Solid Propellant Propulsion System for Low-Velocity, Non-Lethal Projectiles with High Initial Thrust for Spin Stabilization from Fast-Twist Rifling

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Outline

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2) Approach
3) Technical Challenges
4) Solutions
5) Test results
6) Conceptual design for weapon mounted system
7) Wrap Up

Objectives

Develop a Non-Lethal Systems That is:

1) Accurate
   - 10 shot mean radius < 10 cm at range
2) Logistically similar to conventional small arms
   - stockage and supply of ammunition and magazines
3) Light-weight and small
   - add minimal load to the Warfighter
4) Easy for Warfighter integration
   - modular component of individual weapon platform

Approach

- Addressed accuracy by the use of a tight fitting projectile and a fast twist rifled barrel
- Addressed logistical burden by
  - self contained munition
  - reduced weight/size
- Addressed weight/size
  - low pressure in barrel
  - composite construction with thin steel insert for wear resistance
  - short barrel with fixed and open breech operation
- Addressed Warfighter integration
  - attachment for Picatinny rail

Technical Solution: Munition

To meet accuracy, logistics, size, and weight requirements a novel munition must be developed

- Lightweight low velocity projectile
- Consistent interior ballistics with small propellant charges
- High thrust to engrave rifling and overcome angular moment
- Caseless to simplify launcher design
- Low barrel pressure

