See Report Title

DRAFT SF 298

1. Report Date (dd-mm-yy)
19-12-95

2. Report Type
Technical - Test Report

3. Dates covered (from... to)
1995

4. Title & subtitle
Volume I, Executive Summary and Test Plan ~~and Volume II~~, ~~Test Results Report~~ - Operational Capabilities Demonstration & Test for Humanitarian Demining and Other ~~Technologies Development Program~~ Military Operations Other than War

5a. Contract or Grant #
NA

5b. Program Element # 63606A

5c. Project # D608

5d. Task # NA

5e. Work Unit # NA

6. Author(s)
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CECOM NVESD

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Communications and Electronics Command, Night Vision & Electronic Sensors Directorate, 10221 Burbeck Rd, Suite 430, Fort Belvoir, VA 22060-5806

8. Performing Organization Report #
NA

9. Sponsoring/Monitoring Agency Name & Address
Communications and Electronics Command, Night Vision & Electronic Sensors Directorate, 10221 Burbeck Rd, Suite 430, Fort Belvoir, VA 22060-5806

10. Monitor Acronym
NVESD

11. Monitor Report #
NA

12. Distribution/Availability Statement Widest public dissemination.

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

19960628 017

13. Supplementary Notes

14. Abstract As part of an international humanitarian demining effort, Congress provided the Army $10M of FY95 RDT&E funds with direction to develop and demonstrate technologies applicable to humanitarian demining and other Military Operations Other Than War (OOTW) situations. Congress further directed that the technologies developed under this one-year only program be shared in an international environment. In compliance with this direction, the CECOM Night Vision and Electronic Sensors Directorate (NVESD) developed, demonstrated and validated over 30 prototype items for humanitarian demining in 1995.

15. Subject Terms Executive Summary, Test Plan, Mine Detection On-Road and Off-Route, Mine Clearers, In-situ Neutralization, Individual Components

Security Classification of					
16. Report	17. Abstract	18. This Page	19. Limitation of Abstract	20. # of Pages	21. Responsible Person (Name and Telephone #)
Unclassified	Unclassified	Unclassified	Unlimited	264	Harry N. Hambric Project Leader, Humanitarian Demining (703) 704-1086 (DSN 654)

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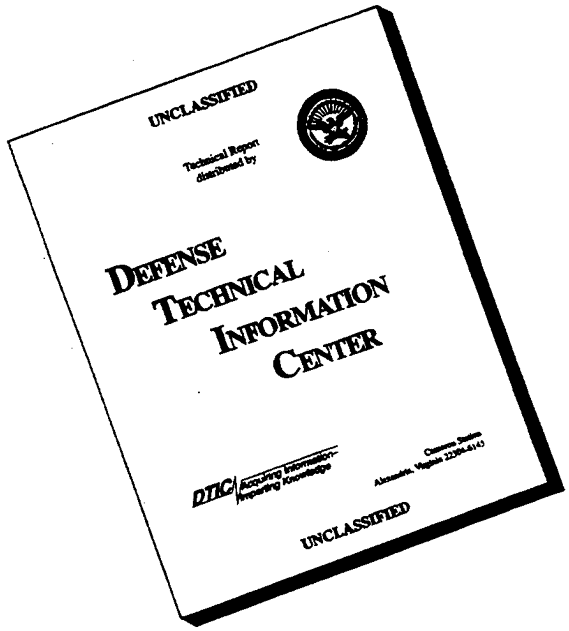

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EXECUTIVE SUMMARY

PURPOSE

To document the Operational Capabilities Demonstration and Test (OCDT) for the Humanitarian Demining Technologies Development Program.

Background

a. Cessation of hostilities does not end the casualties of war. Land mines are frightening residual weapons of war that retard resettlement and economic renewal. This menace denies access to roadways (improved and unimproved), villages and urban areas, agricultural fields and other rural areas long after the declaration of peace. Their numbers and the devastation they extract are staggering. The Department of State publication *Hidden Killers, the Global Landmine Crisis* estimates that some 85-110 million mines in 62 countries maim and kill more than 10,000 people a year. The problem is most acute in underdeveloped nations already ravaged by conflict and that lack the resources and the infrastructure needed to deal with their land mine problems.

b. There is a wide variety of landmines. They range in size and type from anti-personnel models small enough to fit into the palm of a child's hand to large anti-tank mines. There are different activation mechanisms such as pressure, electronic and command detonation. Mines use the blast effect from the explosion and flying fragments to injure or kill their victims. One of many ways to categorize a mine is whether it is a blast or a fragmentation type. Manufacturers make mines from metallic and non-metallic materials. This tremendous diversity makes the demining mission very complex and dangerous. Improvements in demining technology are critical to the success of any effort to reduce this threat.

c. As part of an international humanitarian demining effort, Congress provided the Army $10M of FY95 RDT&E funds with direction to develop and demonstrate technologies applicable to humanitarian demining and other Military Operations Other Than War (OOTW) situations. Congress further directed that the technologies developed under this one-year only program be shared in an international environment. In compliance with this direction, the CECOM Night Vision and Electronic Sensors Directorate (NVESD) developed, demonstrated and validated over 30 prototype items for humanitarian demining in 1995.

d. The diversity of the mine threat pointed to the need for different types of equipment to neutralize them. The short time frame of this program dictated a development effort that maximized the use of existing technology. The requirement to develop equipment for use by host nation deminers with very different languages, cultures and education levels added to the challenge.

e. To meet this challenge, the Army technology base in partnership with private industry and the operational user (CINC demining staffs) integrated and demonstrated Commercial Off The Shelf (COTS) technologies for use in humanitarian demining and in other military OOTW situations. Coordination with CINC demining representatives indicated an immediate need for short term, low technology solutions to the demining problem. This program therefore placed a priority on the integration of basic low risk tools, items and kits to improve efficiency and safety for US demining trainers and host country deminers. Additionally, the need to increase safety, quality control and speed required solutions that leveraged previous and ongoing countermine programs without duplication of effort. Basic research and exploratory development programs conducted in promising areas for countermine application have potential for use in demining. Therefore, this $10M program leveraged the ongoing countermine program both to integrate technologies previously identified in the countermine exploratory development program and as a springboard for fielded countermine equipment (for example, hand held detectors). This program emphasized solutions that determine mined as well as mine-free terrain with a high degree of reliability and that drive down the cost of detection and clearance. Areas of emphasis included:

(1) Mine Detection On-Road and Off-Route
(2) Mine Clearers
(3) In-situ Neutralization
(4) Individual Components

f. At a Humanitarian Demining Action Officers' Workshop, hosted by the NVESD on January 18 and 19, 1995, demining action officers from all CINC staffs addressed their most critical mine countermeasure needs. This input was important to the NVESD decision process that identified the specific prototype equipment developed and tested by this program.

Humanitarian Demining Countermeasure Alternatives: The following list briefly identifies each humanitarian demining countermeasures alternative developed under this program. Complete descriptions of each are located in Volume I (Test Plan) of this report.

Mine Detection On-Road and Off-Route

- Vehicle Mounted Detection (VMD) System: A multi-sensor mine detection system mounted on a remote control vehicle. Sensor technologies are metal detection, thermal-nuclear analysis and cameras.

- Vehicle Mounted Mine Detector (VMMD): A multi-sensor mine detection system mounted on a small utility vehicle. Sensor technologies are Ground Penetrating Radar (GPR) and cameras.

- Ground Based Quality Assurance System: An integrated camera suite to confirm that a mined area has been cleared. System distinguishes between disturbed soil from which mines have been removed and mines that are still present.

Mine Clearers

- Tele-operated Ordnance Disposal System (TODS): Remote controlled mine clearance capability based on a commercial skid loader.

- Mini-flail: A small vehicle based remote control anti-personnel mine clearer.

In-situ Neutralization

- Explosive Demining Device (EDD): A shaped charge approach to neutralize mines in-situ (in-place).

- LEXFOAM: An explosive foam to destroy mines in-place.

- Chemical Neutralization: The use of chemicals to neutralize mines.

- Mine Marking and Neutralization: A hardening foam that makes fuzes inoperable and marks mine locations.

- Shaped Charges: The application of commercial oil well bore hole charges to demining.

Individual Components

- Modular Vehicle Protection (MVP) Kit: A mine detonation protection kit designed for commercial vehicles.
- Blast Protected Vehicle (BPV) Kit: An alternative mine detonation protection kit designed for commercial vehicles.
- Mobile Training System: Suite of multi-lingual, multi-media equipment that provides mine awareness training to host nation people.
- Mini-mine Detector: A compact pocket sized mine detector with performance equivalent to the current Army standard PSS-12.
- Extended Length Probe: A probe attached to a long shaft for greater stand-off distance, and able to assist with identification of a buried object in contact with the probe tip.
- Extended Length Weedeater: A handheld or wheel mounted vegetation cutter with a long shaft.
- Mine Location Marker: A mine marking device that attaches to any open ring handheld mine detector.
- Blast and Fragment Container: A device that permits the destruction of mines in place while protecting high value assets.
- Demining Kit: A hand cart with a collection of hand and power tools for demining, and that serves as a host for a light grapnel system.
- Berm Processing Assembly: Removes mines from berms created by mine clearing blades and plows.
- Mine Clearing Blades: Attaches to commercial construction vehicles for large area clearance.
- Grapnels: Stand-off trip wire activation devices. There are light and heavy models.
- Handheld Tripwire Detector: Use of a small IR camera to detect tripwires.
- Vehicle Towed Roller: Anti-personnel mine detonating rollers designed for commercial host vehicles.
- Towed Light (Swamp) Roller: Anti-personnel mine detonating roller designed to operate in watery areas such as rice paddies, and light enough to be towed by winch or by an animal.
- Command Communications Video and Light System (CCVLS): A mini camera mounted to a helmet or onto a pole with wireless audio and visual links to a remote control station.

- Mobile Video and Light System (MVLS): Helmet mounted mini-camera and a fixed "stand-off" camera that transmit to a remote location.
- Side Scan Sonar: A small sonar that transmits images to a shore-based computer.
- K9 Program: Mine detection using trained dogs.

The overall objective for the Operational Capabilities Demonstration Test (OCDT) was to test and evaluate the above mine countermeasures. The OCDT, which took place during October and November 1995, accomplished this objective. That the majority of these prototypes performed well enough to warrant future development and use for demining testifies to the success of this program. The following matrix displays the current plan for future demining technology development.

Humanitarian Demining Technology Development Program

Future Developments

	FY96	FY97	FY98	FY99	FY00	FY01
Vehicle Based Detection	X	X	X	X	X	X
Ground Based Quality Assurance	X					
Vehicle Clearers	X	X	X	X		
Tele-operated Ordnance Disposal System	X					
In-Situ	X	X	X	X	X	X
Chemical Neutralization	X					
Individual Components	X	X	X	X	X	X
Mobile Mine Awareness Trainer	X					
Mini-mine Detector	X					
Command Communications Video & Light System	X	X	X	X		
Side Scan Sonar		X	X	X		
TOTAL RESOURCES ($M)	3.0	8.0	8.0	8.0	7.0	6.0

Test Documentation

The following OCDT documentation consists of two volumes:

- Volume I Test Plan: Consists of a summary of the humanitarian demining technologies program, a detailed description of each mine countermeasures alternative and the detailed plan for test for each alternative. The detailed plan for test consists of the measures of success upon which the performance evaluation in Volume II are based, test procedures, the test site layout, the schedule for test and sample data collection forms.

- Volume II Test Report: A by-item evaluation of each item's performance. Conclusions and recommendations pertaining to each item follow the evaluation.

The CECOM NVESD is the repository for all test data used to prepare this report.

Questions or requests for information of a technical nature should be directed to CECOM NVESD, ATTN: AMSEL-RD-NV-CD-ES (Mr. Hambric), 10221 Burbeck Rd, Suite 430, Fort Belvoir, VA 22060-5806, DSN 654-1086 (commercial 703-704-1086). For questions regarding how to obtain these items, contact the office of the Deputy Assistant Secretary of Defense for Humanitarian and Refugee Affairs, (703) 697-9848.

VOLUME I

TEST PLAN
OPERATIONAL CAPABILITIES DEMONSTRATION AND TEST

FOR

HUMANITARIAN DEMINING AND OTHER MILITARY OPERATIONS OTHER THAN WAR

October 26, 1995

TABLE OF CONTENTS

Purpose

To describe and document the Operational Capabilities Demonstration and Test (OCDT) for humanitarian demining technologies. This OCDT will demonstrate and validate countermine technologies specifically designed for humanitarian demining. This test is part of an Army-led, Congressionally directed one-year only program to develop and demonstrate humanitarian demining technologies that can be shared in an international environment. This OCDT supports the one-year only Congressional $10M RDT&E increase to PE0603606A/D608 (Landmine Warfare and Barrier Advanced Technology). Congress directed the Army to develop and demonstrate technologies applicable to humanitarian demining and other Military Operations Other Than War (OOTW) situations.

Background

a. Cessation of hostilities does not end the casualties of war. Land mines are frightening residual weapons of war that retard resettlement and economic renewal. This menace denies access to roadways (improved and unimproved), villages and urban areas, agricultural fields and other rural areas long after the declaration of peace. Their numbers and the devastation they extract are staggering. The Department of State publication *Hidden Killers, the Global Landmine Crisis* estimates that some 85-110 million mines in 62 countries maim and kill more than 10,000 people a year. The problem is most acute in underdeveloped nations already ravaged by conflict and that lack the resources and the infrastructure needed to deal with their land mine problems.

b. There is a wide variety of landmines. They range in size and type from anti-personnel models small enough to fit into the palm of a child's hand (M14) to full size anti-tank mines. There are different fuzing methods such as pressure and command detonation. Mine kill mechanisms include blast, fragmentation and directed fragmentation. Mines are manufactured from metallic and non-metallic materials. This tremendous diversity makes the demining mission very complex and dangerous.

b. In the Fiscal Year 1995 Defense Authorization Act, Congress provided a one-year only $10M RDT&E increase for humanitarian demining. The Congressional language directs the Army to develop technologies for mine detection, classification, mapping and neutralization for use in humanitarian demining and in other Military OOTW. The language includes direction to emphasize technologies that can be shared in an international environment. The diversity of the mine threat points to the need to develop different types of equipment. The short time frame of this program dictates a development effort that maximizes the use of existing technology. The requirement to develop equipment for use by host nation deminers with very different languages, cultures and education levels adds to the challenge.

c. To meet this challenge, the Army technology base in partnership with private industry and the operational user (CINC demining staffs) will integrate and demonstrate Commercial Off The Shelf (COTS) technologies for use in humanitarian demining and in other military OOTW situations. Coordination with CINC demining representatives indicates an immediate need for short term, low technology solutions to the demining problem. This program will therefore seek to integrate basic low risk tools, items and kits that improve efficiency and safety for US demining trainers and host country deminers. Additionally, the need to increase safety, quality control and speed require solutions that leverage previous and ongoing countermine programs without duplication of effort. Basic research and exploratory development programs conducted in promising areas for countermine application have applicability for potential use in demining. Therefore, this $10M program will leverage the ongoing countermine program both to integrate technologies previously identified in the countermine exploratory development program and to be a springboard for fielded countermine equipment (for example, hand held detectors).

Technology solutions that determine mined as well as mine-free terrain with a high degree of reliability and that drive down the cost of detection and clearance will be emphasized. Areas of emphasis include:

(1) Mine Detection On-Road and Off-Route
(2) Mine Clearers
(3) In-situ Neutralization
(4) Individual Components

d. The CINC demining staffs are a crucial part of this technology program. The success of this effort depends on how rapidly it delivers operational technology that best supports the needs of deminers around the world. At a Humanitarian Demining Action Officers' Workshop, hosted by the NVESD on January 18 and 19, 1995, demining action officers from all CINC staffs addressed their most critical equipment needs. The matrix at Appendix A is a prioritized equipment requirements list as a result of the workshop. This matrix was a key factor in the NVESD decision process that selected the specific prototype equipment for development, integration and test in accordance with this plan.

Test Objectives

The overall objective for this Operational Capabilities Demonstration and Test (OCDT) is to demonstrate and evaluate the humanitarian demining technologies developed under this program. This OCDT presents a unique challenge due to the wide variety of equipment and the need to provide a test environment applicable to humanitarian demining situations around the globe. Appendix B contains the list of countries identified by the United States as having the highest priority for demining assistance. Appendix C depicts the most common anti-personnel and anti-tank mine threat for humanitarian deminers around the globe. Because these two appendices depict the geographical environment and the humanitarian mine threat, they are important inputs to the design of this test. Specific test objectives are:

a. To measure the capabilities of equipment and material developed under the Congressionally directed humanitarian demining technology program.

b. To perform the demonstration so that the results are meaningful to all CINC humanitarian demining staffs.

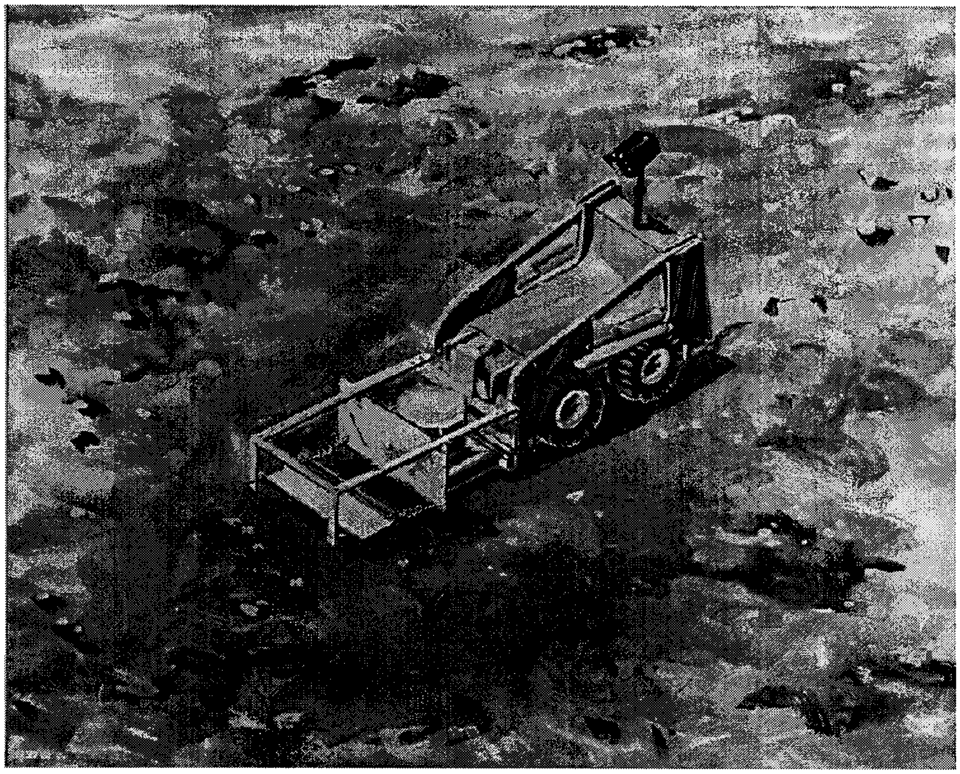
c. To evaluate all equipment tested under the program and publish the results for the humanitarian demining community.

Equipment to be tested

The humanitarian demining technologies developed under this program are described on the following pages.

a. Mine Detection On-road and Off-route

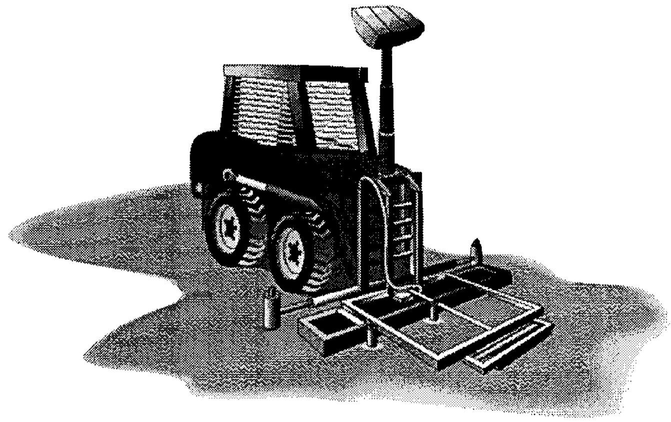
(1) Vehicle Mounted Detection System



This on-road and off-route system detects buried or surface emplaced metal or plastic mines. Operators can rapidly switch the system between on-road and off-route configurations. The two configurations have a remote controlled vehicle with a mast mounted camera suite in common. The system includes a control station for the operator that permits control of the vehicle and sensor systems, and provides real-time output. The station also displays sensor data and video. The control station is both man-portable and able to fit in vehicle-mounted equipment racks.

Two interchangeable detection modules, each containing a metal detection array and a Thermal Neutron Analysis (TNA) sensor, give the system its on-road and off-route capability. The purpose of the TNA is to confirm that an object found by the metal detection array is a mine. The sensor uses a Californium 252 radiation source which emits neutrons that penetrate the ground. These neutrons cause the high nitrogen content of land mines to emit gamma rays which are picked up by the sensor head and analyzed. The TNA thus discriminates between metal objects with no explosive content and land mines. This greatly increases the efficiency of the demining process when compared to metal detection alone. With metal detection only, deminers must treat every object found as a mine until they uncover it and establish its identity. The system marks mine locations with a paint sprayer. To record and report mine location information, the system uses a combination of Global Positioning System (GPS) and wheel encoders.

(2) Vehicle Mounted Mine Detector (VMMD)



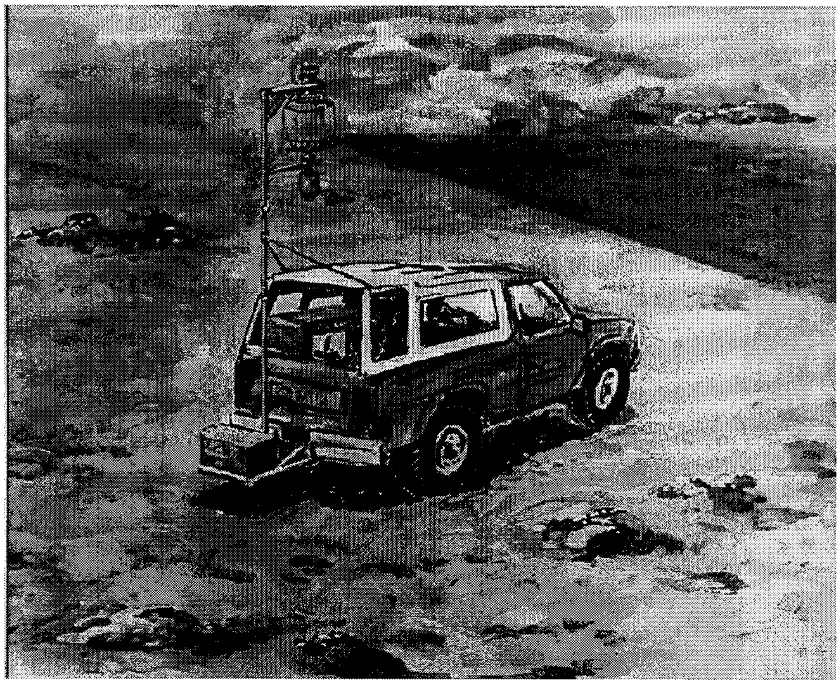
a. The Vehicle Mounted Mine Detector consists of a variety of sensors and real-time video transmission to detect on-road and off-route landmines. The VMMD uses IR and ultraviolet (UV) cameras for stand-off detection, and ground penetrating radar (GPR) for close-in detection. A FLIR Systems, Inc. Prism camera with a 30 degree diagonal Field of View (FOV) and an NEDT of less than 0.1 degrees C, and a Hammamatsu UV camera were the stand-off detectors used during the demonstration. This sensor combination increases the probability of detection and the efficiency of mine clearing.

b. The ground penetrating radar (GPR) close-in sensor detects and identifies buried landmines greater than or equal to 2 inches in diameter off-road and at least 8 inches in diameter on-road. The GPR subsystem couples two key technologies: sophisticated 3-D processing, and advanced frequency stepped radar. The intent of the frequency stepped approach is to permit operation at an RF duty factor approaching unity, to remove the short pulse radar requirement that the RF equipment be instantaneously broadband, and to achieve a fully coherent radar capability while retaining the high range resolution capability. The frequency range is 700 to 4200 MHz, with 0.4 amplitude resolution, and a 90 dB dynamic range. The GPR's sensors are cantilevered in front of the vehicle on rails, with motors to scan the six foot wide 2 by 16 antenna array. Real-time visual detection and inspection are possible with the GPR system.

c. Besides the sensor suite, the VMMD consists of video cameras, a Global Positioning System to determine mine locations, remote controlled paint sprayers for marking, an operator's command station for operator controls, visual displays and control of sensor functions and parameters, and a skid steer loader vehicle.

d. A portable controller at the operator's command station allows access to the various remote sensor functions. The camera select capability permits the operator to select the video display source from the visual driving camera, the IR camera or the UV camera. The portable controller is small, lightweight and has its own self-contained power. A GIS display is loaded onto the personal computer at the control center. It is very easy to operate and accurately displays the vehicle path, vehicle coordinates, the IR and UV targets received from the target recognition software, and the GPR detections.

(3) Ground Based Quality Assurance

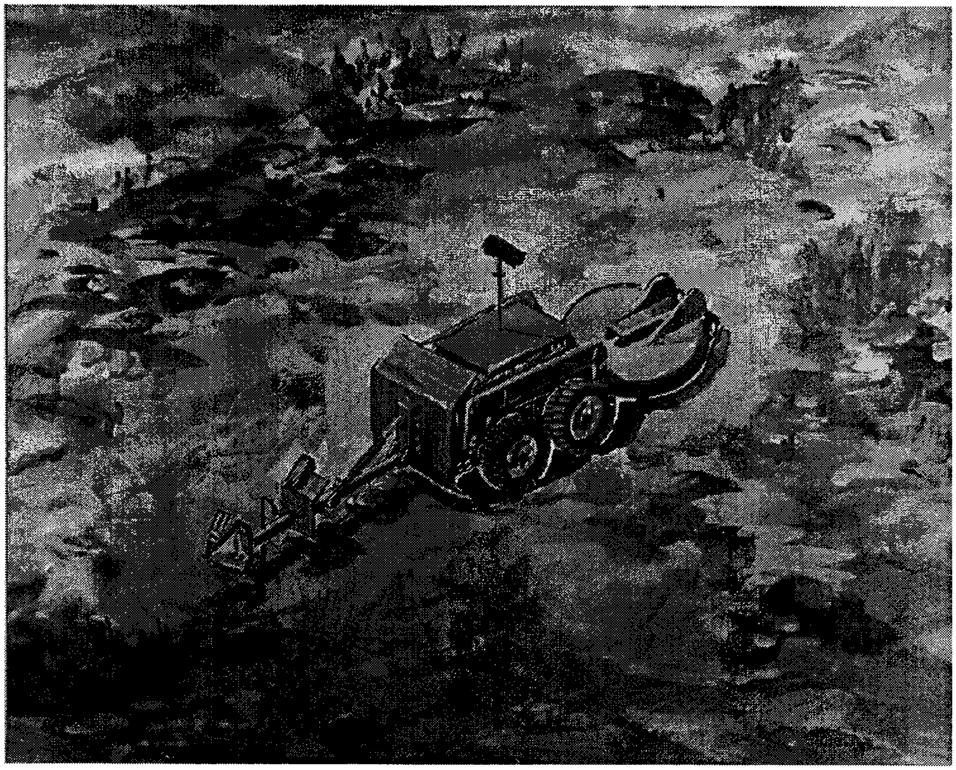


The Ground Platform Mounted QA Sensor Suite uses Infra-Red (IR) (3-5 micron and 8-12 micron), Ultra-Violet (UV) and video cameras to find surface and buried mines, trip wires and anti-handling devices.. The purpose of this system is to confirm that an area believed to be clear of mines is indeed mine-free. A covered, mast mounted platform houses the cameras. The camera assembly can mount to a vehicle or to a static ground position. Signals from the cameras transmit to a computerized control station. An operator at the control station can remotely operate the cameras. The system permits an operator to view an area on a computer screen from any one of the four cameras, and capture an image onto the computer's hard disk at any time. The operator can then import the image into a program to enhance it in various ways to highlight a mine. By performing this technique on images from any combination of the cameras and comparing the results simultaneously on screen, a trained operator can distinguish a possible buried or surface mine. The software also includes Automatic Target Recognition (ATR) capability to designate probable mines for the operator.

b. Mine Clearers

There are two mechanical mine clearance systems, the Improved Mini-Flail and the Teleoperated Ordnance Disposal System (TODS).

(1) Tele-Operated Ordnance Disposal System (TODS)

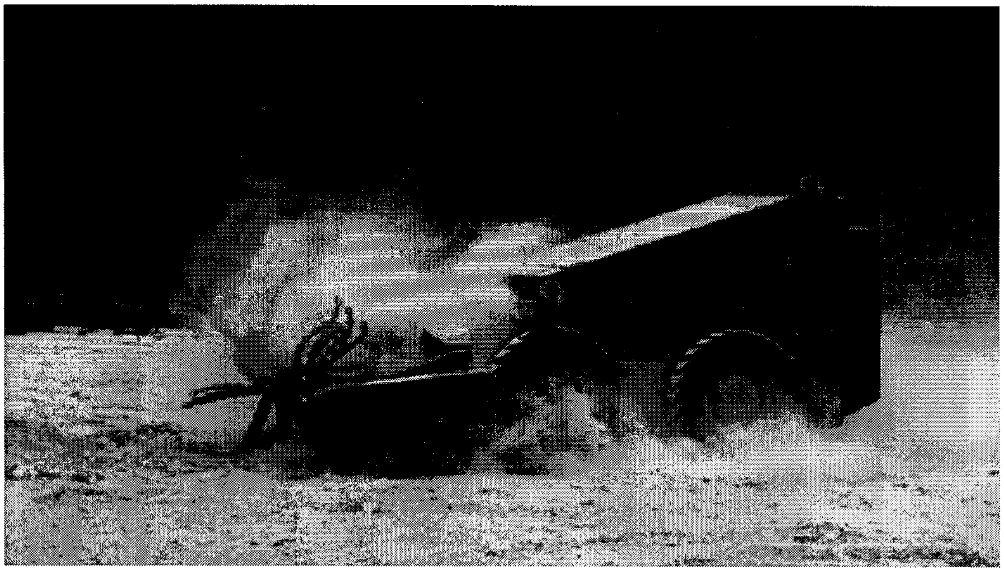


The TODS concept adds mechanical mine clearance capability to an off-the-shelf skid loader. TODS safely removes mines from sensitive or critical areas such as schools, hospitals and power stations. In addition, it also exposes (unearths) and places demolition charges onto mines that are too dangerous for people to approach such as deeply buried, highly sensitive or booby-trapped mines.

Modifications to the skid loader are a teleoperation (remote control) kit, detection capability and clearance attachments. Individual items on the vehicle include video cameras, a manipulating arm with a shovel and a gripping attachment, an air knife, a metal detector, a GPS subsystem, a vegetation cutter and blast deflectors. The modular command & control system allows remote control of each electronic, electromechanical or hydraulic device. The manipulator allows mechanical pick-up and placement of in-situ neutralization devices. The TODS will demonstrate the integration of a variety of sensors and clearing devices under remote control into an effective mine removal system.

The TODS depends on advanced knowledge of approximate mine locations. The exact location is pinpointed with an on-board metal detector or video cameras.

(2) Improved Mini-Flail



The Office of Science and Technology (OST) has already performed research with this small remote controlled clearer. The Mini-Flail is a small utility vehicle (based on a commercial Bobcat chassis) modified with a remote control kit, a rotating flail mechanism and armor protection. It is designed to clear anti-personnel mines from unimproved lines of communication and from off-road areas that are not accessible to large area mine clearers. Improvements to the original design are:

Use of the new 3375 skid steer chassis from John Deer.

Remote reversal of the rotation of the flailing head.

Lighter armor in the flail cover and flail.

Improved integration and protection of electronic controls and circuits.

Improved tires to withstand blasts from AP mines and to spread weight on ground.

c. *In-Situ Neutralization*

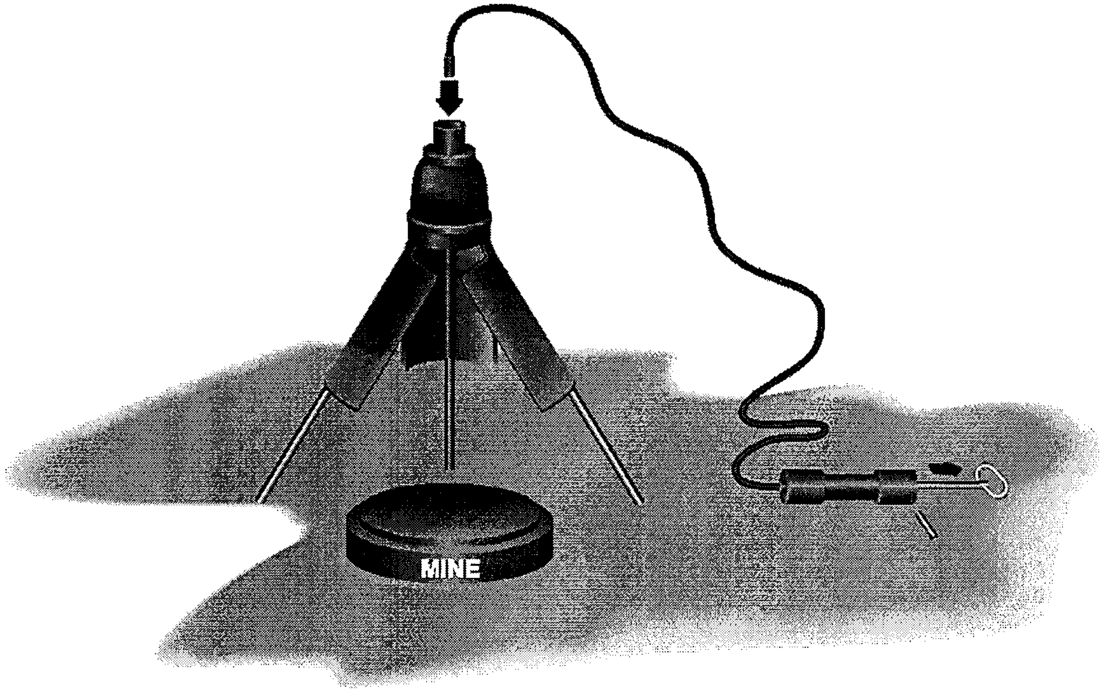
"In-situ" neutralization devices provide for the controlled destruction of individual mines. These devices neutralize mines through the application of explosive charges or through chemical action. A significant advantage to in-situ techniques is that they support US humanitarian demining policy to destroy mines in place. The goal of this policy is to ensure the destruction of mines to preclude anyone from keeping them for future use. However, there are disadvantages to these methods:

- Chemical based methods can be slow and dangerous.
- The explosive detonation of metallic anti-tank mines leaves significant amounts of metal fragments in the ground. These fragments hamper the quality assurance process, and remain an obstacle to efficient use of the land by host nation people.
- They are cost prohibitive.
- The potential exists that host nation people may use the shaped changes as ammunition instead of destroying landmines.

Developing technology in this area concentrates on improving on these weaknesses. The potential for chemical neutralization to increase speed and eliminate residual fragments is of special interest.

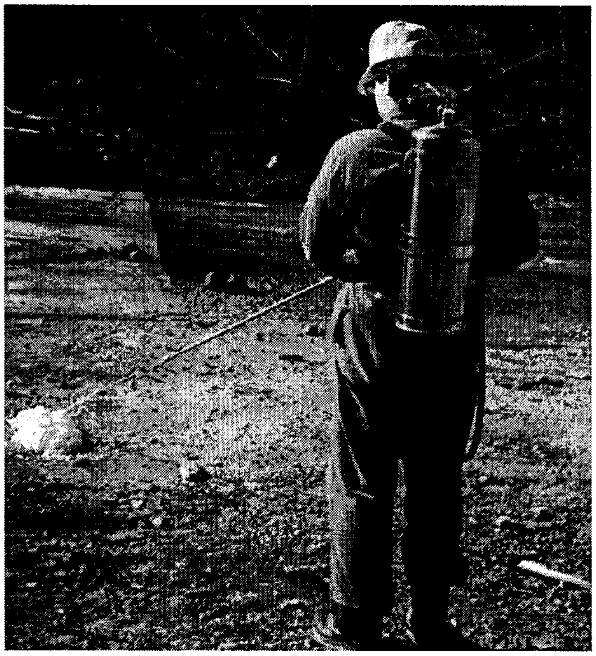
Another goal is cost reduction. A standard block of C4 explosive used to destroy one mine costs about $14. The goal for these systems is to reduce this cost. For example, commercial shaped charges can cost as little as $4.00 each. Also, coordination among demining activities can result in the purchase of larger quantities which reduces unit cost.

(1) Explosive Demining Device (EDD)



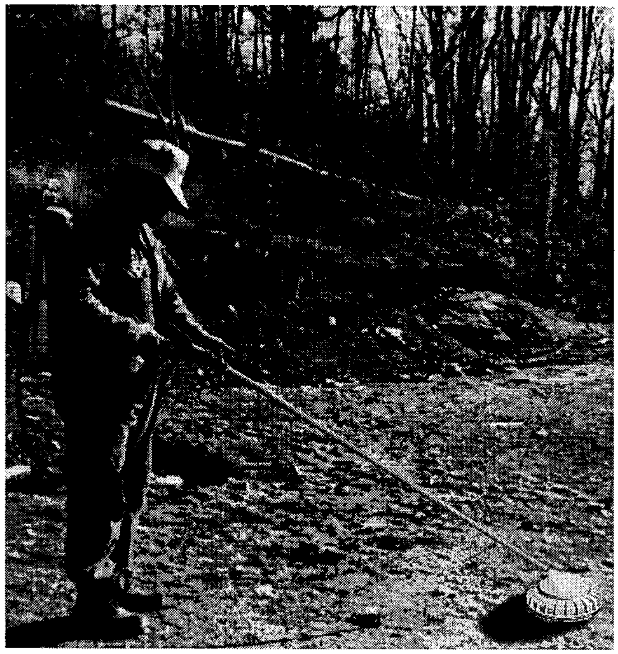
This device is a specially designed shaped charge mine neutralization munition integrated into a fixed time delay fuze assembly. It produces a penetrating jet stream which neutralizes the mine. This design provides the mine neutralization capability of much larger charges. The EDD is designed to neutralize AP and AT mines, both buried and surface emplaced.

