The PECO Wolverine: Evolution of a Demining Area-preparation Tool

This article discusses the development of an essential mine-action tool: a preparation system for demining areas thick with vegetation. After covering the need for the technology, the authors explain how a commercially available product evolved into a highly capable remote-controlled vegetation cutter for demining, and how the manufacturer subsequently adopted the modified system for the commercial marketplace. Modifications made to the PECO are discussed in depth, and an accompanying analysis provides interesting insight into how the PECO project became a success for those in need of an efficient and effective brush-clearing device.

by Ronald Collins and Thomas Henderson [DoD Humanitarian Demining Program]


One of the most significant challenges facing deminers is safely removing thick vegetation that has overgrown mine-suspected areas. This vegetation must be removed before mine-clearance operations can begin. Development of technologies able to meet this need has been an important priority for the HD R&D Program. One of these technologies is the PECO Wolverine. The HD R&D Program collaborated with industry to transform a commercial landscaping vegetation cutter into a capable demining area-preparation system. In humanitarian demining, area preparation is defined as the removal of vegetation and other obstacles to enable demining teams to enter the mine-suspected area and begin manual mine-clearance operations. The PECO Wolverine is an excellent example of industry participation with the HD R&D Program resulting in the availability of a capable area-reduction system in the commercial marketplace.

Responding to a need identified by demining organizations, the HD R&D Program team initiated a new project in 2007 to develop a robust vegetation cutter optimized for small areas. After performing market research, program engineers selected the Brush Blazer, a commercial vegetation cutter manufactured by PECO, Inc., as a starting point for the project. The Brush Blazer is a tracked, lightweight, low-cost, walk-behind vegetation-cutting system.

The PECO Brush Blazer has many ideal features for the challenges associated with area preparation and vegetation reduction in mine-affect ed countries. It is 2.4 meters long, incorporates a 1.2 meter-wide cutting deck and can perform 180-degree turns within its length. The system encompasses numerous safety features that make it excellent for demining tasks, including a chain-guided deck, a front safety bar and the ability to traverse side slopes up to 30%. Transformation of the Brush Blazer into a vegetation cutter suitable for operation in mined areas required two major modifications: integration of a remote-control capability and a significant upgrade to the hydraulic subsystem.

The remote control allows deminers to operate the equipment in mined areas without placing themselves in danger. Because remote control is an important part of many HD R&D Program developments for detection, area preparation and mine clearance, the HD R&D Program had already developed a Standardized Remote Control System package. The SRCS uses a common, proven, supportable hardware configuration that is software programmable for the system to which it is being integrated. The remote-controlled vegetation cutter can also be controlled manually, which allows it to be loaded, unloaded and walked to its designated work area. Integration of the already developed SRCS package into the Brush Blazer was relatively straightforward.

A more complex technical effort facing program engineers was upgrading the hydraulic subsystem. The original Brush Blazer was not designed for the difficult terrain, vegetation density and environmental conditions in mined areas worldwide. Strengthening the hydraulic system was necessary to improve system performance and to provide better power management while traveling and cutting. Specific modifications included replacing the manufacturer’s manually-controlled hydraulic pumps and valves with a load-sensing hydraulic pump and electrohydraulic control valves. The original hydraulic reservoir and heat exchanger were replaced with larger capacity units.

In less than eight months of design and fabrication work, the HD R&D Program transformed the Brush Blazer into a remote-controlled, area-reduction vegetation cutter capable of line-of-sight operation from 400 meters distance. The upgraded PECO Area Preparation System weighs 627 kilograms (1,380 pounds), making it easy to transport in mine-affect ed countries. When operating in a mined area, the pressure the system places on the ground should be as low as possible. The ground pressure of the Area Preparation System is 3.17 pounds per square inch.

Testing the PECO Area Preparation System

The PECO Area Preparation System underwent a technical two-week performance evaluation to determine its capabilities and limitations. Key parameters measured by the test were traction ability, size of vegetation that can be cleared, in one hour, the amount of vegetation that can be cut and performance of the SRCS. Along with demonstrating its improved capabilities for demining operations, the PECO Area Preparation System maintained its commercial capabilities which included cutting trees up to 10 centimeters in diameter. During testing, the system could clear an average of 2,000 square meters of moderate to dense vegetation per hour. With technical testing complete, the PECO Area Preparation System was ready for an operational field evaluation in actual demining operations.

