Detection Of Explosives And Landmines Methods And Field Experiences Proceedings Of The Nato Advanced

The chapters in this volume were presented at the July–August 2008 NATO Advanced Study Institute on Unexploded Ordnance Detection and Mitigation. The conference was held at the beautiful Il Ciocco resort near Lucca, in the glorious Tuscany region of northern Italy. For the ninth time we gathered at this idyllic spot to explore and extend the reciprocity between mathematics and engineering. The dynamic interaction between world-renowned scientists from the usually disparate communities of pure mathematicians and applied scientists which occurred at our eight previous ASI's continued at this meeting. The detection and neutralization of unexploded ordnance (UXO) has been of major concern for very many decades; at least since the First World war. UXO continues to be the subject of intensive research in many ?elds of science, incl- ing mathematics, signal processing (mainly radar and sonar) and chemistry. While today's headlines emphasize the mayhem resulting from the placement of imp- vised explosive devices (IEDs), humanitarian landmine clearing continues to draw signi?cant global attention as well. In many countries of the world, landmines threaten the population and hinder reconstruction and fast, ef?cient utilization of large areas of the mined land in the aftermath of military con?icts.

Conduct efficient, effective and safe searches in any setting K9 Explosive Detection is for detector dog trainers and police departments looking for alternative training ideas or for ways to set up their own course training standards. Ron Mistafa examines some of the major training

systems in use by police departments across North America, and he offers a system that combines the most effective elements of each one. This manual focuses on the how-to aspects of explosive detector dog (EDD) training. A gradual build-up of learning experiences and ongoing problem solving techniques produce more confident EDD teams. Ron also examines US and Canadian laws governing possession of explosive materials and devices, provides tips on working with other police specialty units, and explains how to involve non-police personnel at airports in EDD training.

The Tufts Medical School Nose (TMSN) - a device based on the biological principles by which the vertebrate (canine) olfactory system functions - has been developed to detect the vapor phase signature associated with buried landmines. The device demonstrated it could detect concentrations of 300-500 parts per trillion of vapor phase 2,4 DNT, a compound that accompanies the TNT found in landmines. The TMSN was tested in chambers in association with the Canine Detection Unit at Auburn University and the results were slightly better than the thresholds for dogs detecting this compound. During field tests at Ft. Leonard Wood, MO, the device showed that in automatic detection mode it could detect the presence of the buried TMA-5 antitank and buried PMA-1A anti-personnel landmines placed in known locations. The TMSN also located buried PMA-1A anti-personnel landmines in a blind test in which the Tufts U. operators didn't know whether or not a mine (or how many mines) was present at nine marked locations. In the blind test, the device correctly found four landmines that were present and made two false positive errors.

Detection of Bulk Explosives: Advanced Techniques against Terrorism contains reviews of: existing and emerging bulk explosives detection techniques; scientific and technical policy of

the Federal Border Service of the Russian Federation; challenges in application and evaluation of EDS systems for aviation security; multi-sensor approach to explosives detection. There are also reports devoted to the following individual explosive detection techniques: X-ray systems in airports; neutron in, gamma out techniques; neutron and gamma backscattering; nuclear quadruple resonance, including remote NQR; sub-surface radars; microwave scanners; laser-induced burst spectroscopy (LIBS); acoustic sensors; nonlinear location (NUD); systems for localization and destruction of explosive objects.

Existing and Potential Standoff Explosives Detection Techniques examines the scientific techniques currently used as the basis for explosives detection and determines whether other techniques might provide promising research avenues with possible pathways to new detection protocols. This report describe the characteristics of explosives, bombs, and their components that are or might be used to provide a signature for exploitation in detection technology; considers scientific techniques for exploiting these characteristics to detect explosives and explosive devices; discusses the potential for integrating such techniques into detection systems that would have sufficient sensitivity without an unacceptable false-positive rate; and proposes areas for research that might be expected to yield significant advances in practical explosives and bomb detection technology in the near, mid, and long term.

