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Marine Corps Major General and Other Distinguished Speakers Emphasize Role of Partnerships in Tackling Environmental Issues and Sustaining Mission Readiness

Project-of-the-Year Awards Showcase Innovative Science and Technology

After serving 34 years in the Marine Corps and working closely for nearly a decade with environmental activists and regulators, Major General Michael Lehnert doesn't mince words while discussing the Department of Defense's (DoD) duty to protect the environment as an integral part of maintaining national security.

"Yes, Marine Corps bases are not state parks and they are not laboratories," said Gen. Lehnert, Commanding General, Marine Corps Installations West. "Our mission is military readiness, to provide training and deployment platforms so our forces can hone warfighting skills.

"However, environmental stewardship and military training responsibilities do not have to be at odds with one another. We do have compatible goals," he said. "I believe in forging partnerships that tap into and leverage resources, knowledge, and support to enable and sustain our military mission requirements."

Gen. Lehnert shared these views at the opening Plenary Session of the Partners in Environmental Technology Technical Symposium & Workshop, hosted by SERDP and ESTCP at the Marriott Wardman Park Hotel in Washington, D.C., December 4-6, 2007. More than 900 environmental professionals from the military, academia, private industry, and the regulatory community participated in this event.

The military now recognizes the benefits of cooperating with environmental organizations

in efforts as varied as preserving open spaces on military installations; protecting the land, water, and air in and around bases; and developing and testing alternative energy sources, Gen. Lehnert remarked.

Gen. Lehnert is in a unique position to make these observations. A much-decorated combat veteran, Gen. Lehnert is, by all accounts, the only high-ranking military officer to be the subject of a laudatory profile in the Sierra

Club's magazine.

"The military, regulatory agencies, and environmental interest groups have matured considerably in our attitudes toward one another," he said. "We've discovered we have mutual goals, compatible interests, and that real communication and progress are possible."

Gen. Lehnert urged the audience of environmental professionals to work together

to develop and test innovative technologies aimed at protecting the environment and addressing global climate change while at the same time enabling the military to continue to train and sustain the bases and installations necessary to maintain national security.

"Future generations will neither be well served nor forgiving if we don't get this right because, after all, a country worth defending is a country worth preserving," said Gen. Lehnert.

Opportunities for cooperation and collaboration within DoD, across all federal government agencies, and with private industry, nonprofit organizations, academia, and regulators to address environmental issues are numerous, said Mr. Alex Beehler, Assistant Deputy Under Secretary of Defense



"A country worth defending is a country worth preserving," stressed Major General Lehnert during his Plenary Session address.

(Environment, Safety and Occupational Health) during his Plenary Session address.

In working to achieve sustainability, Mr. Beehler urged the audience to think beyond their own area of expertise when designing projects to make the most of resources available across the board.

“Go out and think broadly, think creatively,” Mr. Beehler said. “You have at this point the greatest support for your efforts and more opportunity to have a huge impact in enhancing the environment and energy than ever before.”

The need for environmental professionals from all sectors to collaborate through programs such as SERDP and ESTCP is more urgent than ever before, considering that global climate change is occurring at a faster rate than previously anticipated, said Plenary Session speaker Dr. Thomas Homer-Dixon, Professor and George Ignatieff Chair of Peace and Conflict Studies, Trudeau Centre for Peace and Conflict Studies, University of Toronto.

Throughout his remarks, Dr. Homer-Dixon detailed a series of alarming environmental findings. For example, he noted that several years ago, the United Nations Intergovernmental Panel on Climate Change (IPCC) had projected the disappearance of Arctic sea ice by around the year 2070. Then in 2006, basing their projections on newer data, many scientists estimated the disappearance instead would take place around 2040. Now, with data from the summer of 2007 and new modeling, a consensus is building that the Arctic ice could disappear by the year 2020, and quite possibly as early as 2013.

“Climate change is considerably more grave than widely recognized,” said Dr. Homer-Dixon. “There is enormous need for social and technological innovation, especially on

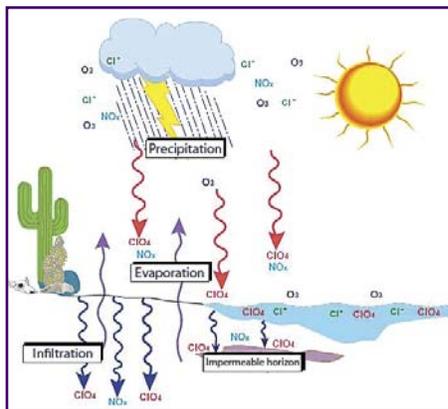
energy issues, to reduce emissions. A significant fraction of this innovation is going to originate in public and private partnerships in the defense sector.”

At the conclusion of the Plenary Session, Mr. Bradley Smith, Executive Director of SERDP, and Dr. Jeffrey Marqusee, Director of ESTCP, presented four SERDP and two ESTCP Project-of-the-Year Awards that recognize successful research and technology developments with significant benefits to DoD. Recipients of this prestigious honor and descriptions of their award-winning projects follow.

SERDP Project of the Year, Environmental Restoration. Dr. Gregory Harvey, U.S. Air Force, Aeronautical Systems Center Engineering Directorate, Wright-Patterson Air Force Base, Ohio—*Identification and Characterization of Natural Sources of Perchlorate*. Because the emerging contaminant perchlorate is a primary component of fuel for rockets and missiles, it has been assumed that most perchlorate in the environment must come from military sources. While scientists have been aware that perchlorate also occurs naturally in the environment, the sources and extent of its occurrence have not been well documented. This groundbreaking project, conducted by Dr. Harvey in collaboration with colleagues at Texas Tech University and the U.S. Geological Survey, for the

first time provides a conceptual picture with supporting data of naturally occurring perchlorate, mechanisms of its production, and how it accumulates and moves in the environment. The results show that the amount of perchlorate produced naturally in the atmosphere and the amount that accumulates in soils in semi-arid and arid environments is much more widespread than previously believed. “This work will have a profound impact in the near term on how the Department of Defense manages this issue by allowing us to understand the source of perchlorate on and near our facilities,” said Dr. Marqusee. “But perhaps more importantly, it will have a big impact on our nation as a whole, as it will enable us to assess options for managing the risks from perchlorate based on a scientific foundation.”

SERDP Project of the Year, Munitions Management. Dr. Yaoguo Li, Colorado School of Mines, Department of Geophysics, Golden, Colorado—*Improving Detection and Discrimination of UXO in Magnetic Environments*. The military trains with live munitions to maintain readiness at all times; however, not all munitions detonate as designed. Cleaning up military sites suspected of containing munitions that have been armed and fired yet remain unexploded is one of the most pressing environmental problems facing DoD, with a projected cost in the tens of billions of dollars. It is particularly difficult to distinguish unexploded ordnance (UXO) from magnetic rocks and soils, especially in complex geological settings found throughout the United States. Building on prior SERDP Exploratory Development (SEED) research, Dr. Li developed a processing technique that screens



Schematic diagram illustrates naturally occurring perchlorate formation in the environment.

