RDECOM

Malcolm Baldrige National Quality Award 2007 Award Recipient

ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NJ

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

7.62mm, Lethal Limited Range Round For USCG

Informational Brief for **NDIA 2011**

25 May 2011

Project Overview & Objectives

Overview

- JSSAP funded effort for USCG
- 7.62mm Lethal Limited Range Round
- For use in harbor security applications.

Objectives

- Reduced maximum range
- Engage and defeat

Customer Requirements

L2R2

- Defeat 1/4 inch of mild steel at 200 meters, at a 45-degree angle
- Match trajectory of M80 out to at least 400 meters.
- Capable of defeating soft target out to at least 400 meters.
- Maximum range of 2000 Meters (1500 Meters desirable)
- Capable of being fired from an M14 rifle and M240 Machine Gun

M80

Value to Warfighter

- Operational environment close to civilian populace
- Lethal force often necessary to accomplish missions
- Use of Small Arms at times is restricted due to potential risk to civilians
- Reduced range ammunition will enable USCG to engage targets

Briefing Overview

- Project history
- Added/optimized features and how they were evaluated
- Current projectile design performance

Project History

2007

2008

2009

2010

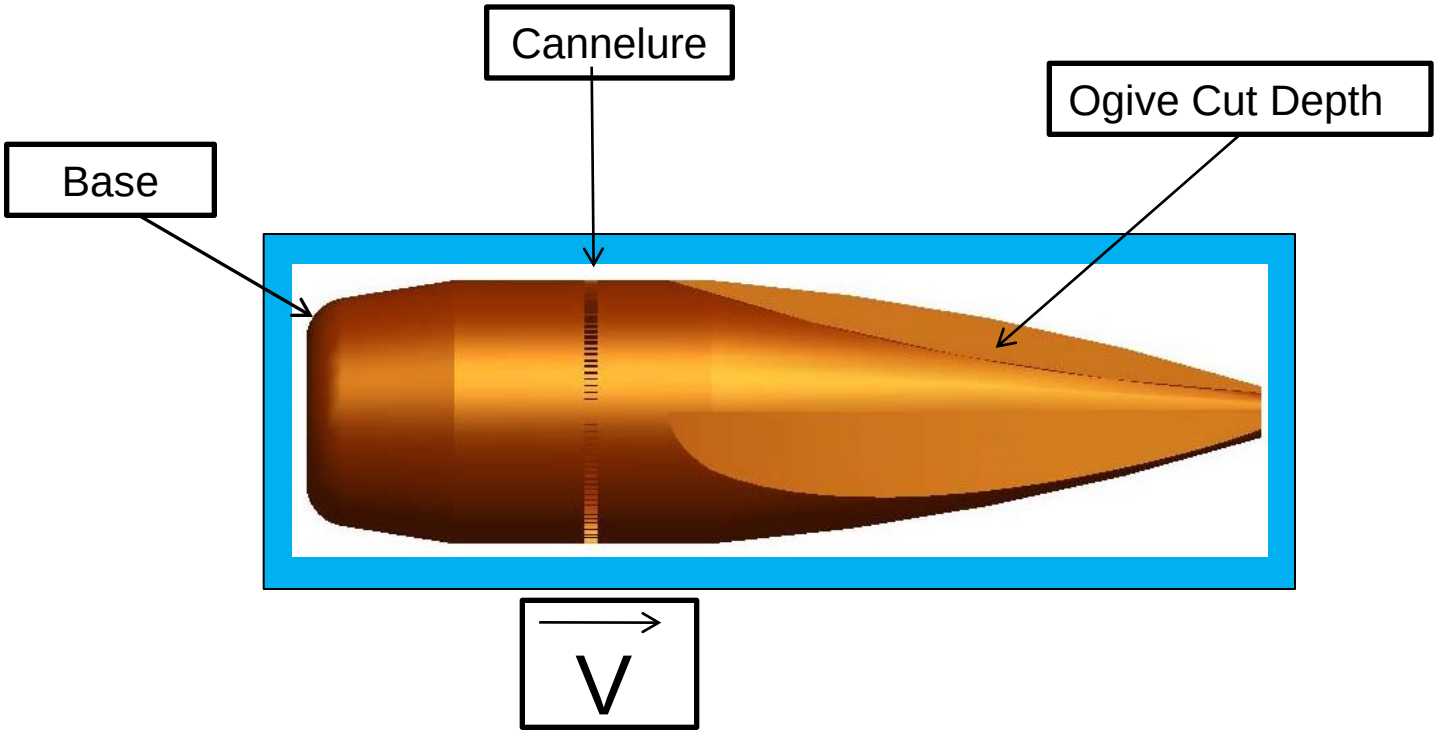
FY11 Tasks

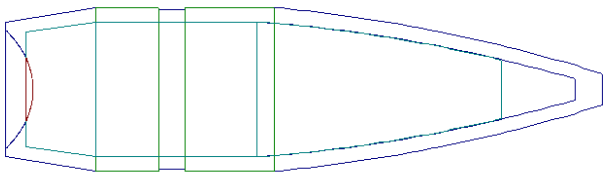
- Spark Range Test
- Dispersion @ 400m
- Radar Test
- CFD Study
- Updated design
- Manufactured projectiles
- Charge Establishment
- Evaluated Penetration
- Entire Cartridge Salt-Fog Test
- Radar Test (w/ & w/o salt-fog exposure)
- Analyze & Document Results

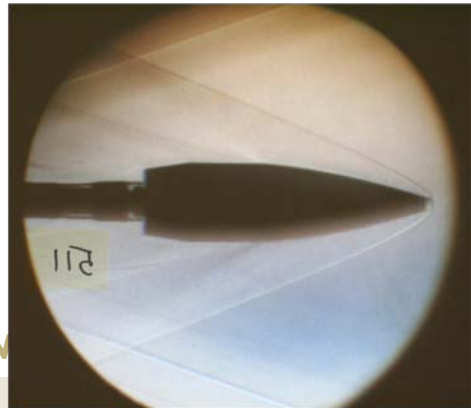
DESCRIPTION

- One piece
- Solid Brass
- Cuts along ogive
- Standard 7.62 x 51mm Case & Primer
- SMP-843 Propellant

Optimized/Added Features that Affect Max Range





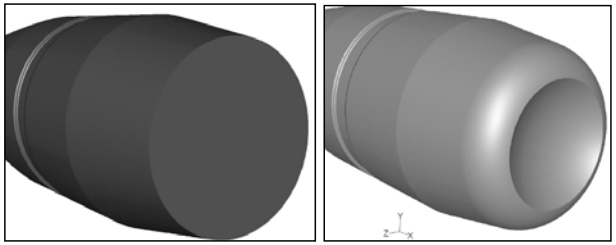


Projectile (M80) Base Geometry Computational Fluid Dynamics Study

- Compared aerodynamics of flat base vs. round base M80
- Validated CFD generated static coefficients with spark range data (BRL-MR-1833)
- Base shape changes wake vortex formation and pressure distribution

