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Survey of Munitions Response Technologies (UXO-4)

Executive Summary

The Strategic Environmental Research and Development Program (SERDP), Environmental Security Technology Certification Program (ESTCP), and the Interstate Technology Regulatory Council (ITRC) jointly developed this Munitions Response Technology document. Our goal with this document is to provide an overview of the current status of technologies used for munitions response (MR) actions and, where possible, evaluate and quantify their performance capabilities. This study provides project managers and regulators an understanding of the performance capabilities of available technologies under real-world site conditions. Detailed observations and critical considerations in the application of munitions technologies are discussed, with particular emphasis on detection technologies.

Detection Technology Evaluation

A large volume of data has been collected over the past several years to document the application and performance of MR technologies. This is particularly true of munitions detection technology. In this study, a significant effort has also been made to develop a database documenting the performance of munitions detection technologies on the Standardized Test Sites and in recent MR actions. The analysis and interpretation of this database has revealed significant insights into current use and performance of munitions detection technologies.

A description of currently used munitions detection technology, as well as findings on the current state-of-the-practice, can be found in Chapter 3. The methodology for the analysis of the performance of detection technology is presented in Chapter 4, and the results of the analysis detailed in Chapter 5.

The interpretation and application of the results to MR projects are discussed in Chapter 6, which may be most useful to the novice reader. There is no single best technology that can be recommended for all applications: rather, the selection of appropriate technology will be dependent on site conditions, munitions of concern, and specific project objectives. This chapter provides hypothetical scenarios that illustrate how the detailed information and metrics in Chapter 5 may be used in evaluating and selecting technologies based on these considerations.

Major Findings

The results of the analysis indicate that currently available magnetometer and electromagnetic induction (EMI) technologies are capable of detecting most munitions

under typical site conditions. However, there are large variations in the performance of munitions detection technology across demonstrators, even when using systems based around the same basic sensors. The ability of a system to achieve optimum performance is a function of both the capabilities of the detection technology and the quality of its implementation. Real-world challenges such as terrain, geologic noise, overlapping signatures, surface clutter, variances in operator technique, target selection, and data processing all degrade from and affect optimum performance. Quality-control and quality-assurance programs are critical to achieving successful results with any munitions detection technology.

Some of the major findings in this report include the following:

- System noise does not generally limit detection ability. This is a strong indication that implementation is a key component in the ability of a technology to achieve project objectives.
- Magnetometers and EMI sensors both have individual strengths in detecting all types of munitions at varying depths. Munitions type and response action objectives must be evaluated.
- Attempts to employ alternative sensor technologies to munitions detection have not resulted in robust performance that is comparable to that achieved by magnetometers and EMI sensors.
- Digital geophysical mapping (DGM) generally achieved a higher probability of detection and lower false-alarm rate than mag and flag. Site conditions may limit the application of DGM.
- All sensors have trouble detecting smaller items. Where these items are of concern, data quality objectives must be tailored with these items in mind.

The objective of the analysis presented in this document is to evaluate currently available MR technologies and their performance drivers. From this analysis we have documented major findings that will provide common understanding to guide regulators and project managers as they set project objectives and determine the appropriate technology for a given site.