U.S. Army
Armament Research, Development & Engineering Center
Picatinny, NJ

120MM LOS-MP

LINE OF SIGHT MULTI-PURPOSE

Army Science Conference

Presented by
Eric Scheper LOS-MP IPT Lead
Matt Hall LOS-MP Engineer

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 NOV 2006	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Line of Sight Multi-Purpose	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Systems Engineer, LOS/BLOS Munitions Division Armament Research, Development, and Engineering Center Picatinny Arsenal, NJ 07806-5000**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM002075., The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**18**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Brief Outline

- ***Program Overview***
  - Exit Criteria
- ***XM1069 Design***
  - Process
  - Cartridge
  - Warhead
  - Fuze (XM1157)
  - Data Link

  } *Modeling & Simulation*
- ***XM1069 Testing***
  - Warhead
  - Structural
  - Concrete Wall
  - Anti-Personnel

  } *Test & Evaluation*
- ***Conclusion***

Line Of Sight Multi-Purpose
(LOS-MP)

Present: 4 Rounds

M908

M830A1

M830

M1028

Target Set

Anti-Personnel

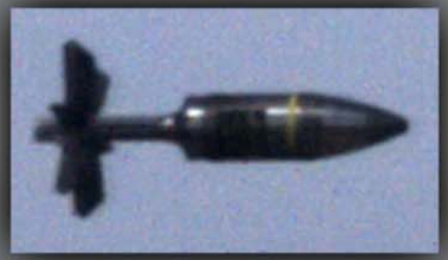
Concrete Walls

Bunkers

Light Armor

Future: 1 Round

XM1069



The LOS-MP combines capabilities of M1028, M830A1, M908 and M830 into ONE Round

Improved Lethality with Reduced Logistic Burden

Program Overview

- **Subset of 120mm MCS and Abrams Ammunition System Technologies (MAAST) ATO**

- **LOS-MP TRL6 Exit Criteria**
  - Double reinforced concrete wall
    - Hole size 30”x50” in 3 shots or less
  - Anti-Personnel:
    - 200-700 meters Threshold
    - 40-2000 meters Objective

All technical data Government generated and owned

LOS-MP Design Process

Initial conceptualization to meet requirements

Definition of high risk process and long lead items

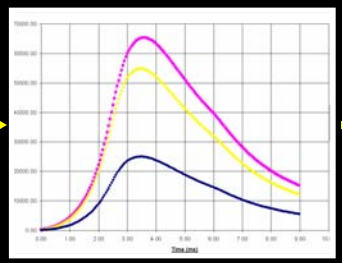
Define shortfalls of M&S: Fill gaps with test, experience

