A premier aerospace and defense company

Ballistic Test Facilities and Systems Modernization at the Lake City Army Ammunition Plant

Ms. Stefana Reilly
Project Manager
ATK Small Caliber Systems

Mr. Danny Huang
US Army, ARDEC
Picatinny Arsenal

Approved # OSR 09S-1471

Indoor & Outdoor Ballistic Test Ranges

A premier aerospace and defense company

2400 Yard Outdoor Ballistic Test Range

- 22 Firing Bays
- 4 Down Range Firing Houses

Indoor Ballistic Test Range

- 14 Velocity & Pressure Bays
- 14 Function & Casualty Bays
- 2 Sub-Ranges 200 Yards

Where We Were In The 1940's

A premier aerospace and defense company

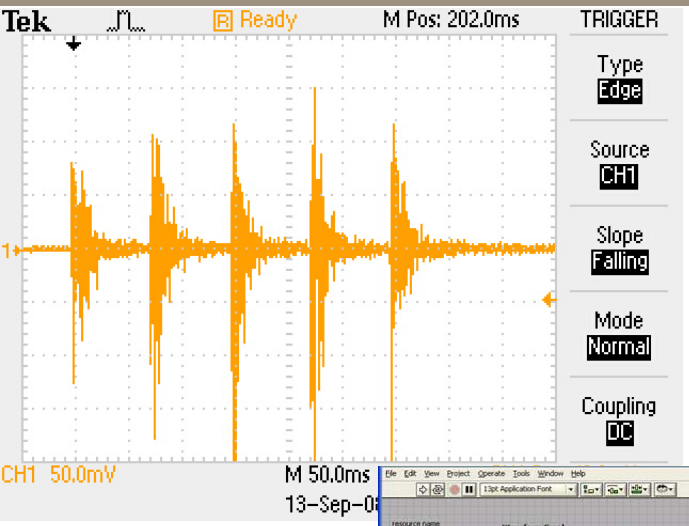
After A Few Upgrades 1970-1980's

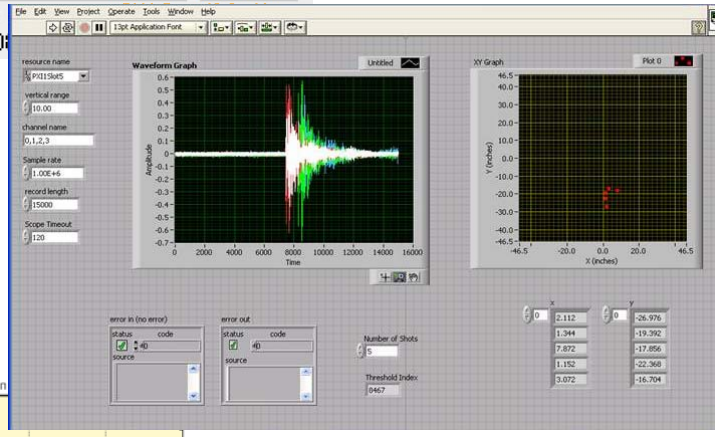
A premier aerospace and defense company

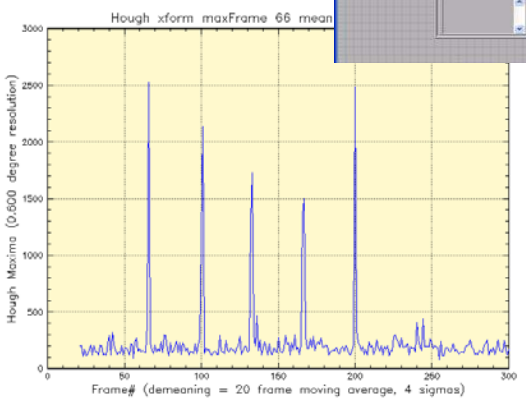
- Testing Only The Ammunition
- MSDOS Based Oehler System
- Labor Intensive Paper Targets
- Personnel In Line of Fire
- Subjective Determination
- Single Point Of Failure
- At Maximum Testing Capacity
- No Flexibility
- Redundant Data Entry
- Long Test Cycle Times

