimate solution often works better than the original proposal.

The ESA is a uniquely American idea. It reflects our country's "can-do" spirit. We believe that we can have our national parks, our wilderness areas and still do the development we want to do. I testified in front of the Canadian Parliament a number of years ago because they were considering the Species at Risk Act. I said that this type of legislation is a good thing. The ESA has established a somewhat adversarial system among the developers and the conservationists in the United States, but it works. And most of the time, it gets at the truth.

Currents: The ESC is also working to reverse the Bush administration's efforts to establish a species "current range" as the baseline for the animal's protected habitat. Right?

Evans: Right. Take the Northern Spotted Owl for example. We all know that its current range is now limited to approximately six million acres of magnificent, big old growth forest. Some of that forest is being cut down—albeit at a much slower rate. But the Northern Spotted Owl's range used to be nearly 27 million acres. Some of those trees will grow back in 50 years or so. But there has to be enough space for the Northern Spotted Owl to go in the event of fire or impacts from climate change—somewhere between six and 27 million acres.

We celebrated victories this year on behalf other species including the Canada Lynx, Marbled Murrelet and Bull Trout. We advocated for these species in meetings that we arranged with various Congressional offices, the Department of Interior Inspector General's Office and the Government Accountability Office.

The ESA is a uniquely American idea. It reflects our country's "can-do" spirit.

Currents: What is the ESC doing about climate change?

Evans: Unfortunately it's not enough to place an animal on the endangered list—that's a slow process and politically cumbersome. Given the warming of the planet, we have to have alternative places for critters to live. One example is the marmots that live up in the high country in Glacier National Park. The winters are too short now, even at the highest elevation. In order to survive, the marmots are moving north where the winters are longer and the elevations higher. So we need to designate new habitats to preserve these species—an ongoing effort that we're championing.

Global warming is threatening wildlife, fish and plants that are already on the brink of extinction. Melting sea ice, warming ocean and river waters, shifting lifecycles and migration patterns are impacting endangered species, including polar bears, penguins, coral, salmon and migratory birds. A recently released report from the United Nation's Intergovernmental Panel on Climate Change states that 20-30 percent of animal and plant species could be at an increased risk of extinction. ESC is working to protect endangered species from the impacts of global warming.

Currents: What do you think is the biggest challenge to future successful collaborations among the Navy and the environmental NGO community?

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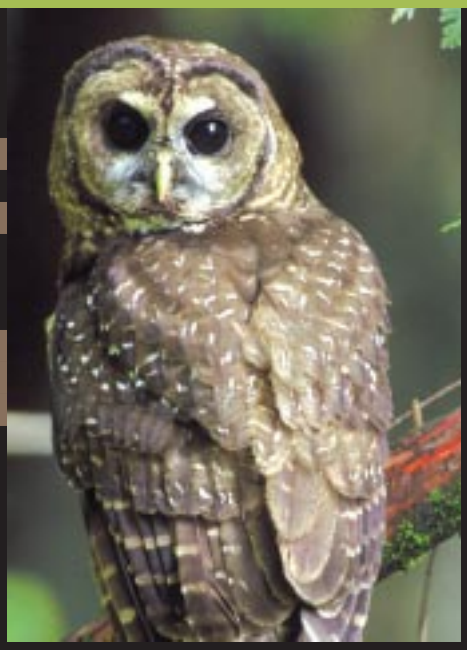
America's Hottest Species:
Ten Endangered Wildlife, Fish & Plants Impacted by Climate Change

THIS REPORT FROM ESC demonstrates ways that our changing climate is increasing the risk of extinction for certain species on the brink of disappearing forever.

The report focuses on ten species that are listed or being reviewed as threatened or endangered under the ESA. The global warming threats to these species include increased disease, diminished reproduction, lost habitat, reduced food supply and other impacts.

Download an electronic copy of this report at www.stopextinction.org/top10.html.

The Basics About the Northern Spotted Owl



Common Name	Northern Spotted Owl
Scientific Name	*Strix occidentalis caurina*
Status	Threatened
Range	South British Columbia, western Washington and Oregon, and northwestern California south to Marin County. Southeastern boundary of range is the Pit River area of Shasta County, California.
Habitat Type	Older forested habitats that provide the structural characteristics required for nesting, roosting and foraging. Multi-layered, multi-species canopy with moderate to high canopy closure.
Threats	■ Loss of suitable habitat as a result of timber harvesting and exacerbated by fire, volcanic eruption, disease and wind storms ■ Small and isolated populations vulnerable to extinction, predation and competition ■ Competition with the barred owl (*Strix varia*) ■ Fire in the relatively dry East Cascades and Klamath provinces of California and Oregon ■ West Nile virus and the sudden oak death tree disease
ESC Protection Successes	On 17 July 2009, the Secretary of the Interior Ken Salazar announced that the Bureau of Land Management (BLM) will withdraw a controversial logging plan affecting federal forests managed by BLM in Oregon. The Secretary also announced that decisions by the Bush administration to reduce designated critical habitat and establish a recovery plan for the Northern Spotted Owl were also being reversed. A new Northern Spotted Owl recovery plan will now be developed.

The Basics About the Marbled Murrelet

Gus Van Vliet, U.S. Fish and Wildlife Service

Common Name	Marbled Murrelet
Scientific Name	*Brachyramphus marmoratus*
Status	Threatened
Range	Extends from Bristol Bay, Alaska, south to the Aleutian Archipelago, northeast to Cook Inlet, Kodiak Island, Kenai Peninsula and Prince William Sound, south coastally throughout the Alexander Archipelago of Alaska, and through British Columbia, Washington, Oregon, to northern Monterey Bay in central California.
Habitat Type	Old-growth forests, characterized by large trees, multiple canopy layers, and moderate to high canopy closure.
Threats	■ Loss of habitat ■ Predation ■ Gill-net fishing operations ■ Oil spills ■ Marine pollution ■ Disease
ESC Protection Successes	The Western Oregon Plan Revisions would have tripled old-growth logging on federal forests in Oregon managed by BLM, reducing habitat for the threatened Northern Spotted Owl and Marbled Murrelet, as well as impacting threatened wild-salmon stocks. An estimated 680 known Northern Spotted Owl sites and 600 Marbled Murrelet sites would have been eliminated over the course of the plan's implementation.

Source: U.S. Fish & Wildlife Service web site (www.fws.gov)

The Basics About the Bull Trout

Common Name	Bull Trout
Scientific Name	*Salvelinus confluentus*
Status	Threatened
Range	Montana, Idaho, Oregon, and Washington with a small population in northern Nevada. No longer occur in northern California.
Habitat Type	Spawn in the fall in streams with cold, unpolluted water, clean gravel and cobble substrate, and gentle stream slopes.
Threats	■ Sensitive to increased water temperatures, poor water quality, and low flow conditions ■ Timber harvest and livestock grazing which degrade stream habitat ■ Dams and other in-stream structures that block migration routes, alter water temperatures and kill fish as they pass through and over dams or are trapped in irrigation and other diversion structures
ESC Protection Successes	In February 2010, USFWS announced a proposed rule to protect 21,000 miles of stream habitat and 500,000 acres of lakes for the threatened Bull Trout. This rule replaces a Bush administration rule that had undermined important, scientifically-recommended habitat protections for Bull Trout.

The Basics About the Canada Lynx

Common Name	Canada Lynx
Scientific Name	*Lynx canadensis*
Status	Threatened
Range	Portions of northern Maine, northeastern Minnesota, the Northern Rocky Mountains (northwestern Montana and northeastern Idaho), the Northern Cascades (north-central Washington), and the Greater Yellowstone Area (southwestern Montana and northwestern Wyoming).
Habitat Type	Boreal forest landscapes that provide one or more of the following beneficial habitat elements: snowshoe hares for prey, abundant, large, woody debris piles that are used as dens, and winter snow conditions that are generally deep and fluffy for extended periods of time.
Threats	■ Shooting, killing, trapping and collecting ■ Harassing individual animals
ESC Protection Successes	On 28 February 2008, USFWS issued new critical habitat for the Canada Lynx. The proposal added approximately 40,913 square miles to the 1,841 square miles of critical habitat for the lynx proposed previously for a total of 42,754 square miles.

Source: U.S. Fish & Wildlife Service web site (www.fws.gov)

Continued from page 11

Evans: There have been conflicts, not so much today, but in the past. We used to hear, "If our troops can't train, we're gonna get killed." I would compare these conflicts to the type of conflicts we have had with the timber industry. Of course, I know that the timber industry is going to make the most money by cutting down the biggest trees but you don't have to do that to survive economically. Often, there are other economically viable options that don't cause the same adverse impact to the species we seek to protect.

Still there are some stereotypes on both sides. I would urge your readers not to think that we're protecting threatened and endangered species because we're anti-military or that we don't appreciate what the Navy is trying to do. The ESC and its member organizations don't file lawsuits frivolously. We can't afford to.

Currents: What are the stereotypes held by those of you in the environmental NGO community about the Navy and its environmental program?

Evans: I'm one of the few people in the NGO community with any military experience whatsoever, which I think is a shame. But, the stereotype on our side is that you're all about machine guns, atom bombs and blowing up buildings. Things you see on television.

Now, after the Services won the right to develop their own Integrated Natural Resources Management Plan (INRMP) and we realized that you were doing a good job of drafting and executing those plans, some of the hyperbole on both sides eased a bit.

These DoD exemptions were the only significant weakening of the ESA in the past 30 years. ESC was founded in 1982 as a "trip wire" to follow endangered species issues every day, all the time and to sound the alarm because the Act was always under assault. Most of what we have seen on the INRMPs front has been very good management of various species.

Currents: Do you think most people are aware that the Navy and other services have dedicated environmental programs?

Evans: They are nowadays. The universal opinion is that there are a lot of people [in the military] doing great things. In 1993, when I was Vice President of the National Audubon Society, I took a couple of trips to military bases to see what kinds of things they were doing. Vandenberg Air Force Base [in California] just blew me away. There were these three Titans going off in one little area and the rest of the base was completely wild. There are lots of sensitive plant and animal species living there.

Another time, I was invited on a Secretary of the Navy's tour of the aircraft carrier USS JOHN KENNEDY. I was one of the few environmental leaders on it, but we got to see what the Navy did for a few days. I got to wander on this great war ship—a city of 6,000 people out there in the ocean. They have some pretty impressive recycling efforts. A little thing like changing a cup with a plastic rim to a cup with a paper rim makes a difference. When they're in the Adriatic, they have a ship come out to offload their trash.

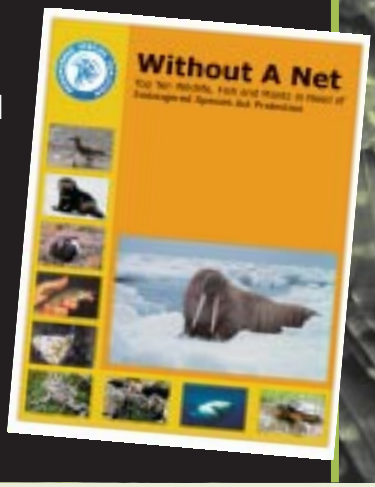
I wrote an article about this visit. I don't know if any of my peers read it,

Anybody who's an environmentalist loves his land. Anybody who's in the military and is defending his land, loves his land.

Without A Net:
Top Ten Wildlife, Fish and Plants in Need of Endangered Species Act Protection

THIS REPORT INCLUDES the top ten species plus three honorable mentions that are in danger of extinction, but are not protected under the ESA.

Download an electronic copy of this report at www.stopextinction.org/top10/withoutanet.html.



but some people in the Marine Corps read it. Then-Colonel Lehnert (now a Major General (ret.)) read it and we started a relationship. To quote General Lehnert, "A country worth defending is a country worth preserving." And that's why I say, we love the land equally. Anybody who's an environmentalist loves his land. Anybody who's in the military and is defending his land, loves his land.

Currents: Do you see a value in setting those tours up again for the next generation of the NGO community?

Evans: Absolutely. It's one of the best things I could imagine. It was a real eye opener. Another program that was going on for a while was a brown bag lunch program. Anyone in the Services could go to an environmentalist's office and talk about current issues. The point was to get to know each other. If the environmentalist's stereotype of the military is "These people are all killers," I believe the stereotype on the other side is, "If these guys aren't commies, they're probably sympathizers." It was like that then. But since that time—and I'd like to take a little credit for it—what we're coming to realize is that this is a really incredible habitat out here and people are just trying to protect it.

One of the best ways to avoid misconceptions and lawsuits is to conduct these tours of military installations. Get to know me and our folks. There is nothing like being able to pick up the phone and say, "Hey, what are you guys doing? I heard about this lawsuit." We can't stop people from filing lawsuits but we can provide moral, legal and political support. We can be political allies as well as scientific allies.

Currents: How do you think that the Navy and the NGOs could be scientific allies?

Evans: Well, let me give you an example. Although I know nothing about the particular science involved here, let's take the issue of sonar use and its potential impact on marine mammals. If I were starting that project, I'd say, let's not just talk to our in-house scientists and scientists at various universities. Let's talk to the one group that is likely to take adverse action—the so-called environmental groups.

We can be political allies as well as scientific allies.

Currents: You may be interested to know that the Navy has a robust marine mammal research program right now. We work with highly respected researchers from scientific institutions, such as Scripps, Woods Hole and Duke University. We have

Navy Shipboard Environmental Protection Highlights

IN THE 1970s, the Navy installed sewage collection and holding tanks to prevent the discharge of raw sewage in coastal waters and in port.

In the 1980s, Navy ships were equipped with Oil/Water Separators and Oil Content Monitors to prevent the discharge of oil at sea.

In the 1990s, the Navy began using Tributyltin-free hull antifouling coatings, far in advance of the international treaty to ban such paints.

The Navy equipped its warships with suites of solid waste equipment (Plastic Waste Processors, Pulpers and Metal/Glass Shredders) to ensure that no plastic is discharged at sea and all other solid waste discharges are made with no environmental impact while at sea.

At the beginning of the 21st century, the Navy began:

1. Converting all of its Chlorofluorocarbon (CFC) air-conditioning and refrigeration systems to non-CFCs to help protect the ozone layer.
2. Outfitting all warships with pollution prevention equipment to reduce generation and offloads of hazardous waste, saving time and money, and protecting the environment.
3. Reducing allowed hazardous material items onboard its ships by 66 percent, and planning to reduce the number of items by an additional 15 percent to enhance the safety and health of its Sailors.
4. Using only uses shipboard paints with reduced hazardous air emissions to enhance air quality in port.

some behavioral response studies of marine mammals that are underway at Bahamas and southern California—they're focused now on beaked whales because we think they may be more sensitive to sound. Those results can be shared with the NGO community.

Evans: That's great. It would be great to get the head of Defenders of Wildlife or the Natural Resources Defense Council to walk on the base or go through the laboratory with you. They'll be impressed with what you are trying to do to minimize the impact of your operations on marine mammals. Because these people love whales, seals and dolphins. And if there's any Service that comes into contact with them, it's the Navy.

Currents: What else would you like to talk about? What else do you want our readers to know about your organization?

Evans: What I would like people to feel and believe is that when we environmental organizations do what we do—when we speak and act as we do—it's out of love. I'm one of the few males that will use that word—love—but it really is love. Love of the critters, love of the land and all of it put together.

That's the only way to explain why 99 percent of the environmental movement is made up of volunteers. People will literally dedicate their careers and lives to the protection of the environment.

I'd also like your readers to know that in spite of what they may read about big, wealthy environmental groups—and there are a few big ones—we can't compare with the resources garnered by even the smallest oil company. We always believe that we're the political underdogs. We can never match corporate power and money. But we also feel that the people are with us.

Look at any public opinion poll—85 to 90 percent of the people don't want animals to go extinct. Since I took over the ESC in 1997, there have been 100 specific legislative assaults on the ESA and only one of them succeeded. Why? Because we call upon people stand up for the things they believe in. That's why people don't mess with parks or wilderness areas. If the American people didn't love these things, they wouldn't exist.

We believe that we environmentalists share a deep, common bond with other groups and institutions in this country, especially the military. The military puts themselves on the line to defend our country and they're doing a great job. I give them credit for this, and I'd like to see more understanding of the military's mission throughout the NGO community. This is why things like your magazine are so important—to promote this understanding.

