



Lethality, Survivability, Mobility and
Sustainment for America's Army

Long Standoff Demolition Warhead Armor, Masonry and Concrete Targets

Mines, Demolition and Non-Lethal Conf

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Warhead Group

Tank-automotive & Armaments COMmand



Outline

- Introduction
- Warhead tests against
 - Armor
 - Brick walls
 - Single and Double reinforced concrete walls
 - Heavy reinforced concrete columns
- Other Warhead Designs
 - Multiple EFP Warheads
 - Fence Piercing Warheads
 - Warheads with more energetic Explosives
- Summary



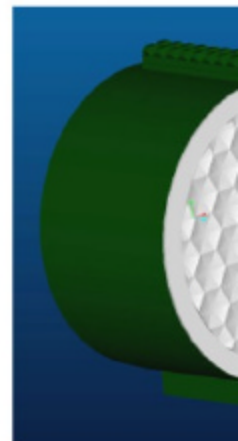
Objective: Develop a family of C-4 pack long standoff Demolition Warhead to de armor, masonry and concrete targets

Approach: Use Explosively Formed Penetrator (EFP) Warhead Technology



EFP Warheads in the M303 SDK

Small, Med
Single EFP



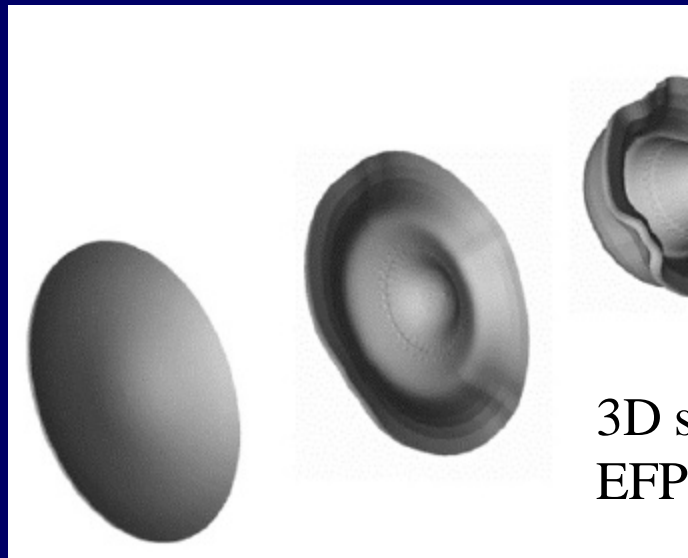
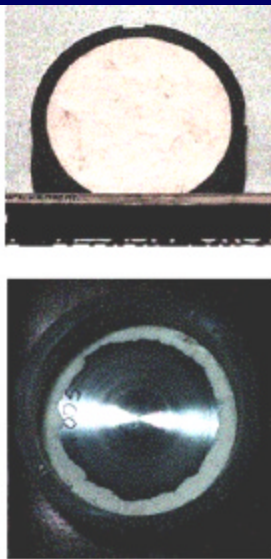
Medium MEFP

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Explosively Formed Penetrator (EFP) Warhead

Handpacked C-4










Housing:
Explosive:
EFP Liner:

Glass filled Polyurethane
Composition C-4
Iron



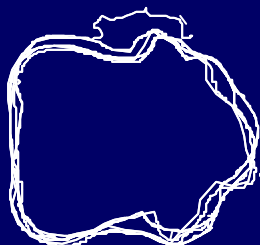
EFP Warheads

	Warhead Dia. (in.)	Weight (lbs.)	C-4 (lbs.)	Hi-speed photo
Small	2	0.35	0.2	
	3	1.14	0.6	
	4	2.76	1.4	
Medium	6	9.5	5.4	
	7	15.1	8.5	
X-Large	8	19.2	11.2	
	12	83.2	47.6	



