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From 1000 to 100 Years in Solving the Humanitarian Demining Problem

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Purpose

This paper serves two purposes: (1) to introduce the Mine Warfare Association (*MINWARA*) and (2) to discuss how the Humanitarian Demining problem might be solved in less than a century. *MINWARA* is an international focal point for Mine Warfare (MIW), Mine CounterMeasures (MCM), and Humanitarian Demining (HMD).

Specifically, *MINWARA* aims to meet the objectives of

- establishing, maintaining, and encouraging open communications with and among all the organizations involved with MIW, MCM, and Humanitarian Demining;
- providing an educational function regarding the use and abuse of sea and landmines;
- stimulating research in the technology and means to counter sea and landmines (MCM) and practicing (via training) and implementing (operationally) "risk avoidance;" and
- stimulating the cross-fertilization of technological approaches to the mine countermeasures/countermine problem among the military, academic, and industrial communities in the U.S. and abroad.

We work closely with all parties interested in any aspect of the mine problem, including the James Madison University Humanitarian Demining Information Center (HDIC).

Bottom Line

MINWARA maintains a consortium of like-minded entities including U.S. government agencies, concerned countries, NGOs (non-government organizations), private corporations, academe, and research laboratories. This organization facilitates the sharing of information on emerging technologies to locate, mark, neutralize, and destroy sea and landmines with more effectiveness and less cost and ensures that new technologies cross- fertilize

and are responsive to user needs. In the HMD area, we believe it is possible to make a large dent in the problem over the next few decades (and certainly in less than 100 years); to achieve this goal will require a clear knowledge of the problem and at least order of magnitude (factor of ten or more) changes in our approach to solving it.

Background

The Mine Warfare Association (*MINWARA*) was founded in June 1995 with objectives congruent with the above purpose statements. The stimulus for the founding of the association was the highly successful Symposium on Autonomous Vehicles in Mine Countermeasures that was held at the Naval Postgraduate School in April 1995. That symposium underscored the need for greater communication and understanding of all aspects of the "Mine Problem" in and among all of the communities (military, government, academic, industrial, popular). The Second Symposium on Technology and the Mine Problem that was co-sponsored (in November 1996) by the Office of Naval Research, the Naval Postgraduate School, and *MINWARA* maintained the momentum of the first symposium, reinforced the perception of needs, and advanced communication within and between the various communities. A third Symposium on Technology and the Mine Problem is scheduled in Monterey for April 4-9, 1998 to continue this process; the fourth will be held in November of 1999. Four workshops (in November 1995, March 1996, April 1997 and planned for November 13-14, 1997) have provided and will provide a strong technical focus, as well as some of the requisite glue that binds the communities together.

As a result of the two longer symposia and three shorter meetings, *MINWARA* has achieved international recognition as a focal point for the application of emergent technology to the Mine Problem. As a not-for-profit Corporation in Virginia and under the scope of the IRS Code Section 501(c)(3), *MINWARA* can complement government and industrial organizations in a unique way. We are in a position to promote synergy among existing or potential approaches to the Mine Problem. From the educational standpoint, there exists a need to evolve communication and understanding among the political and social science communities and the scientific and engineering disciplines in military as well as civilian organizations.

Discussion

In response to the threat of sea and landmines, NGOs throughout the world are becoming increasingly influential among governments in developing policies and leveraging expenditures to mitigate and remediate mined areas. The establishment of open, confident communications and understanding with and among NGOs is clearly in the interests of the U.S. Government and of the Departments of Defense and State. *MINWARA's* approach is one of

"inclusiveness." Its mechanisms are and will be meetings, workshops, and symposia at which all viewpoints will be encouraged to participate. *MINWARA* plans to build on existing relationships that it and consortia members have, especially the James Madison University HDIC program. At the same time, *MINWARA* believes that there must be specific research in social and political science, as well as technological research, to establish the similarities and differences that exist in the understanding of the humanitarian demining problem and in the military approaches to countering mines on land and at sea. The objective in the former HMD case is to provide assurance. The objectives of the latter MCM case are risk management and the implementation of cost and operationally effective solutions. There are several environmental and contextual differences also. These differences and similarities must be clearly characterized and applied to the specific areas needing remediation. Fortunately, some of this has already been done—largely by NGOs.

