During the '70s and '80s, South Africa was involved in a medium-intensity insurgency war in the north of Namibia (then called South West Africa) and southern Angola. The war officially started in 1966 when a small group of trained South West African Peoples Organization (SWAPO) guerrillas infiltrated Ovamboland from neighboring Angola and Zambia, with the purpose of overthrowing the government. They were quickly rounded up by South African Security Forces after they established a base camp in the Ougulumbashe area.

After that, the conflict remained at a low key until 1975, when Angola became independent from Portugal. Although involved in a civil war of its own, the governing party of Angola, MTLA, gave their support to SWAPO in their struggle for inde-

Clearing The Cold-War's COWARDLY KILLERS

by Frank Van Der Waal PHOTOS COURTESY MECHEM

South African Company Makes Subcontinent Safe For Democracy

pendence from South Africa. The war immediately started to escalate with thousands of volunteers leaving the country for military training in Zambia, Tanzania, Angola, East Germany and the Soviet Union. These countries also supported the guerrillas with weapons and equipment and by 1978 the war had intensified to an extent that the South Africans found themselves involved in a full-scale guerrilla war along the entire length of the northern border, including East and West Caprivi.

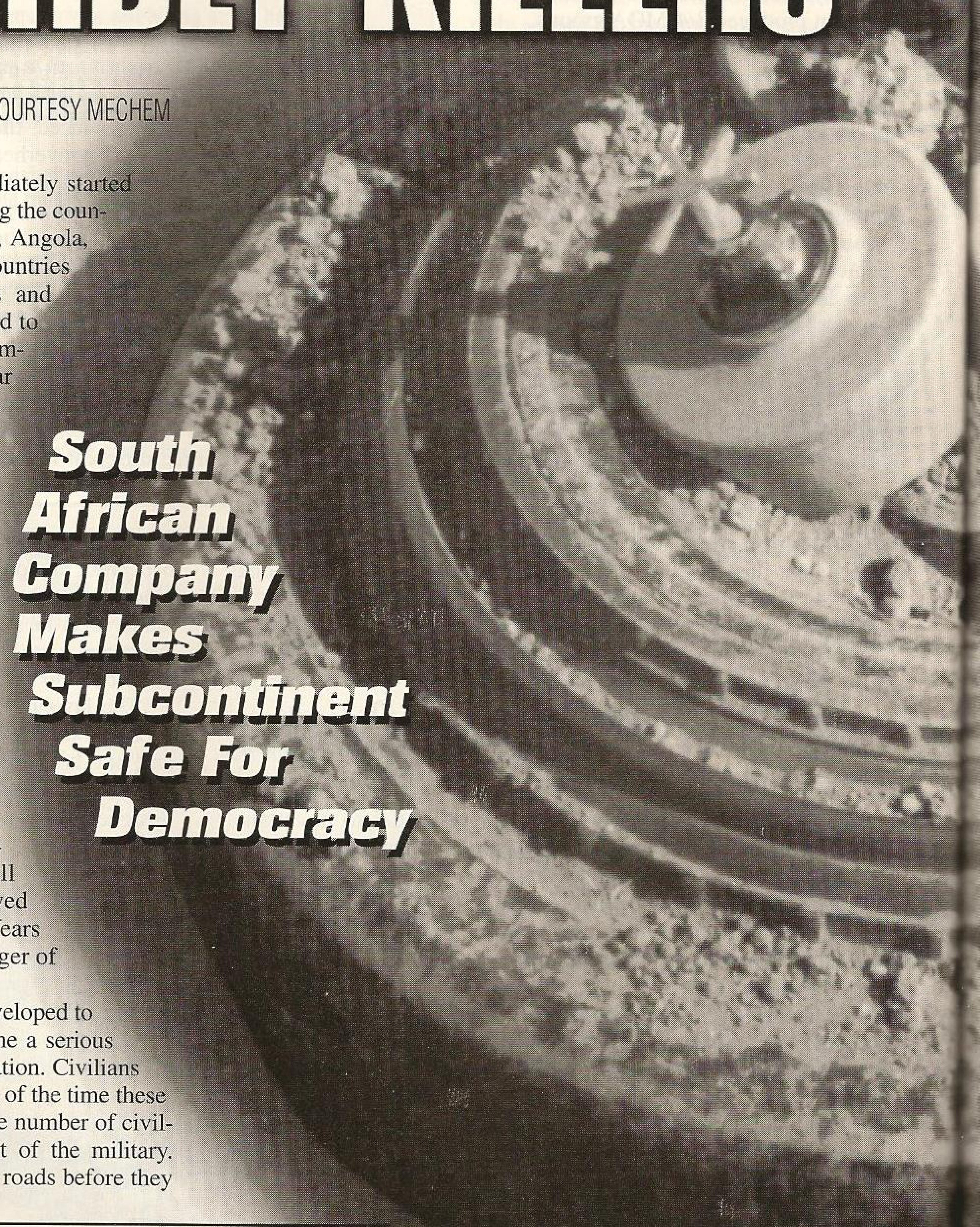
It was in April 1971, that South African troops first came face to face with Russian tank mines, when a TM-46 exploded under the rear wheel of an S.A. Police Ford F-250 near Singalamwe in Eastern Caprivi. During the next year several other incidents took place and because their soft-skinned vehicles offered no protection, heavy casualties were suffered by the S.A. Police. It became the task of a gifted scientist, Dr. Vernon P. Joynt, to design a protection system against these tank mines.