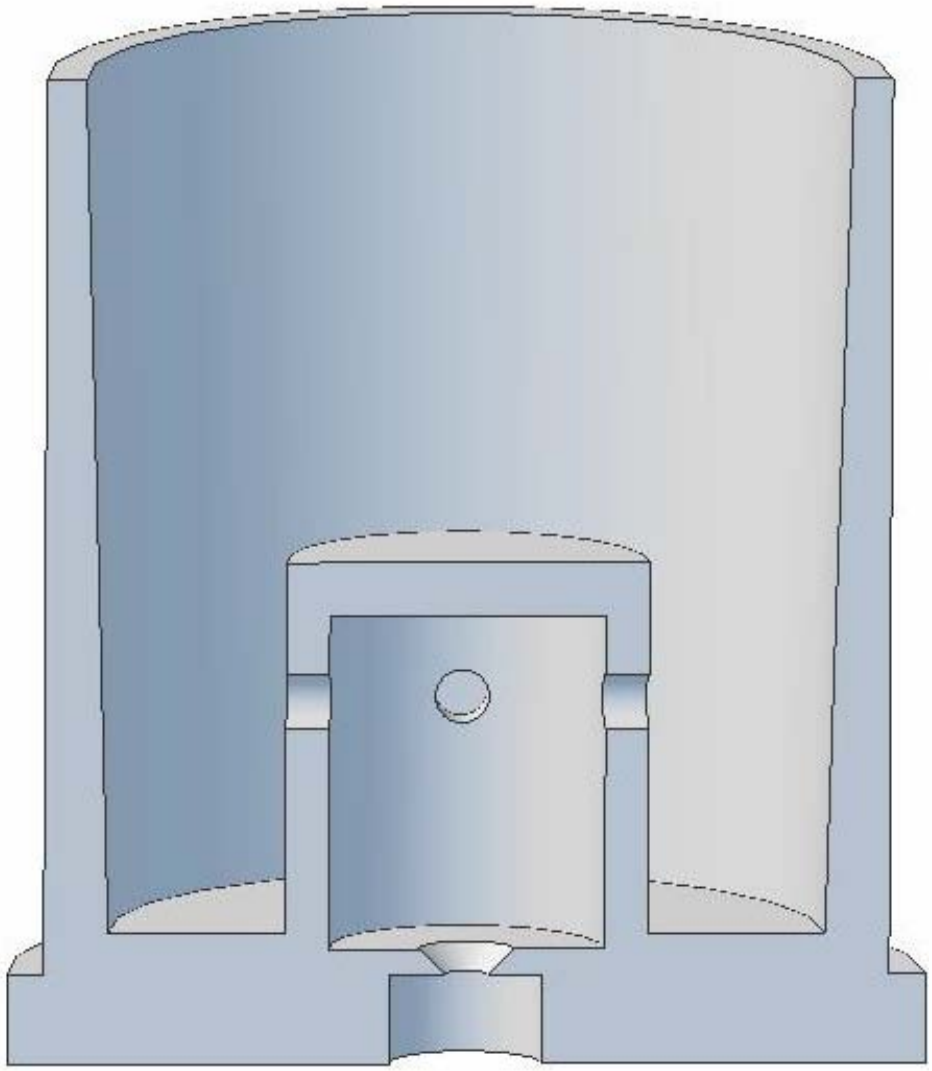
Technical Challenges

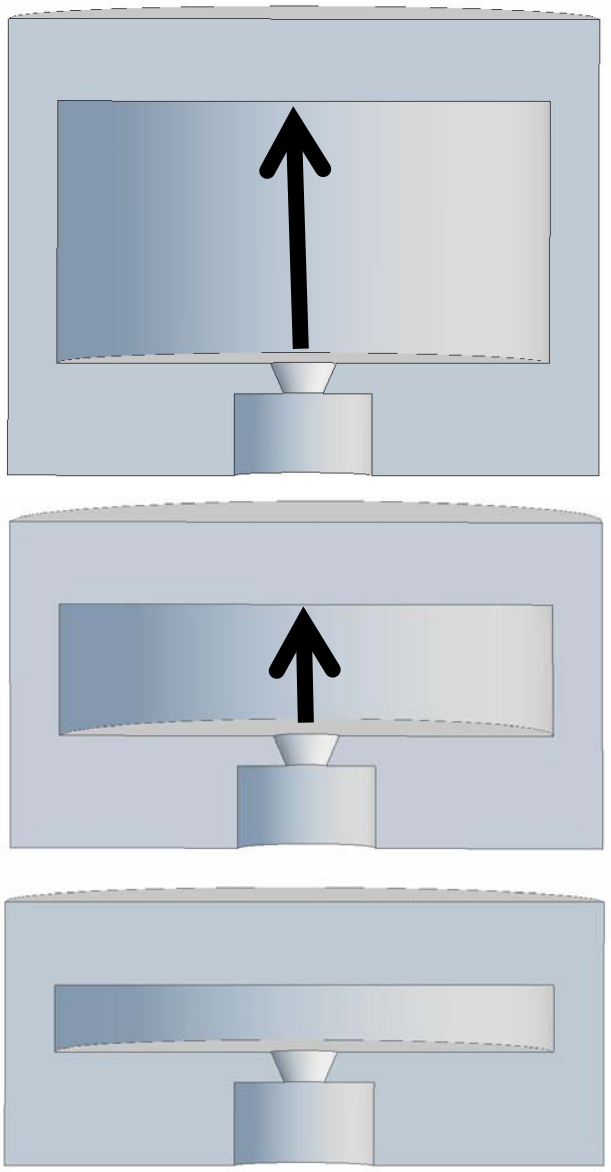
Non-lethal ballistics are large in diameter and low in energy

- small propellant charges are used resulting in poor interior ballistics

- **Present Solution**
  - High-Low system
    - improved interior ballistics
    - large ullage
    - cartridge case
- **Battelle Solution**
  - Variable Volume Combustion Chamber
  - Caseless design