See SYMPOSIUM, page 6

Workshops Identify High-Priority Science and Technology Needs SERDP and ESTCP Respond with Targeted Solicitations

In 2007, the two workshops highlighted below identified research, development, test, and evaluation (RDT&E) needs related to the characterization and management of military munitions in underwater environments as well as munitions constituents on operational ranges. They are the latest in a series of workshops sponsored by SERDP and ESTCP over the past 10 years that have proven to be a unique and invaluable forum for identifying DoD's high-priority environmental needs. With participation by a variety of renowned experts providing diverse viewpoints from the military services, academia, and industry, each topical workshop (1) examines the current state of the science and engineering, (2) identifies gaps in knowledge and technology, and (3) prioritizes those gaps against DoD needs to determine where investments in RDT&E could have the greatest impact on DoD's ability to address its environmental requirements. SERDP and ESTCP use this proven approach to develop solicitations for proposals and seek innovative solutions to DoD's high-priority environmental needs. Results of these 2007 workshops already are impacting current and future SERDP and ESTCP investment decisions.

SERDP and ESTCP Workshop on Technology Needs for the Characterization, Management, and Remediation of Military Munitions in Underwater Environments

July 31 – August 1, 2007 ♦ San Diego, California

Participants

More than 60 representatives from the Office of the Secretary of Defense (OSD); the Army and Navy; EPA; the National Oceanic and Atmospheric Administration; the Woods Hole Oceanographic Institution; the Association for Unmanned Vehicles; academia (Florida Atlantic University, University of Miami, University of New Hampshire, University of Washington, and Washington State University); and private industry (AMTI, BAE Systems, Battelle Memorial Institute, Bluefin Robotics Corporation, C&C Technologies, Inc., Deep Ocean Exploration and Research, Geometrics, Inc., hydroGEOPHYSICS, Inc., International Submarine Engineering, Ltd., Marine Magnetics, Multimax, Inc., NAEVA Geophysics, Oceanering International, Inc., SAIC, and Tetra Tech EC, Inc.)

DoD Need

As a result of past military training and weapons testing activities, munitions are present at thousands of current and former DoD sites encompassing millions of acres. Many active and former military installations have ranges and training areas that include adjacent water environments such as ponds, lakes, rivers, estuaries, and coastal ocean areas. Modern geophysical surveying techniques can be used effectively to characterize sites potentially contaminated with munitions on dry land.

See [UNDERWATER WORKSHOP](#), page 4

SERDP and ESTCP Technical Exchange Meeting on DoD Operational Range Assessment and Management Approaches

August 7 – 8, 2007 ♦ Annapolis, Maryland

Participants

Seventy-five representatives from OSD; the Air Force, Army, Navy, and Marine Corps; the U.S. Army Corps of Engineers; Defence R&D Canada-Valcartier; the Department of Energy; academia (University of Washington and The University of Iowa); and private industry (Booz Allen Hamilton, EA Engineering, Science, and Technology, Malcolm Pirnie, Inc., ManTech-SRS, SAIC, Select Engineering Services, Shaw Environmental, Inc., and Weston Solutions)

DoD Need

The sustainability of DoD's operational ranges is crucial to maintaining the readiness of the military forces and developing and testing improved weapons systems. DoD policy states that the design and use of operational ranges and the munitions used on them must minimize potential harmful environmental impacts. Concern over the release of munitions constituents (MC) on ranges and their potential to migrate to off-range areas is increasing, however, and endangers the long-term sustainability of ranges. Assessment programs are being implemented across the Services although mitigation and management approaches largely are in the developmental stage. There is a need for sound science and effective tools to assess and manage operational ranges in a manner that reduces risk to human health and the environment.

See [RANGE WORKSHOP](#), page 4

UNDERWATER WORKSHOP, from page 3

However, the environment in underwater sites restricts access to and may significantly impact the performance of established and emerging characterization technologies. Environmental concerns and safety considerations often restrict the underwater use of common munitions recovery and demolition technologies.

Objectives

The objectives were to identify gaps in capabilities that could be addressed through integration and demonstration of systems based on existing technologies and gaps in understanding that must be addressed by basic and applied research in phenomenology, sensor development, signal processing, and supporting technologies.

Format

The workshop opened with presentations summarizing background papers on underwater munitions sites and environments, lessons learned from terrestrial munitions response experience, current underwater surveys for other applications, and potentially applicable technologies. Participants then were divided into smaller working groups to address specific questions regarding the state of the science and to develop and prioritize key research and demonstration needs. In the first breakout session, groups were divided by survey objective—wide area assessment, detailed surveys, and reacquisition and recovery. A second breakout session was organized based on sensor technologies. The entire group participated in the final discussions and in the selection of key issues and critical and high-priority research and demonstration needs.

Results

In addition to specific RDT&E needs, which are identified and prioritized in the final report (see Products section, page 14), the following overarching recommendations emerged:

Develop a prioritized survey of the underwater site types and corresponding environmental conditions.

An assessment of the marine sites containing military munitions would guide technology development for survey and remediation.

Establish a test bed for evaluation of sensor technologies. There is a need to develop a site that can be used to determine the effectiveness of various sensor technologies for underwater surveys of military munitions. The test bed would include a range of munitions buried at various depths.

Characterize the acoustic response of munitions and typical bottom clutter. Research is needed to develop a better understanding of the munitions detection capabilities of both well-established and emerging sonar

See UNDERWATER WORKSHOP, page 14

RANGE WORKSHOP, from page 3

Objectives

The objectives were to (1) inform representatives from the range management and assessment communities of applicable technologies developed by SERDP, ESTCP, and the Army Environmental Quality Technology Program and (2) identify technology needs of the range management and assessment community that could be addressed through additional research and development efforts supported by SERDP and ESTCP.

Format

Overviews of the Service's operational range assessment programs, lessons learned from the Military Munitions Response Program, and the state of the science in assessment and management approaches were followed by two breakout sessions on technical issues associated with current range assessment practices and technology needs in the areas of characterization; risk, modeling, and assessment; and mitigation and management. Poster sessions provided additional details on components of the range assessment programs, highlighting specific case studies, and on ongoing research and demonstrations. The entire group participated in the final discussion and selection of the critical and high-priority research and demonstration needs.

Results

In addition to specific RDT&E needs, which are identified and prioritized in the final report (see Products section, page 14), the following overarching recommendations emerged:

Obtain quantitative data to aid in MC source term identification and quantification. This key data gap limits the utility of predictive modeling to determine how and how quickly MCs will migrate in the environment.

Transition and implement improved soil sampling strategies. Much effort has been placed on developing improved soil sampling strategies; however, additional outreach is needed to transition such strategies to the user community for implementation.

