

## THE IMPACT OF TECHNOLOGY ON WARFARE

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**Abstract:** *Over human history, war has been documented since people tend to conflict over territories and control of resources. Over centuries, war became an integral element in demonstrating strength and power among states and plays a significant role in the international system. The paper looks into the impact of technology on warfare by focusing on elements like autonomous vehicles, ethical conflicts posed by autonomous vehicles, the proliferation of war and human suffering, and stealth technology and aerial combat. Technology plays a significant role in modern warfare due to new approaches to making, moving, and concealing military equipment. In addition to improvements in weaponry, technology has played another important role, forcing the military leadership to develop new tactics, techniques, and procedures to be able to reduce or negate the advantages of intelligent weapons. There has also been the proliferation of war and displacement of people. Cyberwars and aerial combat have taken a new shape where the latter uses stealth technology to avoid detection and launch surprise attacks on enemies. The advent of stealth technology, as well as sophisticated guidance capabilities, has helped reducing collateral damage, nevertheless, it has also led to more human suffering, as shown by nuclear weapons, autonomous vehicles, and deadlier arsenal.*

**Keywords:** *warfare; technology; weapon; cyber; stealth; nuclear.*

### Introduction

#### The Impact of Technology on Warfare

War has been documented throughout human history since people are bound to conflict over various interests like resources. The early people faced disputes in different ways despite being peaceful. (Mampilly 2005). The conflicts became more evident following civilization when people started changing their nature due to increased population and the proliferation of agriculture. Conflicts and war became one of the approaches of showing power and strength, and it was later replicated in states across the international system. The global system is described through an anarchy type of formation, and the advantaged countries use their power to pursue their interests while overlooking the well-being of others. Over the years, the manner through which states engage in war is changing due to the advancement of technology. The paper explores the impact of technology on warfare by looking into aspects like autonomous vehicles, cyber wars, and stealth technology and aerial combat.

#### Technology and Weapons

In most cases, there is no central authority which makes it complex for nations to work together, and thus every country pursues its self-interest. In such instances, conflicts and war are inevitable within the international scope. States need to ensure that they are well-equipped

in war by having the right arsenal and weapons. Despite the importance of these weapons, they pose a threat and danger to the infrastructure and lives of people across the world. Technology has played a significant role in developing weapons around the globe (March of the Robots 2012). Unlike in the medieval period, where cannons were used to break city wars, the modern world has seen the advancement of firearms like Unmanned Aerial Vehicles (UAV). Such weapons apply technology to lock down targets from thousands of miles with precise accuracy and prove that the paradigm of warfare is changing in a fast phase.

Throughout history, the world has seen an advancement of technology that has created asymmetries in the arena of warfare. In most cases, rapid changes in technology mostly favor the attacker since the victim is less likely to have a defensive counter-measure approach (March of the Robots 2012). However, the technological changes may be countered by upgrades in the defense systems, e.g., software upgrades. In such cases, the global or regional balance of power may significantly transform the balance of power (March of the Robots 2012). The technological changes and their impacts on warfare call for shared technical literacy and awareness on how these transformations rapidly and inevitably affect the military doctrine and security policies. Some of the significant focus areas are bio-weapons, cyber wars, and autonomous weapons.

### **Change from Humans to Machines and Autonomous Vehicles**

In the past two centuries, the Industrial Revolution brought significant changes in the history of humans, and it is regarded as the period when production became efficient and faster. The changes were felt in different aspects of production. In his book "Understanding the Industrial Revolution," Charles More argues that rapid urbanization, production, and rise of the per capita between 1750 and 1850. There was also an increase in products like iron, cotton, and other agricultural products. The changes brought a proliferation of equipment and machines (More 2002). The revolution also affected the military since there was an advancement of weapons. The changes also enhanced the transportation of guns from one point to another, which brought significant changes to warfare.

