Humanitarian Demining Program
2010

HD R&D Program Objectives

Develop, Demonstrate, and Validate Technologies for Use in Humanitarian Demining

Assess Existing Technologies
- Global commercial-off-the-shelf (COTS) equipment
- Equipment used by international demining organizations

Develop New Technologies
- Integrated mature technologies (e.g., sifting implements)
- Modified commercial equipment as needed
- Unique technology if necessary

Demonstrate Technologies to the International Demining Community
- Technical testing in US & in-country
- Biennial requirements workshop

Transition Technologies Into the Field
- Operational field evaluation

Develop, demonstrate, and validate
Resources

Experienced Personnel
- Engineers (Electrical, Mechanical, Test)
- Physical scientists
- Logisticians
- Expatriate technicians

NVESD Facilities
- 56,000 square foot fabrication facility
- Full electronics shop
- 3D modeling lab
- Machining equipment

Personnel and facilities to build it and field it

Requirements Generation

Biennial workshop
- Solicit presentations of technology needs and demonstrate HD R&D equipment at test site
- Attended by U.S. government entities (HDTC, COOMS, DOS); mine action centers (MAC); non-government organizations (NGO)

User needs drive research
Requirements Generation

Field Assessment

- Request for formal assessment made by MAC, NGO, host nation, or through US Embassy/MILGP
- HD team visits proposed sites, assesses terrain, logistics capacity, and landmine types
- HD team recommends most appropriate technology

*Host nation is a full partner in the program*

Requirements Generation

Field Assessments in FY10

- **Angola**
- **Colombia**
- **Ecuador**
- **Armenia**
- **Senegal**
- **Sri Lanka**
1. Deployment Decision

Upon DoD’s approval of formal request from host nation/NGO, OFE planning begins:
- Prepare a Memorandum of Understanding and Logistics Support Agreement
- Establish an evaluation plan
- Identify training, spares and technical support
- Pack and ship equipment

Host nation develops an ‘organic’ demining capability

2. Primary Evaluation

- Equipment arrives in country and is transported to training/operational area
- Host nation’s operators are trained
- Test and evaluation is executed to determine system’s effectiveness
- SOPs are developed

Working with the host nation
Environmental Challenges
Performance
Reliability
Survivability

Intensive monitoring of new technologies

User Feedback and Analysis
User provides monthly reports to DOD on system performance
- Time worked
- Area cleared
- Mines/UXO found or destroyed
- Failures and necessary repairs
- Fuel consumption
- Operational costs

Technology Assistance
HD R&D’s Commitment
- **Shipment** of equipment to training site/operations site
- Operator **training** (2-4 weeks)
- Periodic site visits – **technical/repair support**
- **Spare & repair parts**
- Return shipment to U.S. upon end of evaluation

User’s Commitment
- **Monthly reports** and periodic email/phone communications
  - Engine hours, fuel consumption, area cleared, mines/UXO found, faults, repairs made or needed, requests for spares, SOP feedback, etc
- **Personnel** – operator, management, maintenance support
- **Fuel, lubricants**
- **Transport among sites in-country**, as required
Technology Development Areas

**UXO/Mine Detection**

**Neutralization**

**Area Preparation**

**UXO/Mine Clearance**

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**Mine and UXO Detection**

- Handheld
- Man-Portable
- Vehicular

**Challenges to Meet:**

- Location/Logistics
- Environment
  - Terrain
  - Soil
  - Vegetation
  - Clutter
- Mine/UXO threats
  - Depth
  - Density
  - Low-metallic
Mechanical Assistance for Mine and UXO Clearance

- Area Preparation
- Mechanical Clearance

Challenges to Meet:
- Logistics/infrastructure
- Level of information
- Environment
  - Terrain
  - Soil
  - Vegetation
  - Clutter/obstacles
- Mine/UXO threats
  - Depth
  - Density
  - AP, AT, UXO

There is No Single Solution to the Mine/UXO Problem!
A multi-layered "System of Systems" approach is needed.