(2) LEXFOAM



LEXFOAM is a nitro-methane based liquid explosive foam used for military and commercial blasting agents. It is effective at clearing or breaching mine fields, including those with sophisticated anti-tank and anti-personnel mines. The closed-cell structure of LEXFOAM gives this technology a greater shattering effect than devices using the same weight of high density explosive. A disposable initiation device permits safe initiation and detonation of both foam and mines. There are two configurations of delivery systems. A man-portable backpack configuration is for small or difficult to reach areas in a minefield. A palletized version is for large open areas of a minefield which are accessible by a commercial pickup truck or equivalent vehicle.

(3) Chemical Neutralization



This effort involves the use of chemical approaches to neutralize mines in-situ. The chemicals change mine's main charge to an inactive state through burning or by detonation. Alternatives to be explored are:

a. Autocatalytic decomposition reaction with amines or metal alkyls in the absence of air (buried mines).

b. Heterogeneous chemical reaction with amines or metal alkyls in the presence of air (surface mines).

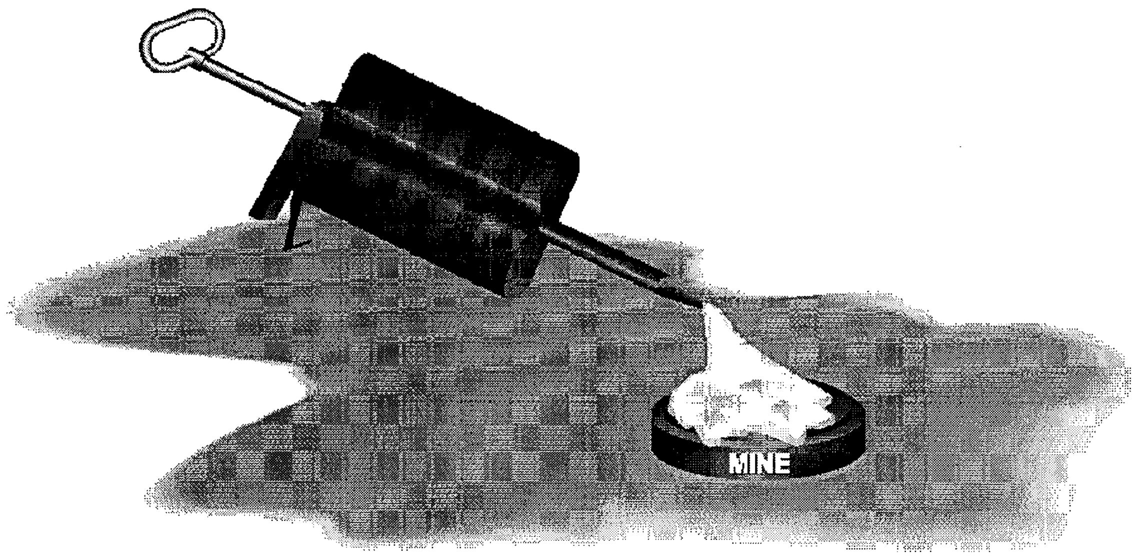
c. Detonation upon contact with interhalogens.

There are two versions of the delivery system used to get the chemical into the mine and in contact with the explosive. For this test, they are identified as "Gun 1" and "Gun 2". They both operate by firing a bullet into the mine to deliver the chemicals. Both systems are positioned above the target mine with a tripod. They differ as follows:

Gun 1: A small plastic bottle, approximately 1.5" in diameter and 3" high, contains the chemical. The capsule sits at the lower end of the tripod, just above the surface of the mine. A rifle caliber bullet is fired from above the capsule. The bullet travels through the chemical filled bottle and continues into the mine. The chemical falls into the hole in the mine created by the bullet and neutralizes the explosive.

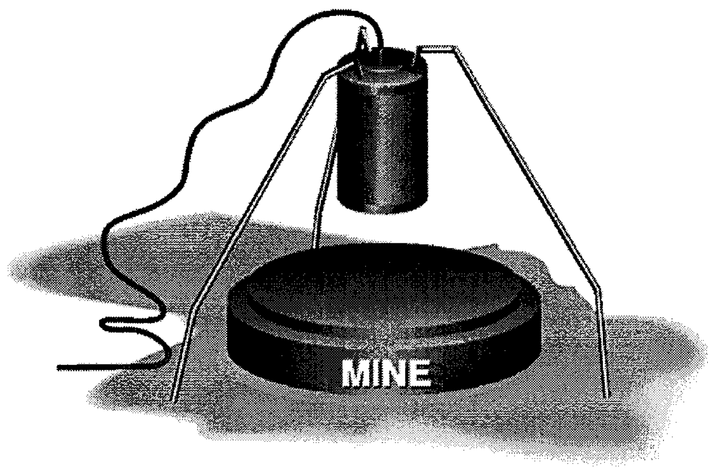
Gun 2: In this version, the neutralization chemical is inside the cartridge so there is no capsule. When fired, the bullet penetrates the mine casing, then releases the chemical to neutralizes the explosive.

(4) Mine Marking and Neutralization



This product consists of a polyurethane foam that hardens after being dispensed. The foam impregnates the exposed parts of a mine and then hardens, which renders the fuze inoperative. The bright color of the hardened material clearly marks the location of the mine. A man-portable dispenser applies the foam. The hardened foam does not destroy mines, but it does make mines safer to handle for subsequent destruction. It also allows the capability to attach a rope to any kind of mine so that it can be pulled out of the ground from a safe distance.

(5) Shaped Charges



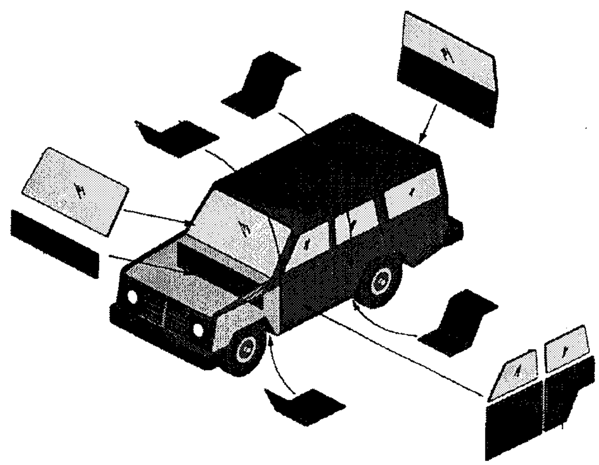
Current mine neutralization shaped charges are too large to use on small anti-personnel mines. Another problem is that hazardous fragments from shaped charge detonations remain after the explosion. This program will demonstrate the effectiveness of commercially available shaped charges. The oil industry uses varying sizes of shaped charges to create oil well bore holes. Selectable size charges permit the use of the optimum charge against a given size mine, reduce fragment waste and diminish the value of shaped charges as ammunition.

d. Individual Components

(1) Vehicle protection kits

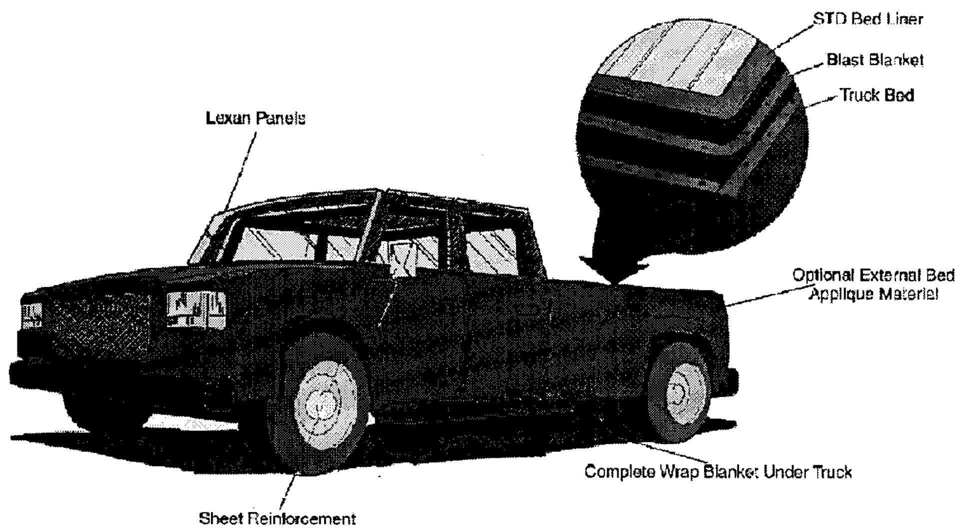
To accomplish the demining mission, a nation may use its military forces, establish a civilian organization or hire a contractor. This means that deminers will use a wide variety of military and commercial vehicles. These vehicles need to protect the people and the demining equipment that they carry. The humanitarian demining technology development program will demonstrate two approaches to add mine protection kits to existing commercial vehicles:

(a) Modular Vehicle Protection (MVP) Kit



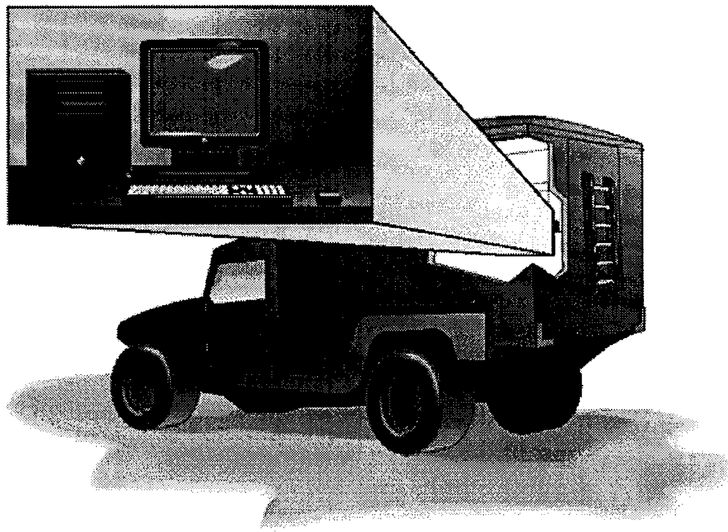
Modular Vehicle Protection is an add-on kit for commercial vehicles to shield its occupants from a mine detonation. It consists of a molded Glass Reinforced Plastic (GRP) ballistic liner module and Aluminum Oxide Ceramic armor fastened to the vehicle interior floor, doors, firewall, rear wheel wells and rear cargo compartment divider. In addition, transparent armor attaches to the windshield, door windows and cargo compartment divider. Steel blast deflectors are in the front wheel wells.

(b) Blast Protected Vehicle (BPV)



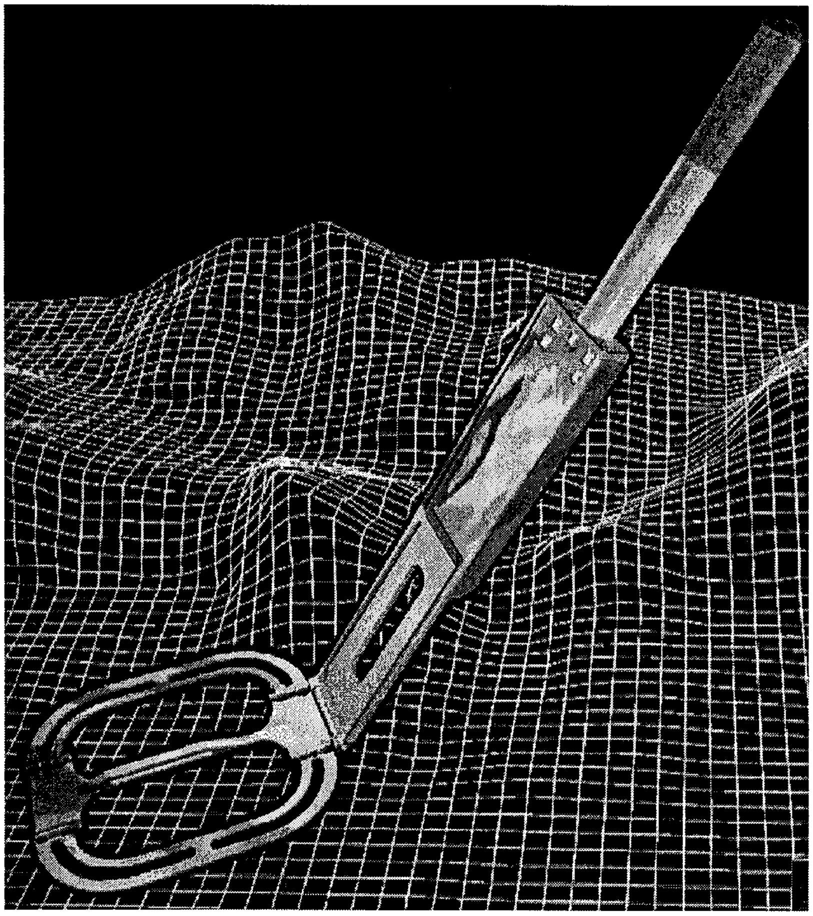
The Blast Protected Vehicle system uses inexpensive off-the-shelf material to add anti-personnel mine protection to vehicles being used for humanitarian demining. This program will evaluate flexible blast blankets mounted under the chassis and transparent armor to protect the vehicle from small AP blast and fragmentation mines. Another modification is the addition of an internal roll bar to protect occupants should a mine blast roll the vehicle. The roll bar also serves as an attachment point for a safety harness and a seat anchor. The blast blanket consists of Kevlar. Rigid glass fiber structures are also used. CBC cement with steel wire for reinforcement is used in the front wheel wells and in the floor of the cab. The transparent armor is Lexan protective shield

(2) Mobile Training System



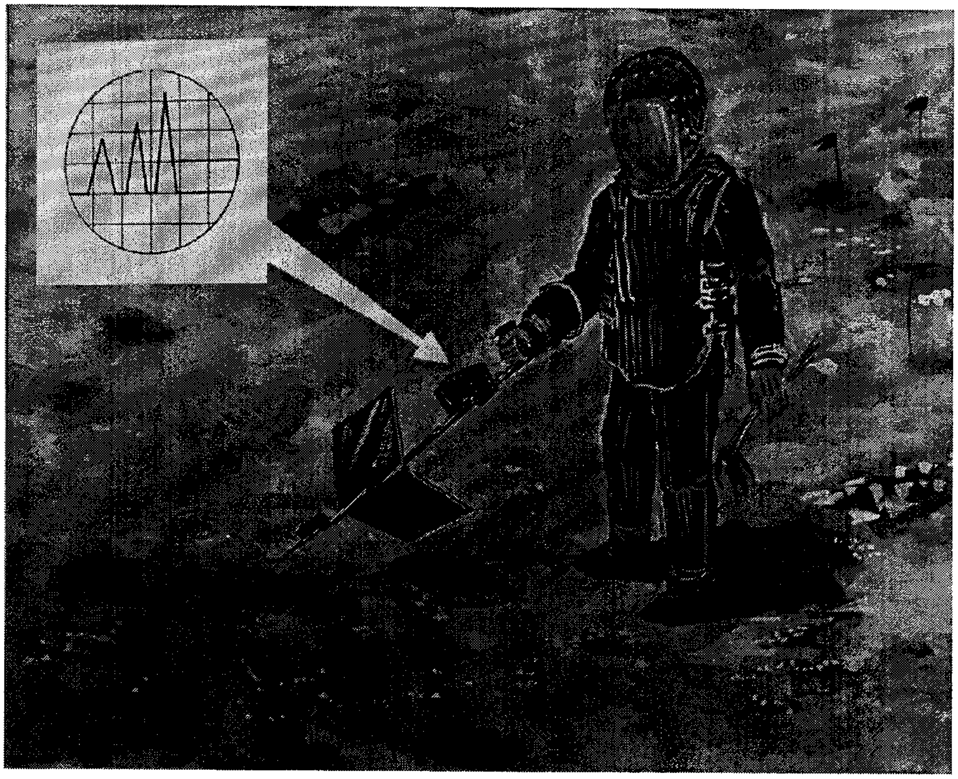
The Mobile Training System is a suite of multi-media audio-visual and computer equipment that provides mine awareness training to host nation people. Effective training on mine recognition and what to do when encountering mines is a significant means to reduce casualties due to landmines. This mobile and multi-lingual mine awareness training facility trains indigenous personnel on mine awareness, safety procedures and what to do in certain situations. There are two versions of mine awareness trainers. A man-portable system fits into suitcases that trainers can hand carry to difficult to reach locations. There is a vehicle mounted version for more accessible areas.

(3) Mini-mine Detector



The Mini Mine Detector is a battery powered, hand held, miniature metal detector. A deminer uses this device to detect buried anti-personnel and anti-tank mines with metal content ranging from several kilograms to as low as a gram. The Mini Mine Detector is designed to fold so that it is as small as possible when not in use. The unit can be transported in a deminer's pocket, thereby available at all times for emergency mine detection. The unit is also rugged and sensitive enough to be used in everyday demining operations as a replacement for the current systems which are much larger. The unit is also designed so that it can easily be used in a prone position which reduces the deminer's profile in the event of an accidental mine activation. The system operates on 4 AA batteries which are commonly available worldwide, and also has a 4 D-Cell battery pack as backup for long mine detection operations.

(4) Extended Length Probe



The purpose of an extended length "smart" probe is to improve efficiency and safety for deminers as they manually probe for mines. Extended length translates to increased safety by positioning the deminer further away from a potential blast. The addition of a blast shield near the base of the probe enhances safety. A vibrator and sensor at the probe tip feeds signals into a computer driven automatic target recognition (ATR) software algorithm. The computer indicates to the operator whether or not the object being probed is a possible mine.

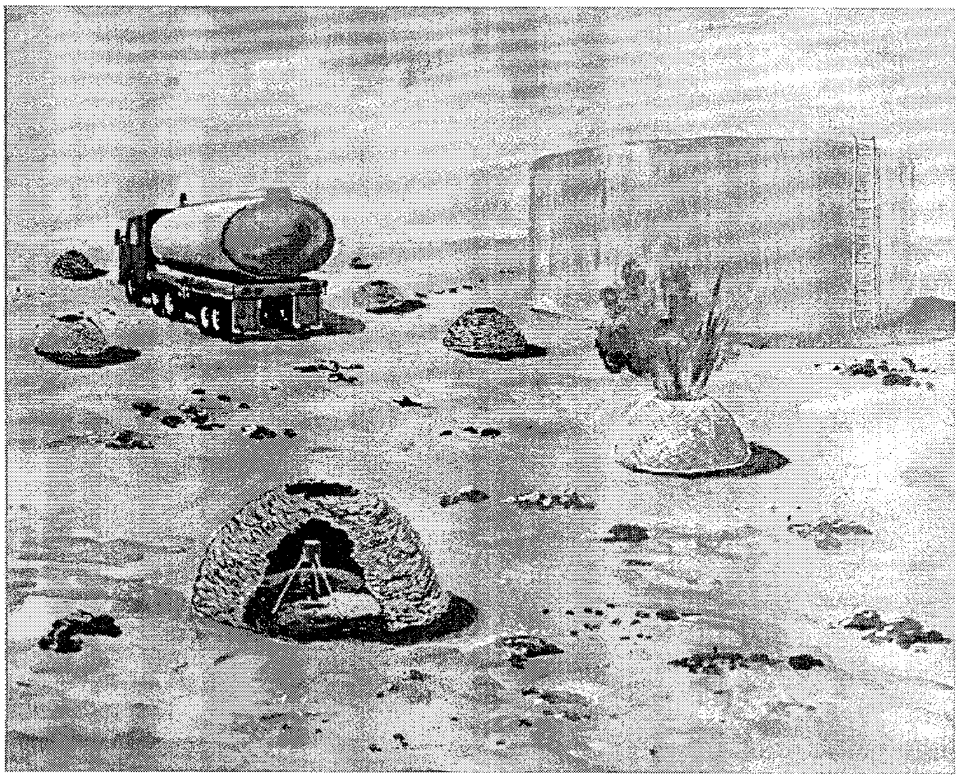
(5) Extended Length Weedeater

There were two prototype variations of the extended length weedeater evaluated. Both are commercial off-the-shelf (COTS) weedeaters that were modified for use as a humanitarian demining tool. The modifications involved lengthening the shaft of the hand held version and extending the handle of the wheeled version. The purpose of these systems is to increase the safety of deminers operating in areas where vegetation conceals mines. It is also necessary to remove vegetation for ground coupling of detectors and visual, or IR sensors. A weed eater with sufficient length will permit safer demining in many areas.

(6) PSS/12 Mine Location Marker

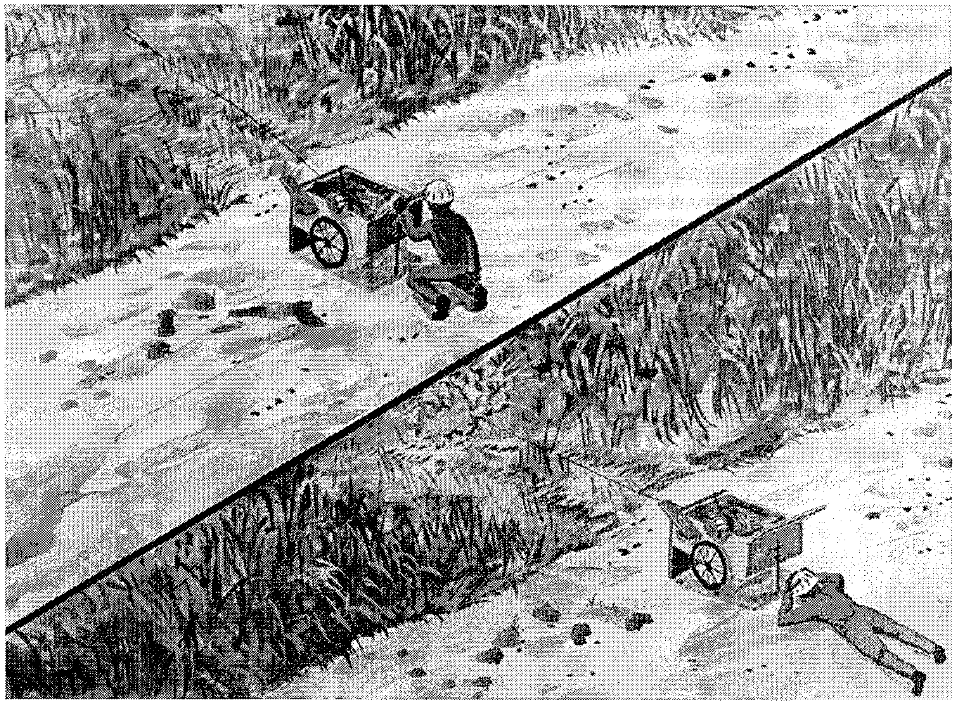
To increase the efficiency of mine detection and marking when using hand held detectors, this effort adds a marking device to the PSS/12 mine detector. Currently, when a person operating the PSS/12 locates a mine, he stops to position a marking item over the spot before continuing to detect. A trigger operated marking device, attached to the hand held detector, can make the marking process much more efficient.

(7) Blast and Fragment Containers



United States demining policy requires the destruction of landmines in place. However, this can be counterproductive if the explosion also destroys high value assets or critical facilities located close to the mine. The practice of placing mines very close to important facilities and augmenting them with anti-handling devices makes the need for a blast and fragment container extremely important. This effort demonstrated the effectiveness of a 27 inch diameter blast and fragment container that deminers place over a mine. It is constructed using single length S2 glass dry rolled into a 1 inch thick cylindrical container weighing just under 85 pounds. The blast and fragment container vents the forces of the mine detonation upward and away from critical structures and contains the fragments caused by the mine detonation, thus preventing the fragments from causing damage to these high value assets or critical structures.

(8) Demining Kit



The demining kit consists of a hand cart or small rough terrain vehicle with a collection of hand and power tools for demining. Kit components will vary depending on the location and terrain involved. The initial kit component list follows:

a. The hand cart or small vehicle to carry equipment. The cart will have a protective shield for the operator mounted on the front.

b. Light grapnel mounted to the front of the cart.*

c. Weed eater.

d. Generator.

e. Air compressor.

f. Leaf blower.

g. Trowel.

h. Three pound hammer.

i. Wire cutter.

j. Pick-mattock.

k. Spade.

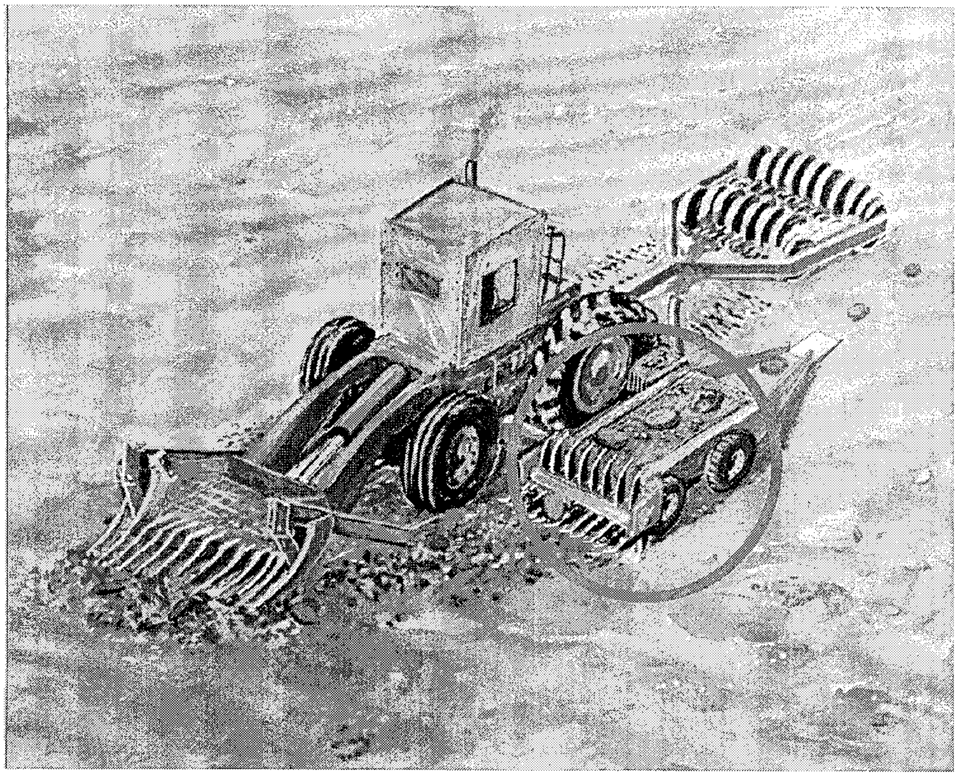
l. Mine probe and accessories.*

m. Explosion container.*

n. Chemical and/or explosive mine neutralization devices.*

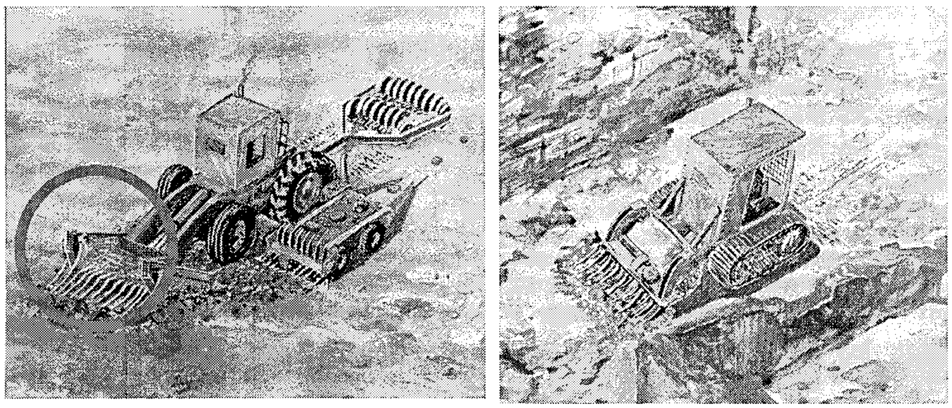
Note: Items marked "*" are humanitarian demining technologies under development as part of this program. Information on these systems appears elsewhere in this section.

(9) Berm Processing Assembly (BPA)



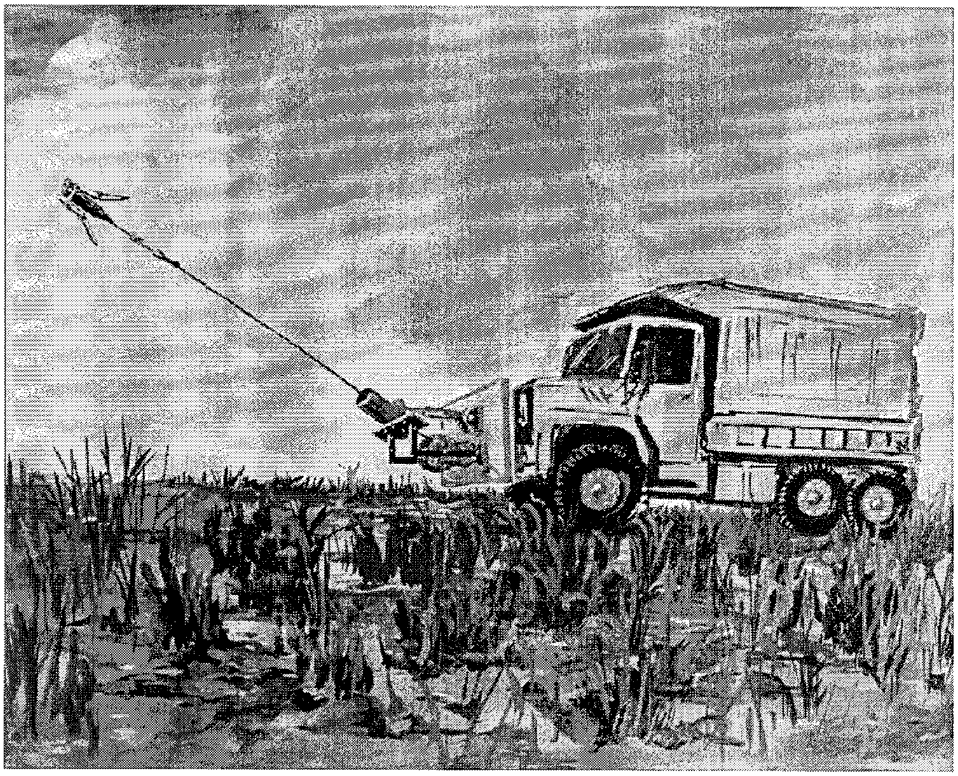
A proven method for clearing lanes/roads through a minefield is the use of side casting blades similar to snow plows. A significant weakness of blades and plows is that they leave a mine contaminated berm on one or both sides of the clearing vehicle. For mine clearing blades and plows to be acceptable humanitarian demining tools, a method to clear these berms must exist. The berm processing assembly is a system that could be towed behind the clearing vehicle to remove mines from an earthen berm by picking up the dirt and applying a mechanical filtering process to isolate AT from AP mines. The mechanism deposits AT and AP mines behind the BPA for subsequent neutralization. The BPA returns the processed soil back to the ground. With the AT and AP mines in plain view behind the path of the berm processor, deminers can neutralize them with significantly greater ease and safety than manually removing them from the berm.

(10) Mine Clearing Blades



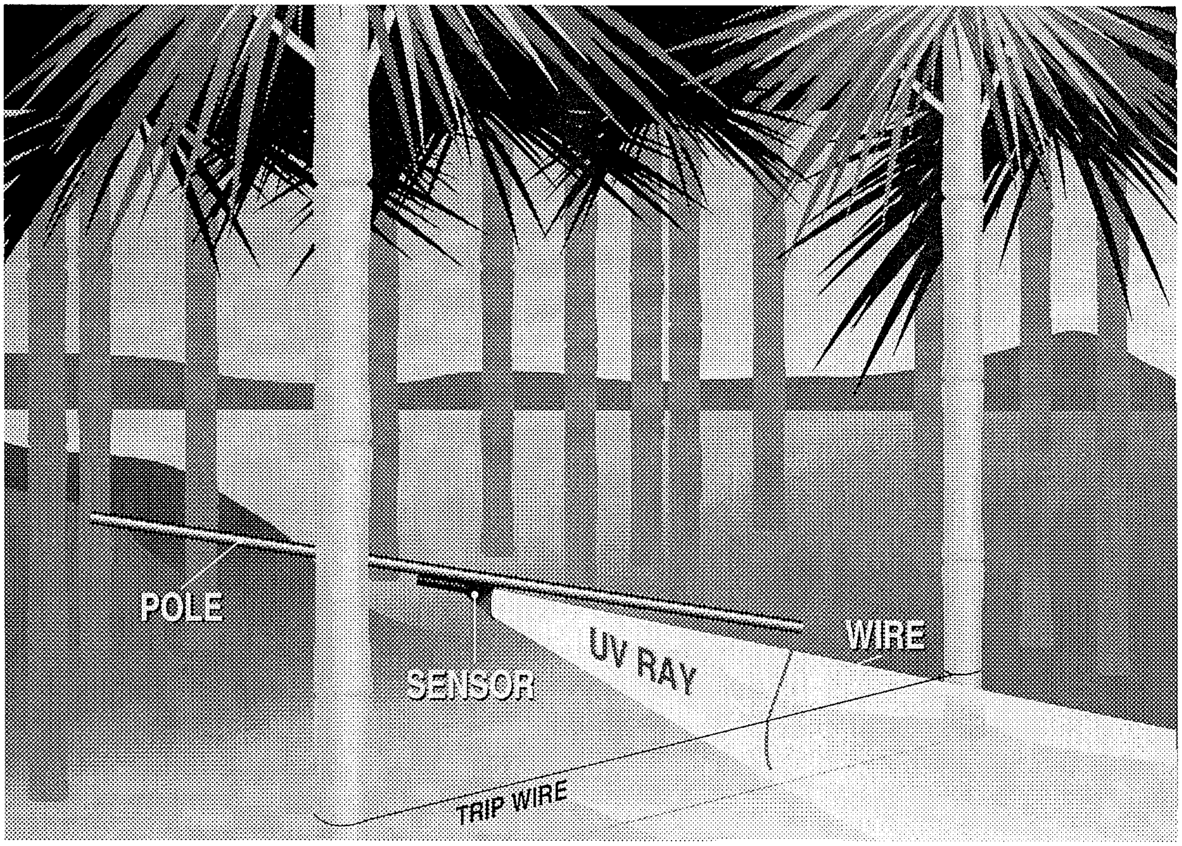
The OCDT demonstrated the effectiveness of mechanical demining blades designed for attachment to commercial construction equipment. The purpose of these blades is to remove AT mines from the path of the host vehicle, and collect or expose them for subsequent neutralization. To be most effective, MCBs could be used in conjunction with the Berm Processing Assembly and with AP detonating rollers. NVESD planned to test two configurations of mine clearing blades. The bucket design not only brings mines buried up to 10 inches to the surface, it does so without destroying a cultivated area's ability to grow crops. The tines are shaped and arranged similar to a field cultivator. The soil is scarified and left in place just as a farmer would cultivate a field. At the same time, buried mines are brought to the surface for subsequent disposal. The bucket is still available for its designed use. It can therefore be of value in clearing obstacles away from mines, filling craters left after a blast and protecting the operator should the vehicle strike a mine. The mine clearing bucket is good for working in confined areas such as forested and urban settings. The second configuration (not completed in time for test) is a mine clearing rake that attaches to a bulldozer. The rake is appropriate for less confined areas such as fields.

(11) Grapnels



A grapnel is a tethered device used to clear trip wires and electrically fired mines. A spring loaded launching device propels the grapnel a to given distance depending on the length of the tether and on the launch force. As deminers reel the grapnel back towards the launch point, it activates trip wires to detonate mines a safe distance away. This test will evaluate heavy and light grapnels. The heavy grapnel operates in relatively large or heavily vegetated areas. The heavy grapnel can extract itself from obstacles as deminers reel it back to its launch point. The light grapnel and launcher configuration will fit onto the demining cart (see below) to support demining operations in small or confined areas. A casting device throws the grapnel attached to a line from a modified deep sea fishing reel. An electric powered reel recovers the grapnel which snags tripwires as it comes in. The light grapnel is not able to extract itself from obstacles, but it is simple and inexpensive enough to be a throw-away item. When a light grapnel becomes tangled, deminers will cut it loose and launch another one to continue the mission.

(12) Handheld Trip Wire Detector



The handheld trip wire detector system gives a deminer on foot important visual aids to locate trip wires in front of him. This system consists of the following components:

a. A 3-5 micron handheld IR sensor with 256 X 256 (platinum silicide) Focal Plane Array (FPA) and 50mm lens.

b. A 0.5kW generator.

