AD NO. _____
DTC PROJECT NO. 8-CO-160-UXO
REPORT NO. ATC-8643 (ADDENDUM 1)

ADDENDUM 1

STANDARDIZED

UXO TECHNOLOGY DEMONSTRATION SITE

BLIND GRID SCORING RECORD NO. 39

SITE LOCATION:
ABERDEEN PROVING GROUND

DEMONSTRATOR:
AETC INCORPORATED
1225 JEFFERSON DAVIS HIGHWAY, SUITE 800
ARLINGTON, VA 22202

PREPARED BY:
U.S. ARMY ABERDEEN TEST CENTER
ABERDEEN PROVING GROUND, MD 21005-5059

OCTOBER 2003

Prepared for:
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ABERDEEN PROVING GROUND, MD 21010-5401

U.S. ARMY DEVELOPMENTAL TEST COMMAND
ABERDEEN PROVING GROUND, MD 21005-5055

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14. ABSTRACT
This firing record documents the efforts of AETC, Inc. utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. The firing record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Site Program Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

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Note: The boxed areas have been added or revised for this Addendum.

SECTION 1. GENERAL INFORMATION

1.1 BACKGROUND

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 U.S. Army Environmental Center (AEC). 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).

1.2 SCORING OBJECTIVES

The objective in the Standardized UXO Technology Demonstration Site Program is to evaluate the detection and discrimination capabilities of a given technology under various field and soil conditions. Inert munitions and clutter items are positioned in various orientations and depths in the ground.

The evaluation objectives are as follows:

a. Detection and discrimination under realistic scenarios that vary targets, geology, clutter, topography, and vegetation.

b. Cost, time and manpower requirements.

c. Ability to analyze survey data in a timely manner and provide prioritized “Target Lists” with associated confidence levels.

d. Collection of high quality, ground-truth, geo-referenced data for post-demonstration analysis.

1.2.1A Scoring Methodology

a. The scoring of the demonstrator’s performance is conducted in two stages. These two stages are termed the RESPONSE STAGE and DISCRIMINATION STAGE. For both stages, the probability of detection (P_d) and the false alarms are reported as receiver-operating

characteristic (ROC) curves. False alarms are divided into those anomalies that correspond to emplaced clutter items, measuring the probability of false positive (P_{fp}), and those that do not correspond to any known item, termed background alarms.

b. The RESPONSE STAGE scoring evaluates the ability of the system to detect emplaced targets without regard to ability to discriminate ordnance from other anomalies. For the blind grid RESPONSE STAGE, the demonstrator provides the scoring committee with a target response from each and every grid square along with a noise level below which target responses are deemed insufficient to warrant further investigation. This list is generated with minimal processing and, since a value is provided for every grid square, will include signals both above and below the system noise level.

c. The DISCRIMINATION STAGE evaluates the demonstrator's ability to correctly identify ordnance as such and to reject clutter. For the blind grid DISCRIMINATION STAGE, the demonstrator provides the scoring committee with the output of the algorithms applied in the discrimination-stage processing for each grid square. The values in this list are prioritized based on the demonstrator's determination that a grid square is likely to contain ordnance. Thus, higher output values are indicative of higher confidence that an ordnance item is present at the specified location. For digital signal processing, priority ranking is based on algorithm output. For other discrimination approaches, priority ranking is based on human (subjective) judgment. The demonstrator also specifies the threshold in the prioritized ranking that provides optimum performance, (i.e. that is expected to retain all detected ordnance and rejects the maximum amount of clutter).

d. The demonstrator is also scored on EFFICIENCY and REJECTION RATIO, which measures the effectiveness of the discrimination stage processing. The goal of discrimination is to retain the greatest number of ordnance detections from the anomaly list, while rejecting the maximum number of anomalies arising from non-ordnance items. EFFICIENCY measures the fraction of detected ordnance retained after discrimination, while the REJECTION RATIO measures the fraction of false alarms rejected. Both measures are defined relative to performance at the demonstrator-supplied level below which all responses are considered noise, i.e., the maximum ordnance detectable by the sensor and its accompanying false positive rate or background alarm rate.

e. All scoring factors are generated utilizing the Standardized UXO Probability and Plot Program, version 3.1.1.

1.2.2 Scoring Factors

Factors to be measured and evaluated as part of this demonstration include:

a. Response Stage ROC curves:

(1) Probability of Detection (P_d^{res}).

(2) Probability of False Positive (P_{fp}^{res}).

(3) Background Alarm Rate (BAR^{res}) or Probability of Background Alarm (P_{BA}^{res}).

b. Discrimination Stage ROC curves:

(1) Probability of Detection (P_d^{disc}).

(2) Probability of False Positive (P_{fp}^{disc}).

(3) Background Alarm Rate (BAR^{disc}) or Probability of Background Alarm (P_{BA}^{disc}).

c. Metrics:

(1) Efficiency (E).

(2) False Positive Rejection Rate (R_{fp}).

(3) Background Alarm Rejection Rate (R_{BA}).

d. Other:

(1) Probability of Detection by Size and Depth.

(2) Classification by type (i.e., 20-mm, 40-mm, 105-mm, etc.).

(3) Location accuracy.

(4) Equipment setup, calibration time and corresponding man-hour requirements.

(5) Survey time and corresponding man-hour requirements.

(6) Re-acquisition/resurvey time and man-hour requirements (if any).

(7) Downtime due to system malfunctions and maintenance requirements.

1.3 STANDARD AND NONSTANDARD INERT ORDNANCE TARGETS

The standard and nonstandard ordnance items emplaced in the test areas are listed in Table 1. Standardized targets are members of a set of specific ordnance items that have identical properties to all other items in the set (caliber, configuration, size, weight, aspect ratio, material, filler, magnetic remanence, and nomenclature). Nonstandard targets are ordnance items having properties that differ from those in the set of standardized targets.

TABLE 1. INERT ORDNANCE TARGETS

Standard Type	Nonstandard (NS)
20-mm Projectile M55	20-mm Projectile M55
	20-mm Projectile M97
40-mm Grenades M385	40-mm Grenades M385
40-mm Projectile MKII Bodies	40-mm Projectile M813
BDU-28 Submunition	
BLU-26 Submunition	
M42 Submunition	
57-mm Projectile APC M86	
60-mm Mortar M49A3	60-mm Mortar (JPG)
	60-mm Mortar M49
2.75-inch Rocket M230	2.75-inch Rocket M230
	2.75-inch Rocket XM229
MK 118 ROCKEYE	
81-mm Mortar M374	81-mm Mortar (JPG)
	81-mm Mortar M374
105-mm Heat Rounds M456	
105-mm Projectile M60	105-mm Projectile M60
155-mm Projectile M483A1	155-mm Projectile M483A
	500-lb Bomb

SECTION 2. DEMONSTRATION

2.1 DEMONSTRATOR INFORMATION

2.1.1 Demonstrator POC and Address

Point of contact:
(703) 413-0500

Address: AETC, Inc
1225 Jefferson Davis Highway, Suite 800
Arlington, VA 22202
(703) 413-0500

2.1.2 System Description (Provided by Demonstrator)

This is the technology demonstration for ESTCP project No. 200108, Handheld (HH) Sensor for UXO Discrimination. Additional information can be obtained from addressee provided in paragraph 2.1.1.

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 (fig.1). 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; necessary for optimizing discrimination and classification performance. Typical data collection time is about 5 minutes per target.

Figure 1. Demonstrator's system.

2.1.3 Data Processing Description (Provided by Demonstrator)

EM61-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 is done 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.