High-Low compared to Variable Volume





excessive pressure prevented by work done on projectile

low ullage

Variable Volume Combustion Chamber

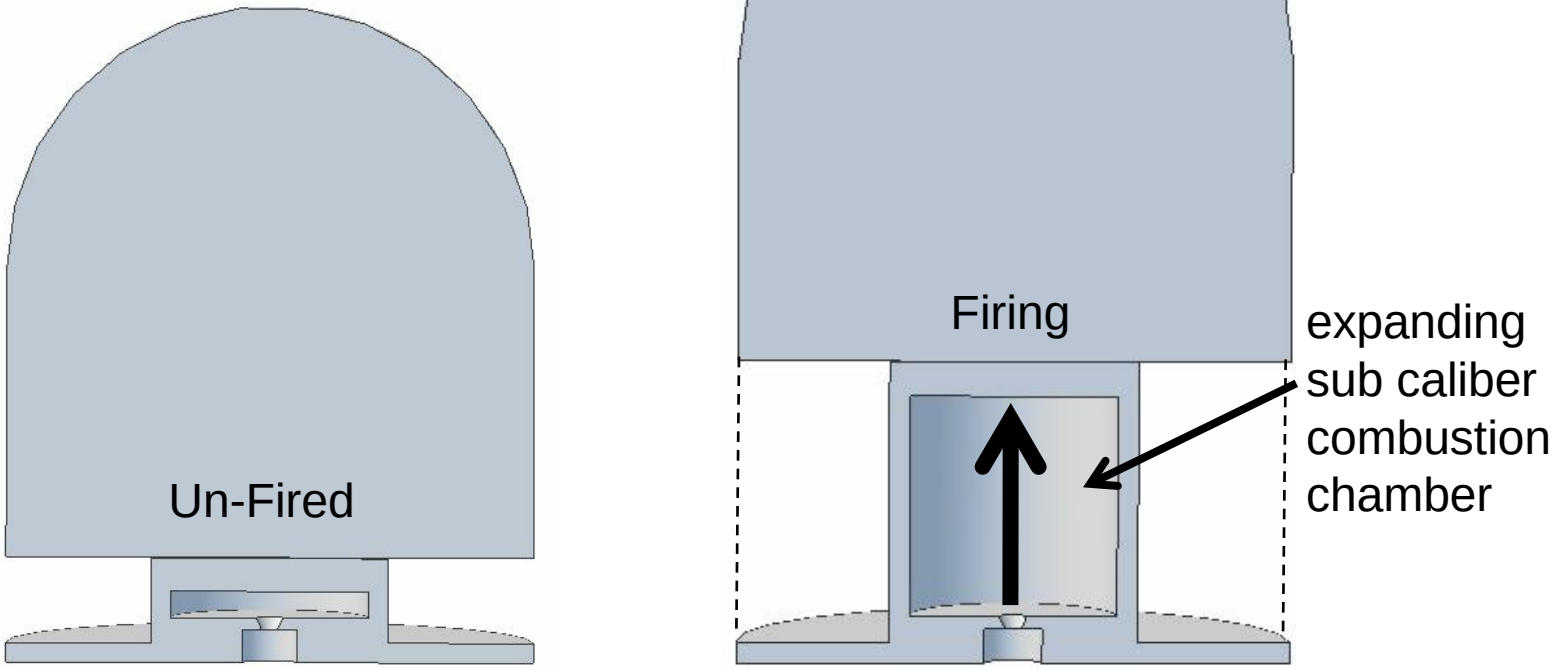
- Small initial volume and low ullage
- Combustion chamber volume increases throughout burn cycle
- Work performed on projectile as propellant burns
- Thrust is maintained during engraving
- Pressure in the barrel is minimal