Improve tools and methodologies to monitor surface water bodies and groundwater. Research is needed to develop characterization approaches and protocols for effectively assessing the risk posed by MCs in open water bodies. Additionally, effort is needed to develop cost-effective sentinel systems for the in-situ, low-level detection of MCs in groundwater.

Improve understanding of fate and transport parameters for MCs under varying environmental and soil conditions. An improved understanding of the dissolution and partitioning between the soil and aqueous phases is needed in addition to additional research on the

See RANGE WORKSHOP, page 14

Department of Defense Partners with NOAA to Study Marine Mammal Response to Underwater Sound

SERDP-Developed Recording Tag Is a Key Component of Controlled Experiments

In a groundbreaking effort that will gather critically needed data to determine how marine mammals respond to sound, an international research team is using underwater sound exposures and state-of-the-art tracking technology on deep-diving whales to conduct a controlled behavioral response study.

These complex experiments are being conducted at the U.S. Navy's Atlantic Undersea Test and Evaluation Center (AUTEK), a technologically sophisticated acoustic range in a deep oceanic trench in the Bahamas. The first phase of field work ran through September 2007, with further experiments to be conducted at set intervals over the next two years.

The behavioral response project marks the first time scientists are using controlled experiments within the natural habitat of marine mammals to study the responses of beaked whales to natural and man-made sound, including mid-frequency active sonar signals used in Navy training exercises.

The research is being conducted with support from a number of sources, including the National Oceanic and Atmospheric Administration (NOAA), the U.S. Navy, and SERDP. The scientists conducting the study are using revolutionary technology developed through a SERDP-sponsored project: a digital acoustic recording tag (DTAG) that enables scientists to monitor typical behavior of deep-diving marine mammals as well as their underwater responses to noise.

Determining how marine mammals respond to sound is of particular concern to the Department of Defense, scientists, regulatory agencies, and environmental groups because it is speculated that one potential cause of marine mammal strandings may be attributable to the timing and location of naval exercises involving sonar

transmissions. An urgent need exists to discover the causes of such strandings and to define safe exposure criteria.

"It's essential to obtain empirical data regarding the effects of sound on marine mammals to better manage and ensure the conservation of these animals while at the same time enabling the Navy to conduct training exercises needed to carry out its

mission," says Mr. Bradley Smith, SERDP's Executive Director.

The researchers leading the behavioral response study at AUTEK are using adaptive experimental procedures and strict shut-down protocols to ensure the safety of the animals involved in the project.

Among the researchers are principal investigator Dr. Brandon Southall, Director for NOAA's Ocean Acoustics Program; chief scientist Dr. Ian Boyd, Director of the Sea Mammal Research Unit, University of St. Andrews, St. Andrews, Scotland; and co-investigator Dr. Peter Tyack, Senior Scientist, Woods Hole Oceanographic Institution (WHOI).

The animals under scrutiny in this project are beaked whales, a suite of species that in the past has been difficult to study because of its deep-diving habits. With SERDP support, Dr. Tyack and WHOI research engineer Dr. Mark Johnson led the team that in recent years developed DTAG. SERDP also supported the field work that developed the capability of tagging beaked whales.

"This controlled study is possible because of the development of DTAG, a



With SERDP support, WHOI researchers developed a novel digital acoustic recording tag (DTAG) for monitoring the behavior of deep-diving marine mammals. As illustrated here, DTAG is attached with suction cups and falls off naturally after approximately 20 hours. By recording the stimulus received, clicks made, location, and three-dimensional orientation of the animal, DTAG serves as a key enabling technology for the groundbreaking behavioral response study now under way.

truly revolutionary technology that for the first time in history has given scientists the ability to understand, in great detail, what whales are doing once they dive," says Mr. Smith.

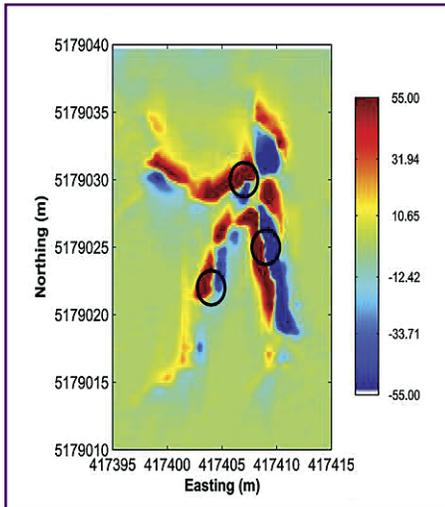
The DTAG, about the size of a sandal and attached to the whale with suction cups, can record both the stimulus received and every click potentially made by the tagged whale (whether in response to a stimulus or not), along with the location of the tagged whale and its three-dimensional orientation in the water. In 2006, Dr. Tyack and his team reported in a study published in *The Journal of Experimental Biology* that DTAG recorded beaked whales diving nearly 1,900 meters, or 6,230 feet, below the ocean surface, the deepest confirmed dives reported for any air-breathing animal.

The controlled exposure experiments being conducted for the behavioral response study at AUTEK are made possible by Dr. Tyack's previous research and his development of DTAG. In the project's first phase, researchers used a low-power, mid-frequency sound source deployed from a research vessel in an area where whales were likely to

See MARINE MAMMALS, page 6

SYMPOSIUM, from page 2

out this geologic clutter and is based on a fundamental understanding of the



Magnetics Data with Emplaced UXO

origin of magnetic soils and their effects on electromagnetic and magnetic data. “These techniques will allow DoD to reduce risks associated with these sites, improve the ability to detect UXO, and reduce the costs to discriminate UXO from natural geology,” said Dr. Marqusee.

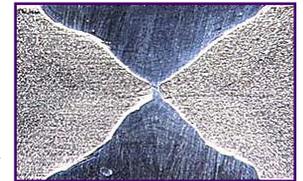
SERDP Project of the Year, Sustainable Infrastructure. Dr. Patrick Mulholland, Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, Tennessee—*Riparian Ecosystem Management: Impacts, Restoration and*

Enhancement Strategies. On many military ranges, training involves operating large vehicles such as tanks on terrain near riparian ecosystems. Such training, over time, often results in vegetation loss and severe erosion from upland areas, which results in sediment buildup in these streams and which eventually can affect water quality downstream and negatively impact associated riparian and stream ecosystems. Dr. Mulholland’s project demonstrates the effectiveness of using low-cost restoration strategies—physical stabilization and revegetation as well as the addition of woody debris at strategic points—to improve water quality and stream biodiversity. “This project provides DoD range managers with additional tools for controlling sedimentation and improving stream quality, major issues they face regularly,” said Mr. Smith.



