THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE

Currents

fall 2012

Spotlight on CARRIER STRIKE GROUP 11

Rear Admiral Peter Gumataotao Highlights RIMPAC 2012, Including Energy & Environmental Successes

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Currents

Chief of Naval Operations
Energy and Environmental Readiness Division

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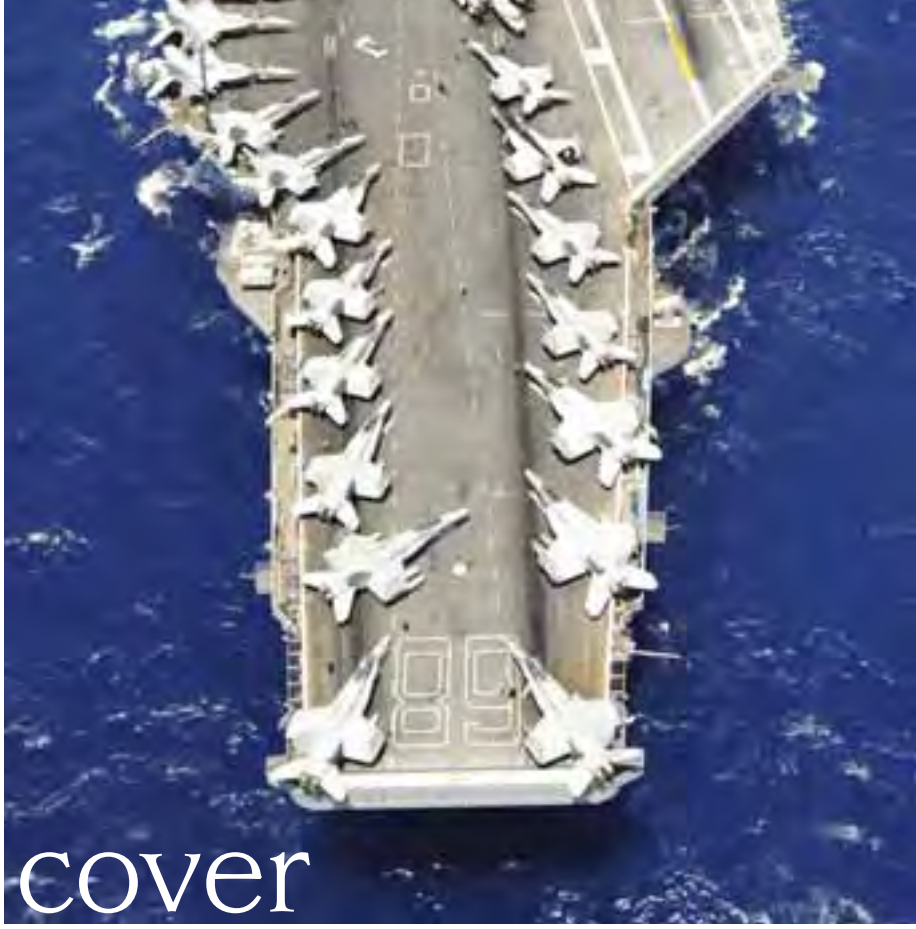

cover

The aircraft carrier USS Nimitz (CVN 68) and the rest of Carrier Strike Group 11 (CSG 11) participated in Rim of the Pacific (RIMPAC) 2012 exercise including the demonstration of the Great Green Fleet. Rear Admiral Peter A. Gumataotao, commander of CSG 11, provides insights into this year's RIMPAC exercise and other energy and environmental successes in this issue of *Currents*.

MC3 Ryan Mayes

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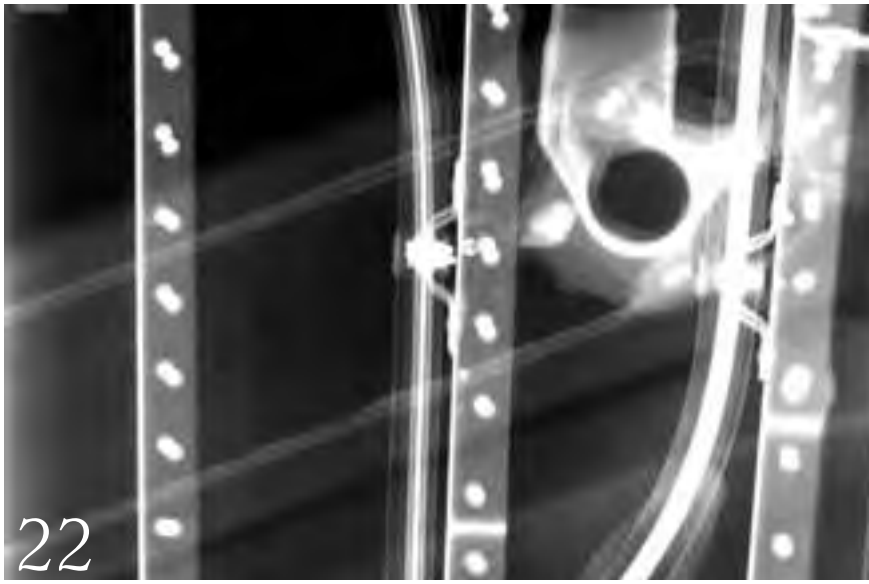

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Phase I Planning Closeout; Phase II & Cleanup Progress; Executive Order & Budget Considerations on the Horizon

IN AUGUST 2012, the Navy achieved a very significant environmental milestone. The 21 August signing of the Record of Decision on the environmental impact statement (EIS) for the Silver Strand Training Complex marked the end of the Navy's "Phase I" program for environmental planning, permitting and consultation for major training and testing areas at sea.

Phase I encompassed preparation of EISs, obtaining Marine Mammal Protection Act (MMPA) permits, and conducting Endangered Species Act (ESA) permits, for thirteen training and testing areas at sea. From west to east, these areas are the Marianas Island Training Complex, the Hawaii Range Complex, the Gulf of Alaska area, the Northwest Training Range Complex, the testing areas of Naval Undersea Warfare Center, Keyport, the Southern California Range Complex, the Silver Strand Training Complex, the Gulf of Mexico area, the testing areas of Naval Undersea Warfare Center Panama City, the Atlantic Fleet Active Sonar Training area, the Virginia Capes Range Complex, the Charleston Range Complex, and the Jacksonville Range Complex. An additional EIS was prepared covering construction of an Undersea Warfare Training Range off northern Florida.

in the early to mid-1990s, which equipped Navy ships to process metal, glass, cardboard and paper waste at sea, in response to stricter international and domestic requirements. The Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) environmental planning program, and the northern right whale ESA consultation program, both begun in earnest in 1996, were the harbingers of a new era of Navy environmental responsibility at sea. Other environmental initiatives yet in the offing, such as the Chesapeake Bay effort in response to Executive Order 13508, and the Coastal and Marine Spatial Planning effort as part of Executive Order 13547, have the potential to dramatically change the Navy environmental protection landscape.

No other environmental program, however, past, present or future, has had or is likely to have as profound an impact on the Navy as the Phase I environmental planning effort. The Phase I effort was begun in earnest in the early part of this century, in part as a result of recognition that litigation had the potential to interfere with ongoing Navy training and testing at sea. Rather than addressing environmental planning at sea through a patchwork of environmental documents prepared for particular events or exercises, the Navy undertook to cover most Fleet training in major training areas in a single EIS, covering a five-year period. In so doing, the Navy addressed squarely the challenge of ensuring that

Of Navy's major environmental initiatives over the years, the Phase I effort was not the broadest in scope, longest lasting, or most costly–but it may be the most consequential.

realistic Navy training would effectively protect marine life, including marine mammals, endangered turtles, fish and other species. The Phase I effort, carried out in the face of aggressive litigation brought by non-governmental organizations, for the first time attracted widespread attention to an environmental issue among the senior-most military and civilian leadership of the Navy. Commitments to environmental protection made by the Navy during this period have been incorporated into routine training and practice at sea, and spurred development of a Navy culture of environmental protection in all activities at sea.

Long before the Phase I effort was complete, in late 2009, Navy was hard at work on "Phase II" EISs that will support the next round of permits, after the Phase I permits expire. As all involved in this effort will attest, this is a gargantuan effort. Phase II will encompass not only Fleet training, but also research conducted by the Office of Naval Research and development and testing activities of the Systems Commands. Notice of intent to prepare the first of the Phase II EISs was published in the summer of 2010, and the first draft EISs for Phase II study areas were made public for review and comment in May 2012. U.S. Fleet Forces Command and Commander, Pacific Fleet will be the action proponents for most Phase II documents, assimilating and coordinating input from the various other Echelon II commands. The Phase II effort requires unprecedented cooperation among diverse Navy stakeholders—and the effort may well become much more difficult in the months ahead.

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The first of the Phase I EISs, and associated MMPA permits and ESA consultations, were completed in January 2009. Over the next three years, another nine EISs were completed, and renewals of year-long MMPA letters of authorizations were obtained as necessary. The National Marine Fisheries Service (NMFS), Navy's principal regulator for activities at sea, deserves considerable credit for the success of this effort. Led by Mr. Jim Lecky, head of the NMFS Office of Protected Resources (OPR), NMFS acted as both a cooperating agency on the EISs, and issuer of the MMPA permits and ESA biological opinions.

Navy's Phase I environmental permitting effort represented a substantial increase in the NMFS headquarters workload, but the OPR staff was invariably supportive of Navy timetables, while working cooperatively with Navy to develop appropriate protective measures. Mr. Lecky retired in April 2012. His contributions to the protection of marine species, while assisting federal agencies in accomplishing important national priorities at sea, cannot be underestimated. Ably filling in as Acting OPR Director since Mr. Lecky's retirement is Ms. Helen Golde, whose professionalism and dedication ensures that Navy and NMFS will continue to work cooperatively and effectively to achieve their mutual objectives.

In mid-2012, it is impossible to predict where the nation and the Navy will be in early 2013 with regard to the budget. Substantial across-the-board decreases may be in the cards, even for the environmental program. Should this occur, difficult choices will be made. Given the direct and immediate connection between Fleet readiness and on-time completion of Phase II environmental planning requirements, substantial priority is likely to be put in this area. To the extent possible, environmental requirements directly supporting Fleet readiness will need to be met, in order to carry out the Navy Title 10 mission of providing ready forces to Combatant Commands in support of national objectives. ⚓

John P. Quinn
Deputy Director, Chief of Naval Operations
Energy and Environmental Readiness Division

LET'S clean up this fall

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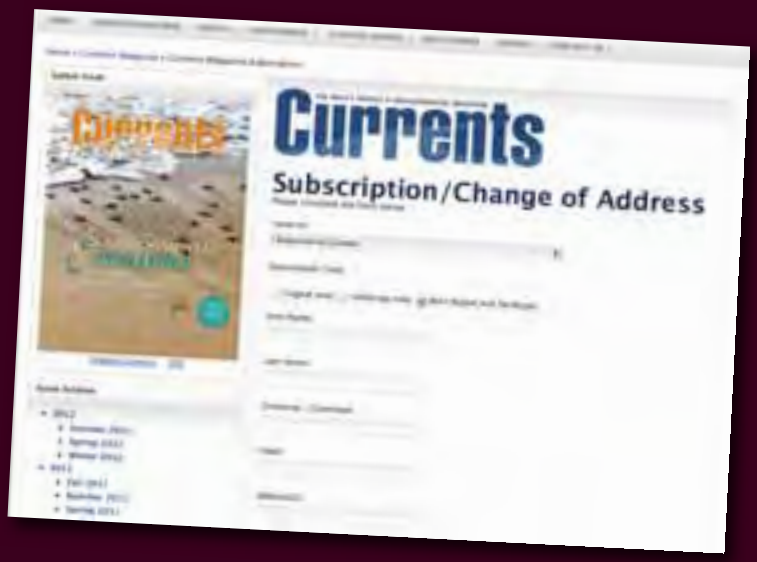

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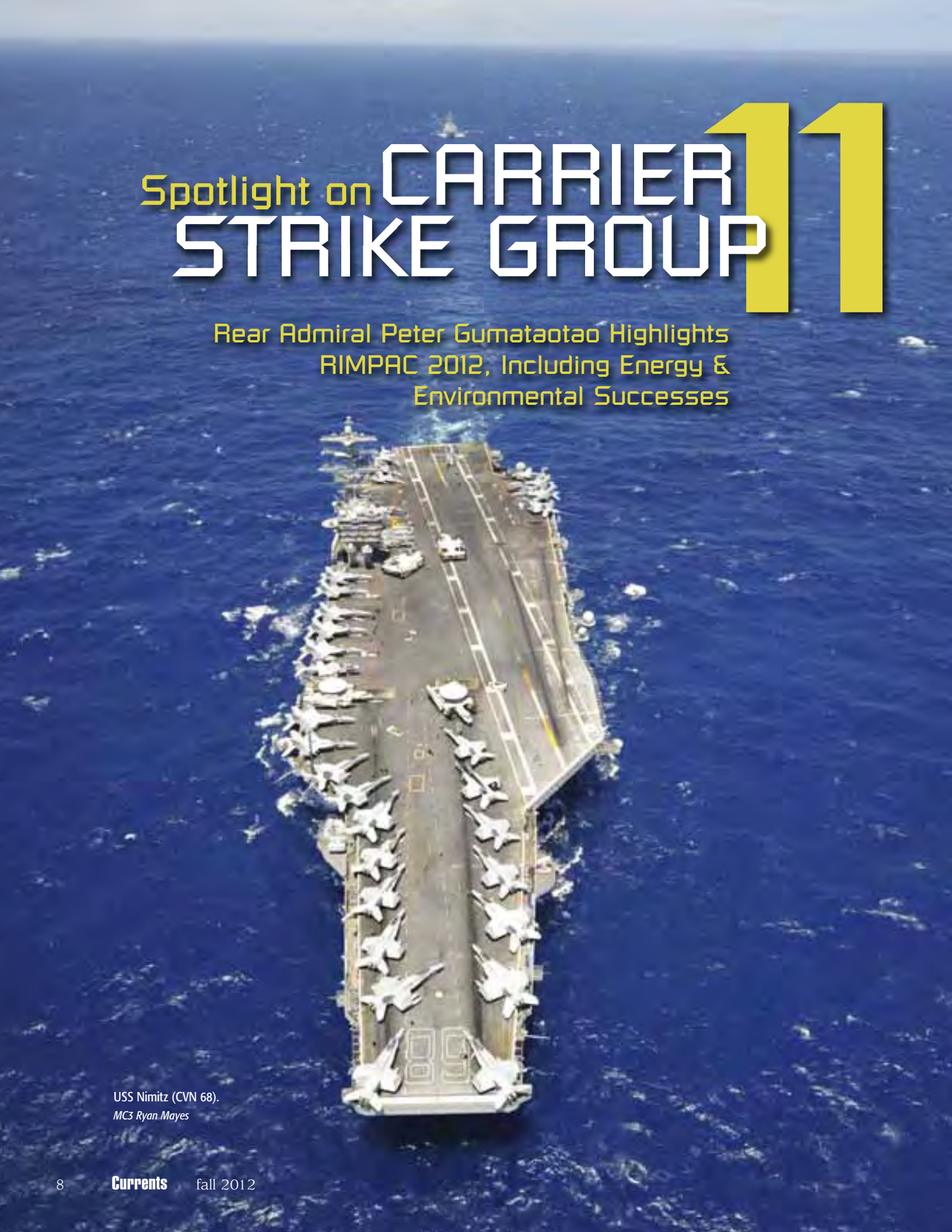
Spotlight on CARRIER STRIKE GROUP 11

Rear Admiral Peter Gumataotao Highlights RIMPAC 2012, Including Energy & Environmental Successes



USS Nimitz (CVN 68).
MC3 Ryan Mayes

On 14 August 2012, Rear Admiral Peter A. Gumataotao discussed this year's Rim of the Pacific (RIMPAC) exercise and other issues with Kenneth Hess, acting director of communication and outreach at the Chief of Naval Operations Energy and Environmental Readiness Division (N45) and Bruce McCaffrey, managing editor of *Currents*.

Currents: Thanks for taking the time to speak with us today Admiral. Could you start by describing your responsibilities in your current position?

Rear Admiral Peter A. Gumataotao: I am the Commander of Carrier Strike Group 11; Nimitz Strike Group. The objective of the Carrier Strike Group is to support the combatant commander's (e.g. Pacific Command, Central Command) requirements in an Area of Responsibility (AOR)—and more specifically, Commander THIRD, FIFTH or SEVENTH Fleets—in a myriad of missions. Right now Carrier Strike Group 11 is in the process of working up for deployment later on in the year. So we're going through something called the Fleet Readiness Training Plan (FRTP) where we do all of the workups starting from the basic phase of training all the way up to the integrated phase.

Currents: Could you explain the mission of Carrier Strike Group 11?

Admiral Gumataotao: We're a very capable, multi-dimensional strike group with six explicit missions. Power projection is a very important role for us. Forward presence is very big. We can do sea control and deterrence, if called upon. We also get involved in maritime security operations—opening up sea lines of communication if necessary. Or even piracy. We can assist in disaster relief operations as the Ronald Reagan did in the coastal waters off Japan in the wake of the 8.9-magnitude earthquake and subsequent tsunami. So those pillars of our mission are key functions that we train up to so that we can be ready at short notice to do whatever the Combatant Commander needs us to do.

Currents: I understand that you and your staff played a major role in the 2012 RIMPAC exercise, which ran 27 June to 7 August, 2012. For those readers who may not be familiar, what is the purpose of RIMPAC?

Admiral Gumataotao: RIMPAC is a biennial, multinational training exercise that started back in 1971 with three nations participating. It has evolved through the years—this is the 23rd exercise. This year we had the largest ever number of nations and ships participating—22 nations, over 40 ships, including six submarines. There were also more than 200 aircraft and close to 25,000 personnel. RIMPAC really speaks to the value of maritime forces from an international perspective. It's the world's largest international maritime exercise.

RIMPAC really speaks to the value of maritime forces from an international perspective.

A lot of our leadership talk about the 70/80/90 formula. Seventy percent of the world is water, 80 percent of the world's population lives at or near the coast, and 90 percent of international commerce moves by sea. If you think of those 70/80/90 numbers, you can see why RIMPAC is a very important exercise. And we're a big part of it. We are a maritime nation. The most fundamental and important thing that I took away from RIMPAC as a carrier strike group commander, is that it improves the

Sailors participate in mooring the aircraft carrier USS Nimitz (CVN 68) as it pulls into Joint Base Pearl Harbor-Hickam in support of RIMPAC 2012.
MC2 Jon Dasbach

readiness of my forces as well as the readiness of participating forces. It's a partnership that enhances interoperability and improves readiness—these are key themes that you see in RIMPAC from its inception back in 1971.

I think that ability to partner with other nations is priceless.

Currents: Is there something specific about RIMPAC in terms of its ability to improve your readiness that you don't get from other exercises?

Admiral Gumataotao: Just the magnitude of it and the challenges that we have establishing a coherent operating picture or plan among our many coalition forces. As robust as our FRTP is, this is something that we won't get day in and day out. We don't normally get a chance to operate with the Russians and the Singaporeans, the Australians, Canadians, the South Koreans, or the Japanese—in the way that we have in this exercise. What RIMPAC does is really enable us to use systems that we would use operating abroad. And when we go overseas to accomplish those missions I referred to earlier—nine times out of ten it's never unilateral. We're always working with host nations and partners. For example, a Chilean was on board Nimitz as the Sea Combat Commander. And I established some good relationships with those senior officers, working day in and day out with them to develop the scheme of maneuver. I learned a lot from them. I know they learned a lot from us. But more importantly, when you're overseas and you already have that relationship with certain navies, you have a better understanding across the lifelines. And sometimes it's just easier to pick

THE BASICS ABOUT CARRIER STRIKE GROUP 11

THE MISSION OF Carrier Strike Group 11 (CSG 11) is to "build a warfighting team that honorably represents our country, completely deters or defends, and if necessary, wins decisively in combat." The centerpiece of CSG 11 is the USS Nimitz. Nimitz is the lead ship of the world's most powerful and capable class of warships (CVN-68). It carries the name of five-star Fleet Admiral Chester W. Nimitz, who held dual command of Commander in Chief, United States Pacific Fleet, for U.S. naval forces and Commander in Chief, Pacific Ocean Areas, for U.S. and Allied air, land, and sea forces during World War II. In addition to Nimitz, CSG 11 includes:

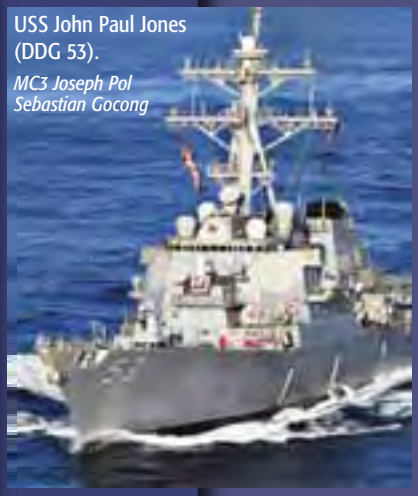
- USS Sampson (DDG 102)
- USS Pickney (DDG 91)
- USS William P. Lawrence (DDG 110)
- USS John Paul Jones (DDG 53)
- USS Vandergrift (FFG 48)
- USS Curts (FFG 38)
- USS Princeton (CG 59)

Source: www.nimitz.navy.mil/uss-nimitz-(cvn68)-legacy.html

USS Sampson (DDG 102).
MC2 Tiarra Fulgham

USS Princeton (CG 59).
MC3 Sean Furey

USS Curts (FFG 38).
MC2 James R. Evans



USS John Paul Jones (DDG 53).
MC3 Joseph Pol Sebastian Gocong

USS Pickney (DDG 91).
MC2 Daniel P. Lapierre

USS William P. Lawrence (DDG 110).
MC2 Scott A. McCall

USS Vandergrift (FFG 48).
MC1 Gerardo Jimenez

up the phone, then you're talking to somebody that you worked with before. You can't get that just training unilaterally within our own Navy.