Where We Are Going: 2008 and Beyond

A premier aerospace and defense company







- Systematic Approach
- Automation
- Real Time Data
- Quantitative Analysis
- State Of The Art Technology
- Increased Testing Capacity
- Eliminate Need For Data Entry
- Eliminate Single Point Failures
- No Downrange Personnel

How We Are Getting There

Replace the obsolete data collection and analysis systems currently used in the indoor and outdoor ballistic acceptance testing facilities, with a modern system that is compatible with current industry and government standards. Implement key projects as identified in the Ballistics QFD analysis. Automate the test range measurement systems to increase the availability of the ballistics testing functions, and to enhance efficiency, accuracy, and consistency

16 Total Projects

Automation

- **Trace Performance**
- **Accuracy**
- **Function & Casualty**
- **Range Conditions**
- **Water "Proofness"**

Upgrade/Rehab

- **EPVAT**
- **Bullet Pull**
- **Linker**
- **Velocity Screen**
- **Transducer Calibration**

Facility/Infrastructure

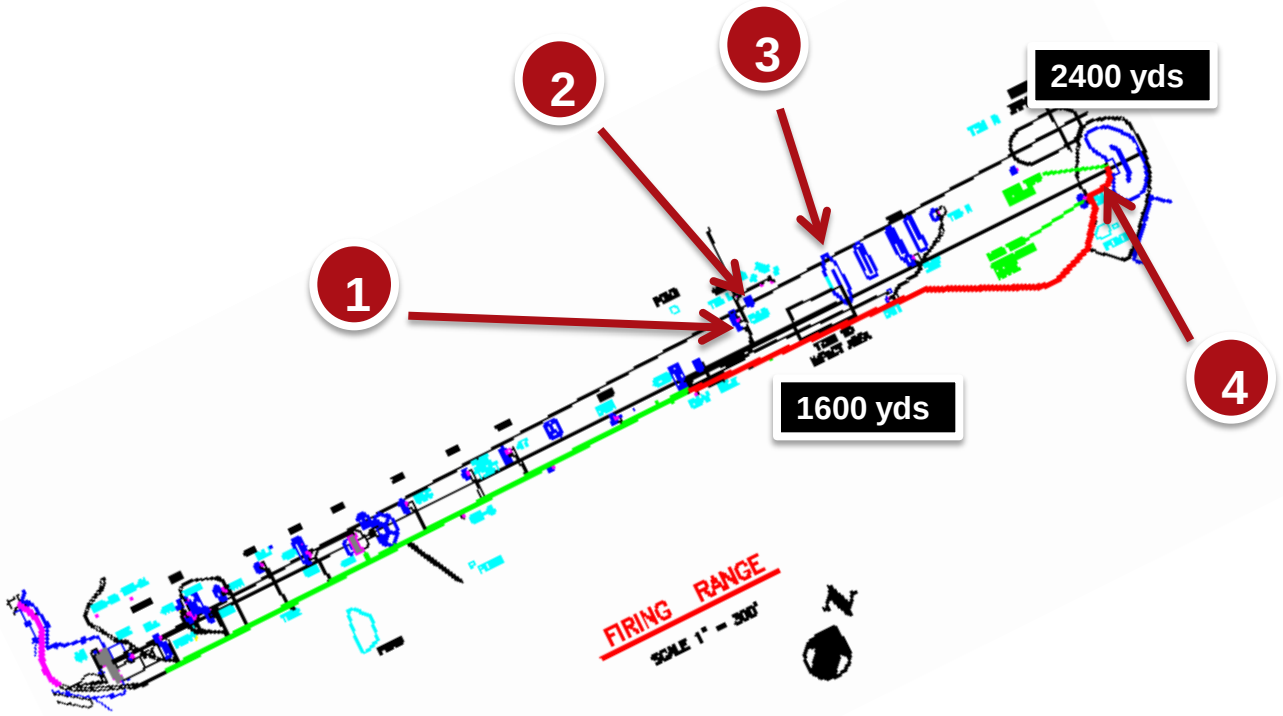
- **Hand Loading**
- **Accuracy Mount**
- **Mercury Lab**
- **Communications**
- **Gun Air Cooling**
- **Observation Houses**

