SON Number: WPSON-13-03 **October 27, 2011**

Strategic Environmental Research and Development Program (SERDP)

FY 2013 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

ENVIRONMENTALLY ADVANTAGED SUBMUNITIONS

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to develop alternative concepts for submunitions that will not result in hazardous contamination on Department of Defense (DoD) ranges or the battlefield. Submunitions have among the highest dud and low-order rates of any type of munition used by the DoD, and consequently create large numbers of unexploded ordnance (UXO) and explosive residues. Submunitions are generally deployed in large numbers over a widespread area to create maximum effect. The result is that although they are small munitions, the UXO that they create have the capability of contaminating large areas. This contamination can compound the effects of other UXO on the same range because remediation of ranges containing submunitions is generally restricted or prohibited. Submunition casings tend to be thin and less durable than other munitions, creating a higher probability of release of their energetic fill.

The need exists for technologies that can significantly lower the existing dud-rate without compromising the performance of the submunition. Current DoD policy requires that all submunitions have a less than 1% UXO rate by 2018. This is a very high standard to meet, considering that the best submunitions in use have a UXO rate of 3-4%, and the worst are substantially higher in practice. Proposals that address <u>any</u> facet of submunition failure will be considered although technologies that improve fuze reliability and functionality are considered to have the best chance to achieve the 1% dud and low-order rate. In that case, proposed work should lead to complete detonation through improved fuzing and detonator trains, including fuze reliability and environmentally sustainable energetic detonator formulations that can be used to initiate very insensitive energetic formulations. Proposed solutions should not include methods that leave energetic material behind, such as self-destructive fuzes, and must not compromise the performance or implementation of the submunition into the cluster munition. Proposals should demonstrate an understanding of the reliability issues associated with current submunitions and should discuss how proposed solutions will address these issues.

Proposals involving the detonator train should eliminate lead-based energetic formulations while maintaining output and reliability.

2. Expected Benefits of Proposed Work

The development of environmentally advantaged submunitions will result in the elimination of range cleanup and battlefield segregation due to submunition unexploded ordnance (UXO). Current explosive ordnance disposal (EOD) practices require that range sweeping be performed routinely after test and evaluation of submunitions. The preferred method of demilitarization requires an external stimulus (usually a block of C-4 explosive) that may result in greater contamination of the range with energetic constituents, either from the stimulus or from the low order detonation of the item. Small submunitions like the widely used BLU-97 Combined Effects Bomb are extremely sensitive to movement and have an increased risk to detonate during disposal. EOD teams typically clear these ordnance items from a distance, with an estimated cost of $1,000 per item. Buried or partially buried UXO costs can be even higher – up to $13,000 per item. UXO or low-order detonations left on range can crack or degrade and release energetic constituents like RDX or TNT onto the range. Improved fuze reliability and detonator trains will reduce or eliminate submunition UXO clean-up and remediation requirements. Lead-free detonators will eliminate the need for costly remediation of training and testing ranges typically required for lead residues left on range even after complete detonation and eliminate worker exposure to lead manufacturing and demilitarization of submunitions.

3. Background

The U.S. Military uses millions of rounds of ammunition every year on ranges and in battle. Modern munitions for the most part are extremely reliable – the result of extensive research, development, and engineering improvements. However, the military realizes that all munitions will have a certain dud and low-order rate. This can be the result of imperfections in design, manufacturing issues, or environmental exposure during storage and transportation. In fact, military specifications generally allow a certain, very low percentage of the munitions to be duds upon lot acceptance testing from the manufacturer (traditionally less than 3%). In some cases, the actual dud rate seen on the test ranges and battlefields can be higher, especially in the case of submunitions, where the standard dud rate historically has been substantially higher than other munitions. Military doctrine requires that we train as we fight. As a result, these items are ubiquitous as UXO on test and training ranges as well as the battlefield. DoD continues to rely on lead-based primary explosives like lead styphnate and lead azide in the detonator train to meet reliability requirements in these submunitions. Lead has been shown to impact human health even at very low levels and as a result, regulation of lead in the environment has become increasingly strict. Leaking UXO and low-order detonations can release energetic materials and lead compounds onto the training range or battlefield, contaminating the soil, water, and air and may require costly clean-up and remediation.

Submunition UXO on the ground can lead to unnecessary civilian casualties or serve as improvised explosive devices in hostile territories. In 2008, the DoD Policy on Cluster Munitions and Unintended Harm to Civilians implemented a policy to only employ cluster munitions that do not result in more than 1% UXO after 2018. Army policy no longer allows live submunitions to be used on Army training ranges, although they are still allowed on testing ranges. Several other efforts have resulted in self-destruct and omni-directional fuzing. For example, improvements in fuzing for the M42 and M46 submunitions have improved their dud rate from 14% to essentially zero. However, these improvements are not applicable to all submunitions due to space and safety considerations.

On the battlefield, submunition UXO hazards have an enormous effect on command and control decisions for battle planning and can severely limit training capabilities. The U.S. Armed Services recorded 177 explosion casualties in the 1991 Persian Gulf War, constituting 13% of the total U.S. military casualties. At least 80 of the U.S. casualties were attributed to cluster-bomb submunition duds.

The BLU-97 munitions are soda-can-sized bomblet submunitions that are dispensed in large numbers (approximately 150-200 bomblets per weapon) to attack "soft" area targets. These submunitions are dispensed by several different weapon systems, including long, medium, and short range missiles, air-dropped bombs, and artillery rounds. The BLU-97 bomblets are dispensed over a relatively large area, resulting in widespread lethality and widely scattered UXO. The original Composition B (RDX, TNT, and wax) explosive has been replaced in the most recent model, IM BLU-97, with PBXN-107 explosive (RDX/acrylic). The BLU-97 was widely used in Kosovo and both Persian Gulf Wars, with an estimated failure rate of at least 7%. At this rate, a weapon containing 200 submunitions would result in 14 unexploded submunitions. The U.S. used a total of 10,035 CBU-87s (a type of cluster munition loaded with BLU-97 submunitions) during the 1991 Persian Gulf War, resulting in a release of up to 140,000 unexploded submunitions. Between January 17 and February 28, 1991, the U.S. and its allied coalition used a total of 61,000 air-dropped cluster munitions containing 20 million submunitions. Even at the 1% dud rate required by DoD policy, this translates to 200,000 UXO, presenting a significant safety and environmental hazard. DoD will continue to rely on submunitions in the field. More reliable fuzing and lead-free detonator trains are needed to comply with DoD submunition policy and to dramatically reduce submunition dud rates, clean-up risks on testing and training ranges, and collateral damage due to UXO on the battlefield.

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

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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.