



Innovative Technologies (Robotics)

USAE uses robotics to support field operations that may include hazardous or dangerous conditions, greatly reducing the risk to human health and safety.

Portable Robotic Crawler System

To safely inspect discharge pipes for MEC explosives contamination, USAE's robotic camera system visually inspects pipelines that may be potentially contaminated with explosives material which may result in removal and subsequent thermal treatment. This system, specially designed for pipes and confined spaces, is cost effective and easily transportable. Used extensively during our MEC Remedial Action project at former Sunflower Army Ammunition Plant, KS project, we robotically inspected >9,100 linear feet of pipeline. This capability increased pipe removal production by reducing the need for UXO technicians to manually inspect shorter runs of pipe, and enhances site safety by reducing entry into confined spaces. As a result, the project realized a cost saving of approximately \$300,000.



USAE's Pearpoint flexitrax 350 robot being prepared to visually inspect a section of 36" diameter pipe

Unmanned Aerial Vehicles (UAVs)

UAVs have numerous applications to increase safety and efficiency on MEC project sites. USAE utilize Federal Aviation Administration certified pilots to operate UAVs in support of pre-proposal site visits and ongoing projects. The aerial images and videography capability enhances wide area assessment data collection and provides a third dimension in risk analysis. To date, USAE has utilized several various-sized UAVs in site surveillance, for observation of explosives disposal tasks, and during pre-construction efforts, at numerous locations across the United States. The aerial observation capability also provides excellent site security monitoring during explosives disposal operations, as well as unobstructed views of large acreage remediation sites, or those difficult to access, such as cliffs, crevices, and steep slopes.



Unmanned Aerial Vehicle (UAV) and Controller

Additional Innovative Technologies

- **Ruggedized tablets:** USAE uses highly-durable tablets in conjunction with receptive positioning receivers to provide sub-meter accuracy during data collection in the field.
- **Seismographic instrumentation:** During demolition activities, USAE monitors blast induced ground vibration and air over-pressure.



- **Armored, robotic heavy equipment —** USAE manages large-scale robotically controlled sifting, vegetation removal, and clearance activities performed by Northwest Demolition & Dismantling (NWDD) and other teaming partners.



UXO Field Personnel entering data on a ruggedized tablet

NWDD's Robotic Sifter with Trommel Bucket, Puerto Rico



Innovative Technologies

USAE employs state-of-the-art technologies and approaches at all of our project sites. We use a formal and proven review process that identifies, analyzes, and tests proposed innovative solutions for safety, field-worthiness, and effectiveness. The following paragraphs highlight some of these innovative technologies.

Digital and Film X-Ray

USAE uses portable x-ray technology (digital and film) in-the-field to provide an additional layer of safety for site personnel. This technology allows qualified and x-ray trained UXO personnel to determine specific munitions as live, practice, or empty. This determination reduces the number of individual or consolidated MEC disposal events, thereby increasing safety, reducing hazards, time, cost, and environmental impact. Overall, the use of the x-ray can result in a safer, more efficient, and cost effective project.

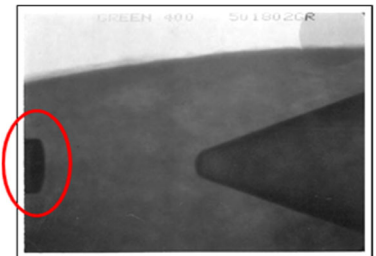
The X-ray contains no active radioactive material. It produces radiation only when pulsing.

Field Portable X-Ray Technology has been successfully used by USAE for more than 18 years, to differentiate between live, practice, and expended munitions in the field. USAE owns several x-ray machines and their associated digital and film-based receiver units. In addition to the significant safety impact of eliminating the need for disposal operations, the use of this technology has resulted in substantial time and cost savings to our customers. USAE has used this technology on more than 45 projects.

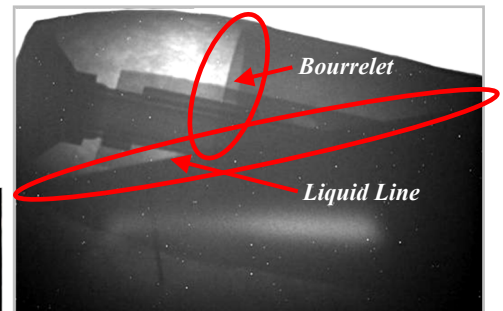
Identifying Munitions Using X-Ray in the Field

2.36" HE Anti-Tank Rocket M6

- Cone shape indicates anti-tank rocket
- Cone with inert filler/no detonator indicates a practice round
- X-ray identification of the live booster for a 2.36" rocket (shown to the right).



4.2" Mortar depicting Burster Tube, the Bourrelet, Baffles, and Liquid Line, indicating a possible chemical-filled munition



Use of a Digital Receiver to View a 4.2" Mortar

X-Ray Features and Benefits

- Menu-based software
- Simple variable pulse setting
- Highly portable



- Flexibility to develop complete radiographic system that can be used with:
 - ◆ Conventional radiographic film
 - ◆ Instant radiographic film within 2 minutes
 - ◆ Digital inspection systems immediately