Legacy Trace Performance Testing

A premier aerospace and defense company

Weapons, Ammunition, & Personnel Transport

Observation House



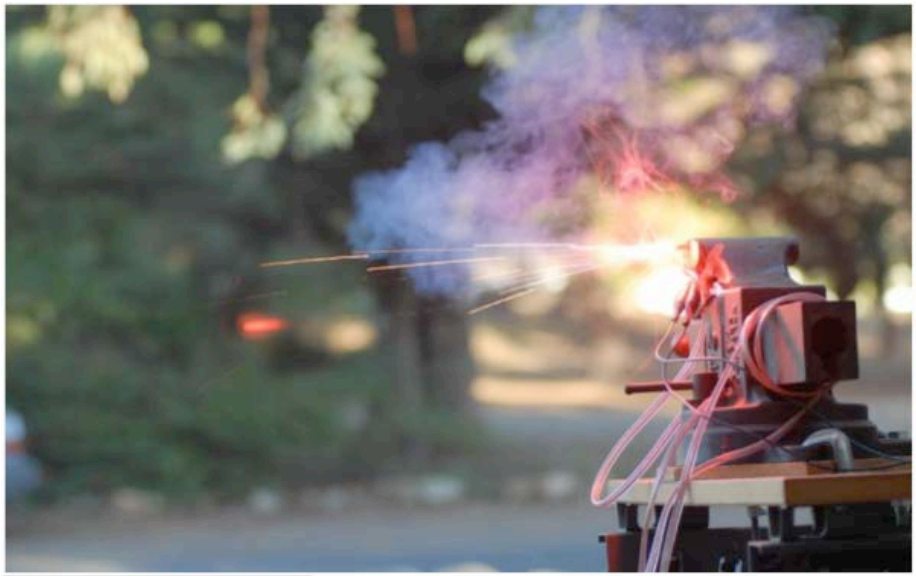
Legacy Trace Performance Testing Not Ideal!

Trace Observation & Evaluation System

A premier aerospace and defense company

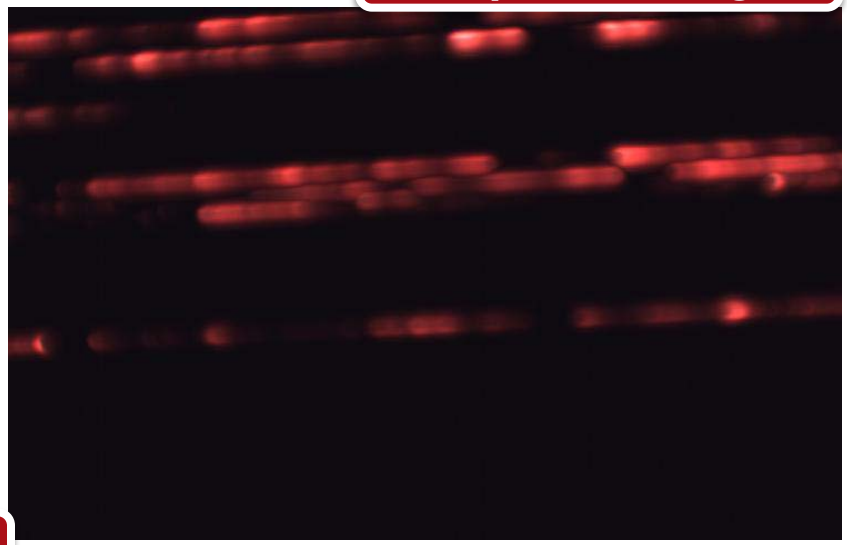
Objectives

- Eliminate Downrange Observers
- Automate Pass/Fail Determination
- Retain Video
- Make Test Data Immediately Available
- Process Data In Real Time



