EUDEM: The European Union in Humanitarian Demining

Karin De Bruyn
VUB-ETRO

Claudio Bruschini
VUB-ETRO

Hichem Sahli
VUB-ETRO

Jan Cornelis
VUB-ETRO

Follow this and additional works at: https://commons.lib.jmu.edu/cisr-journal

Part of the Defense and Security Studies Commons, Emergency and Disaster Management Commons, Other Public Affairs, Public Policy and Public Administration Commons, and the Peace and Conflict Studies Commons

Recommended Citation
De Bruyn, Karin; Bruschini, Claudio; Sahli, Hichem; and Cornelis, Jan (2000) "EUDEM: The European Union in Humanitarian Demining," Journal of Mine Action : Vol. 4 : Iss. 1 , Article 3. Available at: https://commons.lib.jmu.edu/cisr-journal/vol4/iss1/3

This Article is brought to you for free and open access by the Center for International Stabilization and Recovery at JMU Scholarly Commons. It has been accepted for inclusion in Journal of Conventional Weapons Destruction by an authorized editor of JMU Scholarly Commons. For more information, please contact dc_admin@jmu.edu.
EUDEM:
The European Union in Humanitarian Demining

by Karin De Bruyn, Claudia Bruschke, Hisham Salhi and Jan Cornelis

Background of EUDEM

The EUDEM project tried to provide the European Commission, as one of the largest sponsors of research in European humanitarian demining, with a survey titled "A State of the Art on Humanitarian Demining Technology, Products and Practice." Current practices and emerging technologies were discussed so that applied research can be directed toward solving real problems. Sustainable demining has to become more than "a man with a probe."

Framework of the EUDEM project

Public awareness of the landmine problem has grown in the last 5 to 10 years, and so has the response of the international community: The European Union (EU) committed to reinforce its efforts in helping affected nations clear their land of these deadly weapons. Given the scale and complexity of the problem, it would be highly beneficial to increase the coordination for maximum efficiency.

At the EU level, civil research has started within the High Performance Computing and Networking (HPCN) domain of the Information Technologies (IT) program, to promote industrial R&D activities in Europe in support of humanitarian demining operations world-wide. The aim is to bring advanced equipment to the field in two to four years to improve speed, cost and safety of demining operations. ESPRIT is an information technologies program of industrial R&D projects managed by the DG III. Three ESPRIT R&D projects started in early 1998 and six more in early 1999. These projects aim at research, developing and testing new systems for detecting anti-personnel landmines. These R&D projects are supported by testing and evaluation, surveys and data collection. EUDEM is one of these support activities. Recent humanitarian demining falls under the responsibility of DG XIII, as an integral part of the Information Society Technologies program.

EUDEM goals

EUDEM established a list of goals to establish a list of organizations to be consulted, primarily industrial companies developing equipment used in humanitarian demining and organizations performing or supervising humanitarian demining operations. These organizations include key research centers and university laboratories active in this field.

How goals were achieved

EUDEM accessed the Internet to find: lists of existing links and databases, internal list of persons and organizations active in humanitarian demining. EU-funded projects, participant lists to well known conferences in the domain and literature on the subject. The EUDEM database was gradually populated during the survey, and will remain an open working tool allowing updates and new entries on a continuous basis. The EUDEM database is accessible worldwide and not limited to organizations active in Europe.

The survey exploited a combination of literature review, telephone contacts, questionnaires, interviews and other methods.

Selected organizations were visited. Persons active at an organization level, or in demining practice and technical development were interviewed. Also, some organizations not yet active in the field but showing relevant interest and innovative ideas were included.

Methods

In making the selection of contacts, we tried to reach the whole spectrum in the EU. The database now covers a population that goes beyond the list of people that were directly contacted by us.

The questionnaire

After the initial list of organizations was established, the second phase of EUDEM consisted of a mailing. At first, 110 organizations were contacted on Jan. 26, 1999. These organizations received a one-page letter and a two-page questionnaire. The questionnaire was short and most questions could be answered by checking boxes.

The typical interview

Each interviewee received a short introduction of what our survey consisted of, and its purpose. Consequently, a brief overview of the interviewed organization was requested, followed with a clarification of the involvement in humanitarian demining activities. A brief discussion was held on the past and current activities of the organization. Most emphasis was placed during the interviews on the personal opinion of the interviewee with respect to a certain technologies and practices.

When specific projects not necessarily directly related to humanitarian demining were discussed, we tried to identify the project's aims, maturity of the different technologies involved and corresponding cost estimates, testing procedures; transferability of the developed techniques to different aspects of humanitarain demining, technical specifications of the equipment; performances in certain circumstances, compatibility between different techniques, degree of success in the field, R&D activities and strategies, research funding and commercial perspectives.

