



TECHNICAL PAPER

# STANDARDIZED UXO DEMONSTRATION SITES

## PARSONS – MAGNETOMETER SCHONSTEDT/HANDHELD

*MOGULS SCORING RECORD NO. 602*

**T**echnologies under development for the detection and discrimination of unexploded ordnance (UXO) require testing so that their performance can be characterized. To that end, Standardized Test Sites have been developed at Aberdeen Proving Ground (APG), Maryland and Yuma Proving Ground (YPG), Arizona. These test sites provide a diversity of geology, climate, terrain, and weather as well as diversity in ordnance and clutter. Testing at these sites is independently administered and analyzed by the government for the purposes of characterizing technologies, tracking performance with system development, comparing performance of different systems, and comparing performance in different environments.

The Standardized UXO Technology Demonstration Site Program is a multi-agency program spearheaded by the U.S. Army Environmental Center (USAEC). The U.S. Army Aberdeen Test Center (ATC) and the U.S. Army Corps of Engineers Engineering Research and Development Center (ERDC) provide programmatic support. The program is being funded and supported by the Environmental Security Technology Certification Program (ESTCP), the Strategic Environmental Research and Development Program (SERDP) and the Army Environmental Quality Technology Program (EQT).

### DEMONSTRATOR'S SYSTEM AND DATA PROCESSING DESCRIPTION

Parsons will locate and flag detectable anomalies at the Standardized Test Sites (except the Active Response Area) using magnetometer (Mag) detection systems. Locations of detected anomalies will be surveyed and results reported on "dig sheets".

Parsons will safely locate and flag detectable magnetic anomalies using hand-held magnetometers (Schonstedt) within the Standardized UXO Technology Demonstration Site at YPG. As each anomaly is detected, its location will be marked by a pin flag.

A two-man Survey Crew will next survey the flagged locations of detected anomalies using a Real-Time Kinematic (RTK) Global Positioning System (GPS) instrument. Locations will be recorded in Universal Transverse Mercator (UTM) coordinates on the Standardized UXO Technology Demonstration Site Program Reporting Spreadsheets (Dig Sheets). The Survey Crew will use a Trimble 5700 RTK-GPS survey instrument in the Moguls Area.

### PERFORMANCE SUMMARY

Results for the Moguls test broken out by size, depth and nonstandard ordnance are presented in table below. Results by size and depth include both standard



The Magnetometer Schonstedt is shown being demonstrated by Parsons.

The Magnetometer Schonstedt was demonstrated by Parsons at the Yuma Proving Ground Standardized Demonstration Site's Moguls Area.

This technical paper contains the results of that demonstration.

This is a reference document only and does not serve as an endorsement of the demonstrator's product by the US Army or the Standardized UXO Technology Sites Program.

### For more information

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and nonstandard ordnance. The results by size show how well the demonstrator did at detecting/discriminating ordnance of a certain caliber range. The results are relative to the number of ordnance items emplaced. Depth is measured from the geometric center of anomalies.

The Response Stage results are derived from the list of anomalies above the demonstrator-provided noise level. The results for the Discrimination Stage are derived from the demonstrator's recommended threshold for optimizing UXO field cleanup by minimizing false digs and maximizing ordnance recovery. The lower 90 percent confidence limit on probability of detection and Pfp was calculated assuming that the number of detections and false positives are binomially distributed random variables. All results have been rounded to protect the ground truth. However, lower confidence limits were calculated using actual results.

The overall ground truth is composed of ferrous and non-ferrous anomalies. Due to limitations of the magnetometer, the non-ferrous items cannot be detected. Therefore, the summary presented in the "Ferrous Only" table exhibits results based on the subset of the ground truth that is solely the ferrous anomalies. The second table exhibits results based on the full ground truth. The response stage noise level and recommended discrimination stage threshold values are provided by the demonstrator.

## SUMMARY OF MOGULS RESULTS (FERROUS ONLY)

Metric	Overall	Standard	Nonstandard	By Size			By Depth, m		
				Small	Medium	Large	< 0.3	0.3 to <1	>= 1
<b>RESPONSE STAGE</b>									
P <sub>d</sub>	0.55	0.55	0.50	0.55	0.55	0.60	0.70	0.35	0.15
P <sub>d</sub> Low 90% Conf	0.48	0.48	0.40	0.43	0.42	0.41	0.60	0.24	0.01
P <sub>d</sub> Upper 90% Conf	0.61	0.68	0.62	0.64	0.65	0.75	0.77	0.49	0.45
P <sub>fa</sub>	0.75	-	-	-	-	-	0.80	0.85	0.00
P <sub>fa</sub> Low 90% Conf	0.72	-	-	-	-	-	0.75	0.54	0.00
P <sub>fa</sub> Upper 90% Conf	0.80	-	-	-	-	-	0.84	0.76	0.88
BAR	0.40	-	-	-	-	-	-	-	-
<b>DISCRIMINATION STAGE</b>									
P <sub>d</sub>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P <sub>d</sub> Low 90% Conf	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P <sub>d</sub> Upper 90% Conf	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P <sub>fa</sub>	N/A	-	-	-	-	-	-	N/A	N/A
P <sub>fa</sub> Low 90% Conf	N/A	-	-	-	-	-	-	N/A	N/A
P <sub>fa</sub> Upper 90% Conf	N/A	-	-	-	-	-	-	N/A	N/A
BAR	N/A	-	-	-	-	-	-	-	-

Response Stage Noise Level: 0.50  
Recommended Discrimination Stage Threshold: 0.50

## SUMMARY OF MOGULS RESULTS (FULL GROUND TRUTH)

Metric	Overall	Standard	Nonstandard	By Size			By Depth, m		
				Small	Medium	Large	< 0.3	0.3 to <1	>= 1
<b>RESPONSE STAGE</b>									
P <sub>d</sub>	0.45	0.45	0.45	0.40	0.55	0.60	0.55	0.30	0.15
P <sub>d</sub> Low 90% Conf	0.40	0.38	0.36	0.31	0.42	0.41	0.49	0.20	0.01
P <sub>d</sub> Upper 90% Conf	0.53	0.55	0.57	0.48	0.65	0.75	0.65	0.42	0.45
P <sub>fa</sub>	0.75	-	-	-	-	-	0.80	0.85	0.00
P <sub>fa</sub> Low 90% Conf	0.72	-	-	-	-	-	0.75	0.54	0.00
P <sub>fa</sub> Upper 90% Conf	0.80	-	-	-	-	-	0.84	0.76	0.88
BAR	0.40	-	-	-	-	-	-	-	-
<b>DISCRIMINATION STAGE</b>									
P <sub>d</sub>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P <sub>d</sub> Low 90% Conf	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P <sub>d</sub> Upper 90% Conf	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P <sub>fa</sub>	N/A	-	-	-	-	-	-	N/A	N/A
P <sub>fa</sub> Low 90% Conf	N/A	-	-	-	-	-	-	N/A	N/A
P <sub>fa</sub> Upper 90% Conf	N/A	-	-	-	-	-	-	N/A	N/A
BAR	N/A	-	-	-	-	-	-	-	-

Response Stage Noise Level: 0.50  
Recommended Discrimination Stage Threshold: 0.50

**Note:** The recommended discrimination stage threshold values are provided by the demonstrator. No discrimination algorithm was applied. Therefore, the discrimination stage results are not applicable.

To view the full Scoring Record for this demonstration and for all other demonstrations conducted at the Aberdeen and Yuma Proving Grounds in support of the Standardized UXO Technology Demonstration Sites Program please visit our Web site at: [www.uxotestsites.org](http://www.uxotestsites.org).

