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Mine Detecting Rats Make an Impact in Cambodia

by Cynthia D. Fast, Ph.D., Håvard Bach, Paul McCarthy, and Christophe Cox [APOPO]

Despite decades of national and international mine action efforts, Cambodia remains littered with landmines. The casualty rates are among the world's highest, and there is considerable socioeconomic damage from landmines and other explosive remnants of war (ERW).¹ Cambodia has established the goal to clear all known minefields by 2025.² To achieve this, funding must be secured, and land release rates must be increased. This can only be achieved by taking advantage of available resources and improving land release methodology.

The mine clearance capacity in Cambodia is largely composed of manual demining teams and much smaller animal detection units. Historical reasons fueled preference for manual mine clearance; however, considerable improvements in

animal detection methodology have enabled more reliable and effective land release. Moreover, with many of the large, well-defined minefields cleared, technical survey will be essential for effective land release of the vast number of poorly defined mine suspected areas remaining. Despite broad consent that more animals will expedite the land release process in Cambodia, manual teams still disproportionately outnumber animals.

As a nongovernmental organization (NGO), APOPO is best known for its African giant pouched mine detection rats (MDR), previously deployed in Mozambique and currently active in Angola. Internal and external evaluations repeatedly show that APOPO's MDR are exceedingly reliable and efficient.³⁻⁹ Yet, degrees of skepticism lurk within the mine



The APOPO MDR team in Siem Reap, Cambodia.
All graphics courtesy of APOPO.

action industry. Initially, the Cambodian Mine Action Centre (CMAC) was hesitant when APOPO proposed bringing rats into Cambodia. Nevertheless, after APOPO agreed to neuter all rats, and assuaged concerns that the rats could transmit the Ebola virus, shipping arrangements were secured. APOPO accepted rigid initial testing and prolonged quality monitoring of the rats by CMAC.

With joint APOPO/CMAC operations planned for districts in Siem Reap, where suspect land had not been used for almost 30 years, the first group of APOPO mine detection rats arrived in Cambodia in September 2015. Before deploying APOPO's MDRs to the minefield, CMAC conducted two phases of evaluative testing on the rats' performance.

Accreditation of the MDR in Cambodia involved tests that examined the MDRs' abilities to locate buried explosives at the DU4 CMAC Facility in Prasat Bakong. During this test, each rat had to detect a total of six mines hidden within an area of 400 sq m (478 sq yd). To avoid potential influence between rats, unique areas of land containing the same number of mines were used to test each rat. All 14 of APOPO's MDRs passed this initial evaluation, accrediting each rat to operate in a live minefield.

The **CMAC Acceptance Test** occurred after the rats passed their first accreditation and were deployed on a real operational minefield in the Prasat Bakong district of Siem Reap. CMAC performed ground preparation, where vegetation cutting was required, using an armored brush cutting machine at least 24 hours before the rats were deployed to the area. CMAC was cautious and depended on both the initial accreditation test of the rats as well as the close monitoring of the rats during their first three months of deployment. During this period, teams using metal detectors quality controlled 100 percent of the area searched by the MDRs. In this phase, the rats searched a combined area of 53,253 sq m (63,690 sq yd) and found 11 landmines and three items of unexploded ordnance (UXO). It is significant that the manual quality assurance teams did not find any items missed by the rats. Moreover, all mines found by a rat were confirmed by a second rat that independently searched the same area, enabling full clearance.

APOPO's MDR at Work

For the remaining eight months of 2016, APOPO's MDRs sniffed out 67 additional explosive devices, including 43 landmines and 24 UXO, hidden within 225,415 sq m (269,594 sq yd)



Since APOPO and CMAC cleared the mines, Chim Lok and his grandsons can now graze their cattle without fear of injury.

Expense	Manual demining team		MDR team	
	Unit cost (US\$)	Monthly cost (US\$)	Unit cost (US\$)	Monthly cost (US\$)
Team leader	350	350	350	350
Deputy team leader	302	302	302	302
Deminer x10	271	2,710	-	-
Deminer x7	-	-	271	1,897
Rat supervisor	-	-	500	500
Rat handler x4	-	-	271	1,084
Rat leasing (500 US\$ x 8)	-	-	500	4,000
Total		3,362		8,133
Monthly production	-	8,000 m²	-	32,000 m²

Table 1. Cost comparison table based on APOPO/CMAC operations in Cambodia.

of Srae Nuoy in the Varin district. The rats averaged 28,177 sq m (33,699 sq yd) of land cleared each month, with 51,590 sq m (61,701 sq yd) covered in July alone. To provide full clearance, two separate rats independently searched each plot of land, resulting in more than 500,000 sq m (597,995 sq yd) traveled by the MDR team, supported by 11,262 man hours. All rats showed 100 percent agreement in the detection of explosive devices. During this time, 25 percent of the land cleared by APOPO's rats (approximately 56,000 sq m or 66,975 sq yd) was quality controlled with metal detectors, revealing that the MDRs did not leave behind a single explosive item. While the metal detectors discovered more than 22,000 fragments of metal, the rats ignored all fragments that did not contain residual explosives, which undoubtedly contributed to the rats' clearance speed.

