Insensitive Munitions (IM) Melt Pour Explosive Development

Insensitive Munitions & Energetic Materials Technology Symposium

10-13 March 2003

Pamela Ferlazzo
Spider Program (Team Leader)
Picatinny Arsenal, NJ 07806-5000
(973) 724-5789
Email: ferlazzo@pica.army.mil

Purpose

- **Introduce the IM community to new developments in melt pour explosives**

Background

- **Development of IM melt pour explosives has been next to none**
- **Picatinny Arsenal and Thiokol Propulsion developed the first melt pour explosive (PAX-21) to exhibit IM properties (currently in production)**
- **PAX-21 success led to increased interest in all areas of IM melt pour explosives I.e., cost, producibility, facilitization, etc.**

Current Melt Pour Explosives

Examples:

- **TNT based explosives (Octol and Cyclotol)**
- **Composition B**
- **TNT**
- **Tritonal**

Requirements for future explosives:

- **Meet MIL-STD 2105**
- **Explosives to be stored on Navy ships must not contain TNT or Octol**

❖ **Current explosives do not meet above requirements**

IM Melt Pour Explosives

- **Family of PAX**
  - **21- Comp B replacement: RDX, DNAN, AP and trace amounts of MNA (for processability) currently in production**
  - **24 – TNT replacement: DNAN, AP and MNA**
  - **25 – Comp B replacement: RDX, DNAN, AP and MNA (different proportions for RDX, DNAN, and AP) better performance than PAX-21**
  - **26 - Tritonal replacement: DNAN, Al, AP, MNA**
  - **28 – Unitary warheads: RDX, DNAN, Al, AP, MNA**
  - **40 – Octol replacement: HMX, DNAN, MNA ***
  - **41 – Cyclotol replacement: RDX, DNAN, MNA ***

