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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]

The U.S. Department of Defense's Humanitarian Demining Research and Development Program assesses, develops, demonstrates and evaluates new mine and unexploded-ordnance detection and clearance technology for use in worldwide demining operations. The U.S. Army Night Vision and Electronic Sensors Directorate Countermine Division executes the HD R&D Program for DoD. The program focuses on utilizing and enhancing mature technologies, using commercial-off-the-shelf technologies whenever possible. A COTS brush cutter formed the basis of an HD R&D development project beginning in 2007 that resulted in a new area-preparation machine.



PECO Wolverine.
All photos courtesy of Humanitarian Demining R&D 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



Original COTS PECO Brush Blazer.

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-affected 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-guarded 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 con-

figuration 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-affected 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 the



PECO Area Preparation System operating in Thailand.

revised system can 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 moderately 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 OFE took place in conjunction with demining efforts at the Pau Dau border area in northern

Thailand. Prior to beginning the OFE, 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 OFE table (located on page 66) summarizes the PECO Area Preparation System's performance during this limited OFE.

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. A PECO representative visited NVESD to review the



(Left) Ronald Collins remotely operates PECO Wolverine in a technical test at Fort A.P. Hill, Virginia. (Right) PECO Wolverine prototype test at Fort A.P. Hill, Virginia.



TMAC OFE - Performance from February 2008 to October 2009

Mine Field	Pau Dau Border
Total Mines Found	76
Total Area Cleared	150,650 sq meters
Total Hours Operation	417

Table 1: Results of TMAC OFE.

design modifications made to the original Brush Blazer. The representative saw a commercial market for a remote-controlled cutter where rough terrain and side slopes are safety concerns for manual operation. Discussions with HD R&D Program engineers and data from the technical test and the TMAC OFE pointed out areas where the system could be further improved. Naming the new design "Wolverine," PECO replaced the 23-horsepower gasoline engine with a 25.5-hp diesel engine to improve torque and increase safety in hazardous environments. A lower profile diesel engine system provided an additional benefit by lowering the center of gravity which increased stability for operation on slopes. Fuel consumption averages three liters of diesel per hour, depending on the vegetation's density and thickness. PECO integrated a commercially available remote control and added longer tracks for improved stability. The system is equipped with two circular triblades, and the cutting deck can be hydraulically adjusted up and down. The deck movement increases the ability of traversing side slopes and operating in varying terrain with increased vegetation density. Leveling, which sets the distance between the cutting blades and the ground, is adjusted manually. The remote control senses engine loading and will adjust the travel speed to minimize overloading or stalling. The cutting deck is attached with a quick-coupling mount that provides easy installation and deck removal, and a simple method of integrating additional tools. The PECO Wolverine weighs 818 kg. and has a ground pressure of 3.07 psi.

The HD R&D Program procured three Wolverines for technical testing and to have assets available for additional OFEs. Data from the technical test identified a few minor improvements, which PECO has already incorporated.

In June 2010, the HD R&D Program designed and fabricated a tiller attachment for the PECO Wolverine to determine its effectiveness as a rapid quality-assurance tool. Quality assurance takes place following detection and clearance to ensure all mines have been removed and the land is now safe. The

tiller attachment is capable of tilling the soil to a depth of 13 cm. Technical testing for the tiller attachment is ongoing with published results expected in late fiscal year 2011.

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 system, 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 commercially available PECO Wolverine. The Wolverine is one example of the more than 100 technologies the program has provided to demining nongovernmental organizations, mine-action centers and foreign militaries in 35 countries. For additional information on the DoD Humanitarian Demining R&D Program, visit the website at <http://bit.ly/lg9rlW>. ♦



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Thomas Henderson is an Acquisition Analyst with 23 years of government and industry acquisition experience, more than a decade of which were in support of the HD R&D Program. Following a U.S. Army career as a logistician and acquisition professional that included a tour as a product manager, in addition to the HD R&D Program, he also supported Marine Corps combat-engineer acquisition programs. Henderson earned a master's degree from Florida Institute of Technology and a Bachelor of Science degree from Indiana University of Pennsylvania (U.S.).

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