Sub Caliber

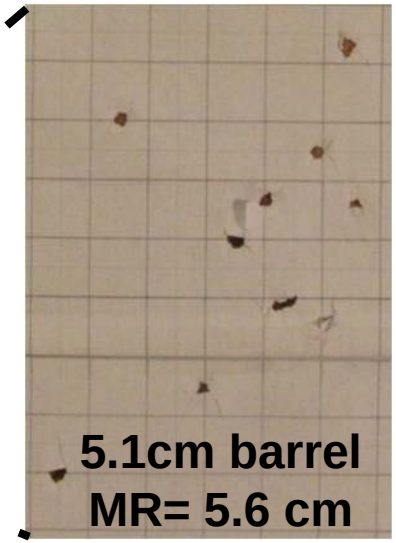
Make combustion chamber sub caliber

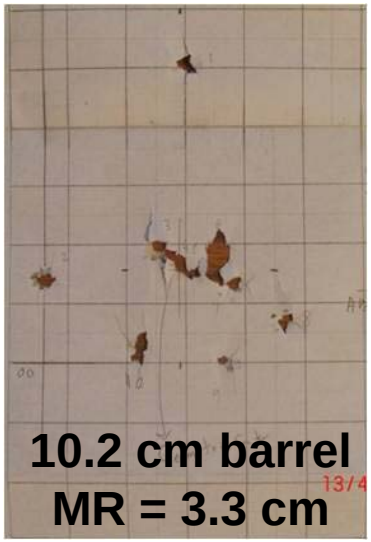
- High internal pressure
- Low force over sub-caliber area

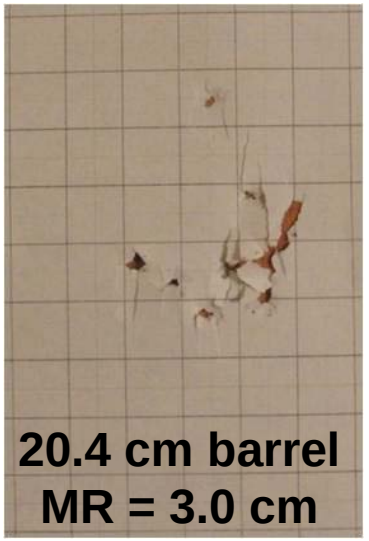
  appropriate for non-lethal ballistics
- Thrust maintained during engraving

