Technology in Warfare: Unmanned Vehicles and the Future of Warfare

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Throughout the history of conflict, one side has been trying to gain an advantage over their enemies. From rocks, to sticks, to bows and arrows, to blades, to gunpowder, and the pinnacle of the atomic and hydrogen bombs, increasingly deadlier ways have been invented to wage warfare. Since the wide-spread availability of electricity, modern-type technology has played an increasing role in warfare. Messages no longer need to be hand-delivered, they can be sent over a telegraph, encrypted radio, or through a satellite. With the Global Positioning System (GPS) satellites and good conditions, a target can be pin-pointed to within ten to fifty feet and ordnance can be delivered to this point. While the use of technology has shifted the balance of power, the use of unmanned vehicles is producing a greater shift in the balance of power.

In order to keep track of the opposing forces and effectively plan a battle strategy, a military force will use surveillance and reconnaissance to gain intelligence on the other force.

> Reconnaissance is a mission undertaken to obtain by visual
> observation or other detection methods, information about
> the activities and resources of an enemy or potential enemy,
> or to secure data concerning the meteorological,
> hydrographic, or geographic characteristics of a particular
> area. Surveillance is the systematic observation of
> aerospace, surface or subsurface areas, places, persons, or
> things, by visual, aural, electronic, photographic or other
> means. Intelligence is (1) the product resulting from the

collection, processing, integration, analysis, evaluation, and

interpretation of available information concerning foreign

countries or areas; (2) information and knowledge about an

adversary obtained through observation, investigation,

analysis, or understanding. (Intelligence, para. 3)

As technology has progressed through the years, the methods of performing

reconnaissance and surveillance have changed, and the types of intelligence gathered

have become more detailed. The amount of information gathered and the speed with

which it can be obtained has dramatically increased.

When France and Britain joined the Ottoman Empire in the war with Russia over

territories in the Crimean War, they communicated by telegraph lines between the

countries. This allowed the allies to communicate, and also allowed the journalists to

send stories back very quickly. Because the telegraph and camera were used, the

Crimean War became known as one of the first modern wars. (Lommers, n.d., para. 1-

3)

During the US Civil War, Abraham Lincoln and the Union made use of manned

balloons to gather intelligence on Confederate forces. By sending the manned balloon

high into the air, the pilot could see over trees and small hills. After receiving a map

drawn from a soldier in a balloon, the soldier's commanding officer, "reported that the

map of the country, rough as it is, which he made during the ascent, convince me that a

balloon may at times greatly assist military movements." (Jarrow, 2011, pg 30) Usage

was limited to days with low wind. Another limit was the support equipment needed to

keep the balloon aloft. Perhaps the biggest disadvantage to the balloon was that the

occupant would attract enemy fire. The telegraph played a vital role during the war, but could be cut or spliced into by both sides to intercept communications. (Greely, n.d.)

In World War 1, new technologies like the machine gun, airplane and tank came into usage. In the air, airplanes were used to spy on and also attack enemy forces on the ground and in the air. The invention of the machine gun made leaving trenches even deadlier, leading to the usage of tanks in warfare. The first tanks were lightly armed and armored, but could protect soldiers as they advanced across the open spaces between trenches. Soon, weapons were developed to defeat the tank's armor, which led to better armor being developed, and the cycle continued. (Weapons, n.d.)

World War 2 saw greater usage of more sophisticated airplanes and tanks on the battlefield. The OQ2 Radioplane Drone was used in anti-aircraft training. "In 1934, (Reginald) Denny had his idea of the radio controlled target plane for gunnery training, and no one would listen to him…", until World War 2 started. (Remote, n.d., para. 11)

In the early Sixties, Lockheed began work on the D-21B Drone which would be attached to and launched from the M-21 aircraft. It would fly at 90,000 feet and take pictures with an on-board camera which would then be dropped by parachute and picked up by another plane. After causing a crash of the manned plane, the drone was fitted to the B-52 plane, but was ultimately abandoned. (Lockheed, n.d.)

In the history of warfare, two opposing forces, while not completely equal, have been more closely equal in power. That is the concept of symmetric warfare. As technology has advanced, the two sides have become increasingly unequal, leading to asymmetric warfare. "Asymmetrical warfare, unconventional strategies and tactics adopted by a force when the military capabilities of belligerent powers are not simply

unequal but are so significantly different that they cannot make the same sorts of attacks on each other." (Sexton, n.d.)

Drone usage continued during the Vietnam War, with drones taking aerial pictures on a planned route. Besides intelligence gathering, drones were used to drop propaganda leaflets and as bait for surface-to-air missiles. The war in Vietnam also saw a rise in guerilla tactics used against American forces. (Guerilla, n.d., para. 9)

During the 1960s and continuing to the present day, spy planes started to come into existence. These planes would fly at very high altitudes and take pictures as they flew over a target. As the airplane technology advanced, missile technology advanced, too. In the early 1960s, one of the U2 spy planes was shot down in Russian airspace. This resulted in strained relations between the US and Russia. It also spurred development of new drone technology. (Lockheed, n.d.)

Some planes, like the SR-71 Blackbird, used speed (Mach 3) and altitude (90,000ft) to avoid detection by radar. In an effort to gain an increased advantage over missile and radar technology, stealth technology started to be developed. By using exhaust heat baffles and modifying the shape of the aircraft, the signature picked up by the radar would look different than the actual plane. (Lockheed, n.d.)