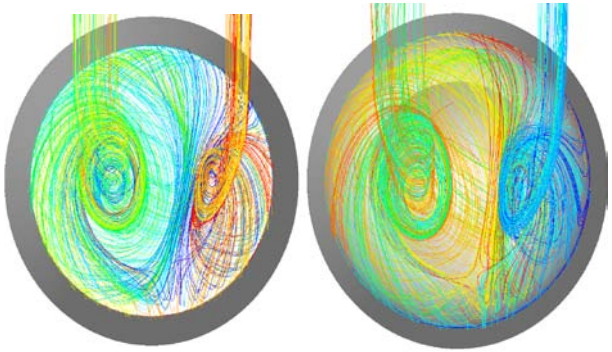
Flat Base

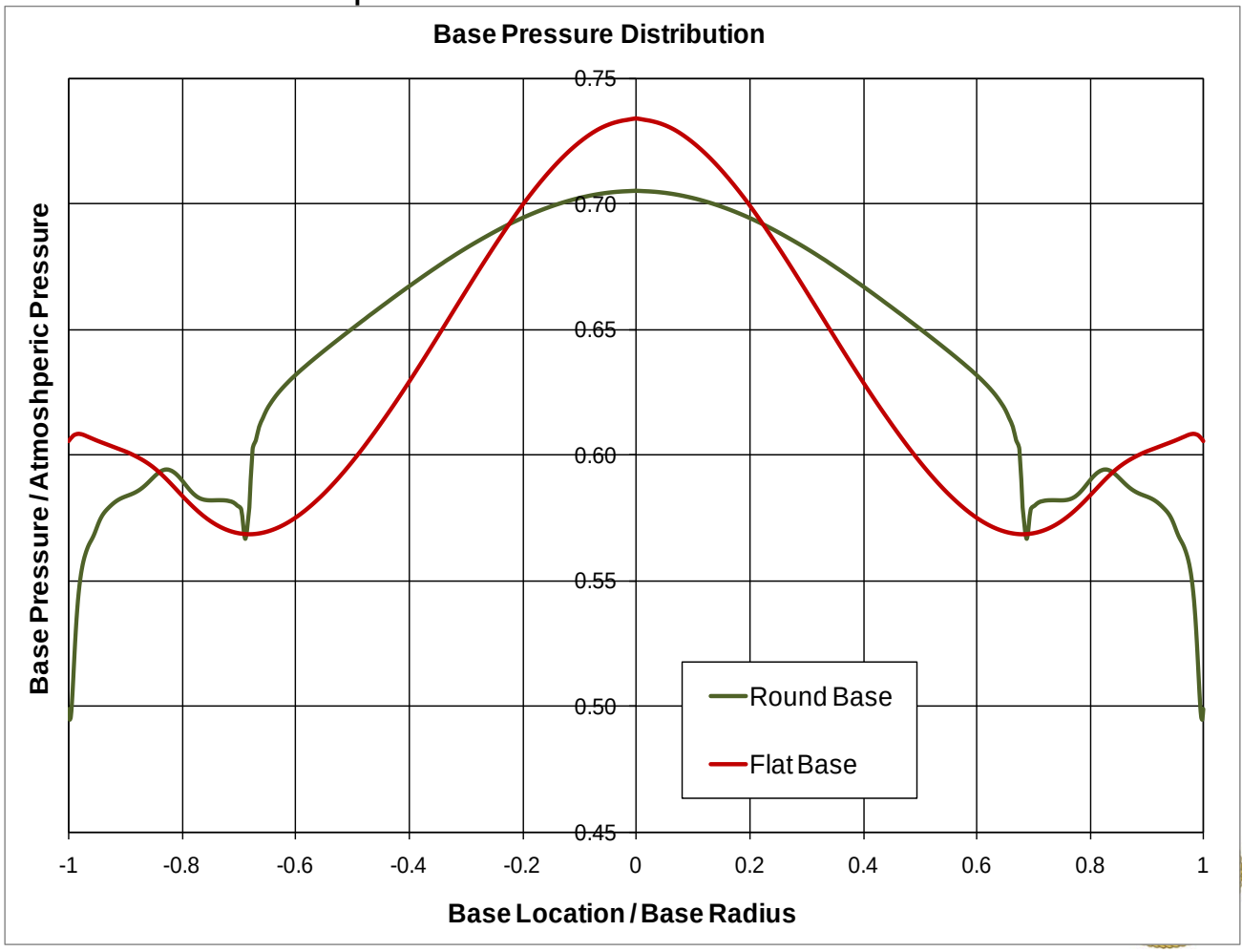
Round Base



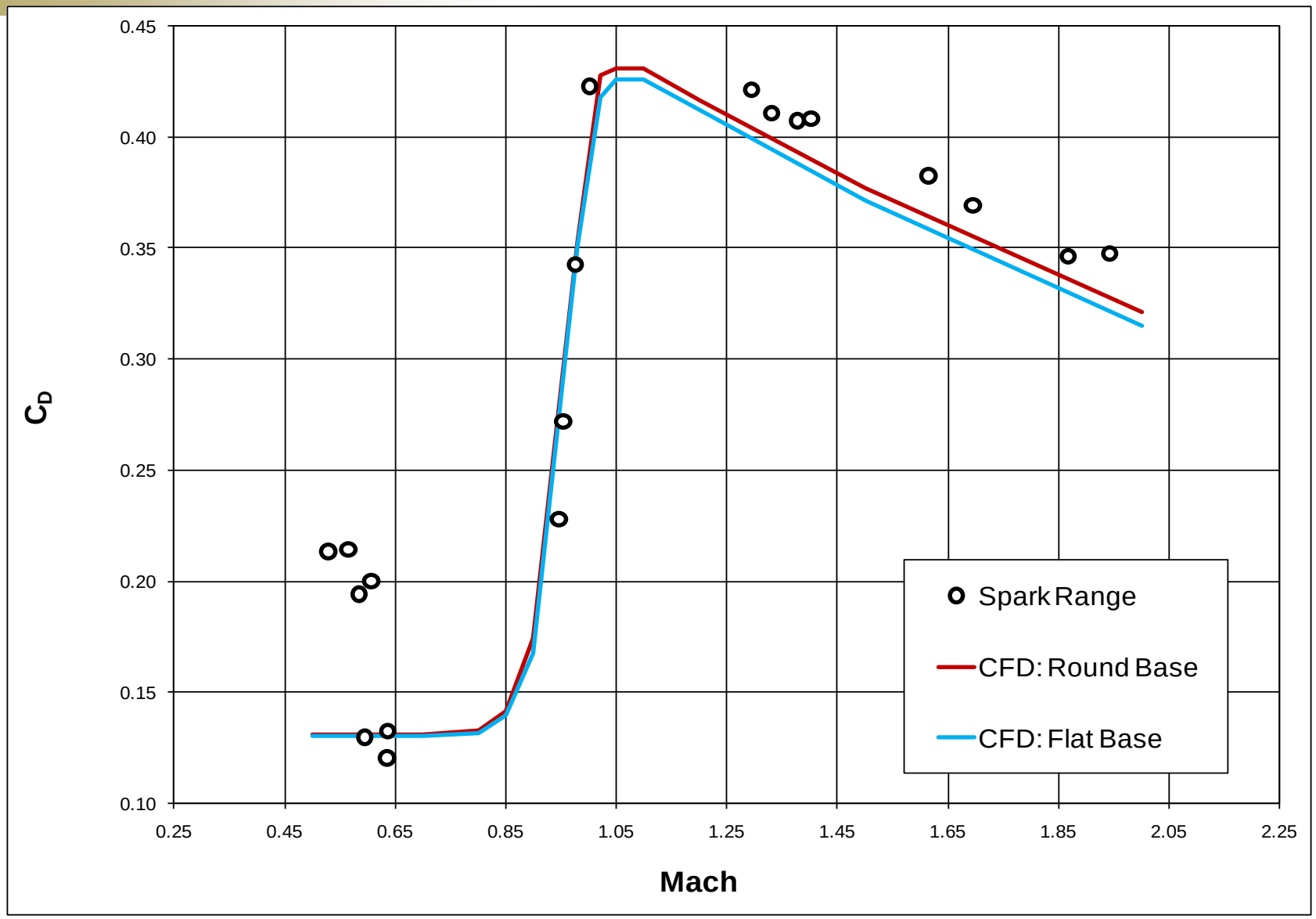
Flat Base

Round Base

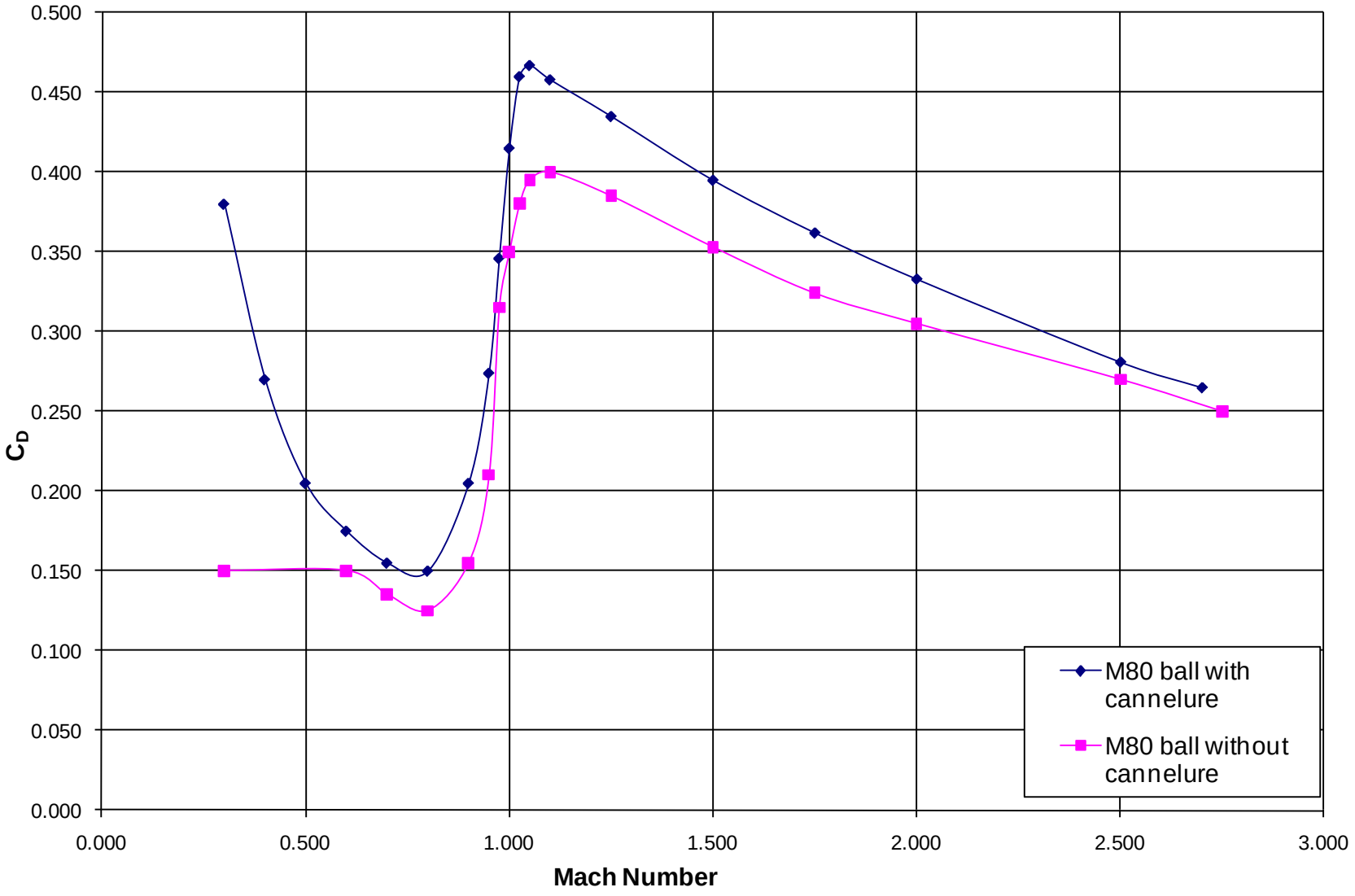