Impacts of Soil Erosion

SERDP Project of the Year, Weapons Systems and Platforms. Dr. Gerald Frankel, The Ohio State University, Department of Materials Science and Engineering, Columbus, Ohio—*Development of Chrome-Free Welding Consumables for Stainless Steels.* DoD personnel perform a significant amount of welding for the manufacture and repair of stainless steel parts and structures in thousands of ships and tanks. In



Welding Interface

many cases, this welding must be conducted in confined spaces.

Welding fumes generated using conventional stainless steel welding rods, or consumables, are particularly harmful because they contain hexavalent chromium, a known carcinogen. The ability to control and capture these fumes is difficult, and the common method of protecting workers by putting them in cumbersome protective gear is impractical in these cramped settings. Building on prior SERDP-funded research, Dr. Frankel and his team developed a novel chromium-free welding consumable. “This project

See SYMPOSIUM, page 7

MARINE MAMMALS, from page 5

have been habituated to these sounds to some extent. By conducting this work on an acoustic range where a grid of hydrophones are laid out along the ocean floor, combined with the DTAGs attached to the whales, the research team can closely track how the animals respond to the different natural and man-made sounds.

In each subsequent phase of the project, researchers plan to increase, in

stages, the sound exposure, while monitoring at all times the animals’ responses to prevent any potentially harmful effects.

The project involves extensive coordination among marine biologists and bioacousticians, all of whom are responsible for different components of the study, including whale tagging, visual observation, passive acoustic monitoring, focal follows (following

individual whales for extended periods), acoustic propagation modeling (computer simulation of how the sound moves from the source through the water), and data collection and analysis. For an overview of the results from the first field season, please refer to the Cruise Report available at www.nmfs.noaa.gov/pr/pdfs/acoustics/brs07_report.pdf.

protects the workforce while still meeting the mechanical and corrosion performance requirements of the current consumables used to weld stainless steels,” said Mr. Smith.

ESTCP Project of the Year. Mr. Antonio Palazzo, U.S. Army Corps of Engineers-Engineer Research and Development Center-Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire—*Implementation and Commercialization of New Germplasms for Use on Military Ranges*. Military training installations contain some of the most intensively used lands in the United States, and multi-ton tank and other vehicle traffic can be destructive to vegetation. Most grasses on military training lands cannot stand up to the wear and tear of military training.



New grasses are able to withstand intensive military training on installations.

When these grasses are destroyed or damaged, the landscape is significantly impacted, creating environmental problems such as erosion that can disrupt troop training. In this project, Mr. Palazzo and colleagues from the U.S. Department of Agriculture demonstrated, using standard horticulture breeding techniques, that it is possible to develop plants that can withstand the rigors of military training—essentially, tank-resistant grass. Mr. Palazzo conducted real-world demonstrations to prove that a commercially viable seed can be grown and maintained. “It’s important to

recognize Tony Palazzo and his team not only for their science and research but also for their effort to translate it into real tools our land managers can use today,” said Dr. Marqusee. “This project allows DoD to more cost-effectively sustain and improve the environment on our ranges while continuing to conduct realistic training.”

ESTCP Project of the Year. Dr. Steven Larson, U.S. Army Corps of Engineers-Engineer Research and Development Center-Environmental Laboratory, Vicksburg, Mississippi—*Grenade Range Management Using Lime for Dual Role of Metals Immobilization and Explosives Transformation*. Grenade ranges are among the most heavily used training areas in the military. These ranges consist of large sand pits surrounded by cement walls into which troops practice throwing live grenades. If the grenades fail to fully explode, munitions constituents such as RDX may remain in the soil. Over time, large amounts of RDX can accumulate in the soil and eventually contaminate the groundwater on the military installation and potentially in surrounding communities. Dr. Larson and his colleagues successfully demonstrated that tilling agricultural lime into the sandy soil of hand grenade ranges increases the pH level in the soil, which leads to the immobilization of heavy metals and the degradation of explosive compounds such as RDX. This



Applying lime to immobilize and degrade contaminants on a grenade range.

proactive approach should become standard best management practice for grenade ranges across DoD in the future. “Bags of agricultural lime, like those found at any neighborhood gardening center, hold the key to preventing groundwater contamination at hundreds of military bases across the nation, thereby avoiding disruptions in troop training and saving DoD millions of dollars in future cleanup costs,” said Dr. Marqusee.

Technical Program and Short Courses

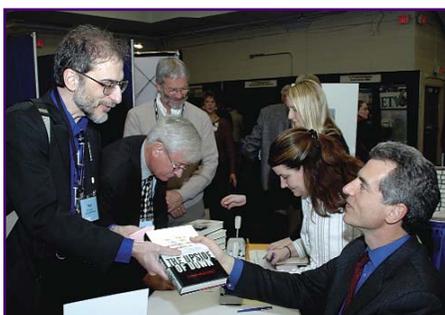
The Plenary Session set the stage for the Symposium & Workshop’s comprehensive technical program that focused on 12 environmental topics of high priority to DoD as well as an exhibit hall of more than 400 poster presentations and exhibit booths showcasing technologies and scientific advancements from a variety of environmental research programs. New this year, SERDP and ESTCP also hosted a forum on Emerging Issues in Ecosystem Science and offered (at no charge) two post-Symposium short courses—Recent Advances in the Management and Remediation of DNAPL Source Zones and Method 8330B and Multi-Increment Sampling for Energetic Residues on Military Ranges. These various venues offered attendees valuable opportunities to exchange information and discuss opportunities for technology transfer and partnerships.

Additional information about the 2007 Symposium & Workshop, including the Project-of-the-Year Awards as well as preliminary information about the 2008 Symposium & Workshop scheduled to be held December 2-4, 2008, in Washington, D.C., is available at www.serdp-estcp.org/symposium. In early June, the web site will provide details on the Call for Poster Abstracts for the 2008 Symposium & Workshop. Abstracts will be due in late July. ◆

PLENARY SESSION



During the opening Plenary Session, three distinguished speakers addressed environmental issues of concern to DoD and encouraged participants to seek innovative approaches to help DoD achieve sustainability. Clockwise from top left: Major General Michael Lehnert (far left), Commanding General, Marine Corps Installations West and Mr. Alex Beehler (far right), Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health) joined SERDP Executive Director Mr. Bradley Smith (center left) and ESTCP Director Dr. Jeffrey Marqusee in the Exhibit Hall; the Plenary Session drew attendees from government, academia, and industry; Mr. Beehler; Major General Lehnert; Dr. Thomas Homer-Dixon, Professor and George Ignatieff Chair of Peace and Conflict Studies, Trudeau Centre for Peace and Conflict Studies, University of Toronto; and Dr. Homer-Dixon signed copies of his book *The Upside of Down* for attendees.