Operating together allows us to be more efficient, to be more effective in supporting the combatant commanders wherever we are—be it in Indonesia, the Horn of Africa, or wherever the situation dictates. The ability to partner with other nations is priceless, and the magnitude of the number of aircraft and ships and submarines that we worked with here, really challenges me and my people and makes sure we're at our best—that we accomplish our mission safely and professionally. This all leads to us being better warfighters in the end.

Currents: What's unique about RIMPAC 2012?

Admiral Gumataotao: As I mentioned, RIMPAC started in 1971 with just three participants—the U.S., Australia and Canada. Even as recently as 2010, we had 14 participants and in RIMPAC 2012 we had 22. That in itself is a great accomplishment.

It is the first time during this international maritime exercise that non-U.S. officers held command functional component positions in the combined task force.

The theme for RIMPAC 2012 that Vice Admiral Gerald R. Beaman (Commander, U. S. THIRD Fleet) had established from day one has been: Capable, Adaptive, Partners. And we illustrated that with all the different countries and all the different procedures we have while operating at sea, all coming together safely and executing different events and scenarios very professionally.

THE EVOLUTION OF RIMPAC

RIMPAC IS A large-scale multinational power projection/sea control exercise. Conducted biennially (every even year) under the leadership of the U.S. THIRD Fleet, RIMPAC is designed to enhance the tactical capabilities and cooperation of participating nations in various aspects of maritime operations at sea.

RIMPAC started in 1971, with just three nations participating–the U.S., Australia and Canada. In 2012, the world's largest international maritime exercise included a record number of nations (22) and participants (25,000). It took place 29 June to 3 August around the Hawaiian Islands.

RIMPAC 2012 marked several important firsts, including the first time that non-U.S. officers commanded components of the exercise, the first demonstration of a biofuel blend, and the addition of a humanitarian assistance/disaster relief event. This event facilitated training and certification for expeditionary forces to respond to foreign disasters as a Crisis Response Adaptive Force Package.

The exercises also included three sinking exercises, multi-force Military Operations on Urban Terrain training, live-fire exercises, surface-to-air engagements, air-to-air missile engagements, surface-to-surface engagements, amphibious assaults, vessel boardings, explosive ordnance disposal, diving, salvage operations, air-to-air refueling, and mine clearance operations.

Source: www.public.navy.mil/surfor/Pages/rimpac2012.aspx

I was really impressed with all of the participating countries. Many countries brought ships, many of them brought troops, and some of them brought observers.

Russia sent three ships—one of them was a Udaloy class—which I had the opportunity to visit while we were underway. (Note: The Udaloy class is a series of anti-submarine destroyers built for the Soviet navy, some of which are still in service with the Russian navy.) I even rode their Helix helicopter, which is a once-in-a-lifetime experience. I never thought I'd do that.

So other than the size, I think there were some other significant points about RIMPAC 2012 worth a mention. It is the first time during this international maritime exercise that non-U.S. officers held command functional component positions in the Combined Task Force (CTF).

For example, the combined maritime component commander was Commodore Stuart Mayer from the Royal Australian Navy. We also had Brigadier General Mike Hood from the Royal Canadian Air Force commanding the air component. And we had other key leaders in the multinational force such as Rear Admiral Ron Lloyd from the Royal Canadian Navy who was the deputy commander to the CTF commander (Admiral Beaman). Having a deputy commander for the CTF that had participated in a previous RIMPAC—really proved beneficial not just in providing continuity but improving upon what we accomplished in previous RIMPAC's. We also had the Japanese Maritime Self-Defense Force's Rear Admiral Kitagawa, the Vice Commander of the CTF, who worked directly with Admiral Beaman. The fact that the functional commanders were non-U.S., and that we were able to seamlessly execute all of the events remarkably well, speaks volumes about the professionalism of these countries and their Officers, Soldiers, Sailors, Marines, and Airmen.

As the commander for CTF 170, I worked for Commodore Stuart Mayer. We spoke daily of operational issues—things that we would be talking about if we were actually supporting a campaign crisis or Humanitarian Assistance and Disaster Relief mission. I was pleasantly surprised to see how well that construct worked. I think Admiral Beaman ensured that all of these key component commanders had, in previous RIMPACs, observed those positions in another role. I think that helped. And I think that's going to be the process for the future—that if any other country wanted to take these key roles they would have to sit through and observe it closely before they could actually assume that role.

Rear Adm. Gumataotao celebrates the 120,000 aircraft trap of arresting engine three with the V-2 Division aboard the USS Nimitz (CVN 68).
MC3 Ryan Mayes

RIMPAC 2012 was the first RIMPAC that included a significant Humanitarian Assistance and Disaster Relief type of event. We had an Expeditionary Strike Group along with marines from different navies and many other folks working with the Hawaii Crisis Response Teams, to include their medical facilities. They exercised statewide mass casualty drills and certifications. So this crisis response adaptive force package folded in very well—not just for the military but for the Honolulu crisis response team themselves. This event was specifically focused on testing out the

Chief of Naval Operations (CNO) Adm. Jonathan Greenert (left) and Secretary of the Navy (SECNAV) the Honorable Ray Mabus observe as the USNS Henry J. Kaiser (T-AO 187) transfers biofuels to the USS Princeton (CG 59) during a replenishment at sea. The fueling was part of the Great Green Fleet demonstration portion of RIMPAC 2012.
Chief MC Sam Shavers

operability—the communications and some of the response capabilities among interagency partners. I was very happy to see that work out very well.

RIMPAC 2012 was the first time that we demonstrated the use of biofuel—what the Big Navy was calling the Great Green Fleet demonstration. Several months ago when I found out that my strike group would be participating, I started to have my folks read up on biofuels because we knew very little about it. We wanted to make sure that what we were taking on board our aircraft, our carrier and our other ships was safe to operate. Through much reading and research as well as information provided to us by OPNAV, my Sailors, officers, and pilots felt very comfortable taking on the biofuel.

Through much reading and research as well as information provided to us by OPNAV, my Sailors, officers, and pilots felt very comfortable taking on the biofuel.

My criteria were that it was safe and transparent to operations. Both of those requirements were satisfied during the demonstration—cross platform utility using biofuel 50-50 mix with both my aviation fuels and also my Diesel Fuel, Marine (DFM).

Currents: Tell us about the Great Green Fleet demonstration. What were the highlights from your perspective?

Admiral Gumataotao: The demonstration of biofuels at sea in a strike group environment during normal operations was one of the key objectives of RIMPAC 2012. The goal was to demonstrate that you can use biofuels at sea with no impact on our ability to conduct our missions—a goal that was safely demonstrated and executed properly. In the Great Green Fleet, we had multiple types of aircraft that took on the biofuel mix from USNS Henry J. Kaiser. It was a 50-50 mix of the hydroprocessed

renewable jet fuel—HRJ-5. That fuel was blended with the aviation JP-5 fuel, and we put it in the aircraft, including the Carrier Onboard Deliveries that brought distinguished visitors out to observe the demonstration on the 18th of July. We put it in the H-60 Sierra helicopters (our personnel transfer helicopters), our H-60 Romeo helicopters, and our F/A-18 Hornets for demonstrating fixed wing operations. We also had surface ships that took on fuel—hydroprocessed renewable diesel (HRD-76). HRD-76 was blended with F-76 marine diesel fuel into a 50-50 blend. And while we had USS Nimitz running on nuclear power, we had USS Chafee (DDG-90), USS Chung-Hoon (DDG-93), USS Princeton (CG-59), and USNS Henry J. Kaiser (T-AO-187), all running on this blend. All in all, we used 700,000 gallons of 50-50 blended biofuels, using both the HRD-76 and the HRJ-5 in my strike group. We burned it all and, more importantly, it was done without any hiccups. I was pretty excited about that. There was no sub-optimization of my aircraft jet engines or my ships' gas turbines.

Currents: What were the most challenging aspects of the Great Green Fleet demonstration?

Admiral Gumataotao: Well, in terms of operational limits, we did not have any—the fuel was transparent. But it took a lot of leadership effort to make sure people understood the significance of what we were trying to do in this demonstration. As you know, Sailors in the 21st Century are very informed. So we made a focused effort to put the word out about biofuel. In fact, when Admiral Beaman came out initially during RIMPAC when we were underway—this is before the biofuel demo—he was down on the mess decks talking to the crew, and he opened it up for Q&A like he normally does. A majority of the questions were about biofuels—which shows you where my Sailors' heads were. They were very informed, asking very educated questions. For example, one Sailor asked, "Will the use of biofuel change the ratings down in engineering?" and the answer is "No." You operate all your systems the same way. Another Sailor asked, "Are there any restraints that we have to consider for our existing systems? Do we have to separate the biofuel from our service or storage tanks?" and the answer is "No." You just use it like you would use any of your F-76 or your JP-5 that you would take on board.

This biofuel demonstration is only one of many other energy-efficient technologies that we are demonstrating at sea.

Look within the lifelines of what we have—the use of Light Emitting Diodes (LED) that are being used in our surface ships. We've seen that LEDs last longer than fluorescent or incandescent fixtures. So you reduce your maintenance and manpower requirements by using LEDs. For our gas turbines, we have to shut them down to do a water wash. (Note: To maintain performance, gas turbines require periodic water washes to eliminate accumulated deposits.) It's very inefficient to shut off the gas turbines then bring them back up again. Not only does that take time, it also burns more fuel. We have this new energy-efficient technology in

The Honorable Ray Mabus and Rear Adm. Gumataotao visit with Sailors assigned to the aircraft launch and recovery equipment division of the USS Nimitz (CVN 68) during the Great Green Fleet demonstration portion of RIMPAC 2012.
MC3 Ian A. Cotter

our gas turbines that allows us to do water washes while the turbines are on-line. Our engineers can actually wash the compressors while the engines are running. This extends the life of our engines and reduces fuel consumption. Being able to water wash your gas turbine on-line is a simple solution but it saves a lot of money.

Many of our ships have the Shipboard Energy Dashboard that provides real-time awareness of the energy that is being used by on board equipment. This allows my Sailors to minimize their energy consumption and improve their efficiency by knowing how well their systems are performing.

Rear Adm. Gumataotao addresses the Honorable Ray Mabus during an all-hands call aboard the USS Nimitz (CVN 68) during the Great Green Fleet demonstration portion of RIMPAC 2012.
MC3 Devin Wray

When I think about energy efficiency, I think about how it improves combat readiness.

We have installed stern flaps on the hulls of many of our surface ships. The flow at the hull actually impacts fuel consumption. You can equate that to airflow over a high-end sports car—minimizing airflow reduces drag and turbulence. Stern flaps on our surface combatant ships reduce the overall resistance across the hull fore to aft so you can actually be more efficient with the fuel that you use. These are the kind of things that I wanted to make sure my guys were focused on—not just the biofuels. We have a lot of initiatives underway which I think is good for us. Here's the bottom line—when I think about energy efficiency, I think about how it improves combat readiness.

If I can get more out of my fuel, I can get more legs on my surface combatants—to get to more places more quickly, to be able to operate longer on station. If you're on a Ballistic Missile Defense (BMD) mission or another mission that requires you to be longer on station, fuel efficiency and reduced maintenance, and the extension of the equipment's life all comes down to improving the warfighting readiness of our ships.

Your best litmus test for a lot of these initiatives is, how transparent is it to the Sailor? How does it improve warfighting without Sailors having to do something other than running their engines and other systems? The benefits you get and the flexibility of being able to use these types of energy resources speak for themselves.

Currents: You were one of the most senior U.S. Navy officials participating in this RIMPAC. Did you have the opportunity to speak with Secretary Mabus about these energy initiatives while this was going on? If so, what insights can you share?

FOR MORE INFORMATION

FOR MORE INSIGHTS into shipboard energy initiatives, read our article entitled "NAVSEA Reducing Fleet Energy Consumption: Shipboard Efficiencies Include Hybrid Electric Drive" in the summer 2012 issue of *Currents*. Read the magazine on-line or subscribe via the *Currents* page on the Department of the Navy's Energy, Environment and Climate Change web site–at http://greenfleet.dodlive.mil/currents-magazine.

Admiral Gumataotao: The SECNAV flew out on a helicopter that was powered by a biofuel blend. I wanted to make sure that he had a chance to meet the Sailors and witness an in-flight refueling with an F/A-18 Rhino tanking in the air. We brought him on board Princeton and Henry J. Kaiser as it was taking on and transferring fuel respectively. We brought him on board Chafee, where he toured the engineering spaces and talked to some of our Sailors. He went over some of the energy initiatives; the Shipboard Energy Dashboard, the gas turbine online water wash, and the LEDs. I think he was very pleased with what he was seeing. I've been with the SECNAV before when I was stationed in Korea. Just like then, I saw that he was very interested in checking in with the Sailors, thanking them for their service, and more importantly, talking about how the sole focus for many of these initiatives is to improve the warfighting readiness of the Fleet. He spoke to the folks down in the hangar bay about how these initiatives are focused on increasing our capability and flexibility to meet the challenges of the 21st Century. I thought from the questions he was getting, our Sailors are very interested in these energy initiatives. I think the Navy writ large is an incredible steward of our environment and our Sailors reflect that. Think about the average age of our Sailors—this is the millennial generation—the majority of them are 19 to 20 years old. They grew up in an environment where you had recycling and no smoking in restaurants. Today's Sailor is very health conscious, very energy conscious, very environmentally conscious.

So those are the preponderance of folks that the SECNAV was talking to. He had a smile on his face because he had a chance to talk to his Sailors, to see his ships and his aircraft, and a carrier operating at sea in full optimum mode on biofuel with no interruptions. He was extremely proud of all of this.

Currents: Let's talk for a minute again about combat capability, which you mentioned as a primary driver for these energy investments. What are some real-life examples of how energy initiatives have enhanced combat capability for Carrier Strike Group 11 or that have affected you as a career naval officer? Perhaps in RIMPAC or elsewhere?

Admiral Gumataotao: Our gas turbine engines consume a lot fuel operating at sea. When we increase our speed to go from Point A to Point B, we suck up a lot of fuel. This requires us to refuel which, in turn, means the FIFTH Fleet or SEVENTH Fleet commander needs to tether an oiler to certain strike groups, particularly for the surface combatants. So if you need to travel to a remote area—for piracy, sea lines of communication protection, or maritime security operations—you are much more limited because of the amount of fuel that you burn per day at higher speeds.

Rear Adm. Gumataotao speaks to the crew on board the USS Nimitz (CVN 68) during the Great Green Fleet demonstration portion of RIMPAC 2012.
MC3 Renee Candelario

Ships and submarines participating in RIMPAC 2012 are in formation in the waters around the Hawaiian islands.
Chief MC Keith Devinney

THE ABCs OF RIMPAC

HERE IS AN alphabetical list of the countries that participated in RIMPAC 2012:

1. Australia
2. Canada
3. Chile
4. Colombia
5. France
6. India
7. Indonesia
8. Japan
9. Malaysia
10. Mexico
11. Netherlands
12. New Zealand
13. Norway
14. Peru
15. Philippines
16. Russia
17. Singapore
18. South Korea
19. Thailand
20. Tonga
21. United Kingdom
22. United States

For a complete list of participating vessels and personnel units, see www.cpf.navy.mil/rimpac/2012/forces.

I know of many times when our training scenarios were postponed because we had marine mammal sightings.

Your time away from station to refuel minimizes your ability to optimize executing your mission.

Hybrid electric drives are not resident within my carrier strike group, but some of the coalition forces that were with us at RIMPAC 2012 have hybrid electric drives on their ships. You lengthen your legs for your surface combatants if you use energy-efficient systems. That's point one.

Point two, with regard to extending the life of our equipment, like gas turbine engines, or saving money via the Shipboard Energy Dashboard or through the use of LEDs—those things add up. It adds up in terms of operational cost savings. So for a warfighter, we always look at where we are spending our money. Are we spending our money on things like unnecessary maintenance or inefficient processes?

The time spent by that Sailor and the money that we spend on the equipment and maintenance tools all come from my Operation & Maintenance account: Navy (O&MN) fund. And when I think about O&MN funds, that's the money that I use at sea to train my team and to maintain my equipment. The more O&MN funds we have available to us, the more we can train. So these energy efficiency ideas are fantastic. They provide us with more latitude as a warfighter to be more flexible and responsive to whatever is asked of us. We need to employ better ways that are less dependent on tethering oilers and allow us to stay on station longer for a BMD, Tomahawk strike, piracy mission, or a maritime security operation. The longer you can keep those surface combatants on station and actually operate your aircraft, provides you more freedom to maneuver and respond to any of the missions that are put before us by the combatant commander.

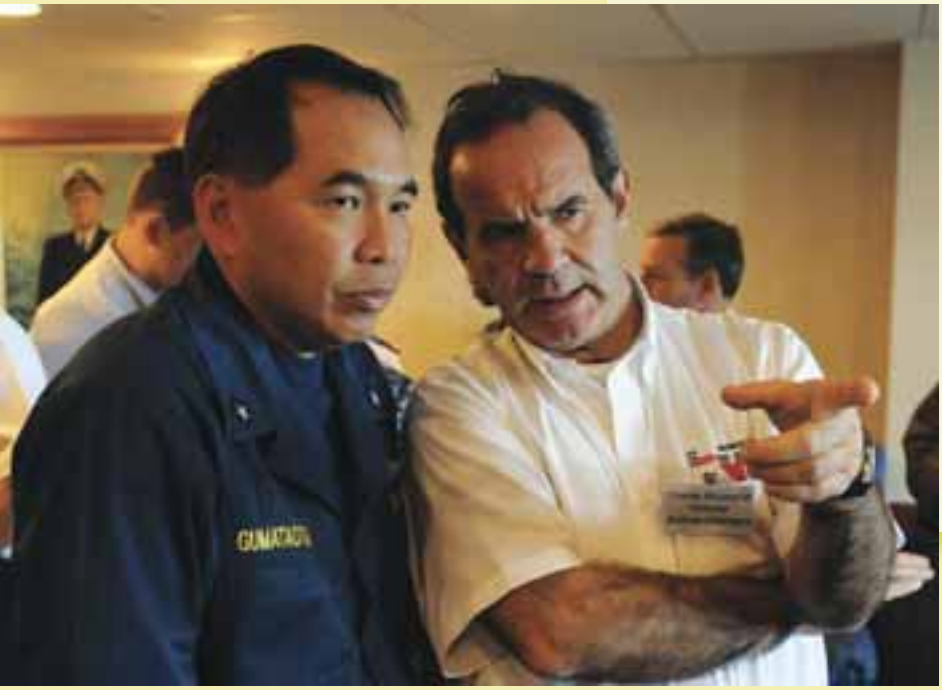
Currents: *Currents* is the Navy's energy and environmental magazine so we cover energy as well as environmental issues. As you know, the Navy has significant environmental compliance requirements to train our forces and test new equipment. Tell us about any environmental factors that impact your decision-making.

Admiral Gumataotao: I think that in the last 15 to 20 years operating at sea, serious attention to this has been embedded into our tactics, techniques, and procedures. We emphasize being stewards of our environment. During the preparations for getting our ships underway as part of RIMPAC 2012—not just the U.S. ships but the coalition ships as well—we talked to them about the potential impact of the use of our equipment, especially our sonar, and what we need to do as environmental stewards to establish and maintain effective lookouts. If marine mammals are spotted in the area, then we immediately maneuver the force to avoid them and reduce or secure our sonar transmissions when appropriate. These safety procedures ensure that we do our part safeguarding marine mammals while continually training with our active sonar or with our use of live ordnance in designated Hawaiian operating areas. We are very prudent in our execution of operations if there is any indication that marine mammals are in the area. There are strict procedures that all ships comply with. I know of many times when our training scenarios were postponed because we had marine mammal sightings.

Currents: Regarding RIMPAC 2012 specifically, please describe any environmental considerations the U.S. Navy and other participants in the exercise had to take into account. What were the challenges in that regard?

Admiral Gumataotao: All U.S. Navy ships are required to be in compliance with all of the environmental protection tactics, techniques, and procedures that we have established as good stewards. We went out of our way to ensure that all of the other countries were aware of these measures and that they were being good stewards of the environment as well. And everybody was in compliance. When I talk about simple things such as the posting of the lookouts during sonar activities, I'm talking about everybody—every ship, every aircraft from each country that participated. All of our protective procedures had been covered in detail during the inport phase of RIMPAC with all of the countries that participated.

Currents: What insights did you gain about energy advancements from the other countries that participated?



Rear Adm. Gumataotao speaks with the Chilean Minister of Defense Andres Allamand during a visit aboard the USS Nimitz (CVN 68) as part of RIMPAC 2012.
MC3 Renee Candalario

Admiral Gumataotao: There were ships from more than one country that had the hybrid electric drives. I know we're installing these drives on our newer class ships—those drives are impressive. In a 10-ship, multinational force coming from San Diego to the Hawaiian operating area to participate in RIMPAC, folks were coming alongside every three to five days to take on fuel. But the ships with hybrid electric drives didn't need to take on fuel nearly as often. Under 18 knots or so, they were operating on their diesel engines and hybrid electric systems. It was only after a speed of about 18 or 19 knots that they needed to engage their gas turbines—those are the real gas guzzlers. One ship only utilized about 16 to 20 percent of their fuel capacity by staying on their hybrid electric fuel drive.