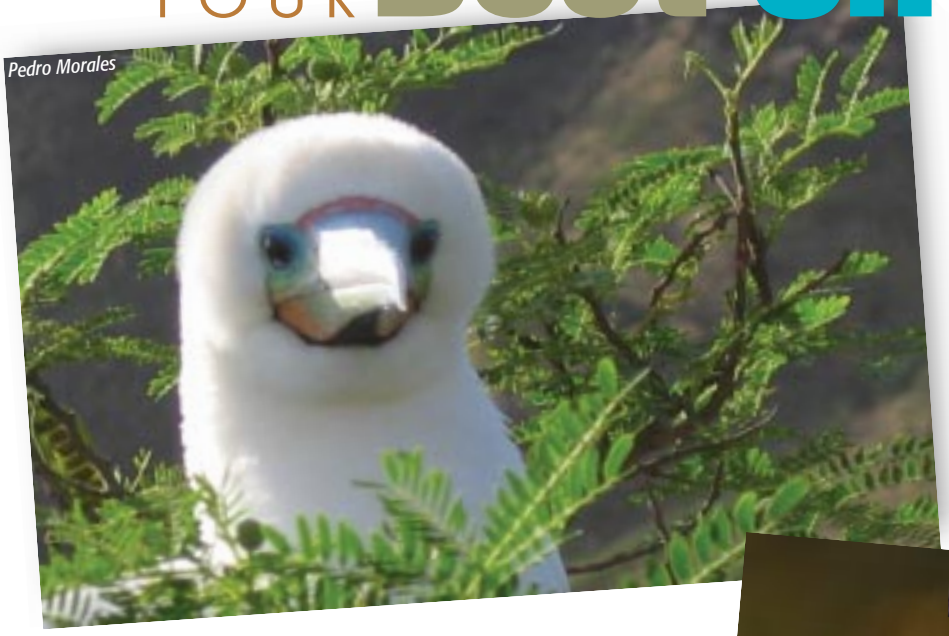
For more perspectives from Brock Evans on a variety of issues, visit his "Endless Pressure" blog at www.endlesspressure.org.

People will say, "You can't do it all, you can't save it all. It's never going to be enough." And I say, "So what are you gonna do, go home?" Our job is to thrust every acre and every species we possibly can into the future.

Currents: Thanks for taking the time to speak with us today, Brock.

Evans: You're welcome. ⚓

GIVE US YOUR Best Shot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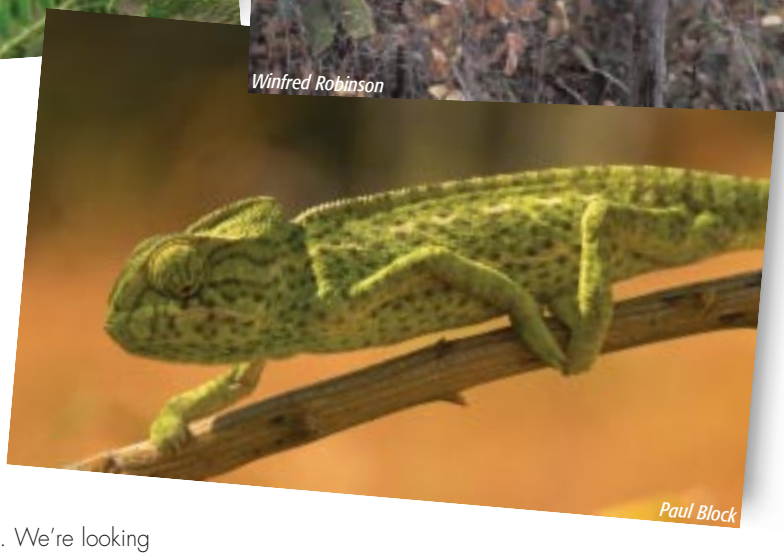

Paul Block

CURRENTS IS LOOKING FOR YOUR BEST IMAGE

Hey, all you would-be photographers out there: Give us your best shot.

How would you like to see your work published in a future issue of Currents? We know that, for many of you, photography is more than a casual pursuit. You love to capture unique views of the world with the click of a shutter. And we'd love to capture your best work.

So share your best shot with us and other Currents readers. We're looking for high quality, high-resolution imaginative images in the following areas:

- Natural resources on land (especially resources on Navy installations),
- Natural resources at sea (especially resources taken from Navy ships),
- Navy personnel protecting the environment, and/or
- Environmental management projects on Navy installations and ships.

With your submission (one image only, please), please provide your name, contact information, and a description of your image and how you shot it. Images must be submitted to our Managing Editor, Bruce McCaffrey at brucemccaffrey@sbcglobal.net in digital format (as .jpg files) at a resolution of at least 300 dots per inch (dpi).

To ensure quality printing, we need an ORIGINAL resolution (i.e., when the photo is taken) of at least 300 dpi. Your original file dimensions should be at least 2,100 by 1,500 pixels. So if you're using a digital camera, please set your file size to the largest size possible.

Help us present the Navy's environmental efforts through your creative eye. We'll take a careful look at all submissions and try to find space to display as much of your inspired work as possible.

SO GIVE US YOUR BEST SHOT!

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

Rocket Science Unlocking Secrets of Cuvier's Beaked Whale

Research Suggests Animals May Filter Mid-Frequency Active Sonar Sounds

ONCE EVERY TWO years, the Society for Marine Mammalogy presents the "Excellence in Science Communication Award" to the science professional who best demonstrates creative and effective communication techniques. The recipient of this award must present exciting, cutting edge scientific ideas to a group of peers, who deem the work worthy of top honors.

In October 2009, at the 18th Biennial Conference on the Biology of Marine Mammals, the winner of that award was Dr. Ted Cranford, a marine biologist at San Diego State University. His award-winning work was sponsored by the Office of Naval Research (ONR) and the Chief of Naval Operations Environmental Readiness Division (N45).

Cranford's winning presentation, "Knocking on the Inner Ear in Cuvier's Beaked Whale," examined the physiological effects of sound, including Navy sonar, on the hearing anatomy of Cuvier's beaked whale (*Ziphius cavirostris*). Though his findings are still undergoing validation experiments and peer-review, the preliminary research is already gaining widespread attention within the scientific community. (Note: Cranford's paper on the function and operation of the tympanoperiotic complex (TPC) in Cuvier's beaked whales has been submitted to Public Library of Science (http://www.plos.org). Another paper about the internal hearing structures of Cuvier's beaked whale is being drafted for submission to Hearing Research. Validation experiments are ongoing.)

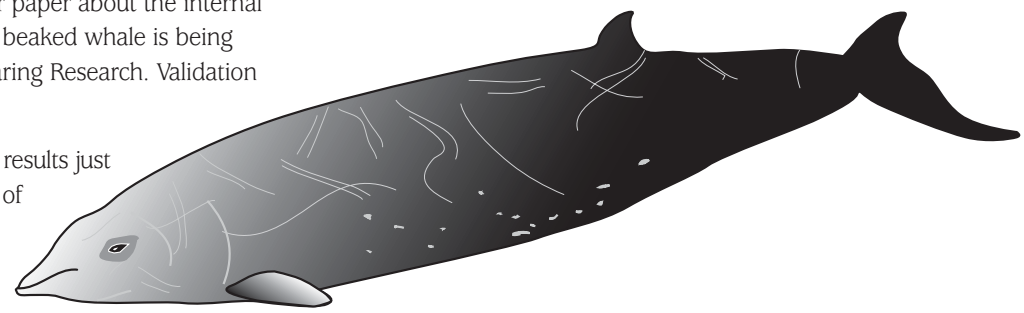
"We published the first set of results just over a year ago in the Journal of Biomimetics," said Cranford. "A lot of unexpected results came from this paper. It gave us a brand new perspective on how these animals are able to receive sound."

"The paper's publisher—the Institute of Physics—said the paper was in the top ten percent of papers downloaded across all of the sixty or seventy journals they published in 2008. That speaks to the fact that people recognize this research is cutting edge. It's a new frontier we're embarking on," he continued. (To read the paper, visit http://www.spermwhale.org/SDSU/My%20Work/Cranford_et_al_Sound_Paths_FEM_BB_2008.pdf.)

While the research has only recently started gaining recognition, Cranford's work studying beaked whale hearing began years ago with the discovery of a stranded beaked whale in 2002. What happened after the stranding may have unlocked a new understanding of these mysterious creatures, through use of cutting-edge technology, innovative computing techniques, and a little rocket science.

A Mystery of a Whale

On 13 March 2002, an adult male Cuvier's beaked whale stranded alive at Gearhart Beach, Oregon, about two hours northwest of Portland. The stranding of any Cuvier's



beaked whale is a sad but fairly uncommon occurrence.

Beaked whales are among the most unusual mammals on earth. Their foraging dives are deeper than any other air-breathing animal on record, sometimes as far as 1,900 meters below the ocean's surface. The length of time they spend underwater between breaths is also unmatched—up to 85 minutes per dive. When they do eventually surface for air, they typically spend only a few minutes at the ocean's surface. This deep diving behavior makes them exceedingly difficult to find and study at sea. In fact, Cuvier's beaked whales are so rarely seen that virtually all scientific information about them comes from studying a small number of stranded specimens.

Scientists have hypothesized that beaked whales—particularly Cuvier's beaked whales—may be especially sensitive to certain sound frequencies. Based on limited research and some real-world cases where these whales have come ashore, scientists believe sound frequencies similar to mid-frequency active sonar may cause these animals to swim away from the sound source under certain conditions. (Note: Cuvier's beaked whales also swam away from killer whale (orca) sounds and random sound samples in similar experiments. For additional details, see http://www.navy.mil/Search/display.asp?story_id = 44857.)

Beaked whales are so difficult to study in the wild that determining the effects of Navy sonar on these animals is an ongoing challenge.

Beaked Whales & Navy Sonar

ACTIVE SONAR HAS been identified as a contributing factor in a handful of marine mammal strandings over the past 15 years. Beaked whale strandings near Greece in 1996, the Bahamas and Spain in 2000, the Canary Islands in 2002 and Spain in 2006 have been linked to active sonar use, along with other factors. Conditions including unusual (steep and complex) underwater geography and limited egress routes (constricted channels) are believed to have contributed to these stranding events. By contrast, thousands of marine mammals die each year as a result of accidental fishing bycatch and strandings due to natural causes. (Note: For additional information on marine mammal strandings and bycatch, visit http://www.nmfs.noaa.gov/strandings.htm and http://www.nmfs.noaa.gov/bycatch.htm on the National Oceanographic and Atmospheric Administration Fisheries web page.) Concerned about the potential impact of sonar on marine species, by the year 2000 the Navy had begun funding substantial research and developing new policies and procedures to protect marine mammals.

The Navy's Marine Mammal Research Program

THE NAVY HAS done more to fund marine mammal research than any other organization in the world over the last five years, dedicating more than $20 million in 2009 alone for marine mammal research projects.

To conduct this research, the Navy funds some of the most respected universities, research institutions, and private companies. Navy-funded marine mammal research covers many areas, including:

- Determining the distribution and abundance of protected marine species and their habitats.
- Improving understanding of effects of sound on marine mammals.
- Developing improved marine mammal protection measures to lessen such effects.
- Improving passive acoustic monitoring techniques to detect and localize marine species, particularly on Navy undersea ranges.

For more about the Navy's work in marine mammal research, see our story entitled "Navy Leads the Way in Marine Mammal Science: Continuing Investments Will Aid Decision Making, Protect Ocean Life" in the winter 2009 issue of *Currents*. You can browse the *Currents* archive and find a digital version of the magazine at www.enviro-navair.navy.mil/currents.

The Navy's marine mammal research program is designed to help in this process. As part of this program, the Navy conducts behavioral response studies in which researchers tag marine mammals and track their movements before, during, and after Navy sonar training exercises or simulated sonar exposures. (See our sidebars for more information on the Navy's behavioral response studies and marine mammal research program.)

But, as the name suggests, behavioral response studies only investigate how an animal's behavior is altered as a reaction to sound. To fully understand the effects of Navy sonar on beaked whales, it is equally important to determine how sound interacts with the anatomy of the animal. And Dr. Ted Cranford knew how to do just that.

"We started with the premise that we could determine if mid-frequency sonar could cause injury to beaked whales," said Cranford. "One way to determine this potential for injury and damage is through computer simulation, something called Finite Element Modeling (FEM)."

"So how do you build one of these computer models? The first thing you have to find is what I call the anatomic geometry. In other words, where are the structures in each head and what are their functions? The primary technology for finding this is x-ray computed tomography (CT)."

Construction Cardboard & Rocket Science

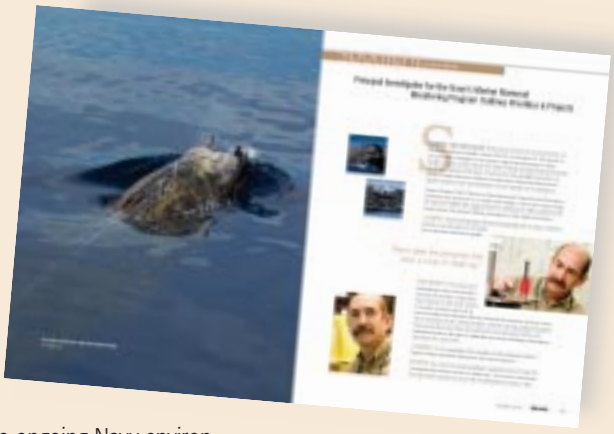
X-ray CT is a technology often used to create detailed images of internal structures in the human body. Patients are placed in a large enclosure and scanned, yielding accurate three-dimensional images which physicians can use for medical diagnoses.

"At the time, nobody had tried to scan larger animals because you couldn't get them in a hospital scanner," said Cranford. Which is why, while working in a Navy laboratory, Cranford was intrigued to find industrial sized CT scanners used to detect flaws in solid fuel rocket motors.

"When I found that out I thought, 'I wonder if we can use these to scan a

We started with the premise that we could determine if mid-frequency sonar could cause injury to beaked whales.

Navy Behavioral Response Studies



IN 2009, MARINE mammals were monitored before, during and after naval exercises using sonar on the Atlantic Undersea Test and Evaluation Center in the Northern Bahamas and the Southern California Offshore Range in California. The Navy also collected data during biological and behavioral studies of marine mammals in the western Mediterranean Sea.

These studies involved the monitoring and tracking of marine mammals using acoustic devices and satellite tags. Several species of marine mammals were tagged during these efforts, including Blainville's beaked whales and Cuvier's beaked whales.

As a result of the studies, specialized information obtained regarding the baseline behavior of beaked whales and their response to sound will be integrated into ongoing Navy environmental planning for exercises and also be made available to science organizations worldwide to support their research efforts.

For more information on Navy-funded behavioral response studies, see our spotlight interview with Dave Moretti, Principal Investigator for the Navy's Marine Mammal Monitoring on Navy Ranges program in the winter 2010 issue of *Currents*.

The industrial x-ray CT scanner at Hill Air Force Base, UT is normally used to scan solid fuel rocket motors. Here, it prepares to scan the frozen head of a Cuvier's beaked whale enclosed in a cardboard tube.

whale head.' It took me about a year to figure out how to really do it."

In 1997, Cranford successfully scanned and mapped the three dimensional anatomy of a sperm whale's head using an X-ray CT rocket scanner at Naval Air Weapons Station in China Lake, CA.

The hardest part was determining the ideal type of container to hold the massive head, according to Cranford. The container had to rotate while keeping the head in the same condition for several days during the scanning process.

Cranford eventually settled upon using giant cardboard tubes—the same type used to pour concrete columns for freeways. The frozen whale head was placed inside the tube, and the tube was filled with insulation foam. Like a giant ice cube wrapped in a thermal blanket, the head could stay frozen for weeks. The x-rays from the scanner could easily penetrate tube and bone and create detailed images of the whale head.

Cranford employed this same process with the Cuvier's beaked whale head from Gerhardt Beach. As part of a study funded by ONR and N45, he set out to gather data on how beaked whales hear specific sound frequencies. (For more information on ONR and N45, see our sidebar.)

A colleague of Cranford's was the first to arrive at the site of the stranding on Gearhart Beach after spotting the 17-foot animal while driving by in his car. By the time he made it down to the surf, it was too late to save the whale.

While a marine mammal stranding event is not uncommon, finding a specimen in such pristine condition is an unusual scientific opportunity for a marine biologist. And such a find was at the very top of Cranford's list.

"We are unraveling the physiology of sound production and hearing in beaked whales, which is something we don't know much about because we have so few specimens to study," said Cranford. "The type we more frequently see is when they're dead on the beach, after a few weeks of floating in the water, which makes the carcass unusable. Getting this fresh specimen was incredibly valuable."

Cranford's colleague packed the head in ice almost immediately after discovery to preserve it. He then sent the head to San Diego, where it was placed into a giant cardboard tube along with four density rods. Density rods are narrow tubes constructed of materials with known density (such as

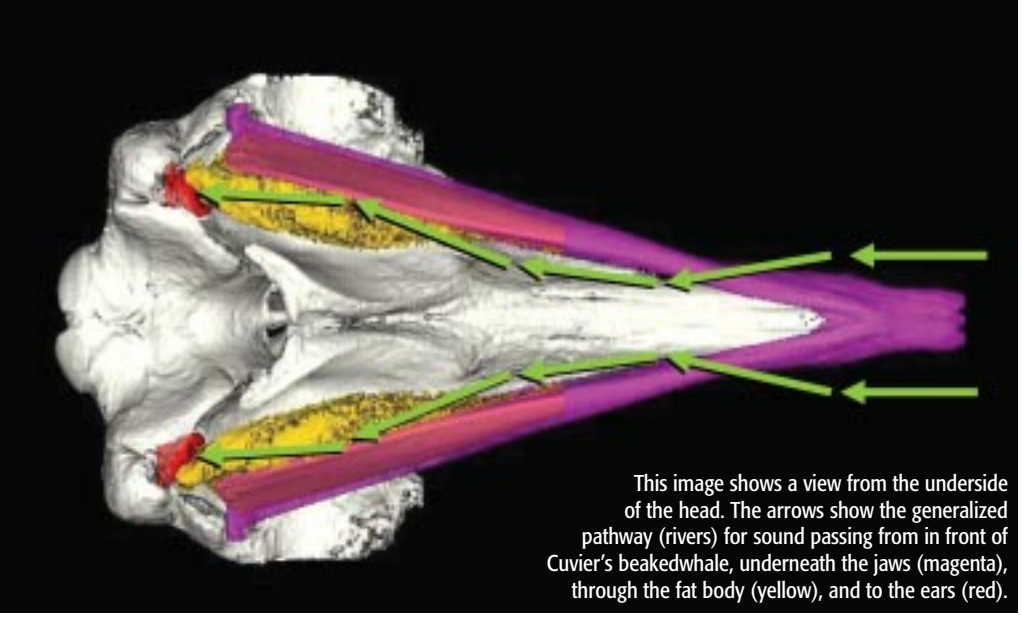
ONR & N45

ONR AND N45 committed $20 million for research on marine mammals and the effects of underwater sound in 2009.

