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TECHNOLOGY IN WAR: IMPLICATIONS FOR THE ARMY

Maj Joe Ballesteros

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INTRODUCTION

The study of wars shows that its scope and social impact has always grown and had a close relationship with the advances of science and technology. The Chinese invented gunpowder and used it to have fun with fireworks and although with a fire-breathing tube they could throw their spears a little further, it was not until the Europeans combined it with the technology of bronze, iron and steel that the development of weaponry began, and rifles and guns were born[1]. The Industrial Revolution introduced the steam engine and with it, engines evolved into the combustion style required for combat vehicles and tanks[2]. The age old dream of flying became a reality with the technology of the aerostat born first, and then the airplane, with its military application developed into the supersonic combat fighters, followed by rocket carrying nuclear weapons and even into space capabilities[3]. Today the Computer and Nanotechnology Revolution, when applied to war, reach limits that would seem like science fiction[4] not so long ago.

World War II is a clear example of how science and technology are used to begin an age of significant military development. The atomic bomb was developed in record time. Launched on Hiroshima and Nagasaki, hundreds of thousands of innocent people were killed and injured, and consequences for future generations that have lasted until today were caused. From here the

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[1] Tonio Andrade, *The Gunpowder Age*: *China, Military Innovation, And the Rise of the West in the World History* (PRINCETON UNIVERSITY PRES, 2016), 16, 74, 89.

[2] Thomas Anderson and Geoffrey Brooks, *Tanks of the Second World War* (Barnsley, South Yorkshire: Pen & Sword Military, 2017), 18.

[3] Walter Sierra, *Beyond the Saga of Rocket Science The Dawn of the Space Age* (Xlibris, 2016), 71.

[4] Daniel Ratner and Mark A. Ratner, *Nanotechnology and Homeland Security: New Weapons for New Wars* (Upper Saddle River, NJ: Prentice Hall, 2004), 1, 45, 76.

development of Weapons of Mass Destruction (WMD) began to accelerate and advances in science and technology were used to produce nuclear, chemical and biological weapons.[5]

The current scientific-technical revolution, with the accelerated development of genetic engineering, biotechnology, cybernetics and telecommunications, has also given an accelerated pace to the arms race. This new arms race has three directions that can be separated in: militarization of space, robotization of weapons (intelligent weapons), and development of cybernetic technologies and information for military purposes (non-lethal)[6]. Further to this, a few years ago the debate began on the use of unmanned aircraft for war. Drones took flight and together with them came the ethical questions generated by using these small devices capable of monitoring in real time and killing.[7]

As a result of the broad scope and almost infinite applications of technology in warfare, this essay will focus on how the use of technology in the army is changing current warfare and how it will affect the direct participation of the human being in the future armed conflicts. To do so, it will show some examples of technology that is currently being employed in war and will demonstrate that although research development continues for future applications in war, human beings will continue to play a key factor.

INCREASING THE POWER

Since the introduction of firearms into the battlefield in the sixteenth century, the military technological revolution has left the importance of the individual soldier relatively sidelined. It is

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[5]Michael Kort and Cathal J. Nolan, *Weapons of Mass Destruction* (New York: Facts on File, 2010), 21, 314.

[6] Paul Scharre, *Army of None: Autonomous Weapons and the Future of War* (New York: W. W. Norton & Company, 2018), 231-248.

[7] Christian Enemark, *Armed Drones and the Ethics of War: Military Virtue in a Post-heroic Age* (New York: Routledge, 2014), 22, 102, 109.

true that the current weapons at your fingertips are much more effective and forceful than muskets and muzzle-loading harquebuses; however, the soldiers' role in combat is not very different. The successive advances in technology have made the automatic rifle much more precise, grenades much more lethal and close support much more effective. The machine gun, in particular, forced important changes in the deployment and evolution of combat. A series of new weapon systems revolutionized the tactical role, through lethality, making new forms of combat possible. Next we will see in four different aspects how this technological evolution has been applied and through clear examples of weapons or systems, what are or could be its implications for the army. These aspects are: The Individual Power, To See from the Distance Shooting with Accuracy and Other tools.