One of the significant aspects that led to changes in warfare was the advancement of the railway network, which brought a lot of benefits concerning the delivery of weapons and supplies to the battlefield. These changes addressed the constraints of soldiers who had to walk long distances and shortages of weapons and supplies during armed conflicts. The guns saw a shift from smoothbore flintlock muskets that had power and ball and cannons that fired shots during the Napoleonic wars in the early 1800s. There was an advancement of weapons to single shotguns used in the Franco-Prussian wars between the 1870s and 1881. Between 1881 to 1890, there was an advancement of guns following bolt action guns and Maxim rifle, which became the first automatic gun and could fire 600 rounds per minute (Grant 2014).

The advancement in technology and new weapons meant war was more "interesting," and fire powder with a higher intensity could be made. There were also new interests that led to an intensification of research and production of new weapons. After World War II, the United States focused on massive technological research on firearms in its "Manhattan Project." The project led to the advancement of quasi-military and military systems, including radar, aircraft, and missiles (Steinberg 2018). The "Manhattan Project" saw the production of atomic bombs and radical changes in ways through which victory and fear were entrusted in the global order due to technological might. Over the cold war period, the United States advanced the Defense Advanced Research Projects Agency (DARPA). Some of the weapons created over this time included the M16 rifle, bombers, stealth fighters, Javelin portable, Tom Hawk missiles, Predator drones, and "fire and forget" missiles (Turse 2004).

Autonomous vehicles and weapons were a significant advancement that allowed soldiers to work safely in risk environments. Drones can be used to operate in places where the lives of fighter pilots are in great danger. Therefore, the use of autonomous vehicles has dramatically reduced the number of casualties in war events. Artificial intelligence has been applied in autonomous vehicles to make various decisions on the war front. However, it is not explicit that these tools can be programmed to understand regulations governing wars which need human capacity and moral judgment. (March of the Robots 2012). Some of the concerns that arise from using such instruments include the ethical and legal responsibility concerning their actions in the entire chain of command. The world also does not have a common ground to navigate these automated weapons, which raises concerns about their use in battlefronts.

Currently, UAVs and robots are novel ways of using technology and machines to carry out war. The origin of such technology dates back to the last century when Germans created V1 and V2 cruise missiles, which are now regarded as ballistic missiles. The first ones were used in the D-Day landings (Christopher Coker 2013). It is vital to note that most drones and robots have been successful in war, reconnaissance, intelligence, and surveillance, e.g., the Predator. Military robots have also been critical in disarming improvised devices (IEDs), as shown in the Afghanistan and Iraq wars. The technology proved to be crucial in addressing the dangers of IEDs, which posed a considerable risk to troops on the war front (Singer 2009).

Over the years, the military has been producing more automated vehicles, and in 2008, the US military had more than 5,3300 drones. The Future Combat Systems develops more vehicles and software (Singer 2009). These vehicles are crewed while others are unmanned and rely on artificial intelligence (AI). This equipment works through the integration of information input by humans. It has been critical in increasing the desire of researchers to substitute soldiers with Lethal Autonomous Weapons Systems (LAWS) or the "killer robots." Although autonomous vehicles do not fully work independently, there is massive research in countries like South and North Korea, the UK, United States, China, and Israel to increase autonomy on land, air, and sea (March of the Robots 2012).

### **Ethical Issues of Autonomous Vehicles**

Autonomous systems can initiate and apply lethal force on their targets based on commands input. However, various issues stand out concerning their abilities to work ethically on the war front as stipulated under the International Humanitarian Law. Humans controlled worthy noting, the war in the 20th century, and to some extent, it was ethical. According to the United States Airforce, humans are obliged to oversee rather than regulate autonomous systems (March of the Robots 2012). These systems are expected to work effectively through improved artificial intelligence to enhance their ability to execute combat decisions. The reliance on such systems has led to various incidents. For instance, the Aegis Combat system faced a technical error that transmitted a negative signal indicating a military plan over the Iran airspace and led to an action by the USS Vincennes. The outcome of the erroneous shooting of civilian aircraft (Flight 655) (Sarah 2014).

The accuracy of autonomous vehicles and AI is thus questioned, and as a result, international think tanks are against its full adoption in warfare. They argue that these weapons are terrible and can pose a danger to civilians and other non-targets if they work independently. The use of firearms also means that the ability to hold people accountable for war crimes is compromised (Farmer 2014). The United Nations thus advises precaution on the use of autonomous vehicles and has that the ultimate decision to terminate anyone's life or execute a target should be based on humans rather than these automated systems. Therefore, despite the adoption of technology in warfare, the ethical concerns since they compromise human actions by executing targets independently.

