There is increasing concern that man-made sounds may have detrimental effects on marine mammals. Anthropogenic ocean noise is associated predominantly with shipping, but a wide variety of other noises such as explosive sources, sonar, and seismic exploration may also contribute. These sources, especially shipping, have contributed to a dramatic increase in the ambient sound field in the oceans.

Marine mammals are protected under the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and National Environmental Protection Act (NEPA). The MMPA prohibits harassment of marine mammals. Some concern exists that Navy sonar activities may constitute harassment to marine mammals, especially to deep-diving whales. If so, this harassment may be subject to regulation under the MMPA.

SERDP, the Office of Naval Research, Navy laboratories, and researchers from the Woods Hole Oceanographic Institution (WHOI) have made major progress in the past decade on marine mammal research. For instance, major advances have been made in the detection and localization of marine mammal sounds, especially the low frequency calls of Baleen Whales. However, the Navy continues to seek further capability to monitor the location, abundance, and behavior of marine mammals and to evaluate the impacts of defense training and testing activities on marine mammals.

Dr. Peter Tyack, a senior scientist at the WHOI spearheading the SERDP project Acoustic Response and Detection of Marine Mammals Using an Advanced Digital Acoustic Recording Tag (CS-1188), is investigating the interrelationships between military noise in the ocean and its affect on deep-diving whales. Tyack has worked with Dr. Mark Johnson, a research engineer at WHOI, to develop a tag that can record acoustic exposure of an animal, along with vocal or behavioral responses to the exposure.

Whale vocalizations and ambient sound are recorded by the tag along with depth and animal orientation that then are used to correlate the reactions of marine mammals to controlled exposures of man-made noise. The resulting response indices are used to understand the reactionary behavior of marine mammals to various noise sources found in the ocean and to help the Navy in establishing safe exposure levels for these animals during naval operations.

The digital acoustic tag (DTAG) attaches non-invasively to the front of the dorsal hump of a whale using suction cups. The result is a set of reference recordings from animals of known position and species that can be used to evaluate acoustic algorithms for passively detecting whale vocalizations. The tag includes orientation and dive sensors providing a direct means for establishing the behavioral response of a whale to an impinging sound. The tag data are compared to recordings of military activity taken simultaneously.

Dr. Tyack and his team of researchers have tagged Sperm, Beaked, and Pilot Whales in the Atlantic Undersea Test and Evaluation Center.

See ACOUSTIC TAG, page 5
Wide Area Surveys Detect and Characterize UXO

The detection, characterization, and remediation of sites contaminated with unexploded ordnance (UXO) is of increasing concern to Department of Defense (DoD) managers. UXO is found on closed, transferred, and transferring ranges that are subject to environmental remediation, as well as areas on active and inactive ranges that are not scheduled for closure but that require range management for sustainability. Many of these sites are located in areas tens or hundreds of thousands of acres in size.

ESTCP projects currently are developing, demonstrating, and validating airborne magnetometry systems. These systems can efficiently survey areas of potential contamination to locate former bombing targets and impact areas and have proven capable of detecting individual large ordnance in massive areas that otherwise would be too difficult or cost prohibitive to survey using vehicular or hand-held approaches. The Naval Research Lab (NRL), through ESTCP project Airborne UXO Surveys Using Magnetometer Arrays (UX-0031), has adapted and extended the vehicular Multi-Sensor Towed Array Detector System (MTADS) magnetometry technology for deployment on a helicopter platform. Oak Ridge National Laboratory (ORNL), in partnership with the Army Corps of Engineers, Huntsville, has demonstrated several generations of airborne magnetometry systems through the project Enhancement and Utilization of Airborne Magnetometry for the Detection, Characterization, and Mapping of Unexploded Ordnance (UX-0037).

ORNL has tested three generations of the boom-mounted airborne magnetometry system at the Badlands Bombing Range (BBR), South Dakota. Detection of individual ordnance has been demonstrated on calibration sites, and each generation has continued to improve system noise and navigation. The system also has been used for production surveys in ongoing cleanup projects in 2001 and 2002 at Shumaker Naval Ammunition Depot and Rocket Test Range in Arkansas, Camp Crowder in Missouri, New Boston Air Station in New Hampshire, Nomans Land Island in Massachusetts, Camp Wellfleet in Massachusetts, and Pueblos of Laguna and Isleta in New Mexico.

NRL demonstrated an airborne magnetometer system at BBR in 2001. The system was evaluated against concurrent deployment of the vehicular system on several subsections of the airborne survey. The airborne system surveyed some 1600 acres and showed reliable detection of ordnance, 105 mm and larger, on blind seeded targets. With additional surveys supported by the Air Force in the fall of 2002, the entire impact area will be characterized.