2.1.4 Data Submission Format

Data were submitted for scoring in accordance with data submission protocols outlined in the Standardized UXO Technology Demonstration Site Handbook (app E, ref 1). These data are not included in this report in order to protect ground truth information.

2.1.5 Demonstrator Quality Assurance (QA) and Quality Control (QC) (Provided by Demonstrator)

2.1.5.1 Purpose and scope. The purpose of the quality assurance plan is to set up procedures for monitoring the demonstration to ensure that the facilities, equipment, personnel, methods, practices and records are in conformance with the data quality objectives.

2.1.5.2 Quality assurance responsibilities. The Site Project Manager, working in coordination with the ATC Program Manager, is responsible for implementation of the QA Plan. The Senior Data Analyst is responsible for running data quality checks on all input files and keeping a log of data quality plots and tables. These will be kept in a master log, available for later analysis and for documentation for the demonstration report.

2.1.5.3 Data quality parameters.

a. Sensor Calibration Procedures and Quality Control Checks. Standardized procedures are used to evaluate individual sensor performance each day prior to beginning of field operations. A standard sensor challenge (steel ball) is used in a fixed sequence. The EM61 data logger is used to record the responses. The data analyst visualizes the data, evaluating the sensor responses and noise levels. The data analyst keeps a log of the responses.

b. Field Equipment Inspection, Servicing, and Maintenance. The EM61-HH sensor and supporting equipment are subject to daily inspection before work begins. Servicing and maintenance of some components (switches, connectors, etc.) can be done onsite. Repair of electronic failure of the EM61-HH driver and recording electronics must be done by Geonics. In the event of such failure, the equipment would have to be shipped back to Geonics for repair. We would then arrange for leased equipment to minimize down time.

2.1.5.4 Quality assurance reports. The Demonstration Report will contain a section dealing with quality assurance evaluations, results and recommendations.

2.1.6 Additional Records

None.

2.2 ABERDEEN PROVING GROUND SITE INFORMATION

2.2.1 Location

The APG Standardized Test Site is located within a secured range area of the Aberdeen Area of APG. The Aberdeen Area of APG is located approximately 30 miles northeast of Baltimore at the northern end of the Chesapeake Bay. The Standardized Test Site encompasses 17 acres of upland and lowland flats, woods and wetlands.

2.2.2 Soil Type

According to the soils survey conducted for the entire area of Aberdeen Proving Ground in 1998, the test site consists primarily of Elkton Series type soil (ref 2). The Elkton Series consist of very deep, slowly permeable, poorly drained soils. These soils formed in silty aeolin sediments and the underlying loamy alluvial and marine sediments. They are on upland and lowland flats and in depressions of the Mid-Atlantic Coastal Plain. Slopes range from 0 to 2 percent.

ERDC conducted a site-specific analysis in May of 2002 (ref 3). The results basically matched the soil survey mentioned above. Seventy percent of the samples taken were classified as silty loam. The majority (77 percent) of the soil samples had a measured water content between 15 and 30 percent with the water content decreasing slightly with depth.

For more details concerning the soil properties at the APG test site, go to http://aec.army.mil/usaec/technology/uxo-soils.pdf on the web to view the entire soils description report.

2.2.3 Test Areas

A description of the test site areas at APG is included in Table 2.

TABLE 2. TEST SITE AREAS

Area	Description
Calibration Grid	Contains 14 standard ordnance items buried in six positions at various angles and depths to allow demonstrator to calibrate their equipment.
Blind Test Grid	Contains 400 grid cells in a 0.2-hectare (0.5 acre) site. The center of each grid cell contains ordnance, clutter or nothing.

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SECTION 3. FIELD DATA

3.1 DATE OF FIELD ACTIVITIES (21 TO 23 OCTOBER 2002)

3.2 AREAS TESTED/NUMBER OF HOURS

Areas tested and number of hours are summarized in Table 3.

TABLE 3. AREAS TESTED AND NUMBER OF HOURS

Area	Number of Hours
Calibration Lanes	8.8
Blind Test Grid	18.3

3.3 TEST CONDITIONS

3.3.1 Weather Conditions

An ATC weather station located approximately 2 miles west of the test site was used to record average temperature and precipitation on an hourly basis for each day of operation. The temperatures listed in Table 4 represent the average temperature during field operations from 0700 through 1700 hours while the precipitation data represents a daily total amount of rainfall. Hourly weather logs used to generate this summary are provided in Appendix B.

TABLE 4. TEMPERATURE/PRECIPITATION DATA SUMMARY

Date, 2002	Average Temperature, ^{o}F	Total Daily Precipitation, in.
21 October	54.2	0.00
22 October	51.6	0.00
23 October	52.8	0.00

3.3.2 Field Conditions

AETC surveyed the blind test grid on 22 and 23 October 2002. The field was dry throughout the survey except for a couple of areas in the blind test grid that were muddy due to prior rain events before testing began.

3.3.3 Soil Moisture

The soil moisture logs are included in Appendix C. Three soil probes were placed at various locations of the site to capture soil moisture data: open field, open field lowland (wet) and open field scenario No. 1 wooded area. Measurements were collected in percent moisture and were taken twice daily (morning and afternoon) from five different soil layers (0 to 6 in., 6 to 12 in., 12 to 24 in., 24 to 36 in. and 36 to 48 in.) from each probe.

The soil moisture data collected are summarized in Table 5. The average moisture content was calculated by averaging the morning and afternoon measurements for each layer of each probe for the duration of the field operations in the Blind Grid.

TABLE 5. SOIL MOISTURE DATA SUMMARY

Layer, in.	Average Moisture Content, %	Standard Deviation, %
Open Field Probe		
0 to 6	32.78	7.04
6 to 12	27.95	9.71
12 to 24	11.63	3.86
24 to 36	30.93	17.65
36 to 48	11.95	8.49

3.4 FIELD ACTIVITIES

3.4.1 Setup/Mobilization

These activities included initial mobilization and daily equipment preparation and breakdown. The one-man crew took 30 minutes to perform the initial setup and mobilization. Equipment preparation on the next 2 days took 25 and 11 minutes while end of day equipment breakdown lasted 12 minutes. (Equipment breakdowns on the other days are captured in either calibration or demobilization times.) Daily start/stop activities totaled 48 minutes for the Blind Grid.

3.4.2 Calibration

The demonstrator spent 8 hours and 45 minutes in the calibration lanes on 21 October 2002. No calibration activities were conducted while operating in the blind grid.

3.4.3 Downtime Occasions

Occasions of downtime are grouped into five categories: equipment/data checks or equipment maintenance, equipment failure and repair, weather, Demonstration Site issues, or breaks/lunch. All downtime is included for the purposes of calculating labor costs (section 5) except for downtime due to Demonstration Site issues. Demonstration Site issues, while noted in the Daily Log, are considered nonchargeable downtime for the purposes of calculating labor costs and are not discussed. Breaks and lunches are not discussed either.

3.4.3.1 Equipment/data checks, maintenance. The demonstrator prepared for the first run of daily operations and set up flags. Total downtime due to equipment/data checks or maintenance was 1.07 hours.

3.4.3.2 Equipment failure or repair. Six minutes elapsed when the data-logger battery failed. AETC had a replacement battery on hand. No other incidents occurred.

3.4.3.3 Weather. No delays occurred due to weather.

3.4.4 Data Collection

The demonstrator spent 14 hours and 57 minutes collecting data in the blind grid. This time excludes break/lunches, and downtimes described in section 3.4.3.