Medium SDK EFP Warhead

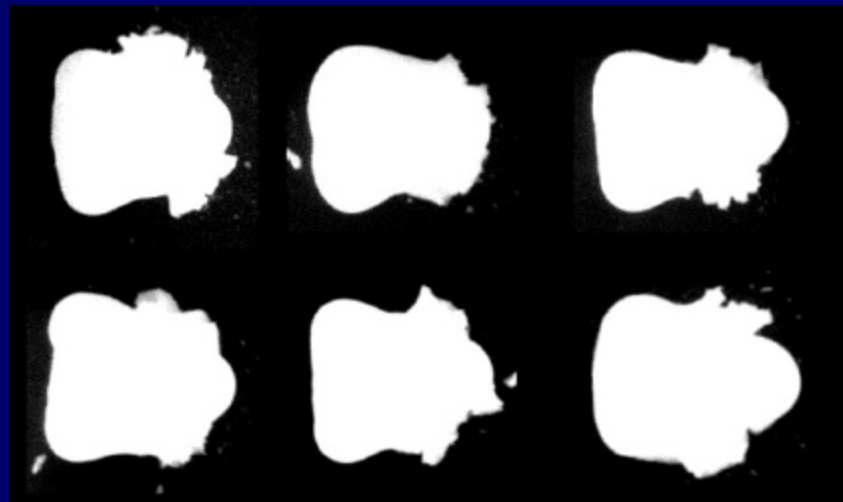
6 X-rays
Overlay



Shot 1

Shot 2

Shot 3



Shot 4

Shot 5

Shot 6

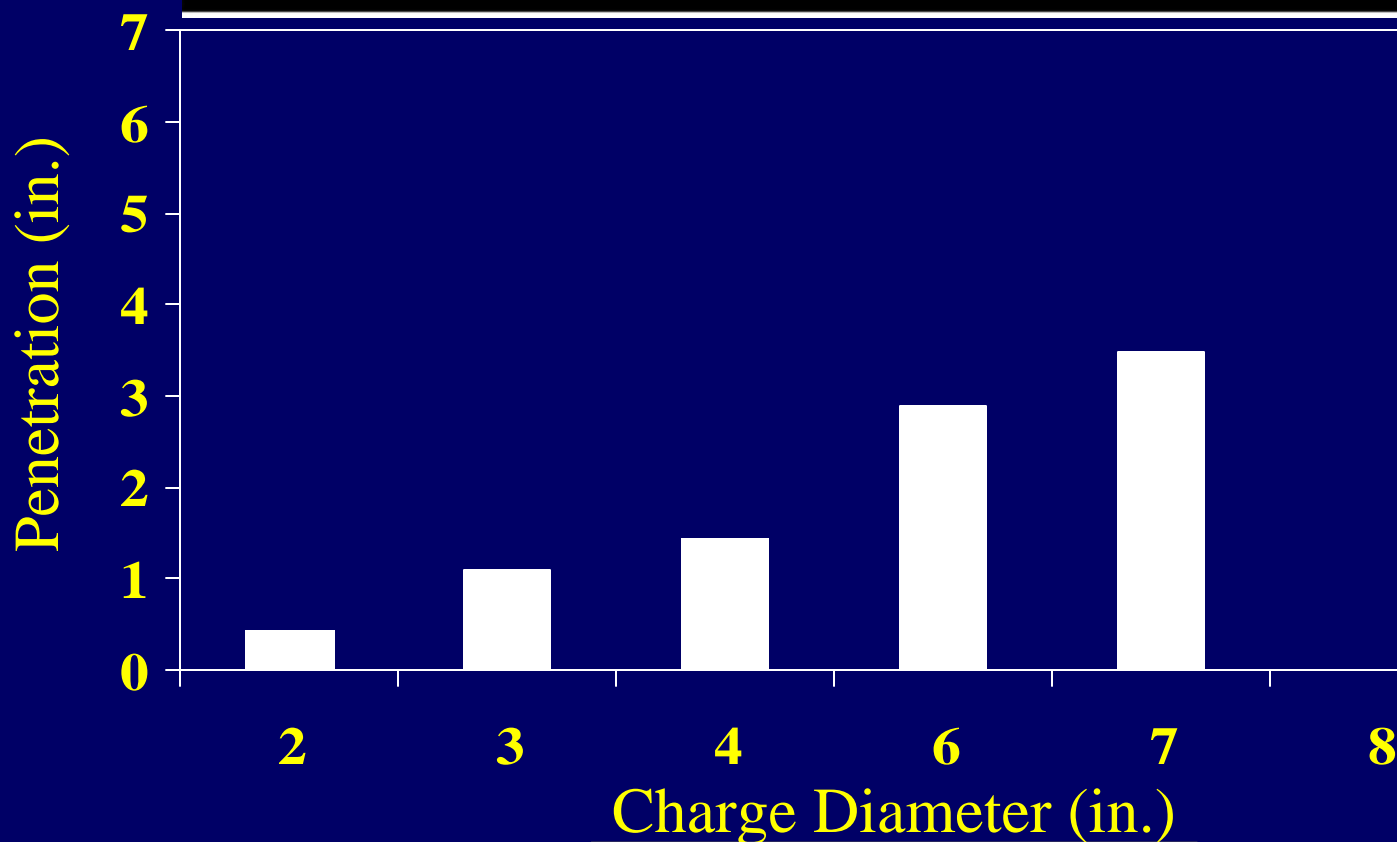
Range (ft.)	50	163	196.5*	229	327	425
No. of tests	17	3	2	3	5	1
Avg. radial miss distance (in.)	2.7	14.6	6.3	10.7	16.8	21.5

