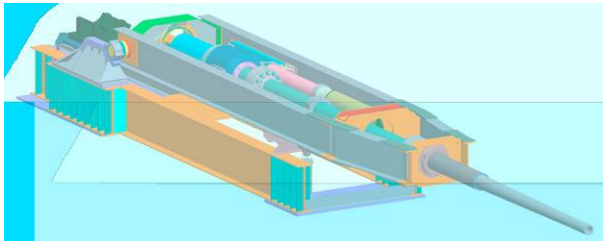
ADVANCED MODULAR GUN

Developing Tomorrow's Weapon Systems with Today's Technology

Presented by
Applied Ordnance Technology and NSWC Dahlgren

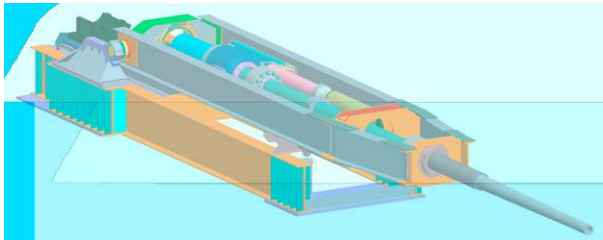
41st NDIA Gun and Missile Systems Conference
Sacramento, CA
March 2006



Third Installment

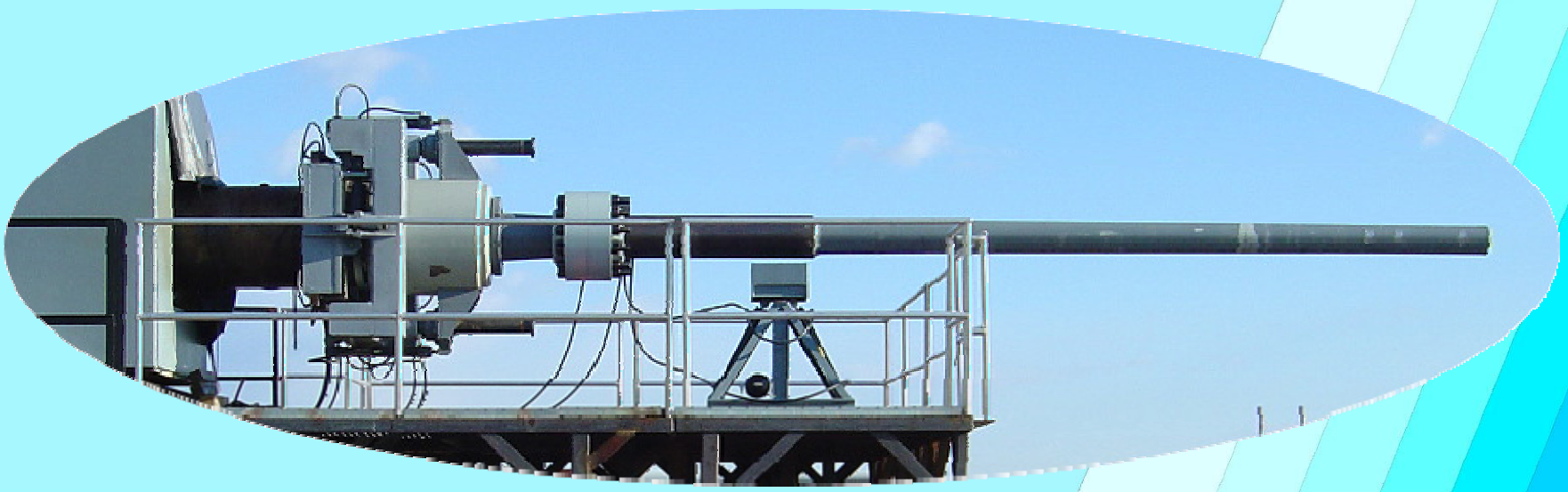
3 Years, 3 Tests, 3 Presentations

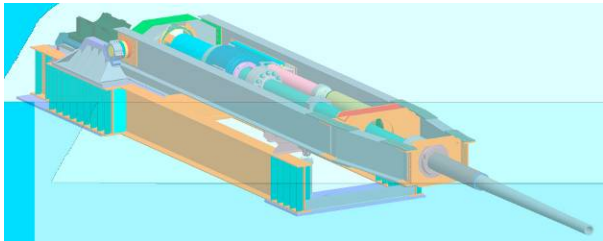
FY03 Proof-of-Concept Test	FY05 Dynamic Setback Test (DST)	FY06 Barrel Joint Test (BJT)
		
Verified • Internal Sealing Concept	Verified • Full-Size Sealing Concept • 50 Liter Chamber • Coupling Components	Verified • Barrel Joint • Modified Chambrage Seal • High-Voltage Ignition Scheme



Outline

- AMG Program Overview
- Barrel Joint Test (BJT) Fixture
- Instrumented Pusher Assembly (IPA)
- Barrel Joint Testing
- Current Status
- AMG Program Summary





AMG Program Overview

Provide the DoD community with a test gun for advancing gun technology in the areas of hypersonic and long range projectiles, advanced propellants, barrel materials, and gun and projectile instrumentation.