Decrease design time and tests

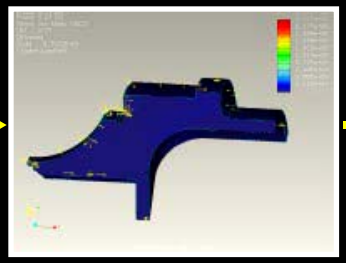
M&S Savings: $6.8 mil/27 months

Modeling/ Configuration
Pro Engineer/ Intralink

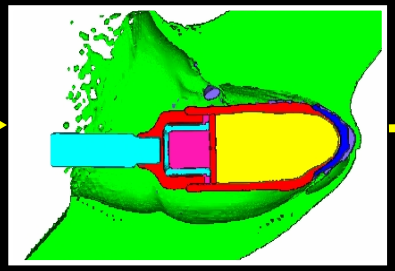
IB Simulation
IBHVG2



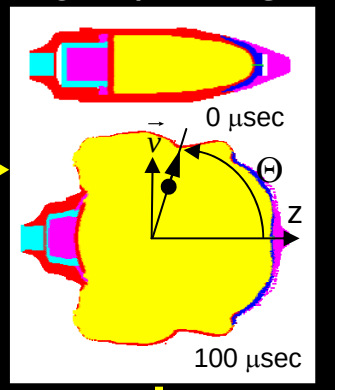
Structural analysis
FBD/ ANSYS



Target penetration
CTH

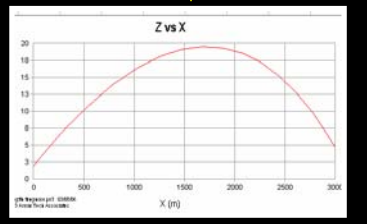


Fragmentation
CALE/PAFRAG

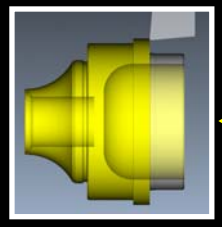


Failure in any model reiterates design process

Flight performance
PRODAS



3D numerical control
Pro Manufacture

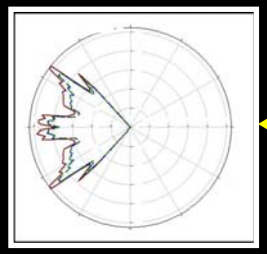


Verify models

Flight Performance

Fragmentation

DR concrete wall

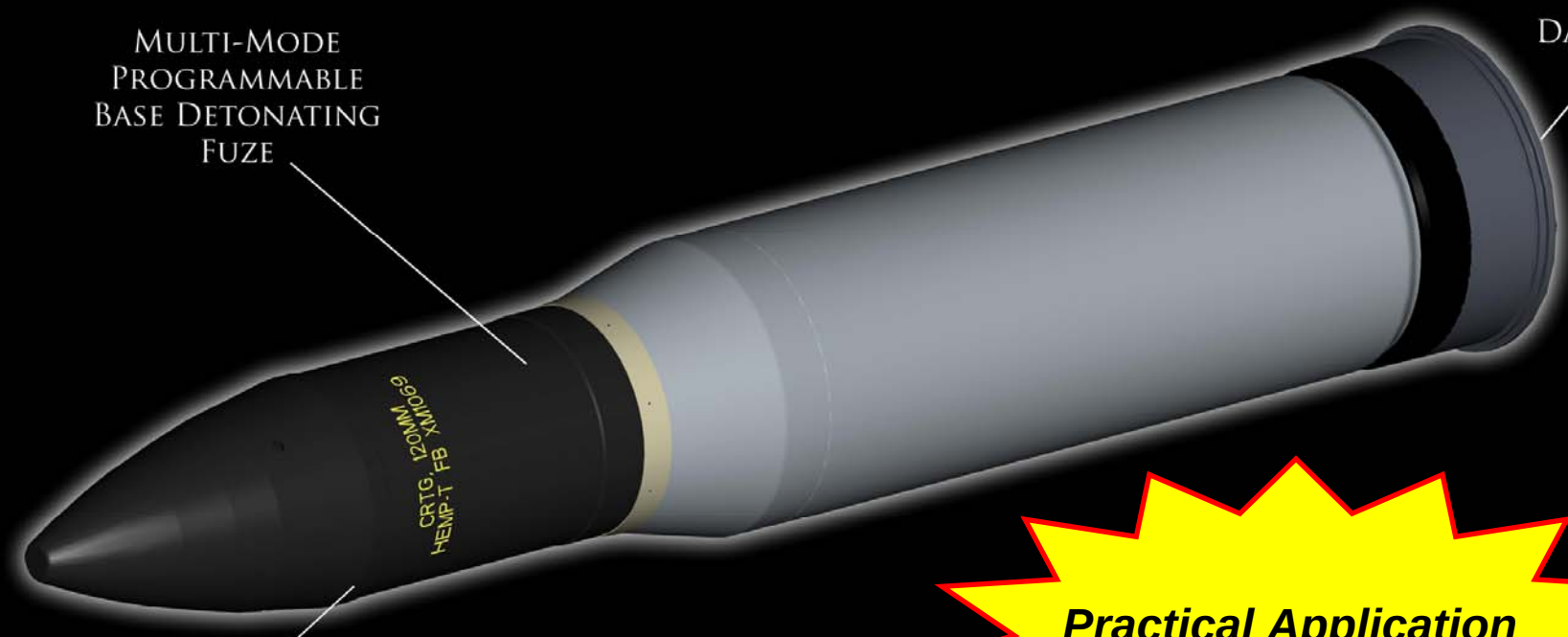


Lethality Models
CASRED/MPR3D/
AJEM/MUVES

No iteration of design during testing !

