



AMC



*U.S. Army Research, Development and Engineering Command
Armament Research, Development and Engineering Center*

Advanced Warhead Technologies

International Armaments Technology Symposium & Exhibition

June 14-16 2004

Briefer: Richard Fong
Armament Engineering Technology Center

Future Combat Vehicles

Today

Our Challenge ...

Lighter ?

More Deployable ?

Survivable ?

More Lethal ?

2005 - 2025



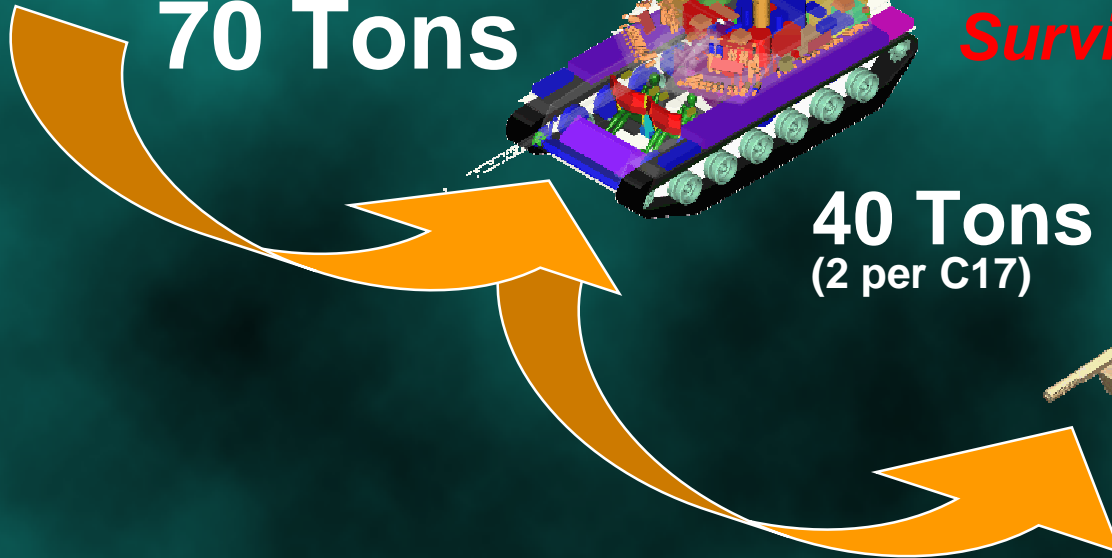
70 Tons



40 Tons
(2 per C17)



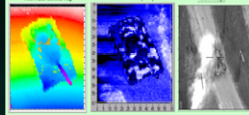
20 Tons
(1 per C130)



Major Lethality Technology Investments



Common Smart Submunitions



LADAR Sensors
F/ Smart Munitions

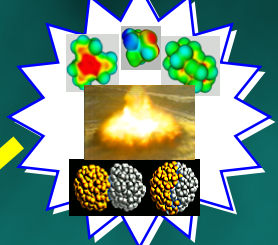
Advanced Warhead Tech



Multi-Mode Warheads

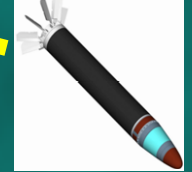


Advanced Energetics



Novel/Nano-Structured Energetics

Smart Munitions



Mid-Range Munition

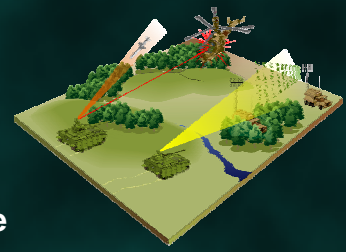
Infantry Ammo



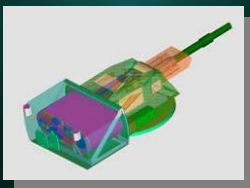
Objective Crew Served Weapon



LtWt Machine Gun & Ammo



Agile Target Effects



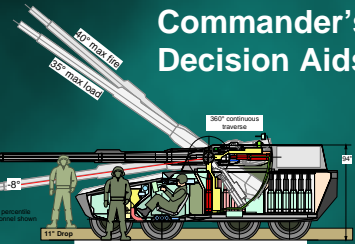
NLOS-M Objective Cannon



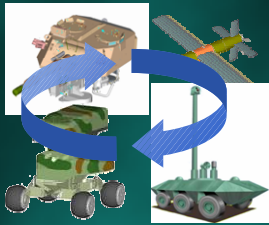
MEMS S&A (OICW)