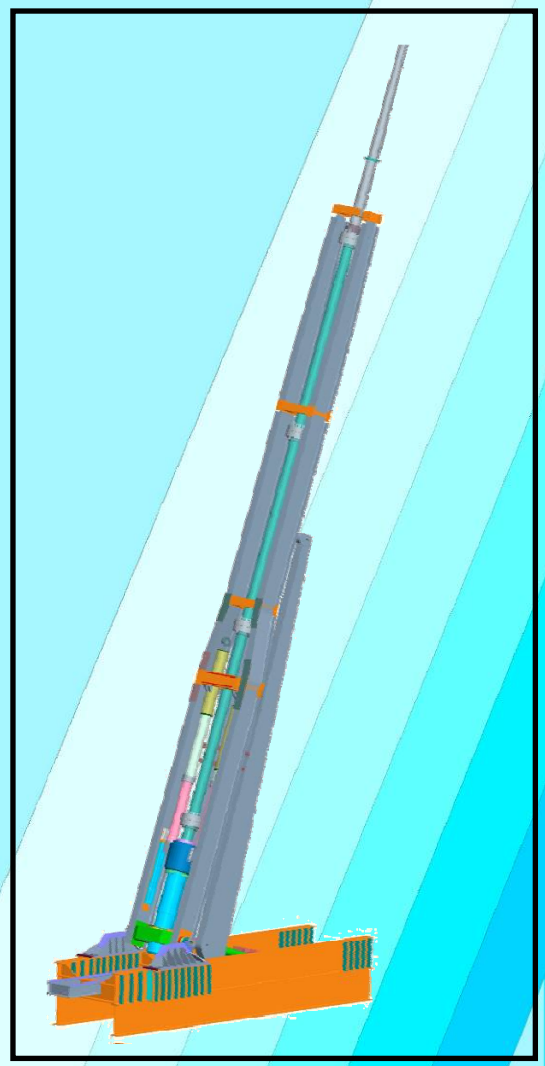
• Modular •

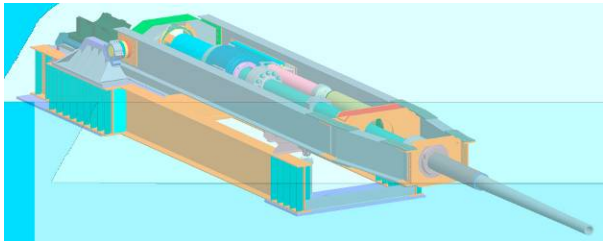
• Large Caliber •

• High Performance •

• Hypervelocity •

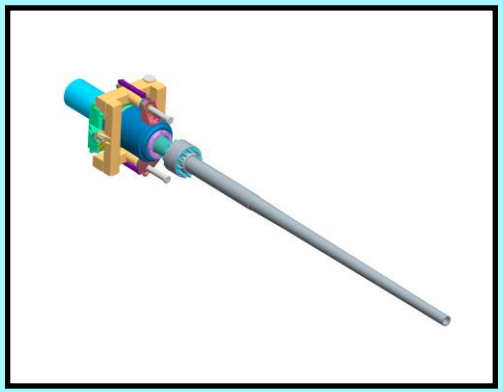
• Transportable •





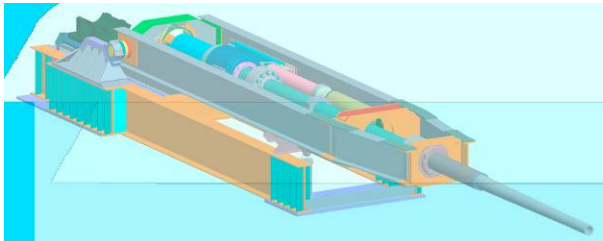
Project Engineering

- Design
- Modeling
- FEA Analysis
- Drawings
- System Integration
- Procurement/Logistics
- Technical Data Package
- Configuration Management
- Procedures Assembly/SOP
- Test Plan/Support