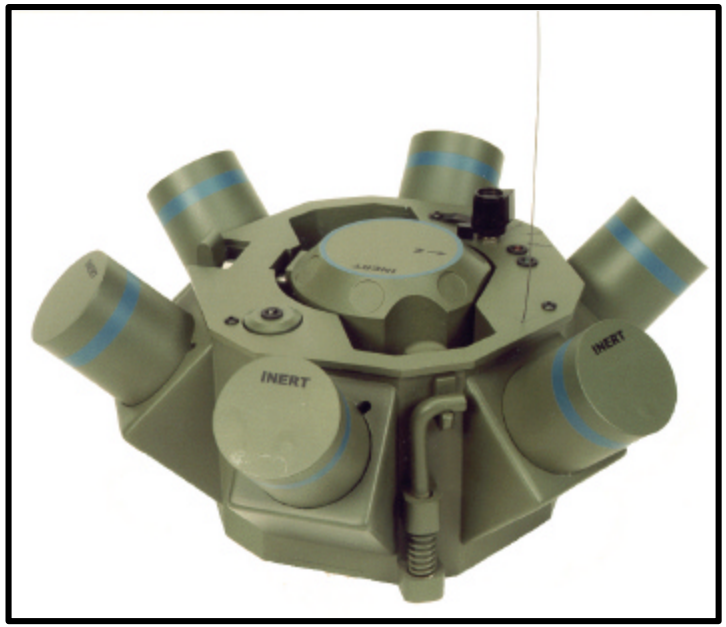
*** Focus of today's presentation**

Spider Program

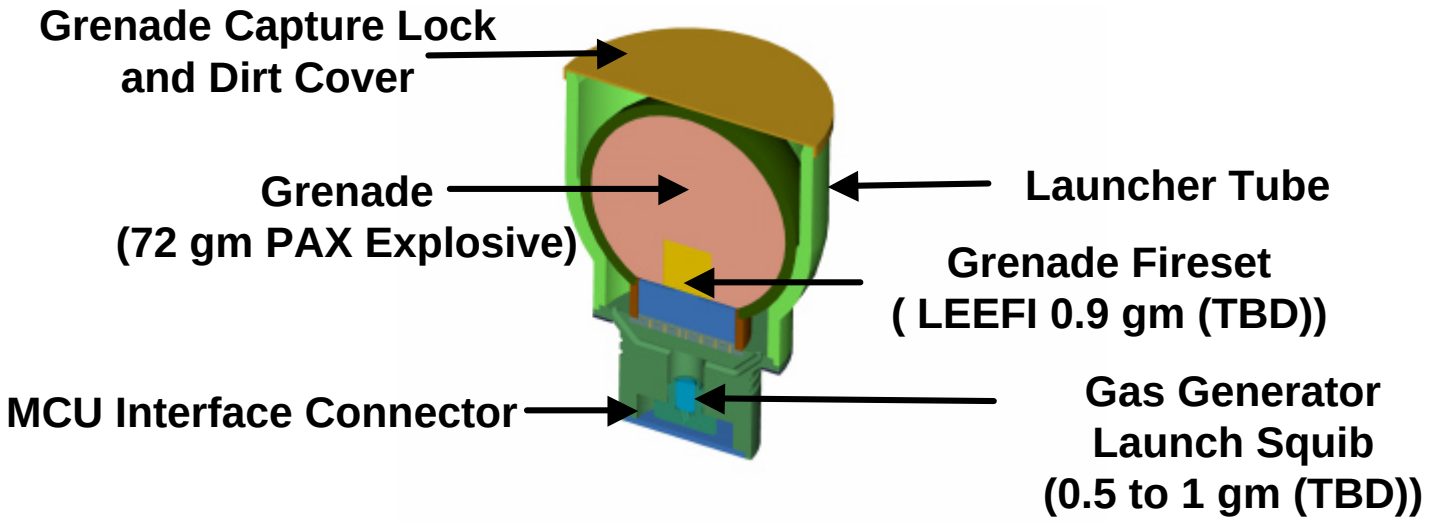
– A smart alternative to Antipersonnel Landmines

Munition Control Unit (MCU)

Contains: 6 Miniature Grenade Launchers (MGLs) with 6 grenades



Grenade Design Summary



Effectiveness requirement – the system must be as lethal as the M16 Antipersonnel Mine (TNT explosive)

