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AUTONOMOUS WEAPON SYSTEMS ON THE BATTLEFIELD

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Abstract-*Many autonomous weapon system, artificially intelligent, networked things will populate the battlefield of the future, operating in close collaboration with human warfighters, and fighting as teams in highly adversarial environments. This paper explores the characteristics, capabilities and intelligence required of such a network of intelligent things and humans – Internet of Battle Things (IoBT), autonomous weapon systems, future in this technology for India*.

Keyword- Autonomous weapon system, unmanned air vehicle (UAV), Internet of Battle Things (IoBT)

INTRODUCTION

Internet of Battle Things is that the emerging reality of warfare. A spread of networked intelligent systems— "things"—will still proliferate on the battlefield where they're going to operate with varying degrees of autonomy. Intelligent things won't be a rarity but a ubiquitous presence on the longer term battlefield [1]. So as to be effective in performing these functions, battle things will need to collaborate with one another, and also with human warfighters. This collaboration would require a big degree of autonomous self-organization and acceptance of a spread of relations between things and humans (e.g., from complete autonomy of an unattended ground sensor to tight control of certain systems), and these modes will need to change as required. Priorities, objectives and rules of engagement will change rapidly, and intelligent things will need to adjust accordingly (Kott et al. 2016).

1. RELATED WORK

At the Pentagon, Paul Scharre helped create the U.S. policy for such weapons. In his new book, Army of None: Autonomous Weapons and therefore the way forward for War [1], Scharre discusses the state of those weapons today. Scharre says while the present weapons aren't like those seen within the movies, the technology is advancing, whether people love it or not. Highlight differences between what's legal within the laws of war and what's morally right — something that autonomous weapons won't distinguish [3] [4].

Research paper by M. L. Cummings International security and US and therefore the Americas Program January 2017 talks about Major advances in areas like adversarial learning and adversarial reasoning are going to be required. Simulated immersive environments may help to coach the humans and AI [2].

INDIA and therefore the CHALLENGE OF AUTONOMOUS WEAPONS by R. Shashank Reddy talks about the introduction of autonomous weapons will profoundly change the character of war and can also affect the understanding of laws of war. A little but fierce international debate has started over the legality and use of such weapons. India is uniquely placed to require a lead within the global discussion about this issue. India should view development and deployment of autonomous weapons through the prism of its security needs and national interests [5] [6] [7].

2. WEAPONIZING OF AI

As AI, machine learning and deep learning evolves further and moves from concept to commercialization, the rapid acceleration in computing power, memory, big data, and high-speed communication isn't only creating innovation, investment and application frenzy but is additionally intensifying the search for AI chips. This ongoing rapid progress and development signify that AI is on its thanks to revolutionizing warfare which nations are undoubtedly getting to still develop the automated weapons system that AI will change.

Being "autonomous" has different meanings in several fields of study. In engineering it's going to ask the machine's ability to work without human involvement. In philosophy it's going to ask a private being morally independent. In politics it's going to

ask an area's capability of self-governing, in terms of military weapon development, the identification of a weapon as autonomous isn't as clear as in other areas.

Autonomous weapon is categorized into two that's defense and offense systems.

3. THE TECHNOLOGY SO FAR

The future of AI in military systems is directly tied to the power of engineers to style autonomous systems that demonstrate independent capacity for knowledge- and expert-based reasoning. There are not any such autonomous systems currently operational. Most ground robots are tele operated, essentially meaning that a person's remains directly controlling a robot from a long way away as if via a virtual cord. Most military UAVs are only slightly more sophisticated: they need some low-level autonomy that permits them to navigate, and in some cases land, without human intervention, but most require significant human intervention to execute their missions. Even people who begin, fly over a target to capture images, then return home still operate at an automatic and not autonomous level, and don't reason on the fly as true autonomous systems would.

