



Presented to:  
ASQ Section 0511  
By: Jim Pastorick  
UXO Pro, Inc.

**UXO***Pro*

Managing Quality on  
Munitions Response  
Investigations and Clean-ups

# Who am I?

- President of UXO Pro, Inc.
- UXO Pro serves as technical consultants to state environmental regulators in munitions response (MR)
- Former Navy diver and EOD technician
- Former manager of munitions response at UXB International and IT Corp.
- ASQ Manager of Quality and Organizational Excellence

# Why are we here?

- MR investigation and clean-up work presents unique quality issues
- I will present:
  1. General regulatory process
  2. History of our technology and procedures (from a quality perspective)
  3. Where we are going
  4. What is good and what isn't so good

# 1. General Regulatory Process

- MR projects follow the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or “Superfund”) 1980
  1. Preliminary Assessment (PA)
  2. Site Inspection (SI)
  3. Remedial Investigation (RI)
  4. Feasibility Study (FS)
  5. Remedial Design (RD)
  6. Removal Action (RA)
  7. Post-removal Actions



# 1. General Regulatory Process

- US EPA, under CERCLA, also gave us management processes
  - Systematic Planning Process
  - Data Quality Objectives (DQOs)
- US Army Corps of Engineers (USACE) follows these also
  - Technical Project Planning (TPP)
  - DQOs
- DQOs are statements that describe the quantity and quality of data required to support future decision-making

# 1. General Regulatory Process

- DoD, EPA and DOE developed the Uniform Federal Policy for Quality Assurance Project Plans (UFP QAPP)
- Standardized worksheets comprise the work plan for any phase of the CERCLA process
- Applicable to all US government environmental data collection
- Modified by DoD for munitions response projects

## 2. History of UXO Technology and Procedures

- The “mag and dig” era (1989 – 2000)
- Simple analog detectors used to find subsurface objects
- Dig everything up and visually identify it
- Quality issues abound
- Still in use



