

UXO Quality Control

Establishing standards in data Quality Control and Quality Assurance for UXO detection

When in doubt, you dig. That's the rule in the investigation of unexploded ordnance (UXO). UXO pose a real threat to both human life and the environment. Millions of UXO may be located in the U.S. on active test and training ranges and Formerly Used Defense Sites (FUDS). During an investigation of UXO-contaminated sites, when the data gives you reason to think something is there – you act on it.

Experience has shown, however, that too often the digging does not result in the discovery of a UXO; and the time, effort and cost involved is wasted. Many of the causes for false alarms, and other inefficiencies in UXO project cycles, can be traced back to data quality issues.

Essentially, all investigations of UXO involve the use of Digital Geophysical Mapping (DGM), and they are highly dependent on quality field data. Assuring the quality of the data holds unique challenges for Government agencies mandated with performing quality assurance of investigation results. First, the geophysical mapping is almost always performed by individual contractors or teams of contractors, each with their own proprietary

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methodology and tools. To date there has been no common hardware platform, software platform, or standard methodology for doing the work, and delivering the data to customers. Second, it doesn't take much to skew the data, and lose data integrity.



**US Army Corps
of Engineers.**



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The connection between repetitive data quality issues with resurveying and lost productivity has led to an intensified focus on improving data Quality Control (QC) and Quality Assurance (QA).

To combat the problem, the US Army Corps of Engineers in Huntsville and industry software developer Geosoft joined forces, with the sponsorship of the Environmental Security Technology Certification Program (ESTCP), to target improvements in the quality assurance and quality control of field data in collaboration with the UXO community.

The cooperative partnership resulted in the initiation of a UXO QC/QA project, funded under ESTCP. The project's first product, a standardized tool set for the QC/QA of collected field data was publicly released in 2002 and an enhanced tool set was subsequently released in 2003. The QC/QA tool sets are available under the industry standard Oasis montajT interface. The principal goals of the project were to standardize Quality Control and Quality Assurance (QC/QA) processes within the UXO community, to improve data quality and detection methods, and to establish a standard software platform for the sharing of SERDP/ESTCP analysis algorithms.

The data quality problem

Over several years, the Huntsville Center had recorded a high number of repetitive problems and false alarms. "We had highly variable data quality, day to day, week to week and month to month," said Scott Millhouse, US Army Corps of Engineers, Huntsville Center. "Sometimes at the end of a project, we would find no relationship between initial performance with the A team, and final performance with the C or D team."

The money spent on false alarms and rework can add up. "Every time we dig it costs us around \$200 dollars a hole, whether we find something or not," says Millhouse.

It's not just about cost, however, it's about ensuring the consistent quality of the data. "We don't want to map a thousand acres, then analyze the data and find out that there's been a problem all along - a repetitive problem," said Millhouse. Issues like faulty equipment, if undetected, can undermine the success of an entire project.

Productivity and use of resources is another key concern. The Huntsville group found that a significant amount of time and resources was spent working with contractors to ensure acceptable levels of data quality. "Our geophysicist and his team would spend weeks at a time on the initial start up of a project, getting problems worked out," explains Millhouse. "And they were seeing the same problems over and over and over again - with different contractors. We just didn't have the manpower to put that kind of effort into every project."

The QC/QA solution

Responding to this problem, the Huntsville Center had been working collaboratively with contractors and others to come up with tests to validate and maintain the performance of equipment, and procedures for the analysis of data. The Center's early efforts helped to define the issues, and to generate a pool of ideas, techniques and expertise in QC/QA problem solving.

Very quickly however, it was recognized that industry tools and a standard platform were required to deliver significant and sustainable improvements in data QC/QA.

"Everyone was aware of the problem," said Millhouse. "The issue became how do we solve it? The answer was to establish the standard tests, and also the software tools to enable contractors to be more effective in meeting data quality expectations."

The decision to partner with Geosoft was made based on the need to build a mature and comprehensive technological solution that could be made readily available to the UXO community on a standard software platform.

"Our goal was to migrate the QC/QA tools to a commercial platform that would ensure easy access by contractors, and Geosoft's Oasis Montaj interface was already established as an open industry-standard platform," said Millhouse. "Geosoft's commercial UXO product was also used by many of our geophysical contractors."