There are many reasons for the shortage of success in bringing these technologies to maturity, including cost and unforeseen technical issues, but equally problematic are organizational and cultural barriers. The US has, as an example, struggled to bring autonomous UAVs to operational status, primarily as a results of organizational in-fighting and prioritization in favor of manned aircraft (Spinetta and Cummings, 2012). for instance, despite the very fact that the F-22 aircraft has experienced significant technical problems and has flown little in combat, the US Air Force is considering restarting the F-22 assembly line – in itself a particularly costly option – as against investing in additional drone acquisitions. Beyond the assembly line, moreover, the hourly operational cost of the F-22 is $68,362, as compared with the Predator's $3,679 (Thompson, 2013); the latter can perform most of an equivalent core functions of an F-22 but air-to-air combat missions, which the F-22 itself couldn't previously perform thanks to technical problems. to offer another example, the US Navy's X-47 was intended to be developed as an autonomous fighter/bomber aircraft, but despite many successful sea trials it's now slated to work as a tanker for aerial refueling – a far cry from its original (achievable) purpose. Both the US Air Force and Navy have chosen to use the overwhelming majority of aircraft acquisition funds for the manned F-35 Joint Strike Fighter, albeit the program has been beset with management and engineering problems, and whose relevance is contested particularly in light of advancing autonomous technologies (Hendrix, 2015). For several within the military, UAVs are acceptable only during a support role, but they threaten the established order if allowed to require the foremost prestigious, 'tip-of-the-spear' jobs. There are, however, other organizational issues limiting the operational implementation of autonomous systems, and one that's increasingly problematic is that the shift in advanced development from military to commercial settings. A metaphorical race is ongoing within the commercial sphere of autonomous systems development. Military autonomous systems development has been slow and incremental at the best, and pales as compared with the advances made in commercial autonomous systems like drones, and particularly in driverless cars. Driverless car development originated with a Defense Advanced Research Projects Agency (DARPA) program in 2004.

Russia, the military is functioning to make a fleet of armed ground-robots.

They're building large, ground combat vehicles that have anti-tank missiles on them, Russian generals have talked a few vision within the way forward for fully robotized units that are independently conducting operations, so other countries are leaning hard into this technology. [2]

Milrem Robotics, a corporation based in Estonia, has developed a robot called THeMIS (Tracked Hybrid Modular Infantry System), which consists of a mobile body mounted on small tank treads, topped with a remote-weapon turret which will be equipped with small or large-caliber machine guns. It also includes cameras and target-tracking software; therefore, the turret can pursue people or objects as programmed. this is often a human-controlled system for now (and Milrem, for its part, insists that it'll remain that way), but the components are there for a robot which will interpret what it sees, identify likely combatants and target them, all on its own. "The possible uses for the THeMIS," the robot's builders gush on the web site, "are almost limitless."

Britain and Israel are already using weapons with autonomous characteristics: missiles and drones which will seek and attack an adversary's radar, vehicle or ship without a person's command triggering the immediate decision to fireside.

CODE's human operators monitor the swarm without micromanaging it, and therefore the autonomy of the drones means they're programmed to improvise and adjust as they pursue their preset mission. The thought here is that CODE goes after mobile or rapidly relocatable targets, therefore the target locations can't be specified precisely beforehand by humans. It's not sort of a Tomahawk aircraft, where you only program within the coordinates then the missile goes and strikes it. The drones need to be ready to search a neighborhood and find targets on the move [3].

A simpler autonomous system is that the loitering munition: a drone which will fly for a few time on its own, trying to find specific signals, before finding a target and crashing into it with an explosive payload. Israel produces a loitering munition, dubbed the "Harpy," which is meant to hunt out and destroy enemy radar stations and which became a detail in U.S.-Israeli relations when some were sold to China within the late 1990s. Companies in several nations, including Slovakia and therefore the us, have also produced loitering munitions.

Facebook and Amazon have drone development programs; and Apple is assumed to possess an autonomous car development project. As long as the knowledge technology companies are spending much more on R&D than does the aerospace and defense sector, it's clear why there has been far greater progress in commercial autonomous systems development. As regards the longer term of warfare because it is linked to AI, the massive disparity in commercial versus military autonomous R&D spending could have a cascading effect on the kinds and quality of autonomy that are eventually incorporated into military systems. One critical issue during this regard is whether or not defense companies will have the capacity to develop and test safe and controllable autonomous systems, especially people who fire weapons.