The Individual Power

For decades, in many countries there have been large programs to provide the soldier with geolocation systems and electronic sensors integrated in sight glasses added to the helmet that give the soldier his absolute position and his position in relation to his comrades and the enemy,[8] protective gear that protect him from projectiles, pointing elements that improve the ability to reach the enemy even when under cover, and all this integrated into a manageable operating system. However all these systems have problems; they are expensive, not entirely reliable and fragile, they add a lot of weight to that carried by the soldier that limits their mobility in combat, and they create logistical problems (batteries, spare parts). For example

[8] National Defence, "Integrated Soldier System Project," DND CAF, February 15, 2018, , accessed May 07, 2018, http://www.forces.gc.ca/en/business-equipment/integrated-soldier-system-project.page.

advanced technology has not yet allowed the creation of a lightweight, flexible bulletproof vest capable of stopping an assault rifle projectile.[9]

This shows that although the efforts of the human being to make an individual fighter more capable with a better ability to perform tasks in an effective way, this technology is not yet at the point to be used on a large scale in modern armed conflicts. Likewise it can also be deduced that the day that its implementation will be fully achieved, the need to employ high numbers of combatants will not be the same since the individual soldier will be more effective in their mission.

However, there are much less ambitious programs that are already having a real impact on the battlefield by helping soldiers solve tactical problems in real combat conditions. Some of them offer the possibility of revolutionizing the use of the army in future war by greatly increasing the soldier's lethality and providing him with truly new capabilities or by eliminating repetitive or physically exhausting tasks will be discussed.

To See From the Distance

Every soldier wants to see what's on the other side of the hill, because his or her life depends on it. To know the disposition of the enemy and to know if he has heavy weapons, the type and the location are literally a matter of life or death for those who walk to fight. That is why the introduction of new types of sensors and platforms, so that the vanguard soldier can transport, operate and receive their data in real time, are a vital enabler for the effectiveness of the army. Sensor platforms such as the American RQ-11 Raven[10], the RQ-20[11] Puma or the tiny

[9] "Land Warrior Integrated Soldier System." Army Technology. Accessed May 07, 2018. https://www.army-technology.com/projects/land_warrior/.

[10] John Pike, "RQ-11 Raven," Vietnam War - American Return to Dog Fighting, , accessed May 07, 2018, https://www.globalsecurity.org/intell/systems/raven.htm.

Wasp III are hand-launched drones capable of navigating by themselves and sending optical and infrared images to frontline control stations. This improves the information available to even the smallest units, which is something that is of special interest in areas of abrupt terrain or urban combat. The problem with these types of remote-controlled devices is that although they can see what is happening, they cannot attack. They are little more than a model airplane that is incapable of carrying even the smallest missiles in the military arsenal[12]. To solve this problem, a new model called Switchblade has been created. It is a drone designed to be transported inside a standard backpack, weighs only 2.7kg and when unfolded it measures 61cm long. In addition to a GPS flight control system capable of directing the device to specific coordinates and a color camera, the Switchblade has a combat head equivalent to a 40mm grenade designed to minimize collateral damage: this means that the apparatus does not simply look, but can attack the enemy by acting in a kamikaze fashion. The Switchblade is not considered a spy device, rather loitering ammunition with limited. It can only operate for 10 minutes since it carries an electric motor. In any case, it substantially improves the soldier's situational awareness.[13]

With these technologies for surveillance from remote points it can be said that the ability to avoid casualties is improved by moving soldiers away from direct combat by observing the enemy's activities from better stand-off. Another advantage that can be deduced from this is the reduction of collateral damage, which is a very important and decisive factor when credibility is one of the better strategies in current conflicts.

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[11] Bill Carey, "AeroVironment Scores Another Small UAS Success," Aviation International News, April 27, 2012, , accessed May 07, 2018, https://www.ainonline.com/aviation-news/defense/2012-04-27/aerovironment-scores-another-small-uas-success.

[12] Guillermo Rocafort, José Ramón Pablos, and José D. Hernández, "Dos Mini UAV De última Tecnología Para La Unidad De élite Del Ejército Del Aire," El Confidencial Digital, , accessed May 07, 2018, https://www.elconfidencialdigital.com/defensa/UAV-tecnologia-unidad-Ejercito-Aire_0_2186781304.html.

[13] "Visit Aerovironment Inc." Aerovironment Inc. Accessed May 08, 2018. http://www.avinc.com/uas/view/switchblade.

