



STANDARDIZED UXO DEMONSTRATION SITES

STANDARDIZED UXO TECHNOLOGY DEMONSTRATION SITES



For decades, soldiers and weapons developers have gone to ranges and training areas to train with and test bombs, projectiles, grenades and other munitions. A portion of these munitions did not function as designed, becoming what is known as unexploded ordnance (UXO). Over the years, UXO has accumulated from these activities at an estimated 1,700 Formerly Used Defense Sites (FUDS), 25 Base Realignment and Closure (BRAC) sites and a number of active installations covering millions of acres.

The U.S. Army is committed to characterizing and remediating these sites to a condition consistent with their intended uses. One major barrier to honoring this commitment is the lack of adequate technology to reliably detect UXO and discriminate between the UXO and non-hazardous materials common to the ranges and test areas.

Failure to discriminate between UXO and non-hazardous materials such as shrapnel, target parts or munitions parts results in a high percentage of false alarms that add significantly to the amount of required excavation, driving up the costs and time required to remediate a site.

Advancements in UXO detection and discrimination technologies are necessary if there is to be a successful restoration and transfer of firing and test ranges. Past testing and experience has indicated that UXO characterization technology results are affected by variations in site terrain, geology, vegetative cover and weather conditions, limiting the confidence in a given technology to detect buried ordnance. The establishment of the Standardized UXO Technology Demonstration Sites Program allows the gathering of data on UXO detection sensors and systems performance and the comparison of results from emerging and existing technologies.

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



For more information

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MISSION

To provide the UXO community with standardized technology demonstration sites, protocols and targets for UXO technology testing and performance. The Standardized UXO Technology Demonstration Sites Program has testing sites located at Aberdeen Proving Ground (APG), MD and Yuma Proving Ground (YPG), AZ. The program provides an automated system for scoring of sensor and system performance in both the response and discrimination stages, allowing for comparison of gathered data. Performance reports are posted to the program's Internet Web site to allow access to testing and demonstration results. The program also maintains a standardized target repository of items available to use for testing and demonstration purposes.

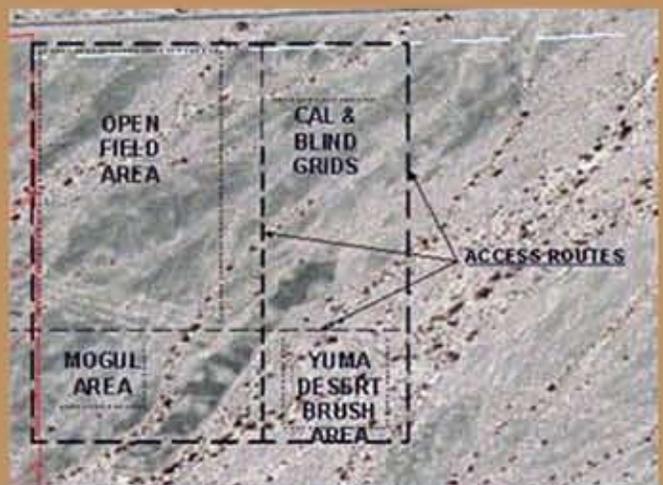
SITES LAYOUT

The sites contain a calibration area, a blind grid, and an open field area with scenario areas. The APG site contains a wooded area and mogul scenarios while YPG site has the desert extreme and holes scenarios. Each site also has a set of challenge areas as listed in the open field description below.

The Calibration Area is designed to provide the user with a sensor library of detection responses of standardized and calibration targets and an understanding of resistivity prior to entering the test fields. It is a surveyed area with emplaced standardized sphere, copper wire hoops and munitions targets of various size and weight. Targets are buried below the surface in lanes at various depth, dip and azimuth. Metal and non-metallic clutter has been cleared down to a depth of 1.2 meters. Adjacent to the lanes is a ground test pit and test stand where users can calibrate their equipment or take measurements of the available targets. Users are provided an example of each of the standardized target and several clutter items that are found in the calibration, blind grid and open field sites to calibrate their equipment. Target emplacement sheets and maps are also provided to the user for this area.

The Blind Grid Area is designed to test the users' ability to detect ordnance and discriminate clutter under controlled conditions. Targets are buried below the surface in lanes at various depth, dip and azimuth. The area contains standardized munitions targets and clutter items emplaced in grid squares. Each grid square has three possibilities: nothing emplaced, a target munition or clutter item. Users receive a map with only the boundary and location of the survey markers included.