3.4.5 Demobilization

It took the one-man crew 15 minutes to break down and pack equipment for demobilization.

3.5 PROCESSING TIME

AETC submitted the raw data from demonstration activities on the last day of the demonstration, as required. The scoring submission data were also provided within the required 30-day timeframe. Issues outside of the demonstrator's control required data to be resubmitted on multiple occasions. On each occasion, the demonstrator was responsive and timely.

3.6 DEMONSTRATOR'S FIELD PERSONNEL

3.7 DEMONSTRATOR'S FIELD SURVEYING METHOD

AETC started surveying the blind test grid in the northeast portion and surveyed in an east/west direction.

One lane would be surveyed and then the demonstrator would return to the beginning of the next lane (example: 1A, 1B, 1C then 2A, 2B, 2C). Flags were placed in the polyvinyl chloride (PVC) pipes delineating the corner of each grid. A 1- by 1-meter wooden grid with a series of cut outs was then placed over each grid. The demonstrator surveyed each hole and recorded the data.

3.8 SUMMARY OF DAILY LOGS

One incident occurred during the demonstration. A data logger battery went dead and was replaced accounting for 6 minutes of downtime. No other significant events occurred during the demonstration. Appendix D contains a detailed description of field operations.

SECTION 4. TECHNICAL PERFORMANCE RESULTS

4.1A ROC CURVES USING ALL ORDNANCE CATEGORIES

Figure 2 shows the probability of detection for the response stage (P_d^{res}) and the discrimination stage (P_d^{disc}) versus their respective probability of false positive. Figure 3 shows both probabilities plotted against their respective probability of background alarm. Both figures use horizontal lines to illustrate the performance of the demonstrator at two demonstrator-specified points: at the system noise level for the response stage, representing the point below which targets are not considered detectable, and at the demonstrator's recommended threshold level for the discrimination stage, defining the subset of targets the demonstrator would recommend digging based on discrimination. Note that all points have been rounded to protect the ground truth.

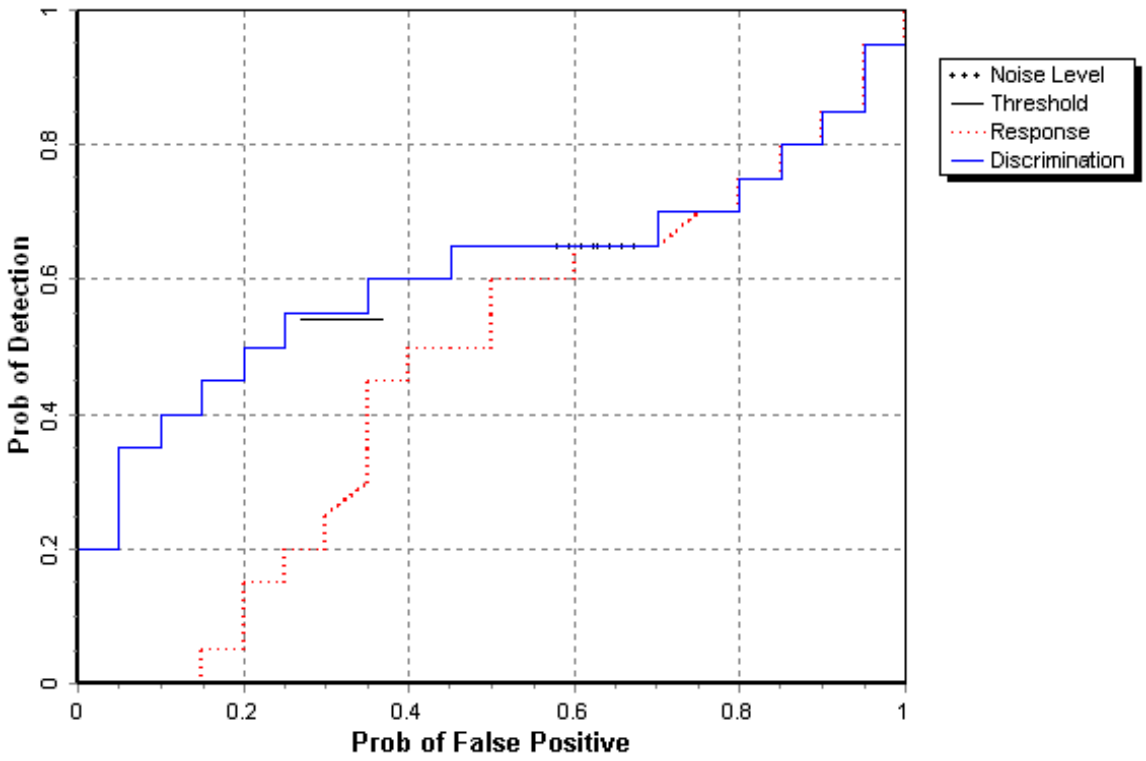

Figure 2. Blind grid probability of detection for response and discrimination stages versus their respective probability of false positive over all ordnance categories combined.

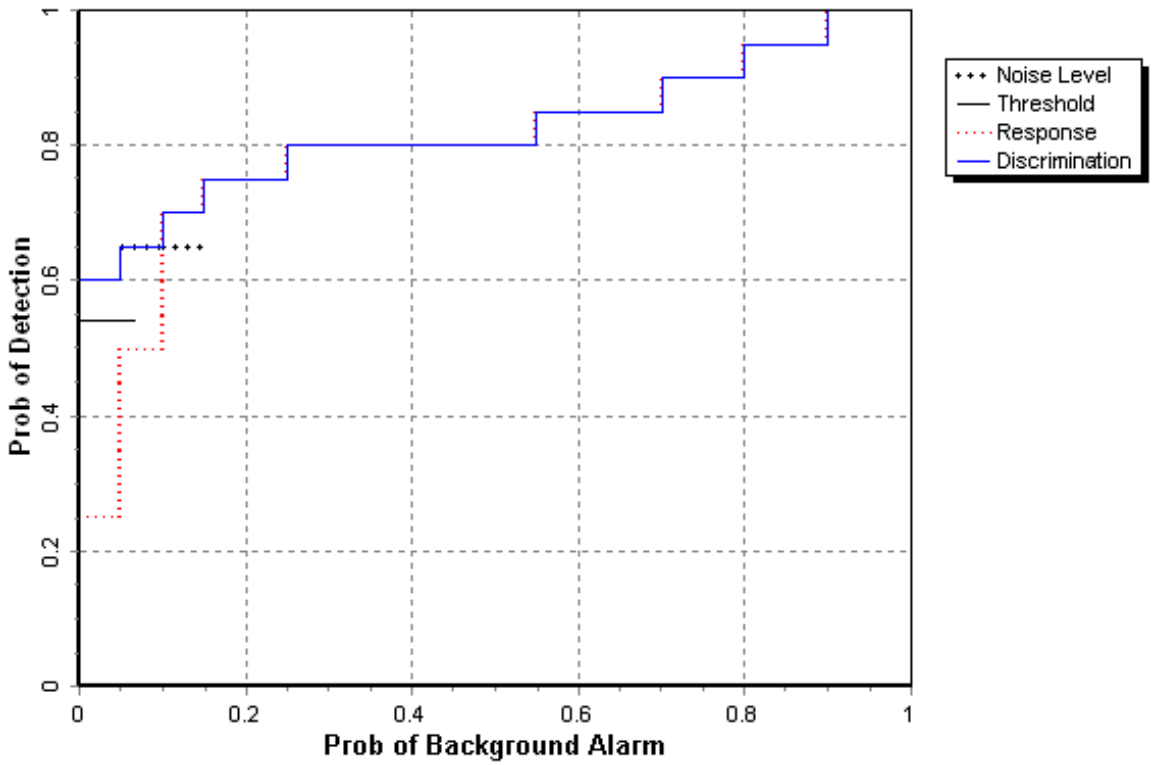

Figure 3. Blind grid probability of detection for response and discrimination stages versus their respective probability of background alarm over all ordnance categories combined.