Shooting with Accuracy

Knowing the enemies location is much better than not knowing, but the ideal is to be able to shoot him before he shoots. The ability to reach an enemy when he is indoors or behind a hill, involves changing the rules of the game for the army. Being able to shoot someone hidden behind a wall or in a ditch makes it easier to ambush the enemy and facilitates the offensive action of one's own forces. For this task, the XM25 CDTE (Counter Defilade Target Engagement) grenade launcher was designed.[14] It is a semi-automatic grenade launcher that uses several types of 25 mm diameter grenades with various explosive charges. The weapon is equipped with a laser distance meter that transmits its information to the grenade before firing, the user can adjust the exact distance to which he wishes the grenade to explode in the air. The projectile can beat targets that are protected by obstacles very efficiently. The grenade launcher can be transported and operated by a soldier with ease, has an effective range of up to 600 to 700 meters and uses five grenade launchers.[15] After a long process of development beginning at the end of the 1990s, the system was deployed in tests in Afghanistan in 2010. Although they worked without a problem, the weapons were very expensive prototypes. [16]

There are other research and development programs that could substantially improve the accuracy of weapons using intelligent systems. One of them is the PIKE that is a small 40mm missile that can be launched from some of the standard US Army grenade launchers and has a range of more than 1.2km. With a weight of just 770 grams it has a combat head of 270 grams

[14] Robert Stirling, *Special Forces Sniper Skills* (Oxford, UK: Osprey Pub., 2012), 166.
[15] James Bonomo, *Stealing the Sword Limiting Terrorist Use of Advanced Conventional Weapons* (Santa Monica, CA: RAND Corporation, 2007), 10-17.
[16] Robert Stirling, *Special Forces Sniper Skills* (Oxford, UK: Osprey Pub., 2012), 167.

optimized to reach a lethal radius of 10 meters and its laser locator is capable of carrying the projectile to less than five meters from the target.[17]

There are technologies of great interest to the military such as the precision guided firearm (PGF) that essentially allows the shooter to determine the desired point of impact through a computerized sight that calculates the exact moment of the shot to ensure that the bullet reaches each intended target.

The Department of Development of the US Armed Forces (DARPA) has a program since 2007 with the same objectives called 'One Shot'[18] to develop technology that extends the effective range of snipers. DARPA also has the EXACTO program, which develops a 12.7 mm caliber rifle that fires bullets capable of varying its trajectory in flight to reach the desired point.[19] In tests carried out in February 2015, with the current prototype, the bullet modified its trajectory to reach a target in motion, even when the shooter was a non-expert. This would mean that any soldier with a vision system like this could easily snipe targets, thus improving ammunition expenditure.

This shows that the application of these technologies increases combat effectiveness by inflicting more damage on the enemy, requiring lower shooting skills. As mentioned earlier, it will also affect the number of soldiers required in combat, however since this technology is still expensive, and full implementation could take a while.

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[17] Brendan McGarry, "Raytheon Unveils New Mini Missile for Special Forces, Infantry," Military.com, October 12, 2015, , accessed May 08, 2018, https://www.military.com/defensetech/2015/10/12/raytheon-displays-new-mini-rocket-for-special-forces-infantry.

[18] Donald Norman. Sull and Kathleen Eisenhardt, *Simple Rules: How to Thrive in a Complex World* (Boston: Mariner Books, 2015), 52.

[19] Chris Martin and Eric Davis, *Modern American Snipers: From the Legend to the Reaper-- on the Battlefield with Special Operations Snipers* (New York: St Martins Press, 2015), 240.

Other Tools

The technologies described above will require fewer soldiers and since there will be fewer, they will have to be much better trained and paid, and in turn, they must be provided with tools that will free them from some routine, dangerous and painful tasks that easily become a nightmare. Technology like robots is already replacing soldiers in some of their oldest and most physically demanding tasks. For example, assisting with the transport of heavy loads, which army has done on its back through almost impassable lands for centuries, has always been the case, evident by the Roman legionnaires nicknamed 'Mario's Mules'[20] because of the amount of weight they carried during their marches.

In the Israeli army, in order to alleviate the tasks of the soldier, they have developed a ground robotic vehicle called the REX.[21] This vehicle looks like a miniature jeep with six wheels, and is capable of transporting 200 kg of equipment for 72 hours without the need to refuel. Its control mechanism is based on voice command and is able to recognize or obey simple directions, and once programmed, it follows a soldier at a fixed distance regardless of the terrain. The robotic vehicle is also capable of evacuating the wounded if a stretcher is affixed, and can form convoys. Its lightweight allows four soldiers to lift it if an obstacle becomes too abrupt. Other robot vehicles are available to perform hazardous tasks such as the SAHAR, designed as a small excavator responsible for locating and disabling trap bombs or mines. It can patrol a specific area, and may even cooperate with other types of drones, such as aerial ones, to maintain

[20] Arturo Sá chez Sanz, *Pretorianos: La Elite Del Ejército Romano* (Madrid: La Esfera De Los Libros, 2017), 35.

