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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!

ATK NTIB TNT Flexible Energetics Facility

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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

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TNT

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

I-TNT

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

Passes Sub-Scale Slow Cook-off

Passes Sub-Scale Bullet Impact

Passes Sub-Scale SCJ Impact

I-TNT Mid-Tier Test Results

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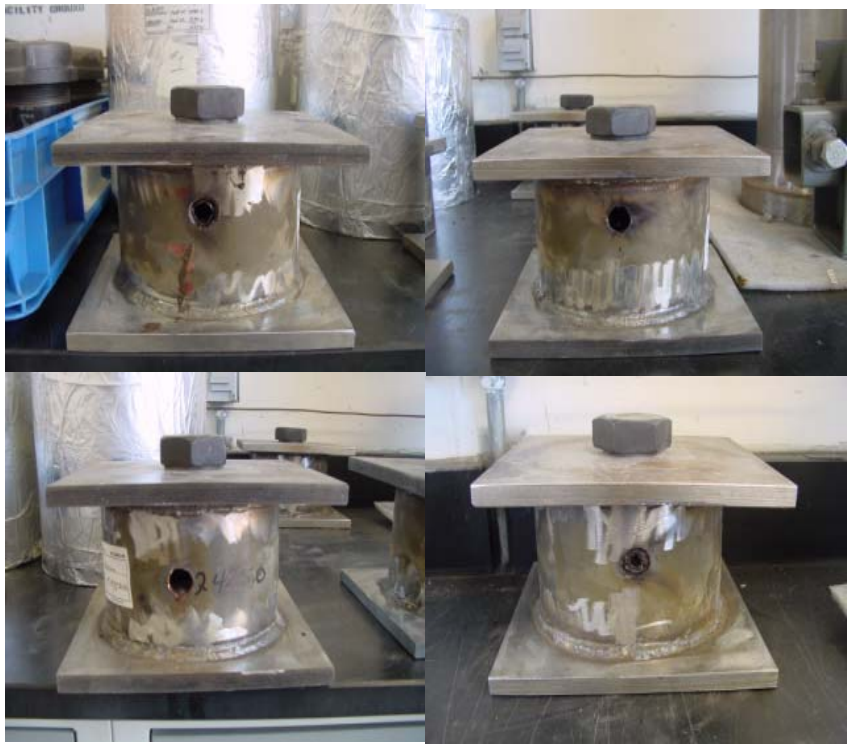
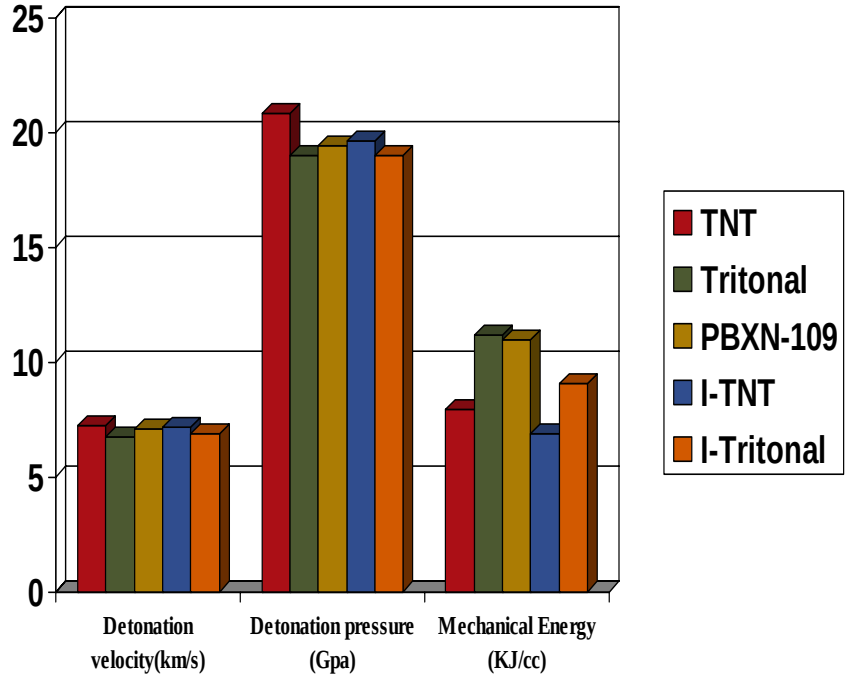


I-TNT demonstrated No Reaction in four Bullet Impact tests using 4” long 155mm case sections.



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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