The 1980s saw an increase in asymmetric warfare and guerilla tactics used against Soviet forces in Afghanistan. The late 1980s and early 1990s brought the rise of the B2 Spirit Stealth Bomber. It relied on its shape, exhaust baffles, and paint to avoid detection by radar. Though technology played an important part in the First Gulf War in the early 1990s, this advantage was hindered when retreating forces set fire to the oil wells. (Battle, n.d.)

The Predator drone came to be used in the mid-1990's Bosnian conflict. Ground control stations were set up in other parts of the world and the video taken could be viewed by commanders in the United States. This created a tremendous advantage in both the speed that intelligence could be gathered and the volume of data. The Predator drone was used in the US conflict in Iraq and Afghanistan. (How, n.d.)

Guerilla tactics played an even greater part in the US conflict in Iraq and Afghanistan. Using lessons learned fighting the Soviets in the 1980s and training from US backed anti-Soviet forces, the guerilla tactics did increasing damage to US military forces. Insurgents could build an IED from unexploded ordnance they recovered and use a cell phone to remotely detonate the device. These were particularly effective against the flat-bottom of the High Mobility Multipurpose Wheeled Vehicle (HMMWV or Humvee) in use at the time. New vehicle were developed, like the Mine-Resistant Ambush Protected (MRAP) vehicle. It has an angled bottom to help deflect the blast force away from the passengers. (Cougar, n.d.)

Currently, research and field trials are being conducted on unmanned and autonomous vehicles. Autonomous vehicles can be programmed to follow a route or make decisions based on data from sensors. There are many reasons to use these vehicles on the battlefield. Unmanned aerial vehicles (UAV) can circle far above an area, unobserved, for as long as their fuel lasts, while sending live video feed back to the command center. Unlike manned aircraft, a UAV doesn't place a human life at risk in the event of detection and counterattack. A small UAV could be carried on a backpack and used with an infrared camera or video camera to gain intelligence in a

similar manner to the Civil War balloons. Pilots for larger drones, like the Predator, can fly from the other side of the world using satellites to carry the signal. (How, n.d.)

An unmanned ground vehicle (UGV), like the Recon Robotics ThrowBot could be quietly driven to a spot or even thrown through a window and provide a live feed so a plan could be developed to reduce human casualties. Some Police and Special Weapons and Tactics units are also making use of the Throwbot. Small vehicles like the iRobot PackBot can be carried and deployed to gain intelligence or deactivate Improvised Explosive Devices (IED). Some soldiers have been using radio controlled hobby vehicles to scout for IEDs ahead of their vehicle patrols. One vehicle found its fifth and final IED when "…the little truck was vaporized when it managed to set off a 500 pound IED that might have otherwise been triggered by the Humvee itself…" (Ackerman, 2011, para. 2)

In an effort to remove humans completely from danger, the Defense Advanced Research Projects Agency (DARPA) has sponsored competitions to develop autonomous, self-driving vehicles. The first competition placed vehicles in a desert environment. Another competition place the vehicles in an urban environment with other autonomous vehicles and human traffic. Autonomous convoys could deliver supplies through dangerous areas eliminating that risk to humans and freeing them for other uses.

For all the advantages of unmanned vehicles, there are many disadvantages. Humans still retain the final decision to fire weapons, so how many levels that decision has to travel, could make it a disadvantage. To avoid confusion, a clear chain of command must be established and maintained.

Man-portable devices are limited in size and dependent on how many replacement batteries are carried. Larger systems require more logistical support. UAVs are dependent on fuel to stay in the air.

In Vietnam and other areas of the world, even parts of the US, the jungle canopy provides a barrier that helps to conceal movement from aerial vehicles. This can be mitigated to some extent by infrared cameras that detect differences in heat between an object and the surrounding environment.

Live-feed video is a remarkable surveillance tool when used properly. Improper use can lead to "battlefield micromanagement". "More and more frequently, generals insert themselves into situations inappropriately, and their command leadership role becomes command interference." (Singer, n.d., pg. 80)

> While this general was doing a job normally entrusted to junior officers, who was doing his job? New technologies allow him and other senior flags to make tactical decisions as never before. But the captains, majors, colonels, and so forth, whom they cut out of the chain, cannot, in turn, assume responsibility for the strategic and policy questions that the generals would have wrestled with instead. (Singer, n.d., pg. 81)

Those officers in the field may not gain the decision making experience they will need when they are promoted to higher ranks. This lack of experience could cause a significant problem as senior leadership retires.

One concern with the use of unmanned vehicles is that, without human lives being at stake, more wars will be fought because the machines can be more easily replaced. The only way to prevent this would be adherence to strict international policy.

The most limiting factor for an airplane is the human pilot. The human body can only withstand so many G-forces before the pilot loses consciousness. A computer is not limited by those same forces.

Another disadvantage is that the opposing force will not be able to directly attack the stronger force, leading to a rise in asymmetric warfare. Guerilla tactics, like ambushes and IEDs, will become more prevalent. New technologies, like autonomous vehicles, will be developed to counteract this. This could result in an arms and tactics race between the two forces.

With the rise in guerilla warfare and unknown terrorist cells, DARPA's Improv Program has asked industry and skilled hobbyists for submissions for new ways technology could place assets at risk. "In Improv we are reaching out to the full range of technical experts to involve them in a critical national security issue." (Mining, 2016, para. 4)

Technology has greatly impacted the methods and type of intelligence a military force can gather. Because it is not perfect and has shortcomings, technology does not guarantee success, but it can increase the odds in favor of the technologically advanced force. As the opposing force finds itself unable to directly face the enemy on the battlefield, it will start to use more guerilla tactics. Unmanned vehicles can mitigate

some of the guerilla tactics, but will give rise to newer tactics. Without that change in tactics, future armed conflict will favor the more technologically advance force.

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