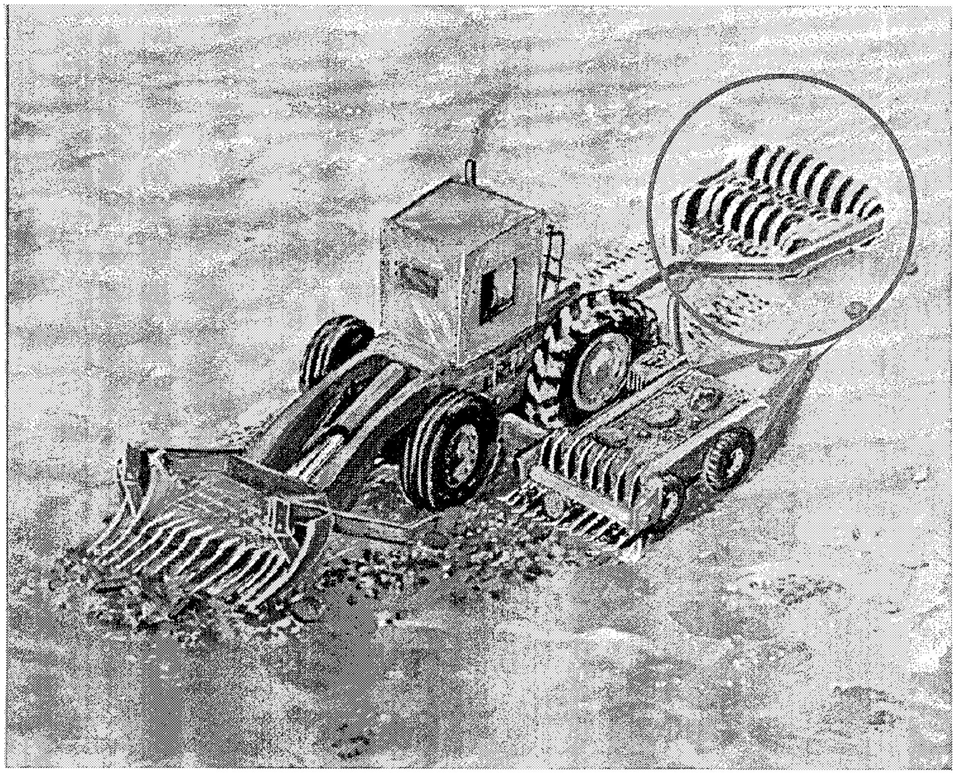
c. A 200 watt light bulb mounted in polished / smooth aluminum reflector. This component provides an outside (active) means to radiate the target area prior to using the handheld IR sensor.

d. A tri-pod and/or demining cart attachment brackets.

e. A 9" to 13" high resolution television monitor.

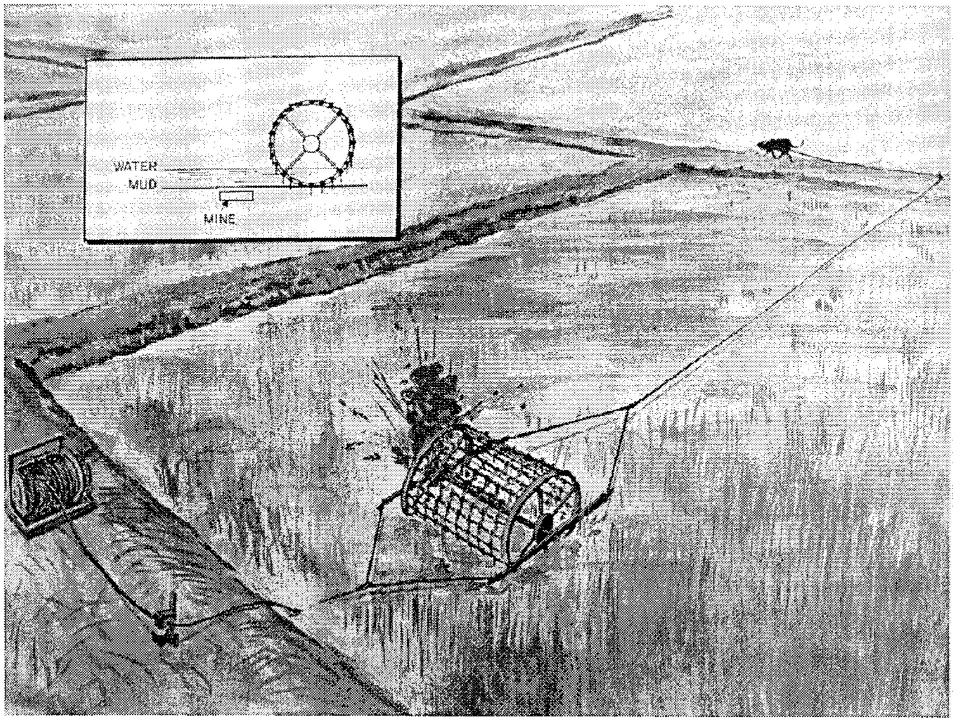
f. An 8mm or standard VHS recorder.

(13) Vehicle Towed Roller



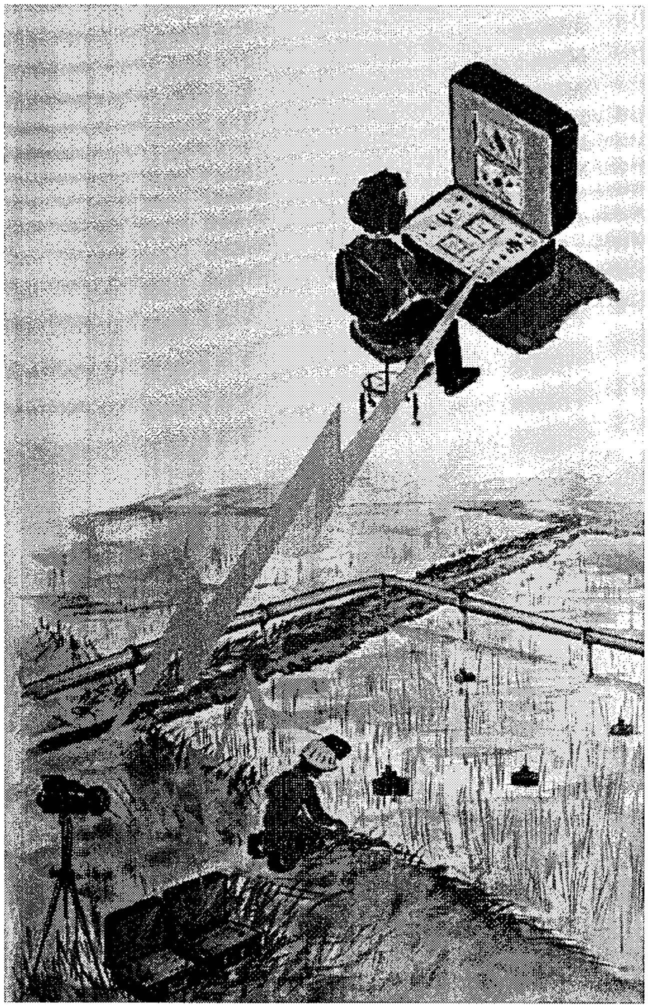
Anti-personnel mine detonating rollers towable by commercial vehicles will provide large area clearance.

(14) Towed Light (Swamp) Roller



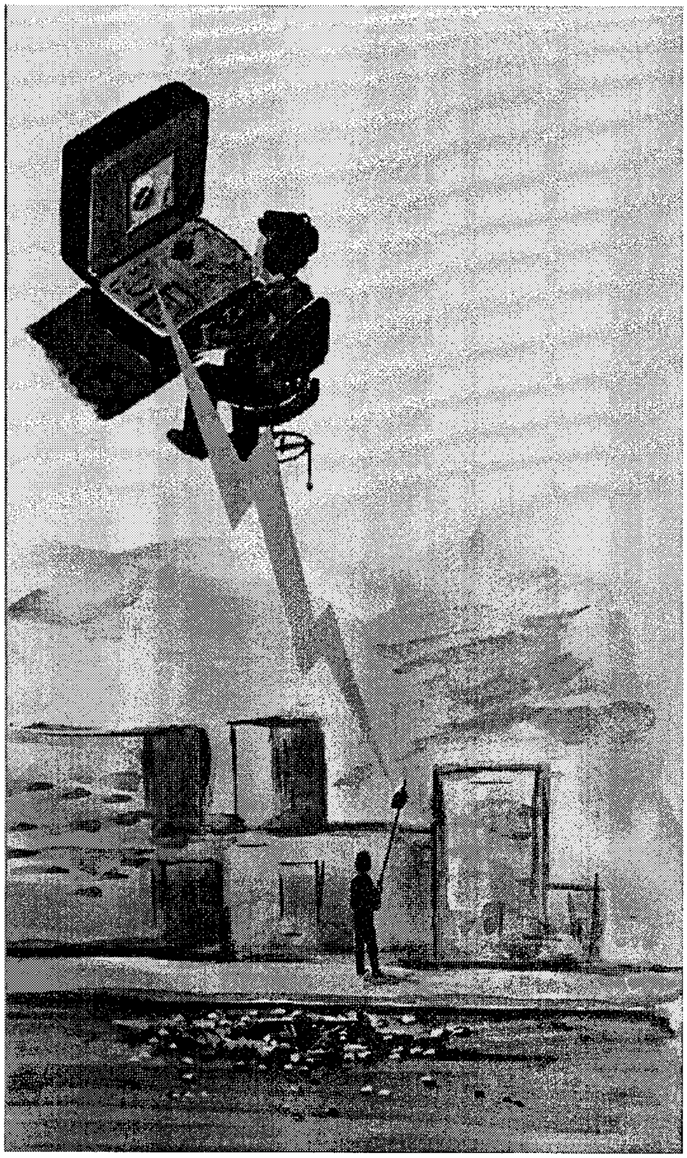
Light anti-personnel mine detonating rollers towable by small winches or animals will reduce the cost and increase the safety of demining in watery areas. Examples are wet vegetated areas and rice paddies. The availability of animals that can drive light rollers exceeds that of motorized vehicles in some countries.

(15) Command Communications Video and Light System (CCVLS)



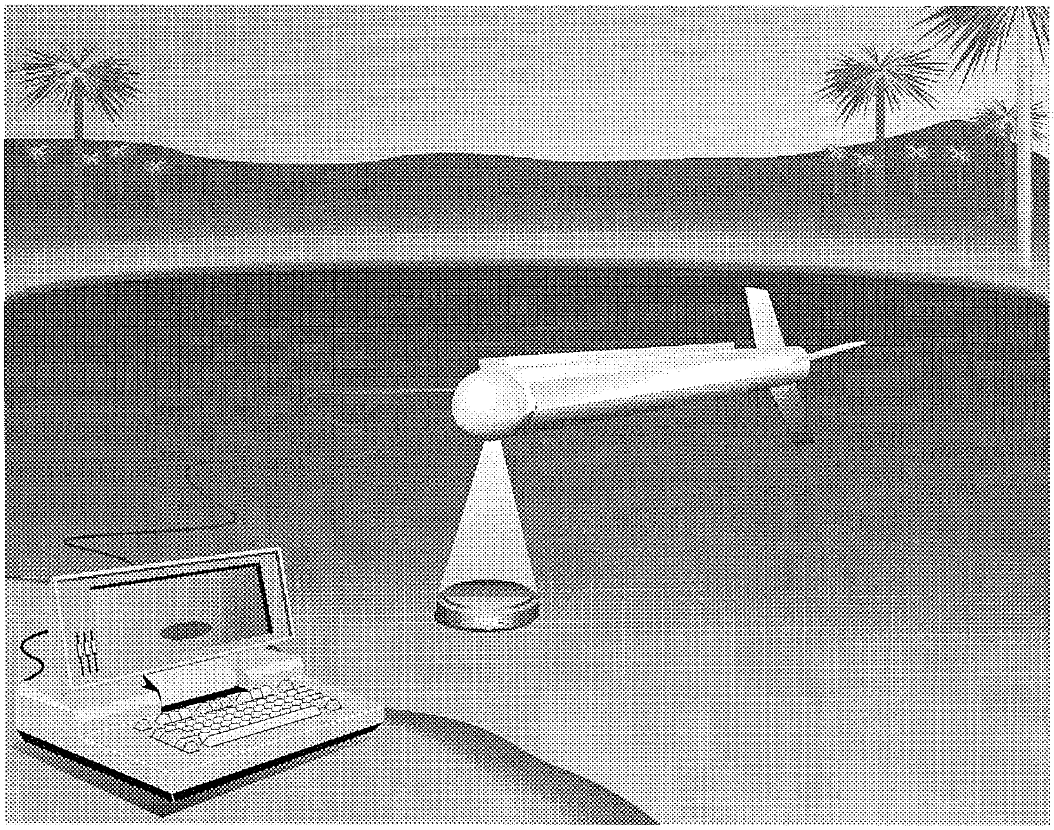
The Command Communications Video and Lighting System (CCVLS) is a command and control system that enables a technician to transmit real time audio and video from a demining work area back to a command post at distances up to one mile line-of-sight. This allows the operator at the command post to monitor and record all activity in the demining work area while greatly enhancing the safety and allowing the review of the actual demining procedures. The CCVLS is a self contained, rapid deployment field video and audio communications system. Three easily transportable cases house the system. Deminers use a low power, on-body 25 mw HERO safe transmitter to send and receive audio. A miniature helmet mounted video and light source combination transmits to a 25-foot safe radius from the mine. The CCVLS combines these signals, plus the video from a separate wide angle video camera positioned outside the safe area, to the command post via RF link or coaxial link.

(16) Mobile Video and Light System (MVLS)



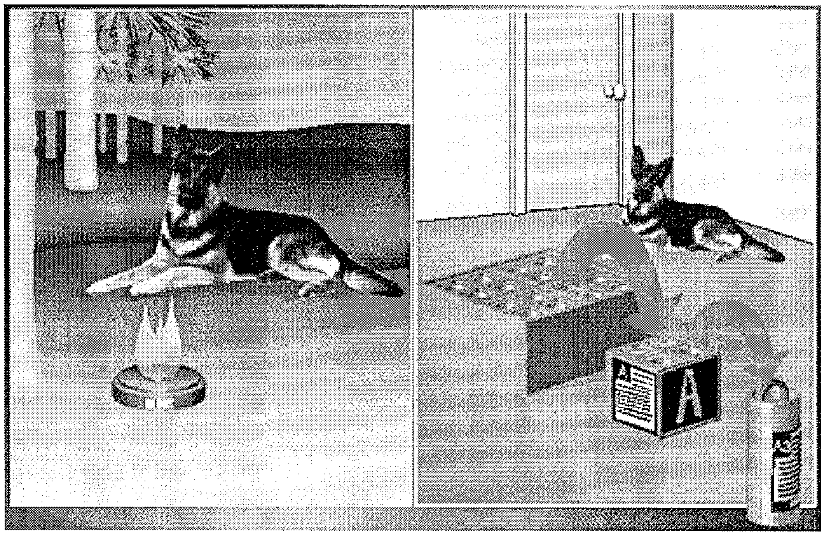
The Mobile Video and Light System (MVLS) is a modular system of readily interchangeable components that enhance reliability, serviceability and in-the-field reconfiguration as the situation requires. This system allows demining personnel to transmit real time video images from the field to a safe area command post. The command post consists of a single case containing a flat screen LCD monitor, a compact video tape recorder and an RF receiver antenna. Transmission is by means of a light wheel coaxial cable or a wireless RF link. A single ruggedized, compact and lightweight case houses the video camera and light source (white, IR, or UV). The compact size of the video camera head allows for a variety of mounting possibilities, such as to a helmet or a to a telescoping pole. The MVLS is designed to allow hands-free operation in a mined area or it can be used for training purposes.

(17) Side Scan Sonar



The Side Scan Sonar detects and provides photographic quality images of very small targets, such as mines and ordnance in water with zero visibility. The operator can determine any variation to the normal environment and allow for pinpoint accuracy in marking target objects. The system uses a personal computer for control, display, and data storage functions. It also incorporates a fully integrated navigational plotter and software for image enhancement. The complete system consists of a towfish (600kHz), a coaxial cable, and an IBM compatible PC incorporating an interface board, cables and the software package.

(18) K9 Program



Explosive materials in mines emit vapors that trained dogs can detect. This program will demonstrate the effectiveness of dogs as mine detectors. There are two alternative K9 techniques:

- Free Leash. Under handler control, dogs operate in suspected mined areas and alert when they encounter a mine. The dogs alert by sitting down next to a mine when they detect it. Besides mine detection capability, the test will also evaluate the ability of dogs to detect trip wires.

- "Checkmate" System. With this method, the dogs do not enter the mined area initially. Deminers place collector boxes at appropriate locations in suspected mined areas. The collector boxes are vacuum filters. They trap the scent of explosive material in the air if a mine is close to the box. Three methods exist for placing the collector boxes; by hand, from a vehicle mounted platform and from the air. When put in place, the collector boxes have markings showing their exact location. After a period of time, deminers retrieve the boxes and transport them to the dogs. When a dog alerts to a collector box, deminers can then perform a detailed search, using a free running dog, in the area from where they retrieved the box. Collector boxes that the dogs do not alert to indicate mine free areas. The Checkmate concept thus allows deminers to limit their effort to the areas indicated by the dogs.

Appendix D contains the Critical Issues and Criteria for each of the above technologies.

Test Concept

a. The Operational Capabilities Demonstration and Test (OCDT) will exercise all of the above described technologies in an environment as close to that of the worldwide humanitarian demining environment as possible. The following three critical areas identified by the CINC demining staffs best describes this environment:

- Lines of Communications (LOCs)
- Villages and urban areas
- Agricultural fields and other rural areas.

Although these broad areas exist everywhere in the world, there are large differences between them depending on their geographical location. An agricultural field for PACOM could be a Cambodian rice paddy, whereas for CENTCOM it could be an arid field in Eritrea. The equipment described above represents the full range of demining technologies (detection, mapping, marking, clearing and quality assurance). The challenge for the OCDT is to test this range of demining technologies in each of the three critical demining situations with results that are meaningful to all CINC demining staffs.

b. Due to the time and resources required, it is not feasible to perform the OCDT in multiple OCONUS locations. The most logical course of action is to minimize the number of test sites and simulate the three critical areas as closely as possible. The OCDT will take place at Range 71A, Fort A. P. Hill, VA.

(1) The test site consists of 17 different sections that simulate the global humanitarian demining environment. Each section represents a different demining scenario. The areas include footpaths in vegetation and in the open, simulated roads, urban and rural settings, generic areas to test individual technologies and a blast pit for explosive testing. A detailed layout of the A. P. Hill site is at Appendix F.

(2) The NVESD will populate each of the 17 areas with mines representative of the humanitarian demining environment. Government personnel will operate the equipment using a test procedure appropriate to the technology. Appendix G contains a matrix depicting what equipment each of the 17 areas will support.

(3) Due to the wide variety of equipment, the data collection process will vary depending on the technology. Appendix K contains data collection forms for each technology.

Schedule

The test schedule is at Appendix H.

Resources

a. Equipment

(1) Mines

Appendix G shows the mine population that will support the OCDT. This mine population reflects the most common humanitarian demining mine threat across all major commands.

(2) Host Equipment

Appendix E contains a list of supporting equipment and material required for the OCDT.

(3) Data collection equipment and materials.

(a) Two personal computers with software. The computers will host the database of the mine population for the test site, and house the application that will control the data entry and analysis of equipment performance. They will also serve the necessary administrative functions required on site such as periodic reports and the maintenance of an activity log.

(b) Data collection forms. Tailored data collection forms will accommodate the different performance and technologies of the various equipment. This test will therefore use multiple data collection forms during the test.

(c) One Activity log for shift supervisors to record ongoing events. The log will be important to the development of lessons learned to improve the quality of any future testing of this technology.

(3) Command and Control (radios, walkie-talkies).

(4) Administrative equipment and material (tablets, pencils, generator(s), fuel for generators, clipboards, vehicles, desks, tables, chairs, activity log, fencing).

b. People

Personnel from the Environmental Systems Branch of the CECOM Night Vision and Electronic Sensors Directorate (NVESD) will conduct the test. Lead Project Engineers will control the test for each of their technologies. The 5th Special Forces Group (5th SFC(A)) will provide operators and evaluators. Contractors will be in the vicinity of the test site as required.

c. Facilities

(1) Ft. A. P. Hill Range 71A. Site preparation will consist of the following activities:

(a) Site construction in accordance with the layout at Appendix F.

(b) Storage area for prototype equipment.

(c) Appropriate contractors will provide for kennels and other facilities needed for the dogs.

Measures of Success

Measures of Success are part of the detailed test plan at Appendix D.

Data Collection

Data collection will take place using forms specific to the item under test (Appendix K). The contents of each data collection form will support the evaluation of the technology in terms of its measures of success. Test personnel will record maintenance failures to determine needed design improvements for any item selected for further development. The Special Operations Forces (SOF) participants will operate every technology, and complete the data collection forms. A data collector, usually the project leader for the technology under test, will assist the operator as needed as well as record information. Each system will operate according to its specific test profile in Appendix D. Operators and data collectors will record performance on the appropriate data collection forms.

Appendix A: Equipment Requirements Matrix

18-19 January 1995 Humanitarian Demining Action Officers' Workshop

USER REQUIREMENTS FOR COUNTERMINE FOR HUMANITARIAN DEMINING AND MILITARY OPERATIONS OTHER THAN WAR

(BASED ON DEMINING ACTION OFFICER WORKSHOP REVIEW AND ANALYSIS)

	PRIORITY I	PRIORITY II	PRIORITY III

S&T	• UPGRADE SAPPER KITS TO DEMINER'S KIT
	  • HAND & POWER TOOLS
	  • LIGHT ARMOR PROTECTION CART
	• MINE/COUNTERMINE DATA BASE
	• TRIP WIRE DETECTOR
	  • VISUAL (IR/UV/VISUAL)
	  • MECHANICAL GRAPNEL
	• TRIP WIRE FEELER
	• VEHICLE UP-ARMOR KITS FOR CIVILIAN VEHICLES
	• ENHANCED PROTECTIVE FOOTWEAR & BODY ARMOR
	• LIGHT AP MINE ROLLER FOR WHEELED/LIGHT TRACKED VEHICLES
	• OFF-ROUTE SENSOR/CLEARING SYSTEM
	• ON-ROUTE SENSOR/CLEARING SYSTEM
	• VAPOR SNIFFERS
	  • DOG (K-9)
	  • ENHANCED K-9 SYSTEM (COLLECTORS)
		• MULTI-LINGUAL MEDIA CAPABILITY
		• TEST MINE RESISTANT VEHICLES
		• CHEMICAL NEUTRALIZATION
		• HANDHELD CLOSE-IN SENSORS FOR MINE MARKING OF METALLIC AND NONMETALLIC MINES
			• SMART PROBE
			• INFLUENCE MINE ACTIVATORS (SEISMIC, MAGNETIC, BEAM CUTTING, PHOTOELECTRIC CELL, OFF-ROAD)
			• FIRING WIRE DETECTOR
			• SMALL RC ROBOT FOR URBAN MISSIONS

ACQUISITION	• UPGRADED POWER SYSTEM FOR PSS-12 DETECTOR
	  • SOLAR
	  • RECHARGEABLE
	  • GENERATOR
	• INERT/SIMULATED MINES FOR REALISTIC TRAINING
	• WARHEAD (M-42) DESTRUCTOR KITS
	  • UPGRADE STAND
	  • UPGRADE FIRING CHAIN
	• TRAIL (MINI) FLAIL W/POWER TAKEOFF OR OTHER DEVICES (ARMS, BOOMS, ETC.)
	  • REMOTE CONTROL
	  • UPGRADED POWER TRAIN
	  • LOWER GROUND PRESSURE
	  • DAY/NIGHT OPERATION
		• MOBILE TRAINER SYSTEM
		  • DEMINER TRAINER
		  • MINE AWARENESS TRAINING
		• SPECIAL PURPOSE HAND & POWER TOOLS FOR UNIQUE DEMINING SCENARIOS
			• ROME PLOWS W/CLIMATE CONTROL AND LEXAN/KEVLAR CAB FOR OPERATOR PROTECTION
			• ARMORED BUSH HOG (REMOTE CONTROLLED) FOR JUNGLE VEGETATION REDUCTION (UPGRADE MINI-FLAIL)
			• TARGET ILLUMINATOR
			  • LASER
			  • HIGH INTENSITY LIGHT
			• GPS RECEIVERS W/DATA TRANSMISSION TO REPORT "TARGET LOCATIONS"
			• STANDOFF ENGAGEMENT OF MINES/UXO
			• WIDE FIELD OF VIEW SENSOR FOR QUALITY ASSURANCE MISSION

TABLE XX

Table XX illustrates a detailed ordering of Countermine Development and Acquisition priorities based on the 17 - 18 Jan 95 Demining Action Officer Workshop review and analysis. These results serve to establish relative priorities for the application of resources:

- Priority I requirements should be addressed now.
- Priority II requirements should be developed into program initiatives as soon as technology and resources permit.

Appendix B: Critical Nations in Need of Humanitarian Demining Assistance

List of Priority Countries

CENTCOM
Eritrea
Ethiopia
Afghanistan

SOUTHCOM
Nicaragua
Honduras
Costa Rica
El Salvador

EUCOM
Angola
Mozambique
Namibia
Rwanda

PACOM
Cambodia
Laos
Vietnam

Appendix C: Most Common Anti-Personnel and Anti-Tank Mines

Threat Anti-Personnel Mines

Humanitarian Demining and OOTW

M14, M18A1, MON Series, PMD, PMN Series, POMZ Series, PP-Mi Series, OZM Series

EL SALVADOR
M14
M18A1

NICARAGUA
MON Series
PMD-6
PP-Mi Series

HONDURAS
PMD-6
PMN Series
PP-Mi Series

ETHIOPIA
MON Series
OZM Series
PMD-6
PMN Series
POMZ Series
PPM-2

MOZAMBIQUE
Except M18A1
PPM-2
Type 69
Valmara 69

ERITREA
DM-11
M16A1
PPM-2
Type 69

ANGOLA
Except M18A1
DM-11
PPM-2
Type 72
PRB M409
VS-MK II
DM-31
M-16
Valmara 69

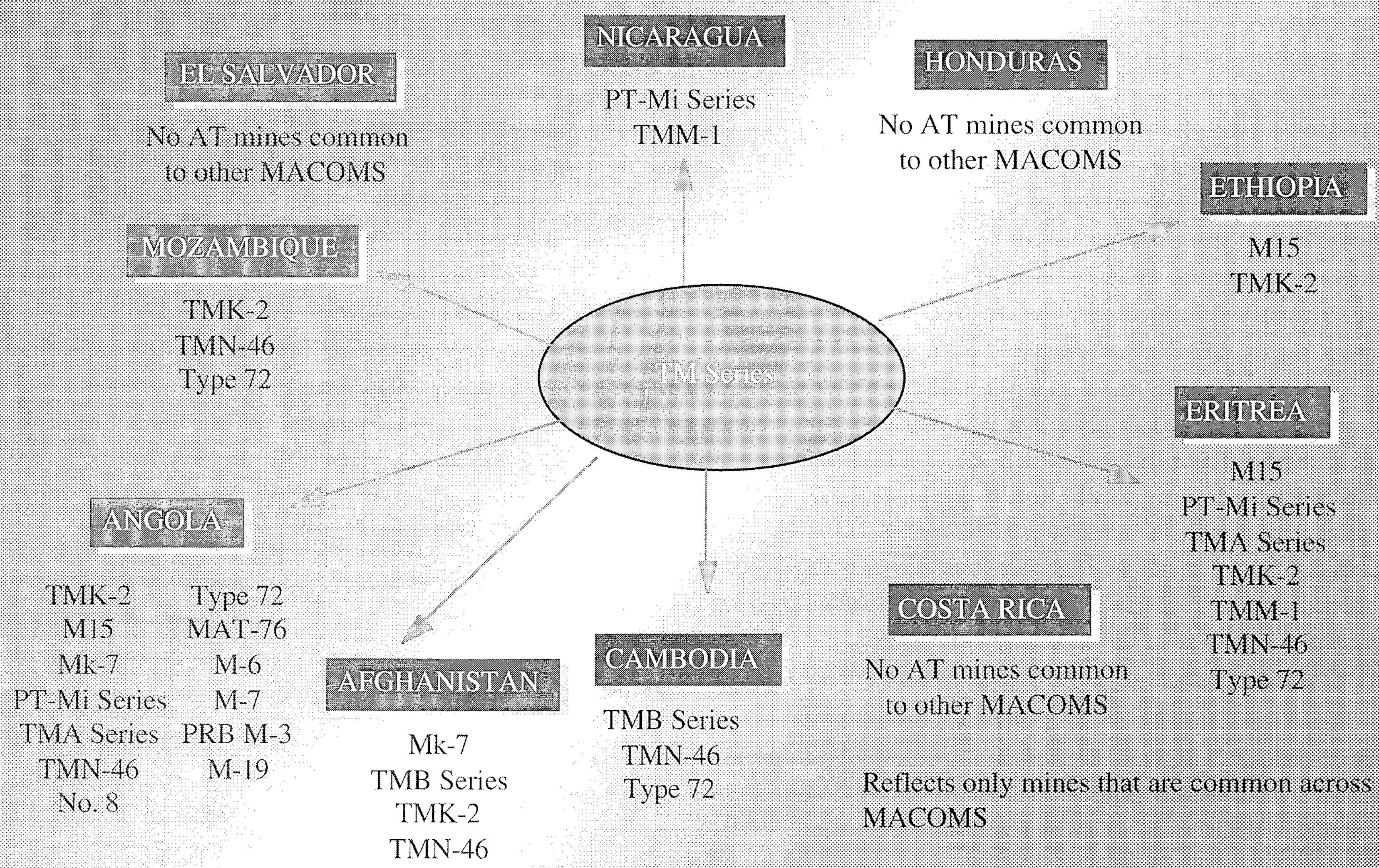
AFGHANISTAN
Except M14
OZM Series

CAMBODIA
M16A1
PPM-2
Type 69
Valmara 69

COSTA RICA
M18A1
PP-Mi Series

Reflects only mines that are common across MACOMS

Threat Anti-Tank Mines
Humanitarian Demining and OOTW



Appendix D: Objectives/Measures of Success/Detailed Test Design

Appendix D:

Objectives, Measures of Success and Detailed Test Procedures

I Mine detection on-road and off-route.

These Measures of Success apply to the vehicle based sensor detection and quality assurance systems:

a. Vehicle Mounted Detection System:

1. Objectives:

(a) Tactical

(1) To remotely find buried land mines with a jumbo array metal detector

(2) To remotely find buried land mines with infra-red and ultra-violet cameras

(3) To remotely verify if a video or metal detection is an explosive device without digging

(4) To remotely operate on-road and off-road

(5) To remotely find surface/standoff mines with a IR/UV mine detector

(b). Strategic:

(1) To determine the suitability of the vehicle based detection prototype to operate in humanitarian demining environments.

(2) To evaluate the ruggedness of the vehicle and its subsystems.

(3) To determine the amount of training that is required for indigenous personnel to operate the equipment effectively.

(4) To evaluate the logistical support required to sustain the equipment.

(5) To perform two independent tests of each area (time permitting)

2. Measures of Success.

Quantitative Measures

(a) How many mines did the entire system find? (Combination of IR/UV, metal detect, TNA)

(b) Were all the mines found with the metal detector?

(c) How many mines were found with the infra-red/ultra-violet (IR/UV) system?

(d) How accurate was the Thermal Neuron Analyzer (TNA) sensor in verifying the presence or absence of a target in the different areas?

(e) Can the suite of video equipment detect trip wires and directional mines in the wooded areas?

(f) How accurately does the marking system mark the objects it detects?

(g) What is the false alarm rate for the close-in and stand-off sensors?

Qualitative measures:

(h) In which area did the system work the best?

(i) What times during the day and under what conditions (weather, heat, light, ground covering, etc.) are the sensors most accurate in detecting land mines and trip wire devices?

(j) How easy is the vehicle mounted mine detection system to set up, operate and maintain? How many hours of training are required?

(k) How good is the quality of the video that is transmitted back to the command station? What is the quality of the 3-D images that are transmitted to the command station? Can the shape of the buried device be determined?

3. Data Acquisition Procedure:

(a) Personnel Required: 2 SOF operators, the NVESD lead engineer.

(b) Pretest: The engineer trains the SOF operators on the use of the remote controlled detector. The major components are: IR/UV and visual cameras for spotting mines, a jumbo array metal detector, a TNA (Thermal Neutron Analyzer), and the paint sprayer. The systems are then calibrated for the specific test area in the calibration lane.

(c) Locations and priority:

Priority 1: 1. Field 12. Farm 7. Unimproved Road
Priority 2: 17. Pattern 6. Gravel 5. Sealed Gravel
Priority 3: 10. Urban 16. Sand

Priority 4: 3 Concrete 4. Asphalt

(d) Time of test: One day each area beginning on 2 November.

(e) Test Procedure:

(1) The operators determine what search pattern to run based on terrain.

(2) The video equipment is used first to spot surface anomalies. These are noted.

(3) The team begins a systematic search of the minefield.

(4) The system scans the ground with the metal detector as it moves in the search pattern.

(5) All metal detections and visual anomalies are interrogated with the TNA sensor.

(6) All metal detections and TNA detections are marked with paint and GPS.

(7) The entire area is completed in this manner.

(8) All marks are visually inspected by an independent judge to see what was missed.

(9) Survey exactly all marks and reduce data to determine the number of mines found.

(10) A video record of interesting activities is taken intermittently during operations.

(11) All paint marks are removed.

(12) A different operator team, driver and sensor, is then used on the same area.

(13) Two passes are completed by two independent teams.

(14) The off-road version will be used in the urban and unimproved road areas.

(f) Video detection system will be used to search wooded and grassy area for tripwires and standoff mines. Operators must be unfamiliar with the locations of the targets.

(g) A demonstration or evaluation will be performed to provide data on the system's ability to be removed from the operating area without requiring special equipment.

4. Data Recording Procedure:

(a) Record mines found - type, depth.

(b) Record mines missed - type, depth.

(c) Note IR/UV, metal detector, TNA performance, and system as a whole.

(d) Record time to clear entire area.

(e) Record time between paint marker refills.

(f) Record total operating hours and failure data.

(g) Record rate of re calibration.

(h) Analysis of this data will result in the NVESD's best judgment of the expected effectiveness of the Vehicle Based Detection in the humanitarian role. Analysis will include input from SOCOM as the user representative.

(i) Record environmental conditions.

(j) Mines and/or trip wires found by IR and UV cameras.

(k) Mines found by TNA sensor.

(l) Mines and/or trip wires found on-road versus off road.

(m) Number of passes to achieve 100% detection.

(n) Speed of detection, defined by the time taken to reach 100% detection in each lane.

(o) False alarm rate.

(p) Ease of training, equipment set up, operation.

(q) Safety hazards of operating equipment.

(r) Quality of IR, UV and video transmitted to command station.

(s) Quality of 3-D images transmitted to the command station, to include identification of shape and anti-handling devices.

(t) Accuracy of the GPS display in showing vehicle path and location of detected mines.

(u) Operator / data collector evaluation of any human factors issues.

(v) Detection Operator / data collector evaluation of the Vehicle Based Detection's suitability for the humanitarian demining environment.

b. VMMD:

1. Objectives.

(a) To determine the ability of the vehicle mounted mine detection prototype to detect mines from off-road and on-road environments.

(b) To determine the suitability of the vehicle mounted mine detection prototype to operate in humanitarian demining environments.

(c) To evaluate the ruggedness of the vehicle and its subsystems.

(d) To determine the amount of training that is required for indigenous personnel to operate the equipment effectively.

2. Measures of Success.

(a) Determine percentage of landmines that can be detected after each pass using a combination of the IR and UV stand-off sensors, and the GPR close-in sensor?

(b) What percentage of landmines are found in both on-road and off-road environments?

(c) What is the reported type and diameter of the mines that are detected and those that are undetected?

(d) What times during the day and under what conditions (weather, heat, light, etc.) are the stand-off sensors most accurate in detecting landmines?

(e) How easily is the vehicle mounted mine detection system set up, operated and maintained? How many hours of training are required?

(f) What are the possible safety hazards if any, that may occur when operating the equipment?

(g) How good is the quality of the video that is transmitted back to the command station? What is the quality of the 2-D images that are transmitted to the command station? Can the shape of the buried device be determined?

(h) How accurately (distance from each mine in feet) does the marking system mark the objects it detects using the GPR sensor?

(i) How rugged is the system and how often does the system need repaired? (Operation time versus down time)

(j) How accurately does the GIS display on the lap top computer show the vehicle path as well as the location of marked targets?

3. Data required:

(a) The different areas that contain the identified mine population to be cleared will be surveyed and entered into a database.

(b) Mines (types, size, etc.) and/or trip wires found by IR and UV cameras will be recorded. The farm field, grass field, unimproved road, patterned minefield, and various road surfaces will be used for the VMMD detection areas.

(c) Mines (types, size, etc.) detected and undetected by GPR sensor will be recorded.

(d) Mines and/or trip wires detected on-road versus off road will be recorded.

(e) The number of passes required to achieve 100% detection for GPR sensors will be determined. Note: This will not be done for all areas. The farm or grass field may be the only one depending on time available.

(f) The speed of detection, defined by the time taken to reach 100% detection in given area above will be recorded. Again, this will only be done for the farm or grass field.

(g) The false alarm rate = false alarm detections (non targets)/ total number of detections will be recorded for both on-road and off-road environments.

(h) The environmental and weather conditions will be recorded for each test run in each test area.

(i) The ease of training, equipment set up, and operation will be noted based on operator feedback.

(j) Safety hazards of operating equipment will be recorded based on operator feedback.

(k) The quality of IR, UV and video images transmitted to the command station will be evaluated.

(l) The quality of 2-D images transmitted to the command station, to include identification of shape and anti-handling devices will be evaluated.

(m) The accuracy of the paint marking system in marking detected objects will be determined by recording the distance of the mark from the mines exact location. This distance from the mine location to the mark of the VMMD system will be recorded.

(n) The ruggedness of the VMMD system will be noted and recorded based on operators observations. The operation time versus down time will be recorded.