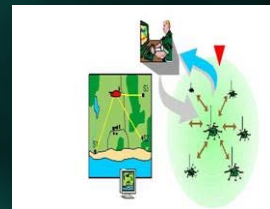
MEMS IMU



FCS 120mm
LOS/BLOS ATD



Commander's Decision Aids



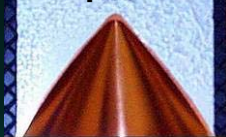
Acoustic/Seismic Sensors

U.S. Army ARDEC

Center of Excellence for Warheads & Energetics

Shaped Charge

Compact SC



HEAT



Javelin



Explosively Formed Penetrator



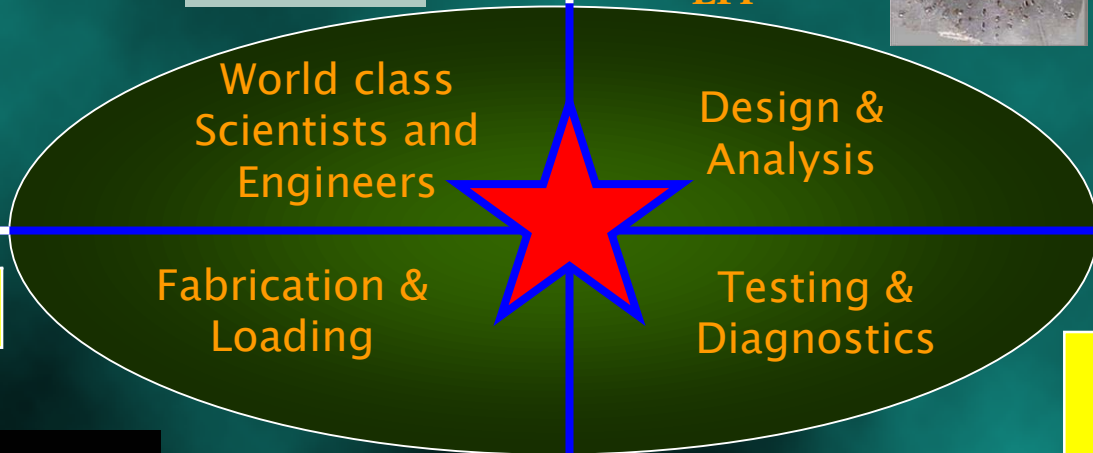
Single EFP



SLAM Demolition Kit

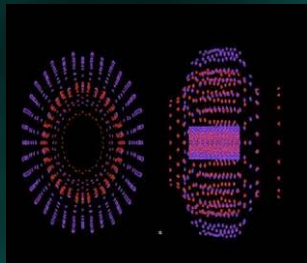


TOW2B SADARM

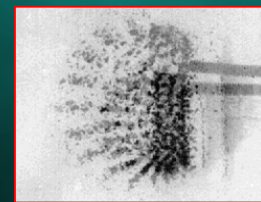


Fragmentation

on



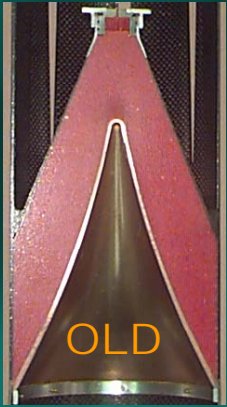
Novel Energetics Blast/Thermob



Providing Overmatching Lethality for the Objective Force!!!

Compact Multi-purpose SC Warhead Concept

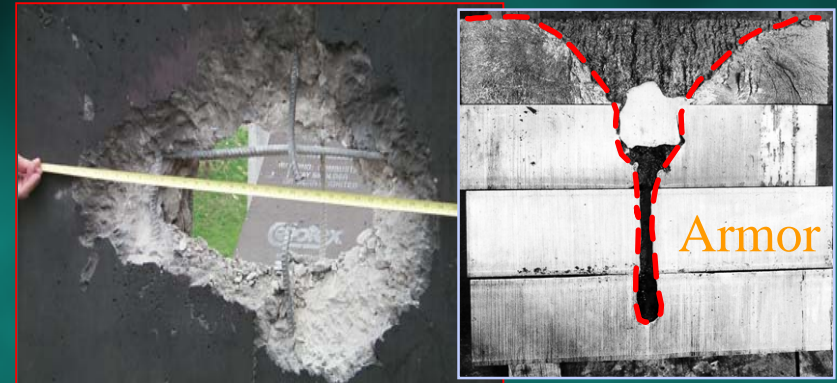
Compact Warheads



Shorter, lighter!



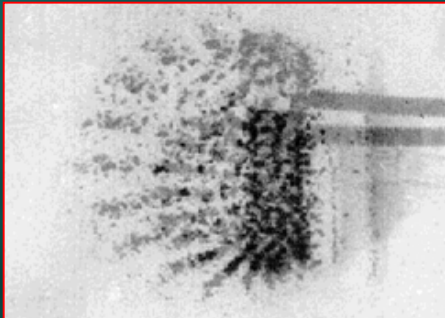
Wide Area Penetration



Defeat Walls & BMP!

Multi-purpose

Fragmentation/Blast



Defeat Bunkers!
Defeat Helicopters!
Anti-personnel lethality!

Deep Penetration

Defeat Tanks!



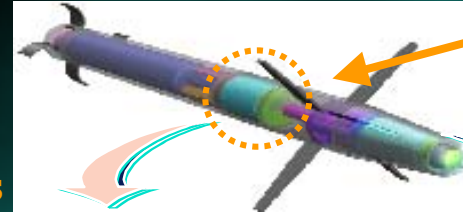
Compact (Multi-purpose) SC Warhead

Develop and demonstrate technology for:

- Lighter compact SC anti-armor warheads, with current or better anti-armor performance.
- Robust armor defeat with some multi-purpose capability against bunkers, urban targets (masonry walls etc.), helicopters and personnel targets.