The Australian Navy, represented at RIMPAC 2012 by the HMAS Darwin and one of their helicopters, signed a statement of cooperation with the SECNAV in looking at energy efficient initiatives. It was good to see the Australians side-by-side with us yet again. Ever since I was a young ensign, we operated frequently with the Australian Navy. So in addition to the Nimitz, Chafee, Chung-Hoon, Princeton and Henry J. Kaiser, we had the Darwin off to our starboard side steaming in close formation.

Currents: Is there anything else you want *Currents* readers to know from your perspective?

Admiral Gumataotao: I want your readers to know how proud they should be of the young men and women that man the rails, the engineering spaces, and the flight decks day in and day out. They don't look for any accolades.

Rear Adm. Gumataotao speaks with Rear Adm. Jorge Portocarrero of the Peruvian navy during a visit aboard the aircraft carrier USS Nimitz (CVN 68) as part of RIMPAC 2012.
MC3 Christopher Bartlett

There are many great Americans representing us—wearing our country's cloth—that you should be very proud of.

I joined the Navy back in 1976 and it can be difficult operating at sea. I've been married for nearly 26 years and have a family. I am often asked, "Why do you stay in?" It's simple—because of the folks I'm associated with. They're very professional, very patriotic, and really believe in the team—they don't believe in the "me." As old as I am, I am still inspired when I watch these young men and women do their best in sometimes very dangerous situations.

There are many great Americans representing us—wearing our country's cloth—that you should be very proud of. I thank all of the Americans that take the time, stop for a moment, and say thank you to these young men and women.

We had over 300 distinguished visitors while we were underway. And to a person, as they walked around the flight deck, as they felt the heat, saw these folks working so closely together, clearing the deck, setting the tension on the cable on the arresting gear while launching aircraft they said, "Thank you for your service."

So for those who have never served, I just want to ask that when you come across somebody in uniform, say "Thank you." It goes a long way.

Currents: Thank you for your time today, Admiral.

Admiral Gumataotao: Thank you very much and take care. ⚓

SOME OF MY Best Shots

I took these pictures of a hatchling loggerhead sea turtle in Atlantic Beach Florida, near Naval Station Mayport the day after a tropical storm passed through the area. I was part of a group of marine biologists waiting for the weather the clear so that we could support an upcoming shock trial. (Note: The Navy has been relying on ship shock trials for many decades to ensure that newly designed ships can withstand the rigors of war. Ship shock trials involve the detonation of explosive charges near the ship, along with a detailed analysis and evaluation of the effects of that detonation on the ship.)

The storm's heavy swell pushed the newly hatched sea turtle onto the beach where it was drying up while tangled in a huge amount of marine debris. The sea turtle looked lethargic. We carefully untangled the sea turtle and placed it at the water's edge. After a couple of minutes, we were glad to see the sea turtle swimming away.

The photos were taken with a Sony Cyber-shot camera with a 35 mm lens, 1/80 exposure, F-stop of 2.8, and ISO-100.

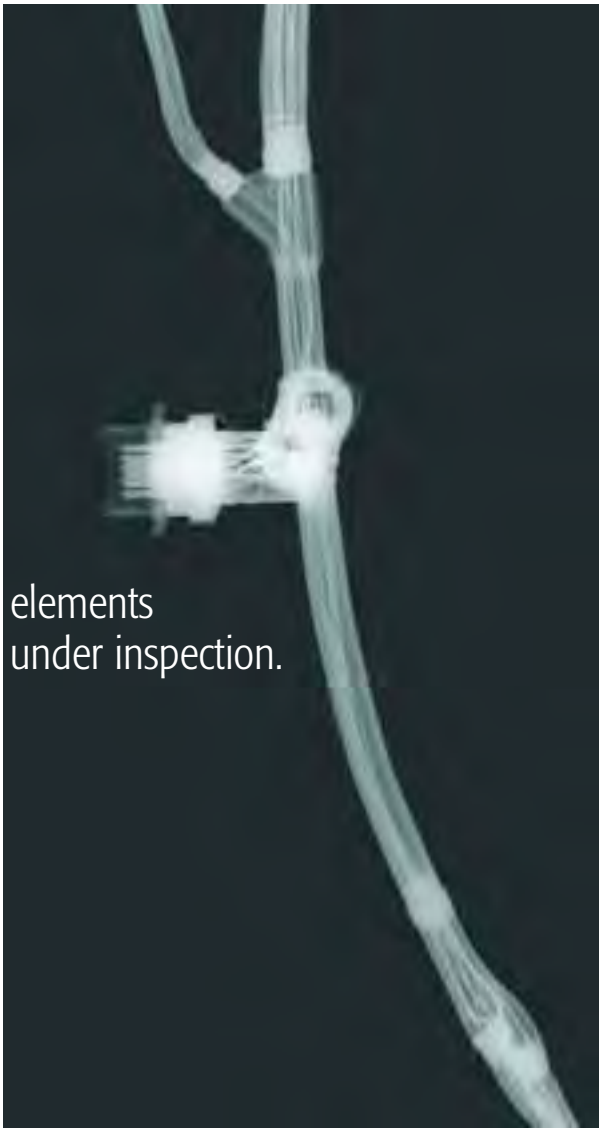
Rafael Arnaldo Olivieri ◉ Booz Allen Hamilton ◉ olivieri_rafael@bah.com

Submit your own Best Shot to Bruce McCaffrey ◉ *Currents'* Managing Editor ◉ brucemccaffrey@sbcglobal.net

Going Digital: Assessing the Viability of Computed Radiography

Innovative Method for Non-Destructive Testing Has Strengths & Limitations

MANY NAVAL ACTIVITIES including the Navy's Fleet Readiness Centers (FRC) are faced with replacing aging chemical and film-based radiographic imaging systems used for non-destructive testing (NDT) (or non-destructive inspection (NDI)) with systems that do not rely on such an approach—so called computed radiography (CR) systems. However there are benefits, requirements, concerns, and challenges associated with implementing this technology that are worth noting.



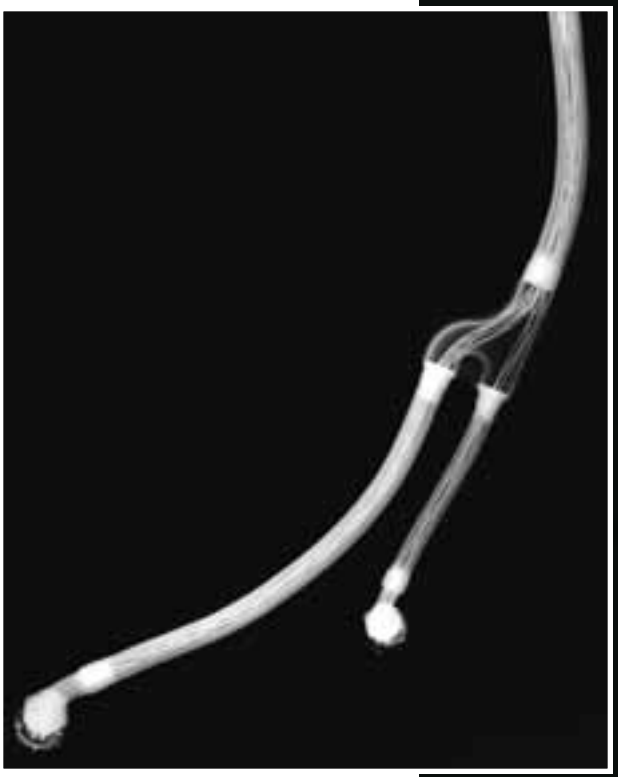
A computed radiography system includes all the elements needed to create an X-ray image of a part under inspection.

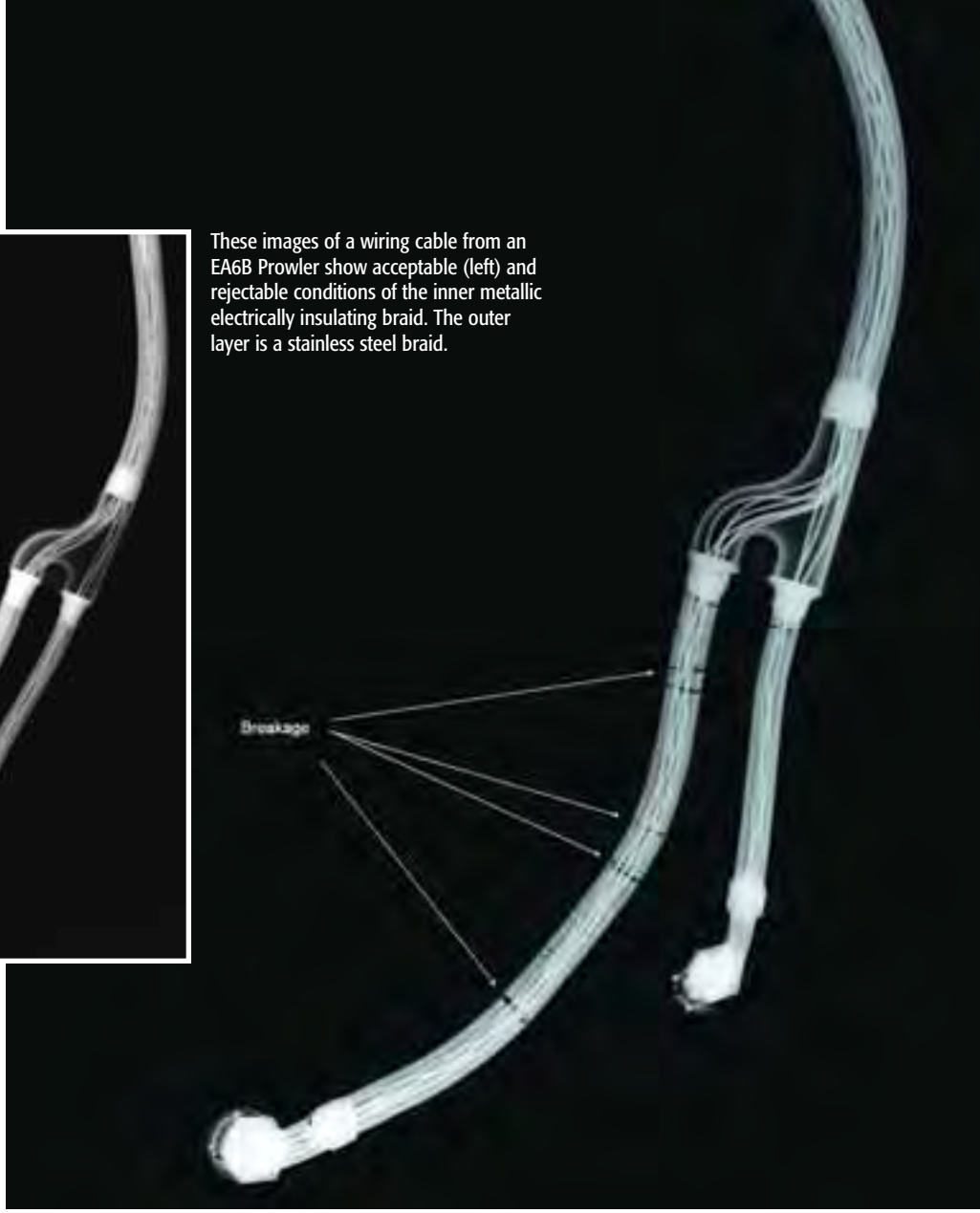
Computed Radiography System Basics

A CR system, a type of digital radiography, includes all the elements needed to create an X-ray image of a component (part) under inspection. Unlike a film-based system, however, the end result is a digital image. (See our sidebar entitled "Film-based, Computed & Direct Digital Radiography. What's the Difference?" for a summary of three radiography inspection technologies). A CR system's four main elements are:

1. A phosphor image plate (IP)
2. An IP reader
3. A central processing station with special software
4. A high-resolution monochrome X-ray monitor

The plate surface is coated with storage phosphors that capture the energy from radiation. These phosphors absorb and store the radiation energy and create a latent image. The exposed plate is processed when a laser in the IP reader scans the plate and the stimulated phosphors reveal the image as visible light. The visible light can then be converted into an





These images of a wiring cable from an EA6B Prowler show acceptable (left) and rejectable conditions of the inner metallic electrically insulating braid. The outer layer is a stainless steel braid.

phor material and exposure. The plates may be reused numerous times. Similar to conventional X-ray film, phosphor plates are stored in cassette format.

CR has only recently been optimized for industrial purposes. The latest generation of industrial CR system is durable and robust and has greatly improved resolution and contrast capability. As a result, CR rivals the performance of film radiography in most applications.

Why the Move Away from Film?

Several factors are influencing the move away from film-based X-ray techniques and toward CR systems. They include:

- Eliminating costly chemicals and resulting hazardous waste
- Providing an adaptable image medium
- Reducing other consumables that a film-based system requires
- Protecting worker health and safety
- Improving productivity by reducing work turn-around time
- Allowing for the quick sharing of the results with off-site experts

Eliminating Chemicals and Hazardous Materials

With CR systems, images are generated on a medium that does not require traditional film's chemical bath processing. Traditional film chemicals must be used within a limited timeframe, requiring processing laboratories to maintain a constant stock of fresh film and chemicals which are rapidly increasing in cost. The cost of procuring and maintaining these supplies is high, and film developing chemicals must be disposed of as hazardous waste, with increasing costs.

Adaptable Image Medium

CR's image plate is typically only .025 inches thick and can be easily cut with scissors or a knife. Image plates can be shaped to meet specific imaging needs, although the cut portion must be refit into the larger IP for reading the image.

Film-based, Computed & Direct Digital Radiography: What's the Difference?

RADIOGRAPHY IS AN NDT technique used to look inside components to ensure those components are free of dangerous defects. X-rays or gamma rays are projected through the component onto an imaging medium. Traditionally, that imaging medium was film. NDT applications are now moving toward digital imaging, much like individuals have moved to digital cameras, and dentists and doctors to digital X-rays. Some of the differences among the technologies are noted below:

TYPE	DESCRIPTION
Film-based	X-ray sensitive film is exposed to radiation source. After exposure, the film holds a latent image (i.e., not visible) until it is developed in a chemical bath to reveal the image of the component.
Computed Radiography	Instead of film, a plate with photo-sensitive storage phosphors is exposed. When the phosphors are stimulated by radiation, they hold a latent image, much like film. Instead of a chemical bath to develop the image, a laser scans the plate and the stimulated phosphors reveal the image as visible light. The light is converted into a digital format and the image is computed. The phosphor plates are flexible and can be cut to different shapes.
Direct Digital Radiography	The X-ray image is captured directly on a rigid imaging plate, which typically is made of either amorphous silicon or amorphous selenium. The image is transferred directly to a computer as a digital file. No intermediate processing step is needed.

Reducing Consumables and Laboratory Equipment

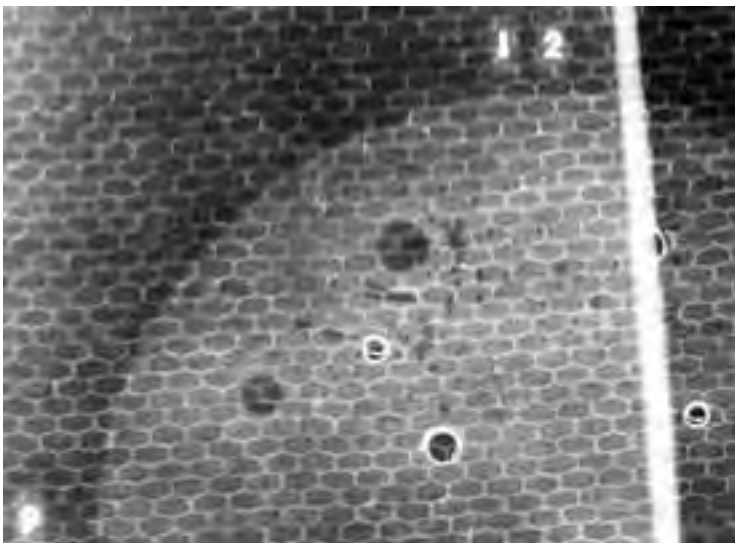
The image plate used in CR can be reused from 200 to 5,000 times, unlike traditional X-ray film. Other consumables eliminated through the process change include envelopes, marking pencils, cleaning materials, gloves, and shields. CR systems also eliminate several pieces of support equipment, including water chillers, safe lights, silver recovery units, light-tight doors or light traps, film viewers, and densitometers for checking film density and proper exposure, in addition to the developing tanks and processors.

Worker Health and Safety

Operators benefit from significantly reduced chemical and radiation exposure. The ALARA concept ("As Low As Reasonably Achievable") is used within the Navy to control radiation exposure. In order to comply with ALARA, an operator must use some combination of time, distance, and shielding to minimize exposure. In the case of CR, both the amount of radiation and the length of exposure are significantly reduced compared to film, which makes the operator's task safer and faster.

Productivity Improvements

The opportunities for productivity improvements are substantial. First, the reduced radiation dose for exposure and shorter exposure times per shot allow CR inspections to occur within a smaller shielded area. This contributes to quicker inspection site set-up and allows other work efforts to continue nearby. The decreased exposure times also make the inspection process shorter, reducing personnel time. Second, image processing times are down from a minimum of 12 minutes for film to one minute for CR. This enables the system operator to determine quickly if shots are acceptable or need to be retaken. Third, with CR, an operator can manipulate the presentation density and inspect a wider range of material thicknesses with a single exposure on a single imaging plate as opposed to taking multiple film shots that use either



This F18 main landing gear door image illustrates the contrast sensitivity of the new CR system. The door has a carbon/epoxy skin bonded to structural aluminum honeycomb and a repair patch has been applied (circular area). The irregular, dark spots are voids in the adhesive between the patch and the honeycomb. The small, round, dark areas are "unbonds" where the loop of wire was placed between patch and honeycomb to prevent adhesive from penetrating into these areas.

different exposure times or different film speeds. Finally, CR systems allow users to transmit, evaluate, and store images electronically. The digital format makes internet transmission possible, as well as reducing the storage demands of traditional film.

An additional consideration is the future availability of film. As conventional film becomes less prevalent in the consumer world, it is projected that industrial access to conventional film will become more limited as well.

Limitations of Computed Radiography

While CR offers several operational advantages over conventional film processing, it also has its limitations. As with any new technology, it has both a learning and an acceptance curve. Standards for accepting and rejecting inspection results are being developed. Although many ongoing expenses are reduced compared to film, some still exist and the up-front costs to procure the equipment are substantial. Finally, the complexity of CR systems warrants careful consideration by potential installation locations.

The Learning Curve

Conventional film-based radiography has well-established procedures for radiographic techniques. These procedures include the amount of radiation, length of exposure, and resulting image quality. Because CR typically requires less radiation and shorter exposure time, operators need to learn a new process for achieving acceptable results. In addition, the image's spatial resolution (i.e., how coarse or fine the image) affects interpretation of the results. There is concern that until training and standards are well established and coordinated, images potentially could be over analyzed and anomalies that would have been acceptable under wet film processing will now be rejected.

Standards for Accepting or Rejecting Results

Current accept/reject standards are based on film and the proven history of how defects will appear in a film-based system. Changing the capabilities of the imaging system also changes the predictability of results. Research is needed to build a new stock of digital results, with proper resolution and clarity that are subjected to an analytical process that addresses probability of detection, probability of failure, and desired or expected service life. This process is still underway. Pending new standards, CR will not be accepted for certain types of inspections.

System Expenses

Typical CR systems are more expensive to purchase than film processing systems—coming in at approximately twice the cost. In general, depending upon system configuration, conventional CR systems approach a purchase cost of $125,000 to $175,000. It is important to note that these costs are dropping while the cost of the film-based system is staying the same or increasing. Each CR image plate costs approximately $550 to $700, nearly equal the cost for 100 sheets of film. An important difference, however, is that the CR image plates can be reused up to thousands of times.

The image plates require occasional cleaning and other maintenance. While climate control for the image plate storage is not necessary per se, moisture can be a serious problem. Moisture and the presence of dirt and grime will shorten the life of the image plate.

Two support equipment items that will still be needed in a CR system are film identification units and some type of storage cabinets for CD-ROMs—items that must be included in the initial purchase of a CR equipment package from the manufacturer.

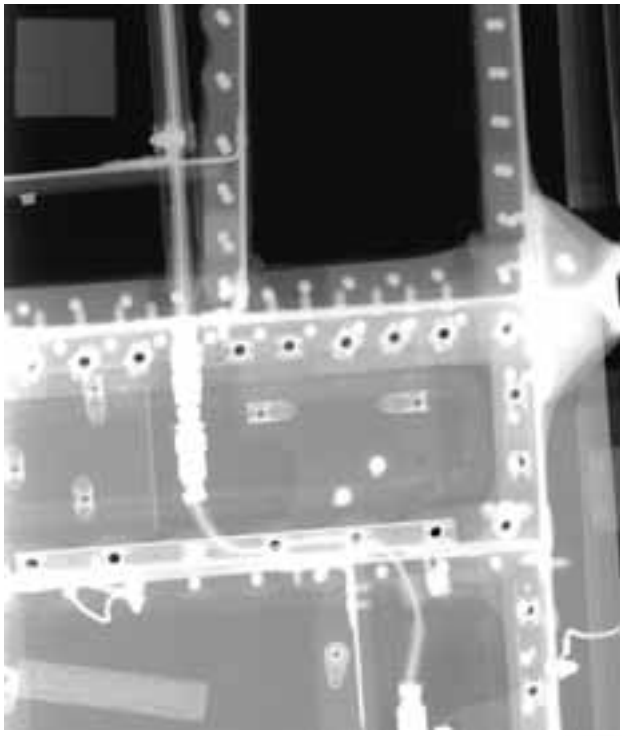

An NDI inspector works with the image plate and reader.

