Demonstration of Insensitive Common Explosives (ICE)

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Problem Statement

There are several problems with current IM compounds, such as:

- High cost
- Additional production steps for melt-pour facilities
- Some IM compounds require extensive investment in existing facilities
- Multiple compounds needed to produce limited IM results
- Toxicity concerns for personnel and waste management
- Life-cycle analyses are limited
- Lethality degradation
- Sensitivity concerns
- Balance between impact and thermal threats
- Currently, there are unique solutions for different munitions

There Exists A Need For A Common, Low-Cost IM Solution For Bomb And Artillery Fills!
US Government awarded ATK a contract to produce TNT.

ATK NTIB TNT facility designed and built as a flexible energetics facility and offers a more environmentally friendly process:

- Currently producing TNT and can produce other flexible energetics such as Dinitroanisole (DNAN), TEX, NTO and CL-20
  - >100,000 lbs made during startup
- 5-15 million pound annual TNT capacity
- Continuous operation requires changeover planning
- Current process produces no red/yellow water and offers a significant reduction in emissions/waste stream
- Fewer impurities (no or significantly reduced exudation); purity is 99.99% 2,4,6-TNT

NTIB Facility At RAAP Is A Flexible Energetics Plant
Why TNT-Based Insensitive Common Explosives?

- TNT is the historic common explosive.
- TNT processing is well understood.
- TNT already has low impact sensitivity and good thermal sensitivity.
- TNT is low cost.
- Manufacturing and loading infrastructure is already in place.
- TNT offers tailorable performance (Comp B, Tritonal, Octol, etc.)
- Formulation only needs to be less sensitive than TNT at same or improved performance.

Insensitive Common Explosive (ICE)

There is a Reason Why TNT Has Been The Explosive of Choice for 100 Years.
What Is I-TNT (PAX-44)?

- I-TNT is a reduced sensitivity TNT-based formulation
  - I-TNT formulation is simple (I-TNT = TNT + Additive)
  - Additive is low cost, readily available and environmentally friendly

- I-TNT (PAX-44) is a “drop in” to the NTIB TNT manufacturing and loading operations
  - I-TNT takes advantage of the low-cost NTIB TNT production line and provides a range of flexible alternatives for performance
  - Minimal modifications to manufacturing and melt/pour facilities will be required for optimization

I-TNT (PAX-44) Formulation is Being Developed for 155mm HE Projectiles
Program Accomplishments

- Additives screened for IM characteristics
- Mixes made and testing completed for down select
  - Thermal compatibility, Vapor Pressure, Efflux Viscosity, Shrinkage, Toxicity, Solidification Properties and Hazards Sensitivity (friction, impact, ESD, etc.)
- Sub-scale testing completed
  - Bullet Impact, Slow Cook-Off, Shape Charge Jet
- Mid-Tier testing completed
  - Used 4” long, 155mm enclosed sections
- Cheetah® Performance Prediction completed and verified with Dent and Rate
- Full-scale testing initiated
  - Currently awaiting process changes to improve cast quality

I-TNT Program Has Made Rapid Progress Due To Ease Of Formulation Development
I-TNT Sub-scale Test Results Compared to TNT

**TNT**

Dent and Rate Data
0.32 in (85 RB): 6.64 km/s

436°F

**I-TNT**

Dent and Rate Data
0.325 in (83 RB): 6.51 km/s

416°F

- Passes Sub-Scale Slow Cook-off
- Passes Sub-Scale Bullet Impact
- Passes Sub-Scale SCJ Impact
I-TNT Mid-Tier Test Results

I-TNT demonstrated No Reaction in four Bullet Impact tests using 4” long 155mm case sections.

Cheetah® modeling predictions for I-TNT compared to other explosives.

I-TNT Demonstrated Reduced Sensitivity And Matched TNT Performance
Planned Work

- Optimize melt/pour process to fill 155mm M795 rounds
  - Feedback from melt/pour facility has been positive for small-scale pours:
    - “I-TNT shows great promise.”
    - “I-TNT is compatible with our current process.”
  - Transition “lessons learned” during small-scale pours to a full-scale pour at IOWA Army Ammunition Plant
- Conduct full-scale 155mm testing
  - Full series of IM tests + Arena tests for performance
- Related formulation development
  - Leverage I-TNT success for transition into bomb fill solution using same formulation

I-TNT Program Is Moving Forward For Full-Scale 155mm Testing In 2006
Summary

- NTIB TNT facility at RAAP currently in initial production of TNT to meet current warfighter needs.
- I-TNT utilizes current TNT production, melt/pour and LAP facilities with minimal infrastructure changes.
- Tactical systems that use TNT will require minimal design changes when transitioning to I-TNT.
- Tactical configuration (155mm M795) demonstrations will be completed this year.

I-TNT’s Low-Cost IM Formulation Can Be Rapidly Transitioned To Production at NTIB TNT Facility.
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