Multi-purpose Warhead
for FCS munition - MRM

Compact
Shaped
Charge



Bunkers



Urban Structures



Helicopters



Payoff:

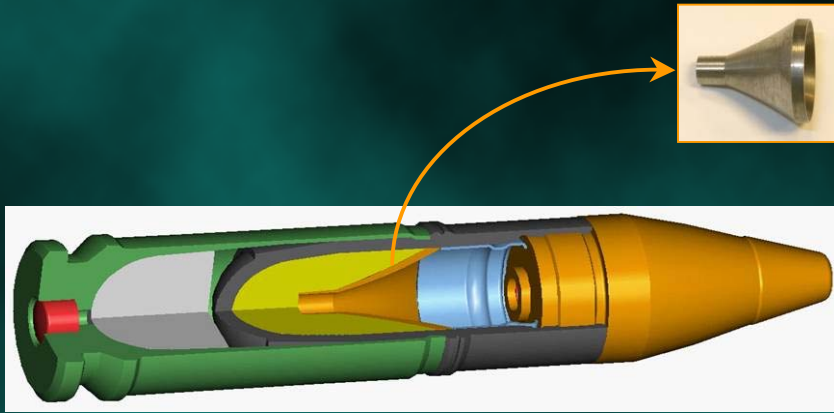
- Increased maneuverability and range of munitions
- Increased munitions lethality over a broader spectrum of targets
- Lighter munitions, less required munitions, faster deployment

Affordability:

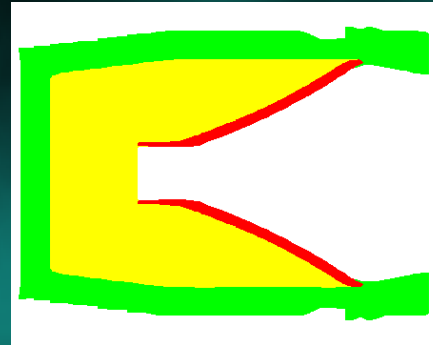
- Cost Drivers: Liner Materials, S&A Technology
- Liner materials with proven production base
- Less expensive S&As through electronics

Shaped Charge

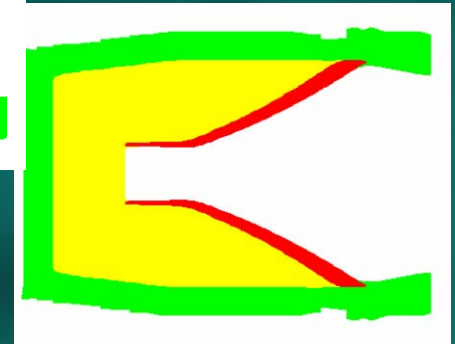
“OCSW Armor-Piercing Ammo Redesign”



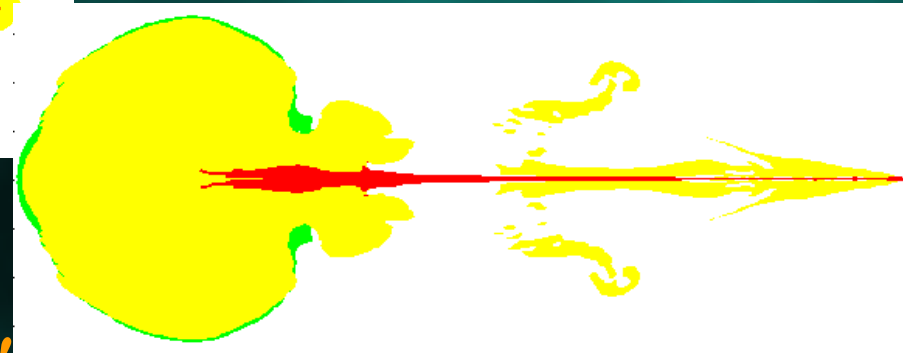
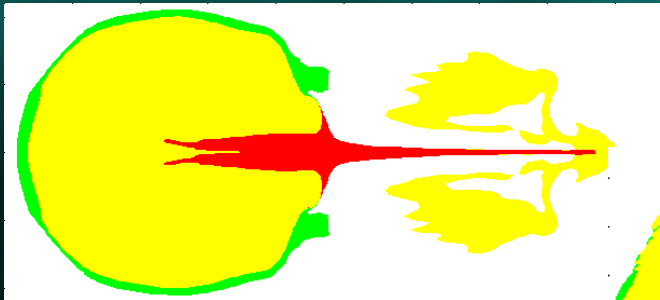
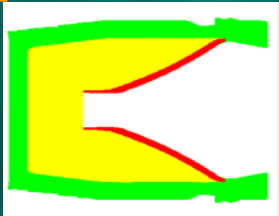
NEW



OLD



Improved Design



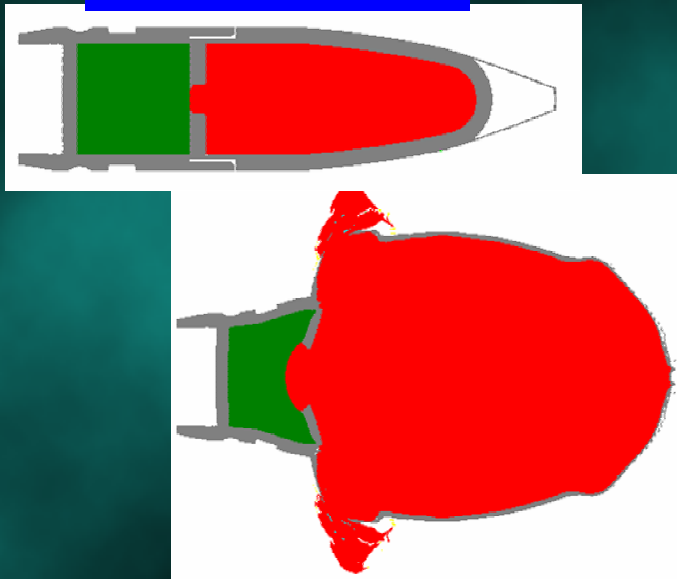
- *Improved Manufacturability!*
- *IM Explosive: PAX2A!*
- *20% Predicted Penetration Increase!*

