Figure 15a: ROC curve for lane 2 (testee 7). The total number of negatives (fragments, clutters or noise) is shown.

Figure 15b: ROC curve for lane 2 (testee 3). The total number of negatives (fragments, clutters or noise) is shown.

Figure 15c: ROC curve for lane 4 (testee 7). The total number of negatives (fragments, clutters or noise) is shown.

Figure 15d: ROC curve for lane 4 (testee 3). The total number of negatives (fragments, clutters or noise) is shown.

Table 12: False-alarm rate (false alarm rate) of eight testees for each lane.
and its demining and area-preparation tools can provide a area for demining, remove anti-personnel mines and leave an area ready for quality-assurance proofing and subsequent use.

Based on the positive results from the evaluation, the HD R&D Program deployed the Mantis to Nicaragua in spring 2005 for an operational field evaluation. Under the direction of the Nicaraguan Army Demining Units, the Mantis is currently operating in a minefield 6 kilometers (4 miles) long with Class II (medium to severe) vegetation and terrain near the town of Jinotepe. In the first four months of operation in Nicaragua, the Mantis removed 5,600 kilograms (12 tons) of metal with the magnet attachment and cleared 64,090 square meters (16 acres) of land (clearing vegetation, and cultivating and sifting soil). NADU members also reported the blast-resistant SETCO tires were extremely effective in encounters with PMN mines, not incurring any damage to the vehicle when hit. In addition, the roller attachment has encountered and destroyed 10 PMN mines and the cultivator has uncoupled numerous UXO items. To date (in combination with the Hitachi excavator), NADU members have removed 14,529 mines and cleared 436,175 square meters (108 acres) of land for further manual and mine-detection dog quality assurance. In fact, after the mechanical clearance process with the Hitachi and Mantis, five mines remained in the entire area. Further investigation is underway to determine why these mines were left in the ground. Early indications suggest the mines were outside of the area worked by the machines, their fuses were non-functioning, or they were deeply buried.

In the right conditions, mechanical de-mining with versatile mechanical systems such as the SDTT and Mantis allow for faster, safer and more efficient mine clearance operations. However, minefield locations and conditions often preclude the use of such machines. For example, the Mantis is not intended for use in minefields with the threat of anti-tank mines. The Nicaraguan mechanical-de-clearance effort has not proven to be completely effective because of this cause. However, with continued effort in developing effective operating procedures and development of attachments for multi-functional systems like the Mantis and SDTT, the HD R&D Program can be confident the SDTT and Mantis, with their associated tools, will provide the humanitarian-demining community with highly reliable, cost-effective systems augment current catalogs of de-mining tools and expand area-reduction and demining capabilities. 

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Charles Chichester is Deputy Program Manager for the U.S. Humanitarian Demining Research and Development Program at the U.S. Army Communications Electronics Research and Development Command, Night Vision and Electronic Sensors Directorate, at Ft Belvoir, Va. He is responsible for executing the mechanical and tool development programs. He has served in a variety of positions with the U.S. government and military and is a graduate of the U.S. Military Academy. He is a certified instructor in the professional development program of the ARMY and has over 35 years experience in humanitarian demining.

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6920 farm tractor capable of operating a number of specialized and commercial off-the-shelf implements to address some of the vegetation clearing, soil preparation, area reduction, quality assurance, and mine-pure removal and neutralization problems in humanitarians-demining operations. The system is equipped with front and rear power take-offs, standard three-point hitches in the front and rear, and a loader frame. The tractor was modified in June and reassembled under contract to the HD R&D Program by Pearson Engineering Ltd.

The purpose of developing a system such as the Mantis is to provide deminers with a mine-survivable vehicle that has multiple functions and is based on a COTS technology (i.e., John Deere farm tractor). The tractor has been armored, fitted with a 180-degree rotating drier’s cab and anti-personnel/mine-survivable SETCO wheels with an innovative wheel-hub interface incorporating a dowel and plate design. This design allows the wheel to separate from the axle in the event of an anti-tank mine detonation, thus reducing the shock effect through the axle. The tractor acts as the prime mover for a suite of COTS and specialized implements generally used by the construction and earth-moving industries but also applicable to mine clearance and subsequent operations. Along with the mine-resistant John Deere tractor, this toolset currently consists of a rotary mower, area-reduction roller, rotary mine comb, grab, four-in-one bucket, heavy cutters, cultivator, seed drill, tine, swivel cultivator, bed makers, mine filler, tree extractor, magnet and hedge cutter. Together the prime-mover tractor, these mine-clearance and area-deminers with capabilities to perform their work effectively and efficiently.

In August 2004, the Mantis and its complementary tools underwent a thorough performance evaluation conducted by the HD R&D Program staff members and supported by engineers from the United Kingdom under the auspices of the International Test and Evaluation Program for Humanitarian Demining. For the soil and vegetation within the environment where the testing occurred, the results of the performance-demonstration assessment show the Mantis and its demining and area-preparation tools can provide an area for demining, remove anti-personnel mines and leave an area ready for quality-assurance proofing and subsequent use.

Based on the positive results from the evaluation, the HD R&D Program deployed the Mantis to Nicaragua in spring 2005 for an operational field evaluation. Under the direction of the Nicaraguan Army Demining Units, the Mantis is currently operating in a minefield 6 kilometers (4 miles) long with Class II (medium to severe) vegetation and terrain near the town of Jinotepe. In the first four months of operation in Nicaragua, the Mantis removed 5,600 kilograms (12 tons) of metal with the magnet attachment and cleared 64,090 square meters (16 acres) of land (clearing vegetation, and cultivating and sifting soil). NADU members also reported the blast-resistant SETCO tires were extremely effective in encounters with PMN mines, not incurring any damage to the vehicle when hit. In addition, the roller attachment has encountered and destroyed 10 PMN mines and the cultivator has uncoupled numerous UXO items. To date (in combination with the Hitachi excavator), NADU members have removed 14,529 mines and cleared 436,175 square meters (108 acres) of land for further manual and mine-detection dog quality assurance. In fact, after the mechanical clearance process with the Hitachi and Mantis, five mines remained in the entire area. Further investigation is underway to determine why these mines were left in the ground. Early indications suggest the mines were outside of the area worked by the machines, their fuses were non-functioning, or they were deeply buried.

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