Unmanned Technology - The Holy Grail for Militaries?

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Abstract:

Unmanned vehicles are increasingly prevalent in military operations today. Whether remotely piloted or autonomous, such platforms offer numerous advantages, most notably by sparing human soldiers from performing tedious or dangerous tasks. While useful, significant limitations and controversies prevent unmanned systems from completely replacing humans on the front lines. Militaries must consider these challenges when deciding how best to employ unmanned technology in the future.

Keywords: Military Ethics; Military Technology; Military Transformation; Unmanned Warfare

INTRODUCTION

Since the advent of industrialization, humans have constantly improved their technology so as to reduce manual work and improve efficiency. Movies such as "Star Wars" have fueled human imagination and spurred the development of unmanned technology. What constitutes a robot or unmanned vehicle? It is a machine that is controlled, in whole or in part, by an onboard computer, either through independent Artificial Intelligence (AI) or remote control by human operators (as is the case for most military robots).[1] While unmanned technology can be used to replace humans for many tasks, is it really the holy grail for militaries?

EVOLUTION OF MILITARY UNMANNED TECHNOLOGY

The first use of unmanned air technology can be traced back to the First World War, where radio-controlled unmanned aircraft were used as "flying bombs" by the United States (US) Thereafter, such early Unmanned Aerial Vehicles (UAVs) were developed as targets for training and as decoys. UAVs were utilized for reconnaissance purposes in the 1960s and by the 1970s, the US experimented with them for active combat purposes. However, it was not until the 1990s that Unmanned Combat Aerial Vehicles (UCAVs) were developed and used in operations, with the advancement of more reliable communication links.[2]

The earliest recorded use of Unmanned Ground Vehicles (UGVs) can be traced back to the radio remote-controlled "tele-tanks" used by the Soviet Union in the 1930s.[3] In the US, a number of UGV applications were demonstrated in the 1980s, such as weapons launching, Reconnaissance, Surveillance and Target Acquisition (RSTA), and Explosives Ordnance Disposal (EOD). Today, UGVs are capable of autonomous operations and armed attacks.[4]

As for underwater vehicles, the first Remotely Operated Underwater Vehicle (ROV) was used by the Royal Navy to recover practice torpedoes in the 1950s. In the 1960s, the US Navy developed a "Cable-Controlled Underwater Vehicle" (CURV) for rescue operations and the recovery of objects from the ocean floor. In the 1970s, early Autonomous Underwater Vehicles (AUV) were developed by the US and Soviet Union. With advances in processing capabilities and high yield power supplies, the

XM1217 Multifunctional Utility/Logistics and Equipment, Transport version (MULE-T) UGV

21st century has seen more widespread use of ROV and AUV in mine clearing and inspection, anti-submarine warfare, and area protection.[5]

The evolution of unmanned technology has seen its increasing prevalence in modern warfare, including asymmetrical warfare. The US in particular has deployed thousands of UAVs in its current operations and is relying more and more on the use of UCAVs in recent campaigns, with "nearly four times as many drone strikes in Pakistan during the first two years of the Obama administration as there were during the entire Bush administration."[6]

ADVANTAGES AND DISADVANTAGES OF UNMANNED TECHNOLOGY

Advantages

What are the advantages offered by unmanned systems that see them gaining favor with many militaries? The following might provide an answer:

1. **Capability Increase, Force Multiplier.** Unmanned systems can provide a capability increase to forces through expanded surveillance capabilities and all-weather operations. Armed drones can "loiter, observe and strike, with a far more precise application of force."[7] The possibility of deploying more than one unmanned system per human operator can also be a force multiplier, especially during force projection. At the same time, the task and load capacity of soldiers can also be increased with the aid of unmanned systems.

2. **Risk Reduction.** Unmanned systems can help reduce unnecessary risk to humans. They are ideal for filling roles that are known in the field as the "Three Ds": Dull, Dirty and Dangerous. Unmanned systems are able to reduce operational risks to soldiers such as Chemical, Biological, Radiological and Explosive (CBRE) threats or the breaching of obstacles, especially while under enemy fire.[8]

3. **Situation Awareness and Intelligence Gathering.** Unmanned systems can provide heightened situation awareness and are highly suitable for intelligence gathering. According to LG David Deptula of the United States Air Force (USAF), "the next phase will enable a single drone

to provide as many as 60 simultaneous live video feeds directly to combat troops. Some new drones will be as small as flies, others walk—all appear destined to work with decreasing human input."[9]

4. **Consistency.** Unmanned systems are consistent in performance as compared to humans who may be affected by fatigue, stress and other distractions. On the other hand, poorly programmed unmanned systems can also be consistently bad.