Fragmentation Warheads

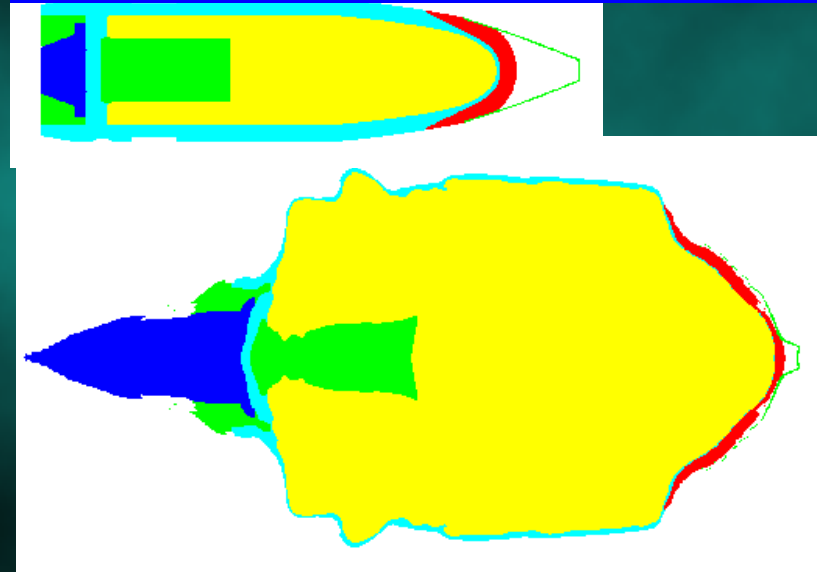
“ALACV Nose Frag Concept”

CALE
 $t=30\mu\text{sec}$

Baseline



Nose Fragmenting Design



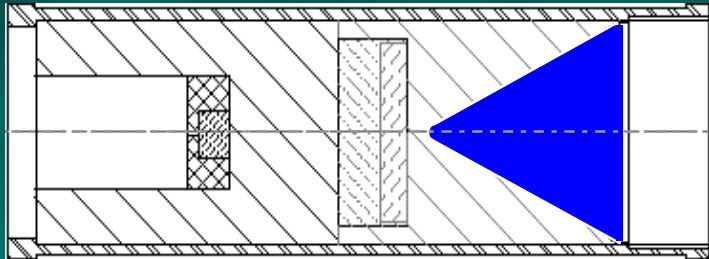
Significant increase in lethal area!

Combined Blast/Shaped Charge

“Shoulder Fired Munition”



Combined shaped charge warheads produce both high blast and increased penetration



CURRENT SOLUTION

- 1 AT- 4 (anti-armor)
- 1 BDM (anti-bunker)

ONGOING WORK

- 1 combined anti-armor/bunker



BEFORE

AFTER



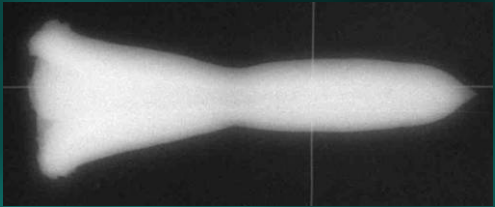
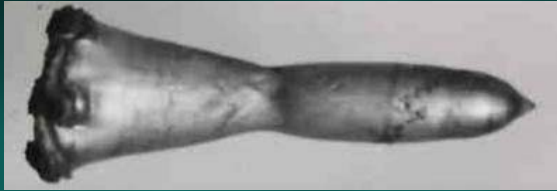
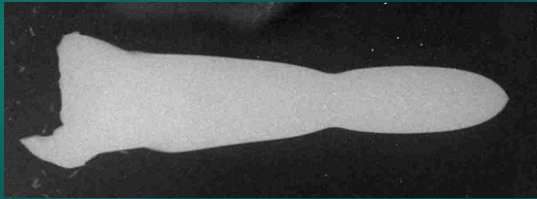
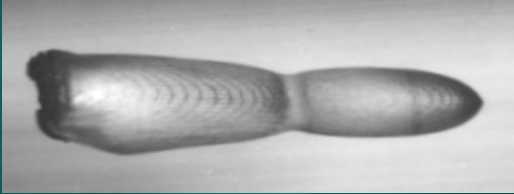


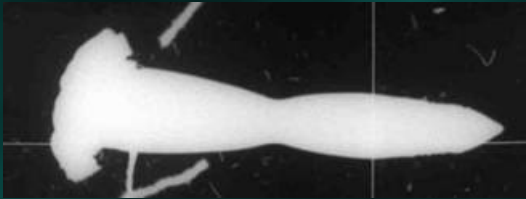

EFP Warheads For FCS Munitions

GOALS: Develop Smaller, More Lethal, Multi-Purpose, Longer Standoff EFP warheads to defeat Full Spectrum of Targets.