The detection of hidden explosives has become an issue of utmost importance in recent years. While terrorism is not new to the international community, recent terrorist attacks have raised the issue of detection of explosives and have generated a great demand for rapid, sensitive and reliable methods for detecting hidden explosives. Counterterrorist Detection Techniques of Explosives covers recent advances in this area of research including vapor and trace detection

techniques (chemiluminescence, mass spectrometry, ion mobility spectrometry, electrochemical methods and micromechanical sensors, such as microcantilevers) and bulk detection techniques (neutron techniques, nuclear quadrupole resonance, x-ray diffraction imaging, millimeter-wave imaging, terahertz imaging and laser techniques). This book will be of interest to any scientists involved in the design and application of security screening technologies including new sensors and detecting devices which will prevent the smuggling of bombs and explosives. * Covers latest advances in vapor and trace detection techniques and bulk detection techniques * Reviews both current techniques and those in advanced stages of development * Techniques that are described in detail, including its principles of operation, as well as its applications in the detection of explosives

Filled with practical applications and research, Biodegradation of Nitroaromatic Compounds and Explosives presents an international perspective on environmental contamination from explosives. It covers biodegradation strategies for DNT and a wide variety of other nitroaromatic compounds of environmental significance and makes the information accessible to practicing environmental and chemical engineers. Biodegradation of Nitroaromatic Compounds and Explosives gives you a synthesis of ongoing research and an appreciation of the remarkable range of biochemical strategies available for the transformation of nitroaromatic compounds. It provides a realistic assessment of the current and potential field applications of the various strategies.

Detection and quantification of trace chemicals is a major thrust of analytical chemistry. In recent years much effort has been spent developing detection systems for priority pollutants. Less mature are the detections of substances of interest to law enforcement and security

personnel:in particular explosives. This volume will discuss the detection of these, not only setting out the theoretical fundamentals, but also emphasizing the remarkable developments in the last decade. Terrorist events—airplanes blown out of the sky (PanAm 103 over Lockerbie) and attacks on U.S. and European cities (Trade Center in New York and the Murrah Federal Building in Oklahoma City, railways in London and Madrid)--emphasize the danger of concealed explosives. However, since most explosives release little vapor, it was not possible to detect them by technology used on most organic substances. After PanAm 103 was downed over Scotland, the U.S. Congress requested automatic explosive detection equipment be placed in airports. This volume outlines the history of explosive detection research, the developments along the way, present day technologies, and what we think the future holds. - Written by experts in the field who set out both the scientific issues and the practical context with authority - Discusses and describes the threat - Describes the theoretical background and practical applications of both trace and bulk explosives detection

Over 1000 soil samples were collected at the surface and at depth near buried TMA-5, TMM-1, PMA-1A, PMA-2, and Type 72 land mines at a research minefield at Fort Leonard Wood, Missouri, in 1998 and 1999. Soil samples were extracted with acetonitrile and analyzed by GC-BCD for nitroaromatic, nitramine, and aminonitroaromatic compounds to determine the concentrations of explosives-related chemical (ERC) signatures that collect in soil near buried land mines. The most often detected 20 different ERC compounds were 2,4-dinitrotoluene (2,4-DNT), 2,4,6-trinitrotoluene (2,4,6-TNT), and two environmental transformation products of 2,4,6-TNT: 2-amino-4,6-dinitrotoluene (2-ADNT) and 4-amino-2,6-dinitrotoluene (4-ADNT). Generally, in surface soils, either 2-ADNT, 4-ADNT, or 2,4-DNT were the ERCs most often

