Pookie Rides Again

Following the buzz caused by sniffer wasps and the scurry from mine-seeking rats, now it seems it is time for the African bush baby to come into its own. Mine clearance specialist MineTech International is completing work on a three-year project to transform an abandoned Zimbabwean war relic into a cost-effective mine detection platform for the 21st century. Project leader Willie Lawrence of MineTech International plots the progress of the revival of Pookie.

by Willie Lawrence, *MineTech International*

Introduction

In the drive to improve safety and efficiency in mine clearance, one thing to remember is that old need not necessarily mean outdated. Often it's the tried and tested solutions that prove the best. Born out of the necessity to counter the heavy casualty toll from landmines planted on roads in former Rhodesia in the early 1970s, Pookie is testament to the fact that cost effective solutions on the front line of mine detection need not be rocket science.

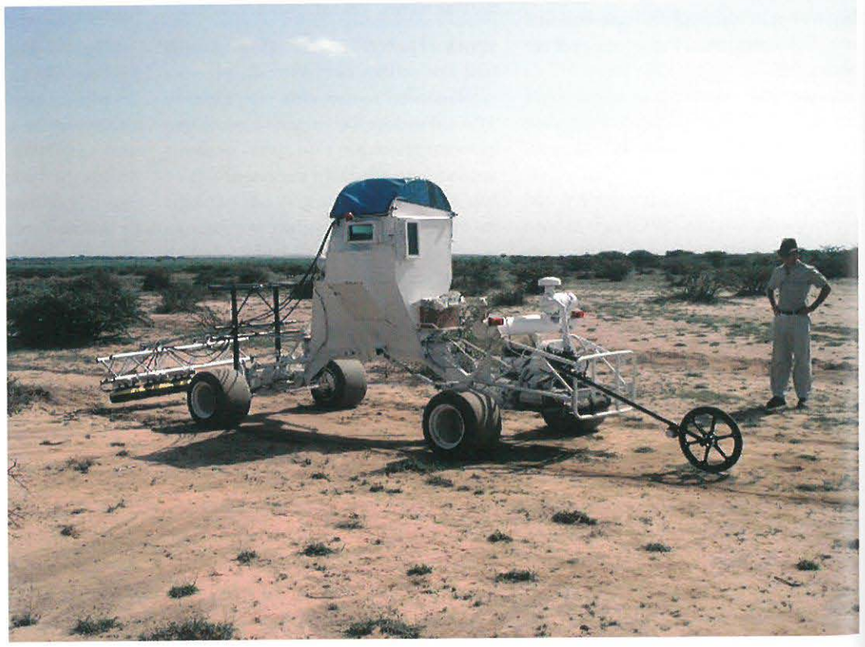
After some 20 years of dust gathering, Pookie rides again, proving its potential as a platform for modern mine detection technology and in particular as a vehicle to deliver GPR safely in close proximity to the mine. Recent field tests in Eritrea were designed to highlight how a partnership between the old and the new could be used effectively in clearing mines from unsurfaced roadways. This article examines the work done to date in the revival of Pookie, identifies the results and findings of the field tests and outlines the steps now being taken to bring Pookie back from its burrow for modern-day mine detection.

The History of Pookie

Between 1972 and 1980, it is estimated that more than 600 people were killed and thousands more injured by landmines on hundred of kilometres of roads and runways in Rhodesia. The toll would have been much higher but for the invention of Pookie, a small detection vehicle designed to travel ahead of military and civilian convoys and light enough not to detonate anti-tank mines.

Pookie, so named because of its resemblance to the small wide-eyed African bush baby, was constructed on a light-weight chassis and carried a one-person armour-plated cab. The cab had a V-shaped undercarriage designed to deflect any blast away from the driver and to combat centre blast mines. The wheels were positioned some distance from the cab, again to protect the driver in the event of detonation by offsetting the seat of explosion, and they were housed in Formula One racing tires, apparently bought in bulk from the South African Grand Prix. Wide with low pressure, they exert a minimum ground force. The vehicle was propelled by an engine from a Volkswagen Beetle that was capable of taking Pookie to mine detection speeds of up to 60 kilometres per hour. Two drop-arm detectors were mounted left and right and equipped with a detection system that bounced magnetic waves into the ground as well as an acoustic signal to indicate metal.