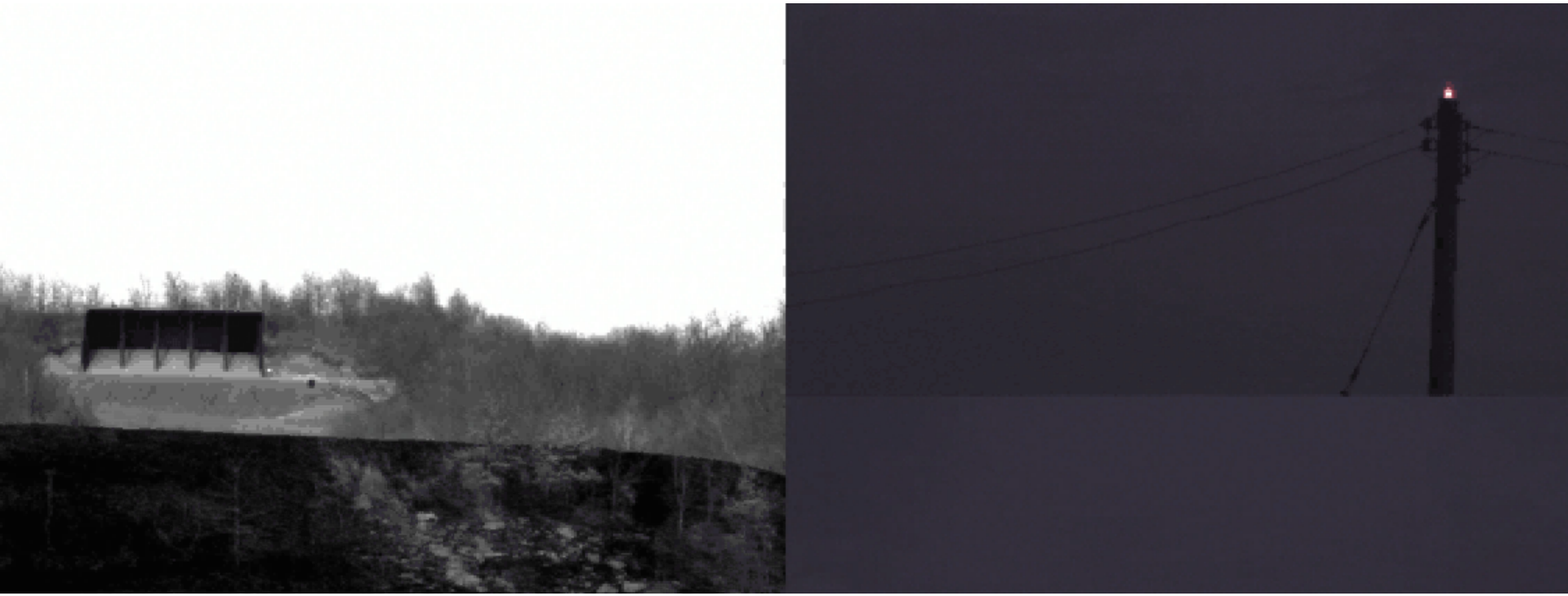
Tracer Spectral Characteristics Measured