## 2. History of UXO Technology and Procedures

- “Mag and dig”
- Photo shows two ordnance detection systems





## 2. History of UXO Technology and Procedures

- “Mag and dig”
- Photo shows the problem

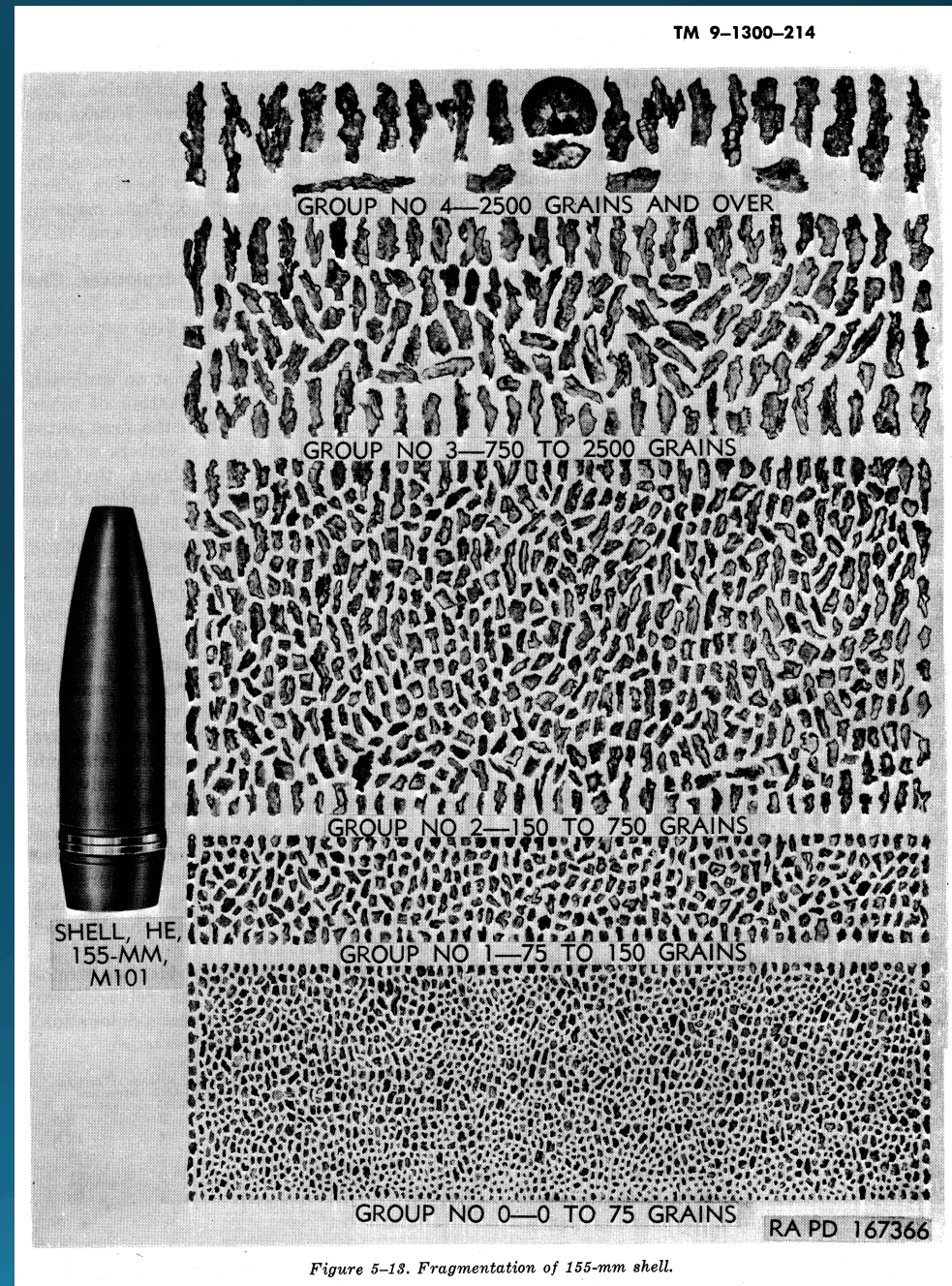


Figure 5-18. Fragmentation of 155-mm shell.

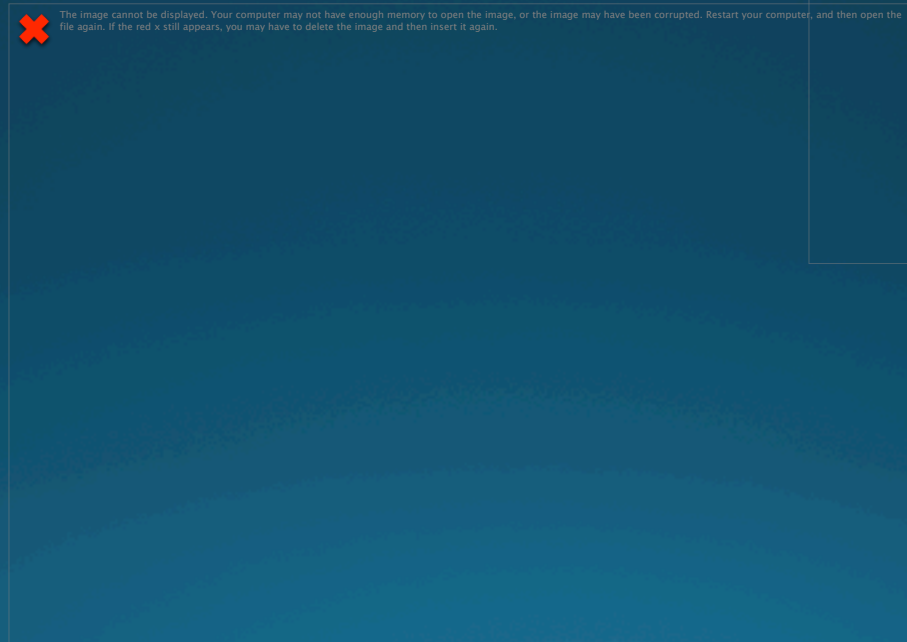
## 2. History of UXO Technology and Procedures

- The “digital geophysical mapping” (DGM) era (2000 – today)
- Sensor and navigation data is recorded
- Still dig everything up and visually identify it
- The standard today



## 2. History of UXO Technology and Procedures

- “DGM era”:
  - Data is recorded
  - Quality (process and product) is greatly improved
  - Allows standardized and verifiable data acquisition and management