A cooperative agreement was struck for Geosoft to code the complete QC/QA tool set into their current UX-Detect product, and also to make the basic tools freely available as part of their industry standard Oasis Montaj interface. The agreement, funded under ESTCP, provides the tools for all contractors to reach a certain quality level, without requiring an additional financial investment.

Project success

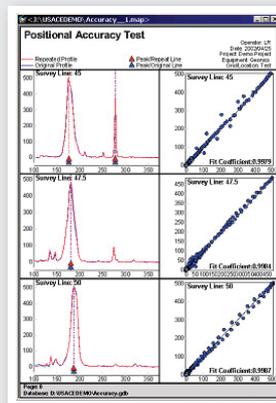
The Huntsville group is already starting to see improvements in data quality and consistency. “We’re seeing greater consistency and day-to-day data matching, improved repeatability, and increased production,” says Millhouse.

Wide spread use of the new QC/QA tool set has improved field data by identifying and correcting instrument and acquisition errors prior to demobilization. The software includes tests to verify that geophysical equipment is working properly and that contractors are meeting performance requirements throughout the project cycle. The tools have also enabled UXO investigations to be more efficient and cost effective, with less reworking of mapped areas.

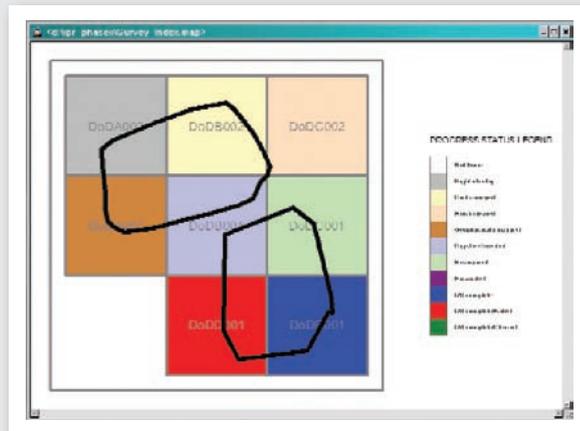
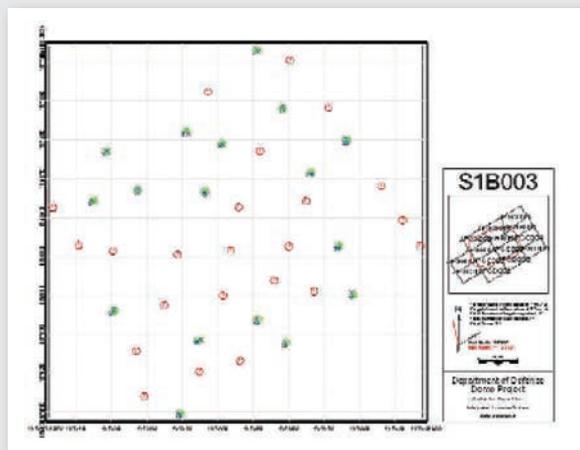
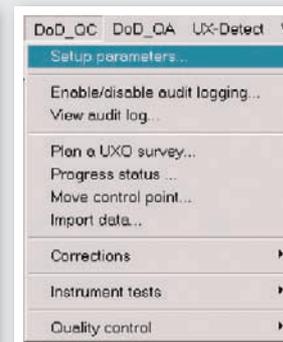
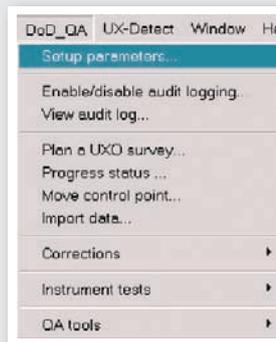
In addition, the project is establishing a standard platform for sharing analysis algorithms developed by other groups who have been funded under SERDP or ESTCP. One of ESTCP’s goals for the UXO program is to provide tools for the field that everybody can use to add value and quality. In order to enable the establishment of a common platform for learning, developing and distributing discrimination and analysis techniques, emerging successes from the ESTCP and SERDP programs will be written as a Geosoft executable (GX) that can be run under the Oasis montaj interface.