*50 meters

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Armor penetration data at



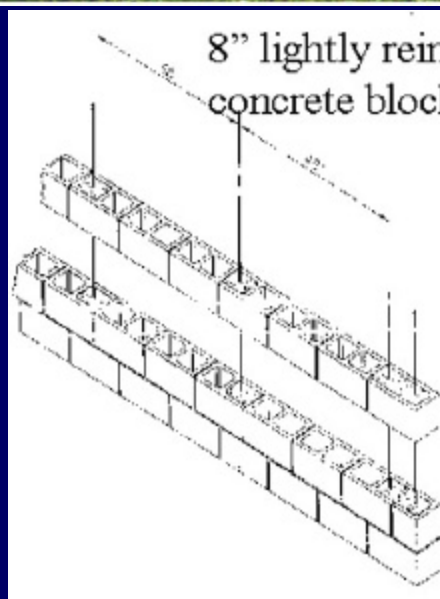
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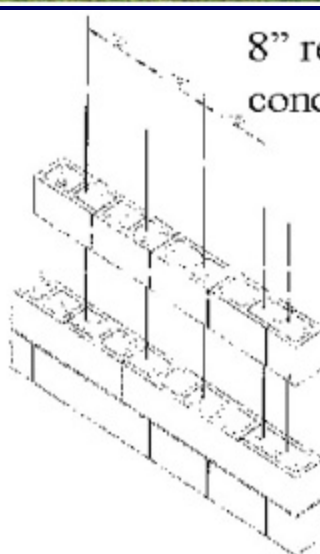
Concrete and Masonry Ta Requirements

- Create a $>8''$ dia. opening
 - 8'' double brick wall
 - 8'' reinforced concrete block wall
- Reduce load bearing capacity (remove 75% of concrete)
 - 24'' reinforced concrete column
- Create entry hole ($> 39.3''$ or 1 meter dia. Hole)
 - 12'' triple brick wall
 - 8'' double reinforced concrete wall

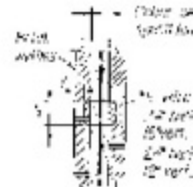
8" Wall Targets Description



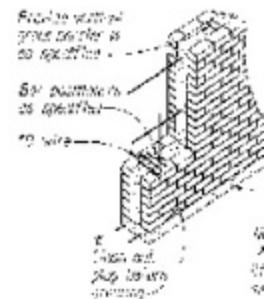
8" lightly reinforced
concrete block wall



