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Use of Mechanical Equipment in Mine Clearance

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In recent years, mechanical equipment has become more and more prominent in demining programs around the world. This article provides an overview of mechanical demining equipment and highlights the involvement of the Geneva International Centre for Humanitarian Demining (GICHD) in promoting such equipment.

by Johannes Dirscherl, *GICHD*

The Mechanical Demining Equipment Catalogue

In 2002, the GICHD published the first issue of the *Mechanical Demining Equipment Catalogue*. The purpose of this document was to provide the international demining community with an overview of commercially available equipment. The listed information was based on documentation provided by manufacturers, test reports provided by independent sources and subjective lessons learned in the field. A section on each machine attempted to broadly state an opinion on the capacities and restrictions of each piece of equipment.

In February 2003, the second issue of the catalogue was published. Several new pieces of equipment were added, and almost every manufacturer reported the latest versions of their machines. The catalogue is available in hard copy, on CD or on the GICHD website (see contact information below).

The Necessity of Mechanical Equipment

Mine clearance programmes are based mainly on manual demining—a slow, dangerous and work-intensive method. The use of mechanical clearance equipment is increasingly becoming acceptable to the demining community. The main roles for mechanical devices include area reduction and ground preparation. The cost-effectiveness model developed by the GICHD allows programme managers to utilize mechanical assets to their fullest operational and, therefore, cost-effective potential.

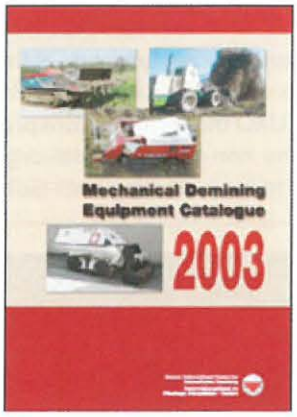
In July 2002, the GICHD published the study "Mine Action Equipment: Study of Global Operational Needs." The purpose of this study was to examine the effects of technical equipment improvements on the productivity of demining programmes. One of the major conclusions is that the effective determination of the outer edge of mined areas is of predominant importance for increasing productivity. It is generally acknowledged that sustained acceleration of this process is possible only if dogs or mechanical clearance equipment is used.

Limits of the Currently Available Mechanical Equipment

The productivity of a piece of equipment is closely related to its size. The larger a piece of equipment, the greater its potential productivity. Yet the size of a piece of equipment goes together with critical logistical and, therefore, financial implications, which may negatively impact cost-effectiveness.

Flail Systems

Flail systems are commercially available in various sizes. They are the most common demining vehicles in the world. Their usefulness for ground preparation and vegetation clearance is beyond doubt. Yet their capability of clearing mines reliably is—with good reason—the subject of intensive dispute within the demining community. Agreement as to standardized and internationally accepted test procedures has not been reached. This struggle of philosophies may continue for some time. Regardless of disputed clearance performance, some systems can throw mines or parts of mines out into previously cleared areas, increasing the time required for the post-clearance confirmation process. The dust arising from the flailing process may considerably impair the manoeuvrability of the vehicle and may even cause serious technical problems (e.g., overheating) under specific operational conditions.



Mechanical Demining Equipment Catalogue 2003. c/o GICHD

Tiller Systems

Tiller systems have evolved from forestry equipment. Depending on their configuration, they may even be used for soil with a high rock ratio. The clearance performance tends to be similar to flail systems. In order to withstand the detonation pressure from mines, the tiller drum needs to be relatively heavy. For that reason, the platform vehicle tends to be a

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heavy-tracked vehicle with a high-performance engine. Consequently, there will be high costs in procuring and maintaining such equipment. Due to their technological complexity and heavy weight, such machines tend to be inappropriate for programmes in developing countries with poor road infrastructure.

Design Priorities

Some mechanical systems are showing potential capacity as primary ground processors with minimal alternative clearance backup to deal with the specified residual risk. Reaching a technological breakthrough is perhaps delayed by the lack of profitable markets for commercial manufacturers to exploit. However, a system as near as possible to a "stand-alone system" is not far from being realized.

Supplementing an acceptable degree of clearance performance for various types of soil, the following characteristics are considered to be of primary importance in the design of clearance machines:

• **Protection of the operator**: Only if it is guaranteed that the operator is protected against the detonation of an anti-vehicle or fragmentation mine will the use of the system in a minefield be considered acceptable. In this context, it needs to be added that remotely-controlled systems do guarantee the protection of the operator to a high extent. However, they also incorporate disadvantages. Due to the distance from the vehicle, the operator may not react adequately to undulating ground or other obstacles.

• **Mobility**: In most mine-affected countries, road infrastructure is limited. Weight and dimensions of the vehicle have to allow for transportation to remote areas of operation with limited logistical difficulties.

• **Cost-effectiveness**: Regardless of procurement and operating costs (spare parts, petroleum, oil and lubricants (POL), required staff), the cost of clearing one sq m of a mined area needs to be lower than the cost of employing other assets (manual deminers, mine detection dogs) with the same result in terms of quality. For machines, this invariably requires continuous operation for as many hours as possible with as much area cleared as possible.

• **Repair**: The invariably high wear-and-tear effect on the equipment results in a high demand for maintenance. While the construction of the system needs to be solid and simple, it must be possible to repair and maintain it on site.

• **Availability of spare parts**: The availability of spare parts needs to be guaranteed. It is considered useful that the equipment is based on a commercial vehicle that is manufactured either in the country of operation or by a company that provides global parts service.

The Future

In the medium term, the GICHD believes that, given suitable topography, soil and mine type, machines capable of becoming "stand-alone" assets will become realized. While this may be so, for the foreseen future there will be a need for at least some form of backup clearance system in support. The goal is that this backup system will be minimal, fast and highly cost-effective. It will be based on the known residual threat likely to be left by a particular machine. In most current situations, the combined applications of mine detection dogs, manual teams and machines in measures suitable to a specified environment will continue to provide the best results. ■

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