System Location Requirements

The complexity of CR systems warrants careful attention to the intended installation location prior to implementation. The temperature should be stable, and there should be no heat sources (including direct sunlight) within close proximity. Moisture, excessive dust and corrosive gases will also degrade performance; humidity and ventilation need to be considered and constant vibration and shock must be avoided as well.

Computed Radiography Systems under the Pollution Prevention Equipment Program

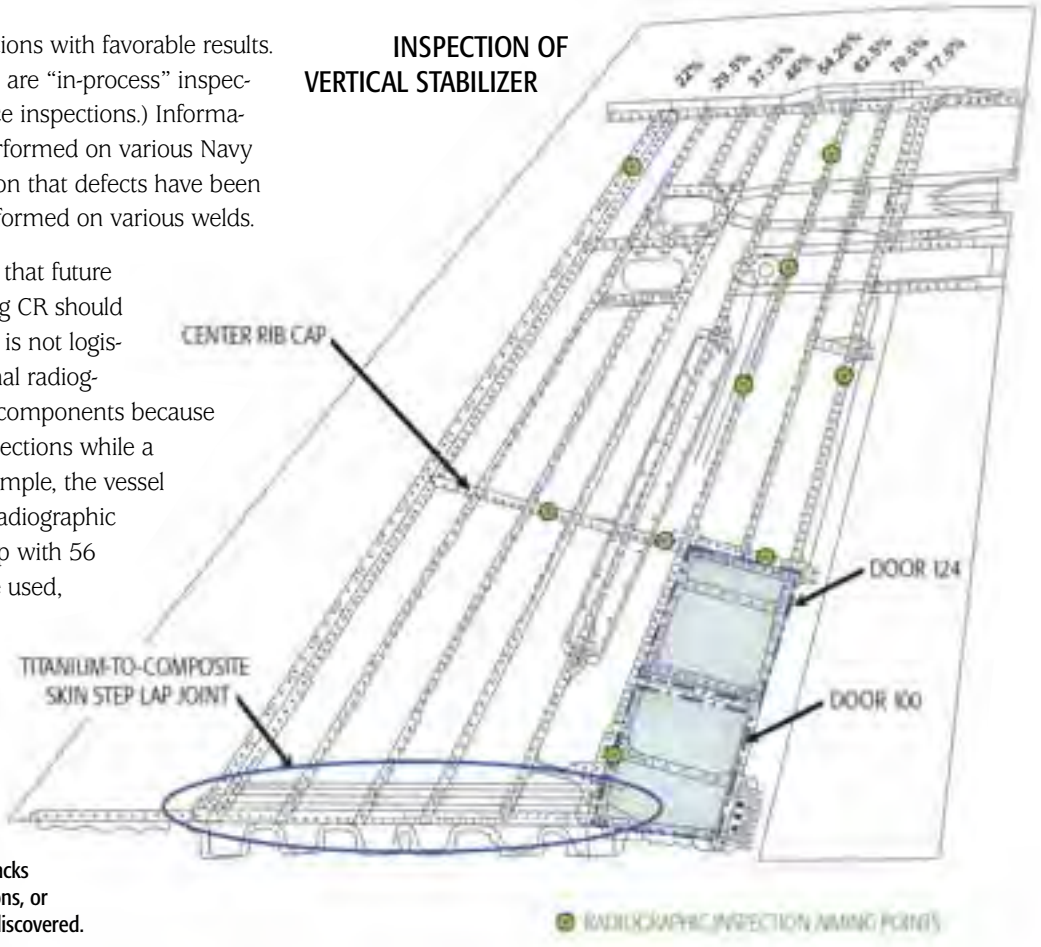
The Navy's Pollution Prevention Equipment Program (PPEP) made it possible to procure multiple CR systems for several sites within a single Navy region. Of the systems provided under PPEP, Navy Region Northwest (NRNW) has implementation experience that is key to CR implementation Navy-wide. The first two sites within NRNW—Naval Base Kitsap Bangor and Naval Air Station Whidbey Island—received their systems in 2003 and have used them



for several informational inspections with favorable results. (Note: Informational inspections are "in-process" inspections rather than final acceptance inspections.) Informational inspections have been performed on various Navy Fleet components and verification that defects have been properly removed has been performed on various welds.

Initial work experience suggests that future time and cost savings from using CR should be substantial. In many cases, it is not logistically feasible to use conventional radiography methods to inspect Fleet components because of the time required for the inspections while a vessel is in dry dock. In one example, the vessel components required multiple radiographic inspections, ultimately ending up with 56 images being taken. If film were used, each image would require 23-minutes exposure time for a total of more than 21 hours—

INSPECTION OF VERTICAL STABILIZER



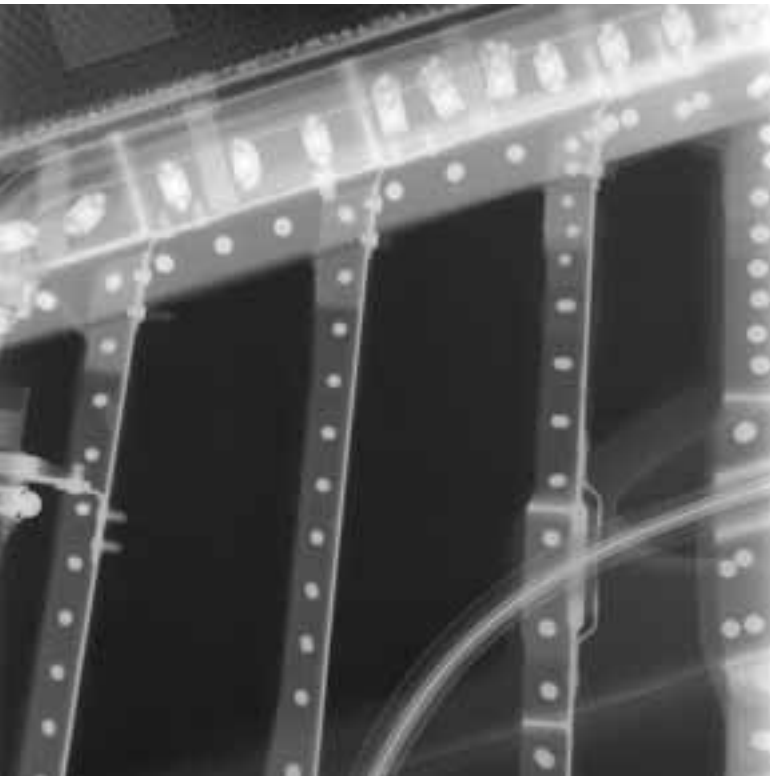
This illustration identifies the specified locations for film placement for X-ray inspection of the F18 Vertical Stabilizer. The inspection is intended to identify cracks that form in the spars between inspections, or monitor cracks that have already been discovered.

and this does not account for the additional time required for retakes. Protecting workers and ensuring compliance with ALARA regulations would also extend overall inspection time. Using CR for these inspections reduced exposure time to 3.5 minutes per exposure, saving roughly 18 hours in exposure time (retakes, if needed, would only add minutes to this total). And because radiation exposure is substantially lower, ALARA compliance is not an issue.

Given the available vessel time for the inspections, this number of conventional radiographic shots for each of these components would not have been possible.

By performing both a film-based and a CR exposure on the same component, operators demonstrated that the digital images were of the same or better image quality. In addition to comparable image quality, operators welcomed the safety benefits associated with the CR process including:

1. Reducing the exposure to radiation
2. Eliminating the need for film-development chemicals
3. No longer needing to dispose of hazardous waste products



NESDI Project to Validate Use of Computed Radiography at the Navy's FRCs

THE NAVY ENVIRONMENTAL Sustainability Development to Integration (NESDI) program has just launched a new project (#474) entitled "Replacement of Film Radiography with Computed Radiography" to determine the viability of replacing film radiography systems with CR systems at all three Navy FRCs. The demonstration site will be the Fleet Readiness Center Southeast (FRCSE) in Jacksonville, Florida.

FRCSE disposes approximately 120 gallons of hazardous waste produced from film-based radiography operations each year. Film development processes require the use of hazardous materials including potassium sulfite, hydroquinone, ammonium thiosulfate, and sodium sulfate. These materials require special disposal methods which can be costly to the FRC and the environment. To ensure environmental and mission sustainability, steps are currently underway to phase out film-based radiography and implement computed radiography at FRCSE, other FRCs, and elsewhere in the fleet.

A technical evaluation of the VMI 5100MS CR system was completed in Fiscal Year (FY) 2011 and Fleet authorization was given in the first quarter of FY 2012. (Note: See "Authorization of VMI 5100MS Computed Radiography System for Crack Detection and General Radiography" memo dated 11 January 2012.) This technical evaluation was funded by the Naval Air Systems Command's Program Manager-Air 260 (Common Support Equipment). Fleet sites began receiving VMI 5100MS systems in December 2011. The NESDI effort will be dedicated to the additional validation that is necessary beyond the Fleet technical evaluation to ensure that the new technology can meet the FRC performance requirements as well.

Although the performance has been characterized for the VMI 5100MS CR system, FRCSE requirements for radiography must be tested and if possible, converted, to prove that CR is an acceptable alternative to film radiography for FRC operations. The first year of this two year effort will involve obtaining the most recent software and hardware configurations of the VMI 5100MS. Testing of all current film radiographic procedures would proceed thereafter. Testing involves ensuring CR can meet the inspection requirements for film. All standards and components for demonstrating CR would be either fabricated or obtained. The second year would involve finishing technique conversion, completing work on any technical documentation, and getting authorization to utilize CR in the FRCs.

For more insights into the execution of this project, contact Ian Hawkins. For more information about the NESDI program, visit www.nesdi.navy.mil or contact Leslie Karr, the NESDI program manager at 805-982-1618 or leslie.karr@navy.mil.

Projected Savings

Informational inspections using CR have already yielded time and cost savings. Annual savings for a trial CR system have been calculated to be anywhere between $50,000 and $194,000, depending on equipment usage rates, specific technical applications, and increasing material and waste disposal costs.

Savings are based upon several factors, including:

- A 500- to 2000-exposure lifespan for the image plate
- Elimination of hazardous waste disposal expenses and the associated cost for silver reclamation
- Saving water by eliminating film rinsing and eliminating climate controls for chemicals
- Reduced personnel cost due to reduced exposure times.

Once the CR process is approved, NRNW will benefit once the CR technology is routinely applied across the region. There are also several expected environmental benefits to be gained from implementikng a CR system. Eliminating chemicals from traditional film development will help meet the waste reduction requirements under the Resource Conservation and Recovery Act and Executive Order 13148 (Greening the Government Through Leadership in Environmental Management). In addition, digital imaging will help reduce reporting requirements. Average annual savings for the newest CR system are projected to be up to $689,000 based on a general return on investment analysis.

With continued effort and research, Fleet activities will be at the forefront for implementing this new technology for inspecting welds and castings.

Obstacles to Implementation

Regrettably, the Navy facilities that received the CR systems are not yet able to fully utilize them. For these activities, the use of CR is restricted to informational inspections—not final acceptance inspections. Several factors contribute to this limitation. The first factor is the

Perspective from the Fleet Readiness Center Southwest

PERSONNEL FROM THE Fleet Readiness Center Southwest (FRCSW) in San Diego, California (North Island) also have extensive experience with the selection, implementation, and trouble shooting of CR systems. At FRCSW, the types of components on which CR is typically used include:

1. F18 Vertical Stabilizer (internal) spars
2. F18 Inner Wing Panel (internal) spars
3. H53 Tail Pylon Assembly
4. F18 Horizontal Stabilizer Hydraulic Servocylinder internal assembly
5. Parachute Harness Sensing Release unit
6. Control Rods

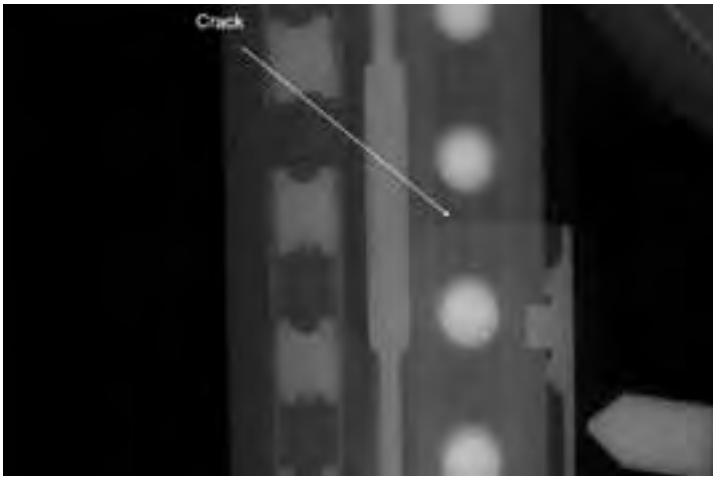
The first three inspections are intended to identify and monitor indications of structural cracks in the spars, ribs, or intercostals of structural assemblies. The fourth and fifth inspections are intended to verify proper assembly/configuration of subcomponents internal to major system components. The last inspection included in the list above is intended to identify entrapped water and corrosion of internal surfaces of the control rod tube.

Based on these inspections, North Island personnel have documented the following lessons learned with regard to the proper use of CR:

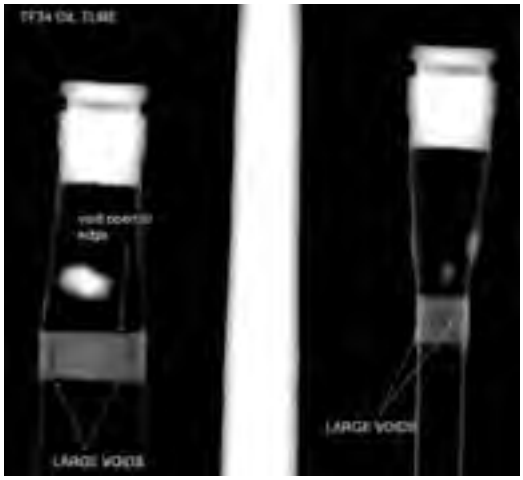
1. It will be necessary to correlate CR with film when detection of "tight" cracks is required. Crack indications in CR can be more subtle than those in film.
2. Application and resolution of Image Quality Indicators that can simulate "tight" cracks will provide greater confidence in CR when duplicate film exposures cannot be produced.
3. Consultation between geographically disparate NDI activities (including the Navy's three FRCs as well as Marine Air Logistics Squadrons/Aviation Intermediate Maintenance Departments) is simplified by the ability to exchange digital image files.
4. The performance of the CR system's X-ray Tube Head has a significant impact on detection of fine/low contrast indications.

CONTACT

Manny Goulart
Fleet Readiness Center Southwest
619-545-8655
manuel.goulart@navy.mil



The result of a high flight hour x-ray inspection for F18 A-D models taken with wing fully assembled. The top and bottom wing skins constitute about one inch graphite/epoxy composite. The lower flange of the wing spar is about 0.25-inch aluminum. The spars constitute the majority of the load bearing structure of the wing thus the significance of this inspection. The wing is otherwise comprised of fuel and foam. The results image shows span-wise cracks running from hole to hole indicating stress corrosion cracking.



Often radiographic inspections are requested to assess the integrity of a weld or brazed joint. A common defect of these types of joints is porosity or voids. In these images, the darker, circular areas in the brazed section indicate porosity, which is usually the result of a poor brazing process. Whether or not the porosity is allowable is determined by the acceptance criteria from a drawing or welding specification.

reliability of weld defect indications. Because of the major technical differences between the two techniques, discontinuities and anomalies may be difficult for the untrained eye to detect. The capacity to certify that individual components are capable of providing a baseline of information is crucial, but has yet to be established. Related to this is the frequency of certification and calibration. Procedures for system certification (including the frequency of calibration) have yet to be finalized.

Several ongoing studies are being undertaken which will ultimately determine the requirements and procedures for CR inspections. One study is focused on ensuring that the results obtained through CR are compatible with those obtained through traditional film processing. The Naval Sea Systems Command has contracted Northrop Grumman to evaluate the qualification requirements for CR systems. (Note: This is an ongoing effort and results have yet to be finalized.) The existing operating practices for technicians are for film-based radiography and are not directly applicable to CR because of the major technical differences between the two techniques. The goal is to have a set of procedures that ensure reliable and consistent detection and evaluation results, regardless of the operator. Another study is focused on ensuring that original data in the digital image files cannot be altered.

A third study, sponsored by the Navy Environmental Sustainability Development to Integration (NESDI) program is verifying that a CR system can meet the performance requirements at the Navy's three FRCs. (For more information about this study, see our sidebar entitled "NESDI Project to Validate Use of Computed Radiography at the Navy's FRCs.")

In addition to Navy authorization, these naval activities face their own obstacles to implementing and using CR. Consolidation of inspection processes among the activities is the primary obstacle. In addition, once a determination is made on the lead activity for implementing CR, training the two sites will benefit from standardization.

Summary

CR offers several advantages over film-based techniques, but issues about implementation remain. ⚓

CONTACTS

Greg Levcun
Navy Region Northwest
360-315-1086
DSN: 960-1086
greg.levcun@navy.mil

Chris Mahendra
Naval Air Systems Command
732-323-7131
DSN: 624-7131
christopher.mahendra@navy.mil

Ian Hawkins
Fleet Readiness Center Southeast
904-790-6410
DSN: 942-6410
ian.hawkins@navy.mil

Join Navy & Marine Corps Leaders at the 2012

NAVAL ENERGY FORUM

Join Navy's Task Force Energy and the National Defense Industry Association (NDIA) for the 2012 Naval Energy Forum, 17 October at The Ronald Reagan Building & International Trade Center in Washington, D.C.

The theme for this year's forum is "Art of the Long View: From Easter Island to the Spratlys," highlighting the importance of using energy in a judicious manner to enhance combat capability today and ensure availability of resources for future generations.

The Secretary of the Navy Ray Mabus and other top Navy and Marine Corps leaders will be on hand to highlight progress towards the Navy's energy goals and identify challenges yet to be overcome.

Register today!

Date

17 October 2012

Location

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

Metro

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

Parking

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

Airport

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

Attire

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

Contacts

Lisa Lambrecht
Chief of Naval Operations Energy and Environmental Readiness Division
703-418-3021
lisa.lambrecht@urs.com

Kari King
National Defense Industrial Association
703-247-2588
kking@ndia.org

For more information and to register visit
www.ndia.org/meetings/3600/Pages.

NAVFAC EXWC Successfully Demonstrates Real-time Water Quality Monitoring System

NESDI-Sponsored Effort Designed to Prevent Interruptions from Natural Disasters & Intentionally Destructive Actions

PERSONNEL FROM THE Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC), formerly the Naval Facilities Engineering Service Center, have successfully demonstrated the feasibility of On-line Water Quality Monitoring (OWQM), a real-time drinking water quality monitoring system at Naval Base Ventura County (NBVC) to assure Safe Drinking Water Act (SDWA) compliance and sound water quality surveillance.

Drinking water systems are vulnerable to interruption from natural disasters (including earthquakes and floods), deterioration of infrastructure, and intentionally destructive actions. Significant water quality problems are associated with the loss of chlorine residual in the water distribution system and the promotion of biological growth. The SDWA requires that detectable chlorine residual be maintained in the water distribution system to ensure proper safeguards against biological-related illnesses. These water quality problems have a direct impact on consistently achieving regulatory compliance.

The Navy must be able to provide safe drinking water in sufficient quantity to its installations to accomplish its primary mission of national defense. For the first time, the Navy has validated through a pilot-scale demonstration an effective and timely method to monitor drinking water quality. The standard practice for water quality compliance is to manually collect grab samples for laboratory analysis on a weekly or quarterly basis. This procedure does not allow water system staff adequate time to respond to changes in water quality and therefore, increases the chance of poor water quality events occurring outside "normal" sampling events. Often times, this practice also does not provide adequate information to enable the assessment and mitigation of water quality issues.

Navy water infrastructure managers need cost-effective real-time water quality monitoring technologies for improving compliance and water system operations, as well as ensuring the health and safety of base personnel. OWQM coupled with automated notification and mitigation procedures could address this deficiency. Benefits of implementing OWQM systems include:

- Contaminant warning
- Regulatory compliance (e.g., prevention of nitrification)
- Operational support (e.g., reduction of water age)

Navy water utilities have not implemented an OWQM strategy to date due to the limited availability of proven cost effective technologies. Emerging water quality monitoring technologies need to be evaluated periodically and the information passed along to installations so sound investments in OWQM systems may be possible.

With funding provided by the Navy Environmental Sustainability Development to Integration (NESDI) program, NAVFAC EXWC personnel have demonstrated several of the latest OWQM technologies at NBVC in Port Hueneme, California. While the field installation of OWQM systems was first reported in the fall 2009 issue of *Currents*, in this article the findings and lessons learned from the pilot demonstration of OWQM system are presented.

Contaminant Warning

Three major contaminant areas for consideration for OWQM include:

- Chemical (including biotoxins)
- Biological (pathogens)
- Radioactive material

Since thousands of potential contaminants could poison a water system, either intentionally or unintentionally, it would not be realistic to attempt to monitor for individual contaminants. Instead, surrogate parameters (measurable properties of water that are affected to some degree by most known contaminants) that react to the various contaminant classes are measured. Prior identification of the potential contaminants that may be introduced into a water distribution system helps in the selection of the right instruments to be used in a monitoring station. A list of potential contaminants also provides water utility managers with insight into the potential threats to their systems and provides public health officials a sense of the medical emergencies that might occur. The U.S. Environmental Protection Agency (EPA) developed a list of twelve contaminant classes (shown in the following table) and, through extensive testing, determined a detection level for each.