On first trials, Pookie detected every metallic mine and went on to prove itself both reliable and safe. Even though Pookies did detonate anti-personnel mines and several booby-trapped anti-tank mines in action with the Rhodesian army, this was only at the cost of new wheels and rim replacements, but no serious human casualty.



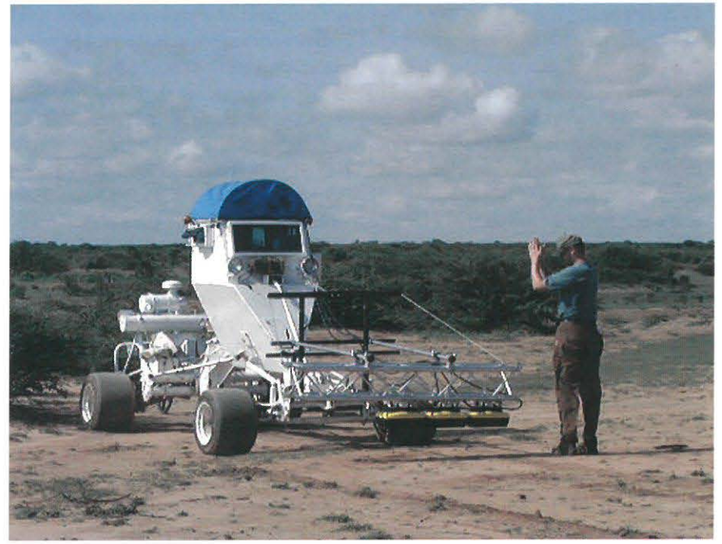
The Pookie.

At the end of the Rhodesian conflict, Pookie went out of commission, and it sat around gathering dust as a war relic from the early 1980s onwards. However, the advent of new mine detecting technology has added a new lease of life to this vehicle. In late 1999, MineTech brushed off the cobwebs and began looking at the potential of Pookie as a low ground pressure platform for Ground Penetrating Radar (GPR), enabling GPR to be used safely in close proximity to target mines to enable accurate mine detection.

Pookie's New Mission

MineTech began a three-year collaboration with a team from a German company, Tricon, with the objective of converting Tricon's GPR technology into a viable application in the field. As a first step, the GPR system was initially trialed in Mozambique, mounted on the front of a Landrover on trial minefields. The results were good, and the technology proved its ability to identify density changes in the soil surface on a trial stretch of road to a depth of 0.5 metres. What was needed to convert this into a practical application was the right platform from which to gather the information. As a lightweight vehicle designed specifically for unsurfaced road conditions, Pookie once again came into its own, able to traverse anti-tank mines and take the GPR system directly to a problem area.

In stage two of the project, trials were first conducted combining Pookie with the GPR system. These were held in Somaliland. The results were conclusive enough to show that the GPR system worked with its new mounting partner, but it wasn't quite a marriage made in heaven. Although the basic concept was sound, Pookie would need more than just a facelift to bring her into the 21st century. In the next phase, the VW engine was replaced by a hydraulic pump system, a Hatz 40 Horsepower hydraulic motor manufactured in Germany and used on numerous small vehicles in the mineral mining world. The motor is capable of travelling at 10 kilometres per hour, slow for the movement of a Pookie between targets, but a good average speed for quality GPR data gathering. Pookie was set to run on slightly inflated formula one racing slicks, delivering a weight distribution that exerts a pressure of only four pounds per square inch per wheel on the road surface. (However, the steering system wasn't man enough to deal with the enhanced tires and ground to a halt at speeds in excess of 20 kilometres per hour.) This was replaced with a hydraulic steering system and steering ram, which linked to the original relay system by a number of arms and joints. Pookie also needed a substantially enhanced power system sufficient to support five radar sensors from the system. This was provided by two small lightweight, 12-volt batteries linked to the motor's alternator. The GPR system used by Tricon was fixed to Pookie with aluminium spars designed to overhang the front of Pookie by approximately 1.5 metres. These carry five sensors that pass over the ground as Pookie moves. Each sensor is 40 centimetres wide giving a total width of coverage of two metres.



The Pookie during testing.

To complete the project, a full pilot of the system was needed in a theatre with a high concentration of mined roads. Eritrea was the obvious choice, with an ongoing need for this type of technology. In 2001, Pookie went on location on roads in Senafe, Eritrea, 130 kilometres south of Asmara. This first full pilot project was funded by the German government and run in conjunction with the Eritrea Mine Action Centre, who was asked to be responsible both for targeting the Pookie team and for conducting a form of quality control on the system in general.

