



Effects of Small Caliber Munitions Through Intermediate Barriers

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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
 - Effective Damage Rating is a performance metric currently in development at Picatinny
- Short Study - Rapid Results

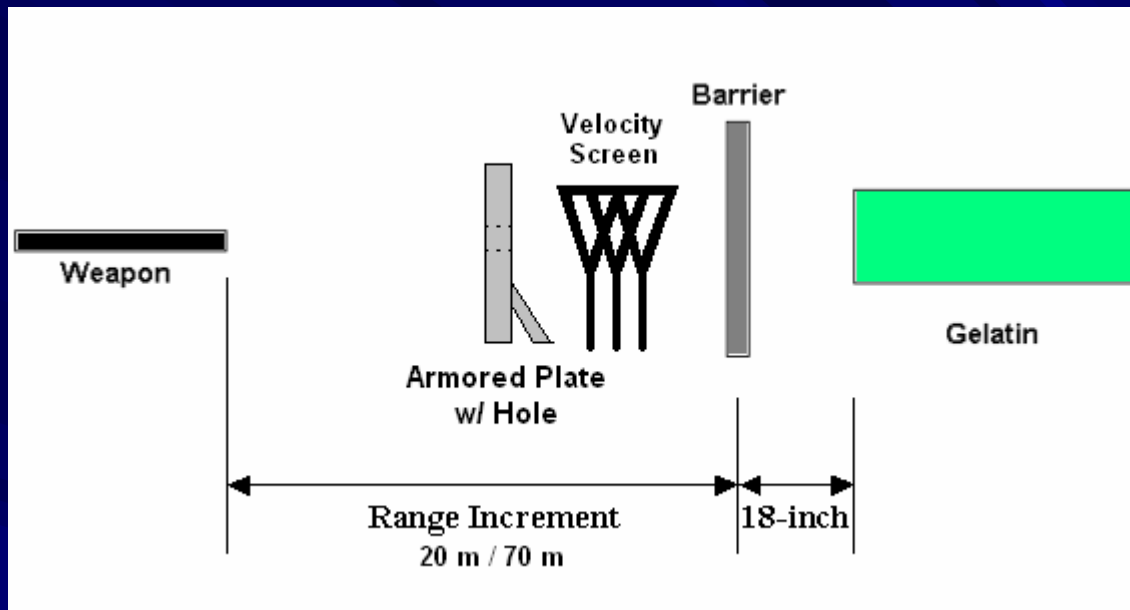
Reality → Model



Iraqi Checkpoint



Test Setup



RANGE SETUP & TEST PARAMETERS

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

Windshield Test Setup

90° Windshield



45° Windshield



Steel Plate Setup

90° Steel Plates



45° Steel Plates


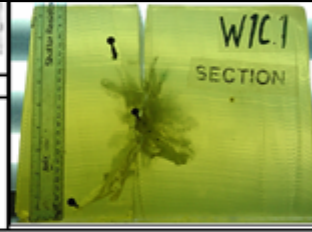


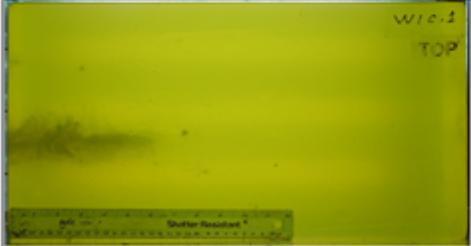
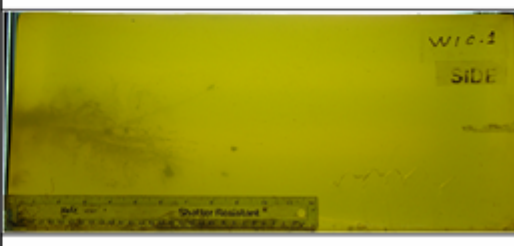
Data Extraction

➔ High Speed Video



Ballistic Gelatin Test Data Collection			
Date of Manufacture	4-Jan-05	Personnel	EB / Herb / Fred
Gelatin Block#	W1C.1	Block Density	11.0 %
Date of Shoot	11-Jan-05	Personnel	Jeremy / Chris
BB Validation Velocity	586 fps	Projectile Weight	62 grns
BB Validation Depth	3.25 in	Range	20.0 m
BB Validation Block Temp	39.1 degF	Impact Velocity	2723 fps
Date of Dissection	#####	Temp of Shot Block	#####
Block Weight	75 lb	Personnel	
Maximum Penetration Depth (1)	9. in	Dynamic MTCD*	
Penetration Depth to Largest (2)	7.5 in	Location of D-MTCD*	
Size of Largest Fragment (3)	0.46 in	Angle of attack at Impact*	
Weight of Largest (4)	8.8 grns	Impact Event Notations	
Neck Length (5)	. in		
Significant Fracture Length (6)	7.25 in		
Fracture Profile Max Diam (7)	6. in		
FP Max Diam Location (8)	3.25 in		
Tot. Project. Wt. Recovered (9)	50.2 grns		