Several prototype vehicles were designed over the next 20 years, culminating in very successful mine protection as found in vehicles like Casspir, Buffel and Mamba, all designed by Dr. Joynt and his teams. They saved hundreds of lives during the next decade. Years later, Dr. Joynt became the first General Manager of Mechem Consultants.

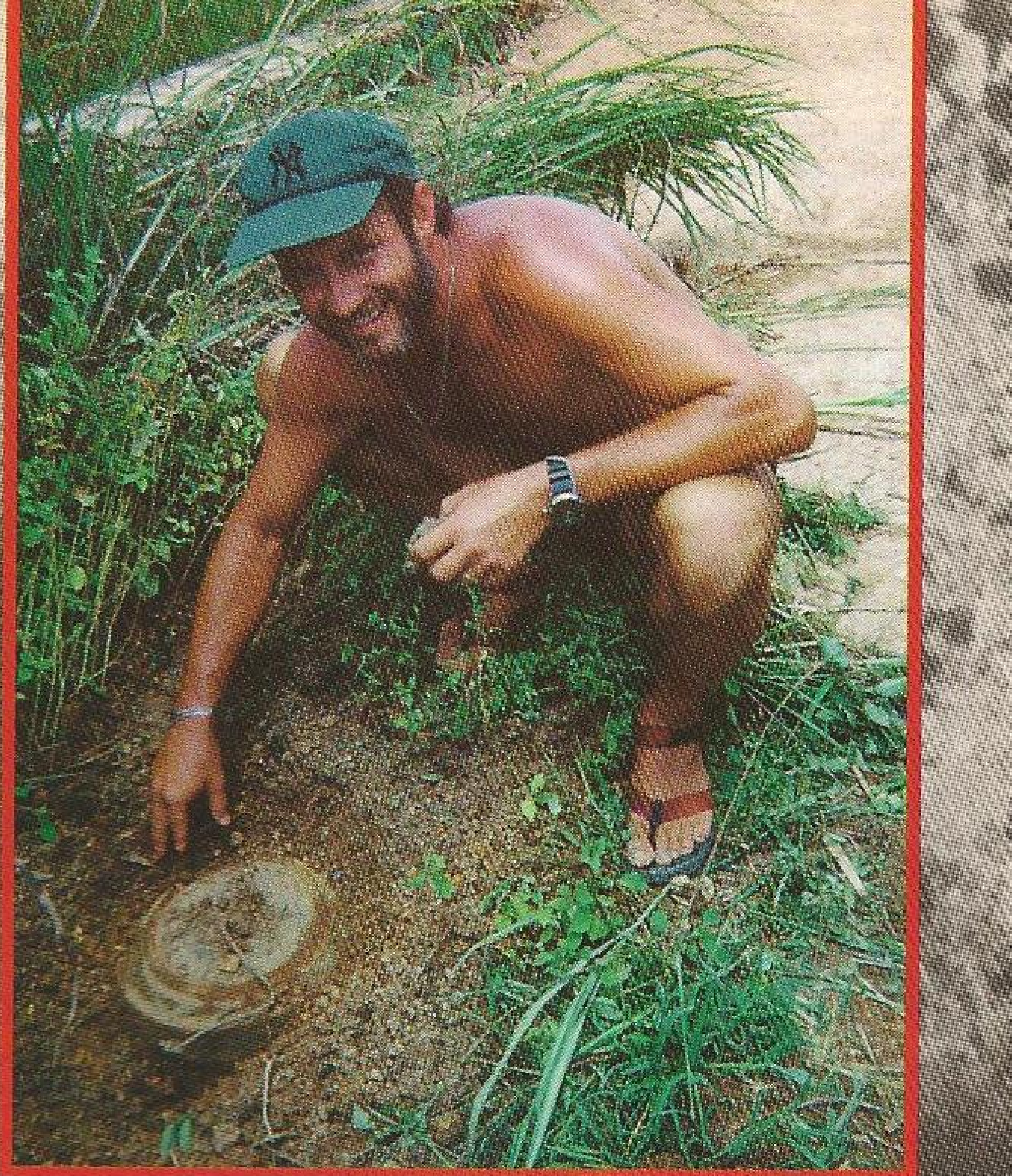
At the same time, a capability had to be developed to detect and destroy these mines that had become a serious threat to the military as well the civilian population. Civilians were using the same roads as the military (99% of the time these roads were gravel and sand tracks) and soon the number of civilian mine casualties were far higher than that of the military. Military vehicles were not allowed to travel on roads before they were cleared by engineers, except in emergencies. This meant that several thousand kilometers had to be covered by engineers on foot each week and offensive mine hunting became a very important part of the South African Defense Force activities in the Operational Area. Dr. Joynt once again became involved, this time in the research of mine detection, and applied all known information to develop detection systems to assist the military.

