SON Number: MRSON-12-01 **October 28, 2010**

Strategic Environmental Research and Development Program (SERDP)

FY 2012 STATEMENT OF NEED

Munitions Response (MR) Program Area

ADVANCED TECHNOLOGIES FOR DETECTION, DISCRIMINATION, AND REMEDIATION OF MILITARY MUNITIONS ON LAND

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to develop sensors, signal processing methodologies, sensor platforms, supporting technologies, or remediation technologies to address the diverse challenges associated with the cleanup of Department of Defense (DoD) munitions-contaminated terrestrial sites (sites contaminated with unexploded ordnance [UXO], discarded military munitions [DMM] and related items). Capabilities are needed for a wide variety of site conditions, particularly those with difficult geology, terrain and vegetation, and complex munitions and clutter distributions. Many sites or sections of sites have sparsely distributed subsurface munitions and clutter items that can clearly be separated, while other areas have almost continuously overlapping suspected items, which need to be assessed and removed. Munitions ranging in size from 20-mm projectiles to 2000-lb bombs must be detected and discriminated from other non-hazardous items in the subsurface, although proposals need not address the entire range of potential munitions.

Proposals addressing any aspects of munitions response will be considered and those addressing the following topics are of particular interest.

Classification

Significant progress has been made in classification technology. Analysis of geophysics data using simple dipole models to estimate object parameters is routine in research and development and becoming accepted in practice. Previously, testing of these approaches was primarily limited to test sites with only limited application at live sites. In the last several years, the Environmental Security Technology Certification Program (ESTCP) has demonstrated the application of classification technologies at real UXO sites under real world conditions. The research challenges for classification include:

- Complex mix of munitions types.
- High clutter environment.
- Conditions that make collection of high quality data problematic.
- Limits in the information content of currently available sensors.
- Noise sources in data collection, such as platform motion and geolocation error.
- Insufficient signal to noise to discriminate small and deep targets.

Typically, the result of classification is expected to be a list of geophysical anomalies prioritized by the likelihood that they correspond to munitions that will be used to guide digging. Although for most anomalies, this prioritization is straightforward using currently available inversion and classification methods, there is a subset for which it is more challenging. These difficult cases result from causes such as apparently successful inversions that result in incorrect target parameters, local minima in the objective function that are not recognized as such, and distributions of parameters that do not match the assumptions made while developing the classifier. Principled approaches to address these "outlier" anomalies are required.

ESTCP has conducted large scale demonstrations of emerging classification technologies at former Camps Sibert, AL, San Luis Obispo, CA and Butner, NC (serdp-estcp.org/Featured-Initiatives/Munitions-Response-Initiatives/Classification-Applied-to-Munitions-Response). These demonstrations involved the collection of high-density, well-located survey data from a variety of standard and developmental systems and cued interrogation with the developmental systems. Comprehensive ground truth data was collected for 1500 to 2500 geophysical anomalies at each location. Data from these demonstrations will be available for use to support proposed work in response to this SON.

Optimization of Advanced Electromagnetic Induction (EMI) Sensors

Advanced EMI sensors, such as those demonstrated in the ESTCP live site demonstrations, are beginning to show great potential in providing the data required for meaningful classification. These sensors are, however, developmental systems and are thus large, heavy, and often not power efficient. They were designed as research instruments and therefore collect large amounts of data which may be well in excess of what will ultimately be required. Development is needed to produce sensors with improved usability and ergonomics and to support alternative portable deployment approaches. Consideration of such parameters as transmitter orientation and moment, receiver configuration and number, base period of the waveform (and thus maximum decay time available), the trade off of stacking and sampling rate, and deployment strategies may be required.

Tools to Support Informed Decisions on Munitions Response Sites

There is a need for procedures and tools that will allow site managers to make decisions at Munitions Response sites based on quantitative and transparent criteria. The focus is on the needs of individual site managers and teams to answer questions such as what is the likelihood that UXO will be encountered at the site before and after remediation, how to prioritize anomalies for digging in a principled way, how to assess residual uncertainties, and when to stop digging.

Proposals need not address all aspects of this SON. Proposals addressing contamination of soils and groundwater by munitions constituents are not within the scope of this SON. Proposals addressing underwater munitions topics should be submitted under MMSON-12-02: "Improvements in the Detection and Remediation of Military Munitions Underwater"

2. Expected Benefits of Proposed Work

Results from this work will provide expanded capability to cost effectively characterize and remediate munitions response sites, resulting in improved site coverage, significant cost savings, and increased capabilities to deploy advanced technologies for a wide diversity of site conditions.

3. Background

As a result of past military training and weapons testing activities, military munitions are present at sites designated for Base Realignment and Closure (BRAC), at Formerly Used Defense Sites (FUDS) and other closed ranges, as well as on active installations. The detection and remediation of munitions on ranges, munitions burning and open detonation areas, and burial pits is one of the DoD's most pressing environmental problems. The characterization and remediation activities conducted at DoD sites using currently available technology often yield unsatisfactory results and are extremely expensive, due mainly to the inability of current technology to detect all munitions that may be present at a site and the inability to discriminate between hazardous munitions and non-hazardous items. Field experience indicates that often in excess of 90% of objects excavated during the course of a munitions response are found to be non-hazardous items (false alarms). As a result, most of the costs to remediate a munitions contaminated site are currently spent on excavating targets that pose no threat.

The military munitions technology program seeks to both maximize the probability of detection of munitions and minimize the false alarm rate. Our goal is to meet the highest probability of detection desired (near 100%) at each site while reducing the false alarm rate by a factor of up to 100 for highly cluttered sites. These two metrics are closely coupled and must be tackled jointly. In all of DoD's technology objectives, the DoD Munitions and Explosives of Concern (MEC) Research, Development, Test and Evaluation (RDT&E) program is striving to provide tools and full visibility to site managers, regulators and communities concerning the expected performance and associated cost and impact for any cleanup decision.

Complementary SERDP/ESTCP-Funded Projects: Currently, SERDP and ESTCP are supporting a wide array of efforts addressing the munitions response problem. These efforts are primarily directed at the development of geophysical instruments and the collection and analysis of geophysical data, and include a few projects aimed at the underwater munitions response problem. A brief description of these completed and ongoing projects can be found at the SERDP and ESTCP web site (www.serdp-estcp.org/Program-Areas/Munitions-Response).

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Two options are available:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time, schedule, and cost requirements to accomplish the scope of

work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $150,000 and approximately one year in duration. Such proposals may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

5. Point of Contact

Dr. Herb Nelson
Program Manager for Munitions Response
Strategic Environmental Research and Development Program (SERDP)
901 North Stuart Street, Suite 303
Arlington, VA 22203
Phone: 703-696-8726
E-Mail: Herbert.Nelson@osd.mil

For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP web site at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.