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Success of Multi-tools in Mine Action: The Survivable Demining Tractor and Tools and the Mine-Clearing Survivable Vehicle

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The Survivable Demining Tractor and Tools

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The authors examine the various equipment and technologies that allow further effectiveness in demining achievements. Recent developments in demining tools allow for greater protection of deminers, in addition to improved search results. With technological advancements such as the Survivable Demining Tractor and Tools and the Mine-Clearing Survivable Vehicle, the authors express hope for demining centers worldwide.

by Tin Nguyen and Charles Chichester [U.S. Humanitarian Demining Research and Development Program]

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Mine Clearing Survivable Vehicle

Based on the success of the multi-tool-attachments concept used in the SETCO, the HD R&D Program invested in the Mantis mine- and vegetation-clearance system. As its platform, the Mantis uses a modified and armored John Deere 6920 tractor. The system is equipped with front and rear power take-offs, standard three-point hitchs in the front and rear, and a loader frame. The tractor was modified, armored, 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 360-degree rotating drive's cab and anti-personnel-mine-survivable SETCO wheels with an innovative wheel-hub 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 other clearing operations. Along with the mine-resistant John Deere tractor, this toolset currently consists of a rotary mower, anti-roadblock round, rotating mine comb, grab, four-in-one bucket, heavy cultivator, front loader, back hoe, cultivator, bob-turds, mine filler, tree extractor, magnet and hedge cutter. Together the pintos and tractor, these machines augment the deminers with capabilities to perform their work effectively and efficiently.

In August 2004, the Mantis and its complimentary tools underwent a thorough performance evaluation conducted by 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 environment where the testing occurred, the results of the performance-demonstration assessment show the Mantis and its demining and area-preparation tools can prepare an area for demining, remove anti-personnel mines and leave an area ready for quality-assurance proofing and subsequent use.

The DCA Approach to Road Verification and Clearance in Eastern Angola: The DCA Approach

The anti-tank mine threat on access roads in eastern Angola is the greatest impediment to infrastructural rehabilitation, economic recovery and social development in that area. The authors discuss the methods and equipment used by DanChurchAid to verify and clear roads in Moxico and Lundu South provinces.

Figure 1: DCA wide-area detection system.

Figure 2: WADS electronic control module.

1. Road reconnaissance.
2. Road survey and target definition.
3. Target reacquisition.
4. Target investigation and clearance.
5. Quality-assurance survey.

Road reconnaissance. Prior to undertaking survey, verification or clearance activities along a given road, DCA compiles available data on the conflict history in the area and mines incidents along the road to determine the nature of the threat. Road and road-environment attributes impacting subsequent activities such as road type, road width, road-surface condition and degree of vegetative encroachment are recorded during a reconnaissance survey. The data collected during this phase is stored in a geographic information system database and is used to produce WADS and BCT route plans and maps.

Road survey and target definition. Roads are surveyed using the vehicle-mounted DCA WADS. The system is pictured in Figure 1. In mid-2004, the sensor arrays and the sensor(s) can be set up with one to eight Etlinger Uxps 740 sensors in different configurations, depending on road attributes, the type of survey task and the nature of the mine threat. In Moxico and Lundu South provinces, 5-75 meter wide sensor arrays in the 3.0-meter by 1.0-meter and/or 0.5-meter by 0.5-meter configuration are adequate for mine threat reconnaissance needs.

At a survey speed of five kilometers per hour (three miles per hour), metal-jacketed anti-tank and anti-personnel fragments and some of the larger anti-personnel mines, such as the PMN and PPM-2, are easily and consistently detected by sensors in the 1.0-meter by 1.0-meter configuration. Survey speeds of up to 10 kilometers per hour (six miles per hour) with the metal-jacketed targets are being sought. Minimum-metal mines cannot be consistently detected with this configuration.

Incoming data streams acquired during the receiver phases of the Tx/Rx cycles of the sensor coils are acquired by in-vehicle electronic

Charles Chiocchetti is a Deputy Program Manager for the U.S. Army Humanitarian Demining Research and Development Program at the U.S. Army Armament Research, Development and Engineering Command, Night Vision and Electronic Sensors Directorate, at Fort Belvoir, Va. He is responsible for executing the mechanical and demining tool development programs. He has served as a warfare scientist in the 1.0-meter by 1.0-meter and/or 0.5-meter by 0.5-meter-configuration mage system is used to produce WADS and BCT route plans and maps.

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