APPROCHES:

- **Greater Penetration**
- **Multi-Purpose** - Selectable EFP
 - Combined Effects EFP

Comparison of Current Ta EFP Design with recent Cu & Fe designs

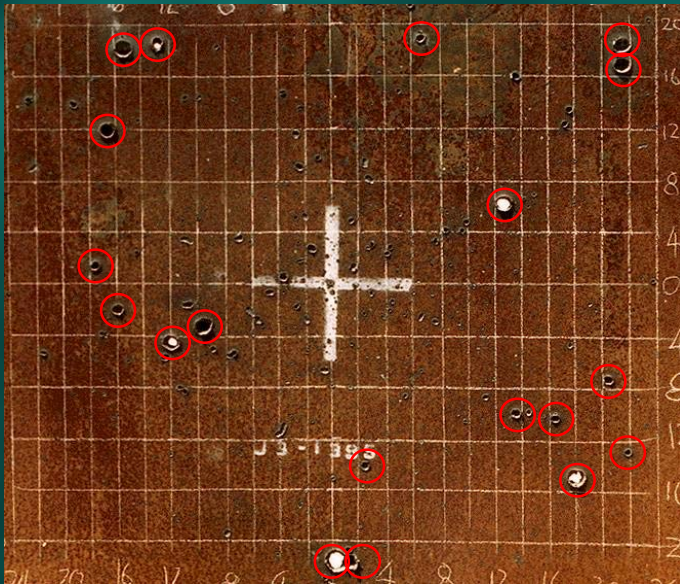
Design	X-ray	Cordin	Length (CD)	Penetration (CD)*
Cu			1.30	1.03
Fe			1.20	0.90
SADARM			0.82	0.85
Ta			1.26	>1.0

**Armor penetration at long standoff*

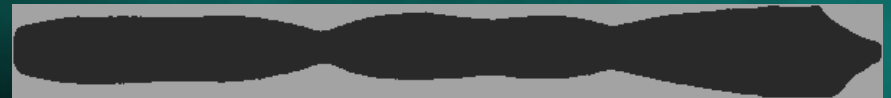
Selectable EFP Warhead



Long Standoff EFP

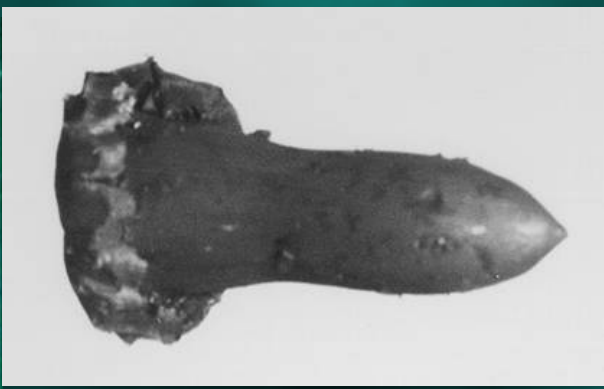
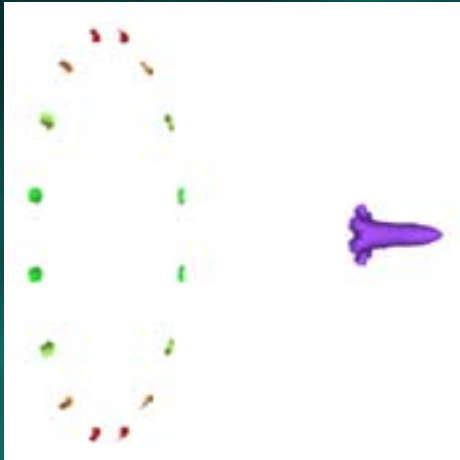
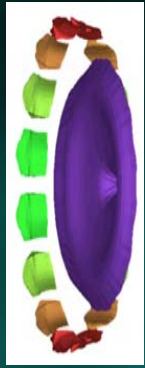
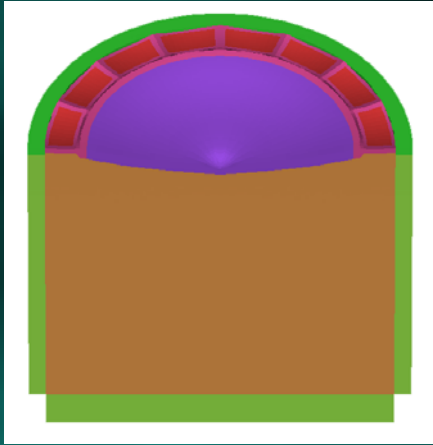