Projectile (M80) Base Geometry and Drag



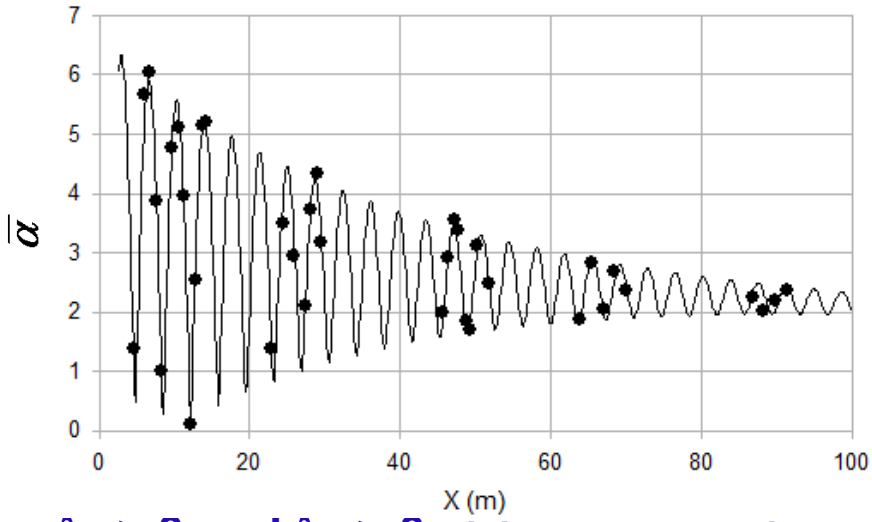
Cannelure and Drag



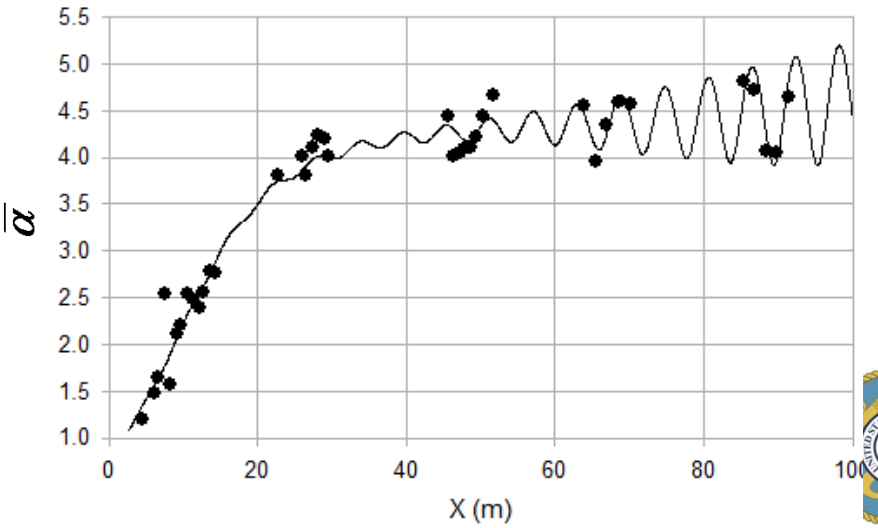
Observed Modal Arms Damping at ARL Spark Range Test