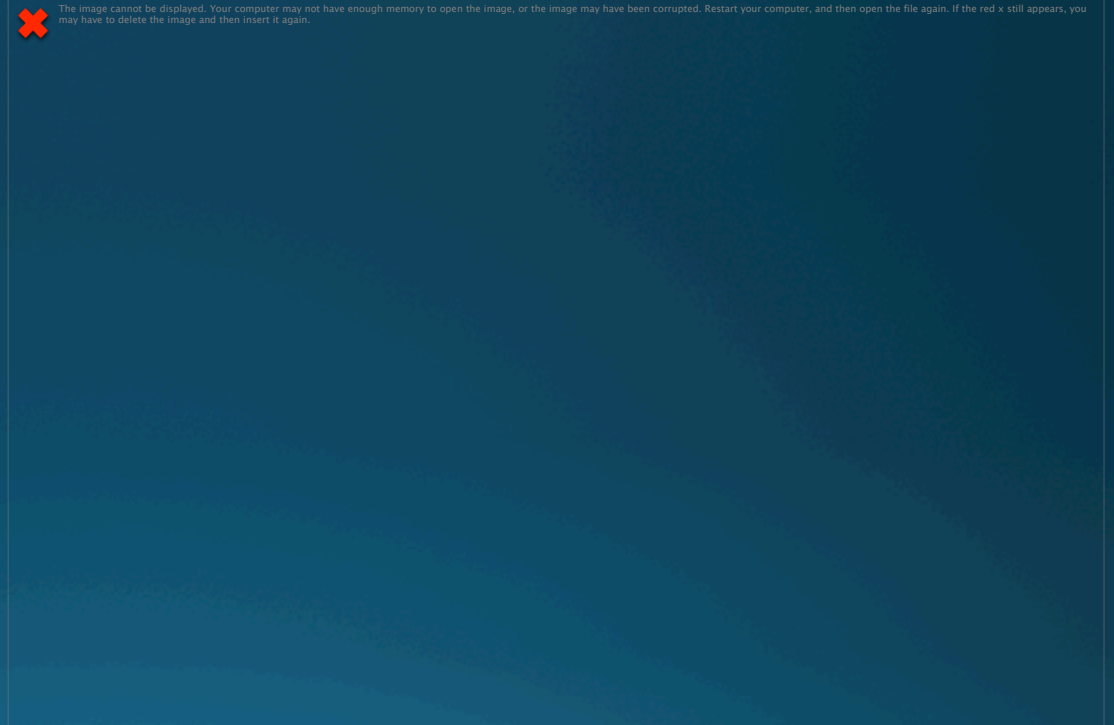


# 3. Where Are We Going?

- “Advanced Geophysical Classification (AGC) era” using advanced sensors is beginning now
- Classification is a process used to make decisions about the likely origin of the geophysical signal from a subsurface object
- If we can determine that a subsurface object is not hazardous from the geophysical signal then....:
  - We can leave it in the ground saving the time and money required to dig it
  - MR projects become more efficient (quicker and less expensive)
  - DoD funding can go farther addressing more MR sites

# 3 Where Are We Going?

- DoD developed classification technology through the **Environmental Security Technology Certification Program (ESTCP)**
- <http://www.serdp-estcp.org/>
- Development has been ongoing for approximately 15 years
- Concludes in 2015



# 3 Where Are We Going?



# Classification Applied to Munitions Response



- **Sort buried metal into two classes**
- **Because we cannot see buried objects, we must rely on attributes determined from geophysical data**

# 3. Where Are We Going?

- The problem:

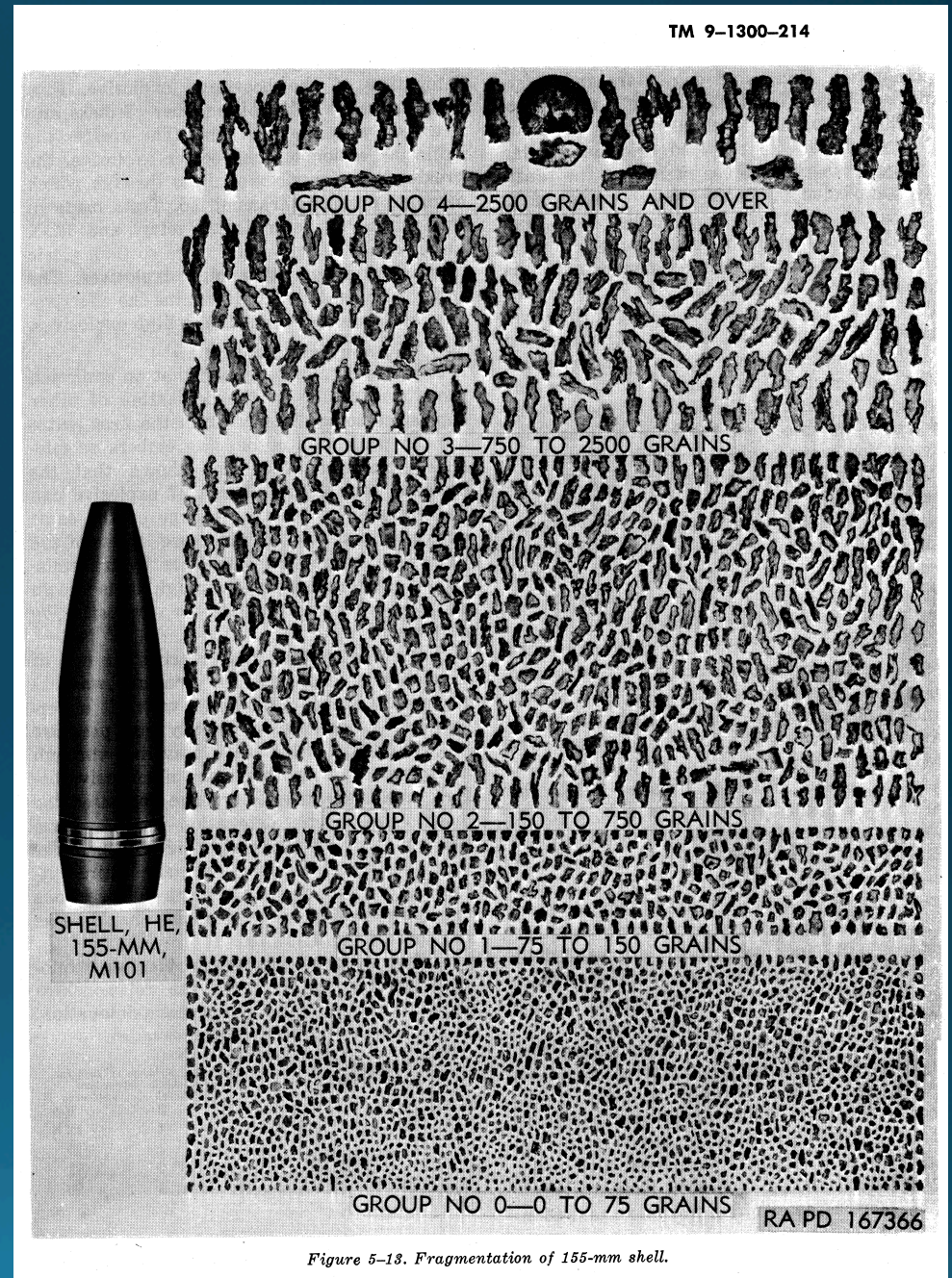




Figure 5-18. Fragmentation of 155-mm shell.



# New Sensor Technology


- New **UXO-specific** EM technologies have been developed and tested under SERDP & ESTCP
- All digital electronics, measuring complete eddy current decay cycle
- Multi-axis target excitation and observation for complete interrogation of principal axis polarizabilities.

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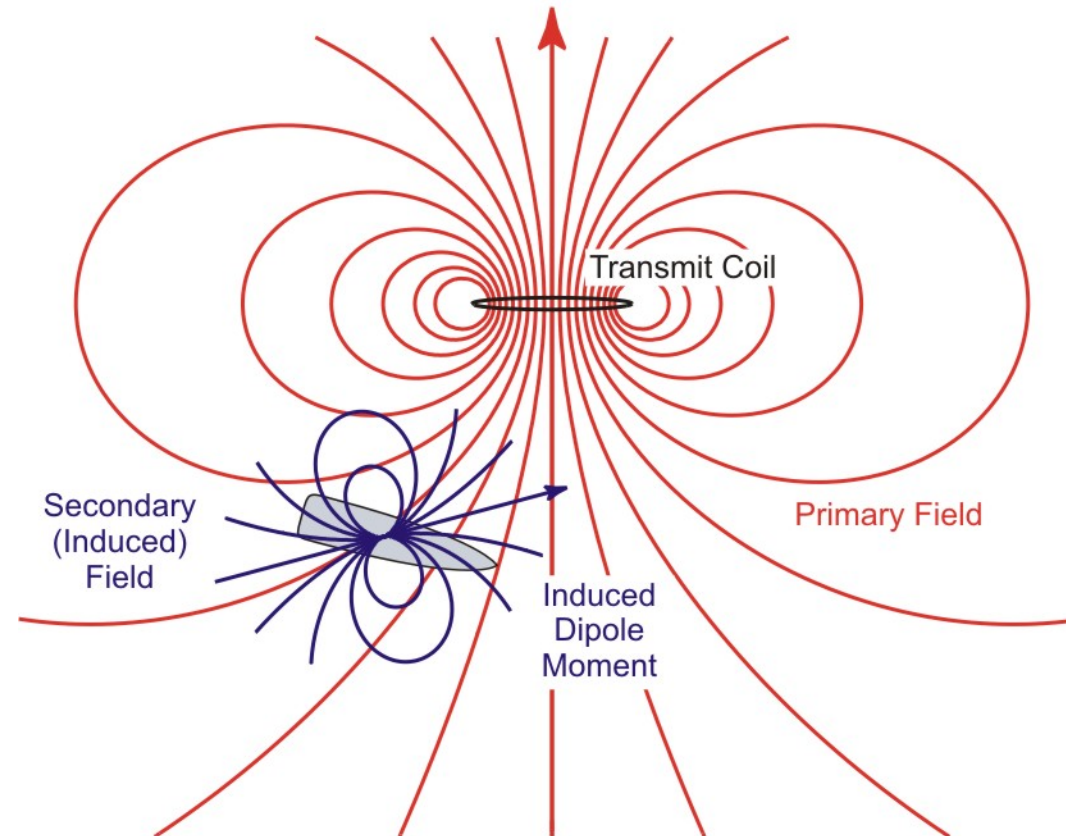
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# Electromagnetic Induction Sensors