120MM LOS-MP
LINE OF SIGHT MULTI-PURPOSE

XM1069 CARTRIDGE



Practical Application of New Technology

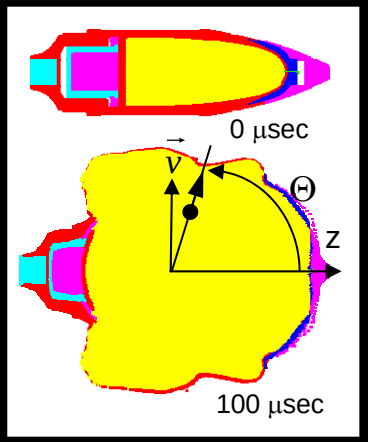
120MM LOS-MP

LINE OF SIGHT MULTI-PURPOSE

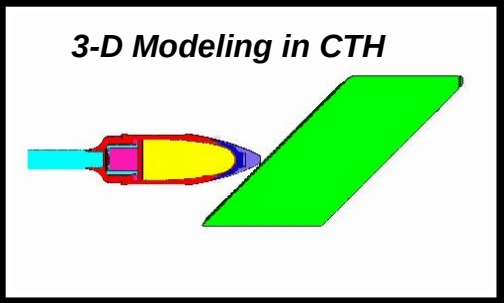
XM1069 Warhead Design

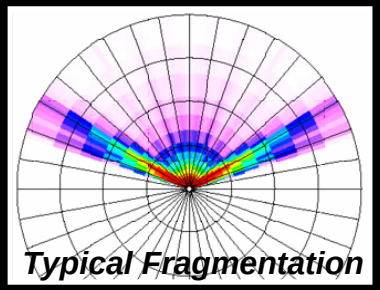
- **Blast fragmenting target penetrating**
  - **Iteration of CTH/ CALE-PA FRAG modeling**
  - **Structural integrity for:**
    - **Concrete Wall**
    - **Earth and Timber Bunker**
  - **Delivers intact warhead and fuze to target sweet spot**
  - **Fragmentation:**
    - **~20000 total fragments**