The first objective was specifically to test the operational issues of the whole system and its performance as a means of gathering data along suspect roads, which could then be used to give an accurate positioning of potential mines in a way that would be of practical use to the deminer. Secondly, we aimed to assess the steps required to link a Pookie/GPR demining solution to international demining standards. From MineTech's perspective, we were keen that the trials be rigorous and conducted in an environment where the system would be open to a wide-ranging scrutiny to ensure an extremely thorough and possibly critical analysis of the package on show. The project team worked as far as possible to the normal MineTech Standard Operations Procedures (SOPs), but part of the aim of the exercise was to develop a set of unique SOPs specifically for the evolving Pookie system.

Findings

The overall conclusion of the trial was positive in that the combination of Pookie as a mechanical platform working in conjunction with GPR does achieve the aim of gathering relevant data on a potentially mined road both safely and cost effectively. In a total of 11 workdays, the team covered 89,436.2 square metres of ground and investigated 79 readings. No landmines were found.

What was clear was that a Pookie working a six-hour data-gathering day at a speed as low as five kilometres per hour can readily cover 10 kilometres of road, a good average and readily achievable. This is based on the average width of road generally experienced in Senafe of between 4.5 and five metres. With a two-metre sensor width, three sweeps over each road section guarantees good coverage and some overlap. The best quality data is recorded at around eight to 10 kilometres per hour. Data gathered at significantly higher speeds becomes too blurred to interpret with any accuracy.

The data was integrated to a GPS to give a position that was then translated to a distance measurement along the road. The system recorded both distance from the start point to target and distance in from the edge or verge. A small tachometer mounted on the rear drive axle was used to pinpoint the position of potential mines with an accuracy of up to one metre at 1000 metres. This was trialed and tested.

Mechanical Performance

The trial was nevertheless a learning experience, and a number of constraints were identified. From an operational perspective, the platform required further modification to improve mechanical availability. Pookie had most difficulty performing in very stony conditions. The formula one tires are good for most roads experienced in Eritrea. However, if seriously rocky terrain is to be surveyed, a more durable tire is needed, an issue that could also be dealt with by better target choice. In the mean time, the racing slick will continue to be used, possibly with a new lighter-weight rim.

Similarly, while the modifications to the steering system were on the whole successful for the speeds required for data gathering, some changes in design are needed for high speed travel between targets. Similarly, the motor, capable of 10 kilometres per hour was perfect for data gathering, but slow for movement between targets. To overcome both of these issues, a trailer is being designed to take Pookie from one job to another. In practical terms, the more important factor in field operation is mechanical reliability, and in this respect, Pookie's motor performed well.

Data Gathering

In terms of data collection, the span of the sensor area at two metres would seem to be ideal, enabling the system to perform effectively on roads of a variety of different widths. It was particularly suited to the average Eritrean road we encountered (between 4.5 and five metres wide). Widening the sensor coverage to, say, six metres would obviously be more efficient on six metre roads but would not cover a road of eight metres and would certainly be problematic on a narrow three-metre track or roadway. Increasing the width of senor coverage also raises the trade-off between weight and performance. Wider coverage means more sensors and an increased power requirement, adding more weight and increasing the risk of detonation.

At the time of the trial, the GPR technology had not been developed to the stage whereby real time data gathering and interpretation could take place. This will possibly be available in due course, and further modification to platform design as well as drills and SOPs will then be needed to manage the concurrent detection and clearance.

In the meantime, the current GPR system is capable of gathering up to eight hours of data in one work exercise. Downloading the data takes a further three hours. Reading the data requires a highly trained eye, and in general, the job of interpretation takes about as long as data gathering, especially in areas of rocky terrain, which generates more readings and consequently requires more interpretation time.

The current method of data capture, download and interpretation was identified as a productivity bottleneck, but this could be modified to improve daily output. Greater efficiency could be achieved simply by overlapping activities, downloading data for interpretation after, say, just two hours of gathering, so that the data can be interpreted at the same time as the next phase of gathering occurs. The other alternative is simply to increase the available manpower for interpretation.

■ The Pookie's detector arms.