Both the NRL and ORNL airborne systems were invited to Aberdeen Proving Ground, Maryland, in July 2002 for further demonstrations against blind seeded targets that were conducted in varied terrains, including shallow water, littoral, and marsh and tidal areas. Deployments will aid the Directorate of Safety, Health and the Environment (DSHE) in characterizing areas suspected to contain UXO and/or ammunition burial pits. The results currently are being processed and analyzed.
NEW TOOLS ESTIMATE RISK FROM METAL-CONTAMINATED SOILS

Thousands of sites at Department of Defense (DoD) installations contain metal-contaminated soils, including lead, arsenic, chromium, and cadmium. SERDP researchers are investigating methods to facilitate better cleanup decisions at these sites. When evaluating a contaminated site, risk assessors estimate the risk from a number of different potential exposure pathways. For future residential or recreational land use scenarios, the ingestion of soil by children is almost always the critical human health exposure pathway. When metal contaminated soil is ingested, the default risk assessment guidelines for most metals implicitly assume that the metal is completely absorbed by the body (i.e., 100 percent bioavailable). Soils, however, often tightly bind metals, potentially reducing their bioavailability. As a result, implicitly assuming metals in soil are 100 percent bioavailable may overstate the risk posed by the soils. The generally low bioavailability of lead and arsenic in soils in mining areas has been well documented, and the bioavailability of metals in soils at DoD sites also may be lower than traditionally assumed.

The SERDP project Quantifying the Bioavailability of Toxic Metals in Soils (CU-1166) led by Dr. Philip Jardine of Oak Ridge National Laboratory, Dr. Mark Barnett of Auburn University, and Dr. Scott Fendorf of Stanford University is investigating the factors that control the bioavailability of metals in soils at DoD sites around the country and developing methods to predict soil metal bioavailability based on major soil properties. Their results have indicated that soil-metal interactions significantly reduce the leachability (bioaccessibility) of chromium and arsenic from soils. Naturally-occurring organic matter in soil, for example, can reduce chromium(VI) to chromium(III), thereby significantly reducing its bioaccessibility. To provide a better fundamental understanding of the relationship between bioaccessibility and speciation, macroscopic laboratory measurements also are being correlated with microscopic metal speciation measured with synchrotron-generated x-ray absorption spectroscopy. From this information, models are being developed that will allow risk assessors to estimate soil-metal bioavailability based on common soil properties. Recently, as illustrated above, a model developed through this research successfully predicted the bioavailability of arsenic in soils (as measured in swine feeding studies) to within an average of 10 percent based on the soil’s pH and iron oxide content. Results for arsenic recently were

See BIOAVAILABILITY, page 4
AIRBORNE MAGNETOMETRY, from page 2

Airborne magnetometry surveys represent state-of-the-art in detection and mapping for characterizing potential UXO contamination where low altitude flight is possible. For large areas, these surveys can be conducted at considerably lower cost than surveys using ground-based systems. On-going demonstrations of both the NRL and ORNL systems will continue to define the capabilities of the current airborne magnetic systems.

For further information about this technology, please contact Mr. Scott Millhouse, U.S. Army Corps of Engineers, Huntsville, Huntsville, AL, at (256) 895-1607 or via e-mail at scott.d.millhouse@hnd01.usace.army.mil or Dr. Herbert Nelson, the Naval Research Lab, Washington, D.C., at (202) 767-3686 or via e-mail at herb.nelson@nrl.navy.mil.

BIOAVAILABILITY, from page 3


Improved fundamental understanding and predictive capabilities (via computer models) of the processes that control the long-term sequestration and bioaccessibility of metals in a wide array of DoD soils will allow site managers and risk assessors to make better initial estimates of site risk. Although site-specific data always will need to be considered in final cleanup decisions, results can be used to prioritize sites and to justify site-specific bioavailability studies, thereby avoiding the unnecessary diversion of DoD funds for unwarranted site cleanup. In future SERDP-funded research, the project team will expand on its finding that certain soil chemical and physical processes can sequester metals and limit bioavailability. The researchers will investigate the strategic use of non-toxic, low-cost, commercially available soil amendments to decrease the bioaccessibility of toxic metals at sites where the natural conditions do not promote sequestration.

For further information about this research, please contact Dr. Philip Jardine, Oak Ridge National Laboratory, Oak Ridge, TN, at (865) 574-8058 or via e-mail at jardinepm@ornl.gov or Dr. Mark Barnett, Auburn University, AL, at (334) 844-6291 or via e-mail at barnettm@eng.auburn.edu.
Program Development Update

SERDP
All proposals submitted in response to the FY 2003 solicitation that have been considered for funding have been reviewed by the SERDP Scientific Advisory Board at its August, September, and October meetings. The Council met on September 30 and approved the draft Program; however, the FY 2003 Defense Appropriations Bill cuts SERDP's budget by $11 million while adding $5.1 million for specific congressional interest projects. This decrease has impacted the ability to fund all approved New Start projects. The SERDP Executive Director, working with his staff, made appropriate decisions for both New Start projects as well as continuing efforts. Principal Investigators (PI) have been notified regarding their funding expected for this coming execution year. PIs should expect to prepare Project Plans and an Execution Plan and discuss them via phone with the designated SERDP Program Manager. Projects under contract must negotiate their contracts with a government Contracting Official prior to release of funding. Expect to prepare a subcontracting plan as part of this negotiation.