Composite Image



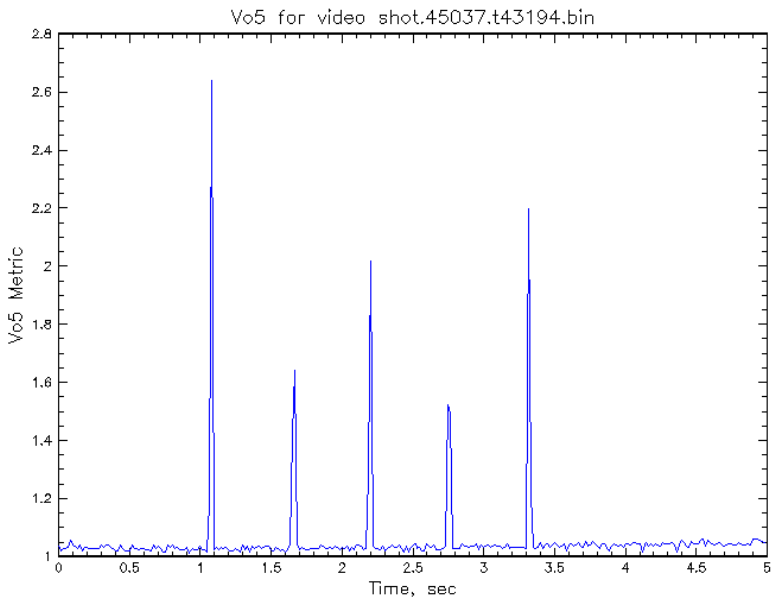
Video From 7.62mm Trace Testing

A premier aerospace and defense company



TOES Challenges

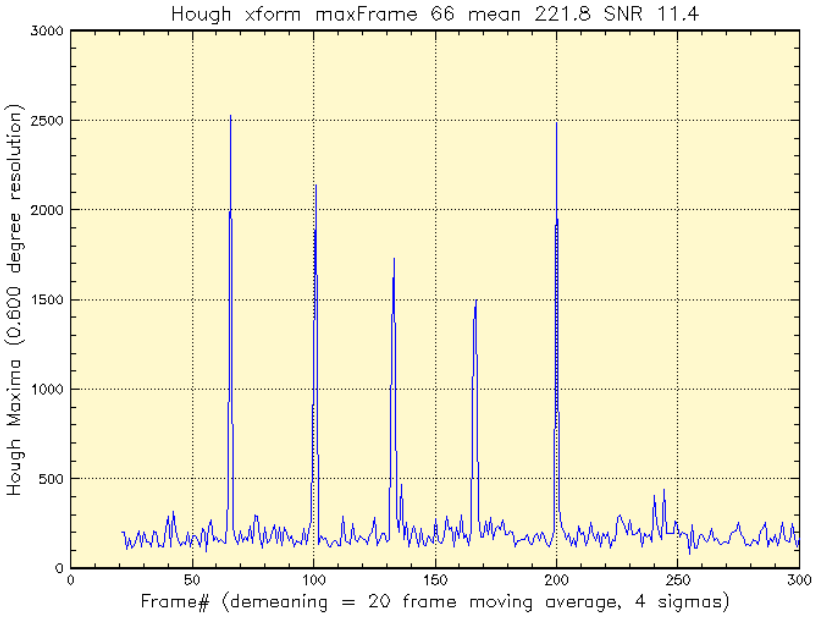
A premier aerospace and defense company



Challenges

- Make Real Time Processing Possible
- Eliminate False Triggers
- Capture Blind Tracer Events

- Step One (Vo5 Algorithm)
  - Measures Structure
- Step Two (Hough Transform)
  - Discriminates Linear Events