8" reinforced
concrete block wall



BRICK/BRICK





8'' Brick wall test results

3'' Warhead

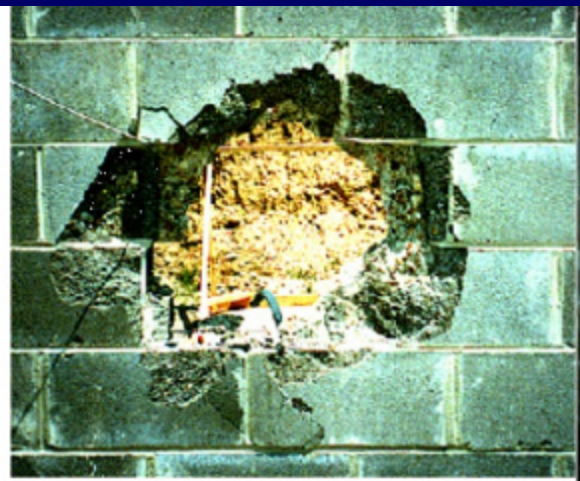
6'' Warhead



- 6-inch warhead defeat target 12'' x 13'' through hole
- Other tests conducted
 - 327.5 ft. (100 m) standoff (13'' X 15'' through hole)
 - 60° Impact angle (15'' X 16.5'' through hole)



8" Concrete block wall test results



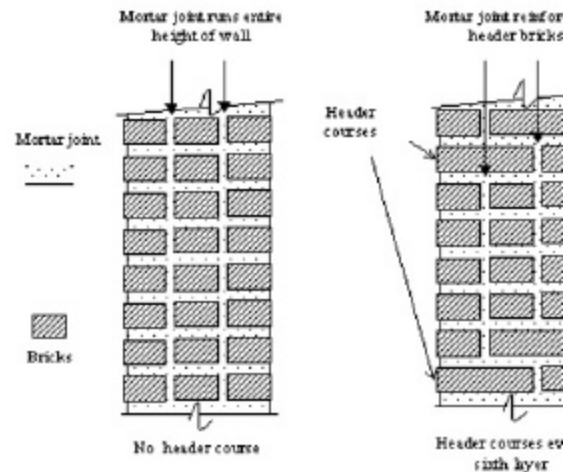
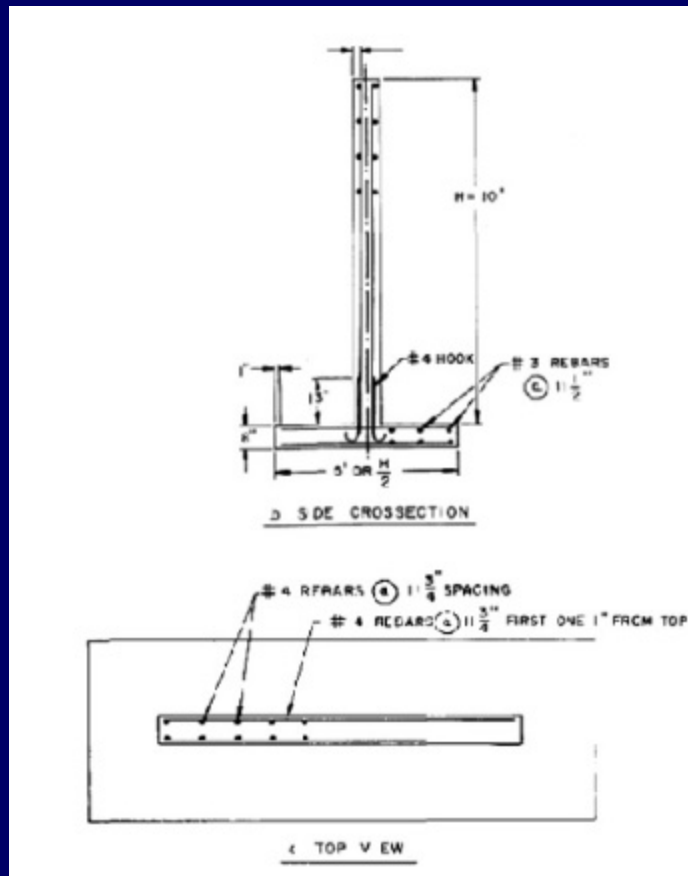
- 6-inch warhead defeat target
 - Aimed between rebars: 16" x 14" clear hole
 - Aimed at rebar: 19" x 17" clear hole
- Other tests conducted
 - 327.5 ft. (100 m) standoff (15.5" X 16" clear hole)
 - 60° Impact angle (18" X 16" clear hole)