Millhouse attributes the project’s successful deployment to the commitment of the people involved and the processes established, as well as the fact that the technological tools are readily available as part of Oasis montaj, the standard platform used by most of the UXO geophysical contractors. “There were no tools available to support QC/QA in the industry. The fact that these basic tools are now available and are free to Government contractors has made the difference,” says Millhouse. “As a result, we’re starting to see wide spread usage.” To promote usage, the Huntsville Center has included a requirement to perform the tests, and to deliver the data in a specific format in their scope of work, Data Item Descriptions (DIDs).

Another key success factor was the Peer Review Process established to support testing of the software in the field. The software underwent an extensive peer review process, prior to release. A select group of peer reviewers, comprised of contractors working for the Huntsville Center, received the software, together with a class on how to use it. Participating contractors were encouraged to begin implementing it on live projects, enabling real-time input on how the software worked in the field. Contractors who previously had to develop their own tools and techniques were able to apply their ideas towards improving the standard toolset.



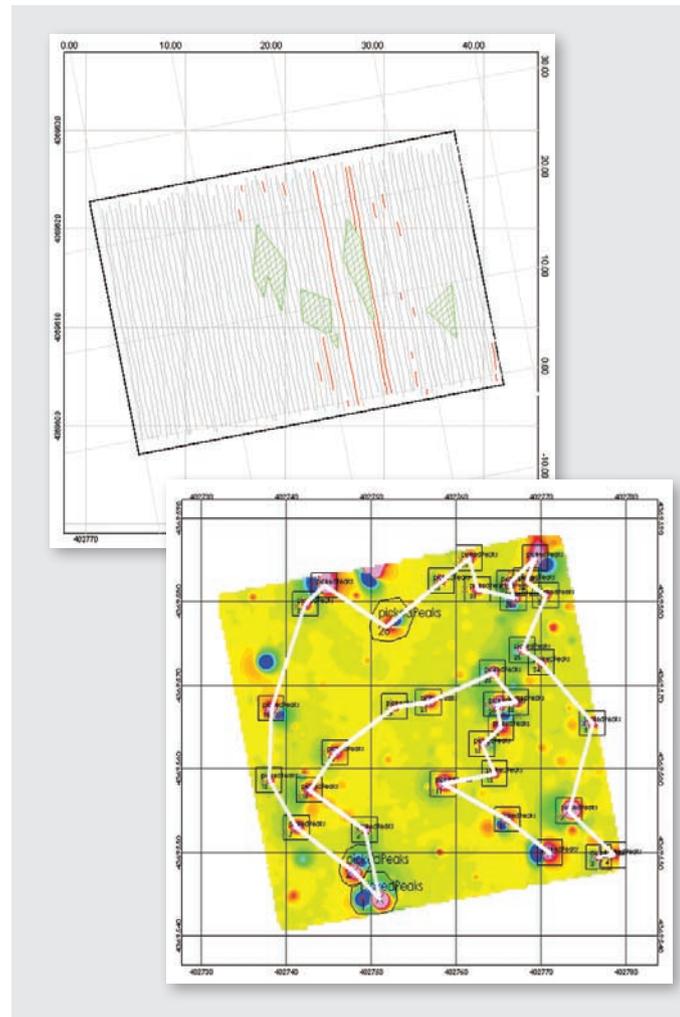
The QC/AQ tool set included in the UX-Process Software has improved field data by identifying and correcting instrument and acquisition errors prior to demobilization.



The input received through the review process contributed to software enhancements which are reflected in the current release. Suggestions for additional capabilities are being considered for incorporation into future releases.

According to Millhouse, the cooperative partnership has proven to be a good model for problem solving in the UXO community, and it has delivered benefits to all parties. Geosoft has gained a better understanding of how its technology is being used in the UXO field, and some insight into the priority of customer's problems. "We have found Geosoft to be very flexible and supportive in responding to our needs," says Millhouse. The Huntsville Center has benefited from efficiency and productivity gains throughout its project cycles; and ESTCP has delivered on its mandate of providing validated tools to improve data quality in UXO investigations.

In summary, investment in the creation of industry QC/QA software standards and common methodology is seen as bringing both short term, and long term benefits. Improvements in data consistency have had an immediate impact on UXO project efficiency and productivity. Equally important, having established a standard platform, future developments and improvements can build on an existing foundation, maximizing the value and return on the investment, eliminating the need for extensive training, and facilitating the sharing of new tools and technology within the UXO community.



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