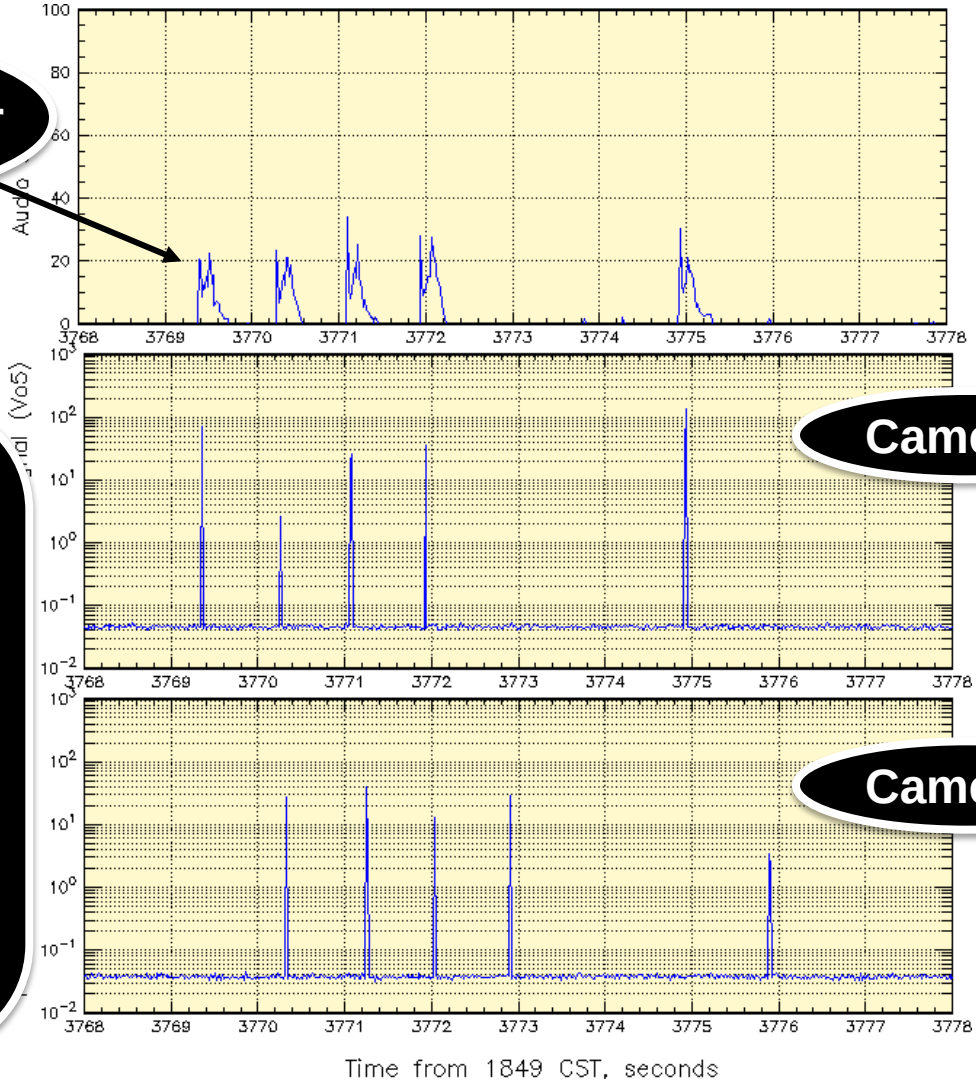


TOES Challenges

A premier aerospace and defense company

How To See A “Blind”

Acoustic Trigger



Benefits

- Fully Automated
- No Downrange Observers
- Real Time Data
- Quantitative Analysis
- Increased Test Capacity