4.2A ROC CURVES USING ORDNANCE LARGER THAN 20 MM

Figure 4 shows the probability of detection for the response stage (P_d^{res}) and the discrimination stage (P_d^{disc}) versus their respective probability of false positive when only targets larger than 20-mm are scored. Figure 5 shows both probabilities plotted against their respective probability of background alarm. Both figures use horizontal lines to illustrate the performance of the demonstrator at two demonstrator-specified points: at the system noise level for the response stage, representing the point below which targets are not considered detectable, and at the demonstrator's recommended threshold level for the discrimination stage, defining the subset of targets the demonstrator would recommend digging based on discrimination. Note that all points have been rounded to protect the ground truth.

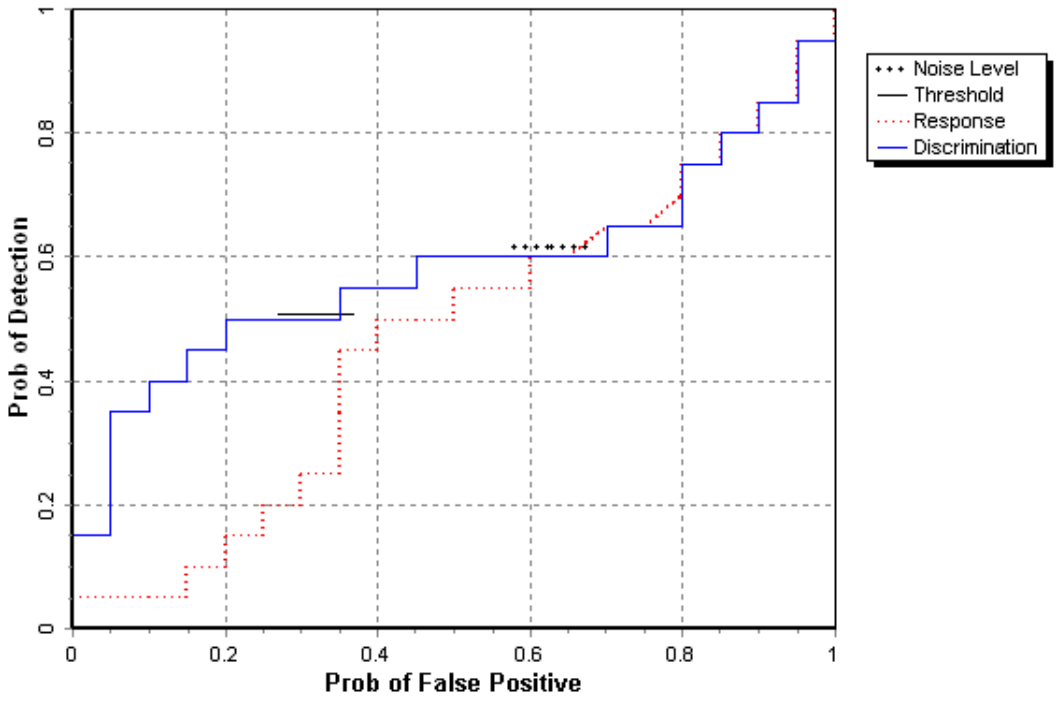

Figure 4. Blind grid probability of detection for response and discrimination stages versus their respective probability of false positive for all ordnance larger than 20 mm.

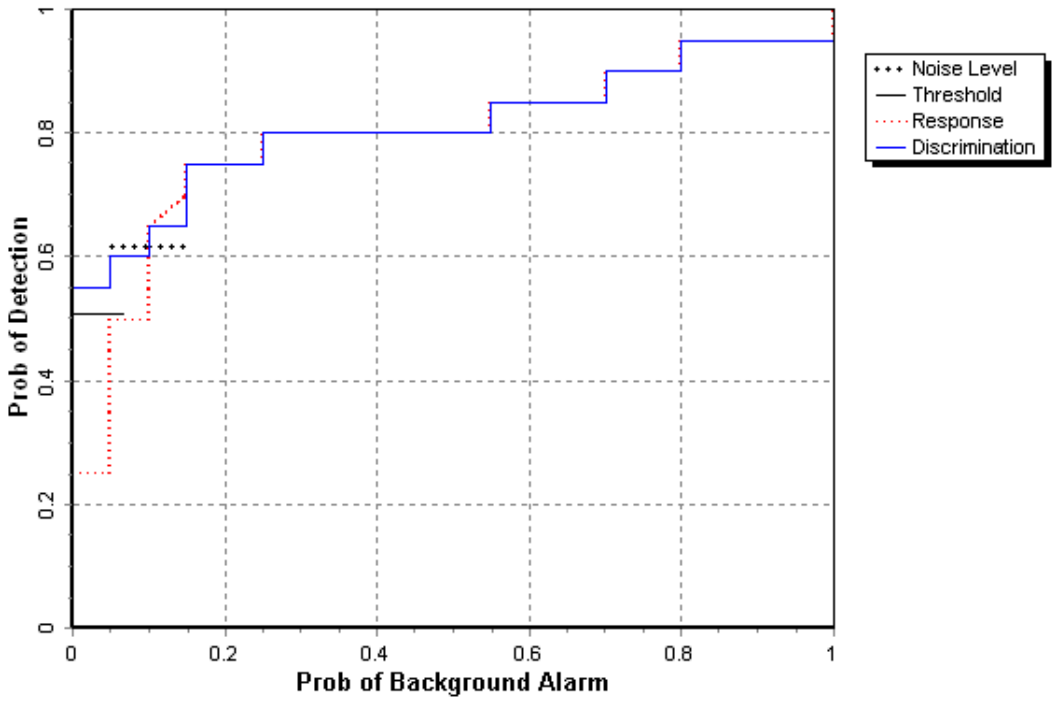

Figure 5. Blind grid probability of detection for response and discrimination stages versus their respective probabilities of background alarm for all ordnance larger than 20 mm.

4.3A PERFORMANCE SUMMARIES

Results for the Blind Grid test broken out by size, depth and nonstandard ordnance are presented in Table 6. (For cost results, see section 5.) Results by size and depth include both standard and nonstandard ordnance. The results by size show how well the demonstrator did at detecting/discriminating ordnance of a certain caliber range. (See Appendix A for size definitions.) The results are relative to the number of ordnances emplaced. Depth is measured from the closest point of 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 Table 6 have been rounded to protect the ground truth. However, lower confidence limits were calculated using actual results.

TABLE 6. SUMMARY OF BLIND GRID RESULTS

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.

4.4A EFFICIENCY, REJECTION RATES, AND TYPE CLASSIFICATION

Efficiency and rejection rates are calculated to quantify the discrimination ability at specific points of interest on the ROC curve: (1) at the point where no decrease in P_d is suffered (i.e., the efficiency is by definition equal to one) and (2) at the operator selected threshold. These values are reported in Table 7.