ONR provides the science and technology necessary to maintain the Navy and Marine Corps' technological advantage. Through its affiliates, ONR is a leader in science and technology with engagement in 50 states, 70 countries, 1,035 institutions of higher learning and 914 industry partners.

N45 works with the fleets, systems commands and government regulatory agencies to develop effective environmental policy and ensure Sailors and Marines can train and operate in compliance with environmental laws.

For more information on ONR, visit http://www.onr.navy.mil. For more information on N45 and the Navy's environmental programs, visit https://www.navy.mil/oceans.



This image shows a view from the underside of the head. The arrows show the generalized pathway (rivers) for sound passing from in front of Cuvier's beakedwhale, underneath the jaws (magenta), through the fat body (yellow), and to the ears (red).

glass or aluminum), and are used to aid researchers in analyzing the density of tissues in a CT scan.

The tube was then filled with insulating foam to preserve the specimen, and sent to Hill Air Force Base in northern Utah where the head was scanned over several days in one of the world's largest industrial x-ray CT scanners.

The scanning process revealed how the head of Cuvier's beaked whale is structured. By segmenting the CT images based on tissue density, researchers differentiated the tissues in the head for future analysis. The head was then thawed and dissected, and the elasticity of each mass was measured by Dr. Robert Shadwick at the University of British Columbia. These values, combined with the tissue density values given by the CT scan, were the two primary building blocks for the computer model. And they took Cranford one step closer to unraveling the mystery of sound and Cuvier's beaked whale.

Rivers of Sound

The scientific community often looks at computer modeling with skepticism. Models typically try to predict things that cannot be completely pinned down—things like the weather or the behavior of animals. But Cranford was interested in a Finite Element Model (FEM) to reveal how Cuvier's beaked whales hear.

"FEMs allow us to calculate solutions to mathematical equations that are firmly grounded in physics," said Cranford.

"It's the same reason very effective models can be built to test how a building will withstand an earthquake. The properties of the building—steel, concrete and drywall—are all known entities."

Cranford partnered with Petr Krysl of the University of California at San Diego to develop the FEM.

"Petr is a structural engineer who knows how to build these models," said Cranford. "It's the perfect collaboration. He builds these tools and gets a lot of enjoyment out of seeing somebody use them. I get to ask all of these interesting questions, but I couldn't come anywhere near building the tools to answer them. We're making a lot of headway very quickly."

It was previously thought that beaked whales received sound through their thin lower jawbone. But the computer simulations indicated a different scenario.

Sounds arriving from in front of the animal's head actually entered through the space underneath the jaw and tongue region, through what is known as the "gular pathway." The sound passes through the throat and then through an opening in the posterior part of the hollow lower jaw, propagating along a fat body to the ear.

The model showed that the fat body, tissue and bone were all connected to channel this "river of sound" through the whale's head. The anatomy acts

Cuvier's beaked whale.
Greg Schorr, Cascadia Research

as a wave guide to direct sound back to the animal's ears.

All living toothed whales are missing the bony wall inside the lower jaw. This feature, it turns out, is essential for this sound reception pathway to function. Some of the earliest fossils of toothed whales also show the same hollow jaw, suggesting that this pathway developed early in the evolution of whales.

"So we are not only finding out new things about this animal, but the principles we're discovering may be more broadly applicable to all living toothed whales as well as ancient whales," said Cranford.

Hearing Sonar

To truly determine the physiological response of a beaked whale to Navy sonar, one must get to the heart of the matter. Or in this case, the inner ear.

Using existing anatomic information from a digital library, the computer model allowed Cranford to predict how the bony ear complex (tympanoperiotic complex (TPC)) would vibrate when exposed to incoming sound. This "vibrational analysis" describes how the features of the inner ear interact to produce the collective motion of the TPC.

The vibrational analysis tested sounds from 2.5 to 60 kilohertz (kHz) to determine the distribution of the sound pressure over the ear bone surface and the frequencies at which the bony ear complex vibrates.

Most U.S. Navy mid-frequency active sonar operates between 3 and 5 kHz. It turns out that those frequencies reach the ears with reduced amplitude and are largely filtered out.

Conversely, the frequencies at which beaked whales use biosonar to communicate and catch prey (12.5 kHz to 42.5 kHz) are amplified.

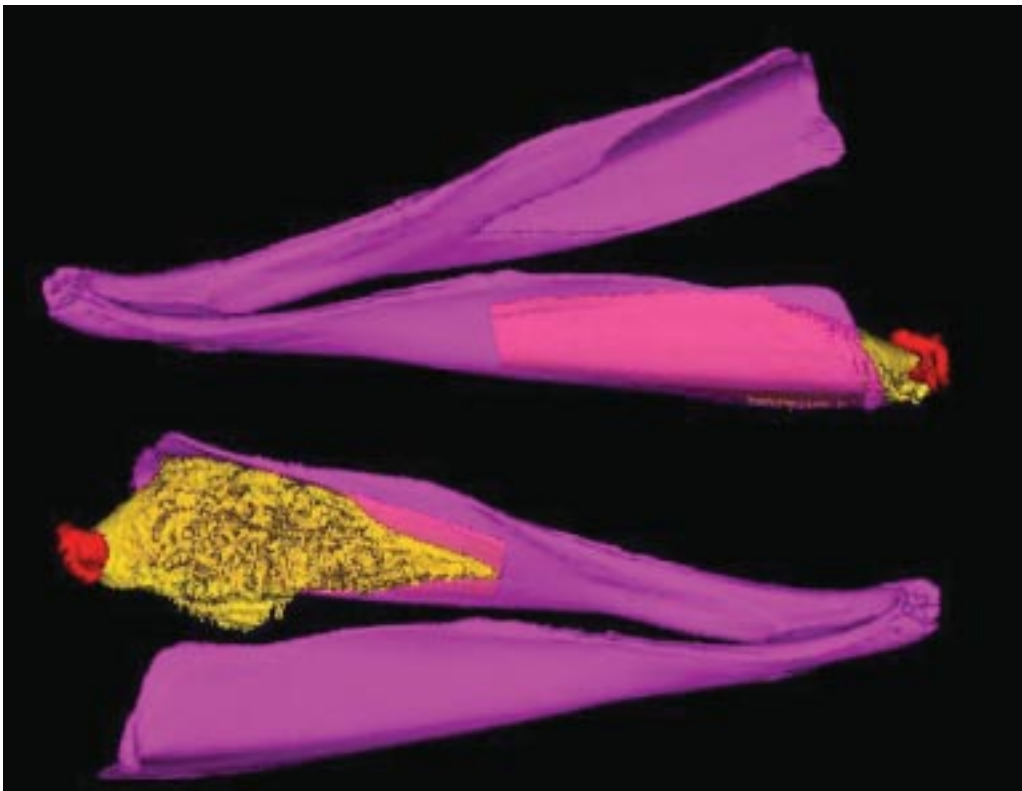
"This evidence suggests that Cuvier's beaked whale hearing anatomy treats sounds of different frequencies in different ways," said Cranford. "It's filtering out some sounds and amplifying others."

According to Cranford, one of the most powerful things about this modeling approach is that it gives researchers the ability to do virtual experiments—that is, the ability to test what would happen inside an animal's head without using a live animal. Another aspect of virtual experiments which has yet to be tested but has enormous potential is the ability to test mitigation strategies.

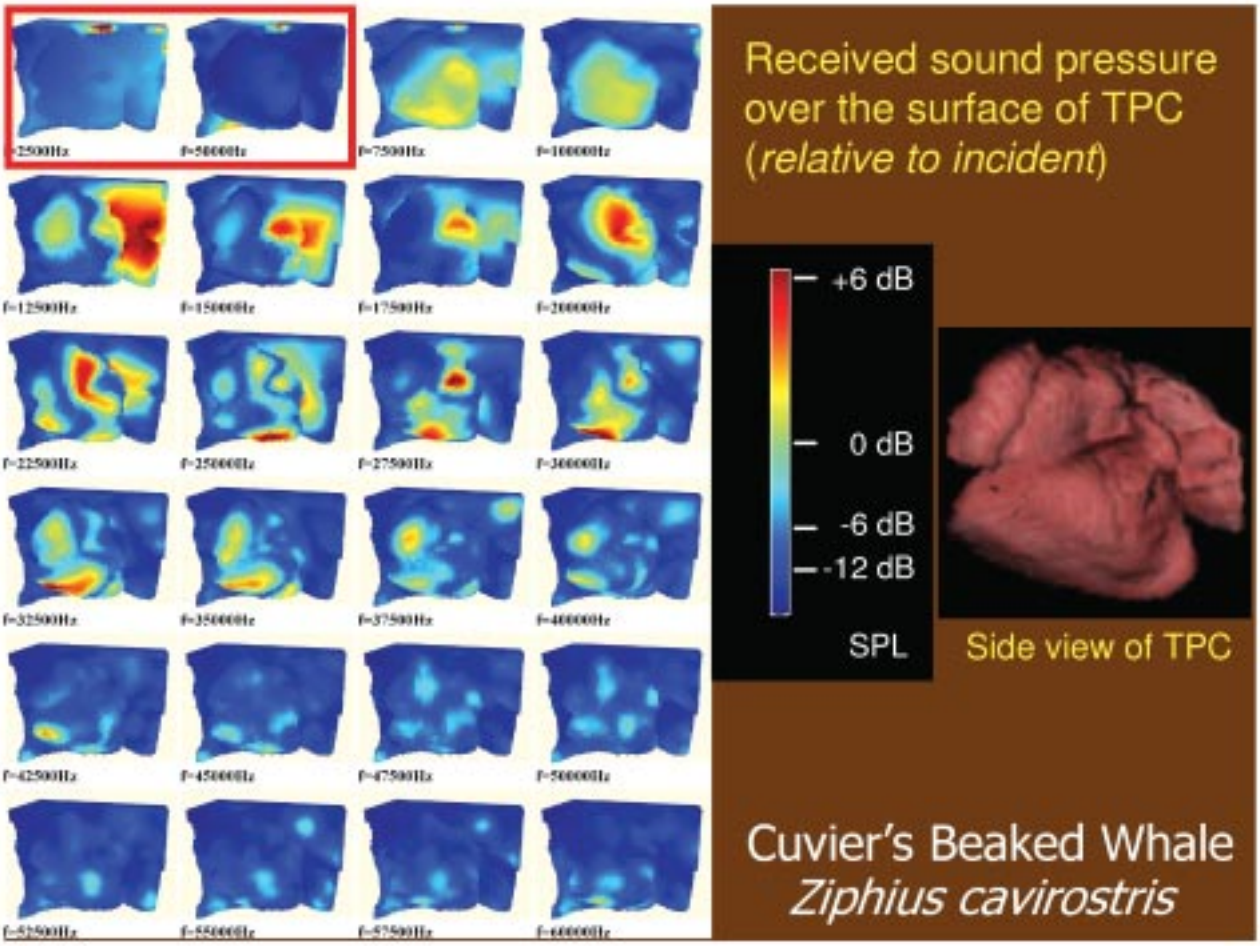
"We don't know exactly what an animal will do behaviorally when it hears a particular sound of a particular loudness or a particular frequency," said Cranford. "But these models will help us understand how a sound is going to interact with the anatomy of the animal."

These answers will also bring us closer to answering longstanding questions about the effects of Navy sonar on beaked whales.

"We are gaining a better understanding about the physics of whale hearing," said Cranford. "With this approach, we can begin to sort out which ideas have validity and which don't."



These views of the jaws (magenta) from a Cuvier's beaked whale are reconstructed from x-ray CT scans. The image on the top shows that the rear portion of the jaws is hollow and there is no bony wall on the inside. This is even more evident in the image on the bottom, as the fat body (yellow) is clearly seen because the bony wall is missing. The ear complex (red) is also shown.



The inner ear of Cuvier's beaked whale, seen in each of the 24 subpanels, was exposed to sound at various frequencies. Researchers were able to visualize how sound was interpreted at each frequency using the key on the right.
Green means pressure is equal to the sound pressure incident on the head (0 decibels (dB)).
Blue means sound pressure is -12 dB below incident pressure, or four times less than the incident.
Red means sound pressure is +6 dB, or twice the incident pressure.
The first two subpanels (outlined in red) are the frequencies produced by Navy mid-frequency active sonar. The blue color indicates that these frequencies are largely filtered out before reaching the ear.

Ted Cranford

Looking Ahead

"Even though these findings are promising, our next step is to reproduce the study with a similar species for which hearing tests are available, such as the bottlenose dolphin," said Cranford.

These validation experiments are currently underway. Luckily, a large amount of data already exists about the bioacoustics and biosonar of bottlenose dolphins. If Cranford applies a similar FEM approach to bottlenose dolphins and obtains like results, this will validate his beaked whale hearing model.

"Thus far we're pointing in the right direction," said Cranford.

Cranford plans on publishing more results, especially with beaked whales found on Navy ranges. Eventually, he sees expanding the technology to other creatures of the sea.

"Each set of organisms presents its own challenges. The whales are probably the most difficult. But they're not the only ones. The Navy is interested in what's happening to all the organisms in the ocean. And they're the only ones that are stepping up to the plate to try and figure out what the effects of sound are," he concluded. ⚓

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Christmas Trees Provide Unique Beach Stabilization Opportunity

Volunteers Help to Restore Dunes at JEB Little Creek-Fort Story

INSTEAD OF HAULING their Christmas trees to the curb after the holidays, over 100 residents and military personnel on Joint Expeditionary Base (JEB) Little Creek-Fort Story, VA partnered to help restore the beach areas hardest hit by a late 2009 northeaster. Natural resources staff with Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic set up tree accumulation areas at both the East (formerly U.S. Army Garrison Fort Story) and West (formerly Naval Amphibious Base Little Creek) properties.

"This is a great project to support, is easy to participate in, and helps the environment. This is especially true following our recent storm," said Sara Bell, NAVFAC's natural resources specialist. "Not only can our military families go green by buying a real tree this holiday season, but they now know that they can help our base go green all year long by donating their tree. We have limited and valuable training beaches on the JEB. Our military families can help protect those scarce resources."

After the November 2009 storm, most of the gently sloping sand dunes had eroded into vertical-faced drop-offs. Some dunes were completely washed out and water and sand poured into the developed areas of the installation. Luckily, discarded Christmas trees started piling up on 26 December. By 12 January 2010, the tree turnout was impressive—51 and 71 trees from the East and West campuses, respectively. About half of the trees came from other Navy and Army installations, showing that this really was a team effort that spanned military branches and bases.

On the morning of 12 January, the temperature was 30 degrees Fahrenheit (°F) with a wind-chill of 19°F, yet volunteers still turned out to help with tree placement. At JEB East, the Christmas trees were placed landward of sand fencing still in place. At JEB West, trenches were dug at the dune base and trees were "planted" upright to protect the dune face.

"I was impressed that people still showed up. Once we reached the dune crest, we had to lean into the wind to get the trees over the sand fencing. The trees help reestablish the dunes by catching more sand than the fencing alone. Where there is no sand fencing yet, the upright trees will guard against wind and water erosion," Bell said.

Trees were placed behind sand fencing at JEB Little Creek-Fort Story.
Sara Bell

She notes that the project would not have been a success without tree donations and the volunteer assistance from co-workers, housing management, and citizens. Bell has plans to continue restoration efforts in spring and autumn 2010 by installing more sand fencing and planting native warm and cool season grasses.

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Chief of Naval Operations Environmental Award Winners Named for FY 2009

Awards Recognize Exceptional Environmental Stewardship

WINNERS OF THE Fiscal Year (FY) 2009 Chief of Naval Operations (CNO) Environmental Awards competition, sponsored by the CNO Environmental Readiness Division were announced 5 February 2010.

The annual CNO Environmental Awards competition recognizes Navy ships, installations, and people for exceptional environmental stewardship. The FY 2009 competition categories included: natural resources conservation, cultural resources management, environmental quality, sustainability, environmental restoration and environmental excellence in weapon system acquisition.