detected and were present at the highest concentrations. ERCs were much more prevalent near TMA-5 and PMA-1A land mines than TMM-1 and PMA-2 mines. ERCs were spatially heterogeneous in soil, but were found most often in a discontinuous cylinder around the perimeters of the mines, under the mines, and in a discontinuous halo in the surface soil. It appears that the frequency of detection of ERCs in soil near the TMA-5 and PMA-1A mines is continuing to increase with time. Soil/air partition coefficients, estimated for ERC analyses using explosives-contaminated soil from the research minefield, and the median values for these compounds, estimated in the surface soils, were used to predict the concentrations of ERCs in the boundary layer air above buried TMA-5 and PMA-1A mines. 2,4-DNT and the two isomers of ADNT give the greatest promise for success in chemically detecting buried mines. Forensic and Environmental Detection of Explosives is the first comprehensive book on the detection of explosives. It combines the two main fields of application: * Forensic detection of explosives - the detection of hidden explosives in airfreight, luggage, vehicles, and on suspects. * Environmental detection of explosives - detecting on-site explosives in soil and water of contaminated areas and the detection of landmines. Dr Jehuda Yinon is a world renowned expert on the analysis of explosives and has served as consulting expert during the Oklahoma bombing trial, where his previous book Modern Methods and Applications in Analysis of Explosives was quoted by both the prosecution and defense experts. This new book complements the author's previous book on the analysis of explosives. It includes the following features: * Classifications of explosives * Explanations of the basic terms related to the detection of explosives * Vapor detection methods * Probing radiation methods * Tagging of explosives * Systems integration and performance testing * Detection of explosives in

contaminated areas * Detection of landmines. This book is an ideal reference book for those working in forensic and law enforcement agencies concerned with the detection of hidden explosives, as well as for environmental scientists dealing with explosives decontamination. The book is also recommended as a text book for graduate students in analytical, environmental and forensic science.

Soil Magnetism: Applications in Pedology, Environmental Science and Agriculture provides a systematic, comparative, and detailed overview of the magnetic characterization of the major soil units and the observed general relationships, possibilities, and perspectives in application of rock magnetic methods in soil science, agriculture, and beyond. Part I covers detailed magnetic and geochemical characterization of major soil types according to the FAO classification system, with Part II covering the mapping of topsoil magnetic signatures on the basis of soil magnetic characteristics. The book concludes with practical examples on the application of magnetic methods in environmental science, agriculture, soil pollution, and paleoclimate. Provides an overview of the major findings of uncontaminated soil profiles and proposes a system of magnetic characteristics Elucidates the relationship between geochemical and magnetic characteristics of different soil types, providing a basis for wider recognition and application of soil magnetism in classical pedagogical characterization of soils Covers the peculiarities of the main taxonomic soil groups in terms of magnetic mineralogy and depth variations in concentration, grain size, and phase composition of iron oxides

The fast detection of explosives from the vapor phase would be one way to enhance the protection of society against terrorist attacks. Up to now the problem of detection of explosives, especially the location of explosives whether at large areas e. g. station halls, theaters or

hidden in cars, aircraft cargo, baggage or explosives hidden in crowds e. g. suicide bombers or bombs in bags has not been solved. Smelling of explosives like dogs do seems to be a valuable tool for a security chain. In general different strategies can be adopt to the basic problem of explosive detection: • bulk detection • vapor detection Normally meetings cover both aspects and applications of the detection. Even though both methods might fulfill special aspects of a general security chain the underlying scientific questions differ strongly. Because of that the discussions of the scientists and practitioners from the different main directions are sometimes only less specific. Therefore the NATO Advisory Panel in Security-Related Civil Science and Technology proposed a small series of NATO ARW's which focuses on the different scientific aspects of explosives detection methods. This book is based on material presented at the first NATO ARW of this series in Moscow which covered the topic: Vapor and trace detection of explosives. The second ARW was held in St. Petersburg and treated the topic Bulk detection methods. The third workshop was held in Warwick and focused on electronic noses which cover a somewhat different aspect of vapor detection.

This thesis presents a new system for detection of landmines that are partly occ luded and completely visible. Landmine detection is indispensable to all the cou ntries affected by war. In Lebanon, 22 deaths and 133 injuries were caused by th ousands of cluster bombs fired on the South in the previous war. Several researc hes have tackled systems and promising methods have been devised. However, some limitations in these methods hinder their full exploitation in real applications . Main limitations include detecting false positives and the failure to detect m ines with the change inn environment. The work in this thesis is aimed to overco me some of these limitations through the proposed approach. First, a system with normal camera and

infrared camera are combined to detect landmines. These landm ines are detected according to their geometrical shapes, specifically circular a nd rectangular mines. RANSAC is used to detect circular mines, while PCA links r ectangular landmines in the two images. Finally, area and boundary verification are used to confirm the detection and to neglect any false alarms. The performan ce of the landmine detection system is demonstrated on a experiments representin g different cases.

