Coral reef communities around the globe have experienced serious declines in recent years because of the cumulative effects of natural and anthropogenic stressors, such as increasing ocean temperatures and overfishing. Current projections estimate that by 2030 less than 50% of the world’s coral reefs will remain. Executive Order 13089 “Protection of Coral Reefs” aims to reverse this trend by requiring federal agencies whose actions may adversely affect U.S. coral reef ecosystems to take steps to minimize these impacts and promote the protection and enhancement of these unique ecosystems. In response to this Executive Order and the associated National Action Plan, SERDP-funded researchers have developed complementary methodologies that enable the Department of Defense (DoD) to assess the health of coral reef ecosystems quickly and economically, determine if stressors are potentially related to DoD activities, and monitor changes in those coral reef communities over time.

The National Action Plan developed by the Coral Reef Task Force to implement Executive Order 13089 provides a cohesive strategy that covers the spectrum of coral reef conservation, from mapping, monitoring, management, and research to education and international cooperation. With approximately 25 DoD installations and numerous ranges in areas with documented coral reef communities, SERDP is addressing the research and technology development aspects of this plan that support a science-based ecosystem approach and adaptive management capabilities to respond to environmental change and emerging threats to these ecosystems. Specific DoD needs include rapid assessment and inventory techniques to determine which reef communities are at greatest risk and to prioritize mitigation efforts. Additional monitoring and assessment techniques also are needed to determine the trends in and causes of reef community declines.

Under SERDP project Analysis of Biophysical, Optical and Genetic Diversity of DoD Coral Reef Communities Using Advanced Fluorescence and Molecular Biology Technologies (SI-1334), Dr. Paul Falkowski and Dr. Maxim Gorbunov of Rutgers University developed an innovative monitoring and assessment approach that involves measuring and analyzing physiological properties unique to the photosynthetic mechanisms of coral species using Fluorescence Induction and Relaxation (FIRe). This technique produces a robust suite of fluorescent and photosynthetic parameters that together give a real-time assessment of coral reef ecosystem health and viability. These parameters are sensitive to environmental stressors reflected by changes in the coral physiology. Monitoring these parameters can alert resource managers to early stress development in coral reef communities.

Dr. Falkowski and Dr. Gorbunov furthered their SERDP efforts by adding controlled manipulation experiments on coral species to the study design. By exposing coral species to a
SERDP-funded research and development efforts and ESTCP-funded demonstration and validation activities continue to provide a rapidly increasing number of outstanding environmental innovations. These advances are highly important and relevant to the Department of Defense (DoD), Department of Energy (DOE), Environmental Protection Agency (EPA), and many other user communities.

**Standardized Approach for Amphibian Ecological Risk Assessments Reduces Uncertainty in Wetland Cleanup Levels**

Wetlands often comprise a significant portion of open space at DoD facilities and are prime habitat for various amphibian species, which play a key role in wetland ecology. Although amphibians are frontline indicators of possible adverse impacts to wetland ecosystems, no standardized procedure exists to evaluate the potential toxicity of sediments and hydric soils to amphibians. Because limited ecotoxicity data are available for amphibians, decisions regarding wetland remediation are often inappropriately based on data from aquatic (fish) or terrestrial (earthworm) species that are not typical of wetlands and may be more or less sensitive to chemical stressors than amphibians. Considerable uncertainty is associated with the application of these aquatic and terrestrial cleanup standards to wetlands. With ESTCP support, a standardized approach for more accurately assessing potential risks to amphibians at DoD facilities has been demonstrated that will allow wetland remediation efforts to be targeted to best advantage.

Efforts conducted as part of ESTCP project Demonstration and Certification of Amphibian Ecological Risk Assessment Protocol (ER-0514) combined and expanded on work the U.S. Army and U.S. Navy initiated. The toxicity test that the U.S. Army Center for Health Promotion and Preventive Medicine developed focused on 28-day adult salamander exposures to mesic soils in order to generate toxicity data that support development of soil screening levels for the explosives 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), and cyclotrimethylenetranitramine (RDX).

With ESTCP support, the soil exposure protocol was tested for copper and lead contaminants using both laboratory-spiked and field-collected soils. Reductions in toxicity were observed with field-collected soils as compared to laboratory-spiked soils, indicating that currently used methods may overestimate site risks to amphibians such as salamanders.

This “soil exposure protocol” evaluates the effects on salamander growth, survival, and target organs following contaminant exposure.

The toxicity test developed by the Naval Facilities Engineering Command evaluates potential risks to early life stage frogs and toads from exposure to sediments. This “sediment exposure protocol” evaluates effects on amphibian growth and survival as a result of 10 days of exposure to contaminated sediments. Since the sediment exposure protocol was developed, it has been used operationally at federal and state sites—including the Naval Air Station, Cherry Point, North Carolina; the Massachusetts Military Reservation, Cape Cod; a lead-contaminated site managed by the Massachusetts Highway Department; and a U.S. Environmental Protection Agency Region 4 cadmium-contaminated site in Tennessee—to help characterize the potential effects of contaminants on

The sediment exposure protocol submitted to ASTM as a draft standard evaluates effects on frog growth and survival following 10 days of exposure to contaminated sediments. Shown here is the size reduction in Northern leopard frog tadpoles exposed to copper-spiked soils. The ESTCP demonstrations showed a reduction in toxicity with field-collected sediments as compared to the laboratory-spiked sediments.

See AMPHIBIAN RISK ASSESSMENT, page 12
Given increasing population growth and land development pressures in the southeastern United States—along with numerous collocated mission-critical DoD bases encompassing approximately 2.4 million acres—the Southeast represents a major challenge and opportunity for sustainability planning. In April 2007, SERDP partnered with DoD’s Sustainable Ranges Initiative (SRI) to sponsor the two-day Southeast Regional Planning and Sustainability Workshop to (1) identify high-priority issues of shared concern among the military, academia, and other key stakeholders related to sustaining military training land, regional planning, and compatible land use in the Southeast and (2) explore collaborative approaches that engage the academic and research community and build on existing efforts to help address these high-priority issues. Nearly 100 experts from academia and the public, private, and nonprofit sectors participated (see sidebar).

Sprawling development patterns in the Southeast increasingly place restrictions on the military’s ability to train on existing installations and limit DoD’s ability to expand ranges. These development patterns also negatively impact local communities with increases in air and water pollution, greenhouse gas emissions, energy consumption, loss of biodiversity, abandonment of older built areas, and inequities among different population groups defined by class and race. The loss of working landscapes and critical natural areas caused by this type of development also restricts the military’s ability to sustain lands compatible for training. Existing plans, institutions, and analysis tools employed by DoD and these communities generally are inadequate to manage the existing growth and development pressures.

Workshop attendees explored regional planning and sustainability issues in the Southeast, in particular current and projected trends, through a series of background papers and presentations. Five breakout sessions focused on identifying issues of common concern for the following land use types: built environment, military, agricultural, forest, and land corridors. For each land use type, social, environmental, and economic issues as well as potential solutions in the form of policy, research, and outreach/engagement were discussed. Key recommendations described in the workshop final report are highlighted here.

**Policy**

- **Develop DoD guidance for encroachment planning.**

  While DoD has many ongoing programs to address encroachment, the Services and installations need guidance to identify issues early on and develop effective responses.