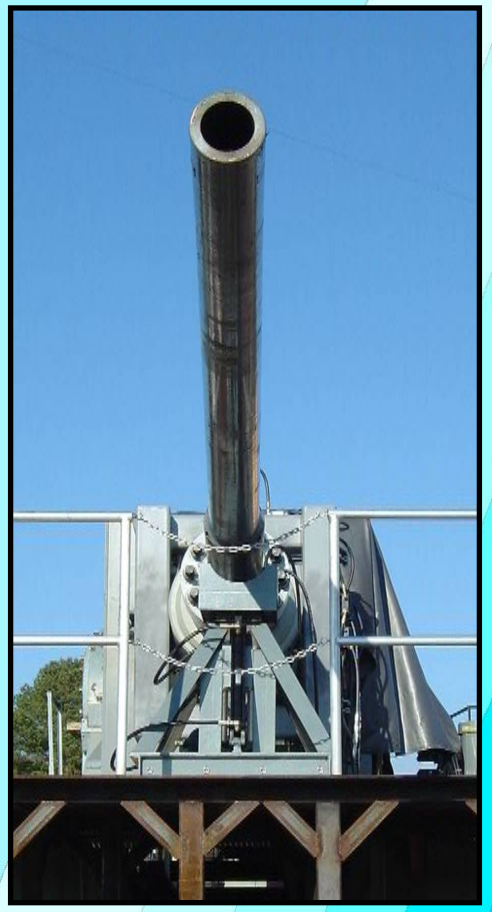
Turning Ideas

Into Reality

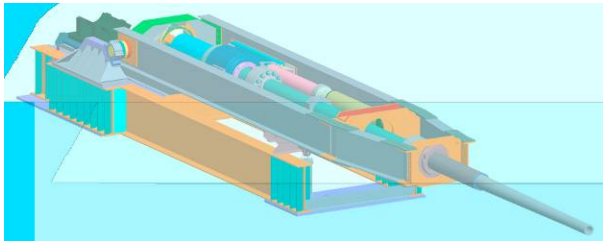


BJT Fixture

- **5.2-in. Bore**
- **Smoothbore Barrel Segments**
- **65 Caliber**
- **Large Volume Chamber**
- **Unique Chamber/Barrel Coupling Mechanism**



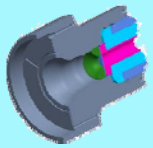
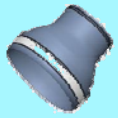
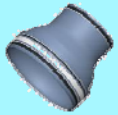
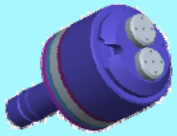
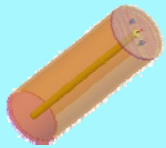
BJT Fixture



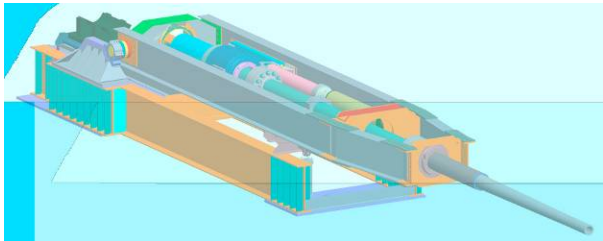
BJT Fixture

• MODULAR •
• 88% BJT Built from DST •
• Configurations Reversible •
• Continue to Add to Existing Test Fixture •

DST Fixture

DST	BJT
	
	
	
	

BJT Fixture



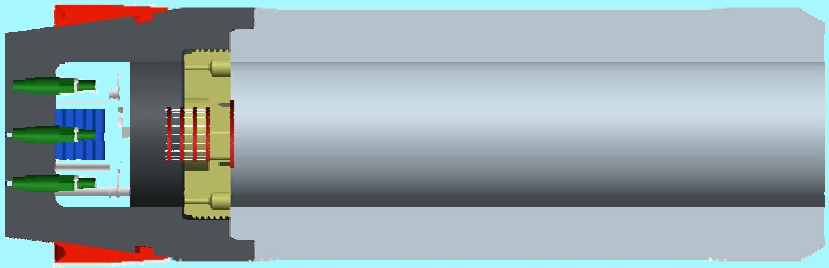
Instrumented Pusher Assembly

Objective:

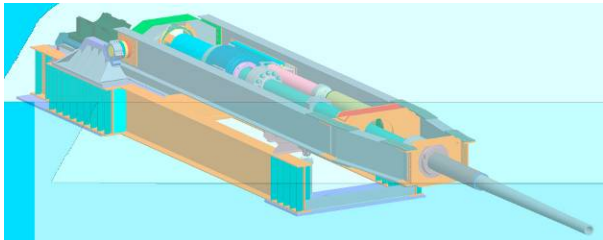
- **Capture Interior Ballistic Data**
- **Begin working on instrumentation package for high-G, high-velocity environment.**

