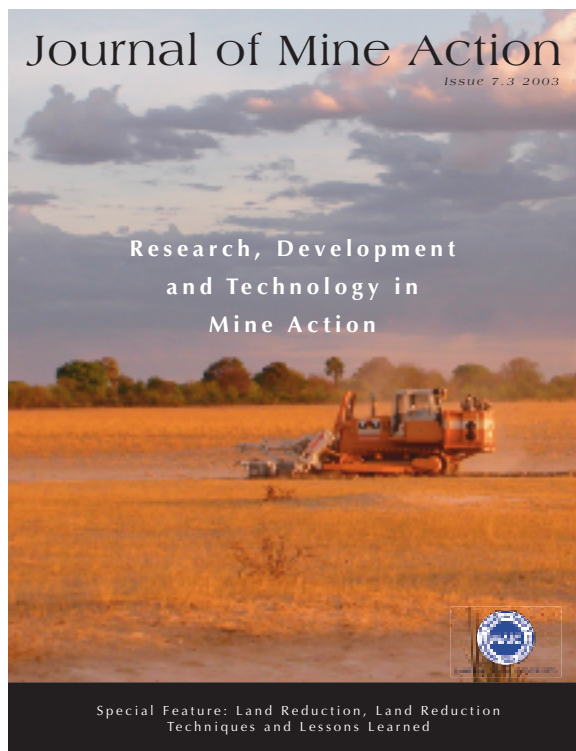


Research and Development



Why is research and development so important to the field of mine action?

Current demining technologies and practices can be slow and laborious. Many research institutions are working on projects that could potentially increase the efficiency, speed and safety of demining, thereby accelerating efforts toward a mine-safe world. Researchers have focused both on developing new technologies and on making improvements to old ones; each has yielded advances that show significant potential for the future.



The *Journal of Mine Action* provides an avenue for exchange of information between users and developers of technology.



Japan Alliance for Humanitarian Demining Support (JAHDS) member Tetsuya Kanazawa demonstrates "Mine Eye," a new landmine detector. The "Mine Eye" can produce three-dimensional images.

What improvements have been made to the metal detector?

Metal detectors detect anything metal beneath the surface, including bottle caps, tin cans and other non-explosive debris and litter, which can significantly slow the work of the deminer. Additional sensors have been added to metal detectors that create images of the object being detected. For example, the HSTAMiD system recently developed by the US Army combines a hand-held ground penetrating radar (GPR) device and a metal detector.

What is the potential for using GPR to detect landmines?

Radio waves are used to measure the distance and size of objects located beneath the ground. By measuring the radio waves that are reflected back from the ground, an image can be created that represents the relative density of all elements in the target area. GPR is an area of great interest to researchers in the field of mine action.

How is infrared technology being used to detect landmines?

Infrared sensors measure the difference in temperature between an object and the ground surrounding it, and absorb and disburse heat at varying rates. An infrared camera can be mounted on an aircraft to take photos of suspected areas. This methodology can be used to mark the boundaries of a suspected minefield.



Amanda Aker, a chemical engineer with Nomadics, examines an amplifying fluorescent polymer under a black light. The polymer exhibits a dramatic reduction in fluorescence when exposed to traces of nitroaromatic explosives such as TNT. The polymer was engineered by research partners at the Massachusetts Institute of Technology (MIT), and is a key component of Nomadics' Landmine Detector and Advanced Sensors.

What kind of research is being done using plants in detecting landmines?

Research being done by the University of Alberta (Canada) has found that genetically engineered plants can detect landmines if they are planted in the area of landmines. The leaves or flowers of modified plants change color when planted in the vicinity of certain explosive elements. Chemicals in the landmines leak into the soil around them, which changes the soil composition; this changes the chemical processes in the plant and activates the modified gene in the plant, making it look different.

What is Remote Explosive Scent Tracing?

Remote Explosive Scent Tracing (REST) is a detection method in which filters are placed in vehicle-mounted vacuuming systems which collect air samples from the road. The filters are replaced periodically and taken back to base where they are "analyzed" by MDDs to determine if an explosive scent is present. A positive reaction by a MDD indicates that landmines might be present and other MDD and manual deminers are used to more thoroughly search the area.

Other than dogs, are there other animals that might be used for locating landmines?

A research project in Tanzania trains Giant African Pouched rats to detect landmines. Results have shown that the rats are as capable as dogs at detecting low concentrations of explosives. Rats are quick and easy to train and require less one-on-one handling than dogs. They are small and easy to house, transport, and feed. They have also proven to accommodate repetitive behavior, which typically results in better endurance



Giant African Pouched Rats are now being trained to detect mines in Tanzania.



Scientists are studying how bees might assist in detecting landmines planted in fields through their ability to transport scents collected on their furry bodies while gathering pollen.

and longer search. Their small size and lack of robustness and response to human commands limit their general applicability.

How can bees be used to detect landmines?

Using bees to detect landmines is a new and promising area of research. Bees are known to follow certain scents. If bees are trained to find TNT or other substances, areas where they cluster may be explored as the possible location of a landmine. The bee's fur also attracts a variety of particles in different forms (liquid, gas or solid), which can be tested for the presence of certain chemicals. Bees are much less expensive to maintain than dogs and easier to train, but can only follow one scent.

How can bacteria detect landmines?

Bacteria can be genetically altered and spread across an area, becoming fluorescent when they interact with elements in an explosive. Mapping concentrations of the bacteria using stand-off illumination and GPS technology can help identify potential locations of landmines. This method is somewhat time-consuming, as it takes time for the chemical to incorporate into the bacteria. Bacteria that can degrade explosive chemicals have also been studied.

Besides the metal detector, are there other promising mechanical devices that might aid detection and clearance?

Yes. There are many kinds of machines, such as rotary flails and robots that have been developed and that may be useful in certain circumstances. Flails are devices that are attached to a cylinder and beat the ground as they roll over the land to detonate pressure-sensitive explosives. Machines of this type may not be suitable to all terrain or minefield locations. Robotic machines have also been used to detect and/or destroy landmines. Some robots are designed to roll over the ground and detonate the mines in advance of other techniques. Other robots are more sophisticated and prod the ground in the place of a human. This kind of equipment is expensive to repair or replace.



The TEMPEST works by remote control without exposing the operator to danger.