5. **Efficiency and Productivity Increase.** Like robots, unmanned systems can replace humans in low level, manual jobs, thus freeing manpower for higher value jobs. According to Lance Winslow, "it is estimated that for every soldier or airmen on the front line or participating at the tip of the sword, there are 20-25 military personnel in the command and control and logistical supply chain. Military robotics clearly increases efficiency and productivity."[10] Singer suggests that "unlike humans, robots can perform boring tasks with unstinting accuracy for long periods of time."[11]

Disadvantages

While the aforementioned advantages of unmanned systems seem numerous, they are not perfect. The following are some of their disadvantages:

They are ideal for filling roles that are known in the field as the "Three Ds": Dull, Dirty and Dangerous.

1. **Human Dependency and Lack of Intelligence.** The main disadvantage of robots is that while they can replace human mechanical work very easily, they cannot replace human intelligence.[12] Robots are only good at what they are programmed for, thus they remain dependent on the human programmer to initiate the process. Furthermore, missions that require the use of human intuitive reasoning are still beyond the ability of unmanned systems.[13]

2. **Power and Energy Dependence.** While many of our power and energy sources have increasingly greater capacity, unmanned systems cannot last infinitely and are still plagued by the need to be recharged.[14] Power and energy remains an outstanding and critical issue.

3. **Security Vulnerabilities.** Just like computers, unmanned systems may be susceptible to cyber attacks. Two years ago the *Wall Street Journal* reported that "Iran-funded militants in Iraq were able to hack into US drone live-video feeds with $26 off-the-shelf software." In another unnerving incident, *Wired* reported in October that a fleet of USAF drones was infected with a computer virus that recorded all the keystrokes used when operators issued commands. The military was not able to determine how the drones got infected and even the USAF cyber security team did not know about the virus until they read about it online.[15] Command network vulnerabilities could therefore be an avenue for the enemy to disable or take control of unmanned systems.[16]

4. **Cost.** A recent Pentagon report noted that "crashes and component failures are driving up the cost of unmanned air vehicles and limiting their availability for military operations. Of particular concern are those that have become useful tools of war—the Predator and the Global Hawk among them. Reliability issues have sparked disagreements among military and civilian experts, amid congressional criticism that UAVs are becoming too expensive."[17] According to USAF Secretary Michael Donley, "paying for the labor—both military personnel and contractors—associated with unmanned aircraft operations has become "unsustainable."[18]

5. **Reliability Issues.** It is possible that technical glitches or errors may result in malfunctions and cause accidental casualties.[19] Indeed, "the Defense Department's 2002 UAV Roadmap confirms a mixed history of Class A mishaps—those causing loss or severe damage to an aircraft—especially when compared to manned aircraft. Officials noted, however, that comparing UAV mishap rates against manned aircraft may not

be entirely fair, because commanders take risks with UAVs that they typically would not with piloted airplanes."[20]

6. **Situation Bias.** According to Lora Weiss, "testing poses a challenge because there is no realistic way to subject an unmanned system to every conceivable situation it might encounter in the real world. Moving to smarter and more autonomous systems will place an even greater burden on human evaluators and their ability to parse the outcomes of all this testing. They will never be able to assess all possible outcomes, because this would involve an infinite number of possibilities."[21]

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CONTROVERSIES

While there are constant debates on the advantages and disadvantages of using unmanned systems, there are many controversies that inhibit a full change to unmanned systems.