Methodology:

- **Leverage ARL Instrumentation Expertise**
- **Utilize Existing, Gun-proven Sensors and TM Solutions**
- **Embed Instrumentation in a Modular Fashion**



IPA on Display at ARL's Booth



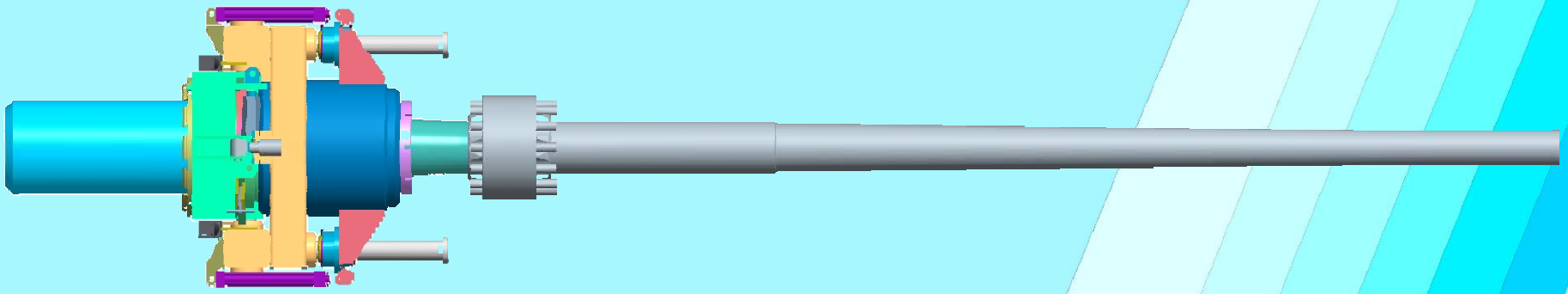
Barrel Joint Test

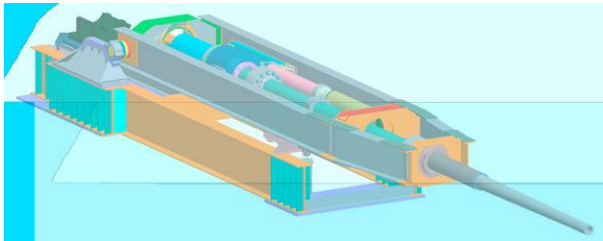
Primary Objectives:

- **Evaluate Barrel Joint**
- **Verify High Voltage Ignition Scheme**

Secondary Objectives:

- **Evaluate Modified Chambrage Seal**
- **Evaluate Obturator**
- **Demonstrate Repeatable Chamber/Barrel Mating**



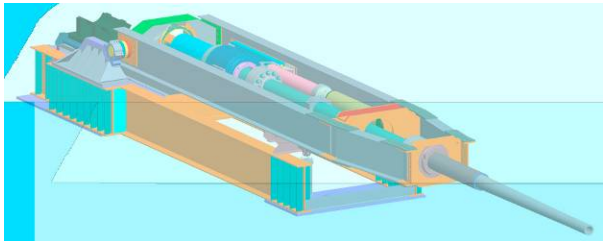


Barrel Joint Test

Test Results:

- **Conducted 19 Shots**
- **10 shots 98,000 to 103,000 psi**
- **10 shots 3,900 to 4,050 ft/s**
- **Barrel Joint sealed**
- **Repeatable Charge Performance**
- **Good IB Data from IPA**
- **No Blow-By on Chambrage Seal**
- **Excellent Obturation**
- **Repeatable Chamber/Barrel Mating**

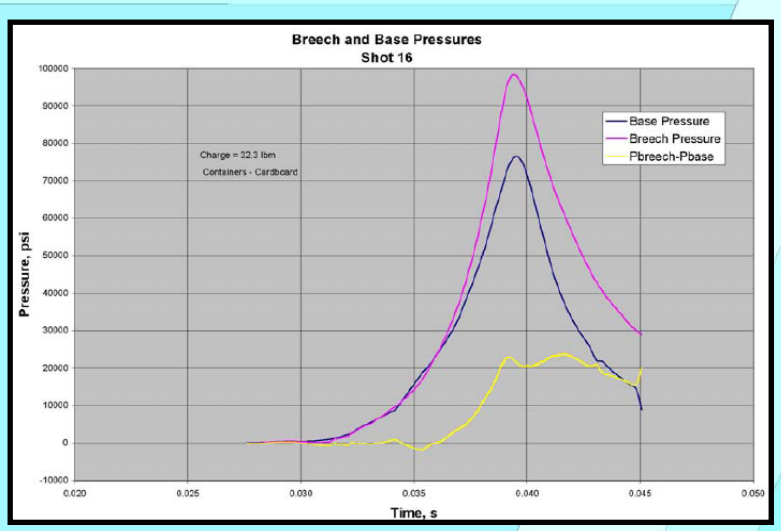
Muzzle Blast from BJT Testing
(from NSWC-Dahlgren PRTR)