The latest EM techniques for detecting concealed targets, whether explosives, weapons, or people Extensively illustrated from basic principles to system design, the fundamental concepts of RF, microwave, millimeter wave, and terahertz detection systems and techniques to find concealed targets are explained in this publication. These concealed targets may be explosive devices or weapons, which can be buried in the ground, concealed in building structures, hidden under clothing, or inside luggage. Concealed targets may also be people who are stowaways or victims of an avalanche or earthquake. Although much information is available in conference proceedings and professional society publications, this book brings all the relevant information in a single, expertly written and organized volume. Readers gain an understanding of the physics underlying electromagnetic (EM) detection methods, as well as the factors that affect the performance of EM detection equipment, helping them choose the right type of equipment and techniques to meet the demands of particular tasks. Among the topics covered are: Ultra-wideband radar and ground-penetrating radar Millimeter, sub-millimeter, and terahertz systems Radar systems including Doppler, harmonic, impulse, FMCW, and holographic Radiometric systems Nuclear quadrupole resonance systems Author David Daniels has many years of experience designing and deploying EM systems to detect

concealed targets. As a result, this publication is essential for scientists and engineers who are developing or using EM equipment and techniques for a diverse range of purposes, including homeland security, crime prevention, or the detection of persons.

This report describes continuing efforts to detect landmines by using novel fluorescent polymers that sense the ultra-trace concentrations of nitroaromatic compounds emanating from explosives contained in mines. Under this contract, scientific studies were made and several new generations of detectors were developed and tested in an effort to understand the chemical signature of landmines. It has been shown that the landmine chemical signature tends to be heterogeneous and can be dispersed in the environment near the mine location. This makes it difficult to pinpoint the exact location of the mine using trace chemical detection methods. However, evidence currently available indicates that it may be possible to isolate a mine location to within a small, well-defined area. Also discussed in this report is a promising method for standoff detection of suspected mines using small beads coated with the amplifying fluorescent polymer. Nomadics was able to demonstrate the detection of the quenching effect at a distance of 58 meters.

Honey Bees: Estimating the Environmental Impact of Chemicals is an updated account of the different strategies for assessing the ecotoxicity of xenobiotics

against these social insects, which play a key role in both ecology and agriculture. In addition to the classical acute laboratory test, semi-field cage tests and full field funnel tests, new te

Clearing large areas that are suspected of containing landmines is an expensive and time-consuming task. Upon the completion of demining operations, few, if any, landmines may be found. Technologies that can locate individual landmines in a minefield exist, but most of these methods are relatively slow and expensive. In addition, these technologies are not generally suitable for rapid screening of an area for the presence of landmines. Hence, technologies that can quickly ascertain whether there is an actual landmine threat in an area are needed. The explosive contained in landmines produces a bouquet of chemical vapors that can contaminate the environment near a mine. Under the DARPA Dog's Nose Program, Nomadics developed a sensor (known as Fido) that utilizes novel fluorescent polymers to detect ultra-trace concentrations of nitroaromatic compounds emanating from landmines. Evidence currently available indicates that it may be possible to quickly deduce mine locations to within an area of a few square meters. Field data supporting this conclusion have been obtained using our sensor, and the conclusions drawn are supported by other accepted laboratory analysis methods. These results are driving development of sampling

and sensing equipment that may be suitable for rapidly isolating mined areas within large minefields. Preliminary data from field tests using prototype soil and vapor samplers with Fido sensors will be presented.