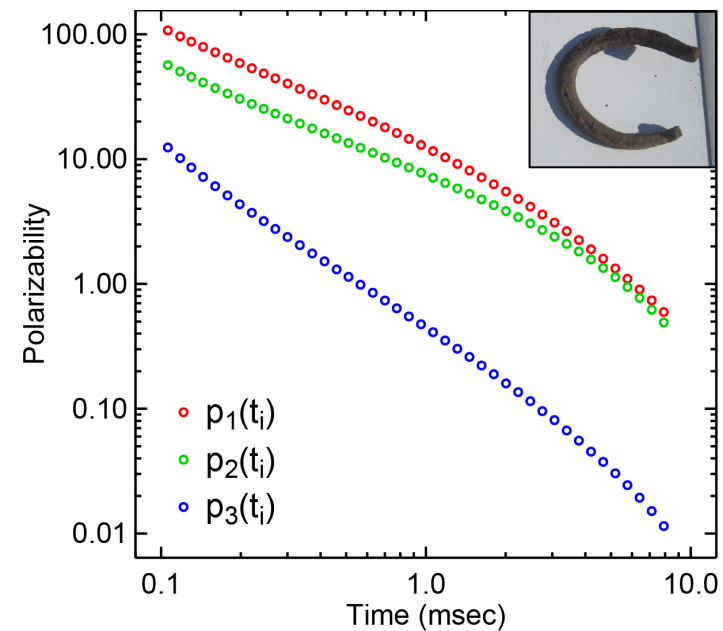
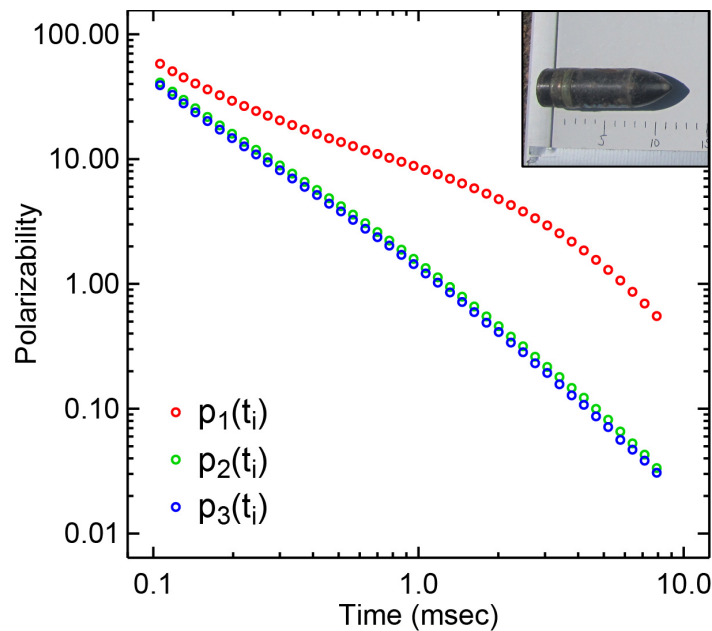
Typical Electromagnetic Induction Sensor





# Target Features from EMI Data

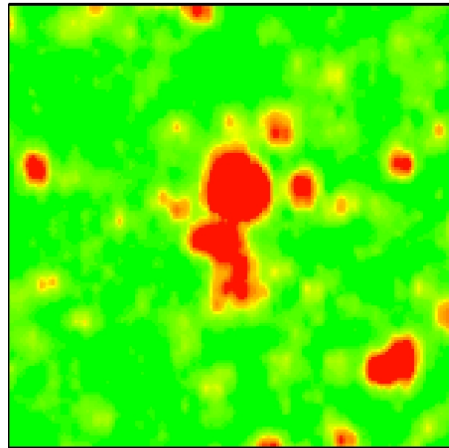
- Principal axis polarizability curves completely specify target's EMI response characteristics
  - ◆ Independent of sensor/geometry
  - ◆ Contain all information useful for classification



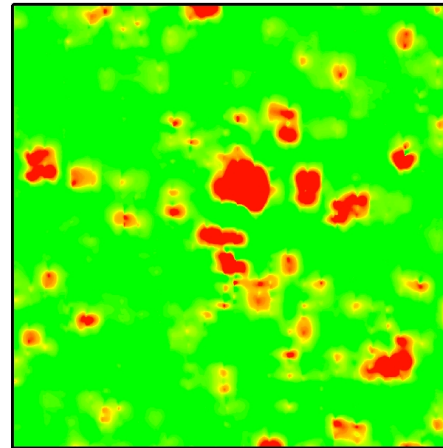
**Key Point** Shape of curve reflects shape of object