New Methods For New Technology

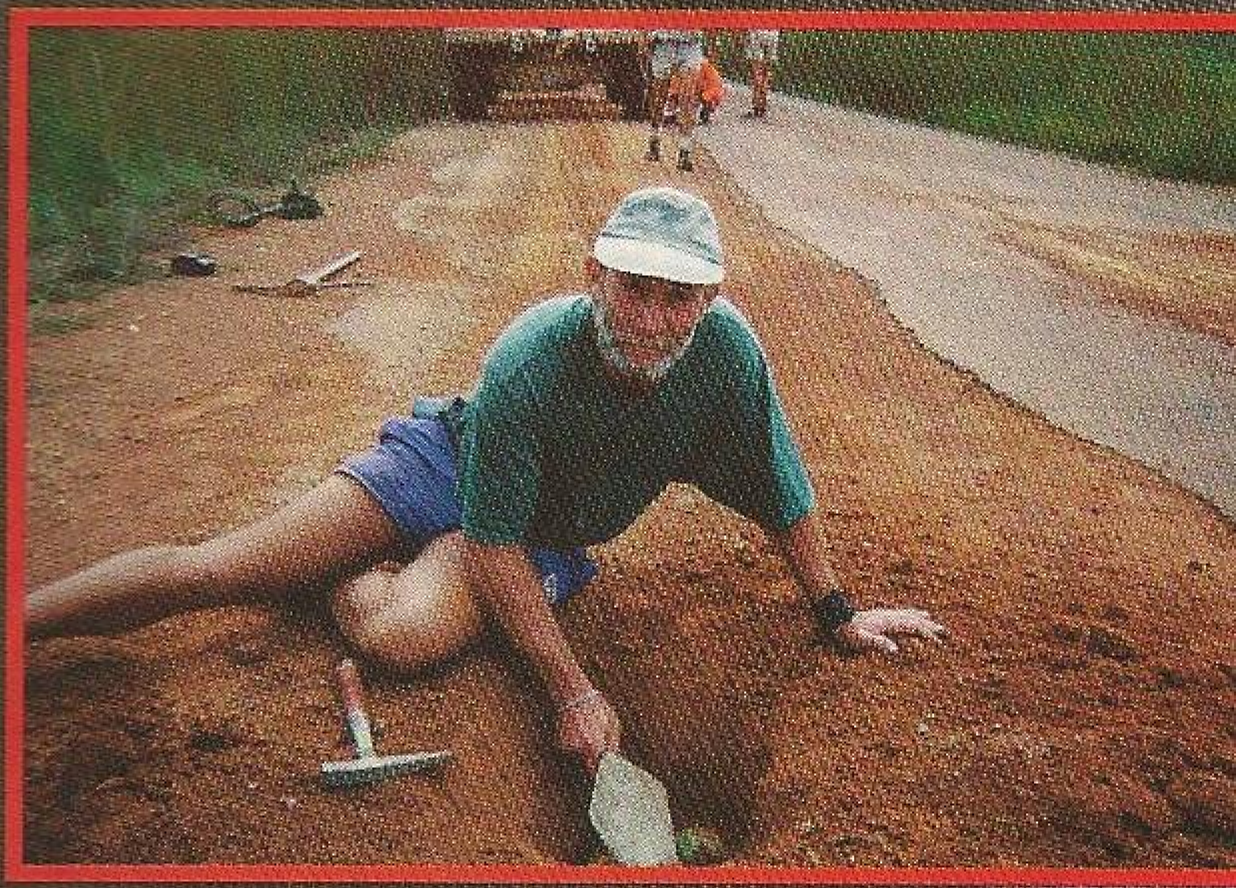
Although the traditional methods of detection proved to be effective enough at the time, it was recognized that mines with a minimal metal content could be missed by metal detectors and it was impractical to try and probe the entire length and width of



Czech PT-MI-BA3 AT mine, which has a bakelite body with little metal to be detected, planted with PMA2 antipersonnel mines to make detonation more probable and removal more difficult. This indiscriminate combination can be set off by even a man on a bicycle.



(above, left) Soviet 1,000 pound bomb had a cortex det cord in the nose cone, connected to an AP pressure switch. (above) Operator with Soviet TM-57 AT mine with metal casing — det cord from fuze well to pressure switch is usually removed and the mine blown off-road. New types are taken for analysis and dog training.



Operator uses trowel and geologist's hammer to uncover a Chinese Type 72 AP mine, sitting atop an AT mine.

(right) Chinese Type 72 AT mine atop a Soviet TM-46 AT mine, typical of double-mining. With more than 80 types of mines found so far, the possible combinations for double-mining are seemingly limitless.

all the roads with prodders. The use of sniffer dogs was suggested as it was well known that police forces around the world were already using the smelling ability of dogs to detect drugs, stolen property, bodies, etc. It was known that most mines are filled with explosives that have a nitrate base and handlers started to teach dogs to recognize the distinctive smell of TNT, RDX, Trotyl etc. The training phase proved promising and it was only when actual detection searches started under operational conditions, that dog handlers and scientists started to realize how many new problems they were facing.

Dogs that were trained in the mild climate of Pretoria suffered in the heat of the operational area, where temperatures were usually in the high thirties.

After about half an hour of diligent searching, dogs would start heading for shady spots under the trees and lose interest in the work because of the heat and fatigue. Several dogs died from heat exhaustion and dehydration in spite of precautions taken. In spite of the fact that provision was made for acclimatization and to get used to the particular "background smells" of the area, operational results were unsatisfactory. This was mainly due to the fact that the dogs could only be utilized in the early hours of the day when it was cooler, resulting in poor productivity. To expand the number of dogs in order to increase their work capability was only a limited solution, because of the logistical and transport problems that it created.

