Technology's Promises

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Technology's Promises

Every technology under development makes big promises. Here are five projects that may someday impact the world of mine action.

by JJ Scott, MAIC

Introduction

Preuse any brochure or website that promotes a developing technology and there is one word that will come up repeatedly: promise. Every new gadget promises to vastly improve, simplify or otherwise revolutionize some aspect of modern life, and the products aimed at mine action practitioners are no different. Each promises to make demining quicker, easier, safer or cheaper, and each breakthrough promises to be more earth shattering than the last. I looked into a variety of devices that promise to have an impact on some aspect of mine action, from new mine-detecting sensors to new types of landmines—even a potential landmine-substitute. These projects vary widely in their goals, budgets and feasibility, but all share one common bond: if fed enough money, each promises to forever alter the practice of mine action.

Fido

Dogs are superb at detecting landmines. Their noses are some of the most sensitive detection devices ever created. That is, until they get tired. Or sick. Or get too hot outside. All cause dogs' effectiveness to drop rapidly. Dogs also tend to lose interest in demining as the day wears on, which is an inevitable though particularly dangerous consequence of their assigned task. How might one retain the mine-sniffing benefits of dogs while negating their shortcomings? Nomadics, Inc., with funding from the U.S. Army, is developing a vapor-detecting sensor they call "Fido" that promises to detect mine-like objects as effectively as a dog but will never get tired, never get sick, never get bored and never get frets. I quiri...
Robotic Snakes

The challenging terrain that deminers often face can severely hinder their ability to carry out vital procedures such as surveying a known or potential minefield. Landmines might be set or unmined objects over or near terrain, making it impossible to determine the presence or location of landmines within the area. One man, Dr. Ian Gravagne of the University of Hawaii, has recently proposed a novel method: the use of robotic snakes to survey minefields.

Using a robotic snake as a sensor platform allows the snake to navigate over landmines or other objects that standard robots cannot access. A robotic snake that could faithfully reproduce a real snake's motions could easily slither through dense foliage, avoiding obstacles or deep pools of water through a thick forest. Of course, robotic snakes would also work splendidly on land, providing the normal benefits of mechanical solutions: they won't tire, they maintain a known standard of detection, and if they do run up against any object, they simply shed a few more pieces of rubber from their tails.

Alas, it will be years before robotic snake technology reaches the level it must prove in order to displace useful field minefields. No existing snake prototype could move well enough, carry enough or long enough to make good on the snake's promise to mine action. Dr. Gravagne has presented his idea to several interested parties, but the impression they all gave him was, "economically, not a good-enough product." Current prototypes honestly don't dislodge all that well, limiting their utility to only the larger objects. They also can't carry enough weight to accommodate both sensors and batteries—either of which a robotic snake is fairly useless without. This is why some researchers also hope that "while impression-looking prototypes exist..." the "interested" industries and individuals do not seem prepared to fund the [research and development] necessary...to get a practical snake-like animal to follow the snakes or minefield." It seems that lots of people are intrigued by the possibilities offered by robotic snakes but not interested enough to actually pay for their development.

REST

Robotic snakes would provide an effective method of bringing sensors into contact with the scent of explosives, but they lack the visual sensors that a dog or sensor-equipped robot could use to determine the scent to the sensor. Proving that such a scenario is not only possible but also useful, the Geneva International Center for Humanitarian Demining (GICHED) is currently facilitating the further development of a technique that they call Remote Explosive Sensing Tracetrack. REST is based on a technique originally developed by the South African company Metchem, which had named it the Mechem Explosive and Drug Detection System (MEDDS). The REST system is now used primarily as a area reduction method, most often along roads, where it has proven especially effective. At height as REST involves, however, brings among nitrate areas to a remote detector that determines the presence or absence of explosives. First, a team equipped with scent trapping devices venture into the suspect area and detect the presence of nitrate. Then, the scent trapping devices are used to find the source of the nitrate in the mine area. The scent trapping devices are positioned at a distance from the suspect area, and the results are analyzed. The REST system allows for the rapid detection of landmines in areas that are difficult or impossible to reach by other means.