## **The proliferation of War and High Civilian Casualties**

Adopting technology in making both light and sophisticated ones has contributed to increased suffering among civilians. Over the years, conflicts and wars have led to a growing number of internally displaced people, and the number of fatalities from disputes has increased. Although war will always have casualties, technology is changing the paradigm of war, and modern weapons can inflict severe suffering. Some of the current arsenals which have proven to be deadly include nuclear weapons. The world has also seen chemical weapons which have advanced with technology. For instance, during the World War, the Nazi regime used gas chambers to execute people, proving to be a deadlier and quicker way of killing people (Gregory 2005).

The use of poisonous gas during the holocaust led to the deaths of an estimated 1.5 million people from the Jewish community in Nazi-occupied regions in Europe (Reddy 2000). The approach was criticized as inhuman and contributed to suffering among civilians. Comparably, the United States dropped an atomic bomb in Nagasaki and Hiroshima in Japan in 1945. The impact of the bombings was severe and led to a high number of deaths and injuries. The resulting radiation affected people from miles away, leading to burning, among other physical and psychological concerns. Such bombs demonstrate how the advancement of technology has led to the development of weapons that cannot just terminate lives but end civilization (Reddy 2000, 7,8).

The uptake of modern military technology has increased the involvement of non-state actors (civilians) in war. Currently, more groups are coming up to challenge countries' territorial sovereignty, leading to anarchy and control of territories that they acquire through armed conflicts. The 9/11 attacks in the United States on Pentagon and World Trade Center are examples of such groups where terror groups challenge the authority of another country. As a result, the U.S started an international war on terror in Iraq and Afghanistan. However, their efforts were met with strong resistance from the Al Qaeda and Taliban through their use of IEDs. These devices were planted in various buildings and roads and were proof that their use is changing with technology. They were responsible for losing more than 3,100 U.S troops and injured over 33,000 soldiers. As a result, the United States Department of Defense spent over 2 billion USD in 2007 to train its soldiers on IEDs (Gregg 2013).

Separatists' actions in the Luhansk and Donetsk areas of Ukraine demonstrate how technology have impacted war, leading to loss of lives and destruction of infrastructure. The separatists rely on sophisticated weapons, which have allowed them to control the region and challenge the authority of Ukraine over these areas. The groups work closely with their allies to acquire weapons and other supplies which allow them to work effectively. The suffering of civilians in the hands of this group was reported following the shooting of flight MH-17 over the Ukraine airspace. The incident used a surface-to-air missile. It was met with strong criticism with accusations being projected towards the Donetsk leader and Russia, accused of supporting the group with equipment and ammunition (Sky News. Weapon Moved to Russia After MH17 Shot 2014). The casualties of MH-17 can be seen via the lens of victims of circumstances since they were killed in a war that they did not take part in, which can be attributed to a wrong utilization of military technology or error.

Similarly, the Syrian government under the Assad regime has been accused of using chemical gas on civilians. Although the government denied such reports and accused rebels of the actions, the incident shows the changing nature of warfare and how civilians are suffering. The action also indicates the struggles between states and civilians who acquire military weapons. The crisis in Syria resulted in the loss of livelihoods, housing, shelter, water, and food, and most of the civilians became refugees in the neighboring states. Over the last ten years, the country has seen an estimated 3 million people flee from Syrian to Lebanon and

Turkey. Another 6.5 million people have been displaced internally in the country, and about 150,000 people seek asylum through the European Union (Syrian Refugees. A Snapshot of the Crisis- In the Middle East and Europe 2013).

## **Cyber War**

Cyberwar refers to conflicts within cyberspace where information technology plays the major factor towards superiority. The advancement of technology has been critical for countries to use this medium to acquire confidential and classified data from their allies. Non-state actors also play a significant role in cyberspace. For example, a pro-Arab created a website called "UNITY" to support Palestine in its conflicts with Israelis. The site attacked most Israeli commercial websites and interfered with the internet service providers, which also grounded the country's stock exchange (Trendle 2002, 7). One of the interesting aspects of this war is that it has no time frame or boundaries and can be used by countries to advance their objectives.