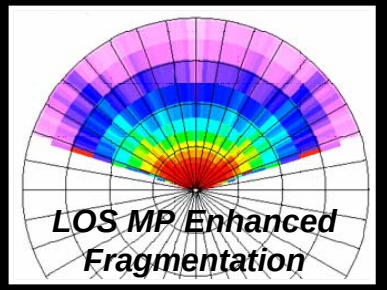
4 Patents Pending



CALE/ PAFRAG predictions



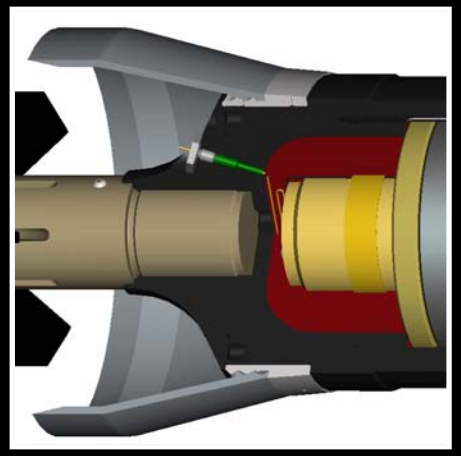




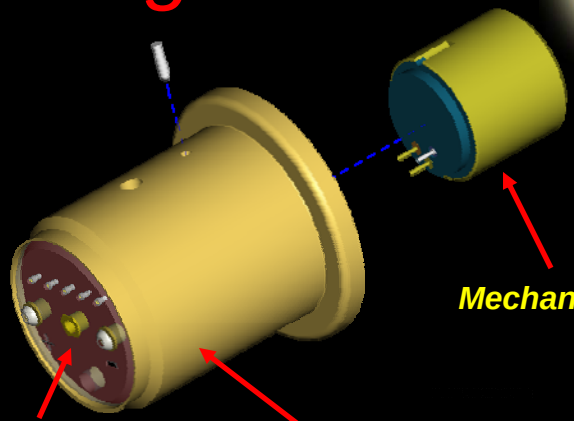
Survivable & Lethal

120MM LOS-MP
LINE OF SIGHT MULTI-PURPOSE

XM1069 Fuze Design



Patent Pending



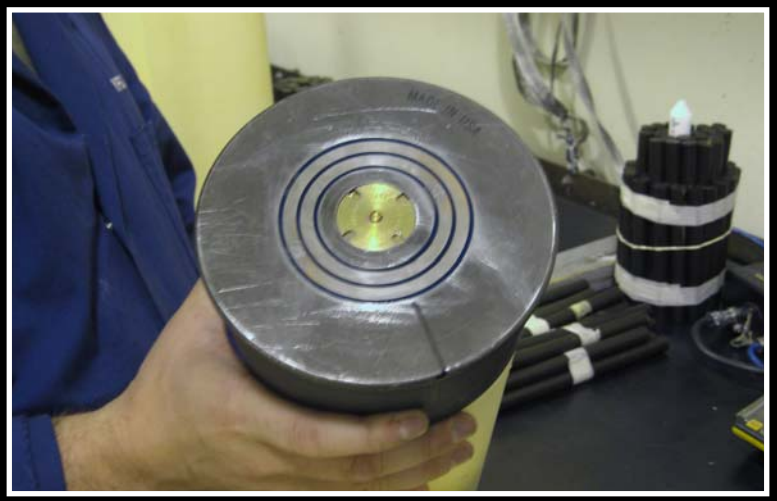
- **Multimode Programmable Base Detonating (XM1157)**
  - **5 modes: 4-Point Detonate, Timed airburst**
  - **Dual safe: Setback, commit to launch**
    - 3 leaf mechanism
    - Electronically controlled piston actuator
  - **Power, function mode and time sent via data link**
  - **S&A**
    - **No rotating contacts**
    - **90 degree rotor**
  - **Electronics**
    - **Dual Micro-controller**
    - **Enhanced Capabilities**

Preliminary AFSRB approval

120MM LOS-MP
LINE OF SIGHT MULTI-PURPOSE

XM1069 Data-Link

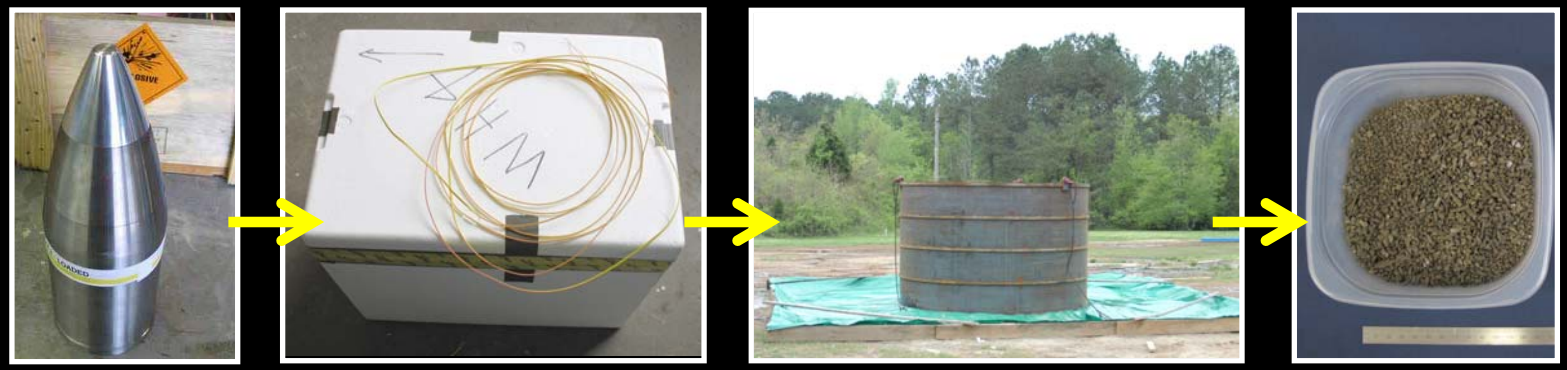
- Provides ability to:
  - Power fuze
  - Set function mode & time
  - Verify data and munition status
- Primer ignition isolated from data transmission