This volume presents selected contributions from the “Advanced Research Workshop on Explosives Detection” hosted by the Department of Information Engineering of the University of Florence, Italy in 2018. The main goal of the workshop was to find out how Science for Peace and Security projects in the field of Explosives Detection contribute to the development and/or refinement of scientific and technical knowledge and competencies. The findings of the workshop, presented in the last section of the book, determine future actions and direction of the SPS Programme in the field of explosives detection and management.The NATO Science for Peace and Security (SPS) Programme, promotes dialogue and practical cooperation between NATO member states and partner nations based on scientific research, technological innovation and knowledge exchange. Several initiatives were launched in the field of explosive detection and clearance, as part of NATO’s enhanced role in the international fight against terrorism. Experts and scientists from NATO members and partner countries have been brought together in multi-year projects, within the framework of the SPS Programme, to cooperate in the scientific research in explosive

detection field, developing new technologies and methods to be implemented in order to detect explosive substances in different contexts.

Master's Thesis from the year 2016 in the subject Engineering - Robotics, Mansoura University, language: English, abstract: This thesis studies strategies for humanitarian demining using robotic units. The author presents a low-cost system for landmines detection. The proposed system uses fusion of low cost multi sensors instead of using very expensive one. The proposed robot used sensor fusion technique to increase the probability of mine detection. The author has developed decision level fusion to decrease false alarm of mines detection. He used complete coverage path planning to find all possible mines in the environment. The author proposed using multiple robots with the same structure to use complete coverage path in parallel way to save the time. He proposed effective obstacle avoidance algorithm to help the robot moves in autonomous motion. The proposed robot is light in order not to trigger mines and be destroyed. He proposed effective method to destroy mines where they are using arm on the robot to help defusing method. The purpose of the thesis is to give an efficient solution for the landmines problem. By using robots that are capable of exploring and destroying buried landmines. The author also aimed to make the proposed robot with simle components to provide the soldiers and local

landmines environments citizens with effective solution that they can use to save their lives.

This report contains results of a field trial performed by a landmine detection prototype based on the detection of residual explosives in soils. The trial was carried out at a mine field that included 25 buried mines, 25 empty sites, and one with a TNT block buried in the soil. In order to evaluate the efficiency of the system, the detection of explosives (TNT & RDX) was performed on these 51 sites. A preliminary evaluation of the explosives contained in the soil was also performed. Results showed whether the concentration of explosives was below the detection limit of the prototype. In addition, the report summarizes problems in the detection of land mines with trace explosive detectors in general or by using an electronic nose or dogs.

Nuclear quadrupole resonance (NQR) a highly promising new technique for bulk explosives detection: relatively inexpensive, more compact than NMR, but with considerable selectivity. Since the NQR frequency is insensitive to long-range variations in composition, mixing explosives with other materials, such as the plasticizers in plastic explosives, makes no difference. The NQR signal strength varies linearly with the amount of explosive, and is independent of its distribution within the volume monitored. NQR spots explosive types in configurations missed

by the X-ray imaging method. But if NQR is so good, why it is not used everywhere? Its main limitation is the low signal-to-noise ratio, particularly with the radio-frequency interference that exists in a field environment, NQR polarization being much weaker than that from an external magnetic field. The distinctive signatures are there, but are difficult to extract from the noise. In addition, the high selectivity is partly a disadvantage, as it is hard to build a multichannel system necessary to cover a wide range of target substances. Moreover, substances fully screened by metallic enclosures, etc. are difficult to detect. A workshop was held at St Petersburg in July 2008 in an attempt to solve these problems and make NQR the universal technique for the detection of bombs regardless of type. This book presents the essentials of the papers given there.

A comprehensive guide to training and certifying K9 explosive detection teams Learn how to: - Train your K9 to detect and safely alert for explosive substances. - Conduct operational searches in buildings, vehicles, ships, and planes. - Train your dog for the specialized work of mine detection. In the high stakes realm of explosive detection, where even the smallest mistake can have fatal consequences, the margin of error is zero. Well trained dog-handler teams can play a key role in explosive detection, but only if their training is top notch. Dr. Resi Gerritsen and Ruud Haak have worked with police departments around the world to help them establish and improve their K9 explosive detection training programs, and in this book they

share their expertise with handlers and trainers looking to enhance their own performance. They teach how to pick the right dog for explosive detection work, how to train the dog to detect explosives, and how to properly execute a variety of training and operational searches. They also provide some of the background knowledge you'll need about common explosives and the many factors that can influence a K9's work. Along with essential health and safety precautions for you and your dog, you'll also learn how to test and certify dogs and handlers to ensure excellent performance in the field.