The 25 winners listed alphabetically within category are:

Natural Resources Conservation Small Installation Award:

- Commander Fleet Activities Yokosuka, Japan
- Naval Air Station Pensacola, FL
- Naval Weapons Station Seal Beach Detachment Fallbrook, CA

Natural Resources Conservation Individual or Team Award:

- John R. Burger of Pacific Missile Range Facility, Hawaii
- Environmental Team of Naval Undersea Warfare Center Division Newport, RI
- Michael F. Wright of Naval Air Station Oceana, VA

Environmental Quality Non-industrial Installation Award:

- Naval Base Coronado, CA
- Naval Base San Diego, CA
- U.S. Naval Support Activity Bahrain

Environmental Quality Individual or Team Award:

- Awni M. Almasri of Naval Facilities Engineering Command Europe Africa Southwest Asia
- Environmental Program Management Team of U.S. Navy Region Center, Singapore
- Environmental Quality Team of Naval Air Weapons Station China Lake, CA

Environmental Quality Large Ship Award:

- USS DWIGHT D. EISENHOWER (CVN 69)
- USS FRANK CABLE (AS 40)

Sustainability Industrial Installation Award:

- Fleet Readiness Center East, Cherry Point, NC
- Fleet Readiness Center Southwest, San Diego, CA

Environmental Restoration Installation Award:

- Former Naval Air Facility Adak, AK
- Naval Air Facility El Centro, CA
- Naval Air Station Brunswick, ME

Environmental Restoration Individual or Team Award:

- Alameda Point Environmental Restoration Team of Base Realignment and Closure Program Management Office West, CA
- Environmental Restoration Team of Naval Base Ventura County, CA
- Vieques Naval Installation Project Management Team, Puerto Rico, of Naval Facilities Engineering Command Atlantic

Environmental Excellence in Weapon System Acquisition Team Award:

- F/A-18E/F & EA-18G Program Office (PMA-265) Green Hornet Team of Program Executive Officer, Tactical Aircraft Programs
- F-35 Lightning II Environmental, Safety and Occupational Health Team of Program Executive Officer, Joint Strike Fighter Program
- Marine Species Mitigation Research Team (PMA-264) of Program Executive Officer, Air Anti-Submarine Warfare, Assault and Special Mission Programs

Rear Admiral Herman Shelanski, director of the CNO Environmental Readiness Division, commended the winners.

"Bravo zulu to all award winners, and thanks to all commands who participated. You have achieved environmental excellence while supporting the maritime strategy. Your sustained commitment to environmental stewardship is an integral part of Navy operations and vital to overall Navy mission accomplishment."

The CNO award winners will be honored 1 June 2010 in a ceremony in Washington, D.C. at the U.S. Navy Memorial and Naval Heritage Center. ⚓

This article originally appeared on the Navy Newsstand at www.navy.mil.

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N45 Provides Expanded EPCRA Guidance for Environmental Managers

New EPCRA Guidance on Batteries Makes Reporting Easier

THE CHIEF OF Naval Operations Environmental Readiness Division (N45) has expanded its "Getting Started with the Emergency Planning and Community Right-to-Know Act (EPCRA)" (May 2009) guidance with a new section on batteries. "How to Consider Batteries Under EPCRA" expands on the previous guidance by providing detailed information on:

- Developing a list of batteries stored and used at the installation,
- Applying battery exemptions,
- Identifying and calculating battery thresholds, and
- Preparing and submitting EPCRA reports for batteries.

Sample calculations on batteries for each section of EPCRA are also provided. The new section covers all applicable EPCRA reporting requirements including:

- Emergency Planning (Section 302),
- Hazardous Chemical Inventory Reporting (Sections 311/312), and
- Toxic Chemical Release Reporting (Section 313).

In addition, an Excel™ spreadsheet, "Calculation Manual—Batteries," included with the expanded guidance provides a template for calculations and documentation for an EPCRA battery analysis. Sample values (that must be deleted when used for an installation) are included in italics in the spreadsheet to assist the user.

You may request a copy of "How to Consider Batteries Under EPCRA" and the accompanying calculation spreadsheet from Anita Firestine at anita_firestine@urscorp.com or download an electronic version from the Toxic Release Inventory Data Delivery System (TRI-DDS) web page at https://dod-tridds.org/tri-web/ (login required). Once on the TRI-DDS site, click on "Documents" on the left side menu bar to view two battery-related files. ⚓

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BE PART OF OUR FALL ISSUE

Submissions Are Due by 23 July

We're already planning our fall 2010 issue and you can be a part of it! If you have a story that you want us to consider, you need to submit your final text and images by 23 July 2010.

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

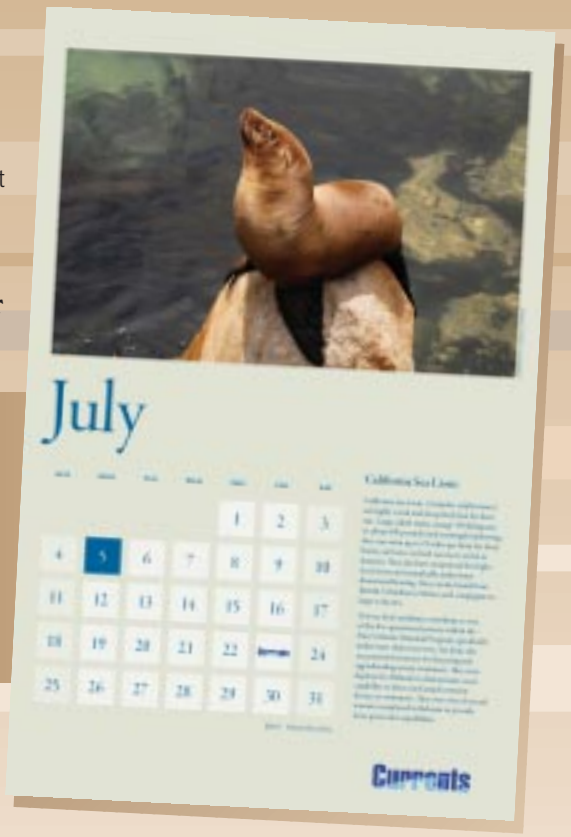
We look forward to reading your stories about all the great work you're doing as the Navy's stewards of the environment.

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

Currents Deadlines

Fall 2010 Issue: Friday, 23 July 2010
Winter 2011 Issue: Friday, 22 October 2010
Spring 2011 Issue: Friday, 21 January 2011
Summer 2011 Issue: Friday, 22 April 2011

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



Demolitions Clear the Way for Fleet Readiness & Quality of Life at Pearl Harbor

Meeting Reduction Goals Involves More than Just Sending in the Wrecking Ball

AT THE CONTROLS of a large excavator, outfitted with a "hole-ram" jackhammer, Naval Facilities Engineering Command (NAVFAC) Hawaii transportation department equipment operator Dean Johnasen, carefully punches holes in the Red Hill Water Tank. The tank, constructed with concrete, and held together with a web of rebar, doesn't look like it should take so much effort to knock down. However, as is the case with all demolitions performed by the Navy at Pearl Harbor, there's more to it than meets the eye.

"We always take a great deal of pride in our work when taking down a structure," said Gary Collins who works in the NAVFAC Hawaii transportation department. "It is exciting and satisfying, especially when the building is very well built and a challenge to demolish correctly."

The elaborate preparatory work and careful demolitions are carried out

The NAVFAC Hawaii transportation department takes great care when demolishing any building. Here, small holes are punched in the Red Hill Water Tank in order to make separating the concrete from the recyclable rebar easier.
James Johnson

The Banyans, made of concrete, metal trusses and rebar, being disassembled by NAVFAC Hawaii Transportation personnel. The effort took many days due to the construction materials of the building.
Denise Emsley

under the Navy's Demolition Footprint Reduction Program, which has been in effect since 1998 and is a high priority in Hawaii. The goal is to reduce infrastructure inventory by 20 percent as part of the Navy Shore Vision 2035—a long term effort to revamp Navy infrastructure.

"It's an ambitious goal," said NAVFAC Hawaii Public Works Department Head, Cmdr. Lore Aguayo. "We have a couple of ways to reduce infrastructure, the first is to demolish a facility and not build anything in its place, or build a facility that makes it possible to consolidate several other buildings, which can then be torn down."

Reducing infrastructure saves the Navy money. Old facilities use more resources like water and electricity than their newer counterparts because they were not built to the energy efficiency and sustainability standards in use today. Older facilities also cost more to maintain. Every year, these buildings drain limited resources which could be better used elsewhere.

Building 193, formerly used by the Family Services Center, was demolished in 2008. The Navy estimates that the removal will save $150,500 in building maintenance costs each year. These savings will help recapitalize infrastructure and other needs.

The Banyans (Building 1247), a former Navy Officers' Club which was also used as a conference center, reached the end of its useful life in 2008 and has since been replaced by

Prior to demolition, an old, wooden two-story structure (Building 193) located on base at Pearl Harbor housed the Navy's Family Service Center. The Center moved into a new building adjacent to the renovated Moanalua Shopping Center, providing a clean, fresh and pleasant environment where military personnel and their family members can visit without entering the base.
Denise Emsley

NAVFAC Hawaii's remediation crew prepares most Navy structures scheduled for demolition in Hawaii. They remove asbestos tile, lead-based paint and any other items that would be harmful to the environment or public health.
Denise Emsley

a new, state of the art conference center on Ford Island, saving the Navy $342,000 in building sustainment costs each year.

As Navy missions and programs evolve, old facilities sometimes find themselves in less than ideal locations. Therefore, when a building is torn down, it is not always replaced by a new facility built in the same space. That is what happened with both the Family Services Center and The Banyans. New buildings to fit those needs have been built in locations better suited for their current uses, which allows the old lots to remain vacant. Those areas are either paved or landscaped, whichever makes best use of the newly acquired space.

Demolishing a building is not as straightforward as sending in the bulldozer or wrecking ball. The Navy recognizes the need to be good stewards of the environment and preserve historically important buildings.

Environmental Considerations

Some existing Navy facilities in Hawaii were built at a time when strict environmental regulations were not in place. For example, NAVFAC Hawaii Environmental Services extensively tested the Red Hill Water Tank to ensure that the concrete did not contain levels of asbestos that could be released into the air and soil in the surrounding area during demolition. Many of the buildings removed under the Navy's Demolition Footprint Reduction Plan were built in the 1940s and 1950s. Along with asbestos, some of these structures were built with lead paint, wood treated with arsenic and other environmentally hazardous materials.

"We understand that we have tighter environmental regulations now, compared to 50 years ago," said Francisco Pena, a supervisory environmental protection specialist at NAVFAC Hawaii. "So, when demolishing a building, we take great care to follow all the rules to ensure environmental protection and public safety."

For each demolition project, NAVFAC Hawaii conducts an environmental evaluation and works with other federal, state and local environmental agencies when appropriate. Nonhazardous materials left over from a demolition site, such as certain types of metals and wood products are recycled. Materials that cannot be recycled are sent to landfill facilities. That is why NAVFAC Hawaii equipment operator Johnasen at the Red Hill Water Tank demolition project took so much care to punch small holes into the concrete. Doing so makes the concrete easier to separate from the recyclable rebar. The process of sending the concrete to a landfill also becomes more efficient.

Preserving Pearl Harbor's History

"[We have] a great amount of the same infrastructure that we had in World War II," said Vice Adm. Robert T. Conway Jr., former commander, Navy Installations

Command, in a July 2008 *Seapower* magazine interview. "Why do we have all this stuff? Over the years, we've kept so much stuff that it's not affordable anymore. If the single Sailor or the family is being impacted, or worse yet, the warfighting capabilities, it makes sense that we transform ourselves."

Despite cost savings and the need to modernize shore infrastructure, the decision to demolish a building can be very difficult because it may have special historical significance. At Pearl Harbor, many structures date back to World War II or earlier. These buildings reflect the architecture and building methods of their time, and often are not adequate for today's purposes. When considering an older building for demolition, the Navy works diligently with groups like the State Historic Preservation Division, and makes recommendations in conjunction with the State Historic Preservation Officer.

"In some cases, considerations involve trade-offs," says Aguayo. "The Navy does not have the funds to maintain all its historic buildings, but the cost-savings of reducing the number of old structures can be used to improve the conditions of buildings with the most historic value."

Three storage warehouse buildings along Pearl Harbor's M4 pier, which date back to the World War II era, are a prime example.

The facilities were built to be used as warehouses for pier work. Over time, they have become less usable for that purpose, and are ideal candidates for the Navy's Demolition Footprint Reduction Program. However, the warehouses have historically important architectural elements which can be beneficial to preserve.

Demolishing a building is not as straightforward as sending in the bulldozer or wrecking ball. The Navy recognizes the need to be good stewards of the environment and preserve historically important buildings.

In this situation, the Navy has decided to retain one of the buildings, and remove the other two. Before demolition, elements such as doorframes and windows, will be removed from the two buildings, and used to refurbish the remaining warehouse. As part of its restoration, the Navy plans modern upgrades to the remaining facility as well, such as energy efficient lighting components. This will save money and allow the Navy to use the warehouse for its original purpose.

As Navy installations such as those in Hawaii move forward and modernize, change is inevitable. Personnel involved in the Navy's Demolition Footprint Reduction Program remain responsive not only to Department of Defense needs, but also to environmental regulations, historic preservation considerations and the quality of life at surrounding communities. ⚓

From left to right, warehouse facilities 148, 147 and 146 along Piers M4 and M3 are a part of the Navy at Pearl Harbor's Footprint Reduction Program. Buildings 147 and 146 are scheduled to be torn down in the near future, while 148 is being renovated.

James Johnson

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"How inappropriate to call this planet **Earth**

when it is quite clearly **Ocean**."

- Arthur C. Clarke

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Lasering on the Pasquotank

Coast Guard Using Laser Beams to Reduce Hazardous Waste Stream

THE UNITED STATES Coast Guard Aviation Logistics Center (ALC), located on the Pasquotank River in northeastern North Carolina, provides support for 27 Coast Guard Air Stations throughout the United States and Greater Antilles. The Elizabeth City depot employs over 1,450 civil service, active duty and contractor

U.S. Coast Guard ALC in Elizabeth City, NC.
Dave Silva

Representative inventory of Coast Guard operational aircraft in 2009.
Dean Schaan

personnel; one of the elements of this support is the annual depot overhaul of approximately 40 of the 200 aircraft in the Coast Guard's inventory. Possibly the greatest challenge of the aircraft overhaul procedure is the effective removal of the polyurethane topcoat in preparation for new paint prior to re-entering service.

Conventional aerospace coatings removal methods, utilized throughout the Department of Defense (DoD) and Department of Homeland Security (DHS), result in a major waste stream consisting of toxic chemicals and spent media blast materials. The chemicals that are typically used in this process are also high in volatile organic compounds and hazardous air pollutants, both of which are targeted for reduction/elimination by environmental regulations.

Because of these environmental concerns, ALC is continually searching for alternative ways to reduce these process hazardous waste streams.

From Toxic to Biodegradable

In 2005, ALC began using biodegradable cornstarch blast media as an alternative to the abrasive media normally used. This process has proven to be extremely effective and has reduced the hazardous waste stream associated with topcoat removal. In addition, ALC partnered with the U.S. distributor, Midvale Technologies, of GPX, to recycle the spent media into a new product called StarZorb®. StarZorb leaves ALC with a new Material Safety Data Sheet and goes on to a licensed Treatment, Storage and Disposal Facility where it is used as an absorbent. The material is then mixed with other waste liquids and solids at a cement plant, creating fuel for a kiln. The resultant kiln ash has been tested and determined to be sterile. This sterile ash may be mixed with other biodegradable waste products and utilized as backfill in mining operations. Trees and bushes have been successfully planted in the newly filled and landscaped areas, representing a true "cradle to grave" process.

New Technology Sought

Although the cornstarch blast media is ALC's primary topcoat removal

process, there were still areas on the airframe, and individual parts, which could only be stripped utilizing chemicals. Because of the environmental concerns with aircraft overhaul procedures and in support of ALC's Environmental Management System (International Organization for Standardization (ISO) 14001:2004 certified) another methodology was sought to supplement the topcoat removal process and minimize the remaining waste stream.

ALC capitalized on its membership on the Environmental Security Technology Certification Program (ESTCP) board. ESTCP's goal is to demonstrate and validate promising, innovative technologies that target the most urgent environmental needs of DoD. These technologies provide a return on investment through cost savings and improved efficiency. Through this program, the ALC signed a letter of agreement with Wright-Patterson Air Force Base (AFB) to proof a new topcoat removal technology involving handheld lasers.

Laser coating removal is a non-intrusive energy process that can be applied to a variety of substrates, including composites, glass, metal and plastics. Lasers can be created at short, medium or long wavelengths, in either a pulse application or a continuous wave. The pulsed laser application is preferable for topcoat removal because it requires a much lower applied temperature (a higher temperature could harm the substrate). A thin layer of the coating is vaporized by the laser application, creating a plasma, or ionized gas. The plasma cracks the coating, at which point 99 percent of the debris is available for collection in a high efficiency particulate air (HEPA) filtrated vacuum system.