TABLE 7. EFFICIENCY AND REJECTION RATES

	Efficiency (E)	False Positive Rejection Rate	Background Alarm Rejection Rate
At Operating Point	0.83	0.49	0.81
With No Loss of P_d	1.00	0.10	0.29

At the demonstrator's recommended setting, the ordnance items that were detected and correctly discriminated were further scored on whether their correct type could be identified (table 8). Correct type examples include "20-mm projectile, 105 HEAT Projectile, and 2.75-in. Rocket". A list of the standard type declaration required for each ordnance item was provided to demonstrators prior to testing. For example, the standard type for the three example items are 20mmP, 105H, and 2.75in, respectively.

TABLE 8. CORRECT TYPE CLASSIFICATION OF TARGETS CORRECTLY DISCRIMINATED AS UXO

Size	% Correct
Small	93.1
Medium	53.8
Large	66.7
Overall	80.0

4.5 LOCATION ACCURACY

The mean location error and standard deviations appear in Table 9. These calculations are based on average missed depth for ordnance correctly identified in the discrimination stage. Depths are measured from the closest point of the ordnance to the surface. For the blind grid, only depth errors are calculated, since (x, y) positions are known to be the centers of each grid square.

TABLE 9. MEAN LOCATION ERROR AND STANDARD DEVIATION (M)

	Mean	Standard Deviation
Depth	0.10	0.04

SECTION 5. ON-SITE LABOR COSTS

A standardized estimate for labor costs associated with this effort was calculated as follows: the first person at the test site was designated "supervisor", the second person was designated "data analyst", and the third and following personnel were considered "field support". Standardized hourly labor rates were charged by title: supervisor at $95.00/hour, data analyst at $57.00/hour, and field support at $28.50/hour.

Government representatives monitored on-site activity. All on-site activities were grouped into one of ten categories: initial setup/mobilization, daily setup/stop, calibration, collecting data, downtime due to break/lunch, downtime due to equipment failure, downtime due to equipment/data checks or maintenance, downtime due to weather, downtime due to demonstration site issue, or demobilization. See Appendix D for the daily activity log. See section 3.4 for a summary of field activities.

The standardized cost estimate associated with the labor needed to perform the field activities is presented in Table 10. Note that calibration time includes time spent in the Calibration Lanes as well as field calibrations. "Site survey time" includes daily setup/stop time, collecting data, breaks/lunch, downtime due to equipment/data checks or maintenance, downtime due to failure, and downtime due to weather.

TABLE 10. ON-SITE LABOR COSTS

	No. People	Hourly Wage	Hours	Cost
INITIAL SETUP				
Supervisor	1	$95.00	0.50	$47.50
Data Analyst	0	57.00	0.00	0.00
Field Support	0	28.50	0.00	0.00
Subtotal				**$47.50**
CALIBRATION				
Supervisor	1	$95.00	8.75	$831.25
Data Analyst	0	57.00	0.00	0.00
Field Support	0	28.50	0.00	0.00
Subtotal				**$831.25**
SITE SURVEY				
Supervisor	1	$95.00	18.33	$1741.35
Data Analyst	0	57.00	0.00	0.00
Field Support	0	28.50	0.00	0.00
Subtotal				**$1741.35**

See notes at end of table.

TABLE 10 (CONT'D)

	No. People	Hourly Wage	Hours	Cost
DEMOBILIZATION				
Supervisor	1	$95.00	0.25	$23.75
Data Analyst	0	57.00	0.00	0.00
Field Support	0	28.50	0.00	0.00
Subtotal				**$23.75**
TOTAL				**$2,643.85**

Notes: Calibration time includes time spent in the Calibration Lanes as well as calibration before each data run.

Site Survey time includes daily setup/stop time, collecting data, breaks/lunch, downtime due to system maintenance, failure, and weather.

SECTION 6. COMPARISON OF RESULTS TO DATE

No comparisons to date.

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SECTION 7. APPENDIXES

APPENDIX A. TERMS AND DEFINITIONS

GENERAL DEFINITIONS

Anomaly: Location of a system response deemed to warrant further investigation by the demonstrator for consideration as an emplaced ordnance item.

Detection: An anomaly location that is within R_{halo} of an emplaced ordnance item.

Emplaced Ordnance: An ordnance item buried by the government at a specified location in the test site.

Emplaced Clutter: A clutter item (i.e. non-ordnance item) buried by the government at a specified location in the test site.

R_{halo}: A predetermined radius about the periphery of an emplaced item (clutter or ordnance) within which a location identified by the demonstrator as being of interest is considered to be a response from that item. If multiple declarations lie within R_{halo} of any item (clutter or ordnance), the declaration with the highest signal output within the R_{halo} will be utilized. For the purpose of this program, a circular halo 0.5 meter in radius will be placed around the center of the object for all clutter and ordnance items less than 0.6 meter in length. When ordnance items are longer than 0.6 meter, the halo becomes an ellipse where the minor axis remains 1 meter and the major axis is equal to the length of the ordnance plus 1 meter.

Small Ordnance: Caliber of ordnance less than or equal to 40 mm (includes 20-mm projectile, 40-mm projectile, submunitions BLU-26, BLU-63, and M42).

Medium Ordnance: Caliber of ordnance greater than 40-mm and less than or equal to 81-mm (includes 57-mm projectile, 60-mm mortar, 2.75-in. Rocket, MK118 Rockeye, 81-mm mortar).

Large Ordnance: Caliber of ordnance greater than 81-mm (includes 105-mm HEAT, 105-mm projectile, 155-mm projectile, 500 pound bomb).

Shallow: Items buried less than 0.3 meter below ground surface.

Medium: Items buried greater than or equal to 0.3 meter and less than 1 meter below ground surface.

Deep: Items buried greater than or equal to 1 meter below ground surface.

Response Stage Noise Level: The level that represents the point below which anomalies are not considered detectable. Demonstrators are required to provide the recommended noise level for the Blind Grid Test area.

Discrimination Stage Threshold: The demonstrator selected threshold level that they believe provides optimum performance of the system by retaining all detectable ordnance and rejecting the maximum amount of clutter. This level defines the subset of anomalies the demonstrator would recommend digging based on discrimination.

Binomially Distributed Random Variable: A random variable of the type which has only two possible outcomes, say success and failure, is repeated for n independent trials with the probability p of success and the probability 1-p of failure being the same for each trial. The number of successes x observed in the n trials is an estimate of p and is considered to be a binomially distributed random variable.

RESPONSE AND DISCRIMINATION STAGE DATA

The scoring of the demonstrator's performance is conducted in two stages. These two stages are termed the RESPONSE STAGE and DISCRIMINATION STAGE. For both stages, the probability of detection (P_d) and the false alarms are reported as receiver operating characteristic (ROC) curves. False alarms are divided into those anomalies that correspond to emplaced clutter items, measuring the probability of false positive (P_{fp}) and those that do not correspond to any known item, termed background alarms.

The RESPONSE STAGE scoring evaluates the ability of the system to detect emplaced targets without regard to ability to discriminate ordnance from other anomalies. For the RESPONSE STAGE, the demonstrator provides the scoring committee with the location and signal strength of all anomalies that the demonstrator has deemed sufficient to warrant further investigation and/or processing as potential emplaced ordnance items. This list is generated with minimal processing (e.g., this list will include all signals above the system noise threshold). As such, it represents the most inclusive list of anomalies.