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### Workshop Participants

#### Academia
- Auburn University
- Clemson University
- Georgia Institute of Technology
- Georgia State University
- North Carolina State University
- Southern Rural Development Center
- Texas A&M University
- United States Military Academy
- University of Arizona
- University of Florida
- University of Georgia
- University of North Carolina, Chapel Hill
- University of Texas at Austin
- University of Virginia

#### Department of Defense
- Office of General Counsel
- Office of the Secretary of Defense
- SERDP/ESTCP
- Air Force Center for Engineering and the Environment (AFCEE)
- Eglin Air Force Base
- U.S. Army Environmental Command
- U.S. Army Environmental Policy Institute
- U.S. Army Corps of Engineers
- U.S. Army Forces Command
- U.S. Army Installation Management Command Southeast
- Fort Benning
- Fort Stewart
- Navy Region Southeast
- U.S. Marine Corps
- Marine Corps Air Station, Beaufort

#### Other Federal Organizations
- Department of Energy, Oak Ridge National Laboratory
- National Oceanic and Atmospheric Administration, Coastal Services Center
- U.S. Department of Agriculture, Forest Service
- U.S. Department of Commerce, Economic Development Administration
- U.S. Environmental Protection Agency
- U.S. Geological Survey
- U.S. Institute for Environmental Conflict Resolution
- U.S. Marine Corps

#### State and Local Organizations
- North Carolina Department of Environment and Natural Resources
- International City/County Management Association
- Columbus Consolidated Government
- Pima County

#### Private Industry
- Forest Capital Partners, LLC
- Sustainable Forestry Initiative, Inc.
- The Clarkson Group, LLC

#### Non-Governmental Organizations
- American Farmland Trust
- Coastal Conservation League
- Ecological Society of America
- Southeast Watershed Forum
- Sustainable Sandhills
- The Nature Conservancy
• Establish improved coordination mechanisms between DoD and states. State-level liaison offices can aid the military in dealing with the myriad of regional and local resource planning and regulatory issues that encroach on the military’s ability to perform its mission. Similarly, an organizational structure within DoD for interacting with state authorities on encroachment planning issues would assist efforts to share long-term growth needs and develop mutually beneficial plans.

**Research**

• Establish “living laboratories” as test beds for regional planning. Living laboratories at one or more military installations would facilitate testing and developing novel approaches to planning for sustainable regions, in particular protecting corridors, and conducting outreach and engagement activities.

• Enhance capabilities for planning and implementing a coherent and supportive regional framework to guide growth and change. Key projects include a regional-scale audit of local planning and growth management programs, studies of institutional frameworks and their performance in supporting military missions and economic sustainability, and the design of decision-support tools to assess impacts of planned changes (civilian and military) on urban and environmental systems.

• Improve understanding of natural system dynamics and explore means of integrating ecosystem service values to develop markets. Emphasis would be on quantifying ecosystem service values and developing monitoring protocols for measuring them across landscapes as well as assessing the cumulative effects of multiple disturbances on ecosystems.

• Assess impacts of public land use plans and policies on land market behavior. Studies would entail evaluating the impacts of growth management tools on land markets, conducting stakeholder surveys on alternative land uses, undertaking social marketing regarding mutually beneficial land uses, and assessing the potential future impacts of state and federal laws.

**Outreach and Engagement**

• Establish sustainability planning teams at the DoD installation level. Sustainability planning teams of skilled and experienced spatial data analysts, urban and conservation planners, and facilitators would build capacity within the community to plan at regional and local levels.

• Develop communication, public engagement, and leadership building strategies. Improved sharing of data, information, and knowledge through cooperation, coordination, and collaboration will enhance the military’s ability to protect its missions and achieve sustainable economic development.

• Publish best practice manuals for built and natural environments. Manuals of best sustainable practices should describe successes; identify best urban design, communication, and engagement principles; and recommend practical techniques to achieve sustainable communities in the context of military training lands.

• Encourage development of university-based sustainability institutes. The institutes backed by relevant courses and degrees would bring together interdisciplinary groups of faculty, professionals, and students in social sciences, natural sciences, urban planning, and environmental policy. DoD base operators, scientists, and outreach staff would also be actively engaged.

• Establish education and public outreach programs. Until training can be incorporated into Service schools and activities, DoD should establish training programs for conducting effective outreach and engagement activities. Outreach and education programs developed in collaboration with nongovernmental organizations (NGO) and university extension programs could create a forum for increasing public acceptance.

• Strengthen partnerships among academia, NGOs, and federal agencies. In addition to existing partnerships focused on interagency planning and coordination, expanded partnerships for research and technical assistance are recommended. For the ecological and natural resource management sciences, DoD could more effectively engage with interdisciplinary groups of scientists through, e.g., the Cooperative Ecosystem Studies Unit (CESU) network.

Collectively, these recommendations provide direction for DoD and other organizations that are working to address sustainability issues nationwide and, in particular, throughout the Southeast including SRI, SERDP, ESTCP, and Legacy. SRI is a multilayered strategy designed to assist military installations (particularly training and testing ranges) in working with partners at all levels to help ensure the sustainability of and access to vital DoD land and resources (https://www.denix.osd.mil/denix/Public/Library/Sustain/Ranges/about/about.html). This approach encourages more effective regional planning, compatible land use, and community partnerships and has enabled DoD to join with other federal agencies and state governments of five Southeastern coastal states (North Carolina, South Carolina, Florida, Georgia, and Alabama) to...
Environmentally Advanced Aerospace Coatings Being Implemented at Lockheed Martin, Hill Air Force Base, and Air Force Plant 42

Two new environmentally advanced aerospace coatings (FP 212 and FP 60-2), demonstrated and validated through ESTCP, are in the process of transitioning to use on various weapons systems at Lockheed Martin Aeronautics, Hill Air Force Base (AFB), and Air Force Plant (AFP) 42. Implementation of FP 212 and FP 60-2 will decrease volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions and will lead to significant cost savings by decreasing material use and coating application time. Furthermore, these new coatings provide increased durability such that enhanced performance compared to existing coatings is anticipated, resulting in a decrease in downtime, costs, and emissions over the life-cycle of the aircraft. Under ESTCP project Scale-Up, Demonstration, and Validation of Environmentally Advanced Reliable Coatings (WP-0305), investigators studied the effectiveness of the newly formulated low-VOC, quick-curing aerospace coatings. FP 212 and FP 60-2 were qualified for weapons systems use and tested for spray system compatibility.

Several benefits of using the environmentally advantaged aerospace coatings were demonstrated. For FP 212, the altered formulation of the aerospace coating drastically reduced VOC content, addressing the regulatory concern of high VOC and HAP emissions. The lower VOC content also contributed to a decrease in application time, labor hours, and, in elevated temperature and humidity conditions, a greater than 50% decrease in material use. These improvements, together with outstanding coating durability demonstrated through testing, have led Lockheed Martin Aeronautics and Hill AFB to approve implementation of FP 212 as a replacement for conventional aerospace coatings. FP 60-2 has passed all laboratory-scale qualification testing and is currently going through production acceptance testing, which includes spray optimization testing with the robotic spray system and performing spot checks of critical material properties from production size batches of material. Once the production acceptance testing is complete, FP 60-2 will be transitioned to production processes at AFP 42 and at Lockheed Martin Aeronautics, assuming test results are acceptable.

The overall cost and environmental benefits of these aerospace coatings are significant. The Life Cycle Cost (LCC) savings of transitioning FP 212 and FP 60-2 to production and Programmed Depot Maintenance (PDM) processes of the weapons systems of interest are expected to reach approximately $50 million. Life-cycle VOC and HAP emissions for these systems are expected to decrease by 400,000 pounds and 460,000 pounds, respectively.

For additional information, please contact Mr. Frank Brown, U.S. Air Force, Aeronautical Systems Center, Wright-Patterson AFB, Ohio, at (937) 255-3566 or frank.brown@asepafl.af.mil.