Training sessions for aspiring laser operators. *Dean Schaan*

ALC's Laser Systems

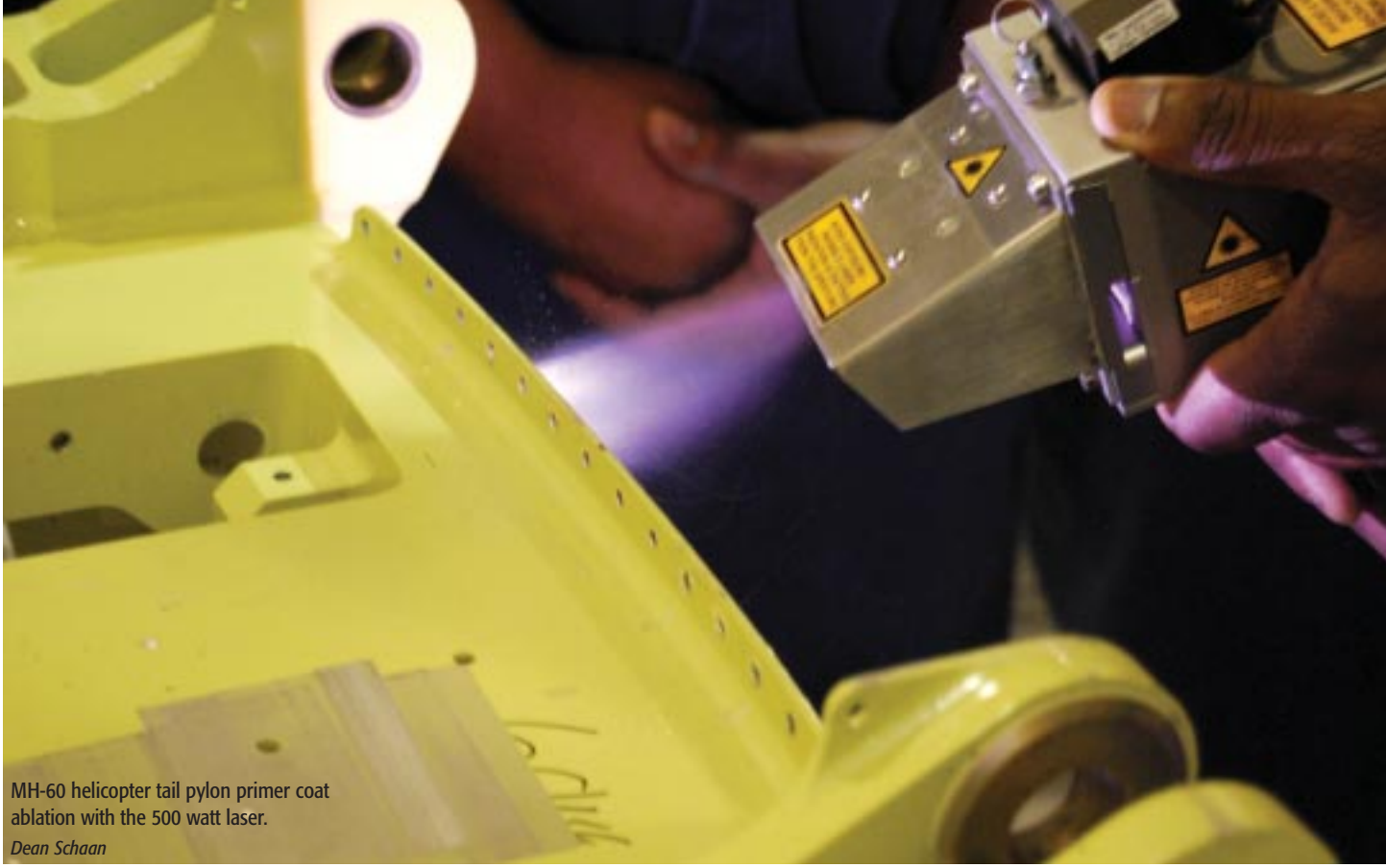
ALC procured two lasers via a simplified acquisitions procedure from a commercial off-the-shelf vendor. Fume extraction units (vacuum systems) for each of the two lasers were also procured. ALC required the units to be handheld (functional for aircraft parts and small areas on an airframe), and the wave guides (fiber optic cables) needed to have sufficient protections to allow for them to be pulled across concrete shop floors and aircraft surfaces. The handheld unit needed to provide scanning widths up to or greater than three inches to maximize the coating removal process. Two lasers were purchased, a 300 watt (maximum pulse peak power of 230 kilowatts (kW)) and a 500 watt (maximum pulse peak power of 450 kW). The historical solicitation for the laser ablation equipment can be found on Federal Business Opportunities dated 24 July 2007 by the Coast Guard at Elizabeth City, NC.

Safe laser operation was foremost on the agenda for the Safety, Environmental and Health Office (SEHO) at the ALC as they wrote a comprehensive Class I-IV laser operating procedure. The office director's primary mission was to ensure that no laser radiation, in excess of the maximum permissible exposure limit, reached the human eye or skin of an ALC employee. The SEHO paralleled its laser safety procedure with the American National Standards Institute Z136.1-2000 standard and appointed a Laser Safety Officer (LSO) to watch over the maturing program.

Laser coating removal is a non-intrusive energy process that can be applied to a variety of substrates, including composites, glass, metal and plastics.

Testing the Laser Process

The MH-60 Jayhawk (Sikorsky) helicopter fleet (one of four product lines at ALC) approved the first engineering request to conduct testing on aircraft wheels. Each of these wheels had previously been chemically stripped at a rate of anywhere from six to eight man hours to seven days work



MH-60 helicopter tail pylon primer coat ablation with the 500 watt laser.
Dean Schaan

per wheel—depending on humidity levels—with a substantial hazardous waste stream being generated. The aluminum/magnesium wheels proved to be a perfect test bed for the two lasers. The 500 watt laser worked well as the wheel was turned on a rotating table. It was determined that constant table rotation was imperative (regardless of revolutions per minute). The 300 watt laser was used to ablate the coatings in the concave forms of the inner wheel taking advantage of the much smaller stylus and one laser eye.

The HU-25 Falcon (Dassault Falcon Jet), a medium-range surveillance fixed-wing aircraft, was utilized for the first airframe testing. After removing 95 percent of the paint using the cornstarch method, sensitive areas around the windows and under belly remained. The laser proved very effective in these areas and provided the functionality that was desired as well as a significant time savings and hazardous waste stream reduction.

The HU-25 product line also experiences unscheduled or "drop-in" maintenance from time to time. One one occasion, a drop-in aircraft from Texas had moderate corrosion on the center wing plank (under belly). This corrosion was effectively removed and the aircraft was returned to service without having to induct the craft prematurely into overhaul. The corrosion removal technique has also been tested successfully on the engine bell mouth on the HU-25, greatly lengthening the service life of that component.

The MH-65 Dauphin (Eurocopter) product line requested an engineering

To Learn More

FOR MORE INFORMATION about the Coast Guard's experience with cornstarch blast media, see our article entitled "Cornstarch & The Coast Guard: Using An Environmentally Benign Substance to Remove Paint" in the winter 2005 issue of *Currents*. You can browse the *Currents* archive and subscribe to the magazine via the Naval Air Systems Command's environmental web site at www.enviro-navair.navy.mil/currents.

Fuselage stripping on a HU-25 Falcon around the search window.
Dean Schaan

study on the practicality of ablating the myriad of topcoat layers from the airframe's vertical stabilizer. This component is constructed of composite material and the heat index on the substrate was understandably a preliminary concern. The 500 watt laser effected the removal of the multi layers with great results. The laser has also been tested to remove the topcoat and corrosion from the helicopter collective handle grip—a handle that controls the blade angle of the helicopter. This part had previously been cleaned in a blasting cabinet (glove box) and the Mean Time Between Failure (MTBF) was historically high. Minimal, if any, damage was transferred to the substrate once the technique was perfected, and the MTBF is expected to migrate even higher.

Another unlikely application was realized during the ongoing testing of the lasers: the removal of soot from engine exhaust guards. The MH-60 has a stainless engine exhaust fairing that is subject to periodic visual inspection and possibly Nondestructive Inspection testing. Soot forms with the incomplete combustion of burning fuel (indicative of a gas turbine engine) and hinders the inspection for cracks or abnormal wear. The laser removed the soot satisfactorily without any damage to the substrate. In addition to facilitating a much more accurate visual inspection, the laser process has also returned badly scored fairings to service.

ALC's material engineer was an integral part of the qualifying of this laser methodology. An analysis was performed on each substrate to determine if peak temperatures during the process were high enough to change the mechanical properties or damage the base substrates. Desired peak temperature limits of 300 degrees Fahrenheit (F) for the aluminum panels and 200 degrees F on the graphite epoxy panels were established.

Adapt Laser fume extraction unit that captures approximately 99 percent of debris.
Dean Schaan

Training is Essential

The training curve for a laser operator is not to be underestimated. Each of the ALC technicians received no less than three hours of classroom training (laser concepts and safety/environmental health) and a minimum of 16 hours of hands-on training to receive laser qualification. The original equipment manufacturer (Adapt Laser Systems in Kansas City, MO) provided the training as part of the procurement.

A vital part of the training involved ergonomics. Awkward body, thumb and hand positioning are required to effectively operate the handheld laser. To reduce the potential for musculoskeletal damage, configuration and control adjustments were made and the majority of the discomfort to the operator was overcome. The ALC training manual and syllabus for this new technology is still being developed, with a focus on safety and health.

In cooperation with ESTCP, the original equipment manufacturer, and Wright-Patterson AFB, the ACL has just begun to realize the opportunities afforded with the new laser systems. The hazardous waste streams associated with topcoat removal processes at ALC decreased by eight percent in calendar year 2007, and is certain to decrease even further once the laser removal process is fully operational. ⚓

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Maintenance Center Albany Puts the Hex on Hexavalent Chromium

Safer Substitute Found for Anodizing Aluminum Parts

THE MARINE CORPS Logistics Command (LOGCOM) Maintenance Center Albany (MCA) recently replaced a hexavalent chromium (Cr(IV)) anodizing process for aluminum parts with a more benign trivalent chromium process.

LOGCOM, located in Albany, Georgia, is the focal point for the planning and execution of maintenance management for ground weapon systems for U.S. Marines. As the leadership organization for the two maintenance centers that maintain, repair and rebuild ground combat and support equipment, Logistics Command encourages all efforts to improve security, support and safety of providers and users. Each maintenance center strives to improvise, improve and enhance product refinement, development and security.

An important part of LOGCOM's work revolves around the anodization of aluminum parts. The anodizing process oxidizes and creates a protective coating on the metal, also known as a conversion coating. Traditionally hexavalent chromium has been a key ingredient in the process, but hexavalent chromium is also a well-known toxin. The Occupational Safety and Health Administration (OSHA) has stated that hexavalent chromium may cause cancer in workers who breathe airborne emissions.

Due to the serious health and environmental risks related to the use of hexavalent chromium, national and international restrictions and controls are increasing. These restrictions will continue to increase lifecycle costs and regulatory burdens while decreasing material availability. A recent memo (dated 25 November 2008) disseminated by the Office of Secretary of Defense, directs the Department of Defense (DoD) to make substantial investments in finding suitable replacements for hexavalent chromium applications.

Lamar Petties, MCA Risk Management Manager, discusses the reasons for choosing trivalent chromium as a replacement. "Trivalent chromium is better for not only the work environment, but the larger environment. It is cheaper in the long run because it doesn't cost as much for disposal." As far as processes go, there won't be a noticeable difference. "Both the hexavalent chromium and trivalent chromium anodizing are dip-tank processes requiring parts to be dipped into containers of the solution," says Petties. "With the trivalent chromium process, we become more environmentally compliant, create a safer working environment, and will have equaled, if not increased, corrosion protection."

Due to the serious health and environmental risks related to the use of hexavalent chromium, national and international restrictions and controls are increasing.

Lee Sanders is the National Sales Manager for Government and Military accounts for Chemetall, the chemical

company that is providing the trivalent chromium product, Metalast TCP-HF. Mr. Sanders stated, "This is proof that government can keep up with civilian manufacturing in innovation and technology. Being the first DoD depot to make this change was not scary for them once they thoroughly studied the technology and calculated the benefits. There is no longer a reason to use hexavalent chromium for conversion coatings and seals. Any agency reluctant to change needs to review the alternatives."

Mr. Sanders sees trivalent chromium as a solid stepping stone to a no-environmental-impact conversion coating. The chemical coatings industry is reaching a point that he calls "the chemical equivalent of putting a man on the moon." He adds, "We now have products that contain no metal and perform as well as zinc phosphate."

Today's chromium-containing coatings are environmentally and waste stream friendly. These products are making their way through the testing programs at various government research agencies for future use on military equipment.

The benefits of the new trivalent chromium process include:

- Air-emission reductions,
- Reductions in wastewater treatment and hazardous waste generation,
- Energy use reductions,
- Quality improvements,
- Lower toxicity and worker exposure, and
- Regulatory compliance.

The trivalent chromium transition initiative was an element of a larger phased project which focused on removing hexavalent chromium from all of the production processes of the LOGCOM depots. Phase I of this initiative commenced nearly ten years ago, and included a joint project with the Army Research Laboratory and the Naval Surface Warfare Center, Carderock Division. This project successfully removed hexavalent chromium from United States Marine Corps primers and topcoats.

Phase II focused on a two-part effort that led to the removal of hexavalent

Welding operations can also produce hexavalent chromium.

chromium in the anodizing process and the discovery of a safer product that met the same performance specifications. Phase II also addressed the depot's hazardous chromium plating operations. After a technical and cost-benefit analysis, the decision was made to outsource chromium plating operations.

As a result of Operation Iraqi Freedom, the armor and stainless steel workloads in MCA were significantly expanded. Phase III was initiated to address the hazards created from welding and grinding operations. The high temperatures generated in these processes can cause chromium to convert to a hexavalent state.

Teaming with National Defense Center for Environmental Excellence, Concurrent Technologies Corporation, and several other industry partners, a Sustainable Installations Initiative Project: "Hexavalent Chromium (Welding) Emissions Reductions" was launched in Fiscal Year 2006. The project included baseline hexavalent chromium emissions in the welding and grinding operations and finding the best solution to ensure short- and long-term compliance with OSHA hexavalent chromium limits. The team also identified air filtration equipment that can mitigate emissions with the least impact on output and welder ergonomics.

As a result of these efforts, MCA has successfully eliminated hexavalent chromium in all of their production processes. Not only have they significantly enhanced working conditions for employees, but they have accomplished it in a cost-effective manner without impacting production.

Steve Allen, MCA Coatings Branch Manager said, "What we are doing today is on the cutting edge in multiple areas. This kind of thinking is important in cleaning up the environment, making working conditions safer while still getting the job done. We are probably riding the crest of the wave in this technology." ⚓

Photos by Gregory Russell

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Oil Recycling Nothing New to Craney Island

Decades-Old Operation Saves Over a Million Dollars Annually

WITH AN EVER-INCREASING emphasis on reducing waste and environmental compliance throughout the Department of Defense (DoD), one program is ahead of the curve—and they've been there since the 1950s.

Located on picturesque Craney Island in Portsmouth, VA, Craney Island Defense Fuel Support Point (DFSP) is home to the largest fuel reclamation operation in the DoD. Although the program has been in place for over 50 years, this is no static program. Over the past five years, Craney Island's thriving operation has enjoyed a 71 percent growth in sales of their premier reclaimed product—Fuel Oil, Reclaimed (FOR).

Tried & True

As the Navy moves ahead with greening its petroleum supply chain with innovative drop-in solutions such as biomass fuels, it is easy to lose sight of highly successful green processes that have been in place for a long time.

By taking petroleum products destined for disposal and converting them into a usable product, Craney Island's oil recycling and re-use program reduces the waste stream significantly. In a 1996 U.S. Environmental Protection Agency study involving a similar operation, it was determined that by establishing a formal oil marketing campaign, a Navy base could potentially reduce their industrial waste stream by 80,000 pounds.

Financial efficiencies are also a direct result of the oil recycling and re-use program. In 2008, FOR sales of 1.7 million gallons generated a flow of 1.78 million dollars directly back into the Defense Logistics Agency working capital fund. These regenerated dollars ultimately result in enhanced support for the warfighter. Conversely, had this product been sold to commercial vendors for disposal instead of bringing it back into the supply chain, DoD would have lost over one million dollars in potential revenue.

Savings are also realized by the Navy's own re-use of recycled oil. For example, in 2008, approximately 1.6 million gallons of recovered oil was recycled from regional Navy sites. As a result, Naval Facilities Engineering Command (NAVFAC) utilities used 1.7 million gallons of FOR, saving approximately $600,000 in oil purchasing costs. Recycling oily waste also results in an annual disposal cost avoidance of approximately $500,000, resulting in annual savings of over a million dollars.

In addition, system maintenance costs of less than $25,000 per year make Craney Island's oil recycling and re-use program economically efficient.