The DISCRIMINATION STAGE evaluates the demonstrator's ability to correctly identify ordnance as such, and to reject clutter. For the same locations as in the RESPONSE STAGE anomaly list, the DISCRIMINATION STAGE list contains the output of the algorithms applied in the discrimination-stage processing. This list is prioritized based on the demonstrator's determination that an anomaly location is likely to contain ordnance. Thus, higher output values are indicative of higher confidence that an ordnance item is present at the specified location. For electronic signal processing, priority ranking is based on algorithm output. For other systems, priority ranking is based on human judgment. The demonstrator also selects the threshold that the demonstrator believes will provide "optimum" system performance, (i.e., that retains all the detected ordnance and rejects the maximum amount of clutter).

Note: The two lists provided by the demonstrator contain identical numbers of potential target locations. They differ only in the priority ranking of the declarations.

RESPONSE STAGE DEFINITIONS

Response Stage Probability of Detection (P_d^{res}): P_d^{res} = (No. of response-stage detections)/ (No.of emplaced ordnance in the test site).

Response Stage False Positive (fp^{res}): An anomaly location that is within R_{halo} of an emplaced clutter item.

Response Stage Probability of False Positive (P_{fp}^{res}): P_{fp}^{res} = (No. of response-stage false positives)/(No. of emplaced clutter items).

Response Stage Background Alarm (ba^{res}): An anomaly in a blind grid cell that contains neither emplaced ordnance nor an emplaced clutter item. An anomaly location in the open field or scenarios that is outside R_{halo} of any emplaced ordnance or emplaced clutter item.

Response Stage Probability of Background Alarm (P_{ba}^{res}): Blind Grid only: P_{ba}^{res} = (No. of response-stage background alarms)/(No. of empty grid locations).

Response Stage Background Alarm Rate (BAR^{res}): Open Field only: BAR^{res} = (No. of response-stage background alarms)/(arbitrary constant).

Note that the quantities P_d^{res}, P_{fp}^{res}, P_{ba}^{res}, and BAR^{res} are functions of t^{res}, the threshold applied to the response-stage signal strength. These quantities can therefore be written as $P_d^{res}(t^{res})$, $P_{fp}^{res}(t^{res})$, $P_{ba}^{res}(t^{res})$, and $BAR^{res}(t^{res})$.

DISCRIMINATION STAGE DEFINITIONS

Discrimination: The application of a signal processing algorithm or human judgment to response-stage data that discriminates ordnance from clutter. Discrimination should identify anomalies that the demonstrator has high confidence correspond to ordnance, as well as those that the demonstrator has high confidence correspond to nonordnance or background returns. The former should be ranked with highest priority and the latter with lowest.

Discrimination Stage Probability of Detection (P_d^{disc}): P_d^{disc} = (No. of discrimination-stage detections)/(No. of emplaced ordnance in the test site).

Discrimination Stage False Positive (fp^{disc}): An anomaly location that is within R_{halo} of an emplaced clutter item.

Discrimination Stage Probability of False Positive (P_{fp}^{disc}): P_{fp}^{disc} = (No. of discrimination stage false positives)/(No. of emplaced clutter items).

Discrimination Stage Background Alarm (ba^{disc}): An anomaly in a blind grid cell that contains neither emplaced ordnance nor an emplaced clutter item. An anomaly location in the open field or scenarios that is outside R_{halo} of any emplaced ordnance or emplaced clutter item.

Discrimination Stage Probability of Background Alarm (P_{ba}^{disc}): P_{ba}^{disc} = (No. of discrimination-stage background alarms)/(No. of empty grid locations).

Discrimination Stage Background Alarm Rate (BAR^{disc}): BAR^{disc} = (No. of discrimination-stage background alarms)/(arbitrary constant).

Note that the quantities P_d^{disc}, P_{fp}^{disc}, P_{ba}^{disc}, and BAR^{disc} are functions of t^{disc}, the threshold applied to the discrimination-stage signal strength. These quantities can therefore be written as $P_d^{disc}(t^{disc})$, $P_{fp}^{disc}(t^{disc})$, $P_{ba}^{disc}(t^{disc})$, and $BAR^{disc}(t^{disc})$.

RECEIVER-OPERATING CHARACERISTIC (ROC) CURVES

ROC curves at both the response and discrimination stages can be constructed based on the above definitions. The ROC curves plot the relationship between P_d vs. P_{fp} and P_d vs. BAR or P_{ba} as the threshold applied to the signal strength is varied from its minimum (t_{min}) to its maximum (t_{max}) value.[1] Figure A-1 shows how P_d vs. P_{fp} and P_d vs. BAR are combined into ROC curves. Note that the "res" and "disc" superscripts have been suppressed from all the variables for clarity.

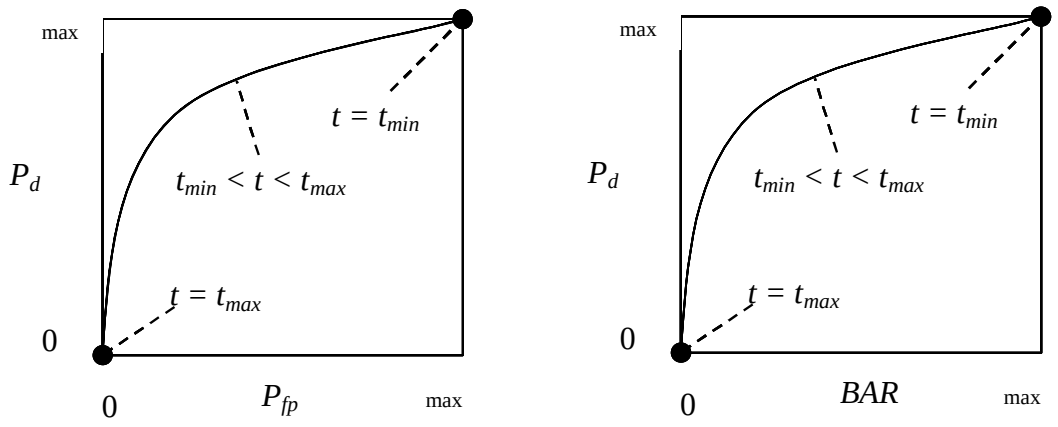

Figure A-1. ROC curves for open-field testing. Each curve applies to both the response and discrimination stages.

[1]Strictly speaking, ROC curves plot the P_d vs. P_{ba} over a predetermined and fixed number of detection opportunities (some of the opportunities are located over ordnance and others are located over clutter or blank spots). In an open field scenario, each system suppresses its signal strength reports until some bare-minimum signal response is received by the system. Consequently, the open field ROC curves do not have information from low signal-output locations, and, furthermore, different contractors report their signals over a different set of locations on the ground. These ROC curves are thus not true to the strict definition of ROC curves as defined in textbooks on detection theory. Note, however, that the ROC curves obtained in the Blind Grid test sites are true ROC curves.

METRICS TO CHARACTERIZE THE DISCRIMINATION STAGE

The demonstrator is also scored on efficiency and rejection ratio, which measure the effectiveness of the discrimination stage processing. The goal of discrimination is to retain the greatest number of ordnance detections from the anomaly list, while rejecting the maximum number of anomalies arising from nonordnance items. The efficiency measures the amount of detected ordnance retained by the discrimination, while the rejection ratio measures the fraction of false alarms rejected. Both measures are defined relative to the entire response list, i.e., the maximum ordnance detectable by the sensor and its accompanying false positive rate or background alarm rate.

Efficiency (E): $E = P_d^{disc}(t^{disc})/P_d^{res}(t_{min}^{res})$; Measures (at a threshold of interest), the degree to which the maximum theoretical detection performance of the sensor system (as determined by the response stage tmin) is preserved after application of discrimination techniques. Efficiency is a number between 0 and 1. An efficiency of 1 implies that all of the ordnance initially detected in the response stage was retained at the specified threshold in the discrimination stage, t^{disc}.