- Yaw damps out at muzzle velocity
- Yaw increase at Mach .75

$\lambda_F < 0$ and $\lambda_S < 0$ (Shot 32421, Mach 2.6)

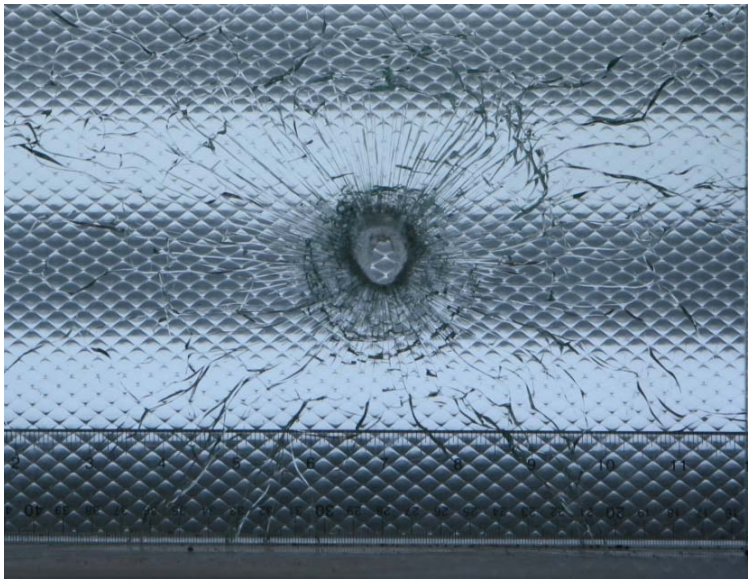


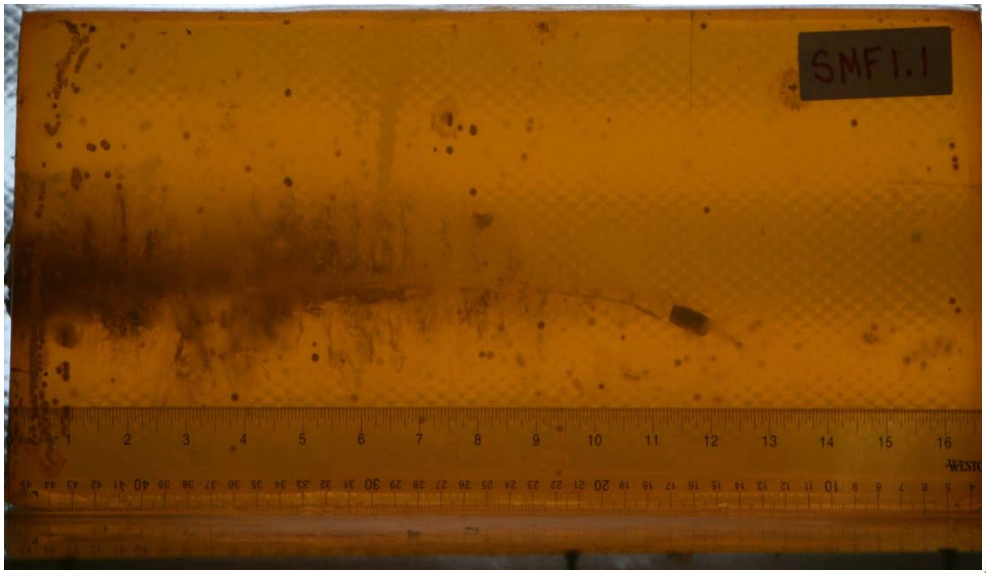
$\lambda_F > 0$ and $\lambda_S > 0$ (Shot 32412, Mach 0.74)



L2R2 vs. Automobile Windshield Glass

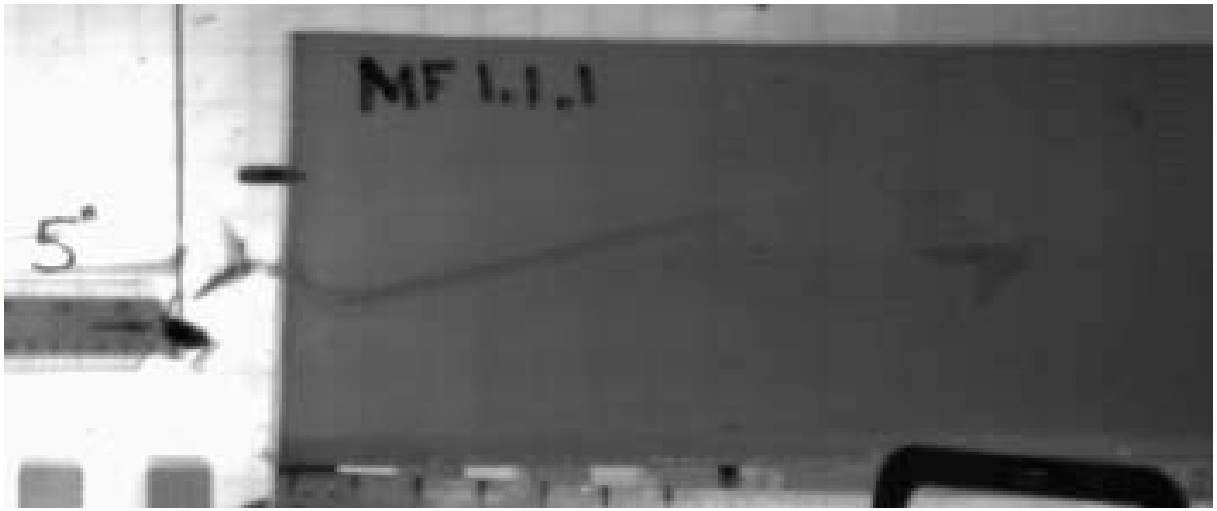
- 0.27” total thickness
  - Glass 0.115”
  - Laminate 0.04”
  - Glass 0.115”
  - Meets SAE Z26.1 standards
  - 50m (2800 ft/s)





