GENERAL DYNAMICS
Ordnance and Tactical Systems

Reactive Material Neutralizer Technology

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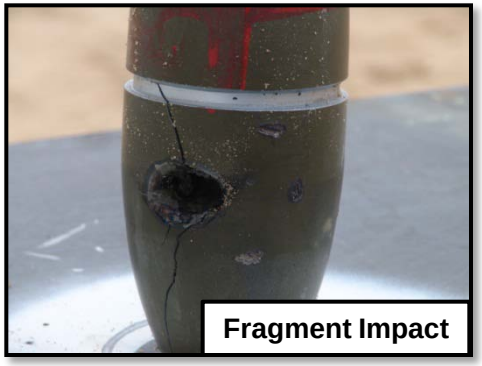
Introduction

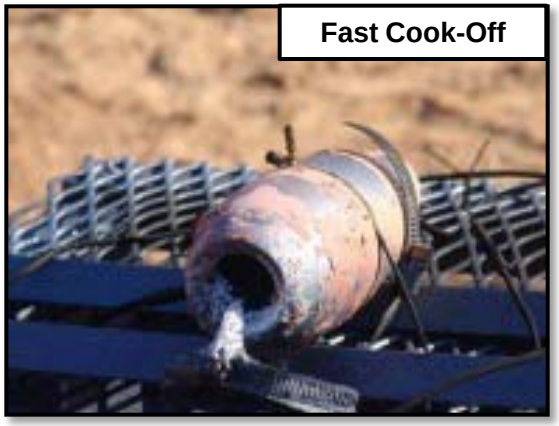
- GD-OTS Niceville Has Developed a Reactive Material (RM)-Based Neutralization Technology With Broad Application to High Explosives (HE) Neutralization
  - Neutralizers Contain Non-Detonable, High Flame Temperature RM Fill
  - No S&A Required, Unreacted Neutralizers Not Classified as Unexploded Ordnance (UXO) or Explosive Remnants of War (ERW)

Application

EOD/RSP's For IM Compliant HE Fills

- Increased IM Compliance of High Explosive Fills Increases The Difficulty of Explosive Ordnance Disposal and Render-Safe Procedures
  - ↗ Reduced Shock, Impact, Friction, and Sympathetic Reaction Sensitivity
  - ↗ Result: Existing Procedures Have Reduced Effectiveness
- All HE Fills Eventually Succumb to Thermal Threat
  - ↗ Thermal Decomposition, Leading to a Burn or Deflagration