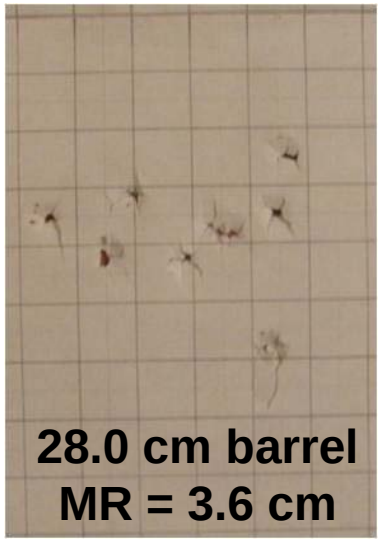


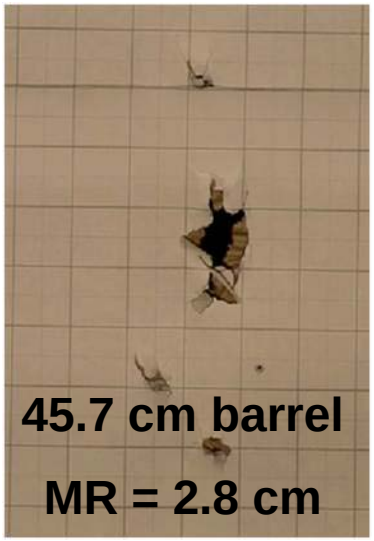
Results: 10 Shot Groups at 27 Meters

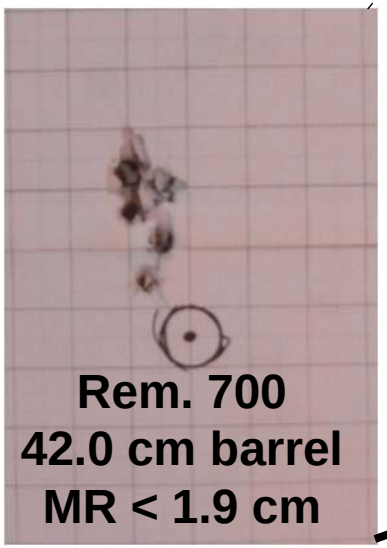












All Pictures Show 15 x 23 cm area of Target

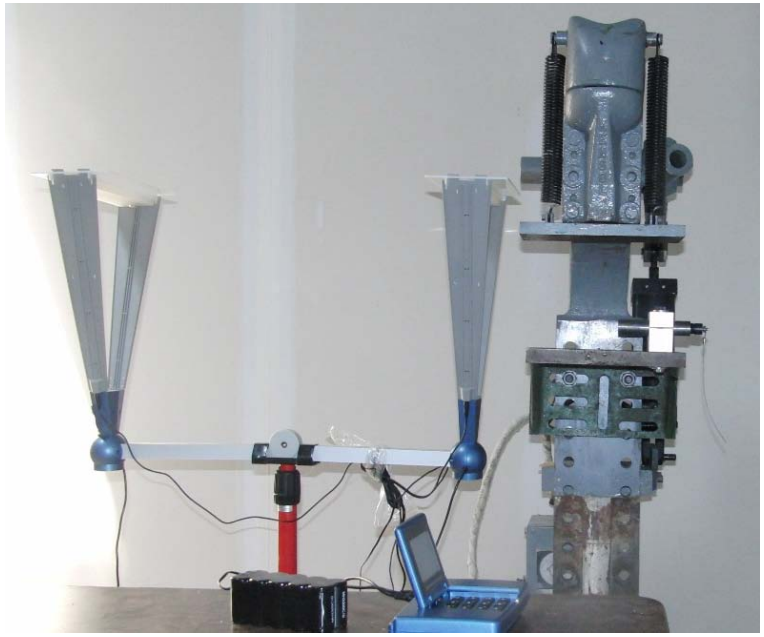
Results of Velocity & Dispersion for 10 Shots, Identically Loaded Ammunition

Battelle
The Business of Innovation

	23 to 30 cm in front of muzzle					
	5.1 cm barrel	10.2 cm barrel	20.4 cm barrel	28.0 cm barrel	45.7 cm barrel	Rem. 700 42 cm barrel
# of Recorded Vel.	10	10	9	7	7	10
Ave. Vel. (m/sec)	112	110	102	92	92	125
Sigma Vel. (m/sec)	2.7	2.4	4.5	4.8	3.9	3.9

Mean Radius (cm) 27 meter Range, 10 Shots					
5.6	3.3	3.0	3.6	2.8	< 1.9
Mean Radius (inches) 27 meter Range, 10 Shots					
2.2	1.3	1.2	1.4	1.1	<0.75

Measuring Velocity Near the Muzzle and Dispersion at 27 Meters

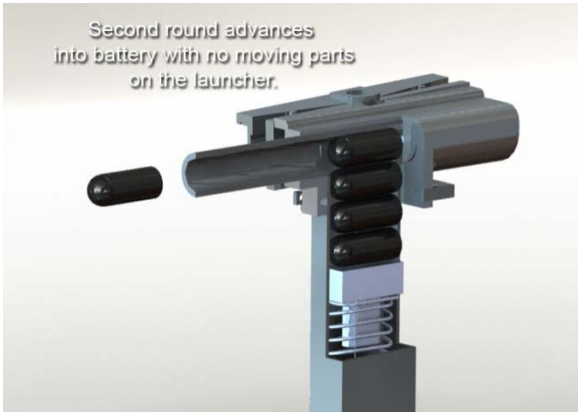


Conceptual Rail Mounted Launcher

- Barrel does not have to contain pressurized propellant gas allowing for a fixed and open breech launcher
- Projectiles fire directly from top of magazine into rifled barrel
- Next round advances into battery by the action of the magazine
- Barrel can be very short because all the thrust occurs in less than 2 cm of projectile travel & accuracy has been demonstrated

1

2



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Wrap Up

Battelle developed non-lethal system

- ✓ Accurate
- ✓ Logistically similar to conventional small arms
- ✓ Light-weight and small
- ✓ Easy for Warfighter integration

Up Coming Demonstration

Plan to Demonstrate at ARDEC's ATF Range
June 2011

- Hardware
- Technical information
- Live fire demonstration

Contact Information

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