Driving the HD Machine in the African Bush

Almost every country in Southern Africa has a mine problem and most of these countries have a tradition of solving their own problems. Because the region is famous for its mine-resistant vehicles, this paper concentrates on innovative mechanical technologies—but it could just as easily have concentrated on PPE or testing facilities where Southern Africa also leads the way.

by Andy Smith, *AVS Mine Action Consultants*

R&D in Southern Africa

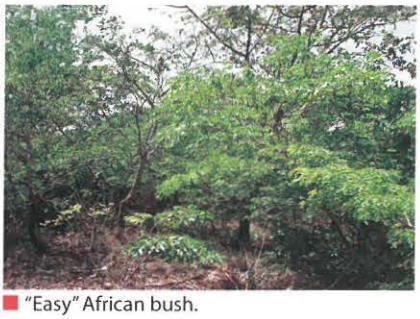
If you measure research and development (R&D) success by the presence of the equipment somewhere in the field, then a lot of useless equipment can be called a "success." This is because those who supported the R&D want to be able to claim "success" so they "give" equipment to field users. Sometimes this is a direct gift, sometimes it is formally a "loan" or is tied to further funding. This equipment would often be wholly uneconomic for the users to buy—because its utility is far too limited to justify the expense. Sometimes it is not even wanted, but "political" concerns lead to it being accepted. If you measure R&D success in terms of the equipment being purchased and used around the world, the number of R&D successes falls dramatically. Moreover, most of the R&D that has achieved this success was "homegrown." It did not originate in the ivory towers and defence research centers of the developed world. Most of it was also very low-cost. Often it was the result of inspired lateral thinking that led to improving existing technology and methods.

The most famous—and successful—mechanised mine-detection system ever was the Pookie, developed in Zimbabwe (then Rhodesia). Unfortunately it was only good at locating large steel-cased mines recently buried on roads, but that was what it was designed to do and it saved many lives. With its low-weight, "V"-hull, sacrificial wheels and high-frequency VHF detector pans it was truly revolutionary in the 1970s.

■ The Pookie: a single-seat mine-resistant mine-detection vehicle.

Mechanical Assistance

When looking for more sophisticated mines laid a long time before they are cleared, the use of machines had to change. Old minefields in many parts of the world tend to be overgrown, and the vegetation must be cut to allow thorough mine clearance, which is where most "mechanical assistance" comes to the fore these days.



■ "Easy" African bush.

Steel Wheels and Rollers

Using machines to "deal with" the vegetation began with MECHEM's steel-wheel and rollers in the early 1990s. The wheels and rollers were attached to AT mine-resistant vehicles developed during South Africa's involvement in the Angola and Mozambique wars.

The wheels and rollers "crushed" the undergrowth, which tended to spring back up unless the machines were followed up by deminers immediately. Deminers had to follow up because the wheels and rollers left mines and ordnance behind. The system pushed a cushion of vegetation over the mines making it less likely that the wheels would initiate them. In the first half of the 1990s, several deminers were severely injured or killed while following this kind of area preparation. (These examples are recorded in the DDIV/DDAS introduced in another paper in this journal.) Civilians were also injured in areas supposedly cleared by these methods. As a result, the wheel and roller methods

■ An example of a simple steel wheel – standing about 125cm (4 feet) high.

MgM mulcher mounted on the back of an armoured "Wolf."

lost credibility in Mozambique. Rollers were also used in the early days in Angola, where, in 1993, there was a fatal accident with a roller system mounted on a tank. Rollers have not been used by any of the serious humanitarian demining groups in Angola since that time.

Experience in Africa proved that steel wheels and rollers do not clear mines and do not leave ground that is safe to walk on—lessons that are still being learned in the industrial R&D centers of Europe and the U.S.A. Steel wheels can be AP blast proof and can save the body of a vehicle from an AT blast, so they have a purpose in HD. Contact Vernon Joynt, Technical and Scientific Consultant, CSIR South Africa: vjoynt@csir.co.za

Steel wheels are being used on vegetation clearance machines in Mozambique now. This allows the machine to move through the entire area, and if it accidentally detonates a mine with its wheels, no harm is done. They are preferable to tracks which can be severely damaged by large AP mines.

Vegetation Mulchers (flails)

Cutting (as opposed to "crushing") minefield vegetation was probably started by MgM in Angola but may have been led by Leonard Kawinski's side-mulching tractor in Cambodia, which he came up with at about the same time. In both cases, commercially available off-the-shelf technology was adapted to the purpose.

MgM uses the bush-cutting technology available to South African ranchers to mulch the lighter undergrowth in advance of their deminers. They mounted their mulcher on a blast-resistant vehicle which made it much more versatile. Contact: Hendrik Ehlers, Director MgM at ehlers@MgM.org

Firsts for Africa
- Steel wheels
- Vegetation mulchers on mine-proof vehicles
- Locally made Monster-flail
- Tree shears on mine-resistant vehicle
- Mini-mulcher
- Successful ground processing

An NPA Aardvark starting up in Angola. When up to speed, the dust raised makes it impossible to photograph.