Multiple EFP Test Results



Short Standoff EFP

Multi Purpose Combine Effects Warhead

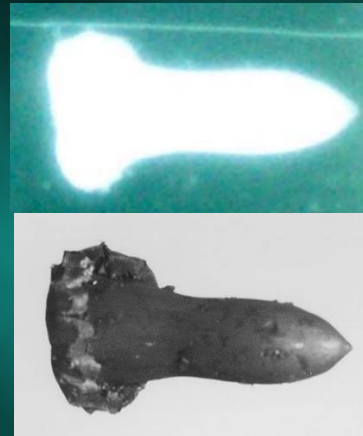


Combined Effects Warhead

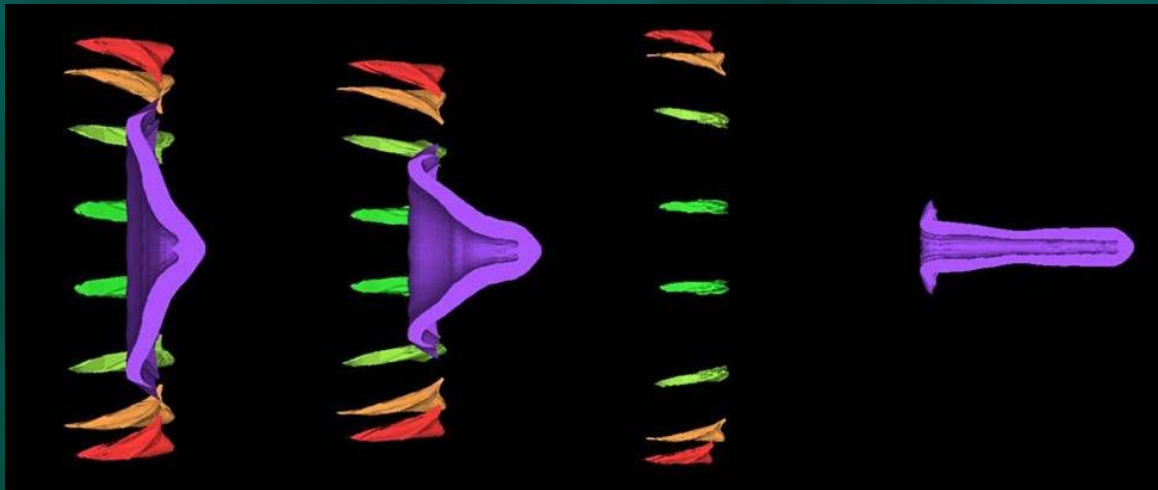
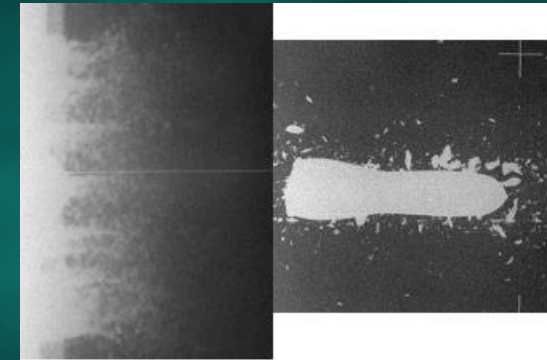
Design 1



Design 2

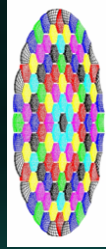


Design 3

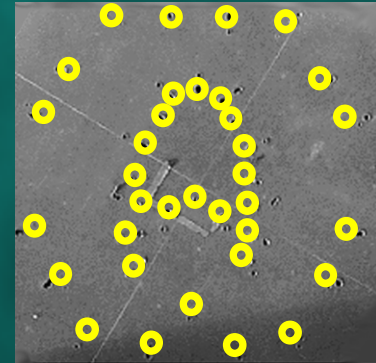


Design 4
"To be tested"

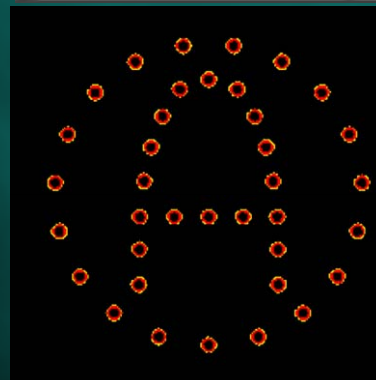
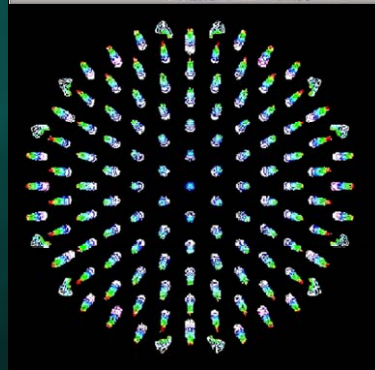
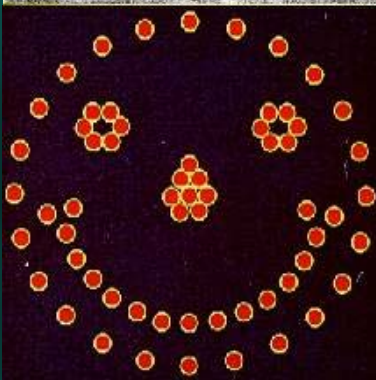
MEFP Warhead Pattern