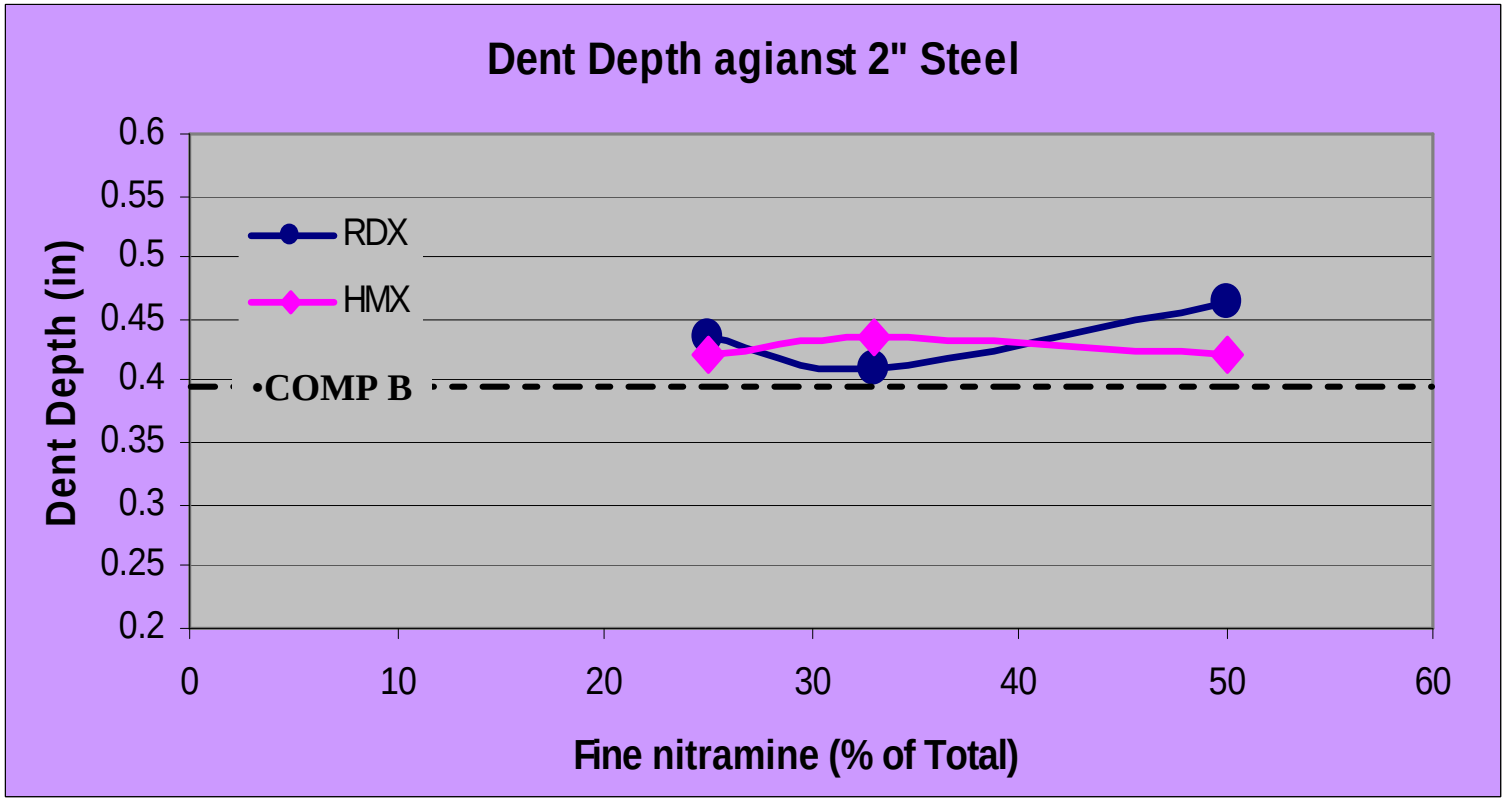
Melt Pour Explosive Development for Spider

- **Requirements:**
  - **Retain advantages of melt pour operation**
  - **Exhibit high detonation velocities and pressures for fragmentation**
  - **Maximize detonation reliability**
  - **Retain low shock sensitivity**
  - **Keep it cheap**

