Koch Mine Safe and the Cordon Sanitaire Clearance Program

Through the work of Koch GmbH and Mine-Tech, the 359 km-long Cordon Sanitaire in Zimbabwe is being demined in one of the first humanitarian demining efforts of its kind.

By Henry Thompson, *RHS Associates*

Background

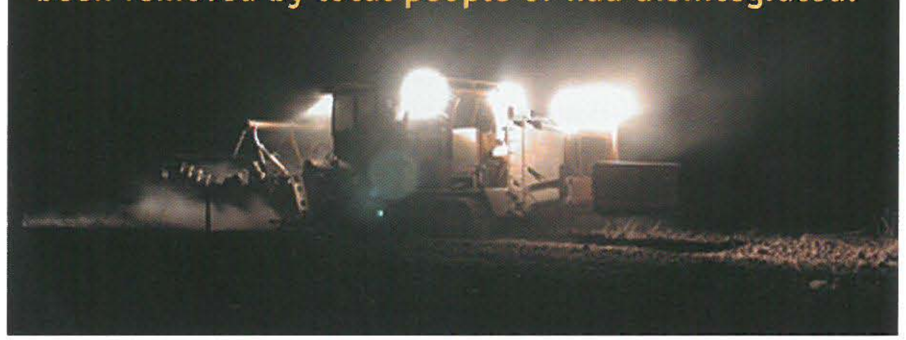
In 1993, the European Union (EU) funded a survey of the Cordon Sanitaire in Zimbabwe, a series of six border mine fields covering 766 km. The contract for the survey was won by the mine clearance NGO Mine-Tech, who had three months to perform the survey in late 1994.[1] Mine-Tech did not survey all of the mine fields because the fields and a major portion of the adjacent service road had not seen maintenance for two decades. However, maps were available at the Zimbabwean Army Engineer's Headquarters at Pomona Barracks, and Mine-Tech completed the survey and handed over the final report. The report included maps, diagrams and a broad assessment of the problems and difficulties in clearance. While the report also contained some significant inaccuracies, it did present a broad overview of the mine fields.

Of all mine fields, the top priority was a 359 km-long one in the northeastern corner of Zimbabwe. To advise on the tendering process for a clearance contract, the EU hired consultant Patrick Blagden. The European Development Fund provided funding for the project, while the Zimbabwean Ministry of Defence handled financial control and contractual issues. The invitation to tender was issued in late 1997, and was comprised of two contracts: main works (clearance) and quality assurance (QA).

This was one of the humanitarian demining industry's first major contracts offered to international competition for a project of this scale. The issues of assuming risk and the disclosure of information were not fully explored. The Zimbabwe Ministry of Defence, as the client, provided the bidding companies with very limited information, while the tender documents defined the scope of work as the clearance of 10,000,000 m^2 of mine-infested land in 18 months. It also required the bidding companies to bid with a fixed price.