Scent collection on filters, whether for inspection by dogs or by machines, will almost certainly always offer advantages in terms of efficiency for area reduction, so scent collection is more likely to be used in the future. The REST system is one emerging technology that has already had a positive impact on the detection and disposal of landmines. The REST system is capable of detecting landmines within a 10-meter radius, allowing the system to be stretched to its greatest capacity.

Under development by the Department of Defense's (DoD) Weapon Systems Technology Information Analysis Center (WSTIC), the Side Attack Mine (SAM) engages targets from a distance. When an unwrapping vehicle passes nearby, the SAM's tracking system uses this information to provide a near-term target, launching a projectile toward the target.

Contrary to its deceiving name, the WSTIC project is not a classic bounding AP mine. Instead, Bordauer uses a telescoping appendage to elevate itself about three meters, increasing its field of view and allowing it to home in on a target. The wand then slides on track rotationally like the SAM, Bordauer then attacks its target from the side. The mine uses sensors to detect nearby targets and then use some of its most impressive characteristics to avoid this tact. This is certainly an advance in lethality. But do these mines offer any similar advantage to the job of those who use them? Mr. Kogler answered in the affirmative. If the mines work as advertised, each minefield would require less of them. Fewer mines in place means fewer mines to remove. But that's not the only advantage these next-generation mines will offer the minefield attacker. Today's mines don't boast the capability to deliver a communications module, allowing a man-in-the-loop-type capability. In the future, Mr. Kogler explained that "this ability will aid demining operations by allowing a soldier to turn the mines into tools of war." The mines will still be victims activated, but only so long as the mission lasts. Also, some programs can self-destruct in mines, blowing them to bits after a certain amount of time. This would presumably be a backup to the "off" switch.

The mines outlined above offer advantages for many reasons. One is an improved ability to make use of minefields. Fewer solders will need to lay fewer mines that will destroy more targets, while unused mines will self-destruct or be turned "off" so deminers can safely remove them. It's as much of a win-win scenario as it can be found along the minefield/mine action interface. But will the humanitarian potential of these mines ever be realized? After all, improved technology comes at a price: these next generation mines will cost at least $1,500 (U.S.) each.

This brings up an important consideration: assuming that militaries continue to use mines for area denial, will the mines become more effective? There is no doubt that they will.

Metal Storm

When used by legitimate armies (not always the case), metal mines can be extremely effective as an area denial weapon. A metal minefield fulfills this role very well, defending against both infantry and armor cheaply and effectively. AP mines incapacitate the soldier; AT mines impale the tank. Once employed, neither can be removed indefinitely, ensuring that no one gets in. Permanency and reliability are two of landmine's advantages over other area denial systems. Once a minefield is installed, area denial is assured. But when the war has ended and the soldiers have disposed of the landmines, the landmines remain to exact an unwarranted toll on civilians. AP and AT mines linger on, assuming a new role: denuding land to the cities that need to be redeveloped.

What if a military could lay down a minefield that held no mines? What if a military could achieve its area denial objectives without the unwarranted tolls left when the soldiers left? What if soldiers could identify potential targets of their area denial systems before they were blown up, using new technology known as Metal Storm, under development in Australia by Metal Storm LTD., promises to address the per-
masnecy problem of landmines while maintaining their area denial "advantages." Let us first outline the technology itself before moving into its potential impact on the mine action world. Metal Storm technology allows nearly simultaneous firing of multiple projectiles from the same barrel, resulting in unprecedented rates of fire. By firing from 36 barrels at the same time, a prototype gun demonstrated by the company nearly vaporized 15 wooden doors in just two tenths of a second, representing a firing rate of over one million rounds per minute. Metal Storm uses an entirely electrical firing system, doing away with 20th century relics such as mechanical firing pins and triggers. The only parts of a Metal Storm gun that move are potential leads. And they move fast. Because each barrel is fired so soon after the previous, by some strange law of aerodynamics those in the rear "pods" the bullets in front, increasing their velocity. Reload is accomplished by simply inserting another factory-packed rush of bullets into the barrel. Besides bullets, Metal Storm technology has been adapted to much larger munitions, including 60- and 60-mm rounds and a variety of grenades, greatly upgrading the destructive capability of this weapon system.

