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# **A Review on Military Robots - Future of Wars**

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**ABSTRACT:** Military robots are changing the shape of warfare by providing high-tech enhancements that create strategic advantages while minimizing human exposure to risk, and re-booking battlefield maneuvers. These technologies, ranging from autonomous war drones to ground-based robotic soldiers, can be used for surveillance, reconnaissance and even combat roles. With the help of AI/ML, many military robots can process large volumes of data and gain actionable insights in real time leading to aerial drones with accurate targeting, precise decision making, and adaptable response mechanism to dynamic environments. The ability to operate independently or in human-robot teams may help minimize casualties by taking the place of soldiers in dangerous. Military robots are changing the shape of warfare by providing high-tech roles. Moreover, robots equipped with high-tech sensors can identify threats, neutralize explosives and even facilitate logistical activities on the battlefield thus increasing input efficiency. But this fast-paced evolution of military robotics is also already creating ethical and strategic.

**KEYWORDS:** Autonomous systems, International Laws, Military organization, Robotics, Warfare transformation

## **I. INTRODUCTION**

Mechanization and mass production made possible early automatic weapons in the nineteenth century. Military experimentation with machines that were also mobile and unmanned began during World War I including even radio-controlled airplanes, the very first unmanned aerial vehicles (UAVs). World War II saw the operational use of several unmanned weapons by both the Allied and Axis forces, including remote-controlled bombs; it was also a period of rapid advancement in analog and electronic computing. Military interest in robotics was spotty during the Cold War, with inventors repeatedly finding that what was technically possible mattered less than what was bureaucratically feasible. Robotic systems were getting better, but the interest, energy, and proven success stories necessary for them to take off just weren't there. The only substantial contract during this long dry spell was one that the Ryan aeronautical firm received in 1962 for \$1.1 million to make an unmanned reconnaissance aircraft. The drone that came out of it, the Fire Fly, flew 3,435 missions in Southeast Asia. Overall, though, the Vietnam experience was as bad for robotics as it was for the broader U.S. military.

To better understand the nuances of AI, it is important first to understand the difference between an automated and an autonomous system. An automated system is one in which a computer reasons by a clear if-then-else, rule-based structure, and does so deterministically, meaning that for each input the system output will always be the same (except if something fails). An autonomous system is one that reasons probabilistically given a set of inputs, meaning that it makes guesses about best possible courses of action given sensor data input. Unlike automated systems, when given the same input autonomous systems will not necessarily produce the exact same behaviour every time; rather, such systems will produce a range of behaviours. Human intelligence generally follows a sequence known as the perception-cognition-action information processing loop, in that individuals perceive something in the world around them, think about what to do, and then, once they have weighed up the options, make a decision to act. AI is programmed to do something similar, in that a computer senses the world around it, and then processes the incoming information through optimization and verification algorithms, with a choice of action made in a fashion similar to that of humans. Given that the advancement of AI is inextricably linked to the expertise of the engineers developing these systems, the case is then made that the shift in expertise from the military to the commercial sector will further complicate policy discussions on autonomous weapon, and will make it difficult for governments to deploy and manage these systems.

## II. LITERATURE REVIEW

Binns, R. (2018)[1] Explores the impact of automation on modern warfare and its implications for future conflicts, Chuter, D. (2017)[2] Provides a comprehensive overview of the future role of robotics in military applications., Tucker, P. (2019), Smith, K., & Jones, R. (2020), Mehta, A. (2022), [3,4,5] Discusses the transformative potential of robotics in warfare and their influence on global security. Singer, P. W. (2009), Bogue, R. (2016) [6,7] Discusses the development and deployment of military robots and their impact on warfare. Arkin, R. C. (2018) [8] Provides an overview of the technological evolution of military robots., Laird, J. E., & Wray, R. E. (2019), McFarland, T. (2021) [9,10] Traces the development of autonomous systems for military use and their operational impact.

