Effects of Small Caliber Munitions Through Intermediate Barriers

Mr. Chris Gandy ARDEC
Mr. Jeremy Lucid ARDEC
Mr. Shawn Spickert-Fulton ARDEC

May 17th 2006

Believe nothing you hear, and only half of what you think you see.

- Rumors Suggest That Some 5.56mm Projectiles can not Penetrate Automobiles
- What are the Penetration Capabilities of 5.56 Ammo Against Intermediate Barriers?
- Can Fielded Munitions meet the Needs in Iraq & Afghanistan?

Typical Intermediate Barriers

Concrete Wall

Insurgent Vehicle

This Vehicle ran a Checkpoint in Iraq.
Could this have been Prevented?

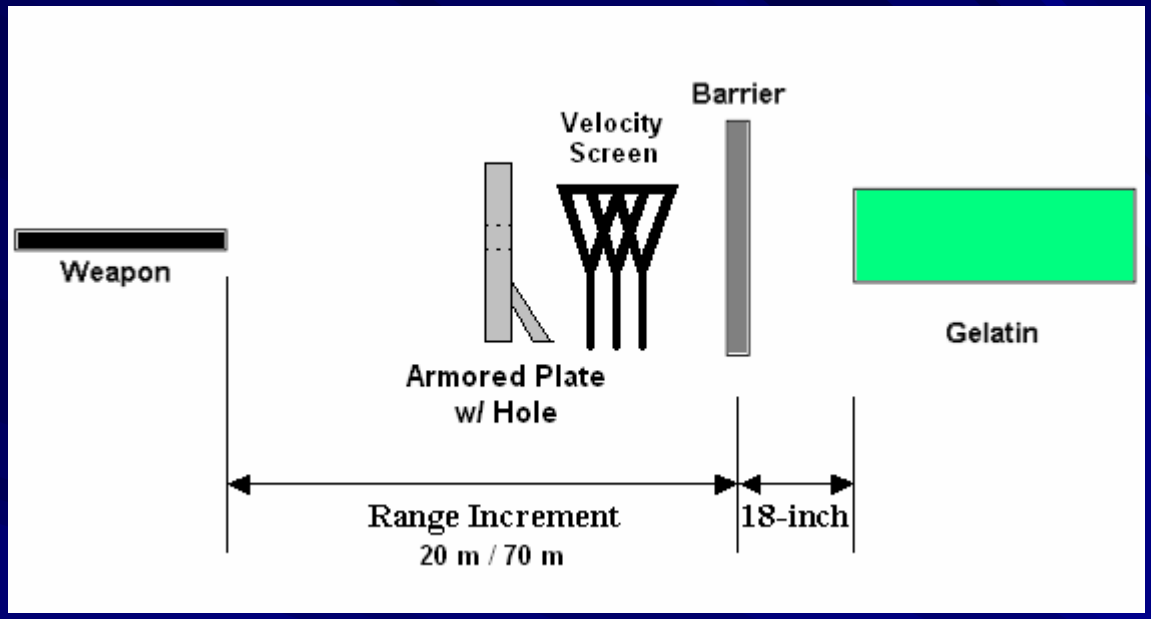
Phase I Scope

- Evaluate Terminal Effects of Select 5.56mm & 7.62mm Ammunition Through:
  - Automobile Windshields
  - Simulated Automobile Doors
- Collect Static & Dynamic Data
- Analyze Using EDR Methodology
  - **E**ffective **D**amage **R**ating is a performance metric currently in development at Picatinny
- Short Study - Rapid Results

Reality ➔ Model

Iraqi Checkpoint

Test Setup



RANGE SETUP & TEST PARAMETERS

Ranges: 20m & 70m	M16 (5.56mm)	M4 (5.56mm)	M240 (7.62mm)
M193 (5.56mm - 55grain)	Intermediate Barriers • No Barrier (Baseline) • Windshields • Simulated Car Doors		
M855 (5.56mm - 62grain)			
MK262 (5.56mm - 77grain)			
M80 (7.62mm - 147grain)			