Target Plate

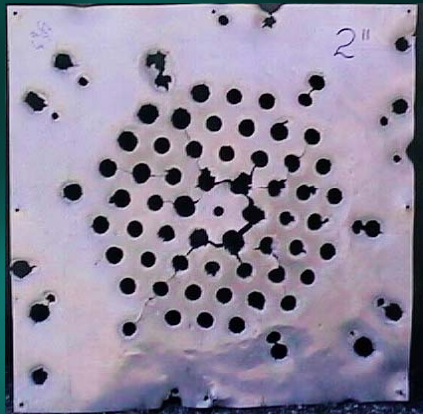


Simulation

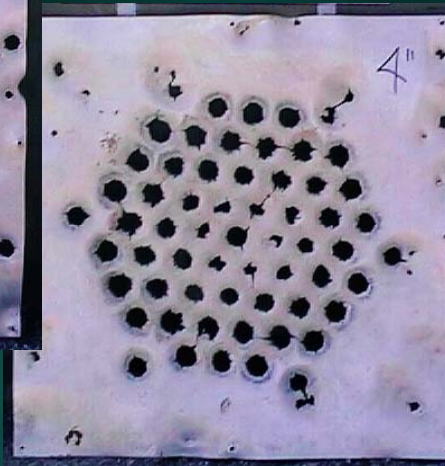


MEFP Warhead For Mine Neutralization

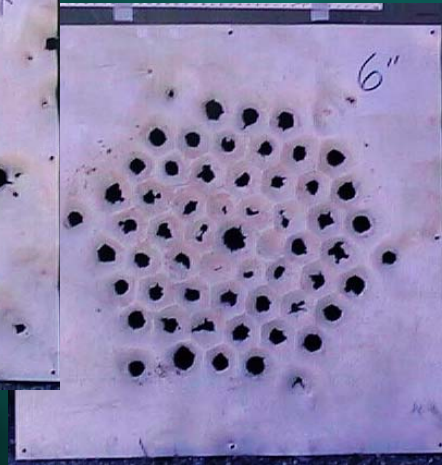
“Design 1B Proof/ Verification Tests”



2"



4"



6"



8"

**Soil Overburden Tests
Conducted at Ft. AP Hill
(Witness Panels Buried Every 2")**

M303 SOF Demolition Kit

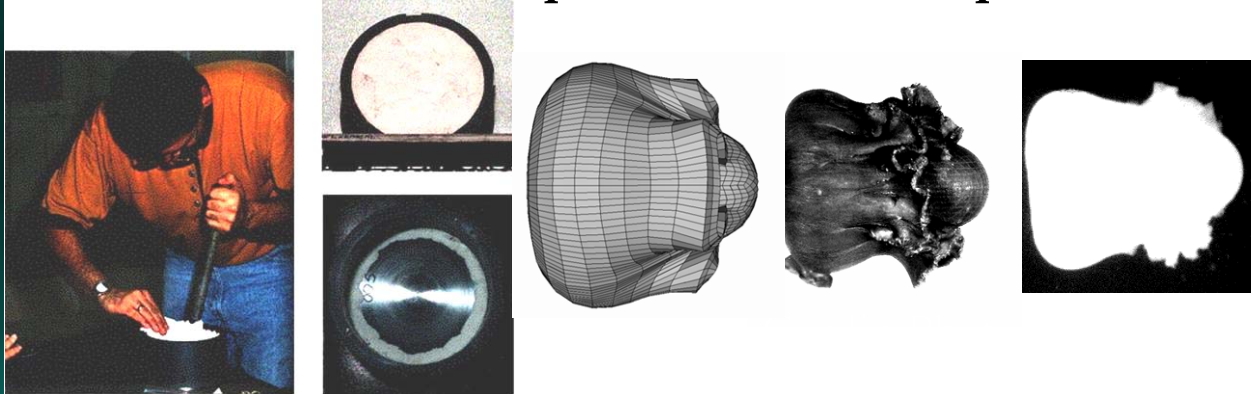
Small, Med & X-Large
Single EFP Warheads



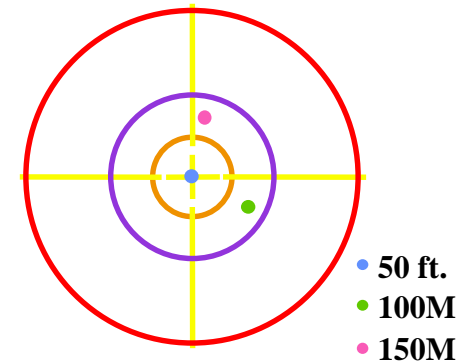
EFP Formation

Special Operation Forces Demolition Kit EFP Warhead

Baseline EFP Warhead packed with C-4 Explosive



Hit Point Accuracy



Warhead



Armor Target (Exit)



Concrete Wall (Exit)



Brick Wall (Exit)



Column

Challenge:

Create a “man-size” hole and cut both rebar in a 8” double reinforced concrete wall