The Process

The oil recovery program at Craney Island consists of the recycling and re-use of oily waste water and waste oil from ship and shore activities. A truly regional recycling process, used and off-specification petroleum products are brought into Craney Island from many different sources and locations in the Mid-Atlantic area. Oily waste from ships is pumped from Naval Station Norfolk piers into the Public Works Center (PWC) oil recovery system, where it joins other used petroleum products, including used automobile oil from vehicle maintenance shops, into holding tanks. It is then pumped through a pipeline from Naval Station Norfolk to the PWC Water Treatment Plant at Craney Island, where the oil and water are separated.

Craney Island DFSP also receives oily waste and off-specification product from ships berthed pierside

at Craney Island. Finally, a nominal amount of waste oil recovered from on-site remediation projects provides another input into the system. This multi-stream product is sampled and tested prior to being placed in a settling tank. As the product ages in the tank, water and other impurities drop out as a function of time and temperature (heat accelerates the process). The product is sampled and tested periodically until it meets the FOR specification. Once the product meets proper fuel specifications, it is stored in Craney Island storage tanks until purchased by a customer, such as PWC Utilities, which burns FOR at a steam plant for power generation.

William "Jack" Jackson performs FOR testing while Lieutenant Konrad Krupa, FISC Norfolk fuel intern observes.
LCDR Dave Roddy

William "Jack" Jackson oversees all FOR testing at Fleet and Industrial Supply Center (FISC) Norfolk's fuel laboratories, and brings a wealth of experience to the process. "Since starting work at Craney Island in 1972, I have tested FOR at least 500-600 times," Jackson states. "Not a drop of FOR is issued to our customers unless it meets every specification."

The Product

The FOR specification is approved for use by the Department of the Navy and is available for use by all departments and agencies of the DoD. FOR is the product of a mixture of oils, and is subject to regulation by the Code of Federal Regulations (CFR) 40 CFR 266, Sub-part E. FOR can be used as a substitute for the American Society for Testing and Materials standard D 396 (the standard specification for fuel oils) either directly or as a blend in stationary fuel-burning furnaces for heating buildings, generating steam or other purposes.

Two FOR settling tanks on Craney Island DFSP.
Dale Devorss

Craney Island's regional fuel operation partners with various organizations to ensure environmental compliance. Environmental oversight is provided in concert between NAVFAC Mid-Atlantic Regional Environmental Division and the Virginia Department of Environmental Quality.

The Bottom Line

Clearly, the Craney Island oil recycling program provides a viable, proven energy solution which saves taxpayer dollars while reducing impact on the environment. This unique program ultimately drives the goal which every program under the Naval Supply Systems Command shares—enhanced delivery of logistics support to the Navy's operational forces. ⚓

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NESDI Program Releases FY09 Year in Review Report

Case Studies Demonstrate Program's Impact Across the Fleet

THE NAVY ENVIRONMENTAL Sustainability Development to Integration (NESDI) program has released its annual report to highlight the program's accomplishments in Fiscal Year (FY) 2009 and share its strategic objectives for FY10.

The report, entitled "Accomplishments of the Navy Environmental Sustainability Development to Integration Program in Fiscal Year 2009: A Year in Transition," contains insights into the NESDI program's successes in FY09. In particular, program personnel achieved the following specific milestones in FY09:

1. Made investments based on Fleet requirements,
2. Maintained a collaborative management approach,
3. Conducted program reviews to ensure successful project execution,
4. Made significant progress on a critical mass of projects,
5. Made in-roads into the range community,
6. Began to understand climate change impacts on the Navy shore community,
7. Improved the efficiency of the program through enhanced web site functionality,
8. Expanded the collection of needs and proposals, and
9. Leveraged resources and expertise of other technology demonstration programs.

This annual report also provides highlights of the technologies that were successfully demonstrated and validated in FY09 as well as a listing of the new efforts that the NESDI program will consider for funding in FY10 and beyond.

In FY09, the following NESDI projects were well on their way to successful integration across the Fleet:

1. **Assessing Climate Change-Related Impacts on U.S. Navy Installations Initiation Decision Report**

   This report provides an assessment of climate-change impacts on Navy installations and provides recommendations to support Navy readiness.

2. **Potable Water Quality Management**

   The first NESDI project in this area resulted in the publication of The Potable Water Quality Management Guidance Document which provides Navy drinking water program managers with the direction and information for meeting compliance goals contained in the new disinfection byproducts rules.

   A follow-aon project is validating a real-time contamination detection system that continuously monitors drinking water supplies to ensure that high quality drinking water is being delivered and provides water security surveillance to guard against the threats of terrorist attacks on water systems.

3. **Prohibited & Controlled Chemical List**

   This project provided the Navy with standard chemical inventories for both weapon system program and facility operations managers to use to improve their hazardous material management and minimization efforts.

4. **Toxicity/ Bioaccumulation of Munitions Constituents in the Marine Environment**

   This project resulted in the development of a comprehensive data set on toxicity of munitions constituents to regulator-approved marine species and the definition of potential bioaccumulation, cellular level impacts and trophic transfer.

5. **Advanced Anodizing Aircraft Parts Using Process Control Technology**

   This project successfully demonstrated and integrated technologies to optimize the application of anodized coatings, thereby reducing labor and waste.

6. **Environmental Effects of Lasers on Biota in the Marine Environment**

   This study assessed the extent and diversity of the laser-based systems being used in an underwater environment which may have an effect on the biological community and marine life.

7. **Web-Based Model Server**

   This project increased the accessibility of joint/interagency environ-

mental models through a common user interface with web-based model simulation architecture.

8. **Direct-Push and Point-and-Detect, In Situ Sensors for Perchlorate**

   This project is validating the use of direct push and point-and-detect sensor systems, for use in the field, to measure perchlorate either for rapid screening and monitoring purposes or for contaminant source characterization of perchlorate in groundwater or surface waters.

9. **Containment and Long-Term Monitoring Strategies for Contaminated Sediment Management**

   This project is generating a suite of integrated containment and monitoring strategies for remediating contaminated sediments and assessing the long-term effectiveness of remedial actions.

10. **Underwater Ordnance Casing Corrosion**

    This project will result in an underwater corrosion prediction model for unexploded ordnance (UXO) which will predict time to penetration of UXO items in the marine environment, and will produce a user's guide.

NESDI program management personnel selected the following projects for either end-of-year late starts or new starts in FY10:

1. **Demonstration of Physical & Biological Conditioning of Navigational Dredge Material for Beneficial Reuse.**

   This project will evaluate the effectiveness of conditioning methods on weathered and freshly dredged marine sediment to enhance its beneficial reuse potential.

2. **Chemical Safety—Environmental Management System**

   This project will result in the development of the Chemical Safety—Environmental Management System—Enterprise (CS-EMS-E) for Commander Navy Region Mid-Atlantic in Norfolk, VA. CS-EMS-E is a web-based hazardous waste management system that will track and report state and federal regulatory compliance as well as billing information on associate cost rendered for the management, storage, transportation, treatment and disposal of hazardous waste.

3. **Mitigation of Environmental Impacts from the Venting of Full-Scale Practice Bombs at Navy Ranges**

   Practice, full-scale inert (FSI) bombs are used extensively at most of the Navy's land-based test and training ranges. After range clearance operations have been completed, these bombs are lined up in a designated area for venting. This project will result in the development of Best Management Practices and guidance to all Navy activities that will ensure munitions constituents resulting from the venting process do not migrate off site.

The NESDI program is the Navy's environmental research and development demonstration and validation program, sponsored by the Chief of Naval Operations Environmental Readiness Division and managed by the Naval Facilities Engineering Command. The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness.

For a hardcopy of the NESDI program's FY09 Year in Review report, please contact Lorraine Wass at 207-384-5249 or ljwass@surfbest.net. An electronic (pdf) version of the report can be downloaded from the program's web site at www.nesdi.navy.mil.

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Sulfur Hexafluoride: The Good, the Bad & the Future

Managing a Mission-critical Greenhouse Gas

SULFUR HEXAFLUORIDE (SF_6) is a gas used by the Navy in many tactical systems, from shipboard targeting radar to torpedo propulsion systems and underwater warfare acoustic countermeasures. Unfortunately, SF_6 is also a potent greenhouse gas (GHG) —more than 22,800 times more potent than carbon dioxide. Because SF_6 is non-flammable, nontoxic and a strong dielectric (providing excellent electrical insulation), it is a critical material in a host of Navy applications including the MK 50 torpedo, electric switchgear on shoreside power facilities, submarine countermeasures and mine hunting and in radar domes.

Clearly, proactive management and control of SF_6 emissions will be needed to sustain mission capability while complying with emerging GHG reduction policies and regulations. As the debate continues on how to best regulate GHGs, several key Department of Defense (DoD) offices collaborated to assess the risks related to DoD's use of SF_6 and identify risk management actions.

In November 2007, the Clean Air Act Services Steering Committee (CAASSC)—which addresses military issues relevant to the Clean Air Act (CAA)—and staff from the Office of the Secretary of Defense's (OSD) Emerging Contaminants Program discussed the possibility of conducting an assessment related to the evolving regulatory climate surrounding SF_6. The Emerging Contaminants Program, part of OSD's Chemical and Material Risk Management Directorate (CMRMD), identifies, assesses and takes steps to manage the impacts posed by emerging contaminants (EC) on major DoD functional areas before regulations take effect. The program uses a "scan-watch-action" process for "looking over the horizon" to identify and assess ECs. This collaborative assessment prompted the development of Risk Management Options (RMO) and a recommendation that SF_6 be elevated to CMRMD's high priority "Action List" for ECs.

The DoD's assessment found that 22 states had GHG emission targets. Most significantly, the California Air Resources Board has proposed a phase-out of all uses of SF_6 in 2013. In this instance, the CMRMD, Air Force and the DoD Regional Environmental Coordinator teamed up to secure an extension until 2020 for critical uses of SF_6 as a tracer gas to trace leaks in tanks and pipelines.

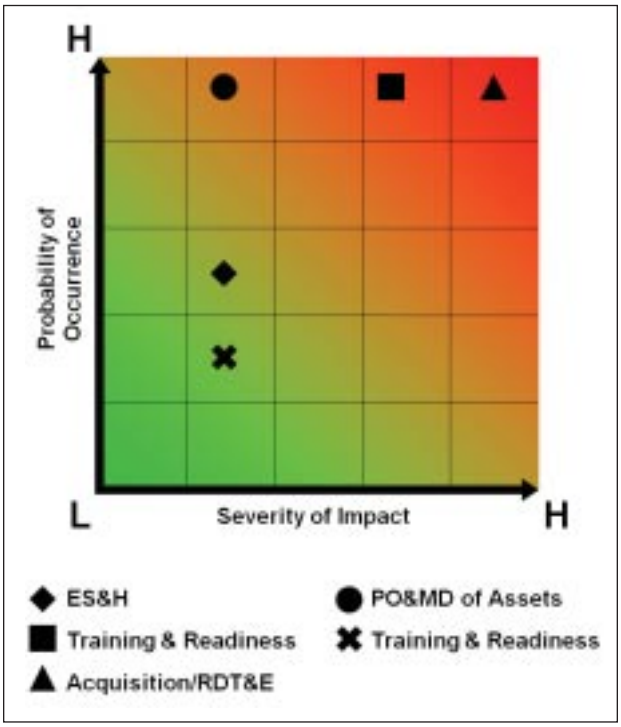
SF_6 is also monitored under the United Nations Framework for Climate Convention (UNFCC) and the Intergovernmental Panel on Climate Change. After the United States Supreme Court in April 2007 deter-

SF_6 in the Atmosphere

AVERAGE GLOBAL SF_6 concentrations increased by about seven percent per year during the 1980s and 1990s, mostly as the result of its use in the magnesium production industry, and by electrical utilities and electronics manufacturers. Given the low amounts of SF_6 released compared to carbon dioxide, its overall contribution to global warming is estimated to be less than 0.2 percent.

Torpedoes released from ships like the guided-missile frigate USS CROMMELIN (FFG 37) utilize SF_6 in their propulsion systems.
Mass Communication Specialist Seaman Adam Thomas

mined that GHGs are air pollutants under the CAA, the U.S. Environmental Protection Agency issued a proposed "endangerment" finding for GHGs under Section 202(a) of the CAA. These developments, in combination with a recent U.S. House of Representatives energy bill identifying SF_6 as a GHG, led to CMRMD's conclusion that restrictions, reductions in availability, higher costs and producer phase-outs are the likely results of potential GHG regulations. The graph below summarizes the first phase of the SF_6 assessment and displays which DoD functional areas are most likely to be affected by expected changes in the management of SF_6 risks.



Summary of impact assessment of SF_6 on DoD functional areas.

The potential risks and impacts to DoD functions were identified through the input of subject matter experts. On the graph shown below, high risks to DoD are in the upper right, while lower risks are located in the lower left. Possible SF_6 regulations (i.e., a proposed GHG regulatory scheme) would pose high risks to both Acquisition, Research, Development, Testing and Evaluation (Acquisition/RDT&E) and Training and Readiness. Regulation of SF_6 would pose little to moderate risk in other DoD functional areas, such as Production, Operations & Maintenance and Disposal (PO&MD), and Environment, Safety & Health (ES&H). The results of the assessment were so striking that SF_6 was elevated to the CMRMD's "Action List" and development of RMOs was accelerated. As a result of the assessment, some risk management actions were initiated immediately. For example, the Strategic Environmental Research and Development Program issued a Statement of Need for research on substitutes in November 2008.

Navy personnel launch a torpedo powered by SF_6 among other constituents.
Mass Communication Specialist Seaman Leah Allen

The assessment and draft RMOs were completed by CMRMD in June of 2009.

The RMOs include:

- Expanding research and development for substitutes for SF_6 in DoD applications,
- Developing a mandatory DoD policy for leak detection, capture and reuse,
- Leveraging research and development being performed by the Electric Power Research Institute regarding substitutes for use in electrical infrastructure, and
- Evaluating the feasibility and cost of stockpiling SF_6 for critical uses.

The fact that DoD would need a baseline for SF_6, and means to reduce its use, was underscored on 5 October 2009 when President Obama issued Executive Order (EO) 13514, Federal Leadership in Environmental, Energy and Economic Performance. Aimed at making broad improvements in the sustainability of the federal government, the EO requires all federal agencies inventory their GHGs and set targets to reduce their emissions by 2020.

The SF_6 RMOs were endorsed for implementation by the executive-level EC Governance Council at its annual meeting on 13 October 2009.

Conclusion

The military services have many critical uses for SF_6, and awareness is growing that the gas is a potent global warmer for which cost increases and restrictions are on the horizon. The collaboration between the CAASSC and CMRMD resulted in an expedited and thorough assessment of the risks and the development of RMOs to manage the risks. However, as there are currently no suitable SF_6 substitutes for most military operations, finding, testing, and qualifying substitutes may be a long-term effort. All of these factors point to the need for a well-organized plan for minimizing releases until substitutes are developed, tested and deployed. ⚓

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SERDP & ESTCP Recognize Outstanding Projects at Partners Symposium

Winners Include Novel Approach for Detection of Underwater Munitions

SEVEN PROJECT-OF-THE-YEAR AWARD recipients were recognized at the 2009 Partners in Environmental Technology Technical Symposium and Workshop sponsored by the Strategic Environmental Research and Development Program (SERDP) and its partner in environmental technology, the Environmental Security Technology Certification Program (ESTCP). The awards recognize outstanding research and technology developments with significant benefits to the Department of Defense (DoD).

One of the most notable efforts recognized at the symposium was a new approach for wide-area detection and identification of underwater munitions.

A significant number of DoD installations have adjacent waters containing military munitions, some buried in sediment and some lying on the sediment floor. As little is known about the location or quantities of these munitions, technologies are needed to efficiently assess potentially contaminated areas. Existing technologies are limited in part because they are unable to see beneath the sediment floor.

For their development of an effective technique for wide-area detection and identification of underwater munitions using an innovative structural acoustic sonar system, Dr. Brian Houston from the Naval Research Laboratory (NRL) and his project team received the SERDP Project-of-the-Year Award for Munitions Management. Instead of using images, structural acoustics uses the "ringing" that objects make when hit by soundwaves. By interpreting the sound patterns and tone, researchers are able to discern information about the size and nature of an object. This technology holds tremendous potential to provide DoD with a new capability to identify and characterize underwater munitions sites at high coverage rates.