Windshield Test Setup

90˚ Windshield

45˚ Windshield

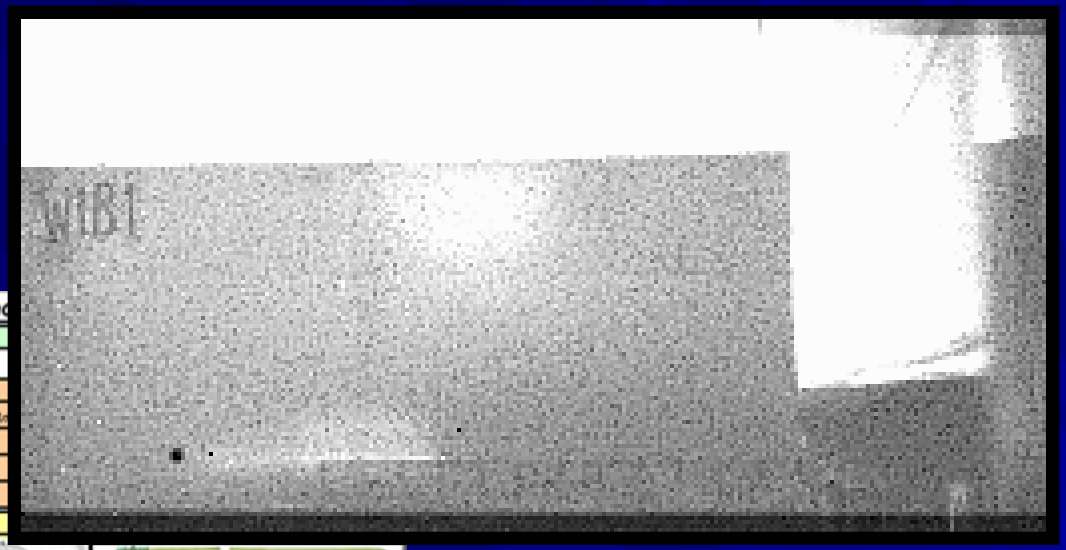
Steel Plate Setup

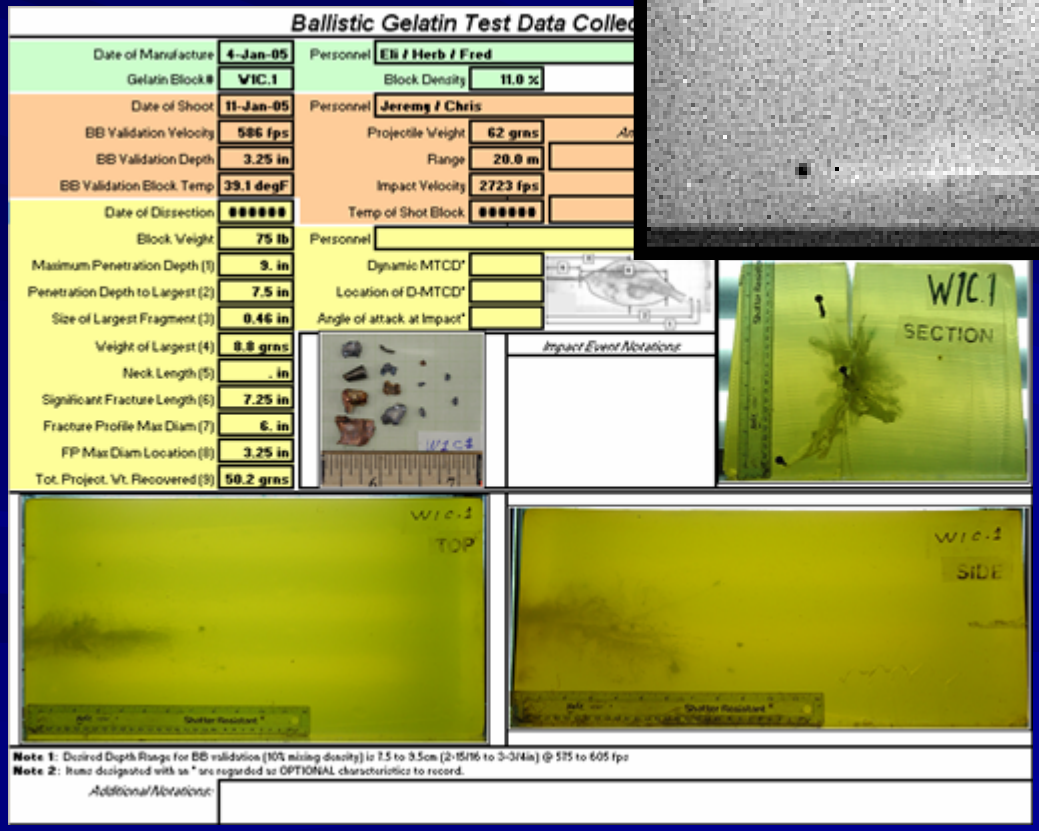
90˚ Steel Plates

45˚ Steel Plates

Data Extraction

- High Speed Video



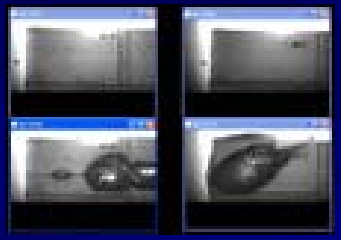


- Recovered Projectile Parameters
- Gelatin Damage Parameters

Qualities & Considerations

(Big Picture)

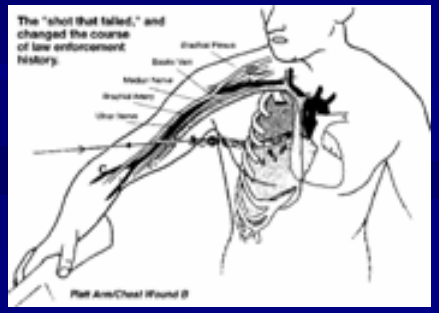
Shape and Type of Effect



Mission(s)

- Engagement Ranges
- Time to Acquire
- Operational Environments
- Number & Type

Adequate Reach



- Intermediate Barriers
- Body Armor
- Shot Lines

Other Factors

- Legal Restrictions
- Logistics
- Weapon Signature

- Consistency

Evaluating Results

- Numerous metrics available
- Understand capabilities & limitations of each metric
- Remember large number of variables and scenarios encompassed
- Focus in on key performance characteristics and on thresholds of performance
- Understand the expected range of variation in “typical” use
- Assess general performance envelope

Phase I Preliminary Conclusions

- All Shots Penetrated all Barriers
- Measurable Damage was Observed in Gelatin Simulant
- 7.62mm Produced more Damage Than 5.56mm
- Result Depends on Where Damage was Inflicted
- Results Entered into ARDEC Database Where Overall Performance Is Currently Being Gauged

Phase II Methodology

- Short Study – Rapid Results
- If you can't Penetrate the Barrier then the Target can not be Reached
- Ammo Capability not Limitation
  - Can you Breach the Barrier?
  - How Often does this Occur?

Phase II Scope

- Evaluate Terminal Effects of 1,600 Rounds of 5.56mm & 7.62mm Ammunition Through:
  - Automobile Windshields at Steeper Angles
  - Simulated Truck Doors w/ Increased Shell Thickness
  - Concrete Blocks
- Establish Quick Go/No Gages For Intermediate Barriers To Assist In Assessing The Threat

Phase II Test Setup

Weapons:

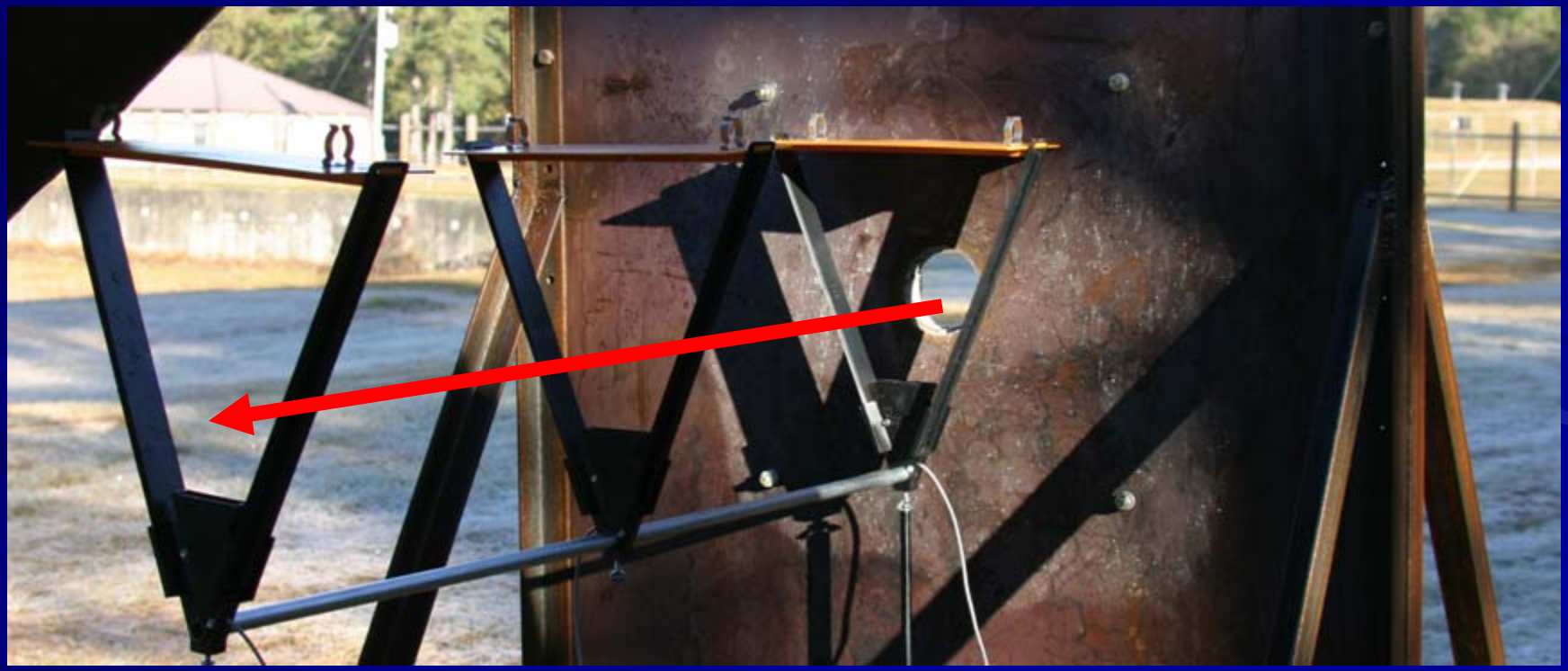
- M4
- M16
- M249
- M24
- M240

Ranges:

- 75m
- 200m

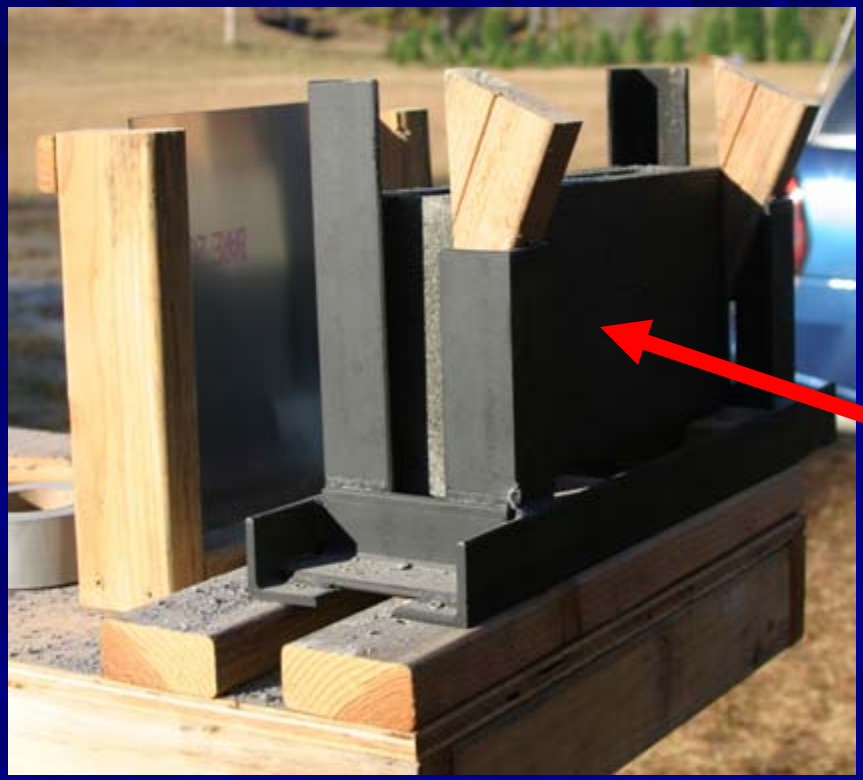
USAMU – Ft Benning

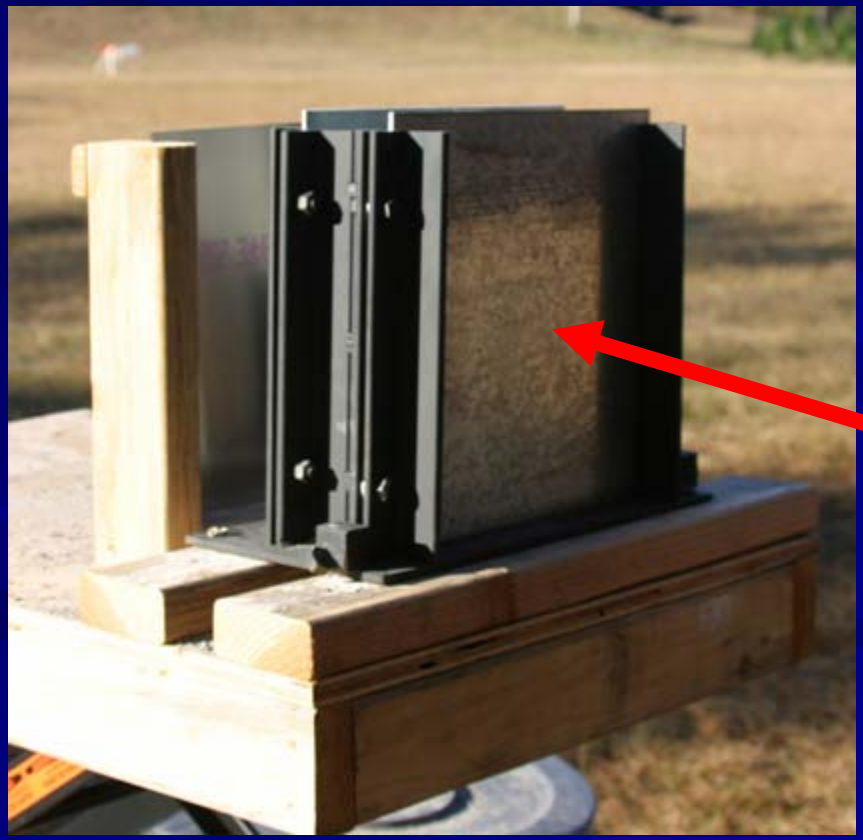
5.56mm Ammo	7.62mm Ammo
M193 M855 MK262 M995	M118LR M80