4. THE TECHNOLOGY SO FAR

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5. The possible advancement

Agents will need to become useful team-mates—not tools—of human warfighters on a highly complex and dynamic battlefield. illustrates an environment wherein a highly-dispersed team of human and intelligent agents (including but not limited to physical robots) is attempting to access a multitude of highly heterogeneous and unsure information sources and use them to form situational awareness and make decisions (Kott et al. 2011), while simultaneously trying to survive extreme physical and cyber threats. They have to be effective during this unstructured, unstable, rapidly changing, chaotic and rubble-filled adversarial environment; learning in real-time under extreme time constraints, with only a few of observations that are potentially erroneous, with uncertain accuracy and meaning, or are even intentionally misleading and deceptive. It's clearly far beyond this state of AI to figure intelligently in such an environment and with such demands. Especially, Machine Learning, an area that has seen dramatic progress within the last decade, must experience major advances soon become relevant to the important battlefield. Let's review variety of the required advances.

Over 30 countries have or are developing armed drones, and with each successive generation, drones have more autonomy. Automation has long been utilized in weapons to help identify targets and maneuver missiles. But thus far, humans have remained on top of things of deciding whether to use lethal force. Militaries have only used automated engagements in limited settings to defend against high speed rockets and missiles

Humans have developed many control schemes that allow us to bend natural processes to our will, and machines must continue these developments, tapping into a capacity for learning and adaptation to magnify these traditional techniques. In some cases, this means identifying pieces of our planning and control systems that are particularly hard to model and letting

the system learn them (Richter et. al. 2015). In other cases, we'll take a more holistic view of learning to plan and control: recent advances in planning have allowed us to sidestep the challenge of thinking through all of the compounding choices by substituting enumeration with sampling and relying on the mechanisms of probability to supply us a path to convergence and optimality (Karaman and Frazzoli, 2011; Tedrake et. al. 2010). Intelligent systems will learn to guide their sampling over time as the way to understand the knowledge they have built about the earth and their capabilities while still retaining the facility to be flexible just in case their model isn't quite right. Modeling probability distributions are often challenging, but learning to transform a simple distribution can accomplish the same goal and provide a path to learnable sampling-based control (Lenz et. al. 2015).

6. Future war ways for India

Disarmament instead of limitation has been the first framework for India's approach to the international regulation of weapon systems. The country has also opposed inequity and discrimination within the structuring of limitation treaties. Its refusal to sign the Nuclear Non-Proliferation Treaty and therefore the Comprehensive Nuclear-Test-Ban Treaty reflects these considerations.49 Since the 1990s, though, India has moved toward a stress on national security considerations and has been willing to support pragmatic limitation measures as a part of its new self-perception as a responsible power [4]. The difficulty of autonomous weapons in India is probably going to be driven by the country's unique security situation, which features two hostile neighbors and therefore the ever-present threat of insurgency. This position gives Indian military preparedness a really defensive tint wherein the singular objective is to defend Indian borders and assets with minimal loss of lives. Autonomous weapons could provide the dual advantages of reducing military casualties and rising potency in defensive capabilities. Their single-biggest profit may be that they are not ruled by human emotions, creating it doable to deploy them 24-7, three hundred cardinal days a year in any weather or geographical condition. They could perform many functions with stripped to no military casualties. this is often ready to have a tangible impact in areas just like the Siachen ice mass at intervals the high Himalaya Mountains, on the border with Asian country, wherever Asian nation has lost 883 troopers since 1984, all to the robust weather.50 In 2014, Asian nation recorded quite one hundred seventy five infiltration makes an attempt across the road of management,51 the effective military boundary between Asian nation and Asian country, and it's quite doable that type of makes an attempt went unnoted. The perpetrators of the Gregorian calendar month 2016 attack on the Pathankot Air Force Station altogether chance slipped across the international border from Asian country. [5] Given the robust earth science of the road of management and thus the international border, autonomous weapon systems just like the SGR-1 or a standardized system would possible be higher able to check infiltration makes an attempt than routine manned patrols. To boot, associate degree autonomous system would in all probability be higher able to guard and defend the road of Actual management with China, a lot of that passes through distributed, unsettled mountainous regions, wherever manned patrols ar ineffective. Another issue that will tilt the balance in favor of India's development of autonomous weapons is that the country's need to shield its sizeable and growing area assets; autonomous systems may meet this want throughout a way a lot of economical manner than any manned system. P. W. Singer, a senior fellow at New America, has acknowledged that the employment of autonomous weapon systems may play a polar role at intervals the protection of area assets and in any potential area conflicts. This may become vital particularly in lightweight of the much-publicized Chinese capability to destroy satellites in orbit. An implements of war that will mechanically observe incoming threats to satellites and launch missiles to intercept them in seconds would be necessary to counter such a capability. Further, as long as China is probably developing autonomous weapons of its own, it's reaching to become necessary for Asian nation to develop such systems. The Defense analysis and Development Organization (DRDO) confirmed in 2013 that the country is developing "robotic soldiers" with a "very high level of intelligence to alter them to differentiate between a threat and a fan," to be deployed in areas just like the road of management. It declared that "a range of labs ar already operating throughout a giant way" on such systems. The descriptions of these systems nearly match that of a completely autonomous weapon, and will be the clearest indication from any country that such weapons system is underneath development. The then chairman of the DRDO explicit that exact same year that these autonomous systems would be prepared for preparation around 2023.However, as a result of the DRDO has traditionally protrusive its delivery dates and is vulnerable to exaggeration, these statements should be crazy a grain of salt associate degreed thought of an expression of intent rather than as a result of the ultimate word on delivery timelines. Whereas it remains to be seen if Asian nation can deploy autonomous weapon systems by 2023, it's already started getting and deploying near-autonomous weapon systems just like the Harpy defense Suppression System. Asian nation and thus the Challenge of Autonomous Weapons Phalanx Close-In weapon , it is also doable that Asian nation can bit by bit move toward larger automation of missile defense shields together with the Prithvi defense and thus the Advanced defense . These systems target objects and not humans per se, and thus the acquisition of one needn't essentially mean the event or preparation of the alternative. However, this highlights the actual fact that Asian nation is quickly adopting weapon systems with ever-greater