Changes in surrogate parameters can alert water system operators to the presence of some contaminants. Surrogate parameters can be measured by commercially available and relatively affordable instruments. However, the effectiveness of these instruments varies and their sensitivity may not be sufficient to detect minor (but real) impacts due to other impurities in the water. Furthermore, changes in water quality and surrogate parameters also occur due to the dynamic nature of distribution systems (e.g., operational changes or source water blending). EPA recommends the use of Total Organic Carbon (TOC), conductivity, and chlorine residual as the primary surrogate parameters based on the relationship of changes in these parameters with the twelve classes of contaminants shown in the figure below.

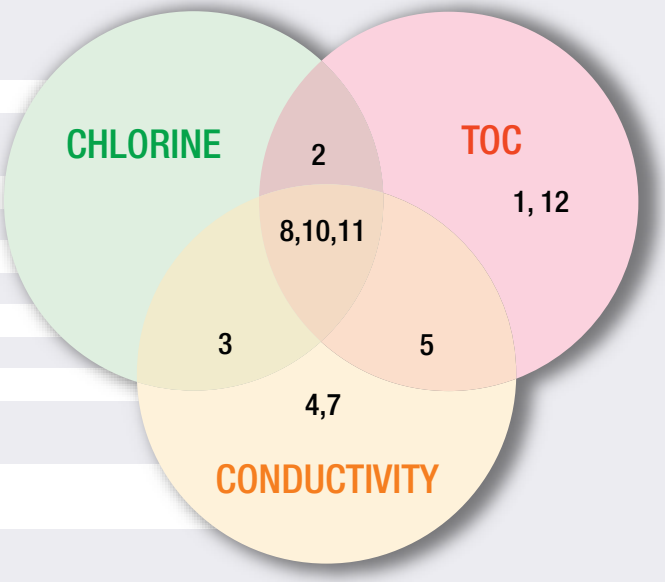
Selection of On-line Monitoring Technologies

Real-time drinking water quality monitoring technologies demonstrated at NBVC consisted of two OWQM stations equipped with the best competing technologies available

Contaminant Categories and Detection Potential Using On-line Monitoring and Laboratory Analysis

Class	Description	On-line Monitoring	Laboratory Analysis
1	Petroleum products	M	H
2	Pesticides (with odor or taste, chlorine reactivity)	H	H
3	Inorganic compounds	H	H
4	Metals	M	H
5	Pesticides (odorless, chlorine resistant)	H	M
6	Chemical warfare agents	L	M
7	Radionuclides	M	H
8	Bacterial toxins	H	M
9	Plant toxins	M	M
10	Pathogens causing diseases with unique symptoms	H	M
11	Pathogens causing diseases with common symptoms	H	M
12	Persistent chlorinated organic compounds	M	H

Note: The letters represent detection potential: H=high, M=medium, L=low.



Three surrogate parameters detect 12 classes of contaminants.

at that time. Surrogate parameter selection was based on analysis conducted by the EPA and its subsequent recommendations for contaminant monitoring and consideration of the particular conditions of the Port Hueneme water system for regulatory compliance and operational support. The following sensor technologies were selected for the demonstration system:

- Hach Water Panel (total chlorine, pH, conductivity, turbidity, temperature)
- ATI Water Panel (total chlorine, free chlorine, pH, conductivity, oxidation reduction potential (ORP), turbidity)
- s::can ammo::lyser (ammonia, pH, temperature, potassium)
- s::can Ultraviolet-Visible (UV-Vis) spectro::lyser (TOC, dissolved organic carbon (DOC), nitrate, turbidity, UV fingerprint—200–400 nanometers)

In addition, the following non-water quality monitoring technologies were demonstrated:

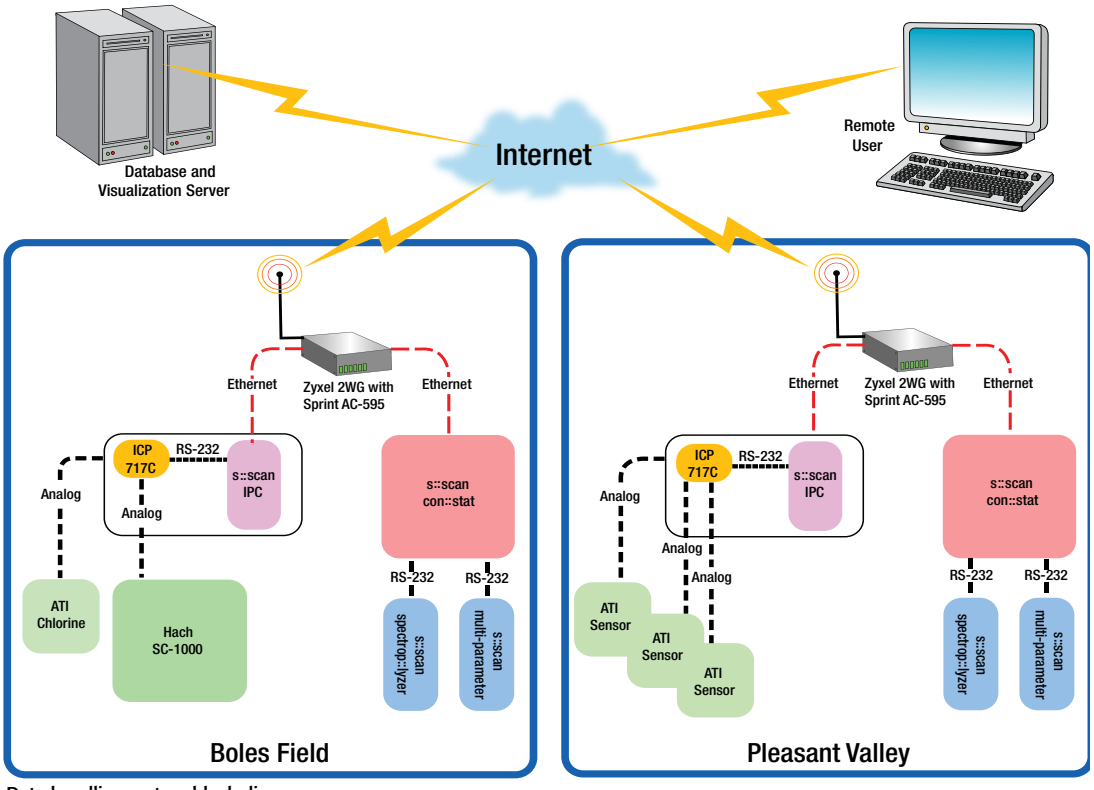
- s::can Event Detection System (EDS) software
- CH2M Hill Postgres Central Database
- CH2M Hill spatial OWQM dashboard

One station utilizes both a Hach monitoring panel and an ATI chlorine analyzer; the other station includes a full suite of ATI analyzers. The monitoring station with the Hach panel includes the standard CL-17 analyzer for measurement of total chlorine and an ATI Q45H analyzer for measurement of free chlorine. The other station includes two ATI Q45H analyzers—one configured for combined chlorine measurement and one for free chlorine. Because the Hach panel CL-17 chlorine analyzer requires the use of reagents (N, N-diethyl-p-phenylenediamine sulfate (DPD) and buffer solution) that cannot be discharged to the ground water, this system has been installed where a sanitary drain is available. Both stations used the s::can UV-VIS spectro::lyzer and ammo::lyser.

Selection of Data Handling & Transfer

The two monitoring stations were configured for data collection and transfer only (no automated sample collection, direct operator interaction, or centralized supervisory control and data acquisition data archiving was used).

The data are transferred to a central server by cellular data communication using Carrier Detect Multiple Access for further analysis and visualization. The data are then loaded into a data warehouse where they can be used by a web server process for presentation and visualization to the end users. Data handling and transfer is illustrated in the following figure.

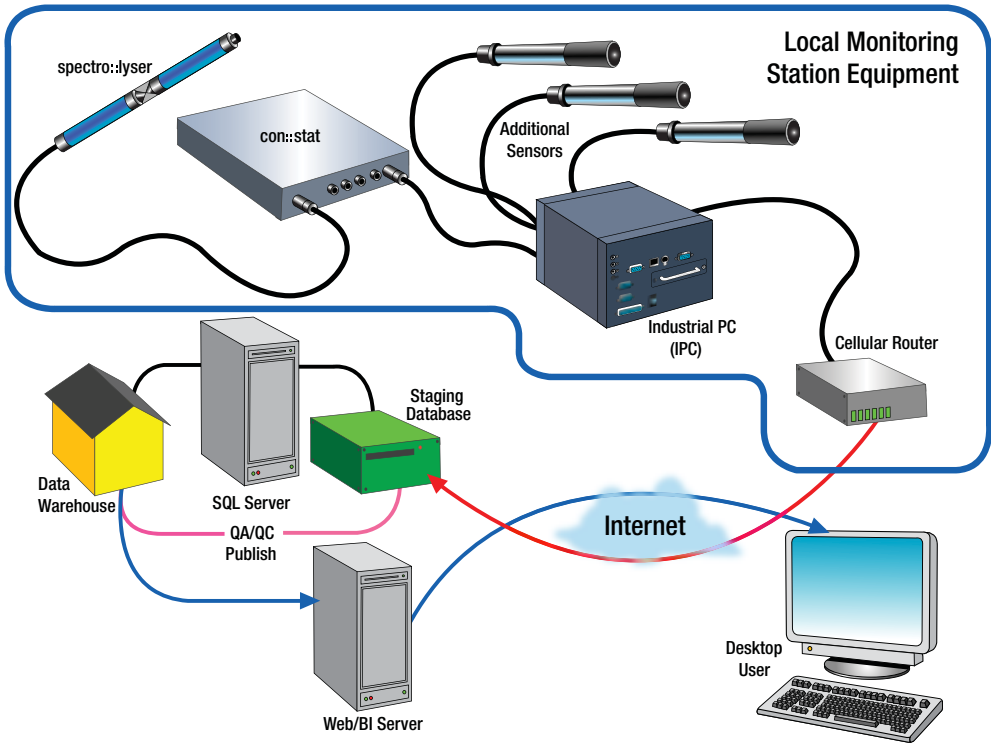


Data handling system block diagram.

Data Management System Design

The OWQM data flows from an Industrial Personal Computer (IPC) in the monitoring station to the central database utilizing a web service application (shown in the following figure). Once the data are received by the central server, they are processed and stored in the central database.

The central database runs a polling process every two minutes. This process queries the database to determine the most recent data timestamp to ensure that all collected data are transferred even in the event of a transaction or communication failure in the previous polling cycle.



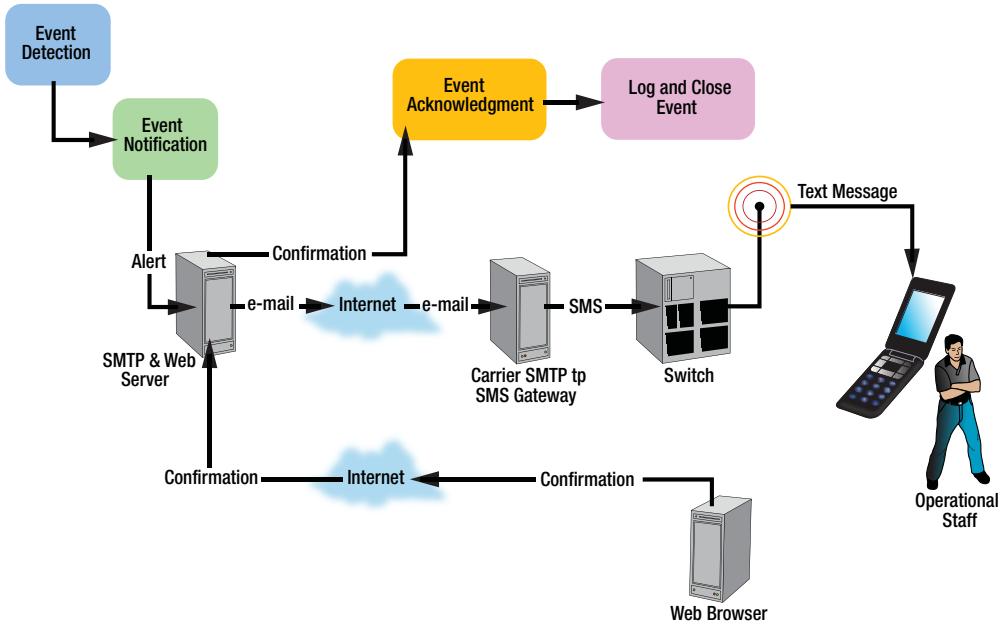
OWQM information flow diagram.

Water Quality Event Notification & Confirmation

Event notification is the final step of the event detection process. Anomalous behavior must be communicated to pertinent operations staff after the previous steps of data collection, verification, processing, and analysis against the methods defined above have been completed.

The data flow depicted in the following figure portrays this process flow with both the local processing of data at each monitoring location and also centralized processing of multiple sites. The aggregated data at the centralized server are analyzed in further detail via spectral fingerprint matching and differential data analysis.

Once an event is verified, operations staff is notified. While notification can happen in a number of ways, the operations staff has elected to get text messages via their existing cellular phones. Operations staff may then further investigate the event by navigating to the OWQM web site to view the data in more detail.



Event notification and confirmation data flow.

The OWMQ station at the Pleasant Valley Gate—where the water main enters NBVC.

The OWMQ station at Bolles Field aboard NBVC.

System Evaluation

Two sites (shown in the above images) were selected to investigate the benefits of OWQM technologies:

- Pleasant Valley Gate—where the water main enters the Base. This station monitors the source water and assists with management of the system as needed due to source water changes.
- Bolles Field—a remote loop in the distribution system where the issues of low chlorine residual and nitrification tend to occur.

Both OWMQ stations experienced some initial equipment problems due to anomalous water quality in the distribution system. However, using the techniques listed below, these problems were mitigated or eliminated:

- Iron oxide fouling—mitigated with the addition of an autobrush and stainless steel housing for the spectro::lyser.
- Air in distribution system—mitigated with the addition of the degasser for the ammonia analyzer and will be a standard recommendation.
- Calcium carbonate corrosion—eliminated by replacing the spectro::lyser aluminum body with a stainless steel body.

As a result of experience with various manufacturers' sensors, the Hach water panel will be replaced with a smaller, multi-parameter probe for conductivity, chlorine residual, and turbidity. This decision is based on the fact that the Hach CL-17 Chlorine Analyzer requires the use of reagents in the field and has relatively high maintenance requirements. In addition, the Hach Panel has reached its useful life and should be replaced with a more robust and sustainable technology.

The Data Communication and Management systems performed extremely well and can be easily applied at different locations. The web site was accessed by the end users and provided real-time data about the distribution system. For this project, the data were collected and processed independently of a Defense network, and accessed through a secure web-site managed by the contractor (CH2M Hill). For the data to be collected, processed and managed on a Defense network there will be additional requirements to assure the security of the information.

Real-time monitoring of water quality parameters can assist in regulatory compliance, especially where there are known issues. The distribution system at NBVC continues to have nitrification problems as the water supply uses chloramines. Issues, such as this, can be monitored and addressed more quickly and effectively with real-time monitoring in place. Problems such as water aging and changes to the source water can be identified by monitoring water quality parameters. OWQM systems enabled these impacts to be mitigated. Due to lower demands on the water distribution system during non-fire flow events, the NBVC water system also suffers from water aging and associated low-chlorine residual. OWQM systems assisted with control of this issue as well.

Conclusions

Qualitative and quantitative results for accuracy, maintenance, and usability were compiled into recommendations for implementation at other new site installations. Recommendations from the project's successful outcomes as they relate to the use of the technology by the Navy are:

- The use of OWQM systems should be considered for all installations that are required to meet the SDWA's regulatory compliance requirements.

- The use of OWQM systems should be considered for all installations for which their Vulnerability Assessments have indicated a security risk associated with potential contamination of the water supply.
- Periodic maintenance and use of consumables and moving components in sensors adds a level of complexity and cost (in dollars and manpower) that must be minimized for a practical system.
- Selection of instruments for accuracy, reliability, usability and overall cost is important.
- The system must be locally managed and integrated into the day-to-day management and monitoring of the water system to provide the greatest value.

OWQM system costs are based on the particular installation and the size and layout of the water distribution system. For the NBVC demonstration, two monitoring stations were adequate, however other installations may require more monitoring stations. The cost of implementing monitoring stations will be dependent on their location and availability of the services required at that site. Overall, the costs based on the demonstration system are approximately:

- $147,000: capital cost per installation
- $116,500 to $141,500: capital cost per monitoring station (dependent on site improvements required)
- $8,100: annual operation and maintenance cost per site

Real-time monitoring of water quality parameters can assist in regulatory compliance, especially where there are known issues.

Technical Memorandum (TM-NAVFAC ESC-EV-1201), Demonstration of Real-Time Drinking Water Quality Monitoring Technologies, documents the findings in greater detail and provides information that may assist activities determine if OWQM stations would be beneficial for their facilities. (To download a copy of this report, log into the NESDI web site at www.nesdi.navy.mil with your username and password. Once on the web site, select "Projects and Proposals" then "Manage Any Project" then "356" in the "Text Search" field. Once you have found project 356, select "Edit" then "Files/Photos" then "Upload Reports and Files" where you will find a pdf version of the report. Alternatively, you can contact Steve Fann for a copy of the report.)

CONTACT

Steve Fann
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1016
DSN: 551-1016
steve.fann@navy.mil

The Basics About the NESDI Program

THE NESDI PROGRAM seeks to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

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

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

COMPACFLT Representatives Attend Annual Western Pacific Naval Symposium

Delegates Impressed With Navy's Environmental Planning Efforts

THE U.S. NAVY'S leadership in environmental stewardship drew the interest of many delegates at the Western Pacific Naval Symposium (WPNS) inaugural Environmental Working Group meeting hosted by the Indonesian Navy.

Lt. Cmdr. Tony Miani and Mark Murray from the environmental planning staff of Commander, U.S. Pacific Fleet (COMPACFLT), represented the U.S. Navy at the June 2012 meeting in Jakarta, Indonesia.

The WPNS has 20 member nations and four observer nations and meets annually to promote naval cooperation in the Western Pacific Region.

In 2011, participants in the WPNS Workshop agreed to establish the Environmental Working Group to promote and share environmental concerns among participating navies. The intent of this working group is to:

- Provide a forum to discuss environmental issues with regional implications
- Discuss challenges in compliance
- Share relevant research and environmental management plans
- Facilitate alignment of mitigation policies
- Provide environmental recommendations to the WPNS

The inaugural Environmental Working Group meeting was attended by delegates from 15 nations. They discussed issues ranging from sustainable fishing practices to climate change. Participants in the meeting included delegates from Indonesia, Australia, Brunei Darussalam, Canada, France, Malaysia, Papua New Guinea, Japan, Philippines, Singapore, Vietnam, Thailand, and United States.

Miani and Murray attended at the direction of the Chief of Naval Operations, Adm. Jonathan W. Greenert.

During one of the panel discussions, Miani presented the topic of Environmental Compliance and At-Sea Training Activities. The major focus of his presentation was the U.S.

Lt. Cmdr. Tony Miani speaking at the inanaugural meeting of the WPNS Environmental Working Group.

Lt. Cmdr. Tony Miani and Mark Murray of the COMPACFLT staff plant a tree in Jakarta while an Indonesian Navy sailor looks on. Miani and Murray recently represented the U.S. Navy at the first meeting of the Western Pacific Naval Symposium's Environmental Working Group.

Participants in the WPNS Environmental Working Group.

Navy's compliance with the Marine Mammal Protection Act and the Endangered Species Act. The delegates expressed great interest in the Navy's efforts, particularly by the operational community, to attempt to determine the types and frequency of training four to nine years in advance. Several delegates with planning experience said they were impressed with the Navy's ability to do such long-term planning.

Miani said, "Many of the other delegates also spoke highly of the U.S. Navy's demonstration of our environmental stewardship with our willingness to mitigate environmental effects of our training activities while ensuring Sailors receive the training they need. This type of balancing exemplifies the Environmental Working Group's mission."

Miani and Murray answered numerous questions from other delegates during several functions hosted by the Indonesian Navy. In addition to the topic presentations, discussions on environmental approaches taken by the varying navies in attendance, each delegate from the participating nations planted a tree at Ecopark in Jakarta to mark the inaugural Environmental Working Group meeting.

Murray said, "We were honored to participate in the tree-planting ceremony as it symbolized the participating navies' commitment to environmental stewardship."

Describing the historic meeting, Vice Admiral Marsetio, deputy chief of staff of the host Indonesian Navy, said, "We want all countries in the Pacific region to care about the environment."

The WPNS provides a forum for nations to manage regional security issues, some of which may be beyond the scope of one country to manage. The framework for this cooperation takes many forms, ranging from informal agreements, bilateral and multilateral activities to formal government agreements. The WPNS is an effective example of a multilateral activity, as this environmental working group clearly demonstrates.

Photos courtesy of Lt. Cmdr. Tony Miani

CONTACT

Mark Matsunaga
Commander, U.S. Pacific Fleet
808-471-3769
mark.matsunaga@navy.mil

Take Action this Fall! October 2012 is National Energy Action Month

Celebration Sheds Light on Energy Innovations & Efficiencies

IN 2009, PRESIDENT Barack Obama proclaimed October as "National Energy Awareness Month" to promote energy activities. The proclamation states that, "During National Energy Awareness Month, we recognize the contributions of individuals, organizations, and companies that are committed to advancing energy innovation and efficiency, and we promote the importance of a clean energy economy to our Nation."

President Obama signed a similar proclamation in 2010, but in 2011 encouraged citizens to move beyond awareness to action, designating October as "National Energy Action Month."