Utilizes production primer and case base

Warhead Testing: Frag Recovery

- **Fragment Recovery**
  - **Fragment recovery determines efficiency of warhead to produce desired fragment size and number**
  - **Fragmentation recovery results validate and refine PAFRAG/CALE modeling data**

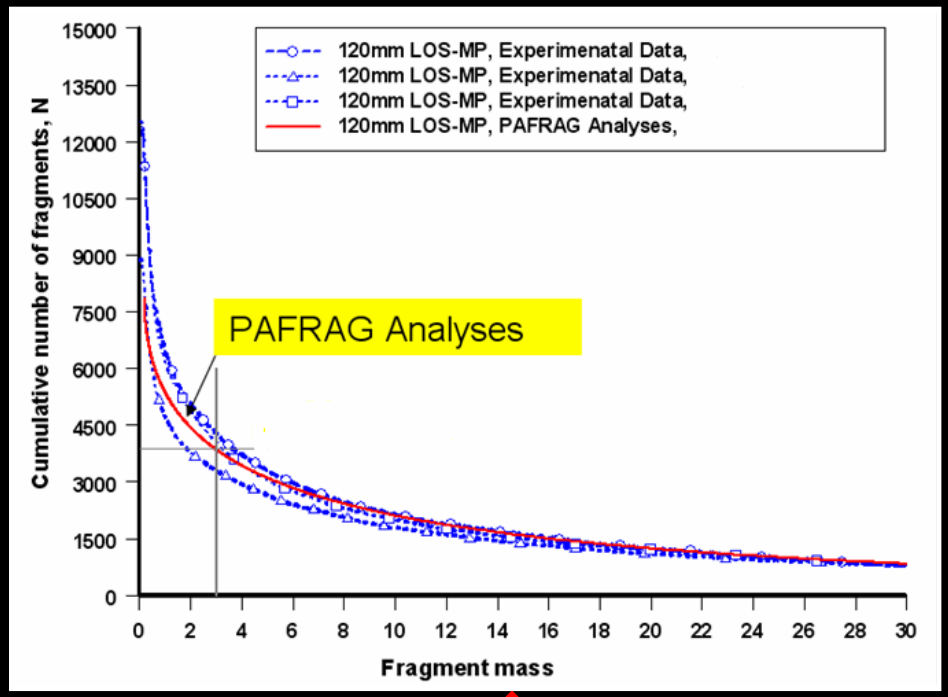


93% fragment mass recovery was achieved

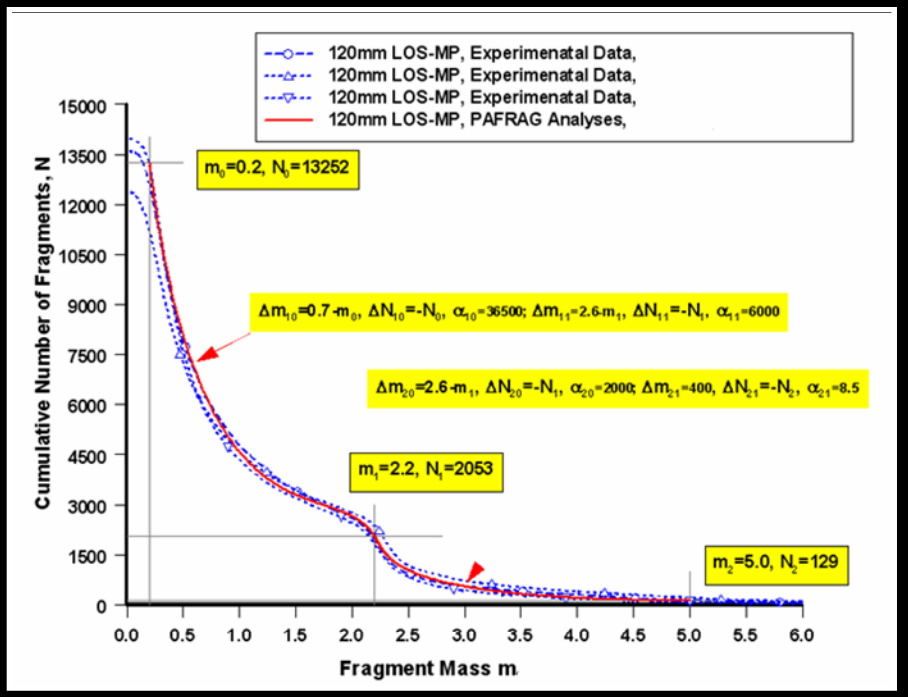
Fragment Recovery Data

Experimental vs CALE/ PAFRAG Analysis

Body Fragment # vs Mass



Nose Fragment # vs Mass

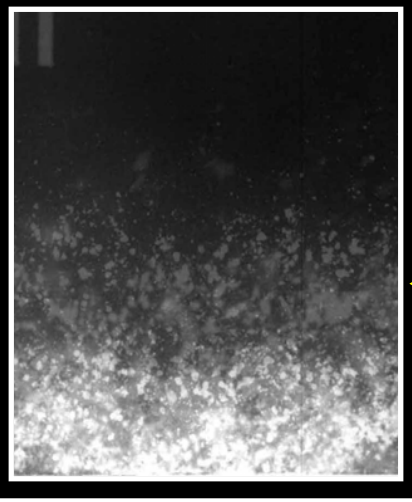


Simulation predicted experimentation

120MM LOS-MP
LINE OF SIGHT MULTI-PURPOSE

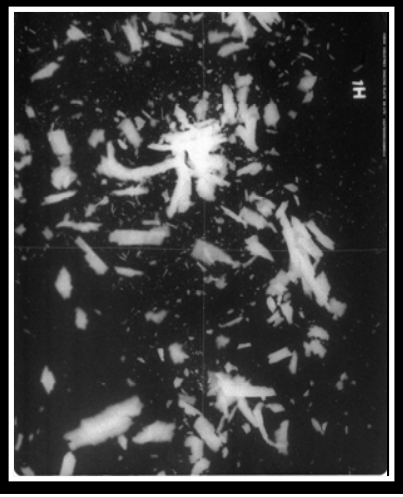
Warhead Testing: Frag Velocity