8" Reinforced Concrete Wall and 12" Triple Brick Wall

8" Double reinforced
concrete wall

12" Triple brick





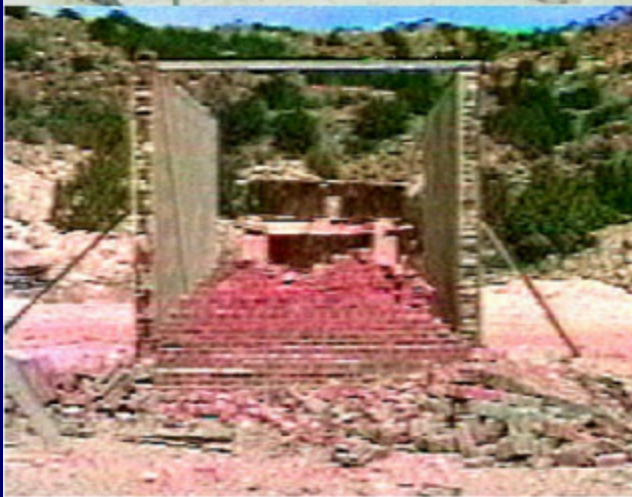
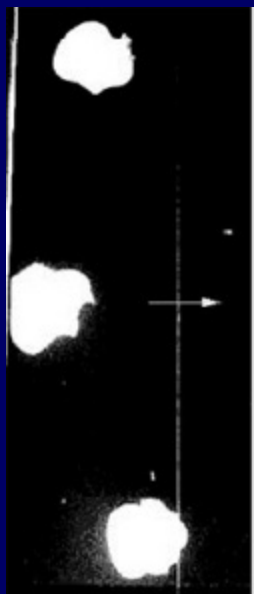
Approach to creating a 1 meter diameter opening



- Use an array of three warheads

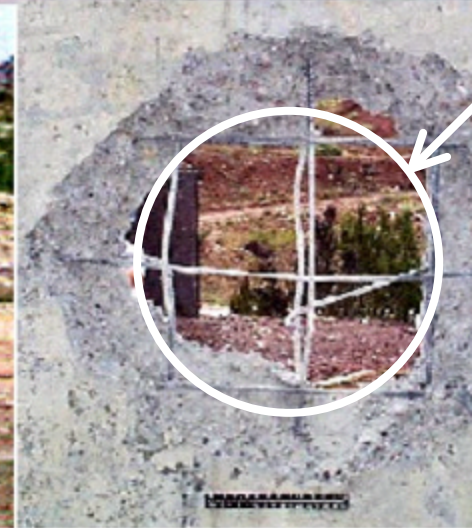
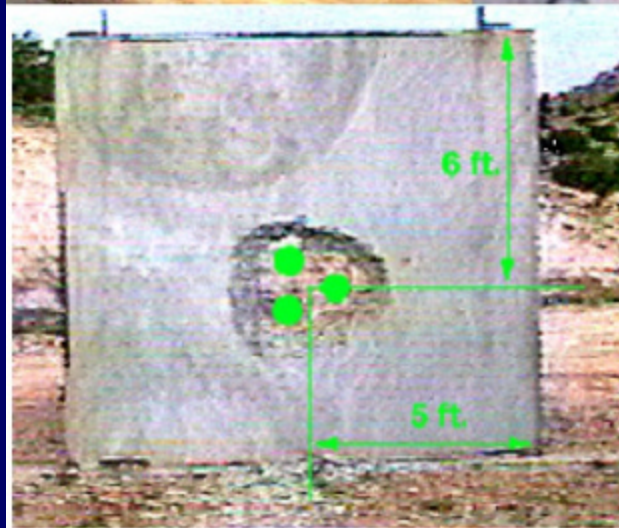
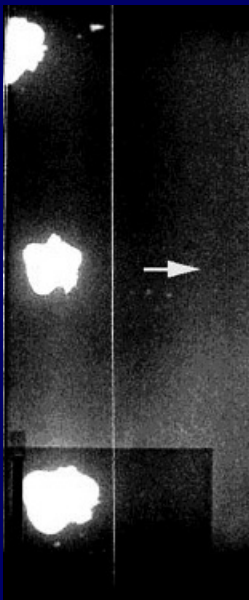