Note 1: Desired Depth Range for BB validation (10% mixing density) is 7.5 to 9.5cm (2-15/16 to 3-3/4in) @ 575 to 605 fps
Note 2: Items designated with an * are regarded as OPTIONAL characteristics to record.

Additional Notations:

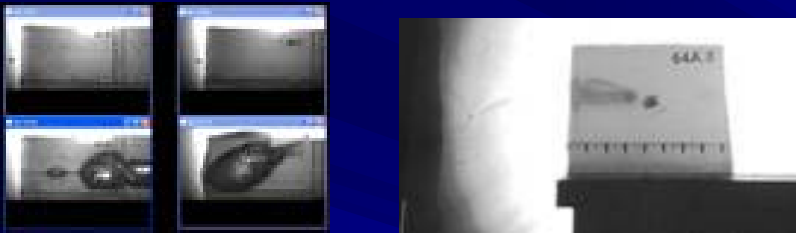
➔ Recovered Projectile Parameters

➔ Gelatin Damage Parameters

Qualities & Considerations

(Big Picture)

Shape and Type of Effect



Mission(s)

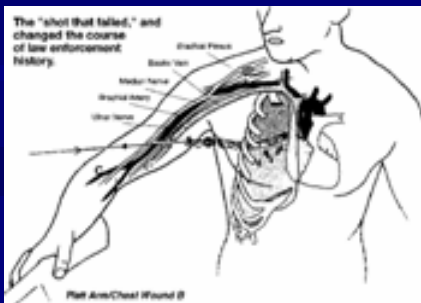
Engagement Ranges

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

➔ M193

➔ M855

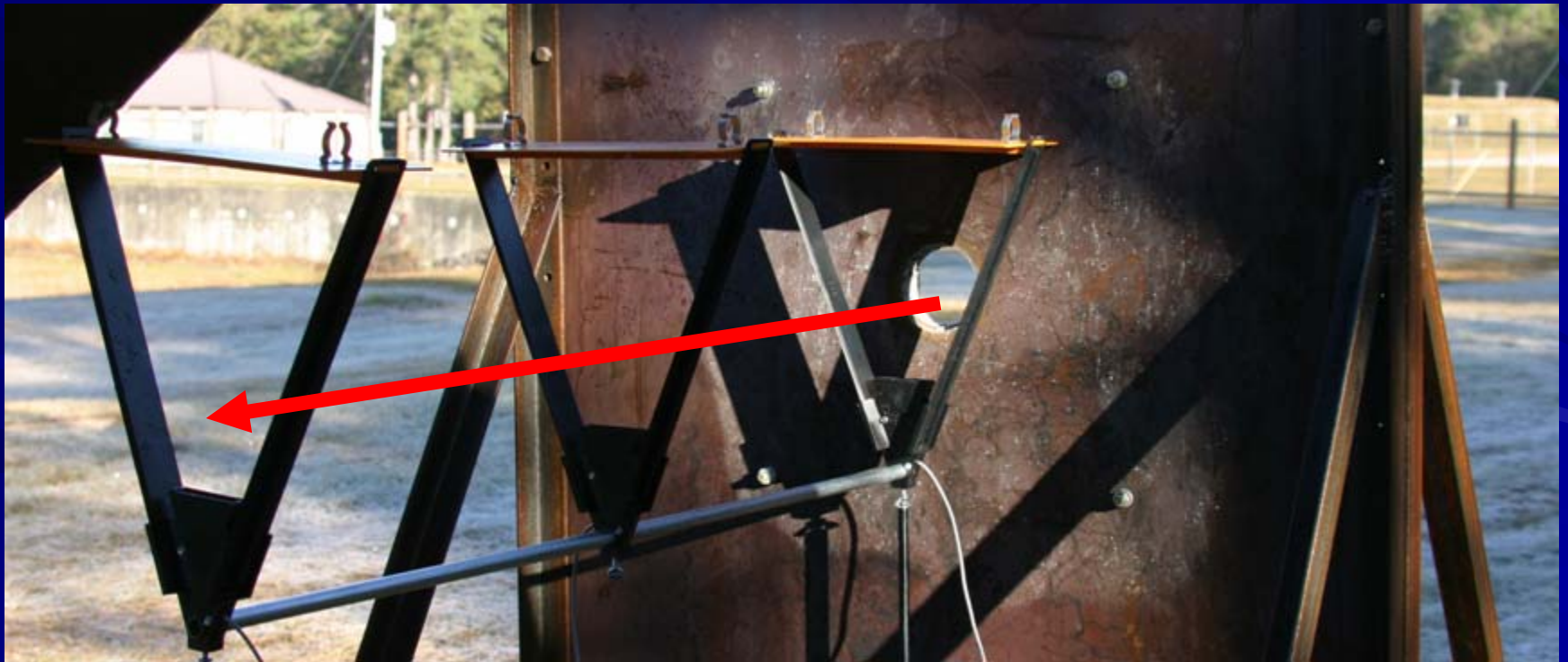
➔ MK262

➔ M995

7.62mm Ammo

➔ M118LR

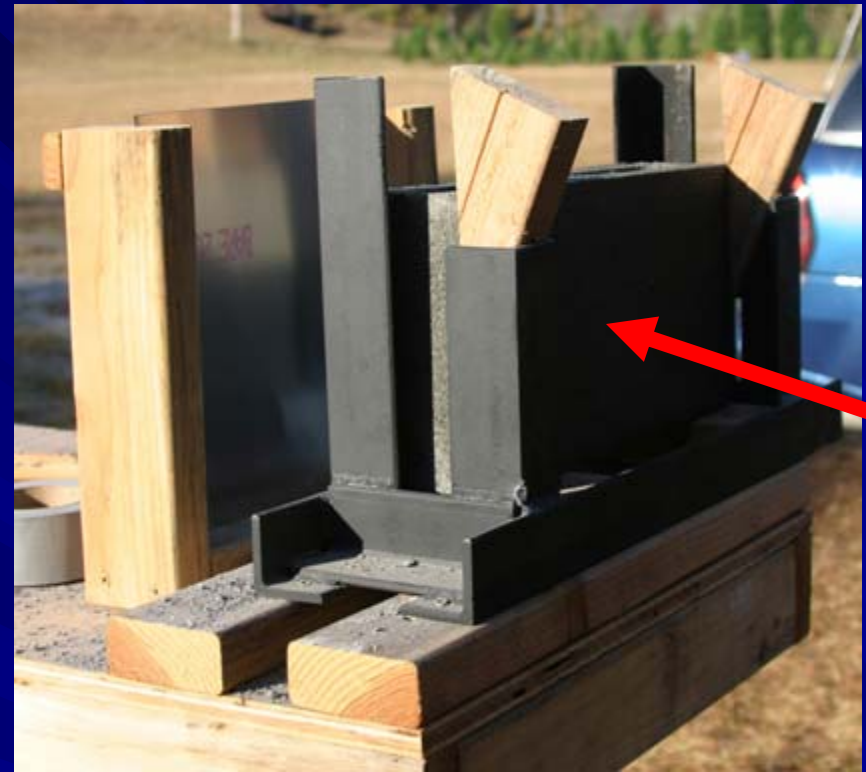
➔ M80



Automobile Windshields



Concrete →



← Steel

2W8G.3

12-1-2005

2247 fps

PARTIAL PENETRATION

2W8G.3
2247FPS

Witness Sheet
.020" Al

F FRONT 2W8G.3
2247FPS

Front Barrier

F36399

REAR 2W8G.3

Rear Barrier

Barrier 1



Partial Penetration



Witness Plate 1

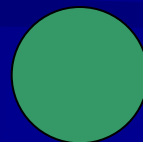


FRONT

Barrier 2



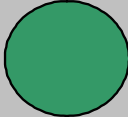
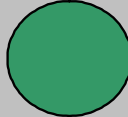
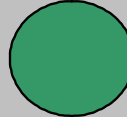

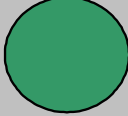

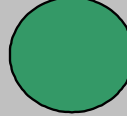
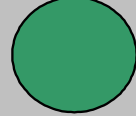
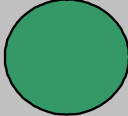
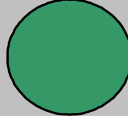






Full Penetration



Witness Plate 2



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 ?

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