Comprehensive Perchlorate Ecotoxicology Resource Available

The Society of Environmental Toxicology and Chemistry (SETAC) has published Perchlorate Ecotoxicology by SERDP Principal Investigators Dr. Ronald Kendall and Dr. Philip Smith of The Institute of Environmental & Human Health (TIEHH) at Texas Tech University. The comprehensive book details the ecological risks of environmental perchlorate contamination. The resource was compiled using an extensive database, established by TIEHH through a multidisciplinary ecotoxicology research program funded by SERDP, and contributes to the developing science of addressing endocrine disruptors that present challenges because of their potential for subtle biological effects.

The initial chapters of Perchlorate Ecotoxicology provide an overview of the state of the science and extent of perchlorate contamination in the environment, including that from nonmilitary-related activities. Subsequent chapters offer additional perspective on the effects of perchlorate on thyroid function in mammals, birds, amphibians, fish, and invertebrates. In the final chapters, the book describes the application of population models to perchlorate ecotoxicology. By integrating all of the information presented, the co-authors offer an application of the ecological risk assessment paradigm toward a better understanding of perchlorate ecotoxicology.

For additional information on the Perchlorate Ecotoxicology resource, please visit www.setac.org under the SETAC Store link.

Protocols Guide Soil Sampling Efforts at Military Training and Testing Ranges

SERDP, the U.S. Army Environmental Command, the U.S. Garrison Army Alaska, and the U.S. Army Corps of Engineers Distributed Source Program have supported extensive research to investigate the mass loading and fate of energetic munitions constituents (MC) on military live-fire training and testing ranges. This research highlighted issues that should be considered when developing and implementing scopes of work for sampling, sample processing, and analysis of energetic residues. The ESTCP project Validation of Sampling Protocol and Promulgation of Method Modifications for the Characterization of Energetic Residues on Military Training Ranges (ER-0628) validated protocols for the collection of surface soil samples at military training and testing ranges to characterize energetic MCs.

In the past, little guidance has been available for site characterization activities addressing the concentration and mass of energetic MC residues in military training range soils. Energetic residues are heterogeneously distributed over military training ranges as particles of various sizes, shapes, and compositions. Most energetic MC residues are deposited on the ground surface, and the highest concentrations exist at firing positions, near targets, and where demolition activities are performed. In the case of impact and demolition ranges, the greatest quantities of energetic MC residues are from rounds that fail to detonate as designed. Many of the existing sampling and analysis plans failed to acquire the information needed to address potential risks to humans and the environment.

To address the compositional and distributional heterogeneity associated with the distribution of energetic MC particles and to obtain representative mean energetic MC residue soil concentrations, these protocols employ a multi-increment sampling strategy with a
SERDP Research

Additional information on these efforts can be found at www.serdp.org under the Research Projects link.

High-Accuracy Multisensor Geolocation Technology to Support Geophysical Data Collection at Munitions and Explosives of Concern (MEC) Sites (MM-1564)

Principal Investigator: Dorota Grejner-Brzezinska/The Ohio State University

The objective of this project is to develop high-accuracy and high-reliability geolocation algorithms and tools, based on multisensor integration, to significantly improve the state of the art in sensor georegistration. Navigation technologies developed under this project will facilitate accurate and reliable operation of new and emerging UXO detection sensors, where precise sensor location and orientation are required.

Technical Assessment of IMU-Aided Geolocation Systems for UXO Detection and Characterization (MM-1565)

Principal Investigator: Christopher Jekeli/The Ohio State University

Discrimination between MEC and relatively safe background clutter depends on the instrument technology as well as on the processing methodology that inverts the detection data to infer MEC. This project will determine if current methods using integrated inertial and global positioning system (GPS) technologies are adequate to reduce the probability of false positives in the detection process and how innovative geolocation procedures could improve the characterization of buried objects for identification as MEC. Improved geolocation will aid the inversion of field data.

Development of Low-Cost Technologies for Remote Detection of UXO (MM-1567)

Principal Investigator: Deborah Bleau/U.S. Army Benet Laboratories

The objective of this project is to develop packaging and passivation technologies to demonstrate low-cost, high-survivability passive radio frequency identification (RFID) devices for inventory tagging and remote sensing, using the 155-mm M483A1 Dual Purpose Improved Conventional Munition (DPCIM) cargo round as a test-bed munition. Specifically, the focus is on detection of small-caliber munitions such as 40-mm rounds.

Miniature Wide-Band Atomic Magnetometer (MM-1568)

Principal Investigator: Mark Prouty/Geometrics, Inc.

Magnetometers and electromagnetic (EM) devices are two of the most commonly used instruments for identifying UXO. Having a single sensor with the direct current magnetic field sensitivity of a total-field magnetometer and the sensitivity and bandwidth of wire coils used as EM sensors would greatly improve efficiencies in gathering sufficient data for discrimination. Building on the results of SERDP project MM-1512, this project will develop small, wide-bandwidth, extremely sensitive total-field magnetic sensors.

Magnetic Sensors with a Picotesla Magnetic Field Sensitivity at Room Temperature (MM-1569)

Principal Investigator: Sy-Hwang Liou/University of Nebraska

This project will investigate a low-cost, practical magnetic sensor system suitable for high-sensitivity magnetic field mapping, based on solid-state magnetic tunneling junction (MTJ) devices with a sensitivity in the picotesla range at room temperature. The highly sensitive magnetic sensor will be applicable to the diverse detection and discrimination problems of sites contaminated with MEC.

Machine Learning Approach for Target Selection and Threat Classification of Wide-Area Survey Data (MM-1570)

Principal Investigator: Jim McDonald/SAIC Incorporated

The objective of this project is to apply a new, highly efficient, and automated data analysis approach to data collected in wide-area surveys. Using a small set of ground truth data, researchers will implement an inductive machine-learning process using image-based analyses to develop a Target Model, first to select likely magnetic anomalies, then to rank and classify their probability of being UXO.

Next-Generation Data Collection System for Mobile Detection and Discrimination for UXO (MM-1571)

Principal Investigator: Stephen Billings/Sky Research, Inc.

To achieve reliable discrimination performance with electromagnetic induction (EMI), very high signal-to-noise ratios (SNR) and centimeter-level positional accuracy are required. This project will conduct a feasibility study for a cart- or towed-array system capable of discriminating buried UXO during a moving one-pass survey. The next generation data collection system will optimize the data density, SNR, time synchronization, and position and orientation accuracy of magnetometer and EMI data collected from a moving platform.
A Complex Approach to UXO Discrimination: Combining Advanced EMI Forward and Statistical Signal Processing (MM-1572)
Principal Investigator: Fridon Shubitidze/Sky Research, Inc.
This project will extend the physically complete forward models, developed under the SERDP Exploratory Development (SEED) project MM-1446, to treat complex data sets in the presence of heterogeneous background-clutter noise; develop robust methods and algorithms of geophysical data inversion that are practical for real-field data; and develop a mixed modeling approach and statistical identification while controlling for sensitivity and specificity. The aim is to develop robust and efficient signal processing algorithms and software as tools for UXO discrimination under realistic field conditions.

Simultaneous Inversion of UXO Parameters and Background Response (MM-1573)
Principal Investigator: Leonard Pasion/Sky Research, Inc.
This project focuses on the accurate recovery of target parameters from geophysical sensor data, even in cases when targets of interest sit in a magnetic or conductive host. Specific objectives include determining the extent to which a highly conductive or magnetic host interacts with a buried metallic target and developing improved recovery of target parameters by simultaneously inverting target parameters and the properties of the host material. For overlapping responses of targets commonly found at cluttered sites, the research will provide tools that improve the existing capabilities of reliably discriminating between hazardous UXO and nonhazardous metallic items.