At the rate that government and nongovernmental organizations are clearing existing landmines, it will take 450-500 years to rid the world of them. Concerned about the slow pace of demining, the Office of Science and Technology asked RAND to assess potential innovative technologies being explored and to project what funding would be required to foster the development of the more promising ones. The authors of this report suggest that the federal government undertake a research and development effort to develop a multisensor mine detection system over the next five to eight years.

This book collects lectures of an international NATO-Russian Advanced Research Workshop on Detection and Disposal of Improvised Explosives (IE) used by terrorists. The disposal of IE is especially dangerous, because they are often much more unstable and mechanically more sensitive than commercial or military explosives. This text covers detection of explosives by different analytical methods and the different shape and compositions of the explosive charge, and offers up-to-date advice on handling and disposal.

The purpose of this workshop was to investigate the use of ionizing radiation techniques for detecting land mines and, in particular, to identify technological advancements that would alter

the assessment of the prior workshop held on March 1973. Although emphasis was placed on application of developed or emerging technology to the problem of the detection of buried land mines, detection of concealed explosives in the context of security was also considered. Automatic detection of explosives in luggage and hand-carried items received the greatest attention. Lesser attention was given to detecting explosives concealed within a building's structure. Three particular explosives detection scenarios were considered, and the requirements for each were explicitly discussed by panel members. The first of these, the detection of buried, nonmetallic, anti-vehicular mines, was the area of greatest concern and was given the greatest emphasis by the panel. The other two, detection of anti- personnel mines and detection of explosives in luggage and packages, were considered in less detail.

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ABSTRACT: The recent popularity of improvised explosive devices, and the continuing threat presented by unexploded land mines pushes the detection of hidden explosives to the forefront of scientific research. For maximum utility, a detection device should be handheld, be inexpensive, respond quickly, have little interference, and detect explosives without direct contact with the explosive device. Few instruments are available that can meet most of these requirements, primarily because measuring explosives in the vapor phase demands a sensitivity of low parts per billion to parts per trillion of explosive material.

This book examines both the potential application of electronic nose technology, and the current state of development of chemical sensors for the detection of vapours from explosives, such as those used in landmines. The two fields have developed, somewhat in parallel, over the past decade and so one of the purposes of this workshop, on which the book is based, was

to bring together scientists from the two fields in order to challenge the two communities and, mutually, stimulate both fields. It begins with a review of the basic principles of an electronic nose and explores possible ways in which the detection limit of conventional electronic nose technology can be reduced to the level required for the trace levels observed for many explosive materials. Next are reviews of the use of several different types of solid-state chemical sensors: polymer-based sensors, i.e. chemiluminescent, fluorescent and optical, to detect explosive materials; metal oxide semiconducting resistive sensors; and then electrochemical sensors. Next, different pattern recognition techniques are presented to enhance the performance of chemical sensors. Then biological systems are considered as a possible blue-print for chemical sensing. The biology can be employed either to understand the way insects locate odorant sources, or to understand the signal processing neural pathways. Next is a discussion of some of the new types of electronic noses; namely, a fast GC column with a SAW detector and a micromechanical sensor. Finally, the important issues of sampling technologies and the design of the microfluidic systems are considered. In particular, the use of pre-concentrators and solid phase micro extractors to boost the vapour concentration before it is introduced to the chemical sensor or electronic nose.

Anti-personnel Landmine Detection for Humanitarian Demining reports on state-of-the-art technologies developed during a Japanese National Research Project (2002–2007). The conventional method of landmine detection is using metal detectors to sense the metal in mines, but often other metal fragments in minefields camouflage landmines and hinder progress using this form of demining. The challenge is to develop detection

systems that can discriminate between AP landmines and random metal fragments. The JST adopted research proposals and the results are reported here. This book concentrates on aspects of three approaches to AP mine detection: enhancing and confirming the results of metal-detection scans using GPR; using robot vehicles and manipulators to operate within minefields remotely; and methods of sensing the explosives within mines. Results are presented in the fields of GPR, nuclear quadrupole resonance, neutron thermal analysis and biosensors. The integration of these methods for workable robot operation is demonstrated. The project was carried out in conjunction with mine action centers in Croatia, Cambodia and Afghanistan. Evaluation data from field trials are also given.

