

COMMERCIALIZATION OFFICE - PILOT OPERATIONAL REQUIREMENTS DOCUMENT

Blast Mitigation of Fuel Tank Explosions

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Point of Contact:

**Mark Protacio
Commercialization Office
SETA Support
Mark.Protacio@associates.dhs.gov**

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1. General Description of Operational Capability

This Operational Requirements Document (ORD) describes the use of an explosion suppression system to protect fuel containers. A “fuel container” ranges from fuel tanks found in vehicles, boats or trains to fuel storage tanks at airports, seaports and the neighborhood gas station.

Some of today’s largest terrorist targets are our country’s critical infrastructure/key resources (CI/KR) such as airports, seaports, bridges, energy facilities, railways, and mass transit systems. The use of an explosion suppression system in fuel containers can mitigate the IED threat by preventing fuel tank explosions. Attacks have the potential of causing disastrous consequences, resulting in catastrophic loss of life, destruction of assets, environmental issues and financial turmoil through the interruption of operations.

While many areas central to our national infrastructure are exposed to the threat posed by the targeting of fuel storage facilities, a field-proven system to protect these assets is required. An explosion suppression system provides the capability to “render safe and neutralize explosive threats” across a broad range of applications.

The operational capability described herein will provide the user community (DHS, state, local and tribal government agencies) with anti- explosion technology that will support the hardening of strategic assets and mitigate dangerous explosions from terrorist attacks or accidents.

The solution should be applicable to explosion suppression needs within border security, cargo security, transportation security, counter-IED, maritime security, and critical infrastructure protection.

1.1. Capability Gap

A gap currently exists in the protection of strategic assets critical to our national infrastructure from our borders to gas stations to our vital facilities. The possibility of accidental and/or terrorist attacks on fuel tanks and storage facilities is real and remain a critical, yet unresolved national security issue.

1.2. Overall Mission Area Description

The objective of using an explosion suppression system is to prevent destructive pressures from being generated after the explosive ignition of vapors or gases from an attack on a fuel tank. These pressures arise when heat is released by rapid self-sustained burning. While explosions appear to be instantaneous, this burning reaction, in fact takes time and its progression can be recorded and analyzed.

Research has yielded an extensive database of mechanisms which may be introduced to moderate a reaction and therefore suppress an explosion.

Border Security

Represents active needs:

- Improved ballistic protection
- Non-lethal compliance measures for vehicles, vessels, or aircraft.

Counter IED

Represents active needs:

- Capability to assess, render safe, and neutralize explosive threats
- Rapidly deployable blast-mitigation concepts.

Infrastructure Protection

Represents active needs:

- Effective and affordable blast protection for critical infrastructure
- Rapid mitigation technology

1.3. Description of the Proposed Product or System

A system shall work to mitigate the effects of a fuel tank explosion. Possible solutions may include, but are not limited to internal hardware, external hardware and coverings, new materials for use as fuel tanks, additives to fuel that will prevent catastrophic explosions, etc. A system shall work in a passive manner, not requiring any human interaction or knowledge of an impending attack on the fuel tank or surrounding area.

1.4. Supporting Analysis

Our analysis is supported by the U.S. Army Medical Corps which found “Not since military operations in Vietnam has the U.S. military medical system experienced the number and severity of burn trauma casualties now attributed to military operations in Iraq and Afghanistan. During the early phases of U.S. military operations in the Global War on Terrorism (GWOT), most of the burn injuries were related to handling fuel and munitions. Subsequently, burns and associated injuries from improvised explosive devices (IEDs) have become more prevalent.”

1.5 Mission the Proposed System Will Accomplish

A proposed solution shall provide an explosion suppression system for a “platform,” such as vehicles, tankers, aircraft, or boats, etc. Once installed, the solution shall provide the anti-explosion capability for that platform and will provide an enhanced level of safety to any occupants or nearby persons. A proposed solution shall help protect all individuals from burns and the effects of an out-of-control explosion.

1.6. Operational and Support Concept

1.6.1. Concept of Operations

A proposed solution shall be used in conjunction with a fuel tank (internally, externally, as a substitute material for the tank, etc.) that will mitigate the effects of an explosion of the fuel contained in the tank. A solution shall be passive in nature, requiring no human interaction in order for mitigation to occur. A solution must work, or be tailorable to work, for all types of conventional and non-conventional fuels to be stored, including but not limited to gasoline, diesel, jet fuel, ethanol, biodiesel, etc.