L2R2 vs. 20% Ballistic Gelatin

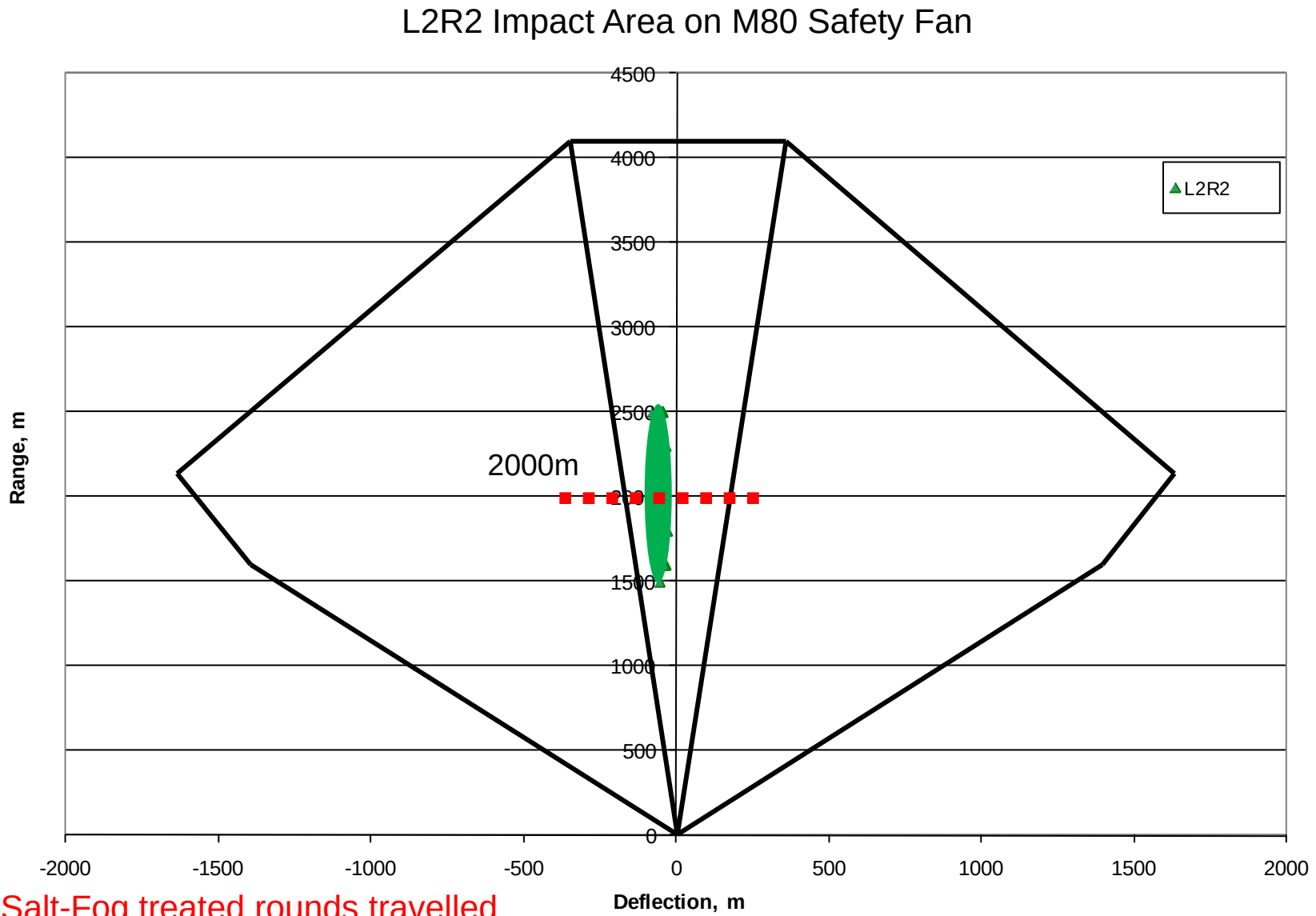
50m Velocity (2800 ft/s)



400m Velocity (1800 ft/s)

Entire Cartridge Salt-Fog Humidity Test

Max Range Impact Area
(salt-fog treated/untreated)