The EUDEM Database

Analysis

The overall response rate to the questionnaire has been high. The entries were taken into account for the extraction of statistics until the end of May 1999. Out of the 168 contacted organizations, 96 entries were made in the online database at http://www.eudem.slu.ac.be/

A brief analysis on the distribution of the entries over the different countries reveals the following stated in Graph 1. Note that nine entries of organizations from outside the EU have been registered. Distribution of entries in the EUDEM database over countries (total: 96)

The greatest number of database entries clearly comes from Industrial Small and Medium Enterprises with less than 250 employees [Industrial SME (<250 pers.)] see Graph 2. These are often not exclusively focusing their production on tools for humanitarian demining. Their willingness to participate in the EUDEM survey may also be explained by commercial agendas. The eight entries labeled "consultancy" in Graph 2 are small companies, mostly created by
Involvement in humanitarian demining

The 87 European organizations that filled in the "type of involvement in demining" field are all mentioning mine detection, some combined with clearance/demining and/or survey/mapping. Out of the 87 organizations, 74 percent declared to be involved in mine detection.

European technologies

Out of the 87 respondents in Europe, (see Graph 1) only 70 have given information on technology studies. The nine organizations outside of Europe are not taken into account. The numbers given in this section should not be taken as absolute numbers. We find the highest focus on the Ground Penetrating Radar (GPR) technology, declared by 20 organizations. The second highest was the Metal Detector (MD), mentioned by 15 organizations.

The State of Humanitarian Demining

The organizations and individuals we encountered include industrial companies, operators, key research centers, university laboratories and government agencies active in humanitarian demining, as well as some organizations not yet active in the field but showing relevant interest and innovative ideas. We concentrated mostly on detection, and partly on clearance and destruction equipment technologies; other aspects of the mine action process were investigated with the operators themselves, and some government agencies. The organizations are subdivided as follows: EUDEM found a myriad of equipment, ranging from dogs to technological systems, used for humanitarian demining.

The following table shows the technology, and the correlating maturity and cost. We added comments to clarify the aforementioned fields. Technological "maturity" should be interpreted as a qualitative measure expressing a mixture of the state of advancement of the R&D, demonstration of demining capabilities useful for humanitarian demining, and demonstration of building a practical system. "Cost" includes technological cost only, and does not take into account the actual productivity in the field. (See Table 2)

Conclusions and Discussions

The EUDEM report is a summary of EU humanitarian demining technology, products and practice. Sometimes the conclusions reflect personal opinions of the authors, and some of them had to be simplified leaving out nuances in order to make their message clear. For detailed information and the origin of the individual conclusions, the reader is referred to the information coming from different sources in the original report and its annexes.

The conclusions are classified in three categories: policy, related to organizational and coordination aspects; practice, related to currently used demining technology and procedures; and technology, related to R&D for new technologies, specification of equipment and testing.

Policy

Equipment procurement agency

Several NGOs have stressed the need for new technology to speed-up current demining procedures, but no one has suggested how to invest. Each circumstance requires specific logistics, campaign organization and equipment, and as a consequence not all existing equipment is continuously in use. Investment in equipment maintenance is also too high. The concept of an Equipment Procurement Agency, acquiring, organizing and maintaining a central pool of equipment, could form the basis of a solution to meet the market requirements. Work on setting up such an agency is currently ongoing.

Information sharing

Apart from the normal protection of industrial property rights, we have found many government-funded projects for humanitarian demining purposes which are not directly related to any of the above public. Initially, this resulted from the early military involvement in the domain. For example, many classified NATO reports could bring the development of new technologies, the assessment of usefulness of certain techniques and the standardization of testing protocols.

EUDEM database

The EUDEM database is an attempt to give an overview of European humanitarian demining. It could serve as a common repository and a practical search tool for all participants in the demining sector, simplifying contacts and favoring joint efforts. Maintaining the availability of the EUDEM database requires effort, continued over a number of years. Information sources on humanitarian demining can be consulted via the Internet, but most of them repeat the same topics.

Practice

Mine dog programs

Although the use of dogs is far from being a perfect science, well-run dog programs have managed to convince skepetic deminers. The use of dogs is approved by most humanitarian demining organizations for area verification and mine-field detonation purposes, which allow important time gains to manual clearance operations and quality control after mine-clearance activities.

Mechanical systems

An evaluation is observed from mechanical demining towards mechanically assisted demining adaptable to local circumstances. Machines usually have to be backed-up by some manual method. These systems are employed for mine verification and area reduction tasks, as well as clearance of actual mine fields. Large mechanical systems require substantial investments.

Humanitarian vs. military objectives

It is important to understand that mine detection and mine-field detonation technology is based on military operational doctrine, compared to humanitarian or post-conflict requirements.