Processing for Clutter Evasion in UXO Discrimination (MM-1590)
Principal Investigator: Kevin O'Neill/U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory
This SEED project aims to improve UXO discrimination by (1) developing a new, fast processing capability for magnetic and EMI data to infer a comprehensive, continuous picture of magnetic fields or equivalent sources about an apparent anomaly; (2) exploiting aboveground as well as belowground projections from surface data; and (3) using complete, continuous, three-dimensional subsurface or above-surface views to distinguish contributing items, thereby isolating distinct UXO and clutter signals without having to assume any particular number of them or model for them.

Optimal Sensor Management for Next-Generation EMI Systems (MM-1591)
Principal Investigator: Larry Carin/Signal Innovations Group, Inc.
The objective of this SEED project is to develop the basic Partially Observable Markov Decision Process (POMDP) sensor-management framework, which entails defining the class of actions and observations of relevance to adaptive UXO sensing with next-generation EMI systems. Rather than having to a priori (in hardware) design a system to address time/energy constraints, a more complete EMI system can be designed, and the POMDP framework can guide efficient utilization of the sensor resources.

Nontraditional, Physics-Based Inverse Approaches for Determining Location of Buried Objects (MM-1592)
Principal Investigator: Fridon Shubitidze/Sky Research, Inc.
Determining the location and orientation of buried objects are the most time-consuming, nonlinear inverse problems in UXO discrimination tasks. This SEED project aims to develop new, nontraditional, physics-based inverse approaches to determine buried object location and orientation from actual EM data without solving traditional ill-posed inverse scattering problems. Improvements in discrimination may lead to fewer excavations of non-UXO geophysical anomalies, thus reducing cleanup costs.

Single Ferromagnetic Nanocontact-Based Devices as Magnetic Field Sensors (MM-1593)
Principal Investigator: Stanko Brankovic/University of Houston
The objective of this SEED project is to fabricate a prototype device based on a single ferromagnetic nanocontact as the magnetic field sensor. Devices will have distinctively different nanoncontact structures ranging from single crystal nickel, cobalt, or iron contacts to contacts with a significant presence of metal oxide in their structure. This research may lead to fully functional, low-power, and small magnetic field sensors for portable or airborne use with improved sensitivity and stability.

Helicopter Magnetometer Platform Based on Compact Induction Sensors (MM-1594)
Principal Investigator: Yongming Zhang/QUASAR, Inc.
This SEED project will demonstrate the feasibility of improving the detection sensitivity and discrimination capability of helicopter-based magnetometry by integrating the compact induction sensor developed under SERDP project MM-1444. Researchers also will test a simple noise cancellation algorithm with a reference sensor mounted on the same platform. Benefits will include rejection of direct current noise, lower noise than Cs-magnetometer in the detection band, better discrimination capability due to a three-axis vector signature, and possible use of a reference sensor to cancel vibration noise.

Phenomenology and Signal Processing for UXO/Clutter Discrimination (MM-1595)
Principal Investigator: Thomas Bell/SAIC Incorporated
The objectives of this project are to (1) establish relationships between the parameters that characterize a target’s EMI signature and the physical attributes of the target that can be used to develop effective classification rules and (2) devise robust processing and analysis procedures for estimating the target parameters from data collected above an unknown target without spatially mapping the data. The robust parameter estimation procedures developed will be directly applicable to existing sensor technologies and should be of use in the specification of future sensors.

EMI Using an Array of Three-Component Sensors for UXO Detection and Discrimination (MM-1598)
Principal Investigator: Michael Asten/Flagstaff Geoconsultants
Building on the results of SERDP project MM-1445, which successfully demonstrated the capability of using fluxgate magnetometers as B-field sensors in time-domain EMI measurements on inert UXO and demonstrated a geometry and signal processing approach capable of delivering improved target location and orientation, this project aims to develop an operational prototype EMI detection system known as B-Field Electromagnetic Array for Munitions and Ordnance Discrimination (BEAMOD). The use of an array of vector sensors in EMI data acquisition together with the wider bandwidth at low frequencies will improve target location and discrimination.
## ESTCP Demonstrations

Additional information on these efforts can be found at [www.estcp.org](http://www.estcp.org) under the Technologies link.

### The Magnetic UXO Recovery System (MURS) (MM-0732)

**Principal Investigator:** Bill Lewis/Air Force Research Laboratory

Current methods used to remove UXO from test ranges and impact sites are costly and expose explosive ordnance disposal (EOD) technicians to risk. This project will demonstrate the MURS, a novel magnetic recovery system that leverages an existing automated ordnance excavator. MURS may be useful for shallow water, soil surface, and potentially subsurface UXO recovery.

### Underwater Simultaneous EMI and Magnetometer System (MM-0733)

**Principal Investigator:** Andrew Schwartz/U.S. Army Engineering and Support Center, Huntsville

The objective of this project is to demonstrate and validate the Underwater Simultaneous EMI and Magnetometer System (USEMS), which employs concurrent magnetometers and EM61 sensors through the interleaving process. Leveraging the successful deployment of concurrent magnetometer/EM61 data acquisition hardware and software demonstrated in prior ESTCP projects, USEMS will provide DoD and its contractors a precise method for surveying underwater sites for MEC.

### Underwater Acoustic Positioning Systems for MEC Detection and Reacquisition Operations (MM-0734)

**Principal Investigator:** Andrew Schwartz/U.S. Army Engineering and Support Center, Huntsville

This project will modify two long baseline positioning systems, AquaMap Seafloor and RangeNav (Desert Star Systems, LLC), for use in high-precision, underwater MEC detection and reacquisition operations. It is anticipated that both acoustic positioning systems will be comparable in price to survey-grade, real-time kinematic differential global positioning systems (DGPS) or robotic total stations (RTS) and will generate simple coordinate strings that are output via RS232. The systems also will provide a means to reacquire anomalies and record anomaly findings using the dive station.

### Demonstration of U.S. Army Engineer Research and Development Center S-Tracker System (MM-0735)

**Principal Investigator:** Charles Hahn/U.S. Army Corps of Engineers, Engineer Research and Development Center, Environmental Laboratory

The objective of this project is to demonstrate a functional tracking/navigation system suitable for use by UXO sensor platforms working in and out of overhead tree canopy. The S-Tracker system couples real-time kinematic (RTK) GPS positioning with a terrestrial positioning system composed of RTS, with all of the positioning data assembled on the sensor platform, to provide a navigation tool for the sensor operator. The system will be applicable for use in areas where RTK GPS does not work well.

### Mitigation of Underwater UXO Blow-in-Place (BIP) Explosions (MM-0736)

**Principal Investigator:** William Wild/Space and Naval Warfare Systems Center

Underwater BIP operations in support of cleanup projects and training have the potential to damage adjacent natural structure and critical habitat as well as aquatic species. This project will demonstrate and validate bubble curtains, a blast attenuation-barrier and mitigation technology that is in practice for underwater construction and demolition applications. Such engineering-based methods will mitigate the adverse environmental effects of BIP operations by reducing underwater blast pressure and acoustic energy.

### Development of Parameters for the Collection and Analysis of LiDAR at Military Munitions Sites (MM-0737)

**Principal Investigator:** Robert Selfridge/U.S. Army Corps of Engineers

Light Detection and Ranging (LiDAR), especially when accompanied by concurrent digital imagery, has been shown in previous demonstrations to be an effective tool for wide area assessment (WAA). The objectives of this project are to (1) systematically investigate the effect of the type and density of vegetation cover on the effectiveness of airborne LiDAR, (2) evaluate the ability of current software packages to automatically discriminate ground features typical of munitions sites, and (3) summarize lessons learned from this and prior WAA Pilot Program demonstrations in a guidance document.