(o) The accuracy of the GIS display in displaying the vehicle path and the location of detected mines will be evaluated.

(p) Operator / data collector evaluation of the VMMD's suitability for the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) The Vehicle Mounted Mine Detection (VMMD) system will be operated in 10 mine detection areas at the Fort A. P. Hill Range 71A test site. These areas are currently defined as 1.) **Area 1 - Grass Field**, 2.) **Area 3 - Concrete Road**, 3.) **Area 4 - Asphalt Road**, 4.) **Area 5 - Sealed Gravel Road**, 5.) **Area 6 - Gravel Road**, 6.) **Area 7 - Unimproved Road**, 7.) **Area 9 - Foot Path Under Canopy**, 8.) **Area 12 - Farm Field**, 9.) **Area 16 - Sand**, and 10.) **Area 17 - Patterned Field.**

Mines and trip wires of known type, number, and location will be emplaced and surveyed into these test areas. Additional man-made targets will be similarly emplaced to measure the VMMD's false positive performance. Each mine emplaced will be recorded and entered into the test database. This will be the baseline against which VMMD performance will be evaluated. The VMMD system will make one pass for each area test run. Following each pass, the area will be inspected and each marked item will be recorded. The distance from each target will be recorded. All mines and their individual characteristics will be recorded as they are detected. Those mines that were not detected will also be recorded.

(b) The NVESD engineer for the vehicle mounted mine detection project will instruct Special Forces personnel on the use and operation of the equipment. Special Forces user representatives will operate the equipment during the test. The VMMD prototype will perform with an operator and a data collector. A driver is also required for testing purposes. Video cameras positioned outside the detection area will record the progress from an adjacent point of view. The projected sequence is as follows:

Mine detection and marking each day. Record exact locations of paint marks made by the VMMD. Measure the distance between the actual location of the mines and the mine markings made by the VMMD system. The mines and their characteristics will be recorded as they are detected. The detection times to cover each area will be recorded. The time between paint marker refills will be noted.

During system performance, the operator and data collector will record their evaluation concerning the IR and UV video quality, the 2-D image quality transmitted to the operator station, and the accuracy of the GIS display in showing the vehicle path and location of detected mines. Various passes will be made at varying times and weather in the grass field (Area 1).

- **Setup** - day 1. Arrive on site and set up equipment.

- **Off-road** - days 2-4. Operate the VMMD system in off-road environments (areas 1, 12 and 17) against antipersonnel mines, antitank mines, and trip wire devices.

- **Off-road** - days 6-8. Operate the VMMD system in off-road environments (areas 5, 9 and 16) against antipersonnel mines, antitank mines, and trip wire devices.

- **On-road** - days 9-10. Operate the VMMD system in on-road (areas 3, 4, 5, 6) environments against antipersonnel mines and antitank mines.

(c) Logistics data will obtained from the contractor. Actual or predicted RAM data will be recorded by recording the number of hours operated, and documenting any failures on a Test Incident Report (TIR) form. Data for the vehicle will not be included, as the detection and marking system does not require a specific vehicle.

(d) Safety, human factors and general comments from the operator and data collector will be recorded on a data collection form. When completed, this document will be entered into the test database.

5. Data Analysis Procedure:

Recorded data from all VMMD performance tests, and additional data provided by operators and data collectors, will be entered into the automated database and a report generated describing the VMMDs performance. Once entered into the database, information from (d)(2) above will be used to generate performance statistics to support the required data. Operating hours and failure data, whether from on-site experience or contractor provided, will be used to evaluate the RAM characteristics of the system. Operator and data collector comments from the VMMD form will be used to analyze all other items in section (c) above. Analysis of this data will result in the NVESD's best judgment of the expected effectiveness of the VMMD in the humanitarian role. Analysis will include input from SOCOM as the user representative.

c. Ground Platform Mounted Quality Assurance:

1. Objectives.

(a) To determine the ability of the ground platform mounted QA prototype to find mines remaining in off-road and on-road environments after the areas have been demined.

(b) To determine the suitability of the ground platform mounted QA prototype to operate in humanitarian demining environments.

(c) To determine the amount of training that is required for indigenous personnel to operate the equipment effectively.

(d) To evaluate the logistical support required to sustain the equipment.

(e) To determine optimum heights/ranges for QA detection.

2. Measures of Success.

(a) Searching areas already cleared and not obscured by foliage, what percentage of landmines and trip wire devices can be detected after three passes using the IR, UV and video sensors? How many passes are required for 100% detection? Can the system distinguish between a cavity from a removed mine and a mine still in place?

(b) What percentage of landmines are found in on-road versus off-road situations?

(c) What is the diameter of each mine detected by the camera suite?

(d) What is the false alarm rate?

(e) What times during the day and under what conditions (soil, weather, heat, light, etc.) are the sensors most accurate in detecting landmines and trip wire devices?

(f) How easy is the ground platform mounted QA system to set up, operate and maintain?

(g) What are the possible safety hazards if any, that may occur when operating the equipment?

(h) How good is the quality of the video that is transmitted back to the command station? What is the quality of the 3-D images that are transmitted to the command station?

(i) How rugged is the system and how often does the system need repaired?

(j) Can the ground platform mounted QA system be removed from a minefield without using special equipment should a detonation occur?

(k) What is the optimum height and range for QA detection?

(l) Are there any human factors issues regarding the Ground Platform Mounted QA System?

(m) What is the overall suitability of the Ground Platform Mounted QA System for humanitarian demining?

3. Data required:

(a) Identified mine population to be cleared - entered into a database. Includes location of cleared areas, types of mines removed.

(b) Mines and/or trip wires found by IR and UV cameras.

(c) Number of passes to achieve 100% detection.

(d) Mines and/or trip wires found on-road versus off road.

(e) Diameter of the mines detected.

(f) False alarm rate.

(g) Results to 2a, 2b and 2c under different conditions of (soil, weather, heat, light).

(h) Ease of training, equipment set up, operation.

(i) Safety hazards of operating equipment.

(j) Quality of IR, UV and video transmitted to command station.

(k) Quality of 3-D images transmitted to the command station.

(l) Ruggedness of system and mean time between failure rate.

(m) Demonstration of removal from the minefield without using special equipment.

(n) Results of tests from various heights and ranges.

(o) Operator comments regarding human factors issues with the Ground Platform Mounted QA System.

(p) Operator and data collector comments on overall suitability of the Ground Platform Mounted QA System for humanitarian demining.

4. Data Acquisition Procedure:

(a) The ground platform mounted QA system will be operated in the mine clearance lanes at the Fort A. P. Hill Range 71A test site. Mines of known type, number, and location will be placed in these lanes. Each mine to be detected will be pre-marked with a representative marking device.

(b) The NVESD engineer for the vehicle mounted mine detection project will instruct Special Forces personnel on the use and operation of the equipment. Special Forces user representatives as well as NVESD personnel will operate the equipment during the test. The prototype will perform with an operator and a data collector. Video cameras positioned outside the clearance lane will record the progress from another point of view. Projected sequence is as follows:

Mine detection and marking each day. Record data on the capability of the camera suite to detect mines. Following each pass, data showing the performance of each camera, and the display at the control system, will be recorded for input into the test database. Operator will mark every detection of a suspected mine. The location of each mark will be recorded for input into the test database for performance analysis. Operators will complete the Ground Platform Mounted QA System Questionnaire which will provide input regarding video quality, safe removal of a failed or damaged system from a minefield, ease of use, safety, human factors and overall suitability for the humanitarian demining environment.

- Off-road - days 1-3. Operate the Ground platform mounted QA system in off-road environments (areas 9 and 12) against antipersonnel mines, antitank mines, and trip wire devices.

- On-road - days 4-5. Operate the Ground platform mounted QA system in on-road (areas 5, 6, 7, 8) environments against antipersonnel mines, antitank mines, and trip wire devices.

(c) Actual RAM related data will be collected as it occurs during the demonstration. Hours of operation will be tracked, and any failure will be documented on a TIR. This will be input into the test database for combination with an engineering analysis that will predict RAM based on available component reliability data.

(d) Comments from the operator and data collector regarding safety, human factors and overall suitability of the Ground Platform Mounted QA System for the humanitarian demining environment will be recorded on a data collection form. When completed, this document will be entered into the test database.

5. Data Analysis Procedure:

Recorded data from all ground platform mounted QA performance tests, and additional data provided by operators and data collectors, will be entered into the automated database and a report generated. Data collected as described in (d)(2) above will fulfill collection requirements (c)(1) through (c)(7) and (c)(14) above. Data collected according to the procedure in (d)(3) above will respond to (c)(12). Remaining items in (c) above will come from operator / data collector comments. Analysis of this data will result in the NVESD's best judgment of the expected effectiveness of the ground platform mounted QA in the humanitarian role. Analysis will include input from SOCOM as the user representative.

II Mine Clearers.

a. Tele-Operated Ordnance Disposal System (TODS):

1. Objectives:

Tactical

(a) To remotely uncover land mines with a machine.

(b) to remotely excavate a mine or suspect area with an air knife.

(c) To remotely remove mines from sensitive areas without activating them.

(d) To complete these missions in a variety of different soil types.

(e) To remove both AT and AP mines.

(f) To remotely remove vegetation from a mined area.

Strategic

(a) To determine the suitability of the vehicle based detection prototype to operate in humanitarian demining environments.

(b) To evaluate the ruggedness of the vehicle and its subsystems.

(c) To determine the amount of training that is required for indigenous personnel to operate the equipment effectively.

2. Measures of Success.

Quantitative measures

(a) Was the metal detector useful in pinpointing the exact location of the marked mines?

(b) How effective was the video system as an aid to excavating the mines?

(c) Can the TODS remove mines from the ground without detonation?

(d) Is the grass cutter able to trim grasses and light brush to allow access to ground emplaced and buried mines? What obstacles or conditions affect the cutter operation?

(e) What mines does the air knife detonate, and at what range?

(f) What is the maximum weight the TODS is able to lift or drag?

Qualitative measures:

(a) In which area did the system work the best?

(b) Did one team do significantly better than the other?

(c) How easy is the TODS to set up, operate and maintain? How many hours of training are required?

(d) What are the possible safety hazards if any, that may occur when operating the equipment?

(e) How rugged is the system and how often does the system need repaired?

(f) How accurately does the GPS display on the lap top computer show the vehicle path as well as the location of marked targets?

3. Data Acquisition Procedure:

(a) Personnel Required: 2 SOF operators, the NVESD lead engineer.

(b) Pretest: The engineer trains the SOF operators on the use of the remote system. The major components are: The gripper arm, the bucket, the air knife, the metal detector, and the grass cutter.

(c) Locations and priority:

Priority 1: 10. Urban 7. Unimproved Road

Priority 2: 1. Field 6. Gravel 5. Sealed Gravel 16. Sand
Priority 3: 12. Farm

(d) Test Procedure:

(1) An overgrown area with mines is cleared of vegetation first for the detection systems.

(2) Given that the mines are marked with paint, or an approximate GPS location is given, the operator uses the metal detector to locate the object.

(3) The object is excavated with the air knife/bucket..

(4) The mine is picked up with the gripper arm.

(5) Test mines are uncovered and simulated charges are placed on exposed mines.

(6) A video record of interesting activities is taken intermittently during operations.

(7) A different operator then completes the same mission.

(8) Two of each type of AT and AP mines are picked up.

(9) A demonstration or evaluation will be performed to provide data on the system's ability to be removed from the operating area without requiring special equipment.

4. Data Recording Procedure:

(a) Record mine type, depth.

(b) Note camera and metal detector performance.

(c) Record time to uncover or clear mine.

(d) Record total operating hours and failure data.

(e) Analysis of this data will result in the NVESD's best judgment of the expected effectiveness of the Vehicle Based Detection in the humanitarian role. Analysis will include input from SOCOM as the user representative.

(f) Record environmental conditions.

(g) Ease of training, equipment set up, operation.

(h) Safety hazards of operating equipment.

(i) Accuracy of the GPS display in showing vehicle path and the location of detected mines.

(j) Operator / data collector evaluation of any human factors issues with the Vehicle Based Detection Operator / data collector evaluation of the TODS suitability for the humanitarian demining environment.

b. Mini-Flail:

1. Objectives.

Tactical

(a) To remotely destroy antipersonnel land mines.

(b) Survive multiple antipersonnel mine detonations with only light damage.

(c) Repair easily in the field.

(d) To remotely operate on-road and off-road.

(e) Test the new design's ability to destroy blast protected mines.

(f) Expose mines that cannot be detonated with the chains.

(g) Evaluate the automotive worthiness of the new design.

Strategic

(a) Evaluate the ruggedness of the remote control subsystem, the vehicle and the clearing mechanisms when used by uneducated host nation deminers.

(b) To determine the suitability of the vehicle for operation in humanitarian demining environments.

(c) To evaluate the ruggedness of the vehicle.

(d) To determine the amount of training that is required for indigenous personnel to operate the equipment effectively.

(e) To evaluate the logistical support required to sustain the equipment.

2. Measures of Success:

(a) Given an assigned area, can the Mini-flail efficiently clear 100% of the non-blast hardened AP mines located in that area? Does the new flail hammer design damage by cutting hardened AP mines?

(b) For Lines of Communication (LOC) that must remain usable, can the Mini-flail clear so that the LOC remains usable for its intended purpose?

(c) Can the mini-flail dislodge and cast from their place of burial only blast hardened pressure fuzed mines?

(d) AT mines will be practice/instrumented mines to measure activation potential? What are safety concerns?

(e) What terrain/obstacle characteristics can the mini-flail successfully negotiate in difficult mobility environments?

(f) What kind of AP mines will the mini-flail withstand?

(g) Will the Mini-flail be able to drive over an anti-tank mine, without activating it? (need smoke fuses)

(h) Is the Mini-flail simple to operate and maintain by host nation deminers?

(i) Is the Mini-flail's RAM performance suitable for the humanitarian demining environment?

(j) Can the Mini-flail be removed from a minefield without requiring special equipment?

(k) Can the flail sweep small mines and UXO from their resting place for other disposition?

3. Data Acquisition Procedure:

(a) Personnel Required: 2 SOF operators, the NVESD lead engineer.

(b) Locations:

(1) Large clearance area with inert M-15 mines.

(2) areas 9. Canopy and 15. Woods.

(3) Demo Pit.

(c) Non-Explosive Test Procedure:

(1) The vehicle is to be operated in fields and wooded areas to evaluate the flailing performance and the tendencies to jam, as well as mobility on slopes and through brush.

(2) Test the Mini-Flail's ability to run over anti-tank mines without detonating them. Test this ability with the following inert mines:

Mine:	Depth:
M-15	Shallow buried
M-15	Three inches
VS-1.6	Shallow buried
VS-1.6	Three inches
TM-46	Shallow buried
TM-46	Three inches
M-19	Shallow buried
M-19	Three inches

(3) Operate flail to throw objects to the front of flail to observe how well buried mines (not detonated) are uncovered. Test this ability with the following inert mines:

Mine:	Depth:
M-15	Shallow buried
M-15	Three inches
VS-1.6	Shallow buried
VS-1.6	Three inches
TM-46	Shallow buried
TM-46	Three inches
M-19	Shallow buried
M-19	Three inches

(d) Explosive Test Procedure:

(1) Detonate one each VS50 mine under a tire.

(2) Operate the Mini-Flail over 4 ea. M16s and 8 ea. simulated PMN mines to evaluate the ability of the flail to withstand repeated detonations from these mines.

(3) Operate the Mini-Flail over one each 1/4 pound block, one each 1/2 pound block and one each 1 pound block of TNT. One M14 mine will be attached to each block of TNT. The purpose of this test is to determine the ability of the chains to withstand blast mine detonations.

4. Data Recording Procedure:

(a) Identified mine population to be cleared - entered into a database.

(b) Number of live anti-personnel mines detonated in non-vegetated terrain.

(c) Number of live anti-personnel mines detonated in vegetated terrain.

(d) Speed of clearance over light ground cover and over heavy ground cover.

(e) Evaluation of cleared area after the system performs.

(f) Probability of encounter of anti-tank mine under platform's wheels.

(g) Probability of initiation from encounter with anti-tank mine.

(h) Are there any safety issues or concerns regarding the mini-flail.

(i) Determination of mini-flail's limits regarding negotiating obstacles and difficult terrain.

(j) Data reporting the strongest AP mine that the mini-flail can withstand.

(k) Number of times mini-flail drives over AT mine, number of times that the AT mine is activated.

(l) Ease of repair after damage from detonation - how many hours? - parts interchangeability. Parts of specific concern are the chain/hammer assemblies and the drum/drive assemblies.

(m) RAM data.

(n) Availability of contractor support in most critical countries.

(o) Price and availability of critical system components in global market.

(p) Demonstration of removal from the minefield without using special equipment.

(q) Ability of mini-flail to sweep small mines and UXO to where they can be neutralized.

III In-situ Neutralization

a. Explosive Demining Device (EDD):

1. Objective:

(a) To demonstrate performance of the TRACOR Explosive Demining Device for neutralizing shallow buried AP and AT mines in-situ.

(b) To evaluate the contamination aspects associated with the use of a shaped sharge system such as the EDD and its compatibility with operational requirements for removal of all metal to 18 inches.

(c) To ascertain the stability, safety and ease of use of these in-situ devices by supported host nation deminers.

2. Measures of Success:

(a) How effective is the EDD against plastic, metallic and wooden AP mines?

(b) Is the EDD highly stable in storage and in transit, and able to withstand normal handling?

(c) Is the EDD simple to operate?

(d) Are there any human factors issues with the EDD?

(e) Is the EDD suitable for use in the humanitarian demining environment?

3. Data Required:

(a) Number of mines successfully destroyed vs. number of mines tested.

(b) Detailed chemical composition of the EDD as well as the amount of explosive (TNT, Comp B, RDX).

(c) Collection showing ease of use, assembly and disassembly of the dispensing system.

(d) Safety, human factors and general comments from operators and data collectors.

4. Data Acquisition Procedure:

(a) 15 AP mines will be used to support the EDD performance evaluation. 12 of the mines will be shallow buried. For the EDD test, shallow buried is defined as buried so that the top of the mine is nearly even with the ground surface. The top of the mine is covered with a very thin layer of dirt (less than an inch). The remaining three mines will be buried to a depth of 1 inch and covered. The first detonation will take place against 9 shallow buried mines. The second shot will take place against the remaining 6 mines (3 shallow buried and 3 buried one inch). The following matrix describes the physical layout and surface emplaced mine types

Test #1:	PMD6 (wood)	M14 (plastic)	M16 (metallic)	
	O	O	O	Shallow buried (very lightly covered)
	O	O	O	Shallow buried (very lightly covered)
	O	O	O	Shallow buried (very lightly covered)
Test #2	PMD6	M14	M16	
	O	O	O	Shallow buried (very lightly covered)
	O	O	O	Buried to 1" and covered

* Separation: No less than three meters may exist between any two mines to prevent sympathetic detonation.

(b) Recommended safety personnel and equipment: emergency medical team, fire extinguishers, ear plugs and sufficient blast shield shelters for observers. The range safety officer is the authority concerning safety procedures and equipment during the conduct of this test.

(c) A description of the soil type in the demolition pit area will be recorded. As explosive testing begins, the air temperature will also be recorded.

(d) There will be one iteration of the test. Testers will place the EDD precisely above the mine. From the time that the device is activated by pulling a striker, test personnel have 5 minutes to move to a safe distance prior to initiation. After detonation, all personnel will wait for at least 10 minutes to allow for fumes to dissipate and for metal debris to cool. Following application, data collectors will verify by personal observation and photographs that the mines have been neutralized. Video cameras and binoculars will be used during application, and to record neutralization in process.

(e) **IN CASE THE EDD MALFUNCTIONS: No one will enter the area for at least 30 minutes after the attempted detonation. The mine target will then be destroyed using the most appropriate method under the direction of the range safety officer.**

(f) A test will be conducted to determine the EDD's effectiveness against AT mines. All four mines will be metallic AT mines (TM46, TM62 or equivalent). Three of the mines will be shallow buried with the top of the mine even with the ground surface. The top of the mine will be covered with a very thin layer of ground. The fourth mine will be emplaced one inch below the ground surface and covered.

AT Mine 1	O	(shallow buried, top even with ground surface and lightly covered)
AT Mine 2	O	(shallow buried, top even with ground surface and lightly covered)
AT Mine 3	O	(shallow buried, top even with ground surface and lightly covered)
AT Mine 4	O	(emplaced one inch below surface and covered)

(g) Operators and data collectors will comment on safety, human factors and provide general comments based on their experience with the equipment.

5. Data Analysis Procedure:

Data collection from the above described testing, video tapes, photos and neutralized mines will be analyzed to determine the effectiveness of the Explosive Demining Device. The analysis will conclude with conclusions and recommendations regarding the overall suitability of the EDD in the humanitarian demining environment.

b. LEXFOAM:

1. Objective:

(a) To evaluate ability of in-situ devices to effectively destroy mines in-place to comply with US demining policy.

(b) For explosive devices, to determine their ability and efficiency at destroying mines. Also, to evaluate the stability, safety and ease of use of these in-situ devices by supported nation deminers.

2. Measures of Success:

(a) Can LEXFOAM destroy or render permanently unusable 100% of the surface emplaced mines against which the technology is applied?

(b) How many mines can be engaged with a single charging of the system?

(c) How long does it take to recharge/reload the system?

(d) Are the instructions adequate?

(e) Is LEXFOAM simple to operate and maintain given the humanitarian demining situation?

(f) Is LEXFOAM safe for deminers to use in humanitarian demining situations?

(g) Are there any human factors concerns with the use of LEXFOAM?

(h) Is LEXFOAM suitable for use in the humanitarian demining environment?

3. Data Required:

(a) Number of mines successfully destroyed vs. number of mines tested.

(b) Analysis to predict performance of LEXFOAM in various soil types.

(c) Number of surface emplaced mines successfully destroyed.

(d) Number of mines cleared with one charging of the system.

(e) Time to recharge/reload system.

(f) Instructions on quantity of LEXFOAM to apply to a mine.

(g) Data on ease of operation as judged by operator/data collector.

(h) Size of the detonation cord (or cap) needed to initiate LEXFOAM.

(i) Chemical analysis of LEXFOAM.

(j) Data collection forms with operator/data collector comments regarding safety, human factors and overall suitability in the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) Receive chemical composition of LEXFOAM.

(b) 18 AP mines will be used for the LEXFOAM test. The following matrix describes the physical layout of the surface emplaced mines:

Test #1 (nine mines):

PMD6 (wood)	M14 (plastic)	M16 (metallic)	
O	O	O	Shallow buried (top is uncovered)
O	O	O	Shallow buried (top is uncovered)
O	O	O	Shallow buried (top is uncovered)

Test #2 (six mines):

PMD6	M14	M16	
O	O	O	Shallow buried (top is uncovered)
O	O	O	Buried to 1" (top is uncovered)

Test #3 (three mines): This test will provide data to evaluate the ability of LEXFOAM to destroy multiple mines with one detonation. Three plastic AP mines will be arranged in a triangular pattern on the surface with two to three meters between mines. LEXFOAM will be applied, using the backpack unit, in such a manner that all three mines are connected. A single detonator will be placed at one of the mines and activated. When safe to do so, the triplet will be inspected to determine if all three mines were destroyed.

(c) Each mine will be flagged to show its location. One sandbag will be placed at each mine for safety.

(d) A description of the soil type in the demolition pit area will be recorded. As explosive testing begins, the air temperature will also be recorded.

(e) **IN CASE THE LEXFOAM MALFUNCTIONS: No one will enter the area for at least 30 minutes after the attempted detonation. The mine target will then be destroyed using the most appropriate method under the direction of the range safety officer.**

(f) A test will be conducted to determine the LEXFOAM's effectiveness against AT mines. All four mines will be metallic AT mines (TM46, TM62 or equivalent). Three of the mines will be shallow buried with the top of the mine even with the ground surface and the top of the mine exposed. The fourth mine will be emplaced one inch below the ground surface with the top of the mine uncovered.

AT Mine 1	O	(shallow buried, top even with ground surface and uncovered)
AT Mine 2	O	(shallow buried, top even with ground surface and uncovered)
AT Mine 3	O	(shallow buried, top even with ground surface and uncovered)
AT Mine 4	O	(emplaced one inch below surface with top of mine uncovered)

(g) Recommended safety personnel and equipment: emergency medical team, fire extinguishers, ear plugs and sufficient blast shield shelters for observers. The range safety officer is the authority concerning safety procedures and equipment during the conduct of this test.

(h) There will be one iteration of the test. Following application, data collectors will verify by personal observation and photographs that the mine has been neutralized. Video cameras and binoculars will be used during application, and to record neutralization in process.

(i) Record how many mines can be neutralized with one charge of the backpack system.

(j) Time how long it takes to recharge the system.

(k) Specific data should be taken to evaluate the adequacy of the instructions regarding how thick that LEXFOAM should be applied to AP and AT mines to achieve the best chance of detonation.

(l) Collect safety related data from chemical analysis and from operator/data collector comments regarding safety, human factors and general suitability for LEXFOAM in the humanitarian demining environment.

5. Data Analysis Procedure:

Study results of all LEXFOAM testing. Together with hard test data, operator/data collector comments and any other data gathered regarding LEXFOAM, provide a summary of performance, recommended uses.

c. Chemical Neutralization of Landmines:

1. Objective:

(a) To evaluate ability of in-situ devices to effectively destroy mines in-place.

(b) For chemical techniques, to determine their ability to neutralize all types of mines without leaving behind fragments that hinder the quality assurance or development of the land. Also, to evaluate the safety and ease of use of these devices by supported nation deminers.

2. Measures of Success:

(a) Can each chemical technique successfully neutralize plastic, metal and wood AP and AT mines to which the technology is applied?

(b) Are there any environmental considerations associated with the use of chemicals for in-situ neutralization (for example, are any of the chemicals considered to be pollutants)?

(c) How many mines can the chemical techniques successfully be applied to in one workday, taking safe working area requirements into account? Safe working area is defined as the need to remain a safe distance from a mine after application of the chemical neutralizer. The speed and violence at which the chemical action initiates, and the length of time it takes for the mine to become neutralized could restrict deminers from efficiently clearing a given area.

(d) Are there any safety concerns regarding chemical neutralization technology?

(e) Are there any human factors issues with chemical neutralization technology?

(f) Is the chemical neutralization approach to in-situ neutralization suitable for the humanitarian demining environment?

3. Data Required:

(a) Number and types of mines against which the chemical neutralization techniques are applied.

(b) Number and types of mines successfully neutralized.

(c) Number of attempts to apply neutralization technology.

(d) Estimated number of mines successfully neutralized in one workday.

(e) Soil temperature recorded during the test.

(f) Operator and data collector comments regarding safety, human factors and overall suitability for the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) IN CASE OF A MALFUNCTION: No one will enter the area for at least 30 minutes after the attempted detonation. The mine target will then be destroyed using the most appropriate method under the direction of the range safety officer.

(b) For all testing, recommended safety personnel and equipment are an emergency medical team, fire extinguishers, ear plugs and sufficient blast shield shelters for observers. The range safety officer is the authority concerning safety procedures and equipment during the conduct of this test.

(c) Chemical System I (burning): This alternative uses two chemicals. The first chemical is diethylene triamine. Delivery is by a capsule, which will be known as "Gun 1" for this test. The second chemical is diethyl zinc. Delivery for the second alternative is by a cartridge, which will be known as "Gun 2" for this test.

(1) Anti-Personnel Mine Test: For each version, three plastic, three metallic and three wood AP mines (total of 18 mines, nine for Gun 1 and nine for Gun 2) will be placed in the demolition pit area. The following matrix describes the physical layout and mine types.

Neutralization by autocatalytic decomposition of explosives (TNT & Comp B)
<u>"Burning System" against AP mines</u>

Chemical: Diethylene triamine
Capsule
Delivery System: Gun 1

Mine Types/Names:

Plastic	Metal	Wood
(PMN2)	(M16)	(PMD6)
2 w/caps	2 w/caps	2 w/caps
1 w/o cap	1 w/o cap	1 w/o cap

Chemical: Diethyl zinc
Cartridge
Delivery System: Gun 2

Plastic	Metal	Wood
(PMN2)	(M16)	(PMD6)
2 w/caps	2 w/caps	2 w/caps
1 w/o cap	1w/o cap	1 w/o cap

Mine Layout:

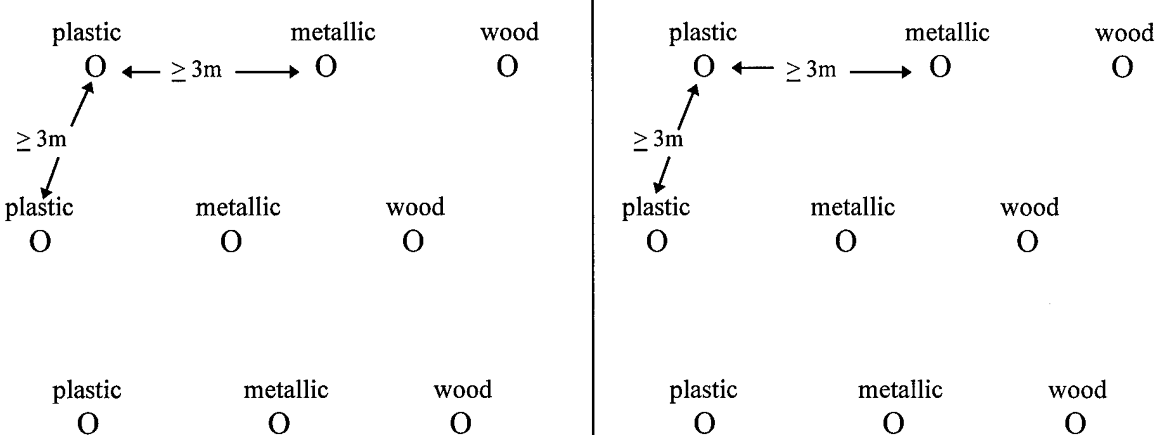


Figure 1

INSTRUCTIONS/NOTES:
1. Every mine shallow buried (mine buried so its top is even with the ground surface and uncovered).
2. Separation will be no less than three meters between any two mines.
3. One sandbag at each mine.
4. One wire marker with flag at each mine.
5. C4 charge on top of each mine.
6. Contractor will deliver 4 <u>capsules</u> for each of the three types of mines to be tested under the "Gun 1" system for a total of 12 capsules. Contractor will also deliver 3 each Gun 1 delivery systems.

7. Contractor will deliver 4 cartridges for each of the three types to be tested under the "Gun 2" system for a total of 12 capsules. Contractor will also deliver 3 each Gun 2 delivery systems.
8. If necessary, a substitute metal mine will be a tin can containing 1/2 lb. of TNT.
9. Two of the three mines of each type will be with blasting caps and one will be without blasting caps. For example, for the three plastic mines to be neutralized with Gun 1, two will have blasting caps and one will not.

(2) Anti-tank mine test. Each Chemical System I version will be tested against four AT mines for a total of 8 mines. All mines will be shallow buried. A block of C4 will be placed under each AT mine as a back-up detonation mechanism if the chemical neutralization technology fails to work. The following matrix describes the physical layout and mine types. There will be at least five meters between any two mines. The AT mines will be neutralized one at a time.

Neutralization by autocatalytic decomposition of explosives (TNT & Comp B)
<u>"Burning System" against AT mines</u>

Chemical: Diethylene triamine Capsule Delivery System: Gun 1	Chemical: Diethyl zinc Cartridge Delivery System: Gun 2
Mine Types/Names:	
Plastic (M-19) · Metal (TM-46) · Wood (TMD-44)	Plastic (M-19) · Metal (TM-46) · Wood (TMD-44)
Mine Layout:	

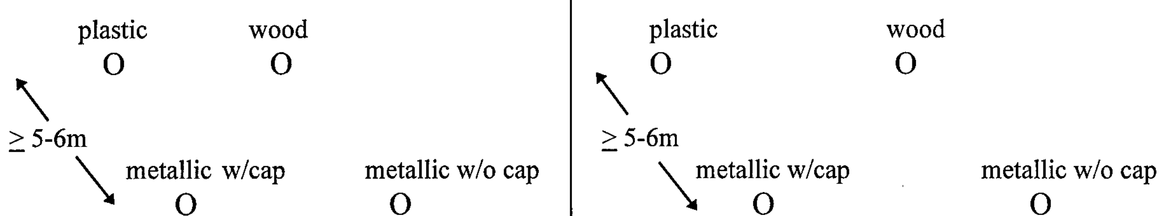


Figure 2

INSTRUCTIONS/NOTES:
1. Every mine shallow buried (mine buried so its top is even with the ground surface and uncovered).
2. Separation will be no less than five meters between any two mines.
3. One sandbag at each mine.
4. One wire marker with flag at each mine.
5. C4 charge under each mine.
6. Contractor will deliver a total of 6 <u>capsules</u> of diethylene triamine for use with the "Gun 1" system. Four capsules will be used for record test as shown above. Two capsules are for back-up.
7. Contractor will deliver a total of 6 <u>cartridges</u> of diethyl zinc for use with the "Gun 2" system. Four cartridges will be used for record test as shown above. Two cartridges are for back-up.
8. The same delivery systems used for the AP mine test above will support the AT test.
9. Each mine will be neutralized one at a time.

(d) Neutralization by deflation/detonation of explosive (RDX) (detonation system): This alternative is designed to destroy AP mines containing RDX. The chemical is Bromine tri-flouride. There are two methods of delivery, by capsule and by cartridge. This demonstration will use each delivery method against three VS50 shallow buried AP mines, for a total of six mines.

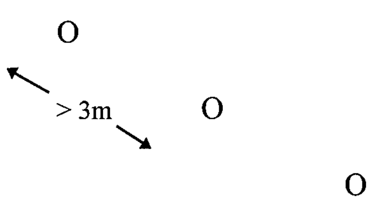
<u>Neutralization by deflation/detonation of explosive (RDX)</u>

Chemical: Bromine triflouride in a capsule

Delivery System: Gun 1

Mine Types/Names: All mines are VS50 Plastic AP

Mine Layout:



Chemical: Bromine triflouride in a cartridge

Delivery System: Gun 2

Mine Types/Names: All VS50

Mine Layout:

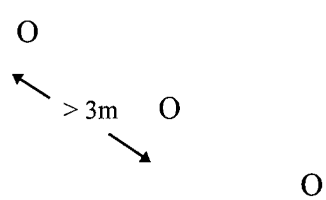


Figure 3

INSTRUCTIONS/NOTES:
1. Every mine shallow buried (mine buried so its top is even with the ground surface and uncovered).
2. Separation will be greater than three meters between any two mines.
3. One sandbag at each mine.
4. One wire marker with flag at each mine.
5. Contractor will deliver a total of 6 <u>capsules</u> of bromine triflouride for use with the "Gun 1" system. Three capsules will be used for record test as shown above. Three capsules are for back-up.
6. Contractor will deliver a total of 6 <u>cartridges</u> of bromine triflouride for use with the "Gun 2" system. Three capsules will be used for record test as shown above. Three capsules are for back-up.
7. Contractor will deliver three Gun 1 delivery systems and three Gun 2 delivery systems for this demonstration.

(e) As explosive testing begins, air and soil temperature will be recorded. Test personnel will place the chemical delivery system directly above the mine and detonate it remotely. A success will be evident because the target mine will explode.

(f) Mines will be neutralized as follows:

- AP - six mines using the "burning system" with the gun 1 delivery system. The six mines will the three plastic and three metal mines as depicted on the left side of figure 1.
- AP - three wooden mines using the "burning system" with the gun 1 delivery system and three VS50 mines using the "detonation system" with gun 1. The three wooden mines are represented on the left side of figure 1. The VS50 mines are those depicted on the left side of figure 3.
- AP - six mines using the "burning system" with the gun 2 delivery system. The six mines will be the three plastic and three metal mines as depicted on the right side of figure 1.
- AP - three wooden mines using the "burning system" with the gun 2 delivery system and three VS50 mines using the "detonation system" with gun 2. The three wooden mines are represented on the right side of figure 1. The VS50 mines are those depicted on the right side of figure 3.
- AT - four mines using the "burning system" with the gun 1 delivery system. This shot will neutralize the mines depicted on the left side of figure 2.
- AT - four mines using the "burning system" with the gun 2 delivery system. This shot will neutralize the mines depicted on the right side of figure 2.

(g) After detonation, all personnel will wait for at least 20 minutes to allow for fumes to dissipate and for metal debris to cool.

(h) Operator and data collector will include comments on safety, ease of use, human factors and overall suitability for the humanitarian demining environment.

5. Data Analysis Procedure:

Data collection will be aligned with the specific data requirements listed above. Results will be evaluated, and conclusions and recommendations reached with respect to safety and on the effectiveness of this technology in the humanitarian demining environment.

d. Mine Marking and Neutralization:

1. Objectives.

(a) To mark land mines.

(b) To freeze the activation mechanism in the mine so that a deminer cannot accidentally activate a marked mine.

(c) To neutralize land mines in such manner that they can be safely removed from a distance without setting them off.

(d) Create a foam usable over a large temperature range.

2. Measures of Success:

(a) Does the foam encase the mine without causing it to detonate (this includes mines with anti-handling devices)?

(b) Does the foam prevent mines from detonating after neutralization?

(c) Does the foam adhere to trip wires to preclude tension release fuses from functioning?

(d) Does the foam adhere to pull cords as well as the mines so that a deminer can remove a suspected booby trapped mines from a safe distance?

(e) Does the foam perform effectively in all soil types and climactic conditions?

(f) Is the foam dispensing system simple and easy to use?

(g) Are there any toxic effects associated with the polyurethane foam?

(h) Does the foam withstand the effects of wet, freezing, arid, etc. weather without disintegrating?

(i) Are there any safety of use problems associated with the mine marking and neutralization system?