Thus it happened that free-running sniffer dogs were never used to their full potential during the years of conflict. Dr. Joynt maintains to this day that free-running dogs used in isolation (without making use of combinations of other techniques) can only guarantee an efficient clearance rate of about 60%.

The New Rescue Dogs

During these years scientific tests were conducted by Dr. Joynt and his team of scientists and operators and it was established that the smell of the explosives inside a buried mine contaminated the soil above and around it, no matter what material was used to encase the explosive. Experiments with vapor pressures were conducted and it soon became obvious that if they could find a way to collect the vapors near the road surface, they could let the dogs analyze substantial distances without having to walk more than a few dozen meters in conditions that were ideal, compared to the harsh conditions on the road itself.

A fabric was chosen and treated chemically to improve its ability to collect and retain the smell of explosives and a hollow tube-like sample collector was manufactured. A suction device was developed and after many experiments it was calculated that sucking air at a rate of about 80 liters per minute was sufficient to cover 4 to 5 meters of road width when moving in a mine-protected vehicle at a speed of about 10km per hour. It was discovered that the system is very sensitive and that the smell of propellants used in firearm cartridges could be picked up and identified by the dogs, as well.

It was also found that, due to its sensitivity, the system could easily be contaminated and that "false positives" could occur if care is not taken to decontaminate hands and equipment with soap and water or a special chemical. It was also established that the system worked very reliably in hot conditions as the smell of explosives seemed to be released more freely than when it was subjected to low temperatures. In fact, it was discovered that a prevailing wind could blow the smell of propellants as far as 40 meters and still be collected and identified by the system.

Today the MEDDS system is a proven and tested technique to verify large distances of road and several contracts have been successfully undertaken in Africa. Even in the countries where fighting had been fierce (e.g. Angola), it is a known fact that mines occur with substantial distances between them, resulting in a lot of wasted time if the traditional detection methods are used searching clean areas. One of the biggest advantages of the MEDDS system is that it eliminates the negative areas and thus the time that would have been wasted searching for mines in such areas.