### Local Positioning System for an Active UXO Sensor (MM-0738)

**Principal Investigator:** William San Filipo/Geophex, Ltd.

This project aims to provide a new method for precision local relative position and coil orientation of an EMI sensor, generating multiple sample locations required for advanced data analysis. The technology to be demonstrated will enhance target classification by providing precise multipath sample position information over a target for use by advanced data analysis algorithms, using less expensive and less cumbersome hardware than other systems on the market. It will be entirely autonomous from the EMI sensor and adaptable to any dipolar EMI transmitter.

### Deep Water Munitions Detection System (MM-0739)

**Principal Investigator:** Chet Bassani/SAIC Incorporated

The objective of this project is to demonstrate an integrated deepwater sensor platform suitable for munitions detection in water depths up to 100 ft. The Deep Water Munitions Detection System will be capable of detecting medium and large ordnance with adequate horizontal positioning for routine reacquisition by EOD divers. It will provide DoD the capability to conduct wide area assessment and comprehensive munitions detection surveys in water up to 100-ft depth. Accurate positioning data along with the magnetometer data will provide sea floor magnetic contour maps and provide accurate data inversions yielding target parameters such as location, size, and depth.

### Operational Evaluation of a New Acoustic Technique for UXO Filler Identification (MM-0740)

**Principal Investigator:** Wesley Cobb/University of Denver

Personnel involved with remediation of DoD sites need better tools to discriminate between UXO and nonhazardous items. The objective of this project is to demonstrate and validate a new technology, which was developed under SERDP project MM-1382, for identifying the filler material in UXO. The filler identification technology utilizes acoustic waves to identify the materials inside sealed UXO. Its implementation would permit personnel to quickly identify hazardous items and optimize remediation efforts.

### Next Generation HeliMag UXO Mapping Technology (MM-0741)

**Principal Investigator:** Jack Foley/Sky Research, Inc.

The helicopter-borne Airborne Multisensor Towed Array Detection System technology (HeliMag) is used to detect and map the density and distribution of MEC at specific sites within the larger footprint of a military facility. This project will evaluate, develop, and implement various HeliMag technology improvements that will benefit DoD’s military munitions response mission by decreasing unit costs for WAA through greater speed and efficiency, reduced labor needs, and increased data accuracy and quality.

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**FY 2007 Munitions Management Initiatives**

(continued)
variety of natural (elevated temperature, excess light) and anthropogenic (heavy metal pollution) stressors and observing the corals’ physiological responses and corresponding F.I.R.E readings, they were able to diagnose the type of stressors impacting coral health. The result of these efforts led to the design of bench-top F.I.R.E instruments for long-term monitoring of coral health. With these instruments, resource managers are now able to detect detrimental changes in the coral, determine the type of stressors, and direct appropriate management actions.

Dr. Pamela Reid of the University of Miami, Florida, took a broader approach to developing monitoring and assessment techniques under SERDP project Application of Remotely Operated Vehicle (ROV)-Based Video Technology to Complement Coral Reef Resource Mapping and Monitoring (SI-1333). She initially created two-dimensional maps (mosaics) of coral communities by collecting and combining video images. These mosaics and the associated algorithms developed to standardize their production were optimized through a series of steps that reduce image error and uncertainty as well as georeference the images. The video mosaic technique increases the speed, efficiency, and repeatability with which coral reef plots of up to 500 m² can be analyzed to extract indicators of reef condition. The mosaics provide detailed views at the plot scale, filling the gap between diver measurements and remote-sensing surveys. The flexibility of the mosaicing algorithm developed by Dr. Reid’s team allows a variety of applications, from low-cost surveys with handheld video cameras to mapping of deep reefs with remotely operated platforms. Applying this technique will enable resource managers to efficiently assess the condition of reef communities at the colony level and monitor changes in the colony structure resulting from a disturbance or from management action.

Through further analysis of these mosaics, Dr. Reid and her research team demonstrated the utility of coral reef mosaics for monitoring and assessing changes in coral reef health from both natural and anthropogenic disturbances, as different stressors can trigger different coral responses. Additional development of this video mosaicing technology has been performed to generate three-dimensional maps of individual coral reef colonies. Such maps enable calculation of reef rugosity and coral volume, expanding the range of indicators available for use in monitoring coral reef condition through mosaic analyses.

Together, these SERDP projects provide coastal DoD installations and ranges with valuable techniques for monitoring and assessing the health of coral reef communities. The video mosaicing technique can be used to perform meso-scale assessments of coral reef community health and determine regions where reef condition has deteriorated. The bench-top F.I.R.E system then can be applied to those smaller scale areas to determine the type and origin of stressors involved in causing coral reef health deterioration. Replication of the video mosaicing technique can be used to monitor coral reef recovery over time once management actions have been implemented. By applying sound science and these innovative technologies, DoD resource managers can put adaptive management principles into practice.

Data generated by the complementary techniques developed with SERDP support will enable DoD to target management actions to appropriate areas and on the stressors that are impacting coral reef communities. These monitoring and assessment tools not only satisfy specific conditions of Executive Order 13089 and the associated National Action Plan but also provide a means to collect the robust data needed to satisfy compliance requirements for other statutes, regulations, and executive orders directly related to operations conducted in marine areas. As new training requirements arise over time, these tools also can facilitate the environmental planning process and minimize future impacts to DoD coral reef communities.

For more information on SERDP project SI-1334, please contact Dr. Paul Falkowski at (732) 932-6555 ext. 244 or falko@marine.rutgers.edu and Dr. Maxim Gorbunov at (732) 932-7853 ext. 366 or gorbunov@marine.rutgers.edu, Rutgers University, New Brunswick, New Jersey. Additional information pertaining to the bench-top F.I.R.E system can be found at www.satlantic.com/fire. For more information on SERDP project SI-1333, please contact Dr. Pamela Reid, University of Miami, Florida, at (305) 361-4606 or preid@rsmas.miami.edu.
Spotlight on SERDP and ESTCP FY 2007
Throughout 2007, new initiatives in all SERDP and ESTCP focus areas have

SERDP and ESTCP initiatives in **Sustainable Infrastructure** (SI) focus on the science and technologies required to sustain military training and testing areas as well as the natural and cultural resources and built infrastructure that supports these areas and deployed forces. In 2007, SERDP research and development efforts are investigating methods to assess cumulative effects of stressors on threatened and endangered species; examine fragmentation effects on species; assess and control non-native invasive species (NIS) transport by military vehicles; detect and identify military impulse noise; and develop a watershed modeling system for Fort Benning, Georgia. SERDP Exploratory Development (SEED) efforts are focused on developing environmentally friendly deconstruction techniques for buildings and other permanent structures containing lead-based paint to enable recycling of concrete materials. ESTCP investigators are demonstrating technologies to facilitate and streamline cultural resources management, improve migratory bird monitoring, reduce building energy consumption and waste generation, and decrease jet engine noise levels during static testing. Collectively, the results from these projects will help DoD in its ongoing efforts to achieve sustainability.

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**SERDP Research**

Additional information on these efforts can be found at [www.serdp.org](http://www.serdp.org) under the Research Projects link.

**Forecasting the Relative and Cumulative Effects of Multiple Stressors on At-Risk Populations (SI-1541)**

Principal Investigator: Joshua Lawler/University of Washington

Successful and efficient management of at-risk populations requires an understanding of how various stressors interact and impact persistence and population trends. This project seeks to develop a spatially explicit population model capable of evaluating both the relative and cumulative impacts of a variety of stressors, including climate change and military activities, on a range of at-risk species.