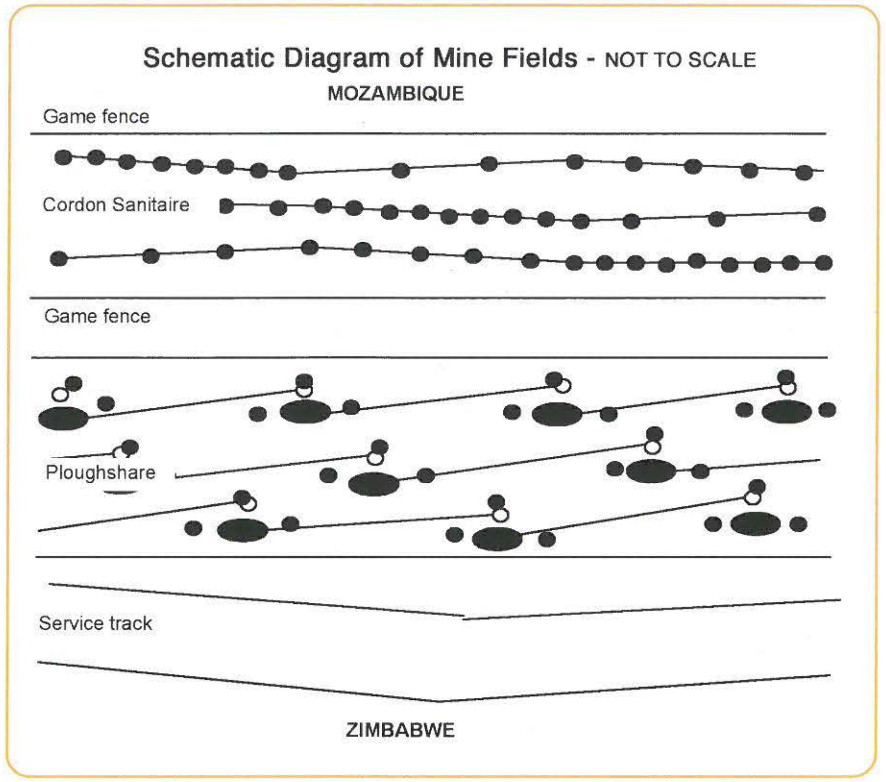
Six companies expressed interest in performing the clearance. Mine-Tech was one of the companies allowed to bid—an unusual action for a company that performed the initial survey. The bidding companies were allowed to visit the mine field at the Mukumbura end for two days under the supervision of the Ministry of Defence, but high vegetation hid much of the visible detail within the mine field. Four companies (Mine-Tech, Koch GmbH, Royal Ordnance and Mineclear) then presented technical accreditation and bids that were judged by a technical threshold and by price.[2] Koch made its bid in partnership with Mine Safe, a Zimbabwean company owned by retired Zimbabwean army officers.

> "The mine field was fenced on both sides by a game fence of three strands of steel wire supported on thin steel posts set in concrete and was cleared of vegetation... By 1997, virtually all the fencing had been removed by local people or had disintegrated."



c/o Henry Thompson

After passing the technical pre-qualification, Koch Mine Safe (KMS) won the contract with the lowest bid. And while Koch couldn't provide a performance guarantee, it was successful in finding backing for deployment from a major Dutch salvage and dredging company, Royal Boskalis Westminster NV, a group that owned the German subsidiary company Heinrich Hirdes GmbH, an EOD company. The QA contract was issued to BacTec.



c/o Henry Thompson

The Cordon Sanitaire

The Cordon Sanitaire mine field consisted of a 25 m-wide strip of ground laid with three rows of blast AP mines at a density around 5,500 mines per kilometer. The mine field was fenced on both sides by a game fence of three strands of steel wire supported on thin steel posts set in concrete and was cleared of vegetation. The bottom strand held a thin wire mesh game fence. Also attached to the fence was an intruder alarm system linked to control points that fed information to patrol teams. By 1997, virtually all the fencing had been removed by local people or had disintegrated. Three lanes of mines were laid using knotted ropes. Within the three rows, patterns were only discernable over short distances. The majority of mines in the Cordon Sanitaire were the South African R2M2 and the Portuguese M969. The Italian VS50 was also laid. Due to breaches of the mine field and animal incursions, there was a good level of in-filling with more random patterns and different landmines.

The Cordon Sanitaire was backed for most of its length by a second "ploughshare" mine field containing three rows of large fragmentation mines mounted on pickets one meter above the ground. The fragmentation mines were laid with 30 m tripwires and three additional blast mines protected each mine. The mine density in this field was around 100 fragmentation mines and 300 buried blast mines per kilometer. The rows were unevenly spaced and the vegetation was not cleared, so the mine field contained substantial trees and dense thorn bush. The field was subject to a great deal of in-filling and randomly spaced APLs, and had a service track running behind and parallel to it to allow patrolling and maintenance. Amazingly, the Cordon Sanitaire was even found to run up to 8 km into neighboring Mozambique —indicating the hasty nature of its deployment.

Under its contract, KMS was restricted to three working teams, though mechanical methods were allowed only if the land was manually checked. The contractor had to ensure that environmental damage was minimal.

The Clearance Operation

KMS planned to deploy its clearance operation in October 1998, but it actually deployed six months late at Mukumbura in March 1999. The mine clearance outfit experienced problems assembling manual teams because the available pool of experienced deminers in Zimbabwe was minimal, meaning KMS had to do more training than anticipated. As a result, there is now a small outflow of KMS-trained deminers joining other companies. Also, in March, Alistair Craib gained control of the demining operation from Patrick Blagden and made his first visit to the project.