Cyber-attacks have played a significant role in the United States and China relations, and it has been demonstrated through national telecommunication corporations in the two states. United States legislators have been closely monitoring Chinese companies like ZTE and Huawei, whose activities are seen as a significant threat to national security. The legislators ensured that the organizations did not merge with local entities because they would access classified data. The Chinese government has also been skeptical towards working with American organizations following Edward Snowden's leak. China rejected working with office 365 Suite and Microsoft Windows 8, raising concerns of possible hacking (Stevens 2014). The concerns came amid either side of attempted hacking, especially on security details and federal data.

The North Atlantic Treaty Organization (NATO) has also faced cyber-attacks on its websites. In 2014, various NATO sites were hacked by Cyber Berkut, and most of the classified information was leaked. The organization further reports an estimated 200 million malicious activities daily, which raise concerns about the safety of the entity's data. As a result, NATO enacted a policy that allows the use of article 5 if any member state is attacked via cyberspace (Stevens 2014). Cyber warfare thus demonstrates the use of technology, how it has transformed the physical war to cyber-attacks, and how they can be used successfully by states and other agencies to advance their goals.

## **Stealth Technology and Aerial Combat**

The Stealth concept is among the technologies adopted by the military and defines the act of proceeding, acting, or moving covertly. The features or qualities of being covert or furtive entails processes that enhance extreme quietness and care to avoid being noticed or detected. When used within the military concept, the idea means avoiding being detected by both own and enemy forces. The use of this technology means that the military can be deployed in a way that is not detectable by the enemy (Kapur 2014). Stealth technology thus allows forces to operate or move in areas where they have a tactical or strategic advantage over their enemies within the battlefield.

A comprehensive and complete definition of stealth concept is described as Low Observable (LO) technology which entails several techniques that are applied in ships, personnel, aircraft, submarines, satellites, and missiles to make less detectable or invisible under sonar, radar, infrared, and other methods of detection. The technology is enhanced by camouflage to parts of the electromagnetic spectrum. In recent years, the technology has

become more linked to military aircrafts' abilities to avoid detection by the radar and other approaches employed to engage or detect aircraft.

Since the ancient era, combatants have realized the significance of hiding their forces from the eyes of their enemies. The hidden forces are vital for deployment during critical moments to enhance a surprise attack and offer a decisive advantage on the battlefield. The invisible army can be used to pursue weak enemy locations to attain a breakthrough or be utilized to exploit enemy weakness within defenses established by other forces. Before the adoption of airplanes on the battlefield, surprise or stealth entailed positioning troops in locations that were not easily visible by the enemies due to a limited line of sight (Kapur 2014). Such forces were critical in enhancing tactical and strategic surprise and enhanced victory. The acquisition of knowledge concerning the location and existence of these reserve forces by enemies is essential in warfare.

The two-dimensional type of battlefield has been a significant aspect of warfare and has led forces to control the strategic point or "the higher ground." Locating allied forces on higher grounds was critical in expanding the areas that could be kept under surveillance due to more prolonged and heightened lines of sight attained in elevated locations. Enjoying a longer line of sight in these areas allows for tracking and detecting hidden or stealthy deployment of forces by the enemies. A higher strategic and tactical point can be enjoyed through a modification of equipment or camouflage that minimizes enemy forces (Zohuri 2020). The higher tactical ground thus means that forces can delay their detection, plan, and execute surprise attacks on their enemies.

Surprise in the battlefield is attained if not observed earlier, unexpectedly entering the combat. During the earlier times, some of the methods used to hide forces included tying fresh vegetation like twigs and grass on the bodies of the soldiers. Others used equipment and uniforms that match the area's background, like brown and green in jungle areas, sand brown and khaki in deserts, and white in snow-capped mountains and arctic regions. Armies also broke down the equipment and personnel shapes via camouflage patterns that entailed two or more shades to create a distinctive outlay of equipment and soldiers. Paints applied on faces and skins also served similar purposes, and it was widely used on the battlefield in early times (Ghaida A. Al-Suhail 2018, 80-96).

