Standard Operating Procedure
DAGCAP-2

Geophysical Classification Organization Demonstration of Capabilities - Virtual Site

Version 2
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DoD Environmental Data Quality Workgroup

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1 Introduction

The US Department of Defense (DoD) developed advanced geophysical classification (AGC) to improve the efficiency of cleaning up munitions and to focus its resources on addressing the potential explosives safety risks at munitions response sites (MRSs). To ensure quality data, the Office of the Deputy Assistant Secretary of Defense for Environment, Safety and Occupational Health created the DoD Advanced Geophysical Classification Accreditation Program (DAGCAP) to accredit organizations that use AGC at MRSs. A critical part of this accreditation program is the requirement for Geophysical Classification Organizations (GCOs) to perform a witnessed demonstration of capability (DOC). The purpose of this standard operating procedure (SOP) is to specify the methods and procedures to be employed when the Virtual Site software package is used for a GCO's DOC as part of an out-year reassessment in conjunction with the DAGCAP. This is offered in place of the mobilization to the Aberdeen Test Center (ATC) unexploded ordnance (UXO) test site at the Aberdeen Proving Ground (APG) required for the DOC phase of an initial assessment.

2 Personnel, Equipment, and Materials

This section describes the personnel, equipment, and materials required to implement this SOP.

2.1 Personnel and Qualification

The following GCO personnel will be required for the DOC:

- Project Geophysicist
- QC Geophysicist
- Data Processor

Personnel involved in the DOC will meet the qualifications as described in the DoD Quality System Requirements (QSR) v3.0 as required.

The following additional personnel will be required:

- Accreditation Body (AB) representative(s)
- Any other personnel (e.g., DoD oversight personnel) as designated by the DAGCAP Program Manager

2.2 Equipment and Materials

The following is a list of required equipment and materials to be provided by a GCO:

- Validated software package for data analysis
- SOPs for all operations to be performed under DAGCAP
- A computer with Microsoft Excel 2013 or later (.xlsx capable) with the ability to run macros

3 Procedures

3.1 Prior to Arrival at the Site

When a GCO (in consultation with their AB) is ready for the DOC, the AB and GCO will identify a mutually convenient location for the DOC and inform the DAGCAP Program Manager of the location and date.

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At the time of this communication, the GCO will confirm they have the most recent DoD TOI Library in their possession. If a more recent version is available, the DAGCAP Program Manager will provide it in the HDF5 format.

3.2 At the Site

3.2.1 Onsite Preparation

Upon arrival at the site, all personnel will participate in an opening meeting. At this time the AB will provide electronically the details of the virtual site, typically a 0.5-acre area, which will be the subject of the demonstration. Additionally, the IVS configuration and several Excel spreadsheet templates will be provided for the GCO to use to construct their data requests / prioritized diglist submissions. The QC geophysicist will also be provided with the location, depth, orientation, and item description of the QC seeds within the demonstration area electronically.

3.2.2 Demonstration of Capability

The demonstration is designed to require approximately two (2) days on site; however the AB will discuss specific scheduling in advance of the demonstration. Immediately after the opening meeting, the AB representative will provide the initial dynamic data set electronically. The data is synthetic Geometrics MetalMapper 2x2 data, provided in HDF5 (.h5) file format. As all data are generated by the Virtual Site software package, no data collection effort or personnel are required.

The GCO shall conduct analysis operations in accordance with their approved SOPs. Operations will be monitored by the AB representatives to ensure that all SOPs are being followed and validated QC and analysis procedures are being employed during normal working hours. Work may continue outside normal working hours, in coordination with the assessor. During the DOC, all communication with the government will go through the assessor. As each set of Virtual Site data are uniquely generated for the DOC, standard SOPs for data handling may be followed, without the restrictions that are required for the initial DOC at APG.

The GCO QC geophysicist will monitor the detection and correct classification of the QC seeds, which have been inserted into the synthetic data. The government will provide no feedback (for example, no training data will be provided) during the DOC. If the QC seeds are not included with a Dig Decision of 1 they will be counted as false negatives during scoring (see Section 4.1 – Scoring).

In addition to the IVS data, periodic sensor function test (SFT) data will be provided.

The GCO will notify the AB as soon as possible if the DOC will extend beyond the planned two days so

that arrangements can be made for continued observation.