- **Fragment Velocity**
  - **Determines static detonation fragment velocity**
  - **Fragmentation velocity results validate and refine PAFRAG/CALE modeling data**



Nose Fragment Velocity
Test: 0.740 mm/µs
Predicted: 0.750 mm/µs

Fragment Velocity Test Setup



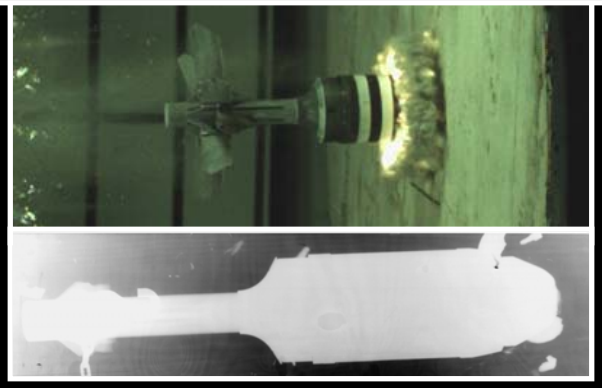
Body Fragment Velocity
Test: 1.360 mm/µs
Predicted: 1.200 mm/µs

Projectile Structural Testing

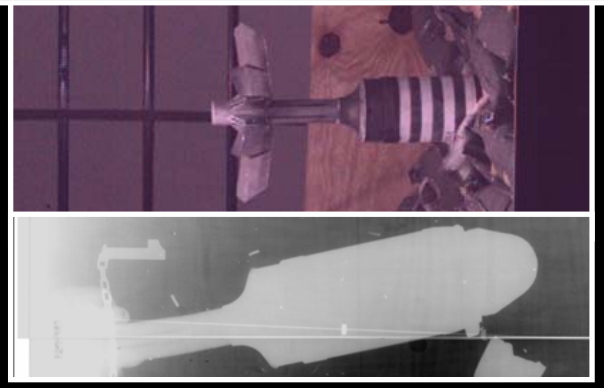
- XM1069 Structural Testing
  - Validate Propulsion models
  - Validate FEA models
  - Validate CTH model
  - Evaluate target deceleration (for fuze programming)
    - Concrete/ Double Reinforced Concrete: Equal difficulty
    - E&T Bunker hardest on airframe