Every action to save energy, large or small, from individuals to entire government agencies, can contribute to significant energy savings, reduce dependence on foreign oil and help minimize greenhouse gas emissions.

As a *Currents* reader, you know that the Navy has taken an aggressive position on responsible use of energy. Beginning with Secretary of the Navy (SECNAV) Ray Mabus establishing five ambitious energy goals (see the goals at http://greenfleet.dodlive.mil/energy) and continuing with energy saving efforts at naval housing, installations and on ships, the Navy is taking the lead in changing culture and actions. The Navy is enacting fuel conservation measures, adding hybrid systems, changing the way ships are powered, and using new, drop-in replacement fuels that do not require changes to our warfighting systems.

As Vice Admiral Phil Cullom noted during the 2011 Naval Energy Forum, "We have to alter the way we think about energy. We must develop and practice frugal habits; we must conserve energy, not just when it's convenient—but at all times. Thoughts drive actions. Actions become habits. Habits become lifestyles."

> We recognize the contributions of individuals, organizations, and companies that are committed to advancing energy innovation and efficiency, and we promote the importance of a clean energy economy to our Nation.
>
> *—President Barack Obama*

Naval Energy Forum 2012

The 4th annual Naval Energy Forum will take place 17 October 2012. The forum is an opportunity to interface with Navy and Marine Corps leadership and to hear firsthand the successes and challenges in achieving the SECNAV's aggressive goals. (For more information, see our article about this year's Forum on pages 30–31 in this issue of *Currents*.)

Solar carports are just one of the many Navy renewable energy projects being deployed at installations all over the world. Bases in California, such as Naval Base San Diego, have ample sunlight which they can convert to electricity with solar panels.

Lee Saunders

Naval Weapons Station China Lake broke ground on its 118-acre solar farm earlier this year. The array is expected to generate 30 percent of the installation's energy. Jackalyne Pfannenstiel, then-Assistant Secretary of the Navy for Energy, Installations and Environment (third from left) took part in the groundbreaking ceremony to commemorate this significant achievement.

MC2 Josh Cassatt

Other notable Navy energy events scheduled for this fall include the SECNAV Energy & Water Management Awards ceremony taking place 3 October, and ribbon cuttings for photovoltaic arrays at Marine Air Ground Task Force Training Command (MCAGCC) Twentynine Palms, Marine Corps Logistics Base (MCLB) Barstow and Marine Aviation Detachment (MAD) China Lake. Also, be on the lookout for the announcement of the Navy's one gigawatt policy.

Need some ideas as an individual? Check out the Department of Energy's Energy Savers web site at www.energysavers.gov and blog at www.eereblogs.energy.gov/energysavers.

For information geared to larger organizations and facilities, review the list of resources available from the Federal Energy Management Program at www1.eere.energy.gov/library.

Brite, the Navy energy mascot, reminds Sailors, Marines, and their families to be energy efficient. This Energy Action Month, how will you and your families be more energy efficient?

Cpl. Justin Boling

The History Behind National Energy Awareness Month

THE FEDERAL GOVERNMENT first set aside time to raise energy awareness in 1981 with American Energy Week, which was observed from 1981 through 1985. It became a month-long observance at the U.S. Department of Energy in 1986. On 13 September 1991, President George H.W. Bush proclaimed October Energy Awareness Month. Since then, the Department of Energy has been conducting energy awareness campaigns each year that promote the wise and efficient use of our nation's energy.

To meet the SECNAV's aggressive energy goals, Marines are training with new renewable energy technologies, like solar panels, as part of field exercises. Back in the states, the Marines will be busy with ribbon cuttings for several large scale solar arrays at MCAGCC Twentynine Palms, MCLB Barstow, and MAD China Lake.

Diane Durden

We have to alter the way we think about energy. We must develop and practice frugal habits; we must conserve energy, not just when it's convenient—but at all times. Thoughts drive actions. Actions become habits. Habits become lifestyles.

—Vice Admiral Phil Cullom

Tell us how your organization is acting on these ideas and moving towards energy savvy lifestyles. You can share your ideas with other *Currents* readers on the *Currents* Facebook page at www.facebook.com/navycurrents. You can also submit your stories and images directly to our Managing Editor, Bruce McCaffrey, at brucemccaffrey@sbcglobal.net by Friday, 2 November. Your submissions will help us tell the story about Navy energy innovations and efficiencies for inclusion in a future issue. Bruce is also available at 773-376-6200 if you have any questions about your submittal. ⚓

SERDP & ESTCP Announce FY 2014 Funding Opportunities

Solicitations to be Released in Late October & Early 2013

THE STRATEGIC ENVIRONMENTAL Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP) fund research and demonstration projects that respond to the Department of Defense's (DoD) high-priority environmental and energy requirements. Projects are led by researchers from industry, academia, and government labs. Both programs use a competitive proposal selection process that includes a brief pre-proposal, followed by a full proposal and oral presentation upon request.

The Fiscal Year (FY) 2014 SERDP Core and SERDP Exploratory Development (SEED) solicitations will be released on or about 25 October. The Core solicitation seeks proposals for basic and applied research and advanced technology development. Core projects vary in cost and duration, consistent with the scope of the work proposed. The SEED program is designed to investigate innovative approaches that entail high technical risk or require supporting data to provide proof of concept. SEED projects are limited to not more than $150,000 and are approximately one year in duration. SEED projects that are successful are considered for additional follow-on funding. All submissions must be in response to a Statement of Need (SON) associated with the solicitation. Core and SEED solicitations have different SONs and different due dates. Upon release of the FY 2014 solicitations, detailed instructions and SONs will be available at www.serdp-estcp.org under "Funding Opportunities."

The FY 2014 ESTCP solicitations are scheduled to be released in early 2013. All proposals must respond to a Topic Area associated with the solicitation. ESTCP projects are formal demonstrations in which innovative technologies are rigorously evaluated. ESTCP demonstrations are conducted at DoD facilities and sites to document improved efficiency, reduced liability, improved environmental outcomes, and cost savings. Information about the ESTCP solicitation process is available at www.serdp-estcp.org under "Funding Opportunities."

CONTACT

Valerie Eisenstein
SERDP and ESTCP Support Office
703-736-4513
veisenstein@hgl.com

BE PART OF OUR Spring Lineup

SUBMIT YOUR ARTICLE BY 18 JANUARY

It's not too late to join the *Currents* team. If you want to be in the line-up for our Spring 2013 issue, you need to submit your text and images by 18 January 2013.

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

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

CURRENTS DEADLINES

- Spring 2013 Issue: Friday, 18 January 2013
- Summer 2013 Issue: Friday, 19 April 2013
- Fall 2013 Issue: Friday, 19 July 2013
- Winter 2014 Issue: Friday, 18 October 2013

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

Rare Southern California Sperm Whale Sighting

Dolphin/Whale Interaction Is Unique

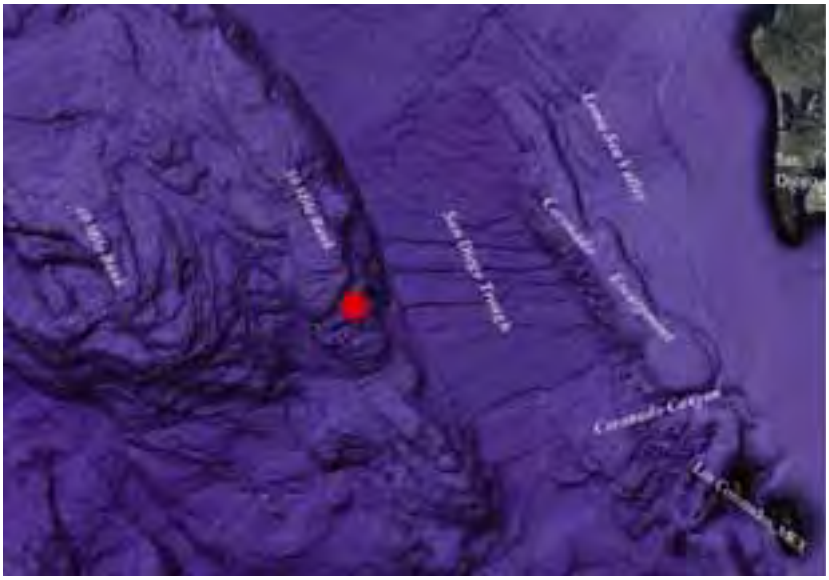
IN MAY 2011, a rare occurrence took place off the Southern California coast. For the first time since U.S. Navy-funded aerial surveys began in the area in 2008, a group of 20 sperm whales, including four calves, was seen—approximately 24 nautical miles west of San Diego.

Operating under a National Marine Fisheries Service (NMFS) permit, the U.S. Navy has been conducting aerial surveys of marine mammal and sea turtle behavior in the near shore and offshore waters within the Southern California Range Complex (SOCAL) since 2008. During a routine survey the morning of 14 May 2011, the sperm whales were sighted on the edge of an offshore bank near a steep drop-off.

NMFS estimates that approximately 300 sperm whales are thought to occur year-round off California, primarily in offshore deep waters, with the highest abundance from April to mid-June and from August to mid-November. Visual sightings of sperm whales, however, are rare in the Southern California Bight, particularly so close to shore. (Note: A "bight" is a natural curve in the coastline.)

The sperm whale sighting off San Diego was exciting not only because of its rarity, but because there were also two species of dolphins, northern right whale dolphins and Risso's dolphins, interacting with the sperm whales in a remarkable manner. To the knowledge of the researchers who conducted this aerial survey, this type of inter-species association has not been previously reported. Video and photographs were taken of the group over a period of 67 minutes as the whales traveled slowly east and out over the edge of the underwater ridge. The adult sperm whales undertook two long dives lasting about 20 minutes each; the calves surfaced earlier, usually in the company of one adult whale. During these dives, the dolphins remained at the surface and appeared to wait for the sperm whales to re-surface.

Several minutes after the sperm whales were first seen, the Risso's

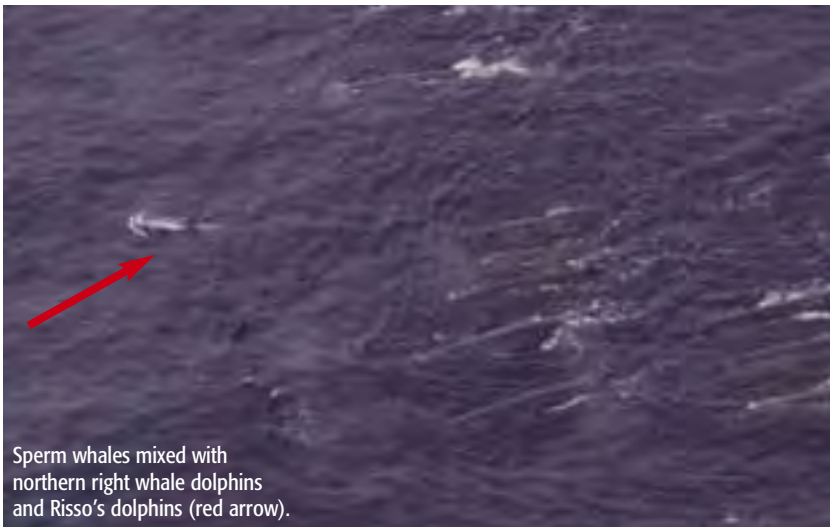


Sperm whale sighting (red dot) location in relationship to key bathymetric features in Southern California.

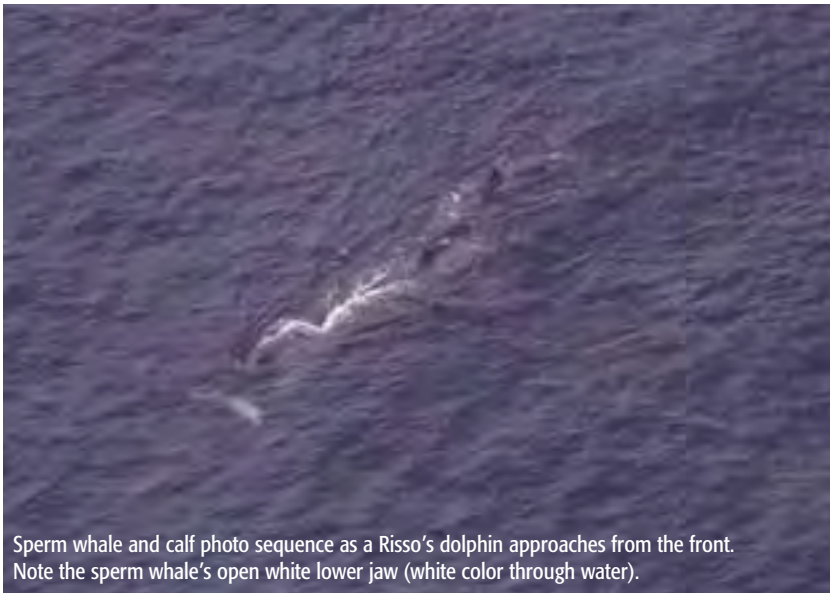
Sperm whales with northern right whale dolphin (red arrow).

dolphins swam in-between the sperm whales, and one Risso's dolphin breached directly in front of a sperm whale. Subsequently, the adults moved closer together, positioning themselves so that the calves were surrounded by the adults. This appeared to be a defensive posture by the sperm whales, as adults typically protect calves from predators and whalers by tightly surrounding the calves, often with the adults' wide tails facing outside the group as a means of defense to hit potential predators. As documented on video, some of the Risso's dolphins charged towards the heads of the sperm whales on multiple occasions, followed by fast retreats. Sperm whale adults responded by dropping their lower jaw, exposing their white gums and teeth to the dolphins (notably, sperm whales only have teeth on their lower jaw) while making forceful blows/exhalations. In fact, on several occasions, a Risso's dolphin swam perpendicular to the heads of about 10 sperm whales that were lined up in a row. Risso's dolphins appeared to direct their charges only towards adult sperm whales that had recently surfaced from long dives; they were not directed toward the four calves in the group. The sperm whales may have been regurgitating their food when they were seen dropping their jaw and opening their mouths.

After the initial apparently aggressive interaction, the sperm whales appeared to slow down, spread out, and lie virtually motionless at the



Sperm whales mixed with northern right whale dolphins and Risso's dolphins (red arrow).



Sperm whale and calf photo sequence as a Risso's dolphin approaches from the front. Note the sperm whale's open white lower jaw (white color through water).

surface. The Risso's dolphins eventually worked their way into the more spread-out group of sperm whales. Both Risso's and northern right whale dolphins actually approached several sperm whale calves. They were not seen to charge the calves and this time the adults did not appear to react to these approaches. The research team's overall impression was that the initial apparent antagonistic response became more neutral after about 20 minutes, and the sperm whales continued on their same traveling route. When the sperm whales were last seen, the dolphins were no longer observed in the vicinity.

Northern right whale dolphins intermingled with the Risso's dolphins and sperm whales, although they did not approach sperm whales as closely or abruptly as the Risso's dolphins. Northern right whale dolphins have been seen apparently following foraging Risso's dolphins on several occasions off the Southern California coast. Researchers suspect they are associating with the Risso's to help find prey, but this has not been established, as such observations are rare.

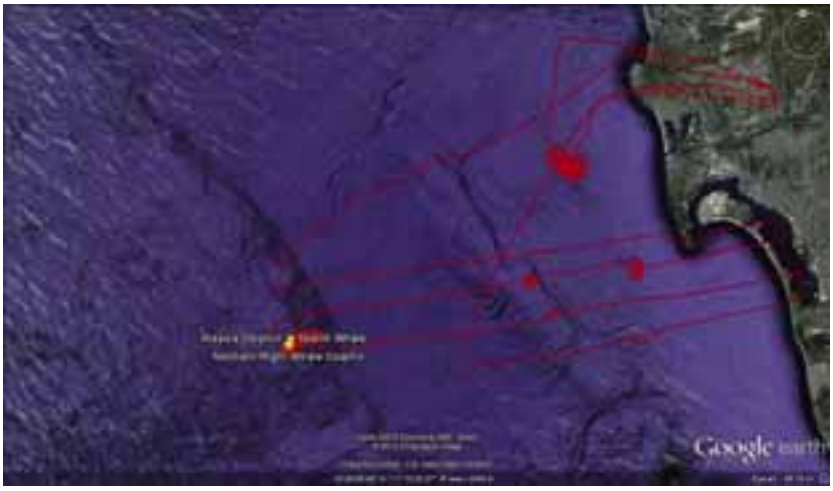
Risso's dolphins have been reported to behave aggressively with other cetacean species, including short-finned pilot whales. However, this

Sperm whales with Risso's dolphin approaching from the rear. The sperm whale at lower left is exhaling.

may be the first documented occurrence of head-on charging by Risso's dolphins to another cetacean species, accompanied by the jaw display response from sperm whales. Sperm whales have been seen clapping their jaws together in response to aggressive pilot whales in the Gulf of Mexico. Thus, jaw displays by sperm whales may be a counter-aggressive behavior. Apparent harassment of sperm whales by pilot whales and Risso's dolphins may cause sperm whales to regurgitate their food, allowing the aggressors to eat the regurgitated food. This is a feeding technique (kleptoparasitism) displayed by some birds, including jaegers and roseate terns.


Sperm whale and calf.

The rare encounter described above is but one of many remarkable observations which have occurred during aerial surveys conducted to gather baseline data on many little known marine mammal species in Southern California. The region's relatively high animal density and species diversity—associated with high biological productivity caused by mixing of strong currents in the region—makes it an ideal location for marine mammal study. SOCAL scientists are currently analyzing data on the abundance, density, distribution, and behavior of different species of marine mammals within the range complex. These data provide valuable baseline information that can be compared to marine mammal occurrence and behavior during Navy training events. These studies currently represent the most current and extensive information on marine mammals in Southern California, and provide detailed information on behavior of offshore species for which little has been published or is known. Due to the unusual nature of this sperm whale encounter, a detailed account is currently being prepared for submission to a peer-reviewed scientific journal as part of the U.S. Navy's ongoing goal to contribute to general knowledge and dissemination of information about marine mammals in the region.


Location of the sperm whale/dolphin sighting on 14 May 2011—24 nautical miles west of San Diego, California. Red lines are the tracklines followed by the observation airplane on this day.

The 2011 surveys were conducted on behalf of the Navy by Smultea Environmental Sciences under contract to HDR, Inc.

Photos by David Steckler under NMFS permit number 14451

CONTACTS

Cathy Bacon
HDR, Inc.
682-351-1490
catherine.bacon@hdrinc.com

Chip Johnson
U.S. Pacific Fleet
619-767-1567
DSN: 767-1567
chip.johnson@navy.mil

NESDI Program Puts Green Technologies Into Action

A Better Oil Trajectory Model & Greener Tank Target for Ranges Among New Products for the Fleet

FOR THE PAST several years, the Navy Environmental Sustainability Development to Integration (NESDI) program has been providing green solutions to the fleet—among them is a better model for predicting oil trajectories and an environmentally friendly range tank target.

The NESDI program evaluates, demonstrates, validates, and integrates innovative technologies, processes, and materials into fleet operations. NESDI projects also fill knowledge gaps that help to minimize operational environmental risks, constraints, and costs.

A vital component of the NESDI program's strategy is putting technology into action—into the hands of Sailors and other fleet personnel charged with the maintenance of weapon system platforms and the sound management of field installation environmental programs. Effective and successful technology integration depends on the ongoing communication and collaboration with end users—the ultimate target of NESDI products and services. These solutions can include technology innovations or replacements, material substitutions, new information or data, or new software or models.

The projects summarized below have all moved technology into action—from initial evaluation to ultimate integration into the hands of the fleet. While not all projects will be subject to each category outlined below, the categories do provide different types of assessment. The projects presented here demonstrate the depth and breadth of NESDI program investments.

The NESDI program evaluates, demonstrates, validates, and integrates innovative technologies, processes, and materials into fleet operations.

Evaluation

Before making a decision to expend limited resources to demonstrate a particular technology, it is often appropriate to evaluate existing and emerging technologies. One type of evaluation process results in what the NESDI program calls an Initiation Decision Report (IDR). IDRs help to identify what might already exist or be on the horizon to address an environmental need. The IDR recommendations focus follow-on demonstrations and promote more efficient solutions to user-defined needs.

Two recent NESDI projects produced IDRs—the Dredge Spoil Management Alternatives IDR and the Waste-to-Clean Energy IDR.

Dredge Spoil Management Alternatives Initiation Decision Report–Study Assesses the Viable Use of Contaminated Dredge Spoils

This IDR evaluates options for beneficial re-use of dredge spoils. Factors considered include Munitions and

Dewatered dredged material.

Explosives of Concern (MEC) detection and removal/exclusion, physical separation of dredged material fractions, contaminant remediation (bioremediation/landfarming), amending/landfarming (topsoil creation), sediment washing, chemical stabilization, cement manufacture, thermal treatment, and base catalyzed decomposition. The IDR presents three promising emerging technologies that would promote the beneficial use of Navy dredged material.

The Problem & the Need

The Navy regularly produces large volumes of dredged material during routine dredging of ports and waterways to maintain navigable depths and during construction and restoration projects. Dredged material is typically disposed in open ocean disposal areas or, in the case of contaminated dredged material, in managed confined disposal areas. However, environmental concerns, regulatory constraints, and limited capacity of existing confined disposal sites are increasingly restricting traditional options.

As a result of chemical and toxicity testing, together with increasingly stringent regulations, a larger amount of dredged material is now being classified as unsuitable to dispose of using traditional options such as open ocean disposal. Disposing larger volumes of dredged material has become particularly problematic due to the presence of chemical contaminants and/or failed toxicity testing and a lack of low-cost disposal options.

