To the Reader:

The purpose of this document is to inform the reader of the significant accomplishments made by the Department of Defense Humanitarian Demining Research and Development (R&D) Program. This document provides detailed descriptions of the most promising equipment developed and evaluated in fiscal years 1999 and 2000. In addition, it contains short descriptions of prototype demining equipment evaluated since the program began in Fiscal Year 1995.

This guide exists to help governmental and non-governmental organizations and humanitarian donors identify means to assist nations in establishing and sustaining indigenous demining capabilities. Additionally, American embassies, foreign governments, and regional Commanders-in-Chief can use this guide to learn about available equipment that can assist in dealing with landmines, and potentially, other unexploded ordnance. Equipment developed under this program, and available now, stands ready to make a measurable difference in the international humanitarian demining effort.

Honorable Brian E. Sheridan

Assistant Secretary of Defense

(Special Operations/Low-Intensity Conflict)

Disclaimer

The technologies displayed in this document were developed and evaluated under the Department of Defense Humanitarian Demining Research and Development Program. The purpose of this publication is to provide information to organizations involved in humanitarian demining activities. Demining is an inherently dangerous activity. This document provides an overview of the types of products and technologies that are available for demining in order to bring as many options as possible to the reader. DoD does not endorse the listed products or companies, and makes no warranties or representations concerning the use of the listed products. Interested agencies are encouraged to contact listed vendors and contractors directly for equipment availability and current pricing. The Department of Defense points of contact, however, would appreciate any and all feedback on equipment use and suitability.

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Preface

A. Meeting the Challenge

In 1996 President Clinton committed the United States to help clear the world of antipersonnel (AP) landmines:

"The Department of Defense will undertake a substantial program to develop improved mine detection and clearing technology and to share this improved technology with the broader international community."

Subsequently, in 1997, the Secretaries of State and Defense jointly announced the *Demining 2010 Initiative,* with its stated goal of :

> **". . . eliminating the threat posed by landmines to civilians everywhere on the face of the earth by the end of the next decade."**

The scope of this task is daunting. Buried mines are difficult to detect and dangerous to remove. In many of the afflicted countries, mines are deployed to deny civilian access to villages, roadways, and agricultural areas.

To meet this challenge, the United States has developed a systematic approach that:

- Attacks the problem globally through international cooperation with both governmental and non-governmental organizations (NGOs)
- Develops new demining tools through research and development
- Develops and promulgates mine and demining information, instruction, and mine awareness
- Provides global on-the-ground support and assistance

This document provides information on the capability, utility, availability, performance, and limitations of mine detection equipment, mine and vegetation clearance equipment, and other emerging research and development initiatives undertaken by the Department of Defense in support of solving the humanitarian demining problem by 2010.

B. Global Cooperation

International cooperation is being developed on several fronts. Intergovernmental cooperation takes advantage of local government infrastructure and distribution channels. For the United States, Special Operations Forces (SOF) components of the theater commands, Explosive Ordnance Disposal units, civil affairs, and psychological operations units provide assistance through local governments for demining and mine awareness training programs.

Intergovernmental cooperation is also vital in developing mine databases and equipment effectiveness analyses. The International Test and Evaluation Program (ITEP) represents the beginning of a new type of international partnership to assess demining technology and equipment. Canada, the Netherlands, the United Kingdom, the United States, and the European Commission's Joint Research Center embarked on a cooperative demining pilot test project. The objective of this project is to evaluate existing commercial off-the-shelf metal detectors available for use as mine detectors that may be suitable for humanitarian demining. In-air testing was conducted at the Defense Research Establishment Suffield (DRES), Canada, shown below.

DRES Non-metallic building.

In-soil testing was conducted at the TNO Physics and Electronics Laboratory in the Netherlands, shown below.

***Guartel Detector* during In-Soil Tests at TNO.**

Mine lanes at TNO.

The United Kingdom scored and analyzed the experimental data. The United States provided the tested detectors, as well as test support during data acquisition. In-field testing was conducted in Cambodia and Croatia. The tests will identify those detectors best suited for particular geographical conditions or operational environments.

Mines Advisory Group (MAG) deminers training on the *Survivable Demining Tractor and Tools* in Cambodia.

Other areas of international cooperation in humanitarian demining technology include United States participation with the United Nations Mine Action Service, the European Community, and the Geneva International Centre for Humanitarian Demining in the development of statements of requirements (SOR) for specific technologies. The United States also cooperates globally with industry, academia, commercial demining companies, international organizations, NGOs, and private volunteer organizations to develop and implement systems that meet humanitarian demining needs.

C. Demining Tools

Demining is a slow and dangerous process. To meet the *Demining 2010 Initiative*, it is imperative that new tools and techniques be developed for the deminer. The Department of Defense has developed a Humanitarian Demining Technology Development Roadmap to guide the course, speed, and content of its research and development strategy. The research and development priorities focus on technologies that support five functional areas the United States believes will contribute the most to the goal of eliminating the global threat of landmines:

- Personal Protection
- Handheld Detection
- Wide-Area Detection
- Vegetation Clearance
- Mechanical Mine Clearance

The research and development roadmap has been carefully tailored to serve international needs and synchronized with the goals and objectives of the international community of nations that have also assumed mine action responsibilities. The objective of the research and development roadmap is the timely placement of new capabilities in the deminer's hands to meet the 2010 goal established by President Clinton.

As can be seen in the chapter **Detection Equipment**, the United States has completed development of a number of detection systems: the *Mini Mine Detector*, the *Camcopter*, *Ground Based Quality Assurance*, *HIMS*, *VMDS*, *VMMD*, and *SAMS*. Emerging technologies include frequency domain handheld mine detectors, new acoustic mine detection systems, and energy focused ground penetrating radars.

Prototype *Geophex 3* Frequency Domain Detector.

***Energy Focused GPR* prototype.**

***Brassboard Acoustic Detection System*.**

The **Clearance Equipment** chapter summarizes the various machines for clearance of vegetation and landmines as well as in-situ neutralization.

***MgM Rotar* in Namibia.**

***LEXFOAM*® undergoing evaluation in Cambodia.**

***Mini-Flail*.**

The R&D Program has teamed with DRES, the Aberdeen Test Center, Natick Research Labs, Brooke Army Medical Center Institute of Surgical Research, and the Casualty Care Research Center to address needs/requirements for deminer boot protection, tools, and protective gear. The **Individual Deminer Protection and Tools** chapter covers this functional area in detail.

Boot testing at BAMC.

Individual Deminer Tool Kit.

Variety of helmets and visors under evaluation.

Helmet, visor, and vest on MAG deminer in Cambodia.

D. Global On-The-Ground Support

Providing people and equipment in each mine afflicted area is important for timely and efficient humanitarian demining assistance. As briefly described before, on-the-ground assistance is provided by SOF for training local people how to recognize, detect, and clear mines. Importantly, the United States also provides technical in-country support for new research and development items that are provided for evaluation in mine-afflicted countries. This unique in-theater assistance plays a major role in accelerating the development process by insuring that lessons learned in the field are rapidly integrated into improvements of demining tools, training, and information.

Thiokol Flares for an in-situ neutralization alternative to explosives.

Mini Mine Detector can be folded into a belt-carried pouch.

The *RHINO Earth Tiller*, antitank blast-survivable large area clearer.

The *Survivable Demining Tractor and Tools* prepares AP-mined areas for demining.

Floating Mine Blade for large area clearance.

Demining Support System to assist deminer and mine awareness training.

Tempest for small area vegetation clearance.