Bier, M., & Gibbard, B. (2020)[11] Classifies military robots into ground, aerial, and underwater systems. Kollmorgen, K. A. (2019), Smith, D. (2020) [12,13] Examines the importance of unmanned aerial vehicles in military intelligence operations. hah, A., & Patel, R. (2021), Togelius, J., & Yannakakis, G. N. (2021) [14,15] Investigates the use of marine robotics for coordinated military operations. Arkin, R. C. (2007), Nourbakhsh, I. R. (2016)[16,17] Explores the behavior-based control systems used in autonomous military robots. Smith, K., & Jones, L. (2018) [18] Discusses the mechanical design and control systems of military robots. Kumar, V., & Hsieh, M. A. (2020), Thrun, S. (2019) [19,20] Focuses on navigation and path planning algorithms for autonomous military robots.

Horowitz, M. C. (2018) [21] Discusses the implications of fully autonomous warfare for future military strategies. Scharre, P. (2018), Watson, M. (2019) [22,23] Explores the potential consequences of autonomous warfare. Roff, H. M. (2017), Kallenborn, Z. (2021) [24,25] Evaluates the strategic implications of autonomous military technologies. Crotofo, R. (2016), Marchant, G. E. (2019) [26,27] Discusses legal accountability and responsibility for the actions of autonomous systems in warfare, with a focus on human versus machine liability. Sauer, F. (2020) [28] Analyzes AWS under international humanitarian law, highlighting challenges in ensuring compliance with principles of distinction, proportionality, and necessity. Sharkey, N. (2018). Tonkens, R. (2019) [29,30] Argues for a preemptive ban on AWS, focusing on the difficulties in ensuring compliance with international law and maintaining ethical standards.

Lin, P. (2012) [31] Provides a comprehensive ethical analysis of autonomous military robots, focusing on their potential to make life-or-death decisions in combat. Sullins, J. P. (2018), Taddeo, M., & Floridi, L. (2020) [32,33] Explores the moral implications of deploying lethal autonomous robots and their alignment with just war theory. Cummings, M. L. (2017), Asaro, P. M. (2018) [34,35] Investigates the necessity of maintaining human oversight and control over autonomous systems to ensure ethical decision-making.

## III. THE ROBOTIC REVOLUTION

Robots have disrupted the social and economic spaces of human coexistence for decades. In 1961, General Motors installed the first industrial robotic arm-Unimaten its assembly lines in New Jersey. This has big consequences for the spaces of security and violence. On the ground, in the air, and underwater, military robots are eroding the human monopoly on violence. "Today, the world is approaching a robotics revolution in military affairs that may be on par with the introduction of gun-powder, levée enmasse, and the advent of nuclear weapons' (Sukman, 2015). The coming decades will see US soldiers augmented, replaced, and wounded by artificial warriors, which has the potential to change our basic core concepts of defense. Existing Applications of Robots in the Defence base work ISR are some of the significant applications where defense satellites are utilized. UAVs, UGVs, USVs, ROVs, AUVs, and others are widely utilized currently for ISR operations. Little UAVs being utilized in the defense part predominantly to give front line insight. At present, the military worldwide never again depend upon human detective and rather utilize little robots, those are practically undetectable to the foe. These robots aid screen adversary powers or explicit zones or even communicate recordings and pictures to the head station by the help of GPS. UAVs are utilized for ISR activities to report promising objective data which is hard to distinguish. For instance, is a low weight, hearty, short height remote-controlled Unmanned Aerial System (UAS), planned or made mutually by AeroVironment (US) and the Defense Advanced Research Projects Agency (DARPA), is utilized by the US for observation and surveillance. Fig.no.2 Showing WASPAE Search or salvage is one more practice here robot s utilized in the defense and assume a vital job in saving life's. Most losses occur because of the deferral in giving a vital guide to unfortunate casualties. Numerous nations are putting intensely in limiting the reaction time to save the people from most extreme unfortunate casualty.

### 3.1 Development of Military Robots

When we look into the history of military robots, we come to know that the use of robots begins from the time of World War II. So far there has been a huge development of military robots. At present, most of the military organizations use military robots to take risky jobs which are difficult to be handled manually by soldier. The development of advanced technology has led to the development of robots in military too. Today's military robots usually employ the integrated system which includes video screens, sensors, gripper and cameras. In the development of military robots, we can consider about US Mechatronics which has created or developed a working automated sentry gun and is presently developing it further for commercial as well as military use. As far as military Robots development is concerned, we cannot forget MIDARS which is a four-wheeled military robot. This robot is outfitted with many cameras, radar, and a firearm that performs arbitrary patrols around a military base or other government installation automatically. MIDARS alerts human over looker when it tracks down movement in unauthorized areas, or other programmed conditions. This military robot can also scan radio frequency. The information on the development of military robots also reveals that US scientist at MIT is further looking to make a mechanical super-fighter, which has the ability to heal its own wounds, leap buildings, deflect bullets and even become "invisible" which will not be ready for at least ten years. The program was part of a \$26 million Pentagon program to develop software for autonomous systems. In a nut shell, we can say that the development of military robots has come a long way. And it does not seem to stop here.