(j) Are there any human factors issues associated with the dispensing system or the chemical foam at any time before, during or after application?

(k) Is the mine marking and neutralization system suitable for use in the humanitarian demining environment?

3. Data Acquisition Procedure:

(a) Personnel Required: 1 SOF operator, the NVESD lead engineer.

(b) Locations:

(1) 10. Urban 13. Rice paddy 15. Woods 16. Sand
(2) 2. Field 7. Unimproved Road

(c) Test Procedure:

(1) Mines are partially unburied and marked with the foam.
(2) It is important to use both long buried and short buried mines.
(3) The foam is allowed to set.
(4) The material is then stepped on to insure the mines are inerted.

(d) For mine removal:

(1) The mines are partially unburied.

(2) It is important to use both long buried and short buried mines.

(3) A piece of rope with a knot is placed near the mine.

(4) The mine is foamed so that the foam also covers the rope and knot.

(5) The mine is then pulled out of the ground from a safe distance.

(6) The foam is to be tested against bounding mine fuses and tripwires.

(7) The wires are to be pulled after the foam sets to see if the mine will function.

(8) The foam is to be tested in heavy grass and bushes.

(9) The foam is to be tested in water.

(10) The foam is to be tested at various temperature ranges.

4. Data Recording Procedure:

(a) Did the foam neutralize the mines?

(b) Would a mine have activated during the application of the foam because of an anti-lift device?

(c) Could the mines be pulled out of the ground?

(d) Could the mines be destroyed with a charge after they were removed?

(e) Is the color sufficient to be seen from a distance?

(f) Can the foam effectively be used in grass or water?

(g) Can the foam be used in a variety of temperatures?

e. *Shaped Charges:*

1. Objectives:

(a) To evaluate the effectiveness of commercially available well bore hole shaped charges in various sizes to destroy mines in-situ.

(b) To evaluate shock tube initiation techniques for mine neutralization events.

(c) To provide system which lessens the amount of fragmentation from the neutralization event.

(d) To preclude the system from being used in a weapons role.

2. Measures of Success:

(a) Can the shaped charges destroy 100% of the mines against which they are applied?

(b) Are the shaped charges stable in storage and in transit, and able to withstand normal handling considering the humanitarian demining environment?

(c) Are the shaped charges safe for deminers to use in humanitarian demining situations?

3. Data Required:

(a) Mines to be tested - ID, type, size in diameter.

(b) Description of each shaped charge.

(c) Success or failure to neutralize for each shaped charge design tested.

(d) Soil types in which tested.

(e) Stability of shaped charges in handling and storage - available from industry sources.

(f) Degree of fragmentation with each shaped charge demonstration.

(g) Operator comments on the safety of use for the various shaped charges tested in the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) Perform test in blast pit area of the test site.

(b) Perform shaped charge testing according to the following matrix:

	PMD-6	VS-50	M16	OZM	M15
Charge Type #1	1		1		1
Charge Type #2	1		1		1
Charge Type #3	1		1		1
Charge Type #4		1		1	1
Charge Type #5		1		1	1
Charge Type #6		1		1	1

(c) Perform test or use existing data on the stability and storage characteristics of the shaped charges.

(d) Collect operator comments regarding safety of use considerations, and the overall suitability of the various size commercial shaped charges for the humanitarian demining environment.

5. Data Analysis Procedure:

Input data collection into database, calculate and report success statistics for each type of shaped charge in each soil type. Input operator comments on safety of use and overall suitability considerations. Input safety of handling and storage data. If tests in different soil types did not prove practical, include an analysis of what may be expected in different soil types. Analysis will reduce the raw data into a summary of the test, and provide conclusions and recommendations regarding the use of this technology in the humanitarian demining environment.

IV Individual Components:

a. Modular Vehicle Protection (MVP) Kit:

1. Objective:

To determine the effectiveness of the survivability enhancements to protect personnel from the effects of on and off-route AP mines as well as light AT mines.

2. Measures of Success:

(a) Can the MVP kit withstand the effects (penetration or plastic deformation of the crew compartment) of M16A2, M18A1, PMN and POMZ-2M mines?

(b) Can the MVP kit limit damage caused by AP mines to the vehicle such that tire replacement and engine compartment repairs are the only repair needed to continue the demining mission?

3. Data required:

(a) Time to install vehicle armor kits.

(b) Determination as to the degree of modularity of the MVP design.

(c) Results of automotive inspection to ensure that normal maintenance and operation can be accomplished with the armor kits installed.

(d) Determination that the kit does not cause mechanical difficulties such as overheating and loss of maneuverability.

(e) For live mine testing, record the number and location of any penetrations, and extent of plastic deformation.

4. Data acquisition procedures:

This test consists of two parts which will be conducted in sequence. The automotive portion will collect data to assess any degradation of vehicle operation caused by the protection kit modifications. The destructive survivability test will follow the automotive portion.

(a) Automotive: This portion of the test will gather data to assess four automotive related areas of interest as listed below. The sequence will follow the order as listed. Testers will record and photograph defects as they appear and recommend corrective action regarding:

(1) Ease of installation of the kit onto the host vehicle. By observing and recording the kit installation, testers will comment on the suitability of the installation process in a humanitarian demining environment.

(2) Adaptability of the kit to a wide variety of commercial vehicles.

(3) Maintainability degradation, if any. By observation after installation of the kit, determine if there is any interference with the ability to properly maintain the vehicle. For example, determine if one can still perform normal operator level inspection and maintenance actions without having to remove the kit

(4) Vehicle operation: One Special Forces representative with one data collector will drive the vehicle with the complete MVP kit installed for 1 hour. During the hour, the vehicle will be driven, in sequence, for 20 minutes on hard stand, 20 minutes on a dirt gravel road and 20 minutes cross country. The operator and data collector will visually inspect the vehicle every 10 minutes or as needed.

(b) The survivability test will determine the level of protection provided by the MVP. This portion of the test consists of two subtests, underbody and off-route, that will take place in sequence. Following each detonation, test personnel will inspect the vehicle and record any penetrations or plastic deformation to determine the kit's effectiveness.

(1) Underbody: To simulate a PMN mine, detonate one 1/2 lb block of TNT under the right front tire of the protected vehicle. Follow this with a second 1/2 lb block of TNT under the right rear tire. The final underbody event will be to detonate one M16A2 nine inches behind the left front tire of the vehicle.

(2) Off-route: Detonate one POMZ-2M five meters from the left side of the vehicle, then a second POMZ-2M five meters from the right side. Repeat this test with one M16A2 bounding fragmentation mine on each side of the vehicle. The final off-route event will be to detonate an M18A1 five meters in front of the vehicle.

(3) If time and other resources are available, the kit's performance against an AT mine will be assessed by detonating a TM46, or 12 lbs of TNT to simulate an AT mine under the left front tire of the protected vehicle.

5. Data Analysis Procedure:

Perform analysis of effectiveness of kits based on data obtained from detonations. Report on times to install and remove the kit, and include observations as to improvements. Perform engineering analysis on suitability of interface design for use on multiple types of commercial vehicles. If vehicle specific adaptations are required, the analysis will include an engineering discussion as to the expected cost, time to obtain, and provide recommendations. Vehicle performance test results will be used to determine if the vehicle is at all affected by the presence of the kit, and recommend improvements to the design if appropriate.

b. Blast Protected Vehicle:

1. Objective:

To determine the effectiveness of survivability enhancements to protect personnel from the effects of on and off-route AP mines.

2. Measures of Success:

Can the vehicle armor kit withstand the effects of M16A2, M-18A1, POMZ-2M and PMN mines without penetration or plastic deformation of the crew compartment?

3. Data required:

(a) Time to install the armor kit.

(b) Adaptability of armor kit to a variety of commercial vehicles.

(c) Results of automotive inspection to ensure that normal maintenance and operation can be accomplished with the armor kits installed.

(d) Determination that the kit does not cause mechanical difficulties such as overheating and loss of maneuverability.

(e) For live mine testing, record the number and location of any penetrations and extent of plastic deformation. Also, assess the severity of the resulting vehicular accident and any resulting damage/casualties.

4. Data acquisition procedures:

(a) Automotive: This portion of the test will gather data to assess four automotive related areas of interest as listed below. The sequence will follow the order as listed. Testers will record and photograph defects as they appear and recommend corrective action regarding:

(1) Ease of installation of the kit onto the host vehicle. By observing and recording the kit installation, testers will comment on the suitability of the installation process in a humanitarian demining environment.

(2) Adaptability of the kit to a wide variety of commercial vehicles.

(3) Maintainability degradation, if any. By observation after installation of the kit, determine if there is any interference with the ability to properly maintain the vehicle. For

example, determine if one can still perform normal operator level inspection and maintenance actions without having to remove the kit

(4) Vehicle operation: One Special Forces representative with one data collector will drive the vehicle with the complete BPV kit installed for 1 hour. During the hour, the vehicle will be driven, in sequence, for 20 minutes on hard stand, 20 minutes on a dirt gravel road and 20 minutes cross country. The operator and data collector will visually inspect the vehicle every 10 minutes or as needed.

(b) The survivability test will determine the level of protection provided by the BPV. This portion of the test consists of two subtests, underbody and off-route, that will take place in sequence. Following each detonation, test personnel will inspect the vehicle and record any penetrations or plastic deformations to determine the kit's effectiveness.

(1) Underbody: To simulate a PMN mine, test personnel will detonate one 1/2 lb block of TNT under the left front tire of the protected vehicle. Next in sequence will be one 1/2 lb blocks of TNT under the right front tire then one under the left rear tire. This will be followed by one M16A2 nine inches behind the left front tire of the vehicle. The final shot will be a 1.5 lb block under the center of the vehicle.

(2) Off-route: Detonate one POMZ-2M five meters from the left side of the vehicle, then a second POMZ-2M five meters from the right side. Repeat this test with one M16A2 bounding fragmentation mine on each side of the vehicle. The final off-route event will be to detonate an M18A1 five meters in front of the vehicle.

5. Data Analysis Procedure:

Perform analysis of effectiveness of kits based on data obtained from detonations. Report on times to install and remove the kit, and include observations as to improvements. Perform engineering analysis on suitability of interface design for use on multiple types of commercial vehicles. If vehicle specific adaptations are required, the analysis will include an engineering discussion as to the expected cost, time to obtain, and provide recommendations. Vehicle performance test results will be used to determine if the vehicle is at all affected by the presence of the kit, and recommend improvements to the design if appropriate.

c. Mobile Training System:

1. Objectives:

(a) To evaluate the ability of mine awareness trainers to provide valuable information regarding landmines and booby traps to host nation people and provide the information in the language practiced by the host nation.

(b) To evaluate how easily the mine awareness database can be transported to various locations via suitcase type containers.

(c) To evaluate the ruggedness of the mobile mine awareness trainers.

(d) To determine the amount of training that is required to effectively operate the mobile training systems.

2. Measures of Success:

(a) Can the mine awareness trainers provide information regarding landmines and booby traps to host nation people in their native language?

(b) Can two people carry the man-portable suitcase version?

(c) How rugged are the mine awareness trainers? Is the multi-media and computer equipment shock mounted, environmentally housed, or protected in some way for transportation purposes?

(d) Can the mine awareness trainers be transported via military or civilian aircraft, land or sea?

(e) What time is required for users to learn how to operate the mine awareness database and the multi-media equipment? Is the database user friendly? Is the quality of the information sufficient for the required mission, and if not how can the database be improved?

(f) Are there any safety issues associated with either the vehicle-mounted or man-portable mobile training system?

(g) Are there any human factors issues associated with either mobile training system?

(h) What is the overall suitability of mobile training systems for humanitarian demining?

3. Data Required:

(a) Description of each system component to include weight, dimensions, and operating instructions.

(b) User's perspective on how useful the information contained in the mine awareness database is and any possible improvements that could be made.

(c) Verify that the mine awareness database information is provided in at least 3 different languages to the extent it is provided in English.

(d) Ability of two people to carry the man-portable version.

(e) The ruggedness of the mine awareness trainers and the database configurations for transportation purposes.

(f) Capability of trainers to be transported via military or civilian aircraft, land or sea.

(g) Time required to learn how to operate the complete database configuration effectively.

(h) Possible improvements that can be made to improve operator's ability to run the database.

(i) Operator and data collector comments regarding safety, human factors and overall suitability for the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) All equipment will be weighed, measured, and photographed.

(b) Train users to set up and operate the equipment, record the training time, and observe the mine awareness trainer and database in use. Observe the system display a presentation in all three languages.

(c) Obtain feedback from the users on what improvements, if any can be made to the database and for what reasons.

(d) Record the time it takes the users to set up and tear down the equipment in the suitcase configuration.

(e) Drive the vehicle-mounted version at different speeds and over different terrain to assist in evaluating system ruggedness.

(f) Have two people carry the man-portable configuration to another location to verify the two-man carry limit is not breached.

(g) Operator and data collector will provide input concerning safety, human factors and overall suitability of the mobile training systems for humanitarian demining.

5. Data Analysis Procedure:

Input from data collection forms will be entered into the database. Analysis of this data will lead to conclusions and recommendations regarding the suitability of mobile training systems for humanitarian demining.

d. Mini Mine Detector:

1. Objective:

Find buried mines with a small hand held mine detector with the same effectiveness as the current mine detector.

2. Measures of Success:

(a) Is the Mini Mine Detector performance equal to or better than the PSS/12?

(b) How much does the Mini Mine Detector weigh with batteries?

(c) Can the Mini Mine Detector, when folded, fit into the Battle Dress Uniform (BDU) trouser pocket?

(d) What is the endurance of the Mini Mine Detector with standard AA batteries?

(e) Are there any safety of use problems or human factors issues that require improvement prior to using the Mini Mine Detector in a humanitarian demining environment?

3. Data Acquisition Procedure:

(a) Personnel Required: 1 SOF operator, the NVESD lead engineer.

(b) Locations and priority:

(1) Priority 1: 10. Urban 1. Field 12. Farm
(2) Priority 2: 7. Unimproved Road 16. Sand

4. Test Procedure:

(a) The operator searches an area and finds the mines.

(b) The effectiveness of a PSS-12 is compared to the Mini Mine Detector

5. Data Recording Procedure:

(a) Battery life

(b) Effectiveness compared to PSS-12.

(c) Weight.

(d) Size compared to pockets.

e. Extended Length Probe:

1. Objective:

(a) To increase the safety of demining personnel when probing for buried mines.

(b) To allow deminers to immediately detect non-soil material in the probes path and decide if it is a stone or other material.

(c) To determine if the air allows soil to be removed from around mines which may have anti-handling devices.

2. Measures of Success:

(a) Does the extended length probe enable the operator to pinpoint subsurface mines buried up to five (5) inches deep and no closer than two (2) meters away from the operator?

(b) Does the vibrator tip microphone allow the operator to discriminate between objects to determine potential mines with 100% accuracy, accepting false positives?

(c) Will the blast shield protect operator from mine explosions up to equivalent power of the PMN?

(d) Is the extended length probe able to withstand normal operations without noticeable damage?

(e) Are there any safety concerns regarding the extended length probe?

(f) Are there any human factors issues with the extended length probe?

(g) Is the extended length probe generally suitable for operations in the humanitarian demining environment?

3. Data Required:

(a) Depths to which probe is able to indicate presence of a mine to the operator.

(b) Operator determines object is probable mine.

(c) Operator determines object is not mine.

(d) Record of damage from PMN blast when struck by probe.

(e) Operator / data collector comments on ruggedness during normal operations.

(f) Operator comments pointing out any safety concerns with the extended length probe.

(g) Operator comments regarding human factors with the extended length probe.

(h) Operator comments regarding overall suitability in the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) The extended length probe will be tested in area 16 (sand). Besides the mines already emplaced in this area, test personnel will introduce various non-mine objects into the ground. As the operator finds objects with the probe, the data collector will indicate on the data collection record (see Appendix K) the identity of the object (mine or non-mine) as reported by the system.

(b) Tip of probe will be used to detonate a PMN equivalent mine.

(c) Data collection form will include provisions for comments regarding safety, human factors and overall suitability of the extended length probe for humanitarian demining operations.

5. Data Analysis Procedure:

Data collection forms and interviews with operators and data collectors will form the basis of conclusions on the effectiveness of the vibrating tip to distinguish potential mines from items that could not be mines. The description of the amount of damage, if any, will input the analysis process regarding the probe's ability to withstand a PMN mine blast.

f. Extended Length Weedeater:

1. Objective:

(a) To increase the safety of demining personnel when manually clearing areas in preparations for demining events.

(b) To develop workable areas to allow use of visual and IR sensors and metal detectors requiring ground coupling.

2. Measures of Success: (Unimproved Road, Demo pit)

(1) Hand Held:

(a) Is the operator able to uncover an area three (3) meters in a 120 degree arc to the front and to the sides?

(b) Is the system able to cut various types of vegetation?

(c) Will the weedeater cut trip wires?

(d) Does the weedeater activate pressure fused mines while clearing vegetation?

(e) Is there any noticeable wear/damage during normal operations?

(f) Are there any safety concerns regarding the extended length weedeater?

(g) Are there any human factors issues with the extended length weedeater?

(h) Is the extended length weedeater generally suitable for operations in the humanitarian demining environment?

(2) Wheeled: Same as above

3. Data Required:

(a) Distance to front and both sides from operator that the weedeater clears.

(b) Damage report normal operation.

(c) Operator/data collector reports on ease of repair.

(d) Any portion repaired during the demo.

(e) Photos or videos showing performance/damage from mine strike.

(f) Ability to cut thick and wet grass.

(g) Operator comments pointing out any safety concerns with the extended length weedeater.

(h) Operator comments regarding human factors with the extended length weedeater.

(i) Operator comments regarding overall suitability in the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) Weedeater will be operated in high grass area, to include thick and wet grass. Data collection will record distance from operator that is cleared in order to see surface mines, and in order to begin searching for buried mines. Data collection will include video and still photo recordings.

(b) Weedeater will be subjected to a blast equivalent to striking a PMN mine. Damage will be recorded in writing and by photo and video.

g. PSS/12 Mine Location Marker:

1. Objective:

(a) Increase the speed of the demining process while using the handheld detector.

(b) Precisely designate the center of mass of suspected mine targets as determined by the PSS-12 mine detector.

2. Measures of Success: (Field, Farm areas)

(a) Can the mine location marker be easily attached to the PSS/12 within 5 minutes?

(b) Is the mine location marker readily adaptable to any handheld mine detector which has an open center ring?

(c) Does the mine location marker degrade the performance of PSS/12?

(d) How much does the mine location marker weigh, including the spray mechanism and air pack?

(e) Does the mine location marker mark suspected mine location with non-toxic chemical such that the mark remains visible for at least 5 days?

(f) Are there any safety concerns with the mine location marker?

(g) Are there any human factors concerns with the mine location marker?

(h) What is the overall suitability of the mine location marker in the humanitarian demining environment?

3. Data Required:

(a) Time to mount the mine location marker to a standard PSS/12.

(b) PSS/12 performance data from operation in individual components area. Data in video, still photo and written forms.

(c) Weight of base PSS/12 and with marker installed.

(d) Description of chemicals used for mine marking.

(e) Length of time marking chemical remains.

(f) Operator comments pointing out any safety concerns with the mine location marker.

(g) Operator comments regarding human factors with the mine location marker.

(h) Operator comments regarding overall suitability in the humanitarian demining environment.

4. Data Acquisition Procedure:

Mount marking system to a PSS/12 and time with stopwatch. Repeat 2 times. Record results with video, still photo and data collection form. Check marked spots twice a day, record with still photo, for five days. Weigh PSS/12 before and after installation. Operate PSS/12 in accordance with standard doctrine, mark suspected mine locations. Record with video cameras and still photos. Obtain from developer a description of the chemical makeup of the marker. Obtain operator and data collector comments regarding safety, human factors and general comments.

5. Data Analysis Procedure:

Success at meeting time to install and weight requirements will be determined from results of demonstration. Environmental aspects of mine marking chemicals will be analyzed based on report of chemical composition. Video, still photo and tester comments will form basis of conclusions regarding suitability of prototype, safety and human factors.

h. Blast and Fragment Container:

1. Objective:

(a) To permit detonation of anti-personnel mines while safely venting the blast and containing the fragments and preventing them from hitting critical infrastructure facilities or other high value assets nearby.

(b) Detonate landmines without the need of deminers to physically handle the mines and minimize the scattering of fragments.

2. Measures of Success:

(a) How easy is the explosion container to assemble?

(b) Can the explosion container be **safely** placed over a live in-place bounding or pressure fuzed mine?

(c) Determine the number of explosions from blast and fragmentation antipersonnel mines that the explosion container withstand?

(d) Does the explosion container permit detonation of mine without damage to a high value structure or object within 3 feet of the device?

(e) Are there any safety concerns with usage the explosion container?

3. Data Required:

(a) Height and weight measurements and deminers/users comments on the ease of assembly and/or setup of the containers.

(b) Visual and written record of damage of blast container as well as 55 gallon drum (simulated high value asset) placed 3 feet away after every mine explosion.

(c) Operator comments regarding safety concerns with the explosion container.

(d) Operator comments regarding human factors issues with the explosion container.

4. Data Acquisition Procedure:

(a) In blast pit area, one container of each type (three unique containers) will be subjected to 5 explosions from blast antipersonnel mines and 2 explosions from fragmentation antipersonnel mines. The first container, which should be the most rigid, will be first subjected to a half buried fragmentation antipersonnel mine blast to ensure it can survive the worst case scenario and protect any high value asset. The 5 blast mines will then follow and end with the second fragmentation mine. The other two containers will start with the 5 blast mine detonations (surface laid) followed by the 2 fragmentation mines (one buried flush with the surface and one half buried).

(b) A 55 gallon drum of water will be placed 3 feet away from each container to simulate a high value asset. Each blast will be recorded on video tape. After each blast, the containers and the water drum will be inspected for damage. The results will be recorded and photographed. Note: two containers may be blown at the same time to simulate multiple detonations. The schedule follows:

Container #1 (most rigid) Week of October 23

Container #2 (rigid S-2) Week of October 23

Container #3 (S-2, Assembly) VIP Day, November 29 and 30

(c) The area will be inspected to ensure that all large fragments from the detonation remain within the container. Video will also be inspected to review the blast wave results.

(d) Operators and data collectors will provide comments regarding safety, human factors and general comments on the suitability of this prototype for the humanitarian demining environment.

5. Data Analysis Procedure:

Conclusions on how well the prototype explosion containers perform will be derived from analysis of video images and written input from demonstration. Safety, human factors and general comments provided by testers will form part of the data reduction effort.

i. Demining Kit:

Various powered and hand tools in a cart to increase demining speed and enhance safety. See the test plan for a description of the various components that will be in the demining kit.

1. Objective:

(a) To increase the speed and efficiency of deminers when performing manual demining in areas inaccessible by large area detection and clearing devices.

(b) To evaluate a wheeled push cart containing numerous hand tools to increase the speed and efficiency of demining operations.

(c) To evaluate the ability of the cart to serve as a mount for the light grapnel launching assembly.

(d) To evaluate the effort needed to push/pull and maneuver the loaded cart.

2. Measures of Success:

(a) Can the cart, with all accessories in place, be manually pushed or pulled in difficult to reach terrain?

(b) Does the armor attached to the front of the demining cart adequately protect the deminers and their equipment from the effects of an AP mine equivalent to the Valmara 69?

(c) Is the demining cart adequate to support the launch and retrieval mechanism of the light grapnel?

(d) Are there any safety concerns with the demining kit?

(e) Are there any human factors concerns with the demining kit?

(f) What is the overall suitability of the demining kit in the humanitarian demining environment?

3. Data required:

(a) Cart mobility.

(b) Performance of the armor when subjected to the effects of a Valmari 69 detonated 10 feet in front of the cart.

(c) Data from the test of the light grapnel system as to how well the demining cart supported it.

(d) Operator comments regarding safety concerns with the demining cart.

(e) Operator comments regarding human factors issues with the demining cart.

(f) Operator comments regarding suitability of the demining cart for humanitarian demining.

4. Data Acquisition procedure:

(a) Start with a representative load of demining tools inside the cart. The light grapnel system should also be attached. Operators will manually move the cart around the range to the extent necessary for a mobility performance evaluation. Operators will also evaluate the adequacy of the cart to carry the demining tools needed in various demining situations.

(b) Explode Valmari 69 mine 10 feet from the cart, and record damage to the armor in front of the cart.

(c) Collect data from the light grapnel test to determine the cart's ability to support this system.

(d) Collect operator comments regarding safety concerns with the demining cart.

(e) Collect operator comments regarding human factors issues with the demining cart.

(f) Collect operator comments regarding suitability of the demining cart for humanitarian demining.

5. Data Analysis Procedure:

Data collected will be entered into the test database via the above data acquisition process. Data report will be analyzed, and a final report generated that describes the performance of the demining cart and draws conclusions and recommendations regarding the suitability of the demining kit in a humanitarian demining environment.

j. Berm Processing Assembly:

1. Objective:

(a) To remove AT mines from berms created by mine clearing devices such as mine clearing blades so that they can be easily neutralized by demining teams.

(b) To detonate small AP mines removed from the berm.

2. Measures of Success:

(a) Can the berm processing assembly remove 100% of all mines, using multiple passes, from an earthen berm cluttered with grass, brush, rocks and other ground debris created by mine breaching rakes, plows and blades.

(b) At what speed will the BPA clear in acres per hour?

(c) Are removed AT, unexploded AP mines and UXO visible and on top of ground after BPA performs?

(d) Can the BPA be easily attached to any commercial horizontal construction equipment vehicle?

(e) Is the BPA interoperable with front or side-attached mine clearing blades?

(f) When combined as a system on one platform, can the BPA process berms created by the clearing vehicle without slowing the progress of the clearing vehicle.

(g) Can the BPA be attached and removed from the clearing vehicle without the need for special tools or lift equipment heavier than a commercial light recovery vehicle's boom and winch.

(h) Is the BPA simple to operate and maintain by host nation deminers in a humanitarian demining environment?.

(i) Is the field reparability and RAM performance suitable for the humanitarian demining environment?

(j) Are there any safety concerns with the BPA?

(k) Are there any human factors issues associated with the BPA?

(l) Is the BPA suitable for use in the humanitarian demining environment?

3. Data Required:

(a) Number of mines in berm at start of test.

(b) Measured speed of the berm processor in acres per hour.

(c) Number of mines visible in cleared lane after BPA performs.

(d) Attachment process to commercial construction vehicle.

(e) Adaptability of interface.

(f) Operator/Data Collector assessment on ease of operation.

(g) RAM data.

(h) Operator and data collector comments regarding safety, human factors and overall suitability of the BPA for humanitarian demining.

4. Data Acquisition Procedure (Heavy Equipment Lanes):

(a) Prepare and survey the minefield, containing representative AT and AP mines, in which the BPA will perform, and enter this data into the test database. Mines will be both larger and smaller than the grid opening, and will contain smoke fuses or other instrumentation so that detonations can be detected. Representative mines will consist of some combination of those listed in Appendix F.

(b) Berm processor will be attached to a host vehicle. Time to install will be recorded. Operators and data collectors will comment on ease of installation and verify the tools required.

(c) Data collection will take place to determine that all mines were removed from the berm, and placed in the cleared area, exposed, to allow for subsequent neutralization. The BPA's time to make one complete pass along the clearance lane will be recorded. The clearing vehicle will also be timed as it makes one pass without the BPA to determine if the BPA slows the clearing process. The operator and data collector will comment on ease of operation.

(d) Determination of the degree of interoperability of the BPA with other demining devices attached to the mine clearing vehicle. Other demining devices are mine clearing blades and roller assemblies. Each of these systems will be tested individually and the degree of interoperability will be determined through analysis or functional test if applicable.

(e) Hours of operation will be recorded during the test. Any failure will be documented on a TIR. RAM data will be calculated.

(f) Operator and data collectors will comment on the appropriate data collection form on safety, human factors issues and overall suitability of the BPA for the humanitarian demining environment.

5. Data Analysis Procedure:

Data collected from test will respond to questions regarding number of mines cleared vs. number of mines in mined area, ease of installation, how well the BPA interoperates with the MCBs and rollers, its ability to leave mines easily exposed for subsequent neutralization, and any measured RAM data. Data collection will also provide input regarding safety, human factors and overall suitability for the humanitarian demining mission. This data will be analyzed and compared to expected performance. The final test report will state how well the equipment performed, and make recommendations regarding the BPA's suitability in the humanitarian demining environment.

k. Mine Clearing Blades (MCB):

1. Objective:

(a) To clear AT mines from large open areas such as farm land, littoral regions, etc.

(b) To determine the effect the MCB has on AP mines.

(c) To clear AT/AP mines from confined areas using front loader platforms.

2. Measures of Success:

(a) Can the Mine Clearing Blades clear all AT mines, in various soil types, from the surface down to those buried at a depth of 8" using a single pass?

(b) Can the MCB be attached to commercial construction vehicle such as a bulldozer in lieu of or attached to the platform's earth moving blade?

(c) Can the MCB be easily attached to the clearing vehicle without the use of special tools?

(d) Can the MCBs clear without exceeding the allowable combined capability of the tractors normal load and blade dead load?

(e) What effect does the MCB have on AP mines encountered in an area cleared of AT mines?

(f) Does the MCB create a berm in the demined area that would require subsequent berm demining?

(g) Is the MCB capable expanding the width of the initial cleared lane by means of consecutive passes?

(h) What is the effective rate (in acres per hour) that the MCB designs clear?

(i) Can the MCB be easily repaired, within two hours, following damage from detonation of an AT mine of equivalent power to a TM46 mine?

(j) Are the MCB's RAM characteristics and modularity of design sufficient to support humanitarian demining needs?

(k) Is the MCB inter-operable with the vehicle towed roller and the berm processing assembly?

3. Data Required:

(a) Number of mines and position in clearance area/lanes prior to start of test.

(b) Number of AT mines remaining after clearance is performed.

(c) Data or assessment of expected operation in various soil types - sand, clay, bare, grassy, etc.

(d) Record of ease of attachment and removal.

(e) Tools and number of people required to attach and remove blade.

(f) Weight of MCB designs.

(g) Number and orientation of AP mines in area cleared of AT mines.

(h) Measure the berm and location of any mines in the berm left by the MCB.

(i) Number of consecutive passes before host vehicle becomes overloaded.

(j) Speed of clearance in acres per hour.

(k) RAM data.

(l) Operator/data collector comments regarding safety, human factors and any general comments on suitability of the MCB in the humanitarian demining environment.

(m) Operator/user representative input on inter-operability with the berm processor and the towed light roller?

4. Data Acquisition Procedure:

The following will be performed with both the MCB designs: **(Heavy Equipment Lanes)**

(a) The MCBs will traverse a clearance area and remove all AT mines. The clearance lane will contain instrumented, smoke-fuse mines to measure mine activation. Practice mines will be used for clearing.

(b) The blades will be used in vegetated and unvegetated areas.

(c) The demining blades will be tested in conjunction with the vehicle towed roller and the berm processing assembly.

(d) Number of mines cleared will be recorded and compared with the number of mines originally present to determine percent of success. Data collection will include the number of AT mines removed and the number of mines that activated. The number, condition and location of any AP mines.

(e) The time to clear a measured acre of land will be recorded.

(f) Procedures for installation and removal will be recorded. Data collection will include number of people, tools required, and any difficulty to attach the blade to the clearing vehicle.

(g) The MCBs will be weighed and recorded.

(h) The MCBs will be operated by one operator with a data collector to record events during the test. Safety, human factors and general comments from operator or data collector will be recorded on a data collection sheet. This will include comments on the inter-operability between the MCB, the host vehicle, and other attachments such as the BPA and the vehicle towed roller.

(i) RAM data will be recorded during the time the blades are being used.

5. Data Analysis Procedure:

Mine clearing performance will be analyzed based on the data collection information. Install and removal times will be recorded. RAM data during the test will be analyzed, but any results will have a very low confidence level because the test is too short to permit full RAM testing.

I. Grapnels:

1. Objective:

To locate trip wires and firing wires, and remove them or activate the mines attached to them from a distance before entering the area to deal with other types of mines.

2. Measures of Success:

(a) Heavy Grapnel:

(1) Can the heavy grapnel clear all trip wires against which it is launched?

(2) Can the heavy grapnel clear all firing wires buried not deeper than three inches?

(3) Easily attached to the front of a small commercial vehicle such as a pickup truck equipped with at least a 1000 lb. winch.

(4) Grapnel will be able to be launched up to 150 feet from the launch point and be able to be pulled back to the launch point via the winch.

(5) As it is pulled back, the grapnel will clear all trip wires in its path as well as dig into the ground sufficiently to engage flush and buried command detonation and electric firing wires.

(6) The grapnel will be able to extract itself from obstacles as it is winched back to the launch point to preclude the necessity of operators to enter the area to free it.

(7) The grapnel will be sufficiently heavy to overcome light brush and foliage and keep the device on the ground.

(8) The launcher will be adjustable in vertical angle to compensate for overhead obstructions.

(b) Light Grapnel

(1) Can the light grapnel clear all trip wires against which it is launched?

(2) Can the distance to be thrown and clearance of overhead obstacles be adequately adjusted by the setting of the launcher angle.

(3) Can the light grapnel launch direction be adequately set by pointing the demining cart (the launching unit will be attached to the demining cart)?

(4) Can the electric winch motor, which is powered by wet cell batteries/DC current from generator, retrieve the grapnel through high grass/rocky terrain without stalling?

(5) Does the grapnel hang up on limbs/debris during retrieval?

(6) Can tripwires resting on the ground or just above the ground be snagged by the grapnel on the first pass?

(7) What other improvements are needed?

(8) Are there any safety concerns with the light grapnel?

3. Data Required:

(a) Number of trip wires and firing wires installed.

(b) Number of trip wires and firing wires cleared on the first and subsequent passes.

(c) Ease of attachment of heavy grapnel to launch mechanism.

(d) Heavy and light grapnel launch distance.

(e) Performance of winch mechanism during heavy and light grapnel retrieval.

(f) Ability of heavy and light grapnels to extract themselves from obstacles.

(g) Data showing heavy grapnel weighs enough to overcome light brush and foliage and remain on the ground as it is being retrieved.

(h) Vertical angle performance of the heavy grapnel.

(i) Distance and success at clearing overhead obstacles at various launch angle adjustments.

(j) Ability to direct the direction of launch of the light grapnel by pointing the demining cart.

(k) Ability of the light grapnel's electric motor to retrieve the grapnel through high grass/rocky terrain without stalling.

(l) Number of times light grapnel is retrieved.

(m) Number of times light grapnel hangs up on retrieval.

4. Data Acquisition Procedure:

(a) Prepare two lanes, one for the heavy grapnel and one for the light grapnel. Each lane will be further divided into two tandem sections separated by 50 feet. Install 20 trip wires in each lane at various heights from ground level to neck high on a man, over a lane equal in length to the grapnel throwing distance. One end of the trip wire will be attached to a solid object and the other end to an M605 or similar fuse to check for activation during clearing. No explosive charge will be necessary, as the "pop" of the blasting cap will simulate a successful detonation.

(b) The operator will launch and retrieve the grapnel, then record the percentage of trip wires cleared. A check will be made after each cast to determine cumulative results until all mines are cleared. The grapnel will then be advanced to the second lane, and the procedure repeated, but with a different operator.

(c) Operators will lie prone while launching and recovering grapnels.

(d) Safety, human factors and general comments will be part of the data acquisition process.

(e) Operator and data collector comment on how easy or difficult it is to attach the heavy grapnel to the launch mechanism.

(f) Measure launch distances after each launch of the heavy and light grapnels.

(g) Add obstacles to the lane. Launch light and heavy grapnels into the obstacles and collect data on their success at extraction. This include overhead obstacles to determine the grapnels success at clearing such obstacles.

(h) Measure the vertical angle performance of the heavy grapnel.

(i) For the light grapnel, determine the accuracy of launching in the desired direction by pointing the demining cart to which the launcher is attached.

(j) Launch the grapnels into high grass/rocky terrain, and record the ability of the electric motor on the winch to retrieve them.

5. Data Analysis Procedure:

Data collected during conduct of test will be entered into the test performance database. Results will be compared to Measures of Success. Operator and data collector comments will be analyzed and incorporated into the test report.

m. Handheld Trip Wire Detector:

1. Objective:

To provide deminers a handheld tool that can reliably indicate the presence of trip wires in the path of demining activities.

2. Measures of Success:

(a) Can the handheld trip wire detector reveal the presence of any trip wire by manual positioning and by means of illumination?

(b) Can the illumination component highlight a trip wire over a 5 foot horizontal distance in front of the operator, and from the ground to 6 feet high?

(c) Can the string component detect all trip wires above obstructions (grass/brush/etc.) without activating any of them?

(d) Can the UV/IR cameras and intensified light detect any (all) trip wires where they are attached to trees, loose wire in grass, etc.?

(e) Are there any safety concerns with the handheld trip wire detector?

(f) Are there any human factors concerns with the handheld trip wire detector?

(g) Is the handheld trip wire suitable for use in the humanitarian demining environment?

3. Data Required:

(a) Number, location and whether or not above obstructions, of trip wires to be detected.

(b) Number and location of trip wires detected by the handheld trip wire detector.

(c) For each detected location, distance in front of operator and height of trip wire.

(d) Number of trip wires above obstructions such as grass, brush etc. detected without detonation.

(e) Number of trip wires above obstructions such as grass, brush etc. detonated by trip wire detector.

(f) For 2b through 2e above, performance with UV/IR cameras and intensified light.

(g) Operator comments on safety concerns, if any.

(h) Operator comments on human factors concerns, if any.

(i) Operator input regarding overall suitability of the handheld trip wire detector in the humanitarian demining environment.

4. Data Acquisition Procedure:

(a) In individual test area, install trip wires and record exact locations, to include height and those above obstructions and in loose grass.