Muzzle Exit Integrity

DR Concrete Wall
Energy Decrease: 32KJ
Velocity Decrease: 60 m/s

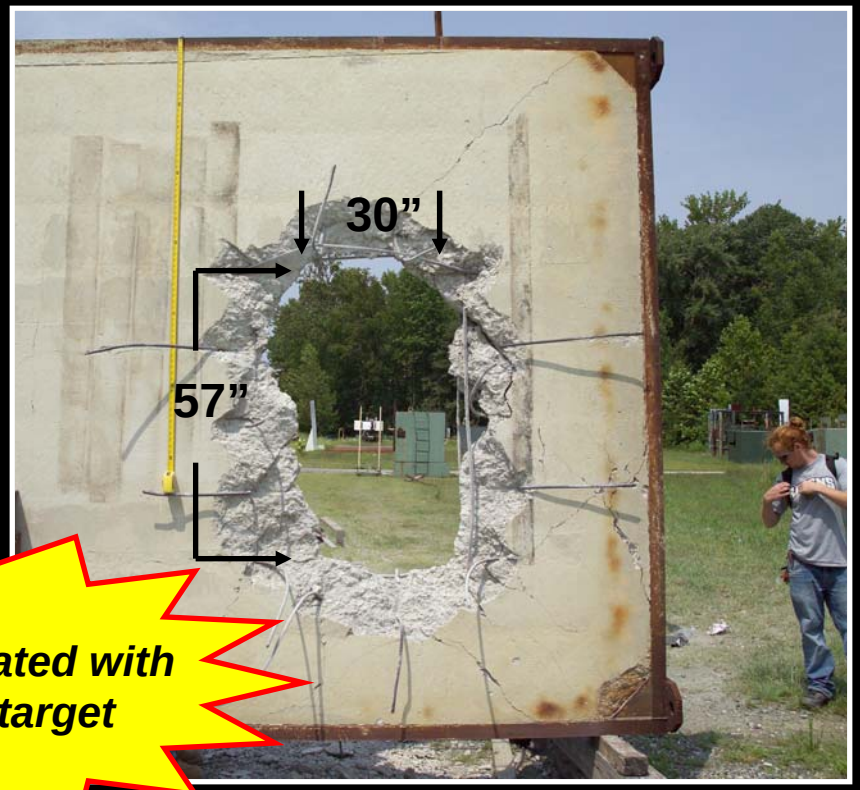


E&T Bunker
Energy Decrease: 210KJ
Velocity Decrease: 162 m/s



TRL6: Concrete Wall Test

- Demonstrated XM1069 integrated with XM1157 fuze & data link
- Defeated target in 2 shots