Moral and Ethical Issues. A key question involving the use of unmanned systems for military purposes is "who decides who lives or dies"? Most high-ranking military men and futurist philosophers believe that "robots should not be allowed to kill humans unless a human being is in the loop, which seems to point towards the future of 'video game warfare' through a 'tele-robotic motif.'"[22] At the same time, unmanned systems have been considered inventions that make it easier to wage war:

> Each level of separation from the actual field of battle lessens the moral and ethical chasm a person must overcome before he can justify taking a human life. The more we employ robots to do our killing, the easier it becomes to control the narrative of conflict as well. Wars are messy affairs that are rarely black and white. Yet unmanned vehicles that fire precision bombs and guided missiles allow us to reduce war to a video game with good guys and bad guys. It is no accident that many of the computer interfaces for modern weaponry resemble game consoles.[23]

cyberpioneer

UAV in Flight

Non-Conformance to International Laws. The rules of warfare require "combatants" to be relatively well demarcated, so that they can "safely" know who to kill. Accountability becomes an issue when there is no one present on the battlefield to be fought except for a flying robot. In many cases, the enemy is often picked off while engaged in clearly non-combatant situations, being unexpectedly attacked during daily activities in a typical civilian setting rather than in a strategic military target area. Drones are therefore not necessarily being "defended against"—instead the target is "assassinated" without a trial or any due process.[24]

Ease of Starting Wars. A study called "The UK Approach to Unmanned Aircraft Systems" states: "it is essential that before unmanned systems become ubiquitous (if it is not already too late) … we ensure that, by removing some of the horror, or at least keeping it at a distance, we do not risk losing our controlling humanity and make war more likely."[25]

Messaging Disconnect. There is a messaging disconnect between the users of unmanned systems and their targets. For example, according to a senior Bush administration official, "the unmanning of war plays to our strength. The thing that scares people is our technology." But this is not the view expressed when you meet with someone, for example, in Lebanon. On the contrary, an editor of a leading newspaper in Lebanon has commented that this shows the perpetrators are cowardly and not man enough to come and fight them directly. There is therefore a disconnect between the message being sent versus the message being received.[26] Furthermore, "the insurgents 'gain every time a mistake is made,' enabling them to cast themselves 'in the role of underdog and the West as a cowardly bully that is unwilling to risk his own troops, but is happy to kill remotely.'"[27]

Threat to Livelihoods. An alleged controversy erupted in the USAF over the decision to give UAV "pilots" flight pay. Though the Air Force decision to give incentive pay to their UAV operators made sense, the announcement that UAV operators would qualify for flight pay has been met with some opposition—"do UAV pilots actually fly UAVs, or just control them electronically?"[28] While the controversy seemed to hinge on flight pay, the underlying issue might have been a perceived threat to the livelihood of the manned aircraft pilots.

ROADMAP FOR USE OF UNMANNED TECHNOLOGY

So what are the considerations for militaries that use unmanned technology? Are there lessons to be learned from other unmanned technology users? How should militaries apply unmanned technology to avoid or minimize the aforementioned controversies? An iterative roadmap with four stages as recommended by the Albright Strategy Group and adapted for the development of unmanned technology is shown in Figure 1 with all the possible considerations explained in the following paragraphs.[29]

Assessment of Necessity. It is necessary to assess the task that should be given to unmanned platforms. The most straightforward approach would be using unmanned technology to replace dull, dirty and dangerous roles. However, not every role can or should be left to unmanned platforms. It might be necessary to assess if there are alternative technologies which are more mature or cost less.

	Definition and Strategy "Know Why"	Direction "Know What"	Technology "Know How"	Action Plan "To Do"
Unmanned Technology Roadmap	Assessment of Necessity	Roles and Responsibilities	Technology Alternatives Cost	Alliance with Industries and Institutions Training and Qualification
		Capability Considerations Clear Statement of Needs Recognize Limitations Rules of Engagement		Tri-Service Approach

Figure 1: Unmanned Technology Capability Development Roadmap

However, not every role can or should be left to unmanned platforms.

Cost. Costs might be acceptable for the development of a small, finite number of unmanned systems. Once systems are fielded, however, there may be considerable unforeseen upkeep costs. Conversely, while there is a certain cost associated with fielding any war fighter, "there is a incomputable political cost associated with human war fighters when they are killed or seriously wounded—not to mention the political costs associated with the physical, emotional, and financial strain placed on their families during their absence, even if they return unharmed."[30]

Rules of Engagement. The Geneva Conventions and their additional protocols is "the body of international law that regulates the conduct of armed conflict and seeks to limit its effects. But when they were first drafted back in 1949, autonomous weapon systems were still consigned to the realm of science fiction and arguments still rage today about how the conventions relate to the use of robotic systems and robots themselves."[31] An international consensus on drone warfare needs to be sought, "given that the technology is certain to rapidly proliferate—more than 50 countries already possess some form of the capability."[32] Militaries need to establish the rules of engagement that they will abide by when employing unmanned technology—however they need to take care that these rules do not prevent them from using the technology to its fullest potential.