Technology

Input from other domains

As a consequence, the reader should not get the impression that the R&D, demonstrated demining capabilities and technology, are currently used by the humanitarian deminers. It is understood that there may be a potential use for some of the technology, equipment, practices and procedures, and the information on them can be of interest to the humanitarian deminers. However, it is not the objective of this EUDEM report to make such recommendations. In addition, the reader should be aware that the information presented does not include an analysis of what is produced in the countries concerned, even if they are EU member states.

Table 2

<table>
<thead>
<tr>
<th>Sensor technology</th>
<th>Maturity</th>
<th>Cost</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Medium (M)</td>
<td>Low (L)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Profiling/surveillance</td>
<td>High (H)</td>
<td>Medium (M)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Magnetic devices</td>
<td>High (H)</td>
<td>High (H)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Metal detectors</td>
<td>Low (L)</td>
<td>Low (L)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Metal detector array</td>
<td>High (H)</td>
<td>Medium (M)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Passive iris wave</td>
<td>Medium (M)</td>
<td>High (H)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Radar</td>
<td>Medium (M)</td>
<td>Low (L)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Passive infrared</td>
<td>Medium (M)</td>
<td>Medium (M)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Infrared analyser/thermal analyser</td>
<td>High (H)</td>
<td>High (H)</td>
<td>Used in practice</td>
</tr>
<tr>
<td>Gamma spectrometry</td>
<td>Medium (M)</td>
<td>Medium (M)</td>
<td>Used in practice</td>
</tr>
</tbody>
</table>

Table 2 (Qualitative) Maturity and Cost evaluation for the previously mentioned technologies. Maturity indication ranges from Low (L) to Medium (M) up to High (H). Cost indication L = <10000 USD; M = 10000 - 500000 USD; H = >500000 USD. (Research forecast 2000-2005, unless otherwise stated.)
destructive testing, signal/image processing, remote sensing, Geographic Information Systems and medical imaging.

Existing vs. new technologies
Several national demining campaign sponsors brought up that less emphasis should be put on development of new technologies. The “improvement of existing technology will resolve the problem faster.” Some prefer an imperfect technique whose limitations are well-known as compared to a new technique that is not yet trusted. The need for complete solutions, taking into account all aspects was stressed by many NGOs – Mine Action is indeed not only about demining.

(Global) R&D trends
Much of the R&D effort for humanitarian demining has gone toward the detection of individual mines. Two approaches seem to be the most predominant: the use of a multi-sensor system, or the combination of a detection sensor. Some research is currently done on wide-area confirmation methods. Airborne mine field delineation or explosive vapor/trace detection to complement—or partially replace—dogs, in order to save precious time by concentrating on areas which really need to be demined. Evolution should be governed by a set of keywords (NPA): “Safer, Faster and Cheaper.”

Sensor technology maturity
Consider: we have to rely on indirect evidence due to the absence of well-established definitions of equipment performance; most of the results of independent performance tests are not publicly available; we have not conducted performance tests ourselves; and we do not share the practical experience of deminers working in the field. We nevertheless think that Table 2 is useful in fixing the large tendencies in technology maturity and equipment cost.

Airborne mine field detection/remote sensing
The role of remote sensing vs. ground-based methods has not yet been fully identified. For airborne mine-field detection on realistic surfaces (1000-to 1000-km), terabytes (1000 gigabytes) of digital data have to be analyzed. Setting-up a measurement campaign is a complex and expensive operation. Although for civilian applications on-board processing might not be a primary requirement, even off-line analysis requires huge computing facilities. The development of remote sensing systems has been primarily done in the military context and it is unlikely that these systems will be operational for civilian applications in the near future. Several platforms have been tested, like airships, aircrafts, drones and helicopters. The privileged sensors are the optical and the IR imager, although UWB-SAR seems to yield promising results for the future. On certain soil types and non-densely vegetated areas the airborne mine field delineation results are reported to be successful (e.g. deserts).

Testing and evaluation
The implementation of specifications for testing protocols is again an international mission. The existence of several ad hoc protocols is a well-known fact after this survey, but they remain proprietary information, which is inaccessible for the research community. In order to test or compare new technologies that are in the development phase or have been developed, a possibility should exist to gain confidence by application in the field. The establishment of a joint working group, focusing on the development of testing methodologies and the design of standards for sensor and system assessment, is currently ongoing. On the European side, the existing Committee of Advisors: Detection of Mines based on Operational Standards (CADMOS) workgroup, promoted by JRC, acts as the core group.

EUDEM started in December 1998 and ended in July 1999. The survey was conducted by EPFL (École Polytechnique Fédérale de Lausanne) and VUB (Vrije Universiteit Brussel). It was funded by EU; DG XIII.

Contact Information
Karin De Bruyn, Claudio Bruschini, Hichem Sahli, Jan Cornelis
VUB-ETRO, Department “Electronics and Information Processing”
Pleinlaan 2, B-1050 Brussels, Belgium
Tel. +32 (0)2 629 2930
Fax +32 (0)2 629 2883
E-mail: kdebruyn@vub.ac.be