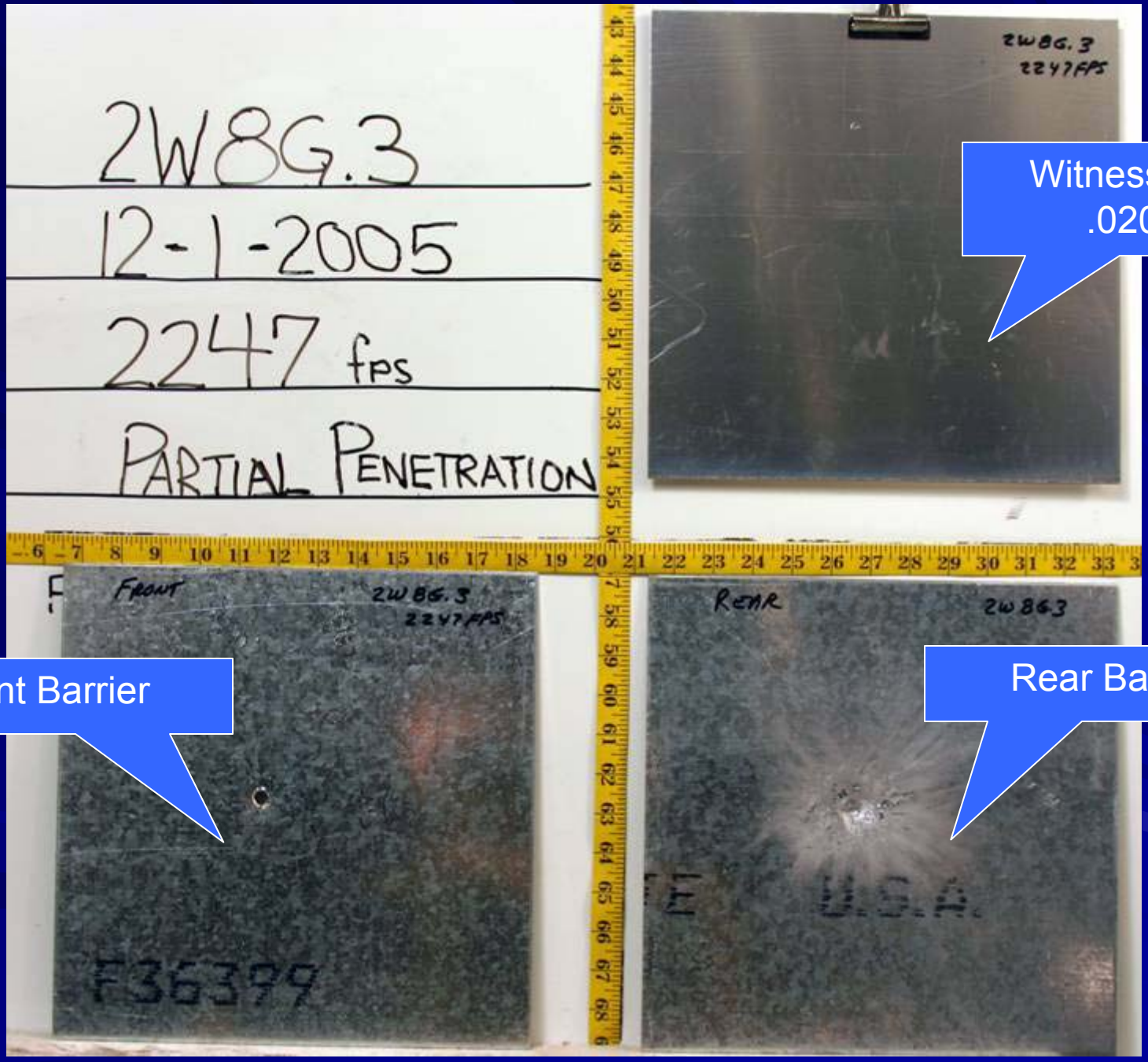
Automobile Windshields

Concrete →



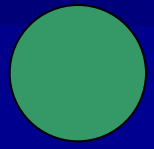


← Steel

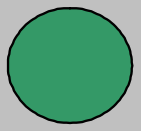
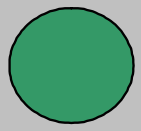
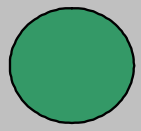
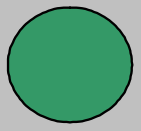
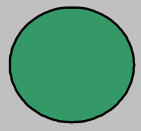
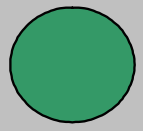
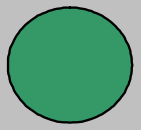
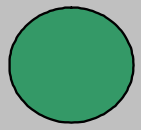

2W8G.3
12-1-2005
2247 fps
PARTIAL PENETRATION
2W8G.3
2247FPS
Witness Sheet
.020" Al
FRONT
2W8G.3
2247FPS
F36399
REAR
2W863
U.S.A.
Front Barrier
Rear Barrier

Partial Penetration

Full Penetration



Preliminary Data - M16 (200m)

AMMO	Windshield		Truck Door	Concrete
	Config 1	Config 2		
M855				
M995				
MK262				
M193				

 No Penetration

 Full Penetration

 Partial Penetration

Special Thanks

USAMU – Ft Benning

Without the help and cooperation of LTC Liwanag and the entire USAMU Team, this test would not be possible.

- Thank You

Questions ?

Chris Gandy – cgandy@pica.army.mil
Jeremy Lucid – jlucid@pica.army.mil
Shawn Spickert-Fulton – sfulton@pica.army.mil