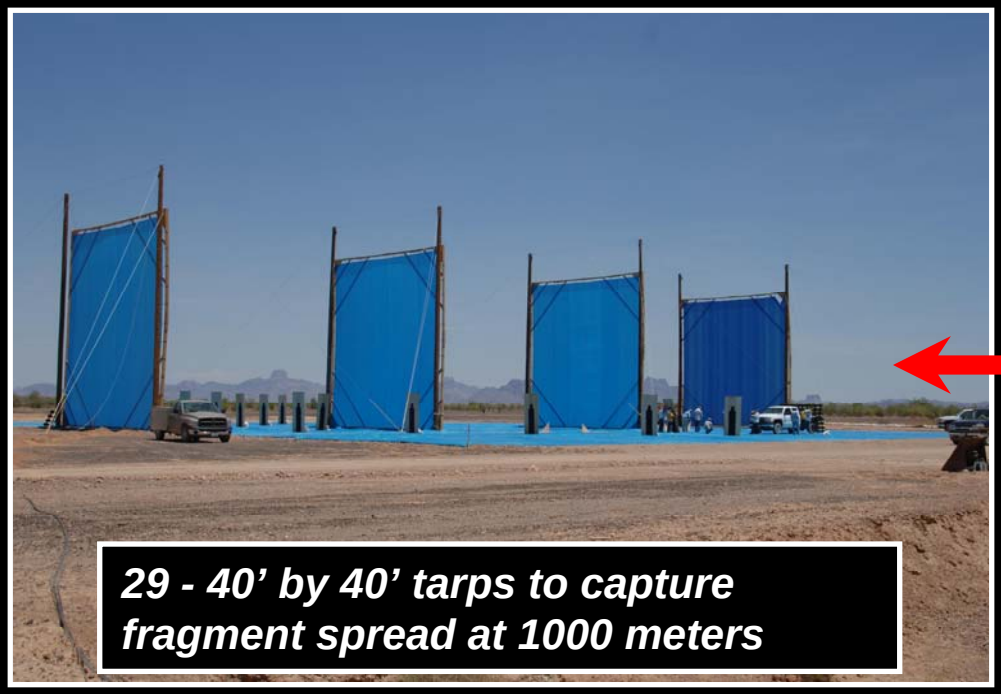
Warhead integrated with fuze defeats target

MOUT standard 8” double reinforced wall

120mm LOS-MP
LINE OF SIGHT MULTI-PURPOSE

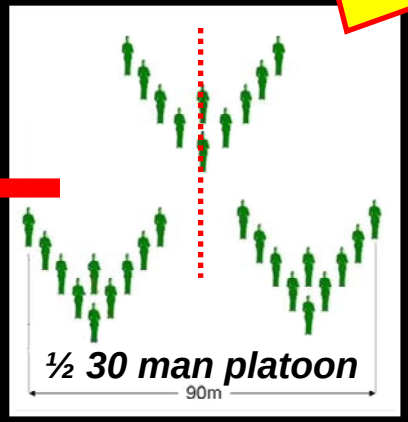
TRL6: Anti-Personnel Test

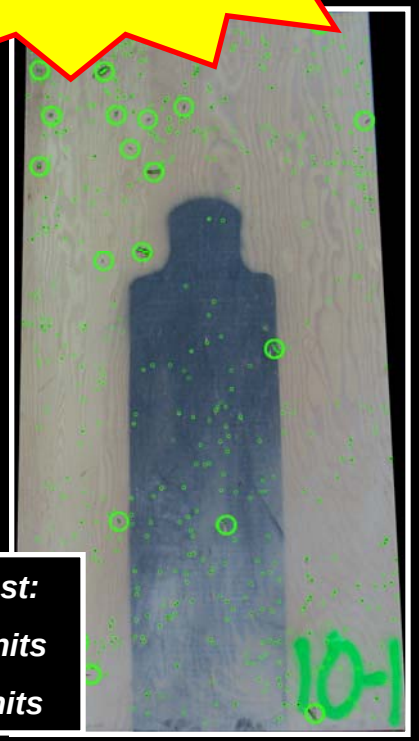
- Demonstrated airburst performance between threshold and objective ranges



29 - 40' by 40' tarps to capture fragment spread at 1000 meters

Performance shown at 1000 meters





Sample silhouette from test:

- ***Large Dots: Body frag hits***
- ***Small Dots: Nose frag hits***

Fired from Abrams SEP Tank with Data link

120MM LOS-MP
LINE OF SIGHT MULTI-PURPOSE

120MM LOS-MP

LINE OF SIGHT MULTI-PURPOSE

Conclusion

- ***LOS-MP TRL6 Exit Criteria has been met***
  - ☑ Double reinforced concrete wall
    - Hole size 30”x50” in 3 shots or less
  - ☑ Anti-Personnel:
    - 200-700 meters Threshold
    - 40-2000 meters Objective
- M&S reduced time and risk
- Testing validated and refined M&S
- LOS-MP technology transitioned to PM-Maneuver Ammunition Systems for potential Advanced Multi-Purpose SDD

LOS-MP Team Acknowledgments