[21] "IAI Unveils New Load-Bearing Robot Vehicle," Army Technology, October 21, 2009, , accessed May 08, 2018, https://www.army-technology.com/news/news67708-html/.

a route or area free of explosives.[22] Both the REX and the SAHAR are being evaluated by the Israeli army for use in combat.

Another of the tedious tasks for the soldiers is to guard in exposed situations. To minimize the wear and tear of this, surveillance robots capable of not only detecting intruders, but attacking them, with or without human direction are being employed. One example is the Israeli GUARDIUM that patrols the borders of the Gaza Strip: about the size of a jeep and equipped with sensors (sound, infrared, cameras, radars, impact detectors), these robots can patrol autonomously for several days monitoring and sending data to rear centers. In case of being attacked they have light armor and non-lethal and lethal weapons with which to respond; if necessary they can be grouped in 'swarms' to attack.[23] Similar in concept, though immobile, are the robotized towers that South Korea deployed on its border with North Korea in 2010, which are armed with machine guns and grenade launchers.[24]

With the use of these technological advances, soldiers can concentrate more of their skills and time on the main task of combat itself, and they will suffer lower physical wear that can allow them to keep fighting more precisely and for longer period of time. Just as this favors the soldier, the cost-benefit ratio can be improved for both armies and governments because the number of personnel can be decreased and the money required in maintaining troops in the battlefield can be utilized for other purposes.

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[22] "IAI Presents SAHAR - an Autonomous Robotic Route Clearance System- A Joint Development of IAI, QinetiQ North America and Watairpoll," Israel Aerospace Industries, May 14, 2014, , accessed May 08, 2018, http://www.iai.co.il/2013/32981-45933-en/IAI.aspx.

[23] U. C. Jha, *Killer Robots: Lethal Autonomous Weapon System Legal, Ethical, and Moral Challenges* (New Delhi: Vij Books India Pvt., 2016), 33-34.

[24] Clay Dillow, "South Korea Deploys Deadly Sentry Bots to Keep Watchful Eyes, Serious Weapons Trained on the Demilitarized Zone," Popular Science, July 13, 2010, , accessed May 08, 2018, https://www.popsci.com/technology/article/2010-07/south-korean-sentry-bots-keep-watchful-eyes-serious-weapons-trained-demilatarized-zone.

CONCLUSION

The trend towards robotization in advanced societies could create a completely new reality; however, traditional armies will continue to be necessary to face terrorist threats and to act in asymmetric wars, doing so with the convenience of technology.

One could certainly talk about positive aspects about the use of technology. Firstly, the interventions in combat could be much easier because the civilian population would be far from the war in a future scenario were battles are only fought between military technologies. Secondly, these technologies could be used to access hostile areas with the aim of bringing humanitarian aid with prior authorization from an international organization.

Better knowledge of the surroundings from technology, better aim and greater lethality by means of grenades and intelligent missiles, relief from arduous and routine tasks such as the transport of heavy equipment and the patrol of dangerous areas could be achieved through technology. The mud, the heat and the cold will remain the same for the soldiers as in the times of the old armies, but their capabilities and effectiveness will be unrecognizable. The future soldier coupled with technology will be much more precise and deadly, provided the technology can be employed to its full potential.

It can be argued that using technology and machines in armed conflicts, will completely displace the human being. This can be deduced by looking at the current application where technology is helping to make the job easier for the soldier and perhaps requires less use of human intervention, but this do not take into account two important aspects: firstly, war is a human activity and as such the human being is the cause of it, and secondly, today's democratic nations always require someone to be responsible and accountable for military actions and this can never be relegated to the machines, that's why a human hand must be behind them. As a final

conclusion, we can say that the human race will never be displaced from the war by technology because it is created to help on it and not to replace them.

After the analysis of the some technological implementations in certain armies and its applications in warfare, it was demonstrated that although research development continues for future applications in war, human beings will continue to play a key factor.

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