NDIA Industry Day

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SBIR Safety and IM Research Area

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Agenda

- Topic Area Overview
  - Topic List
- Summary of Topics
- Contact Information
- Questions

Topic Area Overview

- Safety Research Area
  - Insensitive Munitions
    - Topics Include:
      - Slow Cook-Off Insensitive Munitions Solutions for Solid Rocket Motors
      - Insensitive Munitions Solutions for Large Scale Solid Rocket Motors
  - Hypergolic Propulsion
    - Topics Include:
      - Safe Liquid Hypergolic Propulsion Systems

Insensitive Munitions

- **Insensitive Munition**
  - Munitions which reliably fulfill their performance readiness and operational requirements on demand but which minimizes the probability of inadvertent initiation and severity of subsequent collateral damage to weapon platforms, logistic systems and personnel when subjected to unplanned stimuli.

- **DoD Directive 5000.1:**
  - 3.xx Safety. Safety shall be addressed throughout the acquisition process. Safety encompasses human (includes human / System interfaces), toxic / hazardous materials and substance, production / manufacturing testing, facilities, logistical support, weapons and munitions / explosives. **All systems containing energetics shall comply with insensitive munitions criteria.**

- **MIL STD 2105C Hazard Assessment Tests for Non-Nuclear Munitions:**
  - This document contains a description of tests or references to NATO Standardization Agreements (STANAG's) for the assessment of munition safety and insensitive munitions (IM) characteristics of non-nuclear munitions.

- **Types of Reactions Based on MIL-STD-2105C**
  - Type I Detonation
  - Type II Partial Detonation Reaction
  - Type III Explosion Reaction
  - Type IV Deflagration Reaction
  - Type V Burning Reaction

- **IM Tests Based on MIL-STD-2105C**
  - Bullet Impact
  - Fragment Impact
  - Fast Cook Off
  - Slow Cook Off
  - Shaped Charge Jet
  - Sympathetic Detonation

Insensitive Munitions

- Goals
  - DoD Goals
    - Reduce violence of SRMs when exposed to unplanned stimuli such as heat, bullets, fragments and shock
    - The ultimate objective is no reaction or simple burning
  - MDA Goals
    - New IM technology for both land and sea based operations
    - Focused on SRMs that are 12 inches or greater in diameter
    - Keep performance level of SRM or improve it
    - Technology easily adapted to many different SRM systems

Insensitive Munitions

- Suggested improved technologies (not all-inclusive)
  - Less sensitive propellant formulations
  - New SRM case and container venting systems
  - Bore Mitigation technology
  - New case designs and materials
  - Ballistic and thermal protective schemes

- Envisioned approach
  - Phase I identifies and defines promising technologies
    - Some bench testing may be needed
    - Develop plans for IM testing
  - Phase II builds sub-scale test articles and conducts testing
    - Evaluation of results
    - Outline plan to reach maturation of promising technologies

- Partner suggestions
    - Aerojet
    - ATK
    - Air Force Research Labs
    - Army Research Labs
    - Naval Surface and Air Warfare Centers

Insensitive Munitions

- SCO IM Solutions for SRMs
  - Objective:
    - Develop and demonstrate an IM solution for a large diameter SRM that improves the results of the Slow Cook-Off (SCO) test.
  - Notes:
    - Test goes *until* *reaction*
    - STANAG 4382 applies

Insensitive Munitions

- SCO IM Solutions for SRMs
  - Phase 1:
    - Show understanding of the SCO test and collect data on previously conducted SCO test which can be used in technology development. Develop a prototype of the solution at either a bench or analog scale. Test the prototype by simulating or replicating the SCO test. Outline how the solution can be applied to a MDA system.
  - Phase 2:
    - Refine the solution. Demonstrate the solution on a SRM model at either analog scale or scaled to a 12 inch or greater diameter in a SCO environment. Outline how the solution should be transferred into a MDA system and what additional testing would be needed for complete system integration. Develop a release package that can be used to showcase the technology to potential programs.

Insensitive Munitions

- IM Solutions for Large SRMs
  - Objective:
    - Using a component level or system level approach develop novel and innovative IM solutions for large scale SRMs. The approach can address the motor itself or any part of the missile system in which it is housed.
  - Notes:
    - Large diameter is 12 inches or greater.
    - STANAG: 4240, 4382, 4241, 4496
    - Bullet: 50-cal AP round
    - Fragment: 2” cube at 6800 ft/s
    - Cook-off goes till reaction

Insensitive Munitions

- IM Solution for SRMs
  - Phase 1:
    - Outline the proposed solution, develop a test procedure and build the prototype. The prototype can be at either the bench or analog scale. The prototype should be tested in conditions that closely represent the IM test for which it addresses. An outline of how the technology could be fitted into or used by a current system should be included in the final report.
  - Phase 2:
    - Improve the technology. Conduct analog or sub-scale IM tests of small and large diameter motors. Identify and address any possible technological hurdles that may hinder the technology transfer. Begin work necessary to transition the solution to either industry or a MDA element or system.

Hypergolic Propulsion

- Chemicals
  - Monomethyl Hydrazine,
  - RFNA
  - MON-25

Hypergolic Propulsion

- Safe Liquid Hypergolic Propulsion Systems
  - Objective:
    - Develop and demonstrate a liquid hypergolic propulsion (LHP) system for missiles that can be demonstrated to be safe for storage, handling, transportation and shipboard use.
  - Notes:
    - Show a safe system
      - Compliance with Hazard Classification Standards
      - Compliance with IM Standards
    - Will need to eventually gain Navy approval
      - Weapons Systems Explosive Safety Review Board (WSESRB)
    - Work on Hydroxyl Ammonium Nitrate (HAN)
    - Hypergolic replacement technology

Hypergolic Propulsion

- Safe Liquid Hypergolic Propulsion Systems
  - Phase 1:
    - Show understanding of the safety problems with different types of hypergolic systems. Propose technology solutions or system approach solution to improve the safety of LHPs. Design and conduct proof-of-principle demonstrations. Prepare paper outlining the safety benefits and improvements of the technology or system.
  - Phase 2:
    - Develop a small-scale LHP system or technology demonstration to show its safety characteristics, considering Navy shipboard applications. Conduct hazard classification and IM tests as deemed appropriate. Provide a plan for introducing the proposed LHP systems or technology.

Point of Contact Information

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  - Topics:
    - Slow Cook-Off IM Solutions for SRMs
    - IM Solutions for Large Scale SRMs
    - Safe Liquid Hypergolic Propulsion Systems

Questions