Other SERDP Projects-of-the-Year

Sustainable Infrastructure: Efficient Remote Methods to Map and Monitor Coral Reefs

Dr. Pamela Reid, University of Miami School of Marine Atmospheric Science

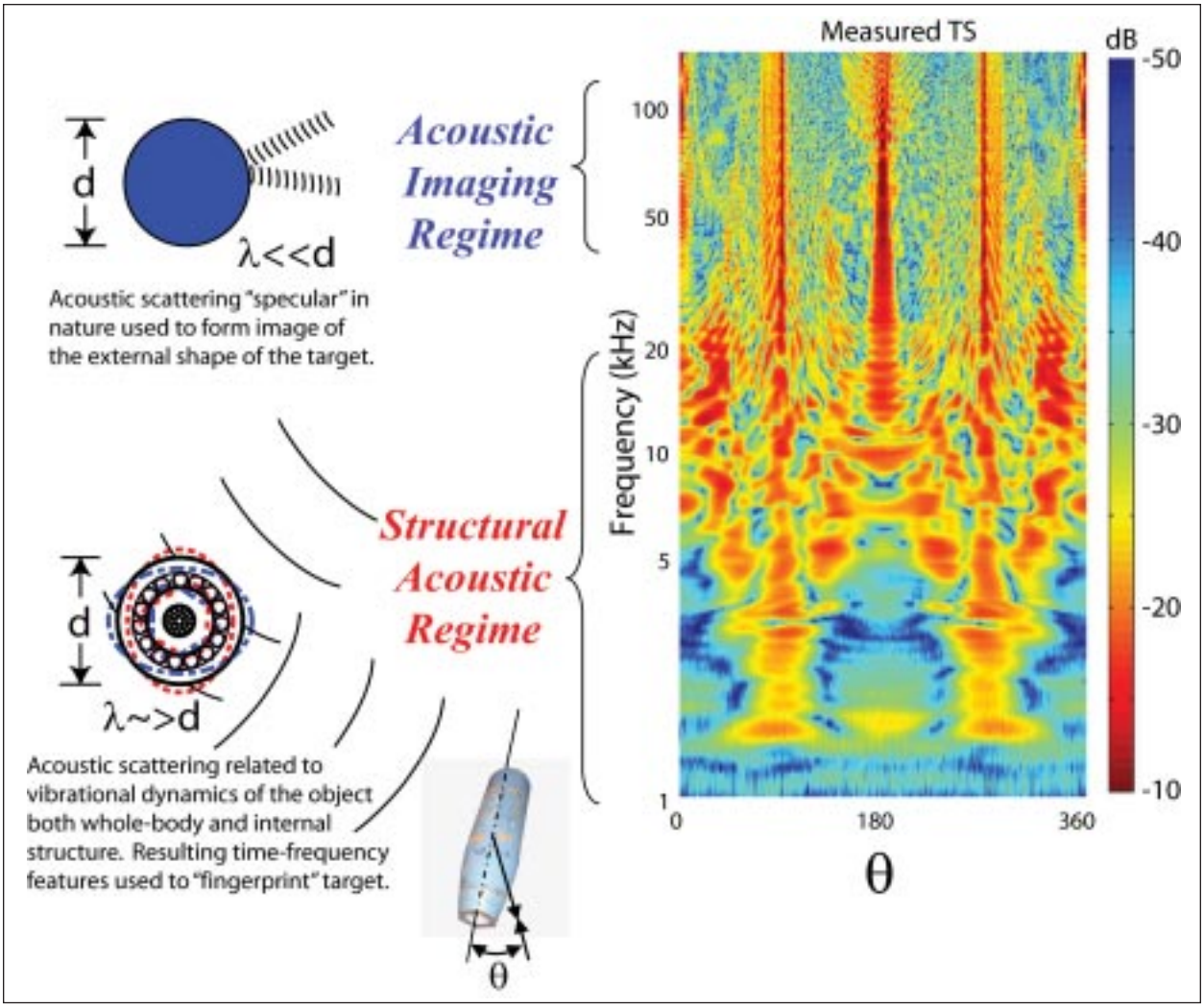
To monitor the health of a coral reef and assess impacts and recovery, DoD needs an accurate depiction of the reef over time. To date, there has never been a consistent historical record or quantitative assessment.

Dr. Reid and her research team developed an innovative technology that increases the speed and repeatability with which reef plots can be mapped and inventoried. Remotely operated underwater video is used to create two-dimensional spatially accurate reef mosaics. These mosaics will provide accurate inventories of reefs under DoD purview, and will serve as a tool for monitoring important indicators of reef health.

Weapons Systems and Platforms: Perchlorate Alternatives for Incendiary and Pyrotechnic Formulations

Dr. Trevor Griffiths, QinetiQ Ltd., Kent, United Kingdom

Perchlorate is a contaminant of significant environmental concern in the U.S. and elsewhere. In the military, perchlo-



To help DoD identify and characterize underwater munitions sites at high coverage rates, SERDP's Munitions Management Project-of-the-Year developed an innovative structural acoustic sonar system. Instead of using images, structural acoustics uses the "ringing" that objects make when hit by soundwaves to discern information about underwater objects.

rate is used as a high-energy oxidizer in rocket propellants and pyrotechnics.

Dr. Griffiths and his colleagues developed environmentally benign, perchlorate-free incendiary and pyrotechnic mix formulations for projectiles such as those used in tanks and howitzers. The ingredients used in these formulations can be obtained readily, and their cost is comparable with the perchlorate compositions. The results of this project demonstrate that perchlorate can be eliminated from these applications without degrading performance.

Environmental Restoration: Sustainable Range Management via Phytoremediation of Royal Demolition eXplosive (RDX), Trinitrotoluene (TNT) & Propellants

Dr. Jerald Schnoor, The University of Iowa Department of Civil and Environmental Engineering

Dr. Neil Bruce, University of York Centre for Novel Agricultural Products, York, United Kingdom

The use of munitions during live-fire training exercises on DoD ranges presents a risk of contaminants leaching into the soil and groundwater and potentially migrating to areas outside of the range. Recent research has demonstrated that enzymes in certain plants found on military installations can actually break down toxic energetic compounds such as TNT and RDX.

Dr. Schnoor and his team advanced the understanding of how existing native plants can degrade and contain energetic compounds such as RDX that contaminate subsurface soils on

ranges. The fundamental molecular biology conducted by these researchers has vastly improved scientific understanding of the structure and the mechanisms of the enzymes that have been identified in the microorganisms that degrade the energetic compounds.

Dr. Bruce and his team succeeded in creating grass varieties with unique abilities to both detoxify TNT and degrade RDX. Using genetic engineering techniques, the researchers modified grasses that naturally grow on DoD ranges, so as to avoid introducing invasive plant species. The project was cited as a "radically new approach for long-term range sustainability" by presenter Dr. Jeffrey Marqusee.

ESTCP Projects-of-the-Year

Sampling Protocol for Characterizing Energetic Residues on Military Training Ranges

Mr. Alan Hewitt, U.S. Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory

Residue from live munitions is a continuing problem at military training ranges.

To determine the likelihood of residue contamination and/or migration, the military needs methods that provide accurate estimates of the amount and type of contaminants in the soil. Traditional environmental sampling techniques have proven inaccurate and expensive when deployed on ranges.

Mr. Hewitt and his team demonstrated a sampling protocol designed specifically for characterizing energetic residues on training ranges—an approach for which they gained the approval of the U.S. Environmental Protection Agency.

This new protocol enables range managers to meet or exceed environmental stewardship requirements while maintaining training and testing activities.

Robotic Laser Coating Removal System

Mr. Timothy Hoehman, Tinker Air Force Base

Aircraft are routinely inspected for corrosion of metal components. These inspections require that paint and coatings be removed—a process that produces significant emissions of volatile organic compounds, organic and inorganic hazardous air pollutants and hazardous waste.

The robotic laser coating removal system demonstrated and validated by Mr. Hoehman and his team is an alternative technology to remove coatings using lasers and a particle capture system. The system has the potential to reduce environmental impacts associated with coatings removal, reduce labor and chemical costs and positively impact production schedules.

Symposium Presentations & Webcasts Available

The 2009 SERDP and ESTCP awards were presented by Dr. Jeffrey Marqusee, SERDP and ESTCP Director, and Dr. Anne Andrews, SERDP and ESTCP Deputy Director, during the Partners Symposium held 1-3 December 2009, in Washington D.C. More than 1,100 environmental professionals from government agencies, academia, and the private sector participated in the annual conference.

Additional information about the 2009 symposium, including session presentations and short course webcasts is available at www.serdp-estcp.org/symposium. The site includes preliminary information about the 2010 event to be held 30 November–2 December 2010, in Washington, D.C. ⚓

To Learn More

FOR MORE INFORMATION about SERDP's efforts to help minimize emerging threats to coral reef ecosystems, read our article entitled "New Technologies on the Way to Help Save Coral Reefs: Assessing Ecosystem Health First Step Toward Rejuvenation" in the winter 2009 issue of *Currents*. You can browse the entire *Currents* archive on the Naval Air Systems Command's environmental web site at www.enviro-navair.navy.mil/currents.

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Partnership Restores Historic Marsh in Northwest

Decade-long Project Aids Salmon Recovery

A HISTORIC MOMENT for the environment, ten years in the making, was finally reached at Naval Air Station (NAS) Whidbey Island, WA last summer in the Pacific Northwest. In late August 2009, high tide rolled into the Crescent Harbor salt marsh—an event that hadn't happened in nearly a century.

But, after Chinook salmon became a threatened species in 1999, and a state-wide push for salmon recovery was established, the Navy recognized that its land was a great candidate for restoration. August 2009 marked the culmination of the base's ecosystem restoration project.

refuge near shore to continue growing. "They actually have no place to go in a lot of cases once they leave the estuaries to start transitioning to saltwater habitat," said Phillips.

Allowing Crescent Harbor to flow into the marsh will directly benefit juvenile salmon. The new habitat will give fish

> Projects like this are happening all the time and demonstrate the compatibility of the Navy's mission with the natural resources that we share.
>
> *—John Mosher, U.S. Pacific Fleet Northwest environmental liaison*

Background

In the 1920s, farmers built dikes in the Crescent Harbor salt marsh so their cows could graze. This led to the marsh being cut off from its main water source—Crescent Harbor. A tide gate and a manmade barrier [a berm] prevented water from flowing in, thereby preventing juvenile salmon and other fish from swimming into the wetlands. This was a problem because the marsh is an ideal refuge for juvenile salmon to mature before swimming out to the ocean.

"The primary objective was to bring tidal flow back in," said John Phillips, NAS Whidbey Island's natural resources program manager who oversaw the project. "To do that, a new channel had to be cut or the tide gate had to be removed. We decided to have a new channel cut."

Need & Benefits

When the volume of salmon is too high in rivers, or when river flooding occurs, juvenile salmon are pushed out of their habitat and forced to find new feeding opportunities, safe refuge and a chance to mature before swimming out to the ocean.

The first step was a feasibility study conducted by Philip Williams and Associates (PWA) and the University of Washington Wetland Ecosystem Team (UW WET). The study determined that the project would reconnect the marsh to the harbor ecosystem on a variety of biological levels, improve tidal flow and tidal levels, and enhance the quality of habitat for juvenile salmon.

This 2003 aerial photo shows the channel snaking around the wastewater sewage treatment plant to let rain water out under E. Pioneer Way via a tide gate. The Navy permanently opened the tide gate in 1994 to re-establish a saltwater connection from Crescent Harbor to the wetlands system behind the dike.
U.S. Navy photo

"It should heavily increase survivorship of smolts [juvenile salmon] that come out of the river and then head out to sea," said Phillips.

Steve Hinton, director of habitat restoration for Skagit River System Cooperative (SRSC) agreed. "I anticipate that salmon will occupy it immediately if they are in the vicinity," he said. "These little near-shore habitats are actively sought out by the little guys."

SRSC is a natural resources management organization that represents the interests of the Swinomish Indian Tribal Community and Sauk-Suiattle Indian Tribe. The SRSC's work is dedicated to enhancing fisheries management in a variety of ways, one of them being habitat restoration. The SRSC was instrumental in executing the project. Hinton helped secure funding, finalize designs for the restoration actions, and set the plan in motion.

The Crescent Harbor Salt Marsh project was part of SRSC's Skagit River Chinook Recovery Plan. "There are a number of these areas that are unique habitats," said Hinton. "We prioritized estuarine and near-shore projects as the most important."

Brian Cladoosby, chairman of the Swinomish Tribe, approved of restoring the land to its original condition. "Over the last 100 years, there have been environmental

The key managers behind the NAS Whidbey Island Salmon Saltwater Marsh Restoration project are Matt Klope, who headed the project until 2001, and his successor John Phillips, the air station's natural resources program manager. Klope is now head of the U.S. Navy's Bird Air Strike Hazard Program.
Walter Haussamen

Miles of early Dutch farmland bought by the U.S. Navy in 1941 to develop the Seaplane Base is open to tide flow after being blocked from the ocean for 100 years.
Naval Aircrewman 1st Class Chad Lewis

Revitalizing this habitat is a tremendous step in recovering threatened Chinook salmon populations in the state of Washington.

–Rear Admiral James Symonds, Commander, Navy Region Northwest

impacts, and for every action there's a reaction," he said. "When they started cutting off these estuaries that the juvenile salmon use to grow up in, it really disrupted their lives and our lives. And so to be able to see projects like this and to reintroduce these kind of estuaries for the salmon to basically hole up in before they go out to the ocean is really awesome," Cladoosby said. "This only helps in our efforts to continue to try to restore and rebuild the wild salmon stocks on the Skagit River."

Hinton added that both tribes were excited to see the project fulfilled. "They feel it's a big step in realizing their long term goals," he said.

Bill Oakes, public works director for Island County, also supported the restoration project. "Coastal estuaries are threatened nationwide, and Puget Sound is no exception," he said.

John Mosher, U.S. Pacific Fleet Northwest environmental liaison, noted the impact of the project as well.

"This project directly benefits the environment and wildlife in Puget Sound," he said. "Projects like this are happening all the time and demonstrate the compatibility of the Navy's mission with the natural resources that we share."

The Process

Getting water to flow through the marsh wasn't as easy as simply digging a new channel. A 30-acre wastewater treatment plant lies in the middle of the marsh, and several access dikes prevent water from circulating freely.

Enabling water to flow into the wetlands required modifications to the

marsh's infrastructure. "The construction project was divided into four parts corresponding to the four areas that blocked the restoration of natural tidal inundation at the site," said Tom Slocum, a professional engineer for the Whidbey Island Conservation District.

Step 1: Breaching a Sewer Intake Dike

The first action was breaching a sewer intake dike between the northwestern and eastern parts of the marsh. A 4.5-foot round culvert that connected the two sectors was sealed off, and a new 30-foot wide channel was constructed to allow more tidal flow and create bigger passages for fish.

Step 2: Replacing Conduit Pipe

Step two consisted of replacing a 43-foot long, 1.5-foot wide conduit pipe between the southwest and eastern parts of the marsh. Four new, 43-foot long, two-foot diameter drains were installed. Capacity for tidal flow and fish passage increased even more with this addition to the marsh.

Step 3: Improving the Dike

The third part of the restoration focused on improving the dike that separates the southwest and northwest parts of the marsh. Two 50-foot "notched weirs" [dam-like devices used to regulate water flow] were installed to better control erosion. This prevented the water from damaging the wastewater treatment plant.

Step 4: Building a Channel

The last part of the restoration was the most critical because it reconnected the marsh to Crescent Harbor. A new 680-foot-long channel, 92 feet wide at its mouth, was built to join the marsh and harbor and allow the tide to flood into the wetland. Once the mouth of the channel was opened up, the final barrier between the new channel and the main channel of the marsh was breached.

Funding

The project received funding from several sources. Island County Public Works applied for a grant through the Salmon Recovery Funding Board and was awarded approximately $225,000 in 2000. Island County contributed $38,000 to the project, which was used to fund the restoration studies completed in 2003 by UW WET and PWA. Approximately $590,000 came from the SRSC after the project's forward progress was temporarily stalled.

Pocket estuaries are within one day's migration from the Skagit River delta to Crescent Harbor by fry migrant Chinook salmon.

Courtesy of Skagit Chinook Recovery Plan, Washington Department of Fish and Wildlife and SRSC

At high tide, about 300 acres of marsh now becomes a habitat for juvenile Chinook salmon to populate and thrive.
Mass Communication Specialist 2nd Class Tucker Yates

Additional costs brought the total cost of the project to around one million dollars. Most of that was the $450,000 spent by Construction Battalion Seabees based in Port Hueneme, CA to install a bridge over the new channel.

Working Together

The various partnerships between the Navy, non-governmental organizations, local agencies and governments, and Native American tribes made the project a reality.

"This is a historic occasion for the Crescent Harbor Salt Marsh, and the Navy feels privileged to have been part of such a noteworthy restoration effort," said Rear Admiral James Symonds, Commander, Navy Region Northwest. "Revitalizing this habitat is a tremendous step in recovering threatened Chinook salmon populations in the state of Washington."

Captain Gerral David, NAS Whidbey Island commanding officer, spoke to the Navy's stewardship as well.

"The Navy tries to be environmentally conscious," he said. "We were aware that this [the marsh] was artificially created by the farmers when they put the dike in, and so our environmental department recognized that we needed to restore it to its natural habitat."

Partners in Flight

THIS RESTORATION IS doing more than giving juvenile salmon new critical habitat. It is also benefiting migratory birds.

Matt Klope, the Navy's Bird Aircraft Strike Hazard program manager, said that this project helps accomplish the Partners in Flight bird conservation plan.

Partners in Flight (PIF) was started in 1990 to prevent the decline of neotropical migratory bird populations. "Neotropical" refers to birds that live in the United States and Canada during warm months and migrate south during the winter. Since more than half of the bird species in the United States are neotropical, the need for conserving their populations is clear.

PIF is made up of more than 300 state and local agencies and nongovernmental organizations, and the Navy is doing its part as a member to protect birds on its installations.