Efficiency Counts: Time's A Wasting

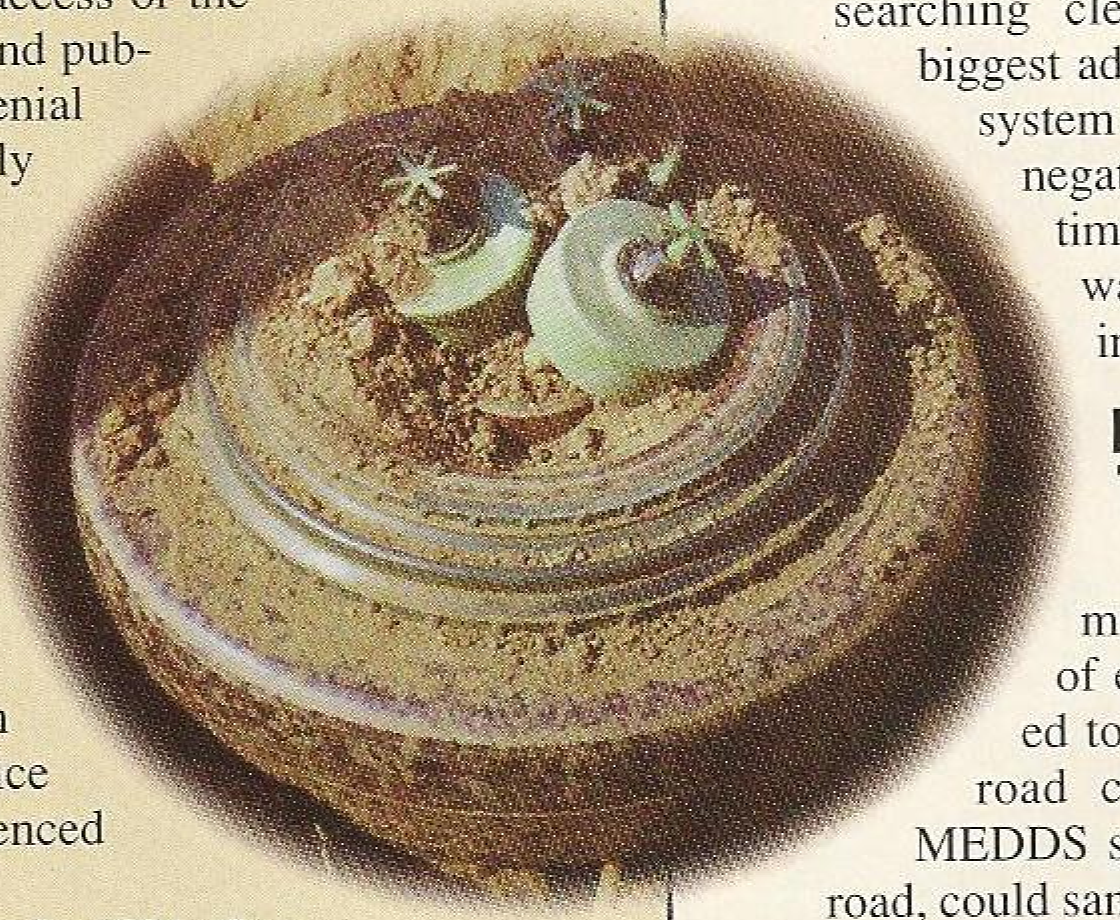
In comparison, using metal detectors a full team of engineers could be limited to less than a kilometer of road clearance per day. The MEDDS system used on the same road, could sample more than 40 km per day. The samples can be analyzed on the same day and the clearance can be concluded the following day, depending on the size of the team and the extent of contamination.

In this way, Mechem, while sub-contracting to Royal Ordnance, cleared 2,000 km of roads in Mozambique for the U.N. in 1994 — in just four and a half months. The contract that they are currently working in Angola requires that they clear a total distance of 7,000 km in six months. Several other smaller road clearance contracts have

Special Forces To Tackle A Special Problem

The U.N. Mine Clearance and Policy Unit estimates that there are more than 110 million active mines littering some 68 countries — with a like number stockpiled waiting to be planted. Every month more than 2,000 people are killed or maimed by mine explosions, and most of the casualties are civilians who fall victim long after hostilities have ceased. For every mine cleared, 20 are laid: in 1994, approximately 100,000 were cleared, while an additional 2 million were planted. It is estimated that it would cost $33 billion to remove *existing* mines. Many experts believe that — if no further mines are planted — it would take 1,100 years to clear the entire world of mines under current conditions.

Land mine usage has dramatically increased over the past two decades, with an emphasis on its potential as a weapon to deny civilians access or the use of farmlands, irrigation channels, roads, waterways and public utilities. In other words, their utility in military denial operations aside, as a practical matter land mines primarily kill and injure peaceful civilians and their children.



A typical case in point is Angola, where there are an estimated 10-15 million mines deployed. There are at least 500 different mine designs, and more than 80 types have been located in Angola, with new types still being found. The general rule holds true in Angola, where guerrilla forces lay anti-tank mines, and government forces lay anti-personnel mines because guerrillas usually move on foot.

Deminers require years of experience, and Mechem relies heavily on former special forces and former police SWAT personnel, with local support from highly experienced support personnel.

Mechem spent more than five years in Mozambique: In 1991, five people cleared more than 12,000 AP mines in three months in a project to clear the power lines between South Africa and the capitol city of Maputo. There were 200-300 mines cleared from around every pylon, and the men were ambushed seven times while conducting these ops. They then set about clearing roads, and in one segment of the contract cleared 2,000km in four and a half months, subcontracting to Royal Ordnance. Other contracts in Mozambique included clearing the Cahora Bassa power line.