This ARW is the third NATO-sponsored workshop on Explosives Detection and Humanitarian Demining. The previous events were • Detection and Destruction of Anti-Personnel Landmines Moscow, 1997 • Explosives Detection and Decontamination of the Environment Prague, 1997. Over the last decade applied research in Humanitarian Demining has made progress to some extend, but according to the tremendous tasks of Demining and the lack of scientific methods for practical detection of explosive devices, research activities are still of the same importance than ever before. Concerning countermeasures against terrorism the detection of explosives is one of the keyfactors, but the practical applications are not sufficient solved. An international exchange of research results are therefore urgent, to find out the most promising measures for

application. The coincidence of this ARW and the terrible disaster of New York and Washington may demonstrate the importance of this task. In consequence the explosive device detection technologies can make a major contribution to collective, family and individual security. In developed countries, these technologies provide a strong deterrent and preventative measure against terrorist threats. In less developed regions, they can improve individual, institutional and state security, lessening the insecurity that motivates many terrorists acts. The elimination of landmine threats is just one of many ways of achieving this. However our attempts to meet the extremely difficult technical challenges posed by landmine and UXO contamination are inevitably leading us to new technological approaches.

The Book Bomb Dog Training written by Sid Murray is a step-by-step guide training a bomb dog from start to finish.In this book Sid walks you through each step starting with 'How to select the right handler', 'How to select and test your detection dog candidate', 'How to set up your training areas' and exactly what you need to do to take your dog from start to a 'finished bomb dog'.Sid Murray has been training detection dogs for over 25 years and is recognized world-wide as an expert in detection dog training.

This timely book covers the most recent developments in the chemical detection of explosives in a variety of environments. Beginning with a broad view of the need for and the potential applications of chemical sensing, the book considers the issue of how to effectively include chemical sensing into systems designed to find hidden explosives

devices. Offering a firsthand look at the latest technologies direct from those who are actively developing them, the book features: A look at the history of the field, including the contributions of recent programs A brief explanation of the chemistry of various explosives and differences in the place where they may be detected An introduction to the problems presented by trace element sensing An overview and comparison of the technologies currently being used and developed Case studies of field experiences with chemical sensors A look at the emerging threat of non-traditional explosives This book is an important reference for explosives engineers, systems engineers involved in the development of related devices, government agencies and NGOs involved in demining efforts, military and law enforcement specialists in mines and explosive ordinance disposal (EOD), as well as environmental scientists and chemists involved in explosives research. In addition to providing field workers with knowledge that will help them decide where and how to search for explosives using chemical sensors. It will provide them with an understanding of the potential and the limitations of chemical sensing in their search for and identification of dangerous devices.

Robots are used in industry, rescue missions, military operations, and subwater missions. Their use in hazardous environments is crucial in terms of occupational safety of workers and the health of rescue and military operations. This book presents several hazardous environment operations and safe operations of robots interacting with people in the context of occupational health and safety.

This report summarizes the results of an interim test of a system that uses the nuclear quadrupole resonance (NQR) signature of explosives for the detection of antipersonnel (AP) and antitank (AT) land mines. The system, designed and built by Quantum Magnetics, Inc. of San Diego, California, has been funded by the Defense Advanced Research Projects Agency (DARPA) Dog's Nose Program to develop technologies using chemical-specific approaches to the detection of explosives. The tests discussed herein were performed the weeks of October 25 and November 29,1999, at Ft. Leonard Wood, near St. Robert, Missouri. The Quantum Magnetics system was tested against AP and AT mine models buried in a set of test lanes. The AT mines were either plastic or metal cased and filled with either TNT or Comp B; the AP mines were plastic cased and filled with either TNT or RDX. This report outlines the current capability that is expected from both a vehicle-mounted and hand-held version of the NQR system.