Salt-Fog treated rounds travelled farther than untreated rounds

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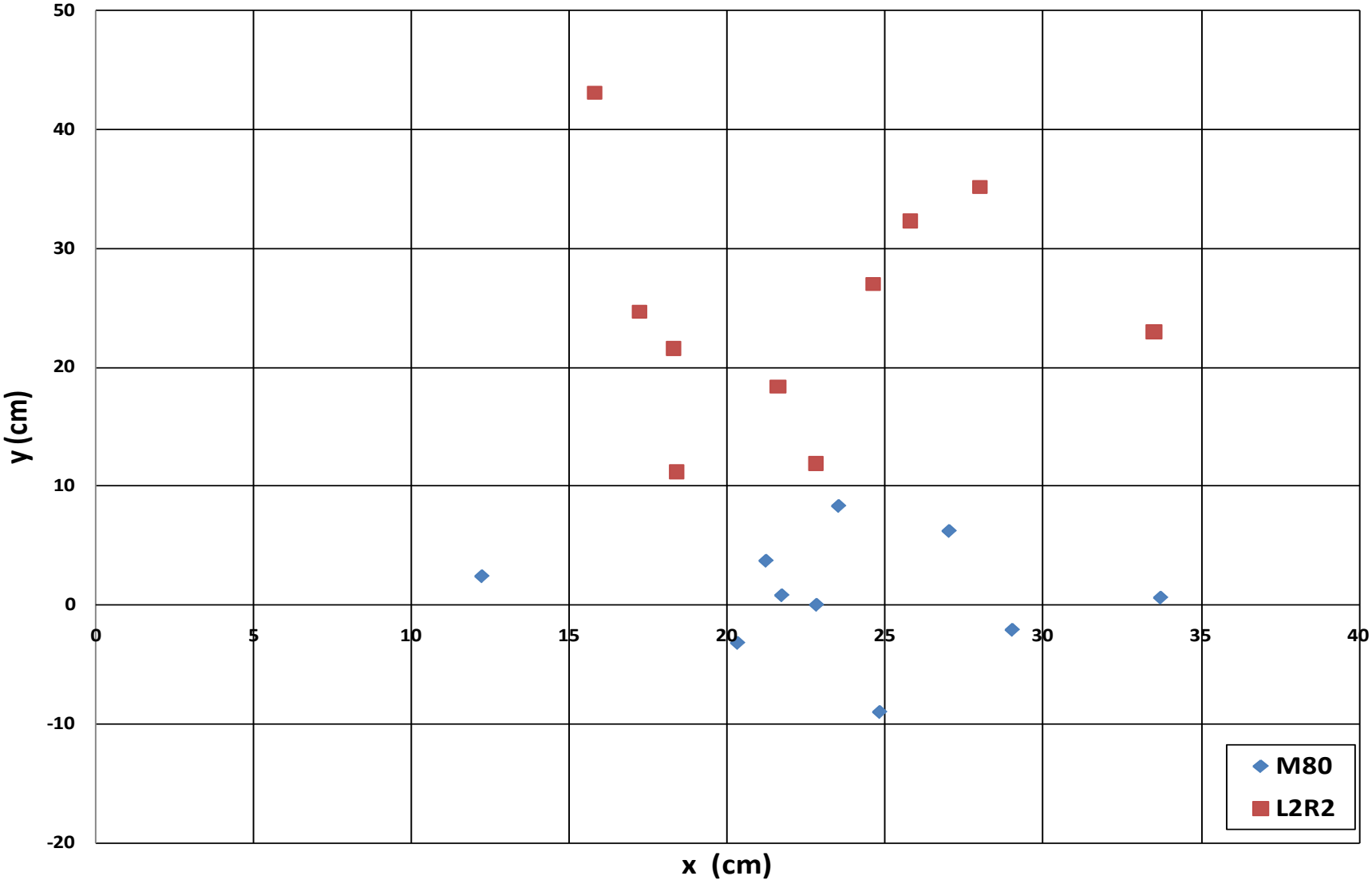
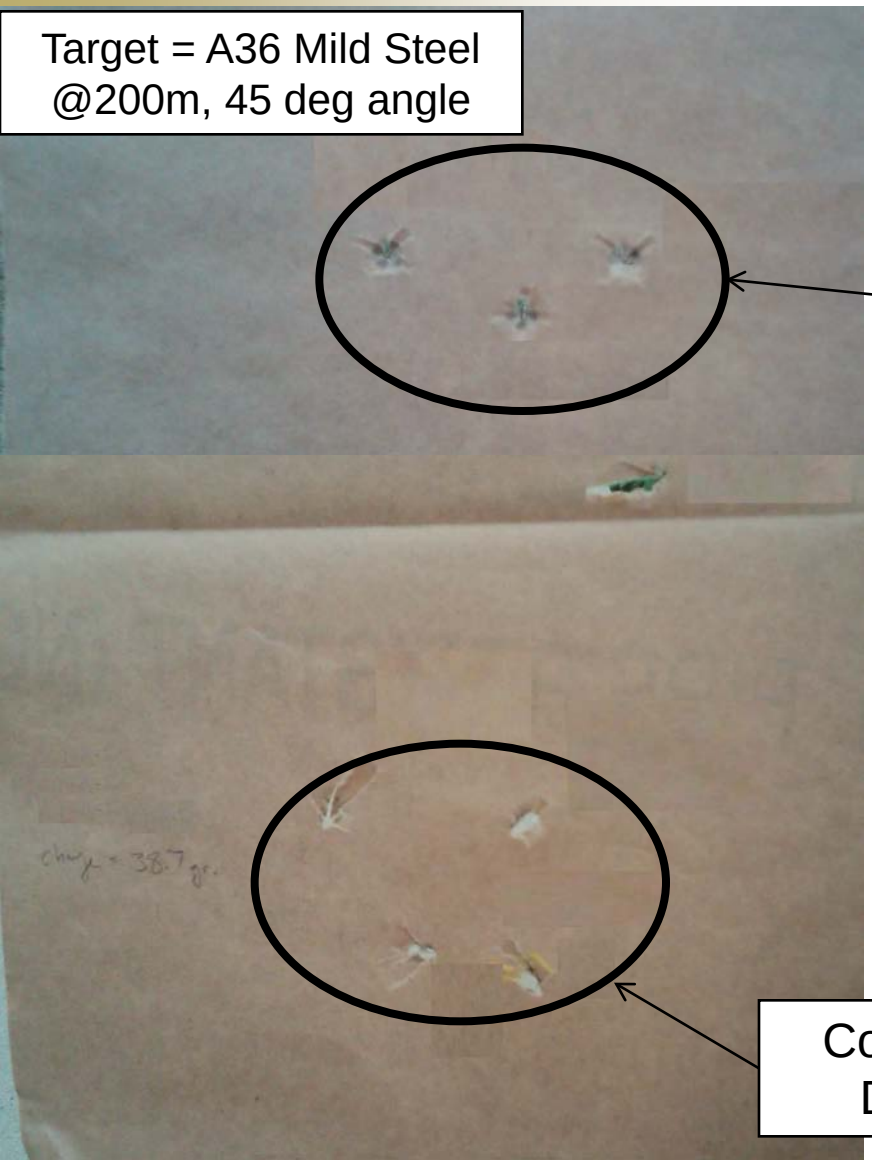
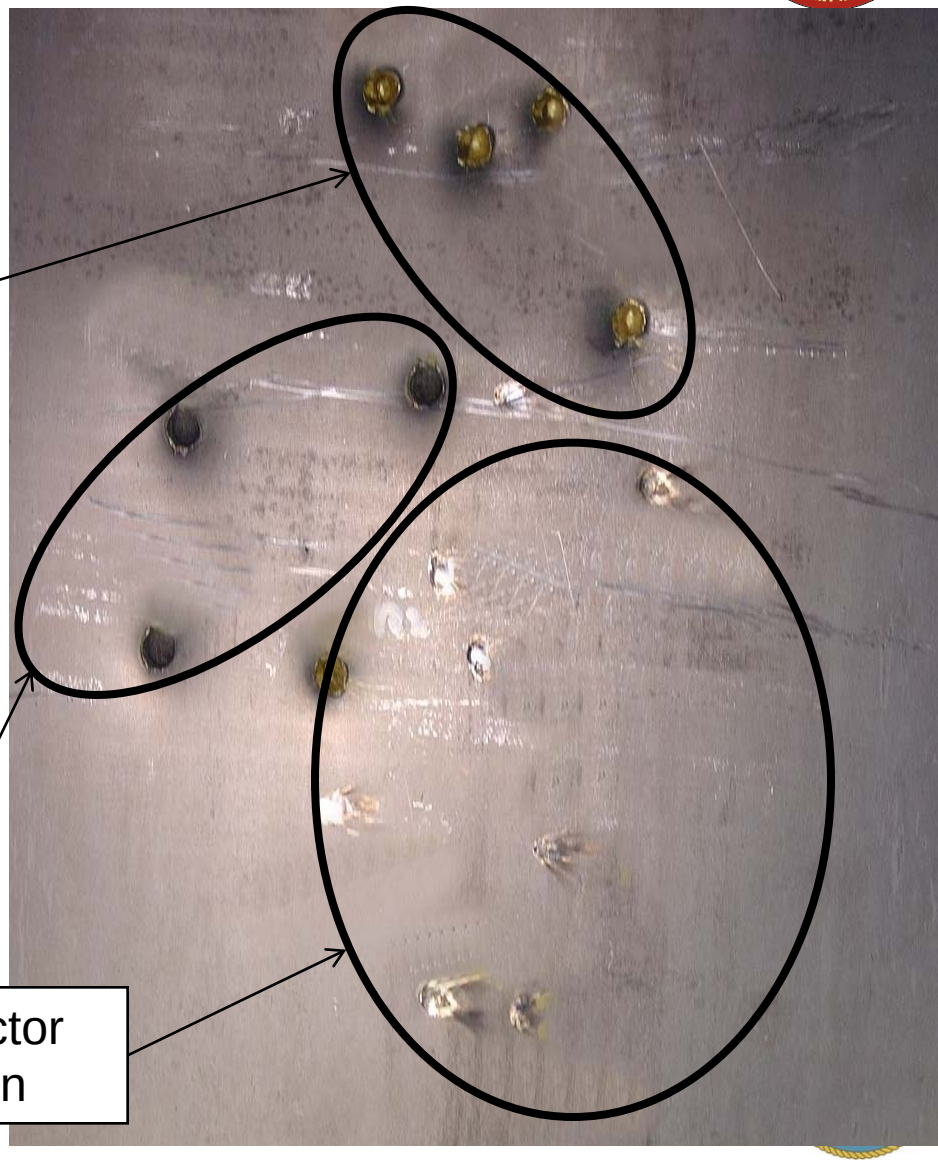
400m Dispersion Results



ARDEC Design vs. M80 & Contractor Design

Target = A36 Mild Steel
@200m, 45 deg angle

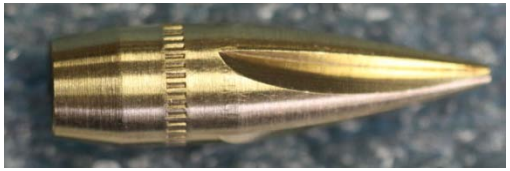




Contractor
Design

Summary

- Significant yaw growth below Mach 1
- Ability to meet distance requirement dependant on initial QE and projectile ogive cuts being free of debris
- Trajectory similar to that of the M80
- Hard target penetration ability not equivalent to that of the M80
- Effective against soft targets and Automobile Glass