False Positive Rejection Rate (R_{fp}): $R_{fp} = 1 - [P_{fp}^{disc}(t^{disc})/P_{fp}^{res}(t_{min}^{res})]$; Measures (at a threshold of interest), the degree to which the sensor system's false positive performance is improved over the maximum false positive performance (as determined by the response stage tmin). The rejection rate is a number between 0 and 1. A rejection rate of 1 implies that all emplaced clutter initially detected in the response stage were correctly rejected at the specified threshold in the discrimination stage.

Background Alarm Rejection Rate (R_{ba}):

BLIND GRID: $R_{ba} = 1 - [P_{ba}^{disc}(t^{disc})/P_{ba}^{res}(t_{min}^{res})]$.
OPEN FIELD: $R_{ba} = 1 - [BAR^{disc}(t^{disc})/BAR^{res}(t_{min}^{res})])$.

Measures the degree to which the discrimination stage correctly rejects background alarms initially detected in the response stage. The rejection rate is a number between 0 and 1. A rejection rate of 1 implies that all background alarms initially detected in the response stage were rejected at the specified threshold in the discrimination stage.

(Page A-6 Blank)

APPENDIX B. DAILY WEATHER LOGS

TABLE B-1. WEATHER LOG

DCP 7 Data from Phillips Airfield							
Date	Time, EDST	Average Temperature, °F	Maximum Temperature, °F	Minimum Temperature, °F	RH, %	Station Pressure, in. Hg	Precipitation, in.
21-Sep-02	2:00	44.3	46.1	43.1	98	30.00	0.00
21-Sep-02	3:00	44.3	46.4	43.0	96	30.00	0.00
21-Sep-02	4:00	46.2	47.2	44.4	90	29.99	0.00
21-Sep-02	5:00	45.5	47.0	43.8	91	29.99	0.00
21-Sep-02	6:00	46.7	48.6	43.8	87	30.00	0.00
21-Sep-02	7:00	48.3	48.8	47.9	80	30.02	0.00
21-Sep-02	8:00	48.2	48.8	47.7	79	30.04	0.00
21-Sep-02	9:00	49.0	50.6	47.9	77	30.07	0.00
21-Sep-02	10:00	50.7	52.6	49.9	71	30.09	0.00
21-Sep-02	11:00	53.7	56.2	51.8	62	30.09	0.00
21-Sep-02	12:00	55.4	56.6	54.3	56	30.09	0.00
21-Sep-02	13:00	56.8	58.0	55.7	52	30.08	0.00
21-Sep-02	14:00	58.4	59.3	57.8	49	30.05	0.00
21-Sep-02	15:00	58.4	59.1	57.5	46	30.04	0.00
21-Sep-02	16:00	59.3	60.2	58.4	44	30.04	0.00
21-Sep-02	17:00	58.4	59.1	57.7	46	30.04	0.00
21-Sep-02	18:00	56.8	58.0	54.5	49	30.04	0.00
21-Sep-02	19:00	51.8	54.8	49.3	66	30.06	0.00
21-Sep-02	20:00	48.4	50.0	46.1	77	30.07	0.00
21-Sep-02	21:00	45.8	46.7	45.0	87	30.08	0.00
21-Sep-02	22:00	43.8	45.6	42.5	93	30.09	0.00
21-Sep-02	23:00	42.1	42.9	41.0	95	30.10	0.00
21-Sep-02	23:59	41.5	44.6	39.9	93	30.12	0.00
22-Sep-02	1:00	42.9	44.3	41.0	84	30.12	0.00
22-Sep-02	2:00	43.6	44.7	41.9	79	30.12	0.00
22-Sep-02	3:00	44.2	44.6	43.6	74	30.12	0.00
22-Sep-02	4:00	42.2	44.3	39.5	79	30.11	0.00
22-Sep-02	5:00	40.1	41.0	38.9	86	30.12	0.00
22-Sep-02	6:00	38.5	40.1	36.9	91	30.13	0.00
22-Sep-02	7:00	36.7	37.9	35.7	94	30.15	0.00
22-Sep-02	8:00	36.5	38.7	35.5	96	30.15	0.00
22-Sep-02	9:00	42.6	46.1	38.4	83	30.17	0.00
22-Sep-02	10:00	48.2	50.0	45.8	75	30.18	0.00
22-Sep-02	11:00	51.0	52.3	49.8	70	30.18	0.00
22-Sep-02	12:00	54.1	56.1	52.1	65	30.17	0.00
22-Sep-02	13:00	57.9	59.6	55.5	54	30.15	0.00
22-Sep-02	14:00	59.5	60.4	58.4	49	30.12	0.00
22-Sep-02	15:00	60.6	61.7	59.8	44	30.11	0.00
22-Sep-02	16:00	60.2	61.0	59.6	44	30.10	0.00
22-Sep-02	17:00	60.1	60.7	59.3	46	30.10	0.00
22-Sep-02	18:00	58.3	59.7	56.2	51	30.10	0.00
22-Sep-02	19:00	52.9	56.5	49.5	67	30.10	0.00

TABLE B-1 (CONT'D)

DCP 7 Data from Phillips Airfield							
Date	Time, EDST	Average Temperature, °F	Maximum Temperature, °F	Minimum Temperature, °F	RH, %	Station Pressure, in. Hg	Precipitation, in.
22-Sep-02	20:00	47.7	49.9	45.7	85	30.12	0.00
22-Sep-02	21:00	45.1	46.1	43.8	92	30.13	0.00
22-Sep-02	22:00	43.9	45.0	42.3	95	30.13	0.00
22-Sep-02	23:00	42.6	43.1	42.2	98	30.14	0.00
22-Sep-02	23:59	41.9	43.0	41.2	98	30.13	0.00
23-Sep-02	1:00	41.0	41.8	40.3	99	30.13	0.00
23-Sep-02	2:00	40.4	41.0	39.4	100	30.13	0.00
23-Sep-02	3:00	39.9	40.5	38.8	100	30.13	0.00
23-Sep-02	4:00	39.3	40.0	38.5	100	30.13	0.00
23-Sep-02	5:00	39.2	40.0	37.9	100	30.13	0.00
23-Sep-02	6:00	39.2	39.9	38.0	100	30.12	0.00
23-Sep-02	7:00	38.9	39.7	38.1	100	30.12	0.00
23-Sep-02	8:00	38.5	39.8	37.7	100	30.14	0.00
23-Sep-02	9:00	43.1	46.7	39.4	98	30.16	0.00
23-Sep-02	10:00	50.1	55.0	46.6	90	30.18	0.00
23-Sep-02	11:00	56.8	58.4	54.4	75	30.19	0.00
23-Sep-02	12:00	58.8	59.6	57.9	66	30.19	0.00
23-Sep-02	13:00	59.9	60.5	59.0	61	30.19	0.00
23-Sep-02	14:00	59.4	60.0	58.2	59	30.19	0.00
23-Sep-02	15:00	59.5	60.9	58.4	55	30.19	0.00
23-Sep-02	16:00	58.2	59.6	57.4	56	30.19	0.00
23-Sep-02	17:00	58.0	58.6	57.4	57	30.19	0.00
23-Sep-02	18:00	56.7	57.8	55.4	56	30.21	0.00
23-Sep-02	19:00	53.7	55.5	52.1	64	30.23	0.00
23-Sep-02	20:00	52.1	52.7	51.3	67	30.25	0.00
23-Sep-02	21:00	52.1	52.7	51.2	60	30.27	0.00
23-Sep-02	22:00	51.3	51.8	50.5	60	30.29	0.00
23-Sep-02	23:00	50.7	51.2	50.0	56	30.30	0.00
23-Sep-02	23:59	49.9	50.4	49.3	57	30.30	0.00
							0.00