Most unsuitable dredged material is currently placed in confined disposal cells in upland (landfills) or aquatic (Confined Aquatic Disposal) locations. These disposal options are very costly, potentially diverting funds from essential mission-related functions and impeding operational readiness. Therefore, alternatives to traditional dredged material disposal methods, such as reuse for a beneficial application, are needed.

The beneficial reuse of dredged material encompasses a broad range of applications including beach nourishment, topsoil creation and possible use as a construction material feedstock. Depending on the chemical and physical nature of the dredged material, certain reuse options may be more feasible than others for the Navy.

Project Approach & Results

The project team identified Navy dredge sites and explored alternative disposal (e.g., landfill cover and other fill applications) and reuse options (cement feedstock, lightweight aggregate production, and topsoil creation) for contaminated dredged sediments. Both maintenance/construction and Installation Restoration (IR) dredging sites were included in the survey. The Navy's Risk Assessment Workgroup (RAW) assembled information about restoration sites, including:

- The associated Engineering Field Division contacts

Recent NESDI Projects: Putting Technology into Action

Evaluation

1. Dredge Spoil Management Alternatives Initiation Decision Report
2. Waste-to-Clean Energy Initiation Decision Report

Demonstration

3. Abiotic Treatment of 1,2,3-Trichloropropane to Protect Drinking Water Resources
4. Predictive Trajectory Model for Oil Spills for Navy Harbors

Validation

5. Alternative Tank Targets

Integration

6. Direct-Push and Point-and-Detect, In situ Sensor for Perchlorate
7. Corn Hybrid Polymer Blast Media for Coatings Removal

- The current phase (study, in progress, closed) of the IR site
- Whether the site is marine or fresh water
- Contaminants of potential concern
- Cost to complete
- Priority status

The project team then contacted site personnel and obtained information regarding the physical properties of the sediment, the amount requiring disposal, and other pertinent site features for inclusion in the report.

As a first alternative, this Navy site-specific information was compared to the requirements for use of dredged material as a cement kiln feedstock to determine whether Navy sites are potential candidates for this reuse application. The research group focused on thermal processing to produce cement and lightweight aggregate specifically, because this reuse option is supported by both the U.S. Environmental Protection Agency (EPA) and industry as an environmentally acceptable and economically beneficial reuse option for dredged material and because previous research has demonstrated that the cement kiln process is economically attractive.

Freshly dredged marine sediment.

During the early stages of the IDR, the project team determined that high salinity characterizes the largest volume of Navy material, particularly material of varying particle sizes (ranging from predominantly silts/clays to mixtures of silts with sand and gravel). It was also determined that many sites produce large volumes only intermittently. Cement feed stocks require a relatively consistent, lower salinity feed to produce cement of known specification. Additionally, it was found that Navy locations that generate dredged material are geographically distant from existing cement kilns and transportation costs would therefore negate the economic benefit of this reuse method. Therefore, it was determined that the cement kiln feedstock option is not presently feasible for the Navy.


Conditioning cell with final product.


The end result–biologically conditioned dredged material.

After comparing Navy needs and potential dredged material disposal and beneficial reuse methods, the following findings were made, as presented in the IDR:

- The Navy dredges a widely varying amount annually ranging from 100,000 cubic yards (cy) to 7,000,000 cy, according to U.S. Army Corps of Engineers Open Ocean Disposal Database. (Because there is no centralized database to track all Navy dredging, a data gap was identified.)
- IR sites containing sediment are most often small volume sites with contaminant levels ranging from low to moderate.
- Fewer IR sites with large volumes of sediment exist, but these sites could benefit by alternative methods such as reuse since contaminant levels are typically low and the large volumes make it economically attractive.
- Maintenance dredging and large construction projects, such as piers, result in the largest volumes of Navy dredged material.
- All Navy dredged material from navigational channels and ports potentially contains MEC which must be removed (or screened by detectors) and certified MEC-free prior to reuse.
- Physical separation of dredged material is a promising technology because it can produce coarse-grained fractions (sand, gravel, lime) immediately useable for applications in construction and agriculture.
- Blending of dredged material with amendments, such as compost, to produce topsoil is a promising low-cost approach for beneficial reuse.

The three most promising options are MEC detection and removal, physical separation, and amending/landfarming (topsoil creation). A landfarming and topsoil creation pilot project using dredged material from Pearl Harbor blended with compost is currently underway at the Navy's former Barbers Point Naval Air Station Biosolids Treatment Facility.

This IDR is now available on the NESDI web site at www.nesdi.navy.mil.

"This is among the best soil available on the island (Oahu)."

–Matt Flach (Joint Base Pearl Harbor-Hickam (after physically handling the treated dredged material)).

Waste-to-Clean Energy Initiation Decision Report–Study Evaluates Viable Options to Landfill Disposal of Solid Waste

This project completed an IDR that evaluates potential Waste-to-Clean-Energy (WtCE) technologies that could help to address the growing compliance problem of landfill space limitations near Navy shore facilities. The IDR evaluates the feasibility of using WtCE conversion technologies as alternatives to landfill disposal and incineration to:

1. Alleviate the closure impacts of solid waste landfills near installations
2. Enhance Navy use of waste as resources and generation of clean renewable energy
3. Prevent overburdening of landfills
4. Avoid ever-increasing landfill disposal costs

The Problem & the Need

Southern California is experiencing a shortage of landfill availability—a problem the rest of the country could face in the near future. Siting new landfills is difficult and greenhouse gas regulations are becoming more stringent. Therefore, naval bases located in southern California must seek alternatives to manage refuse. Commander Navy Region Southwest facility's landfill is projected to reach capacity in 2019.

Project Approach & Results

Personnel from the Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC), formerly the Naval Facilities Engineering Service Center, partnered with personnel from the University of California at Los Angeles Engineering Extension to review over 40 technologies and classify them into three general categories utilized by the Navy:

1. Commercially proven technologies
2. Emerging technologies
3. Developmental technologies

Currently, there are over a dozen commercially proven technologies and over 30 emerging and developmental technologies. The team visited facilities in over a dozen countries to collect planning and operations information corresponding to these technologies. Discussions with facility developers/operators and the regulatory agencies provided valuable information regarding WtCE project planning, design, and operations strategies.

The project team also reviewed and analyzed solid waste generation data from a report funded by Commander Naval Installations Command and completed by Battelle in January 2011, together with the waste composition data provided by the State of California. Based on its findings and discussions, the team determined that the available solid waste feedstock tonnage at the majority of the naval facilities is not of sufficient volume for a stand-alone regional or community-based WtCE demonstration project that is economically feasible. Based on current energy and landfill disposal costs, the Navy should continue to support WtCE technologies as a provider of solid wastes to local commercial and/or municipal WtCE facilities.

Evaluation, Demonstration, Validation & Integration– Four Levels of Technology Assessment & Implementation

WHEN THE FLEET needs green technologies to meet changing demands, the NESDI program provides assistance at a number of different levels. The type of project can vary according to the environmental need and maturity of technologies being considered. The four levels described here provide a structure for understanding types of projects although not every technology will require each level of assessment.

Evaluation

Evaluation provides the opportunity to review the current state of existing and emerging technologies. The results of these evaluations can provide direction and focus for any subsequent demonstrations.

Demonstration

Demonstration projects provide a clearer picture of how a technology might (or might not) meet fleet needs. This type of project can highlight benefits and potential issues, and bring costs and requirements into better focus.

Validation

Validation is often combined with demonstration (then referred to as "dem/val"), yet is presented here in its own category. Validation results reveal how a technology meets more encompassing scientific and engineering specifications, addresses critical operational demands, and can be implemented by personnel.

Integration

Integration is the ultimate goal for proven technologies. When a technology is ready to support the mission, it is time to put it into action to help Sailors and other fleet personnel do their jobs.

The key findings and recommendations contained in the IDR are as follows:

1. Thermal Conversion Technologies

   WtCE thermal conversion technologies have been documented and proven for reliable operation. They are commercially available to meet the Navy's combined goals of renewable energy, distributed power generation, improved recycling recovery, maximizing landfill diversion, and reducing greenhouse gas emissions. WtCE thermal conversion technologies are capable of complying with the most stringent of air emissions standards and can beneficially impact climate change.

2. Other Technologies and the "EcoPark Approach"

   Other types of commercially proven, non-combustion conversion technologies are operational around the world. These technologies, such as anaerobic digestion, are utilized to complete the "EcoPark" approach that is discussed in the IDR. (Note: EcoPark is an integrated material recovery and conversion technology facility concept.) Such an integrated approach is expected to maximize the amount of waste diverted from landfills while providing additional energy generation and production of other useful byproducts.

3. Funding, Acquisition, and Benefits

   Naval installations are a small stakeholder in solid waste management. In many cases, the total lifecycle costs of a WtCE facility suggest that the state and/or local governments should be responsible for the costs supporting the development and operation of a WtCE facility, since they are mandated to ensure compliant, cost-effective solid waste disposal within their respective jurisdictions. It should also be noted that conversion technology projects can be privately funded, designed, procured, constructed, and operated as turnkey projects.

4. Supplemental to the Current, On-Going Navy Effort

   The Navy should have an ongoing effort to track and evaluate emerging/developmental technologies in addition to developing an ongoing effort to monitor and evaluate the various projects that are being developed by local governments and private industry. The "lessons learned" from the development and implementation projects of appropriate and financially sustainable WtCE technologies will be invaluable to the Navy.

5. Recommendations Based on a Model Site Case Study

   Naval Base San Diego (NBSD) was used as the model for a case study to formulate the recommendations in this IDR. Currently, NBSD accumulates approximately 100 to 150 tons of waste per day, which is not sufficient for the "economy of scale benefits" from Material Recovery Facilities with WtCE technologies. The Navy should determine the feasibility of being a principal player/investor and also be an advocate of cost effective, "green" options (of which one is WtCE) for solid waste management via Component Regional Environmental Coordinators responsible for interfacing with state and local governments.

Southern California is experiencing a shortage of landfill availability—a problem the rest of the country could face in the near future.

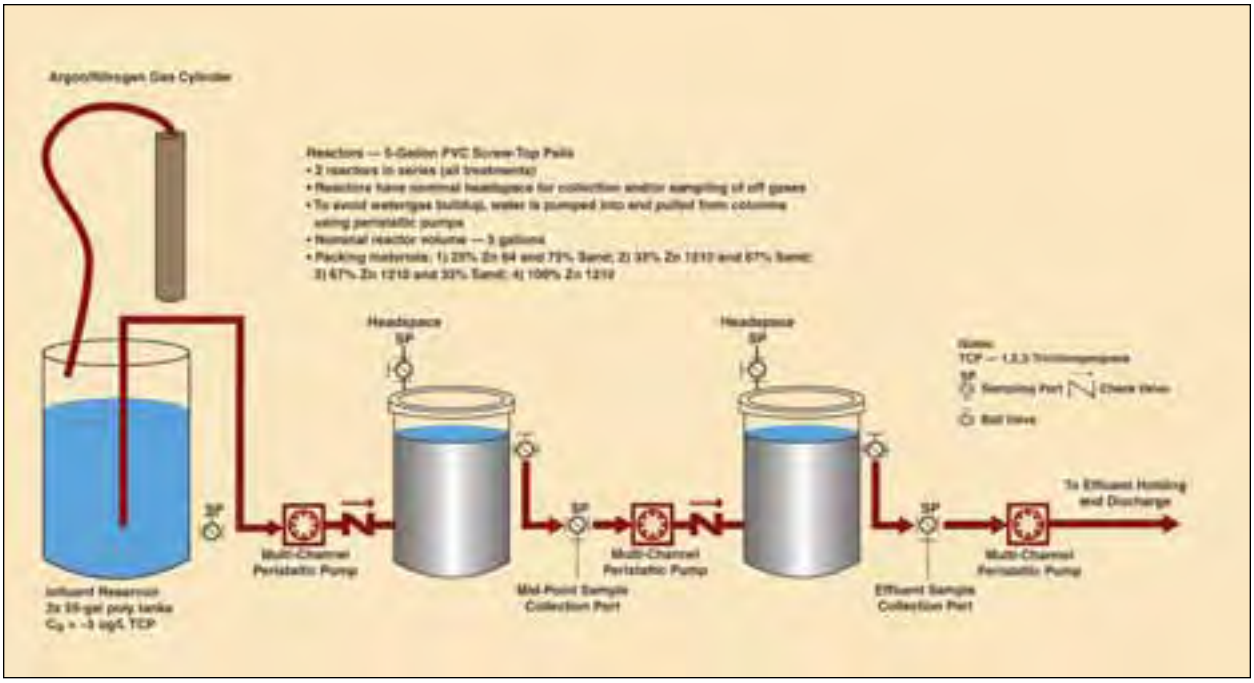
6. Other Recommendations

   Recommendations for installation consideration of WtCE technologies referenced in the IDR include the following:

   - Optimize solid wastes recovery and recycling practices
   - Remove objectionable wastes (e.g., food wastes, consumer batteries) that may reduce the energy value of the remaining solid wastes
   - Assess and characterize remaining solid wastes to estimate energy value and requirements for pre-processing technologies (e.g., shredding, grinding)
   - Conduct a feasibility study of suitable and sustainable WtCE alternatives
   - Initiate action supporting the alternatives recommended in the feasibility study

"I want to thank the NESDI program for educating us via this study. NESDI personnel certainly rose to the occasion. We are looking at a waste management challenge here in San Diego in the coming years and this study provided us with some viable alternatives."

—Leslie McLaughlin (Navy Region Southwest)



Schematic of optimized columns to treat TCP.

Demonstration

Innovative technologies that offer promise might not be sufficiently mature to implement at a full-scale. Depending upon the level of development, a promising solution might require initial laboratory bench-scale testing and/or be appropriate for an in-situ demonstration. This stage offers the opportunity to acquire data on costs and benefits and determine how to move ahead. Two recent projects that have successfully tested and demonstrated a treatment technology and model respectively are Abiotic Treatment of 1,2,3-Trichloropropane to Protect Drinking Water Resources and Predictive Trajectory Model for Oil Spills for Navy Harbors.

Abiotic Treatment of 1,2,3-Trichloropropane (TCP) to Protect Drinking Water Resources—Pendleton Pilot Study Shows Promise for Removing TCP from Groundwater

This NESDI project tested new abiotic treatment methods to remove 1,2,3-TCP from groundwater. It focused on zero valent metals (ZVM) to determine which would be most effective for removing TCP.

The Problem & the Need

The solvent 1,2,3-TCP, which is toxic to humans, is attracting regulatory attention. At Marine Corps Base Camp Pendleton, California, (Camp Pendleton) TCP was detected at levels above California's action level, resulting in two groundwater wells being removed from service. Addressing TCP contamination was a challenge for Camp Pendleton officials because TCP is highly persistent in groundwater, taking a long time to degrade.

Project Approach & Results

This project drew upon results of a Strategic Environmental Research and Development Program research project (ER-1457), which investigated abiotic degradation pathways initiated by various materials, including iron and zinc (Zn).

The specific objectives of this effort included the following:

- Assess the ability of zero-valent zinc (ZVZ) and/or zero-valent iron (ZVI) to effectively degrade TCP in Camp Pendleton groundwater.
- Evaluate potential secondary water quality effects (e.g., changes in pH or dissolved zinc concentration) that could affect future implementation of a ZVZ or ZVI remedy.
- Identify potential factors that may affect performance of ZVZ or ZVI as a remedy for TCP in groundwater.
- Conduct a preliminary evaluation of the full-scale applicability of ZVZ or ZVI for treatment of TCP in groundwater at Camp Pendleton.

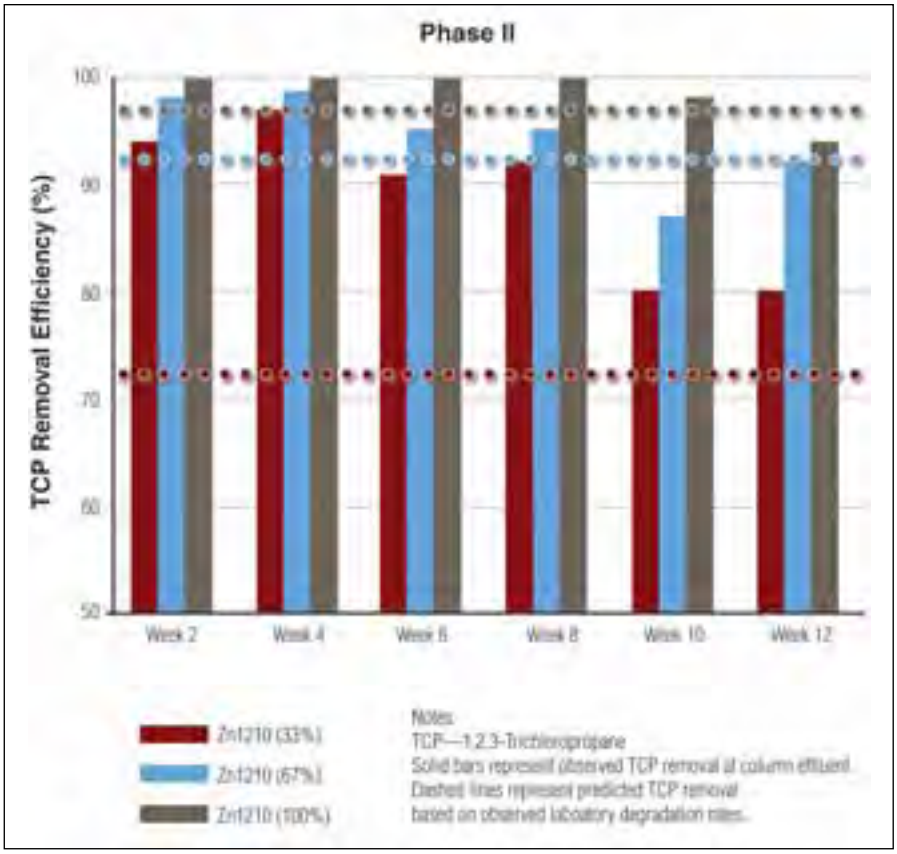
The first stage of this effort was laboratory (bench-scale) testing—conducted to help identify which ZVMs were most suitable for the Camp Pendleton groundwater conditions. This bench-scale testing was also conducted to provide information necessary for subsequent on-site testing to evaluate ZVM performance.

Two phases of on-site column testing were completed to evaluate multiple types of reactive media. Phase I tested:

- A 25% Zn 64 and 75% sand mixture
- A 100% Zn 1210
- A 50% ZVI and 50% sand mixture

Phase II tested:

- A 25% Zn 64 and 75% sand mixture
- A 33% Zn 1210 and 67% sand mixture
- A 67% Zn 1210 and 33% sand mixture
- A 100% Zn 1210



TCP degradation in optimized Phase II columns.

Based on the results of the preliminary laboratory studies and on-site column testing, models were developed to evaluate the costs of applying this technology at scale both in situ (e.g., permeable reactive barrier) and ex situ (e.g., wellhead treatment of TCP at an affected water supply well). This project demonstrated that the chemical and cost effectiveness of using ZVZ, in particular Zn 1210, was particularly promising since it exceeded TCP degradation capabilities.

The project and its results prepare the Navy for increasing regulatory demands regarding TCP and support the remediation of groundwater contaminated by TCP.

Camp Pendleton is now considering a pilot-scale project to treat affected groundwater using a permeable reactive barrier.

"I want to thank the NESDI program for sponsoring this study. We were really scratching our heads trying to figure out how to remediate such a toxic, emergent, recalcitrant compound."

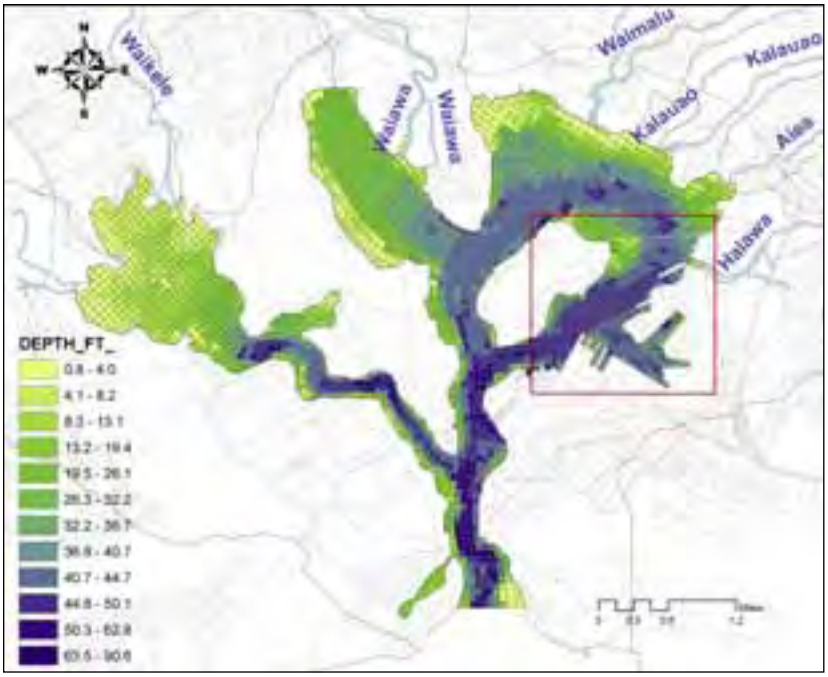
–Theresa Morley
(Naval Facilities Engineering Command Southwest)

Predictive Trajectory Model for Oil Spills for Navy Harbors–New Model Increases Accuracy of Oil Spill Trajectory Predictions

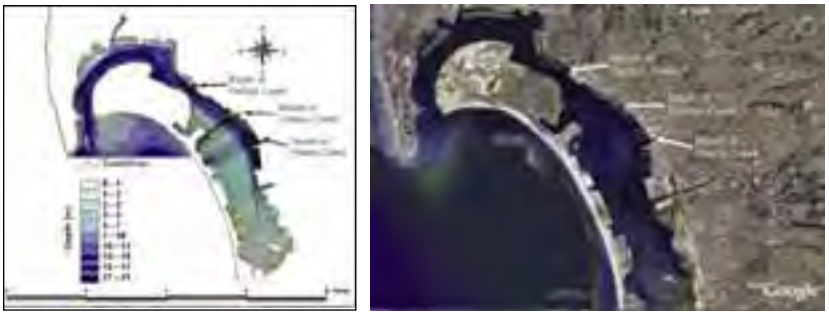
This project improved the predictive accuracy of existing oil spill trajectory models and provided a validated modeling tool to more cost-effectively and efficiently manage oil spill scenarios. This project implements and links two existing models, the National Oceanic and Atmospheric Administration's (NOAA) General NOAA Operational Modeling Environment (GNOME) model and the Navy's Curvilinear Hydrodynamics in 3-dimensions (CH3D), to improve the predictions of oil trajectories following oil spills in Navy harbors. The linked model includes the oil properties and transport prediction from GNOME and the accurate hydrodynamic calculations, including currents and water mass movement in fine resolutions, from CH3D.