MINWARA believes that members of the demining community must look beyond conventional countermine approaches in the Humanitarian Demining aspect of the Mine Problem. *MINWARA*'s initiative is to look to the agricultural engineering community to see what approaches may be viable when combined with the technologies of handling explosives and hazardous materials. Our plan is to sponsor a design competition at the major agricultural engineering schools—for example, the University of California at Davis (UC-Davis), Iowa State University, Virginia Tech, and Penn State University—culminating at *MINWARA*'s April 1998 meeting. According to *MINWARA*, agriculture provided the genesis of the tank in World War I and could provide another interesting solution today. A recent visit by *MINWARA* personnel to UC-Davis showed a number of promising approaches and extensive understanding of robotics and tele-operation, technologies of general use in solving the mine problem.

Paralleling technological innovation must be quantitative analyses of the human and economic costs of failing to act aggressively as well as the costs and benefits associated with the various options. To make progress in the HMD area, one must be able to quantify the problem in terms of well-defined measures of effectiveness. These areas also are fruitful domains for academic research.

MINWARA has extensive professional contacts in academe and industry. Among the universities are MIT, Harvard, Caltech, Stanford, Virginia, Vanderbilt, Northeastern, Michigan State, Iowa State, University of California (Santa Cruz, Santa Barbara, Davis, San Diego), Pennsylvania, Penn State University, University of Florida (Jacksonville and Gainesville), and University of Southern California. Institutions with specific strengths in social and political science aspects of the mine problem are the University of San Diego, University of Norwich, Monterey Institute of International Studies, MIT, James Madison University, and the Naval Postgraduate School. Perhaps the most significant foreign contributor is Prof. J.D. Nicoud of Lausanne,

Switzerland. There are, of course, many others.

State of *MINWARA*

MINWARA currently consists of over 300 individual members, as well as over 20 corporate members. The percentages of individual and corporate members, by category, for the EOY 1996 are given in Tables 1 and 2, respectively. At the individual level, its active categories are well-populated both from private persons and company-designated memberships. The Charter category is being phased out, with the members being transferred to life memberships.

Category	Percent
Active	42
Active (Corporate)	43
Charter	1
Life	9
Life (Corporate)	3
Honorary	1

Table 1. Breakdown of individual members by category.

Corporate memberships are most populated at the Silver and Platinum levels, although we welcome support in any category.

Category	Percent
Bronze	6
Silver	38
Gold	6
Gold	6
Platinum	31

Table 2. Breakdown of corporate members by category.

MINWARA's growth over the past two years has been 30-40% monthly, as seen in Figures 1 (individual member growth) and 2 (corporate member growth).

Growth Plan

We invite individual and corporate members to join us concerning mines, mine warfare, mine countermeasures, and demining. Note that members come from a world market. Current membership by country is given in Table 3.

Country	Percent
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U.S.A.	96
Canada	2
England	1
Australia	<1
Switzerland	<1
Sweden	<1

Table 3. MINWARA members by country.

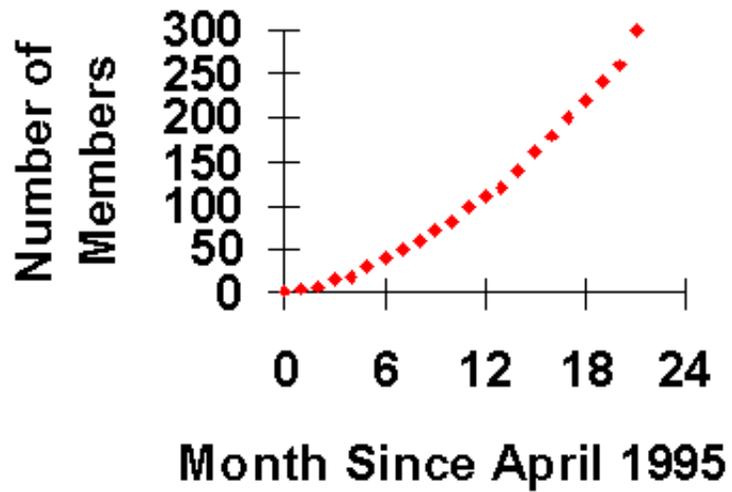


Figure 1. Individual member growth.