The Open Field Area is designed to test the users' equipment under realistic field conditions. These areas





use the same targets as the blind grid area. Targets are buried below the surface in lanes at various depth, dip and azimuth. This area contains a set of challenges that may include:

- Electrical lines
- Wet area
- Swales
- Stone pad/road
- Steel fencing
- Moguls/holes
- Wooded area
- Desert extreme area

The calibration, blind grid and open field areas may contain site-specific inert munitions. Performance data gathered from the site-specific munitions are kept separately. Performance of sensor and systems in the calibration, blind grid, open field and challenge areas are scored using an automated system. Performance reports are then posted to the Standardized UXO Technology Demonstration Sites Program Web site.

PERFORMANCE SCORING

The Standardized UXO Technology Demonstration Sites Program uses an automated scoring system to provide objective analysis of sensor and system performance during both the response and discrimination stages of operation. Performance in the calibration, blind grid, open field and challenge areas are all recorded and scored utilizing a computer program that compares electronically submitted data against ground truth data. Detection and discrimination are evaluated under realistic scenarios that vary targets, geology, clutter, topography and vegetation. The automated scoring process eliminates potentially subjective interpretation of performance.

The response stage scoring evaluates the ability of the system or sensor to detect emplaced targets without discriminating ordnance from other anomalies. The user provides the location and signal strength of anomalies that may warrant further evaluation and/or processing as potential ordnance items. This list is generated with minimal processing, representing the most inclusive list of anomalies.

The discrimination stage evaluates the ability of the system or sensor to correctly identify ordnance and reject clutter based on the list developed during the response stage. A discrimination stage list is generated that contains the output of algorithms applied in processing. This list is

prioritized based on the users' determination that an anomaly location is likely to contain ordnance.

For both stages, the probability of detection (P_{det}) and false alarms are reported as receiver-operating characteristic (ROC) curves. False alarms are divided into anomalies that correspond to emplaced clutter items, measuring the probability of false positives (P_{fp}) and those that do not correspond to any known items, the background alarm rate (BAR) or probability of background alarm (P_{ba}). The user is also scored on efficiency and rejection (R_{fp}) ratios, which measure the effectiveness of the discrimination stage processing. Efficiency measures the amount of detected ordnance retained after discrimination, while the rejection ratio measures the fraction of false alarms rejected. Both measures are defined relative to the entire response list.

Results will be compared between test scenarios (Blind Grid, Open Field, and Site Specific Scenarios) in order to determine if the feature introduced in each case has a degrading effect on the system performance. Comparisons can also be made on standard versus nonstandard targets and site-to-site results.

STANDARDIZED TARGET REPOSITORY

The Standardized UXO Technology Demonstration Sites Program maintains a standardized target repository to provide the UXO community with standardized and nonstandard targets for UXO technology testing and performance evaluation. The repository includes mortars, projectiles, rockets and submunitions from 20mm to 155mm in size. Other targets include nonstandard items such as tail fins, corroded munitions, fuzes and steel spheres, steel discs or copper wire loops.

Standardized Target Repository inventory items are available to members of the UXO community with a validated need. Borrowers may check out the items for up to one year. Users are required to provide raw data collected from the items to the Standardized UXO Technology Demonstration Sites Program. Data will be shared with the UXO community based on a demonstrated need.

DOING BUSINESS WITH THE PROGRAM

SITE USE

Access to the site may be gained through referencing site use in a SERDP or ESTCP proposal or through the EQT program. Prospective users may also elect to pay for the usage of the sites themselves. To request the use of a site, prospective user must submit an application sixty days prior to the desired demonstration date. The application is available on the Internet Web site www.uxotestsites.org. The user must also submit a demonstration plan, including field operations, equipment description and QA/QC plans, thirty days in advance of the desired demonstration date. Final approval authority rests with the Program Manager.

STANDARDIZED TARGET REPOSITORY

To request a loan of items from the Standardized Target Repository, borrowers must submit an application for the items. The application is available for download on the Internet Web site www.uxotestsites.org. Please allow for a lead-time of four to six weeks. Final approval rests with the Standardized UXO Technology Demonstration Sites Program Manager.