Specific Goals for Spider Melt Pour Explosives

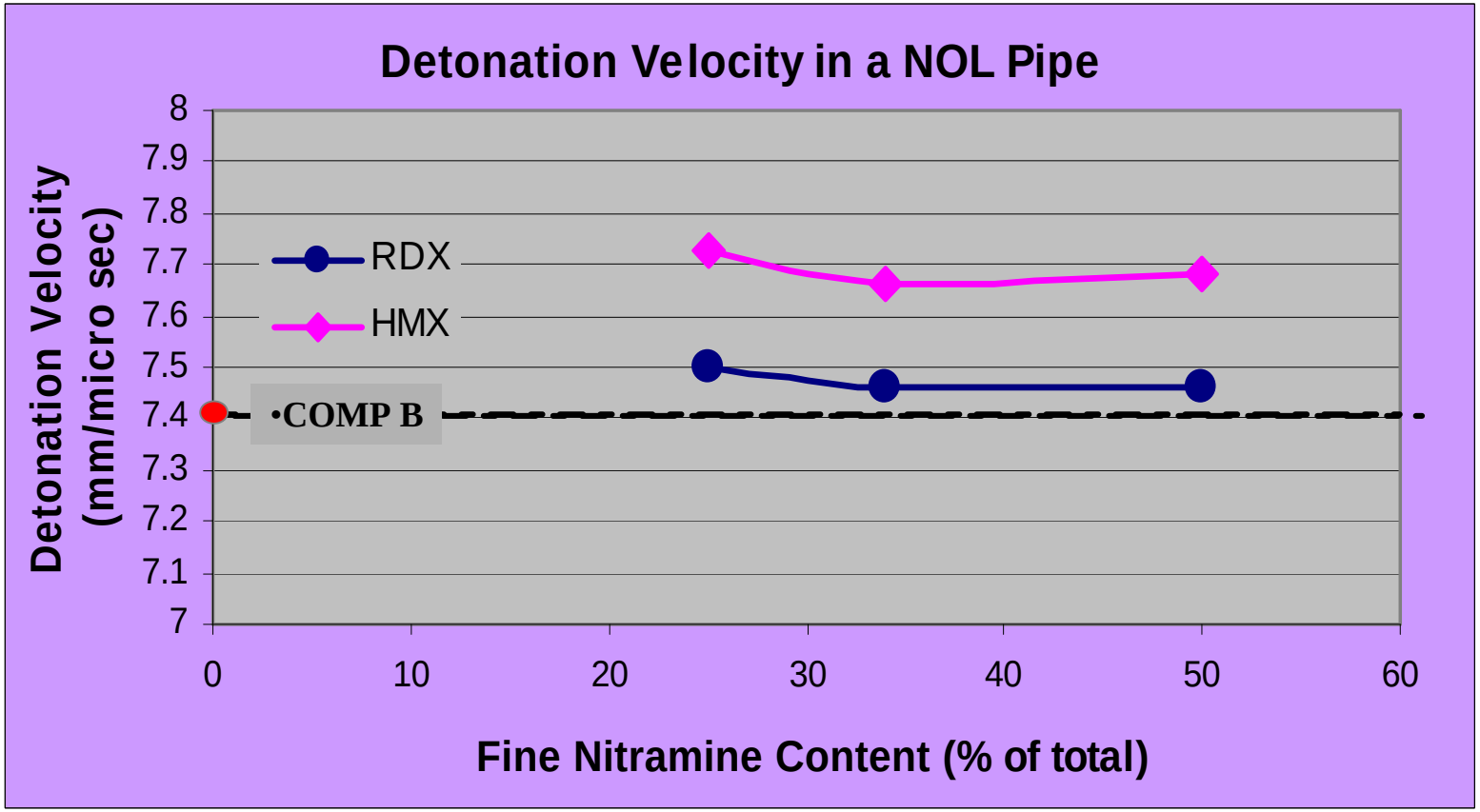
- **Processing – less than or equal to 3.5 kP @ 205 degrees F**
- **Shock sensitivity (NOL card gap) – less than 160 cards**
- **Detonation velocity equal to or greater than Comp B**
- **Dent Depth - equal to or greater than Comp B**