After an initial halt to reassess procedures following some early accidents, work recommenced in April 1999, and clearance efforts moved slowly for four months. Metal contamination forced clearance rates

Minebuster takes to a mine field. *c/o Andy Smith*

Minebuster griddle-rack from the rear. *c/o Andy Smith*

to be about 30 m^2 per two-man lane per day. By the end of May, eight months into the contract, 0.25 percent of the 10,000,000 m^2 of land had been cleared. Efforts were then further slowed by heavy rainfalls, which led to outbreaks of cholera and the suspension of work by local health authorities. Due to the *force majeure*, KMS was granted a two-month extension to its 18-month contract. Meanwhile, BacTec had deployed on schedule in October 1998, but was in trouble because its contract had been negotiated on the basis of payment per unit of land verified.

More flaws in KMS's bid and the terms of the contract arose early in the process. The deminers were spending the bulk of their time locating false signals from pieces of scrap metal in the mine field.[3] This scrap metal came from the remains of fencing and rubbish found in the mine field. The demining company had originally estimated the level of contamination at one false alarm per 20 m^2 and had worked this estimation into its bid. In reality, though, it was finding up to 30 signals per square meter in close proximity to fence lines.[4]

The contract does not specify clearance of all metal but requires clearance to U.N. standards of 99.6 percent of mines removed down to a depth of 20 cm. In practice, KMS cleared all metal from the center mined lanes and was encouraged by the Zimbabwe Ministry of Defence and BacTec to clear all metal, which makes area verification a much simpler task. However, the deminers had underestimated the logistical difficulties of the operation. The soil in winter is very hard, so by July 1999, the manual teams required 7,500 liters of water per day to water the mine field

before prodding or excavating. KMS also had to build access roads to the mine field. The Mine-Tech survey document (and subsequently the Ministry of Defence contract) specified that there was a service track running about 50 m behind the mine field. In reality, the track was between 300 m and 1.7 km from the mine field and no longer existed in certain areas.

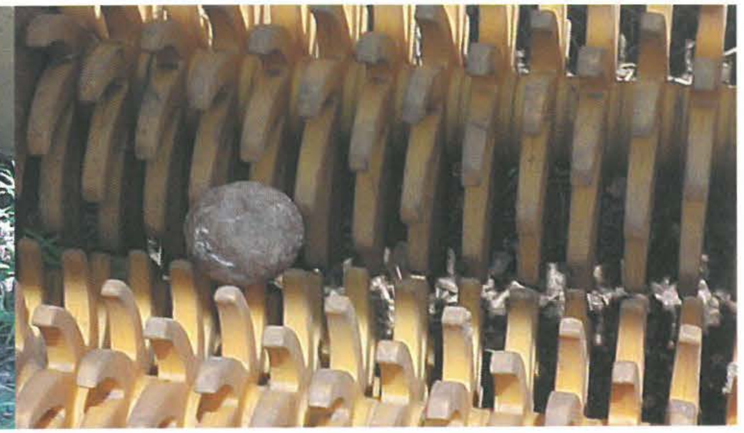
Safety

KMS was also strongly criticized for a high accident rate. From March to June 1999, 12 accidents occurred. Over half of the accidents were incurred during excavation. The primary cause of one-third of these was attributed to management error, notably serious injuries from handling mines.[5] A total of 20 people were injured in 18 accidents from February 1999 to July 2000. Two of the seriously injured subsequently died in the hospital—one from pneumonia contracted in recuperation. Only one accident occurred as a result of stepping on a deep-buried mine on land not yet offered for QA.

The accidents show a number of clear features:

- Only one deminer was seriously injured while clearing mines *and* adhering to all Standard Operating Procedures (SOP);
- Nine out of 14 (64 percent) of those injured were back at work within 10 days of the incident;
- The two fatalities both occurred off-site and under medical care; and
- No one was killed or injured by a ploughshare fragmentation mine (no ploughshare mines were found intact with detonators).