6-inch warhead array test (12-inch Brick wall)



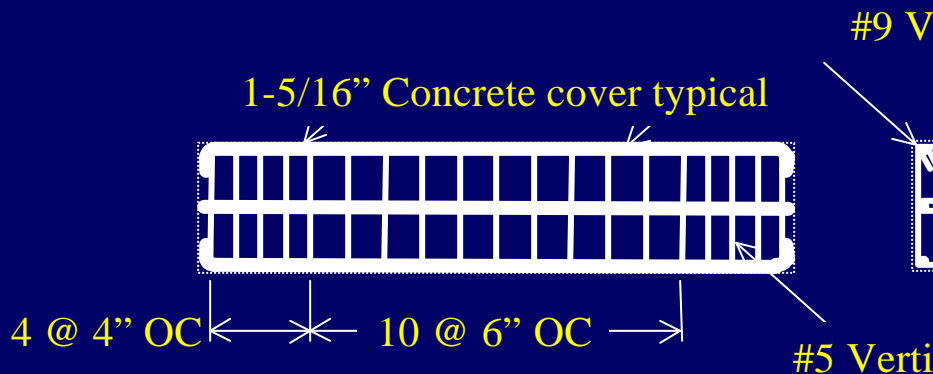


6-inch warhead array (8" reinforced concrete wall)





24" Concrete Columns



Concrete: 9 ksi (5 ksi min)
Cure time: >45 days
Defeat criteria: remove 75 % of concrete