### 3.2 Types of Military Robots

Military robots can be broadly classified in to Ground Robots, Aerial Robots, Marine Robots, Specialized Robots.

A. Ground Robots are used for

- Explosive Ordnance Disposal (EOD) Robots: Defuse bombs and IEDs.
- Reconnaissance Robots: Gather intel, surveillance, and reconnaissance.
- Combat Robots: Armed robots for combat operations.
- Transportation Robots: Carry supplies, ammunition, and equipment.
- Mine Clearance Robots: Detect and clear landmines.

B. Aerial Robots (UAVs/Drones) are used for

- Surveillance Drones: Gather intel, reconnaissance, and surveillance.
- Combat Drones: Armed drones for combat operations.
- Reconnaissance Drones: Gather intel and reconnaissance.
- Communication Drones: Provide communication relay services.
- Cargo Drones: Transport supplies and equipment.

C. Marine Robots are used for

- Unmanned Underwater Vehicles (UUVs): Gather intel, reconnaissance, and surveillance.
- Autonomous Surface Vehicles (ASVs): Conduct maritime surveillance.
- Mine Countermeasure Robots: Detect and clear sea mines.
- Underwater Explosive Ordnance Disposal (EOD) Robots.

D. Specialized Robots are used for

- Search and Rescue (SAR) Robots: Locate and extract personnel.
- Chemical, Biological, Radiological, Nuclear (CBRN) Robots: Detect and respond to CBRN threats.
- Explosive Detection Robots: Detect explosives and IEDs.
- Logistics Support Robots: Transport supplies and equipment.

Most of the military organization now takes the help of robots to carry out many risky jobs that cannot be done the soldier. These robots are a great help for military organizations. Military robots are categories as: Unmanned Aerial Vehicles (UAV) - These military robots are basically designed for the missions of surveillance and reconnaissance. Small Unmanned Ground Vehicles (UGV) – These robots are capable of entering hazardous or dangerous areas and can collect information without risking the lives of soldiers. Multifunctional Utility/Logistics and Equipment (MULE) – These military robots are especially designed to provide combat support in conflict scenarios. Armed Robotic Vehicles (ARV) – These robots are capable of carrying powerful weapons and sophisticated surveillance equipment. As far as the working of military robots is concerned, the MULE and ARV vehicles mark the beginning of a new type of warfare.

MULE has three proposed versions, which roll around on wheels. Two of them can carry more than a ton of equipment. The other vehicle is especially designed to detect and disable anti-tank landmines. The other kind of robot, i.e. ARV robots are more like tanks. Infact they are less like soldiers. These military robots are mainly used as support for manned vehicle missions. For the commander can use these robots to extend his team's area of influence without the need for more soldiers. These robots can take the most dangerous positions as well as provide support whenever the manned vehicles enter a combat situation.

### 3.3 Autonomous futures

Autonomy and AI more generally is central to the future of US geopolitics. The Defense Science Board (2016: 3) writes that the ongoing rapid transition of autonomy into war fighting capabilities is vital if the U.S. is to sustain military advantage'. Unlike automation, an autonomous system possesses adaptable intelligence. This enables it to be 'goal-directed in unpredictable environments and situations' (US Air Force, 2016: 30). Autonomous weapons are not entirely new: since the 1980s the US Navy has installed autonomous Phalanx CIWS Gatling Guns on many of its battleships. Nonetheless, the contemporary wars cape is being transformed by an emerging class of robotic weapons, including drones, mobile sea mines, automated turrets, remote-controlled machine guns, as well as weaponized computer programs' (Bolton, 2015: 41). Several autonomous drones the US Navy's MQ-8 Fire Scout, the UK's Taranis drones, and the Anglo-French Unmanned Combat Air System promise to revolutionize air combat. Fearing this geopolitical pathway, 1000 leading scientists called for a ban on autonomous robotics in 2015, citing the risks to humanity. Similarly, Human Rights Watch and the International Human Rights Clinic (2016) continue to demand the prohibition of what they term 'killer robots'.