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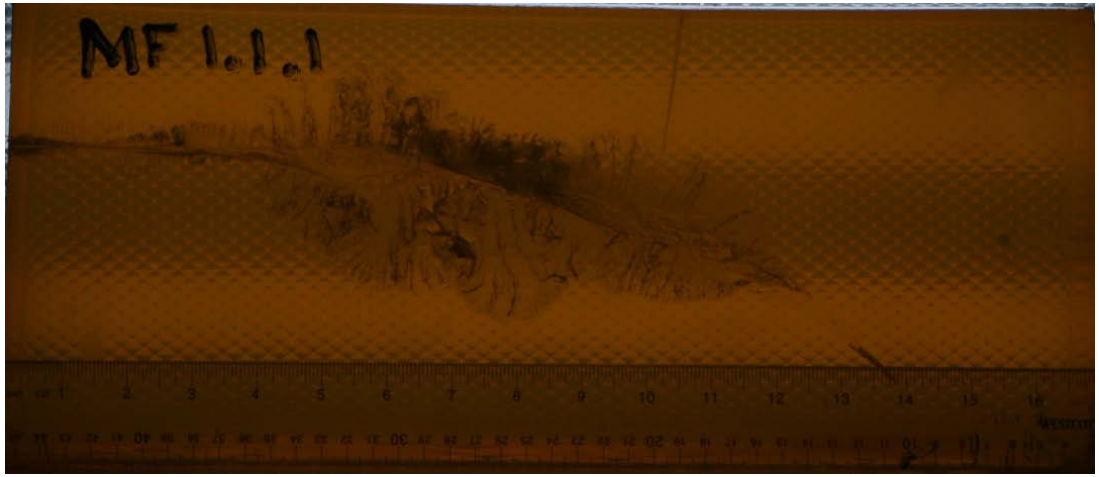
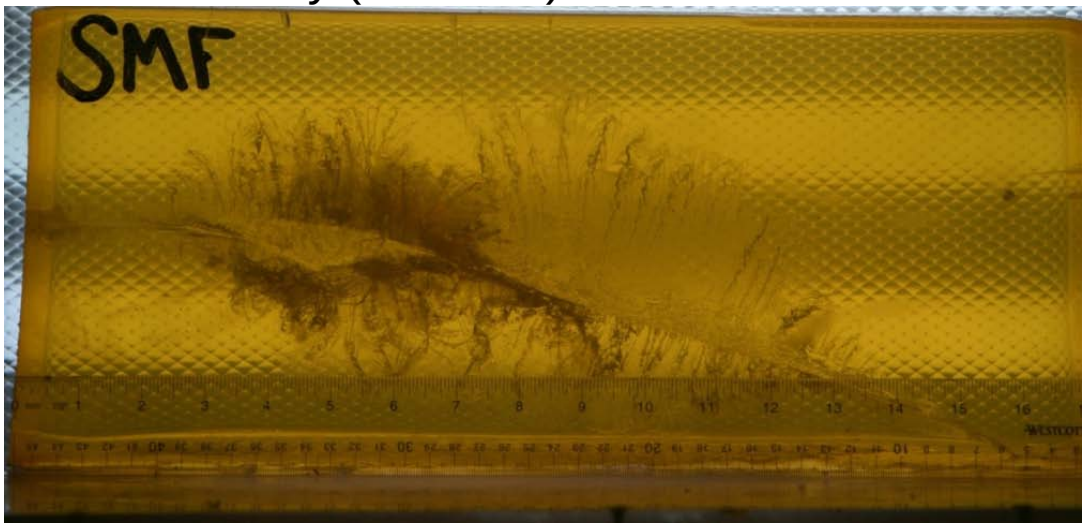
BACK UP

L2R2 vs. 20% Ballistic Gelatin

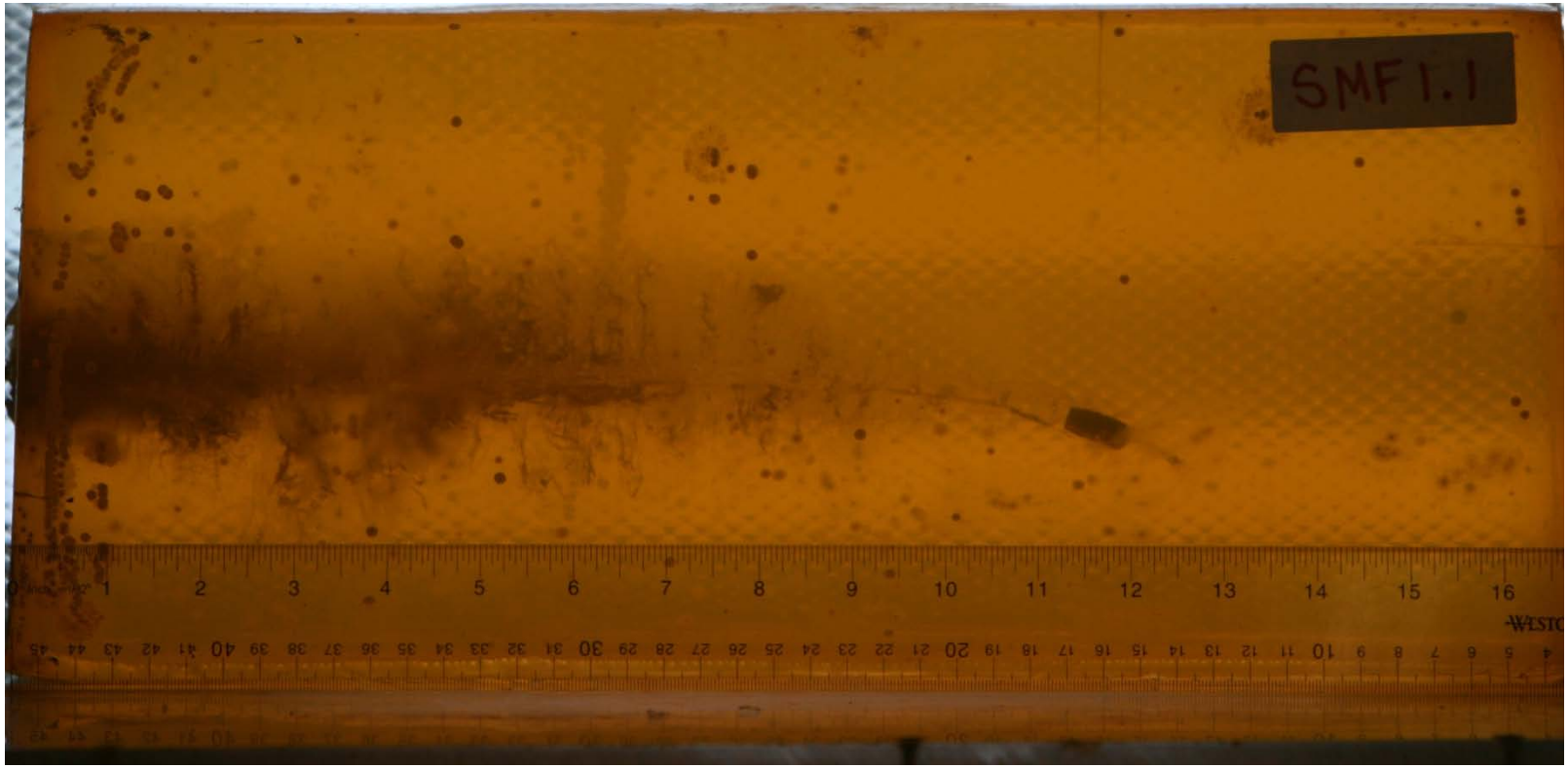
50m Velocity (2800 ft/s)