With this year’s Program Plan completed, SERDP has been working on the Call for Proposals and solicitation for the FY 2004 Program. These announcements were released on November 13, 2002. Check the SERDP web site for information and details www.serdp.org/funding/funding.html.

ESTCP
In a similar fashion, the Defense Appropriations Bill decreases FY 2003 ESTCP funding by $7 million, 25 percent. The ESTCP Director has worked with his staff to prepare a streamlined 2003 Program that has received approval from the Office of the Deputy Under Secretary of Defense (I&E). Project Leads will be contacted to submit Project Plans and Obligation/Expenditure Plans as well as to set up kick-off conference calls with the appropriate ESTCP Program Manager. These plans must be submitted prior to release of funding.

For FY 2004, a solicitation and Call for Proposals should be released in the early January 2003 timeframe. Check the ESTCP web site www.estcp.org for details and updates on these announcements.

(AUTEC) in the Bahamas and have conducted sighting surveys in Onslow Bay, North Carolina, which are locations of important undersea ranges for the Navy. At AUTEC, the effort has generated an excellent record of synchronized diving and vocal behavior from two Pilot Whales among other recorded whale activities. Whales also have been tagged in the northern Mediterranean Sea and in the Gulf of Mexico. In the Mediterranean, tagged Sperm Whales have been monitored for up to 12 hours to note their activity and response to outside stimuli such as sonar, while in the Gulf of Mexico, activity was noted in response to mineral exploration impulse noises. In most cases, the whales continue on with their regular habits with or without some turning or minor maneuvering to investigate the sound source.

A recent editorial article written by Dr. Tyack for the New York Times (http://www.nytimes.com/2002/08/03/opinion/03TYAC.html) highlighted the benefit of tagging data. “Fortunately, new data collected from electronic tags that track the animals...are beginning to offer insight into their lives....” Dr. Frank Stone, Environmental Research and Development Program Manager for the Chief of Naval Operation (N45), recently commented, “The quality of Dr. Peter Tyack’s research...continues to provide critical scientific evidence for the Navy’s use in formulating policy for the protection of marine mammals. The results are critical to the Navy’s advancement of using underwater acoustics to study marine mammals when they are at distances far beyond visual observation, and when they are submerged.”

Data on behavioral reactions of deep-diving toothed whales and other cetaceans to Navy noises make it possible to estimate the impact of naval operations on sea life. The database of vocalizations from tags improves detection and species identification of passive location systems and validates passive acoustic detection and localization methods. These methods offer great promise for monitoring the abundance and distribution of marine mammals on Navy ranges and also for monitoring long-term disruption of behavior or distribution in response to active acoustic operations on the range.

For more information on this SERDP Project, please contact Dr. Peter Tyack, Woods Hole Oceanographic Institution, Woods Hole, MA, at (508) 289-2818 or via e-mail at ptyack@whoi.edu.
SERDP and ESTCP Sponsor In-Situ Air Sparging (IAS) Field Course

SERDP and ESTCP invest in novel technologies for the remediation of Department of Defense sites, and these technologies have great potential for success if implemented properly at a contaminated site. Unfortunately, many technologies that are used to remediate a site are not implemented correctly. In-Situ Air Sparging (IAS) is one technology that can be implemented incorrectly because of its complex nature, and therefore, the chance of a successful cleanup may be compromised. To assist field practitioners who might be considering IAS, SERDP and ESTCP this past summer sponsored an In-Situ Air Sparging Field Course to provide an overview of how the technology can be applied at contaminated sites to achieve optimal cleanup goals.

The IAS course was hosted at the Naval Facilities Engineering Service Center, Port Hueneme, CA, and taught by Dr. Paul Johnson from Arizona State University and Dr. Rick Johnson from the Oregon Graduate Institute who have extensive experience with the design, installation, and operation of IAS systems. Air sparging is a process through which air is injected directly into the saturated subsurface to (1) volatilize contaminants from the liquid phase to the vapor phase for treatment and/or removal in the vadose zone, and (2) biodegrade contaminants in the saturated zone via stimulation by the introduction of oxygen. Practitioners have proposed using in-situ air sparging to (1) treat contaminant source areas trapped within water-saturated and capillary zones, (2) remediate dissolved contaminant plumes, and (3) provide barriers to prevent dissolved contaminant plume migration.