Metal Storm Ltd. has devised several possible uses for their technology, and one of those happens to be a landmine replacement system that is compatible with the Mine Ban Treaty. Both the Australian and U.S. militaries have shown great interest in this potential application, providing a steady flow of funding to bring the company's concepts to fruition. What follows is a basic area denial scenario as currently imagined by Metal Storm Ltd. For more technical information, view the company's website at www.metalstorm.com.

First, friendly soldiers bury a few dozen landmines around the area they are guarding. Then they place several Area Denial Weapon System (ADWS) pods—each containing up to 80 barrels that would be firing into a fixed area to 60-mm rounds and a variety of grenades. In strategic locations so that each pod's line of fire intercepts another's. Some barrels could be reserved for flashbang grenades and other non-lethal ordnance, giving several options for dealing with intruders. Every sensor is connected to every ADWS pod, and all are connected to a central communication hub, represented by a laptop computer in the company's website demo. This laptop is in turn monitored by a soldier who represents the ever-so-necessary man-in-the-loop.

So, we have sensors linked to pods linked to a laptop watched by a soldier. How does this system deny an area? And how is it better than landmines? Let's imagine that enemy forces—say, a few tanks and some armored personnel carriers—are encroaching on the turf that our lone soldier is guarding. From his protected position, he notices his laptop flashing an alert. The bared sensors have triangulated a target's position while it is still out of visual range. In a traditional minefield setting, whatever is out there would already have been blown up, regardless of whether it is a civilian's truck or enemy tanks.

But our soldier has the opportunity to check out the target before he buries it under a barrage of explosive munitions. According to Metal Storm Ltd., the ADWS pods will accommodate a video camera in one of the barrels. The soldier can choose to launch this camera to positively identify the target from a bird's-eye view. In this case, the soldier sees that enemy forces have already infiltrated his perimeter. Using his laptop, our man-in-the-loop orders up a punishing response to this incursion while the sensors keep tracking the target's position. He can choose how many munitions to fire off and also which types to use. As soon as he confirms his decision on the screen, every barrel in every pod erupts simultaneously. A split second later, thousands of 60-mm anti-armor grenades rain down on the enemy tanks and personnel carriers, engulfing them in a flood of explosive fire.

After the soldier's army decides that particular area no longer needs defending, combatants can round up the pods and sensors and transport them to other war zones where conventional munitions were or will be fired and dropped, and those munitions unquestionably leave UXO problems behind. Typical mine detection methods would be severely compromised under such conditions, as the shockwave would eliminate metal detectors and the ubiquitous vapors would negate the use of dogs and even Fidos. Though Metal Storm might not create UXO problems, it might prevent deminers from cleaning up ever. Mr. Vehlow inquired about this potential complication, and he reminded me that any round detonates in an area there will be some sort of sharped effect. He stated that Metal Storm's advantage lies with the man-in-the-loop's ability to tailor the system's response to the identified threat, meaning that no more munitions than necessary would be fired at any one time. I see his point and agree with his reasoning—Metal Storm does offer significant advantages over a conventional minefield for soldiers and deminers alike—but the ability to surmount an area with thousands of grenades in a fraction of a second still does not seem like a huge step forward for society. Nevertheless, the mine action community can look forward to deployment of Metal Storm ADWS pods in as little as 18 months, potentially signaling the beginning of the end for conventional minefields. And that's something to cheer about, isn't it?

Conclusion

As in every other field these days, mine action is bursting with new, promising technologies. The projects outlined above promise to significantly alter the mine action landscape—if they are given proper funding. As Mr. Sikes put it, "From a commercial standpoint, just going out and making demining equipment is not particularly profitable." And there's the crux of the mine action technology problem: so little promise, so little money.

References

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