**Identification and Management of Multiple Threats to Rare and Endangered Plant Species (SI-1542)**

Principal Investigator: Bernd Blossey/Cornell University

The objective of this project is to assess the relative contribution of various biotic and abiotic stressors to selected at-risk plant species and their demography. Through modeling and the creation of vulnerability indices, this research will illuminate the severity of single or combined threats and assist efforts to prioritize responses to these threats in support of more cost-effective management.

**Population Viability Analysis of the Endangered Shortnose Sturgeon (Acipenser brevirostrum) (SI-1543)**

Principal Investigator: Henriette Jager/Oak Ridge National Laboratory

Shortnose sturgeon recovery is threatened by various stressors that differentially exploit vulnerabilities associated with this species’ life stages. Through mechanistic population viability analysis modeling, this project seeks to quantitatively partition the influences on shortnose sturgeon recovery between those under the control of the military and those that are not and to use those results to prioritize recovery efforts and quantify population thresholds.

**Developing Functional Parameters to Develop a Science-Based Vehicle Cleaning Program to Reduce Transport of Non-Native Invasive Plant Species (SI-1545)**

Principal Investigator: Lisa Rew/Montana State University

DoD operations—such as equipment and personnel movement between sites and military vehicle use off-road and on unpaved roads—pose a high risk of transporting and depositing NIS plants within and between sites. This project aims to quantify plant propagule transport extent and vehicle cleaning method efficacy for representative military vehicles to aid in the prevention of NIS spread. NIS probability of occurrence maps will be developed to identify those areas most at risk of invasion.

**Development of a Watershed Modeling System for Fort Benning Using the USEPA BASINS Framework (SI-1547)**

Principal Investigator: Anthony Donigian/AQUA TERRA Consultants

The objective of this project is to identify, adapt, and develop watershed models for compliance and long-term watershed planning and management at Fort Benning, Georgia. Enhancements to the U.S. Environmental Protection Agency (USEPA) Better Assessment Science Integrating point and Non-point Sources (BASINS) modeling system as well as integration of data and products from the SERDP Ecosystem Management Project (SEMP) will enable holistic evaluations of watershed issues related to natural resources management and the impacts of military activities on hydrologic, water quality, and ecological endpoints. Model parameter values and land activity characterizations will be relevant and transferable to other installations.

**Sequestering Lead in Paint by Utilizing Deconstructed Masonry Materials as Recycled Aggregate in Concrete (SI-1548)**

Principal Investigator: Kejin Wang/Iowa State University

More cost-effective, environmentally friendly techniques forremedying and reusing deconstructed masonry materials contaminated with lead-based paint (LBP) are needed. The objective of this SEED project is to sequester and/or physically encapsulate the lead in painted masonry材料s by recycling...
Initiatives in Sustainable Infrastructure

been highlighted. Featured here are Sustainable Infrastructure efforts.

them as concrete aggregate and mixing them with high alkaline portland cement or phosphate cement materials. Researchers will perform screening tests to evaluate a suite of designed concrete mixes to ensure the proper selection of mix proportions that abate the lead hazard in recycled aggregate and meet workability and strength requirements for new field construction.

**System Chemistry to Control Potential Environmental and Safety Hazards of Recycled Concrete Aggregate with Lead-Based Paint (SI-1549)**

Principal Investigator: Stephen Cosper/U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory

Through modeling and laboratory-scale simulation of lead fate and transport, this SEED project will evaluate the potential for lead from LBP to migrate into the environment from crushed concrete demolition products under typical construction scenarios at military installations. This project will build on previous work to help determine acceptable lead concentrations in recycled concrete aggregate for many common uses.

**Development and Implementation of Metrics for Identifying Military Impulse Noise (SI-1585)**

Principal Investigator: Jeffrey Vipperman/University of Pittsburgh

As urban areas encroach on once-remote military training bases, noise complaints have increased with the potential to impact military training exercises. The objective of this project is to develop improved, autonomous military impulse noise detectors building on the results of the initial SEED effort (SI-1436). These noise detectors will improve accuracy by reducing false alarms and require less human interpretation, facilitating responses to damage claims and providing instant feedback if severe noise levels are produced.

**Realizing the Potential of the Effective Area Model: Refining the Software and Incorporating Recent Advances to Maximize Usefulness on Military Installations (SI-1597)**

Principal Investigator: Thomas Sisk/Northern Arizona University

By examining the relationship between natural landscape heterogeneity and that caused by habitat fragmentation and by exploring possible threshold responses in selected species, this project will add functionality to the Effective Area Model (EAM) approach (originally developed under SERDP project SI-1100) while testing the upgraded software and initiating technology transfer for use by DoD land managers and other organizations charged with examining tradeoffs in land use and habitat management.

**ESTCP Demonstrations**

Additional information on these efforts can be found at www.estcp.org under the Technologies link.

**Integrating Predictive Modeling in DoD Cultural Resource Compliance (SI-0720)**

Principal Investigator: Paul Green/Headquarters Air Combat Command

DoD cultural resource compliance currently is carried out on a project-by-project and historic property-by-historic property basis, which can potentially jeopardize mission readiness and range sustainability given the occurrence of more than 150,000 documented archaeological sites. This project aims to demonstrate the effectiveness of archaeological modeling as a technology to support cost-effective and streamlined cultural resource management practices on DoD installations. Archaeological models estimate in an objective and replicable manner the nature, distribution, and significance of archaeological sites.

**Validation and Integration of Networked Avian Radars (SI-0723)**

Principal Investigator: Marissa Brand/Space and Naval Warfare Systems Center

This project will demonstrate and validate avian radar systems as improved tools for natural resource managers and air safety personnel that can automatically detect and track flying resident and migratory birds. Data obtained using these systems will improve aircrew safety, reduce aircraft damage, and preserve war-fighting capabilities by directly supporting DoD’s Bird Aircraft Strike Hazard (BASH) program and reducing birdstrike potential around airfields and low-level military training routes.

**Design, Monitoring, and Validation of a High-Performance Sustainable Building (SI-0724)**

Principal Investigator: Michael Frnka/U.S. Army Installation Management Command—Southeast

Conventional construction techniques create low-performance facilities that increase operations and maintenance costs, reduce occupant productivity and health, consume more resources, and degrade ecological services. This project aims to demonstrate that “whole system” design procedures using off-the-shelf building materials and components can yield higher facility performance and that high-performance construction will provide benefits in terms of life-cycle costs, resource savings, and waste reduction. Lessons learned from this demonstration will be institutionalized in Service standard designs.

**Noise Attenuation Device for DoD Jet Engines During Static Testing (SI-0725)**

Principal Investigator: Norman Helgeson/Naval Facilities Engineering Service Center

Noise emanating from military operations increasingly is becoming an issue of concern for DoD because of its effects on adjacent communities and the subsequent restrictions potentially placed on military training and testing. The objective of this project is to demonstrate that the Noise Attenuation Device (NAD) will significantly reduce the noise produced by jet engines during stationary testing and aircraft run-up. NAD is a large muffler that reduces jet engine noise by intercepting the exhaust plume, mixing it in a confined region with approximately three times the quantity of aspirated air, slowing the plume down, and reducing the intensity of the noise produced.
amphibians and develop preliminary remedial goals, when warranted. With ESTCP support, a laboratory validation phase was conducted for both the soil and sediment exposure protocols. Each assay was conducted with copper- and lead-spiked soils to assess how the protocols could be applied to inorganic contaminants. The sediment exposure protocol was further evaluated to consider site-specific conditions that could influence contaminant bioavailability (i.e., total organic carbon, grain size, cation exchange capacity, and pH). An additional phase of laboratory testing is under way to evaluate the differential sensitivities of various species of larval amphibians to copper and lead in sediment. The validation testing finalized the protocols and developed dose-response relationships that were further evaluated using field-collected soils and sediments in the field demonstration.