From January 1996 Mechem has been in Angola, with a crew consisting of 30 South Africans, 13 Ghurkas, 16 Zimbabweans, six Mozambiqueans, two Americans and one Canadian, plus 10 Angolan *sapadores* (sappers). Quality assurance is by the German firm Gerbera, with eight former East Germans.

—*Peter G. Kokalis*

been successfully undertaken for NGOs, and road contractors.

The Mechem technique, although it revolves around MEDDS, is based on the "Toolbox" principle. This means that to attain the required clearance rate of 99.6% as laid down by the U.N., a combination of detection methods is used, predicated on terrain, weather, types of mines and so on. This also means that the company is striving to have as many technical options as possible in the field, because it maintains that no *single* detection method could guarantee a 99.6% clearance rate. New equipment is constantly being developed and old equipment improved, in order to keep ahead of problems and conditions in the field.

Today, a typical day of road clearance in Angola would look like this: At 0600 the vapor-sampling teams move out in mine-resistant Casspir APCs and are dropped off at intervals of 10 km. Each team has two manual-pump generators that are carried like backpacks. They set off on foot, walking in the Casspir's tracks, covering each side of the road, sucking air through the sample tubes from close to the surface of the road. At about 300 meters they stop to change the samples. This is the most important phase of sampling as contamination can easily spoil the samples. The samples are pre-marked and their numbers are logged on a special route sheet, corresponding with the GPS reading of that spot. The road is also marked with lime or paint to mark the exact change-over point in case the clearance team has to go back to that position (civilian GPS systems are not always absolutely accurate).

All the time, care must be taken not to touch the sample tubes with the bare hands and they are carefully stored in tight plastic containers resembling film canisters. The operators' hands and sample holders are decontaminated with a chemical before new sample tubes are inserted and the sampling can continue.

Every 300 meters samples are changed in this way until the team reaches the starting point of the team ahead of them. In this way both sides of the road can be sampled covering more than 40 km per day. The air samples are transported back to the base camp in plastic boxes and flown by helicopter to the nearest dog analysis center for testing. The results of the analysis are communicated back to the team by radio. As all samples are collected in duplicate, half the samples are flown to the Mechem Dog School in Pretoria for control checking by the dogs there, to compare results with those of the operational dogs.

Russian T-54 tank destroyed by mine during an offensive is inspected by Ronco dog looking for AP mines and booby traps.

Soviet TM-57 AT mine boosted with 200-gram block of TNT. Multinational crew has Austrian AN19/2 Schiebel metal detector.

Protecting Valuable Assets

The operational analysis center is usually located in an area that is considered ideal for dogs' health (i.e., as high as possible above sea level where it is cooler and free from tropical diseases). The dogs work in a shady area and are accustomed to all the smells of the area (referred to as "background smells"), therefore reacting more confidently to foreign smells.

When the mobile base in the field receives the results (usually the following day), the clearance teams (different from the vapor sampling teams) move out in Casspir vehicles to the road sampled the previous day and locate the stretches of road as indicated to positively contain explosives or explosive devices. "Negative" areas (i.e., areas that have not been indicated by the dogs during analysis) can safely be ignored and regarded as clear, as the system is so sensitive that it indicates the smell of spent cartridge cases that have been lying on the roads for years.

Free-running dogs (different from the MEDDS dogs) are sent down the road on both sides to search the whole surface. This is important to locate minimal-metal-content mines that could be missed by metal detectors. After the dogs, the metal detectors are used in the traditional way and if nothing is found, the surface of the road is ripped with hydraulic rippers attached to the backs of the Casspirs, to a depth of approximately 150mm. The procedure is repeated or adapted to achieve the required clearance rate until all the stretches of road are clear, usually totaling between 15 and 30 km per day. Taking into consideration that, on the same day, the sampling team goes out again to carry on with vapor sampling where they left off the previous day, it is easy to understand that, once there is continuity, the teams can clear more than 150 km per week.

There are, of course, factors that may

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