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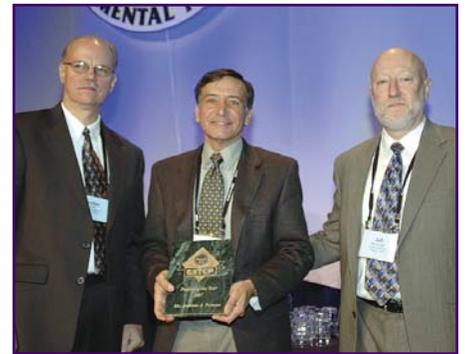


Stimulating presentations on 12 environmental topics of high-priority to DoD encouraged audience participation and follow-on discussion during the technical sessions. Working sessions, forums, and short courses offered additional venues for attendees to exchange information.



TECHNICAL SESSIONS

PROJECT-OF-THE-YEAR AWARDS



Clockwise from top left: Dr. Yaoguo Li (center) and members of his research team were recognized with the SERDP Munitions Management Project-of-the-Year Award; SERDP Sustainable Infrastructure Award recipient Dr. Patrick Mulholland showcased his award-winning research during a poster session; SERDP Executive Director Mr. Bradley Smith (left) and ESTCP Director Dr. Jeffrey Marqusee (right) congratulated Mr. Antonio Palazzo, recipient of an ESTCP Award; Dr. Steven Larson (center, front row) shared an ESTCP Award with his team; Dr. Gregory Harvey (center), with members of his team, received the SERDP Environmental Restoration Award; and SERDP Weapons Systems and Platforms Award recipient Dr. Gerald Frankel (right) and a team member presented their award-winning technology in the Exhibit Hall.



TECHNOLOGY TECHNICAL SYMPOSIUM & WORKSHOP

Washington, D.C. • December 4-6, 2007



The record-breaking number of posters and booths in the Exhibit Hall fostered interactions focused on sharing information and developing partnerships for future collaboration. Numerous events within the Exhibit Hall provided attendees an excellent opportunity to network with the more than 900 environmental professionals.



EXHIBIT HALL NETWORKING

Photos by Craig Kellstrom

SERDP and ESTCP Award FY 2008

Throughout 2008, new initiatives in all SERDP and ESTCP focus areas

SERDP and ESTCP initiatives for **Weapons Systems and Platforms** focus on characterizing and reducing the environmental impact of producing, maintaining, and using Department of Defense weapons systems. Researchers funded by SERDP in 2008 are developing environmentally friendly coatings for high-strength fasteners, investigating the fundamental science of how nonchromate inhibitors function, developing self-remediating submunitions and environmentally benign pyrotechnic casings, and improving the understanding of volatile particulate matter formation in aircraft. ESTCP investigators are demonstrating innovative ultraviolet-curable coatings, advanced treatment systems for shipboard wastewater, biosynthetic pathways for producing energetic materials, and alternatives to depleted uranium in anti-armor penetrators. Results from these initiatives will provide DoD with several benefits, including a reduction in hazardous waste from certain industrial and maintenance processes, increased performance of targeted weapons systems, cost savings from replacing environmentally harmful substances, and compliance with more stringent environmental regulations.

SERDP Research

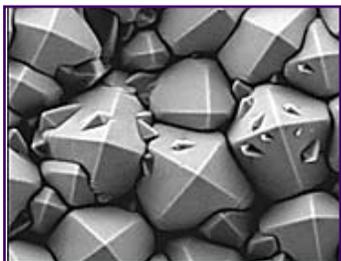
Directed Vapor Deposition of a Cadmium Replacement Coating for High Strength Fasteners (WP-1615)

Principal Investigator: Adam Goff/Luna Innovations, Inc.

This project will investigate a directed vapor deposition process to deposit zinc-nickel-cobalt ternary alloy coatings onto high-strength steel fasteners as a replacement for cadmium plating. This process will improve fastener corrosion performance, reduce the risk of in-service component hydrogen embrittlement, extend the service life of protected components, and offer competitive production throughput as compared to traditional fastener cadmium plating production lines.

Ultra-High Efficiency/Low-Hydrogen Embrittlement Nanostructured Zinc-Based Electrodeposits as Environmentally Benign Cadmium-Replacement Coatings for High-Strength Fasteners (WP-1616)

Principal Investigator: Jonathan McCrea/Integran Technologies, Inc.



The objective of this project is to develop and optimize an advanced nanoscale zinc-based coating by modifying environmentally benign conventional electroplating techniques to yield a coating process that meets or exceeds the overall performance and life-cycle cost of existing cadmium electroplating and that is

applicable to coating high-strength steel fasteners prone to hydrogen embrittlement. This approach will allow existing DoD cadmium plating infrastructure to be used and reduce cadmium use in rework, maintenance, and manufacturing facilities.

Environmentally Friendly Anticorrosion Coatings for High Strength Fasteners (WP-1617)

Principal Investigator: Matt Scott/PPG Industries, Inc.

This project seeks to provide DoD with an environmentally benign, multi-layer, high-strength protective coating system that includes a sacrificial metal base

coat and an organic electrocoat topcoat technology to eliminate the need for cadmium or chromate coatings on high-strength fasteners. Elimination of hazardous materials currently used for high-strength fasteners will substantially improve the life-cycle costs as well as environmental and occupational health issues associated with the manufacture and maintenance of DoD weapons systems.



Corrosion Protection Mechanisms of Rare-Earth Compounds Based on Cerium and Praseodymium (WP-1618)

Principal Investigator: William Fahrenholtz/University of Missouri-Rolla



The objective of this project is to investigate the mechanisms by which rare-earth compounds inhibit corrosion of metallic substrates. Results will include an improved understanding of the phase stability of praseodymium compounds, analytical and electrochemical characterization of

rare earth-based coating performance, and mechanistic models for corrosion protection.

Morphology and Mechanism of Benign Inhibitors (WP-1619)

Principal Investigator: Dale Schaefer/University of Cincinnati

This project seeks to improve understanding of the mechanism of corrosion inhibition by oxide, phosphate, and organic conversion coatings and pigments by determining species distribution at the interface of inhibited aluminum in a water environment using a neutron reflectometer. Increased knowledge of corrosion mechanisms will facilitate use of nonchromated inhibitors.

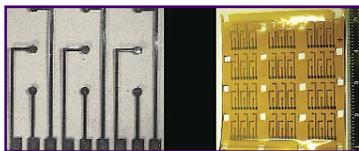
Initiatives for Weapons Systems and Platforms

will be highlighted. Featured here are Weapons Systems and Platforms efforts.

Scientific Understanding of Non-Chromated Corrosion Inhibitors' Function (WP-1620)

Principal Investigator: Gerald Frankel/The Ohio State University

The objective of this project is to develop an improved scientific understanding of the function of nonchromated corrosion inhibitors by evaluating the leading protective coating system



components and exploring the crosscutting, underlying fundamental issues of nonchromated corrosion inhibition, advances relevant to many if not all nonchromate technologies.