Area Preparation

Applications:
- Vegetation removal to provide access to suspect mine areas
- Ground preparation for manual deminers
- Surface metal clutter removal
- Obstacle removal

**Small**
- < 10 tons
- Cuts Brush & Small Trees up to 6 cm

**Medium**
- 10-15 tons
- Cuts Brush & Trees up to 20 cm

**Large**
- > 15 tons
- Cuts Brush and Large Trees

Mechanical Mine Clearance

Mine Removal:
- Rotary Mine Comb, Sifting & Crushing

Area Reduction and Quality Assurance:
- Tillers, Flails, Rollers, Heavy Detonation Trailer


FY10 Operational Field Evaluations (OFEs)

- Iraq: Sifting Technology
- Tajikistan: Mini MineWolf
- PR - Vieques: Mini MineWolf
- Sri Lanka: AP Rollers, Improved Backhoe
- Ecuador: Long Tools, Sifting/Crushing
- Chile: Air Spade, Multi-Tool Excavator
- Angola: Air Spade, Detonation Trailer, HSTAMIDS, JCB Loadall, RMC
- Cambodia: Badger, Explosive Harvesting, HSTAMIDS (3 orgs), Long Tools, MAXX+, Sifting Buckets, Storm, Tempest
- Thailand: Air Spade, Beaver, Beaver, Peco Cutter, SDTT, Tempest, Uni-Disk
- Vietnam: Large Loop, MDA, Shinn/Birdseye Cutters, Walking Tractor

40 Systems in 10 Countries
**OFE: Rotary Mine Comb - Angola**

The Rotary Mine Comb is a dozer-mounted system capable of extricating buried AT mines from the soil and pushing them to the side of the vehicle’s path.

- Many mines in region are plastic-cased—virtually undetectable

**RESULTS:**
- 29 km of suspect road combed
- 116,463 m² total area cleared
- 43 AT mines found
- 7 AP mines found

**OFE: Multi-Tooled Excavator - Chile**

The Multi-Tooled Excavator is a 20-ton excavator that extracts deeply buried mines with special COTS digging and sifting attachments.

**RESULTS:**
- 20,400 m³ cleared in AP-mined riverbed
- 2348 m³ cleared in mixed AP/AT riverbed
  - Recovered 28 AT mines, 36 AP mines
  - 2–4 meter burial depths
  - 1 AT mine detonated with no damage to machine or operator (only digging tool)
- Projected completion early 2011

- AP minefield on Bolivian border in northern Chile
- Operations in the Escritos AP/AT riverbed conducted at night due to proximity to major highway
**OFE: Long Tools - Ecuador**

The Long Tools are hand-held vegetation removal tools used to cut access routes in remote mountain jungles on the Ecuador-Peru border. Hand-held tools are easier to maintain and transport than larger machines.

**RESULTS:**
- 2,359 m² cleared
- Clears 22 m²/hour in this environment

**OFE: Sifting Technology - Iraq**

MAG-Iraq is evaluating COTS and custom sifting equipment to improve the speed and efficiency of technical survey and clearance in AP and UXO contaminated areas.

**Tasks:** Locating pattern mine belts and extracting deep buried targets

**RESULTS:**
- 60,000 m² land cleared
- 75,000 m³ soil volume sifted
- 1,500 AP mines and UXO items found
  - SB33, Type72A, VSSO, V69, Mortars, Grenades, Detonators.
HALO-Afghanistan is evaluating COTS sifting equipment to assist in clearance of deeply buried AP mines and UXO where manual clearance would be impractical.

Tasks: Extracting deep buried mines and UXO covered by sand or building rubble, and working in confined spaces

RESULTS:
- 750,443 m² land cleared
- 125,328 m³ soil sifted
- >21,000 AP mines and UXO cleared

Beaver and Peco are two small-sized, remote-controlled vegetation cutting technologies.