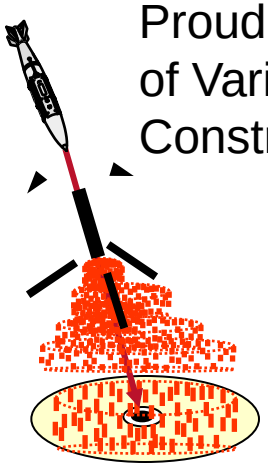


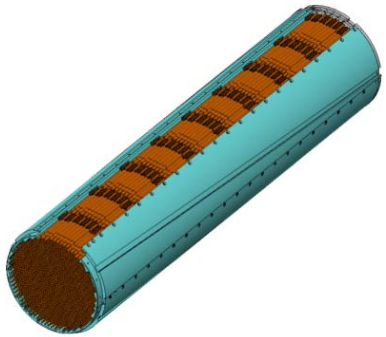
IED/Mine Defeat

- Desire for Low Collateral Damage Effects During Threat Defeat

Neutralizer Development

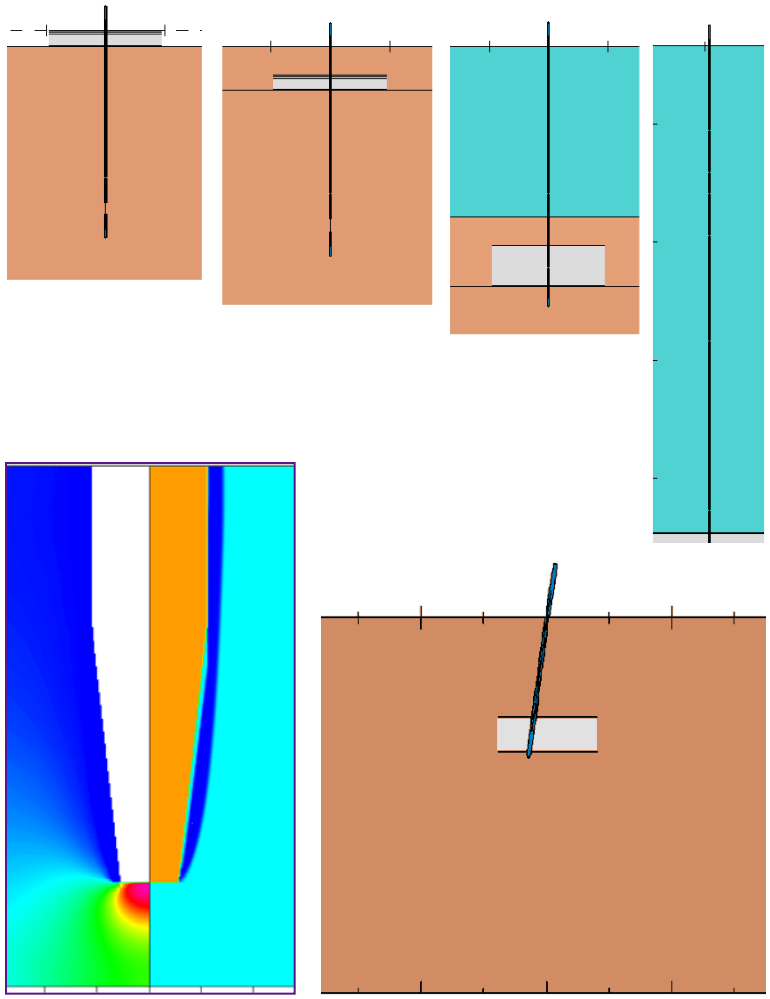
- Reactive Neutralizer Technology Developed During US Navy Countermine System (CMS) Program
  - GD Contracted to Provide RM Neutralizer
  - Goal: Beachhead Clearance of Sea and Land-Based Mines
  - Broad Target Set: Underwater, Buried, Proud, Both Plastic and Steel Casings of Various Thicknesses and Construction





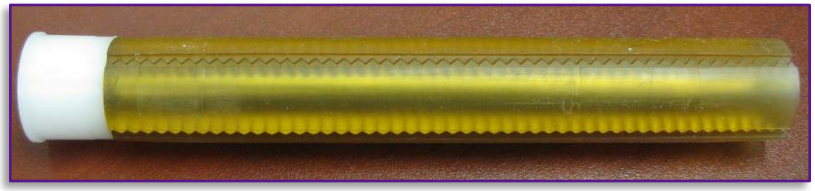
Penetration Analysis/Packaging Study

- Target Set Analysis
  - Layers, Thickness, Materials, Overburden
- OTI*Hull & PENCURV Used for Penetration Analysis
  - PENCURV – Rigid Body Penetration Code
  - OTI*HULL – FD Hydrocode
  - Optimization of Nose Shape/Design for Maximum Trajectory Stability and Minimum Velocity Loss
- Packaging Trade Study
  - Dart Diameter & Mass Yielding Greatest Loadout Within System Requirements