# Detail of Survey Data

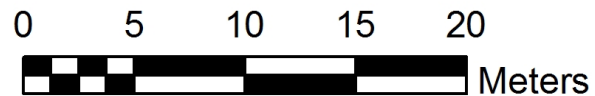
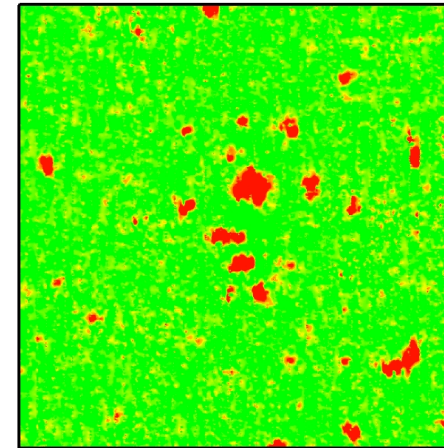
**EM61**



**MetalMapper**

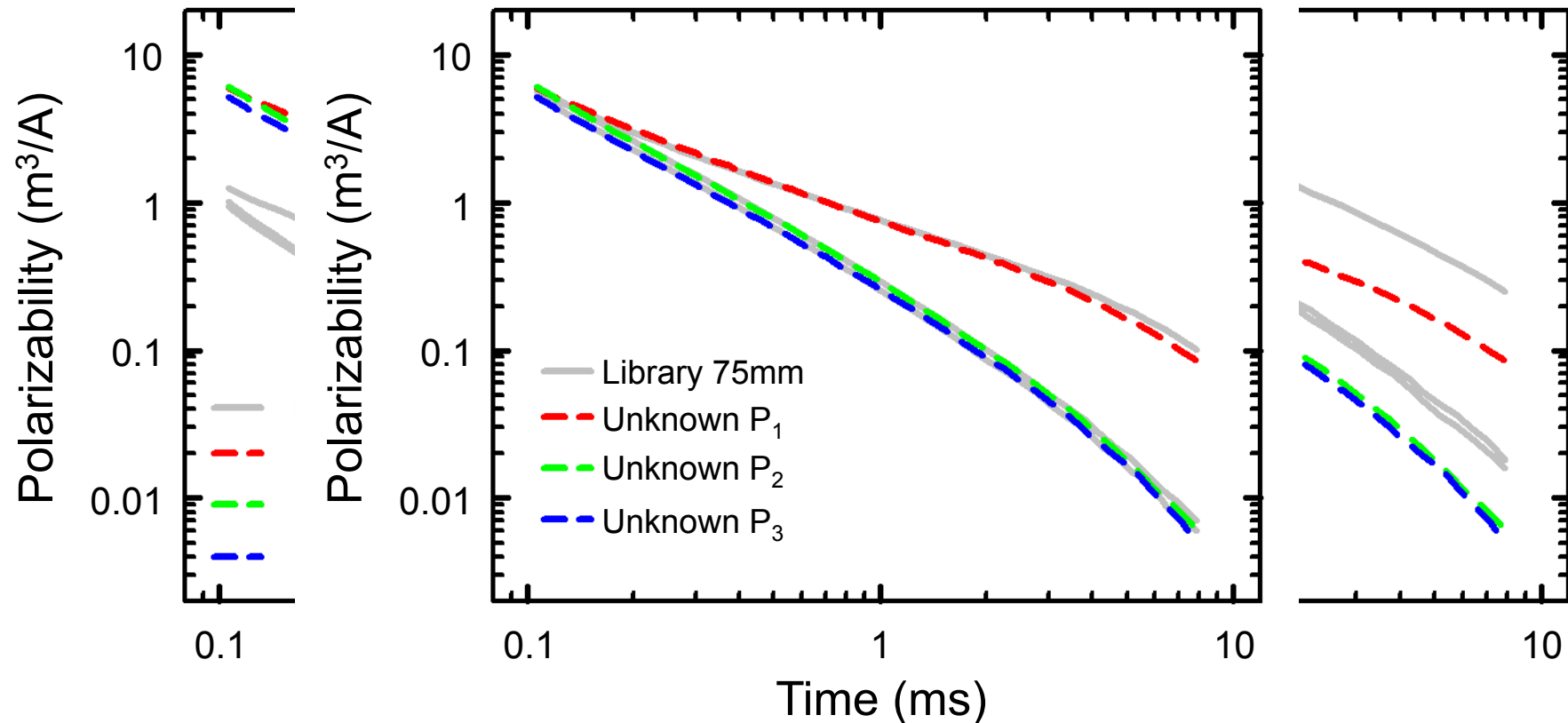


**TEMTADS 2x2**



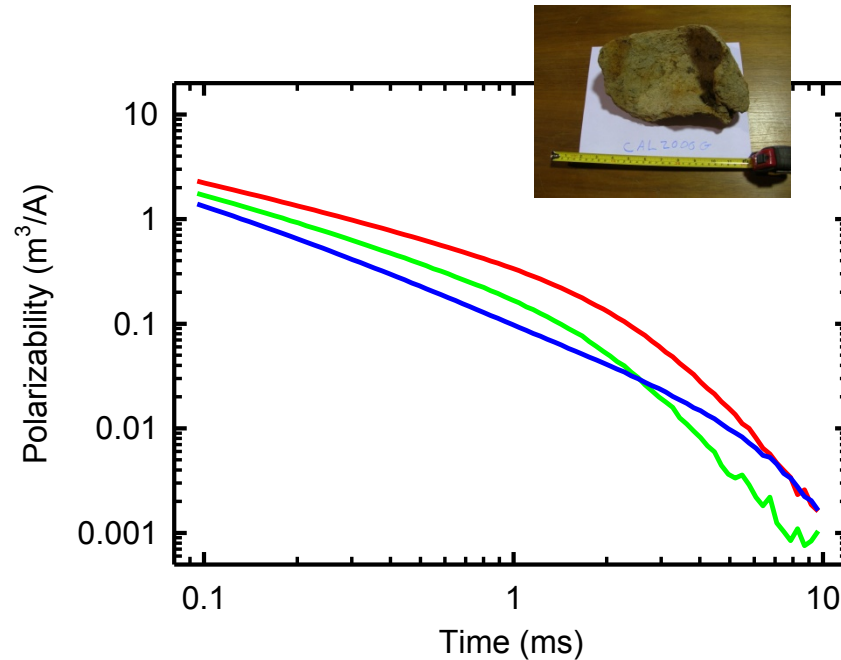
# How Do You Get Classified as a TOI #1

Match a Munition in the Library

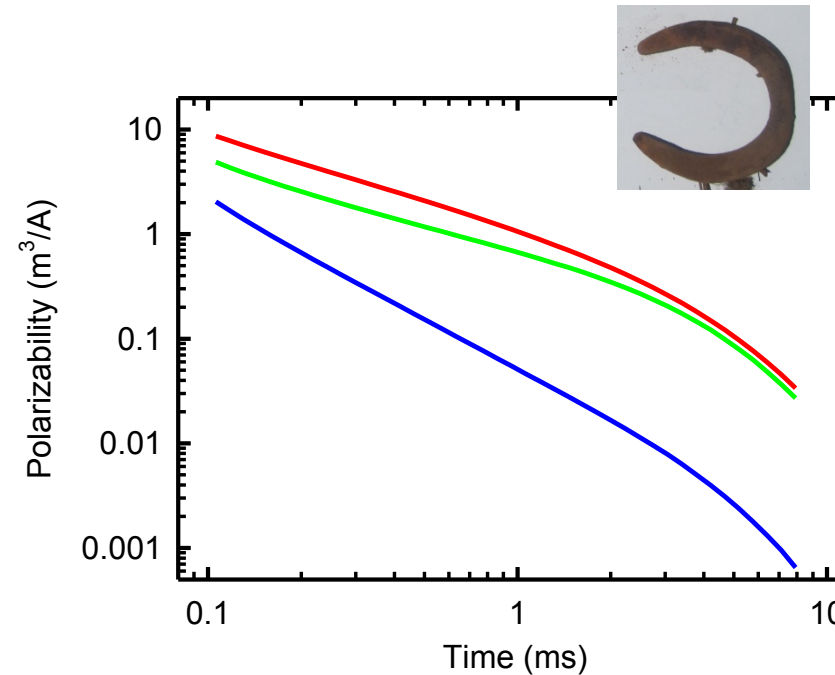


# How You Get Classified as Clutter

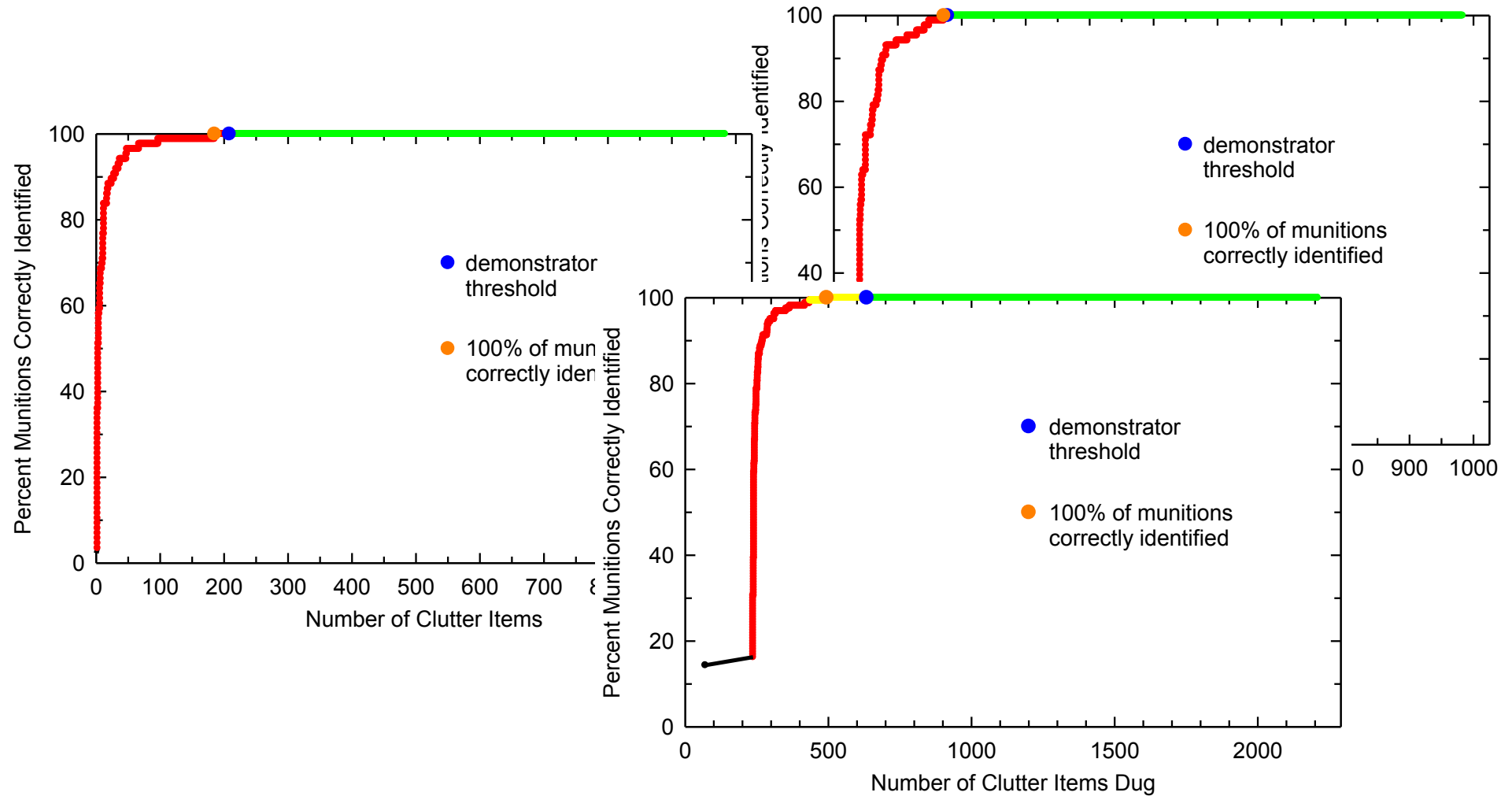
No Symmetry



Known Clutter Item



# Examples from USACE and Production Geophysicists





# 3 Where Are We Going?

- Process QC
- The sensors, equipment and processes have become very standardized
- QC is built in
- Each process and decision is checked, tested, verifiable and repeatable



# 3 Where Are We Going?

- DoD is developing:
  1. ESTCP classification program summary
  2. AGC Uniform Federal Projects Quality Assurance Project Plan (UFP QAPP)
