

**Strategic Environmental Research and Development Program
(SERDP)**

FY 2015 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

SUSTAINABLE GASLESS DELAY FORMULATIONS

1. Objective of Proposed Work

The Department of Defense (DoD) seeks to develop gasless delay formulations free of perchlorate, lead, and hexavalent chromium. A successful proposal will develop, test, and integrate delay technologies into a full-up prototype system. Proposed technologies should maintain or exceed the performance of current delay formulations in terms of:

- Ignitability with common primer mixes
- Consistent burn times with a range of 0.5-2.5 seconds
- Ability to ignite a relevant output charge like black powder or other perchlorate-free mixtures
- Formulation sensitivity
- Processability requirements

Proposals should address delay elements in high-use, multi-item fuze systems, including but not limited to the M201A1, M213, and M228. Delay formulations that can be “tuned” to burn at multiple time scales by adjusting the parameters of a common formulation are particularly of interest. Proposals should discuss all of the following:

- Laboratory evaluation of relevant mechanical properties, optimization of particle size and morphology, and material compatibility.
- Small-scale energetic formulation to allow performance and sensitivity testing as proof-of-principle in preparation for transition from laboratory scale to prototype tests.
- Demonstration of delay formulations in a prototype configuration in both static and ballistic testing over the complete range of operating conditions (-65°F to +160°F).
- Evaluation of potential environmental properties and toxicity of the delay system per ASTM Standard E2552-08, “Standard Guide for Assessing the Environmental and Human Health Impacts of New Energetic Compounds.”

Coordination with a manufacturing partner is highly encouraged as formulations should be compatible with current manufacturing methods.

2. Expected Benefits of Proposed Work

New formulations will eliminate carcinogenic hexavalent chromium, lead, and perchlorate used in delay elements. This will reduce worker exposure to highly toxic ingredients, as well as

reduce costs of complying with Environmental Safety and Occupational Health regulations and potential range contamination. It will also support Office of the Secretary of Defense policy to minimize hexavalent chromium used in weapon systems.

3. Background

Delay elements are used in both commercial and military items requiring a reproducible time interval between the initiation of a primary charge and the ultimate detonation or combustion of the item. The range of time required of the delay element varies from one second through a minute or more depending on the application. Delays can be gas-producing for vented applications (e.g., pyrotechnic hand-held signals) or gasless for applications that require a sealed fuze system (e.g., hand grenades).

At this time, many military pyrotechnic delay formulations contain chromates, lead, barium, and perchlorates. The U.S. Army has been successful at removing environmentally hazardous materials from gas-producing delays for pyrotechnic items however, DoD still needs an environmentally sustainable gasless delay that is highly tunable and fits in the limited space within currently fielded munitions.

Gasless delay elements are used in hundreds of thousands of items per year in a variety of applications. Examples of fuzes and end items that use gasless delay elements include, but are not limited to, the M201A1 (M18, M83 smoke grenades and M14 incendiary grenades), M208 (M8 smoke pot), M228 (M69 training grenade), M213 (M67 fragmentation grenade) and M84 (variant of the M201A1). As an example, the M201A1 fuze is used in roughly 500,000 items per year. The delay compositions used in this fuze contain environmentally objectionable materials such as barium chromate, lead chromate, and potassium perchlorate.

The environmental impacts of hexavalent chromium, lead, and perchlorate are well documented. Hexavalent chromium is a known carcinogen and is heavily controlled by environmental and occupational safety regulations. The Office of the Secretary of Defense directed the Services to reduce the use of hexavalent chromium where possible through a 2009 memorandum “Minimizing the Use of Hexavalent Chromium (Cr⁺⁶).” Lead is highly regulated in all media. A recent study by the National Research Council found that current occupational exposure levels are not protective of DoD personnel at firing ranges and shoot-houses. Perchlorate is a highly water soluble contaminant that has been shown to inhibit normal function of the thyroid. Perchlorate is regulated in drinking water in several states and EPA is developing a national regulation for perchlorate in drinking water.

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 website at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.