Positioning Potential Devices

The method used to translate the GPR data to an accurate position marked on the road was found to be effective, although a second tachometer has now been mounted on the rear of Pookie to act as a failsafe system. It was suggested that the method of verifying positioning for the field team should be re-examined. It's obviously crucial to eliminate any difference in measurement, no matter how slight, that could be caused by uneven ground, the curve in the road or human error, to ensure no mines are missed.

One solution is to ensure the field team uses an identical measuring wheel so the exact same technology is used to re-identify marks. A better alternative, however, is for Pookie itself to operate a second run from the previous day's start point, marking each suspected mine point with a jet of paint from a paint gun mounted on the platform. This reduces any margin for error, with the same instrument used to record initial distance zeroed and used again to verify targets.

Compatibility with International Standards

In order to meet international standards for humanitarian demining, further systems are required to mark the stretches of roadway as they are covered. To tackle this, a marking system has been developed to plot regular points of Pookie's progress. This will help ensure the driver overlaps his run correctly and covers the entire road. As a result of the trials, the SOPs now developed for the system recommend that the area to be investigated for each suspected mine will be a minimum five metres in advance and to the rear of the marked point and across the whole width of the road. This provides a factor of safety in case there is ever a measurement dispute. It also provides a 10-metre by four-metre box that can be used if dogs are on site.

Equally important from an SOP point of view is medical provision and Casualty Evacuation (CASEVAC). A Pookie might be five kilometres away from a control point when a problem occurs, and the question is how to get a team leader or medic upfront rapidly to sort out a problem, whether a simple blocked fuel filter or a mine detonation—which potentially requires a rapid response. Currently, MineTech is investigating a number of practical options, to be included in the SOPs, but the most efficient would appear to be a second Pookie modified to take a second person or tow a stretcher trolley.

Quality Control

In Harare, MineTech is developing SOPs specific to the operation of Pookie to resolve the challenges identified during the project. Emphasised in these will be all the issues relating to safety, techniques of gathering production figures, quality control, support team techniques and logistics relating to support for the system.

There are arguments stating that for a mechanical system to be proved, a second system must cover the same ground entirely. Running a second system over the same ground, however, is not cost-effective demining. For the areas and distances expected to be covered by Pookie, it is simply not going to be efficient. MineTech's approach to quality has always been to build quality standards into working practice through rigorous systems and procedures. To date, this approach has proved consistently effective in that not one undetected mine has yet been found behind a MineTech operation, a record we are keen to sustain.

One approach being investigated to quality test the Pookie GPR system is to run performance tests over sections of road pre-planted with dummy items.

Another is to use dogs to verify individual sections of the ground as a check procedure, and again, MineTech is developing these ideas in the SOPs.

Summary

The modifications identified for the Pookie platform are now virtually in place and the completion of the Pookie pilot has been a successful and important phase in integrating GPR into humanitarian demining. As a result, MineTech can now field two key systems in the quest to improve efficiency in demining: mechanical ground preparation and now electronic mine detection. Thanks go both to the support in terms of funding from the German government and to the Mine Action Centre in Eritrea for its support, confidence and constructive criticism, which have enabled the system to continue to be developed in a positive direction.

Without doubt, the best way of testing and proving a system is not in the laboratory, but in the workplace. In our case, that is a minefield where the unforeseen happens in real time, where problems must be corrected and solutions need to be effective. And it is in the minefield, not on a test bed, that Pookie has earned its stripes as an effective platform for electronic mine detection.

The GPR Pookie is a fast, cost-effective and accurate system for identifying and clearing mines from unsurfaced roads, with an important role to play in opening up essential communication routes in countries such as Eritrea, Sudan, Somalia, northern Iraq, northern Iran and Lebanon. But as far as Pookie is concerned, the potential does not stop there. MineTech is also investigating the role of Pookie as a platform for a broad loop metal detector, and a prototype system is currently under construction.

In the front end of mine clearance, what continues to be needed more than anything are technology solutions that improve removal rates, overall efficiency and safety for everyone involved. And while the pot of money available for the job remains very finite, these solutions need to be easy to implement and cost-effective. In all of these respects, the GPR Pookie fits the bill, with the potential to detect mines and enable mine clearance from communication routes more effectively than previously achieved. ■

**All photos courtesy of Exploration Logistics Group.*

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