Legacy Accuracy

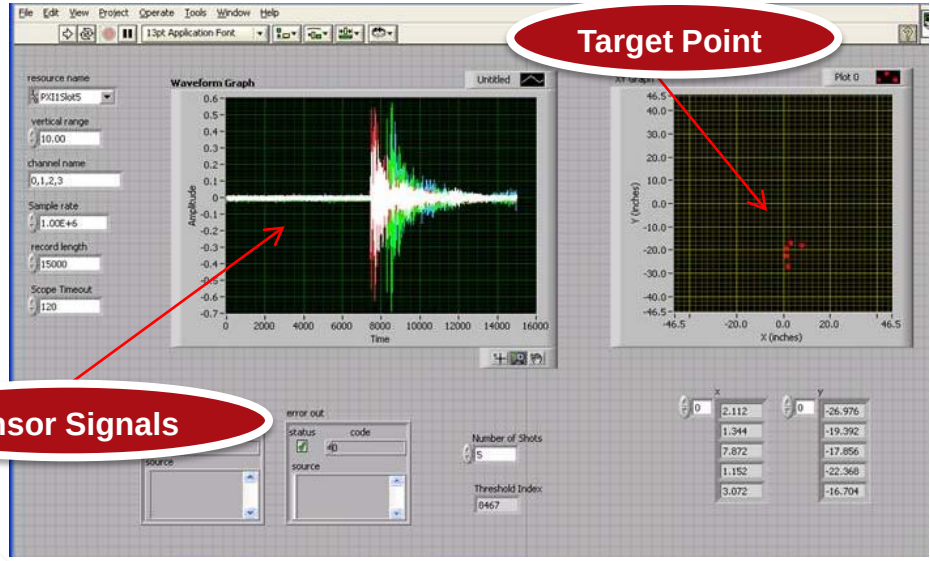
A premier aerospace and defense company

- Operator Staples Target To Wood Frame
- Gunner Tries To Locate Center Of Target
- Gunner Fires Through Target
- Target Cut Down
- Operator Digitizes Target
- Clerk Enters Data Into Spreadsheet

Legacy Accuracy Testing Not Ideal!

Range Accuracy Target System (RATS)

A premier aerospace and defense company



- Projectile Passes Through Target Area
- Wave Is Induced On Aluminum Rod
- AE Sensors Receive Signals
- XY Coordinate Recorded
- Calculation Of Dispersion Characteristics
- Data Automatically Entered

RATS Results

A premier aerospace and defense company

Paper System

- Rotational Error
- Wave Error
- Target Movement Error
- Digitizing Error
- Personnel In Line Of Fire

RATS

- Gunner Centered Easily
  - Spec Requirement
- Actual (x,y) Coordinates
- No Personnel Downrange
- Est. Accurate To 0.1” At 600 Yards