In 2008, the HD R&D Program provided the PECO Area Preparation System to Thailand for an operational field evaluation by the Thailand Mine Action Center. The OFF took place in conjunction with demining efforts at the Pau Daus border area in northern Thailand. Prior to beginning the OFF, HD R&D technicians provided extensive operations and maintenance training to TMAC members. With the added capability of the PECO Area Preparation System, TMAC was able to clear, in one hour, an area of land that normally takes 12 deminers a day to accomplish manually. The TMAC OFF table (located on page 66) summarizes the PECO Area Preparation System’s performance during this limited OFF.

Industry Collaboration Leads to the PECO Wolverine

The HD R&D Program provided the technical data and the test results of the Area Preparation System to PECO, Inc. PECO representative visited NVESD to review the
design modifications made to the original Brush Blazer. This representative saw a com-
merical market for a remote-controlled cut-
ter where rough terrain and side slopes are safety concerns for manual operation. Dis-
cussions with HD R&D Program engineers and data from the technical test and the TMAC OFE pointed out areas where the sys-
tem could be further improved. Naming the new design, “Wolverine,” PECO replaced the 23-horsepower gasoline engine with a diesel engine to improve torque and increase safety in hazardous environments. A lower profile diesel engine system provided an addi-
tional benefit by lowering the center of grav-
ity which increased stability for operation on side slopes. Fuel consumption averages three liters per hour, depending on the vegeta-
tion’s density and thickness. PECO integrat-
ed a commercially available remote control and added longer tracks for improved stabil-
ity. The system is equipped with two circular cutter’s original manufacturer, using the data and lessons learned from the HD R&D Pro-
gram effort, then developed the commercial-
ly available PECO Wolverine. The Wolverine is one example of the more than 100 technol-
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manitarian Demining R&D Program, visit the web site at http://hrd.darmtrac.org.

Table 1: Results of TMAC OFE.

<table>
<thead>
<tr>
<th>Mine Field</th>
<th>Pou Dou Border</th>
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<tbody>
<tr>
<td>Total Mines Found</td>
<td>76</td>
</tr>
<tr>
<td>Total Areas Cleared</td>
<td>150,650 sq meters</td>
</tr>
<tr>
<td>Total Hours Operation</td>
<td>417</td>
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</tbody>
</table>

Summary

The PECO Wolverine project began with a commercial-off-the-shelf brush cutter. The HD R&D Program technicians integrated remote control, strengthened the hydraulic sys-
tem, conducted a technical test and provided it to a supported country for an OFE. The brush cutter’s original manufacturer, using the data and lessons learned from the HD R&D Program effort, then developed the commercial-
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Technical Survey, often an efficient method of achieving land release, can also be prohibitively expensive for certain communities due to the utilization of the same machinery, heavily armored vehicles used in clearance operations. If Technical Survey could be achieved through the use of less expensive agricultural equipment that is already present in communities near suspected areas, land release could be achieved at a much lower price. A similar study explores this possibility by examining the explosion resilience of four different designs of blast-resistant tractor wheels, each made of commercial off-the-shell components and designed for easy reproduction in mine-afflicted communities.

LOCOSTRA: Blast-resistant Wheels Test

by Emanuela Elisa Cepolina | Snail Aid – Technology for Development | Matteo Zoppi | PMARib, University of Genoa | and Vittorio Belotti | PMARib, University of Genoa

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Wheel n° | Wheel Name (used only for reference in the text) | Description | Characteristics
---|---|---|---
1 | All steel | Vented steel wheel | External diameter: 900mm Width: 235mm Weight: 85kg Steel thickness: 4mm
2 | Florida | Embedding a small inflatable tire | External diameter: 900mm Width: 250mm Weight: 86kg Steel thickness: 4mm Inner wheel: inflatable tire wheel (trailer) with tube, external diameter of 500mm
3 | EPR | Embedding a large inflatable tire | External diameter: 890mm Width: 250mm Weight: 161kg Steel thickness: 10mm Inner wheel: inflatable tire wheel (4WD ve-

The wheel prototypes are designed to resist physical damage and protect the vehicle on which they are mounted by consistently absorb-
ing the resulting shockwaves caused by anti-personnel mine explo-
sions. Because the wheels were developed with off-the-shelf material, they are simple and affordable. Moreover, they are designed for easy repair in local, non-specialized workshops and, therefore, are appropri-
ate for developing countries. The average cost of each wheel produced

Figure 1. Wheels tested.

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During May and June 2010, a series of comparative tests were conducted with four different designs of blast-resistant wheels built in the context of the LOCOSTRA (Low COST TRActor) project. Tests took place in an open-air quarry named Valsena near Parma, Italy. Three different types of charges containing 120g of Goma2Eco plastic explosive, 120g of TNT powder and 240g of TNT powder, respectively, were used in the tests.

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