Water Penetration Test Video

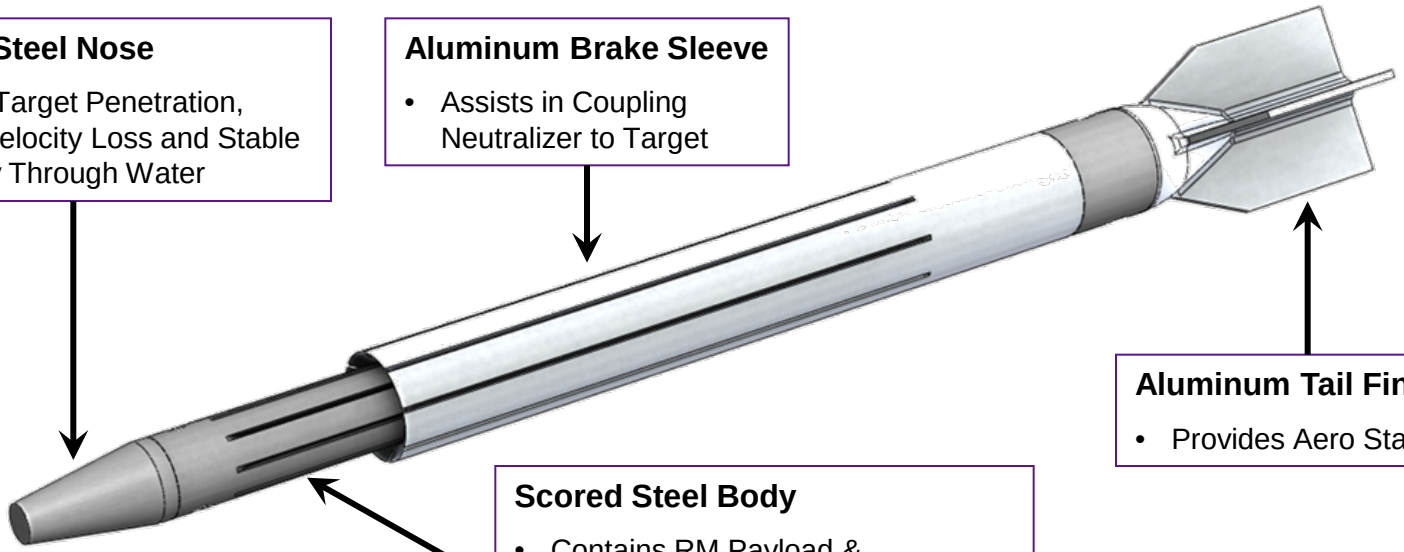
- 4’x4’x12’ Long Tank Constructed For Ballistic Water Penetration Testing
  - Acrylic Front Panels to View Water Penetration/Trajectory
  - Inert Mass Mock Neutralizers Fired via Powder Gun & Sabot
  - Verification of Code-Driven Nose Solution



RM Fill Material Selection

- Selected Group of Candidate Materials From Supplier Base
- Initial Studies Conducted:
  - Initiation Mechanisms/Sensitivity
  - Temperature Effects
  - Output/Effects on Flake TNT
  - Test Results Suggested Dual Material Solution:
    - One Material Easily Initiated, But Limited Effect on HE – Igniter
    - Second Material Harder to Initiate, But Greatest Effect on HE – Sustainer
      - Very High Flame Temperature: ~ 4500 °F

RM Neutralizer Design



Low-Drag Steel Nose

- Provides Target Penetration, Minimal Velocity Loss and Stable Trajectory Through Water