MDR Cost-effectiveness Case Study: Siem Reap Province

A reliable comparison between manual demining teams and MDRs is not straightforward; it requires consideration of the different team structures and operational costs. Manual teams typically have more employees, necessitating additional management. Minimum safety distances introduce deployment constraints that disproportionately affect manual deminers, due to the number of deminers required to clear an area, which leads to deployment on several concurrent tasks and increases in transportation and management requirements. Moreover, the need for minimum safety distances is obviated for MDR in some cases, because they are not physically intrusive and are too light to detonate mines. Rat teams require fewer employees but potentially greater management related to rat care. For simplicity, and from APOPO's experience, project management can be equated across both teams.

Cost/efficiency comparisons can then rely on operational field costs, assuming all other costs, including brush cutting, are the same. The comparison in Table 1 uses the following factors, which are calculated from experience:

- MDR search 20 x 10 m boxes. Manual deminers clear the grids and indications by the rats.
- MDR teams with eight rats clear 1,600 sq m (1,913 sq yd) per day (average double search) and require 285 sq m (341 sq yd) of manual demining.
- Manual deminers average 40 sq m (47 sq yd) per day and require seven manual deminers to support a team of eight rats.
- Although lease is not currently required, an assumed lease price of US\$500 per rat per month has been used to balance the costs of breeding, training, and transporting rats.

Extrapolated productivity figures from APOPO's combined operation with CMAC (as provided in Table 1) show that a balanced operational capacity of rats and manual deminers clears 65 percent more land (24,000 sq m or 28,703 sq yd) than an equally expensive manual demining capacity. Using \$1 million on the operational component of a combined capacity and accepting the figures above would enable the release of 3.93 million sq m (4.7 million sq yd), an additional 1.55 million sq m (1.85 million sq yd) compared to manual mine clearance alone.

Looking Forward

Despite initial challenges in exporting MDRs to Southeast Asia and lengthy evaluations, CMAC and APOPO forged a successful and cooperative land clearance campaign in 2016, with APOPO's MDR helping to clear 573,256 sq m (685,608 sq yd) across seven minefields. This land was returned to

community use as quickly and cost-effectively as possible. Within 17 days, one of these minefields was cleared and handed back to local residents, where they immediately planted rice crops. CMAC was a supportive and highly-valued partner, prompting APOPO to invest more into strengthening this relationship. Pending available funding, APOPO now aims to expand its MDR team to include more than 30 rats in Cambodia by the end of 2017.

Quality control and operational use of the rats in Cambodia demonstrates that the rats are reliable for clearance and, when integrated with manual demining teams, dramatically increase cost-efficiency. APOPO has the capacity to supply a high number of rats to the mine action sector in Cambodia and values CMAC's partnership while maintaining interest in supplying MDRs to other partners. ©

See endnotes page 66



The APOPO MDR working in Siem Reap, Cambodia.

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Cynthia Fast joined APOPO in 2016 as head of training and behavioral research. She holds a psychology Ph.D. and Master's degree, specializing in Learning and Behavior and Behavioral Neuroscience, from UCLA. While a member of the Behavioral and Systems Neuroscience department at Rutgers University, Dr. Fast investigated olfactory learning and perception in rodents. Dr. Fast is a member of the New York Academy of Sciences, Pavlovian Society, Society for Neuroscience, Women in Learning, Association for Chemoreception Sciences, Comparative Cognition Society, and American Psychological Association.

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Håvard Bach is based in Geneva as Head of Mine Action for APOPO. A former Norwegian military engineering officer, he was employed by Norwegian People's Aid in 1992, managing several mine-action programs worldwide. He has worked as head of the operational methods department at the Geneva International Centre for Humanitarian Demining (GICHD) where he managed different studies and projects, including mine-detection animals, mechanical mine clearance, manual mine clearance, and land release. Before joining APOPO in October 2016, he was the chief technical advisor, Operational Methods for NPA.

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Paul McCarthy joined APOPO in 2015 as the program manager for Cambodia. Paul has worked extensively in commercial mine action and private security, supporting large International companies, primarily in the Middle East. Paul served twelve years in the British Army as well as seven years as a U.K. police officer and is currently studying for a Master's Degree in Law.

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Christophe Cox leads APOPO's team from its headquarters in Tanzania. He has a Master of Science in Product Development & Development Sciences, and developed many of APOPO's technical realizations. Christophe has many years of management experience in East Africa.