Greater Accuracy, Greater Precision

Horizontal SD

5.56mm	Mean	StD	P-Value
Paper	1.326	0.302	0.247
RATS	1.304	0.293	

Vertical SD

5.56mm	Mean	StD	P-Value
Paper	1.104	0.151	0.688
RATS	1.112	0.159	

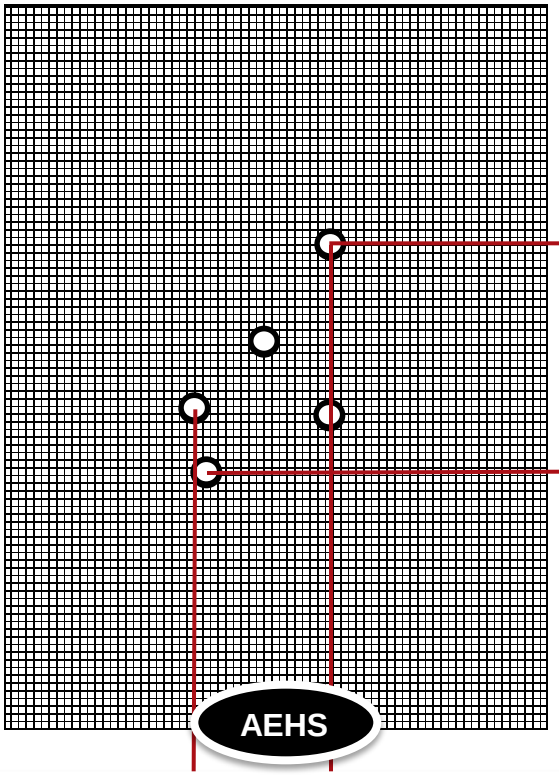
Mean Radius

7.62mm	Mean	StD	P-Value
Paper	4.012	0.916	0.130
RATS	3.992	0.899	

50 Caliber	Mean	StD	P-Value
Paper	5.191	1.037	0.612
RATS	5.198	1.048	

Accuracy Sub-Sonic

A premier aerospace and defense company

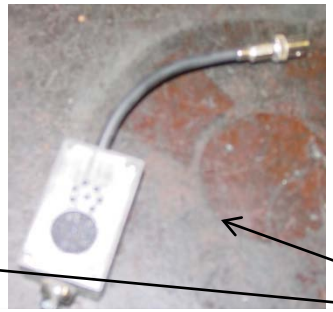


- Screen Type Material As A Target
- Camera Takes Images Of Fired Shots
- Coordinate Recorded, Dispersion Characteristics Calculated
- Data Is Transmitted To Server And Display Application
- Target Is Mechanically Indexed By Gunner From Firing Location

Legacy Function & Casualty

A premier aerospace and defense company

- Acoustic Sensor Adjacent Bay Cross Talk
- Blank Rounds Measured
- Water Trap Causes Wet Environment
- Various Weapon Systems
- MSDOS Based Oehler System
- Cadence Controlled By Operator
- Excessive Manual Gain Adjustment



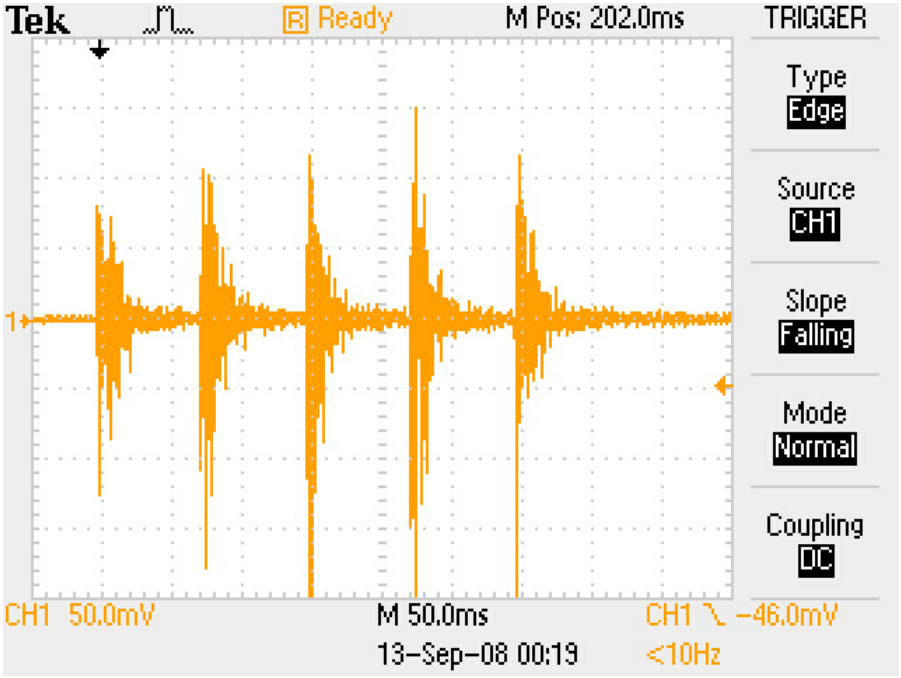
Legacy Cyclic RateTesting Not Ideal!

Not Designed For Gun Blast

Cyclic Rate Calculator (CRaC)

A premier aerospace and defense company

- Senses Pressure Blast
- Up To 1500 RPM
- +/- 2% Of True Rate Of Fire
- Functional Weapons
- Cadence Controlled



Impact

- Systematic Approach
- Reduction In Test Cycle Time
- Quantitative Analysis
- Reduction In Personnel
- Increased Testing Capacity
- Improved Efficiency
- Significant Reduction In Data Entry
- Elimination Of Single Point Failures
- Elimination Of Downrange Personnel

Approved # OSR 09S-1471