CENTRE FOR LAND WARFARE STUDIES

ISSUE BRIEF

No. 186 July 2019

Nanoweapons and the Future of Warfare

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Introduction

Nanoweapons are the weapons of the upcoming future wars. They are going to be used by militaries to conduct silent and deadly warfare in ways that are going to annihilate the enemy forces in a manner like never before. It is going to be silent, precise, and lethal. The debate is no longer about if such a thing is going to happen—it is no longer in the realm of science fiction. The question is *when*, *from where* and *on which target*. Imagine this: a swarm of small mosquito-like robots fly over the enemy's main power grid and releases small amounts of graphite dust per bot. If the swarm consists of even a thousand such bots, it can effectively bring a part of the national grid to a screeching halt. Or imagine a small roach coming and injecting you via what you may otherwise consider to be a bite. But instead of the toxin in a regular roach, this robotic roach which has been released near you and programmed to kill, releases a few nanomolecules of a nerve agent—just enough to kill you. No telltale sign would remain to find of who killed you, how, or why. Such developments are not that far into the future. Extensive research is being done on the subject

Key Points

1. Nanoweapons are the weapons of the upcoming future wars.
2. Nanoweapons would increase the capability of "flexible response options"; keep the conflict at low-intensity level while simultaneously finding a self-gratifying equilibrium.
3. Nanoweapons, due to their size, would have low detection probability.
4. Using expendable nanoweapons instead of sending in men with high-tech military-grade weapons would bring down the cost of war.
5. There is almost no way to know when or how the attack would manifest, or any foreseeable way to monitor or detect nanoweapons.
6. Indian Army must create a core team to propose a roadmap and a blueprint for their use in the future battlefield.

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matter even as we write this paper. It is simply not discussed openly or written about extensively due to the secrecy surrounding such weapon systems—as well as the potential backlash that publicising such military research and development projects may bring—effectively curtailing its development before it fully matures.

Keeping the sensitive nature of such defence projects in mind, this paper will not discuss the various developments in the field of nanotechnology. Instead, we focus solely on the possible use of nanoweapons in warfare. We shall look specifically at nanoweapons in swarms in the future battle space. With this limited scope, we will therefore not cover other possibilities in nanoweapon developments—in chemical, biological, or nuclear domain. While acknowledging that these are certain possibilities, and may be used in future warfare, we look solely at the swarm concept. We believe that large-scale wars which might use Chemical, Biological, Radiological and Nuclear (CBRNE) weapons as singular weapon systems are going to decline in the future due to treaties and "world order" restrictions, while their use may possibly increase coupled with other nanoweapons. That is to say, CBRNE weapons of large-scale being dropped from warplanes may decrease. But nanomolecules or content of CBRNE variety being used alongside nanobots and other nanoweapons may increase. We will look at the latter—and how their use in large swarms can affect the future battle space.

We shall first look at the changing character of war, before looking at swarming capabilities which would be available with the military having nanoweapons. Finally, we will analyse the possible effects that the use of such weapon systems would have on the conduct of war in (what we believe to be near) future.

Nanoweapons and Swarms: A Deadly Combination?

Recent discussions in power corridors across the world have focused on one thing: technology changing the character of war. Concepts and ideas such as grid warfare, hybrid warfare, fifth generation warfare and the like are being used extensively in such discussions. To an extent, discussions surrounding the changing nature and character of war are correct. While the character of war, which refers to the way that wars are fought, is changing with new and emerging technology, the nature of war, which refers to the human based concepts of greed, anger and fear as reasons for war are likely to remain.

Character of war has changed on at least two levels: technology of weapons being used in warfare, and type of battlespace. Nanoweapon technology affects both. This is possible due to the miniaturisation of future carriers, and also of the delivery system. This means that we can expect to see miniature weapons delivery systems, such as the mosquitoes mentioned in the beginning, to deliver/inject nano-size molecules of a decapacitating agent, such as nerve agents. Miniature explosives, which have been so densely packed together, can be dropped not only from warplanes, but also from small quadcopters (four rotor helicopters) that can fit in the palm of the hand. Though independently each may look innocuous and harmless, but when employed in thousands, they would create a critical mass to deliver a big bang. Also, independently, each cell may go unnoticed till they receive a command to concentrate on a point and time of own choosing. The possibilities for using a combination of nanoweapon technology with existing systems is enormous.

Their use will also change the character of warfare by changing the battlespace. The use of small, precise weapons systems will decrease the need as well as the possibility of a large-scale inter-state war from taking place in the future. With the costs of war increasing in all dimensions, military costs, economic costs, domestic and international audience cost, the state leaders' will to initiate large-scale inter-state wars has gradually declined. Countries today not only have international and regional platforms such as the United Nations and bodies such as the NATO, the European Union and ASEAN to air out differences, but also have a range of possibilities at their disposal. This is being talked of as "flexible response options" which allow states to keep the conflict at low-intensity level while simultaneously providing various platforms

for finding a mutually acceptable and self-gratifying equilibrium. Nanoweapons will drastically change the number of such options available with a nation.