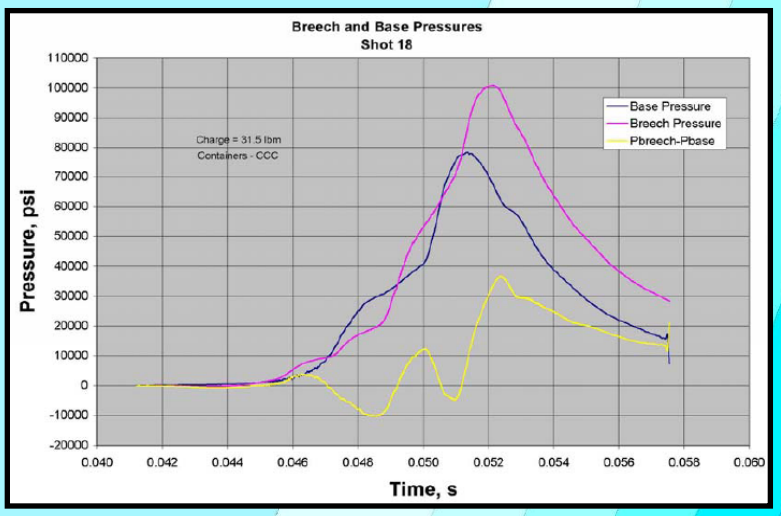
Barrel Joint Test

Charge Performance:

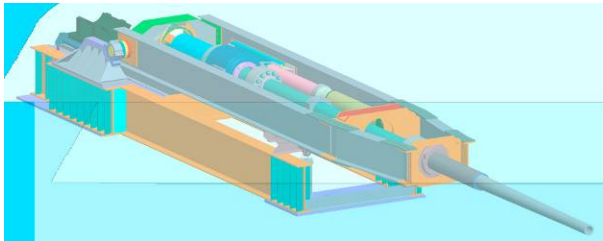
- **NACO**
- **Repeatable Peak Pressures for a Given Charge Weight**
- **Evaluated a Combustible Case and a Cardboard Case**
- **6 shots CCC (5 at 100 KSI)**
- **CCC add 10 KSI in pressure and 125 fps in velocity over a cardboard case**