APPENDIX C. SOIL MOISTURE

UXO SOIL MOISTURE PROBES DATA
11/20/2002

Rec#: 48

1. Item ID (Vender) AETC 2. Date: 10/21/2002

3. Start Time: 835 4. Stop Time 1439

5. Data Collectors Name

---------- REPEAT SECTION ----------

	Morning % Moisture		Afternoon % Moisture	
Wet Area	Time:	854	Time:	1439
1		62.2		47.2
2		59.1		57.6
3		67.1		7.8
4		55.9		29.5
5		52.0		15.5
Tree Area	Time:	845	Time:	1429
1		45.2		35.8
2		63.1		62.2
3		31.8		40.6
4		4.4		0.6
5		0.0		9.4
Other Area	Time:	835	Time:	1419
1		27.0		26.4
2		20.0		19.2
3		14.8		15.1
4		40.9		38.2
5		19.5		19.1

UXO SOIL MOISTURE PROBES DATA

Rec#: 49

1. Item ID (Vender) AETC 2. Date: 10/23/2002

3. Start Time: 747 4. Stop Time 1423

5. Data Collectors Name

---------- REPEAT SECTION ----------

	Morning % Moisture		Afternoon % Moisture	
Wet Area	Time:	805	Time:	1423
1		39.9		39.5
2		71.1		67.3
3		77.8		71.1
4		4.5		4.5
5		4.6		4.6
Tree Area	Time:	756	Time:	1414
1		27.3		24.2
2		41.1		35.7
3		36.1		37.4
4		2.3		2.6
5		5.7		4.6
Other Area	Time:	747	Time:	1405
1		39.5		38.2
2		37.7		34.9
3		7.8		8.8
4		40.1		4.5
5		4.6		4.6

APPENDIX D. DAILY ACTIVITY LOGS

Date	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions	
20021021	1	NA	810	840	30	INITIAL SET-UP	START OF TESTING OPERATIONS	OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	840	913	33	DOWNTIME DUE TO EQUIP MAINT/CHECK	PREPARING FOR THE FIRST RUN OF OPERATIONS	OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	913	1013	60	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021021	1	CALIBRATION LANES	1013	1025	12	DOWNTIME DUE TO EQUIP MAINT/CHECK		OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	1025	1042	17	DOWNTIME DUE TO EQUIP MAINT/CHECK		OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	1042	1159	77	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021021	1	CALIBRATION LANES	1159	1208	9	DOWNTIME DUE TO EQUIP MAINT/CHECK		OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	1208	1216	8	DOWNTIME DUE TO EQUIP MAINT/CHECK		OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	1216	1404	108	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021021	1	CALIBRATION LANES	1404	1414	10	BREAK/LUNCH	NO ACTION	OTHER	NA	NA	NA	NA
20021021	1	CALIBRATION LANES	1414	1710	176	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021021	1	CALIBRATION LANES	1710	1725	15	DAILY START, STOP	END OF DAILY OPERATIONS / EQUIPMENT BREAKDOWN	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	700	725	25	DAILY START, STOP	START OF DAILY OPERATIONS / EQUIPMENT PREPARATIONS	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	725	745	20	DOWNTIME DUE TO EQUIP MAINT/CHECK	SET UP FLAGS	OTHER	NA	NA	NA	NA

Date	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions	
20021022	1	BLIND TEST GRID	745	802	17	BREAK/LUNCH	BREAK	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	802	940	98	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021022	1	BLIND TEST GRID	940	948	8	BREAK/LUNCH	BREAK	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	948	1250	182	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021022	1	BLIND TEST GRID	1250	1256	6	DOWNTIME DUE TO EQUIPMENT FAILURE	DEAD BATTERY / NEEDED TO BE REPLACED	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	1256	1312	16	BREAK/LUNCH	LUNCH BREAK	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	1312	1618	186	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021022	1	BLIND TEST GRID	1618	1628	10	DOWNTIME DUE TO EQUIP MAINT/CHECK	SETTING UP FLAGS	OTHER	NA	NA	NA	NA
20021022	1	BLIND TEST GRID	1628	1640	12	DAILY START, STOP	END OF DAILY OPERATIONS / EQUIPMENT BREAKDOWN	OTHER	NA	NA	NA	NA
20021023	1	BLIND TEST GRID	720	731	11	DAILY START, STOP	START OF DAILY OPERATIONS / EQUIPMENT SET-UP	OTHER	NA	NA	NA	NA
20021023	1	BLIND TEST GRID	731	748	17	DOWNTIME DUE TO EQUIP MAINT/CHECK	PREPARING FOR THE FIRST RUN OF THE DAILY OPERATIONS	PIN FLAGS	FLAGS	NA	NA	NA
20021023	1	BLIND TEST GRID	748	759	11	BREAK/LUNCH	BREAK	OTHER	NA	NA	NA	NA
20021023	1	BLIND TEST GRID	759	945	106	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021023	1	BLIND TEST GRID	945	952	7	BREAK/LUNCH	BREAK	OTHER	NA	NA	NA	NA
20021023	1	BLIND TEST GRID	952	1202	130	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021023	1	BLIND TEST GRID	1202	1220	18	BREAK/LUNCH	LUNCH	OTHER	NA	NA	NA	NA

Date	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions	
20021023	1	BLIND TEST GRID	1220	1237	17	DOWNTIME DUE TO EQUIP MAINT/CHECK	SET UP FLAGS	PIN FLAGS	FLAGS	NA	NA	NA
20021023	1	BLIND TEST GRID	1237	1400	83	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021023	1	BLIND TEST GRID	1400	1407	7	BREAK/LUNCH	BREAK	OTHER	NA	NA	NA	NA
20021023	1	BLIND TEST GRID	1407	1600	113	COLLECTING DATA		PIN FLAGS	FLAGS	LINEAR	CLEAR/UNLIMITED	WET
20021023	1	NA	1600	1615	15	DEMOBILIZATION	END OF DAILY OPERATIONS / EQUIPMENT BREAKDOWN	OTHER	NA	NA	NA	NA

APPENDIX E. REFERENCES

1. Standardized UXO Technology Demonstration Site Handbook, DTC Project No. 8-CO-160-000-473, Report No. ATC-8349, March 2002.

2. Aberdeen Proving Ground Soil Survey Report, October 1998.

3. Data Summary, UXO Standardized Test Site: APG Soils Description, May 2002.

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APPENDIX F. ABBREVIATIONS

AEC	=	U.S. Army Environmental Center
APG	=	Aberdeen Proving Ground
ATC	=	U.S. Army Aberdeen Test Center
ERDC	=	U.S. Army Corps of Engineers Engineering Research and Development Center
ESTCP	=	Environmental Security Technology Certification Program
EQT	=	Army Environmental Quality Technology Program
GPS	=	Global Positioning System
GX	=	Geosoft executable
HH	=	handheld
MS	=	Microsoft
POC	=	point of contact
PVC	=	polyvinyl chloride
QC	=	quality control
ROC	=	receiver-operating characteristic
RTK	=	real time kinematic
SERDP	=	Strategic Environmental Research and Development Program
UXO	=	unexploded ordnance

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APPENDIX G. DISTRIBUTION LIST

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