During the earlier times, warfare was limited mainly to surface soldiers, and approaches to attaining stealth were rudimentary and simple. The methods did not apply technology, and as a result, they were less complex than the contemporary approaches (Ghaida A. Al-Suhail 2018, 80-96). As the technology advanced, complex equipment and weapons were used on the war front. One of the significant changes in warfare was the introduction of fighter jets and other aircraft. The initial aircraft had a distinct shape, and it was slow compared to the modern ones. Visual aspects were all available to spot the plan, and it was mainly attained via visual acquisition. The method was later replaced with equipment that could locate, detect, and amplify elevation and azimuth depending on distinctive acoustic features of aircraft engines.

Over time, technology has led to the introduction of special equipment that can identify and detect elevation and azimuth of aircraft using acoustic and visual sensors (Zohuri 2020). As the methods of detecting aircraft progressed due to the use of more capable radars, it became necessary to introduce approaches of countering these tactical innovations. Various studies have been carried out since the 1940s to establish approaches to delaying aircraft detection. These studies aimed to delay or deny aircraft detection by enemy armies and were later operationalized. It was observed that tactical means alone were not enough to attain this objective in flying aircraft.

Further research found that "stealth" was critical in delaying aircraft detection, and it became a significant area of focus in the 1980s and 1990s. The adoption of this technology

proved vital in aerial combat and led to the introduction of stealth fighter jets. Critical to note, the long history of using stealth in battlefront was essential to developing this new technology. The new aircraft incorporated its cutting-edge technology with traditional approaches of attaining stealth. The application of stealth in modern warfare entails advanced scientific design, and it has become synonymous with high-tech aircraft, which cannot be easily detected (Kapur 2014). Currently, there is a tendency to view stealth aircraft as invincible on the battlefield due to their technology to move and execute their targets.

The assumptions and how these stealth planes are seen are based on the incomplete understanding of the technology, limitations, techniques, and components of these machines. It is also based on their introduction on the battlefield, and as a result, it is a significant aspect of modern warfare. The use of aircraft on the battlefield is relatively a new development. The first aircraft to take part in military operations were developed and deployed in the first decades of the last century. As a result, the technology brought significant changes in air warfare (Zohuri 2020). Like in the case of war on the land, aerial combat's surprise is attained by the abilities of the military to acquire and dominate a central point for advantage over that of the enemy forces. One of the significant ways of achieving the surprise is through stealth technology which makes the aircrafts undetectable by the enemy forces.

During WWI and WWII, airpower was still in its infancy stage, but later research and development led to newer ways of attaining tactical positions. The R&D also led to better methods of achieving surprise and continued throughout the establishment of airpower, as seen in modern aircraft. Over time, the continued understanding of technology and science within the aviation sector established parallel efforts to develop approaches towards operational concerns that started to deliver results (Kapur 2014). The progression due to the adoption of new technology allowed for surprise in aerial combat. Some of the adopted approaches included the utilization of challenging to reach working envelopes, e.g., very high and high-speed regime. British forces in World War II applied such techniques. The approach is also used by the U.S "Blackbird" (U.S A0-12 and SR-71), the "Foxhound" MiG-31, the Soviet MiG-25, MiG-31, and MiG-25 (Kapur 2014).

## Conclusion

Technology has played a significant role in modern warfare following discoveries of newer methods of making, transporting, and even concealing military equipment from the enemies. Technology also made the war deadlier, inhumane, faster, and unethical, especially due to autonomous vehicles and chemical weapons. These issues have created an increased fear and uncertainty, and militia groups and countries have taken advantage of this to advance their agenda, including the occupation of new territories. Technology has led to a proliferation of war which means increased human suffering as suggested by the use of chemical weapons leading to massive deaths and injuries of civilians. Over recent times, cyber wars and aerial combat have also taken center stage in warfare. Stealth technology has also taken a significant role in aerial combat, where armies use this approach to avoid detection and attain a surprise attack on their enemy forces.

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