3.2.3 Ongoing Data Requests

As part of the Virtual Site DOC experience, the GCO may request additional data beyond the originally provided dynamic data. In particular, after the analysis of the dynamic data is complete, the GCO is expected to request a set of cued data collections centered on a list of anomaly locations generated from the dynamic data. An Excel spreadsheet template is provided for this request. Additional cued data requests may be submitted without penalty. At this time limited functionality exists in the Virtual Site software package for dynamic data recollection, but requests will be honored if possible.

The naming convention of the dynamic data file will be:
ProjectPrefix_GEOID_MeasurementType_LineNumber_DateCode_Version
(Example: USACE-DOC1_20180910_DAM_000000_2018177_000)

NOTE: In cued data requests, all location IDs must be numeric only at this time.

Cued data requests shall be formatted as follows:

1. The first six header rows should include the ProjectPrefix, GeoID, Data Type, GCO, Analyst, and request number. The site information (GEOID and Project Prefix) must match what is provided with the synthetic data. The Request number shall be incremented for each request, starting with 1.
2. Each row in the table corresponds to one requested location.
3. The first column contains a location ID (numeric only).
4. The second and third columns hold easting and northing coordinates, respectively (UTM Zone 18N, meters).
5. At this time columns 4 and 5 should be filled with all zeros (0).
6. The table must be in CSV format.

4 Scoring of the Demonstration Results

4.1 Demonstrator Report for Scoring

At the conclusion of data analysis, the demonstrator shall submit a table of detected locations in order to accomplish the remedial objectives as outlined in the CSM. The DAGCAP-1 APG CSM is reproduced in Appendix A and is appropriate for Virtual Site DOCs as well. The table will be generated using the Excel spreadsheet template provided during the opening meeting. The GCO shall construct the table of detected locations using the CSV template on the CD that the AB representative provided upon arrival at the test site. The table shall be formatted as follows:

1. The first six header rows should include the ProjectPrefix, GeoID, GCO, GCO POC, AB Technical

Representative, and AB Representative. The Site information (ProjectPrefix and GEOID) must match what is provided with the synthetic data.

2. Each row in the table corresponds to one detected location.
3. The rows will be ordered according to priority (the first location is the location most likely to contain TOI).
4. The first column contains a Rank Number (beginning with 1 and ascending down).
5. The second and third columns hold easting and northing coordinates, respectively (UTM Zone 18N, meters).
6. The fourth column contains the Dig Decision (1 = dig, 0 = do not dig) for that location. All rows with 1s should be above all rows with 0s.
7. The table must be in CSV format.

4.2 Scoring

The list submitted by the GCO will be compared to site ground truth and three values calculated: 1) the number of detected locations marked to be dug that were truly TOI (True Positives, TP), 2) the number of detected locations marked to be dug that were not truly TOI (False Positives, FP), and 3) the number of TOI that were not marked to be dug (False Negatives, FN). A successful demonstration of capabilities will require that all TOI are marked for digging (FN = 0) and that the total FPs are less than or equal to 40% of the emplaced clutter (rounded down to the nearest integer).

The following rules will be used to calculate the three values listed above.

1. For each location on the list with a "1" in the dig decision column:
   a. The scoring software will draw a 0.25-m radius circular halo around the location from the list.
   b. If there are 0 TOIs in or on the halo, then the scoring software will count the location as 1 FP (regardless of how many clutter items are in or on the halo).
   c. If there is 1 TOI in or on the halo ***and*** the TOI is outside the 0.5-acre test area, then the scoring software will ignore this location (the location will not be counted at all)
   d. If there is 1 TOI in or on the halo ***and*** the TOI is inside the 0.5m-acre test area
      i. If this TOI has already been found in or on another location's halo further up the list (i.e., another location considered more likely to be TOI), then the scoring software will count this location as 1 FP.
      ii. If this TOI has ***not*** already been found in or on another location's halo further up the list (i.e., another location considered more likely to be TOI), then the scoring software will count this location as 1 TP.
2. The scoring software will count each "leftover" TOI as 1 FN. A "leftover" TOI is a TOI in the 0.5-acre test area that was ***not*** in or on any location's halo with a 1 in the Decision column.

4.3 Reporting

At the conclusion of scoring, DAGCAP personnel will report the DOC results (i.e., pass/fail) to the

appropriate AB. The AB will report to the GCO whether the DOC was successful or not as part of its demonstration outbrief. DAGCAP personnel will provide electronic copies of the full scoring report to the GCO and to the AB to for their records.