(b) Operator uses handheld trip wire detector with data collector. For each trip wire located, operator will call out the trip wire. Data collector will record location, distance in front of operator, height, whether or not over obstruction or a loose wire in grass. Demonstration will be performed with and without the high intensity light source, at all IR camera sensitivity settings with the IR camera scanning from possible attach point to attach point.

(c) Operators and data collectors will provide comments on safety, human factors and overall suitability of the handheld trip wire detector for humanitarian demining.

5. Data Analysis Procedure:

Data collection will be input into the test database. The database will generate a report providing statistics giving performance in the form of percentage of trip wires found with the dangling wire, with the IR camera and with and without the UV light source. The report will include statistics on trip wires found in grass and above obstructions. An analysis of operator and data collector comments regarding safety, human factors and overall suitability in the humanitarian demining environment will be part of the report.

n. Vehicle Towed Rollers:

1. Objective:

(a) To determine the effectiveness of AP mine rollers to detonate various types of pressure fuzed AP mines at different orientations.

(b) To determine the ability of AP mine rollers to withstand a large number of PMN detonations (.5 pounds of TNT) and remain functional.

2. Measures of Success:

(a) How many mines on three successive passes can the VTR clear?

(b) How many PMN detonations can the VTR survive under the same interior roller without significant damage? Significant damage is defined as damage of a nature that prevents continuance of the mission.

(c) Can the VTR withstand bounding AP mine fragments without significant damage?

(d) Are the VTRs installation and maintenance requirements suitable for an austere humanitarian demining environment?

3. Data Required:

(a) Number and location of mines at test start.

(b) Number and type of mines activated each pass.

(c) Any damage resulting from mine detonation.

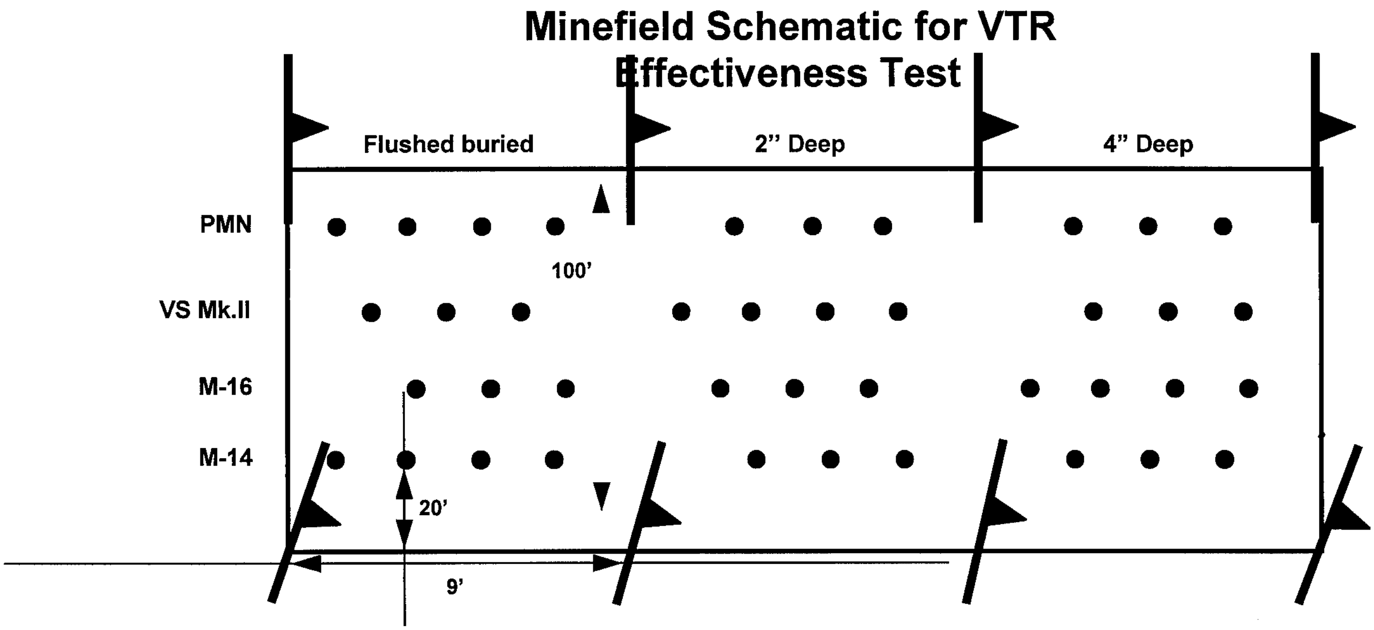
(d) Time and effort to install onto vehicle.

(e) Number of hours between lubrication and maintenance.

(f) Time/tools required to replace roller wheels.

4. Data Acquisition Procedure:

(a) The following schematic depicts the mine layout that will be used to test the vehicle towed roller.



(b) Mine neutralization test against raked mines. Determine activation status of AP mines by type, orientation and depth on each pass.

(c) Mine neutralization test against undisturbed mines. Determine activation status of AP mines by type and depth on each pass.

(d) Automotive test. Determine ability of the roller to function for 12 hr. without lubrication/maintenance. Rollers will be turned and reversed to confirm that this can be done without reconfiguration.

(e) Testing will occur both concurrently with mine rake and separately (preferably not on frozen ground).

(f) Use instrumented or unfuzed or inert mines with functional fuzes for effectiveness testing.

(g) Use live mines or bulk explosive substitutes for blast survivability testing.

(h) Use live mines for fragmentation survivability testing.

(i) RAM testing: Record and photograph defects as they appear and corrective action required/recommended.

(j) Operate rollers at least twice (third pass option, if needed) along clearance lanes with known quantity and positions of anti-personnel mines. After the roller performs its first pass, the mines will be inspected to determine if they have been activated. A second pass will be followed by a similar inspection to determine cumulative performance over two passes. Any activated mines will be reset and re-used. Check for mine degradation with reuse.

(k) Blast mine survivability: VTR will be exposed to 10 iterations of 1/2 lb of TNT under the same roller. Following each blast, inspect the roller to ascertain any damage. Replacement of parts will determine ease of repair. Operator/data collector record data on collection form tuned to the above Measures of Success.

(l) Fragmentation mine survivability: Subject the vehicle towed roller to one M16A2 detonation in the blast pit area. The mine will be detonated from a distance of 9 inches behind the last roller bank on the center line. Record any damage, to include data collection on the ability of the roller wheels to withstand fragments from bounding mines. Also record the times and tools required to replace the roller wheels.

5. Data Analysis Procedure:

Data collection effort will be analyzed using raw test data and comments from operators and data collectors. Analysis will result in conclusions and recommendations regarding the overall suitability of the vehicle towed roller for humanitarian demining.

o. Towed Light Rollers (Swamp Buggy):

1. Objective:

(a) To determine the effectiveness of AP mine rollers to detonate various types of pressure fuzed AP mines in a rice paddy.

(b) To determine the ability of AP mine rollers to withstand mine detonations and remain functional.

2. Measures of Success:

(a) How many mines can the towed light roller clear on three successive passes over the same area?

(b) Can the towed light roller survive 10 1/2 lb TNT detonations without significant damage? Significant damage is defined as damage of a nature that prevents continuance of the mission.

(c) What is required in terms of time, tools and people to prepare the towed light roller for operation?

(d) What is required in terms of time, tools and people to repair/replace individual rollers following damage?

(e) Are the earth anchors for pulley (block and tackle) components not dislodged during use?

(f) Can pulley assemblies be moved to new anchor locations without any reconfiguration of roller hardware?

(g) Does the roller "track" the path designated by the return tow lines?

(h) Can the roller reverse direction without changing the configuration of the towing harness?

(i) Are there any maintainability issues associated with the towed light roller?

(j) Are there any safety issues related to the towed light roller?

(k) Are there any human factors issues related to the towed light roller?

(l) Is the towed light roller suitable for use in the humanitarian environment?

3. Data Required:

(a) Number and location of mines at test start.

(b) Which mines are activated on each pass.

(c) Any damage resulting from mine detonations.

(d) Time, tools and people required to prepare roller for operation.

(e) Time, tools and people required to repair/replace an individual roller.

(f) Any instances of earth anchors for pulley (block and tackle) components dislodging.

(g) Confirmation that pulley assemblies can be moved to new anchor locations without any reconfiguration of roller hardware.

(h) Ability of roller to track path designated by return tow lines.

(i) Confirmation that roller can reverse direction without changing tow harness configurations.

(j) Track hours of use. Record any failures on a TIR. Calculate RAM data based on experience during the test.

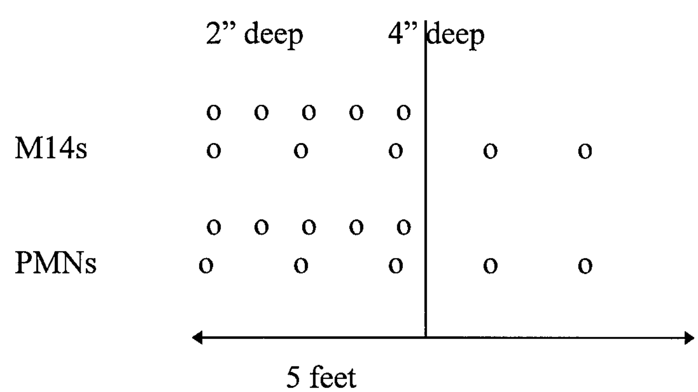
(k) Operator / data collector comments on safety of use for the towed light roller.

(l) Operator / data collector comments on human factors for the towed light roller.

(m) Operator / data collector comments regarding overall suitability of the towed light roller for the humanitarian demining environment.

4. Data acquisition procedure:

(a) Mine neutralization test. Use inert or unfuzed mines for effectiveness testing. Determine activation status of AP mines by type and depth on each of three passes (see schematic below).



Note: The distance between mines in the rows is one foot.

(b) In order to assess mechanical performance, data collectors will record the following:

(1) Any instance of the earth anchors for the pulley (block and tackle) components dislodging.

(2) Whether or not the roller is able to track the path designated by the return tow lines.

(3) Whether or not the roller can reverse direction without changing tow harness configurations.

(4) Whether or not the pulley assemblies can be moved to new anchor locations without reconfiguration of the roller hardware.

(c) Survivability test: In the rice paddy area, subject the towed light roller to detonations from five M14 and from ten each 1/2 lb blocks of TNT. After each detonation, the towed light roller will be examined to record damage. Data collection will specifically record whether or not the damage was limited to the area of contact. After each blast, data collection will determine, by measuring the distance traveled by fragments, if an animal pulling the roller would have been hit.

(d) Automotive test. Determine ability of the roller to function for 12 hr. without lubrication/maintenance. Data collector(s) will measure the vertical angle at which the pressure feet go into mud. During this operation, observe and record any instance of mud interfering with the feet.

(e) Preparation times: Record the time to prepare for operation and tools used.

(f) RAM testing, record and photograph defects as they appear and recommend corrective action.

(g) Data collection forms will include entries for comments on safety, human factors and overall suitability of the towed light roller for humanitarian demining.

5. Data analysis procedures:

Data collected during the test will be entered into the test database for calculation of performance statistics and generation of a test report. Manual analysis of this data, along with subjective comments provided by operators and data collectors will be analyzed to arrive at conclusions and recommendations on the suitability of the towed light roller for humanitarian demining.

p. Command Communications Video and Light System (CCVLS):

1. Objective:

(a) To assist demining personnel in safely locating, identifying, and clearing landmines and trip wire devices from mined areas as well as sensitive and hard to reach areas.

(b) To provide the ability for real time remote monitoring of an individual deminer's activities as well as audio communications between the command station and the deminer.

(c) To provide the deminer with hands free tools to locate mines and trip wire devices.

2. Measures of Success:

(a) Can the CCVLS light sources locate partially exposed landmines in holes, around or underneath obstacles, hard to reach areas or in bunkers using the variety of different mounting possibilities?

(b) How effective and audible is the two-way radio communication system between the deminer and the operator at the command site?

(c) How clear is the video quality at the command and control station that is transmitted from the perimeter link unit and the deminer's walk around unit?

(d) Can the CCVLS support the deminer without undue discomfort?

(e) Is the CCVLS safe to operate given the humanitarian demining environment?

3. Data Required:

(a) Quantity and location of trip wires located and the environment and conditions in which they were found (2a). (Urban Area, bunker and areas with trip wire devices, such as the high grass area in the unimproved road test area.)

(b) Quantity and location of landmines located using the CCVLS light sources and the environment and conditions in which they were found (2a). (Urban Area, bunker and possibly the Unimproved Road area will be used.)

(c) Transmission distance and the quality of audio and visual signals transmitted between the deminer and the command control station (2b, 2c). (Urban Area to command station)

(d) Operator reports on how comfortable the CCVLS is to work with during demining operations (2d).

(e) Operator and data collector reports on safety, human factors and overall suitability of the CCVLS in a humanitarian demining environment (2e).

4. Data Acquisition Procedure:

(a) An urban area will be set up with mines and trip wires in unique areas, as well as, in or around obstacles. A bunker will be set up to test the cameras with the IR and UV light sources. The operators will be trained to use the CCVLS equipment and will then use it to receive and transmit video and audio back to the command post during demining procedures.

(b) The operator will use his equipment, his observations and the feedback from personnel at the command post to complete his mission of locating mines and trip wires. The perimeter link unit will monitor all the deminer's activities from a safe distance to provide an alternative view for the personnel at the command post. If required, the operator will be equipped with other countermine devices such as metal detectors, probes and weed eaters to perform his mission.

(c) When a mine or booby trap is found, the operator will remove the device with guidance from the personnel at the command post. The operator at the command post will monitor and record all operations.

Note: The CCVLS equipment may also be used for the VIP day during demolition testing.

(d) Comfort and Ease of Operation. The comfort or discomfort of using the equipment will be noted as well as the ease of operating the equipment. Comments from the operators will be noted after extended periods of use.

(e) Communications. The communication links will be evaluated to determine their overall range and capability and to determine if any problems or loss in communication resulted during the operator's mission.

(f) Data collection will include obtaining comments from operators and data collectors on safety, human factors and the overall suitability of the CCVLS for humanitarian demining.

5. Data Analysis Procedure:

Data from CCVLS light sources, the quality of the audio communications and video components, and operator/deminer feedback on the comfort of operating the equipment without distracting discomfort, on safety and overall suitability will be analyzed. The test report will include an evaluation of the performance of the CCVLS to include conclusions and recommendations in a humanitarian demining environment.

q. Mobile Video and Light System (MVLS):

1. Objective:

(a) To assist demining personnel in safely locating, identifying, and clearing landmines and trip wires from sensitive and hard to reach areas.

(b) To provide the ability for real time remote monitoring of an individual deminer's activities.

(c) To give a deminer hands free tools to locate mines and trip wire devices.

2. Measures of Success:

(a) Can the MVLS locate partially exposed landmines in holes, around or underneath obstacles, hard to reach areas, high grass, around corners, or in bunkers using a combination of the three light sources and different mounting options?

(b) Is the audio and video quality at the command station acceptable and clear?

(c) Can the MVLS support the deminer without undue discomfort?

(d) Is the MVLS equipment safe to operate given the humanitarian demining environment?

3. Data Required:

(a) Number and location of trip wires located and the environment and conditions in which they were found(2a). (Urban Area and areas with trip wires will be used for testing the UV camera. May also test equipment in the Unimproved Road test area or a bunker using the telescopic pole).

(b) Number, type and location of landmines located using MVLS cameras and the environments and conditions in which they were found(2b). (Urban Area, bunker and possibly the Unimproved Road area)

(c) Transmission distance, quality of video signals and audio transmitted from the deminer to the command station (2c). (Urban Area)

(d) Operator reports on the comfort and ease of operating the MVLS during demining (2d).

(e) Operator and data collector reports on safety, human factors and overall suitability of the MVLS in a humanitarian demining environment (2e).

4. Data Acquisition Procedure:

(a) The urban area will be set up with mines and trip wire devices located in and around simulated urban structures, as well as, in or around obstacles. Mine and trip wire emplacement will cover all situations described in paragraph (2a) and (2b) above. The operator/deminer will first be trained how to operate the MVLS equipment, then will use it to transmit and receive video to and from the command position. Operator at the command position will monitor and record all user's activities.

(b) The operator will use the MVLS equipment and his personal observations to complete his mission to locate mines and trip wire devices. If required, the operator will be equipped with additional countermine devices such as metal detectors, probes and weed eaters to perform his mission.

(c) When a mine or trip wire device is found, the operator will remove the device while the operator at the command post monitors the ongoing operation. The command post will also record all demining operations.

(d) Comfort and Ease of Operation. The comfort or discomfort of using the equipment will be noted as well as the ease of operating the equipment. Comments from the operators will be noted after periods of use.

(e) Communications. Audio and video will be transmitted from the deminer to the command post. The communication links will be evaluated to determine their overall range and capability and to determine if any problems or loss in communication resulted during the operator's mission.

(f) Data collection will include operator and data collector comments regarding safety, human factors and overall suitability of the MVLS for humanitarian demining.

5. Data Analysis Procedure:

Data from MVLS sensors, the performance of the video quality components, and operator/data collector comments on the system being suitable for the deminer to operate without distracting discomfort, on safety and overall suitability will be analyzed. The test report will include an evaluation of the performance of the MVLS to include conclusions and recommendations in a humanitarian demining environment.

r. Side Scan Sonar:

1. Objectives:

(a) To determine if a small high resolution imaging sonar can provide images that identify suspected mine targets in shallow water.

(b) To determine standoff distance required to image small mines in creeks, ponds, or rivers. For testing purposes, The pond test area will be used.

2. Measures of Success:

(a) Can the side scan sonar identify by producing an image of manmade items/landmines in shallow water and if so, what are the diameters of the mines it can identify?

(b) Can the side scan sonar operate without interference when attached to a floating collar or floatation devices?

(c) Can the side scan sonar towfish be maneuvered by an operator in a shallow water pond 15-30 feet in length using a reel or other guiding device?

(d) Are there any safety of use issues associated with the side scan sonar system?

(e) Are there any human factors issues associated with the side scan sonar system?

3. Data Required:

(a) Location/depth and size/diameter of mines that can be detected in a shallow water (approx. 5 foot deep) pond (2a). What are limitations of the system if any?

(b) Quality and clarity of the sonar images of mines found at various distances and depths (2a).

(c) Operator or data collector report of any interference when attached to floating collar or other floatation devices (2b).

(d) Operator or data collector report of the side scan sonar's ability to be moved using a reel or other guiding device (2c). What are the limitations if any?

(e) Operator/data collector report of any safety issues concerning the use of the system (2d).

(f) Operator/data collector report of any human factors issues concerning the use of the equipment (2e).

4. Data Acquisition Procedure:

(1) Location and identification (type (AP or AT), depth, and size/diameter) of each mine in the pond will be recorded. The side scan sonar's towfish will be placed in the water at one end of the pond. The computer system and an operator will be in a safe area at least 25 meters away from the pond. Once imaging begins, a second operator will take instructions from the computer operator while guiding the towfish around the pond using a reel or other guiding device. Data will be recorded and stored in the PCU.

(2) For each test, the data collector will record and report each mine found by the side scan sonar on data collection medium. Those mines that went undetected will also be recorded and any possible reasons will be noted.

(3) Operator will provide input regarding interference with the floating collar or other floatation devices.

(4) Operator will provide input regarding any difficulty of maneuvering or guiding the side scan sonar with the reel or other guiding device.

(5) Data collector will collect data on ruggedness and RAM during performance of the test and from any contractor provided actual data.

(6) Data collector will collect operator input regarding safety of use, and human factor issues for this technology in the humanitarian demining environment.

5. Data Analysis Procedure:

Raw data from test, to include operator and data collector comments will be collected on paper medium and entered into the test database. The database will contain the performance statistics, conditions, and comments provided by operators and data collectors. This information will be reduced to a summary of this portion of the test, to include conclusions and recommendations for the use of this technology in the humanitarian demining environment.

s. K9 Program (Checkmate):

1. Objectives:

(a) To determine the ability of dogs, trained to detect vapors and other clues associated with explosives, to detect mines and tripwires.

(b) To determine the most effective of two different approaches to the use of vapor sniffing dogs. The two approaches are free roaming and confined K9s.

(c) To perform an analysis of the operational suitability of trained dogs in humanitarian demining.

2. Measures of Success:

(a) How well does the manpack sample collection system perform?

(b) How well does the vehicle based sample collection system perform?

(c) Do the free running dogs reliably locate a mine in a suspected mined area as indicated by the confined dogs?

(d) Can two or more dogs consistently alert on a collection filter that had been placed near a known mine?

(e) For a suspected mine, can one dog alert to a sample using the "Checkmate" technique?

(f) For an area that is known to be clear, do any Checkmate dogs falsely alert to the presence of a mine?

(g) Are the use of dogs a viable technology in areas of the world where humanitarian demining takes place?

3. Data Required:

(a) Surveyed locations of all mines in each area to be used for this portion of the test.

(b) Location of each sample collection box emplaced by the manportable backpack and by the vehicle mounted system.

(c) For each sample collection box, whether or not the dog alerted to the box. This data is required by dog.

(d) For the free running dogs, when introduced to a suspected mined area (as indicated by the confined dogs alerting to sample collection boxes), how effective are they at locating individual mines?

(e) Number of times free running dogs alerted in a known clear area (false alarm rate determination).

(f) Observations on the effectiveness of the handler - dog team.

(g) Data on cost to train and maintain a dog program for a supported nation. Identification of cultural acceptability of dogs in a given nation.

4. Data Acquisition Procedure:

(a) The Checkmate Program will be evaluated using six areas at Ft. A. P. Hill Range 71A. The areas are Dogs 1 and 2, concrete road (area 3), asphalt road (area 4), gravel (areas 5 and 6) and the unimproved road (area 7) (see Appendix F). Environmental and weather data will be collected during the test. This data will be used in analyzing the performance of the Checkmate approach to the use of dogs to detect mines.

(b) Settle In: Activities in this paragraph are not part of record test. All personnel, dogs and equipment will arrive in the area. The first two days after arrival will be used to acclimate the dogs to the area. The confined dogs and the free running dogs will be warmed up and tested using known positive samples.

(c) Collection of air samples by vehicle: As the vehicle travels along the various road surfaces, operators will gather samples every 0.1 miles. Distance will be measured using the vehicle odometer. Two confined dogs will be tested independently, with recorded results for every sample showing its location and whether or not each dog alerted to the presence of mines. A list of results (positive or negative) at each location measured and a preliminary map will be prepared showing locations of probable mines.

(d) Collection of air samples by manportable backpack: Operator will collect one air sample every 50 meters. The position of the collection point along the road will be measured by counting human steps, as done on actual operations. Two confined dogs will be tested independently, with recorded results for every sample showing its location and whether or not each dog alerted to the presence of mines. A list of results (positive or negative) at each location measured and a preliminary map will be prepared showing locations of probable mines.

(e) Collection with remote sensors: This activity will take place in Dog 1. Four sample collection boxes will be placed around known mine locations. The boxes will be ? meters from the mine, and equidistant from each other. If the confined dogs alert to mines at this distance, new boxes will be emplaced progressively further away from the mine until the dogs no longer alert.

(f) Tests with free running dogs: Free running dogs will be introduced to those areas corresponding to samples that the confined dogs alerted to. Data will be collected as to whether or not the free running dogs successfully pinpointed the mines.

(g) Observe and record the degree of control, or lack of, by the handler. To prevent non-successful completion of a test course when the dog “quits working” the handler will remove the team from the course. Data collectors will record how the dog reacts when the handler and detector operator approach the alert area.

(h) Check an area 10’ x 500’ with a AN/PSS-12 to confirm that the area is clear. Introduce the free running dogs and use this area to record false alerts. False alerts will be recorded after 20 minutes of search time where the test monitor is aware that there is no mine target closer than two meters.

(i) For mines that the dog has alerted on, but the mine detector operator cannot locate, the normal procedure is to conduct a careful manual probe exploration f the target area. Since multiple tests will be conducted of the same area we cannot allow operators to probe. In this situation one of the test monitor personnel with knowledge of the mine locations will identify the exact location of the mine so marker to mine distances can be obtained.

(j) Study priority countries listed in Appendix B to determine the existence of any cultural issue that would prohibit the use and maintenance of vapor sniffing dogs in the supported nation.

5. Data Analysis Procedure:

Recorded detection performance will be determined by comparison with the actual locations of the mines. Performance of the confined dogs will be analyzed by comparison with known locations and types of mines with what the dogs indicated. Cultural data acquired from country studies will be analyzed to determine any taboos against the use of dogs, a culture that uses dogs for food, or identify where their use may not be practical due to cost and maintenance requirements.

t. K9 Program (Leashed/Free Roaming):

1. Objectives:

(a) To determine the ability of dogs, trained to detect vapors and other clues associated with explosives, to detect mines and tripwires.

(b) To determine the most effective of two different approaches to the use of vapor sniffing dogs. The two approaches are free roaming and confined K9s.

(c) To perform an analysis of the operational suitability of trained dogs in humanitarian demining.

2. Measures of Success:

(a) Can the dogs alert and rest not closer than one (1) meter to mines?

(b) Can the dogs alert to buried and surface emplaced, metallic and non-metallic, on-road and off-route AP and AT mines 100% of the time?

(c) Can the dogs locate tripwires without engaging them?

(d) Can the dogs effectively search for mines following an explosion?

(e) Can the dogs effectively search for mines with scattered explosives in the area?

(f) Can the dogs effectively search for mines in areas that have been exposed to fire?

(g) Is the handler able to control the animal at a level sufficient to make the handler - free running dog team an effective mine detection tool?

(h) For an area that is known to be clear, do any roaming dogs falsely alert to the presence of a mine?

(i) Are the use of dogs a viable technology in areas of the world where humanitarian demining takes place?

3. Data Required:

(a) Roaming dogs - Number and locations of mines and tripwires in the test area.

(b) Roaming dogs - location of mines and tripwires that the dogs alert to. Compare this to actual database to determine number and types of mines that were missed.

(c) Roaming dogs - Number of mines that the dogs alert to following an explosion in the area.

(d) Roaming dogs - length of time from an explosion until the dogs can effectively search for mines.

(e) Roaming dogs - number of mines that the dogs alert to following a low order detonation with scattered pieces of high explosive.

(f) Roaming dogs - the extent that an area contaminated with high explosives has to be cleaned in order for dogs to resume their search.

(g) Roaming dogs - number of mines that the dog alerts to in an area that has been burned.

(h) Roaming dogs - type of explosives most often alerted to, and type of mine (metal / plastic) most often alerted to.

(i) Number of times roaming dogs alerted in a known clear area.

(j) Observations on the effectiveness of the handler - dog team.

(k) Data on cost to train and maintain a dog program for a supported nation. Identification of cultural acceptability of dogs in a given nation.

4. Data Acquisition Procedure:

(a) The K9 effort will be evaluated using 5 different areas (see Appendix F, Test Layout). The roaming dogs will use all 5 areas. Dog 1, Dog 2 and Dog 3 will be used to test detection.

(b) Free running detection procedures require dogs to be leashed except when the terrain or foliage is such that it might be unsafe to the dog or handler to keep the dog on a leash. Begin with database of known mine and tripwire locations. Introduce dogs and record where they alert to mines using appropriate survey techniques. Test monitor personnel will closely observe the path taken by the dog to evaluate if it might cross the path of a mine before returning to alert. This evaluation is subjective and is not cause for failure, however it is indicative of further evaluation being required. Record the success of alerting to tripwires.

(c) Observe and record the degree of control, or lack of, by the handler. To prevent non-successful completion of a test course when the dog "quits working" the handler will remove the team from the course. Data collectors will record how the dog reacts when the handler and detector operator approach the alert area.

(d) To test the ability of roaming dogs to search for mines after one mine detonates in the vicinity. Dog area 1 will be used for this portion of the test after the initial detection phase is completed. Detonate one mine, then introduce the roaming dogs and record with appropriate survey equipment where they alert to mines. If the dogs are unable to search for mines immediately after the detonation, record how long it takes before they can search successfully.

(e) Dog area 4 will be used to test the ability of roaming dogs to search mines in the presence of explosive material. Record the locations of all alerts. Remove the TNT pieces and re-introduce the roaming dogs. Record the locations of all alerts.

(f) Emplace six each AP mines one inch deep and six AP mines three inches deep, six feet apart in a 10'x x200' area (Dog area 5). Within the same area, place two Val-69 or M16 mines with trip wires in a "v" shape. Burn this area to create burned wood and soot. Introduce the roaming dogs. Record the location of all mines that the dog alerts.

(g) Check an area 10' x 500' with a AN/PSS-12 to confirm that the area is clear. Introduce the roaming dogs and use this area to record false alerts. False alerts will be recorded after 20 minutes of search time where the test monitor is aware that there is no mine target closer than two meters.

(h) For mines that the dog has alerted on, but the mine detector operator cannot locate, the normal procedure is to conduct a careful manual probe exploration f the target area. Since multiple tests will be conducted of the same area we cannot allow operators to probe. In this situation one of the test monitor personnel with knowledge of the mine locations will identify the exact location of the mine so marker to mine distances can be obtained.

(i) Study priority countries listed in Appendix B to determine the existence of any cultural issue that would prohibit the use and maintenance of vapor sniffing dogs in the supported nation.

5. Data Analysis Procedure:

Recorded performance will be determined by comparison with the actual locations of the mines. Cultural data acquired from country studies will be analyzed to determine any taboos against the use of dogs, a culture that uses dogs for food, or identify where their use may not be practical due to cost and maintenance requirements.

Appendix E: Support Equipment Requirements

Support Equipment Requirements for Test

04-Mar-96

Item	Qty	Equipment
5-ton truck		
	1	Heavy Grapnel
	1	
55 Gallon Drums		
	8	Vehicle Based Detection
	8	
Accelerometer		
	1	BPV
	1	MVP
	2	
Administrators		
	4	All
	4	
Anti-handling Instruments		
	0	Chemical Neutralization
	0	EDD
	0	Hardening Foam
	0	Smart Probe
	0	
Auger		
	1	MCB
	1	
Booby traps		
	0	CCVLS

Item	Qty	Equipment
	0	MVLS
	0	
BPA		
	0	Vehicle Towed Roller
	0	
C2		
	2	Admin
	2	
C4		
	0	Chemical Neutralization
	0	
Computer		
	2	Admin
	2	
Data Collectors		
	5	All
	5	
Demining Cart		
	1	Light Grapnel
	1	
Detonating Charges		
	0	TODS
	0	
Dozer		
	1	BPA, MCB, Veh Towed Roller
	1	

Item	Qty	Equipment
Engineer Stakes		
	20	MCB
	20	
Firing Wires		
	0	Grapnels
	0	
Forklift		
	1	MCB
	1	
Fuel		
	0	Admin Vehicles
	0	Blast Protected Vehicle
	0	Dozers
	0	Ground Based QA
	0	Mini-flail
	0	Mobile Trainer
	0	Modular Vehicle Protection
	0	Suburban
	0	Teleoperated Ordnance Disposal
	0	Vehicle Based Detection
	0	VMMD
	0	
Generators		
	2	All
	2	
GPS		
	0	All

Item	Qty	Equipment
	0	
Grader		
	1	MCB
	1	
LIFEMAN Dummies		
	0	BPV, MVP
	0	
M605 or similar fuze		
	0	Grapnels
	0	
Marking paint		
	0	MCB
	0	
MCB		
	0	Vehicle Towed Roller
	0	
Measuring tools		
	0	Blast/Frag Container
	0	Grapnels
	0	Handheld TW Detect
	0	Mini Mine Detector
	0	Mobile Trainer
	0	Weedeater
	0	
Mine instrumentation		
	0	MCB

Item	Qty	Equipment
	0	Towed Light Roller
	0	
Mines		
	690	All
	690	
Obstacles		
	0	CCVLS
	0	Grapnels
	0	Handheld TW Detect
	0	Mini-flail
	0	
Office Software		
	2	Admin
	2	
Operators		
	4	All
	4	
Overhead Obstructions		
	0	Grapnels
	0	
Pressure sensors		
	0	Towed Light Roller
	0	Vehicle Towed Roller
	0	
PSS/12		
	1	Mine Location Marker, MCB

Item	Qty	Equipment
	1	Mini Mine Detector
	2	
Radios		
	5	Admin
	5	
Recovery Vehicle		
	0	All
	0	
Sandbags		
	100	Vehicle Based Detection
	100	
Simtex		
	0	Chemical Neutralization
	0	
Smoke fuzes		
	0	All
	0	
Still Photo Cameras		
	0	All
	0	
Stopwatches		
	0	All
	0	
Tamper		
	1	MCB
	1	

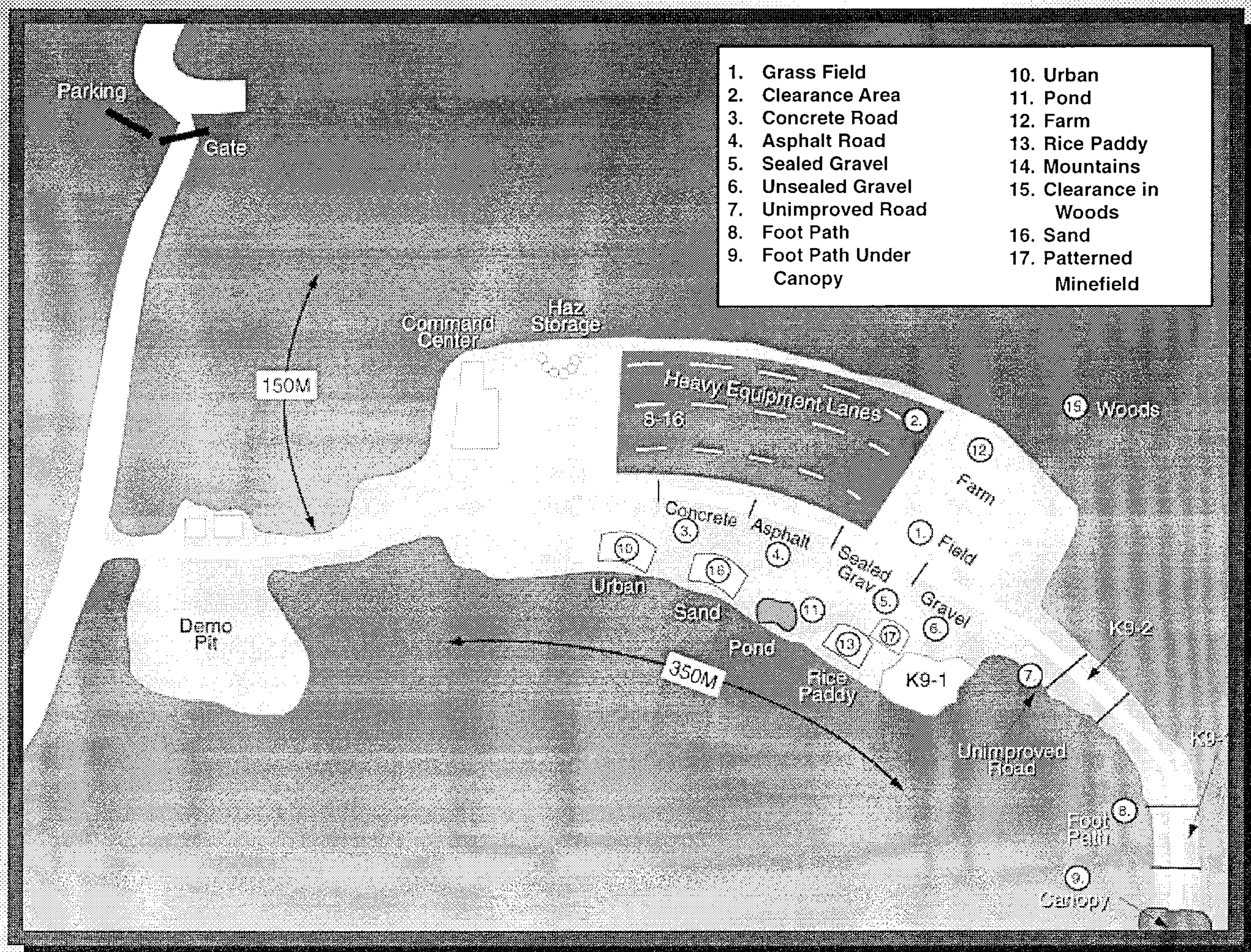
Item	Qty	Equipment
Test Database		
	1	Admin
	1	
Thermometer		
	0	Chemical Neutralization
	0	
TNT		
	0	Chemical Neutralization
	0	
Tools		
	0	All
	0	
Tower		
	1	Ground Based QA
	1	
Trip Wires		
	0	CCVLS
	0	Ground Based QA
	0	Handheld Trip Wire Detector
	0	Heavy Grapnel
	0	K9 Program
	0	Light Grapnel
	0	MVLS
	0	Vehicle Based Detection
	0	VMMD
	0	

Item	Qty	Equipment
Truck		
	1	Heavy Grapnel
	1	Towed Light Roller
	2	
Vehicle Towed Roller		
	1	MCB
	1	
Video Cameras		
	0	All
	0	
Water		
	600	Vehicle Based Detection
	600	
Weather Station		
	1	All
	1	
Weight Scale		
	1	All
	1	

Appendix F: Test Layout - Fort AP Hill

Humanitarian Demining

A.P. Hill Range 71-A Integrated Test Site



Appendix G: Use of Test Areas and Mine Locations by Test Area

TEST EQUIPMENT VS AREAS AVAILABLE FOR TEST

Planning Matrix

			3a							3b							17a	17b				21	22	
			Concrete	forced Concrete														Pattern Calibration				Dog 4		
Test Area	1	2		3	4	5	6	4	8	9	10	11	6	13	14	15	16	17	1	18	19	20		21	
Equipment													10						1						
Mine Detection On-Road/Off Route								4		1			6					11	1	1					
Ground Platform Mtd QA					X	X	X		X									X							
Vehicle Mod Detect	X			X	X	X	X	X			X		X				X	X							
VMMD	X			X	X	X	X	X	X	X			X					X							
Mine Clearers	4							2					3				2		1		1				
PMA3										X						X									
Teleoperated Ord Disp Sys	X						X	X			X		X				X								
In-Situ Neutralization																									
Chemical Neutralization																								X	
Explosive Demining Device																								X	
LEXFOAM Dispersal System																								X	
Mine Marking & Neut											X			X		X	X								
Shaped Charges																								X	
Individual Components			1		1		1	1					2						1						
TM-62			1	1	1			1					2						1					X	
Modular Vehicle Protection			1	1	1			1					2						1					X	
Mobile Training System			1					1					1						1						
Mini Mine Detector	X		1					1			X		1						1						
Extended Length Probe	X	X	1	1	1		X	1			X		2				X		1						
Extended Length Weedeater								X																X	
Mine Location Marker	X	X																							
Demining Tool Kit																									
Explosion Container																								X	
PPM2																					1				
Berm Processor		X																							
Mine Clearing Blade(s)	5	2	6	6	8	5	7	16	8	10	10	11	35	13	14	15	18	28	10	19	21	20		21	0
Grapnels, Heavy																X									
Grapnels, Light																X									
Handheld Trip Wire Detector																X									
Vehicle Towed Roller		X																						X	
Towed Light (Swamp) Roller														X										X	
Mobile Video & Light Syst											X				X										
Cmd Commo Video & Light											X				X										
Side Scan Sonar												X													
K9 Program (Ronco)																				X	X	X			
K9 Program (SAIC)																				X	X	X			

Legend of Areas:

1	Field	10	Urban	18	Dog 1
2	Clearance	11	Pond	19	Dog 2
3	Concrete	12	Farm	20	Dog 3
4	Asphalt	13	Rice paddy	21	Blast Area
5	Sealed gravel	14	Mountain		
6	Gravel	15	Woods		
7	Unimproved Road	16	Sand		
8	Foot Path	17	Pattern		
9	Canopy				

Mine Requirements for Test

Area	1	2	3a	3b	4	5	6	7	8	9	10	11	12	13	14	15	16	17a	17b	18	19	20	21	22	
Mine	Field **	Clearance ***	Concrete	Reinforced Concrete	Asphalt	Sealed Gravel (1 depth)	Gravel (2 depths)	Unimproved Road	Foot Path	Canopy	Urban	Pond ***	Farm **	Rice Paddy	Mountains	Woods (Tripwire) ***	Sand	Pattern	Pattern Calibration	Dog 1	Dog 2	Dog 3	Dog 4	Blast Pit	Total by Mine *
PMD-6	7							4			2		6				4		1					19	24
M14	11	13								1	2		10					9	1	1				13	48
VS-50	7	13						4		1	2	6	6				4	11	1	1				23	56
PMN-2		13																						8	13
VS-Mk.2		5																		1	1			1	7
Type 72 (AP)																						1		1	1
TS-50	4							2					3				2		1		1	1		1	14
PMA3										1															1
M16	1							1		1	1		1			2	1							17	8
Val-69	1							1		1	1		1				1							4	6
M18																2								9	2
OZM																2									2
OZM-72																					1				1
MON-50																						1			1
POMZ-2																2								4	2
TMD-44	3		1		1	1	1	1			1		2				2		1					2	14
TM-62	3		1	1	1	1	2	1			1		2				1	3	1					5	18
M15	3	40	1	1	1	1	2	1			1	2	2				2	3	1	1	1			5	63
VS 1.6	2		1	1	1	1	1	1					1						1						10
VS 2.2	2		1	1	1	1	1	1					1						1						10
M19	3		1	1	1	1	2	1			1		2				2		1	1	1			5	18
M21																					2				2
M25																				1					1
MH6																								1	0
PROM 1																					1				1
PPM2																					1				
																									0
Totals	47	84	6	5	6	6	9	18	0	5	12	8	37	0	0	8	19	26	10	6	9	3		118	323
Total Mines:	323																								
Inert	92																								
Live unfuzed	231																								
Other Expl																									
Smoke fuzes		240														40									280
	40																								

* The formulas down the "total by mine" column do not include the mines for detonation because they are not additive. Detonation will be accomplished with mines removed from the various areas after testing in those areas is concluded.

