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THE CASE FOR THE FLAIL: Mechanical Landmine Clearance for the Humanitarian Application A Manufacturer's View

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Profiles

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Mechanical Landmine Clearance for the Humanitarian Application
A Manufacturer's View
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INTRODUCTION

The basic requirement for a Mechanical Landmine Clearance System is to assist the overall humanitarian program to achieve effective and affordable landmine clearance while minimizing the risk to those involved. It is well understood that complete landmine clearing must involve a variety of tools. Experience has shown that the flail system, used together with other classical techniques, represents the most effective approach that present technology allows.

The Aardvark Flail evolved from a system first introduced in World War II to breach the minefields protecting "Fortress Europe." Years of field experience and design improvements have resulted in a system capable of clearing all types of mines in a non-combatant environment. The 14-ton Aardvark MK IV currently in production (See Figure #1) is made up of a tractor-like chassis with an enclosed, armored cab powered by a common Ford diesel engine. The tractor is fitted with a specially designed flail system that is driven by a variable-speed engine power takeoff. The air conditioned and filtered cab provides a "reasonably" comfortable environment for the operator.

The vehicle is equipped with half-tracks for traction and terrain clearance. In this configuration it may be driven to and from the base camp to the clearance site. For longer distances, the tracks may be exchanged for large diameter puncture-proof tires that permit driving over secondary roads and bridges at speeds up to 30 km per hour (See Figure #2). The modest weight and size also allows for air transport in both C-130 and larger aircraft. With a properly trained crew, this vehicle provides the capability of clearing up to 3,000 square meters of ground per hour, while providing full protection to its operators. In thousands of hours of field operation by more than 150 units in over 25 countries, no crewmember has ever sustained an injury.

COST

The decision to use the flail rests with the donor and host country, taking into consideration such factors as terrain, local conditions, available funding and cost of operations. A very conservative analysis was recently performed, based on equipment cost, spare parts, consumables, and manpower, for a fleet of four Aardvarks in operation. The result is an average overall cost of $0.33 per square meter (SM), while clearing at the rate of about 600 SM per hour. This is a very attractive figure and, no doubt, compares favorably with other means of mine clearance, particularly considering the level of clearance effectiveness provided by the flail.

Low overhead, the use of basic agricultural components, unsophisticated but effective armor, and careful design has kept the cost of the flail system to a minimum. The "sacrificial" elements -- the chains -- are an unavoidable operational cost, but they do absorb part of the blast energy, thereby reducing the likelihood of damage to other elements of the system.

OPERATIONS

Field reports of operational mine clearance and formal evaluation tests have demonstrated that the equipment has functioned very effectively. There have been no cases of mines left unexploded, undetected, or not destroyed, except due to operator error or extraordinary situations. Earlier model flails had experienced some problems with the Italian-designed Valsella mines, which have a unique sensor system. This problem seems to have been overcome, as evidenced by our experience in Angola and Mozambique, where these mines were successfully disrupted by the flail. It follows that flail clearance has a very high probability of meeting established quality assurance requirements.

The flail is also very adept at clearing mines in areas that have tall grass, brush and substantial shrubs with diameters of up to 4 inches, thereby eliminating the risky step of manually clearing the brush before clearance can commence. Another effective use of the flail is to determine the boundaries of mined areas, which then opens paths. This increases the accessibility for hand deminers, while enabling them to determine the type of mines employed.

Operations in Kuwait, Afghanistan, Mozambique, and Angola have shown the equipment problems caused by elevated temperatures and heavy dust clouds. Information gained has influenced design changes in later model flails and pointed out the advantage of a retrofit program for older models.

In Mozambique, where an Aardvark engineer was present, it was possible to record performance information that is not usually available. The project involved the clearance of a 50-meter-wide path to provide access and restore service to high voltage transmission lines. During one month, a single flail cleared 140,000 square meters

through heavy brush and destroyed over 5,000 mines (primarily anti-personnel). The flail was operated for 22 days, for a total of 160 flailing hours, yielding a clearance rate of 875 meters per hour (See Figure #3). After mechanical clearance, the area was checked manually with detectors. No live mines were found and confidence in the flail among the operators was reinforced.

SAFETY

During the clearance of many thousands of square meters in Europe, Africa, the Middle East, and Asia, and the detonation of thousands of mines and other ordnance items, not one operator has been injured. Compared with other types of mine clearing, this is an extraordinary achievement.

MAINTENANCE AND SUPPORT

While ease of operation and maintenance is relative to local capability, we have found that the employment of factory trained local workers with basic mechanical skills increases the reliability of the equipment and the operation in general. Operator and technician confidence, enthusiasm, and competence, together with sustained operational and technical support, are essential to effective application of mechanical mine clearance. The basic flail clearance system is simple, operationally proven, efficient, and effective, but unless it is supported by a regular inspection program, routine maintenance, proper lubricants and oils, and an air compressor and welding equipment, it will become just another piece of abandoned machinery.

ECONOMIC AND POLITICAL FACTORS

The decision to introduce mechanical mine clearance has as much to do with politics and procedural preference as it does with humanitarian concerns, economics, safety and efficiency. These are aspects of the worldwide clearance effort that need to be addressed, but which are beyond the manufacturer's ability to materially influence. There are, in fact, more basic problems, for instance, how to get monies promised by donors into actual mine clearing operations, rather than funding other less productive activities. Hardware manufacturers are not policy makers, but in our view some of the points at issue are:

- Local economy’s dependence on mine clearing operations as employment agencies.

- Does the donor community have effective oversight to ensure the money is well spent?
- Is the host country self-sufficient or dependent on aid?
- The political standing of the host country, vis-à-vis the donor.
- Does the potential clearance operation have an economic as well as humanitarian impact?
- NATO and other military involvement in humanitarian mine clearance.

It is our experience that when the user is financially independent, mechanical clearance can be successfully incorporated as a major element in the national mine clearance program, particularly when the local military is the sole authority involved in operations. Perhaps it is time to consider that wherever possible, the professional military be engaged as the organization most able to deal with equipment operation, maintenance, and support, thereby enhancing the overall effectiveness of the mine-clearing program.

ENVIRONMENTAL FACTORS

Some objections have been raised against the use of flails on the basis of environmental damage. Given the nature of the operation, and the fact that the soil and vegetation is churned into mulch by the flail, such objections seem without much merit. In fact, the agricultural harrowing effect of the flail was proven a great benefit to, and much appreciated by, farmers in Afghanistan.

CONCLUSIONS

Results from field operations and government agency tests have demonstrated that mechanical mine clearance in the form of the flail can greatly assist in the safety and effectiveness of the overall mine clearance program. Military and civilian users employing the equipment for post-conflict clearance have expressed favorable comments on the effectiveness of the Aardvark flail which, of course, have been duly noted by the manufacturer. Finally, free market selection of the Aardvark flail by international customers has added a substantial vote of confidence, leaving the expectation that the flail will continue to play a major role in humanitarian demining for many years to come.