RESULTS:
- > 430,000 m² cleared
OFE: Uni-Disk & SDTT - Thailand

Uni-Disk is an armored 25 ton commercial excavator used in heavy wooded and hard-to-reach areas for area preparation.
- Attachments include Rotar Bucket, Shinn Mulcher and Digging Bucket

**RESULTS:** Has been working with Tempest and SDTT since '01
- Cleared 6.3 million m² of heavy vegetation in eastern Thailand

Survivable Demining Tractor & Tools is a modified tractor with a suite of area preparation and area reduction attachments.
- Attachments include grapple, cultivators, rollers, buckets, etc.

**RESULTS:** Has been working with Uni-Disk & Tempest since '01
- Cleared 6.3 million m² of heavy vegetation in eastern Thailand

**Improved area clearance by 70%**

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OFE: HSTAMIDS - Cambodia

Handheld dual-sensor that combines metal detection and GPR, allowing operators to discriminate mine-like objects from metallic clutter.

First humanitarian fielding of true Mine Detector
- Of 5.8 million total detections, ≈95% are declared "Clutter"
- Of the "Mine" calls, 1 out of 20 is a mine, versus 1 out of 360 without discrimination
- "Clutter" is rapidly investigated as QA, improving productivity. Typical manual excavation ≈ 10-15 minutes vs. rapid excavation ≈ 1 minute
- Revolutionized demining SOPs

<table>
<thead>
<tr>
<th>Dates</th>
<th>Area Searched (m²)</th>
<th>Mine Calls</th>
<th>Clutter Calls</th>
<th>Total Detections</th>
<th>Clutter Rejection (%)</th>
<th>Mines Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar '06-Jul '10</td>
<td>2,501,358</td>
<td>314,664</td>
<td>5,494,948</td>
<td>5,809,612</td>
<td>94.58%</td>
<td>16,135</td>
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**OFE: STORM - Cambodia**

STORM is a commercial excavator designed to remove vegetation and sift AP mine-laden soil. Four spider-like legs provide maneuverability in rough and steep terrain.

- Cleared trenches, and former military defense positions previously inaccessible by machines.

**RESULTS:** Since Feb '09

- 9,965 m$^2$ area cleared
- 159 mines and 30 UXO found

**OFE: Maxx Plus - Cambodia**

Maxx+ is a small, remote controlled, excavator-based system that clears medium vegetation and sifts mine-laden berms and other soil in areas that manual clearance teams cannot work.

**RESULTS:**

- Processed 16,878 m$^3$ of soil
- 165 AP mines found
  - Type 69 and 72, PMD6
- 115 UXO found
  - RPG, Grenade, Mortar
RESULTS: Since Mar ’10
• 4220 m² Vegetation Removed
• 1102 m³ Soil Volume Sifted, Averaging 50 cm depth
• 83 AP mines, and 5 UXO items found
  • MD82B, Type72A, Type69, POMZ2M,
  • 60mm Mortars, Grenades, BK82mm, RPG2

Tasks: Clears vegetation off of soil berms and sifts for AP mines and UXO

OFE: Explosive Harvesting System - Cambodia

System removes explosives from stockpiled AT mines and high explosive projectiles to be recast into cost-effective disposal charges for in-situ mine & UXO neutralization
- Continue to develop specialized charges for case disruption and non high order alternatives for large bombs
- OFE initiated in 2005

Results as of Aug ’10:
- Ordnance processed: 5,750
- Total scrap metal recovered: 42,282 kg
- Total explosive recovered: 15,751 kg
- Total charges distributed: 170,741
  - CMAC 111,853
  - HALO 54,674
  - MAG 4,214

Win-Win.
✓ Stockpiles reduced
✓ Expensive, imported explosives no longer required
Mini MineWolf OFE - Tajikistan

Mini MineWolf is a remote tilling system that can rapidly reduce mine suspect areas by physically destroying mines, with capacity to survive multiple AP mine blasts.

Results: Jun – mid-Aug '10
- 56,000 m² cleared
- Found/destroyed:
  - 16 AP blast mines
  - 2 AP frag mines (OZM-72)
  - 16 ML7 booby traps

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