Scientific Understanding of the Mechanisms of Non-Chromate Corrosion Inhibitors (WP-1621)

Principal Investigator: Marta Jakab/Southwest Research Institute

This project will improve understanding of the mechanism of selected alternative inhibitors under realistic metallurgical and environmental conditions to facilitate the development of nonchromate inhibitor systems with an effectiveness comparable to that of chromates. Detailed knowledge of the mechanism of the inhibitors will enable a science-based approach for selecting optimum combinations to achieve the corrosion protection required by a specific application.

Rapidly Degradable Pyrotechnic System (WP-1622)

Principal Investigator: Vladimir Gilman/Infoscitex Corporation

The objective of this project is to develop a material system for producing a high-strength, noncorroding, highly inert, environmentally safe, extended/indefinite shelf life pyrotechnic housing/casing that also can be readily degraded on demand using specially tailored and safe enzymes. This material system will reduce the release of hazardous materials into the environment from discharged pyrotechnic assemblies and reduce cleanup costs of training grounds.

Metal Alloy Additives as Agents for Munitions Self-Remediation (WP-1623)

Principal Investigator: Christian McGrath/U.S. Army Corps of Engineers-Engineer Research and Development Center-Environmental Laboratory

This proof-of-principle project will identify effective additives to munitions that will initiate the degradation or transformation of compounds of concern only upon exposure to the environment. Self-remediation additives would ameliorate any ecological and human health risks associated with crystalline munitions released into the environment from low-order or failed detonation.

Cyclic Dinitroureas as Self-Remediating Munition Charges (WP-1624)

Principal Investigator: Robert Chapman/Naval Air Warfare Center, Weapons Division

The objective of this project is to ascertain the suitability of certain explosive cyclic dinitrourea derivatives as self-remediating munition or submunition fills in weapons. Safety and environmental hazards caused by unexploded ordnance and low-order detonations can be alleviated by adopting alternative

munition and/or submunition fills that are self-remediating in the environment as well as potentially superior in performance to existing fill formulations.

Measurement and Modeling of Volatile Particle Emissions from Military Aircraft (WP-1626)

Principal Investigator: Allen Robinson/Carnegie Mellon University

Many DoD facilities are located in areas designated as nonattainment with respect to National Ambient Air Quality Standards, but the impact of emissions from these facilities on local and regional air quality is not well understood. This project will obtain a fundamental understanding of volatile particulate matter (PM) emissions from military aircraft and develop modeling tools that will assist DoD in accurately and cost-effectively assessing the impact of volatile PM emissions.

Development and Application of Novel Sampling Methodologies for Study of Volatile Particulate Matter in Military Aircraft Emissions (WP-1627)

Principal Investigator: Meng-Dawn Cheng/Oak Ridge National Laboratory



This project will characterize the formation and transformation of volatile particles in military aircraft emissions using novel sampling methodologies. Development and testing of a dilution tunnel and thermomoder-detection technology will enable precision measurement of volatile and nonvolatile particulates in aircraft exhaust emissions.

Extreme Light Diagnostics for Measuring Total Particulate Emissions (WP-1628)

Principal Investigator: Mel Roquemore/Air Force Research Laboratory

The objective of this project is to evaluate solid and volatile aerosol particulates in controlled, simulated turbine-engine plume environments. An in-situ diagnostic technique that can be used to obtain time and spatially resolved measurements of total mass, composition, and number densities of solid and aerosol particles will provide the type of data needed to understand and model the formation, growth, and impact of these particles on the environment.

See FY 2008 WP INITIATIVES, page 12

FY 2008 Weapons Systems and Platforms Initiatives (continued)

ESTCP Demonstrations

Ultraviolet-Curable Powder Coatings (WP-0801)

Principal Investigator: Corey Bliss/Air Force Research Laboratory

This project will demonstrate, validate, and implement an ultraviolet (UV)-cure powder coating (UVPC) on DoD depot production hardware to replace liquid-based organic coatings. An existing commercial-off-the-shelf (COTS) ultraviolet-curable powder and a commercially available robotic curing station will be utilized. Significant energy, hazardous waste, and labor reduction can be realized at DoD facilities using UVPCs.



Demonstration of Advanced Oxidation Treatment of Shipboard Blackwater and Graywater (WP-0802)

Principal Investigator: Tina Lerke/Naval Surface Warfare Center, Carderock Division



The objectives of this project are to (1) demonstrate that advanced oxidation technology is capable of handling DoD vessel wastewater while meeting current and possible future treatment requirements and (2) evaluate this type

of system installation and operation in a realistic shipboard environment. Using shipboard treatment rather than a holding tank will increase mission flexibility, reduce or eliminate disposal costs, and reduce security risks in foreign ports.

Biosynthetic Manufacture of Energetic Precursors (WP-0803)

Principal Investigator: Jerry Salan/Naval Surface Warfare Center, Indian Head

This project will establish environmentally benign, microbial syntheses of 1,2,4-butanetriol (BT) and phloroglucinol (PG), precursors to manufacturing the energetic ingredients 1,2,4-butanetriol trinitrate (BTTN) and 1,3,5-triamino-2,4,6-trinitrobenzene (TATB). Demonstration and validation of these manufacturing routes will provide a domestic source of BT and PG that supports long-term, cost-effective production of BTTN and TATB.

Ultraviolet-Curable Coatings for Aerospace Applications (WP-0804)

Principal Investigator: Jerome Jenkins/Hill Air Force Base

The objective of this project is to demonstrate, validate, and implement COTS UV-curable coatings as an alternative to hazardous and long cure time coatings currently used on aerospace equipment. Implementing UV-curable coatings at DoD facilities will increase productivity and lead to significant environmental, occupational, safety, and health benefits.

Demonstration of Tungsten Nanocomposite Alternatives to Depleted Uranium in Anti-Armor Penetrators (WP-0805)

Principal Investigator: Lee Magness/Army Research Laboratory



This project will demonstrate the materials and processing technologies needed to produce tungsten nanocomposite anti-armor penetrators that display superior penetration performance relative to conventional, tungsten-heavy alloy penetrators while, at the same time, eliminating matrix alloying elements that are known or suspected to be toxic. Successful demonstration of a material that can replace depleted uranium (DU) will allow DoD to address the economic, environmental, and health issues inherent with using DU materials.

F ♦ A ♦ Q

Frequently Asked Question

SUBJECT: SERDP'S INVESTMENT STRATEGY

Q: How does SERDP identify environmental science and technology research opportunities to meet Defense requirements?