PAX-40 and 41 vs. COMP B



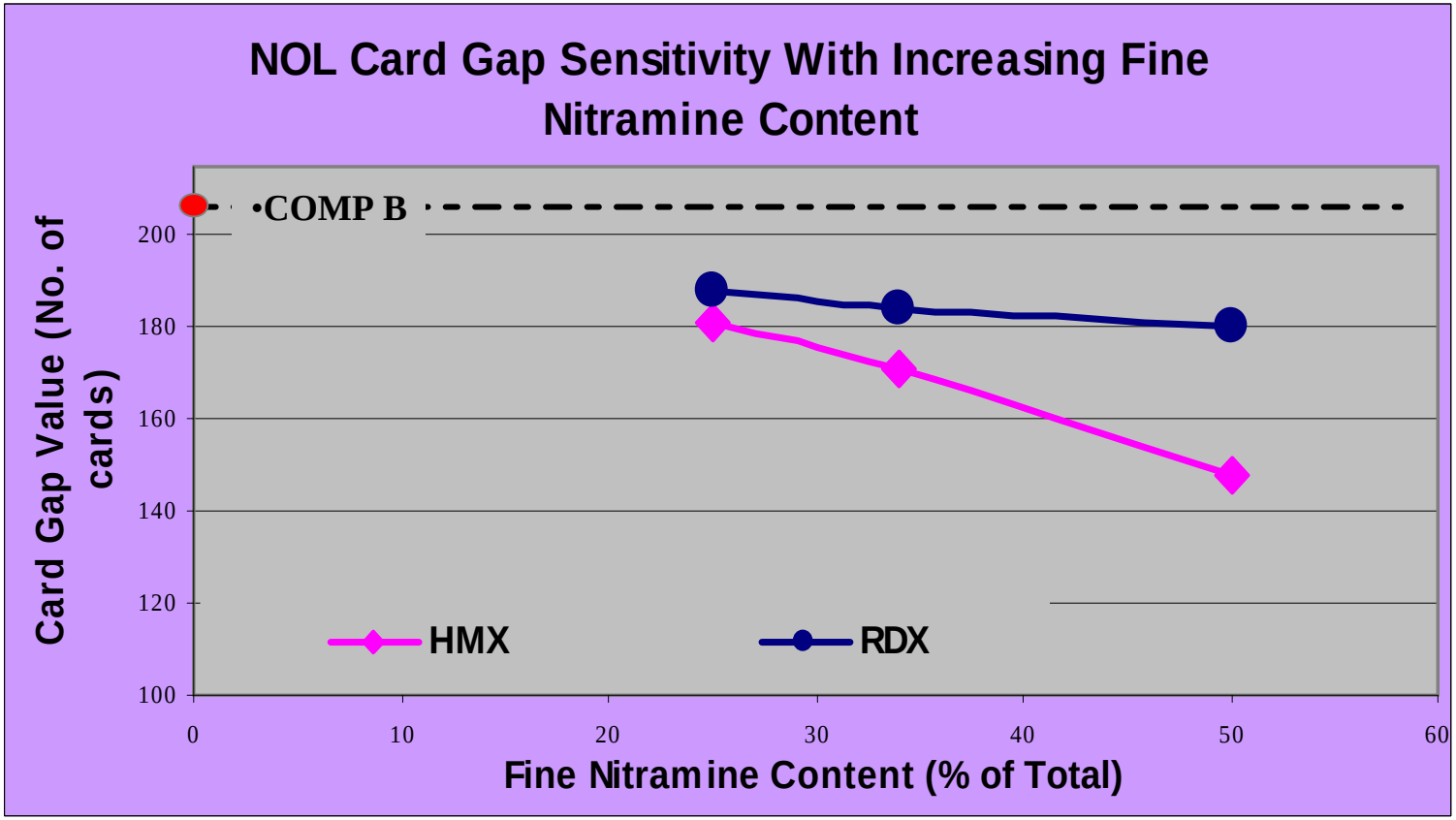
PAX 40 & 41 exhibit larger dent depths than COMP B consistent with higher detonation pressures.

PAX-40 and 41 vs. COMP B (cont.)



- PAX-40 & 41 exceed COMP B's detonation velocity
- HMX versions are faster than RDX versions
- Less fine nitramine/more coarse increases the velocity.

PAX-40 and 41 vs. COMP B (cont.)



- PAX-40 & 41 are less shock sensitive than COMP B.
- Finer sizes of nitramine lowers shock sensitivity.
- HMX is less Shock sensitive than RDX

Examples of Improved IM Systems with Melt Pour Explosive

Relative to COMP B

60mm Mortar HE IM cartridge

Payoffs

- **Ease of loading of melt pour explosives into various munition items**
- **Typically less expensive than pressed explosives in manufacture, load and facilitization**
- **Increased IM characteristics without decreasing performance**
- **Performance and shock sensitivity can be tailored for a given system based on particle size and the percentage of ingredients**
- **Toxicology studies for the family of PAX explosives can be achieved by analogy and minimal testing based on previous results/findings from PAX-21**