levels of autonomy and will not, therefore, recoil from developing or adopting associate degree autonomous weapon that targets humans [6].

7. THE DANGERS

It's a freezing, snowy day on the border between Estonia and Russia. Troopers from the two nations are on routine patrol, all sides amid associate degree autonomous weapon, a tracked automaton armed with a machine gun associate degreed an optical system which can determine threats, like individuals or vehicles. As a result of the patrols converge on uneven ground, associate degree Estonian soldier visits and accidentally discharges his assault gun. The Russian automaton records the gunshots associate degreed outright determines the appropriate response to what it interprets as an attack. In however a second, each the Estonian and Russian robots, commanded by algorithms, flip their weapons on the human targets and hearth. once the shooting stops, a dozen dead or contusioned troopers lie scattered around their companion machines, deed each nations to sift through the portion — or blame the alternative aspect for the attack. Autonomous weapons systems can inevitably lack the pliability that humans ought to adapt to novel circumstances that as a result killing machines can build mistakes that humans would presumptively avoid.

The lack of transparency in AI technologies that are associated with hottest advances in machine vision and speech recognition systems is to boot cited as a supply of potential ruinous failures.

The weapons may be hacked. The weapons may represent the hands of "bad actors." we have a tendency toapons won't be as "smart" as we expect and can unknowingly target innocent civilians. As a result of the materials necessary to form the weapons ar low-cost and easy to urge, military powers may manufacture these weapons, increasing the probability of proliferation and mass killings. The weapons may alter assassinations or, or else, they could become weapons of oppression, permitting dictators and warlords to subdue their individuals.