The Problem & the Need

Oil spills in harbors may pose great risks in terms of degrading the environment and creating hazards to safe



Model grid for the linked CH3D+GNOME model for Pearl Harbor with bathymetry in color contours.

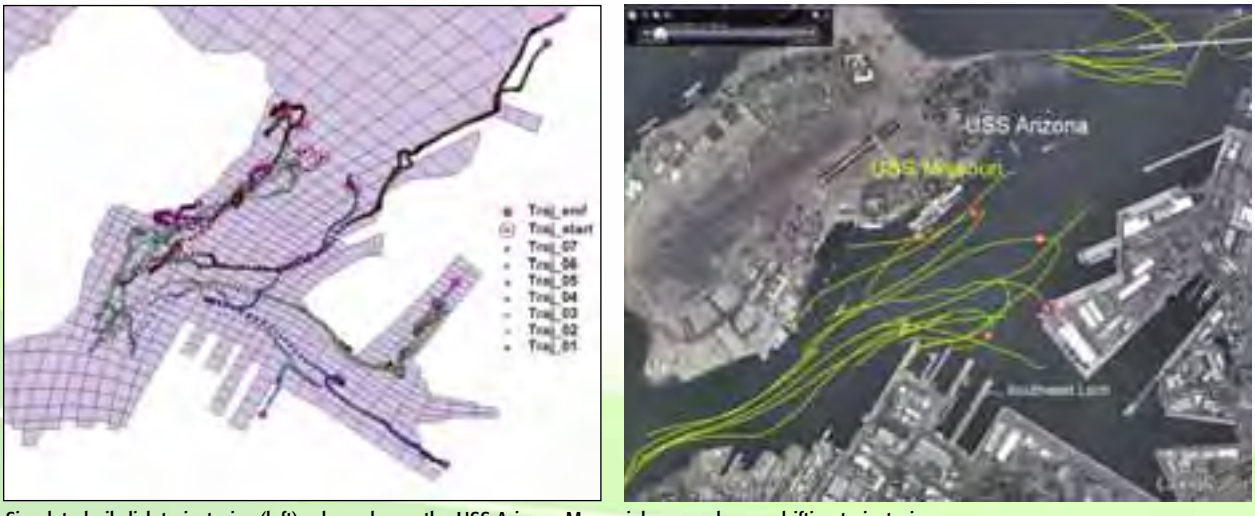


Model grid for the linked CH3D+GNOME model for San Diego Bay with variable grid sizes.

navigation of the waterways. In order to reduce the risk of oil spill occurrence and to effectively design and conduct cleanup and recovery efforts, the Navy needs accurate numerical models to simulate oil spill events, including the transport of oil slick trajectories.

Following an oil spill in an estuary or harbor, the spilled oil immediately undergoes a series of processes controlling its fate and transport. Factors such as wind speed, water currents, and turbulence make it difficult for Navy On-Scene Coordinators (NOSC) and other Navy personnel to predict the oil's trajectory.

Currently, Navy personnel use NOAA's GNOME model for predicting oil spill trajectories. The setup, running, and output of this model is fast, timely, and flexible enough to deal with various time scales. However, oil trajectories predicted by GNOME involve high uncertainty and lack accuracy because it is a transport model and not a hydrodynamic model. GNOME does not compute currents, but relies on data from an external source.



Simulated oil slick trajectories (left) released near the USS Arizona Memorial versus drogue-drifting trajectories.

Project Approach & Results

Project personnel selected two Navy harbors to be used for the demonstration of the merged model—Pearl Harbor, Hawaii and San Diego Bay, California. These harbors were selected based on multiple factors including traffic volume, accumulated knowledge about the site, accessibility of the site, and relevant data about the site.

The linked model for Pearl Harbor uses the same model grid and time step as those for the hydrodynamic model, providing adequate fine resolutions of transport in both space and time. (The study of San Diego Bay is underway.) Therefore, the transport of oil slicks is simulated at greater resolution with improved accuracy, compared to the old oil spill model. For example, oil slicks released by design near the USS Arizona Memorial were projected to oscillate back and forth by the "approximate" tidal currents near the release site. With the linked model, oil slicks are projected to be transported to wider and farther ranges depending on the timing of release and tidal conditions, both of which are adequately simulated by the linked CH3D + GNOME model. The same level of requirements and predictive accuracy are expected when the linked CH3D + GNOME model is applied to other harbors.

The Navy now has a model that simulates oil slick trajectories from an oil spill in Navy harbors with improved prediction accuracy. In particular, NOSCs have access to a better modeling system that can be used for both pre-planning (forecast) and cleanup for oil spill events. Overall, the Navy's oil spill management teams may more effectively and efficiently prepare and deploy spill recovery and cleanup equipment through the use of the predictive model results.

"A key element in effectively managing the response to a large oil spill is to deploy response resources in advance to areas where the oil may have an impact. This new model will provide NOSCs with a more accurate tool to predict the fate and transport of that oil. As a result, responders can prevent the oil from damaging environmentally, culturally, and economically sensitive areas which are vital to the people of Hawaii."

–Cynthia Pang (NAVFAC Hawaii)

Validation

While a demonstrated technology might address a need, in some cases more specific information may be required before a technology can be implemented across the fleet. Does the technology require significant modifications to existing equipment? Does it address critical operational requirements? Will fleet personnel be able to use it? Validating a technology helps to address these and other issues.

The NESDI program's efforts to validate the use of an alternative tank target for Navy ranges provides one example of this approach.

Alternative Tank Targets– New Targets Provide Green Alternatives for Navy Ranges

This project demonstrated and validated an Alternative Live Fire Ground Target (ALFGT) developed by NAVFAC EXWC personnel. The ALFGT contains no hazardous components and is an effective replacement for the diminishing supply of M60 tanks.

The Problem & the Need

The Navy's land-based air-to-ground (ATG) ranges must include hard targets. Managing the targets' lifecycle

The latest prototype of the ALFGT being built.

is a challenge for sustainable range operations. Hard targets, traditionally surplus armored vehicles such as unserviceable tanks and armored personnel carriers, are required on high-explosive ranges because of their durability. However, these targets present environmental and operational challenges because of their environmental impacts, high lifecycle costs, occupational and explosive safety concerns, and their limited availability.

Environmental requirements of traditional hard targets, such as a surplus M60 tank, require significant preparation to remove hazardous, radiological, and special waste materials. In addition to the hazardous wastes generated from target preparation, their use on-range can present a significant environmental liability. Inevitably, some wastes remain in some of the components of a M60 tank because extracting all of the fluids is difficult. The fluids that remain can be released to the environment during its lifetime on-range as a target.

Project Approach & Results

NAVFAC EXWC personnel worked to develop an alternative target initially designed for use at both Naval Air Station (NAS) Fallon and the Pinecastle Range Complex, which have the Navy's largest ATG training operations. General criteria that guided the first prototype included having the alternative target's size as close as possible to the M60 without exceeding the lifting weight limits of available moving equipment. The first prototype, tested in April 2007, was modular in design, so that each component could be moved with lighter equipment.

The latest prototype of the ALFGT placed in the live impact area.

The ALFGT survives close hits from 500-pound bombs.

After the design and testing of the first prototype, however, both NAS Fallon and the Pinecastle Range Complex acquired new tank retrievers. This led to a significant alteration of the design. NAVFAC EXWC personnel developed a second prototype of the ALFGT based on lessons learned from the first prototype. This ALFGT prototype, built on-site at the Pinecastle Range Complex in August 2009, is 8.5-feet wide by 15.3-feet long by five feet tall, including the turret. Its footprint is a little less than three-quarters of the size of a M60 tank, although the ALFGT is much shorter. It is constructed of concrete and steel, is now a single piece, and is much stronger than the first prototype. It has thicker steel with many gussets joining the steel plates. It is also has angled sides to help prevent the penetration of bomb fragments.

The newer design is much simpler and quick to build. Although it took about a week and a half for two workers to build the first ALFGT at the Pinecastle Range Complex, it should only take about a week to build subsequent targets with the proper equipment and experience.

The latest prototype was used from October 2009 to May 2012 and maintained its structural integrity despite sustaining many close hits, proving that it can be a viable target for ATG training. New lessons learned will allow the next generation of alternative tank targets to be even stronger. It should be noted that a direct hit from a bomb, like the one that completely destroyed the alternative tank target, would also completely destroy the commonly-used M60 tank target.

Although the ALFGT was designed for use at heavily used ranges, it may also be used at other ranges as well. In addition, the first (modular) prototype may still be a viable option on island ranges where heavy moving equipment is not available.

These ALFGTs now provide the Navy with the capability to produce a green, affordable, long-lived target in-house for air-to-ground training that eliminates the need for either pre- or post-cleanup costs.

"I believe that this type of environmentally friendly target will be viable if funding can be obtained to construct it. Traditionally, M60 tank targets that contained asbestos in their engine compartments resulted in abatement that cost over $35,000 to remediate."

–Chris Townsend (Pinecastle Range Complex)

Integration

Once technologies are shown to meet a defined environmental need, have been demonstrated and/or validated, and are ready to support the mission, it is time to put them into action. For many of these technologies, it is necessary to receive approval from the appropriate technical authority and reflect the approved use of that technology in guidance and maintenance manuals. From there, the equipment or process needs to be integrated into field and industrial operations so that Sailors and other fleet personnel can use them.

Two NESDI supported projects that have been integrated into fleet operations are reflect this stage of technology maturity are Direct-Push and Point-and-Detect, In situ Sensors for Perchlorate and Corn Hybrid Polymer (CHP) Blast Media for Coatings Removal.

Direct-Push and Point-and-Detect, In situ Sensors for Perchlorate–Perchlorate Sensor Now Part of Fielded Suite of Site Characterization Equipment

This NESDI project validated the use of a direct push and point-and-detect, field deployable sensor system—the Surface Enhanced Raman Spectroscopy (SERS) system—for real time and in-situ use to measure perchlorate, either for rapid screening and monitoring purposes or for contaminant source characterization of perchlorate in groundwater or surface waters.

The Problem & the Need

Perchlorate, used as the oxidizer component and primary ingredient in solid propellant for rockets and missiles, is

Edward's Site 285 soil samples as deep as five meters below ground level were collected for later analysis using EPA Standard Method 6860.

exceedingly mobile in aqueous systems and can persist for many decades under typical ground and surface water conditions. Perchlorate has been found in groundwater, drinking water, and soils, mainly in the southwestern United States, at levels ranging from eight to 3,700 parts per billion (ppb). As the ground water contamination has become more apparent and new regulatory actions levels are being established, detection and cleanup are rapidly emerging needs.

Because perchlorate is considered to be an explosive residue, there is a need to screen for perchlorate to assess vulnerabilities related to environmental contamination to sustain range operations both on and off range and determine if environmental conditions impact range operations.

In 1999, there were several known Navy perchlorate sites including Naval Weapons Industrial Reserve Plant McGregor, Outlying Landing Field San Nicolas Island, Allegany Ballistics Laboratory, Naval Surface Warfare Center

Indian Head, and Marine Corps Air Station El Toro. This number may increase as more sites are evaluated.

Some of the issues surrounding perchlorate include:

- Human health. Perchlorate can affect the thyroid gland by blocking iodine uptake resulting in lower thyroid hormone levels. This deficiency results in abnormal metabolism, growth and development.
- Chemical and physical characteristics. Because perchlorate is soluble in groundwater and highly stable, contamination is often found at great distances from the source. Experience has shown that conventional sampling may not accurately represent perchlorate contamination levels.
- Clean-up. Common ground water clean-up techniques, such as filtration, sedimentation, air-stripping, or sorption onto activated carbon, are ineffective for perchlorate removal.

While human health action levels are still being developed, EPA has released a draft human health risk benchmark calculated at 1 ppb—substantially below previous benchmarks. The likelihood of significant monitoring requirements on past and active ranges is growing. Regulators have begun to initiate policies that require intensive sampling efforts as a requirement for site closure. This type of sampling effort will be prohibitively expensive unless more effective site characterization methods are developed.

Project Approach & Results

The validated SERS system includes a portable Raman system (complete with laser, spectrometer, detector, and computer) with a detachable fiber optic probe. A SERS sensor module that houses the cationic-coated SERS substrates was designed and built to mount onto the fiber optic probe. The sensor module was deployed inside a direct push cone penetrometer sampling probe to measure perchlorate in-situ in real time as a function of depth.

Demonstrations were conducted at Edwards Air Force Base Site 285. Located in the northern part of the base, Site 285 is the former site of the National Aeronautics and Space Administration's Jet Propulsion Laboratory solid rocket motor activities. Contamination at the site resulted from the use of ammonium perchlorate, an ingredient in solid rocket fuel. Soil samples were collected from Site 285 to test the sensor's ability to accurately measure levels of perchlorate concentrations in contaminated groundwater. Because perchlorate acts like a solid in soil but dissolves like table salt in groundwater, researchers were able to obtain groundwater samples from the soil at Site 285. Data from the sensor was compared with EPA Standard Method 6860. Using split samples, the correlation coefficient between the standard method and the real time sensor was 0.94.

Given the accuracy of the real-time sensor in comparison to standard methods, it can be used to rapidly delineate the location of perchlorate plumes. Understanding the extent and concentration of underground plumes is important when designing the most cost effective remediation approach and determining the efficacy of the treatment process.

The SERS system has since been installed in all Navy Site Characterization Analysis Penetrometer System (SCAPS) trucks and is now available for use by Navy regional program managers with sites containing potential subsurface perchlorate plumes.

"Letting the Navy access Site 285 last September was a no-brainer. This cutting-edge sensor will save the government time and money. Normally, a team has to send samples to a laboratory, where it can take two to six weeks for an analysis. Many times, it means two to six weeks of waiting for the sampling crew because the team relies on the test results to determine where the next samples need to be taken to delineate the plume. With the Navy's sensor, a team will be able to take samples and get on-site analysis in real-time. This expedites the cleanup process and saves time and money."

—Bruce Oshita (Edwards Air Force Base)

Corn Hybrid Polymer Blast Media for Coatings Removal—New Media Proven Effective on Delicate Substrates

After its successful demonstration and validation steps, Corn Hybrid Polymer (CHP) is now being integrated into fleet use as an alternative stripping method for coating removal and selective stripping of delicate substrates. The project leading up to integration focused on the following objectives:

- Provide an effective, environmentally preferred media to remove coatings from difficult, high-value, Naval

Sea Systems Command and Naval Air Systems Command (NAVAIR) delicate substrates including fiberglass, thin aluminum alloys, carbon fiber, graphite and Kevlar

CHP was used to strip this fiberglass radome mast at the Trident Refit Facility Bangor.

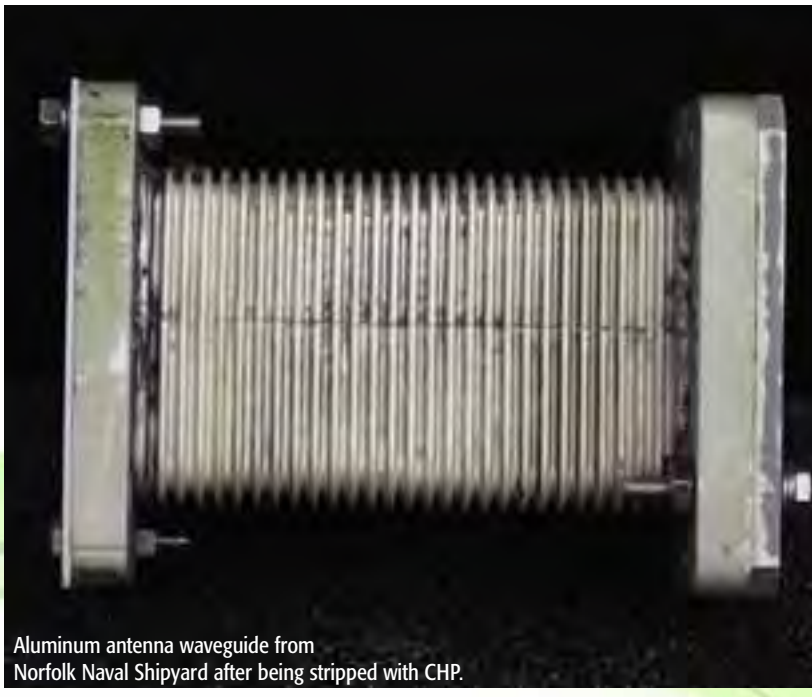
- Introduce the media to facilities where it is not currently in use
- Implement the use of CHP media on a broader and larger scale

The Problem & the Need

Department of Defense (DoD) industrial facilities increasingly need alternative methods for stripping delicate substrates such as composites and thin aluminum alloys. These facilities need new stripping methods to respond to changing environmental and health and safety regulations. Such changes are making manufacturing, repair, and rework practices increasingly difficult, less efficient, and more costly. The practices also can cause damage that requires re-work, increase downtime, and diminish the service life of the military assets. These methods also can release solvent vapors into the atmosphere, generate hazardous waste, and expose workers to potentially unsafe working conditions.

Project Approach & Results

CHP media is a crystallized cornstarch material that is 100 percent organic, non-toxic, and biodegradable. Various Air Force, U.S. Coast Guard, and Navy facilities currently use the CHP blasting technology on more durable substrates. This project identified several facilities to demonstrate the media's use on delicate substrates.



Aluminum antenna waveguide from Norfolk Naval Shipyard after being stripped with CHP.

Successful demonstrations were completed at three Navy shipyards and other facilities between Fiscal Year (FY) 2009 and FY 2011 including:

- Norfolk Naval Shipyard
- Naval Undersea Warfare Center Keyport
- Naval Station Kitsap
- Naval Air Station Whidbey Island
- Puget Sound Naval Shipyard
- Pearl Harbor Naval Shipyard
- Naval Air Warfare Center (NAWC) Lakehurst

Accomplishments to date include the following:

1. NAWC Lakehurst has received formal NAVAIR approval to utilize CHP as a qualified Type VII media in their blasting processes, and added media-specific information into the Support Equipment Cleaning, Preservation, and Corrosion Control (17-1-125) manual.
2. The Puget Sound Naval Shipyard and Intermediate Maintenance Facility is converting one of its blasting booths and a glove box/cabinet blaster to CHP blast media.
3. Portsmouth Naval Shipyard was impressed with the results documented by the Northwest regional and east coast demonstrations, and is preparing a new shipyard blast booth for CHP use.
4. Norfolk Naval Shipyard is considering the conversion of a glove box blaster to CHP for small delicate substrate items (i.e. waveguides).
5. The Corpus Christi Army Depot has approved CHP for use on H-60 helicopter components (rotor blades), including Army, Navy and Marine Corps assets.
6. Florida, Tennessee, North Carolina, Missouri, Mississippi, Kansas, Oklahoma, Utah, Texas and California are among the states that have already approved CHP for bio-based media recycling.

These demonstrations confirmed that CHP media causes no damage to these substrates during coatings removal processes due to the nature of the media and the lower blast pressures used. CHP can be used in standard, light abrasive blast equipment and as a "drop-in" replacement for many plastic media blasting systems. The media can be used repeatedly (typically 12 to 15 times), and can be recycled through an approved Treatment, Storage and Disposal Facility.

Overall, the project has provided Navy and DoD facilities a more effective, environmentally preferred media to remove coatings from difficult, high-value, delicate substrates, including fiberglass, aluminum, carbon fiber, graphite and Kevlar.

"NAWC Lakehurst was very impressed with the results of both the standard and low temperature powder coated test coupons blasted with CHP at the Norfolk demonstration. The low blast pressures did not affect the surface profiles of the test coupons. NAVAIR has given approval to utilize CHP as a qualified Type VII media in their blasting processes, and are adding media-specific information into the Support Equipment Cleaning, Preservation, and Corrosion Control (17-1-125) manual."

—Dana Kaminsky (NAWC Lakehurst)

For More Information

FOR MORE INFORMATION, visit the program's web site at www.nesdi.navy.mil, then select "Current Projects" then "View" to display a fact sheet that describes the objectives and accomplishments of other successful NESDI projects.

CONTACT

Leslie Karr
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-1618
DSN: 551-1618
leslie.karr@navy.mil

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2. A series of successful demonstrations of camelina- and algae-based biofuels in several types of aircraft and small boats in 2010 and 2011 that is propelling the Navy toward the Great Green Fleet.

3. Sailors from Navy Region Northwest that continue to foster relations with local Native American tribes by helping to seed three million manila clams along the beaches of Naval Magazine Indian Island

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