As part of the field demonstration, soil and sediment samples were collected from Travis Air Force Base (AFB) in California and Aberdeen Proving Ground (APG) in Maryland. Samples collected from Travis AFB were associated with wetlands near an active skeet range, and samples collected from APG were associated with a historic small arms range adjacent to a palustrine wetland. Both sites were selected primarily based on the known presence of amphibian habitat overlapping with copper and lead contamination. Results indicated that the weathered, aged soils and sediments collected from the test sites were less toxic than the laboratory-spiked soils. For example, while hydric soils spiked with concentrations of 9,000 mg/kg lead in the laboratory validation phase of testing resulted in 80% mortality, field-collected soils with approximately 17,000 mg/kg lead affected growth, but no mortality was observed. Similar reductions in toxicity with field-collected sediments also were noted.

Based on the results of the laboratory validation, the sediment exposure protocol has been submitted to the American Society for Testing and Materials (ASTM) Sediment Assessment and Toxicology subcommittee, as well as ASTM general membership, as a draft standard. ASTM’s acceptance of a standard inspires confidence among end users and facilitates regulatory acceptance for field use of innovative technologies.

Innovative technologies like the soil and sediment exposure protocols for conducting amphibian ecological risk assessments will provide managers additional tools to assess the risks and the extent of remediation warranted at wetland sites. These protocols will help DoD avoid the use of inappropriate receptors and methods that might under- or over-estimate site risks and result in the costly and unnecessary excavation and destruction of wetland ecosystems.

For additional information, please contact either Ms. Amy Hawkins, Naval Facilities Engineering Service Center, Port Hueneme, California, at (805) 982-4890 or amy.hawkins@navy.mil or Mr. John Bleiler, ENSR, Westford, Massachusetts, at (978) 589-3000 or jbleiler@ensr.aecom.com.
Program Development Update

SERDP

Proposals selected in response to the FY 2008 Core and SERDP Exploratory Development (SEED) solicitations are being presented to the SERDP Scientific Advisory Board (SAB) for review at its September 2007, October 2007, and March 2008 meetings. Fifty-three projects were recommended for funding from the Core solicitation and eight projects from the SEED solicitation. On September 28, the SERDP Council met and approved the FY 2008 Program Plan and the FY 2009 investment guidance. Before completing development of the FY 2008 Program Plan, the SERDP staff began developing the FY 2009 Program, and on November 8, SERDP released the FY 2009 Core and SEED solicitations. Pre-proposals responding to the FY 2009 Broad Agency Announcement for the Core Solicitation are due January 8, 2008. Full proposals responding to the Federal Call for Proposals and requested full proposals responding to the Broad Agency Announcement are due March 6, 2008. Visit www.serdp.org under the Funding & Opportunities link for details regarding the FY 2009 Statements of Need and schedule for submission.

ESTCP

In September 2007 as part of the FY 2008 solicitation, full proposal submitters presented their proposed work to the ESTCP Technical Committees (ETC). The ETCs made recommendations to the ESTCP Director, who selected projects to be funded in FY 2008. Proposal acceptance letters have been sent, and Principal Investigators are being contacted to submit Project Plans and Obligation/Expenditure Plans, as well as to schedule project kickoff conference calls with the appropriate ESTCP Program Manager. These plans must be submitted before the release of FY 2008 funding.

A solicitation for the FY 2009 Program is planned for release on or about January 10, 2008. Watch www.estcp.org for details and updates on funding opportunities.

FY 2009 SERDP Statements of Need

Environmental Restoration

- Reduced Uncertainty and Costs for Managing Large, Dilute Contaminant Groundwater Plumes
- Improved Identification of Munitions Constituent Source Zone Locations and Strength
- Improved Understanding of the Impact of Environmental Parameters and Sampling Methods on Measured Groundwater Contaminant Concentrations

Munitions Management

- Improvements in the Detection and Remediation of Underwater Military Munitions
- Phenomenology of Military Munitions in Underwater Environments
- Advanced Technologies for Detection, Discrimination, and Remediation of Military Munitions
- (SEED) Advanced Technologies for Detection, Discrimination, and Remediation of Military Munitions

Sustainable Infrastructure

- Development of Science-Based Recovery Objectives for Ecological Systems in the Southeastern United States
- Managing and Restoring Southeast Coastal Ecosystems Under the Threat of Climate Change
- Accelerated Pine Forest Mortality in the Southeastern United States
- Understanding Impacts of Military Activities on Archaeological Resources
- Assessment of the Impact of Sea Level Rise on Military Infrastructure

Weapons Systems and Platforms

- Advanced Methods for Removing Solids from Shipboard Waste Streams
- Characterization of Emissions from Open Burn/Open Detonation
- Dynamic Accelerated Corrosion Test Protocol
- Environmentally Acceptable, Direct-to-Substrate Pretreatments for Multi-Material Systems
- Environmentally Benign Aircraft Deicing and Anti-Icing
- Understanding the Science Behind How Methylene Chloride/Phenolic Chemical Paint Strippers Remove Coatings

systematic random (random grid) sampling design. A sample or replicate samples of approximately 1 kg mass are obtained to characterize the average concentration of MCs. The entire sample should be thoroughly pulverized and mixed so as to minimize subsampling variability. This approach is dramatically different from the collection of discrete samples and the common practice of field splitting or laboratory subsampling by removing only a portion of the sample received from the field for further processing. The result is a more representative assessment of the distribution of energetic MC residues on ranges.

Technical report ERDC/CRREL TR-07-10 summarizes the sampling strategies and designs that have been implemented for various types of military ranges, including hand grenade, antitank rocket, artillery, bombing, and demolition ranges. Protocols were developed during investigations on active ranges and primarily addressed potential surface source zones from which energetic residues could be migrating into surface and groundwater systems. Results are integral to development of the conceptual site model for characterization of MCs on operational and non-operational military training ranges under the Sustainable Range Program and the Military Munitions Response Program. Implementation of this guidance for sampling activities will facilitate scientifically defensible environmental characterization efforts and result in more accurate estimates of energetic MC concentrations, which in turn will inform long-term management decisions to achieve range sustainability.

To facilitate transition of these protocols to field use, a workshop encompassing presentations and laboratory and field demonstrations was conducted in August 2007 at the U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory (USACE ERDC-CRREL). A similar training event is being held in conjunction with the Partners in Environmental Technology Technical Symposium & Workshop in December 2007.

Technical report ERDC/CRREL TR-07-10 is available in the SERDP and ESTCP Online Library at http://docs.serdp-estcp.org using 0628 as the Search Phrase. For additional information, please contact Mr. Alan Hewitt, USEC ERDC-CRREL, Hanover, New Hampshire, at (603) 646-4388 or Alan.D.Hewitt@eric.usace.army.mil.
Congratulations to...

ESTCP Principal Investigators
Mr. Thomas Krug, Dr. David Major, and Ms. Suzanne O’Hara from GeoSyntec Consultants and their team members from the University of Central Florida, National Aeronautics and Space Administration (NASA), and Naval Facilities Engineering Service Center who were inducted into the 2007 Space Technology Hall of Fame for their innovative application of emulsified zero-valent iron (EZVI), a remediation technology now being used across the United States. Composed of a surfactant, biodegradable oil, water, and nanoscale ZVI particles in an emulsion, EZVI has been shown to enhance the degradation of chlorinated solvent dense noneaqueous phase liquid (DNAPL) source zones. With ESTCP support, Mr. Krug and his team demonstrated the effectiveness of EZVI at Cape Canaveral Air Force Station Launch Complex 34. The Space Technology Hall of Fame is coordinated by the Space Foundation in cooperation with NASA and honors the application of space technology for the betterment of life on Earth.