A: SERDP is a "requirements driven" program that responds directly to DoD user requirements generated by the Services and sanctioned by the Deputy Under Secretary of Defense (Installations

and Environment). SERDP identifies high-priority DoD science and technology needs or investment opportunities that address these requirements. By compiling information from the military Services and multiple other sources, SERDP refines its overall investment strategy and develops focused Statements of Need (SON) that serve as the basis for annual competitive solicitations. Sources of information include the SERDP Technical Committees (STC), workshops, special studies, DoD environmental committees and work groups, the SERDP Scientific

Advisory Board (SAB), SERDP Technical Advisory Committees (TAC), and science and engineering conferences. By analyzing past and ongoing research and technologies in specific scientific or technical areas, the SERDP Program Office staff identify where future research and investment opportunities exist to address high-priority DoD environmental requirements. For more information, see <http://www.serdp.org/general/about/strategy>. ♦

Program Development Update

SERDP

SERDP released a Federal Call for Proposals and a Broad Agency Announcement (BAA) for its FY 2009 Core Solicitation on November 8, 2007. By the January 8, 2008, deadline, the Program Office received 198 pre-proposals in response to 20 Statements of Need (SON). SERDP Staff reviewed these pre-proposals and, by early February, extended requests for full proposals to the most qualified pre-proposals that met the relevance criterion. Full proposals responding to the Federal Call for Proposals and requested full proposals responding to the BAA were due March 6, 2008. Visit www.serdp.org under *Funding Opportunities* for details.

On November 8, SERDP also released its FY 2009 SERDP Exploratory Development (SEED) Solicitation with one SON in the Munitions Management focus area. Full proposals were due by March 6, 2008. SEED efforts are high risk and potentially high payoff projects that last

no longer than one year with a budget of \$150,000 or less. The SEED maximum funding level increased this year from \$100,000 to \$150,000.

ESTCP

The FY 2009 ESTCP Solicitation BAA as well as the DoD and non-DoD Federal Call for Proposals were released on January 10, 2008. All pre-proposals are due on March 13, 2008. The non-DoD Call for Proposals and BAA solicited pre-proposals in six topics within the Environmental Restoration, Munitions Management, and Sustainable Infrastructure focus areas. The DoD Call for Proposals was sent to DoD organizations soliciting pre-proposals in the four focus areas: Environmental Restoration, Munitions Management, Sustainable Infrastructure, and Weapons Systems and Platforms.

For details regarding the FY 2009 solicitation and submission schedule, visit www.estcp.org under *Opportunities*.

FY 2009 ESTCP Topics

- Remediation of Contaminated Groundwater
- In Situ Remediation of Contaminated Sediments
- Characterization, Control, and Treatment of Range Contamination
- Military Munitions Detection, Discrimination, and Remediation
- Control of Non-Native Invasive Species on DoD Lands and Waters
- Energy Efficiency and Renewable Energy for DoD Installations

SERDP and ESTCP Webinars

Through the U.S. Environmental Protection Agency Technology Innovation Program, SERDP Executive Director, Mr. Bradley Smith, and ESTCP Director, Dr. Jeffrey Marqusee, conducted two online seminars on SERDP and ESTCP Funding Opportunities in December 2007 and January 2008, respectively. These “how to play” briefings offered valuable information for those interested in submitting proposals to the FY 2009 solicitations. Both seminars are available for download at <http://www.clu-in.org/live/archive.cfm>. ♦

Congratulations to...

ESTCP Principal Investigator **Dr. Erika Gasperikova** and her team from Lawrence Berkeley National Laboratory for developing the Berkeley Unexploded Ordnance

Discriminator (BUD), selected as one of the 100 most significant proven technological advances of 2007 by *R&D Magazine*. BUD is an electromagnetic system that can

determine the location, size, and shape of subsurface metallic objects from a single measurement in just a few seconds, allowing for real-time discrimination of hazardous unexploded ordnance from scrap metal. The system does this by simultaneously obtaining the object's

electromagnetic properties in three dimensions in response to a generated current. Through its increased speed and accuracy, BUD has the potential to greatly reduce the time and cost of remediating munitions-impacted sites. Initially developed under a SERDP Exploratory Development (SEED) project, BUD now is being demonstrated at DoD munitions response sites through the ESTCP Discrimination Study Pilot Program and Innovative Technology Transfer Initiative. The 2007 R&D 100 Awards were presented in Chicago on October 18.



Berkeley Unexploded Ordnance Discriminator

UNDERWATER WORKSHOP, from page 4

and acoustic systems. Work should include modeling studies, tank tests, controlled open water tests, and live site demonstrations.

Combine existing sensor and navigation technologies. Various sensor and navigation technologies have different strengths and weaknesses in the underwater environment. Combined systems may provide enhanced capabilities for detecting munitions underwater.

Investigate potential applications for chemical and laser line scanner sensors. Critical evaluation of existing chemical and laser line scanner sensors could determine whether there is a role for these sensors in the underwater environment.

Evaluate munitions mobility in the underwater environment. The movement of munitions should be investigated further because of the risk mobile munitions pose in beach environments and their effects on the cleanup process.

Explore munitions indicators that can be exploited for wide-area surveys. On land, munitions-related features such as aiming circles, munitions-related clutter, and impact craters are exploited to identify areas where munitions contamination is likely. Research should be conducted to determine whether analogous features exist and can be exploited in the underwater environment.

Improve detection of smaller items. Small munitions items are challenging to detect in both terrestrial and marine environments. Improvements in noise cancellation and development of platforms that operate very close to the bottom could improve detection of small items.

Conduct navigational error analysis. The mission objective and choice of sensor will dictate the positioning requirements. An analysis of the error budgets of existing and emerging navigation technologies should be conducted for a variety of environments and objectives.

Improve methods for discrimination and classification. Processing techniques are required to enhance discrimination of munitions from clutter for any sensor that will be employed in the underwater environment. Terrestrial applications have focused on methods for estimating target parameters such as size, shape, and orientation.

Products

A final report of the findings is available in the SERDP and ESTCP Online Library at <http://docs.serdp-estcp.org> using W-07 as the Search Phrase. SERDP has released two FY 2009 Statements of Need (SON) as a result of this workshop—one on improvements in detection and remediation of underwater military munitions and a second on phenomenology of military munitions in the underwater environment. ♦

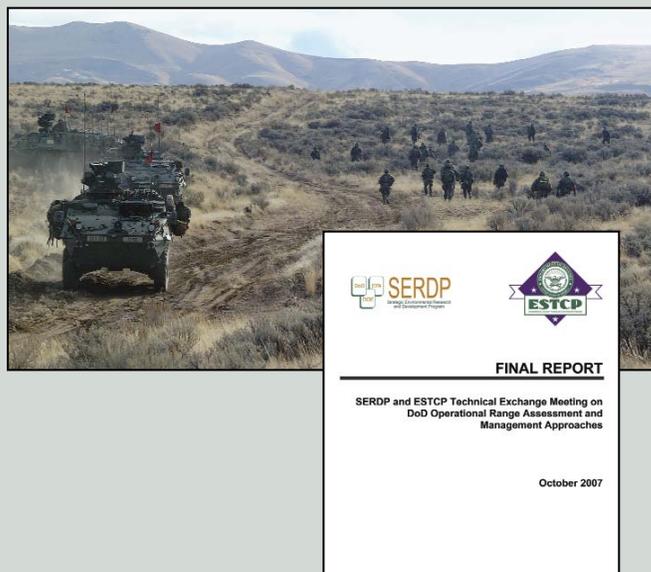
RANGE WORKSHOP, from page 4

fate and transport of MCs in the vadose zone.