Typical P-t Curve for Cardboard



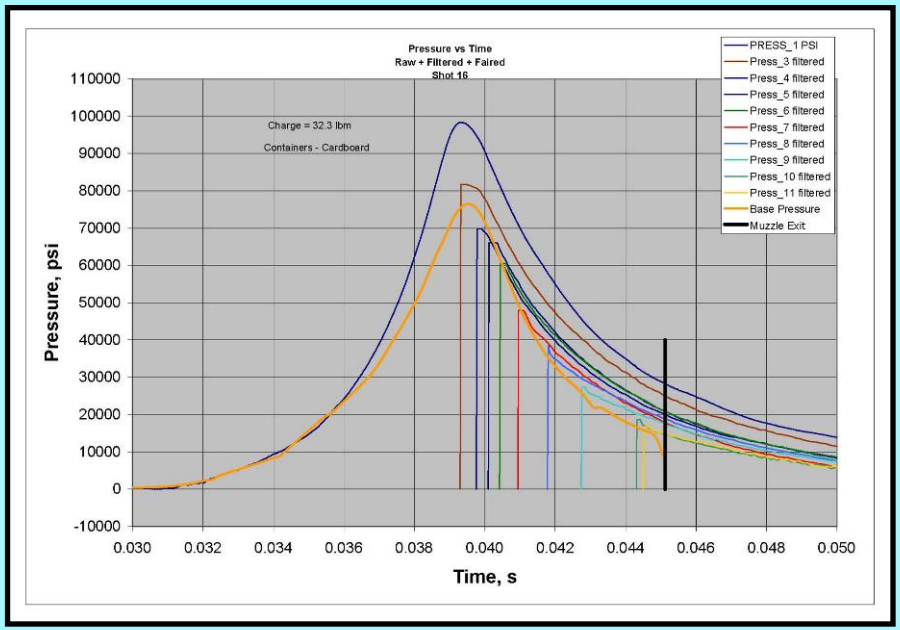
Typical P-t Curve for CCC

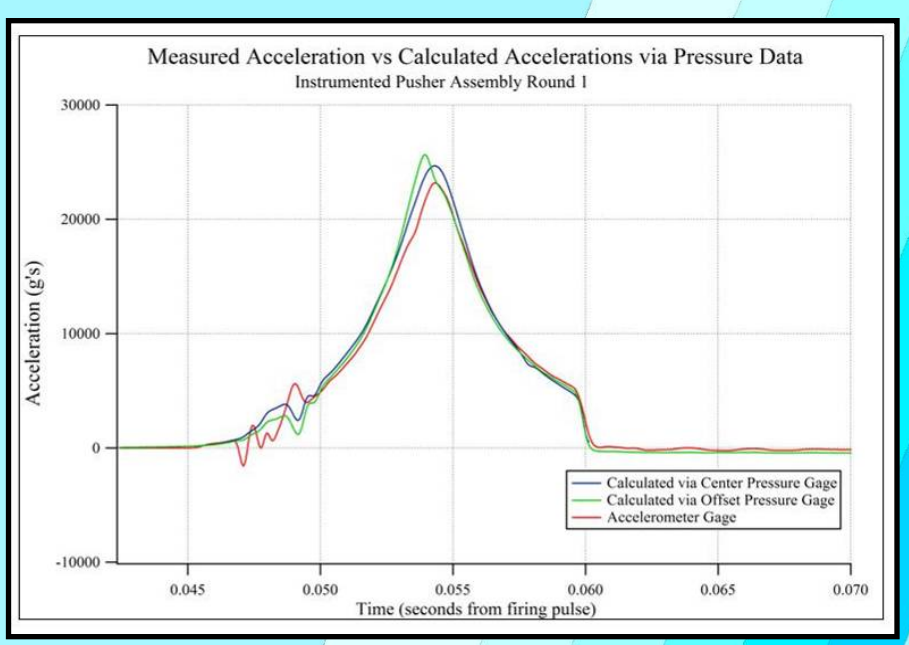


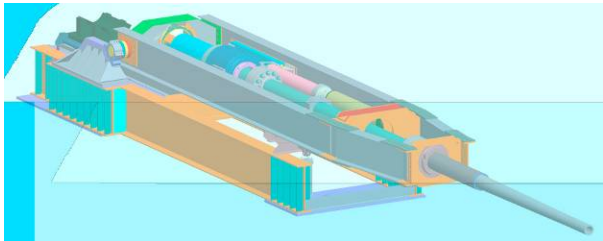
Barrel Joint Test

IPA Data:

- **2 shots**
- **Correlates with Pressure Data on Gun**

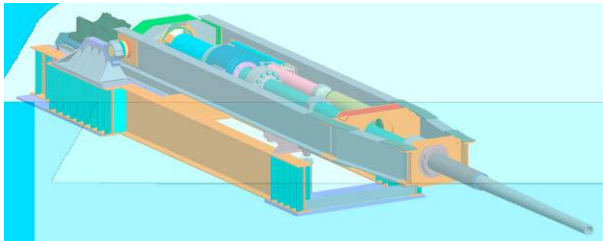






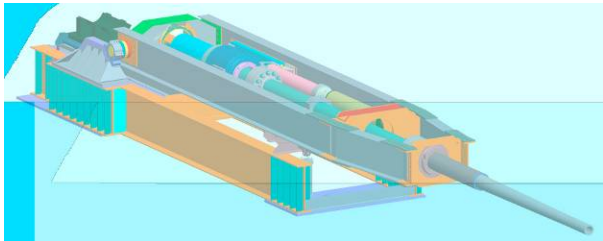
Barrel Joint Test

Normal Speed Views of Test Shots



Barrel Joint Test

High Speed Muzzle View of a Test Shot



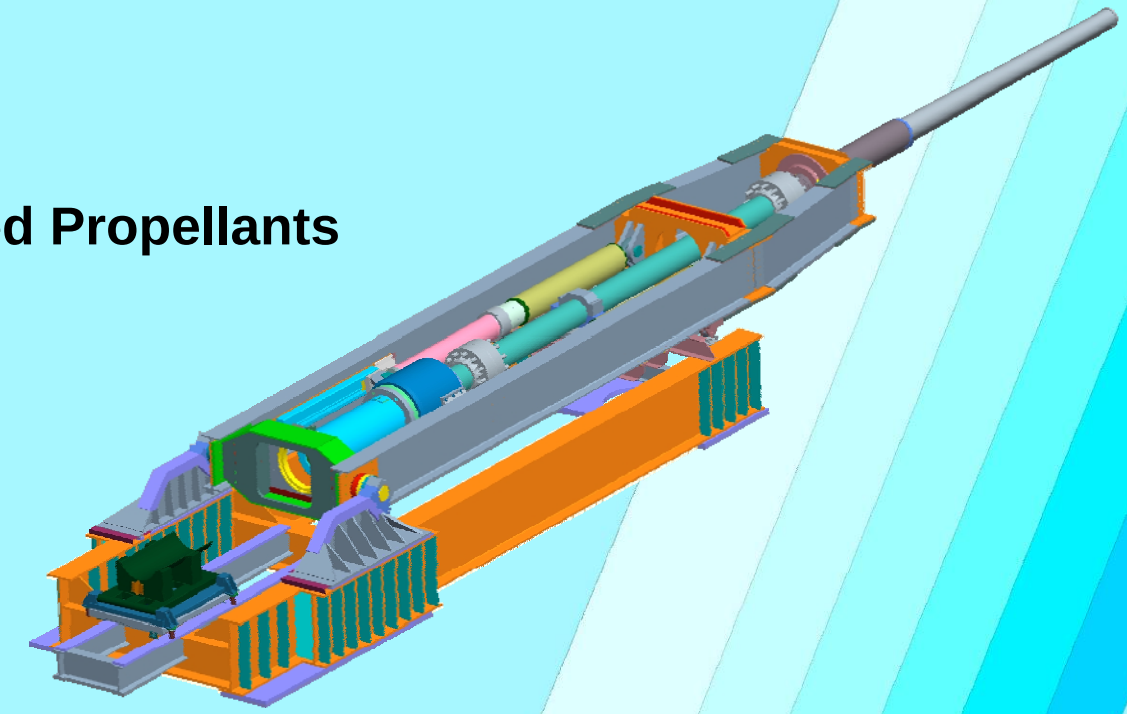
Upcoming Test

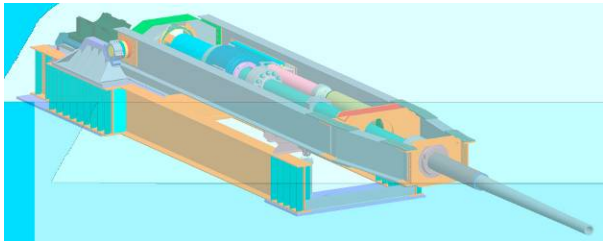
Currently designing Propellant Characterization Test (PCT) Fixture:

- **5.2-in./105-caliber, Smoothbore**
- **Add Stand, Recoil & Chamber Handling to BJT Components**

Objectives:

- **Characterize Advanced Propellants**
- **Increase Performance**
  - **5,500 ft/s**
  - **25,000 G's**





Upcoming Test

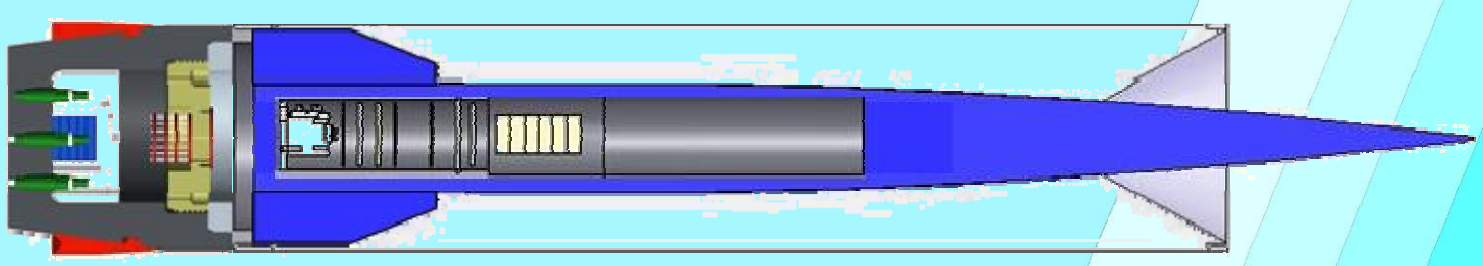
Currently Designing Instrumented Subcaliber Projectile

Objective:

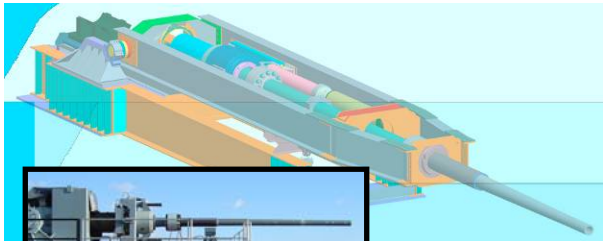
- **Capture Complete Ballistic Cycle (IB to Impact) such as P-t, Acceleration, Balloting, Thermodynamic Heating**
- **Use similar instrumentation package as IPA**

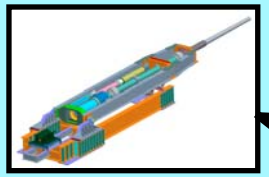
Advantages:

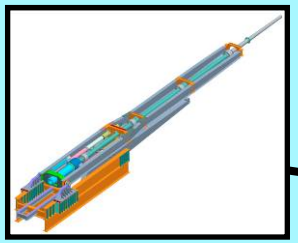
- **Less Obtrusive/Safer Method of Data Acquisition**
- **No PV Instrumentation Needed**
- **Simple Data Capture for Future Projectiles Irrespective of System**

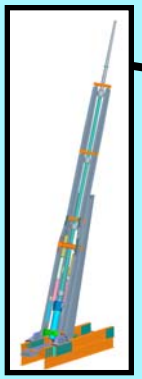


AMG Program Plan

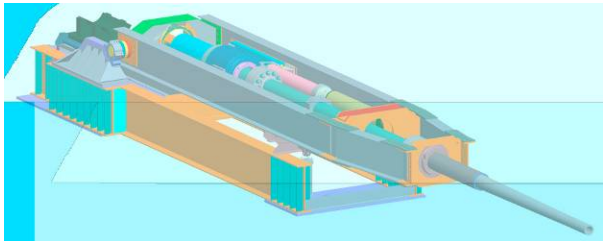






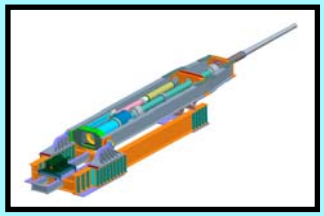


FY06				FY07				FY08				FY09			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Barrel Joint Test															
Instrumented Full-bore Test Slug															
Propellant Characterization Test															
Instrumented Sub caliber Test Slug															
Limited Performance Test, Elevated Shots															
Instrumented Long Range Projectile															
High Performance Test, Horizontal															
Instrumented Hypersonic Projectile															
High Performance Test, Elevated Shots															
Instrumented LR, Hypersonic Projectile															

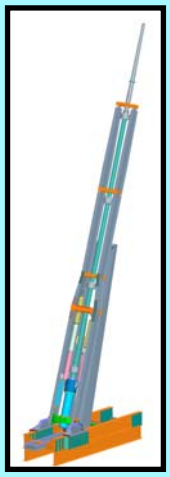


AMG Summary

5.2”/65-cal.
Muzzle Velocity: 4,000 ft/s
Available Now!



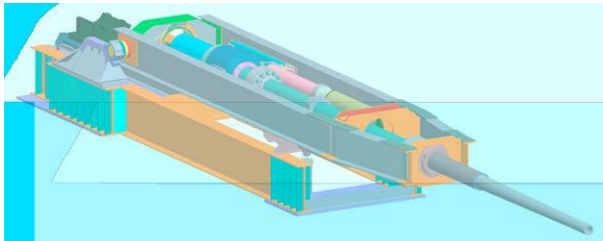
5.2”/105-cal.
Muzzle Velocity: 5,500 ft/s
Available FY07 Q1



5.2”/190-cal.
Muzzle Velocity: 7,200 ft/s
Available FY08 Q2

AMG Applications:

- ✓ Hypervelocity Projectiles
- ✓ Endo-Exo Flight Analysis
- ✓ High-G Instrumentation
- ✓ Long Range Projectile Development
- ✓ High Velocity Terminal Effects
- ✓ Advanced Gun Propellants
- • New Propulsion Technologies
- • Wear & Erosion Mitigation Methods
- • Advanced Gun Barrel Technology



Additional Information

At the Conference:
Mark Adams, AOT
Steve Adams, AOT
Pete DiBona, AOT
Phil Peregino, ARL
R.D. Cooper, NSWC-DD
Brett Kowalczyk, NSWC-DD
Shane Sisemore, NSWC-DD
Jason Budd, NSWC-IHD

Applied Ordnance Technology, Inc.
103 Paul Mellon Court
Waldorf, MD 20602
301.843.4045
www.aot.com
Steve Coladonato, PM
scoladonato@aot.com

AMG – BJT Configuration