Two of the serious handling incidents were partly the result of mine neutralization (taking the detonator out of the mine casing), a procedure that was specified as a SOP under the initial contract. More than 4,000 mines were disarmed in this way, but



Grinding teeth and nylon finger rollers of the Minebuster. *c/o Andy Smith*

following a review of SOPs, the practice was abandoned and, henceforth, all mines were destroyed intact.

One way of assessing accidents in mine clearance is to look at the density of mines and UXO (based on the fact that no mines and no UXO equals no accidents). KMS's teams were handling very large quantities of minimum-metal APLs under a broad range of conditions, including excavating them from down to 35 cm—well beyond the depth required by U.N. standards.[6]

In May 1999, Craib recommended a change in management. As a result, Herman van der Vorm was appointed to replace the previous program director. The appointment proved an immediate success as critical management decisions were implemented and efficiency improved rapidly. By August 1999, the project was operating productively and safely. In September 1999, KMS also introduced alcohol (Breathalyzer) and drug testing and a pay increase.

Mechanical Clearance

Soon after deployment in March 1999, KMS explored the potential for mechanical clearance and commissioned an environmental impact assessment of mechanical clearance of the Cordon Sanitaire mine field. The study concluded that approximately one-third of the mine field was suitable for mechanically assisted clearance, one-third was suitable for clearance with following remediation to reduce erosion and one-third was not suitable for mechanical clearance.

KMS subsequently purchased a Veilhaben Minebuster. The 56 ton machine arrived in Zimbabwe in July, at which point it was renamed the "Mine Collector" and was tested and evaluated to develop working parameters SOPs. These procedures were put into operation in October 1999. Two of the demining teams remained as manual teams working on the ploughshare mine field, and the third team followed the Mine Collector.

The Mine Collector is like a heavy potato harvester built around a crawler tractor with a heavy mill added before the lifting and sifting apparatus. This machine can process a 3 m-wide swath down to a depth of 50 cm. Soil is mixed up by a carbide-toothed grinder and deposited onto a set of three large nylon-finger rollers that break up clods of earth and separate out solids from loose soil that escapes through the rollers. Any solid items such as stones, roots and mines are deposited on a slatted conveyor that deposits them back on the surface some 7 m behind the front mill. Mines and UXO are left on the surface, ready for the manual teams. It was found that roots of some trees would be picked up and bound in the nylon rollers, so working depth (and forward speed) is partially varied according to vegetation. In practice, the Mine Collector works behind two other machines: a bulldozer that removes trees and shrubs and a heavy mine-protected tractor with steel wheels and a ripper that loosens soil and breaks up roots.

When running efficiently, the machine processed 12,000 to 15,000 m^2 of land per day. When following the machine, individual deminers could process 400 to 500 m^2 per day—about 10 times the normal manual rate per person. The Mine Collector ran successfully for a few weeks until the heavy rains returned. The Mine Collector broke down on a number of occasions and several frustrating weeks were spent awaiting spare parts from Germany. From March to May 2000, the productivity declined significantly due to downtime.

Productivity

In February 2000, 17 months into the 18 month contract, the KMS management team looked at its prospects. The teams had cleared less than one-third of the contract area (2.6 million m^2 out of a total of 10 million m^2). The need for a contract extension became obvious. Luckily, the EU and the Zimbabwe Ministry of Defence agreed to extend the company's contract to February 2001.

Comparative densities of mines and UXO in clearance operations in the region:

Region	Square meters	Mines/UXO removed	Square meters per mine/UXO
Koch Mine Safe	3,809,281	65,185	58
NPA, Songo, Cabora Bassa	738,180	12,072	61
Mechem, Massingir	89,634	349	467
Mechem, Corrunana Dam	1,700,000	3,600	472
Mozambican average			1,500 - 2,500

Source: Mechem, NPA Mozambique, Quarterly Report 4th Qtr, 1999, Koch-Mine Safe, IND, Maputo.

Working under extended hours, the mechanical team was capable of bringing the company up to between 6.5 to 7.5 million m² of land by February 2001. The Mine Collector processes 20,000 m² of ground per day, and the manual team covers around 12,000 to 12,500 m² per day, potentially destroying over 1,000 mines per day.