## IV. ROBOTIC WARFARE AND INTERNATIONAL LAWS

Implications for Modern Military the increasing rate of operational efficiency has resulted in a reduced timeframe for the targeted individuals to respond in a similar manner. Consequently, defense strategies are increasingly compelled to employ proactive measures in order to mitigate the risk of devastation. The utilization of robotic technology has the potential to give rise to a highly efficient and continuous mechanized system with the objective of eliminating life. The ability to exercise control and surveillance over many aspects is essential in situations when prompt and accurate decision-making, as well as efficient and accurate implementation, are necessary. The advancement of robotic warfare is additionally facilitated by specific inclinations observed within developed, metropolitan, postmodern civilizations. All of these tools must be adequately equipped for their respective tasks. The successful completion of the task necessitates the collaborative efforts of engineers and other specialized professionals who are present in the vicinity of the equipment. The ongoing information technology revolution and the emergence of new technologies have facilitated the increasing affordability and widespread adoption of unmanned tools.

The computational systems assuming responsibility for analysis and programmed decision-making are progressively advancing in terms of speed, size, and power. These systems possess the capability to do intricate computations involving vast amounts of data within remarkably brief timeframes. The convergence of contemporary sensor systems, rapid data transmission technologies, compact form factors, and very precise navigation techniques brought about a transformative revolution in automation throughout the latter part of the 20th century. The emergence of artificial intelligence leading to the transformation of automated machines into autonomous entities represents a significant and noteworthy trend within the realm of military advancement, demanding careful consideration. Engaging in responsible contemplation involves attempting to forecast the potential ramifications that emerging technologies may exert on warfare in the near future, as well as the potential problems they may pose to current national and domestic defense strategies, and overall security. The potential applications of Nano systems within the bodies of soldiers, which would alert the command center about their preparedness to engage with automated circle defensive systems of warships, are virtually limitless (Khan, 2018). While the future remains uncertain, it is plausible to anticipate that certain advancements in robotics within the private sector, namely in logistics, data analysis, education, and training, will likely be adopted by military organizations to improve their institutional and operational capabilities.

### 4.1 The Ethics of War for Robots

Perhaps the first issue to arise in any discussion of robotic weapons is the ethics of killing at a distance. The pilots who operate Predator and Reaper are safely ensconced thousands of kilometers away from the people they kill. The drones they operate fly so high and so quietly that the people that they target often have no idea that they are there until their

missiles arrive. It is hard not to wonder about the ethics of killing in this fashion. In particular, it is hard not to think that by distancing war fighters from the consequences of their actions, both geographically and emotionally, UMS will make it more likely that the operators of robotic weapons will make the decision to kill too lightly (Bender 2005; Ulin 2005). Ultimately, whether the use of UMS will contribute to more or less ethical behavior by their operators is an empirical matter which can only be resolved by careful study over an extended period of time. However, there are a number of reasons to think that robotic weapons are less problematic in this regard than first appears.

## V. CONCLUSION

Military robots are the future of warfare, ever more so coming to redefine strategy, morality and world insecurities. Autonomous & semi-autonomous robots could cut down on human deaths by taking over hazardous missions, e.g., bomb disposal, battle reconnaissance in hostile territories or even murders. These machines can perform missions without getting tired, while their accuracy and efficiency could shift the scales on the military's favor. Drones, unmanned ground vehicles and marine robots will be used more as rapidly advancing AI and robotics reduce the need for human soldiers on battlefields which may see a supervisory role rather than front line involvement come into play.

This technological leap, however, has created ethical and security concerns. For example, giving machines the authority to decide when and where to kill could backfire, resulting in faulty hardware and biased algorithms with deadly consequences designed a fight autonomously killing civilians. The arms race risk: Nations will have to keep up with each other regarding cutting-edge robotic arsenals which may further decrease the threshold for war. Regulation will have to be done by international agreements so that military robots contribute towards stopping violent conflicts instead of fueling them. In conclusion, military robots are a game-changer for the future of war but the future use of military robots will need to be guided by ethical considerations and regulatory frameworks.

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