Develop additional toxicity data and ecological soil screening levels (Eco-SSL) for MCs. As many of the benchmarks used to define acceptable and unacceptable risk are toxicity-based, additional toxicity data (acute and chronic) and Eco-SSLs are needed for many of the MCs expected to be found on ranges.

Improve predictive modeling capabilities for source zone strength and fate and transport of the MCs in the environment. Advancements in this area would allow for quantitative predictions of the release and migration of MCs to be considered during the development of design, use, and long-term management strategies for ranges.

Improve mitigation and long-term management strategies for ranges. Effort is needed to evaluate the applicability of small arms range management strategies to other types of ranges. Additional effort is warranted to develop long-term sustainable management and mitigation strategies for larger ranges (e.g., air-to-ground and artillery).



Products

A final report documenting the workshop's results is available in the SERDP and ESTCP Online Library at <http://docs.serdp-estcp.org> using W-09 as the Search Phrase. SERDP has released two FY 2009 SONs as a result of this workshop—one on identifying MC source zone locations and strength and a second on MC fate and transport. ♦

Recent Additions to the Online Library

The following are a sample of new publications now available in the SERDP and ESTCP Online Library (<http://docs.serdp-estcp.org>). Access them by entering the project number (e.g., 0125) under Search Phrase. Other documents may be accessed by entering an appropriate keyword or selecting the relevant search filters.

Environmental Restoration

- Cost & Performance Report: Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface (ESTCP ER-9916)
- Final Report: A Framework for Assessing the Sustainability of Monitored Natural Attenuation (SERDP ER-1349)
- Final Report: Sustainability of Long-Term Abiotic Attenuation of Chlorinated Ethenes (SERDP ER-1369)
- Final Report: Enhancement of In Situ Bioremediation of Energetic Compounds by Coupled Abiotic/Biotic Processes (SERDP ER-1376)
- Technical Report: Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents (ESTCP ER-0628)
- Technical Report: Comparison of the Relative Risks of CL-20 and RDX
- Technical Report: Evaluation of the Relative Risk of China Lake 20 (CL-20) Based on Current Toxicity, Fate and Transport, and Other Technical Information

Munitions Management

- Final Report: Frequency Domain Electromagnetic Sensor Array Development (SERDP MM-1450)
- Final Report: Remote Excavation of Heavily Contaminated UXO Sites: The Range Master Phase II (ESTCP MM-0327)
- Final Report: Demonstration of Airborne Wide Area Assessment Technologies at the Toussaint River, Ohio (ESTCP MM-0535)

Sustainable Infrastructure

- Final Report: New Approaches to the Use and Integration of Multi-Sensor Remote Sensing for Historic Resources Identification and Evaluation (SERDP SI-1263)
- Final Report: Development of Bioacoustic Tools for Long-Term, Non-Invasive Monitoring of Threatened and Endangered Birds (SERDP SI-1392)
- Final Report: Development of Metrics for Identifying Military Impulse Noise Sources (SERDP SI-1436)
- Workshop Report: DoD Cultural Resources Workshop: Prioritizing Cultural Resources Needs in Support of a Sound Investment Strategy
- Workshop Report: DoD Southeast Region Threatened, Endangered & At-Risk Species Workshop

Weapons Systems and Platforms

- Cost & Performance Report: Replacement of Chromium Electroplating on Hydraulic Actuators Using HVOF Thermal Spray Technology (ESTCP WP-0038)
- Cost & Performance Report: Effect of Biodiesel on Diesel Engine Nitrogen Oxide and Other Regulated Emissions (ESTCP WP-0308)
- Workshop Report: DoD Metal Finishing Workshop—Chromate Alternatives for Metal Treatment and Sealing



STRATEGIC ENVIRONMENTAL RESEARCH
AND DEVELOPMENT PROGRAM (SERDP)
ENVIRONMENTAL SECURITY TECHNOLOGY
CERTIFICATION PROGRAM (ESTCP)

INFORMATION BULLETIN

WINTER 2008 NUMBER 33

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C ♦ A ♦ L ♦ E ♦ N ♦ D ♦ A ♦ R

F O R S E R D P A N D E S T C P

MARCH 2008

March 11-12

SERDP Scientific Advisory Board Meeting
Arlington, Virginia

March 13

Pre-proposals due in response to the ESTCP
FY 2009 Solicitation Broad Agency Announcement
(BAA) and Non-DoD Federal and DoD Calls
for Proposals

APRIL 2008

Week of April 21

Weapons Systems and Platforms (WP) In-Progress
Review (IPR) Meeting

Week of April 28

Environmental Restoration (ER) In-Progress Review
(IPR) Meeting – Week 1 of 2

MAY 2008

Week of May 12

Sustainable Infrastructure (SI) In-Progress Review
(IPR) Meeting

Week of May 19

Munitions Management (MM) In-Progress Review
(IPR) Meeting

Week of May 28

Environmental Restoration (ER) In-Progress Review
(IPR) Meeting – Week 2 of 2

RELATED CONFERENCES & EVENTS

March 17-20

The (New*) 18th Annual Cleaner, Sustainable
Industrial Materials & Processes (C.S.I.M.P.) Workshop
Coronado, California

For more information, visit
www.exchangemonitor.com/conferences/08/08CSIMP/08CSIMP_Call.pdf.

March 24-28

2008 AFCEE Technology Transfer Workshop
San Antonio, Texas

For more information, visit
www.afcee.brooks.af.mil/products/techtrans/workshop.

March 25-28

National Military Fish and Wildlife Association
(NMFWA) Training Workshop and Business Meeting
Phoenix, Arizona

For more information, visit
www.nmfwa.org/2008_Meeting.

April 6-10

21st SAGEEP – Symposium on the Application of
Geophysics to Engineering and Environmental
Problems
Philadelphia, Pennsylvania

For more information, visit www.eegs.org/sageep.

April 22-24

Third Annual Canadian DND UXO Forum
“Partnership in Managing UXO Risk”
Ottawa, Ontario, Canada

For more information, visit
www.goldenplanners.ca/UXO/2008/UXO_e.

May 5-8

2008 Joint Services Environmental Management
(JSEM) Training Conference & Exposition
Denver, Colorado

For more information, visit
www.jsemconference.com.

May 19-22

Sixth International Conference on Remediation of
Chlorinated and Recalcitrant Compounds
Monterey, California

For more information, visit
www.battelle.org/chlorcon.

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