Now that the wetlands at Crescent Harbor have been restored, Klope said that the Navy can anticipate seeing different types of birds return to the habitat during monitoring. He is well versed in this area, having been the NAS Whidbey Island project lead on the saltwater marsh restoration project until 2001 when he assumed his current duties.

"We're going to see the different species of birds come back. The shore birds will be in here, different kinds of ducks will be in here, the vegetation is going to change, and we're going to get mud flats back. Mudflats are a limiting factor for migrating shore birds–but now we're going to have them."
[Mudflats are sedimentary intertidal areas left bare by retreating tides. They have a high organic content and are attractive to some bird species.]

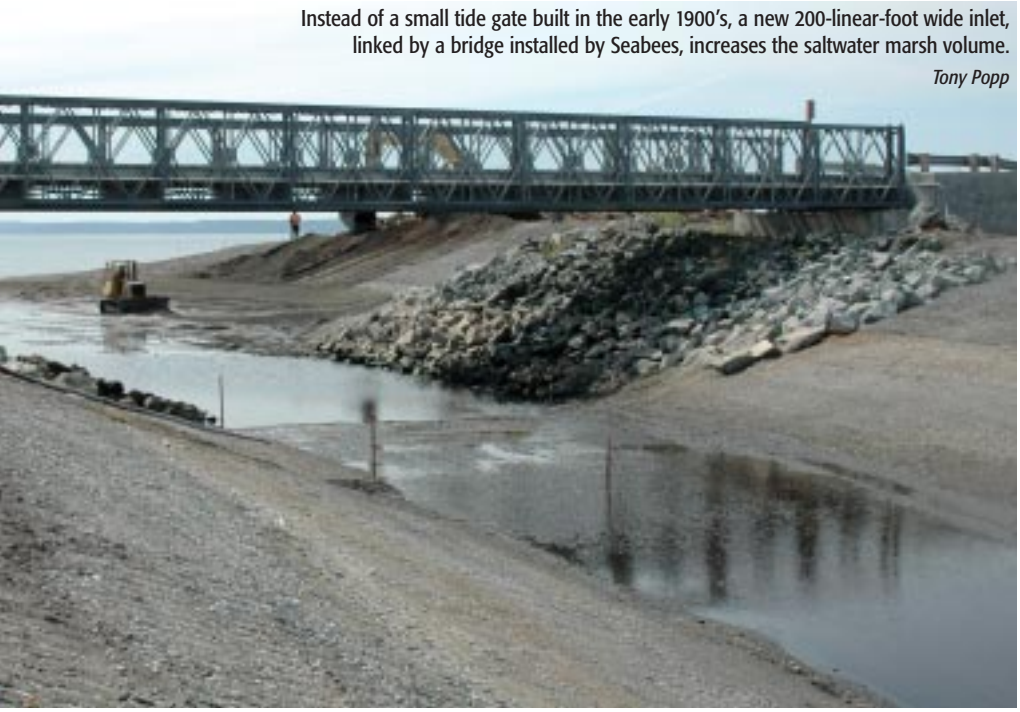
"This is a real win," Klope states, "not only for the salmon, but for the birds."

Access to the new saltwater inlet is breached (left) to the old channel (right) allowing one overall tidal flow system.
Tony Popp

Hinton said that one of the SRSC's goals was to have a strong partnership with the Navy. "We want to be able to work on projects in the future," he said. "I can't say enough about the cooperation and support that I received from the environmental division."

Oakes also applauded the partnership element. "It's been a great environmental partnership with the Navy on their property," he said, also praising UW WET and PWA as partners. "This is a great benefit to Island County," he added. "The aquatic environment is one of the things we love about living here."

The mayor of Oak Harbor, Jim Slowik, is also glad to see the Navy caring for the environment. "The city is focused on sustainability. It continues to develop more modern and better practices in environmental sustainability as well," he said. "It's very gratifying to see that the Navy is also doing that." ⚓



Instead of a small tide gate built in the early 1900's, a new 200-linear-foot wide inlet, linked by a bridge installed by Seabees, increases the saltwater marsh volume.
Tony Popp

Wes DeShano made significant contributions to this article.

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Developments of Interest: November 2009 into January 2010

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

Actions by the Obama administration appear to be establishing a new direction—toward reducing human alteration of natural runoff and drainages—in the federal approach to water system projects, stormwater and flood control.

In December 2009, the White House released a proposed draft of "National Objectives, Principles and Standards for Water and Related Resources Implementation Studies." (Visit http://www.eenews.net/public/25/13401/features/documents/2009/12/03/document_gw_04.pdf to view the entire document.)

This document, and forthcoming guidance, will require federal agencies to weigh the benefits and adverse effects of contemplated water projects, and to justify decisions that call for building structures (dams, levees, channels, pumping plants) versus employing non-structural measures such as management, regulatory policy and pricing policy. The initiative applies to all agencies, but in particular targets the major civil works agencies such as the Army Corps of Engineers and the Bureau of Reclamation.

Separately, the administration has re-established a flood-plain management task force to recommend new policies for flood insurance and possibly a new executive order for flood-plain management. (Visit http://www.nytimes.com/gwire/2009/12/03/03greenwire-draft-project-standards-for-army-corp-put-reso-95501.html for more information.)

The U.S. Environmental Protection Agency (EPA) has announced plans to initiate a rulemaking to reduce stormwater discharges from new development and redevelopment. EPA is considering adopting the approach (currently mandated for federal agencies by the Energy Independence and Security Act (EISA) of 2007 Section 438) of requiring the post development stormwater hydrology of any new construction or redevelopment project to mimic the pre-development hydrology. Typically this is accomplished by means that increase infiltration, storage or retard runoff of water such as permeable pavements, bio-retention areas, cisterns/recycling, and green roofs. (Visit http://edocket.access.gpo.gov/2009/pdf/E9-30627.pdf for more information.)

Taken together, these actions suggest a philosophical shift in the direction of preservation of natural hydrologic systems where possible. The motivations behind this shift are potentially diverse, ranging from acceptance that levees and projects can increase vulnerability to catastrophic storms and prove unsustainable in the long term, to recognition that the goals of the Clean Water Act still remain elusive and that improvement of urban runoff water quality will depend on reduction of impervious cover.

Additional regulatory and environmental news items of interest (November 2009 into January 2010) include:

Greenhouse Gases

Mandatory Reporting of Greenhouse Gases [30-October-09] Final Rule

http://edocket.access.gpo.gov/2009/E9-23315.htm

Health & Safety

Single and Multi-Walled Carbon Nanotubes; Proposed Significant New Use Rules [06-November-09]

http://edocket.access.gpo.gov/2009/E9-26818.htm

Integrated Science Assessment for Particulate Matter [15-December-09] Notice

Recent studies cited indicate negative (damaging) effects to human health, ecological health and to buildings and materials. This suggests potential for even further tightening of particulate matter standards.

http://edocket.access.gpo.gov/2009/E9-29591.htm

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.

Pressed Wood Manufacturing Industry Survey [20-November-09]

EPA is considering what type of regulatory or other action might be appropriate to control the levels of formaldehyde emitted from pressed wood products.

http://edocket.access.gpo.gov/2009/E9-27941.htm

Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites [07-Janiary-10] Notice and Request for Comments

http://edocket.access.gpo.gov/2010/2010-16.htm

Decabromodiphenyl ether (flame retardant) Voluntary Phase-out Initiative [17-December-09]

http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/deccadbe.html

Air

National Ambient Air Quality Standards for Ozone—Revision [06-January-10] Proposed Rulemaking

http://www.epa.gov/groundlevelozone/actions.html

Revisions to Lead Ambient Air Monitoring Requirements [30-December-09] Proposed Rulemaking

http://edocket.access.gpo.gov/2009/E9-31049.htm

Primary National Ambient Air Quality Standard for Sulfur Dioxide (SO_2) [08-December-09] Proposed Rulemaking

EPA has proposed to establish a new, more restrictive SO_2 standard within the range of 50-100 parts per billion measured over one-hour.

http://edocket.access.gpo.gov/2009/E9-28058.htm

Chesapeake Bay

Chesapeake Bay Total Maximum Daily Load (TMDL) Development [10-December-09]

EPA is in the process of establishing a TMDL for nutrients and sediment that will apply to the Chesapeake Bay watershed, covering 64,000-square-miles in Maryland, Virginia, Pennsylvania, Delaware, New York, West Virginia and the District of Columbia.

http://www.epa.gov/chesapeakebaytmdl

Chesapeake Bay Protection and Restoration Section 202 Federal Agency Reports; EO 13508 [04-December-09]

http://edocket.access.gpo.gov/2009/E9-28974.htm

Chesapeake Bay Protection and Restoration—EPA Draft Strategy [09-November-09]

http://edocket.access.gpo.gov/2009/E9-26923.htm

Water

Effluent Limitations Guidelines and Standards for the Construction and Development Point Source Category [01-December-09] Final Rule

http://edocket.access.gpo.gov/2009/E9-28446.htm

Stormwater Runoff Requirements for Federal Projects under EISA Section 438—EPA Technical Guidance [08-December-09]

http://www.epa.gov/owow/nps/lid/section438

Other

Designation of Additional Biobased Items for Federal Procurement [27-October-09] Final Rule

http://edocket.access.gpo.gov/2009/E9-25756.htm

Study: Airport Noise Increases Risk of Strokes [15-December-09]

A study of residents near Germany's Bonn airport has associated exposure to jet aircraft noise with higher risk of strokes and cardiovascular disease.

http://www.time.com/time/specials/packages/article/0,28804,1929071_1929070_1947782,00.html

EPA to List and Address Chemicals of Concern [30-December-09]

http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/2852c60dc0f65c688525769c0068b219!OpenDocument

National Institute for Occupational Safety and Health Nanotechnology Research Strategic Plan and Progress Report [13-November-09]

http://www.cdc.gov/niosh/docs/2010-104/pdfs/2010-104.pdf

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Have Paint Gun Will Travel

Marine Corps Innovates With Laser Gun Paint Spray Technology

WHEN THE U.S. military introduced Chemical Agent Resistant Coating (CARC) in the 1980s, it was to counter the Soviet threat of chemical agents on the battlefield. The Soviet Union's goal was to inflict maximum casualties while temporarily contaminating an area. To counter this, the U. S. needed the ability to rapidly decontaminate personnel and their equipment. Thus, CARC paint was engineered to prevent chemical impregnation and to aid in the rapid decontamination of equipment.

CARC, a polyurethane paint, is used today on all Marine Corps' combat, combat support and combat service support equipment. In addition to its chemical-resistant properties, it is also extremely durable. At the same time, however, CARC is environmentally hazardous and expensive. The Marine Corps takes extraordinary steps to protect its painters from the hazards of CARC by requiring them to wear full personal protective equipment. Without this gear, the exposure to high concentrations of aerosolized CARC during spray painting leads to immediate respiratory irritation and watery eyes. Long-term exposure can cause or aggravate respiratory problems, in particular, asthma.

For these reasons, the Marine Corps was motivated to seek an environmentally friendly and efficient application system that would ensure highest quality; one that could be efficiently managed and maintained while keeping the equipment at the peak of mission readiness.

Meeting this challenge, the Defense Logistics Agency (DLA) Office of Operations Research and Resource Analysis (DORRA) funded development of the Spray Technique and Analysis and Research for Defense (STAR4D) Program at the University of Northern Iowa (UNI). STAR4D provides military coating applicators with individual, hands-on training that focuses on developing proper techniques to improve transfer efficiency and reduce overspray and waste. The Department of Defense's goal is to reduce cost and air pollution by improving the efficiency of spray painting throughout the government.

The Marine Corps Depot with Maintenance Centers in Albany, Georgia and Barstow, California has quickly capitalized on the STAR4D technique and provides extensive training for their civilian Marines in this refinishing technique.

The Marine Corps depot community, driven not only by a need to improve the Marines' war fighting lethality and survivability, but also as a conservator of the public's financial trust, quickly realized the need to move the program beyond the perimeter fences of their depots.

> DoD's goal is to reduce cost and air pollution by improving the efficiency of spray painting throughout the government.

The Corps solution was to develop a mobile laser gun training program to take the new refinishing technique to the Fleet Marine Forces. Consisting of a laser gun, laptop computer and screen with metric displays, the programs will provide immediate feedback to the student.

New rules are anticipated in the near future from the U.S. Environmental

The laser gun at work in the paint booth.

Protection Agency (EPA). These rules will significantly impact the Marine Corps depots, requiring retraining and recertification of all painters. These new standards will apply to proper spray application, setup and maintenance of spray equipment and maintenance records of spray painter training and reporting. The rules also require that new painters be trained and certified no later than 60 days after hiring or six months after the final rule is published, whichever is later. The EPA also states that all painters must be recertified every five years.

Painter Training

The depot laser painter training is a three-day course. The two-day classroom portion covers all of the basic information about coatings, spray guns, techniques and other topics. In-the-booth painting is conducted all three days, utilizing the Corps' new LaserPaint™ technology. As the name implies, the LaserPaint™ spray gun attachment utilizes a laser to maintain a consistent distance, which allows for proper overlap and control.

The mobile training will follow the basic structure but instead of the paint booth they will use a virtual paint exercise called VirtualPaint™, using the screen, laptop and laser gun. VirtualPaint™ is a training simulator providing painters with real world application, without the real world preparation, cleaning or material usage. VirtualPaint™ allows for immediate feedback on spray techniques that painters can analyze to use when they step into the booth.

With proper training, painters are able to reduce the amount of harmful Volatile Organic Compounds (VOC) being released into the environment and the amount of paint wasted during application. Being able to correctly apply coating also reduces the time and effort of completing rework and improves corrosion protection.

Supporting this new process is a new "Coatings Technician Certification" manual. This manual represents the first Marine Corps publication addressing paint application.

The procedure for spray painting at Marine facilities involves the use of an industrial size paint booth to protect the surrounding area, and built-in fans and filters to protect the painter. The painter uses an air pressure atomized paint gun to apply the coating.

The mobile training program features a computer program called VirtualPaint™.

This type of spray painting has always involved a significant amount of waste from overspray. Some of the causes of overspray include:

- Triggering the paint gun when no part is present,
- Improper head-to-target distances,
- Incorrect angles of application, and
- Turbulent air flow conditions within the booth.

Excessive atomization is another prevalent cause of overspray. Often, spray guns have their atomizing and pattern air volumes so high that they are more efficient at fogging than painting.

The laser paint gun utilizes a laser to maintain a consistent distance and more even application.
University of Northern Iowa

Overspray not only causes material waste, it also increases filter loading and sludge, requiring more frequent filter changes and higher volumes of sludge disposal. Filter

The paint booth at Maintenance Center, Albany, GA.

loading, in particular, is troublesome because not only does it create imbalances in the flow of air through the booth, it also reduces the level of air flow, which can create significantly higher concentrations of booth vapors, airborne particulate and contamination.

In addition, paint overspray that settles onto painted parts can seriously degrade the quality of the finished product and ultimately result in increased material costs and reduced productivity.

With the STAR4D technology, the atomized paint particles are delivered at low speeds to the object being painted, so less paint is lost as overspray, bounce and blow back.

How Efficient is STAR4D?

Transfer efficiency (TE) refers to the ratio of sprayed paint that actually lands on the targetted part or component. This number is widely used in calculations involving paint application economics. The TE levels for air pressure atomized spray painting have always been relatively low, with around 15 to 30 percent of the paint actually hitting the target.

The laser training evolution undertaken by the Marine Corps has demonstrated a better than 30 percent improvement in transfer efficiency at their depots, with TE rates greater than 60. A comparable transfer efficiency is expected with the mobile painter training.

Taking a closer look at TE, a gallon of paint will have about four pounds of VOC emissions. At about $30 a gallon, a 55-gallon drum costs about $1,650 with 220 pounds of VOCs. With a TE of 70 percent, you will have an overspray of 30 percent at a cost of $495 and 66 pounds of VOC emissions emitted into the environment.

From an environmental perspective, excessive paint waste correlates to higher VOC emissions and waste generation rates. The fact that finishes are often unacceptable means reapplication may be necessary, which only compounds the VOC emissions. This imposes a greater regulatory burden with respect to air permitting, hazardous waste management and environmental reporting.

The Office of the Secretary of Defense and DORRA have a vested interest in the Marine Corps' STAR4D technology due to the anticipated EPA final rule for 40 Code of Federal Regulations Part 63 that addresses management practices and equipment standards for new and existing finishing operations:

- Subpart HHHHHH—National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources
- Subpart XXXXXX—National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Nine Metal Fabrication and Finishing Source Categories

When these rules are in place, the Marine Corps must be in compliance by 10 January 2011. These rules—often called Maximum Available Control Technology (MACT) standards—require that all painters be certified through hands-on and classroom training before they are permitted to apply surface coatings to parts. In addition, the rules directly impact the Defense Land Systems and Miscellaneous Equipment (DLSME), which encompasses any materiel, equipment and components used by all the Armed Forces of the United States. DLSME includes the Marine Corps inventory of combat vehicles, tactical vehicles, military personnel items, weapons, armament and engineering, communications, base camp, ground support and launch support equipment. ⚓

Photos by Gregory Russell

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