** Except for the M16 and the Val-69, one of each mine will be in the calibration area for the lane. Therefore, of the 46 mines in these lanes, 36 are targets for collection of test data.

*** Inert Mines

Appendix H: Test Schedule

October 15 - November 11, 1995

<table>
<tr><th>SUNDAY</th><th>MONDAY</th><th>TUESDAY</th><th>WEDNESDAY</th><th>THURSDAY</th><th>FRIDAY</th><th>SATURDAY</th></tr>
<tr><td>Oct 15</td><td>Oct 16</td><td>Oct 17</td><td>Oct 18</td><td>Oct 19</td><td>Oct 20</td><td>Oct 21</td></tr>
<tr><td></td><td colspan="5">Mine Clearing Bucket</td><td></td></tr>
<tr><td></td><td colspan="5">Swamp Roller (non-explosive)</td><td></td></tr>
<tr><td></td><td colspan="5">SAIC - K-9 MEDDS</td><td></td></tr>
<tr><td>Oct 22</td><td>Oct 23</td><td>Oct 24</td><td>Oct 25</td><td>Oct 26</td><td>Oct 27</td><td>Oct 28</td></tr>
<tr><td></td><td colspan="3">IET Blast Container (Explosive)</td><td colspan="2">Swamp Roller (Explosive)</td><td></td></tr>
<tr><td>Oct 29</td><td>Oct 30</td><td>Oct 31</td><td>Nov 1</td><td>Nov 2</td><td>Nov 3</td><td>Nov 4</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">OAO TODS</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">QA Device Baseline</td><td></td></tr>
<tr><td></td><td colspan="2">PSS-12 Mine Marker</td><td colspan="3">SAIC VMD</td><td></td></tr>
<tr><td></td><td colspan="5">Coleman VMMD</td><td></td></tr>
<tr><td></td><td colspan="5">Berm Processor</td><td></td></tr>
<tr><td></td><td colspan="5">SIMULA & RST Blast Protected Vehicles (Automotive)</td><td></td></tr>
<tr><td></td><td colspan="5">OST Mini-Flail (Automotive)</td><td></td></tr>
<tr><td>Nov 5</td><td>Nov 6</td><td>Nov 7</td><td>Nov 8</td><td>Nov 9</td><td>Nov 10</td><td>Nov 11</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">Smart Probe</td><td></td></tr>
<tr><td></td><td colspan="5">SAIC Handy Mini-Mine Detector</td><td></td></tr>
<tr><td></td><td colspan="5">SAIC VMD</td><td></td></tr>
<tr><td></td><td colspan="5">Coleman VMMD</td><td></td></tr>
</table>

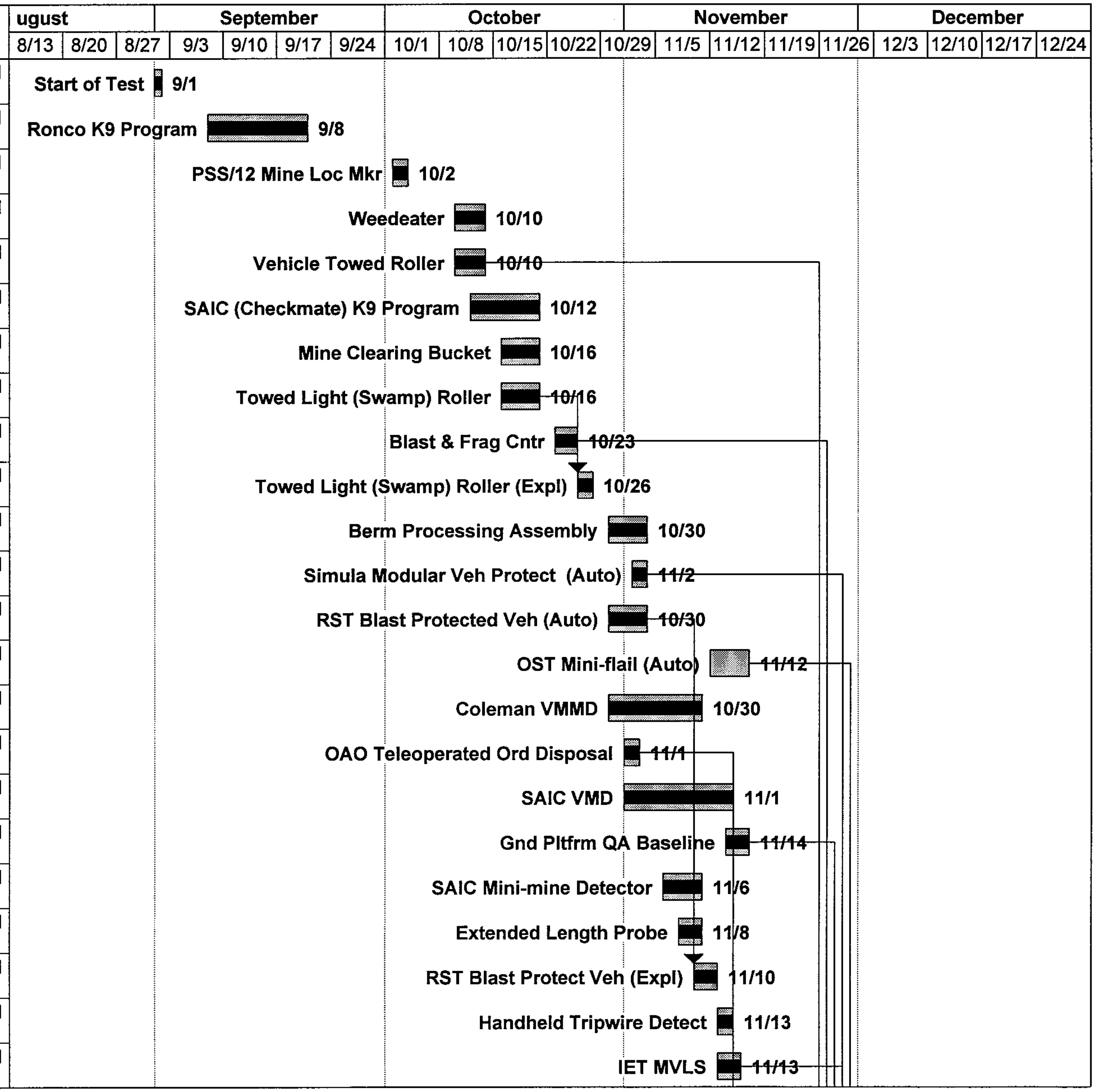
3/4/1996

November 12 - December 9, 1995

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Nov 12	Nov 13 Tripwire Detector SAIC VMD IET Sonar IET MVLS and CCVLS	Nov 14	Nov 15 OAO TODS Hughes Foam Light & Heavy Grapnel	Nov 16 MREL LEXFOAM QA Device follow on	Nov 17 Robotic System Tech	Nov 18
Nov 19 TRACOR Robotic System ...	Nov 20 Chemical Neutralization Mine Clearing Rake and VTR	Nov 21	Nov 22	Nov 23 *Thanksgiving Holidays*	Nov 24 Chemical Neutralization	Nov 25 OST Mini-Flail
Nov 26 OST Mini-Flail	Nov 27 OST Shape Charges	Nov 28 Vehicle Towed Roller	Nov 29 Essex Mobile Trainer IET CCVLS VIP Day IET Blast Container SIMULA Inc.	Nov 30 Demining Kit	Dec 1	Dec 2
Dec 3	Dec 4	Dec 5	Dec 6	Dec 7	Dec 8	Dec 9

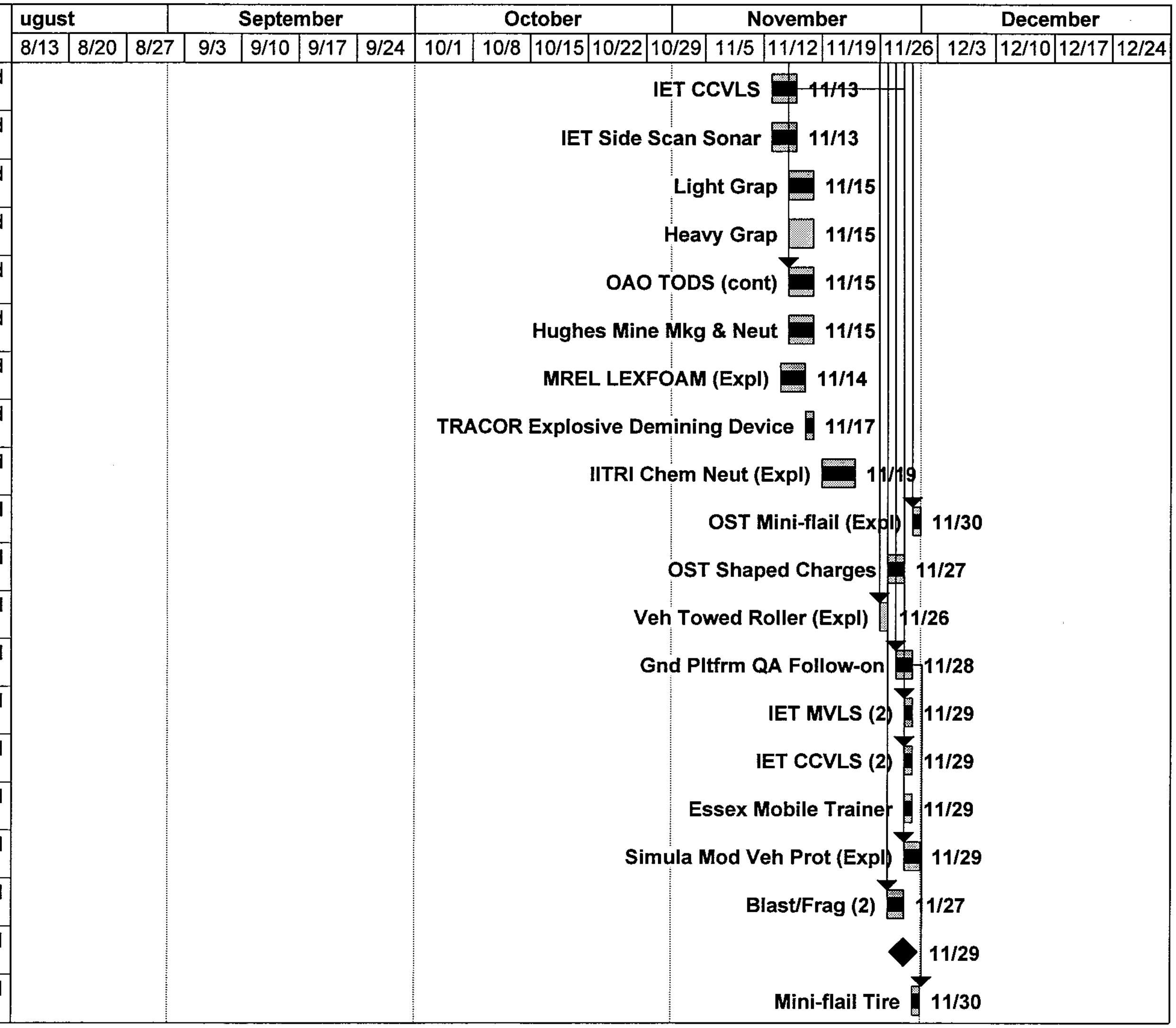
Humanitarian Demining Program
Test Prep & Test

ID	Task Name	Duration
81	4.1 Start of Test	1d
82	4.2 Ronco K9 Program	9d
83	4.3 PSS/12 Mine Loc Mkr	2d
84	4.4 Weedeater	4d
85	4.5 Vehicle Towed Roller	4d
86	4.6 SAIC (Checkmate) K9 Program	7d
87	4.7 Mine Clearing Bucket	5d
88	4.8 Towed Light (Swamp) Roller	5d
89	4.9 Blast & Frag Cntr	3d
90	4.10 Towed Light (Swamp) Roller (Expl)	2d
91	4.11 Berm Processing Assembly	5d
92	4.12 Simula Modular Veh Protect (Auto)	2d
93	4.13 RST Blast Protected Veh (Auto)	5d
94	4.14 OST Mini-flail (Auto)	5d
95	4.15 Coleman VMMD	10d
96	4.16 OAO Teleoperated Ord Disposal	2d
97	4.17 SAIC VMD	10d
98	4.18 Gnd Pltfrm QA Baseline	3d
99	4.19 SAIC Mini-mine Detector	5d
100	4.20 Extended Length Probe	3d
101	4.21 RST Blast Protect Veh (Expl)	3d
102	4.22 Handheld Tripwire Detect	2d
103	4.23 IET MVLS	3d



Humanitarian Demining Program
Test Prep & Test

ID	Task Name	Duration
104	4.24 IET CCVLS	3d
105	4.25 IET Side Scan Sonar	3d
106	4.26 Light Grap	3d
107	4.27 Heavy Grap	3d
108	4.28 OAO TODS (cont)	3d
109	4.29 Hughes Mine Mkg & Neut	3d
110	4.30 MREL LEXFOAM (Expl)	3d
111	4.31 TRACOR Explosive Demining Device	1d
112	4.32 IITRI Chem Neut (Expl)	4d
113	4.33 OST Mini-flail (Expl)	1d
114	4.34 OST Shaped Charges	2d
115	4.35 Veh Towed Roller (Expl)	1d
116	4.36 Gnd Pltfrm QA Follow-on	2d
117	4.37 IET MVLS (2)	1d
118	4.38 IET CCVLS (2)	1d
119	4.39 Essex Mobile Trainer	1d
120	4.40 Simula Mod Veh Prot (Expl)	2d
121	4.41 Blast/Frag (2)	2d
122	4.42 VIP Day	0d
123	4.43 Mini-flail Tire	1d



VIP DAY

AGENDA

November 29, 1995

0800	**Arrive at Fort Belvoir**	
0830	**Depart Fort Belvoir, Travel to Range 71A, Fort A. P. Hill, VA**	
1030	**Arrive at Range 71 A, Fort A. P. Hill**	
1045	**Safety Brief, Bleacher Area in the Demo Pit**	
1100	**Mobile Trainer Display**	
1115	**Live Fire Shots:**	1. Modular Vehicle Protection Kit 2. Blast & Fragment Container

* (Command Control Video & Light System Demonstration)

1145	**Mobile Trainer Display and Video Presentations** (Dogs, Grapnels, Vehicle Mine Detectors, Mine Clearing Blades, Vehicle Towed Rollers, Mobile Video & Light System, Sea Scan Sonar, Blast Protected Vehicles, Shape Charges, Lexfoam, QA Device)	
1215	**Lunch**	
1245	**Static Displays:**	1. SAIC Vehicle Mine Detector 2. Coleman Vehicular Mounted Mine Detector 3. Mine Clearing Blade (Bucket) 4. Mine Clearing Blade (Rake) 5. Berm Processor 6. Towed Light Roller (Swamp Roller) 7. Vehicle Towed Roller 8. Blast Protected Vehicles 9. Shape Charges 10. Deminer's Kit, Weedeater, & Grapnels 11. LEXFOAM Trailer 12. Blast & Fragment Containers 13. Mine Display
1315	**Live Displays:**	1. Miniflails 2. OAO Teleoperated Ordnance Disposal System 3. Hughes Mine Marking Neutralization (Foam) 4. PSS-12 Mine Marker 5. Vibrating Smart Probe
1400	**Live Fire Shot:**	1. Modular Vehicle Protection Kit 2. Blast & Fragment Container
1430	**Depart for Fort Belvoir, VA**	

Appendix I: References

1. Hidden Killers, the Global Landmine Crisis: 1994 Report to the U. S. Congress on the Problem with Uncleared Landmines and the United States Strategy for Demining and Landmine Control, United States Department of State, Bureau of Political - Military Affairs, December 1994.

2. Program Plan for the Development and Demonstration of Countermine Technologies for Humanitarian Demining and Military Operations Other Than War (OOTW), CECOM NVESD, 15 February 1995.

Appendix J: Abbreviations

AP	Anti-Personnel
ASD(SO/LIC)	Assistant Secretary of Defense for Special Operations / Low Intensity Conflict
AT	Anti-Tank
BDU	Battle Dress Uniform
BPA	Berm Processing Assembly
BPV	Blast Protected Vehicle
CCVLS	Command Communications Video and Lighting System
CENTCOM	Central Command
CEP	Circular Error Probability
CINC	Commander-in-Chief
COTS	Commercial Off-the-Shelf
GPR	Ground Penetrating Radar
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
HMMWV	High Mobility Multi-Purpose Wheeled Vehicle
HUD	Head-Up Display
IR	Infrared
LCD	Liquid Crystal Display
LOC	Line of Communication
MCB	Mine Clearing Blade
MTBOMF	Mean Time Between Operational Mission Failure
MVLS	Mobile Video Light System
NVESD	Night Vision Electronic Sensors Directorate
OCDT	Operational Capabilities Demonstration & Test
OOTW	Operations Other Than War
OST	Office of Science and Technology
PACOM	Pacific Command
PCB	Printed Circuit Board
QA	Quality Assurance
RAM	Reliability, Availability, Maintainability
RDT&E	Research, Development, Test and Evaluation
TDEM	Time Domain Electromagnetic Metal Detector
TIR	Test Incident Report
TNA	Thermal Neutron Analysis
TODS	Tele-operated Ordnance Disposal System
UV	Ultra-Violet
VMMD/MC	Vehicle Mounted Mine Detector/Mine Clearer

Appendix K: Data Management Plan

Data Collection Form

Humanitarian Demining Operational Capabilities Demonstration and Test

<u>Vehicle Based Detection</u>

1. Test identification information:

Date: Time:

Area: Pass number:

Operators: Data Collector:

Configuration: On-road Off-route

Hours of operation: Light conditions:

Weather:

2. Detection Performance:

Vehicle Based Detection

Video detection (IR, UV, Video, Stereo vision)

ID #	Object appearance notes (diameter etc)	Which system(s) IR, UV, Video	Time	approximate location	verification Metal/TNA	real mine location	comments

3. If paint needs refilled at any time - record the hours of operation on vehicle when refilled: _______

4. Questionnaire items (1 is the best rating):

Vehicle Based Detection	1	2	3	4	5	6
1. Ease of training/training hours required						
2. Comments:						
3. Degree of autonomous operation						
4. Comments:						
5. Ease of equipment setup						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Video quality IR						
12. Comments:						
13. Video quality UV						
14. Comments:						
15. Accuracy of GIS display of vehicle path and location of marked targets						

Vehicle Based Detection

Vehicle Based Detection	1	2	3	4	5	6
16. Comments:						
17. 3D image quality						
18. Comments:						
19. Ability of system to be removed from minefield without special equipment						
20. Comments:						
21. How clearly can anti-handling devices be seen?						
22. Comments:						
23. How well does the system determine the shape of buried objects?						
24. Comments:						
25. Overall suitability for humanitarian demining						
26. Comments:						

5. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Vehicle Mounted Mine Detector

1. Test identification information:

Date: __________ Time: ________ Area: _______________ Pass number: ________

Operator: ____
Data Collector: _______________________________________

Hours of operation: ___________________________________
Light conditions: ____________________________________
Weather: __________________________________

2. Detection performance:

Vehicle Mounted Mine Detector						
Ground Penetrating Radar and Marking System						
Entry #	Object Detected (Mine or TW)/ **Actual Object**	Description of GPR detection	GPS Detection Location	Marking System Location	Actual Mine Location	Time of Day/ Conditions

Vehicle Mounted Mine Detector

Vehicle Mounted Mine Detector						
Ground Penetrating Radar and Marking System						
Entry #	Object Detected (Mine or TW)/ **Actual Object**	Description of GPR detection	GPS Detection Location	Marking System Location	Actual Mine Location	Time of Day/ Conditions

Note: Sensor suite for this system consists of a Ground Penetrating Radar (GPR) and three cameras (IR, UV, 3-D imaging).

3. If paint needs refilled at any time - record the hours of operation on vehicle when refilled: ______

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Vehicle Mounted Mine Detector

4. IR, UV, Video Sensor Test identification information:

Date: __________ Time: ________ Test Area: _______________ Pass number: ________

Operator: ____
Data Collector: ____

Hours of operation: ___________________________________
Light conditions: _____________________________________
Weather: ____

5. Detection performance of Sensor Detection:

Vehicle Mounted Mine Detector						
Sensor Detection (IR, UV, Video)						
Entry #	Object Detected (Mine or TW)/ **Actual Object**	Description of Sensor detection/ Comments	Approximate Location	Verification by GPR	Actual Mine Location	Time of Day/ Conditions

Vehicle Mounted Mine Detector

Vehicle Mounted Mine Detector						
Sensor Detection (IR, UV, Video)						
Entry #	Object Detected (Mine or TW)/ **Actual Object**	Description of Sensor detection/ Comments	Approximate Location	Verification by GPR	Actual Mine Location	Time of Day/ Conditions

6. Questionnaire items (1 is the best rating):

Vehicle Mounted Mine Detector	1	2	3	4	5	6
1. Ease of training/training time required						
2. Comments:						
3. Ease of equipment setup and operation						
4. Comments:						
5. Safety						
6. Comments:						
7. Human factors						
8. Comments:						
9. Video quality IR						
10. Comments:						

Vehicle Mounted Mine Detector

Vehicle Mounted Mine Detector	1	2	3	4	5	6
11. Video quality UV						
12. Comments:						
13. 2D image quality (shape of buried objects, tripwires & anti-handling devices)						
14. Comments:						
15. Ability of system to be removed from minefield without special equipment						
16. Comments:						
17. Degree of autonomous operation						
18. Comments:						
19. Adequacy of steering cameras						
20. Comments:						
21. Overall suitability for humanitarian demining						
22. Comments:						

7. Additional comments and suggested improvements:

____

____

____

____

____

Data Collection Form

Humanitarian Demining Operational Capabilities Demonstration and Test

Ground Based Quality Assurance

1. Test identification information:

Date: _____ Time: _____ Area: _____ Pass number: _____
Operator: _________________________
Data Collector: _________________________
Hours of operation on system: _____
Mast height: ______

Weather data: _______

Light conditions: _______

2. Detection Performance:

Ground Based Quality Assurance				
Entry #	Object (Mine or TW)	Marker Location	Sensors	Type / Diameter

Ground Based Quality Assurance				
Entry #	Object (Mine or TW)	Marker Location	Sensors	Type / Diameter

Note: Sensor suite for this system consists of three cameras: one 8-12 IR, one 3-5 IR and one UV. A fourth visual camera does not perform as a sensor, but is designed to assist the operator in performing remote operations.

3. Questionnaire items (1 is the best rating):

Ground Platform Quality Assurance	1	2	3	4	5	6
1. Ease of training						
2. Comments:						
3. Ease of equipment setup and operation						
4. Comments:						
5. Safety						
6. Comments:						
7. Human factors						
8. Comments:						
9. Video quality IR 3-5						
10. Comments:						
11. Video quality IR 8-12						
12. Comments:						
13. Video quality UV						
14. Comments:						
15. Video quality visual						
16. Comments:						

Ground Based Quality Assurance

Ground Platform Quality Assurance	1	2	3	4	5	6
17. Image quality						
18. Comments:						
19. Ability of system to be removed from minefield without special equipment						
20. Comments:						
21. Overall suitability for humanitarian demining						
22. Comments:						

4. Additional comments and suggested improvements:

____

____

____

____

____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Teleoperated Ordnance Disposal System

1. Test identification information:

Date: _____ Start Time: _____ Area: _____ Pass Number: _____
Operator: ________________________
Data Collector: ________________________

2. Performance data:

Mine ID	Metal Detector Found (Y/N)	Cutter Cleared (Y/N/NA)	Placed Charge (Y/N/NA)	Unplanned Det (Attachment that caused it and range or "N")	Air Knife Exposed mine (give elapsed time or unsuccessful)

End of Pass, check for usability of area (Y/N): ___
End Time: _____

AT mines encountered: ____
AT mines initiated: ___

Humanitarian Demining Operational Capabilities Demonstration and Test

Teleoperated Ordnance Disposal System - One Time Automotive and Live Mine Demonstrations

3. Automotive performance:

Tele-operation system:
- Range: ___
- Time to stop after command given: ___
- Distance to stop after command given: ___
- Turning circle: ___

Weight: max weight the TODS is able to lift or drag: ____

4. Explosive performance:

Blast pit:

- # of attempts to place charge: ___
- # of successfully placed charges: ___

Subject TODS to 10 "normal" and one "accidental" blasts
Check performance of automotive, teleoperation and detection/clearance components

Blast 1:

Blast 2:

Blast 3:

Blast 4:

Blast 5:

Blast 6:

Blast 7:

Blast 8:

Blast 9:

Blast 10:

Blast 11:

5. Questionnaire items (1 is the best rating):

Tele-operated Ordnance Disposal System (TODS)	1	2	3	4	5	6
1. Ease of Tele-operation system						
2. Comments:						
3. Safety						
4. Comments:						
5. Human factors						
6. Comments:						
7. Ability of knife, gripper and shovel, working together, to expose and neutralize mines						
8. Comments:						
9. Efficiency at clearing vegetation						
10. Comments:						
11. Repariability following damage from mine detonation						
12. Comments:						
13. Training						
14. Comments:						
15. Removal Procedure						

Tele-Operated Ordnance System

Tele-operated Ordnance Disposal System (TODS)	1	2	3	4	5	6
16. Comments:						
17. Reliability						
18. Comments:						
19. Overall suitability for humanitarian demining						
20. Comments:						

6. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mini-flail

1. Test identification information:

Date: _______ Start time: _____ Area: _____ Pass Number: _____
Operator: ________________
Data Collector: ___________________

2. Performance:

AP Mines at beginning of pass: _____
AP Mines remaining after pass: _____

AT mines at beginning of pass: _____
AT mines encountered under platform's wheels: _____
AT mines detonated: _____
Strongest AP mine that the mini-flail cam withstand: _____

Usability of lane as LOC after mini-flail performs: _____

End time: _____

Mini-flail

3, Questionnaire items (1 is the best rating):

Mini-flail	1	2	3	4	5	6
1. Usability of cleared area after mini-flail performs						
2. Comments:						
3. Effectiveness of new flail hammer design						
4. Comments:						
5. Success at negotiating obstacles and difficult terrain						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Ability to sweep small mines and UXO to where they can be neutralized						
12. Comments:						
13. Ability to push AT mines out of the way						
14. Comments:						
15. Efficiency at clearing vegetation						
16. Comments:						

Mini-flail

Mini-flail	1	2	3	4	5	6
17. Repairability following damage from mine blast						
18. Comments:						
19. Removal Procedure						
20. Comments:						
21. Overall suitability for humanitarian demining						
22. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Explosive Demining Device (EDD)

1. Test Identification Information

Date: _____ Time: _____ Area: _____
Operator: ______________________________
Data Collector: ______________________________

2. Air temperature (record just prior to beginning the test): ______

3. Performance:

-- **Ensure separation of at least three meters between AP mines and at least five meters between AT mines.**

-- Test Number 1 - Simultaneous detonation of nine shallow buried* AP mines. Following detonation, inspect each mine and indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

AP mine test #1	PMD6	M14	M16
Shallow buried*			
Shallow buried			
Shallow buried			

-- Comments on results of EDD test #1:

____
____
____
____
____

* For the Explosive Demining Device test, a "shallow buried" mine is defined as one that is buried, but very lightly covered. In other words, the mine is in the ground with the top of the mine almost flush with the ground surface. A very thin layer of ground (less than an inch) covers the mine.

-- Test Number 2 - Simultaneous detonation of six AP mines. Three mines will be shallow buried. The other three will be buried to a depth of one inch and covered. Following detonation, inspect each mine and indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

AP mine test #2	PMD6	M14	M16
Shallow buried			
Buried 1", covered			

-- Comments on results of EDD test #2:

-- Test Number 3 - Simultaneous detonation of four AT mines. All mines will be metallic (TM46, TM62 or equivalent). Three mines will be shallow buried. One mine will be buried to a depth of one inch and covered. Following detonation, inspect each mine and indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

AT mine test	Mine1	Mine 2	Mine 3	Mine 4
Shallow buried				
Buried 1", covered				

4. Questionnaire Items (1 is the best rating):

Explosive Demining Device (EDD)	1	2	3	4	5	6
1. Ease of use						
2. Comments on ease of use:						
3. Ease of assembly and disassembly of dispensing system						
4. Comments on ease of assembly and disassembly:						
5. Safety						
6. Comments regarding safety:						
7. Human factors						
8. Comments regarding human factors:						
9. Overall suitability for humanitarian demining						
10. Comments regarding overall suitability:						

5. Additional comments and suggested improvements:

___

___

___

___

___

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
LEXFOAM

1. Test Identification Information

Date: _____ Time: _____ Area: _____
Operator: ______________________________
Data Collector: ______________________________

2. Just prior to the start of test, record the air temperature: _____

3. Explosive Testing:

- Backpack unit against AP mines:

-- Ensure that the manpack dispenser is full at the beginning of the test.

-- **Ensure separation between mines of at least three meters.**

-- Test Number 1 - Simultaneous detonation of nine shallow buried* AP mines. Mines will be connected with detonation cord. Following application of LEXFOAM, inspect each mine and indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

AP mine test #1	PMD6	M14	M16
Shallow buried*			
Shallow buried			
Shallow buried			

-- Comments on results of LEXFOAM test #1:

____
____
____
____
____

* For the LEXFOAM test, a "shallow buried" mine is defined as one that is buried such that the top of the mine is even with the ground surface and uncovered.

-- **Test Procedure Note**: Test Numbers 2 and 3 will take place at the same time. The same detonation cord that links the six mines in test number 2 will also activate the single point in test 3.

-- Test Number 2 - Simultaneous detonation of six AP mines. Mines will be connected with detonation cord. Three mines will be shallow buried. The other three will be buried to a depth of one inch but will not be covered. Following application of LEXFOAM, inspect each mine and indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

AP mine test #2	PMD6	M14	M16
Shallow buried			
Buried 1", uncovered			

-- Comments on results of LEXFOAM test #2:

-- Test number 3. Purpose is to demonstrate ability to destroy multiple mines connected by LEXFOAM but detonated at one point. Test against three M14s (or equivalent plastic AP mine) arranged in a triangular pattern on the surface **with at least 3 meters separation between them**. Detonate at a single point and record LEXFOAM's success at destroying all three mines.

-- Test Number 4 - Simultaneous detonation of four AT mines. All mines will be metallic (TM46, TM62 or equivalent). Three mines will be shallow buried. The fourth mine will be buried at one inch, but uncovered. **Ensure separation between mines of at least five meters.** Following detonation, inspect each mine and indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

AT mine test	Mine1	Mine 2	Mine 3	Mine 4
Shallow buried				
Buried 1", uncovered				

4. Efficiency of dispenser:

Record or estimate how many mines was the operator able to neutralize before having to reload: ______

If solution remained in the dispenser at the end of the test, can you estimate how many mines could be neutralized before the system would have to be reloaded? _____

How long does it take to reload the system? _____

5. Questionnaire items (1 is the best rating):

LEXFOAM	1	2	3	4	5	6
1a. Quality of instructions, including evaluation of quantity of foam to apply						
1b. Comments on quality of operating instructions:						
2a. Ease of maintenance						
2b. Comments on ease of maintenance:						
3a. Ease of use						
3b. Comments on ease of use:						
4a. Safety						
4b. Comments regarding safety:						
5a. Human factors						
5b. Comments regarding human factors:						
6a. Overall suitability for humanitarian demining						
6b. Comments regarding overall suitability:						

6. Additional Comments and suggested improvements:

____
____
____
____
____
____

7. Note: The chemical composition of LEXFOAM is not part of on-site test data collection. A separate chemical analysis to address any safety or special transportation and storage requirements will be incorporated into the final test report and evaluation.

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Chemical Neutralization of Landmines

1. Test identification information:

Date: _____ Time: _____ Area: _________
Operator: ______________________________
Data Collector: ____________________________

2. Performance:

BURNING

Chemical System I (neutralization by autocatalytic decomposition of explosivesTNT and Comp. B):

AP mines: All mines are shallow buried. For the chemical neutralization test, shallow buried is defind as buried so that the top of the mine is level with the ground surface and uncovered. **Ensure separation between mines of at least three meters**. Ensure that each mine is flagged and sandbagged. Ensure that a C4 safety charge is placed on every mine. Following application, Indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

- $(C_2H_2)_2$ triamine in capsule form using Gun 1 against AP mines:

Record soil temperature just prior to beginning this test: ______

$(C_2H_2)_2$ triamine in capsule form using Gun 1						
Depth	Metallic M16 w/caps	Metallic M16 wo/caps	Plastic PMN2 w/caps	Plastic PMN2 wo/caps	Wood PMD-6 w/caps	Wood PMD-6 wo/caps
Shallow buried						
Shallow buried						

Additional observations or comments (key your comment to the matrix for clarity. For example, use "surface-wood" to make a comment on that specific test)

____
____
____
____
____

- $(C_2H_5)_2Zn$ in cartridge form using Gun 2 against AP mines:

Record soil temperature just prior to beginning this test: ______

$(C_2H_5)_2Zn$ in cartridge form using Gun 2						
Depth	Metallic M16 w/caps	Metallic M16 wo/caps	Plastic PMN2 w/caps	Plastic PMN2 wo/caps	Wood PMD-6 w/caps	Wood PMD-6 wo/caps
Shallow buried						
Shallow buried						

Additional observations or comments (key your comment to the matrix for clarity. For example, use "surface-wood" to make a comment on that specific test)

____

____

____

____

____

AT mines with Composition B and TNT: All mines are shallow buried. For the chemical neutralization test, shallow buried is defind as buried so that the top of the mine is level with the ground surface and uncovered. **Ensure separation between mines of at least five meters**. Ensure that each mine is flagged and sandbagged. Ensure that a C4 safety charge is under every mine. Test against 1 ea plastic, 1 ea wood and 2 ea metal mines. Indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

- $(C_2H_2)_2$ triamine in capsule form using Gun 1 against AT mines:

Record soil temperature just prior to beginning this test: ______

$(C_2H_2)_2$ triamine in capsule form using Gun 1				
Depth	Plastic M19 (Comp B)	Wood TMD44 (TNT)	Metallic TM46 (TNT) w/cap	Metallic TM46 (TNT) wo/cap
Surface				

Additional observations or comments (key your comment to the matrix for clarity).