SERDP Principal Investigator
Mr. William Voorhees from the Naval Air Systems Command and the entire Joint Strike Fighter (JSF) Test and Data Quality Assurance Team who were selected to receive an EPA Climate Protection Award for developing an improved particulate matter (PM) test method targeting high-performance gas turbine engines used by the Department of Defense. The Climate Protection Awards recognize exceptional leadership, outstanding innovation, personal dedication, and technical achievements in protecting the climate. The Climate Protection Partnership Division noted that “The JSF Test and Data Quality Assurance Team developed a test that will, for the first time, allow scientists to accurately gauge the contribution of jet aircraft particulate emissions to global climate change.” The new test replaces EPA Test Method 5, which does not measure particulate size, distribution, or chemical species. In addition to advancing the science of particulate emissions testing, the new test significantly reduces engine run times, lowering emissions and cutting the costs of engine testing by more than $1 million per engine tested. The interim PM test method for the JSF is on track to be completed in Spring 2008. The Climate Protection Award was presented to Mr. Voorhees on May 1, 2007, in Washington, D.C.

ESTCP Principal Investigator Dr. C. Herb Ward and his team from Rice University and the Georgia Institute of Technology who were honored by the Water Environment Federation with the McKee Groundwater Protection, Restoration, or Sustainable Use Medal for their publication comparing bioaugmentation and biostimulation for the enhancement of DNAPL source zone bioremediation (refer to citation below). Using an experimental controlled release system with a known initial DNAPL mass and composition, Dr. Ward and his team have quantitatively assessed the potential for DNAPL source zone bioremediation at near-field scale. In recognition of significant contributions to groundwater science and engineering research, Dr. Ward received the McKee Medal at the Water Environment Federation Technical Exhibition and Conference, October 13-17, 2007, in San Diego, California. Da Silva M.L.B., R.C. Daprato, D.E. Gomez, J.B. Hughes, C.H. Ward, and P.J.J. Alvarez (2007). Comparison of Bioaugmentation and Biostimulation for the Enhancement of DNAPL Source Zone Bioremediation. Water Environment Research 78 (13): 2456-2465.

...And Congratulations to...
...the five graduate students who were selected to receive fellowships from SERDP to attend the Ecological Society of America (ESA)/Society for Ecological Restoration International Joint Meeting August 5-10 in San Jose, California. These fellowships are awarded to increase awareness of conservation opportunities involving DoD and to promote future research. The award-winning students and their paper topics are as follows.

- Mr. Joshua Atwood
  University of Rhode Island
  Phenology of the Invasive Reed Phragmites australis: Implications for Invasions Under Global Change

- Mr. David Coyle
  University of Wisconsin-Madison
  Ecology and Impact of Invasive Root Weeds in a Northern Hardwood Forest

- Mr. Jianjun Huang
  The Ohio State University
  Effects of Fire and Fire Surrogate Treatments on Forest Carbon and Nitrogen Storage

- Ms. Haldre Rogers
  University of Nevada, Reno
  Ecological Genetics of the Mojave Desert Tortoise

- Ms. Bridgette Hagerty
  University of Virginia
  The Effect of Complete Bird Loss on Herbivory and Plant Recruitment
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 a keyword or selecting the relevant search filters.

Environmental Restoration

• Cost & Performance Report: Demonstration and Validation of a Water and Solute Flux Measuring Device (ESTCP ER-0114)
• Final Report: Investigation of the Effects of Perchlorate on Thyroid and Reproductive System Function in Goldfish (SERDP ER-1222)
• Final Report: Enhancement of In Situ Bioremediation of Energetic Compounds by Coupled Abiotic/Biotic Processes (SERDP ER-1376)
• Final Report: Development of Environmental Data for Navy, Air Force, and Marine Munitions (SERDP ER-1480)
• Treatability Study Report: Grenade Range Management Using Lime for Metals Immobilization and Explosives Transformation (ESTCP ER-0216)

Munitions Management

• Cost & Performance Report: Ultra-Wideband, Fully Polarimetric Ground Penetrating Radar for UXO Discrimination (ESTCP MM-9902)
• Final Report: GEM-3D Sensor Development (SERDP MM-1353)
• Final Report: Intra-Inversion Filtering for Use of Magnetic Fields to Locate and Characterize Magnetic Dipoles for UXO Cleanup (SERDP MM-1452)
• Final Report: Enhanced UXO Discrimination Using Frequency-Domain Electromagnetic Induction (ESTCP MM-0033)
• Interim Report: ALLTEM and TMGS May 2006 Tests at the Standardized UXO Test Area at the Yuma Proving Ground (SERDP MM-1328)
• Interim Report: Former Lowry Bombing and Gunnery Range: Practical Discrimination Strategies for Application to Live Sites (ESTCP MM-0504)
• Technical Report: Interpreting Results from the Standardized UXO Test Sites (SERDP MM-1300 & ESTCP MM-0103)
• Technical Report: Range Reference Notebook
• Conceptual Site Model: Former Kirtland Precision Bombing Range
• Interim Report: The MTA UXO Survey and Target Recovery on Lake Erie at the Former Erie Army Depot (ESTCP MM-0324)

Sustainable Infrastructure

• Final Report: Development of the DUSTRAN GIS-Based Complex Terrain Model for Atmospheric Dust Dispersion (SERDP SI-1195)

Weapons Systems and Platforms

• Final Report: Synthesis, Evaluation, and Formulation Studies on New Oxidizers as Alternatives to Ammonium Perchlorate in DoD Missile Propulsion Applications (SERDP WP-1403)
• Final Report: Validation of Alternatives to High Volatile Organic Compound Solvents Used in Aeronautical Antifriction Bearing Cleaning (ESTCP WP-0305)
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<td>A Federal Call for Proposals and a Broad Agency Announcement for ESTCP FY 2009 project funding to be</td>
<td>For more information, visit <a href="http://www.serdp-estcp.org/">www.serdp-estcp.org/</a></td>
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<td>released on or about this date</td>
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<td>SERDP and ESTCP quarterly progress reports due for the first quarter of government FY 2008</td>
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<td>March 6</td>
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<td>Full proposals due in response to the SERDP FY 2009 Core Solicitation Federal Call for Proposals and Broad</td>
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<td>Full proposals due in response to the SERDP FY 2009 SERDP Exploratory Development (SEED) Solicitation</td>
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<td>March 11-13 Scientific Advisory Board (SAB) meeting</td>
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<td>Pre-proposals due in response to the ESTCP FY 2009 Solicitation Federal Call for Proposals and Broad</td>
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**RELATED CONFERENCES & EVENTS**

- **December 4-6, 2007**
  - Partners in Environmental Technology Technical Symposium & Workshop
  - Sponsored by SERDP and ESTCP
  - Washington, D.C.
  - [For more information, visit www.serdp-estcp.org/](http://www.serdp-estcp.org/) Symposium.

- **May 5-8, 2008**
  - Joint Services Environmental Management (JSEM) Training Conference & Exposition
  - Denver, Colorado
  - [For more information, visit www.jsemconference.com](http://www.jsemconference.com).

- **May 19-22, 2008**
  - The Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds
  - Monterey, California
  - [For more information, visit www.battelle.org/environment/er/conferences/chlorcon/default.htm](http://www.battelle.org/environment/er/conferences/chlorcon/default.htm).