400m Velocity (1800 ft/s)



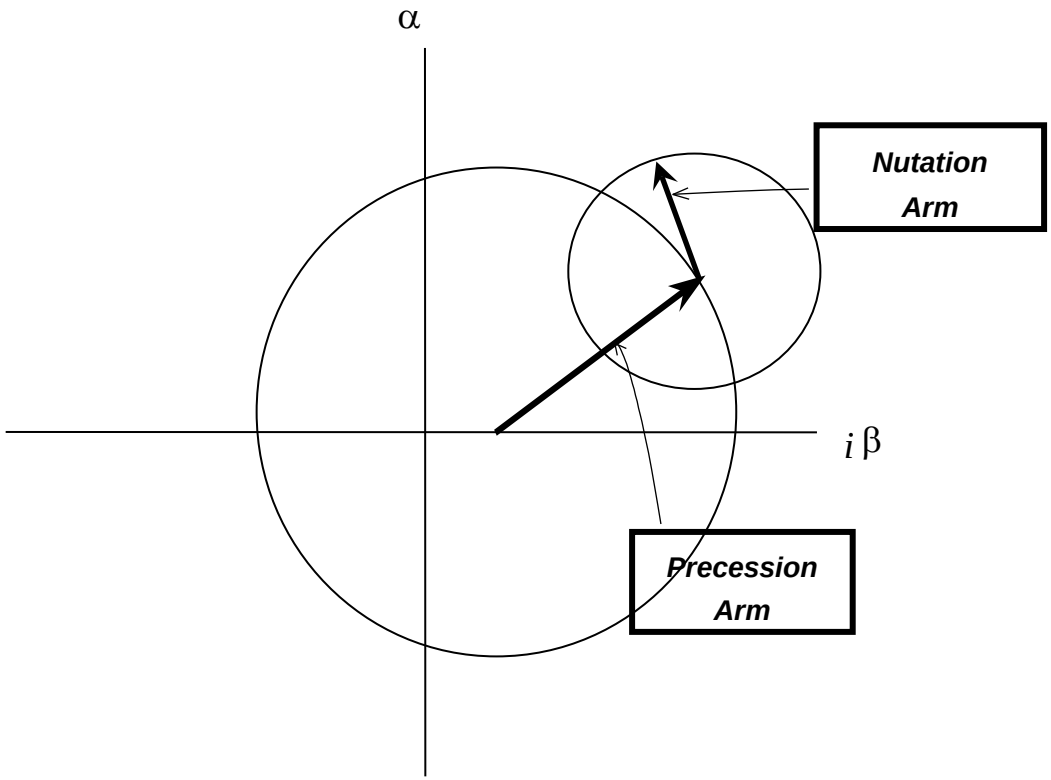
Ballistic Gelatin Behind Windshield



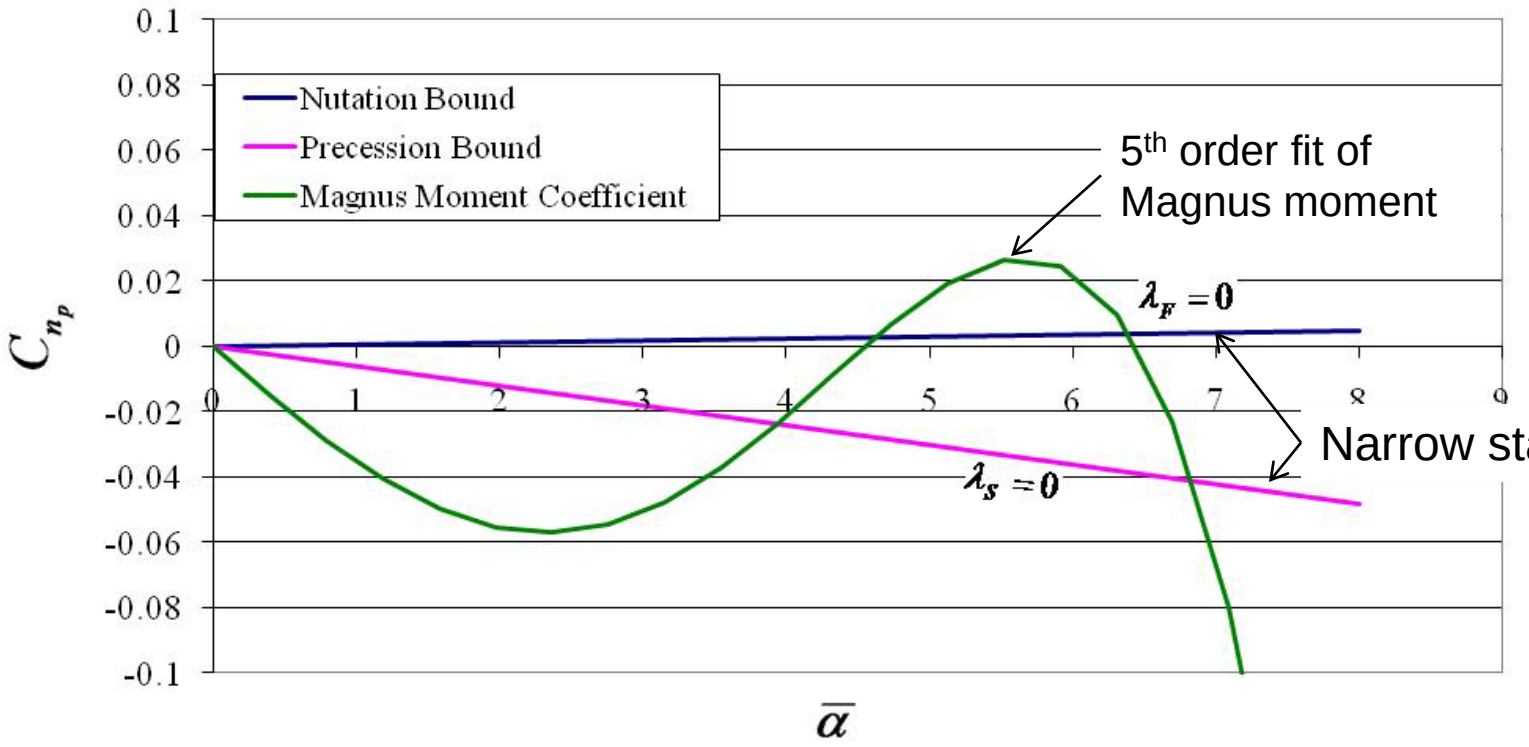
Dynamic Stability Relation to Modal Arms Damping

Stable
- Both arms negative (shrinking) or neutral (not growing)
  - No yaw
  - Limit cycle

Unstable
- Nutation (fast) arm is positive, precession arm positive (growing)
  - Yaw level increases
  - Tumbling possible



Non-linear Magnus Moment



Stability of this round at Mach 0.8 at experimental spin rates is questionable at best