During the three-day course, each student was guided through the principles and practices of implementing IAS by conducting a field study using an existing IAS plot as well as through classroom lectures. Lectures included an explanation of air distribution under different pressures and media and the application of this to the field plot. Students were asked to characterize the site and locate the contamination using a geo-probe and through inspection of soil cores. Based on these observations, students then were allowed to turn on the IAS system and regulate air flow to the areas of contamination. As the system was operating, students were instructed as to which monitoring and test techniques to use to determine the radius of influence from the point of injection. At the conclusion of the course, students understood how to implement and operate an IAS system and were able to observe a decrease in the levels of contamination at the field plot. Equally as important, the students concluded the course with an understanding of how to apply the technology to other contaminated sites.

Based on the positive feedback from participants about the value of the hands-on course, SERDP and ESTCP are planning additional IAS field courses. As these dates are scheduled, they will be posted on both the SERDP and ESTCP web sites.

For more information, contact Ms. Dorothy Cannon, Naval Facilities Engineering Service Center, Port Hueneme, CA, at (805) 982-1614 or via e-mail at cannondl@nfesc.navy.mil.

PROGRESS REPORT DATA (ie., a written summary of the quarter’s technical accomplishments, updated completion dates for milestones, and any concerns regarding technical/financial progress) for the first quarter of Government FY 2003 is due by January 15, 2003. For assistance, contact your Program Manager Assistant.

A FEDERAL CALL FOR PROPOSALS AND A BROAD AGENCY ANNOUNCEMENT SOLICITATION FOR ESTCP FY 2004 PROJECT FUNDING is expected to be released on or about January 9, 2003. Watch the ESTCP web site www.estcp.org for the latest information and schedule.

QUARTERLY REPORTS FOR THE FIRST QUARTER OF GOVERNMENT FY 2003 ARE DUE JANUARY 15, 2003. For assistance, contact your Program Manager.

NEW PUBLICATIONS ARE NOW AVAILABLE ON THE ESTCP HOME PAGE www.estcp.org.

Cost and Performance Reports:

Clean up
- Multi-Site In-Situ Air Sparging
- Tri-Service Site Characterization and Analysis Penetrometer System (SCAPS) Membrane Interface Probe

UXO
- Matched Filter Processor for Detection and Discrimination of Unexploded Ordnance
- Low-Order, Underwater Detonation


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Evaluating the Longevity and Hydraulic Performance of Permeable Reactive Barriers at Department of Defense Sites

Compliance
- Heavy Metals Analyzer
- Validation of the Low Range Differential Pressure (LRDP) Leak Detection System for Small Leaks in Bulk Fuel Tanks
- Field Validation of Real-Time Airborne Lead Analyzer
- Molecular Recognition Technology
- Removing Chromium (VI) from Wastewater by Anionic Liquid Ion Exchange (A-LIX)
- Oil/Water Emulsion and Aqueous Film Forming Foam (AFFF) Treatment Using Air-Sparged Hydrocyclone Technology

Pollution Prevention
- Sodium Hydroxide Recycling System
- Demonstration/Validation of a Zero-VOC Waterborne, Polyurethane Topcoat
- Tri-Service Dem/Val of the Pulsed Optical Energy Decoating (FLASHJET®) Process for Military Applications – Rotary Wing Evaluation

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### Calendar for SERDP and ESTCP

**NOVEMBER-DECEMBER 2002**

**NOVEMBER 13**  
The FY 2004 Core Solicitation for SERDP was released on this date

**DECEMBER 3-5**  

**JANUARY 2003**

**January 9**  
Non-Federal Pre-Proposals due in response to the SERDP FY 2004 Core Solicitation

**January 9**  
A Federal Call for Proposals and a Broad Agency Announcement for ESTCP FY 2004 Project Funding to be released on or about this date

**FEBRUARY 2003**

**January 15**  
SERDP quarterly progress reports due for the first quarter of Government FY 2003

**January 15**  
ESTCP quarterly reports due for the first quarter of Government FY 2003

**FEBRUARY 2003**

**February 4**  
Full proposals requested from qualified proposers responding to the SERDP FY 2004 Core Broad Agency Announcement (BAA) Solicitation

**RELATED CONFERENCES & EVENTS**

**January 28-30**  
FY 2003 Annual U.S. Department of Agriculture and Department of Defense Research Review in Pest Management  
National Wildlife Research Center  
Fort Collins, CO  
For more information, visit www.afpmb.org.

**February 25-27**  
5th Annual AFCEE Technology Transfer Workshop  
Sheraton Four Points Hotel  
San Antonio, TX  
For more information, visit http://www.afcee.brooks.af.mil.

**March 17-20**  
13th Annual West Coast Conference on Contaminated Soils, Sediments, and Water  
Marriott Mission Valley  
San Diego, CA  
For more information, visit http://www.aehs.com/conferences/westcoast/index.htm.

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