  3. Contractor accreditation



# 4 What is Good and What Isn't

- Good - DoD:
  - Has developed sensors and programs to process data that are ready for commercialization
  - Has developed an AGC Uniform Federal Projects Quality Assurance Project Plan (UFP QAPP)
  - Is developing a contractor accreditation program (DAGCAP)
  - DAGCAP is modeled on the DoD Environmental Laboratory Accreditation Program (ELAP)
  - DAGCAP based on ISO 17025
  - Has management and technical requirements specified in a "Quality Systems Requirements (QSR)
  - Accreditation implemented by "Accrediting Bodies"

# 4 What is Good and What Isn't

- Not good – DoD is not minimizing risk of failure because AGC and accreditation:
  - Vastly more stringent and complex than anything we have done in this industry to date (no learning curve)
  - Expensive for contractors and the Accrediting Bodies (who will participate?)
  - In conflict with “performance-based contracting” (PBC)
    - PBC is a “hands-off” approach
    - Contractor is the expert and either sinks or swims on their own
    - No help or guidance for contractor is contrary to ASQ management techniques
    - Regulator, not the buyer, is the enforcer of quality

# Summary

- True advances in hardware, software and processes have been achieved
- Confidence in the system (to leave metal in the ground) needs to be achieved to successfully incorporate classification into the mainstream
- Concern that DoD is taking unnecessary risk with their method of implementation
- Time will tell

# Thank you

Jim Pastorick, President

UXO Pro, Inc.

811 Duke St.

Alexandria, VA 22314

Phone: (703) 548-5300

Email: [jim@uxopro.com](mailto:jim@uxopro.com)

Web site: [www.uxopro.com](http://www.uxopro.com)