EFP Warheads vs. 24-inch Reinforced Concrete Columns



One 8-inch warhead test



Two 6-inch warhead tests



8-inch warhead test summary 24-inch reinforced concrete col

Test 1
Ambient

Test 2
Ambient

Test 3
Cold

Test 4
Cold

Test 5
Hot



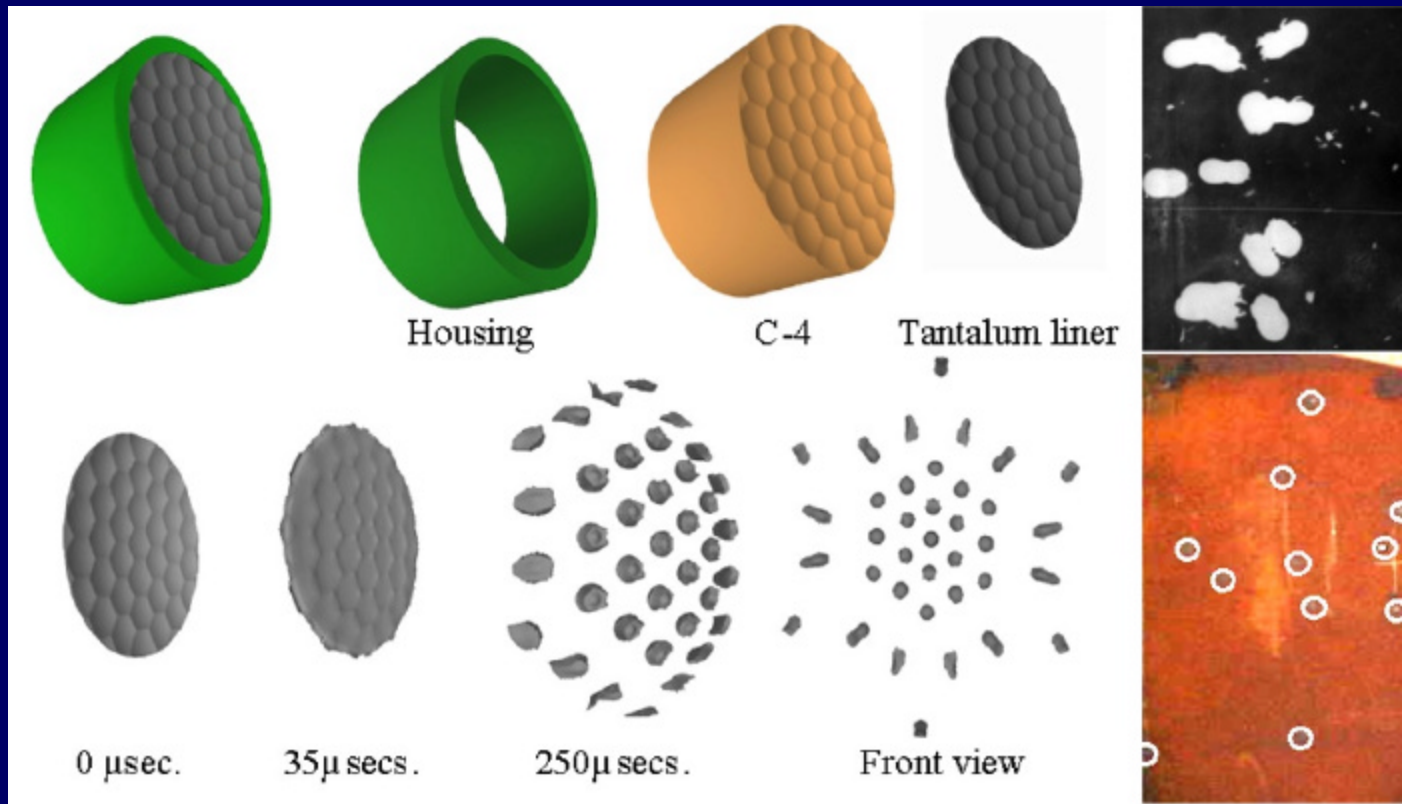


Other Warhead Design

- Multiple EFP Warhead
 - Fire start capability
 - Mine neutralization
- Fence Piercing Warhead
- Extended Range Warhead (PAX-2a explosives)



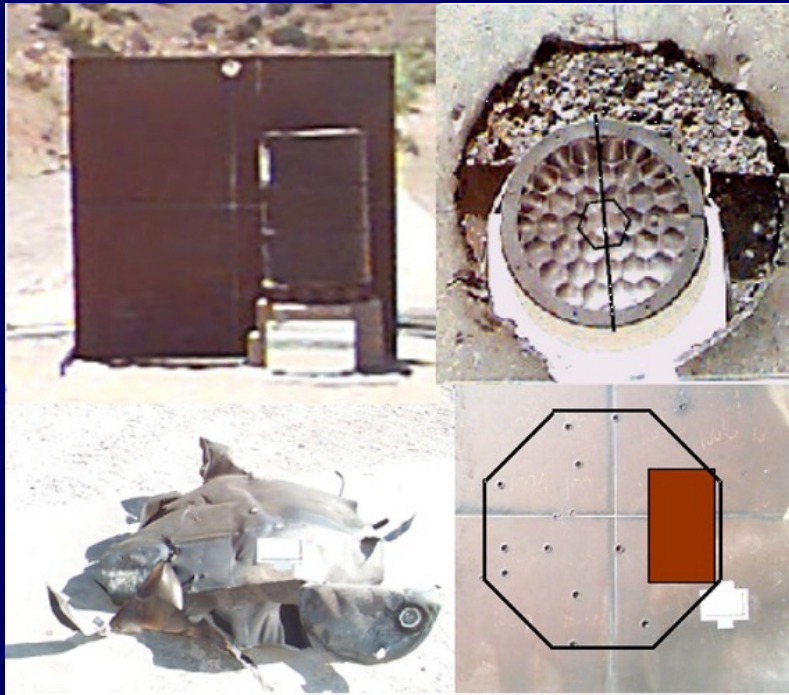
Multiple EFP Warhead



Target Photo @ 75 m
19 Perforation



MEFP Warheads vs. Diesel Fuel Drum Video





MEFP Warhead for Mine Neutralization



MEFP Warhead to neutralize b
mine, demonstrated:

- MEFP warhead design that produces (1 meter) diameter coverage area
- Neutralized mines buried under 3" sand and loose gravel