Capability Considerations. Just like any other technology, it is important to prioritize and decide on capabilities as well as payload, one of which concerns weaponization. It has been suggested that since it will be very difficult to guarantee that autonomous robots can, as required by the laws of war, discriminate between civilian and military targets and avoid unnecessary suffering, they should only be allowed the autonomous use of non-lethal weapons. While the same robot might also carry lethal weapons, it should be programmed such that only a human can authorize their use.[33]

Roles and Responsibility. According to Singer, there is a need "to ensure that responsibility falls where it should," and that the use of unmanned systems be sanctioned with proper authority.[34] Furthermore, "this principle of responsibility is not simply intended for us to be able to figure out whom to punish after any wrongdoing; but by establishing at the start who is ultimately responsible for getting things right, it might add a dose of deterrence into the system before things go wrong."[35]

Training and Qualification. It is recognized that:

> Training is one of the most important ways that safety of operations is maintained and to enable operational effectiveness. Hence, there is a need to develop operator training procedures and qualification processes that will work in unison with regulatory and certification issues. An example is the UK Unmanned Aerial Vehicle Systems Association (UAVS) which has endorsed the need for appropriate training for safe operation of UAVs and is pursuing initiatives to establish accredited Unmanned Aerial Systems (UAS) training centers. It is also working with the government to set out clear guidelines as to the level of qualification for UAV commanders and pilots.[36]

In addition, militaries must not allow unmanned systems to be the technology that severs the connection between men and the battlefield and also the bond between the men fighting a war together. Training must inculcate the human touch and build something more than just men playing "video games."[37]

Recognize Limitations. There is a need to recognize both the technological limitations of unmanned systems and those of the human operators. For example, it was earlier quoted that a single drone may be able to provide 60 simultaneous live video feeds directly to combat troops. However, is it humanly possible for soldiers to make sense of so many simultaneous feeds?

Clear Statement of Needs. Besides limitations, there is also the need to balance the military's requirements versus the various technology options. Though there are many attractive technology options available, the important question is whether there is a need to adopt them. Clear statements of need must be crafted for unmanned systems. For example, a RAND project helped the USAF analyze support options for current UAV systems. Like many unmanned system projects, the USAF UAVs used spiral development, in which prototypes "are fielded at the same time that lessons learned and technology advances are feeding a continuous cycle of redesign. This approach created a fleet with multiple configurations, complicating maintenance and logistical support."[38] Hence, it is necessary to have "a plan in place before production begins to standardize or at least limit the number of configurations within a fleet."[39]

Tri-Service Approach. There must be a tri-service approach to the development and use of unmanned systems. The usual demarcations between service-centric systems become increasingly blurred in the case of unmanned systems—UAVs are used by all the services. A service-centric approach would limit the harnessing of expertise. Furthermore, the dispersion of unmanned systems across the organization "makes it difficult for lessons learned to be easily shared," thus there is a need to structure an approach for sharing experience, such as regular conferences.[40] In addition, operational synergy can be gained if there is interoperability among the air-ground-sea unmanned systems.

Alliance with Industries and Institutions. There is a need to leverage on the expertise of external industries and institutions. While unmanned technology is maturing, further research and development is required, and this is best driven by outside agencies. This can help defray the risk usually associated with research and development while allowing the military to concentrate on its core capabilities.

CONCLUSION

There is a role and place for both unmanned and manned systems on the future battlefield. While operating unmanned systems can prove costly, keeping people out of harm's way is priceless. The use of unmanned systems brings many benefits, but they should be seen as complementary to rather than replacements for existing manned systems. In the end, the importance of the human factor is aptly summed up below:

> *The human factor will decide the fate of war, of all wars. Not the Mirage, nor any other plane, and not the screwdriver, or the wrench or radar or missiles or all the newest technology and electronic innovations. Men—and not just men of action, but men of thought. Men for whom the expression "By ruses shall ye make war" is a philosophy of life, not just the object of lip service.*
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> *–Ezer Weizman, Israeli Defense Forces Air Force Commander.*[41]

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