Monster Flails

The main difference between a mulcher and a ground-engaging flail is the length of the cutters. Mulchers often have cutting "hammers" hinged onto the flail spindle, whereas ground engaging flails have chains between the spindle and the "hammers." The power requirements of a ground-engaging flail are very high and the machines are often designed to withstand multiple AT mine detonations making them suitable for military use. This means that they are large and heavy, so expensive to buy and to operate.

Flailing to detonate mines has been widely tried and abandoned. Nonetheless, Norwegian People's Aid (NPA) introduced

The MINETECH flail—a locally made monster that was far cheaper to make than any commercially available alternative.

the Hydrema and Aardvark flails into their Angola operations in the mid-1990s. They are still apparently operating, although often out of service in a country where logistical support can be tricky.

NPA claims that ground "cleared" with their flails is always covered by a full follow-up with another method (manual or dogs).

PAD (formerly UNADP) in Mozambique have had a military flail from Finland for several years. It also spends a lot of time unused while the technicians wait for spare parts.

With full follow-up required, the performance and the cost effectiveness of ground-engaging flails has long been questioned. Safety is another issue.

Ground-engaging flails do not clear the ground and so in humanitarian demining a full follow-up is always required. The total cost of running the flail must then be added to the cost of the manual clearance, which makes their use prohibitively expensive compared to other methods.

Large flails do have the advantage of being able to "chew" through big trees, but they have the disadvantage of disrupting the ground, destroying any mine pattern there may have been and leaving damaging mines and ordnance behind.

MineTech has been using a long-chain flail for vegetation cutting since the mid 1990s when they recognised the value of cutting the vegetation in advance of deminers. They made their machine because the cost of the blast resistant flails sold commercially was far too high. The MineTech flail could hit the ground, but it is not deployed in that mode.

Locally made also means that the parts required for service and maintenance are available locally which keeps "down-time" to a minimum. If the user relies on the machines, designers should remember that the mean-time to repair can be far more important than the mean-time between breakdowns. Contact: minetech@minetech.co.zw

Tree Shears

MgM has a solution to the problem of large trees that make it hard to use their mulchers. They use a tree-shear, which is simpler and cleaner, leaving no carpet of cuttings or fallen trees for the deminers to negotiate. Contact Hans Georg Kruessen on mgmmoz@tropical.co.mz

A long-chained flail is often much bigger than is needed. Mulchers on extending arms mounted on mine-proof vehicles are smaller, more controllable and less destructive—but the mine-proof vehicle adds a lot to their cost. Back in 1996 it was recognised that the cutting head could be compact enough to allow its carrier to be very small and lightweight—especially if it were radio controlled so that lighter armour could be used. I devised such a machine to meet MineTech's needs, but the donors were more interested in funding mini-flails that hit the ground.

Mini-flails such as the Bozena in Croatia are effective at cutting vegetation, but they also miss mines, break mines, bury ordnance and cost a lot to run and maintain.

Mini-Mulchers

Last year, MgM began to develop a mini-mulcher in Namibia, and it successfully underwent its first trials at the end of May this year. Contact Scott@mgm.org

The MgM Mini-Mulcher is much bigger than the machine planned in 1996, but is a major step in the right direction.

Other Ground Processing

Apart from Monster flails, a range of ground processing machinery has been tried in Africa. In Namibia, the ill-favoured Berm-Processor proved impossible to deploy over rough terrain. In Mozambique, the Krohn system failed to perform as designed. In Zimbabwe, the ground-milling MineBuster was used with controversy

(Left to Right) The Finnish flail standing idle in Mozambique. A Hydrema flail in Ethiopia after it had detonated an AT mine that it had missed with its flail.

■ (Left) The first mini-mulcher during a trial at the end of May 2002. (Below) The MgM Tree shear carries a large trunk out of the mined area.

over its thoroughness and there were several incidents while following it up. In Zimbabwe, Namibia, Mozambique and Angola, a variety of rollers and bulldozer techniques have been used with very poor results.

The only ground processing tool that has performed properly is another example of an existing machine being modified for demining. Very successful at processing the piles of mines and earth left by bulldozers and graders, MgM's ROTAR Mk 2 sifts the soil mechanically, retaining mines and ordnance in its armoured bucket. It also includes an extending arm and mulcher (on the rear) which makes it especially versatile.

Africa is often thought of as a "poor relation" to the sophisticated West. Its demining is often underfunded and any R&D is usually undertaken on a financial knife-edge, but in terms of the development of useful demining equipment—its successes speak for themselves. Even when the "host" machine is manufactured elsewhere, the design concepts originated in Southern Africa and the assembly of off-the-shelf parts took place there. ■

Biography

Andy Smith in an independent Mine Action specialist who has worked extensively in Africa during the last 10 years.

** All photos courtesy of the author except the Mini-Mulcher, courtesy of Michael Ehlers, MgM.*

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■ The ROTAR Mk2 at work in Mozambique.