4.4 Failure of Virtual Site Demo

Unlike the APG DOC, the full scoring results will be provided to the AB and GCO, not simply a pass/fail determination. The basis for a failure will be expressed as, "too many false positives (FPs)" and/or "one or more false negatives (FNs)." A Failure due to FNs will be further explained as "one or more false negatives (FNs) caused by a failure to detect"; or "one or more false negatives (FNs) caused by misclassification"; or "one or more false negatives (FNs) caused by failure to detect and misclassification". Scoring results will be considered final when reported at the outbrief – no rework of data or reporting will be entertained. If the GCO wishes to pursue a follow-up opportunity for a demonstration, they will coordinate with the AB on the Root Cause Analysis and Corrective Action for the failure and request a follow-up demonstration as described above. The follow-up demonstration will not be scheduled or permitted until DAGCAP has approved all RCAs and CAs relating to the DOC non-conformance.

Acronyms

AB	Accreditation Body
APG	Aberdeen Proving Ground, MD
ATC	Aberdeen Test Center
CSM	conceptual site model
DAGCAP	DoD Advanced Geophysical Classification Accreditation Program
DOC	demonstration of capability
DoD	Department of Defense
EDQW	DoD Environmental Data Quality Workgroup
FN	false negative
FP	false positive
GCO	geophysical classification organization
QC	quality control
QSR	Quality System Requirements
SOP	standard operating procedure
TOI	target of interest. Items including munitions, QC seeds, validation seeds, etc. that must be removed from the site to accomplish the remedial objective.
TP	true positive
UXO	unexploded ordnance

Appendix A. Abbreviated Conceptual Site Model

The Virtual Site demonstration of capability (DOC) is simulated to be a location similar to the DAGCAP site at Aberdeen Proving Ground, which is comprised of two subareas as shown in the image below. Therefore the same CSM applies to the Virtual Site DOCs. The CSM from Appendix B of the DAGCAP-1 SOP APG is reproduced here in its entirety.

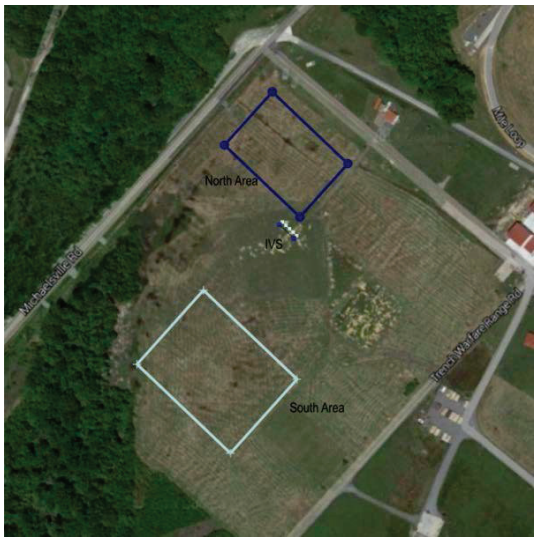

Figure A-1 - Aerial photo of the demonstration of capabilities site showing the two subareas and the location of the IVS

The area containing the DOC site has been used for training and testing for many years. There have been numerous, overlapping ranges at various times at this site. Based on historical records and the Remedial Investigation, at a minimum, the following munitions are expected to be found on the site, although this list may not be comprehensive. Both subareas are expected to have similar munitions.

Munitions Expected on the Site	
Name	Mark/Mod
37mm	M74 HETP
37mm	M74 AT,TP
37mm	M55A1
37mm	M59
37mm	M80A1
60mm	M49A4
81mm	M82
105mm	M1
105mm	M84

The site has been surfaced cleared allowing non-intrusive work to be performed without a UXO escort. There is a small building (shown in the upper right of the image above) set up for storage of equipment, battery charging, and data analysis.

An instrument verification strip (IVS) has been established on the site containing a 37-mm projectile and two small ISO80s. Location and depths of the IVS items will be provided to GCO analysts on site. Small ISO80s have been emplaced as QC seeds. The positions and depths of these QC seeds will be provided to the team QC Geophysicist. Additional validation seeds have been emplaced on the site. The details of these items will remain blind to the GCO.

The remedial objective for 37-mm projectiles is removal to 30 cm below ground level. Any munition detected using a threshold designed to accomplish this objective must also be marked for removal. For the purposes of the DOC, the smallest munition of concern is a 37-mm projectile. At this site, fuzes are not considered TOI.