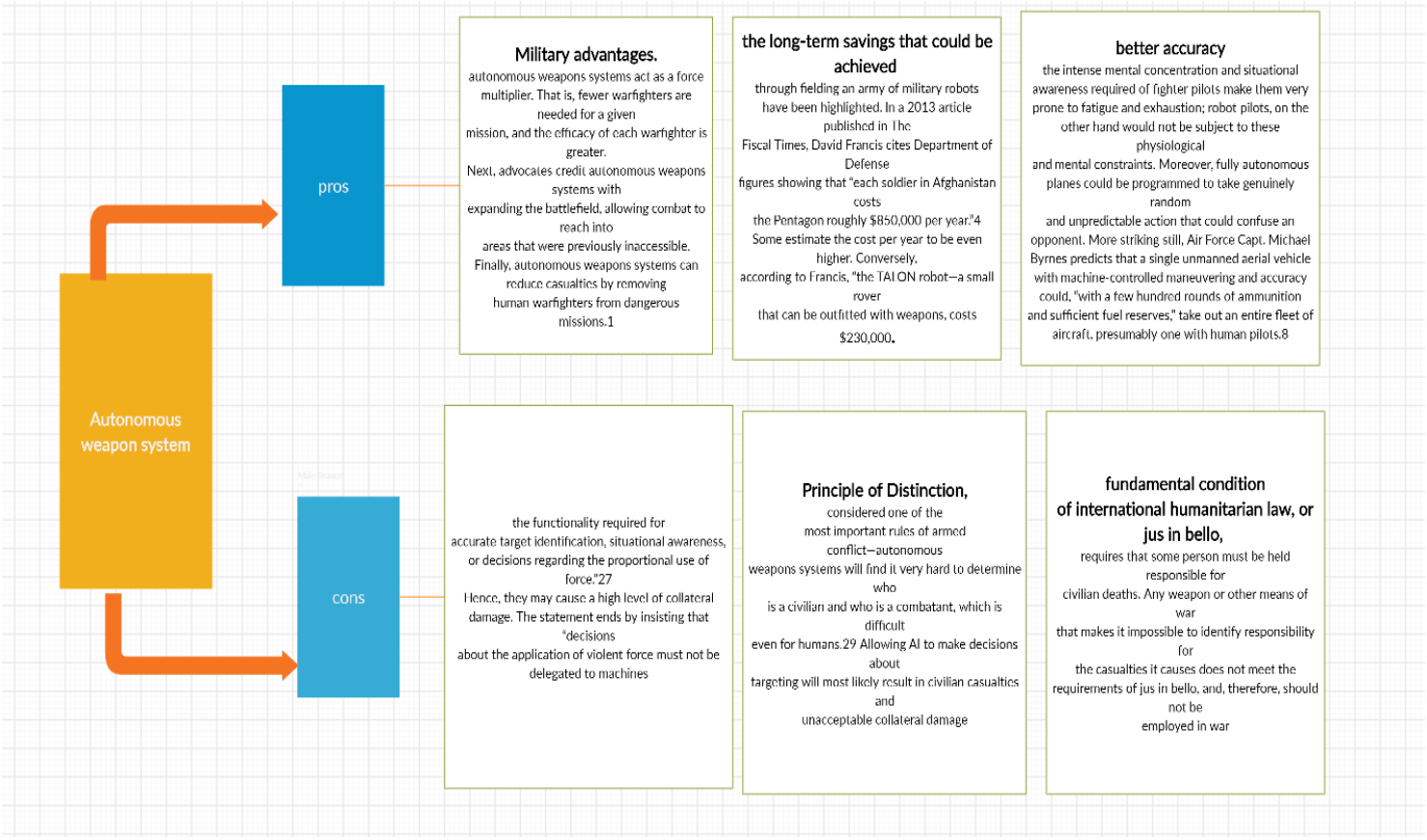

Figure 1.1: Pros & cons of AWS

8. Conclusion

Intelligent things – networked and teamed with human warfighters – are going to be a ubiquitous presence on the longer term battlefield. Their appearances, roles and functions are going to be highly diverse. The synthetic intelligence required for such things will need to be significantly greater than what's provided by today's AI and machine learning technologies. Adversarial – strategically and not randomly dangerous -- nature of the battlefield may be a key driver of those requirements. Complexity of the battlefield – including the complexity of collaboration with humans – is another major driver. Cyber warfare will assume a far greater importance, and it'll be AI which will need to fight cyber adversaries. Major advances in areas like adversarial learning and adversarial reasoning are going to be required. Simulated immersive environments may help to coach the humans and to coach AI. The introduction of autonomous weapons will profoundly change the character of war and can also affect the understanding of laws of war. A little but fierce international debate has started over the legality and use of such weapons. India is uniquely placed to require a lead within the global discussion about this issue. India should view development and deployment of autonomous weapons through the prism of its security needs and national interests.

9. Contribution to the paper

The pros and cons diagram of autonomous weapon system.

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