____

____

Chemical Neutralization

- $(C_2H_5)_2Zn$ in cartridge form using Gun 2 against AT mines:

Record soil temperature just prior to beginning this test: ______

$(C_2H_2)_2$ triamine in capsule form using Gun 1				
Depth	Plastic M19 (Comp B)	Wood TMD44 (TNT)	Metallic TM46 (TNT) w/cap	Metallic TM46 (TNT) wo/cap
Surface				

Additional observations or comments (key your comment to the matrix for clarity).

____

____

____

____

DETONATION

Chemical System II (neutralization by deflation/detonation of explosive (RDX)):

This test will use six surface emplaced VS50 AP mines. All mines are shallow buried. For the chemical neutralization test, shallow buried is defind as buried so that the top of the mine is level with the ground surface and uncovered. **Ensure separation between mines of at least three meters**. Ensure that each mine is flagged and sandbagged. Following application, Indicate success in the following table by placing an "S" for a successful neutralization or a "U" for an unsuccessful attempt.

Record soil temperature just prior to beginning this test: ______

$BrFl_3$ in capsule and cartridge forms:

VS50 AP Mine	Capsule	Cartridge
Surface		
Surface		
Surface		

Additional observations or comments (key your comment to the matrix for clarity. For example, use "surface-wood" to make a comment on that specific test)

____

____

____

____

____

3. Questionnaire items (1 is the best rating):

Chemical Neutralization	1	2	3	4	5	6
1. Quality of instructions						
2. Comments:						
3. Ease of maintenance						
4. Comments:						
5. Ease of use						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Overall suitability for humanitarian demining						
12. Comments:						

4. Additonal comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mine Marking and Neutralization

Test identification information:

Event number:
Mine:
Date:
Time:
Operator:
Data Collector:
weather, temperature:

Time to dispense:
Time to begin to foam:
Time to begin to gel:
Time to non-tacky surface:
Time to hardening:
height:
diameter:
application process:
smoothness:
lift of mines:
adherence to mines:
lanyard:
neutralization test
destruction:
long term stability and color:
night visibility:
number of mines done at once:
notes and instructions: [safety, human factors, water testing, packaging, marking, glove size, etc.]

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Shaped Charges

1. Test identification information:

Date: _____ Time: _____
Operator: ________________________
Data Collector: ________________________

2. Performance:

Mine	Charge ID	Successful destruct (Y/N)	Fragmentation diameter (Y/N)

3. Questionnaire items (1 is the best rating):

Shaped Charges	1	2	3	4	5	6
1. Ease of use						
2. Comments:						
3. Safety						
4. Comments:						
5. Human factors						
6. Comments:						
7. Overall suitability for humanitarian demining						
8. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Modular Vehicle Protection

1. Test identification information:

Date: _____ Time: _____
Operator: ________________________
Data Collector: ________________________

2. Time to install vehicle armor kit: _____

3. Explosive testing:

   a. Underbody:

   - 1/2 lb TNT charge under right front tire:

   Describe damage to vehicle:

____
____
____

   Describe probable casualties:

____
____
____

   Describe repair and estimated time needed to return vehicle to operation:

____
____
____

   - 1/2 lb TNT charge under right rear tire:

   Describe damage to vehicle:

____
____
____

   Describe probable casualties:

____
____
____

Describe repair and estimated time needed to return vehicle to operation:

____

____

____

- M16A2 nine inches behind left front tire:

Describe damage to vehicle:

____

____

____

Describe penetration(s) (number and location):

____

____

____

____

Describe probable casualties:

____

____

____

Describe repair and estimated time needed to return vehicle to operation:

____

____

____

b. Off-route:

- POMZ-2M five meters from left side:

Describe damage to vehicle:

____

____

____

Describe penetration(s) (number and location):

____

____

____

____

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- POMZ-2M five meters from right side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- M16A2 five meters from left side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- M16A2 five meters from right side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- M18A1 five meters in front:

Describe damage to vehicle:

Describe penetration(s) (number and location):

____
____
____
____

Describe probable casualties:

____
____
____

Describe repair and estimated time needed to return vehicle to operation:

____
____
____

c. Optional AT test, if time and resources permit: Detonate one TM46 or 12 lbs of TNT under left front tire:

Describe damage to vehicle:

____
____
____

Describe probable casualties:

____
____
____

Describe repair and estimated time needed to return vehicle to operation:

____
____
____

4. Questionnaire items (1 is the best rating):

Modular Vehicle Protection	1	2	3	4	5	6
1. Ease of kit installation						
2. Comments:						
3. Kit adaptability to a wide variety of vehicles						
4. Comments:						
5. Maintainability degredation						
6. Comments:						
7. Vehicle operation not hampered by presence of kit						
8. Comments:						
9. Safety						
10. Comments:						
11. Human factors						
12. Comments:						
13. Overall suitability for humanitarian demining						
14. Comments:						

5. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Blast Protected Vehicle

1. Test identification information:

Date: ______ Time: ______
Operator: ________________
Data Collector: __________________

2. Time to install vehicle armor kit: _____

3. Explosive testing:

Underbody:

- 1/2 lb TNT detonation under left front tire:

Describe damage to vehicle:

____
____
____

Describe probable casualties:

____
____
____

Describe repair and estimated time needed to return vehicle to operation:

____
____
____

- 1/2 lb TNT detonation under right front tire:

Describe damage to vehicle:

____
____
____

Blast Protected Vehicle

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- 1/2 lb TNT detonation under left rear tire:

Describe damage to vehicle:

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- M16A2 detonation nine inches behind left front tire:

Describe damage to vehicle:

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- 1.5 lb TNT detonation under center (this will be the last underbody shot):

Describe damage to vehicle:

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

Off-route:

- POMZ-2M five meters from left side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

Blast Protected Vehicle

- POMZ-2M five meters from right side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- M16A2 five meters from left side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

Blast Protected Vehicle

- M16A2 five meters from right side:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

- M18A1 five meters in front:

Describe damage to vehicle:

Describe penetration(s) (number and location):

Describe probable casualties:

Describe repair and estimated time needed to return vehicle to operation:

____

____

____

4. Questionnaire items (1 is the best rating):

Blast Protected Vehicle	1	2	3	4	5	6
1. Ease of kit installation						
2. Comments:						
3. Kit adaptability to a wide variety of vehicles						
4. Comments:						
5. Maintainability degredation						
6. Comments:						
7. Vehicle operation not hampered by presence of kit						
8. Comments:						
9. Safety						
10. Comments:						
11. Human factors						
12. Comments:						
13. Overall suitability for humanitarian demining						
14. Comments:						

5. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mobile Training System

1. Test identification information:

Date: ______ Time: ______
Operator: ____________________
Data Collector: ____________________

2. Measurements of each component:
   Weight: ____
   Dimensions: _____

3. Obsevations and comments on system performance:

Time to learn to operate mine awareness database and support equipment:

____
____
____

Comments on adequacy of training material. Address quality and usefulness of presentation in English and each additional language (minimum of 3 other languages), any difficulties associated with training or system operation:

____
____
____

Set-up time: _____
Tear-down time: ___

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mini-Mine Detector

1. Test identification information:

Date: ______ Time: ______
Operator: ____________________
Data Collector: ____________________

2. Physical dimensions

Weight: ____

Dimensions, folded: ___
Operating Dimensions, unfolded: ____

3. Operate until batteries are drained -record endurance: _____

4. Detection Performance:

Area 1: Field

Mine Type	Depth	PSS/12 Performance	Mini-Mine Detector Performance
M14	Surface (cluster)		
M14	Surface (cluster)		
M14	Surface (cluster)		
M14	Surface (cluster)		
M14	Surface		
M14	Surface		
M14	2”		
M14	2”		
M14	4”		
M14	4”		
PMD6	Surface		
PMD6	Surface		
PMD6	2”		
PMD6	2”		
PMD6	4”		
PMD6	4”		
VS50	Surface		

Mini-Mine Detector

VS50	Surface		
VS50	2”		
VS50	2”		
VS50	4”		
VS50	4”		
TS50	Surface		
TS50	2”		
TS50	4”		
M16			
Val69			
TMD44	1”		
TMD44	6”		
TM62	1”		
TM62	6”		
M15	1”		
M15	6”		
VS 1.6			
VS 2.2			
M19	1”		
M19	6”		

Note: Calibration mines not included

Area 10: Urban

Mine Type	Depth	PSS/12 Performance	Mini-Mine Detector Performance
M14	Surface		
M14	Surface		
PMD6	Surface		
PMD6	Surface		
VS50	Surface		
VS50	Surface		
TS50	Surface		
M16			
Val69			
TMD44	1”		
TM62	1”		
M15	1”		
M19	1”		

4. Questionnaire items (1 is the best rating):

Mobile Training System	1	2	3	4	5	6
1. Two man carry						
2. Comments:						
3. User friendly (2)						
4. Comments:						
5. Ease of mounting to and removing containers from vehicle						
6. Comments:						
7. Ruggedness - support equipment shock mounted and environmentally housed - i.e. protected for transportation						
8. Comments:						
9. Transportability						
10. Comments:						
11. Effectiveness of training materials						
12. Comments:						
13. Safety						
14. Comments:						
15. Human factors						

Mobile Training System

Mobile Training System	1	2	3	4	5	6
16. Comments:						
17. Overall suitability for humanitarian demining						
18. Comments:						

5. Additional comments and Suggested improvements:

____

____

____

____

Mini-Mine Detector

Area 12: Farm

Mine Type	Depth	PSS/12 Performance	Mini-Mine Detector Performance
M14	Surface (cluster)		
M14	Surface (cluster)		
M14	Surface (cluster)		
M14	Surface (cluster)		
M14	Surface		
M14	Surface		
M14	2"		
M14	2"		
M14	4"		
M14	4"		
PMD6	Surface		
PMD6	Surface		
PMD6	2"		
PMD6	2"		
PMD6	4"		
PMD6	4"		
VS50	Surface		
VS50	Surface		
VS50	2"		
VS50	2"		
VS50	4"		
VS50	4"		
TS50	Surface		
TS50	2"		
TS50	4"		
M16			
Val69			
TMD44	1"		
TMD44	6"		
TM62	1"		
TM62	6"		
M15	1"		
M15	6"		
VS 1.6			
VS 2.2			
M19	1"		
M19	6"		

Mini-Mine Detector

Area 16: Sand

Mine Type	Depth	PSS/12 Performance	Mini-Mine Detector Performance
PMD6	Surface		
PMD6	2"		
PMD6	2"		
PMD6	4"		
VS50	Surface		
VS50	2"		
VS50	2"		
VS50	4"		
TS50	Surface		
TS50	2"		
M16			
Val69			
TMD44	6"		
TMD44	6"		
TM62	6"		
M15	6"		
M15	6"		
M19	6"		
M19	6"		

5. Questionnaire items (1 is the best rating):

Mini-mine Detector	1	2	3	4	5	6
1. Ruggedness						
2. Comments:						
3. Reliability						
4. Comments:						
5. Safety						
6. Comments:						
7. Human factors						
8. Comments:						
9. Overall suitability for humanitarian demining						
10. Comments:						

6. Additional comments and suggested improvements:

____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
<u>Extended Length Probe</u>

1. Test identification information:

Date: ______ Time: ______
Operator: __________________
Data Collector: ___________________

2. Performance:

Area	Indicated mine (Y/N)	Indicated non-mine (Y/N)	Actual mine (MineID)	Actual non-mine (Object Descr)

Extended Length Probe

3. Detonation:

Describe damage following blast from PMN or equivalent explosive force:

Extended Length Probe

4. Questionnaire items (1 is the best rating):

Extended Length Probe	1	2	3	4	5	6
1. Ruggedness						
2. Comments:						
3. Safety						
4. Comments:						
5. Human factors						
6. Comments:						
7. Overall suitability for humanitarian demining						
8. Comments:						

5. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Extended Length Weedeater

1. Test item identification:

Date: _____ Time: _____
Operator: ____________________
Data Collector: ______________________

2. Performance:

Measure distance from operator that weedeater clears: _______

Measure height of cut vegetation / grass: _____

Describe damage and repairability following excessive use:
____
____
____

3. Questionnaire items (1 is the best rating):

Extended Length Weedeater	1	2	3	4	5	6
1. Ease of repair						
2. Comments:						
3. Ability to cut thick wet grass and woodland vegetation						
4. Comments:						
5. Does the weedeater activate fuses from bounding mines?						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Overall suitability for humanitarian demining						
12. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mine Location Marker

1. Test identification information:

Date: _____ Time: _____
Operator: ____________________
Data Collector: ______________________

2. Performance:

Time to mount mine location marker to PSS/12: _____

Weight of PSS/12 with installed mine location marker: ______

Duration that mark remains on the ground: _____

Weather during 5 day period on and after application of mark:

____
____
____

Mine Location Marker

3. Questionnaire items (1 is the best rating):

Mine Location Marker	1	2	3	4	5	6
1. Interfere with operation or performance of the PSS/12						
2. Comments:						
3. Adaptability to any mine detector with an open center ring						
4. Comments:						
5. Safety						
6. Comments:						
7. Human factors						
8. Comments:						
9. Overall suitability for humanitarian demining						
10. Comments:						

4. Additional comments and suggested improvements:

____

____

____

____

____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Demining Kit

1. Test identification information:

Date: _____ Time: _____
Operator: ____________________
Data Collector: ______________________

2. Performance:

Describe ability of the cart's ability to hold the tools necessary for humanitarian deminers in various geographical demining situations:

____
____
____
____
____

Describe degree of ease or difficulty with which the demining cart can be manually moved in varying terrain:

____
____
____

Describe damage to cart armor following Valmari 69 blast:

____
____
____
____

3. Questionnaire items (1 is the best rating):

Demining Kit	1	2	3	4	5	6
Adequacy of mounting instructions						
1. Comments:						
2. Effective fit of items into demining cart						
3. Comments:						
4. Safety						
5. Comments:						
6. Human factors						
7. Comments:						
8. Overall suitability for humanitarian demining						
9. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Explosion Container

1. Test identification information:

Date: _____ Time: _____
Operator: ______________________
Data Collector: ________________________

2. Performance:

Measurements:
Height _____
Weight _____

Explosive testing: For each detonation, describe the damage, if any, to the simulated high value target near the blast and fragment container. For detonations involving fragmentation mines, also inspect the area around a reasonable distance from the container to determine if any large fragments escaped the container. Include the results of this search in the comments.

Blast mine detonation 1:

____
____
____
____

Blast mine detonation 2:

____
____
____
____

Blast mine detonation 3:

____
____
____
____

Explosion Container

Blast mine detonation 4:

Blast mine detonation 5:

Fragmentation mine detonation 1:

Fragmentation mine detonation 2:

Explosion Container

3. Questionnaire items (1 is the best rating):

Explosion Container	1	2	3	4	5	6
1. Safety						
2. Comments:						
3. Human factors						
4. Comments:						
5. Overall suitability for humanitarian demining						
6. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Berm Processing Assembly

1. Test item identification:

Date: _____ Time: _____ Pass number: _____
Operator: ____________________
Data Collector: ______________________

2. Performance:

- Installation:

Time to install the Berm Processing Assembly onto the host vehicle: _____

Did the attachement require any special tools, or lift equipment heavier than a commercial light recovery vehicle's boom and winch (y/n or comments):

____
____
____

- Time:

Clearance time for clearing vehicle without BPA: _____
Clearance time for clearing vehicle with BPA: _____

Evaluate the feasibility of attaching the BPA, a mine clearing blade (address both side and front attached blades), and the vehicle towed roller to the same host vehicle. The intent of this portion of the demonstration is to determine whether one or multiple host vehicles better support the demining mission.

____
____
____
____
____
____
____
____

Berm Processing Assembly

- Clearance performance:

How many mines did the BPA remove from the berm? _____

Did the BPA place all removed AT, unexploded AP and UXO on top of the ground, clearly visible, in the cleared lane?

____

____

3. Questionnaire items (1 is the best rating):

Berm Processing Assembly	1	2	3	4	5	6
1. Ease of Installation						
2. Comments:						
3. Ease of Operation						
4. Comments:						
5. Interoperability with MCB and vehicle towed roller						
6. Comments:						
7. Adequacy of installation instructions						
8. Comments:						
9. Reliability						
10. Comments:						
11. Safety						
12. Comments:						
13. Human factors						

Berm Processing Assembly

Berm Processing Assembly	1	2	3	4	5	6
14. Comments:						
15. Overall suitability for humanitarian demining						
16. Comments:						

4. Additional comments and suggested improvements:

____

____

____

____

____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mine Clearing Blades

1. Test identification information:

Date: _____ Time: _____ Pass number: _____
Rake (check if this test applies to the rake): _____
Confined area blade (check if this test applies to the confined area blade): _____
Operator: ____________________
Data Collector: ______________________

2. Performance:

- Installation and host vehicle interface

a. Blade weight (confined area design): _____

b. Can the MCB be attached to the host vehicle without the use of special tools (y/n and comments)? Special tools are defined as those that are proprietary or cannot be found or fabricated in a humanitarian demining environment.

____
____
____
____

c. How many people did it take to attach the rake? _____
d. How many people did it take to attach the confined area blade? _____

e. Can the MCB be attached to the host vehicle in lieu of or attached to the platform's earth moving blade:

Rake _____ Confined area blade _____
Comments: ____

____
____
____
____

Mine Clearing Blades

- Clearance performance:

a. Use separate clearance performance form to record actual performance. This section provides space to record general observations and comments on how well the MCB performed.

____
____
____
____
____
____

b. Comment on the MCB's ability to clear without exceeding the allowable combined capability of the tractors normal load and the blade dead load:

____
____
____
____

c. After the MCB clears a given area, how large, if any, is the berm that remains to the side of the cleared area? The intent to this item is to determine the extent of berm demining necessary following clearance with blades.

____
____
____

d. Describe how the MCBs affect the AP mines that they encounter (i.e. do they detonate them or push them deeper or push them into berms). The intent is to determine the most appropriate method to clear any residual AP mines that remain after the blades clear the AT mine population.

____
____
____
____

e. By observing the performance of the MCBs, estimate their clearance speed in acres per day: ______

- Maintainability: From inspection and observation during the test, provide comments on how easy or difficult it should be to maintain the mine clearing blade in the humanitarian demining environment.

____
____
____
____

Mine Clearing Blades

3. Questionnaire items (1 is the best rating):

Mine Clearing Blades	1	2	3	4	5	6
1. Ease of Installation						
2. Comments:						
3. Ease of Operation						
4. Comments:						
5. Ability to expand width of initial cleared lane with consecutive passes						
6. Comments:						
7. Interoperability with BPA and vehicle towed roller						
8. Comments:						
9. Safety						
10. Comments:						
11. Human factors						
12. Comments:						
13. Overall suitability for humanitarian demining						
14. Comments:						

4. Additional comments and suggested improvements:

Clearance Performance

Mine Pop. At Start	Mine Pop. After Pass
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________
____________	____________

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
<u>Grapnels</u>

Light Grapnel

1. Test indentification information:

Date: _____ Time: _____
Operator: ________________________
Data Collector: __________________________

2. Performance:

Number of trip wires and firing wires installed: _____ (if this is not the first pass, this number would be the number of trip wires remaining in place in the lane following the previous pass. Use the lane map to record tripwire data (location and height of installed trip wires, and the results)

Number of trip wires and firing wires cleared: _____

Launch distance: _____

Number of light grapnel retrieval attempts: _____
Number of successful light grapnel retrievals: _____

Grapnels

3. Questionnaire items (1 is the best rating):

Light Grapnel	1	2	3	4	5	6
1. Ability to set launcher angle to adjust throwing distance and to clear obstacles						
2. Comments:						
3. Winch mechanism performance						
4. Comments:						
Light grapnel directiona accuracy via pointing cart						
5. Comments:						
6. Ability of electric motor to retrieve grapnel through high grass and rocky terrain wihout stalling						
7. Comments:						
8. Safety						
9. Comments:						
10. Human factors						
11. Comments:						
12. Overall suitability for humanitarian demining						
13. Comments:						

Grapnels

4. Additional Comments and suggested improvements:

Heavy Grapnel

1. Test item indentification:

Date: _____ Time: _____ Pass Number: _____
Operator: ________________________
Data Collector: __________________________

2. Performance:

Number of trip wires and firing wires installed: _____ (if this is not the first pass, this number would be the number of trip wires remaining in place in the lane following the previous pass. Use the lane map to record tripwire data (location and height of installed trip wires, and the results)

Number of trip wires and firing wires cleared: _____

Comments on trip wire and firing wire clearence performance:

____
____
____

Launch distance: _____

Grapnels

3. Questionnaire items (1 is the best rating):

Heavy Grapnel	1	2	3	4	5	6
1. Ease of attachment to launch mechanism						
2. Comments:						
3. Winch mechanism performance						
4. Comments:						
5. Obstacle self-extraction ability						
6. Comments:						
7. Heavy enough to stay on ground through light brush and foilage						
8. Comments:						
9. Performance at various angles						
10. Comments:						
11. Safety						
12. Comments:						
13. Human factors						
14. Comments:						
15. Overall suitability for humanitarian demining						
16. Comments:						

Grapnels

4. Additional comments and suggested improvements:

Grapnels

Trip and firing wire detection (use for heavy and light grapnels and handheld tripwire detector: Lane is 20' wide and 100' long. Mark trip wire locations and heights prior to start of test. For passes after the first pass, start with the trip and firing wire populations that remain after the last pass. Use the space below to record results.

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Handheld Trip Wire Detector

1. Test item identification:

Date: _____ Time: _____
Operator: __________________
Data Collector: ___________________

2. Performance:

Use the map found in the grapnel data collection section to record the installation and performance of the handheld trip wire detector. Information for each wire must include location, height, where attached (tree, structure, loose in grass, etc) For each trip wire found, annotate on the map the following data at a minimum:

Tripped by operator: _____
Did the handheld detector cause a detonation: _____
Detected by handheld detector: _____
Distance in front of operator: _____
Height: _____
Over obstruction: _____
Loose wire in grass: _____
Detected by:
Wire: _____
UV: _____
IR: _____

3. Questionnaire items (1 is the best rating):

Handheld Trip Wire Detector	1	2	3	4	5	6
1. Safety						
2. Comments:						
3. Human factors						
4. Comments:						

Handheld Trip Wire Detector

Handheld Trip Wire Detector	1	2	3	4	5	6
5. Overall suitability for humanitarian demining						
6. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Vehicle Towed Roller

1, Test identification information:

Date: _____ Time: _____ Pass Number: _____
With MCB: _____
Without MCB: _____
Operator: ____________________
Data Collector: ____________________

2. Performance:

Installation and automotive:

Time to install roller assembly onto host vehicle: _____
Describe effort involved to install given the humanitarian demining environment:

____
____
____

How many hours can the vehicle towed roller be operated between lubrication and scheduled maintenance? Include comments, if desired, on maintainability in the humanitarian demining environment.

____
____
____

Based on the effort required to repair the vehicle towed roller after each survivability test detonation, assess repairability (especially roller wheel replacement). If desired, include recommendations for improvement.

____
____
____
____
____

Mine Clearing performance:

Use the schematic diagram for the vehicle towed roller test to annotate mines cleared by the roller.

Vehicle Towed Roller

mines present at start of test: _____ For the second and any subsequent passes, all mines will be reset.

mines activated: _____

Survivability: The vehicle towed roller will be subjected to 10 detonations equivalent to a PMN AP mine. After each detonation, data collectors will describe the damage.

Damage following 1st PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 2nd PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 3rd PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 4th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 5th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 6th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Vehicle Towed Roller

Damage following 7th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 8th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 9th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following 10th PMN equivalent detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

Damage following a bounding fragmentation mine (M-16A2) detonation (include appraisal as to whether the roller is still able to continue its mission):

____

____

____

3. Questionnaire items (1 is the best rating):

The purpose of item 1 is to determine if the host vehicle and attached vehicle towed roller can back out of a mined area without requiring people to enter the area to reconfigure the roller.

Vehicle Towed Roller	1	2	3	4	5	6
1. Ability of roller to be turned and reversed without requiring reconfiguration						
2. Comments:						
3. Safety						
4. Comments:						
5. Human factors						
6. Comments:						
7. Overall suitability for humanitarian demining						
8. Comments:						

4. Additional comments and suggested improvements:

____
____
____
____
____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Towed Light Roller

1. Test Item Identification:

Date: _____ Time: _____ Pass Number: _____
Operator: ______________________
Data Collector: ______________________

2. Performance:

Installation and automotive:

Time to install roller assembly onto host vehicle or animal: _____
Describe effort involved to install given the humanitarian demining environment:

____
____
____

Are anchors for pully (block and tackle) components dislodged during use (y/n): _____

Comments:

____
____
____

Can the roller reverse direction without changing the configuration of the towing harness (y/n): _____

Comments:

____
____
____

Can the pully assemblies be moved to new anchor locations without any reconfiguration of the roller hardware (y/n): _____

Comments:

____
____
____

Towed Light Roller (Swamp Buggy)

Can the roller track the path designated by the return tow lines (y/n): _____

Comments:

____

____

____

____

Mine Clearing performance:

Use the schematic diagram for the towed light roller test to annotate mines activated by the roller.

mines present at start of test: _____ For the second and any subsequent passes, all mines will be reset.

mines activated: _____

Survivability: The vehicle towed roller will be subjected to five M14 detonations and 10 detonations equivalent to a PMN AP mine. After each detonation, data collectors will describe the damage.

Damage following 1st M14 detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____

____

____

Damage following 2nd M14 detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____

____

____

Damage following 3rd M14 detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____

____

____

Towed Light Roller (Swamp Buggy)

Damage following 4th M14 detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

Damage following 5th M14 detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

Damage following 1st PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

Damage following 2nd PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

Damage following 3rd PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

Damage following 4th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

Towed Light Roller (Swamp Buggy)

Damage following 5th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____
____
____

Damage following 6th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____
____
____

Damage following 7th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____
____
____

Damage following 8th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____
____
____

Damage following 9th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____
____
____

Damage following 10th PMN equivalent detonation (include appraisal as to whether the damage is limited to the area of contact, whether a towing animal would have been hit and whether the roller is still able to continue its mission):

____
____
____

Towed Light Roller (Swamp Buggy)

Repair of damage:

Time to replace damaged components: _____

Tools and people required to replace roller wheels:

____

____

____

____

3. Questionnaire Items (1 is the best rating):

Towed Light Roller	1	2	3	4	5	6
1. Safety						
2. Comments:						
3. Human factors						
4. Comments:						
5. Overall suitability for humanitarian demining						
6. Comments:						

4. Additional comments and suggested improvements:

____

____

____

____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Mobile Video and Light System

1. Test Identification information:

Date: _____ Time: _____ Area Number: _____
Operator: ________________________
Data Collector: ________________________
Weather conditions:

____

____

2. Performance:

Entry no.	Object ID (mine or tripwire)	Mine type	Depth	Sensor(s) used (IR, UV, white light)

Address the ability of the MVLS to detect mines in the following situations:

In holes:

____

____

Mobile Video and Light System (MVLS)

Under obstacles:

____

____

Hard to reach areas:

____

____

High grass:

____

____

Around corners:

____

____

Address the ability of the MVLS to detect trip wires in the following situations:

In holes:

____

____

Under obstacles:

____

____

Hard to reach areas:

____

____

High grass:

____

____

Around corners:

____

____

Max range of radio communication system: _____

Mobile Video and Light System (MVLS)

3. Questionnaire items (1 is the best rating):

Mobile Video and Light System	1	2	3	4	5	6
1. How effective is the radio communications system between the operator and the control station?						
2. Comments:						
3. How high is the video quality at the remote control station?						
4. Comments:						
5. How comfortable and easy to operate is the MVLS?						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Overall suitability for humanitarian demining						
12. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Command Communications Video and Light System

1. Test Item Identification:

Date: _____ Time: _____ Area Number: _____
Operator: ___________________________
Data Collector: ___________________________
Weather conditions:
____
____

2. Performance:

Entry no.	Object ID (mine or tripwire)	Mine type	Depth	Sensor(s) used (IR, UV, white light)

Address the ability of the CCVLS to detect mines in the following situations:

In holes:
____
____

Command Communications Video and Light System (CCVLS)

Under obstacles:

____

____

Hard to reach areas:

____

____

High grass:

____

____

Around corners:

____

____

Address the ability of the CCVLS to detect trip wires in the following situations:

In holes:

____

____

Under obstacles:

____

____

Hard to reach areas:

____

____

High grass:

____

____

Around corners:

____

____

Max range of radio communication system: _____

Command Communications Video and Light System (CCVLS)

3. Questionnaire items (1 is the best rating):

Command Communications Video and Light System (CCVLS)	1	2	3	4	5	6
1. How effective is the radio communications system between the operator and the control station?						
2. Comments:						
3. How high is the video quality at the remote control station?						
4. Comments:						
5. How comfortable and easy to operate is the CCVLS?						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Overall suitability for humanitarian demining						
12. Comments:						

4. Additional comments and suggested improvements:

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
Side Scan Sonar

1. Test Item Identification:

Date: _____ Time: _____ Area Number: _____
Operator: ___________________________
Data Collector: ___________________________
Weather conditions:
____
____

2. Performance:

Entry no.	Mine type	Depth	Diameter

3. Questionnaire items (1 is the best rating):

Side Scan Sonar	1	2	3	4	5	6
1. How severe is interface, if any, when attachd to floating collar?						
2. Comments:						
3. Can the side scan sonar be adequately moved with 15-30 foot tube?						
4. Comments:						
5. How rugged is the side scan sonar given the humanitarian demining environment?						
6. Comments:						
7. Safety						
8. Comments:						
9. Human factors						
10. Comments:						
11. Overall suitability for humanitarian demining						
12. Comments:						

4. Additional Comments and suggested improvements:

____

____

____

____

Data Collection Form

Humanitarian Demining Operational Capabilities Demonstration and Test

K-9 Leashed / Free Roaming

1. Test item identification:

Date: ___________ Time: ___________

Operator: ___________________

Data Collector: _____________

2. Performance:

Entry Number	Location of marker placed at location of alert animal's head	Actual location of mine as determined by detectors or survey

K-9 Leashed / Free Roaming

Describe the actions of the alerted animal when the handler approaches it:

____

____

____

Describe how the animal reacts when the mine marker is emplaced:

____

____

____

Describe how the animal reacts when the mine detector operator approaches:

____

____

____

Which direction does the animal take when returned to search mode?

- Away from the mine: ______
- In the path of the mine: ______

- How controllable is the animal during egress from the mine?

  Controlled: _____
  Tugging at leash: _____
  Playful, jumping etc: _____

3. Additional comments and suggested improvements:

____

____

____

Data Collection Form
Humanitarian Demining Operational Capabilities Demonstration and Test
K-9 "Checkmate"

1, Test item identification:

Date: ___________ Time: ___________
Operator: ____________________
Data Collector: ______________

2. Performance:

Remote placement of sensors:

Sample Collection Box ID #	GPS Location	First Dog	Second Dog

Manportable Backpack:

Sample Collection Box ID #	GPS Location	First Dog	Second Dog

Vehicle:

Sample Collection Box ID #	GPS Location	First Dog	Second Dog

For free running dogs:

Sample Collection Box ID #	Dog Alert (y/n)

Describe the actions of the alerted animal when the handler approaches it:

____

____

____

Describe how the animal reacts when the mine marker is emplaced:

____

____

____

Describe how the animal reacts when the mine detector operator approaches:

____

____

____

Which direction does the animal take when returned to search mode?

- Away from the mine: ______
- In the path of the mine: ______

- How controllable is the animal during egress from the mine?

  Controlled: _____
  Tugging at leash: _____
  Playful, jumping etc: _____

3. Additional comments and suggested improvements:

____

____

____

____

____

Appendix L: Radio Frequency Authorization

AMSEL-RD-NV-ME 5 Oct 1995

MEMORANDUM FOR RECORD

SUBJECT: Radio Frequencies Authorization at Fort A. P. Hill

1. Reference: Phone conversation between Jason Regnier, NVESD, and Mr. Charlie Osborne, Ft. A. P. Hill DOIM Frequency Authorization, 13 June 1995.

2. Reference: MEMORANDUM FOR RECORD, SUBJECT: Radio Frequencies Authorization at Fort A. P. Hill, 2 Oct 1995.

3. The following frequencies were inadvertently left off the list from yesterday. NVESD would like to request them also for the period of 16 October to 1 December 1995.

72.4 MHz, 10 milliwatts, FM, bandwidth 3 KHz
72.72 MHz, 10 milliwatts, FM, bandwidth 3 KHz

4. Attached is the entire list of frequencies requested.

5. The point of contact for this action is Mr. Jason Regnier, (703) 704-2438, fax (703) 704-2432.

JASON REGNIER
Electrical Engineer
Environmental Systems Branch

US ARMY CECOM
NIGHT VISION DIRECTORATE
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jregnier@belvoir.army.mil

AMSEL-RD-NV-ME 5 Oct 1995

US ARMY CECOM Night Vision and Electronic Sensors Directorate request for radio frequencies authorization at Fort A. P. Hill from 16 October to 1 December 1995.

30.4 MHz, 6 watts, FM, bandwidth 20 KHz
30.45 MHz, 6 watts, FM, bandwidth 20 KHz
72.4 MHz, 10 milliwatts, FM, bandwidth 3 KHz
72.72 MHz, 10 milliwatts, FM, bandwidth 3 KHz
139.0125 MHz, 2 watts
169.7 MHz, 2.5 watt, FM
403 MHz, 4 watts, 10 KHz
403 MHz, 4 watts, 10 KHz
905.050 MHz, 10 mW, FSK, bandwidth 40 KHz
905.150 MHz, 10 mW, FSK, bandwidth 40 KHz
905.350 MHz, 10 mW, FSK, bandwidth 40 KHz
905.850 MHz, 10 mW, FSK, bandwidth 40 KHz
908.550 MHz, 10 mW, FSK, bandwidth 40 KHz
908.750 MHz, 10 mW, FSK, bandwidth 40 KHz
915 MHz, 4 watts, 12 MHz RF Video link 1
923.050 MHz, 10 mW, FSK, bandwidth 40 KHz
923.150 MHz, 10 mW, FSK, bandwidth 40 KHz
923.350 MHz, 10 mW, FSK, bandwidth 40 KHz
923.800 MHz, 10 mW, FSK, bandwidth 40 KHz
926.550 MHz, 10 mW, FSK, bandwidth 40 KHz
926.750 MHz, 10 mW, FSK, bandwidth 40 KHz
945 MHz, 4 watts, 12 MHz RF Video link 2
1708.0 MHz, 2 watts
1720 MHz, 1 watt, FM, bandwidth 6 MHz
1765 MHz, 1 watt
1810 MHz, 1 watt, FM, bandwidth 6 MHz
1815 MHz, 1 watt
1870 MHz, 0.025 watt

*1000 MHz to 3550 MHz, 128 steps of 20 MHz step size, 2 watts, ground penetrating radar, shielded and aimed at the ground

The point of contact for this action is Mr. Jason Regnier, (703) 704-2438, fax (703) 704-2432.

US ARMY CECOM
NIGHT VISION DIRECTORATE
ATTN AMSEL-RD-NV-CD-ES JASON REGNIER
10221 BURBECK RD SUITE 430
FORT BELVOIR VA 22060-5806

OAO	139.0125 MHz data link at two watts	
	1708.0 MHz video at two watts	

SAIC 1720 MHz, 1 watt, FM, bandwidth 6 MHz
1810 MHz, 1 watt, FM, bandwidth 6 MHz
range 905 -927 MHz 905.050 MHz, 10 mW, FSK
905.150 MHz, 10 mW, FSK
905.350 MHz, 10 mW, FSK
905.850 MHz, 10 mW, FSK
908.550 MHz, 10 mW, FSK
908.750 MHz, 10 mW, FSK
923.050 MHz, 10 mW, FSK
923.150 MHz, 10 mW, FSK
923.350 MHz, 10 mW, FSK
923.800 MHz, 10 mW, FSK
926.550 MHz, 10 mW, FSK
926.750 MHz, 10 mW, FSK

COLEMAN 403 MHz, 4 watts, 10 KHz RF Modem 1
403 MHz, 4 watts, 10 KHz RF Modem 2
915 MHz, 4 watts, 12 MHz RF Video link 1
945 MHz, 4 watts, 12 MHz RF Video link 2
*1000 MHz to 3550 MHz, 128 steps of 20 MHz step size, 2 watts, ground penetrating radar, shielded and aimed at the ground

IET 169.7 Mhz, 2.5 watt, FM
1720 MHz, 1 watt
1765 MHz, 1 watt
1815 MHz, 1 watt
1870 MHz, 0.025 watt

Mini-Flail 72.4 MHz, 10 milliwatts, FM, bandwidth 3 KHz
72.72 MHz, 10 milliwatts, FM, bandwidth 3 KHz

Microwave Transmitters (Hap)

hand held 30.4 MHz, 6 watts, FM, bandwidth 20 KHz
30.45 MHz, 6 watts, FM, bandwidth 20 KHz