EFP Warheads vs. Target protected by Fencing



Test Setup

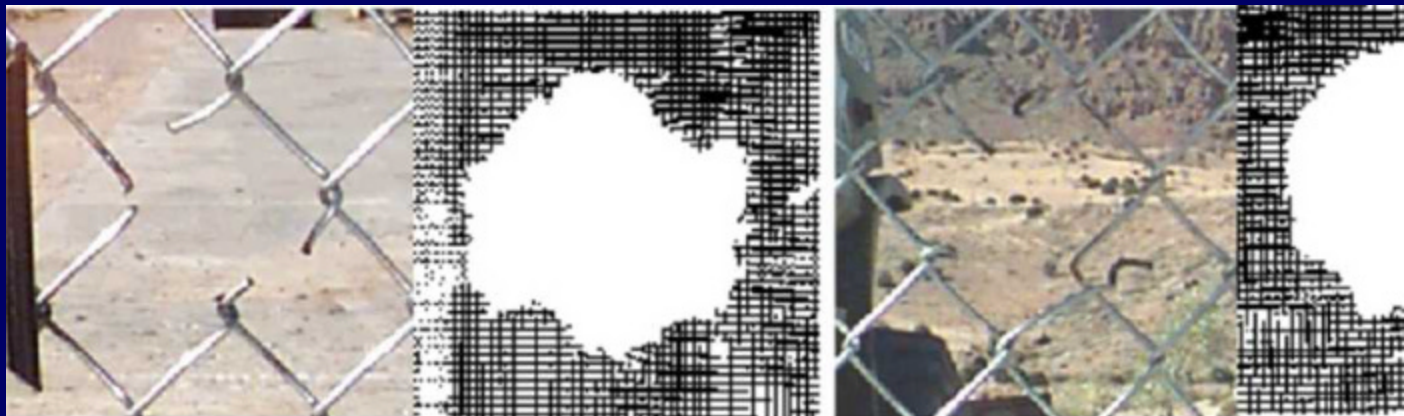
Fence at 30 & 40 ft.

Yaw Screen at 35 & 45 ft.

2.5" Armor at 50 ft.



Target





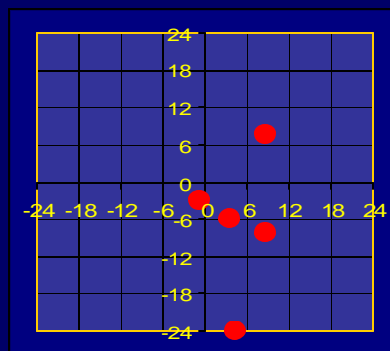
SDK Warhead with PAX

(327.5 ft. Or 100m. Against 2.5" RH)

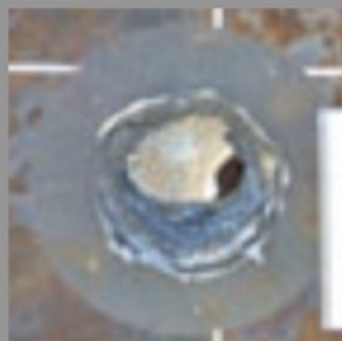
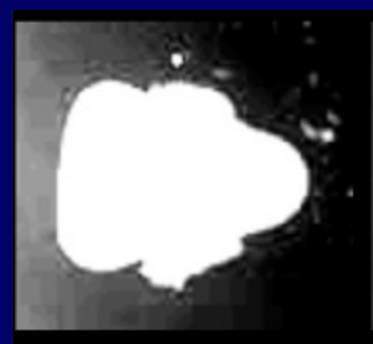
Cold



Cold



Hot



Target Holes

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Summary

- EFP Technology can be used for long stand off demolition warheads
- Demonstrated a family of EFP warhead defeat of
 - Armored targets
 - Concrete block walls
 - Double and Triple brick walls
 - Reinforced concrete block walls
 - Reinforced concrete columns
- Other warhead designs being developed
 - Defeat other SOF targets
 - Increase warhead effective range (25-100%)



Acknowledgements

- George Lutz – Office of the Project Manager for Close Combat System
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