On average (over both mine fields), KMS's teams are lifting and destroying one mine per 58 m² of ground. In the Cordon Sanitaire mine field, this broad average rises to one mine per 20 m². The mechanical team working in the center of the Cordon Sanitaire clears one mine per 12 m² *on average*—spot densities can be more than double this figure.

Two things characterize the current clearance program:

• *The high density of mines and number of mines being cleared.* In June 2000, KMS cleared 421,000 m². By mid-July 2000, the team had cleared a total of 3,809,281 m² of land and 65,185 mines—one mine per 58 m². By any standards, the current safety record of KMS is exceptional considering the conditions.

• *No "missed mines" have been reported by BacTec, which assesses 10 percent of the land cleared.* The level of quality achieved under these conditions is very high. ■

"KMS was also strongly criticized for a high accident rate. From March to June 1999, 12 accidents occurred. Over half of the accidents were incurred during excavation. The primary cause of one-third of these was attributed to management error, notably serious injuries from handling mines.[5]"

Contact Information

Henry Thompson
RHS Associates Ltd.
33 Ludlow Way
Finchley London N20JZ
Tel: 44-208-444-3496
Fax: 44-208-883-2399
E-mail: henry@rhsassociates.co.uk

References

[1] Chris Pearce, Director, Mine-Tech, Interview in Johannesburg, June 6, 2000.
[2] Alistair Craib, EU and Zimbabwe Ministry of Defence Consultant, Interview Feb. 6, 2000.
[3] Koch-Mine Safe was using Vallon detectors, fine German detectors capable of high sensitivity—but more complex to use than many comparable models. The QA team was using British Guartel MD8 detectors, a robust and simple model.
[4] Temba Kanganga, Mine Safe, Deputy Project Manager. *The Road Forward: Humanitarian Mine Clearance in Southern Africa.* SAIIA Johannesburg, August 6, 2000.
[5] Data from Andy Smith, DDIV database, April 6, 2000.

Mine Detection Dogs At Work

continued from page 87

the [dogs'] ability to detect plastic mines when metal detectors are ineffective is even more important."

The Global Training Academy has the capacity to train 30-36 dogs per year in mine detection. In 2001, 18 dogs will be trained for deployment in Lebanon, Oman and Thailand. In addition, the Academy currently has dog teams working in ten countries: Mozambique, Rwanda, Bosnia, Costa Rica, Honduras, Nicaragua, Croatia, Namibia, Thailand and Afghanistan. These dog teams often work with the host country's military in mine clearance operations.

Contact Information

Dan Hayter, Director
Global Training Academy
P.O. Box 445
Somerset, TX 78069
Tel: (210) 622-9460
Fax: (830) 429-3122
E-mail: Gtaden@aol.com

M-Detect

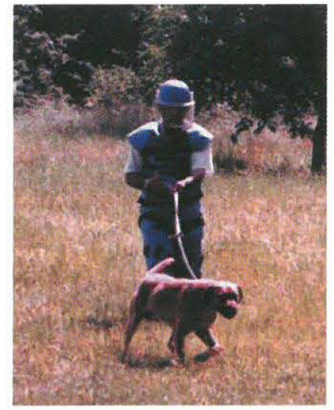
M-Detect, a mine dog training facility in Germany, specializes in training MDDs for mine detection operations in mine-affected countries. Each year, M-Detect trains and deploys approximately eight dogs. This year, MDDs are being trained for deployment in Bosnia-Herzegovina and Croatia. Martin Weitkamp, director of M-Detect, said MDDs are "an important part of the international demining toolbox" if used as quality assurance in unknown areas. Weitkamp adds that dogs should not be used in a known mine field in place of deminers or demining machinery but in unknown areas where sweeping the fields with an MDD is faster and more efficient.

Contact Information

Martin Weitkamp, Director
M-Detect
Munsterstrasse 13
D-59387 Ascheberg
Germany
Tel: +49-2599-92-5207
Fax: +49-2599-92-5295
E-mail: wd-weitkamp@t-online.de
Website: http://www.securatec.de

Conclusion

MDDs are an effective means for mine clearance operations worldwide. With proper training from mine dog companies and organizations, MDDs employed in mine-infested countries return successful results. Their driven success continues to be an asset to countries in times of need. ■



The training period ends with MDD leading the trainer.
c/o Martin Weitkamp