1.6.2. Support Concept

The design shall support easy installation. No special skills are required. After the initial installation, there is no further operation or maintenance of the solution/product needed. During installation and subsequent integration into a given platform, there shall exist no personnel safety hazards or specialized training requirements.

2. Threat

Fuel explosions through IED attacks or bomb blasts are a threat that terrorists have repeatedly utilized in attacks against the United States.

- **9/11 attacks**
 - *Terrorists utilized large commercial aircraft with full fuel tanks as effective weapons*
 - *The 9/11 Commission Report cited multiple government sources of corroboration:*
 - *DOJ : “a fueled Boeing 747, used as a weapon, ‘must be considered capable of destroying virtually any building located anywhere in the world’”*

- **Fuel and IED-related burn injuries are at an all-time high**
 - *“Not since military operations in Vietnam has the U.S. military medical system experienced the number and severity of burn trauma casualties now attributed to military operations in Iraq and Afghanistan. During the early phases of U.S. military operations in the Global War on Terrorism (GWOT), most of the burn injuries were related to handling fuel and munitions. Subsequently, burns and associated injuries from improvised explosive devices (IEDs) have become more prevalent.”- U.S. Army Medical Department Journal*
 - *Targeting fuel is a strategy terrorists have used for years and continue to utilize with devastating effectiveness.*

3. Existing System Shortfalls

While most fuel tanks do not possess any type of explosion mitigation, there are products on the market that can be added to the outside of a vehicle fuel tank, which seal the tank from spills once the outer protection system is penetrated, the applications are limited

4. Capabilities Required

The performance metrics included are delineated in terms of the minimum acceptable Threshold (T) and the desired Objective (O) Values

4.1. Operational Performance Parameters

Form Factor

A solution can be based on any demonstrable technology of any form factor.

Environmental

A solution shall mitigate explosions and performance shall not be adversely affected by rain, wind, altitude (in the case of aircraft) or any other conditions to which a fuel tank may be subjected in its normal operating environments.

Temperature

A solution shall operate between the following range of temperatures -10°C/+14°F to +50°C/+122°F (T) and -30°C/-22°F to +100°C/+212°F (O).

Product Operation

A system shall operate in a way that no user input is required to initiate blast mitigation action.

4.2. Key Performance Parameters (KPPs)

Price

The solution price shall be installed at \leq \$1 per gallon of fuel protected.

4.3 System Performance.

4.3.1 Mission Scenarios

A solution needs to be applicable to any and all applications where a fuel tank is found in a static or dynamic environment.

4.3.2 System Performance Parameters

A solution shall mitigate the damaging effects (defined as of a fuel tank explosion by at least 75% (T) and 95% (O).

4.3.3 Interoperability

A solution shall work with all major types of fuel tanks ranging from 15 gallons up to 20,000 gallons.

4.3.4 Human Interface Requirements

Once installed, direct human interface with a solution shall not be required.

4.3.5 Logistics and Readiness

A solution needs to be installable in the case of a commercially available tank less than 50 gallons in capacity in less than 1 hour and ready-made kits need to be readily available for applications such as aircraft, fuel tanks, common storage tanks, etc. Solution providers shall provide a list of all available kits.

4.3.6 Other System Characteristics

System shall not interfere with the normal operations of the fuel tank. There shall be no performance loss as a result of installing a system in terms of efficiency, miles per gallon ratings, emissions, etc.

5. System Support

5.1 Maintenance

Once installed, a system shall require inspection at intervals of every 5 years (T) or every 10 years (O).

5.2 Supply

Systems shall have a shelf life of at least 5 years (T) or at least 10 years (O) and shall be storable, if required, at user facilities.

5.3 Support Equipment

Systems shall be installed and maintained using COTS tools and hardware.

5.4 Training

Training on system installation and inspection shall be provided by the solution provider (or qualified, trained department/agency personnel) and shall take no longer than 8 hours.

5.5 Transportation and Facilities

Transportation of the system will depend on specific application sizes. For applications under 100 gallon tanks, a system shall be able to be transported by a full-size pick up truck. Larger system applications shall be able to be transported by semi-truck. Solution provider shall list all available ready-made standard and custom kits.

6. Force Structure

Potential uses for a proposed solution vary greatly and include but are not limited to public transit busses and associated fuel storage facilities, first responder response vehicles, commercial airports and airfields, trucking companies, motor coach companies, and passenger ferries. A conservative estimate of the potential available market is over 1 million units.

7. Schedule

Solution shall be available in < 1 year (T) or < 6 months (O).

8. System Affordability

Solution's total delivered price is \leq \$1 per gallon of fuel protected.