Near-Term Solution To Provide Soldier With Wall Breaching Capability

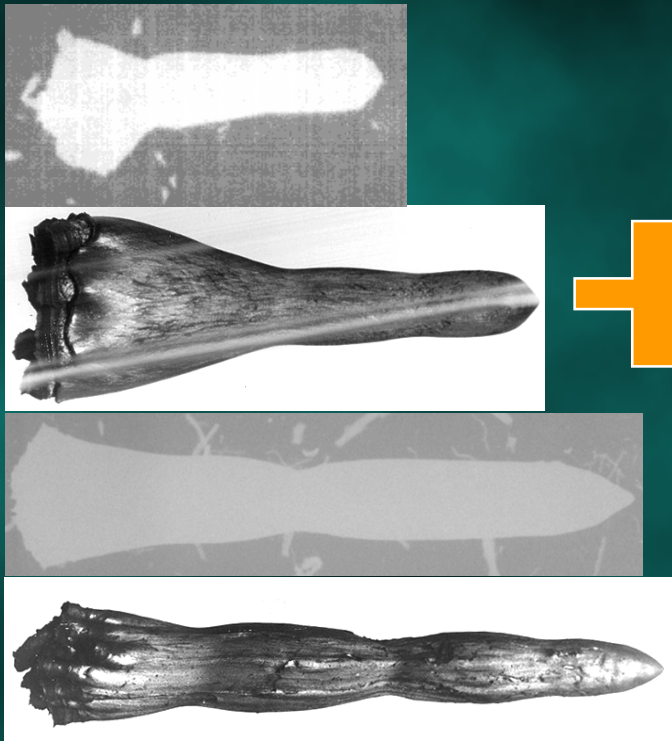


Post-Target Photo

Greater Warhead Performance with MPE

- Increased EFP velocity
- Increased EFP effective range

EFP growth with LX-14



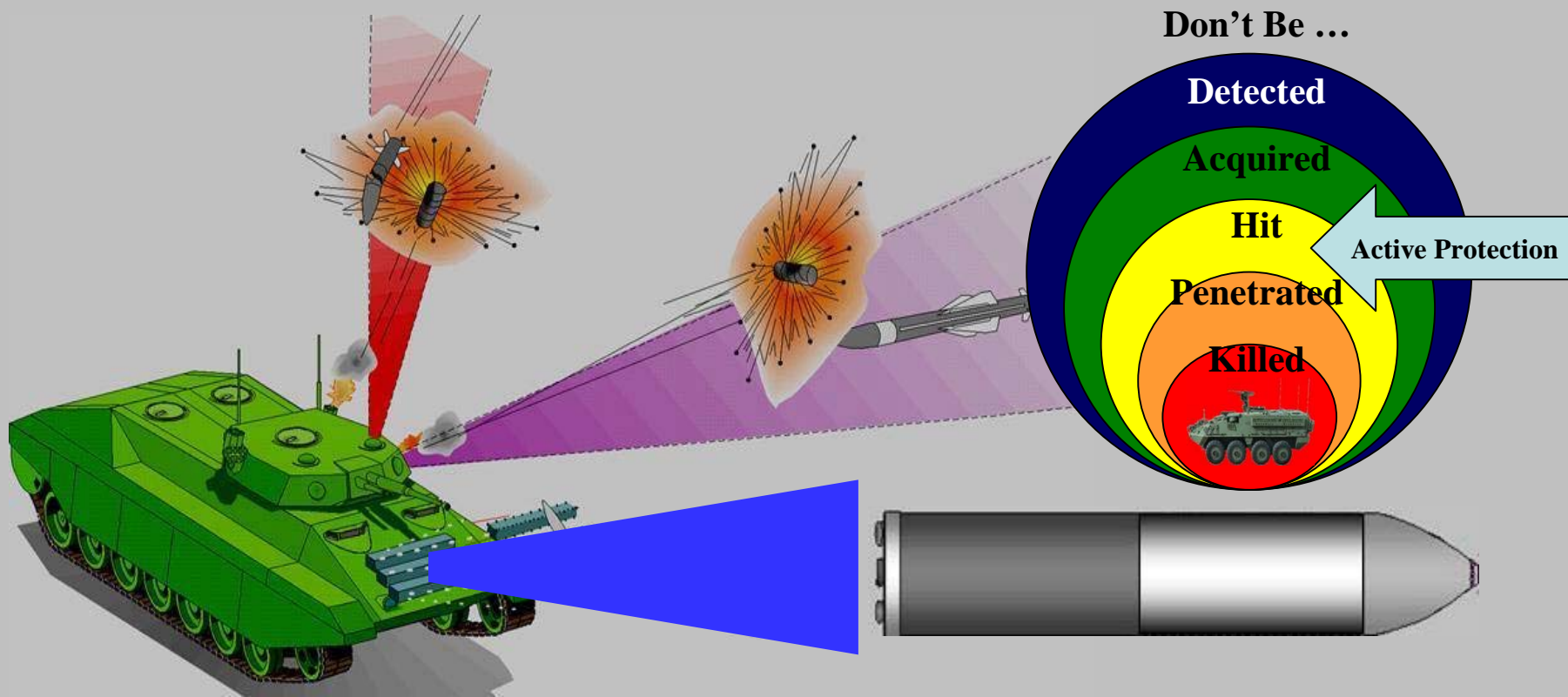
+ **MPE** **→**

- Greater increase EFP length and penetration
- Greater K.E. on targets
- Greater Warhead Performance!!

Enabling Smaller, More Lethal, Multi-Purpose Smart Munitions For Future Combat Systems(FCS)

FCS VEHICLE SURVIVABILITY

“Active Protection Systems”



Summary

- Major Advances in Shaped Charge & EFP Warheads
 - Innovative Warhead Concepts
 - Improved Modeling Capabilities
 - Improved Designs
- Transitioned Advanced Warheads To Major Weapon Systems
- Developing Enabling Technologies & Advanced Warheads for FCS Munitions (smaller, lighter, more lethal, multi-purpose)
- Developing Robust Kill Mechanism For APS To Defeat Both C.E. & K.E. Threats

U.S. Army ARDEC IS.....

***THE CENTER OF EXCELLENCE FOR ADVANCED WARHEADS
SUPPORTING THE ARMY'S TRANSFORMATION !***