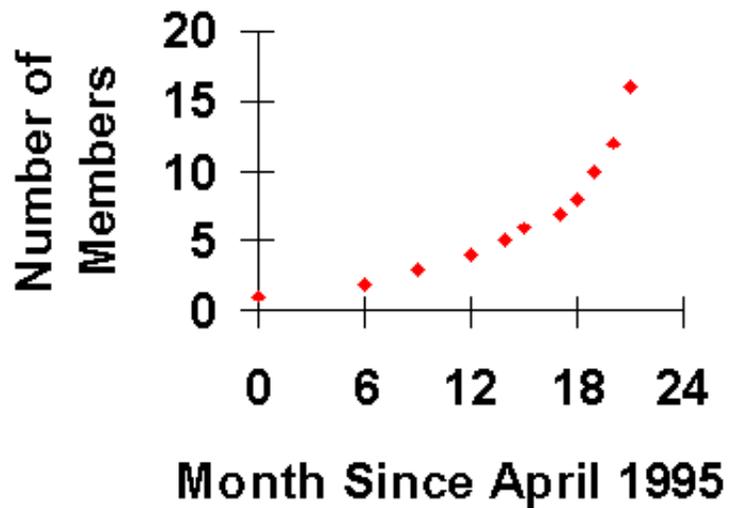


Figure 2. Corporate member growth.

The demographics of *MINWARA*'s membership is shown in Figure 3. Its largest member concentrations are in the NE and SE, where it has targeted its Spring 1997 and Fall 1997 meetings. Most members currently come from the U.S.; however, *MINWARA* does have representation from Australia, Canada, France, Sweden, Switzerland, and the UK. If the development of *MINWARA* follows that of most other current markets (cellular, personal computer, Internet, etc.), then it will begin to see even more member growth on the international side.

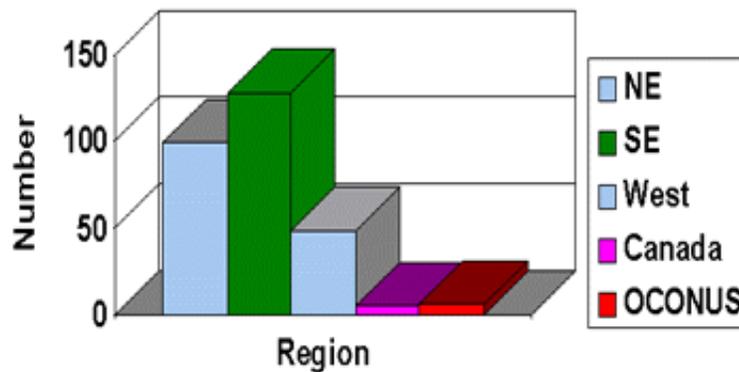


Figure 3. *MINWARA* members by region.

Solving the HMD Problem

The Humanitarian Demining problem is a difficult one. The difficulty is threefold:

1. Warfare is common and especially in peacetime, members of the demining community must be prepared for war.
2. Many millions of mines and UXO (unexploded ordnance) exist in numerous countries of the world.
3. Mines are being laid quicker than we can possibly clear them.

The HMD problem dwarfs the well-publicized environmental problems in scope, effects on society, and potential cost. Solving the problem will require many approaches:

- Old ideas implemented in new ways
- New ideas
- New technology
- Increased funding and manpower
- A clear understanding of the problem and the effect of our remedies.

This last item is of especial importance because we cannot make real progress without measuring it: quantifying the problem in a scientific manner is necessary. How many mines are out there, where are they, and of what type are they? We must define operational measures of effectiveness (MOEs) in order to clearly know the problem and annually measure the effect of our attempts to solve it. For example, if there are one million mines in a country at the beginning of a year, if someone lays 100,000, and if we only demine 1000, then we are not making much progress. Such a small amount of progress will save lives, but it will never solve the problem of there being more mines annually to cause more casualties.

Clearly, we can count or estimate the number of mines. If we can count the stars of the universe and the particles of matter, we can count the mines on earth. The solution of the mine problem will make use of a variety of methods:

- People and training of them
- Computers and information technology (databases, geographical information systems, the WWW)
- Conferences and symposia
- Acquisition of systems
- International agreements.

Making real progress toward the solution of the HMD problem will require order of magnitude increases in effort and technology. Where there are a million mines, we will need to be able to clear hundreds of thousands. Cheap and effective robotic systems may have an important role to play here.

The people that solve the problem will be from a variety of backgrounds

- Government
- Military
- Companies
- Laboratories
- Universities
- Host nations
- Grass roots groups and individuals.

There is thus the old problem of the two cultures (only here there are many cultures – military, academic, popular, scientific, literary, political) who must all work together for there to be progress. If groups become polarized or separated, then a lot of effort is simply wasted in conflict rather than being directed towards progress.

Talk will not solve the problem, but coordinated action will.