TECHNICAL PAPER

STANDARDIZED UXO DEMONSTRATION SITES

AETC EM-61 HANDHELD SENSOR

BLIND GRID SCORING RECORD NO. 39

The EM-61 handheld sensor
was demonstrated by AETC, Inc.
at Aberdeen Proving Ground, Maryland.

The AETC EM-61 Handheld Sensor was demonstrated by AETC, Inc. at the Aberdeen Proving Ground Blind Grid 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.

Technologies 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, Maryland and Yuma Proving Ground, 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 US Army Environmental Center. The US Army Aberdeen Test Center and the US Army Corps of Engineers Engineering Research and Development Center provide programmatic support. The program is being funded and supported by the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, and the Army Environmental Quality Technology Program.

DEMONSTRATOR'S SYSTEM AND DATA PROCESSING DESCRIPTION

The EM61-HH consists of a sensor head mounted on a shaft, a backpack containing battery power and electronics, and a PRO 4000 field HH field computer for data acquisition. Data were collected with the EM61-HH over a fixed 6 by 6 point grid (spacing 15 cm) above the target. The grid provides good position accuracy, which is necessary for optimizing discrimination and classification performance. Typical data collection time is about five minutes per target.

EM6l-HH data are recorded using the HH field computer that is part of the standard equipment package. The data are downloaded via serial port to a notebook computer for processing. Processing and analysis on the notebook are performed using a set of IDL routines that allow display and editing of the data, calculation of the target location, depth and polarizability eigen values, determination of target size and likelihood that it is ordnance or clutter. The procedures for target fitting run significantly faster than the time required to collect the data.

Performance Summary

Results for the Blind Grid test broken out by size, depth and nonstandard ordnance are presented in the table below. Results by size and depth include both standard and nonstandard ordnance. The results by size show how well the demonstrator did at detecting or discriminating ordnance of a certain caliber range. The results are relative to the number of ordnances emplaced. Depth is measured from the geometric center of the anomaly to the ground surface.

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 probability of false positive was calculated assuming that the number of detections and false positives are binomially distributed random variables. All results in the table have been rounded to protect the ground truth. However, lower confidence limits were calculated using actual results.

Blind Grid Scoring Summary

Metric	Overall	Standard	Nonstandard	By Size			By Depth, m		
				Small	Medium	Large	< 0.3	0.3 to <1	>= 1
RESPONSE STAGE									
P_d	0.65	0.65	0.65	0.85	0.50	0.40	1.00	0.40	0.00
P_d Low 90% Conf	0.58	0.56	0.51	0.74	0.36	0.19	0.95	0.27	0.00
P_{fp}	0.65	-	-	-	-	-	0.70	0.55	0.60
P_{fp} Low 90% Conf	0.56	-	-	-	-	-	0.60	0.44	0.25
P_{ba}	0.10	-	-	-	-	-	-	-	-
DISCRIMINATION STAGE									
P_d	0.55	0.55	0.50	0.70	0.40	0.30	0.85	0.30	0.00
P_d Low 90% Conf	0.47	0.46	0.39	0.58	0.30	0.12	0.74	0.21	0.00
P_{fp}	0.30	-	-	-	-	-	0.30	0.35	0.40
P_{fp} Low 90% Conf	0.26	-	-	-	-	-	0.21	0.24	0.11
P_{ba}	0.00	-	-	-	-	-	-	-	-

Response Stage Noise Level: 40.00
Recommended Discrimination Stage Threshold: 60.00

Note: *The response stage noise level and recommended discrimination stage threshold values are provided by the demonstrator.*