Aluminum Brake Sleeve

- Assists in Coupling Neutralizer to Target

Aluminum Tail Fin

- Provides Aero Stability

Scored Steel Body

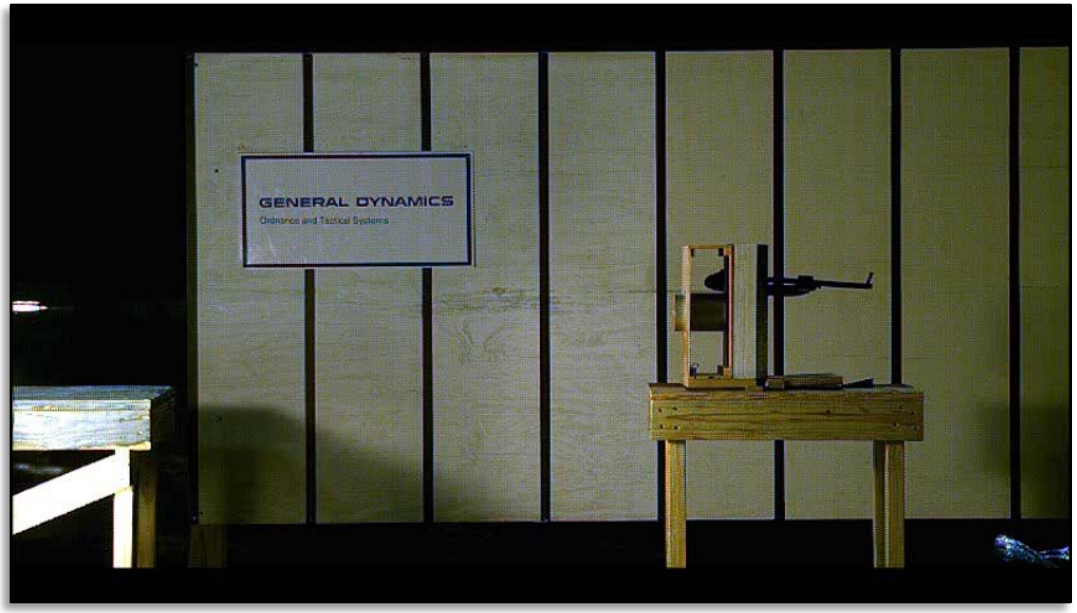
- Contains RM Payload & Mechanical Ignition Mechanism
- Scoring Assists Body Rupture, Release of RM

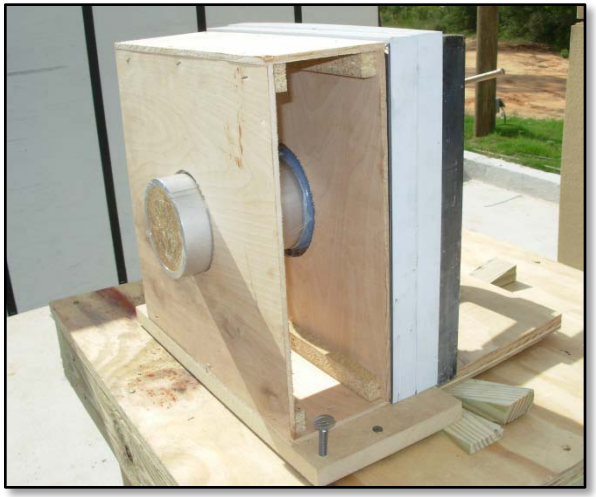
- Neutralizer Can Be Tailored to Defeat A Range of Targets and Engagements
  - ↗ Multiple Materials, Thicknesses, Emplacements, etc.
- Form Factor Can Easily be Adjusted for Integration Into Existing EOD Tools
  - ↗ PAN Disrupter, .50-Cal De-Armer, etc.

Example RM Neutralizer Reaction

- Neutralizer Fired Against Steel Plate
  - ↗ Demonstrates Size of RM Reaction

RM Fill Coupling With HE





- Live Neutralizer vs. Live Target
  - 2lb TNT, Cast From Flake
- Aluminum Tube Casing
- Steel Plate Backstop

Summary

- New Target Defeat Mechanism Identified For Use in EOD/RSP Operations
  - Estimate of TRL 6 Maturity
  - Non-Detonable Fill, No S&A Required
  - Compliant With Cluster Munition Directive
    - Unreacted Neutralizers Not Classified as UXO
- Thermal Output Defeat of Conventional & Reduced-Sensitivity HE's
  - Conventional: Proven During CMS Program
  - Reduced Sensitivity: Unproven, But Results Look Promising
- Technology Can Be Tailored To A Range of Targets and Deployment Systems
- Possible Application as Area Effect Weapon vs. Fuel Farm Target

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QUESTIONS

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