With the amount of work already being done on nanoweapons, we can even today use them for covert strike capabilities. Response options to a state increase from retaliating and non-retaliating to including options such as covertly taking out key personnel that they so desire, local level attacks, as well as paralysing critical infrastructure. Each of these options then can be used as the base level for further escalation by the retaliating country for bigger and more conventional attacks. In the case of India, for instance, it could mean that should an attack like the recent Pulwama attack or the 26/11 Mumbai attacks take place again, the security apparatus could first conduct covert strikes against key personnel, such as the chief of the terror organisation, jam all communication points of the local area, before deciding to launch surgical strikes or using the air force for precision strikes. Nanoweapons can clear the ground for victory even before the battle has really begun.

When used in swarms, the real potential for use of nanoweapons in warfighting comes to light. Nanoweapon swarms would refer to multiple nano-sized bots that may or may not carry nano-sized molecules of an explosive or chemical/biological/alternate content. Their functional coordination is via a singular platform or command and control centre (C2) to achieve a common objective. The objective can be predefined, or modulated at the C2 as the situation progresses. The utility of swarms relies on not only the creation of a feeling of being overwhelmed in an adversary's mind, but also in the fact that creating and using nanobots in swarms allows for multiple kinds of nanotech weapons to be used. It allows for non-lethal nanobot designed for intelligence, surveillance and reconnaissance (ISR) to be sent in the swarm along with their lethal versions which can carry explosive material. Use of nanotech in swarm warfare will also allow for the swarm to take various shapes for different purposes, all the while being controlled and observed at the C2.

Swarm Effect

Using nanoweapons and nanobots in warfare, particularly in a swarm formation can be exceedingly useful on the battlefield—whether tactical, or long range (beyond line of sight). Changing of formations to suit changing needs in a new battlespace which is being increasingly defined by the use of new technology, and merging of civilian technology for use in battlespace cannot be emphasised enough. Nanoweapons, due to their size, would also have low detection probability. This would allow for them to fly out separately, undetected, before collecting at a point/grid/radar that they wish to destroy or jam. By then, detecting them would have little impact. The grid or radar would shortly be destroyed/jammed. Their use over long distances would make it easier for commanders to effect and attack reserves—a turning point for assured victory in your favour. This could be done by carrying them close to the intended target in a mother carrier and then releasing them closer and gradually. This point becomes even more poignant when these nanoweapons are made for single use (self-destruct mode) or kamikaze mode.

Beyond the advantages gained on the battlefield, nanoweapons would also decrease the general costs of war. Using expendable nanoweapons instead of sending in men with high-tech military-grade weapons would bring down the costs associated with war. Secondly, in the case of a reconnaissance or surveillance role, electronic warfare or graphite bombs, the use of nanoweapons and nanobots will also decrease the cost while increasing their net effectiveness. Two scenarios are described in the realm of electronic warfare to showcase how the threat can manifest:

- Electronic Support Measure (ESM) activity: The bots are designed to resonate at known operational frequencies of the adversaries. Limited number of bots are deployed and they lie undetected and get activated once the radio frequencies open up. Once the bots resonate, they would give indication to the operator to take the next offensive action.
- Electronic Counter Measures (ECM): Once the specific frequency of adversary is known, a second set of bots are deployed. The number will depend

on whether the intention is to cause interference in the communication set-up or totally jam the network. These bots would work on a simple principle, that individually each is non-effective in its power output, but collectively they generate enough power so as to paralyse the receivers.

By using limited number of bots, cost saving is effected besides other advantages such as low probability of detection, countermeasures or their destruction.

Due to the nature and the varied character of nanoweapons, their use in the battlefield will increase accuracy on large-scale and precision in small-scale warfare. Their use can span the entire spectrum from precision strikes to take out political, military or militant leaders, to specified area contamination, or large-scale attacks on critical infrastructure. Their use therefore transcends the tactical battlefield and can include even civilian infrastructure—an all-out war for full spectrum effect and decisive victory. It only needs imagination, meticulous planning, and structured use.

Most importantly, using nanoweapons can gain any army the most decisive gain: the psychological effect. The idea that you can be attacked by multiple, small nano-sized weapons seems like a doomsday scenario itself. Knowing that there is almost no way for you to know when or how the attack would manifest, or any foreseeable way to monitor or detect nanoweapons with such low radar cross-section (equivalent echoing area) or electronic emissions—it can possibly cripple the mind. Further when such an attack happens on the live battlefield, no one can attribute such an attack on specific party (state or non-state) until it decides to claim credit for it. The party that has orchestrated the attack, or knows how to mitigate the effect of such a nanoweapon swarm attack—can decisively turn the table on your side—the side that used the smallest weapon with the biggest impact.

Conclusion

Nanoweapons are no longer something from the script of a sci-fi movie, but a reality. Integrating Artificial Intelligence (AI) with such weapon systems would further increase their effectiveness. It is now time that the Indian Army gets involved in increasing their study and development on the subject matter, and creates a core team to propose a roadmap, or rather, a blueprint for their use in the future battlespace with viable timelines. The team should increase their interaction with private precision tool industry (both small and medium enterprises) and apprise them of their future requirement. This would ensure that the time lag from drawing-board to project execution is minimal. The use of nanoweapons for solving internal security problems too has great possibilities. It allows for quick, simple solutions to the security forces dealing with insurgents with both lethal as well as non-lethal options. Their use by the paramilitary forces would greatly increase their effectiveness.

Use of nanoweapons in the (immediate) future battlespace would not only be a force multiplier—it is going to change the game. And they are here. We only need to imagine different ways to use them. As proposed in our paper, the potential lies in using dispersed nanoweapons as collective swarms—a force that no one can really prepare against. We are now counting days to their use.

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